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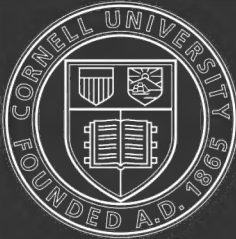
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REPORT

OF THE

GEOLOGICAL SURVEY OF OHIO.

VOLUME IV.

ZOOLOGY AND BOTANY.

PART I. ZOOLOGY.

Part II. never published.

OFFICERS OF THE SURVEY.

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EDWARD ORTON,	ASSISTANT GEOLOGIST.
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PUBLISHED BY AUTHORITY OF THE LEGISLATURE OF OHIO.

COLUMBUS:
NEVINS & MYERS, STATE PRINTERS.
1882.

Em.

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PREFACE.

The plan for the publication of the reports of the Geological Survey, submitted to and adopted by the Geological Board, contemplated the publication of two volumes on Geology, two on Paleontology, one on Zoology and Botany, one on Economic Geology, and a Geological Map of the State.

The Geological Corps were required by the organic law of the Survey to investigate the general geological structure of the State; to collect, study, and describe the fossils contained in the rocks, and to make surveys and reports upon the Geology and resources of each one of its eighty-eight counties. As the material was gathered in obedience to these instructions, it was soon found that the report would exceed in dimensions the estimate made for it. The preparation of a third volume on Geology, and a third on Paleontology was, therefore, authorized by the Geological Board.

Of the series of publications enumerated above, two volumes on Geology and two on Paleontology only had been finished when the appropriations for the continuance of the work of the Geological Corps were suspended by the Legislature. Since that date Vol. III, Part I, Geology, and the Geological Map of the State have been finished by the gratuitous labor of the Corps, and with an expenditure of several hundred dollars from the private resources of the Chief Geologist. They also have been published by the authority of the Legislature.

The volume on Zoology and Botany was also prepared, and its publication was authorized in 1878. The reports written for this volume were as follows: On Mammals, by Prof. A. W. Brayton; on Fishes, by Dr. D. S. Jordan; on Birds, by Dr. J. M. Wheaton; on Mollusks, by Dr. R. M. Byrnes; on Reptiles and Amphibians, by Dr. W. H. Smith; and a catalogue of the plants of the State was compiled by Dr. H. C. Beardslee. The manuscripts of some of these reports, recalled by their authors for changes or additions, were retained by them so long that the publication of the volume has been much delayed. They also have been expanded to such a degree that it has been found impossible to include them all in one cover. In the hope of doing this, however, the volume was enlarged to somewhat undesirable dimensions. Of the manuscripts prepared, those on the Plants of the State by Dr. Beardslee, and on the

Mollusca by Dr. Byrnes, have not been included, but are left to form, with such additions as may be made to the Zoological and Botanical material, a second part of this volume, of which it is to be hoped the preparation and publication will be accomplished at an early date.

In order to make the review of the Botany and Zoology of the State complete, Part II of the volume should contain, in addition to those already written on Botany and Conchology, a report on the lower forms of plant life, especially the Fungi, and others on the Articulates—Crustacea, Insects, etc.—including descriptions of all those which are injurious or beneficial to man. These, if properly prepared, will have much scientific value, and especially those on Economic Botany and on Economic Entomology, will be of great and immediate practical value.

Some impatience has been expressed at the slow progress of the preparation of the volume on Zoology and Botany, and the late appearance of the part now issued. But it should be remembered that all time and thought which have been expended upon these thorough and voluminous reports, destined to be so creditable and useful to the State, have been gratuitously bestowed. Not a dollar has been paid to the authors for the years they have spent in this work, and justice as well as courtesy demands that the invaluable gifts now made to the people of Ohio by the eminent naturalists who have prepared these reports, should be gratefully acknowledged. Probably no where in the history of scientific publication can be found more honorable examples of the gratuitous consecration of time and learning by men of science to the higher interests of the public.

It is possible also that there are some who will fail to appreciate the value of these detailed reports on the Natural History of the State; but with the exception of some scattered newspaper or magazine articles, nothing has been published in regard to the Zoology of Ohio since the catalogue prepared by Dr. Kirtland was issued in 1838, and in that interval there has been felt a constant want in every town, village, hamlet, and farmhouse of a better knowledge of the surrounding objects of nature. In every district school questions are constantly arising, inspired by the natural curiosity of the child, which the teacher has not been able to answer, from the want of means of information in regard to the animals and plants of the State. An interest in nature is almost universal, and its development wholesome and happyfying. Hence, the distribution of documents that will enable every one to learn the character and history of the objects that surround him, will prove not only a gratification but a benefit to a great multitude. All this for the educational influence of such reports. Their bearing upon the practical life of our people is not less real, since a knowledge of the habits of the animals that contribute to the support of man, the birds of the air, the beasts of the field, the fishes of the waters,

will be of great service as a guide in all efforts to increase the productiveness of these sources of aliment. So a knowledge of the plants that serve for beauty or use will make a man a better farmer, a happier and more useful citizen. These considerations are so obvious that no labored argument should be necessary to demonstrate the utility of volumes like this now presented to the public, and the economy of the expenditure of the small sum which it has cost. The avidity with which it will be sought by thousands of our citizens will soon attest their high estimate of its value.

For the care and accuracy with which the volume has been edited, credit is to be given to Dr. J. M. Wheaton, who, in addition to the preparation of the most voluminous report contained in it, assumed the onerous position of editor, has read all the proof, and has decided all the difficult questions of typography. For the mechanical execution of the book we are indebted to the courtesy and cooperation of the Supervisor of Public Printing, Col. J. K. Brown, and to the technical skill of the Public Printers, Messrs. Nevins & Myers.

Of the other volumes contemplated in the original plan of publication of the results of the Geological Survey, only the Second Part of Vol. III, on Paleontology, and Vol. V, on Economic Geology, yet remain unpublished; but the work has progressed slowly, since it has been done without aid from the State. It would before this have been presented to the Legislature for publication, but the opinion has been expressed by the friends of the Geological Survey that it was not at present wise to request appropriations for a volume regarded by some as ornamental rather than useful, and that it should wait the completion of the volume long half done, on Economic Geology. The delay in the publication of this latter volume has been dependent upon a failure to make the appropriation of the small sum necessary to finish the field work and the maps that should accompany it. For this money was absolutely necessary, and the sum of \$5,000 was asked some years ago. During the last session the Legislature appropriated the desired sum, placed the work in charge of Prof. Orton, and it is in a fair way to be completed. When that volume shall have been issued it is to be hoped that measures will be taken to secure the publication of the two half volumes, one on Botany, etc.; the other on Paleontology, which will render the series symmetrical and complete.

Enough has been said in regard to the Botanical and Entomological reports to show their utility and the importance of having them published and distributed. This is not the place to advocate the completion of the reports on the Paleontology of the State; but it is permissible to say that the prejudice that opposes the publication of figures and descriptions of the fossils contained in our rocks is a narrow and unwise one. Aside from the wide-spread interest felt in these extinct forms of animal and plant life, their practical value is undeniable and great. Every geologist knows that fossils constitute his most

reliable guides. They are the criteria by which he judges of the ages and relative positions of the rocks containing them, and thus are labels written upon these rocks, which to one who has learned the language are easily read, and are infallible. All over the world governments, societies, and individuals are spending large sums of money for the diffusion of just such knowledge as is contained in our paleontological reports, and there is little doubt that sooner or later the extremely interesting material which has been gathered for the third volume on Paleontology will be asked for and given to the public by the authorities of the State.

J. S. N.

SECTION I.

REPORT ON THE MAMMALIA OF OHIO.

BY A. W. BRAYTON.

TO PROF. J. S. NEWBERRY, *Chief Geologist*:

DEAR SIR: The account of the Mammals of Ohio herewith submitted is mainly compiled from the standard authorities on North American Mammals. The descriptions of the Rodents is largely drawn from the "Monograph of North American Rodentia," by Cones and Allen; of the Mustelidæ, from the "Fur-bearing Animals of North America," by Dr. Coues.

The works of Prof. Baird, Dr. Gill, Audubon and Bachman, and Robert Kennicott have been freely used, and such extracts made from them as seemed judicious and necessary.

I am also indebted to Mr. Frank W. Langdon, of Madisonville, Hamilton county, Ohio, for valuable lists, field-notes, and other information, drawn chiefly from early histories of Ohio; to Mr. E. W. Nelson, U. S. A., of Chicago, for notes on distribution; to Dr. D. S. Jordan, whose Manual of Vertebrates has been followed in the serial arrangement of the species, for use of books and specimens, and for the revision of proof-sheets, and for other favors.

It is deemed best to include, in this Monograph, not only the wild animals still living in the State, but also those exterminated within the period of settlement.

Very respectfully,

A. W. BRAYTON.

Irvington, Ind, Oct. 3, 1878.

REPORT

ON THE

MAMMALS OF OHIO.

BY A. M. BRAYTON.

The Mammals are air-breathing, warm-blooded vertebrates, having the skin more or less covered with hair; respiration never by branchiæ, but after birth by lungs; heart and lungs in the thorax, separated from the abdominal viscera by a muscular diaphragm; the blood with red non-nucleated blood-corpuscles; blood undergoing a complete circulation, being received and transmitted by the right half of the quadrilocular heart to the lungs for aëration, and afterward returned by its other half through the system; aorta single and reflected over the left bronchus. The cerebral hemispheres are connected by an anterior commissure, and a transverse superior commissure, the corpus callosum, the latter more or less roofing in the lateral ventricles; skull with two occipital condyles, one each side of the foramen magnum; lower jaw composed of a pair of simple rami, and articulated directly by convex condyles with the squamosal bones. Viviparous; fœtus developed from a minute egg, and provided with an amnion and allantois; young nourished for a time after birth by milk secreted in the mammary glands of the mother.

ORDERS OF MAMMALIA.

* Young not born until of considerable size, and nearly perfect development, deriving its nourishment before birth from the blood of the mother through the intervention of a placenta; vagina a single tube, sometimes with a partial septum; cerebral hemispheres connected by a well-developed corpus callosum and a reduced anterior commissure. (*Sub-class Monodelphia.*)

† Brain with a relatively large cerebrum, behind overlapping much or all of the cerebellum, and in front much or all of the olfactory lobes; corpus callosum continued horizontally backwards to or beyond the vertical of the hippocampal sulcus, developing in front a well defined recurved rostrum. (*Super-order Educabilia.*)

Anterior and posterior limbs and pelvis well developed; legs with the proximal joints (humerus and femur) not exerted beyond the common integument of the body.

a. Digits with corneous appendages developed as claws; teeth of three kinds; canines specialized and robust; molars, one or more in each jaw, sectorial, adapted for cutting; incisors $\frac{6}{6}$; scaphoid and lunar bones consolidated, placenta deciduate and zonary. CARNIVORA.

aa. Digits with corneous appendages developed as hoofs; teeth of three kinds; incisors various, often reduced or wholly suppressed, especially in upper jaw; no developed tusks; scaphoid and lunar bones separate; placenta non-deciduate (diffuse or cotyledonary.) UNGULATA.

†† Brain with a relatively small cerebrum, leaving behind much of the cerebellum exposed, and in front much of the olfactory lobes; corpus callosum extending more or less obliquely upwards, terminating before the vertical of the hippocampal sulcus; no well defined rostrum in front. (*Super-order Ineducabilia.*)

b. Incisors (very variable in number without persistent pulps) never $\frac{2}{2}$ or $\frac{4}{2}$; canines present; molars with sharp and pointed tusks; lower jaw with condyles transverse, received into special glenoid sockets.

c. Anterior limbs adapted for flight; ulna and radius united; bones of hand and finger much elongated, supporting a thin, leathery skin extending along sides of body to the posterior limbs; mammae pectoral.

CHEIROPTERA.

cc. Anterior and posterior limbs adapted for walking or grasping; ulna and radius entirely or partially separated; bones of hand and fingers normally developed; mammae abdominal. INSECTIVORA.

bb. Incisors $\frac{2}{2}$ rarely $\frac{4}{2}$; continually produced from persistent pulps, and growing in a circular direction; canines none; molars with ridged surfaces; lower jaw with condyles longitudinal, not in glenoid cavities, but gliding freely backwards and forwards in longitudinal furrows. RODENTIA.

** Young born of very small size, and imperfectly developed, never connected by a placenta to the mother; when born, attached by her to the nipple, from which the milk is forced by the mother into the mouth of the young; cerebral hemispheres chiefly connected by a well-developed anterior commissure, the corpus callosum being rudimentary; vagina more or less completely dividing into two separate passages. (*Sub-class Didelphia.*) MARSUPIALIA.

SUB-CLASS MONODELPHIA.

SUPER-ORDER EDUCABILIA.

ORDER CARNIVORA.

FAMILIES OF CARNIVORA.

* Intestinal canal provided with a cæcum; feet digitigrade; toes 5-4.

† Teeth, 28 to 30; dentition, m. $\frac{1}{1}$ pm. $\frac{2}{2}$, c. $\frac{1}{1}$, i. $\frac{3}{3} \times 2$; head broad; snout short, decurved; claws sharp, compressed, retractile. FELIDÆ.

†† Teeth, typically 42; varying between 38 and 46 (the true molars being the varying element.) Dental formula, m. $\frac{2}{3}$ ($\frac{1}{2} - \frac{3}{3}$), pm. $\frac{4}{4}$, c. $\frac{4}{1}$, i. $\frac{3}{3} \times 2$ CANIDÆ.

* Intestinal canal without a cæcum; feet usually plantigrade, if not, toes 5-5.

† Teeth less than 40; body rather slender; feet often more or less perfectly digitigrade; toes 5-5. MUSTELIDÆ.

†† Teeth 40 or 42; body stout; feet completely plantigrade.

a. Tail rudimentary teeth 42; lower jaw with three true molars; body very large and heavy. URSIDÆ.

aa. Tail well developed; teeth 40; lower jaw slender, with two true molars; body moderately stout. PROCYONIDÆ.

FAMILY FELIDÆ.

The Cats are digitigrade carnivora, with the toes 5-4. They are readily known from allied families by the retractile and very sharp, compressed claws. The palms and soles are densely hairy, with naked pads under each toe and the ball of the foot. The dentition is reduced to its simplest elements among all those mammals having incisors, canines, and molars. Formula, i. $\frac{3-3}{2-2}$; c. $\frac{1-1}{1-1}$; pm. $\frac{3-3}{2-2}$, or $\frac{2-2}{2-2}$; m. $\frac{1-1}{1-1}$ —30 or 28. The canines are long, sharp, more or less curved, usually slightly compressed, and in existing cats possess two longitudinal furrows on the outer side. The posterior molar of the upper jaw, the only permanent one, is very small, and its crown transverse; in front of this is a large sectorial premolar, with a smaller tricuspid one in front of it. The first premolar is very small—absent in *Lynx*. In the lower jaw the posterior molar is sectorial, with two smaller compressed premolars anterior to it. The second upper and first and second lower premolars are trilobed, the central lobe highest, and the lateral sometimes with accessory notches or lobes.

KEY TO THE GENERA OF FELIDÆ.

* Four molars above on each side (pm. $\frac{3-3}{2-2}$); tail at least half the length of trunk; fur compact and glossy; shoulders high; ears not tufted at tips. FELIS.

** Three molars above on each side (pm. $\frac{2-2}{2-2}$); short truncated tail; ears triangular, tufted. LYNX.

GENUS FELIS. Linnæus.

Etymology—Latin, *Felis*, a cat.

1735. *Felis*, Linnæus, *Sytema Naturæ*, I.

The Cats are readily known from the Lynxes by the generic marks given above. They are marked externally by the long tapering (sometimes tufted) tail, always as long as half the body, exclusive of head and neck. The fur is compact, close and glossy, often with symmetrical patterns of coloration. The ears have no pencil of hairs at the tip. The general aspect is cat-like.

Besides *F. concolor*, the Panther, the type of the American species, four representatives of this well known genus are found in the United States: *F. onca* (Linnæus), the Jaguar, or American Tiger, from the Red River of Louisiana south to Patagonia, the largest of the American cats; *F. pardalis* (Linnæus), the Ocelot, or Tiger Cat, from the Red River throughout the lower country of Texas; *F. eyra* (Desm.) the Tiger Cat, a uniform brownish-red cat of the size of the house cat, from the Rio Grande of Texas through Mexico and Central America to Guiana; *F. yaguarundi* (Desm.), a grizzled, brownish-gray cat, larger and more elongate than the common cat. It ravages from the Rio Grande to Paraguay.

FELIS CONCOLOR. (Linnæus).

PANTHER; COUGAR; ROCKY MOUNTAIN LION; PAINTER; PUMA; BLACK PUMA.

1771. *Felis concolor*, Linn., *Mantissa*, 1771, 552.—Erxl., *Syst. Reg. Anim.*, 1777, 511, sp. 17.—Bodd., *El. Anim.*, 1784, 90.—Gmel., *Syst. Nat.*, 1788, vol. i, pt. i, 79, sp. 9.—Schreb., *Säugth.*, 1778, th. iii, 394, tab. civ.—F. Cuv., *Hist. Nat. Mamm.*, 1829, vol. ii, pl. 143.—Cuv., *Ossem. Foss.*, 1825, vol. iv., 40.—Temm., *Mon. Mammif.*, 1827, 134.—Wils., *Illust. Zoöl.*, 1831, pl. i.—Maxilian, *Beitr. Naturg. Brasil.*, 1826, band ii, 358. Reug., *Zoöl. Journ.*, 1835, vol. v., 476.—Fuller, *P. Z. S.*, 1836, 62.—Azara, *Nat. Hist. Quad. Parag.*, 1838, 207.—Swains., *Anim. Menag.*, 106.—Rich., *Zoöl. Beechey's Voy.*, Mam., 1839, 6.—Griff., *Anim. King.* 1827, 436.—Burm., *Weber. Thier. Bras.*, 1854, 88.—Murr., *Geog. Distr. Anim.*, 1866, 100.—Gerv., *Nat. Hist. Mam.*, 1855, 89.—Blainv., *Osteog.*, 1839–64, vol. ii., atl. vi., pls. xi, xiv.—Fisch., *Zoogu.*, 1814, 223, sp. 5.—Id., *Syn.*, 1829, 197.—Jard., *Nat. Libr.*, vol. xvi, 124, pls. iv, v.—Desm., *Mammal.*, 1820, 218, No. 336, pl. 94, fig. 102.—D'Orbig., *Voy. Amer. Merid.*, 1847, 21, *Mamm.*—Barth., *P. Z. S.*, 1861, 141.—Cunningh., *P. Z. S.* 1868, 185.—Sclat., *P. Z. S.*, 1868, 62.—Temm., *Mon. Mamm.*, 1827, vol. i, 134, et App

- 256.—Less., Man. Mamm., 1827, 190, sp. 507.—Coop. & Suck., Nat. Hist. Wash. Terr., 1859, 74, 108.—Baird, U. S. & Mex. B. Sur., 1859, 5.—De Kay, Nat. Hist. N. Y., 1842, 47.—Baird, U. S. P. R. R. Expl. Ex., 1857, vol. viii, 83.—Harl., Faun. Amer., 1825, 94.—Wagn., Suppl. Schreb., 1841, 461.—Aud. & Bach., Quad. N. Am., vol. ii, 1851, 305, pls. xcvi, xcvi, (8vo. ed.)—Less., Nouv. Tab. Regn. Anim., 1842, 56, sp. 512.—Newb., P. R. R. Rep., vi, 1857, 36.—Marcy, Rep. Expl. Red River, 1852, 200.—Woodh., Sitgr. Rep. Zuñi & Colorado, 1854, 47.—Coues, Am. Nat., i, 1867, 286.—Id., Proc. Acad. Nat. Sci. Phila., 1867, 133.—All., Bull. Essex Inst., vi, 1862, 53, 58.—Id., Bull. M. C. Z., ii, 1871, 168.—Jordan, Manual of the Vertebrates, 1878, 16, 2nd ed.
1777. *Felis nigra*, Griff., Syn., sp. 444 (?).—Erxl., Syst. Reg. Anim., 1777, 512, sp. 8.
1788. *Felis discolor*, Gmel., Syst. Nat., 1788, vol. i, pt. i, 79, sp. 12.—Schreb., Säugth., 1778.—Fisch., Zcogu., 1814, 223, sp. 6.—Less., Man. Mamm., 1827, 190, sp. 509.
1827. *Felis unicolor*, Less., Man. Mamm., 1827, p. 190, sp. 508.
1830. *Felis puma*, Shaw, Gen. Zool., 1830, vol. i, 358, pl. cxxxix.—Molina, Saggio Stor. Nat. Chilo, 1810, 245, sp. 8.
1867. *Leopardus concolor*, J. E. Gray, P. Z. S., 1867, 265.—Id., Cat. Carn. Mamm., 1869, 12.—Id., Cat. Mamm. Brit. Mus., 1842, 41.
1869. *Panthera concolor*, Fitzin., Ditzg. Akad. Wiss. Wein., 1869, lix, 629.
1869. *Panthera concolor niger*, Fitzin., Ditzg. Akad. Wiss. Wein., 1869, lix, 634.
1874. *Puma concolor*, J. E. Gray, Ann. & Mag. Nat. Hist., 1874, p. —.

The panther is the second in size of the North American cats. It is larger than the common sheep or largest dog, weighing sometimes one hundred and fifty pounds.

A full sized female, as recorded by Dr. Coues, weighed, without the viscera, eighty pounds; gross weight, estimated, one hundred pounds.

The measurements of the same specimen, taken in the flesh, indicate a fair average :

	INCHES.
From nose to end of tail.....	82.00
Head over frontal curve.....	9.50
Head and body to root of tail.....	50.00
Tail.....	32.00
Stature at shoulders.....	29.00
Fore leg and foot, from elbow.....	15.50
Sole of hind foot.....	11.00
Close girth of chest.....	27.00

The panther, though smaller than the jaguar, *F. onca*, stands higher, owing to the greater relative length of its legs.

In color the panther is not unlike the Virginia deer. The back and sides are of a tawny brownish color, darker on the dorsal line, the under parts dirty white. The only dark markings are a black patch on the upper lip, and on the convexity of the ears; the tip of tail is dusky. The body of the kittens is densely spotted, as usual in this family, and the tail is ringed.

The hair is short, compact, close pressed to skin. The head is small, the ears large, and rounded above; the whiskers are in four horizontal series.

This species is common in Colorado, New Mexico, and Arizona, and ranges from fifty to sixty degrees north latitude to the south extreme of the American continent.

In certain localities of New Mexico and Arizona it wages a terrible warfare upon wild turkeys, destroying hundreds of them, and depopulating their former breeding places to such an extent that in a few years the race will have become almost extinct in this region if measures are not taken to prevent the wholesale slaughter.—[Coues and Yarrow.]

In Dr. Kirtland's list of mammals (Ohio Geological Survey for 1838) is the following :

"*Felis Concolor*" and "*Felis Montana*," Mountain Tiger and Mountain Cat, both known to hunters under the name of 'Catamount.' They both formerly inhabited the State, but have now disappeared. Mr. Dorfeuille has in his museum at Cincinnati well prepared specimens of both species that were taken in Ohio."—[Italics mine. Dorfeuille and his museum are not in existence now, and have not been for years.—LANGDON.]

Mr. Frank W. Langdon, of Madisonville, Hamilton county, Ohio, has given me a series of notes on the mammals of Ohio, chiefly selected from the early histories of the State. From them I select the following :

"The first board of county commissioners offered a bounty of three dollars for wolf and panther scalps under six months old, and four dollars on those over six months old. This bounty was discontinued in 1818." [History of Athens county, Ohio, page 130.—C. M. Walker, 1869.]

The following panther anecdote is taken from the Centennial History of Licking county, Ohio, published at Newark, Ohio, by Isaac Smucker :

"In the autumn of 1805 Jacob Wilson, living within a mile of Newark, was suddenly called to the door of his cabin by the commotion among his swine and pigs. A huge panther had just seized a pig, and when in the act of making off with it was pursued and treed by the dogs not far from the cabin. The pioneer at once seized his trusty rifle and brought it to bear upon the ferocious beast, which at the first fire fell at the root of the tree among the dogs."

GENUS LYNX. Raf.

Lynx, Rafinesque, Amer. Month. Mag., I, Oct., 1817, 437.—Ib., II, 1817, 46.—Aud. & Bach., N. A. Quad., I, 1849, I.

Lyncus, "Gray," DeKay, New York Zool., I, 1842, 50.

Generic Marks.—Molars $\frac{2}{3}$ - $\frac{2}{3}$ (the small anterior premolar of *Felis* absent.) Tail considerably less than half the body, exclusive of head and neck, generally not much longer than head, abruptly truncate at tip.

There are four species of *Lynx* in the United States: the Canada *Lynx*, *Lynx canadensis*, largest of the genus, ranging north, the pads of the feet overgrown with hair so as to be concealed in winter; the other three, *L. fasciatus*, the Red Cat, *L. rufus*, the American Wild Cat, and *L. maculatus*, the Texan Wild Cat, are smaller, have more naked soles, and are more southern in their distribution.

LYNX CANADENSIS, (Desm.) Raf.

CANADA LYNX.

1793. *Lynx*, Penn., Hist. Quad., 1793, 301, sp. 203.
1816. *Felis canadensis*, Desm., Nouv. Dict. d'Hist. Nat., 1816, 108.—Id., Mam., 1820, 224, No. 346.—Gapper, Zoöl. Journ., 1835, vol. v. 203.—Swains. & Rich., Faun. Bor. Am., vol. i, 1829, 101.—Murr., Geog. Distr. Mam., 1866, 101.—Jard., Nat. Libr., vol. xvi, 259, pl. xxxiii.—Less., Man. Mam., 1827, 191, sp. 513.—Harln., Faun. Am., 1825, 98.—Griff., Anim. King., 1827, vol. v, 174.—Fisch., Syn. Mam., 1829, 213, sp. 31.—Less., Nouv. Tab. Regn. Anim., 1842, 57, sp. 548.—Gerv., Hist. Nat. Mam., 1855, 92.
1842. *Lyncus borealis*, De Kay, Nat. Hist. N. York, 1842, 50, pl. x, fig 2.
1842. *Lyncus canadensis*, Gray, Cat. Mam. Brit. Mus., 1842, 46.—Id., P. Z. S., 1867, 276.—Id., Cat. Carn. Mam., 1869, 37, sp. 3.
1847. *Felis borealis*, Temm., Mon. Mam., 1847, vol. i, 109, App., 251.—Less., Man. Mam., 1827, 184, sp. 490.—Id., Comp. Buff., 1839, vol. i, 411.—Wagn., Supp. Schreb., 1841, vol. ii, 519.—Blyth, J. A. S. B., 1842, vol. xi, pt. ii, p. —.
1857. *Lynx canadensis*, Baird, U. S. P. R. R. Expl. Exp., 1857, vol. viii, 99.—Raf., Am. Month. Mag., 1817, vol. ii, 46.—Aud. & Bach., Quad. N. Am., 1849, vol. i, 136, pl. xvii.—Jordan, Manual of the Vertebrates, 1878, 16, 2nd ed.—Le Lynx du Canada, Cuv., Ossem. Foss., 1825, vol. iv, 443.—Buff., Suppl., vol. iii, pl. xlv.—Le Lynx de Mississippi, Buff., Supp., vol., vii, pl. liii.

Specific Marks.—This lynx is the size of a setter dog. The tail is as short or shorter than the head, its last fifth black above, and extreme end

black all round. The feet are large, densely furred in winter so as to conceal the pads. Hind feet about nine inches long. General color grayish hoary with concealed pale rufous, and waved with black, especially on the back; obsolete dark markings on the head; ears with narrow black margin on the convexity, and black pencil of hairs; whiskers chiefly white.

This species may be known from the others by its larger size, and relatively longer hair and feet, independent of color marks. It is nearer *L. rufus* than other American lynxes, but may be at once known by its larger size, fuller fur, larger and densely furred feet concealing the soles. Its relationship to certain European species, *Felis lynx* and *Felis borealis*, is by no means clear.

In the summer pelage the fur is much shorter and less dense; the colors are much the same, with, however, more rufous and less gray. The pads on the feet are distinctly visible in summer, not being overgrown as in winter specimens.

The following measurements were taken from a specimen in the flesh.

	INCHES.
Head	6 $\frac{1}{4}$
Head and body.....	34 $\frac{1}{2}$
Tail, vertebrae	4 $\frac{1}{2}$
Tail, hairs.....	5 $\frac{1}{2}$
Hind feet	9

LYNX RUFUS, (Gm.) Raf.

BAY LYNX; WILD CAT; MOUNTAIN CAT; TIGER CAT.

1776. *Felis ruffa*, Guldenstädt, Nov. Comm. Petrop., xx, 1776, 499.
1788. *Felis ruffa*, Gmel., Syst. Nat., 1788, vol. i, pt. i, 82, sp. 19.—Schreb., Säugth., 1788, th. iii, 412, tab. cix. B.—Desm., Nouv. Dict. d Hist. Nat., 1816, 107.—F. Cuv., Hist. Nat. Mamm., 1828, vol. ii. pl. 141.—Blain., Osteog., 1839, 64, vol. ii, pl. xi.—Desm., Mamm., 1820, 225, No. 347.—Guldenst., Voy. de la Venus, t. 9, fig. 2-4 (skull).—Temm., Mon. Mamm., 1827, vol. i. 141.—Less., Man. Mamm., 1827, 192, sp. 514.—Id., Compl. Buff., 1839, vol. i, 411.—Geoff. St. Hil., Voy. Venus, Zoöl, 1855, 150, pl. ix.—Fisch., Syn. Mamm., 1829, 212, sp. 32.—Less., Nouv. Tab. Règn. Anim., 1842, 57, sp. 549.—Gerv., Hist. Nat. Mamm., 1855, 91.—Blyth, Journ. Asiat. Soc. Beng., 1842, vol. xi, pt. ii, 752.
1829. *Felis maculata*, Vig. & Horsf., Zoöl. Journ., 1829, vol. iv, 380.—Less., Comp. Buff., 1839, vol. i, 411.—Id., Nouv. Tab. Règn. Anim., 1842, 58, sp. 553.

1817. *Lynx rufus*, Raf., Am. Month. Mag., 1817, vol. ii, 46.—Aud. & Bach., Quad. N. Am., 1849, vol. i, 2, pl. i.—Marcy, Expl. Red River, 1852, 200.—Newb., P. R. R. Rep., vi, 1857, 36.—Bd., Mam. N. A., 1857, 90.—Coues, Am. Nat., i, 1867, 287.—All., Bull. M. C. Z., ii, 1871, 168.—Jordan, Manual of the Vertebrates, 1878, 16, 2d ed.
1817. *Lynx floridana*, Raf., Amer. Month. Mag., 1817, vol. ii, 46.
1859. *Lynx rufus* var. *maculatus*, Baird, U. S. and Mex. B. Sur., 1859, 13.—Id., U. S. P. R. R. Expl. Exp., 1857, vol. viii, 93.—Aud. & Bach., Quad. N. Am., 1851, vol. ii, 293, pl. xlii.
1817. *Lynx montanus*, Raf., Am. Month. Mag., 1817, vol. ii, 46.
1867. *Lyncus maculatus*, Gray, P. Z. S., 1867, 297.—Id., Cat. Carn. Mam., 1869, 38, sp. 8.
1817. *Lynx aureus*, Raf., Am. Month. Mag., 1817, 46, sp. 6.—Less., Comp. Buff., 1839, vol. i, 412.
1817. *Lynx fasciatus*, Raf., Am. Month. Mag., 1817, vol. ii, 46.—Baird, U. S. P. R. R. Expl. Exp., 1857, vol. viii, 96.—Suckl., U. S. P. R. R. Expl. Exp., 1860, vol. xii, 109.—Desm., Mamm., 1820, vol. i, 225.
1820. *Felis montana*, Desm., Mam., 1820, 225, No. 349, pl. 98, fig. 2.—Less., Man. Mam., 1827, 194, sp. 522.—Id., Compl. Buff., 1839, vol. i, 411.—Harl., Faun. Amer., 1825, 101.—LeConte., P. A. N. S. Philada., 1854, 9.—Gerv., Hist. Nat. Mamm., 1855, 92.
1820. *Felis floridana*, Desm., Mam., 1820, 225, 350.—Less., Man. Mam., 1827, 194, sp. 523.—Id., Comp. Buff., 1839, vol. i, 412.
1825. *Felis fasciata*, Harl., Fn. Am., 1825, 100.—Swains. & Rich., Faun. Bor. Am., 1829, Mamm., 104.—Murr., Geog. Distr. Mam., 1866, 101.—Cuv., Ossem. Foss., vol. iv. 441.—Buff., Suppl., vol. iii, pl. 44.—Less., Man. Mam., 1827, 193, sp. 520.—Coop. & Suck., Nat. Hist. Wash. Ter., 1859, 109.—Less., Comp. Buff., 1839, vol. i, 411.—Fisch., Syn. Mam., 1829, 212.—Less., Nouv. Tab. Règne Anim., 1842, 57, sp. 550.
1827. *Felis mexicana*, Desm., Mam., 225, sp. 351.—Less., Man. Mam., 1827, 194, sp. 524.—Id., Nouv. Tab. Règn. Anim., 1842, 57, sp. 357.
1827. *Felis mexicana*, Desm., Mam., 325, sp. 359.—Less., Man. Mam., 1827, 194, sp. 525.—Id., Comp. Buff., 1839, vol. i, 411.
1827. *Felix carolinensis*, Desm., Mam., 231.—Less., Man. Mam., 1827, 195, sp. 527.—Id., Comp. Buff., 1839, vol. i, 415.
1859. *Lynx rufus* var. *maculatus*, Baird, U. S. and Mex. B. Sur., 1859, 13.—Id., U. S. Pacific R. R. Expl. Ex., 1857, vol. viii, 93.—Aud. & Bach., Quad. N. Am., 1851, vol. ii, 293, pl. xcii.

1867. *Lynx fasciatus*, Gray, P. Z. S., 1867, 276.—Id., Cat. Carn. Mam., 1869, 38, sp. 6.
 1869. *Panthera concolor maculata*, Fitz., Ditzg. Akad. Wiss. Wein, 1869, lix, 636.

Specific Characters.—Fur moderately full and soft. Above and on sides pale rufous overlaid with grayish, the latter color most prevalent in winter. A few obsolete dark spots on the sides, and indistinct longitudinal lines along the middle of the back. Color on the throat like the sides, but paler. Beneath, white spotted. Inside of fore and hind legs banded. Tail with a small black patch at the end, with indistinct sub-terminal half rings. Inner surface of ears black, with a white patch.

This species has a very wide range, and varies much both with place and season. Those from different localities vary much at the same time.

The synonymy of *Lynx rufus* covers the three sub-species into which Dr. Coues thinks this species is separable—*Lynx rufus*, var. *rufus*, the common bay lynx, which reaches from the Atlantic to the Pacific coast throughout nearly the whole breadth of the United States; *Lynx rufus*, var. *fasciatus*, of the moist north-west coast of Oregon and Washington Territory, is a heavily colored red form; lastly, var. *maculatus*, the profusely banded and spotted form from Florida, described by Prof. Baird.

In one specimen the length of head and body was $28\frac{3}{4}$ inches, tail 7 inches. Another, 27 inches in length, was $15\frac{1}{2}$ inches high at the shoulder, and $6\frac{1}{2}$ inches from heel to end of hind foot. With reference to the variation of *L. rufus* in size and color, Prof. Baird states that in many of our animals of wide distribution there appear to be, as in this case, several races as far as color and dimensions are concerned, in particular species; skulls of the same sex and relative age being different in size. This is particularly true with the cats, deer, bears, and raccoons, and as a general rule the farther south we go the smaller the species. Northern skins of wild cats have the hair longer and softer through the year than southern, while, as in the deer, the hair will have a reddish or bay tinge, replaced by grayish in the winter.

Judge Burgoyne informs Mr. Langdon that wild-cats were occasionally taken in the vicinity of Cincinnati as late as 1814. It is scarcely likely that any remain to the present time, although they are often found in Eastern Kentucky and Tennessee.

FAMILY CANIDÆ.

The Dogs are digitigrade Carnivora, with blunt, non-retractile claws. The feet are, apparently, all four-toed, but the foremost ones have a rudimentary thumb higher up, to which a claw is attached (sometimes wanting). The dentition is typically i. $\frac{3-3}{2-2}$; c. $\frac{1-1}{1-1}$; pm. $\frac{4-4}{2-2}$; m. $\frac{2-2}{2-2}$ =42.

This family is connected to the cats by the hyenas, of which no species occur in North America. Indigenous species of dogs occur in all habitable regions, and the domestic dog thrives wherever man has a foothold.

The dogs are separated from the cats externally by the long, sharp muzzle, small eyes, long hair, bushy tail, contracted belly, and pointed, erect ears; they are related to the hyenas by the blunt, non-retractile claws, by their digitigrade feet, and general appearance.

The *Canidæ* vary much in size from the largest wolves to the California coast fox, scarcely larger than the domestic cat.

There are two groups or sub-families of North American *Canidæ*, the wolves, including the domestic dog, and the foxes. These groups are related by the South American foxes—a fox-like wolf directly intermediate between the fox and wolf forms of Europe and North America.

In the wolves the tail is short, the pupil circular, and the median upper incisors very distinctly lobed on each side; the post-orbital process of the frontal bone is triangular, convex on its upper surface, with its point below the plane of the inter-orbital space. Sub-family *Lupinæ*.

In the foxes the tail is bushy, the pupil elliptical, and the whole form more slender; the upper incisors are scarcely lobed, and the post-orbital process of the frontal bone bent but little downward, the anterior edge turned up; a longitudinal shallow pit or indentation at its base. Sub-family *Vulpinæ*.

The South American fox-like forms (*Lycalopex* and *Pseudalopex* of Burmeister) have the circular pupils and wolf-like character of the post-orbital process, but their tails are even larger than those of the true foxes, reaching to the ground. Prof. Baird, therefore, includes them in the sub-family *Lupinæ*.

KEY TO THE GENERA OF CANIDÆ.

- * Post-orbital process of the frontal bone very convex and curving downwards, with little or no depression or indentation in its upper surface; pupil circular; tail comparatively short; upper incisors distinctly lobed on each side. CANIS.
- ** Post-orbital process bent but little downwards, the anterior edge turned up; a longitudinal shallow pit or indentation at its base; tail long and bushy; pupil elliptical; body more slender; upper incisors scarcely lobed.
- † Tail with soft fur and long hair uniformly mixed; muzzle long; temporal crests coming nearly in contact. VULPES.
- †† Tail with a concealed mane of stiff hairs, without soft fur intermixed; muzzle shorter; temporal crests always widely separated. UROCYON.

GENUS CANIS (Lin.)

Canis, Lin., Systema Naturæ, I, 1735.

The generic characters of *Canis* are included in the description already given. To separate *Canis* from the South American fox-like wolves, *Lycalopex* and *Pseudalopex*, of Burmeister, we have the completely circular pupil, large size, and short tail, as opposed to the smaller size, longer tail, slender muzzle, and pupil varying from round to elliptical of the South American genera.

CANIS LUPUS OCCIDENTALIS. (—.) —.

AMERICAN WOLF; TIMBER OR BUFFALO WOLF; LOBO OF THE MEXICANS; WHITE, GRIZZLED, GRAY AND BRINDLED, RED, DUSKY, AND BLACK WOLVES OF AUTHORS.

a. *White Wolves*.

1829. *Canis lupus albus*, Sabine, Journ., 652.—Rich., F. B. A., i, 1829, 68.—A. & B., ii, 156, pl. 72. White, pure or washed with yellowish, with or without black-tipped tail. Among the largest of the species. Northerly and alpine.

b. *Grizzled Wolves*.

1857. *C. occidentalis*, var. *griseo-albus*, Newb., P. R. R. Rep., vi, 1857, 37; Coues, Am. Nat., 1867, 288.—*C. variabilis*, Maxim.—*C. griseo-albus*, Baird, 104. White, more or less grizzled with gray; large, and rather northerly. An intermediate link between a and

c. *Gray and Brindled Wolves*.

C. lupus, of authors.—*Lupus occidentalis*, Peale, U. S. Expl. Ex., 1848, 26.—Marcy, Expl. Red Riv., 1852, 200.—*Lupus gigas*, Townsend, Proc. Phila. Acad. Nat. Sci., 1850, ii, 75. Gray, of variable shade and pattern, generally brindled; darker along the dorsal aspect, paler or white below; little or no rufous; medium size, most general distribution.

d. *Red Wolves*.

C. lupus, var. *rufus*, A. & B., ii, 240, pl. 20.—*C. occidentalis* var. *rufus*, Bd., 113. Mixed reddish and black, paler below. Small, southerly, especially Texas.

e. *Dusky Wolves*.

C. nobilis, Say., Long's Ex., 1823, i, 168.—*C. occidentalis*, vars. *nobilis* and *mexicanus*, Bd., 111, 113. Dusky or plumbeous brown, with or without darker muzzle band and leg stripe. Small, chiefly southerly.

f. *Black Wolves*.

C. lupus ater, Rich., F. B. A., 1829, i, 70.—A. & B., ii, 126, pl. 67.—*C. occidentalis*, var. *ater*, Bd., 113. Black or nearly so. Small, chiefly southerly, especially Florida.

Specific Characters.—This wolf is the largest of the genus, from 3 to 5 feet long, average about 4; tail 12 to 18 inches; skull 8 to 11 inches, usually 9 to 10; width of skull $4\frac{3}{4}$ to $5\frac{3}{4}$, generally about $5\frac{1}{4}$ inches. Color indeterminate, varying from pure white to grizzled gray and brindled wolves, through mixed reddish and black forms to dusky or plumbeous brown, and even black.

The colors are indicated in the accompanying synonymy by Dr. Coues, who has made six groups of the American wolf, based on the color. The distribution is given in the synonymy. The more usual color, it will be noticed, is the gray, a form of medium size and most general distribution. Should a stray wolf still remain in the hills of Southern Ohio, or occasionally stray over from the mountainous regions of Kentucky, this would be the probable form.

The gray wolf is found all over North America to the arctic regions, the others are more local in their range. A pure white is found in the Upper Missouri and in alpine regions, a dusky, blackish, plumbeous wolf in the Lower Missouri region, an entirely red or rufous in Texas, and an entirely black wolf in Florida and the Southern States; these varying conditions of albinism and melanism, from arctic to southern regions, and the diminution in size toward equatorial latitudes, are well marked in this species. The study of the synonymy is instructive, showing that a species cannot be properly named and defined until collections have been made from all parts of its range, and careful comparisons made between apparently distinct species.

Since the above was written I have the following notes from Mr. Langdon:

In a "History of Seneca County, Ohio," by C. W. Butterfield, published at Sandusky in 1848, I find the following remarks on wolves:

"Wolf Creek, another tributary of the Sandusky, rises in the south-west part of the county (etc. * * * *). This stream, running through a level country, is somewhat sluggish. It received its name from the circumstance of a great number of wolves formerly inhabiting the swamps near its source, and the thickets around the wet prairie a little west of its mouth."

The following extract is taken from the "Pioneer History of the Ohio Valley," Hildreth; 1848, Cincinnati:

"The wolf for thirty years was a great hindrance to the raising of sheep, and for a long period the State paid a bounty for their scalps. Neighboring farmers often associated and paid an additional bounty of ten or fifteen dollars, so as to make it an object of profit for certain old hunters to employ their whole time and skill in entrapping them. At this period (1848) the race is nearly extinct in the Ohio Company's lands."

Dr. Kirtland speaks of the wolf as "becoming very rare"—Ohio Geol. Survey, 1838. List of mammals of Ohio.

GENUS VULPES. Brisson.

To the Sub-family characters already indicated may be added: tail with soft fur and long hair, uniformly mixed; muzzle long; temporal crests coming nearly in contact. These, with the "dissimilarity in color, and a difference in build, easier to remark upon comparison than to express in words, readily distinguish the red fox in any of its pelages from the gray fox." (*Urocyon virginianus*.)

The American foxes included in this genus are the Arctic Fox (*V. lagopus*, Rich); the Swift Fox (*V. velox*, Aud. and Bach.) of the plains west of Missouri to Oregon; the Large Prairie Fox (*V. macrurus*, Baird) of the Upper Missouri to plains of Oregon, and the American Red Fox (*V. vulgaris pennsylvanicus*, (Bodd.,) Coues), which in three well marked color varieties is distributed from the Atlantic to the Pacific.

VULPES VULGARIS PENNSYLVANICUS. (Bodd.) Coues.

AMERICAN RED FOX.

- 1784. *Canis vulpes*, var. *pennsylvanicus*, Bodd., Elenchus Anim., 1784, 96 (from Pennant.)
- 1820. *Canis fulvis*, Desm., Mamm., i., 1820, 203 (from Pal. de Beauv.). Fr. Cuv., Diet. Sci.
- 1829. *Vulpes fulvus*, Rich., Fn. Bor. Am., i., 1829, 91.—Fischer, Syn., 1829, 191.—De Kay, N. Y. Fn. i. 1842, 44, pl. 7, f. 1.—Aud. & Bach., Quad. N. A., ii. 1851, 263, pl. 87.—Baird, Mamm. N. A., 1867, 123.
- 1841. *Canis (Vulpes) vulgaris*, var. *fulvus*, Wagn., Suppl. Schreber, ii. 1841, 413.
- 1875. *Vulpes vulgaris pennsylvanicus*, Coues, Geolog. and Geog. Surveys West One Hundredth Meridian, Chap. II., Vol. V. 1875, 52.—Jordan Manual Vertebrates, 1878, 17.

The ordinary variety of the Red Fox (*V. pennsylvanicus*) may be known from its melanotic forms, the Cross Fox (*V. deussatus*) and Black or Silver Gray Fox (*V. argentatus*) by its prevailing color: a bright, clear, yellowish rufous, darker on the shoulders and flanks. The pelage of the Red Fox is long, fine and lustrous. The hair is much silkier and softer than in the Red Fox of Europe (*V. vulgaris*). The convexity of the ears and outside of the legs below are of a glossy black; space around the black snout, edges of upper jaw, chin, throat, breast, and narrow belly-line more or less purely white, as is usually the tip of the tail. The feet are so clothed with long, soft hair that the claws and balls are nearly hidden. The

brush is large and full, the distance between the ends of the outstretched hairs 6 to 7 inches.

In Northern Ohio, according to Prof. Baird, a variety of the Red Fox is not uncommon in which the long hairs of the body and tail are entirely wanting, leaving the soft, silken fur freely exposed. The colors do not vary from the common variety, except that the red is lighter; there is no black on the tail, or grizzling on the hinder back. Prof. Baird states that this condition of the hair has been observed by him in skins of *Canis griseus*, from Chili, as well as in many other species. Regarding this peculiar condition of the pelage, Mr. Allen is of the opinion that it is the result of a disease which produces a crisp, woolly condition of the fur much as though it had been singed; hence the common name of "Sampson" or "Samson" foxes. The same author states that in Van Buren and Allegan counties, Michigan, about one-third of all the foxes taken are of this variety, and that their skins bring much less in market than those of the common Red Fox; the animal, moreover, is represented as less cunning, and more easily trapped, and has slightly different habits from the normal variety. The specimen observed by Prof. Baird was sent him by Dr. Ackley. Whether this variety is still found in the State is not known to the present writer.

Dr. Coues regards the Cross Fox as a "special state of semi-melanism" of the common fox. This variety, common in northern New York, and sometimes as far southward as Pennsylvania and Ohio, receives its name from the presence of a black cross formed by a black band along the back crossed by another on the shoulder. It shades by varying and almost insensible degrees into the Black or Silver-Gray Fox.

Complete, or nearly complete, melanism distinguishes the Black or Silver-Gray Fox, (*Canis* or *Vulpes argentatus*, or *fulvus* var. *argentatus* of authors.) The color is a uniform, lustrous black, with conspicuously white-tipped tail; more or less of the long hairs of the back and flanks, top and sides of head grayish, silvery at the end, giving a silvered appearance to the pelage. The perfectly black pelts are found, chiefly, in high latitudes.

Such pelts are extremely rare, and command a high price in the market; indeed the varying colors determine the value of the pelt, and so are of great commercial importance; they have, however, no classificatory significance.

"While the Cross and Black or Silver Foxes are usually considered as different 'varieties,' they are not such, in the classificatory sense of that term, any more than are the red, black, or white wolves, the black marmots, squirrels, etc. The proof of this is in the fact that one or both of the 'varieties' occur in the same litter of whelps from nor-

mally colored parents. They have no special geographical distribution, although, on the whole, both kinds are rather northerly than otherwise, the Silver Foxes especially so. It does not appear to be ascertained exactly how far the styles of pelage tend to perpetuate themselves; that is to say, in what proportion of cases a cross will produce a cross litter, or a black a black litter; but the inter-breeding of the several varieties, and their purely accidental origin, from parents of the normal coloration are incontestable.”—[Coues and Yarrow, *Zoöl. Expl.*, W. 100 Merid., V. 1875, 53.]

The same authorities state there is no reasonable question of the specific identity of the American and European Red Fox. The same color variations occur in both. Prof. Baird (*Mam. N. A.*, 1857, p. 130) surmises, from the absence of any fossil remains of the Red Fox in the Carlisle (Penn.) and other bone caves, in which the Gray Fox is abundantly represented, that there is basis for the somewhat prevalent belief that the Red Fox of Eastern America is the descendant of the European Fox imported and run wild many years ago, as did the horses imported and set at liberty by the Spaniards. This might account for its abundance in settled districts, but scarcely allows time for its universal distribution over a continent. Coues and Yarrow (*Zoöl. Expl.*, W. 100 Merid., V. 1875, 54) think it a more reasonable hypothesis that, with many other American mammals, it had an original circumpolar distribution in warmer times, and has spread southward in both hemispheres, developing geographical distinctions of race, but not distinct species. The differences, as observed by Audubon, are all comparative, and not positive. With ample opportunity for comparison, he says the American Red Fox “is a little the largest; its legs are less robust; its nose shorter and more pointed; the eyes nearer together; its feet and toes more thickly clothed with fur; its ears shorter; it has a finer and larger brush; and its fur is much softer, finer, and of a brighter color.”

DIMENSIONS OF ANY OF THE AMERICAN VARIETIES.

Nose to root of tail.....	2-2½ feet.
Tail to end of bones.....	12-16 inches.
Tail to end of hairs.....	15-19 “
Height of ear.....	2½-2¾ “
Height at shoulders.....	12-13 “
Skull, in length and width.....	5½x3 “

Regarding the occurrence of the Red Fox in Ohio, and its taking the place of the Gray Fox, Dr. Kirtland writes as follows:

C. (Vulpes) fulvus.—“The Red Fox was unknown in this region of country until the introduction of the white population, and is supposed by many not to have been originally a native of America. It has now become a common and troublesome inhabitant.”

U. virginianus.—"The Gray Fox was formerly very abundant, but it rapidly disappeared before the advancement of cultivation, and its place is now generally filled by a more cunning and sagacious successor, the Red Fox."—[Ohio Geol. Surv., 1838.]

Of this beautiful animal, Thoreau says:

"His pace is a sort of leopard canter, as if he were in nowise impeded by the snow, but were husbanding his strength all the while; when the ground is uneven the course is a series of graceful curves, conforming to the shape of the surface. He runs as though there were not a bone in his back, occasionally dropping his muzzle to the ground for a rod or two, and then tossing his head aloft when satisfied of his course. When he comes to a declivity he will put his fore feet together and slide swiftly down it, shoving the snow before him. He travels so softly that you would hardly hear it from any distance. Sometimes you will see the trail (in the snow) of many together, and where they have gambolled and gone through a hundred evolutions, which testify to a singular listlessness in nature."—[Thoreau's Excursions—Natural History of Massachusetts.]

GENUS UROCYON. Baird.

Urocyon, Baird. Mamm. N. A., 1857.—*Vulpes*, Brisson.

Etymology, Greek, *oura*—tail, and *kuon*—dog.

Type, *Urocyon cinereo-argentatus*, (Schreb.) Coues.

Generic Characters.—Tail with a concealed mane of stiff hairs without any soft fur intermixed; muzzle short; temporal crests always widely separated. A supplementary tubercle on the lower sectorial tooth; under jaw with an angular emargination below. "Mane-tailed foxes." Two species; the type and *U. litoralis* (Baird) of the island of San Miguel, California.

UROCYON CINEREO-ARGENTATUS. (Schreb.) Coues.

GRAY FOX.

1778. *Canis cinereo argentatus*, Schreber, Säug., iii, 1778, 360, pl. 92 (has actual priority over Erxleben.)—Erxl., Syst. An., 1777, 576.—Gm., Syst. Nat., i, 1788, 74.—Shaw, Gen. Zoöl., i, 1800, 324.—Desm., Mamm., i, 1820, 204 (partim).—Harlan, Fn. Amer., 1825, 90.—Griff., An. Kingd., v, 1827, 148.—Godman, Am. Nat. Hist., i, 1831, 280.—Fr. Cuv., Suppl. Buffon, i, 1831.—Doughty's Cab. Nat. Hist., ii, 1832, 145, pl. 14.—Wagn., Suppl. Schreb., ii, 1841, 436 (partly).—Woodh., Sitgreave's Report Expl. Zuni and Colorado, 1854, 46.
1778. *Canis virginianus*, Schreb., Säug., iii, 1778, 361, pl. 92.—Erxl., Syst. An., 1777, 567.—Gm., Syst. Nat., i, 1778, 74.—Shaw, Gen. Zoöl., i, 1800, 325.—Harlan, Fn. Amer., 1825, 89.—Griff., An. King., v, 1827, 150.—Rich., F. Bor. Amer., 1829, 96 (*Vulpes*.)
1784. *Canis griseus*, Bodd., Elench. Anim., i, 1784, 97 (*Ex Penn.*)
1857. *Vulpes (Urocyon) virginianus*, Baird, Mamm. N. A., 1857, 138.

1875. *Urocyon cinereo-argentatus*, (Schreb.) Coues. Report Geolog. and Geogr. Expl. and Surveys West 100dth Meridian, 1875, 56. Jordan, Man. Vert., 1878, 17, 2d edition.

Specific Characters.—Head and body a little over two feet in length: tail rather more than half as long; stiff, with a concealed mane of bristly hairs. Prevailing color mixed hoary and black; convexity and base of ears, side of neck and edges of belly, and more or less of the outer surfaces of the limbs, rich fulvous or cinamon brown; muzzle banded with black, extending on the chin; lower half of head, tip of chin, and sides of muzzle at end white; tail hoary on the sides, a stripe above, and the tip black; rusty below.

The Gray Fox is about as large as the Red Fox. The length is about twenty-eight inches; tail, to end of vertebræ, thirteen to sixteen inches, to end of hairs, fourteen to eighteen inches; ears two and a half inches high; hind foot five inches; skull four and a half to four and two-thirds by two and a third to two and two-thirds inches.

This fox is not subject to the remarkable variations of color already observed in the Red Fox. Different specimens vary in the shade of the grizzled grayish back, exact color-pattern of the black and white on the head, extent and intensity of the fulvous on the neck, flank and limbs; it is always distinguishable by its colors, however, aside from the differences in build, cranium and general appearance.

The Gray Fox occurs in Oregon, Texas, and California, and with the Red extends from the Atlantic to the Pacific. It is not common in New England, and only accidental in Maine and Canada. It is more southern than the Red Fox, being the prevailing species from Virginia southward.

Taking naturally to the woodlands, and shunning the plains, there are, of course, extensive areas on its ordinary parallels where it may never be met, although prevalent on either side of such treeless regions. Coues and Yarrow (Zool. Expl. W. 100dth Meridian), from whom the subsequent note on the comparative habits of the Gray and Red is quoted, consider the present species the characteristic fox of Arizona, being much more abundant than the Red.

“Sharing vulpine traits with its kind, the Gray Fox has, nevertheless, its peculiarities. It is not a burrowing animal, at least to any great extent; and when it digs, the burrow is simple, with a single entrance. It lies concealed in rank herbage, beneath or inside fallen logs, under partially excavated stumps, and similar retreats. This habit is in evident correlation with its woodland range, for, having no such protection as the Red Fox, which takes to the earth any where, it is forced to abide where there are the natural means of concealment just mentioned. This

same habit, moreover, causes a certain modification of the animal's range with the settling of a country; in clearing off forests the Gray Fox is forced to seek elsewhere; although in effect the circumstances that cause removal of one species are precisely those that invite the other, the Red Fox being able to exist in settled regions where the other could find no suitable resorts. It is this that makes the Red a greater nuisance to the farmer: it sticks close to the farm-yard, being forced, in a measure, to thus supply itself, owing simply to its being in more cultivated districts. The Gray Fox subsists more extensively upon the wild game of his habitat. Another distinctive feature is the climbing powers of the Gray Fox, much greater than would be expected from an animal with non-retractile claws, and no great "hugging" powers. When hard pressed the Gray Fox is treed as regularly as the Red is earthed. The climbing seems to be simply an agile leaping along an inclined trunk, or from bough to bough, though it has been noted that the animal can climb a small trunk by clasping, or even with its claws like a cat or raccoon."

FAMILY MUSTELIDÆ.

The Mustelidæ are a strictly defined family of carnivorous mammals, of which the Weasels and Martens are the typical representatives. It includes, also, the Skunks, Badgers, and Otters. Species of the family are found in all parts of the earth, excepting the Australian region. The genera and species are most abundant and differentiated in the Northern Hemisphere (Arctogæa), where the group attains its most perfect development. The most generally distributed and inclusive genus in both hemispheres, is *Putorius*, the true Weasels, although some twenty genera are recognized altogether.

The commercial importance of the family is indicated by the high price set on the pelt of the Otter, Sable, Ermine, and others.

In 1868, the Hudson's Bay Company sold over 100,000 Sables, 73,000 Mink, 14,000 Otters, 6,000 Skunks, 1,100 Wolverines, 1,500 Badgers, 123 Sea Otters. Beside these, many were handled by other companies.

They possess other relations to man worthy of observation. Mink and Weasels are destructive to poultry. The fœtid liquid secreted by the anal glands of most Mustelinæ, is the means of offense and defense in the Skunks, ranking them among the most disgusting and offensive of animals; and they may, moreover, by their bite, occasion one of the most horrible diseases (*Rabies mephitica*) to which the race is liable. The Wolverine is the worst enemy of the fur hunter, destroying his traps and game. The cruel method of hunting the Badger has added a verb to the language; indeed, it may be said there is scarcely a family of un-

domesticated animals of more importance, or whose habits have been more carefully observed.

The closest affinities of the Weasels are with the Bears, next with the Cats. They stand in the carnivorous series between the Canidæ and the Ursidæ. In size they are medium or small, ranging from the Wolverine, weighing thirty to forty pounds, to the least Weasel, but six or seven inches long, and weighing three or four ounces. The feet may be either plantigrade or digitigrade, and, in the Otters, with the toes palmate, adapted for swimming. The feet may be naked or hairy, with or without naked pads; but this does not indicate whether the animal is digitigrade or plantigrade. (Wagner.)

Some are strictly carnivorous; the Otters are piscivorous, while others are omnivorous. The anal glands, with which most species are supplied, secrete a fœtid liquid, which reaches the maximum of offensiveness in the American Skunks.

The diagnostic characters of the family are taken mainly from the molar teeth, and are as follows:

Family Characters.—Carnivora, with a single tubercular molar tooth only, on either side of each jaw; the sectorial pre-molar of typical shape (rarely, in *Enhydrinæ*, with blunt tubercles). Molars $\frac{1}{2}$ - $\frac{1}{2}$ (in Old World genus *Mellivora* $\frac{1}{2}$ - $\frac{1}{2}$). Feet five-toed plantigrade or digitigrade. Cæcum wanting, as in *Ursidæ*.

Sub-families and Distribution.—The Mustelidæ include, according to Dr. Gill, eight sub-families, three of which, namely, *Mellivorinæ*, *Zorillinæ*, and *Helictidinæ*, are confined to the Old World. The remaining five sub-families *Mustelinæ*—Wolverines, Martens, and true Weasels; *Mephitinæ*—the Skunks; *Melinæ*—the Badgers; *Lutrinæ*—the Otters; *Enhydrinæ*—the Sea Otter, are neither of them peculiar to North America. *Mustelinæ* and *Lutrinæ* are of general distribution in both hemispheres; the lone representative of *Enhydrinæ*, the Sea Otter, is found on both coasts of the North Pacific. The Badgers do not occur in South America, but are common in the Old World. The three genera of Skunks found in North and South America are absent from the Old World, but are replaced by the African *Zorillinæ*.

Four of the sub-families are represented in Ohio—*Mustelinæ*, by the Martens and Weasels; *Mephitinæ*, by the Skunks; *Melinæ*, by the Badgers; and *Lutrinæ*, by the Otters. Of the seven genera and twenty-three species recognized by Professor Baird (Mam. N. A., 1857), Dr. Coues (Mon. N. A. Mus.) admits sixteen species distributed in eight genera. Six species of this family, representing five genera—the Fisher, *Mustela pennanti*; the Common Weasel, *Putorius erminea*; the Common Mink, *Pu-*

torius vison; the Badger, *Taxidea americana*; the Common Skunk, *Mephitis mephitis*; and the Otter, *Lutra canadensis*—may properly be considered as belonging to the mammalian fauna of Ohio. It is quite possible the Little Striped Skunk, *Mephitis putorius*, of the southern and south-western States, should be added to this list of Ohio Mustelidæ. The same may be said of the least Weasel, *P. vulgaris*, of the northern United States, and North, although the lack of citations from the middle States is negative evidence of the distribution at present accepted.

SUB-FAMILIES AND GENERA OF OHIO MUSTELIDÆ.

* Skull with the cerebral portion comparatively compressed backwards; and with the rostral portion comparatively produced, attenuated, and transversely convex above; anteorbital foramen small and opening forwards; feet with little or no interdigital membrane (and the species, with few exceptions, not aquatic).

† Auditory bulla much inflated, undivided, bulging, and convex forwards; periotic region extending little outwards or backwards; palate moderately emarginated.

‡ Last molar of the upper jaw (m. 1) short, small, transverse (with the inner edge inflated at its inner angle); sectorial teeth with a single inner cusp; m. $\frac{1}{2}$; first true molar (sectorial) of upper jaw, followed by a second (tubercular) one; toes short, regularly arched, with last phalanges bent up, withdrawing the claws into sheaths. (Sub-family *Mustelinæ*.)

a. Teeth 38; pm. $\frac{4-4}{4-4}$; body slender; feet and progression digitigrade; sole densely furry with naked pads; lower first molar with an internal tubercle; pelage long and soft. MUSTELA.

aa. Teeth 34; pm. $\frac{3-3}{3-3}$; body slender; feet digitigrade; sectorial tooth without internal tubercle; pelage close and short. PUTORIUS.

‡‡ Last molar of upper jaw (m. 1) enlarged and more or less extended longitudinally; m. $\frac{1}{2}$; toes straight with the last phalanges and claws extended; claws non-retractile (Sub-family *Melinæ*). Body short and stout; tail very short; teeth 32. TAXIDEA.

†† Auditory bulla little inflated, transversely constricted behind the meatus auditorius externus, and thence inwards; in front flattened forwards; periotic region expanded outwards and backwards; palate deeply emarginated (Sub-family *Mephitinæ*). Snout pointed; nostrils lateral; tail long and bushy; foetid perineal glands highly developed; colors black and white, massed in large areas; teeth 32; pm. $\frac{3-3}{3-3}$.

MEPHITIS.

** Skull with the cerebral portion swollen outwards and backwards; and with the rostral portion abbreviated, high and truncated forwards, and widened and depressed above; anteorbital foramen enlarged and produced downwards and backwards; feet with well developed interdigital membrane, and adapted for swimming. (The species highly aquatic, one—the Sea Otter—marine.)

Teeth, normal, 36 (m. $\frac{1}{2}$; pm. $\frac{4}{3}$; c. $\frac{1}{1}$; i, $\frac{3}{3} \times 2$); sectorial tooth (pm. $\frac{4}{3}$) normal, efficient, with an expanded inner ledge; the other molars sub-musteline; posterior feet with normally long digits. (Sub-family *Lutrinæ*.) True molars large, quadrate; body stout, elongate, cylindrical; feet full-webbed; muzzle obtuse; ears small.

LUTRA.

GENUS *MUSTELA*. Linn.

Etymology—Latin, *Mustela*, a Weasel.

Type, *Mustela martes*, Linn.

< *Mustela*, Linn., Syst. Nat., i, 10th ed., 1758.

< *Unerra*, Shaw., Gen. Zoöl., i, 1800; not of authors.

< *Galo*, H. Smith (fide Gray); not of Storr.

= *Martes*, authors after Ray.

> *Pekania*, J. E. Gray, Proc. Zoöl. Soc. Lond., 1865, 107. (Type, *M. pennanti*.)

> *Foina*, J. E. Gray, Proc. Zoöl. Soc. Lond., 1865, 107. (Type, *M. martes fagorum*.)

> *Charronia*, J. E. Gray, Proc. Zoöl. Soc. Lond., 1865, 108. (Type, *M. flavigula*. Bodd.)

Generic Characters.—Dentition: i. $\frac{3-3}{2-2}$; c. $\frac{1-1}{1-1}$; pm. $\frac{4-4}{4-4}$; m. $\frac{1-1}{2-2} = \frac{1-2}{2-2} = 38$. (Same as *Gulo*; one more pre-molar, above and below on each side than in *Putorius*.) Sectorial tooth of lower jaw usually with an internal cusp; form moderately stout; claws strong, curved, acute; tail longer than head, bushy, cylindrical, or tapering; soles densely furry, with naked pads; pelage long and soft, but not shaggy; whole-colored, never whitening in winter; progression digitigrade; habits highly arboreal as well as terrestrial; not aquatic.

The Martens form the connecting link between the Wolverines and Weasels, in the sub-family Mustelinae. Two species are confined to North America—the Fisher (*M. pennanti*) and the American Sable or Marten (*M. americana*); three species belong to the Old World. All yield furs of great value, and slight shades of color, having no classificatory value, are recognized by the furriers as distinct species, and the pelts sold at high prices, the most fashionable shade, of course, commanding the highest price.

The Martens are agile and graceful in their movements, spend much of their time in trees; they are strictly predacious, destroying many small mammals and birds, and even porcupines and raccoons; but are not so ferocious and bloodthirsty as the Weasels, which seem to destroy life without apparent object.

MUSTELA PENNANTI. Erxl.

PEKAN; PENNANT'S MARTEN; FISHER; BLACK CAT.

1777. *Mustela pennanti*, Erxl., Syst. An., 1777, 470, No. 10 (based on the Fisher of Pennant; for discussion of name, in question of priority over *canadensis*, Schreber, cf. Bd. op. infra. cit. p. 151).—Zimm.,

- Geogr. Gesch., ii, 1780, 310, No. 208.—J. Sab., Frank. Journ., 1823, 651.—Griff., Cuv. R. A., v, 1827, 125, No. 354.—Less., Man., 1827, 150, No. 405.—Fisch., Syn. Mam., 1829, 217.—Godm., Am. N. H., i, 131, 203.—Bd., M. N. A., 1857, 149, pl. 36, f. 1.—Newb., P. R. R. Rep., vi, 1861, 24.—Gilpin, Tr. Nov. Scot. Inst., ii, 1870, 959.—All., Bull. Minn. Acad. Nat. Sci., 1874, 69.—Jordan, Manual of Vertebrates, 1878, 18.
1777. *Mustela canadensis*, var. *alba*, Rich., op. cit., 54 ("White Pekan"; albinism.).
1778. *Mustela canadensis*, Schreb., Säug., iii, 1778, 492, pl. 134 (based on the Pekan of Buffon; not *M. canadensis* of Erxl., which is *Putorius vison*).—Zimm., Georg. Gesch., ii, 1870, 309, No. 207.—Bodd., Elench. An., i, 1874, 86.—Gm., S. N., i, 1778, 95.—Turt., S. N., i, 1806, 59 (not same name as on p. 57, which is the American Otter).—Kuhl, Beitr., 1820, 74.—Desm., i, 1820, 183, No. 284; Ency. Méth., pl. 80, f. 4; Nouv. Dict., xix, 379.—Harl., Fn. Amer., 1825, 65.—Less., Mam., 1827, 149.—Griff., Cuv. R. A., v, 1827, 124, No. 353.—Fisch., Syn., 1829, 216.—Rich., F. B. A., i, 1829, 52, No. 18.—Rich., Zoöl. Voy. Blossom, 1839, 10*.—Fr. Cuv., Dict. Sci. Nat., xix, 256.—Martin., P. Z. S., 1833, 97 (anat.).—Emmons, Rep. Quad. Mass., 1840, 38.—Wagn., Suppl. Schreb., ii, 1841, 223.—De Kay, N. Y. Zoöl., i, 1842, 31, pl. 13, f. (skull).—Aud. & Bach., Q. N. A., i, 1849, 307, pl. 41.—De Kay, Fifth Ann. Rep. Reg. Univ. N. Y., 1852, 33 pl. (orig. fig.).—Thomps., N. H. Vermont, 1853, 32.—Kenn., Trans. Ill. State Agric. Soc., vi, 1853-4, 578 (Ill.).—Kneel., Proc. Bost. Soc., vi, 1858, 418.—Giebel, Odontog., 36, pl. 12, f. 1; Säug., 1855, 773.—Maxim., Arch. Naturg., 1861, 229.—Billings, Canad. Geol. and Nat., ii, 1857, 116.—Kneel., Proc. Bost. Soc., vi, 1859, 418 (skeleton).—Hall, Canad. Nat., vi, 1861, 296.—Maxim., Verz. N. A. Säug., 1862, 43.
1784. *Mustela melanorhyncha*, Bodd., Elench. An., 1784, 88, No. 13 (based on Fisher of Pennant).—Zimm., in Penn., Arkt. Zoöl., 1187, 83.
1800. *Viverra canadensis*, Shaw, Gen. Zoöl., i, 1800, 429.
1800. *Viverra piscator*, Shaw, Gen. Zoöl., i, 1800, 414 (based on Fisher of Pennant).
1806. *Mustela nigra*, Turt., ed. L. S. N., i, 1806, 60 (Fisher Weasel of Pennant.).
1827. *Mustela piscatoria*, Less., Man., 1827, 150, No. 403 (quotes *Pennanti*, Erxl. with query).

Distribution.—The habitat of the Peka is approximately between 35° and 65° in wooded districts throughout the greater part of North America. East of the Mississippi it does not occur throughout its prescribed range. As the country has been cleared it has been forced to the distant forests, and is now almost unknown in the Middle States. It was abundant and troublesome in New York as late as 1840, but is now restricted to the mountains of the State, and to the thinly settled portions.

Its remains are found abundantly in the bone caves of Pennsylvania (Baird), and the animal still exists in the mountains of Perry county, north of Carlisle.—(Coues). It is rare in Canada, and but two hundred are taken yearly in Nova Scotia. It probably occurs in the Hoosac Mountains (Allen), and, according to Dr. Emmons, was found near Stamford, Vermont, as late as 1840.

Description.—In its long head, bushy tail and large size the Peka is more fox-like than musteline in general appearance. It ranges in weight from eight and a half to eighteen pounds, and is often as large as a fox two-thirds grown. The males are larger than the females. When full grown they measure thirty inches from nose to root of tail. Many are but twenty-four inches long, and others are even a third longer. The tail-vertebræ are fourteen inches (12 to 16); nose to eye two inches; nose to occiput over curve of head, sixteen and a half inches; distance between tips of ears, seven inches; hind foot, four and a half inches; fore leg, from elbow, six or seven inches; hind leg, from hip, nearly twelve inches.

Specimens vary in color with age and season. The belly, legs, and tail are black or blackish brown; the hinder part of the body above is much the same. On the rest of the upper parts there is a mixture, first of brownish, then of yellowish gray, conspicuous on the shoulders and nape, growing still lighter on the top and sides of the head. These variations are due, mainly, to the long, coarse hairs, which are lustrous black on the tail, except a reddish-gray tinge at the base. This shade extends further along the hair, becoming purer and lighter on the middle back, until, on the shoulders, the hairs have smoky-brown bases and blackish tips, which are overpowered by the intervening brownish-white. The soft under fur is brownish-plumbeous, lighter at the base. Irregular white blotches, even in the darkest specimens, are found on the chest, arm-pits, and between the thighs; the throat may show a few white hairs. The animal is darker below than above; an exception to the usual coloration in this group.

The eyes are large for the genus; the ears are low, but very wide; the muzzle large. The tail is but little shorter than the trunk, bushy at base, tapering rapidly and evenly to an acute tip.

The feet are short and stout, armed with sharp claws. There is a naked ball under the end of each of the five digits, and a V-shaped callosity on each palm and sole. A tenth pad is found near the outer border of the wrist, far back from the others. This pad is wanting on the hind feet.

History and Habits.—The name *Fisher*, applied to this species, as suggested by DeKay, may have been given from its propensity to steal the fish used by trappers for bait, or frozen fish laid up for food. It is an appellation of uncertain origin, inapplicable, as the species is not aquatic, and does not fish or eat fish habitually, therefore, Dr. Coues thinks *Pekan* a better common name, as it does not mislead or perpetuate the existing confusion.

The *Pekan* is carnivorous and predacious; prefers meat to fish. If its natural food fails, it takes to a vegetarian diet, feeding freely on beech-nuts. Richardson was informed that "its favorite food was the Canada Porcupine, which it kills by biting on the belly;" also, that it preys much upon Frogs in the summer time.

The smaller quadrupeds—Mice, Moles, as well as the Hare, Rabbit, and Grouse—fall a prey to the *Fisher*; and the closely allied *Pine Marten* does not always escape. It successfully assaults the *Raccoon*, so that in some localities the abundance of *Raccoons* would seem to be dependent on the scarcity of the *Pekan*.

They are nocturnal in their habits, but not so much so as the *Foxes*. They are very strong for their size; they tear down the wooden traps of the hunter, visiting them regularly, as do the *Wolverines*, to get the bait.

Unlike the *Wolverine*, they do not drag off and bury the sticks of the trap, nor are they as cunning, being readily taken in steel traps. When taken young, it is easily domesticated, grows fat, and is as playful as a kitten.

The *Pekan* is stated to breed but once a year, producing two to four young at a litter. It selects for its breeding place the hollow of a tree, having its entrance some thirty or forty feet from the ground.

It defends its young savagely.

GENUS PUTORIUS. Cuvier.

Etymology—Latin, *putor*, a stench.

< *Mustela*, or *Martes*, of some authors.

= *Putorius*, Cuvier, Regne Anim., i, 1817, and authors.

= *Foxorius*, Keys & Blas., Wirbelth. Eur., 1840.

> *Gymnopus*, Gray, Cat. Mamm. Br. Mus., 1842.

> *Lutreola*, "Wagner," Gray, P. Z. S., 1865, 117. Type *Mustela lutreola*, Linn.)

> *Gale*, "Wagner," Gray, P. Z. S., 1865, 118.

> *Neogale*, Gray, P. Z. S., 1865, 114. (Type *P. brasiliensis*.)

> *Vison*, Gray, P. Z. S., 1865, 115. (Type *P. vison*.)

Generic Characters.—Dentition: teeth 34; i. $\frac{3-3}{2-2}$; c. $\frac{1-1}{1-1}$; pm. $\frac{3-3}{2-2}$; m. $\frac{1}{2}-\frac{1}{2}$; sectorial tooth of lower jaw without an internal cusp; size moderate (in it are the smaller musteline species); body slender, cylindrical; legs short; tail long, terete; ears long, orbicular; pelage usually close and short; usually white in winter in northern species.

This genus contains the true Weasels or Stoats (sub-genus *Gale*), the Ferrets or Polecats of the Old World (sub-genus *Putorius* proper), the American Ferret (sub-genus *Cynomyonax*), and the Minks (sub-genus *Lutreola*).

The most notable difference between this genus and *Mustela*, is in the dentition, *Putorius* having one less molar on each side above and below.

The size is usually not as great, and the body typically slenderer.

PUTORIUS (SUB-GENUS, GALE) ERMINEA. A. & B.

STOAT OR ERMINE; COMMON WEASEL.

Etymology of specific name—"This is a little beast, lesse than a Squirrel, that hath his being in the woods of the land of Armenia, whereof hee taketh his name."—Gwillim, "Display of Heraldrie."

Synonymy—General References.

- 1748. *Mustela candida*, s. *ermineum*, Linn., Syst. Nat., eds. 6th and 7th.
- 1751. *Mustela armellina*, Klein., Quadrupeds, 63.
- 1754. *Mustela erminea*, Linn., Syst. Nat., 12th ed., i, 1766, 68, No. 10.—
Erxl., Syst. An., 1777, 474, No. 13.—Schreb., Säug., iii, 1778, 496,
pl. 137.—Fr. Cuvier, Dict. Sci. Nat., xxix, 1823, 250.—Fisch.,
Syn., 1829, 222.—Bell, Br. Quad., 1837, 148.—Gray, List. Mamm.
Br. Mus., 1843, 65.
- 1788. *Mustela erminea*, a. *æstiva*, b. *hyberna*, Gm., S. N., i, 1788, 98, Nos.
10 a., 10 b.
- 1800. *Viverra erminea*, Shaw, Gen. Zool., i, 1800, 426, pl. 99.
- 1827. *Putorius erminea*, Griff., An. King., v. 1827, 122, No. 345.

American References.

1772. *Mustela erminea*, Forst., Phil. Trans., lxii, 1772, 373.—Harlan, F'n. Amer., 1825, 62.—Godman, Am. Nat. Hist., i, 1831, 193.—Hall, Canad. Nat. and Geol., vi, 1861, 295.
1851. *Mustela erminea*, var. *americana*, Gray, P. Z. S., 1865, 111.
1851. *Putorius erminea*, A. & B., Quad. N. A., ii, 1851, 56, pl. 59.—Allen, Proc. Bost. Soc. Nat. Hist., xiii, 1869, 183.—Jordan, Man. Vert., 1878, 18, 2d ed.
1840. *Putorius noveboracensis*, DeKay, N. Y. Zool., ii, 1842, 36, pl. 12, f. 2 (winter), and pl. 14, f. 2 (summer).—Emmons, Rep. Quad. Mass., 1840, 45.—Baird, M. N. A., 1857, 166, pl. 36, f. 3, skull.—Kennicott, Tr. Ill. State Agr. Soc., 1853-4, 578.—Sam., Ann. Rep. Mass. Agr., for 1861, 1862, 156, pl. 1, f. t.

Distribution.—The Ermine inhabits Europe, Asia, and America, extending north to the limit of existence of terrestrial mammals. It extends south to very nearly the southern border of the United States; no specimens, however, are recorded from the Gulf States, or from New Mexico, Arizona, or Southern California. The range south meets that of *P. brasiliensis*, which conducts the genus into South America.

Specific Character.—The Ermine is about ten inches (8-11) to root of tail; the tail vertebræ, two to five, averaging three and a half to four inches. Tail at all seasons bushy, conspicuously black tipped for about two-fifths, generally, of its length. Outstretched hind feet do not quite reach to the middle of the vertebræ. In summer, dull mahogany or chestnut brown above; fall, sulphury-yellow or whitish beneath; edges of upper lip white; in winter, pure white all over, except tinges of sulphury-yellow, particularly on the belly and hind quarters, and end of tail black. Weight of male, five to eight ounces; of the female, scarcely four.

Relationship.—Dr. Coues, in the "North American Mustelidæ," admits six species of *Putorius*; *P. vulgaris*, Least Weasel; *P. longicauda*, Long-tailed Weasel; *P. brasiliensis frenatus*, Bridled Weasel; *P. nigripes*, Black-footed Weasel; *P. vison*, Common Mink; and the present species, *P. erminea*. Extralimital species are *P. fœtidus*, the well-known "Fitch" of commerce, or "Polecat" (Polish Cat?) of Europe; *P. fœtidus* var. *furo*, the well-known Hunting Ferret, only recognized in a state of domestication; *P. fœtidus* var. *eversmanni*, the Asiatic Polecat, possibly the same as *P. fœtidus*.

The Ermines of Europe, Asia and America are specifically identical.

The author above cited, after a careful review of the three currently

recognized species of American Ermines, *P. noveboracensis*, De Kay, *P. richardsoni*, Bonaparte (= *agilis* Aud. & Bach.), and *P. cicognani* of Bonaparte (= *fuscus* A. & B.), concludes that the American Ermines are of two forms in size alone, and these grade insensibly into each other; also, that no question of coloration, stoutness of body, shape of ear, furriness of feet, character of pelage, can be considered with reference to specific variation, these details depending on fortuitous circumstances of sex, age, season and locality, as merely normal individual variability; moreover, that within certain defined limits neither the length of the animal, of the tail absolutely or relatively to the body, nor length of the black portion absolutely or relatively to length of tail, have any value in specific diagnosis.

Description of External Characters.—The extreme length, cylindrical body, shortness of the limbs, exceptionally long neck, suggests a group of carnivores, fitly called “vermiform”; these features, taken with the low forehead, flat, triangular head, bent forward upon the uplifted and outstretched neck, and small, penetrating eyes full of cunning, suggests the serpent almost as fully as they do the quadruped.

The greatest circumference of the body is little more than half its length; the head is shorter than the neck, bulged at the sides by the masses of temporal and masseteric muscles; the head, across the ears, is two-thirds its length; the small eyes, glittering with changing hues, are midway of the nose and ear; the nostrils are small and circular; the gape of the thin-lipped mouth extends to below the eyes; the ears are high above the fur, rounded, furred inside and out; the whiskers are few, the longest exceeding the head; a few slender bristles grow over the eye and on the cheek. The limbs are stout, tapering to the wrist and ankle; the digits are all clawed, the claws sharp, slightly curved, and moderately stout, adapted for climbing, but not effective in the chase; the feet are densely furred or not, according to the season and latitude; the foot is so densely hairy, in boreal specimens, that, as in the Hare, or Ptarmigan, the palmar tubercles are invisible; the pads are ten on each foot, under each toe are (5), four palmar (9), and one at the wrist (10); these may be readily seen in summer or southern specimens. The extremely variable tail is furred throughout, and has a terminal pencil of black hairs.

As to its fur, like that of its group, it increases in softness, fineness, and density toward the north, and in winter in all latitudes. In the summer, and southward, it is thinner, stiffer, and harsh from admixture of long, bristly hairs. In its summer dress, the Ermine illustrates the “bicolor” pattern, the upper parts ranging from a uniform dull yellow-

ish-brown to a rich mahogany brown, or mink color. Below, the animal is white, tinged with sulphury-yellow, the chin, throat, and insides of the legs excepted; these being white; the line of separation between the upper and lower colors is strict, and the shades nearly uniform.

Skins taken in spring and autumn show every possible step of the transition, from the perfect winter to the summer pelage, and *vice versa*. In the winter the animal becomes (with the exceptions already mentioned) so pure a white as to be emblematic. Professor Baird, in his description of an arctic form of this group, says, "as an ermine, the emblem of spotless purity and integrity, I propose to call it (i. e., *P. kaneyi*, Baird) after Dr. Kane."

Much has been written as to the mode of the change from one pelage to the other, both in the Ermine, Arctic Fox, Northern Hare, Hudson's Bay Lemming, and other animals, some contending that it is by the actual change of color of the existing fur, and that this transition from the summer to the winter color is the result of actual change of temperature, and not merely by the advance of the season. Audubon and Bachman observed a captured specimen, from March 6th to 28th, which, in this period, nearly completed the change from white to summer colors. They report: "We have arrived at the conclusion that the animal sheds its coat twice a year; i. e., at the period when these semi-annual changes take place." Dr. Coues concludes that the change is not altogether coincident with, nor independent of, the change of coat, but occurs in both ways, temperature being the immediate controlling agent in the transformation. Northern animals invariably change color semi-annually; southern species do not change at all; in intermediate regions the change is partial. Autumnal skins, having the hair white at base and brown at tip, demonstrate the change in existing hairs.

"We may safely conclude that if the requisite temperature be experienced at the periods of renewal of the coat, the new hairs will come out of the opposite color; if not, they will appear of the same color, and afterward change." (Coues.)

The changes in color screen the Ermine from enemies, and from its prey also, by assimilation of its appearance with the surroundings; moreover, the animal heat from within is more completely retained by a white than by a dark covering, although not so much warmth is received during direct exposure to the sun's influence.

Winter specimens are white, as a rule, in the northern line of States, and northward. From the southern States no white specimens are quoted. In the inter-region, some may change and others not; and the

varying character of successive winters in temperate regions may determine the degree of variance.

The generic name of the Ermine (from *puteo*, to stink) is very appropriate. Under the influence of fear, anger, or of sexual passion, either sex may emit at pleasure an odor only excelled in extent and penetration by the skunk itself. Special glands, as in most of the family, on either side of the anus, just within the verge of the opening, secrete and emit a fluid which, when the anus is slightly everted and the papillæ in which the ducts of the glands terminate erected, may be spirted several inches in a fine spray. The savages will not eat the flesh, so thoroughly impregnated is it with the fœtor.

The female is smaller than the male. She brings forth her young, four or five as an average number, from March to June, according to the climate, but ordinarily in April or May. The breeding places are under logs, in piles of rocks, tree stumps, or hollows. A nest described by Pallas, was in the hollow of a tree. It was very foul. In one compartment was a heap of fresh mice and shrews; in a second, a quantity of rejected skins, feet, and tails of these animals. The mother fought courageously for her two little ones, followed the captor, and could scarcely be repelled.

The pelt was formerly one of the exports of Canada. It is in but little demand at present, not repaying the Hudson's Bay Company the expense of collecting them. Those taken in Siberia have been chiefly sent to China, Turkey, and elsewhere for vestments, the tails being reserved by law as the exclusive perquisite of royalty. Some Indian tribes on the Missouri decorate the regalia of ceremony with the tails, in imitation of royal fashion.

A vivid idea of the character and habits of the Ermine may be found in the following from Audubon:

"Graceful in form, rapid in his movements, and of untiring industry, he is withal a brave and fearless little fellow. Conscious of security within the windings of his retreat among the logs or heaps of stones, he permits us to approach him within a few feet, and then suddenly withdraws his head; we remain still for a moment, and he once more returns to the post of his observations, watching curiously our every motion, seeming willing to claim association as long as we abstain from becoming his persecutor.

"Yet, with all these external attractions, this little Weasel is fierce and bloodthirsty, possessing an intuitive propensity to destroy every animal and bird within its reach, some of which, such as the American

Rabbit, the Ruffed Grouse, and domestic fowl, are ten times its own size. It is a notorious and hated depredator of the poultry-house, and we have known forty full-grown fowls to have been killed in one night by a single Ermine. Satiated with the blood of probably a single fowl, the rest, like the flock slaughtered by the wolf in the sheepfold, were destroyed in obedience to a law of nature—an instinctive propensity to kill. We have traced the footsteps of this blood-sucking little animal on the snow, pursuing the trail of the American Rabbit, and although it could not overtake its prey by superior speed, yet the timid Hare soon took refuge in the hollow of a tree, or in a hole dug by the Marmot or Skunk. Thither it was pursued by the Ermine and destroyed, the skin and other remains at the mouth of the burrow bearing evidence of the fact. We observed an Ermine, after having captured a Hare of the above species, first behead it and then drag the body some twenty yards over the fresh fallen snow, beneath which it was concealed, and the snow lightly pressed down over it, the little prowler displaying thereby a habit of which we became aware for the first time on that occasion. To avoid a dog that was in close pursuit, it mounted a tree and laid itself flat on a limb about twenty feet from the ground, from which it was finally shot. We have ascertained, by successful experiments repeated more than a hundred times, that the Ermine can be employed, in the manner of the Ferret of Europe, in driving the American Rabbit from the burrow into which it has retreated. In one instance, the Ermine employed had been captured only a few days before, and its canine teeth were filed in order to prevent its destroying the Rabbit; a cord was placed around its neck to secure its return. It pursued the Hare through all its windings in its burrow, and forced it to the mouth, where it could be taken in a net or by the hand. In winter, after a snow storm, the Ruffed Grouse has a habit of plunging into the loose snow, where it remains at times one or two days. In this passive state the Ermine sometimes detects and destroys it.

“Notwithstanding all these mischievous and destructive habits, it is doubtful whether the Ermine is not rather a benefactor than an enemy to the farmer, ridding his granaries and fields of many depredators on the product of his labor, that would devour ten times the value of the poultry and eggs which, at long and uncertain intervals, it occasionally destroys. A mission seems to have been assigned it by Providence to lessen the rapidly multiplying number of mice of various species, and other small rodents.

“The White-footed Mouse is destructive to the grains in the wheat-fields and in the stacks, as well as the nurseries of fruit-trees. Le Conte’s

Pine Mouse is injurious to the Irish and Sweet potato crops, causing more to rot by nibbling holes in them than it consumes, and Wilson's Meadow-mouse lessens our annual product of hay by feeding on the grasses, and by its long, tortuous galleries among their roots.

"Wherever an Ermine has taken up its residence, the mice in its vicinity for half a mile around have been found rapidly to diminish in number. Their active enemy is able to force its thin, uniform body into burrows; it follows them to the end of their galleries, and destroys whole families. We have, on several occasions, after a light snow, followed the trail of this weasel through fields and meadows, and witnessed the immense destruction which it occasioned in a single night. It enters every hole under stumps, logs, stone-heaps and fences, and evidences of its bloody deeds are seen in the mutilated remains of the mice scattered on the snow. The little Chipping or Ground Squirrel, *Tamias lysteri* (sc. *striatus*) takes up its residence in the vicinity of the grain-fields, and is known to carry off in its cheek-pouches vast quantities of wheat and buckwheat to serve as winter stores. The Ermine instinctively discovers these snug retreats, and, in the space of a few minutes, destroys a whole family of these beautiful little *Tamias*; without ever resting awhile until it has consumed its now abundant food, its appetite craving for more blood, as if impelled by an irresistible destiny, it proceeds in search of other objects on which it may glut its insatiable, vampire-like thirst. The Norway rat and the common house mouse take possession of our barns, wheat-stacks and granaries, and destroy vast quantities of grain. In some instances the farmer is reluctantly compelled to pay even more than a tithe in contributions towards the support of these pests. Let, however, an Ermine find its way into these barns and granaries, and there take up its winter residence, and the havoc which is made among the rats and mice will soon be observable. The Ermine pursues them to their farthest retreats, and in a few weeks the premises are entirely free from their depredations. We once placed a half domesticated Ermine in an out-house, infested with rats, shutting up the holes on the outside to prevent their escape. The little animal soon commenced its work of destruction. The squeaking of the rats was heard throughout the day. In the evening it came out licking its mouth, and seemed like a hound after a long chase, much fatigued. A board of the floor was raised to enable us to ascertain the result of our experiment, and an immense number of rats were observed, which, although they had been killed in different parts of the building, had been dragged together, forming a compact heap.

"The Ermine is, then, of immense benefit to the farmer. We are of

the opinion that it has been overhated, and too indiscriminately persecuted. If detected in the poultry-house there is some excuse for destroying it, as, like the dog which has once been found in the sheep-fold, it may return to commit farther depredations; but when it has taken up its residence under stone-heaps and fences in his fields or barns, the farmer would consult his interest by suffering it to remain, as by thus inviting it to a home, it will probably destroy more formidable enemies, relieve him from many petty annoyances, and save him many a bushel of grain."

PUTORIUS (LUTREOLA) VISON. (Brisson), Gapp.

AMERICAN MINK.

Etymology: specific name from *Weasel* through *veso*. (Von Martens).

1756. *Mustela vison*, Briss., Quad., 1756, 246, No. 6 (from Canadian specimens, same as described by Buffon and Pennant).—Schreb., Säug., iii, 1778, 463, pl. 1276.—Gm., S. N., i, 1788, 94.—Turt., S. N., i, 1806, 58.—Cuv., R. A., i, 1817, 150.—Harl., Fn. Amer., 1825, 63.—Less., Man., 1827, 148.—Maxim., Reise, i, 1839, 213.—Blainv., Ostéogr., *Mustela*, pl. 13 (teeth).—Thomps., N. H. Verm., 1853, 31.
1772. *Mustela lustreola*, Forst., Phil. Trans., lxii, 1772, 371.—Sab., Frank. Journ., 1823, 652.—Fisch., Syn., 1829, 221 (partly).—Godm., Am. Nat. Hist., i, 1831, 206.—Hall, Canad. Nat. and Geol., vi, 1861, 295.
1777. *Mustela canadensis*, Erxl., Syst. An., i, 1777, 455 (mixed with synonymy of another species, but clearly referable here from the description, which can only apply to the mink. See Bd, M. N. A., text on p. 151.)
1784. *Mustela canadensis* var. *vison*, Bodd., Elench. An., i, 1784, 86 (after Buffon.)
1809. *Mustela winingus*, Barton, Am. Phil. Tr., vi, 1809, 70 (no descr.; St. Louis, Mo.).
1830. *Putorius vison*, Gapp., Zoöl. Jour., v, 1830, 202.—Emmons, Rep. Quad. Mass., 1840, 43.—De K., N. Y. Z., i, 1842, 37, pl. 11, f. 1. (animal), pl. 8, f. 3, A. B. (skull).—Aud. & Bach. Q. N. A., i, 1849, 250, pl. 33.—Kenn., Tr. Ill. State Agric. Soc., 1853-4-5, 578.—Beasley, Geol. Cape May, 1857, 137.—Baird, M. N. A., 1857, 177, pl. 37, f. 2, 3 (skulls).—Newb., P. R. R. Rep., vi, 1857, 42.—Coop. and Suckl., N. H. W. T., 1860, 93, 115.—Billings, Canad. Nat. and Geol., ii, 1857, 448.—Ross, op. cit., vi, 1861, 29.—Maxim., Verz. Am. Säug., 1862, 62.—Sam., Am. Rep. Mass. Agric. for 1861-2, 157, pl. 1, f. 8.—Gilpin, Tr. N. Scotia Inst., ii, 1870,

- 12, 59.—Ames, Bull. Minn. Acad. Nat. Sci., 1874, 69.—Coues and Yarrow, Zool. Expl. W. 100 Merid., v. 1875, 60.—Allen, Bull. U. S. Geol. Sur., vol. ii, No. 4, 1876, 326 (skull).—Jordan, Man. Vert., 2d. ed, 1878, 18.
1806. *Mustela minx*, Turt., S. N., i, 1806, 58.—Ord, Guthr. Geog., 2d Am. ed, ii, 1815, 291, 298.
1825. *Mustela lutrecephala*, Harl., Fn. Amer., 1825, 63.
1843. *Vison lutreola*, Gray, List Mamm. Br. Mus., 1843, 64 (partly).—Gerr., Cat. Bones Br. Mus., 1862, 92 (partly.)
1844. *Mustela (Lutreola) lutreola* var. *americana*, Schinz, Syn. Mamm., i, 1844, 347.
1869. *Putorius intreolus* [Cuv.], Allen, Bull. M. C. Z., i, 1869, 175 (critical); ii, 1870, 169 (Florida).—Allen, Pr. Bost. Soc. N. H., xiii, 169, 183.—Jordan, Man. Vert., 1876.
1874. *Putorius lustreolus* var. *vison*, Allen, Bull. Ess. Inst., vi, 1874, 54, 59, 62.
1877. *Putorius (Lutreola) vison*, Coues, Mon. N. A. Mus., 1877, 160.

Habitat.—North America at large. North to the Arctic coast, but not abundant north of Fort Resolution.

Specific Characters.—Larger and stouter than the Stoats; ears shorter; tail uniformly bushy, nearly as in *Mustela*; feet semipalmate; color dark chestnut-brown; tail, and usually a dorsal area, blackish; chin white; the edges of the upper lip rarely also white; the throat, breast, and belly often with irregular white patches; length fifteen to eighteen inches; tail-vertebræ six to eight inches.

External Appearance.—The Mink differs from the Stoats and true Weasels in its larger size, stouter form, and lower ears. It is adapted to its eminently aquatic life, and, indeed, related to the Otters by its close-set and felted under-fur, which readily resists the water, by its half-webbed toes, short ears, and bristly, glossy pelage. Indeed, the specific name *Lutreola*, or "Little Otter," given to the European species by Linnæus, is especially appropriate. The dentition is essentially that of the genus *Putorius*. It shares with the Martens the uniformly enlarged, bushy, and somewhat tapering tail, in place of the slender terete tail, with enlarged, bushy tip of the Stoats. It is a true Weasel, however, with thirty-four teeth—not a Marten, which has thirty-eight. The pelage consists of a dense, soft, matted under-fur, intermingled with long, rigid, shining hairs. The gloss is greatest above; on the tail the bristly hairs are in excess. The whiskers are in four or five series, the longest reaching opposite the occiput. Bristles grow also on the middle of the chin, on the cheeks, over and behind the eyes, and usually on the wrists and ankles.

The extremity of the snout is naked and protuberant. The feet are broad, the pads, as in all of the genus, ten on each front, and nine on each hind foot (five isolated pads, one at the end of each digit, five palmar and four plantar). These may or may not be covered with hair, according to season and latitude; ordinarily they are naked.

The digits are webbed at base for some distance, particularly the middle ones. The third and fourth fingers are nearly equal, and are the longest; the second and fifth not so equal, and much shorter; the first is quite short. The toes of the hind feet have about the same relative proportions.

The color runs from a light, dull, yellowish brown to a rich, blackish, chocolate brown. The ordinary color is a rich, dark brown, scarcely or not paler below than above. The tail is quite blackish; the white chin is rarely absent. Not positive in extent, but usually present, are the white patches of the under parts, particularly on the chest between the fore legs, and on the belly between the hind legs. The tail is rarely tipped with white.

Variations in External Appearance.—Two species of the Mink have been recognized in North America—*P. vison*, Gapp., and *P. nigrescens*, Aud. & Bach.: the “Brown Mink,” and “Little Black” or “Mountain Mink,” of hunters and trappers.

Audubon and Bachman based *nigrescens* on the smaller size and darker colors, less deeply palmated feet, and softer and glossier pelage. This is the variety that furnishes the most valuable pelts, formerly often yielding to the hunter from three to five dollars. There is probably no fur which so nearly approaches the famous Sable of Russia, as the northern Black Mink. As with most furs, the caprice of fashion determines the value, the price of this skin increasing tenfold in a decade.

Professor Baird admitted the Little Black Mink as a distinct species “with great hesitation,” not being able “to make such examinations and comparisons as satisfy me of the difference.”

Professor Coues concludes, from results of the examination of numerous specimens in the Smithsonian Institution, from all parts of North America, that the Black Mink does not require formal recognition, being simply one stage of individual variation, shading by insensible degrees into the ordinary form, so that it is impossible to set any line of demarcation between “*P. nigrescens*” and the Common Mink.

That the small blackish varieties are found breeding, has no weight in specific diagnosis, as they grow in stature some time after being sexually mature. Under three years old, the fur, in season, is very handsome, often almost a pure black, with a thin and pliable skin of almost

papery texture. With age the skin thickens and toughens, and the pelage grows rusty.

The "Little Black Mink," moreover, is not characteristic of any circumscribed faunal area.

With reference to the specific difference between *P. lutreola*, of the Old World, and *P. vison*, Dr. Coues has given the following comparative diagnosis :

P. lutreola.—Back upper molar small, quadrate, transverse, the inner moiety scarcely longer than the outer (*vide* Gray); averaging smaller; upper lip normally white.

P. vison.—Back upper molar large, with great constriction across the middle, making an hour-glass shape, the inner moiety of which is nearly twice as large as the outer [forty specimens seen]; averaging larger; upper lip normally dark.

Mr. Allen (Bull. Mus. Comp. Zool., i, 1869, pp. 175-177) asserted, regarding the sub-genus *Lutreola*, that "we have again but one circumpolar and widely dispersed species, with possibly two continental or geographical races." Examination of the molar teeth and skull afterward satisfied him that, while externally the form cannot be specifically differentiated, they are in fact distinct species. The Siberian Mink, *P. sibericus*, is the remaining Old World species.

History and Habits.—The history of the Mink begins prior to the biennial nomenclure. It is noticed, in Smith's Virginia, 1624, as the "Mink"; as the "Minx" (Lawson, Carol, 1709); as the "Otay" (Sagard-Théodat, Hist. Canad, 1636); as the Foutereaux (La Hontan, 1703, and of the French Canadians).

The term *vison*, generally used since Buffon as its specific title, was applied by him in 1765 to a Canadian specimen in M. Aubry's museum, probably the same on which Brisson and Pennant based their descriptions. Dr. Coues ingeniously suggests that the identity in form of *Mink* and *Minx*, may be more than fortuitous; *Minx*, formerly the name of a female puppy, subsequently signified a pert, wanton girl, the forward, prying, and spiteful nature of the animal in question gives a color to the relationship of the terms.

Since the early authors mentioned, the Mink has appeared in the writings of systematic authors, and has furnished material for several nominal species (see synonymy), which have occasioned but little confusion so definite are the zoölogical characters of the animal. Authors, mistaking the number of its teeth (34) have placed it in *Mustela*, teeth 38. Its peculiarly aquatic nature leads it to seek well watered regions; hence in the dry interior regions they are collected in a few places instead of being uniformly dispersed, so, where found, their numbers are exaggerated.

Richardson found the Mink on the Mackenzie at 66°, and Audubon states that he has seen it "in every State in the Union."

Its prime character, as compared with its congeners, is its amphibious mode of life. It is as absolutely aquatic in its nature as the Otter, Beaver or Muskrat. It is perfectly at home in the water, which it frequents as much as the land, imitating so perfectly the motion of the Otter as to suggest a small specimen of that species. The body is submerged, the end of the nose appearing at times. It remains long under water, seeking its favorite food, frogs, molluscs, crawfish, fish and reptiles. It has not the insatiable propensity to destroy life so characteristic of the Ermine, not killing, as a rule, more than it eats. Unlike the Ermine, the Mink is not a good climber, and most birds are safe from its attacks. It is detested by the farmer because of its frequent visits to the poultry-yard in search of eggs and chickens. It visits the same yard repeatedly, killing one or two fowls, and sometimes making off with an entire brood of young chickens; it is not given, however, to the wholesale slaughtering common with the Ermine. It destroys the Rabbit, and not unlikely the Muskrat; it is the enemy of our native rats and mice, the *Arvicolæ*, *Hesperomys*, *Sigmodon* and *Neotoma*, and when tamed the Mink is an excellent ratter, rapidly exterminating these troublesome pests; rats will not fight them, but flee at their scent, and if caught yield at once to the Mink, which severs the vessels of the throat so quickly and perfectly as to be scarcely observable.

The Mink is easily taken, in either steel-traps or dead-falls; it is very tenacious of life, living many hours under the pressure of a log which presses its body nearly flat. Caught by the leg, it makes no intelligent effort to free itself, but in its senseless fury bites and lacerates the part beyond the grip of the trap. It champs the iron in its rage until its teeth are broken. "The countenance of the Mink, with its short ears, small eyes, piggish snout and formidable teeth, is always expressive of the lower and more brutal passions, all of which are intensified at such times."

The Mink is frequently tamed, and becomes ordinarily gentle and tractable, but is given to outbursts of anger; at such times it is no respecter of persons, but bites miscellaneously. Accounts of their quasia-domestication may be found in "Forest and Stream," (October 22, 1874, and July 2, 1874.)

Mr. Resseque, of Verona, Oneida county, N. Y., secured a wild, female Mink in 1867, which proved so prolific that his stock has, on some occasions, amounted to ninety individuals, besides many sold from time to time for "ratters." He finds a ready market for them at \$30 per pair.

Messrs Phillips and Woodcock, of Canadea, N. Y., breed the Mink for its fur. The expense of feeding is but nominal, and the profits are con-

sidered lucrative; one Mink, with her increase, is regarded by these parties as equal to the avails of a cow.

These "Minkeries" are interesting to the Zoölogist, aside from their novelty, as from them is gained some positive information regarding the reproduction of the species. In the minkery the sexes are kept separate, except in March, the rutting season in a state of nature. The females all come in heat within ten days, and continue about four. The females reproduce when one year old.

The gestation scarcely varies twelve hours from six weeks, and occurs but once each year. The litters run from three to ten; the young are blind for the first five weeks. They are light colored, hairless, and about the size and shape of a little finger. One or the other sex predominates in number in each litter. The females attain their growth in ten months; the males require a year and a half. Taken when the eyes are open, kept from the mother and their mates, they are easily tamed; they are mischievous, finding food by their sharp scent not intended for them; they are inordinately fond of bathing, entering any open vessel about the house, and drying themselves by rolling in the nearest fabric at hand.

Minks do not burrow, but avail themselves of the holes of the Muskrat and other animals. In the "Minkery" the nest of the female was formed of grass, leaves or straw, with a lining of her own fur firmly compacted. The opening just admits the dam, and is provided with a deflected curtain which covers the entrance. They do not climb a smooth surface but ascend where it is rough enough for a nail-hold.

The effluvium of the scent-bags is not baneful enough to rout a determined enemy, as in the case of the skunk; it belongs to the class of the musky odors not disagreeable in small quantities to most people. Its service is, evidently, to attract the sexes; both sexes possess the secreting glands. Like the castoreum of the trappers, it is used to increase the efficacy of their bait. Its full strength is tested in taking the Mink from the trap; at such times the degree of feter is only surpassed by that of the skunk.

GENUS TAXIDEA. Waterhouse.

× *Ursus*, pt., of Schreber.

< *Meles taxus*, of authors referring to Am. Badger.

= *Taxidea*, Waterh., Proc. Zoöl. Soc. London, vi, 1838, 154; Transactions Zoöl. Soc. Lond., ii, pt. v, 1841, 343.—Baird, Mamm. N. A., 1857, 200; and of late authors generally.

Generic Characters.—Dental formula: i. $\frac{3-3}{3}$; c. $\frac{1-1}{1}$; pm. $\frac{3-3}{3}$; m. $\frac{1-1}{2-2} = \frac{16}{16}$.

34; body extremely stout, squat, and clumsy, owing to great depression; tail short, broad, and flattened; pelage loose; coloration diffuse; fore claws extremely large, highly adapted for digging; habits thoroughly terrestrial and fossorial; back upper molar a right angle triangle, with hypothenuse postero-external; back upper pre-molar similar in size and shape, but the hypothenuse postero-internal; back under pre-molar with two tubercles; anterior under molar comparatively small, not dilated behind, mostly opposing the back upper pre molar (instead of the upper molar as in *Meles*); cerebral portion of skull depressed, cuneiform, very wide across the flaring occipital crest; the inter-mastoid diameter nearly equalling the inter-zygomatic; sides of the brain case straightened and strongly convergent anteriorly; bony palate, reaching half-way to ends of pterygoids; bullæ auditoriæ at a maximum of inflation, impinging behind upon paroccipitals; condyles of jaw often locked in the glenoid; coronoid of jaw erect, pointed, its posterior edge angulated by the meeting of two straightish lines.

This genus is confined to North and Middle America. There are three other well marked genera in the sub-family *Melinæ*: the European *Meles*, the Asiatic *Mydaus*, and *Arctonyx*. In all the genera the perineal glands are moderately developed, and there is a peculiar sub-caudal pouch.

TAXIDEA AMERICANA. Baird.

AMERICAN BADGER.

- 1778. *Ursus taxus*, Schreb., "Säug.; iii, 1778, 530, f. 142, B. (After Buffon)."
- 1784. *Meles taxus* var. *americanus*, Bodd., Elench. Anim., i, 1784, 136.
- 1787. *Meles americanus*, Zimm., Penn. Artische Zoöl., i, 1787, 74. (Quotes Boddaert.)
- 1788. *Ursus labradorius*, Gm., S. N., i, 1788, 102, n. 7.—Kerr., S. N., i, 1792, 187.—Shaw, G. Z., i, 1800, 469, pl. 106.—Turt., S. N., i, 1806, 63.
- 1796. *Meles labradoria*, Meyer, "Zoöl. Arch., ii, 1796, 45."—J. Sab., App. Franklin's Journ., 1823, 649 (compared with European).—Harl., Fn. Amer., 1825, 57.—Griff., An. Kingd., v, 1827, 116 ("labradorica").—Less., Man., i, 1827, 141, No. 372 ("labradorica").—Fisch., Syn., 1829, 151.—Rich., F. B. A., i, 1829, 37, No. 12, pl. 2.—Godm., Am. Nat. Hist., i, 1831, 179.—Rich., Zoöl. Beechey's Voy., 1839, 4.—Wagn., Suppl. Schreb., ii, 1841, 182.—DeKay, N. Y. Zoöl., i, 1842, 27.—Schinz, Syn., i, 1844, 315 ("labradorus").—Aud. & Bach., Q. N. A., i, 1849, 360, pl. 47.—Bd., Stansbury's Rep., 1852, 311.—Kenn., Tr. Illinois Agric. Soc. for 1853-4-5, 578.—Giebel, Säug., 1855, 761 ("labradorius").—Hall, Canad. Nat. and Geol., vi, 1861, 294 ("labradoricus").—Maxim., Arch. Naturg., 1861, —; Verz. Säug., 1862, 33.

1823. *Taxus labradoricus*, Say, Long's Exp., i, 1823, 261, 369.
1838. *Taxidea labradoria*, (?) Waterh., P. Z. S., vi, 1838, 154; T. Z. S., ii, 1841, 343, pl. 59 (may be the other sub-species).
1842. *Taxidea labradoria*, H. Smith, Nat. Lib., xiii, 1842, 310.—Gray, List. Mamm. Br. Mus., 1843, 70.—Baird, M. N. A., 1857, 745 (Expl. of pls.).—Gerr., Cat. Bones Br. Mus., 1862, 99.
1857. *Taxidea americana*, Baird, M. N. A., 1857, 202, pl. 36, f. 2.—Newb., P. R. R. Rep., vi, 1857, 45 (habits).—Coop., N. H. W. T., 1860, 77.—Suckley and Gibbs, *ibid.*, 117.—Hayd., Trans. Am. Philos. Soc., xii, 1862, 134 (upper Missouri country).—Gray, P. Z. S., 1865, 141; Cat. Carn. Br. Mus., 1869, —.—Coop., Am. Nat., ii, 1868, 529 (Montana).—Stev., U. S. Geol. Surv. Terr. for 1870, 1871, 461.—Allen, Pr. Bost. Soc. N. H., xiii, 1869 (published February, 1870), 183 (Iowa, still numerous); Bull. Ess. Inst., vi, 1874, 46 (Kansas), 54 (Colorado), 59 (Wyoming), 63 (Utah); Pr. Bost. Soc., xvii, 1874, 38.—Ames, Bull. Minn. Acad. Nat. Sci., 1874, 69 (Minnesota).—Coues and Yarrow, Zool. Expl. W. 100 Merid., v, 1875, 63.—Allen, Bull. U. S. Geol. and Geogr. Surv. Terr., vol. ii, No. 4, 1875, 330 (skull).—Jordan, Manual of the Vertebrates, 1878, 19.—Coues, Mon. N. A. Mus., 1877, 263.

Distribution.—In 1858, Professor Baird gave the habitat of the Badger as Iowa and Wisconsin to the Pacific coast, and from Arkansas to 49° North latitude. There is now no doubt that the animal formerly extended eastward to Ohio. Says Dr. Coues (North American Mustelidæ): "A letter addressed by Mr. Edward Orton, not long since, informs me of its occurrence near Toledo, in that State, about twenty years previously, and of its extinction there."

The fact of the former occurrence of the Badger and the present occurrence of the Gray Gopher (*Spermophilus franklini*), is of no little interest, as it extends the distribution of these strictly prairie mammals to the forest regions of the eastward. The writer recalls the capture of a Badger, in 1857, in Kankakee county, Illinois. Mr. Kennicott has the species among the Mammals of Illinois, in 1853-54; and Mr. Allen, writing in 1866, says this species is probably nearly as numerous as formerly." The prairie-like character of Northern Indiana is continued into Ohio, and should be favorable to the existence of the Badger and Spermophiles; and while these animals are eminently characteristic species of the central, treeless regions of the United States, where they attain their greatest abundance, there is no apparent necessity for doubting the former occurrence of the Badger and present habitat of the Gray Gopher in Northern Ohio. It is scarcely likely that the Gopher was ac-

cidentally introduced about Middletown, Ohio, as it has been in New Jersey; or that the Badgers reported to Dr. Coues by Mr. Orton, were escaped members of some traveling menagerie, as in the case of the Texas Civet Cat, *Bassaris astuta*, recently reported from a locality in Ohio. On the contrary, the eastward range in the United States, to Michigan, Illinois, Indiana, and Ohio, of such prairie species, may naturally be accounted for by the general similarity of soil, altitude, and flora of the various regions considered.

Specific Markings.—The badger is about two feet to root of tail, which is six inches; the head is about five and a half, and the longest fore-claw one and a half inches.

The body-coloration above is a grizzle of blackish, with white, gray, or tawny, or all of these; below, uniform whitish, shaded, or not, with gray or tawny. Top of head darker than other upper parts, with a median white stripe; sides of head below the eyes, and its under surface white, with a dark patch below the ear; limbs blackish.

This animal is at once recognized by its stout, thick-set form, flattened, conoidal head, short limbs and tail, broad, flat feet, and enormous fore-claws. The head has short, close, coarse hair, except the black nasal pad. The ears are low, rounded and broad. The eye is small, and high up; it is a little back of the angle of the mouth. The digits are short, and apparently consolidated above, but showing five closely appressed oval pads below; they are shorter than the claws they bear. The second and fourth are sub-equal, and longer than the first and fifth, which are mere claw-bearing balls. The back of the hand is hairy to the claws. There is a single large, irregular palmar pad, separated by a deep furrow from the closely apposed digital naked bulbs. The claws are compressed, arched, with rounded ridge and short edge underneath, blunted with use. The three middle ones are about equal in length, longer and stouter than the lateral ones; these last are sub-equal, and reach about half-way to the ends of the middle claws; they are more compressed and weaker; the inner is quite short, thin, and falcate. Their strong-clawed fore-feet adapt them to their eminently fossorial habits.

The hind-feet are much like the front, but are decidedly smaller, particularly the claws. The foot is about four times as long as broad, hairy above and below more than half-way from the heel to the ends of toes. The claws are less compressed than in front, and are not, like the fore-claws, sharp edged along the median line, but are deeply excavated beneath, sometimes so much as to be simply a thin shell of horn, the edges of which unite only at the base of the claw. The short, broad tail meets the tapering body much as in the Porcupine, not being sharply

separated at its base from the body; the long, coarse hair of the body covers it thickly; the end is obtusely rounded. The colors vary greatly with age, season or condition of pelage, from the pattern already given; this variation is mostly in the relative amounts of the whitish and grayish shades which produce the grizzle. The color-markings of the head are quite uniform; the top is dark-brown, or blackish, decreasing in intensity and purity from the snout to the nape, where it blends with the grayish from behind. This dark top area is split by a sharp white or whitish median stripe from snout to nape; this stripe is constant, though varying in length and width. The extreme muzzle is dark on the sides; the white of the chin and throat extends up opposite the canines to the white ears, only interrupted by a dusky patch anterior to the ear. The feet are dark brown or blackish, the claws, especially the front, light colored. The body-colors vary under climatic influences from the whitish or dirty, yellow-tinged specimens from the dry, interior region, to the fulvous or tawny-tinged specimens, mixed with much nearly pure black, from the well watered regions of the Pacific slope and eastern border of the great central plateau; these two forms grade insensibly into each other.

None of the specimens here described have the median white stripe continued back of the nape, as in the Mexican badger (*T. americana*, var. *berlandieri*, Gray), which has the white dorsal stripe extending, though sometimes interrupted, from the nose to the tail.

History.—The early history of the Badger is involved with the European species, *Meles taxus*, and with the Woodchuck, *Arctomys monax*, by Kalm, and with an Albino Raccoon, the *Meles alba* of Brisson. Buffon doubted if the Badger inhabited America. Boddaert, in 1784, designated it as *Meles taxus*, var. *americana*. Zimmerman adopted the name *M. americanus*, which has priority, although not generally used until formally adopted by Prof. Baird, in 1857. The Badger was described by Say, in 1823, as *Taxus labradoricus*. Sabine called attention to the difference between the European and American species the same year, although the establishment of the American genus, *Taxidea*, was left to Waterhouse, in 1838.

Perinæal Glands.—The peculiar organs of the perinæum and sub-caudal region have not been specially studied in the American Badger, but have been in the European species; it is not likely there is any essential difference in these features between the two. I give here the results of M. Chatin's investigations, as compiled by Dr. Coues:

"The *anal glands* are of the normal, musteline type, secreting a viscid, and extremely fetid liquid, of a rosy-yellow color. The secretory portion

is as in allied species, the center having a large reservoir lined with a brownish membrane, as in other carnivores.

"The Sub-caudal Glands and Pouch.—In front of the insertion of the muscular band, which attaches the rectum to the sacro-coccygeal bones, is a deeply bilobate mass, really a single gland, having but one receptacle for the follicular secretion. This large, central pouch is abundantly provided throughout its surface with short, stiff, brownish hairs. This sac is distended with a yellowish, fetid substance, mixed with numerous hairs, like the viverreum of the Civet; this pouch is continuous, with the pocket-opening under the tail, being, indeed, part of one and the same cavity. In the possession of the central cavity clothed with hairs, and the bilobation of the gland, the sub-caudal glands are analogous to the scent-bags of the Civet; but in the Badgers the gland is always between the tail and the anus, and not between the genitalia and the anus, as in the *Viverra*. They differ, moreover, in the nature of the secretion, and, to a certain extent, in histological structure."

Habits.—The Badger lives altogether in burrows in the ground. The continued excavation of the earth by these animals, in search of food, and in forming its burrows, undermines and honeycombs the ground so completely, in many regions, as to form the chief obstacle to progression by wagons or on horseback.

Its whole structure adapts it to a subterranean life, which it follows so closely and secretively that many points in its economy are not yet fully known; others are inferred rather than proved. One may travel for weeks in the Badger country and rarely see one, or at the best catch a glance as they scramble into the nearest hole.

The Badger has few enemies, and, as a consequence, is very abundant. They are stout enough to ward off Wolves and Foxes. No indiginous animal is known to prey habitually upon them. Their immunity from danger, dependent on their physical prowess, impregnable nature of their retreats, and abundance of their food insures the perpetuation of the species in all unsettled portions of their range. They prey upon small quadrupeds for their staple diet; the nimble Rodents are driven to their retreats, which the Badger quickly enlarges and enters, following their unfortunate tenants to the deepest recesses. They also eat insects, snails, and the eggs of the numerous small birds which nest upon the ground in prairie regions. It may, like the European Badger, prey upon the stores of the wild bees, eating honey, wax and grubs; this habit, however, of our Badgers needs confirmation.

With regard to its character and disposition, I transcribe the following from Dr. Coues: "The Badger has been called a 'timid' animal.

So it is, in the sense that it avoids, rather than confronts, impending danger; but this is simply the instinctive prudence and discretion of a creature which prefers the absolute immunity of its subterranean resorts to the chances of unequal combat in which it is at disadvantage. Certainly no lack of courage, determination, and physical endurance is seen when the creature, captured or cut off from its retreat, is brought to bay. Its pluck then is as conspicuous as its really formidable strength. The cruel sport of 'Badger baiting' is sometimes indulged in the West; and if the animal be given a barrel or similar retreat, in which it is secure from attack in the rear, it may prove more than a match for a strong dog. Indeed, the fighting qualities of the Badger, and stubborn resistance it offers at whatever unfair odds, have supplied our language with a verb of peculiar significance: 'to badger' is to beset on all sides, and harass and worry. The stout, thick-set and depressed shape of the animal is greatly in its favor, combining, with its long, loose hair, to prevent a dog from reaching vulnerable parts, and to embarrass it in attempting to take hold; the snap of the jaws inflicts a serious wound; and finally the tenacity of life is at a high rate."

The Badger is not readily trapped; he will sometimes turn a trap over and spring it from the under side before attempting to remove the bait. With an earth-covered trap, dead fall or garrote, he may be taken; in early spring, while the ground is still hard, they may be easily captured by flooding their retreats.

The habits of the animal in confinement have been carefully studied by Audubon and Bachman. They observed that in running, the fore-feet cross each other, and the body nearly touches the ground; the heel does not press the ground as in the bear, but is slightly elevated above it. In digging, the fore-feet are used for excavating, and the hind-feet, like paddles, to expel the earth from the hole; the animal buries itself in the ground in a minute, and very soon advances to the end of a ten-foot chain, then returns and excavates a fresh gallery, and so amuses itself until dragged away by main force. Their specimen was active and playful at night, but was dull through the day, lying rolled up like a ball with its head under the body for hours at a time. The animal did not refuse bread, but preferred meat, eating a half pound each day. The animal did not seem at all sluggish or inclined to hibernate, even when the weather was so cold as to freeze, continually, the water given him to drink.

The reproduction of the species is not fully known. Dr. Coues has seen a still ungrown specimen in Colorado during the latter part of August. The periods of gestation and lactation are probably unknown.

Mr. Gibson, author of the "Complete American Trapper," states that the nest is in the burrow, and the young are three or four in number.

Richardson, in speaking of its hibernation from November to April, in British America, states that, like bears, the animals do not lose flesh during the winter, but come out fat in the spring; he adds that, as they pair at once, they soon become lean.

The Badger yields a valuable, and at times, a fashionable fur; it is used for robes, muffs, tippets and trimmings.

The London sales of Badger skins in 1873 were 2,700, bringing from one to seven shillings, averaging 1 s. 6 d. In 1875, they sold in this country for from \$1 for best, to fifty cents for "seconds" and ten cents for "thirds."

Thousands of shaving brushes are made from the long hairs; they are also used for artist's brushes; one is known as the "Badger blender." "The fur," says Audubon, speaking of his tamed specimen, "had become, by the month of February, the most effectual protection against the cold that can well be imagined.

The coloration is not striking, but the intimate blending of gray, tawny, black and white is pleasing. The general tone, however, is a grizzled gray, from which arises the common expression, "as gray as a badger." The flesh is eatable; so is that of the skunk, but neither are inviting, scarcely palatable.

GENUS MEPHITIS. (Cuvier.)

Etymology: Lat. *Mephitis*, a foul or noxious exhalation.

× *Viverra* sp., of early authors.

< *Mephitis*, Cuvier, "Leçons d' Anat., i, 1800" (coextensive with the subfamily), and of authors generally.—Baird, M. N. A., 1857, 191.

< *Chincha*, Less., Nouv. Tab. R. An., 1842.

> *Spilogale*, Gray, Proc. Zool. Soc., 1865, 150. Type, *S. interrupta* = *M. putorius*.

> *Mephitis*, Gill, Arrang. Fam. Mamm., 1872, 66.

Generic Characters.—Teeth 34; pm. $\frac{33}{33}$; end of muzzle truncate vertically; palate ending about opposite last molar; coronoid process of jaw conical, erect, its fore and hind borders converging to a vertical apex, in advance of condyle; angle of mandible not exflected; nostrils lateral; tail very long and bushy; soles comparatively narrow, hairy, at least in part; body elongated; snout prominent, not depressed.

The Skunks are terrestrial animals, closely related to the Badgers in external conformation; the walk is plantigrade; the habits more or less fossorial; the fore-claws are large, straight, and well fitted for digging. The Skunks neither climb nor swim; they are slow and lumbering;

their homes are burrows in the ground or dens in rocks and logs; the form is stout, the legs short, and the body low; the tail is bushy, and the pelage loose; the produced and enlarged snout gives them a somewhat hog-like physiognomy. They agree with the Badgers, and are unlike other *Mustelidæ* in having a complete, bony septum separating the posterior nares.

The leading feature, however, of the Skunks is the anal glands, common to the *Mustelidæ*, but in this group reaching the maximum of development, and secreting a fluid which is the most penetrating, diffusible and intolerable of animal effluvia, affording to these otherwise inoffensive, and almost defenseless creatures a means of self-preservation as unique as it is effectual, habitual reliance upon which modify the physiognomy of the entire genus, and impresses its whole nature.

MEPHITIS MEPHITICA. Baird.

COMMON SKUNK.

- 1792, *Viverra mephitica*, Shaw, Mus. Lever., 1792, 173, No. 4, pl. 6; Gen. Zoöl., i, 1800, 390, pl. 94, middle fig.
1808. *Mephitis chinga*, Tied., Zoöl., i, 1808, 362 (partly).—Licht., Darstell. Säug., 1827–34, pl. 45, f. 1; Abh. Akad. Wis. Berl. for 1836, 1838, 280.—Maxim., Reise N. A., i, 1839, 250; Arch. f. Naturg., 1861,—; Verz. N. A. Säug., 1862, 42.—Wagn., Suppl. Schreb., ii, 1841, 198.—Schinz, Syn., i, 1844, 323, No. 13.—Aud. & Bach., Q. N. A., i, 1849, 317, pl. 42.—Giebel, Säug., 1855, 766.—Fitzinger, Naturg. Säug., i, 1861, 315, f. 63.
1820. *Mephitis americana*, var. *K*, Desm., Mamm., i, 1820, 186. (“*Mustella*”, lapsu. Includes all the American Skunks, vars. A—R); Nouv. Dict., xxi, 515 (var. 7).—J. Sab., App. Frankl. Journ., 1823, 653.—Harl., Fn. Am., 1825, 70.—Griff., An. Kingd., v, 1827, 127, No. 358 (partly).—Less., Man., 1827, 151, No. 406.—Godm., Am Nat. Hist., i, 1831, 213, pl.—, f. 1.—Doughty’s Cab. N. H., ii, 1832, 193, pl. 17.—Rich., Zoöl. Beechey’s Voy., 1839, 4.—Emmons, Rep. Quad. Mass., 1840, 49.—De Kay, N. Y. Zoöl., i, 1842, 29, pl. 12, f. 1.—Wyman, Pr. Bost. Soc., 1844, 110 (anat.).—Warren, Pr. Bost. Soc., iii, 1849, 175 (anat.).—Thomps., N. H. Vermont, 1853, 33.—Woodh., Sitgr. Rep., 1853, 44.—Kenn., Tr. Illinois Agric. Soc. for 1853–4, 1855, 578.—Beesley, Geol. Cape May, 1857, 137.—Billings, Canad. Nat. and Geol., i, 1857, 360.—Hall, Canad. Nat. and Geol., vi, 1861, 296.
1829. *Mephitis americana* var. *hudsonica*, Rich., F. B. A., i, 1829, 55, No. 19.

1829. *Mephitis chinche*, Fisch., Syn., 1829, 160 (includes other species; quotes Tiedemann primarily.)
1842. *Chincha americana*, Less., Nouv. Tabl. R. A., 1842, 67.
1857. *Mephitis mephitica*, Bd., M. N. A., 1857, 195.—Coop. and Suckl., N. H. W. T., 1860, 94.—Hayd., Trans. Am. Philos. Soc., xii, 1862, 143.—Samuels, Ninth Ann. Rep. Mass. Agric. for 1861, 1862, 161.—Gerr., Cat. Bones Br. Mus., 1862, 97.—Allen, Bull. M. C. Z., i, 1869, 178; ii, 1871, 169 (critical).—Allen, Pr. Bost. Soc., xiii, 1869, 183.—Gilpin, Proc. and Tr. N. Scotia Inst., ii, 1870, 60.—Stev., U. S. Geol. Surv. Terr. for 1870, 1871, 461.—Parker, Am. Nat., v, 1871, 246 (anat. of anal glands, etc.).—Allen, Bull. Ess. Inst., vi, 1874, 46, 54, 59, 63.—Allen, Proc. Bost. Soc., xvii, 1874, p. 38.—Ames, Bull. Minn. Acad. Nat. Sci., 1874, 69.—Coues, Bull. U. S. Geol. and Geogr. Surv. Terr., 2d ser., No. 1, 1875, 8 (skull and teeth).—Coues and Yarrow, Zoöl. Expl. W. 100dth Merid., v, 1875, 62.—Allen, Bull. U. S. Geol. Surv., vol. ii, No. 4, 1876, 322 (skull).—Coues, Mon. of Mus., 1877, 195.
1744. *Enfan du Diable*, Charlev., N. France, v, 1744, 196.
1772. Skunk, Forst., Phil. Trans., lxii, 1772, 374.—Penn., Arct. Zoöl., i, 1784, 85, No. 33.—Hearne, Journ., —, 377.
- Stinkthier, German. Bête puante, French.

Description of External Features.—The Common Skunk is a heavily-built animal, with short limbs, low ears, small head, and long and bushy tail. The thick-set trunk is large behind, and the broad back naturally curved. The head is conoidal; the eye small and nearer the nose than the ear; the naked nasal-pad is large and protuberant; the nostrils are lateral. The bushy tail has no fine under fur; the long, coarse, almost tow-like hairs, when extended sideways, make the width of tail, in some specimens, greater than the length. The feet expose large plantar and palmar surfaces, usually naked, except that the soles are generally hairy about a third of the way from the heel. The claws of the hind-feet are stout and obtuse; they are covered with hairs; the middle three are about equal in length; the fifth is shorter, and the first does not reach the base of second. The plantar-pads are imperfectly separated into three, to which the terminal toe-balls at once succeed; the toes are very short, and extensively united.

The toes of the front feet are quite different. The third and fourth are sub-equal and longest; the second a little shorter; the fifth reaches scarcely half-way to the fourth, and the first not quite to the base of the second. The three middle claws are even longer than the digits that

bear them; they are acute and adapted to digging, strong, compressed, and little curved; the palmar padded area is indifferently separated into three or four smaller pads.

The white marking exists in almost endless diversity of extent and detail; the most constant pattern is a sharp, narrow frontal stripe, and a broad nuchal area, from which diverge obliquely a pair of stripes toward or to the tail. The hairs of the tail are usually all white at the base; there is a white tuft at the base of coarser and looser hairs than the general cover of the tail. The same coarse white hairs are disposed in irregular bundles in various places along the tail, exceeding the softer dark hairs in length; they are sometimes seven or eight inches in length.

Dr. Coues is of the opinion that there is a tendency to increase of white according, in a measure, to specified geographical areas. In the south Atlantic and Gulf States, the white is at a minimum, the stripes almost wanting, frontal stripe a mere trace, and the nuchal spot reduced or broken. Throughout the west, and in British America, prolongation of the stripes to the tail, or even to its end, is the rule, the stripes gradually separating from a vertebral stripe into which the nuchal stripe is prolonged. Accompanying this color of the western forms, is a bushier tail, its width equal to or greater than its length.

Various cases of this kind have been recognized as species under the specific titles *mesomelas*, *varians*, *macroura*, etc.

A decrease of size with latitude is observable. Florida specimens, full grown, are notably smaller than New England Skunks, some not exceeding thirteen or fourteen inches.

Distribution.—The Skunk is found in entire temperate North America, north to Hudson's Bay and Great Slave Lake, south into Mexico, where its range overlaps that of the White Backed Skunk, *Conepatus mapurito*. It is usually common, and in some districts abundant. From the nature of the animal, they are obviously less affected by the settlement of the country than their inherently wary and secretive carnivorous allies, which are often nearly exterminated as civilization advances. The Skunk, however, is often more abundant in frontier regions than in the unsettled parts of a country. Throughout British America, New England, the middle States, and some of the southern States, *M. mephitis* is the only species of the sub-family *Mephitinæ* known to occur. In most of the west and part of the south, it ranges with *Spilogale putorius*. The extreme south-west may possess the three species found in the United States.

History.—Under the name of "Polecat," "Chinga," "Skunk," "Weasel" (Pennant), and even "Enfan du diable" (Charlevoix), the Skunk ap-

peared in zoölogical literature over one hundred years before the Linnaean system. Gabriel Sagard-Théodat quaintly describes it in his history of Canada, 1636, as follows :

“ Les enfans du diable, que les Hurons appellent Scangaresse, & le commun des Montagnais Babougi Manitou, ou Ouinesque, est un beste fort puante, de la grandeur d'un chat on d'un ieune renard, mais elle a la teste un peu moins aiguë, & la peau couverte d'un gros poil rude & enfumé, et sa grosse queue retroussée de mesme, elle se cache en Hyuer sous la neige, & ne sort point qu'au commencement de la Lune du mois de Mars, laquelle les Montagnais nomment Ouiniscon pismi, qui signifie la Lune de la Ouinesque. Cet animal, outre qu'il est de fort mauuaise odeur, est tres-malicieux & d'un laid regard, ils iettent aussi (à ce qu'on dit) parmy leurs excremens de petits serpens, longs & deliez, les quels ne viuent neant moins gueres long temps. L'en pensois apporter une peau passée, mais un François passager me l'ayant demandée ie la luy donnay.”

This passage contains the earliest account of the Skunk known to Richardson or Dr. Coues. The present species was not clearly indicated by Linnaeus and his early supporters. The *Viverra putorius* L. was based on Kalm's “Fiskatta,” no doubt the present animal, but the primary reference is to Catesby's Polecat, and the description rather suits the *Spilogale*. Later (1736), Linnaeus rested his species on Catesby and Kalm (as in 1758), and involved the history by citing Hernandez, Ray, Seba, and Brisson, thus including animals generically as well as specifically distinct. Not until 1792 was the species described with sufficient pertinence and exclusiveness (*Viverra mephitica*, Shaw) to warrant a tenable specific name.

On account of its literal resemblance to the genus *Mephitis* (Cuvier), the specific title *mephitica* was suppressed until revived by Baird, in 1857, in accordance with the law of priority.

M. chinga (Tiedemann, 1808), is undoubtedly the same as the present species, and was adopted by Tiedemann, Audubon and Bachman, and others, until 1857. Since this date the alliterative name, *Mephitis mephitica* has become current.

Habits.—The disposition, habits, and possibly the structure (as far as this may be conditional on its mode of life) of the Skunk, are modified so completely, as compared with other *Mustelidæ*, by its unique and efficient mode of defense and offense, continual reliance upon which has changed its entire economy, that no correct outline can be portrayed, unless the nature and use of its peculiar armament are understood. “The physiological rôle of this special secretion is obvious. Its relation to the perpetuation of the species, though overshadowed by its exaggeration into a powerfully effective means of preservation of the individual, is evidently the same as in other species of *Mustelidæ*, each one of which has its own emanation to bring the sexes together, not only by amply indicating their whereabouts, but by serving as a positive attraction. In the case

of the Skunk, it would seem that the strong scent has actually tended to result in a more gregarious mode of life than is usual in this family of mammals; and it is certain, at any rate, that the occupancy by one animal of a permanent winter abode, serves to attract others to the same retreat. Burrows are sometimes found to contain as many as a dozen individuals, not members of one family, but various adult animals drawn together. One other effect of the possession of such unique powers is seen not so much in mode of life as in the actual disposition of the creatures. Its heedless familiarity, its temerity in pushing into places which other animals instinctively avoid as dangerous, and its indisposition to seek safety by hasty retreat, are evident results of its confidence in the extraordinary means of defense with which it is provided. In speculating upon the development of this anal armature to a degree which renders it subservient to purposes for which the glands of other *Mustelinæ*, though of similar character, are manifestly inadequate, it may not be amiss to recall how defenceless the Skunk would otherwise be in comparison with its allies. A tardy terrestrial animal, of no great strength or spirit, lacking the sagacity and prowess of the Wolverine, the scansorial ability of the Martens, the agility, size, and prowess of the Otters, and even much of the eminent fossorial capacity of its nearest relations, the Badgers—lacking all these qualities, which in their several exhibitions conduce to the safety of the respective species, it is evident that additional means of self-protection were required; while the abundance of the animal in most parts of the country, and its audacity in the face of danger, show that its confidence in the singular means of defense it possesses is not misplaced.”

As long as the Skunk has been known, it is but a few years since the anatomy of its peculiar defensive organs has been known. The first reliable record is that of Dr. Jeffries Wyman, in 1844, which are here transcribed: “The anal pouches are two glandular sacs of an oval shape, about three-quarters of an inch in diameter, covered with a muscular envelope, and opening into the rectum quite near to the anus by two papillæ. These last, when not protruded, are surrounded by a fold of mucous membrane, and very nearly concealed by it. The fluid is ejected by the contractions of the muscular covering. A small band passes from each sac to the ischium, which rotates these bodies on themselves, and serves to bring their orifices to the anus. The fluid is a peculiar secretion like that of the civet, and not the urine, as is commonly supposed. The common opinion, that the animal scatters it with its tail, is erroneous. The fluid is limited in quantity, and having been discharged, the animal is harmless until the sacs are again filled by gradual secre-

tion." The discharge is not visible, ordinarily, in the daytime; several competent observers state that it has a phosphorescent glow at night.

When the animal is pursued, it leisurely arrests its course, raises the hinder parts, lifts the tail, the nipple-like eminence of the glands appears through the anus, the constrictor muscles of the glands are contracted, and the golden acrid fluid is suddenly ejected several feet upward and backward in two streams.

The scent is almost indestructible. Audubon mentions it as being tolerably strong at a place where a Skunk had been killed in autumn, even after the snow had disappeared the following spring. The acrid discharge often renders dogs permanently blind; there are authentic cases in which men have lost their eyesight in consequence of the severe inflammation induced by the fluid. It is also extremely nauseating, often producing sickness of the stomach and violent vomiting. Like most foul odors, it is decomposed by chloride of lime. Burying affected clothing in the earth removes the odor. That the pelt may be absolutely purified of the scent, is shown by furriers disinfecting them by the same processes used for the skins of Wolves, Foxes, and other *Mustelidæ*.

Like most carnivorous animals, the Skunk is somewhat nocturnal, though often out in the daytime. In northern latitudes it hibernates imperfectly, arousing itself occasionally, perhaps for the evacuation of its anal pouches. In the south it ranges freely at all seasons. It sometimes takes up its winter dwelling oddly enough under barns or tenements, and the cessation of its torpidity during mild periods of weather, is very evident.

Unlike other wary members of its family, it has no fear of man's abode. It sometimes robs poultry, eggs, and milk, committing its depredations in the most awkwardly open manner, scarcely attempting escape when discovered, as though it relied upon the impenetrable atmosphere with which it surrounds itself; hence it often falls a victim to its own cupidity. Away from settlements, it makes its nest in decayed logs and stumps, fence rows, crevices in rocks, or in fact any natural shelter it can secure. Sometimes it excavates burrows near the surface, six or eight feet long, ending in a chamber lined with leaves, where as many as fifteen are found packed together. They are more gregarious than others of the family. Those in a burrow are not necessarily of the same family.

They are extremely productive, bringing forth, in May, eight or ten young. The time of gestation is probably not known.

Were they not so stupidly reliant upon their defensive armor, and so offensive, they might become too abundant; as it is, their natural means of preservation prevent their undue increase. Dogs and Wolves destro

and eat them in spite of their odor, as do also some of the preying birds. Insects, birds' eggs, and young, small mice, and frogs are their ordinary food; occasionally they secure a rabbit in his burrow.

Uses—The Skunk yields a handsome fur, which is put on the market under the name of "Alaska Sable." The Hudson's Bay Company handle a thousand or more yearly. The pelt is one of the staples of American furriers, thousands being yearly exported to Europe. The black furs are the most valuable, often selling for a dollar each.

No special skill is required for their capture; they are easier trapped than disposed of. They are taken readily in fox-traps carelessly set. It is customary to clear them off the range before attempting to take the Fox. The Fox is fond of the Skunk's flesh, and it is often used to bait the fox-traps. The Skunk, once trapped, is easily choked by a running wire noose attached to a long pole in the hands of the trapper, who thus escapes defilement.

Mr. Maynard states that, in Florida, the Little Striped Skunk is domesticated and used as Cats, the scent-glands being removed at an early age. Dr. J. W. Warren has put the Common Skunk under the influence of an anæsthetic, and severed the ducts of the anal glands by cutting down on the outside of the intestine, suffering the glands to remain in their normal position. The adhesive inflammation resulting deprives the animal effectually of its means of annoyance.

Regarding the domestication of the Skunk, Dr. Coues discourses, facetiously, as follows: "The different species of Skunks, in fact, seem to be susceptible of ready semi-domestication, in which state they are, like the Fitch or Ferret, useful in destroying vermin, if they do not also make agreeable pets. Writers speak of the removal of the anal glands in early life, to the better adaptation of the animal to human society, and such would appear to be an eminently judicious procedure. For, though Skunks may habitually spare their favors when accustomed to the presence of man, yet I should think that their companionship would give rise to a certain sense of insecurity, unfavorable to peace of mind. To depend upon the good will of so irritable and so formidable a beast, whose temper may be ruffled in a moment, is hazardous—like the enjoyment of a cigar in a powder magazine."

Hydrophobia from Skunk-bite.—It has long been known that a disease like hydrophobia often results from the bite of the Skunk. This subject has been investigated and presented by the Rev. Horace C. Hovey, in the *American Journal of Science and Art*, for May, 1874, and by John G. Janeway, M.D., Assistant Surgeon U. S. A., in the *New York Medical Journal*, for March 13, 1875.

Mr. Hovey contends that hydrophobia from Skunk bite is different from *Rabies canina*, and proposes for it the term *Rabies mephitica*. He suggests there may be a causative connection between inactivity of the anal glands and the generation of a special hydrophobic virus generated in the glands of the mouth. He also thinks that the mephitic secretion may be the natural antidote to the salivary virus. Mr. Hovey collected the particulars of forty one cases of *Rabies mephitica*, all of which proved fatal except one. He also proposes the theory that hydrophobia originates with the allied genera of *Mephitis*, *Putorius* and *Mustela*, and it is transferred from them to the *Felidæ* and *Canidæ*, and other families. The actual importance of the subject, and the novelty of the views entertained, attracted considerable attention.

Dr. Janeway replied in an elaborate article, detailing cases, and coming to the conclusion that "*Rabies mephitica*" is essentially hydrophobia; that the rabid wounds of the Skunk are fatal in so great a majority of cases, because the animal seizes unprotected parts, usually the face or hand, where there is no clothing to wipe off the virulent moisture of the teeth.

Besides the present species, it is possible that the Little Striped Skunk, *M. putorius*, may occur in Ohio. It is a southern and western species, abundant in Iowa, and possibly occurring in central New York, although the evidence is very unsatisfactory. "Dr. S. J. Parker, of Ithica, New York, has twice seen, by the road-side in that region, a small many-striped Skunk, very different from the common one." The Long-tailed Skunk, of Mexico. *M. macrura*; the White-backed Skunk, *Conepatus mapurito*, of the south-western border of the United States into South America, are the remaining species recognized by Dr. Coues, inhabiting North America.

GENUS LUTRA. Linn.

Generic Characters.—The genus *Lutra* includes musteline animals having a stout but cylindrical and lengthened body; obtuse muzzle; small ears; short, broad feet, with the digits full-webbed; feet naked or partly hairy on the palms and soles; claws small but well formed; tail without special lateral dilatation, long, tapering, nearly cylindrical; pelage without striking color contrasts. Dental formula: i. $\frac{3-3}{3-3}$; c. $\frac{1-1}{1-1}$; pm. $\frac{4-4}{3-3}$; m. $\frac{1-1}{2-2}$ $=\frac{18}{18}=36$. The upper pre-molar has a large internal shelf, making the contour of the whole crown triangular; skull depressed and flattened on top, the dorsal outline more or less nearly straight and horizontal; rostrum extremely short, bringing the fore ends of the nasals opposite the anterior root of the zygoma, the sides of the rostrum erect, the top flat; cerebral portion of the skull swollen backward, with strongly convex lateral outline; anteorbital foramen very large, bounded above by a slen-

der bridge of bone; posterior nares thrown into one conduit; palate extending far back of molars; pterygoids strongly hamulate.

Many of the above expressions are applicable to sub-family *Lutrinæ* as a whole.

Particular points of *Lutra* proper, are the presence of perfect claws, as opposed to their rudimentary condition in some of the Old World Otters (or even wanting, as in *Leptonyx* and *Aonyx*), and in the lack of special dilatation of the tail, as in the South American *Pterura* or *Pteronura*. The *Lutrinæ*, as designated, formerly included the Sea Otter, *Enhydris lutris*, which has the general aspect and cranial features of the ordinary Otter. Its hind limbs, however, are flipper-like organs, not very unlike those of some Seals; the teeth are pebble-like, moreover, instead of sharp and angular, as in ordinary carnivores; indeed, the whole dentition is adapted to a piscivorous diet. While the Sea Otter has, like the Common Otter, the same number of teeth above and below, it lacks one pair of incisors below, and one pair of pre-molars above, reducing the dentition to thirty-two. These differences are the basis of the sub-family *Enhydrinæ*, with the Sea Otter as its only representative.

Besides *Lutra canadensis*, there is a Mexican species, *Lutra californica*, Gray, which Dr. Coues thinks distinct from *L. brasiliensis*. These, with *Lutra vulgaris*, are the distinct, or probably distinct, species with which, as will be seen by the synonymy, the widely distributed *Lutra canadensis* has been confounded.

LUTRA CANADENSIS. Sabine.

COMMON OTTER; LAND OTTER; AMERICAN OTTER.

1806. *Mustela canadensis*, Turton, S. N., i, 1806, 57 (not *Mustela canadensis*, id., ibid., 59, which is *M. pennanti*, the Pekan; not of Schreber, nor of Erxleben, nor of authors).
1816. *Lutra gracilis*, Oken, Lehrb. Naturg. Th., iii, Abth., ii, 1816, 986 ("Stäatenland, Insel. an Amerika, bei New York").
1823. *Lutra canadensis*, "F. Cuvier, Dict. Sc. Nat., xxvii, 1823, 242.—Is. Geoff., Dict. Class., ix, 520."—J. Sabine, App. Frankl. Jour., 1823, 653.—Less., Man., 1827, 154, No. 414.—Griff., An. King., v, 1827, 130, No. 362.—Fisch., Syn., 1829, 225.—Rich., F. B. A., i, 1829, 57, No. 20.—Emmons, "Rep. Quad. Mass., 1838, 25;" Rep. Quad. Mass., 1840, 46.—Rich., Zoöl. Beechey's Voy., 1839, 4.—Maxim., Reise N. Am., i, 1839, 211; Arch. Naturg., 1861, 236; Verz. N. A. Säug., 1862, 60, pl. 8, 6 (os penis).—DeKay, N. Y. Zoöl., i, 1842, 39, pl. 3, f. 1, pl. 33, f. 1, 2, 3 (skull).—Linsley, Am. Jour. Sci., xliii, 1842.—Schinz, Syn., i, 1844, 349, No. 5—Aud. &

- Bach., Q. N. A., ii, 1851-2, pl. 51.—Woodh., Sitgreaves's Rep., 1853, 44.—Kenn., Tr. Illinois Agric. Soc. for 1853-4-5, 578.—Giebel, Säug., 1855, 789.—Beesley, Geol. Cape May, 1857, 137.—Bd., M. N. A., 1857, 184, pl. 38, f. a, b, c, d, e.—Billings, Canad. Nat. and Geol., i, 1857, 228.—Samuels, Ninth Amer. Rep. Mass. Agric. for 1861, 1862, 60.—Hayd., Tr. Amer. Phil. Soc., xii, 1862, 143.—Hall, Canad. Nat. and Geol., vi, 1861, 297.—Ross, Canad. Nat. and Geol., vi, 1861, 35.—Barnston, Canad. Nat. and Geol., viii, 1863.—Gerr., Cat. Bones Br. Mus., 1862, 101.—Allen, Pr. Bost. Soc., xiii, 1865, 183; Bull. M. C. Z., i, 1869, 178; ii, 1871, 169 (Florida).—Gilpin, Proc. and Tr. N. Scotia Inst., ii, 1870, 60.—All., Bull. Ess. Inst., vi, 1874, 46, 63 (Kansas and Utah).—Ames, Bull. Minn. Acad. Nat. Sci., 1874, 69.—Coues and Yarrow, Zool. Expl. W. 100 Merid., v, 1875, 63.—Jordan, Man. Vert., 1878, 19, 2d ed.—Allen, Bull. U. S. Geol. and Geog. Surv. Terr., vol. ii, No. 4, 1876, 331 (skull).—Coues, Mon. of N. A. Mus., 1877, 295.
1820. *Lutra brasiliensis*, Desm., Mamm., i, 1820, 188 (in part).—Harl., Fn. Amer., 1825, 71 (in part).—Godm., Am. N. H., i, 1831, 222, pl. —, f. 2 (in part).—Thomps., N. H. Vermont, 1853, 33.
1823. *Lutra lataxina*, F. Cuv., "Dict. Sc. Nat., xxvi, 1823, 242;" Suppl. Buffon, i, 1831, 203.—"Is. Geoff., Dict. Class., ix, 520."—Griff., An. Kingd., v, 1827, 131, No. 364.—Less., Man., 1827, 154, No. 416.—Fisch., Syn., 1829, 226, No. 4.—DeKay, N. Y. Zool., i, 1842-4.—Schinz, Syn., i, 1844, 350.
1831. *Lutra hudsonica*, (?) F. Cuv., Suppl. Buffon, i, 1831, 194.
1837. *Latax lataxina*, Gray, Ann. & Mag. N. H., i, 1837, 119.
1841. *Lutra vulgaris* var. *canadensis*, Wagn., Suppl. Schreber, ii, 1841, 256.
1843. *Lataxina mollis*, Gray, List. Mamm. B. Mus., 1843, 70 (type fig. by Aud. & Bach., l. c.).
1847. *Lutra americana*, Wyman, Pr. Bost. Soc., ii, 1847, 249 (on articulation of mandible).
Mustela hudsonica, "Lacepède."
1853. *Lutra canadensis* var., Aud. & Bach., Q. N. A., iii, 1853, 97, pl. 122 (fig. by Gray, type of *Lataxina mollis*).
1857. *Lutra californica*, Bd., M. N. A., 1857, 187.—Newb., P. R. R. Rep., vi, 1857, 42.—Coop. & Suck., N. H. W. T., 1860, 115. (Probably not of Gray.)
1863. *Lutra destructor*, Barnst., Canad. Nat. and Geol., viii, 1853, 147, f. — (Lake Superior).
1865. *Latax canadensis*, Gray, P. Z. S., 1865, 123; Cat. Carn. Br. Mus., 1869.

Habitat.—North America at large, being somewhat sparingly distributed over most of the waters of the continent; said to occur in Central America.

The Otter appears to be nowhere in great abundance, nor yet wanting in few if any localities adapted to its habits. Its wildness, wariness, and sagacity, and the nature of its haunts, all conduce to its existence even in well settled districts. Mr. Allen speaks of it as not rare in Massachusetts in 1869. One was brought to the Smithsonian Institution in 1874, taken from the Potomac near Washington City. It is still abundant in Florida, where the natural thinness of its fur tends to its preservation. The "Eastern Shore" of Maryland seems to have always been a favorite resort of the Otter. It is abundant northward, 11,000 skins being set down for 1873, in the Hudson's Bay Company's London quotations. The southern limits of distribution are not settled; no unquestionable evidence is at hand of its occurrence in Mexico.

Specific Characters.—Orbits well defined by prominent conical post-orbital processes, the distance between the tips of which is one-half or more of the intermastoid width of the skull; inner depressed moiety of posterior upper premolar as large and nearly as long as the main outer moiety; general dentition strong; naked nasal pad (an inch long or broad in full-grown individuals) extending back above the nostrils in a V-shaped outline, reaching below the nostrils with a straight transverse border, which sometimes sends a slight spur part way down the median line of the lip; palms hairy between the digits isolating the individual bald digital bulbs, and having an isolated patch or carpal peninsula of hair posteriorly; soles hairy between the digits, isolating the individual digital bulbs, much encroached upon by hair from behind, and having three or four peculiar, small, circular, elevated callosities arranged around the posterior border of the main bald plantar surface; (form, stature, and coloration not diagnostic;) finally attaining a length of four feet or more; liver-brown, with purplish gloss, paler on the under surface of the head, throat, and breast.

External Characters.—The massive columnar body without constricted neck; small, round head; small eyes and ears; long, taper tail; short, stout limbs; broad webbed feet; close-set, glossy hair, and abundant wooly under-fur, common to the genus, are shared by the Otter. The nasal pad is well developed, bald, in general shape an equilateral pentagon; the whiskers are short, stout, stiff bristles, in several series; the eyes are small, nearer the muzzle than the ear; the ears are small, with a thin, pointed conch, about as long as the adjacent fur; the entrance is covered with fur; the short, front limb has a stout wrist, and broad, flat

hand, bearing the toes which, distended, form nearly a semi-circle about the palm; the toes are webbed to about the middle of the conspicuous digital bulbs; the hand is hairy above; the digital bulbs are bald below, but the webbing is more or less completely hairy, isolating the naked bulbs from each other, and from the palmar surface; the main palmar pad is naked, except a posterior scanty patch of hair, which may, by an isthmus, connect with the fur on the wrist; the soles resemble the palms in the webbing—the shape is different; the fourth digit is much elongated, the third shorter, second and first rapidly graduated, and the fifth intermediate between the third and second; all the bald parts of the palm and sole are tessellated with minute papillæ; on the back margin of the naked portion of the plantar pad, are three or four small, definite, elevated circular papillæ, peculiar to this species as far as known, and which Dr. Coues suggests may be the excretory pores of a glandular organ beneath the skin; the claws, back and front, are short, stout, arched, compressed, tapering to an acute point from a thick base; the front claws are larger, sharper, and more arched than the hind ones. The variations in stature are extraordinary; some are twice as large and heavy as others apparently as mature—sexually so, at least. An average length is four to four and one-half feet; nose to root of tail, three feet; nose to eye, one and three-quarters to two inches; nose to ear, three and one-half to four inches; ear less than an inch high, and about as broad; fore foot, three and one-half inches; hind foot four inches; girth of body about one and one-half feet; stature a foot or less; weight twenty to twenty-five pounds. The general color is a highly lustrous, rich, dark liver-brown, but little lighter on the belly. The longer hairs are stiff, and glistening when viewed with the lay of the hairs; this it is that gives the fur its beautiful lustre. The under-fur is a yellowish white at the base, and light liver-brown at the tip; the former color is in excess on the back, the latter on the sides and belly; the transition is imperceptible. There are no special markings anywhere; the darkest part of the pelage is the top of the tail; the soles, palms, and nasal pad are dark.

History of the Species.—Systematic authors of the last century either confounded the present species with the European *L. vulgaris*, or with South American species. Until quite recently this species has been confounded with the Brazilian Otter, by some French and even American authors. The specific characters already given are drawn by Dr. Coues, with special reference to antithesis with *L. vulgaris*. *Mustela canadensis*, of Turton (*Systema Naturæ*, 1806, p. 57, English version), has priority over *Lutra canadensis*, of Sabine (1823), usually quoted as authority for

this species. Turton oddly enough allowed the same name, *Mustela canadensis*, for the Pekan or Fisher, *M. pennanti* (Systema Naturæ, p. 59).

Professor Wyman, in 1847, named our species *Lutra americana*. *Lutra californica*, Baird, and *Lutra destructor*, Barnst., are undoubted *L. canadensis*. The first has the palms and soles less hairy than is usual in *L. canadensis*, and was reluctantly admitted by Professor Baird, he erroneously supposing it to be the true *L. californica*, of Gray. The second is smaller than the average, but as *L. canadensis* grows for several years after sexual maturity, Mr. Barnston's specimens may not be full grown. Neither of these species depart, however, from the normal variations of *L. canadensis*.

Habits.—The general structure of the American and European Otters is so nearly identical, their movement and general attitudes cannot be very different.

Speaking of the European species, Bell has remarked that evidently every facility consistent with the preservation of its structural relations with the rest of the group, is given to the Otter for the pursuit and capture of its proper food. "It swims and dives with great readiness, and with peculiar ease and elegance of movement; and although its action on land is far from being awkward and difficult, yet it is certainly in the water that the beautiful adaptation of its structure to its habits is most strikingly exhibited. It swims in nearly a horizontal position, and dives instantaneously after the fish that may glide beneath it, or pursues it under water, changing its course as the fish darts in various directions to escape from it. When the prey is secured, the Otter brings it on shore to its retreat to feed." The Otter is intelligent and docile, easily domesticated, coming like the dog when whistled for. Several, which Audubon took when quite young, became gentle as puppies, romping with their master about his study. These ate milk and boiled corn meal, refusing fish or meat until several months old. They may be taught to catch fish from the streams for the table. There is no record of the American Otter serving as a purveyor, but instances have been narrated of the fishing habits of the domesticated Old World species, from the time of Albertus Magnus to the late Bishop Heber. This prelate relates that on the banks of the Malta Colly he saw ten large and beautiful Otters (probably the Asiatic species, *Lutra nair*, Fr. Cuvier) tethered to bamboo stakes by the river, some playing in the water, others rolling in the sand. He was told that the fishermen kept one or more Otters to aid in fishing, the Otters sometimes driving the shoals into the net and bringing out large fish with their teeth. The good bishop was so much pleased as to conclude that "the simple Hindoo shows here a better taste and judgment than half the Otter-hunting and Badger-baiting gentry of England."

The fossorial ability of the Otter is not of a high order. Its underground retreats are not as ingeniously constructed as those of the Muskrat. It avails itself of any convenient excavation, as the hollows under the overhanging roots of trees. Audubon found three Otters on a bed composed of the inner bark of trees and soft water grasses. This nest was in a hollow tree, with the entrance under water. The Otters were captured in the morning, by cutting a hole into the tree above the nest, and securing the neck of each animal between the halves of a split sappling. They generally keep near their fishing haunts, but may be driven by a scarcity of fish to resort far inland to the farming lands, attacking lambs, sucking pigs, and poultry; at least this is the habit of the British species.

Richardson speaks of the Canada Otter frequenting rapids and falls in the winter season, to be sure of open water, often traveling long distances in search of unfrozen rapids. Pursued by the hunter on these journeys, it runs so rapidly that a swift runner on snow-shoes can scarcely overtake it. It runs swiftly, and throws itself forward on its belly, sliding several yards through the snow, leaving a deep furrow behind it. This movement is rapidly repeated; it doubles on its track, and dives under the snow to evade its pursuers; if closely pressed, it turns and defends itself with great pertinacity.

The same author states that in the spring of 1826, at Great Bear Lake, the Otters often robbed the nets set under ice, taking off the heads of the fish and leaving the bodies in the net.

The period of gestation of our species is undetermined. The European species, according to Bell, carries her young nine weeks, bringing forth three to five in March or April. The American Otter, according to Richardson, has one litter annually, about the middle of April, of from one to three young. Audubon observes that in the middle and southern States they are about one month earlier.

Uses.—During the century, 1769–1868, the Hudson's Bay Company sold in London 674,027 Otter skins; the Canadian Company sold, from 1763 to 1839 inclusive, 895,832 pelts. The first mentioned company sold 14,966 skins during 1868; the same autumn other companies disposed of 22,000 skins. These figures will give some idea of the commercial relations of this species. The skin is removed by a cross slit down the hind legs, and withdrawn entire. It is stretched with the hair inside, the tail only being slit on the under side and spread out flat. The pelt is of such beauty and value, on account of its rich, warm color and exquisite softness, as well as its large size, that the animal is systematically followed by the professional trapper. Heavy double-spring steel traps are em-

ployed, baited on the pan with fish, or hidden in the snow path, or at the top of the slide; the trap is scented with various animal odors, and care is taken not to handle the trap with bare hands. The sight and smell of the Otter are so acute, and his wariness and sagacity of so high an order, that the utmost caution is required to insure his capture.

Audubon's observation of the "sliding" of the Otter is as follows: "The Otters ascend the bank at a place suitable for their diversion, and sometimes where it is very steep, so that they are obliged to make quite an effort to gain the top. They slide down in rapid succession where there are many at a sliding place. On one occasion we were resting ourself on the bank of Canoe Creek, a small stream near Henderson, which empties into the Ohio, when a pair of Otters made their appearance, and, not observing our proximity, began to enjoy their sliding pastime. They glided down the soap-like, muddy slope of the slide with the rapidity of an arrow from a bow, [†] and we counted each one making twenty-two slides before we disturbed their sportive occupation.

"This habit of the Otter of sliding down from elevated places to the borders of streams, is not confined to cold countries, or to slides on ice or snow, but is pursued in the southern States, where the earth is seldom covered with snow, or the waters frozen over. Along the reserve-dams of the rice fields of Carolina and Georgia, these slides are very common. From the fact that this occurs in most cases during winter, about the period of the rutting season, we are inclined to believe that this propensity may be traced to those instincts which lead the sexes to their periodical associations.

"The Otter is a very expert swimmer, and can overtake almost any fish; and as it is a voracious animal, it doubtless destroys a great number of fresh water fishes annually. We are not aware of its having a preference for any particular species, although it is highly probable that it has. About twenty-five years ago, we went early one autumnal morning to study the habits of the Otter at Gordon and Spring's Ferry, on the Cooper River, six miles above Charleston [S. C.], where they were represented as being quite abundant. They came down with the receding tide in groups of families of five or six together. In the space of two hours we counted forty-six. They soon separated, ascending the different creeks in the salt marshes, and engaged in capturing mullets [*Mugil*]. In most cases they came to the bank with the fish in their mouths, dispatching it in a minute, and then hastened back again after more prey. They returned up the river to their more secure retreat with the rising tide. In the small lakes and ponds of the interior of Carolina,

† "A statement certainly too figurative for literal acceptance." (Cones.)

there is found a favorite fish with the Otter, called the fresh-water trout (*Grystes salmoides*).

"Although the food of the Otter in general is fish, yet when hard pressed by hunger it will not reject animal food of any kind. Those we had in confinement, when no fish could be procured, were fed on beef, which they always preferred boiled. During the last winter we ascertained that the skeleton and feathers of a wild duck were taken from an Otter's nest on the banks of a rice field reserve-dam. It was conjectured that the duck had either been killed or wounded by the hunters, and was in this state seized by the Otter."

FAMILY URSIDÆ.

The family *Ursidæ* formerly included the Raccoons, to which they are allied by the tuberculate premolars, plantigrade walk, and stout body; the group is now restricted to the Bears proper, of large size, clumsy form, and very short tail. The cutting and compressed crowns of the sectorial teeth characteristic of the Cats and Dogs, are here replaced by broad teeth, with the crowns studded with tubercles, adapting the Bears to the more varied nature of their food. The species are not numerous, and, with the exception of one species, *Ursus ornatus*, which occurs in the South American Andes, are only found in the northern hemisphere.

GENUS URSUS. Linnæus.

Generic Characters.—Body thick, clumsy, and large; feet entirely plantigrade; soles naked; nails long; tail very short; head very broad. Dentition: i. $\frac{3-3}{2-3}$; c. $\frac{1-1}{1-1}$; pm. $\frac{4-4}{1-4}$; m. $\frac{2-2}{3-3} = \frac{20}{22} = 42$.

The skull of the Bears is larger, and the muzzle longer and broader than in the Dogs and Cats; the lower jaw is massive and high; the bony palate extends behind the molar teeth.

In the bears the molar teeth (seven) attain the maximum found in placental mammalia; some of the premolars are very small, and early deciduous, particularly the second and third. The first three premolars above and below are small; they have a single fang, and at their crowns are occupied by a single compressed tubercle. The fourth upper premolar represents the sectorial tooth of the carnivora; its shape is triangular with the base posterior instead of anterior, as in Dogs. The first true molar has an oblong crown, with four principal cusps.

There are in the United States two perfectly distinct species; the Black Bear, *Ursus americanus*, and the Grizzly, *Ursus arctos horribilis*, the "Cinnamon Bear" of mountaineers (not the Cinnamon Bear of authors, which is *U. americanus* var. *cinnamomeus*). The Grizzly is probably not specifically different from *U. arctos* of Europe. The two occur under almost every variation of color, but retain their specific characters through-

out. The Barren Ground Bear, *Ursus arctos*, Richardson (Fauna Boreali-Americani), may require to be added to those cited.

The Black Bear must have been early driven from the woods of Ohio. It still inhabits the mountain regions of Tennessee and Kentucky.

URSUS AMERICANUS. Pallas.

BLACK BEAR.

Var. *americanus*.

1780. *Ursus americanus*, Pallas, Spic. Zoöl., xiv, 1780, 6.—Bodd., Elench. Anim., i, 1784, 79.—Gmel., Syst. Nat., i, 1788, 101.—Desm., Mamm., i, 1820, 165.—Harlan, Fn. Amer., 1825, 51.—Rich., F. B. A., i, 1829, 14.—Fisch., Syn., 1829, 143.—Godm., Am. Nat. Hist., i, 1831, 114.—DeKay, N. Y. Zoöl., i, 1842, 24.—Aud. & Bach., Q. N. A., iii, 1853, 187, pl. 141.—Bd., M. N. A., 1857, 225.—Jordan, Manual of the Vertebrates, 1878, 20.—Coues and Yar-row, Geolog. and Geog. Exp. and Surv. West 100 Merid., 1875, vol. v, 69.

1827. *Ursus niger americanus*, Griff., An. Kingd., v, 1827, No. 318.

Var. *cinnamomeus*.

1853. *Ursus americanus* var. *cinnamomeus*, Aud. & Bach., Q. N. A., iii, 1853, 125, pl. 127.

1857. *Ursus americanus* var. *cinnamomeus*, Bd., M. N. A., 1857, 228.

Distribution.—The Black Bear is widely distributed throughout North America. The var. *Cinnamomeus* occurs in the Rocky Mountain region, and in Oregon.

Specific Characters.—The size is small; feet moderate; fore claws not twice as long as the hind claws; color entirely uniform throughout, either black or brownish; hairs darkest towards the tips.

The above characters serve to separate the Black Bear from the Grizzly, which is very large; feet large, with the fore claws twice as long as the back claws. The dark dorsal and lateral flank stripes of the Grizzly are opposed to the uniform coloration of the Black, as are the brownish, yellow, or hoary tips of the hairs in the former to the black tips of the latter. The hair of the Black is much softer than that of the Grizzly, and has not the wiry wool at the base of the long hair as in the Grizzly.

The Bear continued in considerable abundance in parts of Ohio—in Athens county, according to local history (E. Cutler, authority quoted, in history of Athens county, 1869). Taylor, in "History of Ohio, 1854," quotes from the journal of Major John Rogers, January, 1761: "We traveled eleven miles and encamped, having killed in our march, this day, three Bears and two Elks." (Voyage along coast of Lake Erie.)

From the "Pioneer History of the Ohio Valley (Hildreth, 1848, I quote

the following anecdote, as it shows the prevalence of Bears as late as 1805: "One day during the same year (1805), two of the children of John Spencer were playing in the yard of the cabin at the 'Big Spring,' when a huge Bear came along, and seized a pig near them and made off with it. Had Bruin selected the youngest of those children, instead of the pig, the career of the late Colonel William Spencer would have been cut short."

FAMILY PROCYONIDÆ.

The characters of this family, as distinguished from the Bears, are sufficiently indicated under the genus *Procyon*. There is one upper true molar less on each side than in *Ursidæ*. The last premolar of upper jaw and first molar of lower jaw are tubercular. The tail is moderately long, and the muzzle pointed. *Aelurus*, F. Cuvier, and *Cercoleptes*, Illiger, are the typical genera of the closely allied families formerly included with the Raccoons, in *Ursidæ*, but now separated, with the family names *Aeluridæ* and *Cercoleptidæ* (*Arctoidea procyoniformia*, Gill).

GENUS PROCYON Storr.

Generic Characters.—The Raccoons have the body stout; tail well developed (as opposed to *Ursidæ*); muzzle somewhat pointed. Dentition: i. $\frac{3-3}{3-3}$; c. $\frac{1-1}{1-1}$; pm. $\frac{4-4}{4-4}$; m. $\frac{2-2}{2-2}=40$.

The smaller size, longer tail, more pointed muzzle, less number of teeth readily separate the Raccoons from the Bears, to which they are allied by the tubercular teeth, plantigrade walk, and naked soles. The general shape is not unlike that of the badger; it is higher on the legs. The head is broad and depressed, the muzzle pointed to the truncate end. The whiskers are in four principal series, of five or six in each; there is a tuft over the eye, one at the angle of the jaw, and one under the middle of the chin. The ears are rather large; rounded above. They are covered with hair, except about the meatus. The tail is covered with hair and marked with alternate rings of black and whitish; the vertebrae of the tail are about half the length of the head and body. The toes are without webbing, and are cleft nearly to the bases of the hand and foot. The five-toed feet have naked soles from the wrist and heel; the skin of the sole is highly papillose, and doubtless highly tactile. There are no raised pads; narrow, deep furrows, however, cross the under surface, as in the cats and weasels. The claws are curved, non-retractile, moderately sharp; they are nearly equal in all the feet.

In our species, the third and fourth toes are sub-equal, and longest

in the fore foot; the claw of the second reaches to end of third; the thumb is shortest. On the hind-foot, the first toe is much shortest; third and fourth, sub-equal and longest; the second and fifth are about equal, their claws reaching to the bases of the claws of third and fourth.

Two North American species are recognized, ours, and *Procyon hernandezii* of Texas, and west to the Pacific.

PROCYON LOTOR (Linn.) Storr.

RACCOON; "COON."

1758. *Ursus lotor*, Linn., Syst. Nat., i, 1758, 48; 1766, 70.—Schreb., Säug., iii, 1778, 521.—Erxl., Syst. Nat., 1777, 165.—Gm., Syst. Nat., i, 1778, 103.—Harlan, Fn. Amer., 1825, 53.
1780. *Procyon lotor*, Storr, Prod. Meth. Anim., 1780.—Desm., Mamm., i, 1820, 168.—Griff., An. Kingd., v, 1827, 114.—Fischer., Syn., 1829, 147.—Rich., Fn. Bor. Amer., i, 1829, 36.—Doughty's Cab. N. H., ii, 1832, 73, pl. 7.—De Kay, N. Y. Zoöl., i, 1842, 26.—Aud. & Bach., Q. N. A., ii, 1851, 74, pl. 61.—Baird, Mam. N. A., 1857, 209.—Allen, Bull. M. C. Z., i, 1869, 181; ii, 1871, 170.—Coues and Yarrow, Expl. and Surv. West 100th Merid., vol. v, 64, 1875.
1784. *Meles lotor*, Bodd., Elenchus Animal., 1784, 80.

Specific Characters.—General color grayish-white; the tips of the long hairs are black, and impart this color to the back; under fur dark-brown. A large, oblique, black patch on the cheek, continuous with a paler one beneath the jaw; another behind the ear. End of muzzle, except the upper line, together with the posterior border of the cheek-patch whitish. Tail slightly tapering; tip and five rings black; these rings as broad as the rusty-white interspaces. Hind feet not exceeding four inches; above, dirty-whitish. Fore feet not exceeding above $2\frac{3}{4}$ inches. Varies in being nearly black, with the markings obscured; sometimes more or less yellowish or white, with obsolete markings or none. A decided tendency to albinism.

Measurements.—A specimen in the flesh had the following dimensions in inches: Nose, to root of tail, $22\frac{1}{4}$ inches; nose to end of outstretched legs, $23\frac{1}{2}$ inches; nose to eye, $2\frac{1}{4}$; to ear, $4\frac{1}{4}$. Tail, from root to end of vertebræ, $10\frac{1}{2}$; to end of hairs, $12\frac{1}{2}$ inches. Ears, height in front, $2\frac{1}{4}$; height behind, $2\frac{1}{2}$; width, $1\frac{3}{4}$. Arms, between claws, across shoulder, 27; length of fore-arm, $4\frac{5}{8}$; longest claw, $\frac{1}{2}$ inch. Leg, from knee-joint to end of claw, $8\frac{3}{4}$; hind foot, from heel to end of claws, 4 inches.

The colors of the exterior are due to the long, stiff hairs interspersed among the basal hair. Along the back these hairs are black at the end, and usually elsewhere. Sub-terminally the hairs are broadly whitish; then follows a ring of light-brownish, and the base is whitish. The hair

in the annuli of the tail is nearly corn-colored throughout. The under-fur is of a light, sooty tinge, growing much darker on the hind legs. The ears are grayish-white. The result of the sub-terminal whitish annulation of the hairs is a light gray, which is the prevailing color. The under parts are a similar gray, without the tips; here, as in the rest of the body, the dull-brown under-fur shows through. The intervals between the black rings of the tail are grayish-white; they are usually a trifle wider than the black rings. The tail is uniform (about $2\frac{1}{2}$ to 3 inches); the end rounded.

Distribution and Habits.—This well known animal is abundant in the eastern United States, and has been observed in Colorado. It is common in Ohio, usually found in the vicinity of water. It is said to be an expert at catching crayfish and minnows. It is very destructive to green corn, especially the sweet varieties. When once “treed,” they are readily taken—if in holes, by a wire hook driven into a long pole and thrust down to the bottom of the nest. In their blind rage they seize the hook and are easily drawn out, thrown to the ground, and dispatched. The animal is often domesticated; but they make rather savage and treacherous pets, stealing chickens that venture near their chain.

A western form takes its place on the Pacific coast, *P. hernandezii*, Wagler, the California or Black-footed Raccoon.

ORDER UNGULATA.

SUB-ORDER ARTIODACTYLA.

Toes paired; the third and fourth sub-equal and exserted; fifth and second about equal in size and position, and developed or atrophied in nearly equal degree; dorso-lumbar vertebræ usually nineteen; intermaxillaries flattened toward the symphysis; incisors, when present, diverging toward their roots; stomach more or less subdivided or complex; cæcum comparatively small and simple.

FAMILIES OF ARTIODACTYLA.

Molars with two double crescentiform folds, with the convex surfaces internal; canines resembling and parallel with incisors (different in *Camelidæ*); digestive system adapted for rumination; stomach quadripartite; axis with odontoid process like a spout or hollow half-cylinder, and with a sharp, prominent semi-circular rim. (Flower.) (*Pecora*; or *Ruminantia*.)

Hind limbs with femur inclosed within the integument; incisors deciduous from upper jaw, persistent in lower; cervical vertebræ normal (not elongated as in *Giraffidæ*); hinder limbs longer than fore limbs.

a. Horns persistent (common to both sexes), and developed as sheaths of true “horn” on osseous cores originating from the frontal bones. BOVIDÆ.

aa. Horns solid, deciduous, peculiar to the rutting season, not encased in horn, more or less branched; usually wanting in females. . . CERVIDÆ.

FAMILY BOVIDÆ.

The characters of the family are sufficiently indicated in the above Key.

GENUS BISON Smith.

Form massive; head declined; neck short; legs stout; molars comparatively broad, without supplemental lobes; end of muzzle very broad, naked; nostrils widely separated; hoofs broad; ears large; tail long.

BISON AMERICANUS (Gmelin.) Smith.

AMERICAN BISON, OR BUFFALO.

1788. *Bos americanus*, Gmelin, Syst. Nat., i, 204, 1788.—Desmarest, Nouv. Dict. Hist. Nat., iii, 531, 1816; Mammalogie, 496, pl. xliv, 1820.—Harlan, Fauna Amer., 268, 1825.—Godman, Amer. Nat. Hist., iii, 4, 1826.—Desmoulin, Dict. Class. Hist. Nat., ii, 365, 1822.—Richardson, Fauna Bor. Amer., i, 279, 1829.—Fischer, Synop. Mam., 495, 653, 1829.—Cooper, Month. Amer. Journ. Geol. and Nat. Hist., 1831, 44, 174, 207 (remains at Big Bone Lick, Ky.); Amer. Journ. Sci., xx, 371, 1831; Edinb. New Phil. Journ., xi, 353, 1831.—Doughty, Cal. Nat. Hist., ii, 169, pl. xiv, 1832.—Sabine, Franklin's Journey, 668, 1833.—Wagner, Schreber's Säug., v, 472, 1855.—Giebel, Säug., 271, 1855.—Baird, Mam. N. Amer., 682, 1857; U. S. and Mex. Bound. Survey, pt. ii, 52, 1859. Newberry, Pacif. R. R. Expl. and Surveys, VI, iv, 72, 1857.—Suckley and Gibbs, *ibid.*, XII, ii, 138, 1866.—Xantus, Zoöl. Garten, i, 109.—Allen, Proc. Bost. Soc. Nat. Hist., xiii, 186, 1869; xvii, 39, 1874.—Coues and Yarrow, Expl. and Surv. West 100th Merid., vol. v, 67, 1875.
1743. *Bison americanus*, Catesby, Nat. Hist. Carolina, ii, App., 20, xxviii, 1743.—Brisson, Reg. Anim., Quad., 1756.—Smith, Griffith's Cuv., v, 374, 1827.—DeKay, Nat. Hist. New York, Zoöl., pt. i, 110, 1842.—Sundevall, Kong. Sv. Vet. Akad. Handl. för 1844, 203, 1846.—Gray, Knowsley's Menag., 49, 1850; Cat. Mam. Brit. Mus., iii, 39, 1852; Hand-List of Edentate, Thick-skinned, and Ruminant Mam., 85, 1873.—Girard, Cat. Bones of Mam. Brit. Mus., 230, 1862.—Turner, Proc. Zoöl. Soc. London, xviii, 177, 1850.—Aud. & Bach., Quad. N. Amer., ii, 32, pls. lvi, lvii, 1851. Baird, Rep. U. S. Pat. Off., Agricult., 1851, 124 (plate), 1852.—Leidy, Proc. Acad. Nat. Sci. Phila., 1854, 200, 210; Extinct Mam. Faun. N. Amer., 571, 1869.—Allen, Bull. Essex Institute, VI, iii, 1865; Versuch einer natürlichen Geschichte des Rinder, ii, 58.

1766. *Bos bison* var. *b.*, Linn., Syst. Nat., i, 99, 1766.—Kalm, Travels in N. Amer. (Forster's Trans.), i, 297.
1784. "*Bos urus* var., Bodd., Elen. Anim., 1784."
1845. *Bos bison*, Schintz, Synop. Mam., 482, 1845 (in part only).
1867. *Bos bannasus*, Brandt, Zoögeographische und Palæontologische Beiträge, 105, 1867 (in part only).—Lilljeborg, Fauna öfers sveriges och Norges Rygggrad., i, 877, 1874 (in part only).
Taurus mexicanus, Hernandez, Mexico, 598.
Taurus quivirensis, Nieremb., Hist. Nat., 181, 182.
1819. Le bison [d'Ameriqué], Buffon, Hist. Nat., xi, 284, Suppl., iii, pl. v.—F. Cuvier & Geoffroy, Hist. Nat. des Mam., I, livr. xii, 1819; II, livr. xxvii; III, livr. xlv.—G. Cuvier, Reg. Anim., i, 170, 1817; Oss. Foss., 3d ed., iv, 117, 1825.
1867. American bison, Agassiz, Proc. Bost. Soc. Nat. Hist., xi, 316, 1867. Buffalo, Cooper, Month. Amer. Journ. Geol., 1831, 174, 207 (remains at Big Bone Lick).—Knight, Amer. Journ. Sci., xxvii, 166, 1835 (remains at Big Bone Lick).—Lyell, Proc. Geol. Soc. London, iv, 36, 1843 (remains at Big Bone Lick).

Description.—An adult measures about nine feet (two and three-fourths metres) from the muzzle to the insertion of the tail, and thirteen and one-half feet (about four and one-sixth metres) to the end of the tail, including the hairs, which extend about fifteen inches beyond the vertebræ. The female measures about six and one-half feet (about two metres) from the muzzle to the insertion of the tail, and about seven feet (two and one-sixth metres) to the end of the tail, including the hairs, which extend about ten inches beyond the vertebræ. The height of the male at the highest part of the hump, is about five and one-half to six feet (about two metres); of the female at the same point, about five feet (one and one-half metres). The height of the male at the hips, is about four and two-thirds feet (nearly one and one-half metres); of the female at the same point, about four and one-half feet (about one and one-third metres). Audubon states the weight of old males to be nearly two thousand pounds, that of full-grown fat females to be about twelve hundred pounds.

The horns of the males are short, very thick at the base, and rapidly taper to a sharp point, which, in old individuals, becomes worn off on the lower side, and the end is often shortened by the same process, and occasionally much splintered. Their direction is outward and upward, finally curving inward. The horns of the females are much smaller at the base, but nearly as long as in the males; but they taper very gradually, and are, hence, much slenderer, and are rather more incurved at the tips, where they are rarely abraded as in the males. The hoofs are short and broad,

those of the fore feet abruptly rounded at the end; those of the hind feet are much narrower and more pointed. The muffle is broad and naked, having much the same form as in the domestic ox. The short tail has the long hairs restricted to a tuft at the end.

In winter the head, neck, legs, tail, and whole under parts are blackish brown; the upper surface of the body lighter. The color above becomes gradually lighter towards spring; the new, short hair in autumn is soft dark-umber, or liver-brown. In very old individuals, the long, woolly hair over the shoulders bleaches to a light yellowish-brown. Young animals are generally wholly dark-brown, darkest about the head, on the lower surface of the body, and on the limbs. The young calf is at first nearly uniform light chestnut-brown, or yellowish-brown, with scattered darker hairs on the belly, where are also occasionally small patches of white. Toward autumn the light yellowish color is replaced by a darker brown that characterizes the older animals. After the first few months the younger animals are darker than they are later in life; at middle age the coat, especially over the shoulders, becomes lighter, and presents a bleached or faded appearance, which increases with age. The horns, hoofs, and muffle are black, the hoofs being sometimes edged or striped with whitish. The woolly hair over the shoulders is much longer, and more shaggy than elsewhere on the body; it increases in length on the neck above, gradually losing its woolly character, and between the horns attains a length of ten to fourteen inches, nearly concealing the ears and the bases of the horns, and often partially covers the ears. The long hair advances also on the face, where it decreases in length and becomes more woolly again, extending far forward in a pointed area nearly to the nose. The chin and throat are also covered with long hair, which under the chin forms an immense beard eight or ten inches to a foot or more in length. Thick masses of long hair also arise from the inner and posterior surfaces of the upper part of the fore legs, where the hair often attains a length of six or eight inches. A strip of long hair also extends along the crest of the back nearly to the tail. The tail is covered with only short, soft hair till near the tip, from which arises a tuft of coarse, long hair, twelve to eighteen inches in length. The hinder and lower portions of the body and legs are covered with a short, soft, woolly hair. This is moulted early in spring, after which, for a few weeks, the hinder portions of the body are quite or nearly naked. The shoulders retain permanently the long, shaggy covering, which, with the long hair of the neck and head, gives them (especially during the moulting season) a singularly formidable aspect.

The female, as already stated, is much smaller than the male, with a

less elevated hump; much smaller, slenderer, and more curved horns; less heavily developed beard; less shaggy head, etc.; but presents no essential difference in color.

Albinism and Melanism.—Pied individuals are occasionally met with, but they are of rare occurrence. I have seen but a single specimen, the head of which, finely mounted, is now in the Museum of Comparative Zoölogy.

I obtained it from Fort Hayes, Kansas, near which place it was taken in 1870, where it was regarded as a great curiosity. In this specimen (a female), the whole face, from between the horns to the muzzle, is pure white, but in other respects does not differ from ordinary examples. White individuals are still more rare, but are not unknown. A former agent of the American Fur Company, who had unusually favorable opportunities of judging, informed me that they probably occur in the proportion of not more than one in millions, he having seen but five in twenty years, although he had met with hundreds of pied ones. Black ones are rather more frequent, but can only be regarded as rare. The fur of these is usually much finer and softer than that of ordinary individuals; and black robes, from this fact and their great rarity, bring a very large price. They seem to be more frequent at the northward than elsewhere.

Varieties.—There are two commonly recognized varieties of the buffalo, known respectively as the Wood Buffalo and the Mountain Buffalo. The Wood Buffalo is described by Hind as larger than the Common Bison of the plains, with very short, soft pelage, and soft, short, uncurled mane, resembling, in these points, the Lithuanian Bison, or Auroch. It is said to be very scarce, and to be found only north of the Saskatchewan, and along the flanks of the Rocky Mountains, and to never venture into the plains. A supposed variety of Bison, referred to by some of the northern voyagers as occurring north of Great Slave Lake, and known only from vague rumors current among the natives, is, in all probability, the Musk Ox (*Ovibos moschatus*). (J. A. Allen.)

Synonymy and Nomenclature.—The American Bison has been known by the specific name *americanus*, adopted from Catesby in 1743, coupled with the generic name of either *Bos* or *Bis n.* It thus forms almost the only example among North American Mammals of a species that never had a prominent synonym.

In the United States this species is usually called the Buffalo, and this term will doubtless never be supplanted. Its correct English name is doubtless American Bison, the name Buffalo being strictly applicable only to the genus *Bubalus* of Africa and India. The English colonists,

however, following after Lawson and Catesby, adopted the term Buffalo, which is now its accepted common name, and no more a misnomer than is "Rabbit" for the American Hare, or "Robin" as applied to *Turdus migratorius*.

Distribution.—The range of the Bison formerly extended from Great Slave Lake, latitude 62°, to the north-eastern provinces of Maine, and as far south at latitude 25°.

In British North America the range extended from the Rocky Mountains to a line running south-eastward from Great Slave Lake to the Lake of the Woods.

In the United States it extended west of the Rocky Mountains, even to the Sierra Nevada ranges. Within fifty years it occupied the country about the headwaters of the Green and Grand Rivers.

East of the Rocky Mountains its range extended southward far beyond the Rio Grande, and eastward throughout the region drained by the Ohio River and its tributaries. Its northern limit east of the Mississippi was the Great Lakes, along which it extended eastward to near the eastern end of Lake Erie. It is known to have occurred south of the Tennessee and east of the Alleghanies, chiefly in the upper districts of North and South Carolina.

The present range of the Bison is in two distinct and comparatively small areas—the northern, from the sources of the principal southern tributaries of the Yellowstone, northward into the British possessions, embracing an area not much greater than the present territory of Montana; the southern district is chiefly limited to Western Kansas, a part of the Indian Territory, and North-western Texas—a region about equal to the present State of Texas.

The Bison in Ohio.—Mr. J. A. Allen has in his memoir a very detailed account of the distribution of the Buffalo and the history of its extermination in the region of the Mississippi, drawn from the early histories and explorations. Vaudreuil, writing about 1720, in his "Memoirs of the Indians between Lake Erie and the Mississippi," speaks of the abundance of Buffalo on the Sandusky and Ohio Rivers. La Hanton, in his description of Lake Erie, about 1687, says :

"I can not express what quantities of deer and turkeys are to be found in these woods and in the vast woods that lie upon the south side of the lake. At the bottom of the lake we find beeves upon the banks of two pleasant rivers that disembrace into it without cataracts or rapid currents."

Vaudreuil, in 1718, says of Lake Erie :

"There is no need of fasting on either side of this lake, deer are to be found there in such abundance. Buffaloes are found on the south, but not on the north shore."

And again :

"Thirty leagues up the river (Maumee) is a place called La Glaise (now Defiance, Ohio), where buffaloes are always to be found; they eat the clay and wallow in it."

The eastern limit along the Lakes was probably in Western New York, in the locality of Buffalo Creek, which empties into Lake Erie. There are, however, doubtful allusions in earlier writings of its occurrence along the southern shore of Lake Ontario.

There is ample evidence of the former existence and abundance of the Buffalo in Northern Ohio; it occurred in other parts of the State. Colonel John May met with it on the Muskingum in 1788, and Atwater says "we had once the bison and the elk in vast numbers all over Ohio." Hutchins says that in the natural meadows, or savannahs, "from twenty to fifty miles in circuit," from the mouth of the Kanawha far down the Ohio the herds of Buffalo and Deer were innumerable, as also in the region drained by the Scioto.

Mr. George Graham, writing Mr. Allen, under date of "Cincinnati, April 11, 1876," states :

"That the last reliable killing of buffalo is taken from the Lacross manuscripts, and partly from tradition from the lips of the children and grandchildren of those who were present. Of the French who settled at Gallipolis, Ohio, in 1790, but one person ever killed a buffalo. This man's name was Duteil. He was out hunting in the summer of 1795, about two miles west from Gallipolis, and saw a herd of buffalo. He fired without aiming at any particular one, and luckily killed a large one. He was so elated with this feat that, without stopping to examine the animal, he ran as fast as he could to the town; and, having announced his luck, came back followed by the entire body of colonists, men, women, and children. They quickly formed a procession, with musicians playing violins, flutes, and haut-boys in front of the fortunate hunter, proudly marching with his gun on his shoulder, and the animal swinging from poles thrust through between his tied feet, followed by the crowd, singing and rejoicing at the prospect of good and hearty fare.

"The animal was quickly skinned and dressed on its arrival at the town, and for several days there was feasting, as the first and last buffalo of Gallipolis was served up in such a variety of ways and means as none but the French could devise; Charles Francis Duteil remaining until his death the renowned marksman who killed the first and last buffalo, of all the emigrants from France, who settled the town of Gallipolis."

In a later communication to Mr. Allen, Mr. Graham adds:

"From all that I know of the early settlement and history of the West, I am under the impression that the buffalo disappeared from Ohio, Illinois, Indiana, and Kentucky about the year 1800."

Extirpation of the Bison.—The Buffalo was not driven to the westward by the encroachments of settlements; a few herds may have migrated, but it is more probable it was *exterminated*, rather than driven from the central States.

It existed in West Virginia and eastern Kentucky as late, or even later, than on the prairies adjoining the Mississippi. The animal survived at most points only a few years after the first permanent settlements were made. Its history east of the Mississippi is not different from its history in the two small areas to which it is now confined—"a shameful record of wasteful and wanton destruction of life, like that which ever marks the contact of man with the larger mammals."

Mr. Thomas Ashe, in his "Travels in America," performed in 1806, speaks of the great abundance and wanton destruction of Buffalo in the vicinity of Oil Creek and Clarion Creek, Pennsylvania. An old man informed Mr. Ashe that he and his companion killed several hundred near a salt spring for the sake of their skins, worth but two shillings each. The stench was so great they were compelled to leave the place until the carcasses were devoured or abandoned by wild beasts and birds.

"The simple history of this spring," says Mr. Ashe, "is that of every other in the settled parts of this Western World; the carnage of beasts was everywhere the same. I met with a man who had killed two thousand Buffaloes with his own hand, and others, no doubt, have done the same. In consequence of such proceedings not one Buffalo is at this time (in 1806) to be found east of the Mississippi, except a few domesticated by the curious, or carried through the country as a public show."

This last statement refers, doubtless, to the Mississippi below latitude 40°; the Buffalo did not retire to the northward of the Illinois River, according to Breckenridge, until in 1814, and Sibley states, in Schoolcraft's Indians, that two individuals were killed in 1832 by the Sioux Indians on the Trempeleau River, in Upper Wisconsin, and adds: "They are believed to be the last specimens of the noble Bison which trod, or will ever again tread, the soil of the region lying east of the Mississippi River."

Inasmuch as all the larger species of mammalia are everywhere disappearing as civilization progresses, and as large areas are brought under cultivation the faunal and floral character of a country are essentially modified, it seems essential to preserve in the State reports and archives as full and accurate reports as can be obtained of the earlier conditions and distribution of animal life in each great faunal area, so that comparisons with present conditions and limitations may be instituted, and the history of the successive changes noted.

With this object in view, I have quoted freely from Mr. J. A. Allen's history of the American Bison, and shall introduce here Prof. N. S. Shaler's observations on the age of the Bison in the Ohio Valley, which constitute Appendix II. of Mr. Allen's history:

"The springs at Big Bone Lick, as at all other licks of Kentucky, are sources of saline waters derived from the older Palaeozoic rocks. The saline materials, as has been suggested by Dr. Sterry Hunt, have their origin in the imprisoned waters of the ancient seas, or in the salts derived therefrom, which have been locked in the depths of the strata below the reach of the leaching action of the surface water. Whenever the rocks lie above the line of drainage, these salts have been leached away. As we go below the surface they increase in quantity until we reach the level, where these waters remain saturated with the materials which existed in the old sea waters. The displacement of these old imprisoned waters is brought about by the sinking down of water on the highlands through the vertical interstices of the soil and rock and the consequent tendency of the water below the surface to restore the hydrostatic balance. This action is particularly likely to occur when the rocks above the drainage are limestones or shales; while a bed of rock at some distance below the drainage is of sandstone, and permeable to water.

"This is the case at Big Bone Lick, where, at about two hundred feet below the surface, we have the calciferous sandstone, with a structure open enough to admit the free passage of water in a horizontal direction. That some such process is at work, is shown by the fact that the water will rise ten feet or more above the surface of the soil if enclosed in a pipe. The fact that the reservoir of these waters is below the general surface, causes them to appear in the bottom of the valleys, and the considerable abstraction of matter from the underlying beds probably amounts to some hundred cubic feet per annum in the case of Big Bone Lick, causes a depression at the point of escape, and brings about pretty generally the formation of a swamp in a depressed and constantly lowering basin, through which the spring water seeps away, and where a large part of it is usually evaporated. This swamp forms a natural trap for all the higher mammalia in it. When excavations are made near the existing outlets of the springs, we find the remains of large mammals brought by man, the horse, cow, pig, and sheep.

"In the frequent change of outlet of these springs, it comes to pass that at many points near the surface of the thirty or forty acres that lie in the little basin where Big Bone Lick is found, there are old spring vents, about which bones are found, that no longer give forth saline waters. It is a fact bearing on the history of the Buffalo, that their remains about Big Bone Lick are, when found, away from the purest springs, and never at any depth beneath the surface. In the recent springs they are very abundant, but not much more ancient in their appearance than the domesticated animals. The evidence obtained at this point leads to the conclusion that the first appearance of this species into the country was singularly recent, and also shows that their coming was like an irruption in its suddenness. These Buffalo bones are wonderfully abundant in some of the shallow swampy places of this neighborhood. I have seen them massed to the depth of two feet or more, as close as the stones of a pavement, and so beaten down by the succeeding herds as to make it difficult to lift them from their bed.

"As will be seen from the accompanying diagram, there seems to have been some degradation of the surface of this swamp after the deposition of many of the Mastodon remains, and before the coming of the Buffalo.

"This lowering of level was apparently consequent on the down-cutting of the bed of the small creek that drains the valley. The old elevated beds had probably washed a good deal when the Buffalo came, but it was principally by its wallowing and stamping that the bones of the Mastodon, Elephant, etc., were exposed to the air. At no point in this old ground did I find a trace of the Buffalo, though in some of it the bones identified by Mr. Allen as belonging to *Ovibos* were found. There, too, were found the

bones of the Moose and Caribou. I am inclined to believe, from these investigations, that the *Bison americanus* did not appear at Big Bone Lick, until a very recent time.

"All the observations made by the Kentucky Survey, in the caverns of the State and the neighboring district of Tennessee, have led to the discovery of no Bison remains in these subterranean receptacles, where the bones of the Beaver, Deer, Wolf, Bear, and many other mammals have been discovered. The observations of the officers of the survey to be published hereafter, will show that our caves have been used as the homes of the living and the receptacles of the dead, by more than one of the earlier tribes of this region, but they seem never to have brought the bones of this animal to the caves.

"Some years ago, I ventured to call attention to the general absence of the remains of this animal in all the mounds of the historic races, and to the fact that on their pipes and pottery, though they figure every other indigenous mammal and some of the birds of this region, seeking their models even in the Manatee of Florida, I have never been able to find any trace of Buffalo bones in any of the mounds which so often contain bones of other animals, nor have I been able to ascertain that they have ever been found in such places. At an ancient camping-ground on the Ohio River, about twelve miles above Cincinnati, where the remains are covered by alluvial soil of apparently some antiquity, and where the pottery (hereafter to be figured in the memoirs of the survey) is rather more ancient in character than that made by our modern Indians, I found bones of Deer, Elk, Bear, Fox, etc., but none of Buffalo. At a number of other old camps on the Ohio River, there is the same conspicuous absence of the remains of this animal. These evidences, negative and incomplete as they are, make it at least probable that the Buffalo was unknown to the people who built the mounds and preceded the tribes which were found here by the whites in the seventeenth century. The same argument warrants us in supposing that the *Bison latifrons*, with its contemporaries, the Musk Ox, the Elephant, and the Mastodon, had vanished before the advent of this race, or at least before the time of which we have evidence in the fossils already found.

"I have long been of the opinion, without claiming originality therein, that the tribes which built the mounds, and shapely, measured forts of this region, were driven to the southward, by an invasion of other tribes coming from the northward and north-westward.

"In the memoirs now in preparation concerning the ancient peoples of this region, it will be claimed, on what seems to Mr. Lucian Carr, Ethnologist of the Survey, and to myself, sufficient evidence that these mound-building people were essentially related to the Natchez group of Indians, and were driven southward by the ruder tribes of the somewhat related tribes which occupied the northern part of the Mississippi Valley when we first knew it. All this seems to me to have a possible significance in the problem of the coming of the Buffalo. When we remember that the Indians north of the Ohio were much in the habit of burning the forests, and so making open plains or prairies, and that, as Mr. Allen has well pointed out, the Buffalo cannot penetrate far into the denser forests, it may be that it was this destruction of forests that laid the way open to their entrance. The so-called barrens of Kentucky—the southward extension of the Wabash prairies—give us evidence on this point. As soon as the Indians were driven away, these Kentucky prairies sprang up in timber, and are now densely wooded. The same is in part true of other prairies of the Ohio Valley. I am inclined to think that the forcing back of the timber line from the Mississippi, is principally due to the burning of the forests by the aborigines in their eastward working, aided by the continual

decrease of the rain-fall, which I believe to be a concomitant of the disappearance of the glacial period.

"The question of the origin of the Buffalo, and its relation to the earliest tribes of people in this district, is made still more complicated by the fact that there is no doubt that there was an earlier and closely related species of Buffalo in this district, probably coeval with the Mammoth and Mastodon, and probably with the Caribou and Elk, which had doubtless disappeared before the coming of any race of men that has as yet been identified in this country.

"The succession of events in this region, as far as the species of Bison are concerned, seems to have been somewhat as follows, viz. :

"1. The existence of the *Bison latifrons* with the Mammoth and its contemporaries, the Mastodon, Musk Ox (*Bootherium cavifrons*, Leidy), etc. This species, like its contemporaries, by its size gave evidence of the even climate and abundant vegetation of the time just following, and probably in part during the glacial period.

"2. The disappearance of this fauna, followed by the coming of a race (mound builders) that retained no distinct traditions, and have left no art records of the presence of any of the large animals of the preceding time.

"3. The disappearance of this race from the region north of the Tennessee, probably leaving representatives in the Natchez group of Indians, followed by the occupation of the country by a race that greatly extended the limits of the treeless plains to the eastward, and so permitted the coming of the modern Bison into this region.

"I have long been disposed to look upon the succeeding glacial periods as the most effective causes of the changes that led to the determination of new specific characters among animals; and I am strongly disposed to think that in the *Bison americanus* we have the descendant of the *Bison latifrons*, modified by existence in the new conditions of soil and climate to which it was driven by the great changes closing the last ice age.

"When the exploration of Big Bone Lick is completed, it will doubtless show that there was an interval of some thousands of years between these two species."

FAMILY CERVIDÆ.

These are herbivorous animals, having the stomach in four compartments, of the ordinary ruminant pattern. Dentition: i. $\frac{0}{3}-\frac{0}{3}$; c. $\frac{0}{1}-\frac{0}{1}$; pm. $\frac{2}{3}-\frac{2}{3}$; m. $\frac{3}{3}-\frac{3}{3}$. Horns deciduous, solid, more or less branched, developed from the frontal bone, covered, at first, by a soft, hairy integument (velvet). When the horns attain their full size (which they do in a very short time), there arises at the base of each a ring of tubercles known as the "burr"; this compresses, and finally obliterates the blood-vessels supplying the integument, which dries up and is stripped off, leaving the bone hard and insensible; the horns are sexual characters, wanting in the female, excepting in the Reindeer (and very rarely in the Common Deer, *C. virginianus*); they are usually present in the male; they are shed annually, the separation of the beam from the pedicel taking place just below the burr.

The *Cervidæ* are a widely distributed family, few regions being without one or more peculiar species; a notable proportion are found in the New

World. Eight or nine species are found in North America alone. There are three sub-families recognized, the *Cervinæ*, with canines small or none including the Moose, Reindeer, and Common Deer, and constituting the greater part of the family; the *Cervalinæ*, with the canine tooth of the male enlarged and tusk-like, and the *Moschinæ*, or Musk Deer, of the Old World, without horns. The two species, here treated of, fall in the first of these three sub-families.

KEY TO GENERA OF CERVIDÆ.

- * Horns, in males only, large, curving backward, with the snags all directed forward, one of them immediately above the burr; tail very short; hoofs broad and rounded; size very large; muffle very high, and not separated from the lip by a hairy band; a tuft of hair on outside of hind leg above middle of metatarsus. . . . CERVUS.
- ** Horns in males—rarely found in females; muzzle broadly naked. Horns rather small, curving forward; first snag short, some distance above the base, and like the others curving upward. Tail rather long; hoofs rather elongate. Fur shorter and fulvous in summer, longer and grayish in winter. A narrow, short, naked, glandular space on the outer side of the metatarsus. CARIACUS.

GENUS CARIACUS Gray.

This Genus includes the Mule Deer, or Black-tailed Deer, *C. macrotis* (Gray), of the Rocky Mountain region, *C. virginianus macrurus* (Raf.) Coues, the White-tailed Deer, of general distribution in the West, associated in most of its ranges with the Black-tailed Deer, the Dwarf Deer of Arizona, *C. virginianus*, var. *couesi* Rothrock, MSS., and the true *C. virginianus*, east of the Missouri, and north to Maine.

CARIACUS VIRGINIANUS (Bodd.) Gray.

VIRGINIA DEER; RED DEER.

1784. *Cervus virginianus*, Boddaert, Elench. An., i, 1784, 136.—Zimm., Penn. Arkt. Zoöl., 1787, 31.—Gmelin, Syst. Nat., i, 1788, 179.—Kerr's Linn., 1792, 299.—Schreb., Säugt., v, 1836.—Shaw, Gen. Zoöl., ii, 1801, 284.—Desmarest, Mamm., ii, 1822, 442.—Harlan, F. Am., 1825, 238.—Godman, Am. N. H., ii, 306.—Doughty's Cab. N. H., i, 1830, 3; pl. i, male, female, young.—De Kay, N. Y. Zoöl., i, 1842, 113; pl. xxviii, f. i.—Wagner, Suppl. Schreb., iv, 1844, 373.—Aud. & Bach., N. Am. Quad., ii, 1851, 220; pl. lxxxi, cxxxvi.—Pucheran, Mon. Du Cerf., Arch. du Mus., vi, 1852, 305.

Distribution.—This is the best known and most abundant of the American Deer. According to Audubon and Bachman, it is not found north of Maine, from which limit it extends over the whole United States east of the Missouri river.

It is still found in the mountains of New York, Pennsylvania, Mary-

land, Virginia, Tennessee, and Kentucky, and even further south. On the Upper Missouri, and west, the Virginia Deer is replaced by an allied race, the White-tailed Deer, *Cariacus virginianus macrurus* (Raf.) Coues.

More northern specimens of the Virginia Deer are larger than those further south; the Deer of the southern seacoast and its islands are smaller than those of the uplands and mountains of the same latitude.

The Virginia Deer is rarely met with in Ohio at present, except as domesticated in parks.

Description of this well-known animal seems unnecessary here, especially since the publication of Judge Caton's treatise on the Antelope and Deer of America.

GENUS CERVUS Linnæus.

• Generic characters as given in the Key to Genera.

CERVUS CANADENSIS Erxleben.

WAPITI; OR AMERICAN ELK.

- 1756. *Cervus canadensis*, Briss., Quad., 1756, 88.
- 1777. *Cervus elaphus*, var. *canadensis*, Erxl., Syst., 1777, 305.—Bodd., Elench. Anim., 1784, 135.
- 1809. *Cervus wapiti*, Barton, Am. Philos. Trans., vi, 1809, 70.
- 1815. *Cervus major*, Ord, Guthrie's Geog., 2d Am. ed., 1815.
- 1827. *Cervus (Elaphus) canadensis*, Griff., An. King., v. 1827, 308.
- 1835. *Cervus canadensis*, Schreb., Säugt., v, 1835, 990, pl. 246, A.—Desmar., Mamm., ii, 182, 433.—Harlan, Fn. Amer., 1825, 236.—Godman, Am. Nat. Hist., ii, 1831, 294.—Maxim., Reise, ii, 1839, 24, 84.—Gray, P. Z. S., 1850, 226.—Giebel., Säugt., 1855, 348.—Baird, Mamm., N. A., 1857, 338, f. 9 and 10.
- 1836. *Cervus strongyloceras*, Schreb., Säug., v, 1836, pl. 247, F, G.—Rich., Fn. Bor. Am., i, 1829, 251.
- 1842. *Elaphus canadensis*, De Kay, N. Y. Zoöl., i, 1842, 118, pl. 18, f. 2.—Aud. & Bach., Q. N. A., ii, 1851, 84, pl. 62.—Baird, Agric. Rep. U. S. Pat. Office, 1851-2, 116.

Specific Characters.—Hoofs short, broad and rounded. Tail short and depressed. Larmiers nearly as long as eye; naked portion of the muzzle inferiorly only half as wide as the septum of the nostrils. No naked glandular space on the outer edge of the hind-legs, but a short, whitish patch of hairs near the upper part of the metatarsus.

In summer, ground color light chesnut-red, darkest on the neck and legs; throat and median ventral line dusky, almost black. Chin dusky, with a narrow patch of light-yellowish on either side; a broad, median,

yellowish patch under the head. Rump yellowish-white, bordered by a dusky band, which extends down the posterior face of the hind-legs; winter colors more gray.

The Elk ranges in northern latitudes from the Atlantic to the Pacific. Northward, it extends, according to Richardson, as far as the 57th parallel. Baird remarks (1857) that the only well-ascertained eastern localities are the Allegheny regions of Pennsylvania and Virginia; the fact of its occurrence in New York being very uncertain. It is still found in the vicinity of Green Bay, Wisconsin (B. H. Van Vleck), in Minnesota, the Yellowstone region, and west. Their occurrence in Ohio, and also their comparative abundance, is attested by their remains and by authentic parties. From "History of Ohio," by C. Atwater, 1838, I quote: "When Circleville was first settled the carcasses, or rather skeletons, of fifty individuals of the family of Elk lay scattered about on the surface." Also, by same author: "We had an abundance of Deer, and they are common yet in the newer parts of the State. They are the common Red Deer."

The prevalence of Elk is noticed in 1760, in what is now Clark county. "Historical Collections of Ohio," by Henry Howe, Cin., 1848," Also, in the History of State of Ohio, Taylor, 1854, Journal of Maj. John Rogers, Jan., 1761, is found: "Killed in our march this day three bears and two elk." (Voyage along Coast of Lake Erie.)

As to their extermination the following is taken: "A History of Athens County, Ohio—Walker, 1869," page 112: "The buffalo and elk were not exterminated until about the year 1800."

Hildreth states that "the Indians had not quite exterminated the buffalo and the elk," (1797.)

And from Dr. Kirtland's Report on Mammals, in Geol. Survey of Ohio, 1838: "The Elk was frequently to be met with in Ashtabula county until within the last six years. I learn from Col. Harper, of that county, that one was killed there as recently as October of the present season."

SUPER-ORDER INEDUCABILIA.

ORDER CHIROPTERA.

The Bats have the anterior members adapted for flight; the humerus is long and slender, the ulna rudimentary, attached to the curved radius, which constitutes the bulk of the forearm; the carpus is composed of six bones; the metacarpal bones, five in number, are much elongated, as are the phalanges, which are two to five in number—usually two. The bones of the arm and hand support a thin, leathery skin, arising from the sides of the body and extending backwards on the hind members down to their tarsi, and including the tail. Tail usually of nine joints; the interfemoral membrane may or may not include the tip of the tail. The nervous system is highly developed, especially the special senses of hearing and touch. The ears, externally and internally, are highly perfected. The auricles of the insectivorous Bats are frequently much larger than the head, and of great variety of shapes, their variations in form being of great importance in classification. The nose is, in many Bats, the seat of extensive dermal growths, composed of reduplications of the skin, which probably act conjointly with the wing-membranes to augment the sense of touch. The skeleton is noted for its lightness and tenuity, the bones of the Little Brown Bat weighing but eleven grains. The teeth vary from thirty to thirty eight, which, combined with the marked differences in their contour, furnish important characters in classification. The sternum is of great strength and excessive development, the immense power employed in their active flight necessitating the presence of strong osseous points for the attachment of muscles. The whole structure is adapted to the habits of the animal. The great development of the ribs, sternum, and scapula, for the attachment of muscles of flight; the length and strength of the clavicle, and the long bones of the anterior extremity fulfill an obvious purpose. The digestive apparatus is simple, corresponding to their animal regimen. Some foreign species are strictly frugivorous; our species subsist on insects, mainly the crepuscular and nocturnal kinds, as Gnats, Moths, Mosquitoes, and even the heavily mailed Coleoptera.

“The disappearance of the birds of day,” says Dr. Allen, “is a signal for the advent of the dusky host, which, as it were, temporarily relieve from duty their more brilliant rivals in guarding the interests of Nature.”

The relations of this order of mammals to superstition, while no legitimate part of the present history, is very interesting, and is here transcribed from the facile pen of Dr. H. Allen:

"Attendant as they are upon the quiet hours of twilight, when the thickening gloom is conducive to the development of superstitious feeling, Bats have always been associated with ideas of the horrible and the unknown. In olden times, when the imagination of the people exceeded the accuracy of their observations, it was one of the numerous monsters inhabiting their caverns and forests. It has done service in many a legend; its bite was fatal; it was the emblem of haunted houses; its wings bore up the dragon slain by St. George; its image is rudely carved upon the tombs of the ancient Egyptians; the Greeks consecrated it to Proserpine; it is part of the infernal potion of the witches of Macbeth, while Ariel employs it in his erratic flights. In art, its wings have entered largely into the creation of those composite horrors—evil spirits; nor have modern artists escaped the absurdity of encumbering the Satan of Holy Writ with like appendages. But of this association with the monstrous, the intelligent observer ceases to take note, when the finer beauties of structure develop themselves under his gaze. Upon acquaintance, he learns that in anatomical and physiological peculiarities, and zoölogical position, the Bat is a subject for study worthy the attention of the most commendative."

FAMILIES OF CHIROPTERA.

* Bats without upright appendage on the nose. (*Gymnorhina*.)

† Nostrils sub-elliptical; wing-membranes ample; tail completely enclosed in the interfemoral membrane, or the final joint only in some instances exserted.

VESPERTILIONIDÆ.

FAMILY VESPERTILIONIDÆ.

The above characters separate our largest family of North American Bats from the free-tailed *Noctilionidæ*, which have the nostrils circular, the alar membrane narrow, and the tail either much longer or shorter than the interfemoral membrane; also, from the single North American species of the Leaf-nosed Bats, *Phyllostomatidæ*, which are readily recognized by the upright appendage surmounting the rostrum. The latter family is represented by the Leaf-nosed Bat, *Macrotus waterhousii*, Gray, of the West Indies, Mexico, and the southern border of the United States.

GENERA OF VESPERTILIONIDÆ.

* Cheeks without excrescences; ears moderate.

† Incisors $\frac{2-2}{3-3}$	. . . . .	VESPERTILIO.
†† Incisors $\frac{1-1}{3-3}$	. . . . .	ATALAPHA.

GENUS VESPERTILIO (Linn.) Auct.

Vespertilio, Linn., of authors.

Scotophilus, Leach, Trans. Linn. Soc., xiii, 1822, 71.—Allen, Monog., 27.

Vesperus, Keys. and Blas., Wirb. Eur., 1840, 49.

Vesperides, Coues, antea.

Generic Characters.—Dentition: i. $\frac{2-2}{3-3}$; c. $\frac{1-1}{1-1}$; m. $\frac{4-4}{5-5}$, or $\frac{5-5}{5-5}$, or $\frac{5-5}{6-6}$, or $\frac{6-6}{6-6}$ teeth in all, 32, 34, 36, or 38. Known from all others of the family by the four, instead of two, upper incisors. Four sub-genera are based on the varying molar dentition. Our species fall in the sub-genus *Vesperus* (m. $\frac{6-6}{6-6}$),

VESPERTILIO SUBULATUS Say.

LITTLE BROWN BAT.

1823. *Vespertilio subulatus*, Say, Long's Expl. R. Mts., 1823, 65.—Harlan, Fn. Am., 1825, 22.—Rich., F. B. A., i, 1829, 3.—Godman, Am. Nat. Hist., i, 1831, 71.—Cooper, Ann. Lyc. N. Y., 1837, iv, 61.—De Kay, Nat. Hist., N. Y., 1842, 8.—LeConte, Proc. Phila. Acad., 1855, 436.—H. Allen, Monog., 51.—J. A. Allen, Bull. Mus. Com. Zoöl., i, 210.—Id., Proc. Bost. Soc. Nat. Hist., xvii, June, 1874.—Jordan, Man. Vert., 1878, 22.—Coues and Yarrow, Geog. and Geolog. Expl. and Surv. West 100th Merid., v, 1875, 96.

1835. *Vespertilio cavoli*, Ten. m., Monog., ii, 1835, 236.

— *Vespertilio domesticus*, Greene, Cab. Nat. Hist., ii, 290.

Specific Characters.—Length 3 inches, often less; expanse of wings, 8 to 9; tail about 1.50; fore-arm equal tail; longest finger 2 to 2.56; ear usually .40, but from .30 to .75. Molars $\frac{6-6}{6-6}$; teeth 38 in all; upper incisors paired off close to canines, a median space intervening; middle pair markedly bifid, the lateral ones obscurely or not so; lower canines with small basal cusp posteriorly; first two upper premolars small, last one larger, compressed, and bicuspid, the large outer cusp longer than any point of the true molars; lower premolars small, especially the two front ones. Skull thin and papery, crestless, with inflated cranial, and prolonged rostral part, giving a small face, high forehead, pointed muzzle, and foxy or terrier-like physiognomy. Face moderately whiskered. Ears rather large, oval in general contour. Tragus about half as high as auricle; upright, or nearly so; lanceolate. Extreme tip of tail more or less obviously exerted. Interfemoral membrane naked on dorsal surface, except a triangular patch of fur at its base, continuous with the covering of the back. Wing-membranes naked, very delicate, thin, almost diaphanous; usually rather brown than blackish. Fur dark plumbeous at base; at tip varying from quite dark to yellowish-brown, usually palest on the belly.

The Little Brown Bat is one of the two most abundant North American Bats. Dr. Coues states that as many as ten thousand, by actual count, have been destroyed in one building. The same author includes in this species several forms described either by Dr. Allen, LeConte, or others, as distinct species. Two varieties of ordinary *subulatus*, however, are recognizable: one, *evotis*, slender, with large ears and pointed snout; the other, *lucifugus*, stout, with smaller ears and blunted snout.

VESPERTILIO NOCTIVAGANS. LeConte.

SILVER BLACK BAT.

1831. *Vespertilio noctivagans*, LeConte, McMurtrie's Cuv., i, 1831, 33.—Cooper, Ann. Lyc. N. Y., iv, 1837, 59.—De Kay, Nat. Hist. N. Y., 1842, 9, pl. i, f. i.—Wagner, Suppl. Schreb., v, 1855, 754.—Jordan, Man. Vert., 1878, 22.
1831. *Scotophilus auduboni*, Harlan, Month. Am. Jour., i, 1831, 220, pl. 2.—Med. and Phys. Res., 1835, 30, pl. 4.
1835. *Vespertilio pulverulentus*, Temm., Monog. Mamm., ii, 1835, 235.—LeConte, Proc. Phila. Acad., 1855, 435.—Maxim., Arch. Naturg., 1861, 192
- . *Scotophilus noctivagans*, H. Allen, Monog., 39.—J. A. Allen, Proc. Bost. Soc. Nat. Hist., xvii, 1874.
1857. *Vespertilio* (*Vesperides*) *noctivagans*, Coues and Yarrow, Geog. and Geolog. Expl. and Surv. West 100th Merid., v, 1875, 95.

Specific Characters.—Length 3; extent 12; tail 1.25 to 1.50; shin 50; arm 1.50; longest finger 2.75; ear .50; tragus about .16. Molars $\frac{5}{8}$ – $\frac{5}{9}$ (only species with 36 as the total number); central upper incisors bicuspid. Skull flat; not crested; two shallow depressions anteriorly. Base of foot without the rounded lateral swelling of *Vesperus*. Tragus short, broad, and blunt; hardly or not one-half as high as auricle. Ear irregularly oval, inner border running upward and inward to level of head, then upward and outward, ending obtusely; outer border below folded irregularly, bending inward so as to touch the tragus. Snout naked; nostrils wide apart; opening sub-laterally; space between emarginate. Femoral membrane entirely, though scantily, furred on dorsal surface, with numerous minute tufts arranged linearly on central surface. Thumb small, slightly furry. Fur long and silky; black, or nearly so; the ends of the hairs usually white or whitish, giving a peculiar powdery aspect; sometimes entirely black.

This species inhabits North America at large. It is said to be related to *V. discolor*, of Europe. Its dentition and peculiar coloration characterize it distinctly. Mr. J. A. Allen gives it as common in Massachusetts; Dr. Allen limits it to the middle regions of North America. Like most of the family, however, it is doubtless of general and extensive distribution.

VESPERTILIO (VESPERUS) FUSCUS Beauvois.

CAROLINA BROWN BAT.

1796. *Vespertilio fuscus*, Palisot de Beauvois, Cat. Peale's Mus., 1796, 14.—LeConte, Proc. Phil. Acad., 1855, 434.—Jordan, Man. Vert., 1878, 23.

1806. *Vespertilio carolinensis*, Geoffroy St. Hilaire, Ann. du Mus., 1806, viii, 193, pl. xlvii, f. 7.—Harl., Fn. Am., 1825, 9.—Godman, Am. Nat. Hist., i, 1831, 67.—LeConte, McMurt. Cuv., i, 1831, 431.—Cooper, Ann. Lyc. N. Y., iv, 1837, 60.—DeKay, N. Y. Fn., i, 1842, pl. 2, f. 1.—Desm., Mam., i, 1820, 136.—Temm., Man., ii, 1835, 237.—LeConte, Proc. Acad. Nat. Sci. Phila., 1855, 434.—Wagner, Suppl. Schreber, v, 1855, 753.—Woodhouse, Sitgr. Rep. Zúñi and Col. Rivers, 1854, p. 43.
1818. *Vespertilio phaiops*, Rafinesque, Am. Month. Mag., 1818, 445.—LeConte, Proc. Acad. Nat. Sci. Phila., 1855, 434.—Wagner, Suppl. Schreber, 1855, 756.
1823. *Vespertilio arcuatus*, Say, Long's Exped., 1823, 167.
1835. *Vespertilio ursinus*, Temm., Mon. Mamm., ii, 1835, 235.—LeConte, Proc. Acad. Nat. Sci. Phila., 1855, 434.
1875. *Vespertilio (Vesperus) fuscus*, Coues and Yarrow, Geog. and Geolog. Expl. and Surv. West 100th Merid., v, 1875, 92.
- Scotophilus carolinensis*, Allen, Monog., 28.

Specific Characters.—Length 3 to 4; tail 1.33 to 1.50; extent 10 to 12; longest finger 2.66 to 3; arm 1.50 to 2; ear about .50 in height; molars $\frac{4}{2}$ — $\frac{4}{2}$ —front upper one narrowest, the front lower ones smaller than the other three; incisors $\frac{2}{3}$ — $\frac{2}{3}$ —lateral upper pair smaller than central pair; base of foot with a rounded swelling; tip of tail exserted; wing-membrane reaching base of toes; no extension of fur on the wing membrane; leg membrane furred at basal fifth on upper side, elsewhere more or less perfectly naked; ears moderate, furred one-half to one-third up the back, turned more or less outward, with convex inner and straight or slightly emarginated outer border, and well developed basal lobe; tragus nearly half as high as auricle, its tip never pointed, outer border notched near the base; nostrils emarginate; head flat; hairs dark-plumbeous, or dark-cinereous on the basal part, a variable shade of brown at the ends, and usually lighter on the under surface of the body than on the upper.

Distribution—Reported from widely separated localities in the United States; from Cincinnati by Mr. F. W. Langdon.

GENUS ATALAPHA Rafinesque.

Atalapha, Nycticejus, Lasiurus, Rafinesque.

Nycticejus et Lasiurus, Allen, Monog., 11.14.

Generic Characters.—Adult dentition: i. $\frac{1}{3}$ — $\frac{1}{3}$; c. $\frac{1}{1}$ — $\frac{1}{1}$; m. $\frac{4}{3}$ — $\frac{4}{3}$ (subg. *Nycticejus*), or $\frac{5}{3}$ — $\frac{5}{3}$ (subg. *Lasiurus*)=30 or 32 teeth. The variable tooth is the anterior premolar, absent in *Nycticejus*, present in *Lasiurus*, but minute and liable to be overlooked, as it is hidden by the approximation of the next premolar to the canine.

The above characterization, by Dr. Coues, includes a group of bats agreeing in the absence, when adult, of median upper incisors, and so differing from the species of *Vespertilio*. Regarding the name *Atalapha*, the same author says: "Among Rafinesque's names we adopt *Atalapha*, which he says contains 'bats without fore teeth' " (i. e., lacking the middle upper incisors)—an expression, it is true, not accurate, but still intelligible; and, in the case of this writer's work, we have generally to choose between inaccuracy and unintelligibility, excepting when what he says is both erroneous and enigmatical."

ATALAPHA (LASIURUS) NOVEBORACENSIS (Erxl.) Coues.

RED BAT; NEW YORK BAT.

1777. *Vespertilio noveboracensis*, Erxleben, Syst. Anim., 1777, 134.—Harlan, Fn. Amer., 1825, 20.—Godman, Am. Nat. Hist., i, 1831, 68.—Cooper, Ann. Lyc. N. Y., 1837, 57.—DeKay, Nat. Hist. N. Y., 1842, 6, pl. ii.—LeConte, Proc. Phila. Acad., 1855, 432.
1788. *Vespertilio lasiurus*, Gmelin, S. N., 1788, 50.
1796. *Vespertilio rubellus*, Beauvois, Cat. Peale's Mus., 1796.
1806. *Vespertilio villosissimus*, Geoffroy, Ann. Mus., viii, 1806, 478.
1817. *Vespertilio monachus* and *tesselatus*, Raf., Am. Month. Mag., iv, 1817, 445.
1825. *Taphyzous rufus*, Harlan, Fn. Am., 1825, 23.
1829. *Vespertilio blossevillii*, Less. et Garn., Bull. Sc. Nat., viii, 95.
1831. *Nycticejus noveboracensis*, LeConte, McMurtrie's Cav., 1831, 432.
1835. *Nycticejus varius*, Poeppig, Reise Chili, i, 1835, 451.
1842. *Lasiurus rufus*, Gray, List. Mamm. Br. Mus., 1843, 32.
1855. *Nycticejus lasiurus*, Wagner, Suppl. Schreb., v, 1855, 772.
1857. *Lasiurus noveboracensis*, Tomes, Proc. Zool. Soc., 1857, 34.—Allen, Monog., 16.
1875. *Atalapha (Lasiurus) noveboracensis*, Coues and Yarrow, Geog. and Geolog. Expl. and Surv. West 100th Merid., v, 1875, 87.
- Red Bat, Wilson; New York Bat, Pennant.

Description.—Length about 3.75 inches; tail 1.75 to 2.00; extent of wings 10.50 to 12.00; shin .75; arm 1.66; longest finger 3.33; ear .33 to .50 high. Teeth 32; molars $\frac{5}{5}$; front upper premolars hidden by being wedged between the next and the canine; upper incisors small, strongly convergent; lower ones crowded; lower canines pointing backward. Tail entirely included in femoral membrane; head and face hairy; nose blunt, rounded, with semi-lateral nostrils. Ears nearly circular; tragus half as high as auricle, straight on inner border, the end obtuse and abruptly turned. Wings furry in patches; body fur extending to base of third

finger; a conspicuous white tuft at the shoulder, and another at the base of the thumb. Femoral membrane above densely furry, like the back; under surface one-half furred. Fur long and silky; each hair plumbeous at base, then yellowish-brown, passing to reddish or chocolate, and usually white at the tip. Males bright yellowish-red; females have the light red replaced by dark russet, with the whitish tips longer than in the males.

Regarding the abundance, movements, and general appearance of the Bats in general, and particularly of our two most abundant species, I transcribe the following, evidently from the pen of Dr. Coues, in Chapter II, Volume V, of the Explorations and Surveys West of the One Hundredth Meridian:

"In most portions of the United States the Red Bat is one of the most abundant, characteristic, and familiar species, being rivaled in these respects by the Little Brown Bat alone. It would be safe to say that in any given instance of a Bat entering our rooms in the evening, the chances are a hundred to one of its being either one or the other of these two species. The perfect noiselessness and swiftness of its flight, the extraordinary agility with which it evades obstacles, and the unwonted shape, associated in popular superstition with the demons of the shades, conspire to revulsive feelings that need little fancy to render weird and uncanny. But the Bat is no ghost; on the contrary, a substantial, compact little creature of flesh and blood, much like a Mouse with wings, completely animal to the tips of its ears and tail; an erratic, yet busy little hunter for insects out on the fly after bugs attracted to our apartments, not by the light as some suppose, but simply in pursuit of its prey, which is attracted by the light. When captured, which may not be until far on in a breathless attack with brooms, tongs, and hats, during which the furniture is upset and the lamp, perhaps, put out, the little animal will be found a reddish, furry, flat creature, with membranes of exquisite delicacy, folded on each side like half of a tiny umbrella, of which the tremendous long fingers are the stick; humpy about the shoulders, sloping down to a furry expanse behind, with a piggish little head, twisting all ways at once, on a stumpy neck; mouse-like ears, standing straight up; funny, little, snapping, black specks of eyes; and an open countenance indeed—for the mouth is deep, bristling with fine, needle-like teeth, while from the throat comes a sharp, squeaky barking of anger, and perhaps defiance, if we can suppose such a pigmy to have so great a soul. Such is the simple creature that excites emotional persons to fancies not wholly lacking an element of terror; and the utmost damage it could do the clumsy giants, its captors, would be a prick from its tiny teeth—pretty sure to be given to an incautious finger tip.

"An anecdote, illustrating a tender trait of this animal, has been related by Mr. Titian Peale. A person had caught and taken home a young Red Bat. 'Three hours afterward, in the evening, as he was conveying it to the museum, in his hand, while passing near the place where it was caught, the mother made her appearance and followed the boy for two squares, flying around him, and finally alighted on his breast, such was her anxiety to save her offspring. This faithful creature lived two days in the museum, and then died of injuries received from her captor. The young one, being but half grown, was still too young to take care of itself, and died shortly after.'"

ATALAPHA (LASIURUS) CINEREUS (Beauv.) Coues.

HOARY BAT.

1796. *Vespertilio cinereus*, Palisot de Beauvois, Cat. Peale's Phila. Mus., 1796, 14.—LeConte, Proc. Phila. Acad., 1855, 433.
1823. *Vespertilio pruinosus*, Say, Long's Expl. R. Mts., 1823, 67.—Harlan, Fn. Am., 1825, 21; Med. and Phys. Res., 1831, 28.—Godman, Am. Nat. Hist., i, 1831, 68, pl. 2, f. 3.—Rich., F. B. A., i, 1829, 1.—Coop., Ann. Lyc. N. Y., iv, 1837, 54.—DeKay, N. Y. Fn., i, 1842, 7, pl. 2, f. 2.
1835. *Nycticejus pruinosus*, Temm., Mon. Mamm., 1835, 154.—Wagn., Suppl. Schreb., i, 1840, 544; v, 1855, 70.
1838. *Scotophilus pruinosus*, Gray., Mag. Zoöl. Bot., ii, 1828, 498.
1857. *Lasiurus pruinosus*, Tomes, P. Z. S., 1857, 37.
Lasiurus cinereus, H. Allen, Monog., 21; J. A. Allen, Bull. Mus Comp. Zoöl., ii, 208.
1875. *Atalapha (Lasiurus) cinereus*, Coues, Report upon Geog. and Geolog. Expl. and Surveys West of 100th Merid., chap. ii, vol. v. 1875, 90.—Jordan, Man. Vert., 1878.

Dentition as in *A. noveboracensis*. Size larger; length 4 to 5.50; tail 2.33; extent 10 to 15 inches, averaging 12 to 14; ear .33 to .50. Lips and ears marked with black; body colors rich chocolate-brown, or smoky-fawn color, overlaid with white, giving a brilliant, hoary appearance.

This is the only Bat known to inhabit the northern regions, as observed by Kennicott. It is distributed over North America at large, but is most abundant in elevated regions and northern latitudes. Since 1823, it has generally been known by Say's name, *V. pruinosus*. Major LeConte showed it to be identical with *V. cinereus*, Beauvois, and restored the prior name.

Mr. F. W. Langdon informed me that a specimen of this Bat, in the collection of the Cincinnati Society of Natural History, was captured at Coal Springs, Kentucky, three or four miles from Cincinnati.

Atalapha (Nycticejus) crepuscularis, (LeConte) Coues, may occur in southern Ohio, as it is reported from Pennsylvania to Missouri, and south-west.

ORDER INSECTIVORA.

KEY TO FAMILIES OF INSECTIVORA.

- * Molar teeth multicuspid, with the cusps connected by deep re-entering ridges, which describe two elongated triangles, and with at least one extensive antero-internal ledge. Skull with the calvarium wide; broadest about the periotic region, with the foramen magnum sub-circular or oblong; the occipital condyles variously divergent, with the par-occipital processes obsolete or wanting. Pelage very soft. (*Soricoides* as opposed to *Erinaceoides*.)

† Skull with the posterior ridges obsolete; foramen magnum oblong, and inclined far forwards below; with no distinct post-glenoid process; with the tympanic element forming a bulla; intraorbital canal an extensive transverse aperture, arched over by a very narrow, osseous bar; zygomatic arch a slender rod; lower jaw with the ascending rami erect, and without cavities at the bottoms of the coronoid processes. molar teeth with the postero-internal ledge obsolete or wanting. Cervical vertebræ with no hypapophyses; dorsal and lumbar with no hyperapophyses. Sternum with manubrium broad and keeled. Anterior members developed more than the posterior; with carpus more or less enlarged, and at least with an os intermedium. Scapula long and narrow. TALPIDÆ.

†† Skull with the posterior ridges well developed; the foramen magnum sub-circular, and inclined little forwards below; with a well developed post-glenoid process; with the tympanic element annular, not forming a bulla; infraorbital canal a rather long sub cylindrical tunnel, covered by a very broad, osseous wall; zygomatic arch not developed. Lower jaw with the ascending rami deflected outwards, and each with a cavity at the bottom of the coronoid process. Molar teeth with a postero-internal ledge armed with a cusp at its antero-internal angle. Vertebræ characteristic; cervical with well developed hypapophyses; dorsal and lumbar with distinct hyperapophyses. Sternum with the manubrium broad but ecarinate. Anterior members more slender than the posterior; with carpus normal, having no sickle-shaped bone or os intermedium; scapula short and broad. SORICIDÆ.

FAMILY TALPIDÆ.

In addition to the dental and skeletal characters already given in the Key to the Families of Insectivora the following external characters are added: Body stout, thick, and clumsy, without visible neck; limbs very short; the anterior much broader and larger than the posterior; provided with strong claws, adapted for digging. Scapula as long as the humerus and radius together. Eyes small; sometimes concealed by the integument. No external ears; the meatus sometimes minute, and sometimes of ordinary size. Nostrils at end of snout, lateral or superior. Tail usually short; sometimes as long as the body. Fur usually soft, compact and velvety.

A family of general distribution, except in tropical regions and in South America. Each region has its characteristic genera. *Talpa* is found in Europe and Asia; *Scalops*, *Scapanus*, *Condylura*, and *Urotrichus*, in America; the last named genus occurs, also, in Japan, and is the only insectivorous genus known to be common to both hemispheres. *Talpa* is not found in America, although *Scapanus breweri* has been mistaken for *Talpa europea*.

GENUS SCALOPS Cuvier.

Etymology: *Skalops*, mole, from *Skallo*, to dig.

Scalops, Cuv., "Leçons d' Anat. Comp. i, 1800.

This genus, as characterized by Cuvier, included Moles, with the nose

elongated, and not fringed; the nostrils superior or lateral; eyes hidden; tail short; teeth 36 or 34; the two anterior upper ones unusually large, and somewhat like those of a rodent.

Pomel, in 1848, separated a genus, *Scapanus*, the claims of which to generic rank are now fully conceded, for the group with 44 teeth, retaining the name *Scalops* for the species with 36 teeth. In *Scalops* the two lateral incisors on each side above are small, thread-like, and often deciduous; in *Scapanus* all the teeth in both jaws in front of the last premolar, except the broad anterior upper incisors, are of nearly equal size, conical, the upper with the points rounded off, the lower more compressed and with the points more acute. In *Scalops* the tail is nearly naked; in *Scapanus* the tail is densely hairy.

Prof. Baird, in 1857, admitted three species of *Scalops*; *S. argentatus*, Ohio, and west; *S. aquaticus*, the well-known species of the eastern United States, and *S. latimanus* of Mexico. The latter is shown by H. Peters as equivalent to *S. aquaticus*, or to the western form, *S. aquaticus*, var. *argentatus* (Aud. and Bach.), so *Scalops* stands represented by one species and a geographical race. In the genus *Scapanus*, Pomel, are two well-defined species; *S. townsendi* the Oregon Mole, and *S. breweri*, the Hairy-tailed Mole of Connecticut and New York to Cleveland, Ohio. *Condylura cristata* (L), the Star-Nosed Mole, and *Urotrichus gibbsi* of the Western Coast, complete the series of American *Talpidae*.

SCALOPS AQUATICUS Fischer.

COMMON EASTERN MOLE.

- 1758. *Sorex aquaticus*, Lin., Syst. Nat., 10th Ed., i, 1758, 53.—Erxleben, Syst. Reg. Anim., 1771, 123.—Schreber, Säugt, iii, 566, table 108.—Boddaert, Elenchus Anim., 1784, 124.—Gmelin, Syst. Nat., i, 1788, 112.
- 1771. Brown Mole, Penn., Syn. Quad., 1771, 314.
- 1777. *Talpa flavescens*, Erxleben, Syst. Reg. Anim., 1777, 118. (From Pennant.)
- 1800. *Talpa purpurascens*, Shaw, Gen. Zoöl. Mamm., i, 1800, 521.
- 1820. *Scalops canadensis*, Desmarest, Mam., i, 1820, 155.—Harlan, Fauna Am., 1825, 32.—Woodruff, Am. Journal Sc., xxviii, 1835, 168. (Habits.)
- 1829. *Scalops aquaticus*, Fischer, Syn., 1829, 249,—Bachman, Bost. Jour. Nat. Hist., iv, 1843, 28.—Wagner, Suppl. Schreb., ii, 1841, 103.—Aud. and Bach., Quad. N. A., i, 1849, 81, pl. 31.—Jordan, Man. Vert., 2d Ed., 1878, 25.

1842. *Scalops argentatus*, var. *argentatus*, Aud. and Bach., Journal Acad. Nat. Sci., Phila., viii, 1842, 292; N. A. Quad., iii, 1653, 252, pl. cl., f. 4.—Wagner, Suppl. Schreb., v, 1855, 573.—Kennicott, Pat. Of. Rep. Agric. 1857, 97. (Description and habits.)

Specific Characters.—Average length from nose to root of tail $4\frac{1}{2}$ inches; of tail to end of vertebræ .95 inch; hand .85 inch; foot .75 inch; width of palm exceeds its length, and varies from .60 to .90 inch as the extremes. Eyes and ears excessively minute; the eyes not covered with integument, a minute orbital opening being apparent. Muzzle long and depressed; snout truncate at an angle of about 45° ; on this surface are the antero-superior nostrils; the flexible snout extends nearly three-eighths of an inch beyond the upper jaw. The tail is nearly naked. Color dark plumbeous, with occasionally a brownish tinge; feet, tail, nails, and snout are of a light flesh-color. The hind feet are rather slender and weak, but this is made up by the great size of the spade-like hands, nearly an inch in breadth, attached by short, strong arms to robust shoulders. Feet not under the body, but standing out at the sides edgewise with the palm. In short, the whole form—the set of the limbs, great shoulders, short arms, broad hands and fossorial claws, united with the extraordinary muscular strength of the animal—adapt it to its method of ploughing through the soil, where it seems to travel as easily as on the surface. The earth seems scarcely less dense when one of these animated little ditchers is seen gliding along, not *over*, but literally *through*, the meadows, leaving his well-arched viaduct behind him, than does the water in the adjacent streams before the thrust of some sharp-nosed and large-finned darter or sun-fish.

Variety argentatus.—This form was established by Audubon and Bachman, “after some hesitation and doubt” (Quad. N. A., iii, p. 253), and admitted by Baird, who, however, questions “whether the two can, with entire propriety, be separated.” Dr. Coues, as already stated, regards it as no more than a geographical race of *S. aquaticus*, and states that “none of the ascribed characters are diagnostic.” Among the assigned characters of this form are the greater size, slenderer head, more elevated nostrils, eyes entirely covered by the integument, proportionally larger ears, and especially the soft, dense, and glossy silvery grey fur, which reflects, in different lights, “tints of silver, purple, and bronze.”—Kennicott. Both forms are to be found in Ohio, as I am informed by Mr. Langdon. Prof. Baird gives the habitat of *argentatus* as from Detroit west.

History and Habits.—The most noticeable feature of this animal is its fore feet, short legs, and robust shoulders, adapting it to plough through the soil.

"In motion the fore feet are thrust forward at the sides, with the edges answering to the thumb of a man's hand, placed downward, and the nails taking hold in the earth; the body is drawn along with ease and rapidity, as a row-boat is propelled by oars, the hind legs carrying the posterior parts. Those I have observed burrowing through unbroken soil appeared to loosen the earth in front with the long snout, and then to thrust it aside with the fore feet by the same movement which carried the body forward, the ground being raised above by the upward pressure of its powerful head and shoulders. The snout was kept in constant motion, undoubtedly as much in search of food as to loosen the particles of earth for the passage of the body."—Kennicott.

The mole constantly furrows the ground in search of insects which it usually finds within two or three inches of the surface. It rarely goes deeper, unless in winter or very dry weather, when the insects are deeper.

It is not known that this mole departs from its insectivorous habits. Kennicott observed that specimens kept in confinement ate sparingly of potatoes and lettuce, but died in three days, while others, kept in barrels of earth in which both vegetables and softened and dry corn were abundant, died without eating them.

It is not probable that this species does any injury to vegetation; they rather protect it by destroying noxious insects, and much of the mischief attributed to them is done by the various *Arvicolæ* and *Spermophiles*. On certain English farms the Mole (*Talpa europea*) is regarded as a benefit, especially to grass lands and pastures. Our species is usually nocturnal, sometimes found moving on cloudy days, and very early or very late on pleasant days.

The nest is of soft grass or leaves, usually under a log or stump, nearly a foot, or even more, below the surface. From five to nine young have been observed; the gravid female has been observed in February; young have been observed the last of May, and also in July. It is active in winter, and if the above statements are exact, there are probably two litters produced annually.

GENUS SCAPANUS Pomel.

Scalops, Cuvier, Leçons d' Anat. Comp., i, 1800.

Scapanus, Pomel,* Archives Sc. Phys, et Nat., ix, 247, 1848.—Gill, Synop. Insect. Mamm.—Bull, U. S. Geol. Surv., 2d Ser., No. 2, pp. 91-120.—Jordan, Manual Vertebrates, 1876, 25, First Edition.

* NOTE.—Ce troisième genre diffère des scalops par la position latérale et non supérieure de l'ouverture des narines, et par la formule dentaire comprenant une intermédiaire supérieure et trois inférieures de plus. Les espèces sont: *Scapanus Townsendii* et *Breweri* (Scal. *Townsendii* et *Breweri*, Bachm.)" Archives sc. Phys. et Nat., ix, 247, 1848.

Generic Characters.—Dental formula: i. $\frac{3-5}{3-3}$; c. $\frac{1-1}{1-1}$; pm. $\frac{4-4}{4-4}$; m. $\frac{3-3}{3-3} = \frac{8-8}{2-2}$.
 44. Teeth of both jaws, anterior to last premolar (excepting the broad anterior upper incisors), are of nearly equal size, conical, the upper ones with the points rounded off; the lower more compressed, and with the points more acute. The premolars increase in diameter from first to third, though of equal length; the fourth is much larger, and triangular in section. Externally, there is a small acute lobe on the anterior edge of each premolar, and on all the molars close to the base of the crown; a similar lobe on the inner edge of the corresponding teeth of lower jaw. The molars are in close contact; the teeth of upper jaw anterior to molars are separated by diastemata. Lower incisors nearly equal; second not larger than the first. The nostrils are near the end of the muzzle, either lateral or superior. The tail is more or less hairy.

SCAPANUS BREWERI (Bach.) Jordan.

HAIRY-TAILED MOLE.

1843. *Scalops breweri*, Bachman, Proc. Bost. Soc. Nat. Hist., i, 1841, 41.—
 Ib., Bost. Journal Nat. Hist., iv., 1843, 32.—Wagner, Weigman's
 Archiv., 1843, ii, 31.—Ib., Suppl. Schreb., v, 1855, 573.—Aud. &
 Bach., N. A. Quad., ii, 1851, 173, pl. i, xxiv.
 1857. *Scalops (Scapanus) breweri*, Baird, Mamm., N. A., 1857, 68.
 1876. *Scapanus breweri*, Jordan, Manual Vertebrates, 1876, 25; 2d Ed.,
 1878, 25.

Specific Markings.—A specimen in alcohol measured 1.65 inches from tip of nose to occiput, 4 inches to root of tail; tail 1.05 inches; tail to end of hairs 1.25 inches; length of hand .72 inch; of foot .75; breadth of palm .55 inch. The body is rather more slender than *Scalops aquaticus*. The head is rather pointed and elongated, owing to the great development of the muzzle, which projects about one-third of an inch beyond the incisors. The muzzle is depressed, tapering to a rounded truncate tip. There is a broad groove on the under side from the incisors to the bulb of the nose, which is terminal and smooth. The remainder of the muzzle is wrinkled and corrugated. Nostrils open on the sides of the terminal bulb; they are slightly visible from above, but not from beneath. The eye is minute and covered with skin; it is a little back of the angle of the mouth, and midway between the tip of the snout and the occiput. There is no external ear; the auditory opening is an oval cavity about one-twelfth of an inch in diameter, situated just above the insertion of the arm. The tail is thick and blunt at the end, entirely and densely covered with rigid hairs about one-sixth of an inch long. The third finger is longest; the second about the same size, but not as

long; the fourth smaller and shorter; the first is larger than the fifth. The palms are about as broad as long, exclusive of the claws; these are long and fossorial, and much larger than those of the hind feet. The hind feet are narrower and weaker than the fore, although about the same length. The under surfaces of all the feet are perfectly smooth, the upper with scanty hairs; there is a ciliated border of short hairs about the posterior and lateral margin of the palm. The fur is long and full, the longest hairs on the back measuring .35 inch. Above the fur is a dark ashy, plumbeous from the roots, glossed with ashy brown; this ashy brown tinge is more decided beneath, and extends more towards the roots; towards the chin there is a slight tinge of reddish brown. The hairs on the sides and extremity of the tail are tipped with silvery.

Prof. Baird mentions a specimen from Cleveland, presented by Prof. Kirtland, which had the tail almost entirely white, and the fur with whitish patches distributed irregularly over the body. Prof. Baird gives the distribution of this species as from Connecticut and New York to Cleveland, Ohio. Mr. F. W. Langdon has a specimen in his collection, taken by J. W. Shorten, at Rome, Adams county, Ohio, in May, 1877.

FAMILY SORICIDÆ.

In addition to the characters already given, based principally on the teeth and skeleton, the following more appreciable external characters are selected:

The Shrews are Mouse-like Insectivora, distinguished by an elongated and pointed muzzle, extending some distance beyond the incisor teeth, and ending in a naked cartilaginous muffle, with the nostrils pierced in the sides. The eyes are minute, and usually hidden in the fur, but are apparent on close examination. External ears are developed, with two inner lobes protecting the meatus; one lobe is formed from the antitragus, the other by the helix. The feet are five-toed, each toe with a distinct claw; the fore feet are little, if at all, broader than the hind feet; feet nearly plantigrade, and naked beneath. The external ears and smaller anterior feet readily separate the Shrews from the Moles.

Besides the above, the stomach is simple; the cæcum wanting; liver five-lobed, with a gall-bladder; the right lung four, and the left one-lobed. There is a peculiar glandular organ near the fore legs, on each side, wanting or small in the female or young, and much developed in the male during the breeding season. "The peculiar odor, more or less musky, of *Soricidæ*, is due to the secretion of these glands, and makes the Shrew-Mouse unacceptable as food to the cat that may have killed it." (Owen.)

The teeth vary from 28 to 32; there are two large incisor teeth in each

jaw, directed nearly horizontally forward; the upper much curved, and forming a hook; the lower straighter, and with the cutting edges lobed.

They are an abundant and widely distributed family, remarkably voracious, feeding on worms, insects, and mollusks, sometimes destroying small vertebrates and readily devouring each other. They are chiefly nocturnal; some species of *Neosorex* are aquatic. The young, at birth, are naked and blind. None hibernate, but all are about in the coldest weather.

The Shrews are represented in America by three genera; *Sorex* (L.), the most generalized type, also occurring in the Old World; *Neosorex* (Bd.) includes the Water Shrews, and is peculiar to North America, where it replaces *Crossopus*, of the Old World; *Blarina*, the most characteristic American genus, has no exact Old World analogue.

All are small and difficult to study. Measurements of such small animals are often fallacious. Color variation, due to age, sex, season, or geographical distribution, have furnished data for worthless species; moreover, the tail and lips, and possibly the feet, undergo extraordinary changes at the rutting season, so that such terms as "*pachyurus*," "*longirostris*," "*platyrhynus*," are of doubtful implication. Perhaps no family of North American mammals, of equal abundance, is so little known. Their nocturnal and subterranean life, combined with a shy and wary disposition and diminutive size, often baffles the attempt of the naturalist to study their habits, or even to secure specimens of the known species.

Contributions to our knowledge of American insectivora, since Professor Baird's treatise in 1857, are mainly due to Dr. Gill—"Synopsis of Insectivorous Mammals," < Bull. U. S. Geol. and Geog. Surv., 2d ser., No. 2, pp. 91-120, May 14, 1875; to Mr. J. A. Allen—"Catalogue of the Mammals of Massachusetts, with a Critical Review of the Species," Bull. Mus. Comp. Zool., Cambridge, i, No. 8, pp. 143-252, 1863; to Dr. Elliot Coues—"Precursory Notes on American Insectivorous Mammals, with Descriptions of New Species," in which several new sub-genera and species derived from Professor Baird's MSS., written in 1861, are brought out, and other species described by Dr. Coues, based on material not at that time available.

GENUS BLARINA Gray.

1851. *Blarina*, Gray, Proc. Zool. Soc. Lond., 1851. (Type *Sorex talpoides*, Gapper.)

Generic Characters.—Teeth 32 or 30 ($\frac{2}{1}\frac{0}{2}$ sub-genus *Blarina*, Gray, emend.; $\frac{1}{1}\frac{6}{2}$ sub-genus *Soriciscus*, Coues). Ears small, the parts directed forward so

as to show no opening or appearance of a concavity of auricle. Tail short; scarcely or not as long as the head; haired, with a small terminal pencil. Fore feet broad, palms naked, claws enlarged. Body stout; the species ranging from the largest to the smallest of American Shrews.

In the sub-genus *Soriciscus* occur most of the species, and among them the smallest Shrews in America. *Sorex parva*, Say, the type species, and *Blarina exilipes*, Baird, extend north to the Ohio, and possibly may occur in Ohio.

BLARINA (BLARINA) BREVICAUDA Baird.

SHORT-TAILED SHREW.

1823. *Sorex brevicauda*, Say, Long's Expd., i, 1823, 164.—Harlan, Faun. Amer., 1825, 29.—Bachman, J. A. N. Sc. Ph., vii, 1837, 381.—Aud. & Bach., Quad. N. A., iii, 1854, 335.
1836. *Sorex talpoides*, Gapper, Zool. Jour., v, June, 1830, 208.
1837. *Sorex dekayi*, Bach., J. A. N. Sc. Ph., viii, 1837, 377.—Aud. & Bach., Q. N. A., iii, 1853, 246 (original description).
1857. *Blarina talpoides*, Baird, Mam. N. A., 1857, 37.
1857. *Blarina brevicauda*, Baird, Mam. N. A., 1857, 42.
1877. *Blarina* (subg. *Blarina*) *brevicauda*, Coues, Precursory Notes on American Insectivorous Mammals.—Jordan, Manual of Vertebrates, 1876, p. 26, 2d ed., 1878, 352 (addenda).

Description of Species.—Size large; $3\frac{1}{2}$ to 4 inches from nose to root of tail; tail 1 inch; tail to end of hair $1\frac{1}{4}$ inches; hind foot $\frac{9}{16}$; extent of snout beyond teeth $\frac{3}{16}$. Form compact, with the head broad and massive. Tail short, about as long as the head, cylindrical, slightly depressed, naked at root, flesh-colored, thinly clothed with short, brownish-drab hairs, terminated by a pencil. Fur dense and soft, plumbeous at the base, tipped with glossy leaden-brown on the back, and lighter on the belly. Teeth tipped with brown, becoming glossy dark-brown at the points of the incisors. The snout is flesh-color, the lobes brown. The minute black eye is visible in life, the opening through the skin being the size of a small pin-hole. The auricle is directed entirely forward, and fits exactly against the opening of the ear; on lifting it the other parts are seen well developed. The hands are as wide or wider than the feet; palms and soles naked and sextuberculate.

Geographical Distribution.—Range great—from eastern Nova Scotia to Lake Superior, and west to Nebraska; southward, through Pennsylvania, to Columbus, Georgia. South of Pennsylvania it is replaced by the smaller *B. carolinensis*, if, indeed, the two species are not identical, in which case its southern range is extended from South Carolina to Missouri.

Specimens 817-8 in the Smithsonian Institution were collected by Dr. Kirtland, at Cleveland, Ohio, and 2,140-3 by E. Newton, at Salem, Ohio. (*Blarina talpoides*, Baird, Mamm. N. A., 1857, 42.)

History and Habits.—This is the largest, or one of the largest American Shrews; it is active and strong; the snout and head are powerful, and apparently much used in burrowing. It does not burrow under the ground continuously, as does the Mole, but passes along under the grass or leaves, seeking its food, occasionally inclining downwards under the soil, for a foot or more, and then coming to the surface. It does not dig out the earth, but presses it aside, descending beneath obstructions that come in its way, rather than going around them. This is the most abundant of our Shrews, abounding both in woods, meadows, and prairies. In some large areas it is impossible to find a foot-square not crossed by the net-work of well beaten, leaf-covered galleries made by this Shrew in its search for slugs, earth-worms, and the like. They are difficult to get, escaping quickly when once unearthed. They are found at any season lying dead on the earth, left uneaten by birds or carnivorous beasts on account of the disagreeable odor emitted from the body glands. Its traces are not found in swamps or sloughs; it prefers high ground, and is in no sense aquatic. It is active in the coldest weather in winter, like others of the family in the north. From Mr. Kennicott's interesting notes on the habits of this species in confinement, I quote the following:

"While alive, the minute black eye is distinctly seen, and always open; but, though the sense of sight may be possessed in the dark, it certainly is not used in the full light. Upon waving different objects before one, or thrusting my finger or a stick close to its face, no notice was taken of it whatever; but if I made any noise near by, it always started. If the floor were struck, or even the air disturbed, it would start back from that direction. I observed no indication that an acute sense of smell enabled it to recognize objects at any considerable distance, but its hearing was remarkable. An exceedingly delicate sense of touch was exhibited by the whiskers, and if, after irritating a Shrew, I placed a stick against it in even the most gentle manner, the animal would instantly spring at it. I could see that in running along the floor it stopped the moment its whiskers touched anything; and, often when at full speed, it would turn aside just before reaching an object against which it seemed about to strike, and which it certainly had not seen. Unless enraged by being teased, it endeavored to smell every new object with which its whiskers came in contact, turning its long flexible snout with great facility for this purpose. My caged specimens, both male and female, exhibited great pugnacity. When I touched one several times with a stick, it would become much enraged, snapping and crying out angrily. When attacked by a Meadow Mouse confined in a cage with it, one fought fiercely; and though it did not pursue its adversary when the latter moved off, neither did it ever retreat; but the instant the Mouse came close, it sprang at him, apparently not guided in the least by sight. It kept its nose and whiskers constantly moving from side to side, and often sprang forward with an angry cry, when the mouse was not near, as if deceived in thinking it had heard or felt a

movement in that direction. In fighting, it did not spring up high, nor attempt to leap upon its adversary, as the Mouse, but jerked itself along, stepping firmly, with the fore feet well forward and the head high. On coming in contact with the Mouse, it snapped at him, and, though it sometimes rose on its hind feet in the struggle, I did not observe that it used its fore feet as weapons of offense, like *Arvicola*. Its posture, when on guard, was always with the feet spread and firmly braced, and the head held with the snout pointing upward and the mouth and chin pointing forward, in which position its eyes would have been of no use could it have seen. The motions of the animal, when angry, are characterized by a peculiar firmness; the muscles appear to be held very rigid, while the movements are made by quick, energetic jerks. Short springs, either backward, forward, or sideways, appear to be made with equal readiness."

None of the specimens kept captive lived more than a day or two, although well cared for. They would not leave the sides of the wall or cage and cross the middle, but run around the sides; unless sharply chased, they would not jump over an ear of corn in the way, but ran around it. When hurt, this Shrew utters a short, tremulous note; when much enraged, this note becomes longer, harsher, and twittering, like that of some sparrows. Occasionally, a short, clear cry is uttered, softer and lower, but not unlike that of the Common Mink.

BLARINA (*SORICISCUS*) PARVA Say.

LEAST SHREW.

1823. *Sorex parvus*, Say, Long's Expedition, i, 1823, 164.—Harlan, Fauna Am., 1824, 29.—Bachman, J. A. N. Sc. Ph., vii, 1837, 394.
 1837. *Sorex cinerea*, Bachman, J. A. N. Sc. Ph., vii, 1837, 378; pl. xxiii, f. 3.
 1878. *Blarina (Soriciscus) parva*, (Say) Jordan, Manual of the Vertebrates, 2d ed., 1878 (addenda, page 353).

Specific Characters.—Body rather stout; feet small; head two-thirds the length of the foot; foot little more than half the length of skull; tail thin, shorter than the head. Head and body about two and one-half inches long; tail .75 inch; hind foot about .42. Color above, iron-gray, glossed with dark olive-brown; beneath, light-ash, or brownish-gray; tail bicolor, in harmony with the body areas. Dentition: $\frac{1}{1}-\frac{1}{1}$; pm. $\frac{4}{2}-\frac{4}{2}$; m. $\frac{4}{3}-\frac{4}{3}=\frac{1}{1}\frac{8}{2}=30$.

Distribution.—Southern States; north to Pennsylvania; also, at Irvington, Indiana (Dr. D. S. Jordan). Occurring at Carlisle, Pennsylvania, and in central Indiana, this species most probably is found in southern, or even central Ohio. I give it not as a known resident of Ohio, but as a species without reasonable doubt occurring there.

The specimen in Dr. D. S. Jordan's collection, taken at Irvington, Marion county, Indiana, is somewhat flattened by pressure, and has the back part of the skull crushed. The body is rather slender,

the muzzle elongated, the snout distinctly bilobed, and the nostrils lateral; the openings are nearly circular, and not visible from above. The whiskers are white; the longest are half an inch; there are about thirty on each side. The muzzle and chin are nowhere naked, but are covered with whitish, rather rigid hairs, less than one-sixteenth of an inch long. The ears are short, and concealed in the fur. The auricle covers the opening; on lifting it the edges of the antitragus and antihelix are seen to be ciliated at the edges with appressed, white, short hairs; anterior face of ear naked, posterior covered with fur. The body-fur is rather loose and short; on the back the longest hairs measure a little more than two and one-half lines. The tail is one-half inch to end of hairs; about five lines to end of vertebræ; it is slender, nearly terete, well clothed with hairs, has no distinct pencil. The tail is darker above than below; on the anterior side the hairs are granular from an apparently white substance resembling dried gum arabic, which is attached to the ends of many of the hairs; this is evidently an abnormal condition of the specimen. The feet are rather broad and full; the hinder are once and a half the length of the front. The feet and hands are well covered above with white, shining, appressed hairs; both are naked below; all the toes and fingers have well developed claws, at the bases of which are red spots, formed, evidently, by the accumulation of blood after death. The three middle fingers are longest, and nearly equal; the same is true of the toes. The first finger is larger than the very small thumb; the end of its claw extends to penultimate joint of second finger. The feet have six tubercles; on the hands I can discern but five. The fur is lead color at base, then light iron-gray, and tipped with olive-brown; the under parts are of a lighter tint of brownish-gray or light-ash; the feet and hands are white, and the tail indistinctly bicolor. Length of head and body $2\frac{1}{4}$ inches, hind feet .40 inch, tail a little less than $\frac{1}{2}$ inch. The teeth have black tips; the upper anterior incisor is hooked; it has a second hook on the cutting edge, a little in front of the base, its point even with the succeeding teeth. The large upper and long front incisors approach each other at an angle to near the tips, but do not touch; they have no internal lobe. The first and second premolars are about equal; the third is about half the length and size of the two anterior. There is a slight diastema between the third lateral tooth and the first molar. The last molar is scarcely visible from the outside. The lower anterior incisors have each two slight crenulations; they are stout, curved for the anterior third; the front two-fifths are jet-black, and are united to the ivory-white posterior portion by a reddish-brown band; their bases extend back under the bases of the first two lateral teeth.

The small reddish-black tipped cusp, plainly seen on the inside of each molar, is very small on the first three lateral teeth. As the specimen becomes thoroughly dry, the line of demarcation between the lower and upper fur of the animal is plainly visible.

ORDER RODENTIA.

Incisors $\frac{2}{2}$; (exceptionally $\frac{4}{2}$, there being two supplemental posterior teeth); teeth encased in enamel, and continually reproduced from persistent pulps, and growing in a circular direction; canines none; molars atypically with ridged surfaces. Lower jaw with condyles in longitudinal furrows. Members and feet adapted for walking. Placenta discoidal deciduate.

KEY TO FAMILIES OF RODENTIA.

* Incisors $\frac{2}{2}$; tail well developed.

† Hair forming a fur without spines.

a. Tail broad, flat and scaly; feet webbed; molars $\frac{4-4}{2-2}$; body stout and heavy. CASTORIDÆ.

a a. Tail and hind legs excessively elongated; the latter adapted for leaping; molars $\frac{4-4}{3-3}$ ZAPODIDÆ.

a a a. Tail usually long and hairy; molars $\frac{5-5}{4-4}$, or $\frac{4-4}{4-4}$ SCIURIDÆ.

† Fur with stiff spine-like bristles; toes with long curved claws. SPALACOPODIDÆ.

* * Incisors $\frac{4}{2}$; the middle upper incisors large, grooved, the outer ones small; teeth 28; tail very short; ears long. LEPORIDÆ.

FAMILY SCIURIDÆ.

Family Characters.—Dental formula: i. $\frac{1-1}{1-1}$; pm. $\frac{2-2}{1-1}$ or $\frac{1-1}{1-1}$; m. $\frac{3-3}{3-3} = \frac{12}{10}$ or $\frac{10}{10}$. Upper front premolar often deciduous; the last four grinding teeth of nearly equal size. Post-orbital process well developed, either short, pointed, and triangular, or long, slender, and much decurved. Palate broad and flat, extending back of last molar. Feet scansorial or fossorial, body generally elongate, tail always well haired.

The variations in color, size, and general form, are very great, and the number of well defined species is very much less than was once supposed.

Species of the family are found in all continental lands except Australia; they are most numerous in the Northern Hemisphere.

Of the eight genera admitted by Mr. J. A. Allen, *Sciurus* is nearly cosmopolitan, *Cynomys* is restricted to the parks and plains of the Rocky Mountain plateau, *Pteromys* to the tropical portions of Asia, and *Xerus* to Africa. *Arctomys*, *Tamias*, *Spermophilus* and *Sciuropterus* are found throughout the temperate and cold-temperate regions of the Northern Hemisphere.

Representatives of five genera are found in Ohio, as is shown in the accompanying key.

The Squirrels as a group are arboreal; they nest in trees, eat the fruits and buds of trees, and rarely go to the ground except for food. They have a light and graceful but muscular form; their nails are strong and sharp; they climb and leap with the greatest ease, aided by their large and bushy tails, which support and steer them while in the air. The fore feet are prehensile, the Squirrel seizing and holding its food with its hands, standing on the hind feet while eating. Except the Flying Squirrels, they are diurnal, keeping in the trees at night, and usually for a few hours in the middle of the day. The fur is nearly valueless; the flesh properly cooked is excellent food. As a group they are timid, readily domesticated, active in confinement, becoming agreeable and intelligent pets. Their main food is nuts, although they take insects at times, and are often so fond of the cereal grains as to be a nuisance to farmers. Indeed in 1749 Pennsylvania paid \$40,000 from the public treasury in premiums for the destruction of Squirrels. From the nature of their retreats, and natural activity, they evade the attacks of rapacious animals. Preying birds, reptiles, Wild Cats, and Martens at times capture the young, and rarely the old. Man is their worst enemy, although some species are most abundant in the pioneer settlements.

KEY TO THE GENERA OF SCIURIDÆ.

- * A densely furred membrane along the sides between anterior and posterior limbs; tail depressed, flattened, densely furred; permanent molars 5-5 above.

SCIUROPTERUS

- * * Sides without membrane specially modified.

† No cheek pouches; tail bushy, at least as long as body; ears long; no black stripes along the back. SCIURUS.

†† Cheek pouches present.

† Back with three to five distinct black stripes; tail shorter than body, not bushy; cheek pouches well developed. TAMIAS.

†† Not as above; body rather slender, squirrel like; cheek pouches well developed; claw of thumb rudimentary or wanting. SPERMOPHILUS.

††† Body large, thick-set, depressed; cheek pouches shallow; thumb rudimentary, armed with a small flat nail, not a claw; soles naked.

ARCTOMYS.

GENUS SCIUROPTERUS. F. Cuvier.

Etymology: Greek, *Skiouros*, a Squirrel; *Pteron*, a wing.

Sciurus, Linn., (in part) and of early authors generally.

Pteromys, G. Cuvier (in part), and most recent authors.

Sciuropterus, F. Cuvier, Ann. du Mus., x, 1825, 126, pl. x. (Type, *Sciurus volans*, Linn.)

Generic Characters.—Skull short, broad, highly arched, in general form, a miniature of *Sciurus hudsonius*, but the supra-orbital notch deeper,

and inter-orbital region more constricted, the orbital fossæ, auditory bullæ, and ears longer. Premolars, two; the first minute. Limbs united by a furred membrane, which is an expansion of the skin of the sides of the body, supported in front by a slender bone articulating with the carpus, and directed backwards. Tail two thirds as long as head and body, broad and flat, longer hairs directed laterally, thus serving as a rudder in their flight-like leaps, and with the special membrane supporting the body in air in their short flights from tree to tree. *Sciuropterus* may be regarded as a modified form of *Sciurus*, possessing rudimentary powers of flight, through the support of the parachute-like expansion of the skin of the sides of the body and the broad, flat tail. Pelage dense, soft, and furry; ears large, in conformity with their nocturnal habits. Colors, some soft, dull shade of brown above, and whitish beneath. Animals of small size, and crepuscular or nocturnal habits.

This genus is represented in North America by a single species of wide distribution; *Sciuropterus volans* takes its place in Europe; several species occur in Asia.

SCIUROPTERUS VOLUCELLA (Pall.) Geoff.

Var. *volucella* Allen.

SOUTHERN FLYING SQUIRREL.

1743. *Sciurus volans*, Catesby, Carolina, ii, 1743, 76, 77, pl. lxxvi, lxxvii.—Brisson, Quad., 157.—Linn., Syst. Nat., i, 1766, 88 (in part).
 1788. *Scurus volucella*, Pallas, Nov. Spec. Glires, 1788, 351, 353.—Gmelin, Syst. Nat., i, 1788, 153;—Schreber, Säugt., iv, 1792, 808, pl. ccxxii.—Shaw, Gen. Zööl., ii, 1801, 155, pl. civ.
 1818. *Pteromys volucellæ*, Desm., Nouv. Dict. Hist. Nat., xxvii, 1818, 406; Mamm., ii, 1822, 343.—Harlan, Faun. Amer., 1825, 187.—Griff, Cuv., v, 1827, 259.—Fischer, Syn. Mamm., 1829, 365.—Godman, Amer. Nat. Hist., ii, 146.—Yarrell, Proc. Zööl. Soc. Lond., 1830-1, 38 (anatomy).—"D. W. C.," Loud. Mag. Nat. Hist., ix, 1836, 569 (habits).—Emmons, Quad. Mass., 1840, 69.—Thomp., Hist. Vermont, 1842, 47.—DeKay, Zööl. N. York, i, 1842, 65, pl. xvi, fig. 2.—Wagner, Suppl. Schreb., iii, 1843, 231.—Schinz, Syn. Mamm., ii, 1845, 54.—Aud. & Bach., Quad. N. A., i, 1849, 216, 69, pl. xxviii.—Kenn., Pat. Off. Report Agric., 1856-57, 69, pl. viii.—Baird, Mamm. N. A., 1857, 286.—Thomas, Trans. Ill. Agric. Soc., iv, 1860, 657.—Hall, Canadian Nat. and Geol., 1861, 292.—Cooper, Proc. Cal. Acad., ii, 1861.—Tomes, Proc. Zööl. Soc. Lond., 1861, 281 (Guatemala).—Maximilian, Wieg. Arch. f. Naturgesch., 1861, 77.—Allen, Bull. Mus. Comp. Zööl., i, 1869, 224.—Gilpin, Proc. and Trans. Nova Scotia Inst. Nat. Sci., ii, pl. ii,

- 1870, 12.—Adams, Field and Forest Rambles, 1873, 99, 296 (New Brunswick).—Perkins, Amer. Nat., vii, 1874, 132 (habits in confinement).
1828. *Sciuropterus volucella*, Geoffroy, Dict. Class. Hist. Nat., xiv, 1828, 132.—Jordon, Man. Vert., 1878.
1874. *Sciuropterus volucella*, var. *volucella*, Allen, Proc. Bost. Soc. Nat. Hist., xvi, 1874, 189; Bull. Essex Inst., vi, 1874, 66; Mon. N. A. Rodentia, 1877, 655.

Specific Characters.—Size varying with locality; head and body ranging in adults from 7.50 to 4.75 inches; tail vertebræ from 5.00 to 3.50; tail, with hairs, from 6.50 to 4.25, and even less.

Yellowish-brown to pale reddish-brown above, white to creamy white below, with sometimes pale rufous; tail above usually darker than back—decidedly blackish in some northern forms.

History and Varieties of Species.—The Flying Squirrels were separated from ordinary Squirrels in 1800, by G. Cuvier, under the generic name *Pteromys*.

In 1825, F. Cuvier separated the small Flying Squirrels of Europe and North America from the others, under the name *Sciuropterus*, calling attention to the cranial and dental differences, as well as to the evident difference in size and shape of tail.

The wide geographical variation in size has led to the recognition of several species in North America. Prof. Baird, in 1858, with few specimens at hand, hesitatingly admitted four species—*volucella*, *hudsonius*, *alpinus*, and *oregonensis*.

Mr. J. A. Allen, in Monographs of North American Rodentia, recognizes one species with two varieties. The synonymy of var. *volucella* is given above.

Sciuropterus volucella, var. *hudsonius*, Allen, Proc. Bost. Soc. Nat. Hist., xvi, 1874, 289, is the northern form known as *Sciurus hudsonius*, Gmelin, 1788; *Pteromys hudsonius*, Fischer, 1825; *Sciurus sabrinus*, Shaw, 1801; *Pteromys sabrinus*, Rich., 1828; *Pteromys alpinus*, Wagner, 1843; Greater Flying Squirrel of Forster, 1772, etc.

The northern form is large, with the tail dusky to dark, and the general color of the body above less yellowish; it grades insensibly into the Southern Flying Squirrel. "There is," says Mr. Allen, "no break in the sequence from north southward, either in size, color, or other characters, by which the group can be subdivided either specifically or varietyally." The recognition of a northern and southern sub-species is almost entirely arbitrary.

The alteration in average size with the latitude already referred to in the case of the Virginia Deer, nearly all species of extensive north

and south range becoming smaller to the southward, prevails decidedly in the Sciuridæ, and the Flying Squirrel is no exception.

Description and Habits.—The following description and measurements are from Robert Kennicott's Report on the Quadrupeds of Illinois, in the Report of the Commissioner of Patents, 1856:

“Length of old male in March, from nose to root of tail, $4\frac{1}{2}$ inches; vertebrae of tail, 3 inches; tail to end of hair, $37\frac{1}{2}$ inches; breadth of tail in natural position, $1\frac{1}{2}$ inches; width across back, including fur and flying membrane, 4 inches; length of supplemental bone supporting membrane, $\frac{3}{4}$ inch.

“This is certainly the most beautiful of our rodents. In the specimen before me, the long and exquisitely soft fur is slate colored, tipped with creamy-yellowish drab on the back; the top of the tail brownish drab; on the under surface milk-white, tipped with cream color at the outer edges of the membrane and toward the tail, the under surface of which is very light brownish-yellow, tinged with cream.

“The large, prominent eyes are black and lustrous; the whiskers long, and the nearly naked ears rather large. The tail is densely clothed with soft hairs, and smoothly flattened; the feet are slender, with small, arched nails. The skin on the side is extended outward to form a membrane, which is attached to the legs, and to a supplemental slender curved bone, articulating with the joint of the foot. When this membrane is stretched, the animal is enabled to sail through the air to some distance by the force gained in descending from any elevated position, being aided in this by the flattened tail, which also serves as a rudder. It is not to be supposed, however, that the flying squirrel can propel itself through the air like a bird or bat. The tail and membranes only form a sort of parachute to buoy it up, while the force gained by the descent, and by the spring made, carry it forward. When it is about to light it sails upward by using the tail and hinder parts as a rudder, the momentum acquired being sufficient to raise it for some height at a considerable curve.”

The habitat of the Flying Squirrel is strictly among the trees; it does not move about by day, except in cloudy weather. I have seen them in the late evening sailing from the top of one tree trunk to the base of another, but never on the ground. It is gregarious, assembling in hollow trees, from which as many as a dozen will dart when the sides of their retreat are thoroughly thumped. Its food is similar to that of other squirrels. A pair, kept in confinement under the observation of the author, made their nest in a crayon-box placed over a bay window. In the evening they would come to the floor and take up any kind of nuts, ends of ears of pop-corn, and similar food, which was packed away in the box in excess of their daily meals. Their favorite amusement was to jump from the highest point of the transoms directly toward occupants of the sitting room, suddenly veering to the right or left when almost in one's face, and alighting on the floor or furniture at the opposite side of the room. The female joined with the male in these amusements until in April when, heavy with young, she became sluggish. The young, four in number, were brought forth in the drawer of the library table, at

which some of the family sat every evening. The mother was very much annoyed, and even alarmed when the drawer was closed during her temporary absence. The male was not admitted to the drawer, but kept to the box. Finally, the whole family escaped from an open window and took to the woods, or fell a prey to their natural enemies; although Kennicott relates that the species has been known to take up its residence, voluntarily, in and about human dwellings. Be that as it may, we never saw our gentle and beautiful pets again.

GENUS SCIURUS Linnæus.

Etymology: *Skiouros*, a squirrel (*Ski*—shade; *oura*—tail.)

Sciurus, Linnæus, Syst. Nat., 10th ed., 1758, and authors.

Macroxus, F. Cuvier, Dict. Sci. Nat., x, 1818.

Rhinosciurus, Gray, Cat. Mamm. Brit. Mus., 1843, 195.

Rheithrosciurus, Gray, Ann. & Mag. Nat. Hist., 3d ser., xx, 1867, 272.

Macroxus, Gray, Ann. & Mag. Nat. Hist., 3d ser. xx, 1867, 275. (Not

Macroxus, F. Cuvier.)

Generic Characters.—Skull short, very broad between the orbits; cranial portion greatly expanded; post-orbital processes long, slender, decurved; malar-bone slender; ante-orbital foramen a narrow, vertical slit, opening far in advance of first pre-molar; upper grinding teeth four or five; first pre-molar, when two are present, very small; muzzle short; ears well developed, well clothed, sometimes tufted; tail generally as long or longer than the body, broad, with the long hairs drooping laterally; nail of pollex rudimentary; pelage full and soft, but sometimes more or less rigid; coloration variable, but never with well-defined stripes on the dorsum; size generally large; no cheek pouches or lateral membrane. The group above characterized are so homogeneous as not to be readily separated. Some thirty or more nominal species are described, which Mr. Allen reduces to one-third that number. The genus reaches its fullest development in Southern Mexico and Central America, the metropolis of the group, where several species occur. The most obviously variable character is the tail, which varies greatly in length, fullness, and breadth.

SCIURUS HUDSONIUS Pallas.

Var. *hudsonius* Allen.

EASTERN RED SQUIRREL; PINE SQUIRREL; CHICKAREE.

1772. *Sciurus vulgaris*, Forster, Phil. Trans., lxii, 1772, 378.

1777. *Sciurus vulgaris*, e, *hudsonicus*, Erxleben, Syst. Anim., 1777, 416.

1778. *Sciurus hudsonius*, Pallas, Nov. Spec. Glir., 1778, 376.—Gmelin, Syst. Nat. i, 1788, 147.—Schreb., Säugt., iv, 1792, 777, pl. ccciv.—

- Shaw, Gen. Zoöl., ii, 1801, 140.—Kuhl, Beiträge zur Zoöl., 1820, 66.—Desm., Mamm., ii, 1822, 340.—Sabine, Franklin's Narr., 1823, 663.—Harlan, Faun. Amer., 1825, 185.—Godman, Am. Nat. Hist., ii, 1826, 138.—Rich., Fauna Boreali-Amer., i, 1829, 187, pl. xvii.—Fischer, Synop. Mam., 1829, 349.—Gapper, Zoöl. Jour., v, 1830, 205.—"F. Cuvier, Suppl. Buff. Hist. Nat., i, Mam., 1831, 303."—Bachman, Proc. Zoöl. Soc. Lond., vi, 1838, 100; Charlesworth's Mag. N. H., iii, 1839, 383.—Thompson, Nat. Hist. Vermont, 1842, 46; App., 1853, 14 (albino).—DeKay, New York Zoöl., i, 1842, 61, pl. xvii, fig. 2.—Wagn., Suppl. Schreber's Säugt., iii, 1843, 178.—Schinz, Synop. Mam., ii, 1845, 12.—Aud. & Bach., Quad. N. Am., i, 1849, 125, pl. xiv.—Woodhouse, Sitgreave's Expl. Colorado and Zuñi Rivers, 1853, 53 (Indian Territory).—Kennicott, Pat. Off. Rep., Agr., 1856 (1857), 67, pl. vii.—Bd., Mam. N. Am., 1857, 260, pl. xlvi, fig. 1.—Thomas, Trans. Ill. State Agric. Soc., iv, 1860, 656.—Hall, Canad. Nat. and Geol., 1861, 290.—Maximilian, Wiegman. Arch. f. Naturg., 1861, 73.—Ross, New Edinb. Phil. Journ., xiii, 1861, 162; Nat. Hist. Rev., 1862, 274 (to Arctic Circle).—Gray, Ann. and Mag. Nat. Hist., 3d ser., xx, 1867, 418.—Allen, Bull. Mus. Comp. Zoöl., i, 1869, 223; Proc. Bost. Soc. Nat. Hist., 3d ser., xx, 1867, 418.—Allen, Bull. Mus. Comp. Zoöl., i, 1859, 223; Proc. Bost. Soc. Nat. Hist., xiii, 1870, 188; ib., xvii, 1874, 43; Bull. Essex Inst., vi, 1874, 57.—Gilpin, Proc. and Trans. Nov. Scot. Inst. Nat. Sci., pt. iii, 1870, 12.—Stevenson, Hayden's Rep. U. S. Geol. Surv. Wyom., 1871, 461.—Adams, Field and Forest Rambles, 1873, 78, 295.—Merriam, U. S. Geolog. Surv. Terr., 6th Ann. Rep., 1872, 663.—Grinnell, Ludlow's Black Hills of Dakota, 1874, 81.—Jordan, Man. Vert., 1878, 28.
1815. *Sciurus carolinus*, Ord, "Guthrie's Geog." (2d. Am. ed.), ii, 1815, 292.
 1822. *Sciurus rubrolineatus*, Desmarest, Mam., ii, 1822, 333.
 1827. *Tamia hudsonia*, Lesson, Man. Mamm., 1827, 231.
 1843. *Tamias rubrolineatus*, Schinz, Syn. Mam., ii, 1843, 48.
 1874. *Sciurus hudsonius* var. *hudsonius*, Allen, Proc. Bost. Soc. Nat. Hist., xvi, 1874, 288; Mon. N. A. Rodentia, 1877, 672.

Varieties and Distribution.—Of the present species, four geographical varieties are recognized, namely: *hudsonius*, *richardsoni*, *douglassi*, and *fremonti*. These are sufficiently distinct in their extreme phases, but are very much blended wherever their respective habitats meet; the subspecies are readily separated by their coloration, especially the tail markings.

S. hudsonius, including its varieties, is found over most of North America, extending north to the limit of forest vegetation, and south over the northern two-thirds of the United States.

Our variety has a more extensive range than all the others; its habitat embraces nearly all of North America north of about latitude 34° east of the Rocky Mountains, and extending northward over most of Alaska. Its southern limit in the States is irregular, terminating on the Atlantic coast near Delaware Bay, but occupying the highlands of the interior as far southward as northern Georgia and Alabama, and even Monticello, Mississippi. It is not common south of central Illinois and northern Missouri, although Woodhouse notes its occurrence in the Indian Territory.

Description of var. hudsonius.—Average length, from nose to base of tail, six and three-fourths inches; tail to end of vertebræ, four and one-half inches, to end of hairs six inches. Above, pale, grayish, fulvous, each hair once or twice ringed with black; below, pure white, or white with faint annulations of black; generally a rather broad dorsal stripe of yellowish red; in many specimens, a short, conspicuous black lateral line. Ears blackish toward and at the end, with, in winter, a short, bushy pencil or tuft. Middle of tail dorsally of the same color as the middle of the back; the central reddish portion bounded with black, the latter being fringed with pale yellow. Upper surface of feet more or less tawny, often bright golden. The soles of the feet are naked in summer; in winter thickly furred, except the tubercles at base of toes. Winter specimens are, as a rule, redder than summer ones, with the general pelage much fuller, longer, and softer than in summer. Northern specimens are generally longer than southern ones, as usual in species with wide latitude. The brightest or reddest specimens, with whitest under parts, are from New York, Pennsylvania, and Ohio.

Habitat and Habits.—The natural home of this beautiful and active little Squirrel is in heavy timber, on dry, elevated land. It is also very abundant in northern Ohio and Indiana; it may occur sparingly in the southern parts of these States. Mr. Langdon states that it is common at St. Mary's, but is not identified in the vicinity of Cincinnati. It is often found among evergreens, particularly the black spruce, the cones of which form its favorite food.

Mr. Kennicott gives, in Patent Office Report for 1866, interesting notes on its habits, from which the following is abridged:

“Unlike most Squirrels, this species sometimes, but not often, lives in holes in the ground. Unlike others, too, it collects into its hole, in autumn, ample provision of the good things of squirrel life, wherewith to console and sustain itself in the uncomfortable

season of frost and snow. It makes large hoards of nuts, acorns, and seeds; and, in consequence of this good cheer, this Squirrel is seen actively scampering about in cold weather, when his hungry cousins cannot pluck up courage to leave their warm abodes even in search of food. This Squirrel runs with great swiftness, and, though it cannot leap as far as the migratory species, it darts along the trunk of a tree much more rapidly. Its note is a merry, shrill *chir-r-r-r-r*, very unlike the migratory and Fox Squirrels. Like the Red Fox and some other animals, the Chickaree appears in some instances to follow the settlements of the white man. Dr. Kirtland speaks of its having made its appearance, about the beginning of the present century, on the Western Reserve, where it is now, 1856, exceedingly abundant. It may be that this appearance of the Red Squirrel is the result of the destruction of certain enemies."

It is stated, in the Geological Survey of Ohio for 1838, that this species "destroys the Black and Gray species, and also the young of birds. I have myself seen it committing its depredations on a brood of young Robins."

SCIURUS CAROLINENSIS Gmelin.

Var. *leucotis* Allen.

NORTHERN GRAY SQUIRREL.

1792. *Sciurus cinereus*, Schreber, Säugt., iv, 1792, 766, pl. ccxii (nec *S. cinereus*, Linn., 1758).—Harlan, Faun. Amer., 1825, 173.—H. Smith, Griffith's Cuvier, v, 1827, 254.—Fischer, Synop. Mam., 1829, 352.—Thompson, Hist. Vermont, 1842, 45.—Maximilian, Weigm. Arch. f. Naturg., 1861, 66.
1815. *Sciurus pennsylvanicus*, Ord, "Guthrie's Geog. (2d Am. ed.) ii, 1815, 292" (dusky phase).
1826. *Sciurus niger*, Godman, Amer. Nat. Hist., ii, 1826, 133 (melanistic phase) (nec *S. niger*, Linn., 1858).—Richardson, Faun. Bor. Amer., i, 1829, 191.—Gapper, Zoöl. Journ., v, 1830, 206.—Bach., Præc. Zoöl. Soc. Lond., 1838, 96; Charlesworth's Mag Nat. Hist., iii, 1839, 335; Amer. Journ. Sci. and Arts, xxxvii, 1839, 307.—Emmons, Quad. Mass., 1840, 67.—DKay, N. Y. Zoöl., i, 1842, 60, pl. xvii, fig. 1.—Thompson, Hist. Vermont, 1842, 45.—Wagner, Suppl. Schreber's Säugt., iii, 1843, 172.—Schinz, Synop. Mam., ii, 1845, 9.—Aud. & Bach., Quad. N. A., i, 1849, 261, pl. xxxiv.—Maximilian, Weigm. Arch. f. Naturgesch., 1861, 76.—Hall, Canad. Nat. and Geol., 1861, 301.
1826. *Sciurus carolinensis*, Godman, Amer. Nat. Hist., ii, 1826, 131.—Doughty's Cab. Nat. Hist., ii, 1832, 240, pl. xxi.—Baird, Mam. N. Amer., 1857, 256, pl. xlv, fig. 2 (skull) (in part; "larger northern, and black and dusky" varieties only).—Thomas, Tr. Ill. Agr. Soc., iv, 1860, 656.—Hall, Canad. Nat. and Geol., 1861, 301.—Hayden, Trans. Am. Phil. Soc., Phila., xii, 1863, 144.—Allen, Bull. Mus. Comp. Zoöl., i, 1869, 222 (Massachusetts); Proc.

- Boston Soc. Nat. Hist., xiii, 1870, 188 (Iowa).—Gray, Ann. and Mag. Nat. Hist., 3d ser., xx, 1867, 426 (vars. "*major*" et "*niger*").
1830. *Sciurus leucotis*, Gapper, Zool. Journ., v, 1830, 206, pl. xi (based on Canada specimens).—Bachman, Proc. Zool. Soc. Lond., 1838, 96; Charlesworth's Mag. Nat. Hist., iii, 1839, 335; Amer. Journ. Sci. and Arts, xxxvii, 1839, 298.—Emmons, Quad. Mass., 1840, 66.—DeKay, New York Zool., i, 1842, 57, pl. xviii, fig. 1.—Wagner, Suppl. Schreber's Säugt., iii, 1843, 160.—Schinz, Synop. Mam., ii, 1845, 8.
1842. *Sciurus vulpinus*, DeKay, N. Y. Zool., 1842, 59 (winter pelage).
1849. *Sciurus migratorius*, Aud. & Bach., Quad. N. Amer., i, 1849, 265, pl. xxxv.—Kennicott, U. S. Patent Office Rep., Agr., for 1856-57, 62, pl. vi.—Adams, Field and Forest Rambles, 1873, 296 (western and south-western parts of New Brunswick).
1874. *Sciurus carolinensis* var. *leucotis*, Allen, Proc. Bost. Soc. Nat. Hist., xvii, 1874, 287; Mon. N. A. Rodentia, 1877, 700.

Description.—The Northern Gray Squirrel, varies in length of body, from nine to eleven and one-half inches, average length ten and one-half inches; tail vertebræ, eight inches, varying from seven to nine; tail to end of hairs eleven and one-half, varying from ten to twelve and one-half inches. It is whitish-gray above, with a dorsal area and lateral line brownish-yellow, with a more or less fulvous suffusion beneath the surface of the pelage, which shows somewhat through the surface tints; beneath, white. Varies through dusky and annulated phases to intense glossy-black. Tail with the hairs yellowish-brown basally, with narrow, black annulations, and a broad, conspicuous sub-terminal black bar, the hairs all broadly tipped with white, giving a white surface tint, through which the colors above mentioned may be seen. Ears not tufted, with or without a conspicuous woolly tuft of white at the base posteriorly.

The above characters separate var. *leucotis* from *carolinensis*, the Southern Gray Squirrel, which is smaller and has the general color of dorsal surface yellowish-brown, instead of whitish-gray.

The general colors above, give, in var. *leucotis*, a whitish-gray tint, especially marked northward and in winter specimens; while the general color above, of var. *carolinensis*, is mixed yellowish-brown and black.

The dusky phases of *carolinensis* are local in their occurrence, often wholly unknown over wide areas; they occur more frequently near the Great Lakes than further southward. Where the pure black phase occurs, usually every intermediate stage may be found, from the ordinary type to the glossy-black.

Distribution.—The present species ranges eastward along the Atlantic coast to New Brunswick, thence westward over the southern half of Maine, most of the St. Lawrence Valley, southern portions of Canada, Michigan, Wisconsin, Iowa, and up the Missouri at least to the mouth of the Platte, and south to the Gulf. It ranges west to the eastern border of the plains, from Nebraska to Texas, and apparently far into Mexico. Its northern limit coincides nearly with that of the Alleghanian fauna, that is to the isotherm of 44° F. Var. *leucotis* ranges southward over both the Alleghanian and Carolinian faunæ, or about to the isotherm of 56° F., where the two sub-species blend, *carolinensis* extending the range of the species southward to the Gulf coast, into Mexico, and perhaps even to Guatemala.

Besides the above, Mr. Allen recognizes a third variety, which may prove a distinct species. Var. *yucatanensis* is founded on four specimens from Merida, Yucatan; more specimens are requisite to fix its relations to the series.

Habits.—This is the most abundant of American squirrels; it has a wide range, is extremely prolific, and in certain localities exists in almost incredible abundance. Dr. Hoy, of Racine, Wisconsin, relates that he has known a hunter in northern Ohio to kill 160 in a day. The species apparently increases in numbers in certain districts after their settlement. Kennicott speaks of the prevalent report that persons have been compelled to watch the fields during their migrations, probably, to prevent destruction of the crops. Dr. S. P. Hildreth, in the "Pioneer History of the Ohio Valley," 1848, quotes from manuscript of Col. James Barker, of the gray squirrel "coming in millions from the north to the south, destroying whole fields of corn in a few days."

Mr. Frank W. Langdon, Madisonville, Ohio, to whom the writer is principally indebted for notes on Ohio mammals, drawn from the early history of the Ohio country, writes that the gray squirrel is common a hundred miles north of Cincinnati, but is rather vaguely reported in that locality.

The remarkable migrations performed at times by this species constitute a most interesting feature in their history. They congregate in the autumn in immense numbers, and move off in the same general direction, not turning aside for the largest streams, though usually averse to water. Dr. John A. Kennicott relates that during one of these migrations innumerable squirrels swam across the Niagara near Buffalo, New York, landing so exhausted as to be easily taken by hand or knocked down with sticks. Mr. Kennicott has the following notes in regard to these migrations:

"The reason for these migrations is not satisfactorily explained. That they are caused by want of food is hardly probable, as the squirrels are found to be fat at the time, and as often leave localities abounding with food as otherwise. After one of these grand migrations, very few of the species are found in the localities from which they have moved, and these, as if alarmed at the unusual solitude, are silent and shy. They rapidly increase in numbers, however, and in a few years are as abundant as before. I am not aware that they ever migrate except when exceedingly abundant. Of these immense hordes but few probably survive. No sudden increase in their numbers was heard of in southern Wisconsin after the several migrations from northern Illinois. Many are drowned in attempting to cross streams; not a few are destroyed by man; some die from utter exhaustion, and when forced to travel in an unnatural manner, upon the ground, they fall an easy prey to rapacious birds and mammals, all of which feast when the squirrels migrate."

I learn from Dr. Hoy that one of these migrations is said to have taken place in 1842; he witnessed another in 1847, and a third in 1852. From these facts, and from observations made in Ohio and elsewhere, he is of the opinion that the migrations, in most cases at least, occur at intervals of five years; and if he be right, the squirrels, which are now exceedingly abundant again in southern Wisconsin, may be expected to migrate in the autumn of 1857.* He further says that the migrations observed by him in southern Wisconsin occurred when the mast was exceedingly abundant and the squirrels in good condition. Near Racine they were observed passing southward in very large numbers for about two weeks, at the end of September and the beginning of October, and it was a month before all had passed. They moved along rather leisurely, stopping to feed in the fields, and upon the abundant nuts and acorns of the forests. So far had they departed from their accustomed habits that they were seen on the prairie, four or five miles from any timber; but even there, as usual, they disliked to travel on the ground, and ran along the fences wherever it was possible.

* Since writing the above I have received the following letter from Dr. Hoy:

RACINE, *April 2, 1878.*

DEAR SIR: Black and gray squirrels did migrate in 1857, as predicted. Whether there is a precise interval between their migrations I will not pretend to state, yet they did migrate in this section in 1847, 1852, and 1857, since which they have become so scarce that I could not determine whether there was an attempt to migrate or not, as they are nearly exterminated now in this vicinity. In 1857 I knew one negro who stood by a tree, in an open space on the line of a fence, and shot over twenty in one afternoon. In other years one might stand at the same place six months and not see one individual.

Yours,

P. R. HOY.

The food of the gray squirrel is like that of most of the family. They are very fond of blackhaw berries and mulberries. Four to six young are brought forth at a birth; two and three litters are produced annually, the first usually in March. They are somewhat social, several sometimes feed together, and many will take up with the same tree in winter.

Various species of Squirrels are infested with the larval forms of a species of *cestrus*. These grubs are found growing in the skin, in the abscesses formed by the irritation of the growing grub. They are most frequent about the shoulders and buttocks, where the Squirrel cannot destroy them with its teeth. The writer has observed them in the buttocks of about every fifth Ground Squirrel, collected in the vicinity of Menomonee, Wisconsin. "That a fly really emasculates the Striped Squirrel (*Tamias striatus*), seems certain from Dr. Fitch's observations. The Doctor reared the fly from the grubs found in the testes, which were completely eaten out." Professor A. R. Grote, on Squirrels and Emasculation, in "Forest and Stream, March 21, 1878, says: "There is a belief prevalent among hunters that the Red Squirrel habitually castrates the Black and Gray, also, that the old Gray Squirrel emasculates the young of the same species. This popular but fallacious opinion, is based, doubtless, in part, on errors in examination of supposably emasculated individuals, mainly in overlooking the testicles, which are small, except in the breeding season, as well as destroyed by the undoubted work of the larvæ of *cestrus*, and accidental castration in the combats of pugnacious individuals."

SCIURUS NIGER Linn.

Var. *ludovicianus* Allen.

WESTERN FOX SQUIRREL.

1806. *Sciurus ludovicianus*, Custis, Barton's Med. and Phys. Journ., ii, 1806, 43.—Harlan, Fn. Am., 1825, 186.—H. Smith, Griff. Cuv. An. King., v, 1827, 254.—Lesson, Man., 1827, 234.—Fischer, Syn. Mam., 1829, 351.—Baird, Mam. N. Am., 1857, 251.—Hayden, Trans. Am. Phil. Soc. Phila., xii, 1863, 144.—Allen, Proc. Bost. Soc. Nat. Hist., xiii, 1869, 188.
1822. *Sciurus rufiventer*, "Geoffroy, Mus. Par.;" Nouv. Dict. d'Hist. Nat., x, 103.—Desmarest, Mam., ii, 1822, 332.—Harlan, Faun. Amer., 1825, 176 (New Orleans).—Lesson, Man. Mam., 1827, 233.—Fischer, Synop. Mam., 1829, 351.—Schinz, Syn. Mam., ii, 1845, 6 (specimen from Missouri).—Maximilian, Weigm. Arch. f. Naturg., 1861, 70.
1823. *Sciurus macroura*, Say, Long's Exped. R. Mts., i, 1823, 115 (Kansas).

1825. *Sciurus magnicaudatus*, Harlan, Faun. Amer., 1825, 178.—H. Smith, Griffith's Cuvier's An. King., 1827, 225.—Lesson, Man. de Mam., 1827, 235.—Fischer, Synop. Mam., 1829, 351.—Bachman, Proc. Zool. Soc. Lond., 1838, 88; Charlesworth's Mag. Nat. Hist., iii, 1839, 156; Silliman's Amer. Jour. Sci. and Arts, xxxvii, 1839, 296.—Wagner, Suppl. Schreber's Säug., iii, 1843, 166.—Schinz, Syn. Mam., ii, 1845, 11.—Kennicott, U. S. Pat. Off. Rep. Agr., 1856 (1857), 56, pl. vi.
1826. *Sciurus macroureus*, Godman, Amer. Nat. Hist., ii, 1826, 134.—Woodhouse, Sitgreaves's Col. and Zúñi Rivers, 1853, 53.
1838. *Sciurus subauratus*, Bachman, Proc. Zool. Soc. Lond., 1838, 87; Charlesworth's Mag. Nat. Hist., iii, 1839, 155; Silliman's Amer. Jour. Sci. and Arts, xxxvii, 1839, 295.—Wagner, Suppl. Schreber's Säug., iii, 1843, 164.—Aud. & Bach., Quad. N. Am., ii, 1851, 67, lviii.
1838. *Sciurus auduboni*, Bachman, Proc. Zool. Soc. Lond., vi, 1838, 97 (Louisiana; dusky variety); Charlesworth's Mag. Nat. Hist., iii, 1839, 378.—Wagner, Suppl. Schreb. Säug., iii, 1843, 182.—Schinz, Syn. Mam., ii, 1845, 12.—Aud. & Bach., Quad. N. Am., iii, 1854, 260, pl. clii, fig. 2.
1842. *Sciurus occidentalis*, Aud. & Bach., Jour. Acad. Nat. Sci., Phila., viii, 1842, 317.
1851. *Sciurus rubicaudatus*, Aud. & Bach., Quad. N. Am., ii, 1851, 30, pl. lv.
1851. *Sciurus sayi*, Aud. & Bach., Quad. N. Am., ii, 1851, 274, pl. lxxxix.
1855. *Sciurus limitis*, Baird, Proc. Acad. Nat. Sci., Phila., vii, 1855, 331; Mam. N. Am., 1857, 256 (Texas; immature).
1867. *Macroxus ludovicianus*, Gray, Ann. and Mag. Nat. Hist., 3d series, xx, 1867, 426.
1874. *Sciurus cinereus*, var. *ludovicianus*, Allen, Proc. Bost. Soc. Nat. Hist., xvi, 1874, 287.—Jordan, Manual Vertebrates, 1878, 28, 2d ed.
1877. *Sciurus niger*, var. *ludovicianus*, All., U. S. Geolog. Surv. Terr., vol. xi, p. 718.

Varietal Characters.—Length of body 12 to 13 inches, ranging from 11 to 14; tail vertebræ $9\frac{3}{4}$, ranging from $8\frac{1}{2}$ to $10\frac{1}{2}$; tail to end of hairs $12\frac{1}{2}$, from 11 to $13\frac{1}{2}$. Above dusky-gray, with a strong rufous suffusion; ears, feet, and ventral surface fulvous, varying to bright ferruginous. The whole under parts are occasionally black, or mixed black and rufous—never apparently wholly black, or with the under surface pure white.

Known from var. *niger* by its smaller size; besides, *niger* is gray above and whitish beneath, and occurs only from Maryland to Louisiana.

Known from var. *cinereus* by its coloration; the nose and ears in *cinereus* are usually concolor with dorsal surface; the ears are short, scarcely longer than the fur. Var. *cinereus* is found from Virginia northward to southern New York and New England, and possibly may lap over into eastern Ohio.

Geographical Distribution and Variation.—The Western Fox Squirrel occupies the whole region drained by the Mississippi and its tributaries and the Missouri River north to southern Dakota, extending westward along the wooded streams to the plains. The geographical variations attending its wide range of climatic conditions consist in color of an increasing pallor northward and toward the dryer portions of the plains, and in the country adjacent to the Mississippi River is observed a strongly marked increase in color southward. The diminution in size from the north southward is not marked in this variety.

The color variations of this form have led to eight or ten different specific names; the animal was first described, however, by Custis, in 1806, under the name *ludovicianus*.

The Fox Squirrel takes more naturally to groves of oak trees or edges of timber belts than to deep woods; in these places he has ready access to corn fields, which they often rob from the time of roasting-ears until the corn is harvested.

Besides the nuts of trees and seeds of plants, it eats the buds of the basswood, elm, and maple. In autumn they eat the fruit of the thorn-apple. They have been seen to gnaw the bark from dead trees to procure beetles and their larvæ, and, like other Squirrels, to girdle trees in spring to taste the flowing sap. Unlike the Red Squirrel, the Fox and Gray Squirrels do not store up hoards of nuts for winter use in hollow trees, but bury them singly under the leaves in autumn.

Dr. Hoy is of the opinion that they are guided to these solitary caches by the sense of smell, unless the snow is very deep. They do not fail, but scratch away the leaves and snow from the right place and retire to a log or low tree to eat the morsel found. When the snow is deep they feed on buds and such nuts and berries as are left on the trees.

Unlike the Gray Squirrel, this species is not gregarious; more than two adults are rarely found together. Usually this species is not polygamous; it is less prolific than the migratory species, bringing forth usually three young at a birth, and probably producing two litters each season.

Like those of most animals in this order, the young are misshapen, unsymmetrical little creatures, with large heads and closed eyes. They are brought forth in a hole, the nests of twigs and leaves, of which this

species build so many in the forks of trees, being used only as temporary summer-houses. This Squirrel is not known to migrate in companies; they sometimes cross open country, like other Squirrels, in search of food.

It is the shyest of our species; if chased it does not stop on branches or take to the nearest tree, but runs at once to its hole. They are extremely active, rarely lying lazily sunning themselves, as does the Gray Squirrel. Their long bushy tails are in constant motion, as they spring from limb to limb apparently for mere sport.

GENUS TAMIAS Illiger.

Sciurus, in part, of most early authors.

Tamias, Illiger, Syst. Mamm. et Avium, 1811, 83 (type *Sciurus striatus*, Linnæus).

Tenotis, Rafinesque, Amer. Month. Mag., i, 1817, 362.

Generic Characters.—Skull narrowed anteriorly; postorbital processes long, very slender, directed downward and backward; plane of malar bone more oblique, and zygomatic process of maxillary more expanded and depressed than in *Sciurus*, but rather less so than in *Spermophilus*; anteorbital foramen oval, situated in the base of the zygomatic process of the maxillary; upper premolars two or one—when two, the first usually minute; ears of medium size or small, well clothed, but never tufted; cheek pouches large; pollex with a well developed nail; tail shorter than the body, flattened and rather broad, shorter and much narrower than in *Sciurus*; pelage generally full and soft; dorsal surface with two (usually four) longitudinal whitish stripes bordered on each side with a stripe of black, and with, except in one species, a central dorsal stripe of black, known from the smaller species of *Spermophilus* by the absence or rudimentary character of first upper premolar; weaker and relatively smaller dentition; more delicate and papery skull and more flattened tail; known from *Sciurus* by the more slender lower jaw, capacious cheek pouches, and shorter and narrower tail.

As above defined, *Tamias* includes four species, *T. striatus*, *T. asiaticus*, with several localized sub-species, *T. harrisi*, and *T. lateralis*. All are confined to North America except *asiaticus*, which ranges also over a large part of northern Asia and eastern Europe.

TAMIAS STRIATUS (Linn.) Baird.

STRIPED GROUND SQUIRREL; CHIPPING SQUIRREL; CHIPMUNK; also CHIPMOCK.

1731. *Sciurus striatus*, Catesby, Carol., ii, 1731, 75, pl. lxxv.—Linnæus, Syst. Nat., 1758, 64.—Schreb., Säug., iv, 1791, 791.—Erxleben,

- Syst. Reg. Anim., 1777, 426.—Desm., Mam., 1822, 339 (in part).—Harlan, Faun. Amer., 1825, 183 (in part).—Godman, ii, 1826, 142.—Emmons, Quad. Mass., 1840, 68.—Thompson, Hist. Vermont, 1842, 46.—DeKay, New York Zool., i, 1842, 62, pl. xvi, fig. 2.
1756. *Sciurus carolinensis*, Brisson, Quad., 1756, 135.
1784. *Myoxus striatus*, Boddært, Elenchus Animal., i, 1784, 122.
1788. *Sciurus striatus americanus*, Gmelin, Syst. Nat., i, 1788, 150—Fischer, Synop. Mam., 1829, 348.
1820. *Tamias americana*, Kuhl, Beiträg: zur Zoölogie, 1820, 69.—Gray, Ann. and Mag. Nat. Hist., 3d series, xx, 1867, 436 (= *T. striatus*, Baird).
1829. *Sciurus americanus*, Fischer, Synop., 1829, 349 (= *T. americana*, Kuhl).
1829. *Sciurus (Tamias) lysteri*, Richardson, Faun. Bor.-Amer., i, 1829, 181, pl. xv.—Doughty's Cab. Nat. Hist., i, 1830, 169, pl. xv.
1843. *Tamias lysteri*, Wagner, Suppl. Schreber's Säug., iii, 1843, 232, pls. ccciv, cccix.—Schinz, Synop. Mam., ii, 1845, 47.—Aud. & Bach., Quad. N. Amer., i, 1849, 65, pl. viii.—Giebel, Säug., 1855, 639.—Maximilian, Archiv. f. Naturgesch., 1861, 79.
1857. *Tamias striatus*, Baird, 11th Ann. Rep. Smiths. Inst., 1857, 55, foot note; Mam. N. Am., 1857, 292, pl. xlvi, fig. 2.—Kennicott, Rep. U. S. Pat. Off. Agric. for 1856 (1857), 70, pl. viii.—Thomas, Trans. Ill. State Agr. Soc., iv, 1860, 657.—Gilpin, Trans. Nova Scotia Inst. Nat. Sci., ii, pt. 3, 1870, 15 (Nova Scotia).—Allen, Bull. Mus. Comp. Zool., i, 1869, 225; Proc. Bost. Soc. Nat. Hist., xvi, 1874, 189; Mon. N. A. Rodentia, 1877, 782.—Jordan, Man. Vert., 1878.
1861. *Sciurus (Tamias) striatus*, Hall, Canad. Nat. and Geol., 1861, 290.—Adams, Field and Forest Rambles, 1873, 100 (New Brunswick).

Specific Characters.—Length of head and body, 5.75; tail to end of vertebræ, 3.65, to end of hairs, 4.25; middle of dorsal region gray, passing into rufous posteriorly, with five longitudinal stripes of black, the two outer on either side separated by a line of white; sides washed with yellowish; head above, brownish; whole lower surface of body white; tail blackish above, edged with white, centrally below yellowish-rufous, bordered with black and edged with white; a light superciliary line from nose nearly to ear, which above the eye is nearly pure white; a less distinct light line below the eye, which is nearly white on the lower eyelid; below this a faint stripe of reddish-brown, and another somewhat darker behind the eye; nose whitish; feet like the sides of the body.

Unlike most squirrels, the present species preserves great constancy

of coloration; the stripes vary somewhat in width and purity of color. Southern specimens are a little smaller and somewhat brighter colored; melanistic examples are rare in this species.

Distribution.—This squirrel is found from Pembina, Minn., east to the Atlantic coast and south to Georgia and western Missouri. It is not found on the lowlands of the Gulf coast or southern seaboard.

Habits and Habitat—This common and beautiful little squirrel lives in burrows in the earth, usually under stumps, logs, or about fences, in cultivated land; it does not habitually climb trees, nor does it leave the woods.

Like other ground squirrels this species has capacious cheek-pouches; they are by habit nut eaters, although they take readily to corn, even at times following the rows of corn like crows, blackbirds, and gophers, and dig out the planted grains, carrying them off to their burrows. have counted as high as sixty grains of dry corn in the cheek-pouches of a single specimen. A half bushel of hickory nuts and acorns, stored in single burrow, was found in November by Mr. Kennicott.

The call is a short, deep "*clock*," constantly repeated; sometimes a shrill *chip-chip* is uttered, whence the common name "Chipping" Squirrel. When frightened he utters a low chatter.

This animal can not be regarded as an enemy to the farmer; it is not suspicious, is readily shot or trapped, and driven off by cats and terrier dogs. It increases in numbers as its native forests are cleared for cultivation, as it is then protected from its natural enemies, the Weasels, preying birds, and even the Mink and Fox.

The Chipmunk, wherever it abounds, attracts attention by its beauty, industry, and cheerful activity, and I can not do better than to transcribe here from Mr. Kennicott's article in the Agricultural Report for 1856, a pleasant paragraph descriptive of their habits:

"In spring and summer chipmunks make love, rear their young, chase each other over stumps and logs in play, and enjoy themselves in various other ways; and with autumn and its harvest time comes their season of hard work. We are not to suppose, however, that this work is at all disagreeable to them as a man's duties are to him, when he will not cheerfully obey the laws of creation. They may now be seen hastening to and from their holes, their cheek-pouches distended with nuts, acorns, and seeds, or with grain stolen from the neighboring fields. These they continue to collect until cold weather has set in, when they retire to their burrows, where, with well-filled larders, they pass the winter comfortably, regardless of the cold winds which rage about them.

"This species closes the entrance to its burrows late in autumn, and appears to pass the winter in a state of semi-hibernation; for, though taking nourishment and not torpid, it never comes out, except very rarely in long-continued mild weather."

GENUS SPERMOPHILUS. F. Cuvier.

Etymology: Sperma—seed; Philos—lover.

Spermophilus, F. Cuvier, Mém. du Mus., ix, 1822, 293; Dents des Mamm., 1825, 161, 255, pl. iv (Type "*Mus citillus*, Linn.)."

Spermophila, Richardson, Parry's Second Voyage, App., 1825, 313 (= *Spermophilus*, F. Cuvier.)

Spermatophilus, Wagler, Syst. Avium, 1830, 22.

Citillus, Lichtenstein, Darst. neuer oder wenig bekannt., Säuget., 1827-34, pl. xxxi, fig. 2.

Colobotis, Brandt, Bull. Classe Physico-math. de l'Acad. Imp. des Sci. de St. Petersb., ii, 1844, 360.

Otocolobus, Brandt, 1844 (= *Colobotis*).

Otospermophilus, Brandt, 1844.

Generic Characters.—Skull very variable in form; postorbital processes generally triangular, strong, and directed downwards; plane of malar turned outward; position of ante-orbital foramen more forward than in *Tamias*; upper premolars always two, the first variable in size, generally much larger than in *Sciurus* or *Tamias*; grinding-teeth variable in strength and size; cheek-pouches well developed; body slender or thick set; tail long, moderate, or short, cylindrical or flattened; ears large, medium, or rudimentary, never tufted; nail of pollex generally undeveloped; pelage and color patterns variable.

The above diagnosis includes three sections, in their extreme phases as wide asunder as are most allied modern genera, but well connected through various intermediate specific forms. One of these sections provisionally recognized by Mr. Allen as sub-genus *Otospermophilus* Brandt (emend.), including *S. grammurus* and *S. annulatus*? of Colorado and Mexico, tends strongly toward *Sciurus*. Sub-genus *Colobotis*, same author, includes *S. richardsoni*, *S. empetra*, *S. mollis*, *S. spilosoma*, and *S. obsoletus*, with their several varieties, all northern and north-western forms; this group deviates in the direction of *Cynomys*.

The third sub-genus *Ictidomys*, as characterized by Mr. Allen, inclines toward *Tamias*; having the ears small, sometimes rudimentary, tail variable, skull long and narrow, first upper premolar usually small, and the dentition not heavy; it includes *S. tereticaudus* of southern California, *S. mexicanus* from Texas into Mexico, *S. tridecemlineatus* of the prairie region north to the Saskatchewan, and lastly *S. franklini*, whose habitat has heretofore been given from northern Illinois and Missouri northward to latitude 64°; this animal is certainly found, however, in the prairie region of northern Indiana, and the following note from Mr. Langdon

settles undoubtedly the fact of its occurrence in Ohio: "Dr. R. M. Byrnes informs me that he captured a specimen of this species near Middletown. Ohio; others were seen at the same time. The prairie-like character of that portion of the State ought to be favorable to their existence. It is also reported to occur at Mt. Vernon, Ohio, Dr. Byrnes says, on good authority." From Atwater's History of Ohio, 1838, we have the following note: "We have the Gopher, which lives in our wet barrens."

SPERMOPHILUS FRANKLINI (Sabine) Lesson.

GRAY PRAIRIE SQUIRREL; GRAY GOPHER; GRAY-HEADED SPERMOPHILE; FRANKLIN'S SPERMOPHILE.

1822. *Arctomys franklini*, Sabine, Trans. Linn. Soc., xiii, 1822, 587, pl. xxvii; *ibid*, Narr. Franklin's Journ., 1822, 662.—Harlan, Faun. Am., 1825, 167.—Godman, Am. Nat. Hist., ii, 1826, 109.—Fischer, Syn. Mam., 1829, 343.
1827. *Spermophilus franklini*, Lesson, Man. Mam., 1827, 244.—F. Cuvier, Suppl. Buffon, i, 1831, Mamm., 328.—Wagner, Suppl. Schreb., iii, 1843, 244, pl. cex ("*Arctomys franklini*, Sabine," on plate).—Brandt, Bull. Physico-math., Classe Acad. St. Petersb., ii, 1844, 379.—Aud. & Bach., Quad. N. Am., ii, 1851, 248, pl. lxxxiv. Schinz, Syn. Mam., ii, 1845, 67.—Kennicott, Pat. Of. Rep., 1856, Agric. (1857), 79, pl. ix.—Baird, Mam. N. Am., 1857, 314, pl. xlvi, fig. 4 (skull).—Thomas, Trans. Ill. State Agr. Soc., iv, 1861, 657.—Hayden, Trans. Am. Phil. Soc., Phila., xii, 1863, 145.—Allen, Proc. Bost. Soc. Nat. Hist., xiii, 1870, 189 (Iowa), xvi, 1874, 291; Mon. N. A. Rodentia, 1877, 881.—Bishop, Forest and Stream, vii, 1877, 342 (its introduction into New Jersey).
1829. *Arctomys (Spermophilus) franklini*, Richardson, Faun. Bor. Am., i, 1829, 168, pl. xii.

Specific Characters.—Length to base of tail, 9.00 to 10.50 inches; of tail to end of vertebræ, 5.00 to 6.50; to end of hairs, 6.25 to 8.50. Yellowish-brown above, varied with black, the black chiefly in the form of small squarish spots; eyelids white; front and sides of head and neck, the thighs and buttocks pure gray; top of head gray, sometimes varied more or less with yellowish brown; below grayish white; tail grayish white with three lines of black, the outer quite broad and broadly edged with white. Ear small, about .20 high; tail vertebræ about one-half the length of head and body; tail distichous, hairs long and abundant; form rather slender; pelage harsh, consisting of coarse, stiff hairs, without under fur.

History and Distribution.—This very interesting Spermophile is one of the most strongly marked and unmistakable of the genus. It was first

described by Sabine in 1822, and afterwards by Richardson, Kennicott, and Prof. Baird; as the earlier descriptions were based on the accounts given by Sabine and Richardson, it has, as Mr. Allen observes, "fortunately escaped synonyms." It was unknown to Audubon and Bachman until as late as 1851. It is a species of limited range; Dr. Coues found it abundant in the vicinity of Pembina; it occurs in Minnesota and over the prairie region of Wisconsin, Illinois, Missouri, and Iowa. Dr. P. R. Hoy met with it in Eastern Kansas; it extends further south, but is not near so common as *S. tridecemlineatus*.

The species, oddly enough, has been introduced into New Jersey, where it is rapidly increasing and becoming thoroughly naturalized. Regarding its introduction to the sea-board, I quote from Dr. Allen:

"I learned of its introduction there from Mr. Samuel Jillson, who first wrote me about it some three or four years since. Writing him recently for further information respecting the date and manner of its introduction, as well as for information respecting its present numbers, and the area of its range, he has kindly replied as follows, under date of Tuckerton, New Jersey, May 6, 1877: 'The date of its introduction is May, 1867, when a single pair was brought here from Illinois by Mr. Sylvester Mathis. This pair soon gnawed out of their cage and escaped. This was in the village of Tuckerton. They are very common on all the farms here, three miles from the village of Tuckerton. They seem to always keep in the fields, as I have never seen them in the woods. I find very little dirt at the mouth of their burrows—sometimes none. From one to two buckets of water poured in their holes will bring them out. We kill all we can on our farm. They destroy young chickens and turkeys, and the dogs dig large holes in our fields in trying to get at the gophers. I once found one in a salt-hay stack, in spring, dead and coiled up in the smallest ball possible. I also found one dead in my barn well. I think many of them winter in stacks and out-buildings, for I never could drown out any late in the fall in the flat fields. They are never seen here in winter, and no doubt are then dormant.'

Thus, from this single pair, accidentally introduced in New Jersey only eleven years ago, the species has spread over a belt some thirteen miles long and several miles in breadth. Its numbers already render it a farm pest which will not be soon, if ever, eradicated. That the species is capable of reproducing itself so abundantly in a region so different and so distant from its original habitat, is also suggestive. Their sudden distribution over so large an area is due in part to their disposition to migrate from one field to another. Not less than a dozen have been known to appear in a region where none were seen the previous summer.

Mr. Kennicott, in his interesting and detailed account of the habits of this species, in the Agricultural Report of the Patent Office, states that the males lead a wandering life in the summer, and that pairs appear to frequently change their quarters, leaving their winter burrows to breed

in others, and then perhaps hibernating in a third at some distance from this.

Several species of *Spermophilus* are remarkable among North American Rodentia for their carnivorous habits. Dr. Hay has satisfied himself that the Striped Gopher (*S. tridecemlineatus*) acts as a useful check upon the increase of various *Arvicolæ* and other Field Mice, and says that Ground Squirrels cannot inhabit the same locality.

In confinement it kills small Squirrels and Mice presented to it, uttering a low, snarling growl, and emitting a musteline odor. Like the Weasels, it sucks the blood, eats out the brains, and devours the carcass as it needs it. The present species is also carnivorous, but less so than the Striped Gopher. One kept in confinement by Prof. Baird was decidedly carnivorous, and one observed by Dr. Hoy killed mice put in its cage.

This Squirrel inhabits thickets and edges of timber, banks of ditches, and grain-fields. It takes up newly planted corn, as does the Striped Gopher and Chipmunk.

It is not sufficiently carnivorous, however, to warrant its protection when the accounts of benefits and injuries are balanced. The Striped Gopher destroys so many Meadow Mice that it is worthy of protection rather than destruction.

The following account of a colony of this species is transcribed from Mr. Kennicott's article already cited :

"In the early part of summer twenty or thirty of these animals suddenly made their appearance, and burrowed in an old embankment within three or four rods of my father's house. They seemed to have lost the shyness exhibited when leading a solitary life, and were not alarmed at the near approach of man. They even came about the kitchen door to pick up crumbs, and disputed with the chickens for their food. Like the Striped *Spermophiles*, they glided silently to their burrows when alarmed, uttering, as they entered, a remarkably clear whistle twitter, more musical than the voice of any other mammal I ever listened to, and as clear as that of a bird. The same note was uttered when the animal was much hurt or frightened. They fed upon June grass, clover, timothy, and the broad-leaved plantain. * * * A number of young chickens disappearing, and the eggs being eaten in several hens' nests near the burrows of the *Spermophiles*, suspicion rested upon them, probably unjustly, and a war of extermination was commenced. Several were shot, while others were killed with clubs, whereupon the survivors left in a body, as suddenly as they had come, and were never seen again, nor could they be found on any part of the farm."

This Gopher is regarded by the farmers of Iowa as far more destructive than the Striped Gopher, sometimes destroying acres of newly planted corn by eating the seed. The burrows run to the depth of three to four feet, and are quite extensive.

GENUS ARCTOMYS Schreber.

Etymology: *Arktos*—bear; *Mus*—mouse.

- 1758. *Mus*, Linn. (in part), Syst. Nat., i, and early authors.
- 1777. *Glis*, Erxl., Syst. Reg. Anim., 1777, 358 (in part).
- 1778. *Mures soporosi*, Pallas, Nov. Spec. Glires, 1778, 74.
- 1792. *Arctomys*, Schreber, Säugt., iv., 1792, 720 (in part).
- 1825. *Arctomys*, F. Cuvier, Dents des Mamm., 1825, 159, 254, pl. liv (based on *Arctomys alpinus*, Linn., and "*Arctomys empetra*," Pall.

Generic Characters.—Skull with dorsal outline nearly straight; frontal region flat or depressed; post-orbitals triangular at base, with a long, de-curved point; zygomatic arches moderately extended, not widening and diverging posteriorly; grinding teeth rather small, the transverse and antero-posterior diameters about equal, and the molar series very nearly parallel; ante-orbital foramina sub-triangular under and below, but not thrown outward. Size large; body thick set, depressed; cheek pouches small; tail rather short, bushy, and flattened; ears small; nail of pollex broad, flat, or wanting; pelage with long, coarse hairs and thick under fur. Coloration generally yellowish-gray, without either distinct spots or stripes. This genus includes the largest members of the *Sciuridæ*, and, excepting the Beaver, the largest of existing North American rodents.

Besides the species belonging to the fauna of Ohio, two species, *A. flaviventer* and *A. pruinosus*, occur in the west and northward. The latter is twice the weight and bulk of *A. monax*; the former is more nearly allied to *A. monax*, but has smaller ears and larger tail, aside from strongly marked skeletal differences.

The habitat of *Arctomys monax* extends from the Carolinas northward to Hudson's Bay and Liard River, and westward from the Atlantic coast to western Missouri, Iowa, and Minnesota.

ARCTOMYS MONAX (Linn.) Schreb.

WOODCHUCK; GROUND HOG; MARMOT.

- 1758. *Mus monax*, Linn. Syst. Nat., 10th ed., i, 1758, 60.—Pallas, Nov. Spec. Glires, 1778 (in part only).—Boddaert, Elench. Anim., i, 1784, 105.
- 1777. *Glis monax*, Erxl., Syst. Anim., 1777, 361.
- 1792. *Arctomys monax*, Schreber's Säugt., iv, 737.—Shaw, Gen. Zool., ii, 1808, 117.—F. Cuvier, Dict. des Sci. Nat., xxix, 1823, 162.—Sabine, Trans. Linn. Soc., xiii, 1822, 582.—Harlan, Fauna Amer., 1825, 158.—Godman, Amer. Nat. Hist., ii, 1826, 100.—

- I. Geoffroy, Dict. Class. d'Hist. Nat., x, 1827, 186.—Hamilton Smith, Griffith's Cuvier's An. King., iii, 1827, 170 (with plate); v, 1827, 244.—Richardson, Faun. Bor. Amer., i, 1829, 153.—Fischer, Synop. Mamm., 1829, 342.—Emmons, Quad. Mass., 1840, 64.—DeKay, New York Zool., i, 1842, 68, pl. xxi, fig. 4.—Thompson, Nat. Hist. Vermont, 1842, 44.—Wagner, Suppl. Schreb. Säugt., iii, 1843, 259 (in part).—Schinz, Syn. Mam., ii 1845, 61.—Aud. & Bach., Quad. N. Amer., i, 1849, 17, pl. ii.—Kennicott, Trans. Ill. State Agr. Soc., i, 1855, 579; U. S. Patent Office Rep. Agr., 1856 (1857), 82, pl. x.—Baird, Mamm. N. Amer., 1857, 339, pl. xlix, fig. 1 (skull).—Thomas, Trans. Ill. State Agr. Soc., iv, 1860, 657.—Allen, Bull. Mus. Comp. Zool., i, 1869, 226 (Mass.); Proc. Bost. Soc. Nat. Hist., xiii, 1870, 190 (Iowa); xvi, 1874, 294.—Cope, Proc. Amer. Phil. Soc., Phila., xi, 1869, 173 (fossil; bone caves, Virginia).—Gilpin, Proc. and Trans. Nova Scotia Inst. Nat. Sci., ii, pl. iii, 1870, 16.—Adams, Field and Forest Rambles, 1873, 100, 296 (New Brunswick).—Jordan, Man. Vert., 1878.
1777. *Glis canadensis*, Erxl., Syst. Anim., 1777, 363 (in part);=Quebec Marmot, Pennant + Quebec Marmot, Forster).
1778. *Mus empetra*, Pallas, Nov. Spec. Glires, 1788, 74.—Boddaert, Elench. Anim., i, 1784, 105.
1820. *Arctomys melanopus*, Kuhl, Beiträge, 1820, 64 (Canada).
1822. *Arctomys empetra*, Sabine, Trans. Linn. Soc., xiii, 1822, 584; (not *Mus empetra*, Pallas; nor *Arctomys empetra*, Schreber, and previous authors).—Richardson, Parry's Voyage, App., 1825, 315; Faun. Bor. Am., i, 1829, 147, pl. ix (= *empetra*, Sabine, and hence mainly *A. monax*).
1869. ? *Stereodectes tortus*, Cope, Proc. Acad. Nat. Sci., Phila., 1869, 3; Proc. Amer. Phil. Soc., Phila., 1869, 172, pl. 3 (fossil; bone caves, Va.; probably based on an abnormal incisor of *A. monax*).
- La Marmotte d'Amerique*, Brisson.
- Maryland Marmot*, Pennant.
- Monax gris*, F. Cuvier, Hist. Mamm., xxxvii, 1822.

Specific Characters.—Length to base of tail 14.50, varying from 13.00 to 15.50; of tail vertebræ about 4.50; of tail to end of hairs about 6.75. Color above generally mixed fulvous, brownish-black, and gray; below, yellowish-rufous, varying to brownish-rufous. Top of head, upper surface of all the feet, and the tail usually black or brownish-black, varied slightly with pure gray or rusty gray, and even to nearly uniform intense black. The

ears are large, rounded, thinly haired, generally gray, but varying in the darker specimens to brownish-gray, passing into black at the extremities. Tail full, rounded, and bushy, with the hairs generally considerably less than half the length of the head and body. Specimens from the same locality vary greatly in color, the gray above from whitish to yellowish, the black from brownish-black to pure black, and the fulvous from pale to yellowish. The abundant soft under fur is black or dusky at base, then fulvous, passing into brownish-fulvous. Young specimens are much lighter colored than adults, and the pelage generally thinner.

Habits and Habitat.—The Woodchuck is a strictly herbivorous animal. Of cultivated crops it is particularly fond of peas and clover, sometimes making its burrow in a clover field. It is also fond of corn and other grain, leaves and buds. It naturally inhabits woods, as the *Spermophiles* do open prairies; like these it leaves its burrows with great caution, and only for a short distance. Although burrowing at times in open fields, its favorite resort is in wooded rocky bluffs along the banks of streams; often it burrows under logs, brush heaps, or old fences. It produces from four to six young in the early part of summer; these leave the mother before fall, dig their burrows, and shift for themselves. They are not gregarious; they hibernate through the winter. Mr. Kennicott, from whose writings this account of their habits is mainly drawn, states that he has often found a number of them taking refuge in hollow trees, entering a hole at the ground, and climbing up the cavity after the manner of the gray rabbit. Their gait is a series of short and awkward jumps, much like that of a clumsy pig; a man can readily overtake them. They are cautious while feeding, often standing erect, with out-stretched neck, on the alert for danger.

The fur is of no value; the hide is tough, and used for lashes, pouches, and thongs among the backwoodsmen.

Mr. Kennicott states that when fat, which they usually are in autumn, Woodchucks are esteemed by some good eating. Such an one, I take it, was Thoreau's Canadian woodchopper, "a true Homeric or Paphlagonian man," he tells us, who "can hole fifty posts a day, and make his supper on a woodchuck which his dog caught." "Frequently he would leave his dinner in the bushes, when his dog had caught a woodchuck by the way, and go back a mile and a half to dress it, and leave it in the cellar of the house where he boarded. He was so gentle and unsophisticated that no introduction would serve to introduce him, more than if you introduced a woodchuck to your neighbor."

How this Walden neighbor cooked his Woodchuck, Thoreau does not

tell us. Mr. Kennicott says they are sometimes baked whole, or are better, parboiled in milk, and afterwards "fatted down."

Regarding the occurrence of this animal in Southern Ohio, I have the following note from Mr. Langdon :

"Not very common, but can not be called rare. Burrows usually found in the banks of small creeks. On June 11th, 1876, I noticed a Woodchuck climbing *down* a tree in a piece of woods, near Madisonville. He was about thirty feet from the ground when I first saw him, and was coming down head first, although the tree was vertical or nearly so, and about fifteen inches in diameter. As I was not aware that this species was in the habit of climbing trees, I made a note of the circumstance at the time. The identification of the species was complete, as I approached within twenty feet of the animal before it reached the ground, and found its burrow within a few yards of the tree. It succeeded in getting there, however, before I did, on account of the dense undergrowth."

The above observation of this species climbing trees is interesting. Mr. Kennicott states that it sometimes crawls up a leaning tree, or into thick clusters of bushes overgrown with vines, on which it is fond of lying in warm summer days.

FAMILY CASTORIDÆ.

This family has been associated with the *Sciuridæ*, as also has *Haplodontidæ*. The three families are so nearly allied as to be placed by Alston in the same series—*Sciuromorpha*.

The Beavers differ from the Squirrels in being adapted to an aquatic mode of life ; they also lack the strongly developed post-orbital processes of *Sciuridæ*. Instead of truly rooted molars, with multiple fangs, short crowns, and tuberculated triturating surface, undergoing much change by attrition, as in *Sciuridæ*, the molars have, in *Castoridæ*, a long, persistent, dentinal pulp ; the teeth continue to grow for a long period, becoming truly rooted only late in life. The teeth, moreover, are single-rooted ; have no well defined coronal portion, and change little by attrition. The lower jaw is massive, and its symphyseal surface long. The long incisors and general structure of the skull indicate great incisive power—the Beavers being gnawers "par excellence."

The living representatives of the family belong to the genus *Castor*. Other genera are represented by fossil forms.

Castoroides ohioensis, Foster, the "Fossil Beaver" of North America, as large as the full-grown Black Bear, exceeding even the *Capabara*, the largest of existing Rodents, has been referred to this family, but is now the type of the family *Castoroididæ*, Allen. This interesting animal was first described by Mr. J. W. Foster, from two mandibular rami and a radius ten inches long, two inches across the head, and an inch and a half across the distal extremity.

GENUS CASTOR Linn.

Etymology: Latin, *Castor*—a Beaver.

Castor, Linn., Syst. Nat., i, 1776, 178.

Generic Characters.—Feet four-toed; hind feet palmate, with the second toe double-clawed, Tail broad, flat, and scaly. Body stout and heavy, most strongly developed posteriorly. Grinding teeth $\frac{4}{1}-\frac{4}{2}$, single rooted, dentinal pulp persisting to a late period in life. General form of skull sciurine, but lacking post-orbital processes.

Represented by a single living species, formerly distributed over most of the northern hemisphere. Two well-marked subspecies are recognized: var. *fiber* of the Old World, and the New World form, var. *canadensis*. Fossil remains scarcely distinct from the present species are found in the Quarternary deposits of Europe and North America.

CASTOR FIBER Linn.

BEAVER.

1766. *Castor fiber*, Linn., Syst. Nat., ed. 12th, i, 1766, 78.—Forster, Phil. Trans., lxii, 1772, 375.—Erxleben, Syst. Reg. Anim., 1777, 440.—Gmelin, Syst. Nat., i, 1788, 124.—Schreber, Säugt., iv, 1792, 623, pl. clxvi (skull), pl. clxxv (animal).—Shaw, Gen. Zoöl., ii, 1801, 30.—Tiedemann, Zoöl., i, 1808, 481.—Pallas, Zoögraphia Rosso-Asiatica, 1811, 412.—Oken, Naturgesch., iii, 2, 1816, 879.—Cuvier, Règne Anim., i, 1817, 186.—Desmarest, Mamm., 1822, 277.—Knox, Mem. Wern. Nat. Hist. Soc., iv, 1823, 548 (anatomy).—J. Sabine, Franklin's Joun. to the Polar Sea, 1823, 659.—Say, Long's Exped. R. Mts., i, 1823, 464.—Harlan, Fauna Amer., 1825, 122.—Godman, Am. Nat. Hist., ii, 1826, 21.—Griffith's Cuvier's An. King., v. 1827, 207.—Brandt and Ratzburg, Mediz. Zoöl., i, 1829, 13, pl. iii, iv, iv a.—Owen, Proc. Zoöl. Soc. Lond., 1830, 19 (anatomy).—Bennett, Gardens and Menag. Zoöl. Soc., Quad., i, 1835, 153.—Doughty, Cab. Nat. Hist., iii, 1839, 598, pl. 1.—Waterhouse, Charlesworth's Mag. Nat. Hist., iii, 1839, 598 (figure of skull).—Schinz, Europ. Faun., 1840, 57.—Keyserling and Blasius, Wirbelt. Europ., 1840, 31.—Emmons, Quad. Mass., 1840, 51.—Thompson, Hist. Vermont, 1842, 38.—De Kay, Nat. Hist. N. York, i, 1842, 72, pl. xx, fig. 1, pl. viii, figs. a, b.—Nilsson, Skand. Faun., 1847, 409.—Woodhouse, Sitgreave's Exped. down the Zuni and Col. Riv., 1853, 47 (New Mexico).—Giebel, Säugt., 1855, 619.—Blasius, Naturgesch. Säug. Deutschl., 1857, 405.—Wilson, Edinb. New Phil. Journ., 2d ser., viii, 1858, 1 (fossil,

- Scotland; and geog. distr.).—Theirot, Verhandl. Ver. f. Naturk. v. Presburg, 1860–61, 21.—Holzl, ib., 96.—Zeittles, ib., 16.—Smith, Proc. Acad. Nat. Sci., Phila., 1861, 146 (habits Amer. Beav.).—Fitzinger, Zoöl. Gart., 1864, 273 (habits Europ. Beav.).—Reeks, Zoölogist, 2d ser., 1869, 1953 (Newfoundland).—Cope, Proc. Acad. Nat. Sci., Phila., 1869, 173 (fossil, Virginia).—Allen, Bull. Mus. Comp. Zoöl., i, 1869, 226; Proc. Bost. Soc. Nat. Hist., xiii, 1869, 190; xvii, 1874, 43; Bull. Essex Institute, vi, 1874, 49, 56, 61, 65.—Lilljeborg, Fauna öfver Sveriges och Norges, 1871, 346.—Jordan, Man. Vert., 1878, 29.—Allen, Mon. N. A. Rodents, 1877, 433.
2. *Castor canadensis*, Kuhl, Beitr. z. Zoöl., 1820, 64.—Fischer, Synop. Mamm., 1829, 288.—Newb., Pacific R. R. Expl. and Surv., vi, iv, 1857, 62 (California and Oregon).—Baird, Mam. N. Amer., 1858, 355, pl. xlviii, fig. 1 (skull); U. S. and Mex. Bound. Surv. ii, ii, 1859, 40.—Cooper, Pacif. R. R. Expl. and Surv., xii, ii, 1859, 82 (California, Oregon, and Washington Territory): Amer. Nat., ii, 1868, 533 (Upper Missouri).—Suckley, Pacif. R. R. Expl. and Surv., xii, 1859, ii, 100 (Milk River).—Leidy, Holmes' Post-pliocene Fossils, South Carolina, 1860, iii, pl. xxi, fig. 2 (fossil; Ashley River, S. C.); Journ. Phil. Acad. Nat. Sci., 2d ser., v, 1869, 405 (fossil).—Hayden, Trans. Amer. Phil. Soc., xii, 1862, 146 (Upper Missouri).—Coues, Amer. Nat., i, 1867, 362; Proc. Acad. Nat. Sci. Phila., 1867, 135 (Arizona).—Gilpin, Proc. and Trans. Nova Scotia Inst. Nat. Sci., iii, 1872, 152 (Beaver dams).—Green and Brown, Journ. Linn. Soc. Zoöl., x, 1869, 361 (nat. hist. and hunting; Pacific Slope of Rocky Mountains).
1829. *Castor fiber* var. *americanus*, Richardson, Faun. Bor. Amer., i, 1829, 105.—Wagner, Suppl. Schreb. Säug., iv. 1844, 7.—Aud. & Bach., North Am. Quad., i, 1849, 347, pl. xlvi.—Wyman, Am. Journ. Sci. and Arts., 2d ser., x, 1850, 61, fig. 4 (fossil; Memphis Tenn.).—Morgan and Ely, The Beaver and his Works, 1878, 44, pl. i—xxiii, and 26 wood cuts (general history and anatomy.) *
1836. *Castor americanus*, Richardson, Back's Arctic Land Exped., 1836, 494.—Brandt, Mém. Acad. St. Pétersb., 6th ser., Sci. Nat., vii, 1855, 64, pls. i, ii, iii (tail and skull).—Maximilian, Weigm. Arch., 1862, i, 132.
1846. *Castor europæus*, Owen, Brit. Foss. Mam., 1846, 190.
1855. *Castor fiber* seu *europæus*, Brandt, Mém. Acad. St. Petersb., 6th ser., Sci. Nat., vii, 1855, 63.
1868. *Castor fiber* var. *europæus*, Morgan, Amer. Beaver and his Works, 1878, 44.

1875. *Castor (fiber var.?) canadensis*, Coues and Yarrow, Wheeler's Expl. and Surveys west 100th Merid., v, Zoöl., 1875, 123 (Colorado, Utah, and Arizona).

Geographical Distribution.—The Beaver formerly existed along the seaboard to northern Florida, and in Texas to the Rio Grande. Its northern limit is apparently that of the forests; it extends to the Barren Grounds and is abundant in Alaska.

Its present range is much less extended; few are found east of the Mississippi south of the Great Lakes. They remain in northern Maine and New York, and according to an article in "Forest and Stream," November 2, 1876, they are trapped profitably in portions of Virginia. Their former abundance through the Ohio region and west to the Pacific is well attested; the names Beaver Creek, Beaver Dam, etc., are suggestive of their occurrence in Ohio and Indiana. Mr. Langdon says in his notes: "Indefinitely reported from the north-west portion of the State." From "Atwater's History of Ohio" (1838), the following: "Beavers were once here in large numbers on the high lands at the heads of our rivers, but, with those who caught them, they have long since disappeared from among us." From the "Pioneer History of the Ohio Valley," Hildreth, 1848: "The Beaver disappeared in a great measure from this part of the country with their friends and admirers, the Indians." From "History of the State of Ohio," Jas. W. Taylor, 1854: "Beaver Creek, near a little lake two miles long and one mile wide, and a remarkable place for Beaver."

Prof. M. V. B. Knox states that this species is becoming scarce in Eastern Kansas. In that State it seldom builds dams, but lives under overhanging banks and roots, and does much damage to timber along the streams."*

The writer has observed their work on the margin of Drummond Island and in the Sault St. Mary, where soft timber trees like the cottonwood and willow were gnawed smoothly off just above the level of the ground. Occasionally a tree had fallen to the land instead of into the water, although trees leaning to the water are usually selected. In such cases the bark was not gnawed from the trunk or branches, as is done when the trees fall into the water. Pieces are found gnawed into cordwood lengths, evidently that they might be readily dragged away to the underground burrows.

Description.—Body thick, heavy, depressed, enlarging posteriorly, broadest near the hips; head large and broad; nostrils lateral, divided; ears

* Transactions Kansas Academy of Science, vol. 4, 1875, p. 21.

short, rounded, furred, and nearly hidden in the pelage; tail broad and flat, covered with horny, blackish scales; fore feet short and weak, unwebbed; hind feet large, fully palmate; soles of all the feet naked, upper surface hairy; second toe of hind foot usually furnished with a double claw, the supplemental one being placed transversely beneath the true one; under fur soft, dense and grayish; overlying hairs coarse, shining, chestnut. Length of body about thirty inches; of tail about ten; weight of adult, about forty-five to fifty pounds, ranging to upward of sixty pounds. General color above reddish brown, lighter or darker in different specimens; below lighter, approaching grayish. The Beaver is usually darker to the northward, occasionally even nearly black; albinistic specimens creamy white to wholly white.

The Beaver is several years attaining its growth, even increasing in size long after mature dentition. Two-year-old Beavers average thirty-five to forty pounds; old ones sometimes attain a weight of sixty and even sixty-three pounds. The skull increases in size apparently nearly through life, and in weight by the thickening and increased density of the bones.

The Old-World form has the basilar cavity deeper and larger, nasals extending farther backward, and dorsal surface of interorbital region broader than in var. *canadensis*; these variations probably result from long separation of the race and accidental causes rather than to original diversity of the stock; the same conclusion applies to their habits and instincts.

The carminative substance, castoreum, exuding from two pairs of glands, one in each groin, into the preputial and ano-preputial passages of this animal, is a somewhat complex substance, composed of the grayish-colored and somewhat offensive secretion of the upper glands, mixed with the yellow, viscid, and musky matter from the lower glands; these mixed and dried secretions constitute the castor of commerce, which evidently varies with the climate, food, etc. The castor from the American Beaver has a much lower commercial value, and on chemical analysis is found to contain less volatile oil, castorin and resin, and much more carbonate of lime than that of the Russian Beaver.

FAMILY ZAPODIDÆ.

- 1857. < Sub-family *Dipodinae*, Baird, M. N. A., 1857, 428 (*Muridæ*).
- 1868. = Group *Jaculina*, Carus, Handb. Zööl., i, 1868, 101.
- 1872. = Family *Jaculidæ*, Gill, Arrang. Fam. Mamm., 1872, 20.
- 1875. = Family *Zapodidæ*, Coues, Bull. U. S. Geolog. and Geogr. Survey Terr., 1875, 2nd ser., No. 5, 253.

1876. = Sub-family *Jaculinæ*, Alston, Proc. Zool. Soc. London, 1876, 89 (*Dipodidæ*).

Family Characters.—Teeth 18; i. $\frac{1}{1}-\frac{1}{1}$; pm. $\frac{1}{3}-\frac{1}{3}$; m. $\frac{3}{3}-\frac{3}{3}$. Superior incisors compressed, sulcate; premolar small; molars rooted. Cervical vertebræ unanchylosed (cf. *Dipodidæ*). Cranial portion of the skull shorter and broader than in *Muridæ*. Auditory bullæ transverse (cf. *Muridæ*), without special development (cf. *Dipodidæ*). Anteorbital foramen large, rounded, with a supplementary nick, or additional foramen, at its lower portion. Malar mounting the zygomatic process of the maxillary to effect suture with the lachrymal. Zygomatic arch styloid, much depressed. Trunk enlarged posteriorly, in correlation with the shortness of the forelimbs and great elongation of the hind ones, especially of the pes (cf. *Muridæ*, except *Gerbillinæ*); nevertheless, the pes with five perfect and separate metatarsals, and five functionally developed digits (cf. *Dipodidæ*, *Pedetidæ*). Tail greatly exceeding the trunk in length (cf. most *Muridæ*), very slender, scant-haired (cf. *Dipodidæ*, *Pedetidæ*). Progression saltatorial.

GENUS ZAPUS Coues.

1825. *Meriones*, Fr. Cuvier, Dents des Mamm., 1825, 187 (type. Not *Meriones* of Illiger).

1830. *Jaculus*, Wagner, Natürl. Syst. Amphib., 1830, 23 (type. Not of Jarocki, 1821, nor of early authors).—Baird, Mamm. N. Am., 1857, 429.—Alston, Proc. Zool. Soc. Lond., 1876, 89.

1875. *Zapus*, Coues, Bull. U. S. Geol. Survey Terr., 2nd ser., No. 5, 1875, 253 (type).

Generic Characters.—Well developed cheek pouches, internal. Digits of the hand five, the first rudimentary, with a flat, blunt nail; palms naked, granular, and tuberculate. Digits of the foot five, all functional, and with perfect claws and basal webs; sole naked throughout, the heel smooth, the rest granular and tuberculate. Meatus of the ear capacious, closed with large antitragal and tragal flaps. Pelage coarse and hispid. Size small; configuration modified from an ordinary murine shape; physiognomy peculiar.

ZAPUS HUDSONIUS Coues.

LONG-TAILED JUMPING MOUSE.

1780. *Dipus hudsonius*, Zimmermann, Geog. Gesch., ii, 1780, 358, No. 268 (based on the long-legged mouse of Hudson's Bay, of Pennant).—Boddaert, Elench. Anim., i, 1784, 115 (based on Zimmermann).—Schreber, "Säug., 861, No. 6."—Fischer, Syn. Mamm., 1829, 340 (based on Zimmermann).

1787. *Mus longipes*, Zimmermann, Penn. Arkt. Zoöl., i, 1787, 131 (erroneous identification with *Mus longipes* auct.).
1798. *Dipus canadensis*, Davies, Trans. Linn. Soc., iv, 1798, 157, pl. 8, f. 5, 6 ("Jumping Mouse of Canada").—Shaw, Gen. Zoöl., ii, 1801, 192, pl. 161 (after Davies)—Turton, Syst. Nat., i, 1806, 100.—Ord, Guthrie's Geog., 2nd Am. ed., 1815, 292.—Fischer, Syn. Mamm., 1829, 339.
1799. *Dipus americanus*, Barton, Amer. Philos. Trans., iv, No. xii, 1799, 115 (plate not numbered, opposite p. 124).—Barton, op. cit. vi, 1804, 143 (habits).—Ord, Guthrie's Geog., 2d Am. ed., 1815, 292.
1823. *Dipus labradorius*, Turton, Syst. Nat., i, 1806, 99 (Labrador Rat, of Pennant).—Ord, Guthrie's Geog., 2d Am. ed., 1815, 292.
1818. *Gerbillus hudsonius*, Rafinesque, Am. Month. Mag., 1818, 446.—Lesson, Man., i, 1827, 257.
1822. *Gerbillus canadensis*, Desmarest, Mamm., ii, 1822, 331.—Harlan, Fn. Amer., 1825, 155.—Godman, Am. Nat. Hist., ii, 1st ed., 1826, p. —; 2d ed., 1831, 94, pl. —; 3d ed., 1861, 94.—Griffith, Anim. Kingd., v. 1827, 240, No. 624.—Emmons, Rep. Quad. Mass., 1840, 69.—Thompson, Nat. Hist. Vermont, 1853, 44.—Hall, Canad. Nat. and Geol., vi, 1861, 304 (Montreal).
1823. *Mus labradorius*, J. Sabine, App. Frankl. Journ. 1823, 661.
1825. *Gerbillus labradorius*, Harlan, Fn. Amer., 1825, 157 (after Sabine).—Godman, Am. Nat. Hist., ii, 1st ed., 1826, p. —; 2d ed., 1831, 97; 3d ed., 1861, 97.—Griffith, Anim. Kingd., v. 1827, 240, No. 625.
1825. *Meriones umericanus*, Fr. Cuvier, Deuts. des Mamm., 1825, 187, No. and plate 15, figs. a, b; teeth: names not formally presented, but inferable from the context).
1827. *Meriones canadensis*, Less., Man., i, 1827, 258.—Schinz, Syn. Mamm., ii, 1845, 91.
1829. *Dipus labradoricus*, Fischer, Syn. Mamm., 1829, 338.
1829. *Meriones labradorius*, Richardson, F. B. A., i, 1829, 144, pl. 7.—Wagner, Suppl. Schreb., iv, pl. 226 B (after Richardson).—Dawson, Edinb. N. Philos. Journ., new ser., iii, 1856, 2.
1830. *Jaculus americanus*, Wagler, Natürl. Syst. Amphib., 1830, 23.
1843. *Jaculus labradorius*, Wagner, Suppl. Schreb., iii, 1843, 294.—Giebel, Säug., 1855, 599; Zeitschr. gesamt. Naturw., xxv, 1865, 272 (osteology).—Kennicott, U. S. Patent Office Agric. Rep. for 1856, 1857, 95, pl. 11 (habits).—Maximilian, Arch. Naturg., 1861, p. —; Verz. Reise N. Am., 1862, 146.
1845. *Meriones labradorus*, Schinz., Syn. Mamm., ii, 1845, 92.
1851. *Meriones hudsonicus*, Aud. & Bach., Q. N. A., ii, 1851, 251, pl. 85.

1857. *Jaculus hudsonius*, Baird, M. N. A., 1857, 430, pl. 21, f. 5 a-e.—Newb., P. R. R. Rep., vi, 1857, 59 (California).—Baird, P. R. R. Rep., x, 1859, Gunnison's and Beckwith's Routes, Mamm., p. 8.—Cooper and Suckley, Nat. Hist. Wash. Terr., 1860, 83, 101, 127.—Hayden, Trans. Amer. Philos. Soc., xii, 1862, 147 (Fort Union).—Samuels, Ninth Ann. Rep. Mass. Board. Agric., 1862, 178 (habits).—Gilpin, Proc. and Trans. Nova Scotia Inst., ii, 1870, 60 (Nova Scotia).—Allen, Bull. Mus. Comp. Zool., i, 1870, 226 (Massachusetts).—Tenney, Am. Nat., vi, 1872, 330, f. 101 (habits).—Merriam, Ann. Rep. U. S. Geol. Surv. Terr. for 1871, 1872, 665.—Ames, Bull. Minn. Acad., i, 1874, 70 (Minnesota).—Allen, Bull. Ess. Inst., vi, 1874, 60, 65 (Wyoming and Utah).
1875. *Zapus hudsonius*, Coues, Bull. U. S. Geol. and Geog. Surv. Terr., 2d ser., No. 5, 1875, 254; Mon. N. A. Rodentia, 1877, 467.—Coues and Yarrow, Zool. Expl. W. 100th Merid., 1875, 99.—Jordan, Man. Vert., 1878, 2d ed.

Geographical Distribution.—This species inhabits the greater part of British America and the United States. Its exact northern and southern limits are not yet determined. Specimens are reported from Great Slave Lake, latitude 62, by Dr. Coues. The same author has observed it personally in Virginia. Mr. Langdon has "recognized it satisfactorily" in Ohio, where, indeed, we should naturally expect an animal whose dispersion is probably not less than that of *Hesperomys leucopus*, particularly as it shows a strong preference for woodlands, and as there are no very extensive treeless areas in Ohio.

Description—This animal has a general murine form, modified by the extreme development of the hind limbs, particularly of the feet; the legs and thighs are large and muscular; the body tapers from the fore-legs, and is large posteriorly, in correlation with the greatly developed hind-legs. This kangaroo-like structure enables this little animal to take enormous leaps, of even eight to ten feet when alarmed, and has given rise to the common names, "Kangaroo-mouse," "Jumping-mouse." The tail, in relative length, exceeds that of any other of our rodents; it is always longer than the head and body, sometimes nearly twice as long. This feature has suggested the vernacular prefix: "Long-tailed," by which it is distinguished from the "Wood-mouse," and other names common to *Hesperomys leucopus*. The head is conoidal, with a prominent and somewhat blunt snout, and retreating under jaw. The muzzle is small and naked, inferior in position; over it the skin crosses with a deep, transverse fissure, making an imperfect, overhanging flap, freely moveable back and forth. The nose-pad has two median, vertical grooves; the

nostrils are lateral, the whiskers sparse, but some of them nearly half as long as the body. The cylindrical tail tapers uniformly to a fine point, with a slight pencil of hairs at the tip; it is covered with verticillate scales, with short hairs springing from beneath the whorls, but not concealing them. The eyes are small, situated midway between the nose and ear. The ear is remarkable among rodents for the development of the antitragus in the form of a circular, thickened pad, completely reversible, and capable of being applied against the meatus; the tragus expands into a thin, free, rounded border, which may lie in apposition with the opposite antitragal lobe, thus providing for the perfect closure of the meatus. The hands are large, the thumb rudimentary, covered with a broad, truncated nail; the third and fourth fingers longest. The lengthening of the hind limbs, which determine the saltatorial habits of this species, is effected by the elongation of both the *crus* and the *pes*; the former is longer than the latter. The toes are five, the second, third, and fourth sub equal, and much the longest; all have claws. The metatarsals are five, complete from end to end. (Coues.) The foot is covered above with short, silky hairs, below naked; the sole is smooth about half way, then granular; the digits are transversely scutellate below. The general pelage is coarse and hispid, with but little gloss; bristly hairs are mixed with the soft, under fur. The under parts are snowy white, sharply separated from the sandy-yellowish of the sides and outer surfaces of the limbs. There is a dorsal strip of brownish-yellow, heavily shaded with brownish-black; this is about as wide as the lateral stripes already described. The tail is bicolor, corresponding to the body-areas; the ears have a light colored rim; the backs of the hands and feet are whitish; the whiskers are mostly black.

FAMILY MURIDÆ.

The family *Muridæ* includes Rodents, which have the incisor teeth $\frac{1}{1}$; canines and premolars absent; molars $\frac{3-3}{3-3}$; equal sixteen teeth in all. Tibia and fibula united below. The coronoid, condylar, and descending processes of the mandible are well developed and distinct. The ante-orbital foramen is a large pyriform slit, bounded exteriorly by a broad plate of the maxillary; this character is probably diagnostic of the family. The American genera are included in two sub-families:

Murinæ.—Animals which include and resemble the common Rats and Mice. The molars are rooted, tubercular, and with crenate periphery. Incisors compressed, narrower than deep; root of outer incisor causing a protuberance on outer side of mandible; descending process of the mandible, a broad flattened plate, wholly below the plane of the molars; pal-

ate nearly plane; nasals projecting anteriorly. Animals of lithe and supple form, quick in movement, with large, bright eyes, pointed, mobile snout, prominent ears, and lengthened limbs and tail. Abundant in temperate and warm climates, not reaching the Arctic Seas. Found throughout South, Central, and most parts of North America.

Arvicolinæ.—Molars normally rootless (except in *Evotomys*), prismatic, with flat crown and serrate periphery. Incisors often broader than high, root of under incisor causing a protuberance, if any, on the inner side of the mandible, at or near notch between condylar and descending process; descending process of mandible hamular, the apex of the hook attaining the level of the molars; palate highly arched; nasals not projecting beyond pre-maxillaries. Animals with squat and heavy shape, slow movement, small eyes, blunt snout, inconspicuous ears, and shortened limbs and tail as compared with *Murinæ*. Not known to occur further south than Mexico; most numerous represented by individuals in high latitudes; some of them are among the most arctic of mammals.

SUB-FAMILY MURINÆ.

The genera of this sub-family are, by Dr. Coues, separated into two groups: tribe (1) *Mures*, of the Old World, with the tubercles of upper molars in three series, and the palate extending back of the molars; and (2) *Sigmodontes*, New World genera, with the tubercles of upper molars in two series, and the palate ending opposite last molars.

Of the tribe *Mures*, four species of the typical genus, *Mus*, are found in North America, viz.: *M. decumanus*, Pallas, the Brown or Norway Rat, introduced into North America about 1778, and now the commonest species; *M. rattus*, Linnæus, the Black Rat, introduced about 1544, but now being supplanted by the preceding; *M. alexandrinus*, Geoff., the Roof Rat, or White-bellied Rat, introduced in the southern States; and *M. musculus*, Linnæus, the cosmopolitan House Mouse. These pests are among the best known of mammals, but, not being indigenous to the fauna of Ohio, are not treated in the present report.

The tribe *Sigmodontes*, Coues, includes all the indigenous American *Murinæ*. Four genera are recognized; *Neotoma*, *Sigmodon*, *Ochetodon*, and *Hesperomys*—the last with three sub-genera.

GENUS NEOTOMA Say and Ord.

Mus, sp., Say and Ord, 1818-23.—Desmarêt, 1822.

Arvicola, sp., Harlan, 1825.

Lemmus, sp., Fischer, 1829.

Neotoma, Say and Ord, Journ. Acad. Nat. Sci., Phila., iv, pt. ii, 1825, 346 (type *N. floridana*).

Myoxus, sp., Richardson, Zoöl. Journ., iii, 1828, 517 (*N. cinerea*).

Teonomys, J. E. Gray, Proc. Zoöl. Soc. Lond.

Generic Characters—Snout pointed, mobile; whiskers long—to or beyond shoulders; eyes large and full; ears large, orbicular, nearly naked; tail long, either scanty-haired or bushy; feet small, broad; toes short; thumb with an abortive nail; palms naked, with five tubercles; soles naked for the anterior two-thirds, with six evident tubercles; pelage soft, lustrous, white below; skull elongate, twice as long as wide; posterior aspect truncate; no definite bead on upper margin of orbits; under jaw with long, acute coronoid process, overtopping condyle; upper molars mostly three rooted, under with two roots each; upper teeth with usually two external and one internal re-entrant loops of enamel; last tooth in lower jaw conspicuously smaller than either of the other two.

Dr. Coues recognizes three North American species—*N. fuscipes*, *N. cinerea*, of British America and Western United States; *N. floridana*, of United States and Mexico. Besides the above, one is known from Guatemala, *N. ferruginea*.

NEOTOMA FLORIDANA Say and Ord.

WOOD RAT.

1818. *Mus floridanus*, Ord, Bull. Soc. Philom. Phila., 1818, 181.—Desm., Mamm., ii, 1822, 307.—Say, Long's Ex. R. Mts., i, 1823, 54.
1825. *Arvicola floridanus* Harlan, Fn. Amer., 1825, 141; Med. and Phys. Res., 1835, 53, pl. x, f. 1, 2, 3, 4.
1825. *Neotoma floridana*, Say and Ord., Journ. Acad. Nat. Sci. Phila., iv, 1825, 352, pl. x, f. 1, 2, 3, 4; Zoöl. Journ., ii, 1825, 294, pl. x, f. 1, 2, 3, 4; Isis, 1827, xx, 1035.—Griffith, Anim. Kingd., iii, 1827, 160, pl. —.—Aud. & Bach., Q. N. A., i, 1849, 32, pl. iv.—Geoff., Zoöl. Voy. Venus, 1855, 154, pl. xiii.—Kennicott, Agric. Rep. U. S. Patent Office for 1856 (1857) (no text), pl. xiv.—Baird, M. N. A., 1857, 487.—Maximilian, Arch. Naturg., xviii, 1862, p. —; Verz. N. Am. Säug., 1862, 165 —Allen, Bull. Mus. Comp. Zoöl., ii, 1871, 182.—Coues, Proc. Acad. Nat. Sci. Phila., 1874, 175; Mon. N. A. Rodentia, 1877, 15.—Coues and Yarrow, Rep. Expl. and Surv., W. 100th Merid., 1875, 100.—Jordan, Man. Vert., 1878, 31.
1829. *Lemmus floridanus*, Fischer, Synopsis, 1829, 299.
1854. *Neotoma mexicana*, Baird, Proc. Acad. Nat. Sci., Phila., 1855, vii, 333; M. N. A., 1857, 490; U. S. and Mex. Bound. Surv., ii, pt. ii, 1859, Mamm., p. 44, pl. 24, f. 1, a to g (skull).—Coues, Am. Nat., i, 1867, 399.

1855. *Neotoma micropus*, Baird, Proc. Acad. Nat. Sci., Phila., vii, 1855, 333; M. N. A., 1857, 492; U. S. and Mex. Bound. Surv., ii, pt. ii, 1859; Mamm., p. 44.

Specific Characters.—Length about 6 inches; tail about 6; hind foot 1.50; skull averaging 2 inches. Tail scant-hairy, bicolor, grayish and whitish. Adults with general body colors of Norway Rats, but more fulvous on the sides; white below; young gray or slate color. Tubercles blackish; toes and palms flesh-colored; tips white; back of hands and the feet snowy white.

Distribution.—Found in southern United States and northern Mexico; north to Maryland (Audubon), New York (Bell), Massachusetts (Gibbs), Dakota, Illinois, Kansas, and Arkansas (Coues); identified in Ohio by Dr. Byrnes, who, as I am informed by Mr. Langdon, "captured a specimen that was abandoned near New Philadelphia, Ohio."

Professor M. V. B. Knox, of Baker University, Kansas, states that the species is common along streams in middle and western Kansas, where they build nests by piling up sticks and pieces of bark to the height of two or three feet, often about the base of a tree or stump. In these piles they construct a nest of dried leaves and grass.

GENUS *HESPEROMYS* Waterhouse.

Hesperomys is a tribal rather than a generic name, including, according to Dr. Coues, in North America, *Vesperimus*, *Onychomys*, *Oryzomys*, *Ochetodon*, *Sigmodon*, and *Neotoma*, with as many South American genera or sub-genera besides. The same author says: "In our comparative ignorance of South American forms, we shall not venture upon any diagnosis or description of the full genus *Hesperomys*."

SUB-GENUS *VESPERIMUS* Coues.

= *Musculus*, Raf., Am. Month. Mag., iii, 1818, 446.

= *Hesperomys*, Baird, Mam. N. A., 1857, 458.

= *Vesperimus*, Coues, Proc. Acad. Nat. Sci., Phila., 1874, 178 (type *Mus leucopus*).

< *Hesperomys*, of North American writers.

> *Calomys*, Aud. & Bach., Quad. N. A., ii, 1851, 303.

Sub-generic Characters.—Of medium and small size, lithe form, and quick movement; eyes large and prominent; ears rounded, large, thin, scant-pilous, antitragus evident but not valvular; claws weak; hind legs and feet long, the latter with six large conical tubercles; hind feet naked or scant-furred on posterior third; tail terete, slender, closely hairy,

ranging in length from length of body to a little longer than head and body; pelage soft, clear, glossy, with but few bristly hairs; feet and under parts white or whitish; body and tail more or less distinctly bicolor; upper margin of the orbit sharp, but not extended into a crest.

HESPEROMYS (VESPERIMUS) LEUCOPUS Coues.

WHITE-FOOTED MOUSE; DEER MOUSE.

1775. *Mus sylvaticus*, var., Erxleben, Syst. An., i, 1775, 390 (based on New York var. of *Pennant*).
1792. *Mus agrarius* var. *americanus*, "Kerr's Linnæus, 1792, 231" (based on *Pennant*).
1818. *Musculus leucopus*, Rafinesque, Amer. Monthly Mag., iii, 1818, 446.
1822. *Mus leucopus*, Desmarest, Mamm., ii, 1822, 307.—Harlan, Fn. Amer., 1825, 151.—Griffith, Anim. Kingd., v, 1827, 223.—Fischer, Synopsis, 1829, 326.—DeKay, N. Y. Zoöl., i, 1842, 82, pl. 23, fig. 1.—Aud. & Bach., Q. N. A., i, 1849, 300, pl. 46.—Thompson, Nat. Hist. Vermont, 1853, 13.—Kennicott, Agric. Rep. U. S. Patent Office for 1856 (1857), 99, pl. 10.
1829. *Mus sylvaticus* var. *novboracensis*, Fischer, Synopsis, 1829, 318 (New York variety).
1830. *Cricetus myoides*, Gapper, Zoöl. Journ., v, 1830, 204, pl. 10 (Canada).
1839. *Mus noveboracensis*, Selys-Longchamps, Etudes de Microm, 1839, 67.
1849. *Arvicola emmonsii*, DeKay, Rep. Quad. Mass., 1840, 61.
1843. *Hesperomys maniculatus*, Wagner, Weigmann's Archiv., 1843, ii, 141, and 1845, ii, 148; Abhand. Akad. Wissensch., v, pt. ii, 1848, 316 (Labrador).
1843. *Hesperomys polionotus*, Wagner, Weigmann's Archiv., 1843, ii, 52 (Georgia).
1852. *Hesperomys leucopus*, LeConte, Proc. Acad. Nat. Sci., Phila., vi, 1852, 413.—Baird, M. N. A., 1857, 459.—Allen, Bull. Mus. Comp. Zoöl., i, 1869, 227 (Massachusetts), and ii, 1870, 178 (Florida).—Dall., Alaska and its Resources, 1870, 577.—Maximilian, Arch. Naturg., xviii, 1862, pl. 4, f. 4 (penis-bone); Verz. N. Am. Säug., 1862, 156.—Jordan, Man. Vert., 1878, 31; and of most late writers.
1853. *Hesperomys campestris*, LeConte, Proc. Acad. Nat. Sci., Phila., vi, 1853, 413 (New Jersey; type, No. 4726, Mus. Smiths.).—Aud. & Bach., Q. N. A., iii, 1854, 295 (after LeConte).—Baird, M. N. A., 1857, 485 (after LeConte).
1853. *Hesperomys texanus*, Woodhouse, Proc. Acad. Nat. Sci., Phila., vi, 1853, 242; Sitgreave's Rep. Expl. Zuñi River, 1853, 48, pl. 2 (El Paso, Tex.; type, No. 2559, Mus. Smiths.).—Aud. & Bach.,

- Q. N. A., iii, 1854, 319 (after Woodhouse).—Baird, M. N. A., 1857, 464, pl. 8, fig. 1, pl. 52, fig. 5, a, b (Texas and New Mexico); U. S. and Mex. Bound. Surv., ii, pt. ii, 1859, 43.—Kennealy, P. R. R. Rep., x, 1859, 14, pl. 8, fig. 1.
1855. *Hesperomys cognatus*, LeConte, Proc. Acad. Nat. Sci., Phila., vii, 1855, 442 (southern States; types, Nos. 4708, 4709, Mus. Smiths.).—Baird, M. N. A., 1857, 469 (southern States).
1855. *Hesperomys gracilis*, LeConte, Proc. Acad. Nat. Sci., Phila., vii, 1855, 442 (Ohio or Michigan, and Wisconsin; types, Nos. —, 4710, Mus. Smiths.).
1855. *Hesperomys austerus*, Baird, Proc. Acad. Nat. Sci., Phila., vii, 1855, 366 (Wash. Terr.); M. N. A., 1857, 466.—Cooper and Suckley, Nat. Hist. Wash. Terr., 1860, 102, 127.
1855. *Hesperomys boylii*, Baird, Proc. Acad. Nat. Sci., Phila., vii, 1855, 335 (Eldorado county, California; type, No. 356, Mus. Smiths.); M. N. A., 1857, 471, pl. 8, f. 3, pl. 52, fig. 3, a-e (California, Oregon, and Washington Territory).
1857. *Hesperomys gambeli*, Baird, M. N. A., 1857, 464 (Pacific coast, U. S.).—Newberry, P. R. R. Rep., vi, 1857, Zoöl., 60—Baird, P. R. R. Rep. Cal. Route, 1859, No. 3, 82.—Cooper and Suckley, Nat. Hist. Wash. Terr., 1860, 102, 127.
1857. *Hesperomys myoides*, Baird, M. N. A., 1857, 472 (Vermont, based on Gapper).
1860. *Mus agrarius*, Godman, Am. Nat. Hist., i, 3d ed., 1860, 316 (also in the earlier editions).—Linsley, Am. Journ. Sci., xlii, 1842, 351.
1874. *Hesperomys (Vesperimus) leucopus*, Coues, Proc. Acad. Nat. Sci., Phila., 1874, 178; Mon. N. A. Rodentia, 1877, 50.
1875. *Hesperomys (Vesperimus) americanus*, Coues and Yarrow, Rep. Expl. and Surv., W. 100th Merid., 1875, 102.

Specific Characters.—Average length about 3.25 inches; of tail vertebrae 3 inches; nose to eye, $\frac{1}{2}$ inch; length of head $1\frac{1}{8}$ inches; soles, with nails, four-fifths of an inch; ears little more than half an inch. Feet and under parts of adult snowy white; upper parts light brownish-yellow or fawn-color, with a darker stripe along the back. The colors of upper parts vary in different specimens and at different seasons. Some summer specimens are bluish-gray on the back. The yellow color is clearest on the cheeks and along the sides. Upper parts of a young specimen were of a uniform blackish ash-color, without any yellow.

While this animal does not vary in absolute size or relative proportion or in character of pelage with latitude, as one might expect, there is some color variation, which, Dr. Coues observes, is "indescribable

in words, but which strikes the eye familiar with the subject. We venture to assert that we can distinguish, in North America, about twenty kinds of *Hesperomys leucopus*, upon characters at least as constant, reliable, and tangible as those hitherto held to define the greatest part of the 'species' that have been in vogue of late years."

It will be seen in the preceding synonymy, that many of these species are abandoned. Dr. Coles, after an exhaustive review of this species and the nominal species referred to it (Monograph of North American Rodentia), admits three geographical races or varieties, *gossypinus*, *sonoriensis*, and *eremicus*, which, however, grade into each other insensibly.

Distribution and Habits.—This species ranges from the Atlantic to the Pacific, and from the Arctic regions south to Mexico.

This mouse is decidedly a lover of timbered lands. Mr. Kennicott says he has never observed it on the prairie. It is found on wooded farms, but not in large fields clear of trees, stumps, and logs. Its nest is usually in an old stump or hollow log, and occasionally in hollow trees some distance above the ground. It even occupies deserted birds' nests. Dr. Hoy has observed it nesting in the thick branches of thorn trees eight or ten feet above the ground. These nests were of grass, spherical in form, the entrance being a small hole at one side.

This species is active on the ground and climbs readily. It does not burrow. It is sometimes gregarious; a dozen have been found together in winter. It does not hibernate, but travels about either on or under the snow. This species is nocturnal, and so escapes hawks. Owls and Weasels prey upon it; and Mr. Kennicott has found the Milk Snake (*Ophibolus doliiatus*) under logs near its nests. Its numerous enemies keep it from increasing rapidly, although it is a prolific species, producing two or three litters annually, of from four to six young. The young are dragged away from the nest, attached to the teats of the mother, when disturbed. The female shows much affection for the young, moving with great caution, and, in one instance, was observed to return and remove one which had lost its hold and been brushed off.

This species is not at all carnivorous; it feeds on seeds and leaves of grasses and trees, also on acorns and nuts. It lays up stores for winter, stripping off the shells of beechnuts and other seeds with no apparent reason. Several quarts of clean Red Clover seed have been found in a stump, stored away by this Mouse.

The White footed Mouse is a pretty little animal, delicately colored and neatly formed. It occasionally gnaws the bark from fruit trees, but sticks to wooded lands so persistently that it cannot, on the whole, be considered injurious to the farmer. It is timid in captivity, not at all

pugnacious, and when given room, moves by sudden springs, holding high its long tail.

SUB-GENUS ORYZOMYS Baird.

< *Mus* sp., Harlan, Am. Journ. Sci., 1837.

< *Hesperomys* sp., Wagner, Suppl. Schreb., 1843.

× *Arvicola* sp., Aud. & Bach., Q. N. A., iii, 1853.

= *Oryzomys*, Baird, M. N. A., 1857, 458.

Sub-generic Characters.—"Superior margin of orbit with a prominent sharp edge or bead, anteorbital foramen nearly circular above and continued below as a narrow slit. Maxillary plate forming outer wall of foramen not produced anteriorly into a pointed process (cf. *Sigmodon*). Posterior border of palate produced behind last molars, a deep pit intervening on either side; post-palatal notch narrow, with parallel sides, and nearly straight, transverse, anterior border. Hind legs short, but feet very long and large (much as in *Fiber*), with obliquely-set long toes, densely pilous above, but soles perfectly naked, granular, with one long, narrow, postero-internal tubercle (as in *Mus*), and five small ones. Lateral toes very unequal in length, the fifth reaching to the penultimate joint of the fourth (cf. *Sigmodon*); all the toes have a slight but evident basal webbing. Fore feet small, not half as long as hinder, pilous above; palms perfectly naked. Ears small, little overtopping the fur, hirsute both sides, with a fluffy tuft on the concavity. Nasal pads more noticeable than in other sections. Tail long, about equalling head and body, scant-haired, especially above where the dermal scales as well as the vertebral annuli are visible. Fur glossy, but coarse from the number of bristly hairs. Whiskers sparse and short, exceeding, however, those of *Sigmodon*, though falling short of those of *Hesperomys* proper. Exceeding in size any other known North American species of *Hesperomys*, and with the general appearance of *Sigmodon* or even *Mus*." (Coues.)

HESPEROMYS (ORYZOMYS) PALUSTRIS (Harl.) Wagner.

RICE-FIELD MOUSE.

1837. *Mus palustris*, Harlan, Am. Journ. Sci., xxxi, 1837, 386 (New Jersey).
1843. *Hesperomys palustris*, Wagner, Suppl. Schr  b., iii, 1843, 543.—Le Conte, Proc. Acad. Nat. Sci., Phila., vi, 1853, 410.—Allen, Bull. Mus. Comp. Zo  l., ii, 1870, 182 (Florida).
1853. *Arvicola oryzivora*, Aud. & Bach., Q. N. A., iii, 1853, 214, pl. 144, fig. 3.
1857. *Hesperomys (Oryzomys) palustris*, Baird, M. N. A., 1857, 482 (Georgia and South Carolina).—Coues, Proc. Acad. Nat. Sci., Phila., 1874, 184; Mon. N. A. Rodentia, 1877, 113.

Specific Characters.—As this is the only representative of its genus, and as the above enumeration of generic characters is unusually full and minute, it is only necessary to mention a few other characters which are taken from Dr. Coues's Monograph above cited.

The length, from nose to end of tail vertebræ, is from $7\frac{1}{2}$ to $10\frac{1}{2}$ inches, averaging about 8 inches. The body and tail are usually about equal.

The color is mixed yellowish and grayish-brown, and black; darker along the back, shading on the rump and sides into the whitish of the under parts. The hands and feet are densely or scantily covered with satiny, whitish, appressed hairs. The palms and soles are flesh-colored or blackish. The palms are 5, the soles 6-tuberculate. The third finger is longest, the fourth a little shorter, and the second and fifth diminish rapidly. The second, third, and fourth toes are very long and nearly equal; the fifth reaches nearly to the middle of the fourth, the first scarcely beyond the base of the second. The claws are short, thick, little curved, not very sharp. The size of the foot is in striking contrast with the shortness of the leg.

The habitat of this species is the south Atlantic and Gulf States, especially in maritime portions, and in rice fields. It has also been reported from Kansas and Mexico.

This large, rat-like species is the type and only representative of the sub-genus *Oryzomys*. It is eminently aquatic, only surpassed in this respect by the Muskrat.

It has been identified by Mr. Frank W. Langdon, "with some hesitation, on the strength of the posterior half of a small Rat found in the stomach of a Red-shouldered Hawk, killed December 24, 1876," at Madisonville, Ohio. The writer has since examined Mr. Langdon's specimen, and finds that the feet and tail agree, in the minutest details, with the very full description given by Dr. Coues, in the Monographs of North American Rodentia.

—*Hesperomys (Vesperimus) aureolus* (Aud. & Bach.) Wagner, the Red Mouse, inhabits the central and southern States (Coues), but there is no record of its residence in Ohio known to the present writer.

GENUS ARVICOLA Lacépède.

This genus, as defined by Dr. Coues, is equivalent to the sub-family *Arvicolinæ*, excluding the Lemmings, the *Synaptomys*, of Baird, and the rooted-molar group, *Eutamias*.

Generic Characters.—Molars $\frac{3-3}{3-3}$, rootless, perennial, and prismatic; crowns of molars divided into several closed islands of dentine by folds

of the surrounding sheets of enamel that meet from opposite sides and fuse along the median line; upper molars sub-equal in length and breadth; anterior lower molar nearly as long as the other two together. Skull solid, massive. Size medium for the sub-family; form stout; members short; neck indistinguishable; head broad, with convex forehead; muzzle obtuse; lips fairly cleft, hirsute; eyes small, midway between ears and snout; muzzle furry, except nasal papillæ; whiskers 5-seriate; ears well developed, not usually overtopping the fur, orbicular, more or less hirsute both sides, with valvular antitragus; fore feet with mostly naked, tuberculate palms, 4 digitate; thumb obsolete, with abortive, obtuse, flattened, sessile nail; fingers unguiculate, inferiorly scutellate; hind feet with soles neither entirely naked nor entirely furry, 5 to 6 tuberculate, 5-digitate; three middle toes longest and sub-equal, fifth and first successively much shorter; tail terete, always hairy enough to obscure its annuli, and with terminal pencil, sometimes densely hirsute, always longer than the sole, usually longer than the head, but ranging in length from as long as head to nearly half as long as trunk; pelage thick, soft, of ordinary fur mingled with longer bristly hairs; fur uniformly plumbeous at the roots, colored at the tips; general color subdued, the shades diffuse, under parts lighter than upper, tail bicolor.

Four groups of *Arvicola* are recognized by Professor Baird, and characterized by Dr. Coues on dental and external characters: A—*Myonomys*, B—*Chilotus*, C—*Pedomys*, and D—*Pitymys*.

SUB-GENUS PEDOMYS Baird.

Pedomys, Baird, M. N. A., 1857, 517 (type, *Arvicola austerus*, LeConte).—Coues, Proc. Acad. Nat. Science, Phila., 1874, 190.

Sub-generic Characters.—Back upper molar with one external triangle and a posterior trefoil; middle upper molar with one internal triangle; front lower molar with one external and two internal triangles; ear unrimmed; sole 5-tuberculate; fore claws not larger than hinder ones; tail about one-third length of head and body, or a little less; pelage ordinary, grizzly, and rather "austere," the under parts usually with a peculiar, muddy tinge.

The above section is based, by Baird, on *A. austerus*, LeConte. The same author added to the group two other species—*A. haydeni* and *A. cinnamomeus*—neither of which are regarded by Dr. Coues as specifically distinct.

ARVICOLA (PEDOMYS) AUSTERUS LeConte.

PRAIRIE MEADOW-MOUSE.

1853. *Arvicola austerus*, LeConte, Proc. Acad. Nat. Sci., Phila., vi, 1853, 405 (Racine, Wis.; type, No. 2249, Mus. Smiths.).—Aud. & Bach., Q. N. A., iii, 1854, 289 (based on LeConte's description). Kennicott, Agric. Rep. U. S. Pat. Office for 1856 (1857), 97, pl. xii, upper fig. (Illinois).—Jordan, Man. Vert., 1878, 2d ed.
1857. *Arvicola (Pedomys) austerus*, Baird, Mamm. N. A., 1857, 539.—Coues, Proc. Acad. Nat. Sci., Phila., 1874, 190; Mon. N. A. Rodentia, 1877, 210.—Coues and Yarrow, Rep. Expl. and Surv., West 100th Merid., 1875, 108.
- Arvicola (Pedomys) cinnamomea*, Baird, op. cit., 541 (Pembina Dakota).
- Arvicola (Pedomys) haydeni*, Baird, op. cit., 543 (Fort Pierre, Dakota).

Specific Characters.—Total length 4 inches; tail 1 25; feet seven-tenths of an inch. "Above, the hairs are deep black at the base, then ringed with cinnamon-brown, and tipped with blackish; a few long hairs, entirely black, are interspersed; on the head and along the back, the color is darker. Low on the sides and cheeks, the hairs are all tipped with cinnamon-brown, without rings; belly bluish-gray, tinted with cinnamon." Tail bicolor, showing the colors of the upper and under parts of the body respectively; the young are darker above. The pelage is rather coarse, thick, and stout, not lying smooth enough to be very glossy, and so suggesting the fit name "*austerus*." Seemingly stouter and clumsier than *riparius*; tail shorter, head apparently broader, with obtuse muzzle and rather short and spare whiskers.

Habitat.—Western States and adjoining territories, Kansas and Louisiana, especially Illinois, Missouri, and Michigan. In northern Illinois and southern Wisconsin, this is the most abundant native mammal, preferring wet prairies, according to Mr. Kennicott, and never observed by him in the woods. The species is reported by Mr. Langdon, from Madisonville, Ohio, and from Brookville, Indiana. Mr. Langdon reports this species as found in woods, under logs, so it is plainly common to both woods and prairies.

Habits.—*A. austerus* is a prolific species, commonly producing five young at a birth, from April to October. The males do not live with the females and young in summer.

The writer has unearthed many of this species in prairie meadows, when leveling hills, in order that the grass might be cut with the

grain-reaper divested of its grain-apron—a machine often used before the day of the light mowing machines. These burrows are not very deep, rarely extending to the bottom of the hills, which were from twelve to fifteen inches high, and from three to six feet across. The nest is of fine grass, placed in one of the enlarged, numerous channels of which the burrow is composed. The nests are round bunches of grass, with a small cavity in the center and a small passage leading to it. Here the first litter, at least, is produced. Similar nests are found in the grass, however, containing young, in the summer and fall.

Burrows, nests, and runways are made by this species under the snow in winter. These runways are also made on the ground, from burrow to burrow. They are scarcely noticeable, as they are covered with the overarching grass, and yet they are more abundant, proportionally, than the streets and alleys of a populous city. Along these runways they seek their food, which consists of seeds, roots, and grasses. Mr. Kennicott found in the deepest part of one of the excavations, in November, five or six quarts of the round tubers of two species of Blazing Star (*Liatris*), roots of *Helianthus*, grasses, and several bulbs of wild onions. The fleshy roots of the upland Rosin weeds, or Compass plant (*Silphium laciniatum*), are freely eaten by this species. These roots are often four or five inches in diameter, and yet tender enough to be easily cut by a good ploughshare. I have often found them gnawed into irregular shapes, probably by this species.

When corn is cut in the autumn, a pair of these Mice will inhabit a shock, making a burrow under it, and collecting quantities of corn in the burrow. This is done in winter and spring, as well as in autumn. They are not gregarious; two pairs are never found in the same hole. They soon become reconciled to confinement, rarely attempting to gnaw out. Those kept by Mr. Kennicott were omnivorous, eating raw fresh meat, hickorynuts, leaves, and roots of garden plants, grain and vegetables, in enormous quantities. Three ate, in one day, besides other food, the germs from all the kernels of a good-sized ear of corn. In eating, they grasped the food in their fore paws, which are used as hands, with all the facility of a Squirrel. The food is cut in small pieces by the incisors, and then ground by the molars. In digging, the earth is excavated with the fore feet, and thrown back by the hind feet; the dirt is pushed aside with the nose, and also frequently loosened with the teeth. They sometimes dug horizontally, lying on the back, and in removing the earth from an extended burrow, would come out backwards, throwing back the earth with both front and back feet.

Regarding the carnivorous propensities and ferocious habits of this species, I copy the following from Mr. Kennicott's personal observations:

'Adult specimens recently captured and placed together often kill and devour each other, mothers even eating their young.

"One evening I placed in a large cage two old males taken in different burrows. In the course of the night much fighting and crying was heard, and the next morning one was found to have been killed and partly devoured by his companion. The other was supplied with corn and fresh beef, both of which he ate; and in the course of the forenoon a half grown house mouse was placed alive in the cage. This, without provocation, he at once attacked, as if in great rage, uttering his usual cry of anger, with his hair erected and bristling. In fighting he sprung upon the mouse, striking with his forefeet, at the same time snapping quickly with his teeth, and then springing nimbly back. Finally he seized the mouse by the rump with his incisors, and thus broke his back bone.

ter this the latter, which had fought as well as he could, ceased to resist, when the meadow mouse, catching him in his teeth, threw him forcibly to some distance, and continued to strike, bite and toss him about until he was dead. His anger then appeared to subside as quickly as it had risen, and in a few minutes he was observed placidly eating corn. The old males were always very pugnacious, biting and striking at any thing thrust at them.

"When much teased in this way, they sometimes turned on their backs, snapping with their teeth and striking with all their feet.

"When enraged they uttered a low, harsh, creaking note, resembling very much that of a young puppy. If hurt, their voices were clearer and sharper. Sometimes they chattered their teeth in anger. The females were not so pugnacious, and were more silent; seldom crying out in anger, or fighting when teased. They were equally as carnivorous, however, as the males.

"Like most *Arvicola*, this species takes to the water boldly, and swims and dives readily."

SUB-GENUS MYONOMES Rafinesque.

< *Arvicola* of American writers.

= *Arvicola* A, *Hemiotomys*, Baird, M. N. A., 1857, 515 (type, *A. riparius*, Ord.

= *Mynomes*, Rafinesque, Am. Monthly Magazine, ii, 1817, 45.

= *Myonomes*, Coues, Proc. Acad. Nat. Sci., Phila., 1874, 189.

In *Myonomes* the back upper molar has two external triangles and a posterior crescent. Middle upper molar with two internal triangles. Front lower molar with three internal and two or three external lateral triangles. Ear unrimmed in front. Sole, 6-tuberculate. Fore claws not longer than hinder ones. Tail, about one-third the head and body, or more. Pelage, ordinary. Of maximum and medium size.

ARVICOLA (MYONOMES) RIPARIUS Ord.

COMMON AMERICAN MEADOW MOUSE.

1815. *Arvicola pennsylvanica*, Ord, Guthrie's Geog., 2d Am. ed., ii, 1815, 292 (based on Wilson, l. c.)—Wagner, Suppl. Schreb., viii, 588.—

- Schinz, Synopsis, ii, 1845, 247.—Aud. & Bach., Quad. N. A., i, 1849, 341, pl. xlv. fig. —.—Le Conte, Proc. Acad. Nat. Sci., Phila., vi, 1853, 407.
1825. *Arvicola palustris*, Harlan, Faun. Amer., 1825, 136; Med. and Phys. Researches, 1835, 47.
1825. *Arvicola riparius*, Ord, Jour. Acad. Nat. Sci., Phila., iv, pt. ii, 1825, 305 (Philadelphia).—Aud. and Bach., Quad. N. A., iii, 1854, 302 (not figured; in text under "montana").—Le Conte, Proc. Acad. Nat. Sci., Phila., vi, 1853, 406.—Baird, M. N. A., 1857, 522 (eastern United States).—Godman, Amer. Nat. Hist., 3d ed., 1860, i, 301.—Allen, Mamm. Mass., Bull. Mus. Comp. Zool. No. 8, 231.—Jordan, Man. Vert., 1878, 33, and of late authors generally.
1825. *Arvicola xanthognatha*, Harlan, Faun. Amer., 1825, 136.—Godman, Am. Nat. Hist., ii, 1826, 65.
1840. *Arvicola alborufescens*, Emmons, Rep. Quad. Mass., 1840, 60 (Massachusetts; partial albino).
1840. *Arvicola hirsutus*, Emmons, Rep. Quad. Mass., 1840, 60.
1842. *Arvicola nasuta*, Bachman, Jour. Acad. Nat. Sci., Phila., viii, pt. ii, 1842, 296 (Mass).
1842. *Arvicola oneida*, DeKay, N. Y. Zool., i, 1842, 85, pl. xxiv, fig. 1 (young, New York).
1842. *Arvicola rufescens*, DeKay, N. Y. Zool., i, 1842, 85, pl. xxii, fig. 1 (northern New York).
1848. *Arvicola occidentalis*, Peale, Mamm. U. S. Expl. Exped., 1848, 45 (Puget's Sound).
1848. *Arvicola californica*, Peale, Mamm. U. S. Expl. Exped., 1848, 46 (California).
1848. *Arvicola montana*, Peale, Mamm. U. S. Expl. Exped., 1848, 44 (Mount Shasta, Cal.)
1853. *Arvicola edax*, Le Conte, Proc. Acad. Nat. Sci., Phila., vi, 1853, 405 (California).
1853. *Arvicola borealis*, Le Conte, Proc. Acad. Nat. Sci., Phila., vi, 1853, 407.
1856. *Arvicola riparius longipilis*, Kennicott, Agric. Rep. U. S. Patent Office for 1856, 304 (specimen in heavy winter pelage, from West Northfield, Ill.).—Baird, M. N. A., 1857, 524 (in text; same as Kennicott's).
1857. *Arvicola trowbridgei*, Baird, M. N. A., 1857, 529, in text (name suggested from some dental peculiarities of No. $\frac{370}{1284}$, Mus. Smiths., from Monterey, Cal.)
1857. *Arvicola longirostris*, Baird, M. N. A., 1857, 530 (based on supposed

- cranial peculiarities of No. $\frac{1268}{2220}$, Mus. Smiths., from California).
 —Newberry, P. R. R. Rep., vi, 1857, Zool., 61.
1857. *Arvicola modesta*, Baird, M. N. A., 1857, 535 (based on No. $\frac{604}{1717}$, from Rocky Mountains; very young).
1857. *Arvicola rufidorsum*, Baird, M. N. A., 1857, 526 (Holmes' Hole, Mass; a very red specimen).
1857. *Arvicola breweri*, Baird, M. N. A., 1857, 525 (bleached breed from Muskeget Island, Mass).
1862. *Hypudæus riparius*, Maximilian, Arch. Naturg., xviii, 1862; Verz. N. A., Säug., 1862, 174.
1874. *Arvicola (Myonomes) riparius*, Coues, Proc. Acad. Nat. Sci., Phila., 1874, 189; Mon. N. A. Rodentia, 1877, 156.—Coues and Yarrow, Zool. Expl. W. of 100th Merid., 1876, 106.

Description of the Species.—Average length, 4.35; tail, 1.5; fore foot, 3 lines; hind foot, from tuberosity of heel to end of longest claw, four fifths inch.

Gray-brown, darker along the middle of the back, especially toward the tail. Beneath, the plumbeous hairs are tipped with white, resulting in a hoary-ash, whitest on the breast and belly, darkest on the throat. There is no line of demarcation between the upper and under parts.

The typical coloration given above is departed from in three directions: (1) toward red, the extreme of which is reached in the type of "*rufidorsum*;" (2) toward black, including certain northern Illinois specimens, having long, dense, and almost fluffy pelage, forming the variety "*longipilis*," but the fur of this species varies so much in these points with age, health, season of the year, and climate, that "*longipilis*" can not be regarded as even a permanent variety; (3) lastly, the color tends to gray, the extreme of which has passed as "*breweri*." This form has only been found on a low, sandy island, between Nantucket and Martha's Vineyard, and is believed by Mr. Allen to be only a thoroughly sun-bleached form of *riparius*, the scattered grass of the island giving but little shelter from the sunlight from above, and the hot, light-colored sands finishing the bleaching of the under parts. The mice living in the sand dunes of Ipswich show the same half-white appearance of the Massachusetts specimens. Indeed, the present species is, according to Dr. Coues, subject to almost endless variation of size, color, and proportion of parts. The same authority closes an elaborate survey of this species, extending over thirty quarto pages, and including results of examinations of over one hundred and fifty specimens: "We have no alternative, then, but to throw all the names together as indistinguishable synonyms of *riparius*. In 1857 many names, all doubtless supposed by their several proposers to indicate valid species, were either formally or virtually suppressed; and a further

reduction of eight is simply an advance, *pari passu*, with the increase of our knowledge on the subject. We trust that we have proven the position we take, and that we have seen the last of nominal species, based upon the endless variations of *Arvicola riparius*."

Distribution and Habits.—This species is generally abundant in the United States. It is numerous in Ohio, according to Mr. Langdon, who has specimens from Madisonville, Ohio, and Brookville, Indiana.

Dr. Hoy states that near Racine, Wisconsin, they are found in woods, burrowing under stumps and trees, also in meadows. It shows no preference for low lands, as does *A. austerus*, but inhabits both high and low lands. The burrow is simple, and of slight extent.

The animal is gregarious, half a dozen or more inhabiting the same nest in corn-shocks and potato heaps. Mr. Kennicott states that the present species is not as pugnacious as *A. austerus*, which probably drives it off. The voice is a harsh, creaking squeal; the animal is noisy in captivity, crying out almost continually when several are eating together, or at all disturbed.

SUB-GENUS PITYMYS McMurtree.

Arvicola sp., Auctorum.

= *Psammonys*, LeConte, 1829 (pinetorum), (not of Rueppell).

= *Pitymys*, McMurtree, 1831 (same type).

= *Pinemys*, Lesson, 1842 (same type).

Sub-generic Characters.—"Below medium size; body cylindrical and otherwise shrew-like in closeness and glossiness of plumage; tail very short—less than the head, little more than the hind foot; ears small, mostly concealed, sparsely pilous, with flat edges, and border of meatus plane in front; feet small, both 5-tuberculate; fore claws not shorter than hind claws; palms more than half as long as soles; teats only four, inguinal; skull relatively broader than usual; muzzle short, very blunt; nasal branch of intermaxillary reaching beyond ends of nasals; distance from tips of lower incisors to apex of descending process no greater than distance from same point to back of condyle; first under molar with only one external closed triangle and two internal ones; no spur on last triangle of second upper molar; back upper molar with only one exterior triangle and a posterior trefoil." (Coues.)

ARVICOLA (PITYMYS) PINETORUM LeConte.

PINE MOUSE.

1825. *Arvicola pennsylvanica*, Harlan, Fn. Am., 1825, 144 (in part; the description, but not the synonymy; not of authors).

1829. *Psammonys pinetorum*, LeConte, Ann. Lyc. Nat. Hist. N. Y., iii, 1829, 132, pl. ii. (Name inept.)
1831. *Pitymys pinetorum*, McMurtrie, Am. ed. Cuv. R. A., i, 1831, 434.
1842. *Pinemys pinetorum*, Lesson, Nouv. Tab. R. A., 1842, 12.
1842. *Arvicola scalopsoides*, Aud. & Bach., Journ. Acad. Nat. Sci., Phila., viii, 1842, 299 (Long Island).—Wagner, Wieg. Archiv., 1843, 53.—LeConte, Proc. Acad. Nat. Sci., Phila., vi, 1853, 409.
1851. *Arvicola pinetorum*, Aud. & Bach., Q. N. A., ii, 1851, 216, pl. lxxx. LeConte, Proc. Acad. Nat. Sci., Phila., vi, 1853, 409.
1853. *Arvicola apella*, LeConte, Proc. Acad. Nat. Sci., Phila., vi, 1853, 405 (Pennsylvania).—Aud. & Bach., Q. N. A., iii, 1854, 289. (Same as LeConte's.)
1857. *Arvicola (Pitymys) pinetorum*, Baird, M. N. A., 1857, 544.—Allen, Bull. Mus. Comp. Zool., i, No. 8, 234 (Massachusetts; rare; probably its northern limit"); *op. cit.*, ii, No. 3, 184 (Florida.—Coues, Proc. Acad. Nat. Sci., Phila., 1874, 191; Mon. N. A. Rodentia, 1877, 219.

Description.—In length of head and body this Mouse ranges from 3.25 to nearly 4 inches, averaging about 3.50; the tail is from .60 to .95 inch to end of vertebra, and is shorter than the head, and but little longer than the hind feet. The fore feet are longer, comparatively, than those of other *Arvicolæ*, and are broader than the hind feet. The claws of fore feet are long, and the whole foot "fossorial" in character. There are five callosities on both palms and soles. The ear is short, hidden in the fur; the whiskers are shorter than usual; the muzzle is obtuse and nearly covered with fur.

The color varies from rich, glossy chestnut or light bay to a dull brown above; deep plumbeous below. Very young animals are plain mouse-gray.

The general aspect of the animal is quite mole-like, suggesting to Audubon and Bachman the name Mole *Arvicola* (*Arvicola scalopsoides*).

Distribution and Habits.—This little animal is found throughout the eastern United States, from Massachusetts to Florida, east of the Mississippi River. It has also been identified from Kansas and Oregon. It is very abundant in some of the southern States, and said to commit depredations on vegetables, seeds, and grain. While it derives its specific and common name from the fact that it is found in pine woods, Audubon and Bachman state that it is not particularly partial to woodland, nor found in the low situations frequented by the Common Meadow Mouse, but affects chiefly high, level fields with dry soil.

It is said to be very prolific, bringing forth three or four litters during the summer, and, according to Audubon and Bachman, sometimes as many as nine young have been found in one nest. They furnish an important article of diet for the smaller carnivorous quadrupeds and owls.

Two Ohio specimens of this Mouse are in the museum of the Smithsonian Institution, one (young, No. 978) collected by Robert Kennicott. I am ignorant of the exact locality where they were taken.

—Another Genus of this sub family, *Synaptomys*, represented by a single known species, *S. cooperi*, will probably be found to occur in Ohio, as it has been discovered in an adjacent county (Franklin) of Indiana.

It has the general appearance of an *Arvicola*, but the dental characters differ, especially the incisor teeth, which have a longitudinal groove near their outer edge.

GENUS FIBER Cuvier.

Etymology: Latin—a Beaver.

1766. < *Castor*, Linn., Syst. Nat., i, 1766, 78.

1788. < *Mus*, Gm., Syst. Nat., i, 1788, 125.

1792. × *Myocastor*, Kerr, "L. S. N., 1792 (type *Myopotamus coypus*)."

1800. = *Fiber*, Cuv., Leçons, i, 1800 (type *Castor zibethicus*).

1829. < *Lemmus*, Fischer, Syn., 1829, 289.

1827. = *Ondatra*, "Lacépède."—Less., Man., 1827, 286 (type, *Castor zibethicus*).

Generic Characters.—Largest of the family. Form arvicoline, but tail nearly as long as body without head, compressed, nearly naked, reticulate. Hind feet set obliquely; soles naked, quadri-tuberculate; toes incompletely webbed. Fore arm bristle-fringed. Muffle hairy, except the nasal pads. Ears small, with prominent angular antitragus. Whiskers short. Pelage lanuginous, beset with numerous long, glossy hairs. Mammæ, six. Perinæal glands highly developed. Dentition and skull strictly arvicoline. Angular process of squamosal bone overhanging orbit behind; jugal, a mere splint, the squamosal and maxillary spurs actually in contact.

FIBER ZIBETHICUS (L.) Cuvier.

MUSKRAT.

1766. *Castor zibethicus*, Linn., Syst. Nat., i, 1766, 79, No. 3 (quotes Brisson, Kalm, Sarrazin).—Erxl., Syst. Reg. Anim., i, 1777, 444, No. 2.—Bodd., Elench. Anim., i, 1784, 166.

1792. *Mus zibethicus*, Schreb., Säug., iv, "1792," 638, pl. 176.—Gm., Syst. Nat., i, 1788, 125, No. 2 (quotes Schreber).—Shaw, Gen. Zoöl., ii, 1801, 44, pl. 129 (lower fig.).
1792. *Myocastor zibethicus*, "Kerr's Linnæus, 1792."
1817. *Fiber zibethicus*, Cuv., R. A., i, 1817, 192.—Desm., Mamm., ii, 1822, 279; Encyc. Méth., pl. 67, f. 6; Nouv. Dict., xxiii, 506.—Sab., Franklin's Journ., 659.—Harlan, Fn. Amer., 1825, 132.—Griff., Anim. Kingd., v, 1827, 208.—Godman, Am. Nat. Hist., ii, 2d ed., 1831, 58.—Rich., F. B. A., i, 1829, 115 (describes black, white, and pied varieties—DeKay, N. Y. Zoöl., i, 1842, 75, pl. 20, f. 2, pl. 32, f. 3 (skull).—Schinz, Syn., ii, 1845, 257.—Aud. & Bach., Q. N. A., i, 1849, 108, pl. 13.—Kennicott, Agric. Rep. U. S. Pat. Office for 1856-57, 105, pl. 14.—Baird, M. N. A., 1857, 561.—Bulger, P. Z. S., 1865, 682 (habits).—Coues, Proc. Acad. Nat. Sci., Phila., 1874, 196; Mon. N. A. Rodentia, 1877, 254.—Coues and Yarrow, Zoöl. Expl. W. 100th Merid., 1876, 108.—Jordan, Man. Vert., 1878, 33; and of authors generally.
1829. *Lemmus zibethicus*, "Fr. Cuvier, Dict. Sc. Nat., vi, 310, fig. —."—Fisch., Synop., 1829, 289, No. 1.
1827. *Ondatra zibethicus*, Less., Man., 1827, 286, No. 793.—Waterh., Charlesw. Mag., iii, 1839, 594.

Description.—A full-grown specimen is about fifteen inches in length, from nose to root of tail, and the tail ten inches; the body is heavy, eyes small, and incisor teeth large; the ears are small, furry, and deeply imbedded in the general pelage, adapted to exclude water; the tail is modified into the semblance and for the purpose of a rudder, being flattened sideways nearly throughout its length, permitting free lateral, but little vertical flexion. The oblique set of the feet enable the animal to "feather the oar," as Professor Baird puts it, or bring the feet forward in swimming. The sides of the hands and feet are fringed with hairs; the soles and palms are perfectly naked; the hands and feet above are closely pilous, with very short adpressed hairs; the palms have five tubercles, the soles four; the vertical width of the tail is increased by a fringe of stiffish hairs. The color of the body is ashy-brown above, ashy on the under parts. The hair is of two distinct sorts; the basal, long, silky, fine, and slightly wrinkled; this is closely compact, especially on the belly. The basal hair is light, rusty-brown. Mixed with the basal hair, and concealing it on the upper surface, are longer, coarser hairs, of a rich chestnut brown, on the belly and sides of head and body.

Habits.—The Muskrat inhabits North America at large, it is eminently aquatic; on land its movements are as awkward as a duck's. They are

principally nocturnal and somewhat gregarious, several pairs constructing and occupying the same houses and burrows. These latter are numerous and extensive galleries in the banks of ponds, marshes, or sluggish streams. In the burrows the young are usually brought forth, and to them the animals resort when driven from their houses in winter. The entrance to both the burrows and houses are under water.

The houses are built in water three or four feet deep, out of the current. They are principally of rushes, although coarse grass, sedges, sticks, and leaves are piled up with the rushes, and the whole well plastered together with mud. These houses are built in the fall and occupied through the winter. Sometimes, in wide prairie marshes, the young are brought forth in the houses; in that case, but one female occupies a house. If the water course has dry banks, the burrows are usually at the edge of the water; but in some wide sloughs the burrows are several rods from the water-mark, in some elevated spot; in such cases they are approached by a gallery excavated the entire distance from the water to the burrow under the soil. In the piles of rushes—which sometimes are so abundant in a marsh as to suggest, by their large size and well-rounded tops, a crop of marsh grass thrown into bunches ready for the hay wagon—are the chambers occupied by the animal. The entrance may be in the center, when there is a shelf completely around it and above water, on which the Muskrats sleep; again, the entrance is at the side—but under water in either case. Often, in winter, in the large marshes about Chicago, the hunter, sometimes on skates, takes them by thrusting sharp-pronged spears through the top and sides of the houses into the nest. Two, and even three, are taken sometimes in this way at one thrust.

Muskrats are not suspicious; they are easily trapped in steel-traps placed in their runways. In former years, when the fur was used for napping "beaver hats," Muskrats were worth more than Mink, the skins selling for from forty to fifty cents. Like other furs, their value depends on the caprice of fashion. The introduction of silk hats, according to Mr. Kennicott, reduced the price of the skins to from six and one-quarter to fifteen cents, and trapping them was almost abandoned as unprofitable. Of late years they have been in demand for gloves, caps, and some articles of ladies' furs, and have sold at from fifteen to thirty cents.

The Muskrat comes out on the ice, at times, to sun itself, and in spring may often be seen swimming about, or, like turtles, basking on logs in the sun. The author has seen them shot by duck-hunters, when thus exposed, on the Calumet River, in Illinois.

The winter food of this species is, according to Mr. Kennicott, the roots

of aquatic plants. It seeks its food under the ice, and evidently carries it to its burrows. No large stores are observed in its burrows, however, but only roots recently carried in. The summer food consists of leaves of various aquatic plants, and different species of river muscles. Every one at all familiar with the shallows of our streams, will recall the immense heaps of muscle shells, often a bushel or more, by the side of some large stone or log, midway perhaps of the river, and furnishing easy collecting grounds for the conchologist. These are the "oyster restaurants" of the Muskrat. Collecting the muscles from the river bottom, the Muskrat mounts the log or stone, sits up on its haunches like a Squirrel, and opens the shell with its strong incisor teeth, as neatly as a Squirrel opens a nut. Most of the shells are left with the ligament intact. Mr. Kennicott has found massive shells, like those of *Unio plicatus*, left unopened, or with the valves gnawed apart at the back.

The Muskrat is pugnacious, fights when captured, and the males often have fierce battles among themselves. The Mink is its worst enemy, entering its houses and burrows, and pursuing it in the water.

From five to seven young are produced in April or May.

Musk rats are seldom injurious to crops; sometimes they take to vegetable gardens, showing a commendable weakness for parsnips and muskmelons. They are sometimes destructive to growing corn, which they cut off and sink into the water, probably to eat at their leisure. With the exception of the mollusks already referred to, and the occasional eating of a dead fish, they do not depart from a vegetable diet.

Their depredations on canal banks, mill dams, and ice ponds are well known. Along the line of the Illinois and Michigan canal, the "canal walkers" are compelled to keep a sharp eye to the Muskrats, lest they burrow through the bank, and trappers, with their boats, are passed through the locks and given the right of way along the tow-path.

Mr. Kennicott states that "hunters and trappers consider the hind-quarters of the Muskrat very palatable, when roasted on coals; and they, as well as the Indian, esteem the tail a great delicacy.

FAMILY HYSTRICIDÆ.

The American Porcupines, sub-family *Syntheriinae*, differ from the Old World Porcupines, sub-family *Hystriinae*, in the form of skull; in having the clavicles perfect, the tail (except in *Erethizon*) more or less prehensile, the molar teeth fully rooted; in not having five toes to all the feet (usually four, both before and behind); in the tuberculated, instead of smooth soles; in the upper lip being undivided by a vertical groove;

and in modifications of structure, adapting them to an arboreal, rather than to a terrestrial life.

The molars are $\frac{4}{4}$; body more or less armed with spines. Three of the New World genera are South American; the fourth, *Erethizon*, is found north of Mexico.

GENUS ERETHIZON F. Cuvier.

Etymology: *Erethizo*—to irritate.

Hystrix, in part of early authors.

Erethizon, F. Cuvier, Mém. du Mus., ix, 1822.

Echinoprocta, Gray, Proc. Zool. Soc. Lond., 1865, 321.

Toes four in front and five behind, all armed with strong, curved claws. Tail short, thick, depressed, non-prehensile; covered above, at the base, with stiff hairs and spines, and on sides, at apex; and beneath, with thick, rigid bristles. Size large. Limbs short and strong.

The genus *Erethizon* is represented by a single species, divisible into two geographical varieties—the Canada Porcupine, *E. dorsatus* var. *dorsatus*, and the Western Porcupine, var. *epixanthus*.

ERETHIZON DORSATUS (Linn.) F. Cuvier.

Var. *dorsatus*.

CANADA PORCUPINE.

1758. *Hystrix dorsata*, Linn., Syst. Nat., ed. x, i, 1758, 57, ed. xii, i, 1766, 76.—Forster, Phil. Trans., lxii, 1772, 374.—Erxleben, Syst. Reg. Anim., 1777, 345.—Gmelin, Syst. Nat., i, 1784, 119.—Schreber, Säugt., iv, 1792, 605, pl. clxix.—Shaw, Gen. Zool., ii, 1801, 13, pl. cxxv.—Kuhl, Beiträge zur Zoölogie, 1820, 70.—Desmarest, Mam., 1822, 345.—J. Sabine, Franklin's Journey to the Polar Sea, 1823, 664.—Cozzens, Ann. N. Y. Lyc. Nat. Hist., i, 1823, 191.—Harlan, Fauna Amer., 1825, 190.—Godman, Amer. Nat. Hist., ii, 1826, 50.—Griffith's Cuvier, iii, 1827, 206; v, 1827, 263.—Fischer, Synop. Mam., 1829, 368.—Emmons, Quad. Mass., 1840, 71.—Thompson, Hist. Vermont, 1842, 47.—Aud. & Bach., i, 1843, 277, pl. xxvi.
1731. *Hystrix pilosus americanus*, Catesby, Nat. Hist. Carolina, i, 1731, xxx.
1756. *Hystrix hudsonis*, Brisson, Règn. Anim., Quad., 1756, 128.
1842. *Hystrix hudsonius*, DeKay, New York Zool., i, 1842, 27, pl. xxv, fig. 1 (animal), pl. viii, figs. 2, a, b, c (skull).
1835. *Erethizon dorsatus*, F. Cuvier, Mém. du Mus., ix, 423, pl. xx, figs. 1, 2, 8 (skull and molar).—Brandt, Mém. Acad. St. Petersburg, 1835, 387.—Waterhouse, Nat. Hist. Mam., ii, 1858, 438.—Giebel, Säuget., 1855, 478.—Wagner, Suppl. Schreber's Säuget., iv, 1844,

- 27 (in part).—Baird, Mam. N. Amer., 1858, 568.—Allen, Bull. Mus. Comp. Zööl., i, 1869, 235; Mon. N. A. Rodentia, 1877, 388.
—Jordan, Man. Vertebrates, 1878, 34, 2d ed.
1771. *Canada Porcupine*, Pennant, "Syn., 1771, 266; Hist. Quad., 1781, No. 257;" Artic Zoölogy, i, 1784, 109.—Gilpin, Proc. and Trans. Nova Scotia Inst. Nat. Sci., ii, 1870, 89.

Description.—General color brownish-black, varied above with yellowish-white. Body above densely clothed with long, soft, rather woolly hair, intermixed with straight, coarse hair and bristles. The latter are four to six inches long, usually tipped with yellowish white, the light tip from one-fourth to seven-eighths the length of the hair—rarely obsolete or extending to the base. Beneath this, and usually concealed by the pelage proper, on the dorsal surface, are erectile barbed quills, from one to four inches in length. These are usually white at the base and black at the tip, the black varying from one-tenth to one-fourth the length of the quill; a few are entirely black, and others occur entirely white. The quills begin on the nose as short, stiffened, pointed hairs, pass into short spines between the eyes, and so continue to increase in size posteriorly, becoming longest over the hips, on the lower part of the back, and upper side of base of tail; toward the end of the tail they pass again into long, thick bristles and stiff hairs. The young are born without quills, and of a uniform black color. Adults average thirty-five to forty inches in total length; the head is about six inches, and tail vertebræ about the same.

Distribution.—The Eastern Porcupine formerly ranged through most of New England and New York, and over most of the region south of the Great Lakes and north of the Ohio. Northward it extends to the limit of trees, and to the westward probably to the great Saskatchewan Plains, where it merges into the western form. Being a forest animal, it has disappeared with the forests. In 1840, Dr. Emmons gave it as common near Williamstown, Massachusetts. It is found on Mount Monadnock, southern New Hampshire, central and northern Maine, and in portions of Pennsylvania. Godman (Amer. Nat. History, 1826) states, on the authority of Dr. Best, that the "Porcupine is seldom found in Ohio south of Dayton;" but that they were still numerous on St. Mary's River (1826). Mr. Allen states (Monographs of North American Rodentia, page 393), on the authority of Dr. J. M. Wheaton, that a few still survive in Clarke, Champaign, and Ross counties, and that it was common ten years ago in Putnam county. Dr. Wheaton informs me that one was killed in November, 1878, on the line of Wood and Hancock counties, by Mr. H. L. Dunn, of Columbus, and that in that locality they were not uncommon, though less numerous than formerly. Mr. E. W. Nelson, of Chicago, informs Mr. Al-

len that the animal was formerly rather common, though never abundant, in all the wooded region north of the Ohio, but is not now found (west of Ohio) south of the forests of northern Wisconsin and southern Michigan. Dr. Rufus Haymond, in Indiana Geological Survey, 1869, gives the Porcupine as an inhabitant, "now very rare," of Franklin county, Indiana, adjacent to Butler county, Ohio.

FAMILY LEPORIDÆ.

The Hares are a strictly congeneric group, constituting "one of the most natural and best defined groups among mammals."

Dental formula: i. $\frac{2-2}{1-1}$; pm. $\frac{3-3}{2-2}$; m. $\frac{3-3}{3-3}$. Molars rootless; hind legs and feet elongated; ears large and long; tail erect, bushy, short (sometimes rudimentary); fur usually soft, thick, and loose; rami of lower jaw large, deep, and flattened; orbits large; optic foramina confluent; palate reduced to a mere bridge between the premolars. The vertebral processes are long and slender; acromium process of scapula provided with a spine at right angles to the axis of the scapula.

GENUS LEPUS Linnæus.

Etymology: Latin, *Lepus*—a Hare.

The generic characters are indicated in the description already given of the family.

LEPUS SYLVATICUS Bachman.

Var. *sylvaticus*.

WOOD HARE; GRAY RABBIT; WOOD RABBIT.

1792. *Lepus nanus*, Schreber, Säuget., iv, 1792, 881.—DeKay, New York Zööl., i, 1842, 93, pl. xxvii.
1822. *Lepus americanus* Desmarest, Mamm., ii, 1822, 351.—Harlan, Faun. Amer., 1825, 193.—Audubon, Birds of Am., pl. 51.—Fischer, Synop. Mam., 1829, 376 (in part only).—Bachman, Journ. Acad. Nat. Sci., Phila., vii, 1837, 326, pl. xvi, figs. 3, 4 (ear and foot).—Emmons, Quad. Mass., 1840, 56.—Thompson, Nat. Hist. Vermont, 1842, 48.
1837. *Lepus sylvaticus*, Bachman, Journ. Acad. Nat. Sci., Phila., vii, 1837, 403; viii, 1839, 78.—Waterhouse, Nat. Hist. Mam., ii, 1848, 116.—Aud. & Bach., Quad. N. Am., i, 1849, 173, pl. xxii.—Woodhouse, Sitgreave's Col. and Zúñi River Exp., 1853, 55 (eastern Texas and Indian Terr.).—Maximilian, Weigm. Arch., 1861, i, 144.—Baird, Mam. N. Am., 1857, 597, pl. viii, fig. 1 (skull); U. S. and Mex. Bound. Surv., ii, 1859, ii, 47 (Indianola, Texas).—Hayden, Trans. Am. Phil. Soc., Phila., xii, 1863, 148.—Abbott, Cook's Geol. of N. J., 1863, 759.—Allen, Proc. Bost. Soc. Nat.

- Hist., xiii, 1869, 194; Bull. Mus. Comp. Zool., ii, 1871, 184; Mon. N. A. Rodentia, 1877, 327.—Coues and Yarrow, Expl. and Surv., W. 100th Merid., 1875, 128.—Jordan, Manual Vertebrates, 1878, 34, 2d ed.
1838. *Lepus bachmani*, Waterhouse, Proc. Zool. Soc. Lond., vi, 1838, 103; Nat. Hist. Mam., ii, 1848, 124.—Bachman, Journ. Acad. Nat. Sci., Phila., viii, 1839, 96.—Aud. & Bach., Quad. N. Am., iii, 1853, 35, pl. cviii (based on Waterhouse's specimens).—Baird, Mam. N. Am., 1857, 606; U. S. and Mex. Bound. Survey, ii, 1859, ii, 48 (Brownsville, Texas).
1867. *Sylvilagus bachmani*, Gray, Ann. and Mag. Nat. Hist., 3d series, xx, 1867, 222.
1867. *Sylvilagus nanus*, Gray, Ann. and Mag. Nat. Hist., 3d ser., xx, 1867, 221.—Allen, Bull. Mus. Comp. Zool., i, 1869, 239.

Specific Characters.—Length from nose to tail 13.50 to 17.00 inches; hind foot 3.10 to 4.20; ear 2.10 to 3.00; ear two-thirds length of head; head a little shorter than the hind foot. Pale yellowish-brown above, varied with black; sides and rump grayer; nape and limbs yellowish-rusty, fading into whitish on the anterior surface of the hind legs; head above less varied with black than the back; beneath white, except the breast, which is pale yellowish-brown. The hairs of the upper surface have long shining black tips, succeeded by a broad bar of pale yellowish-brown, then a narrower zone of black, and thence to the base grayish-plumbeous. Under fur dark plumbeous, nearly black, often tipped with pale brown.

Distribution.—*Lepus sylvaticus*, including its several varieties, occupies the greater part of the southern half of the continent. Its northern limit corresponds nearly with the isotherm of 45°. Variety *sylvaticus* extends from Southern Maine southward to Florida and the Gulf Coast, and westward to the eastern portions of Kansas, Nebraska, and the Indian Territory, throughout eastern Texas, and southward to Yucatan. Westward, in middle Kansas, it passes into var. *nuttalli*, in Arizona into var. *arizona*, and on the Pacific slope it is represented by variety *auduboni*.

Description and Habits.—The natural habitat of this animal is dry level ground, rather thinly wooded, and interspersed with dense thickets and occasional openings. It is usually less abundant in hilly and heavily timbered regions. On the prairies and in settled country, the Rabbit takes shelter about fences and stacks. In open lands it is preyed on by rapacious birds; large snakes often get the young. Among mammals the Weasels are their worst enemies; the White Weasel and Mink follow them under logs, into trees and burrows, and often in cultivated regions

drive them from under barns and stacks. The Great Horned Owl and the Red-tailed Buzzard are successful rabbit hunters. As with the squirrels, the larvæ of a large gad-fly infest them, and in the summer fleas are abundant in their fur. The Rabbit is very prolific, producing four to six young at a birth, and having three or four litters each year. The young are born clothed with hair and with the eyes open. In open ground the nest is of leaves and grass, finished with fur from the pelage of the mother; the nest is usually in a hollow scratched in the earth. The young leave the nest at an early age, and easily fall a prey when too small to escape by flight. In cultivated districts where the Hawks, Owls, Weasels, Minks, and other natural checks to their increase have been destroyed, Rabbits increase in vast numbers. They sometimes girdle young trees, although no doubt much of the injury to trees charged to the Rabbits, is the work of Field Mice. The Rabbit is easily trapped or snared; sometimes they are poisoned. As the flesh is good in winter, the most natural method of exterminating them is to encourage hunting them for the market. They are worth on the Chicago market from five to fifteen cents apiece, according to the abundance or the state of the weather. I have seen them, when frozen in large boxes, sold by the cubic foot, and shipped from Chicago to New York City.

As with the Northern Hare, Squirrels, and Deer, the Rabbit is subject to epidemics which sweep off numbers of them. Mr. J. A. Allen (*Monographs of North American Rodentia*, pages 371-2) states that he has repeatedly met with their dead bodies in the woods and thickets, and has noted the scarcity of the Rabbit during the years immediately following.

The food of the Rabbit is grass, tender shoots of shrubs, buds, twigs, and sometimes the bark of trees. The main damage to orchards and nurseries is the severe pruning of the young trees. When the snow is deep, they reach the branches of fruit trees, and cut them as clean as with a knife. In winter, according to Mr. Kennicott, they may be tracked to forest trees recently felled, where they resort to feed upon the buds.

In disposition the Rabbit is timid, not resisting when seized. It eludes its enemies by speed and stratagem, doubling on its track when pursued, taking to water which it dislikes, springing to a log and sitting motionless, while the dog passes or is beating about for it. They often return to their forms when chased; sometimes they crowd up a hollow tree by bracing against the sides. It has an acute sense of sound, and often stops when running to listen to any unusual sound, as of a person calling or whistling loudly.

The Rabbit cannot run long, but for a short distance it can outstrip

most dogs. Its powerful hind legs and strong dorsal muscles enable it to take leaps of ten to fifteen feet. It hops along when feeding, a foot or two at a time. The position of the feet in running is peculiar; the fore feet strike the surface near each other; the hind feet are widely separated and come to the earth some distance in front of the fore feet; the fore feet touch the ground but lightly; they are at once raised, and the bound is repeated with the hind legs only. The impression, at first sight of the track in the snow, is that the animal has been running backwards. In making the longest leaps, the front feet come down in the same line, and at some distance behind the back feet.

In winter I have seen them burrowing in the deep snow in the same drifts with the Prairie Hen, and for the same reason, to get shelter from an unusually severe storm. The Wild Rabbit is not naturally, however, a burrowing animal, as is the European Rabbit, often domesticated in the country.

As to the common name, Rabbit, so often given to the present species, it is not properly applicable to any of the American Hares. *Lepus cuniculus*, the Burrowing Rabbit of Europe, is the Rabbit proper, differing from other Old World and from American forms in the shortness of its hind legs. *Hare* is the proper generic or family name, *Rabbit* originally being the distinctive name of the particular species *cuniculus*, the Rabbit of Europe. But the two terms have now come to be interchangeable in this country, and, "however philologically or technically wrong it may be to apply the term Rabbit to any of our wild species, the custom of doing so among the generality of our people, is doubtless as ineradicably fixed as is that of calling the American Bison a Buffalo." (Allen.)

LEPUS AMERICANUS Erxleben.

Var. *virginianus* Allen.

SOUTHERN VARYING HARE.

1825. *Lepus virginianus*, Harlan, Fn. Am., 1825, 196.—Fischer, Syn., 1829, 376.—Doughty, Cab. Nat. Hist., i, 1830, 217, pl. xix.—Bachman, Journ. Acad. Nat. Sci., Phila., vii, 1837, 301 (mainly; somewhat mixed with *L. campestris*).—Emmons, Quad. Mass., 1840, 58.—Thompson, Nat. Hist. Vermont, 1842, 48.
1337. *Lepus americanus*, Bachman, Journ. Acad. Nat. Sci., Phila., vii, 1837, 403; viii, 1839, 76 (in part only).—DeKay, N. Y. Zool., i, 1842, 95, pl. xxvi, fig. 2 (in part only).—Wagner, Suppl. Schreb. Säug., 1844, iv, 104 (in part only).—Aud. & Bach., Q. N. A., i, 1849, 73, pl. xi, xii (in part only).—Baird, M. N. A., 1857, 579 (in part only).—Gray, Ann. and Mag. Nat. Hist., 3d ser., xx,

- 1867, 224 (in part only).—Allen, Bull. Mus. Comp. Zool., i, 1869, 237.—Hall, Can. Nat. and Geol., vi, 1861, 306.
 1877. *Lepus americanus* var. *virginianus*, Allen, Mon. N. A. Rodentia, 1877, 304.

Distribution and Varieties.—*Lepus americanus* is found throughout the wooded portion of the northern half of North America, its southern limit corresponding very nearly to the isothermal line of 50°. It is found in four well marked geographical varieties. Var. *americanus* is found in the more arctic regions of the continent, and shades imperceptibly into the three more southern forms. Var. *bairdi* is an alpine form, found in the Rocky Mountains. Var. *washingtoni* is from the region about Puget's Sound. Var. *virginianus* is found in eastern North America, from Minnesota through the northern tier of States, south to Connecticut, and in the Allegheny Mountains to Pennsylvania and even Virginia.

Habits.—The Varying Hare frequents dense woodland, being seldom or never found in open country. It trusts to fleetness with more confidence when pursued than does the Gray Rabbit, and never seeks shelter in holes or stumps. It is often known to escape from pursuing dogs, and when captured resists by kicking and biting. It probably has but one litter in a season. Otherwise its habits do not particularly differ from the Gray Rabbit.

Description.—Length of body averaging a little over 18 inches; hind foot about $5\frac{1}{4}$ inches; ear a little over 3 inches; weight about $5\frac{1}{2}$ pounds.

Var. *virginianus* differs in color from var. *americanus*, as might be expected from its more southern range. The former, *in summer*, on the upper and outer surface is pale yellowish-brown, varied with black, giving to it a dark umber-brown appearance. On the under surface, the breast and neck are yellowish-brown, chin, throat, and other under parts, white. Ears yellowish-brown mixed with black; apical fourth of anterior border black; posterior border white or yellowish. *In winter*, white, except the extreme tips of the ears, which are narrowly tipped with black.

Var. *virginianus*, *in summer*, is more rufous than var. *americanus*, the general color above being a rich reddish-brown or cinnamon-brown. *In winter*, the seasonal change is less complete and is worn for a shorter time.

The references and synonymy above given apply to var. *virginianus*.

In Ohio it is found only in the north-eastern portion, being confined to those counties known as the Western Reserve, which are embraced in the Alleghenian fauna. Of its occurrence there I am informed by Dr. Wheaton, who states that it is never common, but that he was informed

a few years since by Mr. M. C. Read, of Hudson, Ohio, that they appeared to be increasing in numbers. Dr. Kirtland, in his catalogue (1838) gives it as rare.

—Two other Hares, *Lepus palustris* and *aquaticus*, are in one place accredited to Ohio by Mr. Allen (Mon. N. A. Rodentia, p. 276), as follows: "These species extend northward over the lowlands of the Lower Mississippi, having been found as far north as southern Ohio." As he in no other place or manner refers to either of them as Ohioan, it is probable that "southern Ohio" should read "southern Illinois."

SUB-CLASS DIDELPHIA.

ORDER MARSUPIALIA.

These are implantal mammals, which are born of small size and imperfect development. They are transferred by the mother to the interior of the marsupial pouch or bag, which is present in most species.

This pouch consists of a fold of the abdominal integument, which, in the males, is everted, forming a pendulous bag containing the testes, and, in the females, is inverted, forming a hidden pouch containing the nipples, and usually sheltering the young for a certain period after their birth. The young are attached to the teats, which grow from the upper surface of the pouch, and are sustained by milk which is forced down the throat of the young by the contraction of the cremaster muscle, which is largely developed and extended over the surface of the mammary glands. The teat exactly fills the mouth. The danger of suffocation is averted by the elongation of the upper extremity of the larynx, which is embraced by the soft palate, as in the cetaceans, thus allowing respiration to go on freely, while the milk passes on each side of the laryngeal cone into the œsophagus.

The pelvis of both sexes is furnished with two characteristic supplemental bones—*ossa marsupialia*. These are elongated, flattened, and more or less curved bones, of the sesamoid series, developed in that tendon of the external oblique which forms the mesial pillar of the abdominal ring. These bones are attached to the pubis; they are directed forward, and are so long that the cremaster muscle winds round them in its passage to the testicle or mammary gland. The marsupial bones are equally developed in both sexes; their position and attachment add power to the compressing action of the cremaster muscle; they also give origin to the pyramidalis muscle. The cerebral hemispheres are chiefly connected by a large anterior commissure, the corpus callosum being rudimentary.

The cerebrum does not overlap the cerebellum; the olfactory lobes are large.

The characters given above are diagnostic of a remarkable order of mammals, confined at present to the Australian and Austro-American provinces. About twenty species are recognized in South America; one widely-distributed species is found in North America.

The order *Marsupialia* contains a great variety of forms, representing most orders of mammals—the Primates by the Phalangiers, the Carnivora by the Dasyurians, the Ruminants by the Kangaroos, and the Edentates by the Monotremes.

No Marsupial Bats are known, and the Rodents are represented among Marsupials by a single species.

Aside from the pouch and marsupial bones, the most notable feature of the order is the premature birth of the young, as compared with other mammals. The young of the Great Kangaroo (*Macropus major*), observed by Owen, in 1833, did not exceed an inch and a quarter, from nose to end of tail, twelve hours after birth, and the skin had the color and semi-transparency of the Earth-worm.

The dentition is unlike that of any placental mammals; in these the normal number of incisors is six in each jaw, but in the marsupials they vary from ten above and eight below, to eight above and six below, or even six above and two below. Ordinarily there are four true molars.

Several families of marsupials are recognized. The *Didelphidæ* are peculiarly American, and the only family to be here considered.

FAMILY DIDELPHIDÆ.

Family Characters.—Incisor teeth $\frac{5-5}{4-4}$; canines $\frac{1-1}{1-1}$; premolars $\frac{3-3}{3-3}$; molars $\frac{4-4}{4-4}$. The great number of incisors—ten above and eight below—readily separate the *Didelphidæ* from all other families of mammals. The prehensile tail is usually very long, nearly naked, and covered with a scaly skin, from which grow a few scattered hairs. The feet are five-toed, and plantigrade.

The Opossums are small; the largest is but little larger than a large Cat, while the smallest is but little larger than a small Mouse.

GENUS DIDELPHYS Linnæus.

Didelphys, Linnæus, *Systema Naturæ*, i, 1735.

Generic Characters.—The generic characters of *Didelphys* are essentially given under the family heading.

The genus is restricted to the species having the toes free, and the fur black thickly interspersed with long, coarse hair. Of this partic

ular group but one species belongs to the United States; this is *Didelphys virginiana*, the 'Possum, the only North American representative of the family.

DIDELPHYS VIRGINIANA Shaw.

OPOSSUM; 'POSSUM.

1778. *Didelphys marsupialis*, Schreb., Säugt., iii, 1778.
1800. *Didelphys virginiana*, Shaw, General Zoölogy, i, 1800, 473, pl. cvii —Desm., Mamm., i, 1820, 255.—Harlan, F. A., 1825, 119.—Griff., Cuv., iii, 1827, 24.—Temm., Mon. Mamm., i, 1828, 27.—Fischer, Syn., 1829, 263.—Wagner, Suppl. Schreb., ii, 1841, 37.—DeKay, N. Y. Zoöl., i, 1842, 3, pl. xv, f. 2.—Waterhouse, N. H. Mamm. i, 1846, 165 —Bachman, Pr. A. N. S., 1848, 40 (development). —Aud. & Bach., Quad. N. A., ii, 1851, 107, pl. lxvi.—Giebel, Säugt., 1855, 708.—Burmeister, Erlaut. Fauna Braziliens, 1856, 60, tab. v, vi, f. 1 and 3 (skull).—Jordan, Manual of the Vertebrates, 1878, 35.
1833. *Didelphys californicus*, Bennett, Pr. Zoöl. Soc., i, 1833, 40 —Wagner, Suppl. Schreb. iii, 1843, 40; ib., v, 1855, 223.—Waterhouse, N. H. Mamm., i, 1846, 476.—Aud. & Bach., Quad. N. A., 1854, 331. —Burm., Erlaut. Fauna Braziliens, 1856, 63.
1833. *Didelphys breviceps*, Bennett, Pr. Zoöl. Soc., i, 1833, 40.—Wagner, Suppl. Schreb., iii, 1843, 40; ib., v, 1855, 224.—Waterhouse, Nat. Hist. Mamm., i, 1846, 478.—Aud. & Bach., Quad. N. A., iii, 1854, 224.
1843. *Didelphys pruinosa*, Wagner, Suppl. Schreb. iii, 1843, 40 (note); ib. v, 1855.—Waterhouse, N. H. Mamm., i, 1846, 477.
- Virginia Opossum*, Penn., Quad., ii, 1781, 301; pl. xxxiv; ib., Arctic Zoöl., i, 1784, 73.
- Opossum*, St. Hilaire and Cuvier, Hist. Mamm., iii, 1819 (two plates.)

Specific Characters.—The Opossum averages twenty inches in length from end of snout to root of tail; the tail averages fourteen and one-half inches; the head from end of muzzle to occiput is about five inches. The body fur is interspersed with long white hairs. The hairs of the general pelage are whitish, with brown tips, imparting a dusky shade. The legs and feet are uniformly dark brown or black; the fingers and toes are white. The general color of the head is yellowish-white, the chin and top of head being scarcely darker. There is a dusky suffusion around the eye.

The above are the characters which mark the Eastern form of the Opossum. The Western variety, or, perhaps more properly, geographical

race, is, according to Professor Baird, smaller and darker, with the head dusky above and below, and the tail as long as the trunk and head. This form replaces the eastern in Texas and California, and south to the city of Mexico.

Description and Habits.—One's first impression of the Opossum is so graphically described by Audubon and Bachman, that I transcribe them at length :

"We can imagine to ourselves the surprise with which the Opossum was regarded by Europeans when they first saw it. Scarcely anything was known of marsupial animals, as New Holland had not as yet opened its unrivaled stores of curiosities to astonish the world. Here was a strange animal, with the head and ears of a pig, sometimes hanging on the limb of a tree, and occasionally swinging like the monkey by the tail. Around that prehensile appendage, a dozen sharp-nosed sleek-headed young had entwined their tails, and were sitting on their mother's back !

"The astonished traveler approaches this extraordinary compound of an animal, and touches it cautiously with a stick. Instantly it seems to be struck with some mortal disease ; its eyes close, it falls to the ground, ceases to move, and appears to be dead ! He turns it on its back, and perceives on its stomach a strange and apparently artificial opening. He puts his finger into the extraordinary pocket, and lo ! another brood of a dozen or more young, scarcely larger than a pea, are hanging in clusters on the teats. In pulling the creature about in great amazement, he suddenly receives a grip on the hand—the twinkling of the half-closed eye and the breathing of the creature evince that it is not dead, and he adds a new term to the vocabulary of his language, that of 'playing possum.'

"The whole structure of the Opossum is admirably adapted to the wants of a sluggish animal. It possesses strong powers of smell which aid it in the search for food ; its mouth is capacious, and its jaws, possessing a greater number and variety of teeth than any other of our animals, indicate its omnivorous habits ; its fore paws, though not armed with retractile claws, aid in seizing its prey, and conveying it to the mouth. The construction of the hind foot, with the soft yielding tubercles on the palms, and its long nailless opposing thumb, enable it to use these feet as hands, and the prehensile tail aids it in holding on to the branches of trees, whilst its body is swinging in the air ; in this manner we have observed it gathering persimmons with its mouth and fore paws, and devouring them while its head was downward, and its body suspended in the air, holding on sometimes with its hind feet and tail, but often by the tail alone."

The Opossum is nocturnal like most predacious animals. Where it abounds, it may nearly always be found, on bright starlight or moonlight nights, when the weather is warm and calm, hunting its nightly range in search of food. Its gait is rather slow, heavy, and awkward, truly plantigrade, an amble or pace, advancing the two legs on the same side at the same instant. It travels no more than its appetite demands, rarely making a circle of more than a mile in a single night. The Opossum is not often met in cold or stormy nights. In spring and summer it is sometimes met with by day, especially is this so in places where it is not often molested.

As to its omnivorous character, the Opossum may be compared with the Raccoon. In the summer and autumn it breaks down the corn, especially sweet corn, of which, like the Raccoon, it is very fond. They eat chestnuts and sweet acorns, beechnuts, and the like, and most wild berries and cherries. Its resort to the persimmon tree in the season of the fruit is proverbial. Worms, insects, roots, and tender shoots of various plants are scratched from the leaves and earth, and serve as food, especially in the early spring. Young ground birds, eggs of quails and partridges, marsh robins, and other birds which build their nests low, are readily devoured, as are mice and other rodents, and especially broods of young rabbits.

The nest or den of the Opossum is variously situated. Sometimes they occupy the hollow of a fallen tree, but oftener under the roots of trees or stumps.

The animal excavates a cavity and lines it with whatever material is at hand—grass, leaves, or rubbish. Often, in the South, the long, hanging moss (*Tillandsia*) forms the bed.

The Opossum does not take to its den when pursued, but to the nearest tree, where it calmly sits in some comfortable crotch, perhaps not twenty feet from the ground, where it solemnly watches the dogs, until the hunter comes to their aid, when, if the tree is a small one, the animal is readily shaken down, doubled up like a ball, into the jaws of the dogs. It does not offer much resistance, but sullenly growls and gives up the unequal combat. If no dogs are present the Opossum doubles up into a heap, and feigns death so artfully that boys have taken them up and carried them home for dead.

This protective device seems to exhaust the wit of the Opossum, as it does not avoid the ordinary means of capture, readily entering any kind of trap set for it. Captured young, they are easily domesticated, relinquishing their nocturnal habits, associating with dogs and cats, and becoming troublesome by their mischievous habits.

The Opossum possesses an unusual interest to the student of our fauna, as being our typical and only North American representative of Marsupials. Its curious appearance and habits have claimed the attention of naturalists and historians from the time of the early settlement of the country.

Lawson says, in his *History of Carolina*: "She is the wonder of all animals. The female doubtless breeds her young at her teats, for I have seen them stick fast thereto when they have been no bigger than a small raspberry, and seemingly inanimate. * * * If a cat has nine lives, this animal has nineteen; for if you break every bone in their skin, and

mash their skull, leaving them for dead, you may come in an hour after, and they will be gone quite away."

This gemmiparous theory of Lawson that the "female doubtless breeds her young at her teats," illustrates the superficial nature of the first observations on Marsupial reproduction.

Early authors—among them Pennant—contended that "the pouch was the matrix of the young Opossum, and that the mammæ are, with regard to the young, what stalks are to the fruit."

De Blainville speaks of two sorts of gestation, one uterine, the other mammary.

In 1819 Geoffrey St. Hillaire inquired of naturalists: "Are the pouched animal's born attached to the teats of the mothers?"

Godman, in 1826, admits, in his otherwise complete history of the animal, that "the peculiarities of its sexual intercourse, gestation, and parturition, are to this day involved in profound obscurity."

DeKay, in 1842, states: "The young are found in the external abdominal sac, firmly attached to a teat in the form of a small gelatinous body not weighing more than a grain."

This was nine years after Owens' observations on the development of the Great Kangaroo. DeKay, however, simply quoted such natural history literature as was nearest to hand; and, as is remarked in the Bibliography of North American Mammals (Gill & Coues), DeKay's Fauna of New York "has not been recognized as of high authority, nor has it exercised much influence upon the progress of science."

It was long believed that there existed a direct passage from the uterus to the teat, but this, of course, was disproved by dissection. Another opinion was that the embryo was formed where first found.

It is at once seen that the facts regarding the reproduction of this common animal have been developed very slowly, and not until Owen gave an exact description of the corresponding organs in the Kangaroo and discovered the fœtus *in utero*, could naturalists conclude the discussion of reproduction in the Opossum.

Audubon and Bachman attempted for several years to secure gravid females, but were baffled, as also were various French and English naturalists, by the fact that the Opossum does not breed in confinement. Another difficulty was that the females retire to their burrows during the period of utero-gestation, which, in North Carolina, the seat of Audubon's observations, is about the last of February and first week of March. Of thirty-five taken at that time (1847), in three successive nights, there was not a single female; but a week later, when the young were in the pouches, more females were taken than males. In February,

1848, gravid females were secured by searching hollow logs, trees, and burrows.

Three females were dissected at different stages of gestation. The young of one weighed two and one-half grains each; of another, three grains; and one specimen of the young of a third female, secured by a Cæsarian operation at the moment when all the rest had been exuded, weighed four grains. The average weight is between three and four grains.

The same author describes the young opossum as "little creatures that are nearly as well developed as the white-footed mouse and several other species of rodentia. They are covered by an integument, nourished by the mammæ, breathe through nostrils, perform the operations of nature, are capable of a progressive movement at the moment of their birth, and are remarkably tenacious of life, moving several inches on the table by crawling and rolling, and surviving two hours with the thermometer at 66° Fahrenheit."

The period of gestation is from fifteen to sixteen days—exactly fifteen in the case of one female under the personal observation of Dr. Michel, as recorded in the transactions of the Academy of Natural Science for April, 1848.

The young are naked and flesh-colored, the eyes and ears covered with skin, through which the organs are visible. The mouth is a small orifice, just large enough to receive the teat, which is not much, if any, larger than the body of a pin.

The body is half an inch long; the tail about one-fifth inch. The growth is rapid, the young increasing in a week from four to thirty grains, and in length nearly two inches. The teats of the mother, at this age of the young, are an inch long, much distended, and apparently drawn into the stomach of the young.

At twelve days the eyes are not yet open; the ear-holes are apparent, and the nails visible and sharp. At four weeks the young at times let go the teat and protrude the head from the pouch, and a week or so later may be seen on the mother's back, secured by winding their tails about their mother's.

The mother defends them with courage, growling or snapping at dog or man she may meet with while traveling with her family in search of food. Some attach themselves to her back; others wind their tails about her legs; and so the family is dragged along.

At this stage the young are well furred, and have a "mild, innocent look, and are sleek and in fine condition. This is the only stage in which the word pretty can be applied to the Opossum."

The Opossum is very prolific, bringing forth two and sometimes even three litters each year. The female produces young when a year old. The first litter remains with the mother about two months, by which time a second brood is in the pouch. Both litters remain in the vicinity of the mother until autumn, by which time they are old enough to care for themselves. The number of young found in the pouch is usually less than the number born. Six is the smallest and thirteen the greatest number observed by Audubon and Bachman, whereas fifteen were found in the uterus of one female. Of course those in excess of the number of teats must perish, as those first attached seem incapable of losing their hold.

The same authors conclude that the young are licked or shoved into the pouch by the mother. The pouch is distended by the jaws at times, the female lying on one side, with the body drawn into the shape of a ball, so that the parts of the genital passage reach the edge of the marsupial pouch; then, as the young appear, they are licked into the pouch.

Experiments made by Audubon and Bachman indicate that the young instinctively find and seize the teat. The young, when taken from the uterus and rolled in warm cotton, drew the fibers into the mouth. Moreover, when six of a brood of ten were removed from the teats, and three young of another litter, and double the size, were put back in the pouch, they were found the next morning attached to the teats, together with two of her own which were returned with them.

The following abstract by Prof. Owen from Dr. Chas. D. Meigs "On the Reproduction of *Didelphys virginiana*," in American Philosophical Society, April, 1847, I transcribe, as adding to our knowledge, of the peculiar mode of reproduction in this species:

"Dr. Meigs reckons the utero-gestation of a female *Didelphys virginiana*, which bred in captivity, as extending from the 18th February to the 7th March—a period of seventeen days—when she brought forth thirteen young, which were found attached to as many nipples. The mammae began to enlarge four days prior to birth. On the 6th of March she was observed to lay on her side, with her nose turned inward between her legs towards her belly, and took scarcely any notice of the keeper's hand when introduced into the box. The transit of the fetuses was probably in preparation or operation at this time. The young, observed on the 7th, and which were certainly not in the pouch on the 5th, and probably not until the night of the 6th, were naked, of a rose tint, each three and a half grains in weight, and eight-venths of an inch in length to the end of the tail; adhering strongly to the nipple, sucking actively, and clinging to the fur by the unguiculate digits of their fore limbs, which they freely used. One survived separation from the nipple one hour and twenty-nine minutes, turned itself over and moved round the glass in various directions, respiring by the nostrils twenty-two times per minute, and ejecting bubbles of milk from its mouth. The hind limbs were each a mere bud, with feeble indications of toes without claws. The tongue is very large—one-

third the entire weight of the head. The power of suction is such that the point of a pencil applied to the oral pore is held so strongly that the young can be partially lifted up by it. On March 14th the young weighed twelve grains, showing an increase of weight at the rate of two hundred and fifty per cent. in seven days; it was now one and one-tenth inch long. On March 18th weight was eighteen grains; the claws appeared on the hind toes; the testes had descended into a large scrotum; the eye-lids were still sealed, but movements of the eye-ball were visible beneath the skin. On May 22d Dr. Meigs found one of the young crawling on the body of the dam; its weight was forty-two grains; the eyes were open. This gave a term of gestation of seventy-four days. But the young return to the pouch for food and shelter until near the time for reception of a succeeding litter."

Distribution.—The Hudson River, according to Audubon and Bachman, is the eastern limit of the Opossum; in Texas and Mexico, and west to the Pacific, the western form replaces the Common Opossum.

This animal is not uncommon in central and southern Ohio, Indiana, and Illinois; the northern portions of these States are not so congenial to it. Like the negroes, with whom the Opossum is associated in song and story, while it can thrive in the northern portions of the United States, its natural home is in the south. Opossums are not unfrequently captured in Marion county, Indiana. The writer has seen the carcasses and one live specimen exposed for sale the present month (December, 1878), in the Indianapolis market.

They are readily sold to the negroes, who, doubtless, remember the 'Coon and 'Possum hunts of the old plantation days, and the feast of 'coon-grease and 'possum-meat that was almost sure to follow. The meat is too fat and rank to suit a refined, or, at least, an uneducated taste; yet they readily sell for from fifty to seventy-five cents to their equally strong-scented and dusky purchasers.

Irwin Russell, in "Christmas Night in the Quarters," *Scribner's Monthly*, January, 1878, gives the only explanation the writer has noticed of the nakedness of the Opossum's tail. This subject, to be sure, belongs to speculative zoölogy, but the Opossum is so unique among our mammalian fauna, that I see no reason why bard and minstrel should not contribute their legends and speculations, as well as anatomist and naturalists their facts and observations. To those grave and sedate readers, who do not know

"A little nonsense, now and then,
Is relished by e'en the wisest men,"

I would say, "pass this by, but in so doing you will miss a good thing." To the transcendental zoölogist, I let it go for what it is worth.

WHY DE HA'R IS MISSIN'.

Go 'way fiddle!—folks is tired a-hearin' you a-squawkin'.
 Keep silence for your betters—don't you heah de banjo talkin' ?
 About de 'possum's tail she's gwine to lecter—ladies, listen!—
 About de ha'r what isn't dar, an' why de ha'r is missin'.

I omit the flood, and the loading and launching of the ark, and pass on to the final denouement:

De ark, she keep' a sailin', an' a sailin', an' a sailin';
 De lion got his dander up, an' like to bruk de palin'—
 De sarpints hissed—de painter yelled—tell, what wid all de fussin',
 You e'u'dn't hardly heah de mate a-bossin' roun' an' cussin'.

Now Ham, de only nigger what was runnin' on de packet,
 Got lonesome in de barber shop, an' e'u'dn't stan' de racket;
 An' so for to amuse he-self, he steamed some wood an' bent it,
 An' soon he had a banjo made—de fust dat was invented.

He wet de ledder, stretched it on, made bridge, an' screws, an' apron;
 An' fitted in a proper neck—'twas very long an' tap'rin'.
 He tuk some tin, an' twisted him a thimble for to ring it;
 An' den de mighty question riz, how was he gwine to string it?

De 'possum had as fine a tail as dis dat I am singin';
 De ha'rs as long an' thick an' strong—des fit for banjo-stringin';
 Dat nigger shaved 'em off as short as wash-day dinner graces;
 An' sorted ob 'em by de size, from little e's to basses.

He strung her, tuned her, struck a jig—'twas "Nebber min' de wedder;"
 She soun' like forty-'leven bands, a-playin' all togedder;
 Some went to pattin', some to dancin'; Noah called de figgers,
 An' Ham, he sot and knocked de tune, de happiest ob niggers!

Now, sence dat time—it's mighty strange—dere's not de slightest showin'
 Ob any hair at all, upon de 'possum's tail a-growin';
 An' curi's, too—dat nigger's ways; his people nebber los' 'em—
 For where you finds de nigger, dar's de banjo an' de 'possum!

But the Opossum's tail, shorn as it is of its musical strings, still has, according to some of the older writers, wonderful medicinal virtues.

In Godman, occurs the following quotation from Marcgrave's *Natural History of the Spanish American Colonies*: "The tail of this animal is a singular and wonderful remedy against inflammation of the kidneys; and if it be chewed and placed on a part into which thorns have been thrust, it extracts them, and I believe in all New Spain, there is not to be found another remedy as useful in so many cases."*

The above is an instance of the credulity and disposition to deal in the marvellous, which, in days of "Lang Syne," and, occasionally, in the present, is deemed an almost essential quality of the natural historian.

* "Excitat venerem, et generat lac, medetur colicis doloribus prodest parientibus, et accelerat partum promovet menses."—Godman, i, page 365.

ADDENDA.

The writer expected, as will be seen from the letter of transmission, to have read the proof-sheets of this report, with the assistance of Prof. D. S. Jordan. An arrangement had, however, been made by Prof. Newberry, for the reading of the proof at Columbus, by Dr. J. M. Wheaton.

For this reason some portions of the report, which had been retained for additional information, and others for which I have but recently sufficient authority for inserting, failed to find their proper place, and are here inserted.

A change is necessary in the nomenclature in some cases, and it is here indicated.

Important notes from other observers have been received too late for insertion in the proper place, and will be found here.

Dr. Wheaton desires me to say that the responsibility for typographical errors rests with him; and I take this opportunity of returning thanks to him for corrections made and omissions supplied.

Page 14. *CANIS LUPUS OCCIDENTALIS* (—) —.
 should stand as

CANIS LUPUS Linnæus.

Var. *occidentalis* (—) Coues.

Page 16. *VULPES VULGARIS PENNSYLVANICUS* (Bodd.) Coues.
 should stand as

VULPES VULGARIS Fleming.

Var. *pennsylvanicus* (Bodd.) Coues.

Page 28. *PUTORIUS* (SUB GENUS, *GALE*) *ERMINEA* A. & B.
 should stand as

PUTORIUS (*GALE*) *ERMINEUS* (L.) Aud. & Bach.

To precede *Putorius vison*, page 35:

PUTORIUS (*GALE*) *VULGARIS*.

WEASEL; LEAST WEASEL.

1645. *Mustela vulgaris*, Aldrov., Quad. Digit., 1645, 307.—Klein, Quad., 1751, 62.—Briss., Quad., 1756, 241, N^o. 1.—Erxl., Syst. Anim.,

- 1777, 471, No. 12.—Schreb., Säugt., iii 1778.—Gm., S. N., i, 1788, 99.—Desm., Mamm., i, 1820, 179, No. 275.—Fr. Cuv., Dict. Sci. Nat., xxix, 1823, 251, No. 7.—Is. Geoff., Dict. Class., x, 213.—Less., Man., 1827, 146.—Fisch., Syn., 1829, 223.—Flem., Br. An., 1828, 13.—Jen., Br. Vert., 1835, 12.—Bell, Br. Quad., 1837, 141. Gray, List Mamm. Br. Mus., 1843, 65.—Gieb., Säugt., 1855, 782. Farwick, Zoöl. Gart., xiv, 1873, 17 (albino).—Harlan, Faun. Amer., i, 1825, 61.—Maxim., Reise, ii, 1841, 98.—Thomps., Nat. Hist. Vermont, 1853, 30.—Hall, Canadian Nat. and Geol., vi, 1861, 295.—Kirtland, Ohio Geolog. Survey, 1838, 160, 176.
1761. *Mustela nivalis*, Linn., Fn. Suec., 2d ed., 1761, 7, No. 18; S. N., i, 1766, 69, No. 11.—Müll., Zoöl. Prod., 1776, 3, No. 15.—Erxl., Syst. Anim., 1777, 476, No. 14.—Schreb., Säugt., iii, 1778, pl. 138.—Less., Man., 1827, 146.—Forst., Phil. Tr., lxii, 1772, 373.
1788. *Mustela vulgaris*, a. *æstiva*, b. *nivalis*, Gm., S. N., i, 1788, 99, Nos. 11 a, 11 b.
1800. *Viverra vulgaris*, Shaw, G. Z., i, 1800, 420, pl. 98.
1827. *Putorius vulgaris*, Griff., An. Kingd., v, 1827, 121, No. 344.—Brandt, Wirb. Eur. N. E. Russl., —, 26.—Emm., Rep. Quad. Mass., 1840, 44.—All., Proc. Bost. Soc. Nat. Hist., xiii, 1869, 183; Bull. M. C. Z., i, 1870, 167.—Jordan, Man. Vert., 1878, 18.
1829. *Mustela (Putorius) vulgaris*, Rich., F. B. A., i, 1829, 45.
1831. *Mustela gale*, Pall., Zoög. R. A., i, 1831, 94, No. 32.
1840. *Factorius vulgaris*, Keys. & Blas., Wirb. Eur., 1840, 69, No. 147.
1842. *Mustela pusilla*, DeKay, N. Y. Zoöl., i, 1842, 34, pl. 14, f. 1.
1851. *Putorius pusillus*, Aud. & Bach, Q. N. A., 1851, 100, pl. 64.—Baird, M. N. A., 1857, 159.—Suckley, N. H. W. T., 1860, 92.—Sam., Rep. Mass. Agr. for 1861, 154, pl. 1, f. 2, 4.—Maxim., Arch. Naturg., 1861, —.—Ross, Canad. Nat. and Geol., vi, 1861, 441.—Merriam, Rep. U. S. Geol. Surv. Terr., 1872, 661 (Idaho).—Ames, Bull. Minn. Acad. Nat. Sci., 1874, 69.
1877. *Putorius (Gale) vulgaris*, Coues, Mon. N. A. Mustelidæ, 1877, 102, pl. vi, figs. 2, 4.

Common Names.—*Common Weasel*, Penn., Hist. Quad., 1781, No. 192; Arctic Zoöl., i, 1784, 75, No. 25.—*Wiesel*, *Kleine Wiesel*, German.—*Wezel*, Belgic.—*Væsel*, Danish.—*Sneemuus*, Danish (white).—*Swömuus*, Swedish (white).—*Ballattula*, Italian.—*Comadreja*, Spanish.

Specific Characters.—General body colors substantially as in *P. ermineus*; under parts white, very rarely tinged with sulphury yellow. Size small; length of head and trunk six or eight inches; tail slender, cylindrical, pointed at tip; tail concolor (sometimes blackish at tip in western speci-

mens); tail vertebræ fifteen (Gerrard), varying in length from one to two inches.

Description and Habits.—This Weasel differs from its ally, *P. ermineus*, in its smaller size and the general dimensions of the tail. In the *Ermine* this member is at all seasons brushy, and conspicuously black-tipped for about two-fifths of its total length.

The mahogany-brown of the Weasel turns to white in winter in northern New England; but this change, according to Mr. J. A. Allen, does not occur as far south as in Massachusetts, where it sometimes takes place in the *Ermine*.

Of the habits of the Weasel in America little is known; they probably do not differ essentially from the same species in Europe or Asia.

Although not common in collections, and rather rarely taken at present, Audubon represents it as a common animal, feeding on small rodents, insects, eggs, and young birds.

The accompanying account of its habits is drawn from the writings of Thomas Bell, and is at the same time interesting and reliable:

“The Weasel climbs trees with great facility, and surprises birds on the nest, sucks the eggs, or carries off the young. * * *

“I have observed that when the Weasel seizes a small animal, at the instant that the fatal bite is inflicted, it throws its long, lithe body over its prey, so as to secure it should the first bite fail; an accident, however, which I have never observed when a Mouse has been the victim. The power which the Weasel has of bending the head at right angles with the long and flexible, though powerful neck, gives it great advantage in this mode of killing and seizing its smaller prey. It also frequently assumes this position when raising itself on its hinder legs to look around.

“The disposition which has been attributed to the Weasel of sucking the blood of its prey, has, I believe, been generally much exaggerated. * * * The first gripe is given on the head, the tooth, in ordinary cases, piercing the brain, which it is the Weasel’s first act of Epicurism to eat clean from the skull. The carcase is then hidden near its haunt, to be resorted to when required, and part of it often remains until it is nearly putrid.

“The Weasel pursues its prey with facility into small holes, and amongst the close and tangled herbage of coppices, thickets, and hedge-rows. It follows the Mole and the Field Mouse in their runs; it threads the mazes formed in the wheat-rick by the colonies of Mice which infest it; and its long, flexible body, its extraordinary length of neck, the closeness of its fur, and its extreme agility and quickness of movement, combine to adapt it to such habits, in which it is also much aided by its power of hunting by scent—a quality which it partakes in equal degree with the Stoat. In pursuing a rat or a mouse, therefore, it not only follows it as long as it remains within sight, but continues the chase after it has disappeared, with the head raised a little above the ground, following the exact track recently taken by its destined prey. Should it lose the scent, it returns to the point where it was lost, and quarters the ground with great diligence till it has recovered it; and thus, by dint of perseverance, will ultimately hunt down a swifter and even a stronger animal than itself. But this is not all. In the pertinacity of its pursuit it will readily take the water, and swim with great ease after its prey.

"It is, however, sometimes itself the prey of hawks, but the following fact shows that violence and rapine, even when accompanied by superior strength, are not always a match for the ingenuity of an inferior enemy. As a gentleman of the name of Pinder, then residing at Bloxworth, in Dorsetshire, was riding over his grounds, he saw, at a short distance from him, a kite pounce upon some object on the ground, and rise with it in its talons. In a few minutes, however, the kite began to show signs of great uneasiness, rising rapidly in the air, or as quickly falling, and wheeling irregularly around, whilst it was evidently endeavoring to force some obnoxious thing from it with its feet. After a short but sharp contest, the kite fell suddenly to the earth, not far from where Mr. Pinder was intently watching the manœuvre. He instantly rode up to the spot, when a Weasel ran away from the kite, apparently unhurt, leaving the bird dead, with a hole eaten through the skin under the wing, and the large blood-vessels of the part torn through."

According to the same author, the female Weasel brings forth four or five young, and is reported to breed more than once each year. The nest is a hole in a bank, or perhaps in a hollow tree, lined with leaves and herbage. She defends her young even to the sacrifice of her own life, rushing from her nest and fastening upon the nose or lips of whatever animal may assail her.

Dr. Coues remarks that the name "Weasel" should, in strictness, be given to the present species, as distinguished from its allies, the Stoats and Ferrets, although it has come to have rather a generic application to the various species of the same immediate group. The derivation is obscure. Webster does not give the meaning, but suggests that the German *Wiese* is a meadow. The vernacular names of this species are fully given in the synonymy.

Geographical Distribution.—This animal is of circumpolar distribution. It is found in the northern parts of the United States, in British America and Alaska, and the northern parts of the Old World.

Dr. Coues remarks, in his Monograph of North American Mustelidæ, that "the total lack of citations of this species from southern or even Middle districts in the United States, is an evidence, though of a negative character, of the geographical distribution at present assigned," evidently not having seen Dr. Kirtland's Report of the Mammals of Ohio, in which the Weasel is included under the name *Mustela vulgaris*, and with the note that "the Weasel is becoming more common as the country becomes populated." In the same report, Dr. Kirtland, speaking of the Ermine, under the name *Mustela erminea*, says: "This beautiful animal is occasionally met with, but is mistaken for a *White Weasel*."

Dr. Wheaton killed an animal of this genus in May, 1860, at Black Hand Rock, on the borders of Licking and Muskingum counties, Ohio, which he was not able to preserve, and which at the time he took to be the Least Weasel. He describes it as "smaller than the Chipmunk,

brown above, whitish below, with a shorter tail, black toward the end." The tail, black toward the end, is not entirely inconsistent with *P. vulgaris*, although an almost constant character of *P. ermineus*, while the short tail and small size favor Dr. Wheaton's opinion, formed at the time, that the specimen was the Least Weasel, *P. vulgaris*. The peculiar circumstances under which the specimen was found—a Weasel asleep, contrary to the old adage—and the vigorous defense it made by use of its anal glands, are full of interest, and warrant the introduction, in this connection, of the faithful account Dr. Wheaton has given me of the capture and loss of the specimen under consideration :

"Five students, of Denison University, Granville, Ohio, among whom was myself, were so fortunate as to secure the company of five young ladies from the seminary, for a picnic at Black Hand Rock. The ascent to the top of this rock is somewhat difficult, and was made single file. I was ahead, followed by a now eminent attorney, a late Brigadier General, and the young ladies, all of whom are now ornaments to society and mothers in Israel. Suddenly I noticed a little animal apparently asleep at my feet. I instinctively grabbed it, and as instinctively the General hit it with a stick so hard that it was somewhat stunned. I held up my trophy to the view of the young ladies, much gratified that I was able, so early in the day, to prove myself a hero. Greatly to my surprise, they turned their heads away in shame, crying 'Put it down! put it down!' At the same time my nose took the general alarm, and turning to the beast, which I still held in my hand, I discovered a miniature volcano on either side of its anus, sending forth sulphurous fire and smoke. I felt that I had better die than surrender just then, and held on to it, in spite of my immediate inclinations, insisting that I was going to skin it and take it home. The young ladies insisted, declared, and almost cried, until I thought the cruel joke was turned from me, when I surrendered and dashed it against the rock. The animal certainly was an adult, as far as the anal glands were concerned.

Whether Weasel or Ermine, one is certainly excusable in dropping, under such circumstances, an animal whose odor "is only less penetrating and more fugitive than that of the Skunk itself."

Page 41. TAXIDEA AMERICANA Baird.

should stand as

TAXIDEA AMERICANA (Bodd.) Baird.

Page 48. MEPHITIS MEPHITICA Baird.

should stand as

MEPHITIS MEPHITICA (Shaw) Baird.

Page 56. LUTRA CANADENSIS Sabine.

should stand as

LUTRA CANADENSIS (Turton) Sabine.

Page 93. SCAPANUS BREWERI (Bach.) Jordan.

should stand as

SCAPANUS BREWERI (Bach.) Porcel.

To precede *Family Soricidæ*, page 94:

GENUS CONDYLURA Illiger.

Condylura, Illiger, *Prodromus*, 1811, 125.

Astromycter, Harris.

Talpasorex, Schinz.

Rhimaster, Wagner, *Suppl. Schreb.*, ii, 1843, 113.

Generic Characters.—Moles having a fringe of elongated caruncles encircling the end of the nose. The nostrils are circular and terminal; the auditory openings are large; the tail is nearly as long as the body, and is covered with hair. Dentition: i. $\frac{3-3}{3-3}$; c. $\frac{1-1}{1-1}$; pm. $\frac{4-4}{4-4}$; m. $\frac{3-3}{3-3} = \frac{22}{2} = 44$.

This genus was founded by Illiger, who based the inappropriate name it bears on a supposed peculiar series of nodes on the tail, caused by its shrinking most around the middle of the vertebræ.

There is but one species of this remarkable genus, and it is limited to the northern portions of North America. The difference between *Scalops* and *Condylura* are notable. As in the Common Moles, the fore feet are large and flattened, but longer and narrower; the tail is much larger than in either *Scalops* or *Scapanus*; the eyes are larger and the ear much more fully developed. But the most remarkable characters of *Condylura* are found in the ciliated extremity of its nose, from which its specific name is derived, and in the lacinated processes on the under surface of its fingers. The teeth, also, are entirely unlike those of the Common Mole.

Its nearest relationship is with the Genus *Urotrichus*, which, with it, may be considered, according to Prof. Baird, as forming a connecting link between the Moles and the Shrews.

CONDYLURA CRISTATA (Linn.) Desmarest.

STAR-NOSED MOLE.

1758. *Sorex cristatus*, Linn., *Syst. Nat.* (10th ed.), i, 1758, 53; ib. (12th ed.), i, 1766, 73.—Erxleben, *Syst. Reg. Anim.*, 1777, 121.—Schreber, *Säugt.*, iii, 1778, 566.—Bodd., *Elenchus Anim.*, i, 1784, 124.—Gmelin, *Syst. Nat.*, i, 1788, 112.
1777. *Talpa longicauda*, Erxl., *Syst. Reg. Anim.*, i, 1777, 118 (from Pennant).—Shaw, *Gen. Zoöl., Mamm.*, i, 1800, 523.
1800. *Talpa radiata*, Shaw, *Gen. Zoöl., Mamm.*, i, 1800, 523.
1800. *Sorex radiatus*, Shaw, *Gen. Zoöl., Mamm.*, i, 1800, 531, pl. cxxx.
1819. *Condylura cristata*, Desmarest, *Journ. de Physique*, lxxxix, 1819, 230; ib., *Mamm.*, i, 1820, 157.—Harlan, *Fauna Am.*, 1825, 36.—Godman, *J. A. N. Sc., Phila.*, V, i, 1825, 169.—Griffith, *Cuv.*, ii,

- 1827, 210.—Ib. v. 1827.—De Kay, New York Zoölogy, 1842, 12.
1820. *Condylura longicauda*, Desmarest, Mamm., i, 1820, 158.—Harlan, Fauna Am., 1825, 38.—Griff, Cuv., V., 1827, 110.—Rich., F. B. A., i, 1829, 13.—Fischer, Syn., 1829, 248.—Giebel, Säugt., 1855, 891.
1825. *Condylura macroura*, Harlan, Fauna Am., 1825, 39.—Fischer, Syn., 1829, 248.—Thompson, Nat. Hist. Vt., 1842, 28.
1841. *Rhimaster cristatus*, Wagner, Suppl. Schreb. ii, 1841, 117.—Ib. v. 1855, 575.
1771. Radiated Mole, Pennant, Syn. Quad., 1771, 313.—Ib. Hist. Quad., 1781, No. 351.—Ib. Arctic Zoöl., i, 1784, 140.
1771. Long-tailed Mole, Pennant, Syn., 1771, 313.—Ib. Hist. Quad., i, 1781, 486.—Ib. Arctic Zoöl. (2d ed.), i, 1784, 140.
- Haarnase Spitzmause. Taupe du Canada; Delafaille, Ess. sur L'hist. Nat. de la Taupe, 1769, fig.

Description.—The general contour of this species is as in the Common Moles, *Scalops* and *Scapanus*, a thick-set and clumsy body, with large palms, and no distinction of neck.

The head tapers rapidly from the occiput, then gently to the elongated snout. The muzzle is thicker than in the Common Mole; its tip truncated, and the margins extended into a fringe of elongated and radiating fleshy processes, eleven on each side, arranged symmetrically around the circumference of the snout.

The longest of these caruncles are at the sides; they measure one-fifth of an inch, and are distant about one-third of an inch from the center of the nose. The upper lacinations are attached a little nearer the nostrils than the rest. The nostrils are circular, terminal, and central, and separated about one-tenth of an inch. The muzzle is naked in front of the fringes, and has a short and deep furrow on its under side.

The eyes are small and distinct, with palpebral openings nearly one-twentieth of an inch in diameter; they are midway between the end of nose and centre of meatus. They are probably functional. The ear does not project above skin; the oval meatus is nearly parallel with the top of the head; the antitragus and antihelix are distinct, and serve as valves to close the meatus.

The tail is as long as the trunk; it is annulated with coarse scales, scarcely to be seen among the long, bristly hairs which grow between the scales; it is constricted at the base, enlarged at the basal fourth, from which it tapers to the end; has about sixteen joints or vertebræ, show-

ing no nodes or irregularities caused by the vertebræ, as the name *Condylura* would indicate. Ordinarily, it is about one-fifth of an inch in its greatest thickness, but during the breeding season it grows to half an inch or more in diameter, owing to the deposition of fat under the skin.

The pelage is of two kinds of hair; a dark plumbeous basal ur, with sooty tips, giving the animal a uniformly dark-brown or blackish tinge, and coarser hairs, the longest measuring half an inch, thickly interspersed with the basal hair. The fur is not as fine as in *Scalops*, and is without the lustrous gloss of the Common Mole.

The hands have a fringe of hair encircling the entire palm; the whole of the under surface and most of the upper is without hairs and closely covered with a pavement of plates, of a brownish color, larger near the outer margin above, but of nearly uniform size below. Both surfaces of the hind feet have a similar coating of plates.

The hind feet are narrower than the front, but are considerably longer. On both fore and hind feet the fingers and claws decrease regularly from the fourth to the first. The front feet are webbed between the basal joints.

The outer edge of the under surface of each front toe is produced, forming lacinated horny processes; these are not found on the hind feet; the exact use of these peculiar processes, as of the nasal fringes so characteristic of this genus, are not at present known.

The skull is longer and slenderer than in allied moles; the cranium is almost as high as broad; the auditory openings large and conspicuous as in the shrews; the posterior edge of the palate has a notch extending to the per ultimate molar.

The upper incisors are axelike, and project nearly horizontally; those of opposite sides lie near together, forming the two halves of a kind of spoon. After these comes a slender, vertical, thread-like incisor, which has in immediate contact a long, canine-like incisor, having a small spur on its outer back edge; this is followed, after a considerable diastema, by a diminutive canine with a single fang, to which succeed three compressed molars having double fangs, a large-pointed central lobe, and two basal ones. There is no interval between the last premolar and the molars; the anterior premolars, the canine, and the third incisor are separated from each other.

In the lower jaw, which is very delicate, the premolars are nearly similar to the upper ones in form and position; the canine is large and distinct, with posterior basal fang; the three incisors are directed longitudinally forward, the two inner ones with their fellows of the opposite

ramus forming a continuous spoon-shaped projection, allied to that of the upper jaw. The posterior filiform incisor lies against the second, and is so small as to be scarcely discernible.

Habits and Habitat.—This species ranges from latitude 40° to 46°. It is found in the eastern and northern States, and west to Minnesota. It has been taken in Michigan and in parts of northern and central Illinois. Professor Baird examined specimens from Halifax, N. S., Carlisle, Pa., Ft. Ripley, Minnesota, and Essex county, New York. Mr. Kennicott reported it as not very rare in Edgar county, Illinois, where it was observed inhabiting the prairie.

The Star-nosed Mole is at present nowhere a common animal, at least few collectors have specimens in their museums. Godman, however, speaks of them as being so abundant in soft meadows and river bottoms that in many places it is scarcely possible to move without breaking down their interminable galleries. (Godman's Natural History, Vol. I., page 72.)

I find no account of the occurrence of this mole in Indiana, although it probably inhabits the northern part of this State, as well as Ohio and Illinois. Specimen 282 of the National Museum was collected by Professor J. P. Kirtland, at Cleveland, and is, I believe, the only specimen known from Ohio.*

Dr. J. M. Wheaton kindly called my attention to Dr. Kirtland's list of the mammals in Ohio, published in the Geological Report of the State for 1838, (now very rare) in which this specimen is mentioned; otherwise this species would have been omitted from the present report.

This species, as to food and general habits, resembles the common mole, preferring, however, low, swampy grounds, and not excavating its galleries to so great an extent. According to Godman its most frequent runways are on the margins of small streams, which are followed in their minutest windings. In confinement it feeds on flesh, raw or cooked, refusing all vegetable foods. Their natural food is the larvæ of insects peculiar to wet meadows.

The chamber, or nest, is a space of several inches extent, dug in some spot where the soil is tenacious and the cell not exposed. A nest containing three young has been found under a stump. Like most species of American moles and shrews, of its breeding habits little or nothing is known.

* Dr. Wheaton writes me October 28, 1879, as follows: "Mr. C. C. McLaughlin tells me that Mr. A. C. Freeman, of Butler P. O., Richland county, Ohio, captured a Star-nosed Mole at that place in the spring of 1879. This is reliable."

BLARINA (SORICISCUS) PARVA. (Say), Jordan.

LEAST SHREW.

On page 98 of this report I have given this species, "not as a known resident of Ohio, but as a species, without reasonable doubt, occurring there," basing this assumption on its occurrence at Carlisle, Pennsylvania, and at Irvington, Marion county, Indiana, where Dr. D. S. Jordan took a specimen in 1874, which is now in my possession.

Since then I am enabled, through Mr. F. W. Langdon, to verify the range ascribed in the body of the report. Under date of Madisonville, Hamilton county, Ohio, January 19th, 1879, Mr. Langdon writes me that among some shrews forwarded by him to Dr. Coues for examination was a specimen of the Least Shrew, also two specimens of the Short-tailed Shrew, all from Madisonville. Of the Least Shrew Mr. Langdon says: "This is a species of considerable interest, having been originally described by Say as *Sorex parvus*. Dr. Coues writes me in regard to it." "'*Sorex parvus*, Say,' has never been identified, but for years has been kicked around promiscuously among all the northern species of the family. * * I have not the slightest doubt that you have the veritable animal of Say, in the specimen you send."

The opinion of Dr. Coues is based on the examination of both the skin and skull of Mr. Langdon's specimen. The skull of the specimen secured by Dr. Jordan was, unfortunately, mutilated by the cat who caught it, but the species is identified beyond question.

The occurrence of the Least Shrew in both Ohio and Indiana is worthy of note, as the geographical distribution of the species of *Sorex* and *Blarina* has been but little studied, and indeed the number of species of these genera is yet uncertain. Harlan describes a female specimen, and gives the habitat as "Council Bluffs, Missouri."

Mr. Langdon's specimen of the Hairy-tailed Mole, *Scapanus breweri*, taken in Adams county, Ohio, carries the distribution of this species farther south than has been previously recorded.

THE WOLF AND WILD CAT.

Regarding the occurrence of the Wild Cat and Wolf at the present day in Ohio, I insert a paragraph from the Ohio State Journal of December 20th, 1878. I have written to the parties, but as yet have no confirmation of the circumstances as stated:

"*Wolf in the Woods.*—At this season of the year fox hunts and other sports of the forest are in vogue in the country, but even in this thickly settled part of the country savage beasts that have more than fun in their prowling around are occasionally met. It will be remembered that about this time last year there was great excitement in Union

county about a leopard that had been seen in the vicinity of Richwood, and traced by its depredations and different contests with adventurous hunters. That wild beast was finally caught, stuffed and put on exhibition in the towns of Union county to satisfy the curiosity of those whom it had kept in terror for some time. In Union county there are very large forests, perhaps the largest in the State, and it is known as a great region for hunters. Last week a man was attacked by a wolf in Jerome township, Union county, about four miles from Plain City. The circumstances are as follows: John Robinson was out in the woods cutting wood, and in the evening had started for his house, when he was suddenly attacked by a ferocious wolf. He raised a terrific yell and with his weapons at hand managed to keep the savage beast at bay until a neighbor, named John Boner, came to his relief and shot the wolf. It measured five feet in length, and was a heavy, strong beast of its kind. It is not ascertained whether it is a wild inhabitant of those woods or one that escaped from some cage, but it is thought to be a wild native of those forests. The wood-cutters in that county meet with wild beasts almost every winter."

SPERMOPHILUS TRIDECIMLINEATUS (Mitchell), Audubon and Bachman.
Var. *tridecemlineatus*. Allen.

STRIPED GOPHER; STRIPED PRAIRIE SQUIRREL; EASTERN STRIPED SPERMOPHILE.

1821. *Sciurus tridecemlineatus*, Mitchell, Med. Repos., xxi, 1821, 248.—Desm., Mamm., ii, 1822, 339 (from Mitchell).
1822. *Arctomys hoodi*, Sabine, Trans. Linn. Soc., xiii, 1822, 590, pl. xxix; Franklin's Journal, 1823, 663 (Carlton House).—Fisher, Synop. Mamm., 1829, 544 (from Sabine).—Wagner, Schreber's Säuget., pl. cxc. (name on plate).
1825. *Arctomys tridecemlineatus*, Harlan, Faun. Amer., 1825, 164.—Godman, Am. Nat. Hist., ii, 1826, 112.
1829. *Arctomys (Spermophilus) hoodi*. Richardson, Faun. Bor. Amer., i, 1829, 177, pl. xiv.
1849. *Spermophilus tridecemlineatus*, Audubon and Bachman, Quad. N. A., i, 1849, 924.—Hoy, Pat. Off. Rep. Agr., 1853 (1854), 68 (habits).—Kennicott, ib., 1856 (1857), 74, pl. viii (general history).—Baird, Mamm. N. A., 1857, 316 (in part).—Thomas, Trans. Ill. State Agr. Soc., iv, 1860, 657.—Allen, Proc. Bos. Soc. Nat. Hist., xiii, 1870, 189 (Iowa).—Jordan, Man. Vert., 2d ed., 1878.
1874. *Spermophilus tridecemlineatus*, var. *tridecemlineatus*, Allen, Proc. Bost. Soc. Nat. Hist., xvi, 1874, 291; Mon. N. A. Rodentia, 1877, 871.

Leopard Ground Squirrel, Schoolcraft, Travels, 1821, 331.

Striped American Marmot, Sabine.

Striped and Spotted Ground Squirrel, Say, Long's Ex., ii, 1823, 174.

Hood's Marmot, Sabine.

Leopard Marmot, Richardson.

Leopard Spermophile, Aud. and Bach.

Specific Characters.—Length 5.50 to 8.50; tail vertebræ 2.75 to 4.00; tail to end of hairs, 3.75 to 5.50.

General form slender and musteline; ears small; tail with hairs usually more than half the length of body. Color above deep chestnut brown, varying with locality from pale reddish chestnut to nearly black, with seven nearly uninterrupted lines of yellowish-white, extending from forehead to tail, and alternating with six longitudinal rows of sub-quadrate yellowish-white spots; below yellowish-white varying to tawny, strongest on the sides; buttocks more ferrugineous; eye-ring yellowish-white; upper surface of muzzle gray, sides and front yellowish; tail narrow, black above and below, varied somewhat with chestnut, and whitish-edged.

The hairs are reddish-yellow at the base, crossed by a broad band of black and light-tipped.

The above characters are intended to cover both the extreme western form, var. *pallidus*, and the eastern or Mississippi Valley form, var. *tridecemlineatus*. The latter averages larger, above is deep chestnut brown, varying to almost black; it has the white lines rather narrow, about one-third the width of the interspaces; the sides are strongly yellowish, varying to yellowish-rufous.

History and Habits.—This species was described in June, 1821, by Dr. Mitchell, from specimens taken on the Upper Mississippi, under the name of *Sciurus tridecemlineatus*, and by this specific name most American writers have designated it. Eight months later Sabine described it to the Royal Society of London as *Arctomys hoodi*. This appellation has been almost uniformly adopted by European authors. Scarcely any two authors have used the same common name.

In Iowa, Wisconsin, and Illinois it is universally called "gopher," being confounded with the true gopher, *Geomys bursarius*.

This species, like the Gray Gopher, is decidedly a prairie animal. It is often met with in oak openings and sparsely wooded ridges, but never in heavy timber; its favorite habitation is on dry prairie knolls.

It is found singly, in pairs, and where the soil is dry and food abundant as many as forty or fifty may inhabit a single acre; each pair keeps to its own burrow.

Probably few Ohio farmers' lads ever saw this species; it is described here, on the authority of Dr. Kirtland, Hood's Marmot, being included in that list. It is not probable that so accurate and excellent a naturalist as the lamented Professor Kirtland would be in error as to the occurrence of so positively marked an animal as the striped *Spermophile*, and I introduce it in this addenda without the least hesitation, only

regretting that an earlier knowledge of its occurrence in Dr. Kirtland's list had not permitted its appearance in the body of this report.

The writer can recall a common pastime of the school boys in Northern Illinois. During the long noon intermissions of the spring or summer term, several of the larger boys, with a couple of pails, would resort to some adjacent field and "drown out gophers," by pouring water into their burrows; the nearly strangled animals came more dead than alive to the surface and were readily caught alive, or more probably caught by the dogs, who understood the sport as well as the boys. No mercy is shown them, as they have a bad reputation among the farmers, mainly because of their injuring cornfields by digging up the newly planted seed. I have known farmers, residing on newly broken prairie, to feed the gophers abundantly by scattering corn on the fields and about the burrows so that the planted corn might not be molested. The corn thus fed had been previously soaked in poisoned water. This, with shooting and "drowning out" usually proved an effectual safeguard for the planted corn. This species, like the prairie rattlesnake *Caudisoma tergeminus*, rapidly disappears before the plough, rarely invading fields not adjacent to meadows or wild prairies.

The carnivorous habits of this species have been mentioned in connection with the Grey Gopher.

Dr. Hoy, of Wisconsin, has shown that this animal feeds upon mice and insects when captive, killing and devouring mice with all the dexterity and ferocity of the weasel. Dr. Hoy found the skins of meadow mice in the burrows of this spermophile, and, as Mr. Kennicott suggests, it is quite likely that their good offices in the destruction of mice and insects more than compensates for any mischief they may do in cornfields.

This is the most beautiful inhabitant of the prairie. Lithe and graceful, beautifully striped and spotted, it takes the place on the prairie of the common chipmunk or striped squirrel of the woodlands.

Their droll manner, under observation, is described by Kennicott:

"In passing near a knoll inhabited by them, numbers may be seen standing upright at the entrance of their burrows, so straight and motionless as to be easily mistaken for as many sticks. But as you approach one he will disappear by a movement so rapid that he can scarcely be followed by the eye; and if it were not for the whistling chatter accompanying his disappearance you might think your vision had deceived you, and that nothing had been there. But, upon stepping back several rods, it is more than likely he will have resumed his position before you are aware of it. If you remain close to his hole, he will only thrust out his head and eye you suspiciously."

Five to nine young—usually six or seven—are brought forth at the end of May or first of June; they are naked, blind, and remarkably em-

bryonic, even for rodents, having no hair until the twentieth day, and not opening the eyes until the thirtieth day. One litter is produced each year.

There is a summer and a winter burrow. The first is temporary, often excavated by the male, who leads a solitary, and more or less roving life during the time of gestation. The pair hibernates, and the female brings forth the young in a more complicated burrow, having at least two entrances, and a large side chamber dug above the level of the burrow and lined with soft grass. These nests are sometimes a foot in diameter.

Geographical Distribution.—Richardson found this species abundant about Carlton House, on the Saskatchewan. It is abundant at Pembino and on the Red River settlements. In the United States it is found from Minnesota westward to the Rocky Mountains, and southward to Missouri and Western Texas.

Through the prairie region it extends eastward to Northern Ohio. I do not know in what part of Ohio Dr. Kirtland observed it. Robert Kennicott states that its range in Illinois does not extend southward beyond latitude thirty-nine degrees.

Judge Potter, of Toledo, has furnished notes since the report was in press on the time of disappearance of certain mammals now extinct in Ohio. These we give almost without alteration or rearrangement:

OHIO STATE FISH HATCHERY,
TOLEDO, OHIO, December 21, 1873.

ALEMBERT W. BRAYTON, Esq.,

Dear Sir: I am this moment in receipt of yours of 18th instant, in reference to the Mammals of Ohio. I send you a few notes, of which you can make use in your general description of the animals named.

F. concolor, or American Panther, can scarcely be said to have inhabited Ohio for the last fifty years. From 1835 to 1845 they were occasionally found in the northern part of the State. In the latter year, two were killed near Toledo, one of which I saw, a very large one. Since then there has, probably, none been found in the State.

The Lynx (*F. canadensis*) has seldom been seen in Ohio. I killed one near Toledo in 1848, the last I have had any account of. One was killed the same year in the same neighborhood by a hunter.

Lynx rufus, common Wildcat, was once quite common in Ohio, and is still frequent in the northern counties of the State.

Canis lupus, the Wolf, is still occasionally found in the northern part of the State, but not common. They are fast disappearing.

Vulpes, the Red, Black, and Cross Foxes are still abundant in most parts of the State. They prefer a higher latitude than ours.

Urocyon cinereo-argentatus is a very long name for the Grey Fox, still common throughout the State.

Mustela americana, the Pine Marten, is extinct in Ohio.

Putorius vulgaris, and *P. ermineus*, the Brown and White Weasles, are still common in Ohio.

P. Vison the Mink, is still common in all portions of the State.

Gulo luscus, the Wolverine, is probably extinct in the State. I was in at the death of one in 1842, near Toledo, but have heard of none since.

Lutra canadensis, the Otter, is still occasionally found in most parts of the State.

Taxidea americana, American Badger, is, probably, extinct in the State. There was a colony of them in Lucas county as late as 1833; since then I have heard of none being taken.

Mephitis mephitica, the Skunk, is quite abundant all over the State.

Ursus americanus, the Black and the Brown Bear, are still, occasionally, found in the northern tier of counties of Ohio.

Procyon lotor, the Raccoon, is still abundant.

Of the *Marsupiales*, the Oppossum is still found in most parts of Ohio.

The *Cervus canadensis*, Elk or Wapiti, and *Canis virginianus*, the Red Deer, were the only members of the *Cervidae* common to the State. Elk disappeared about fifty years ago. The Red Deer is found in the northern part of the State, though not in great abundance.

The Moose and Caribou, I believe, never inhabited Ohio.

Of the Rodents native to Ohio, the Beaver, I believe, is the only one entirely extinct in the State.

Very truly,

EMORY D. POTTER.

ARCTOMYS MONAX.

Regarding the arboreal habits of the Woodchuck I quote the following interesting note from a letter received from Dr. J. M. Wheaton, under date of Columbus, Ohio, November 29, 1878 :

"I can confirm all that Mr. Langdon says of the Woodchuck climbing trees. The first one I ever killed (about 1855) I shot from an oak tree, about twenty feet from the ground. It had started down head first, in the endeavor to reach the ground, when my dog discovered it and called a halt. I shot at it with fine bird shot, and it fell to the ground, and with the dog rolled to the bottom of a steep hill, about twenty feet—arrived at the foot of the hill it was dead; and "if anything more is necessary," as the Irishman said, I can show you the place and the skull. The last one I saw was about May 1, 1878. It tumbled about five feet from a beech tree to the top rail of a fence and thence to the ground, and soon disappeared in its hole in a fence corner of a clover field, near the wooded bank of a stream."

SECTION II.

REPORT ON THE BIRDS OF OHIO.

BY J. M. WHEATON, M.D.

1

PROF. J. S. NEWBERRY, *Chief Geologist* :

DEAR SIR: I have the honor to submit herewith report on the Birds of Ohio. During the six years it has been in preparation, I have collected in this vicinity more than two-thirds of the birds here enumerated. No species has been admitted to the list which has not been personally identified, except on unimpeachable authority.

In the preparation of this report I have received valuable assistance from yourself, Dr. Elliott Coues, U. S. A., Washington, D. C. ; Messrs. Frank W. Langdon, Cincinnati ; R. K. Winslow, Cleveland ; M. C. Read, Hudson ; and others, to whom acknowledgments are made in the following pages.

Very respectfully,

Your obedient servant,

J. M. WHEATON.

Columbus, Ohio, November 1, 1879.

REPORT

ON THE

BIRDS OF OHIO.

BY J. M. WHEATON, M.D.

The State of Ohio is situated between $38^{\circ} 25'$ and 42° north latitude and $80^{\circ} 30'$ and $84^{\circ} 5'$ west longitude from Greenwich, or $3^{\circ} 30'$ and $7^{\circ} 50'$ west from Washington. It is thus the most southern of the northern tier of States, its northern border corresponding in latitude with the southern border of Michigan and New York. Its extreme length is, from east to west, about 220 miles; its greatest width from north to south about 210 miles. Its area is approximately 40,000 square miles. About two-thirds of the State is under cultivation, and of the remaining third nineteen-twentieths is woodland. Before cultivation a few small prairies in the western and central portions of the State interrupted the general woodland.

Two-thirds of the State may be considered as forming a part of the great Mississippi Valley, while about the northern third is in the basin of the great lakes. The water-shed which divides the streams flowing into Lake Erie from those tributary to the Ohio, traverses the State from near the north-east corner in a south-westerly direction as a low ridge, the greatest elevation of which is nowhere more than 1,400 feet above the sea. This water-shed is lower in Ohio than in Pennsylvania and New York.

The variations in the general surface of the State are not great. The elevation of Lake Erie is $565\frac{1}{2}$ feet, and that of Cincinnati, the lowest point, 429 feet above tide water, or 135 feet below the Lake.

The section of the State lying between the water-shed and the Lake is generally level, presenting a gradual slope to the north. The central

and western portion is also level, while the eastern portion is rolling, and the southern becomes hilly as the Ohio River is approached.

The average temperature throughout the year varies about five degrees; that of the vicinity of Cincinnati being 54° and of Northern Ohio between 49° and 50° Fahrenheit. The difference between the temperature of the winter is greater than that of the summer months. In Northern Ohio the average temperature during winter is from 27° to 28° . In Southern Ohio it is about 35° . In summer the average for Northern Ohio is about 71° , for Southern Ohio 75° .

There is a variation of about 14 inches in the mean annual rain-fall in different parts of the State, that of the extreme south-west corner being 46 inches and that of the Lake shore 32 inches. With the exception of a few localities, of limited extent, the decrease in rain-fall is gradual, and about one inch for every twenty miles ascent in latitude, and bears a direct ratio to the annual temperature. The prevailing winds are from the west.

Otherwise than above stated, the topography of the State is uniform. No large bodies of water are found, the largest being artificial reservoirs constructed in connection with the various canals for the purpose of securing a uniform and regular supply of water for the same. The largest of these is the St. Mary's reservoir, situated in Mercer and Auglaize counties, which covers an area of 17,000 acres, to a depth of ten feet. Three others, of smaller dimensions, are the Lewistown, in Logan county, Loramie, in Shelby, and Licking, in Licking, Fairfield, and Perry counties, all, except the latter, which is nearly central, are in Western Ohio. In the north-eastern portions of the State numerous small lakes are situated.

The rivers of the State are numerous and many of them are large. Those emptying into the Ohio flow through the wide valleys formed by the action of their own waters. These diverge somewhat in their course to the Ohio. Those emptying into the Lake are fewer in number, and converge towards the Lake.

The Ohio River separates the southern, and more than half of the eastern border of the State from the adjacent States, and is one of its natural boundaries. In its course westward it forms a considerable curve to the south, the lowest point of which is near the middle of the southern border of the State.

Lake Erie extends into the northern border of the State at its middle, causing a curvature of that border corresponding with though less well marked than the convexity formed by the Ohio. In the western portion of the Lake are several islands, which have afforded breeding-

places for some birds not known to breed in other localities in the State. The Lake exerts an emphatic influence on the climate, zoölogy, and botany of Northern Ohio, as has been well shown by Dr. Kirtland, whose article on that subject I insert here as showing the peculiarities of this region and a general view of the climatology of the State :*

"Very erroneous opinions are entertained by even intelligent people, respecting this section of country, so far as its climate and the species of the animal and vegetable kingdoms are concerned. A series of observations, embracing a period of ten years, have disclosed some very interesting facts upon these points.

"The locality where these observations were made, is situated five miles west of Cleveland, half a mile from the lake, one hundred and fifty feet above its surface, and fully exposed to its influence. During the ten years, the temperature has in no instance fallen below zero; while at Columbus, Marietta, and Cincinnati, situated from 120 to 150 miles to the south, it has frequently sunk to 5°, and has occasionally fallen to 10°, at some of those places. Their latitudes are as follows, to wit :

"Point of observation near Cleveland—

"North 41° 31'.

"Columbus, 39° 57'.

"Marietta, 39°.

"Cincinnati, 39° 5' 54".

"The more tender vegetation is usually cut down in all Northern Ohio—a few localities excepted—within five days of the 25th of September. The lake shore is an exception. Dahlias, maize, and sweet potatoes are generally killed simultaneously here and at Cincinnati—never before the 26th of October, and sometimes not until late in November. In one instance, at least, the lake shore escaped two weeks later than did Cincinnati.

"At the present moment, October 25, vegetation is as verdant and thrifty as it has been at any time during autumn, though it was cut down throughout the West generally several weeks since.

"The foliage of the fruit and forest trees, having subserved its purposes, is falling without the intervention of frost, and the wood of the more tender trees, such as the peach and cherry, has attained a maturity that will render it sufficiently hardy to withstand the impressions of cold during winter. This occurring annually, gives to these trees a degree of vigor, health, and productiveness not to be met with in localities where their growth is suddenly arrested by frost, at a period when they are immature.

"In the middle and southern sections of Ohio, spring sets in during the month of March—perhaps earlier. The warm winds blowing up the valleys of the Mississippi and Ohio, in conjunction with others causes, bring forth vegetation earlier; but cold weather and disastrous frosts too often follow.

"While these changes are progressing in those parts of the State winter will remain steadfast at this point. Little advancement will be made by spring, so long as any considerable bodies of ice float upon the lake, even as low down as Buffalo. No sooner do they disappear than spring sets in with a reality, and vegetation puts forth with *sub-arctic* rapidity.

* Peculiarities of the Climate, Flora, and Fauna of the South Shore of Lake Erie, in the Vicinity of Cleveland, Ohio; by J. P. Kirtland. Am. Jour. Sci. and Arts, 2d Series, xii, 1852, pp. 215-9.

"The lake rapidly imbibing heat at this season, becomes a safeguard against any subsequent vernal frost. Its influence was manifested in a satisfactory manner early in the present season. On the 1st of May, spring seemed to be fully established; fruit trees had blossomed and in some localities young fruits had formed. The morning was cold and the temperature declined during the day and evening. At 2 o'clock P.M., it was 48° Fahrenheit; at 7, 34°; and at 9, 32°. The atmosphere was calm and clear, indicating to an experienced observer the approach of a destructive frost. At 10 o'clock P.M., it had risen to 40°; a heavy cloud of haze hung about twenty degrees above the lake and soon overspread the whole horizon. The morning of the following day was warm and misty: by 12 o'clock A.M., it was clear and spring-like. Not a fruit germ was injured on the lake shore. A different state of things occurred throughout the west and south-west, where no local influences interfered. The temperature steadily declined, without intermission, during the day and night, down to about 26°. The day following was cold and blighting, and fruits were generally destroyed.

"The modes by which the lake exerts its influence on such occasions do not appear to be uniformly the same at different times.

"On the approach of a cold night, as in the instance above noticed, the warm emanations condensing may give off caloric, and obscure the atmosphere with haze, mist, or clouds, when no frost will occur.

"Under circumstances apparently similar, on the approach of a cold night, neither haze, mist nor clouds may form, but a stiff breeze springs up, and the stars become unusually brilliant. The thermometer vacillates between 30° and 38°, rising with gusts of wind, and falling during the intervals of calm. *Then* no frosts will appear.

"Again, none of those modifying causes may intervene, but the temperature may fall below freezing-point, ice form on the surface of the water, and the expanded fruit, leaves, and blossoms congeal. Under such circumstances, the first rays of the rising sun, the next morning, will be arrested by a haze, which will soon thicken, and before noon a warm rain will probably fall. The frost will be abstracted so gradually from frozen vegetation as not to impair its vitality,

"These contingences have all occurred within the period of our observations. The year 1834 proved an exception. The general cold prevailed over the local warmth of the lake; freezing weather continued two or three days, and fruits were cut off, even to the shore of the lake.

"In autumn, this great body of water begins to part with its warmth to the colder incumbent atmosphere, and the process continues during the winter. While its progress is most rapid strong westerly winds prevail at the earth's surface, while volumes of clouds, at a high elevation, may at the same time be moving rapidly in an opposite direction.

"These counter-currents have sometimes given origin to a phenomenon in the city of Cleveland, not well understood by all of its good citizens. The vane of the lofty spire of the Baptist church, standing on a high ridge of ground, may point steadily to the north, while that on the low cupola of the First Presbyterian church, situated on a less elevated plateau, may be directed to an opposite point of the compass, with a stiff southerly breeze at the same time. Cold north winds begin to prevail about the middle of October. The emanations from the lake then begin to condense and pass off to the south, in the form of thick clouds, without discharging, at first, much rain. About the 20th of October the cold from the north seems to gain the ascendancy; squalls of rain, hail, and rounded snow appear alternately, with intervals of clear and warm weather.

These squalls always precede the autumnal frosts. Our gardeners feel no apprehension for their tender vegetables till these premonitions have appeared.

"Common observations, as well as the more sure test, the rain-gauge, show that larger amounts of vapor from the lake are carried south, condensed in the form of rain or snow, than fall in this vicinity.

"During winter comparatively little snow falls, and still less accumulates here, though it may be abundant on the higher grounds in the interior.

"This region is also not so frequently favored with showers in summer as the central portion of the State. Long and severe droughts often prevail, but they are in part counteracted by moisture in the atmosphere. This quality sustains vegetation, and also imparts a blandness and freshness to the atmosphere during the hottest days of summer, very observable on approaching the lake from the interior. During that season it is peculiarly pleasant and invigorating to invalids, and equally harrassing to them during the spring season.

"The indigenous vegetation of this vicinity is of rather a southern type—shown by the absence, in a great measure, of evergreens, and the occurrence of more southern genera, as the *Cercis*, *Ilex*, *Æsculus*, *Nelumbium*, *Gleditschia*, *Magnolia*, etc. Elliott's Botany of South Carolina and Georgia has been found to be a convenient hand-book for investigating our flora. On the other hand strange hyperborean plants are frequently found, which have been washed down from the far northwest, through the chain of great lakes.

"Many of our birds are species whose most northern ranges of migration have been assigned many degrees south of this by ornithologists. The hooded, Kentucky, yellow-throated-wood, cerulean, and prairie warblers annually rear their young in this vicinity. Trail's fly-catcher and the piping-plover have been repeatedly seen here, and the purple ibis is an occasional visitor. The list might be greatly extended.

"Great numbers of the *Sylvicolidae* annually congregate here during their migrations, and seem to make it a resting place, both before and after passing the lake. More northern species occasionally resort here during winter, for the purpose of obtaining food, or are driven here by storms, such are the pine grosbeak and the white owl. The Bohemian wax-wing visits us almost every winter, and sometimes in large flocks. The pine finch is described by some ornithologists as resorting to the United States only at long intervals, and during winter. It visits our gardens and grounds in numerous flocks, every season, early in July, and remains here till the ensuing spring. The young, at their first appearance, still retain much down about their plumage, and can not have been long absent from their nests. The food of these birds is *Aphides* during summer, and at other times small seeds of grapes and other vegetables.

"The insect tribes show still more strikingly southern affinities. The *Papilio Cressphontes*, figured and described by Boisduval and LeConte, as the *Papilio Thoas*, has been repeatedly taken here, though it has been considered as exclusively southern in its resorts. In the south, the larva feeds on the orange and lemon; here, Major LeConte informs me, it lives on the Hercules-club.

"The *Papilio Ajax* and *P. Marcellus* have also been described as southern insects; and the late Mr. Doubleday located the former exclusively in Florida, and fixed the most northern limit of the latter in Virginia. Still they are common at this point, and subsist in the larva state on the pawpaw. An undescribed species of *Libythea* has been taken in northern Ohio; it has been found, also, in South Carolina, and is without doubt legitimately a southern species.

"The *Cherocampa tersa*, an elegant miller, was taken in our garden, in the month of May last. Dr. Harris describes it as a native of South Carolina, where it feeds on a species of plant which does not grow at the North. The food it finds as a substitute has not been discovered."

From this description of the peculiarities of the climate of the southern shore of Lake Erie, we may not only understand, why many birds, usually considered as more southern in their breeding range, should choose that region for their summer residence, but also why some northern birds should find suitable winter quarters there, and for that reason do not visit, in numbers, the central and southern portions of the State.

In other States, localities have been recently discovered which are peculiar in their bird fauna, probably for similar reasons.

Differences in the fauna of the eastern and western portions of the State are not marked, and consist chiefly in a difference in the relative abundance of some species. There are a few species, however, which are not found in the eastern portions of the State.

By far the largest part of the State is strictly Carolinian in its faunal characters; a small portion, the north-eastern corner, is as emphatically Alleghenian.

LATITUDINAL VARIATION.

In deference to the authority whose nomenclature I adopt, and on whom I have drawn for descriptions, several Ohio birds are described as varieties of species which also are given as Ohioan.

To those who have never made the science of ornithology a study, or who are unacquainted with its recent progress, this may require an explanation. It is to be found in the fact that many birds inhabiting or breeding in widely separated regions, and once considered different species, are found to gradually lose their distinctive characters, as individuals from intermediate localities are examined. In some instances, an examination of members of the same species from different localities has shown a constant and uniform difference in characters, which difference is expressed in calling one group a variety of the other.

As the variation between birds of the same species must follow some law or laws to be of any scientific interest or value, the determination of these laws has engaged the attention of the most eminent American ornithologists in late years. Among these investigators none have been more prominent than Prof. J. A. Allen, of the Museum of Comparative Anatomy, from whose writings I quote the following on the subject of latitudinal variation:*

"In North America, a geographical variation exhibits two marked phases (as has already been stated), a differentiation with differences of latitude and elevation; and,

* Proceedings of the Boston Society of Natural History, Vol. XV., June, 1872.

secondly, differentiation with differences of longitude, which, for convenience, may be termed respectively latitudinal and longitudinal variation. In respect to both, differentiation occurs in different degrees in different groups, in accordance with their general tendency to variation, or, as it were, in proportion to their normal degree of plasticity. In regard to variation with latitude, the modifications are apparently more general than in what I have termed longitudinal variation: the differentiation affects not merely color but size and the details of structural parts, whereas color appears to be the main element affected by longitudinal variation. The fact of variation in size has been conceded as a general law by the majority of at least American ornithologists and mammalogists, since it was so fully established by Prof. S. F. Baird, in 1857 and 1858, in his admirable reports on the Mammals and Birds of North America, published in the series of the Government reports on the exploration and survey of the various Pacific Railroad routes.

"Latitudinal variation presents the following phenomena, which are of such general occurrence that even the exceptions, if such there really be, are exceedingly few:

"1st. *As regards size*: There is a general reduction in the size of the individual, from the north southward, amounting not unfrequently to as high as 10 to 15 per cent. of the maximum size of the species. The reduction is much greater in some species, and in some groups of species, than in others, but is almost invariably considerable and easily recognizable.

"2d. *In respect to the bill*: The variation of the bill is somewhat inverse to that of the general size; as a rule the southern forms having generally relatively, and often absolutely, larger bills than northern ones, the increased size taking different proportions in different species and different styles of bill. Those of a stout, thick, conical form generally increase in size, but especially in thickness. Those of a slender or terete form become slenderer and relatively longer at the southward, with a decidedly greater tendency to curvature.

"3d. *In respect to the claws*: A similar increase in size is apparent in the claws, especially in that of the hallux, at southern localities, perhaps less marked and less general than the increase of the bill, with which it evidently correlates.

"4th. *In respect to the tail*: A marked elongation of the tail at the southward has been noticed in many cases, both in Cape St. Lucas birds (Baird) and in those of Florida.

"5th. *In respect to color*: The differences in color are especially obvious, and may be reduced to two phases of modification: (a) a general increase in intensity at the southward; and (b) an increase in the extent of dusky or black markings at the expense of the intervening lighter or white ones, or, conversely, the reduction in size of white spots and bars. Under the general increase in intensity, the iridescence of lustrous species becomes greater, and fuscous, plumbeous, rufous, yellow, and olivaceous tints are heightened in species with the color continuous in masses.

"Under the repression of light colors, the white or yellowish edgings and spots on the wings and tail become more or less reduced; and frequently, to a great degree in species barred transversely with light and dark colors, the dark bars widen at the southward at the expense of the white or lighter ones, sometimes to such an extent as to greatly change the general aspect of the species, as is the case in the *Ortyx virginianus* of the Atlantic States, and in other well known species; also, under the tendency to the increase of dark colors, longitudinal streaks and blotches in a light ground increase in extent and intensity of color."

Prof. Allen, after mentioning the coincidence of pale colors with dry

atmosphere and high latitudes, as well as the converse, suggests that there may be laws governing variation between the members of higher groups similar to those which he considers as varietal. He says:

"Whatever may be the cause of the above modifications of structure and color, at different localities, we certainly find the following coincidences:

"1st. In accordance with the increase in the intensity of color in individuals of the same species from the north southward, in the northern hemisphere, the brighter colored species in general represented in both the temperate and tropical regions occur, as a general rule, at the southward; the same fact holding good also for sub-families. In cosmopolitan genera, families, etc., the tropical species are almost always brighter colored than the extra-tropical ones. All the most gorgeously colored families of birds are either exclusively tropical or semi-tropical, with generally the outlying species more plainly colored than the average for the family.

"2d. In accordance with the increase in the size of the bill at the southward, all the species that have this member enormously developed are tropical or semi tropical; not only such families as have the beak at its maximum of development, as the toucans and hornbills, but in all groups in which it is unusually large, the extreme development is reached in the inter-tropical regions.

"3d. In respect to the tail, with very few exceptions, all long-tailed forms reach their highest development within or near the equatorial regions.

"The facts indicated above in respect to the inosculation of forms formerly regarded as specifically differentiated will evidently require modifications of the hitherto accepted nomenclature. Evidently, many of these forms are so strongly marked that they should be, in some manner, recognized in nomenclature, though admittedly of less than specific rank. Most naturalists now practically recognize as species such groups of individuals as are not known to graduate by nearly imperceptible stages into any other similar group, and as varieties such groups of individuals as occur at certain localities, or over certain areas, which differ more or less from other groups inhabiting other (generally contiguous) localities, with which there is evidence that they do more or less fully intergrade. Convenience seems to demand such a course, in order to enable the naturalist to specify what particular variety or race of a species inhabits a given section of country: a method, in fact, already more or less generally practiced."

As the State of Ohio presents no marked elevations of surface and its area is too limited to admit of any marked geographical variation in species, I have found it interesting to follow the suggestions contained in the concluding paragraphs above quoted, and have compared our resident and summer resident birds with migrants, as regards the variation in those of a similar type or pattern of coloration. This comparison and its results, in which I attempt to show that southern species (residents and summer residents) differ from northern species (migrants and winter visitors) in being more highly developed in coloration and pattern of plumage, northern birds remaining in a condition, in these respects, resembling the young of the southern forms, was made the subject of a paper read before the Columbus Natural History Society, August 29, 1874. This paper will be found in the appendix to this report.

In the following pages I have made free use of the writings of several authorities. The descriptions of species are almost without exception or alteration from Dr. Elliott Coues' Key to North American Birds,* The Keys to the Genera are from Prof. D. S. Jordan's Manual of Vertebrates,† the definitions of the higher groups are by Dr. Coues, and taken from the introductory chapter of North American Birds ‡

The nomenclature adopted is that of Dr. Coues in his Check List of North American Birds,|| with such modifications as changes, made since its publication, require. This is followed by references to all writers, whether general or local, who have mentioned that species as Ohioan. This is followed in most cases by such synonyms as will enable changes in the nomenclature to be traced. Following the description, I give, as briefly as possible, an account of its general and breeding habits, together with such biographical observations as seem to me interesting or valuable.

In the appendix I have inserted a list of the birds, with the dates of their appearance and disappearance, as observed by me in this vicinity; a list of the birds identified by me in my garden in this city; a Bibliography of Ohio Ornithology, and a Glossary of such scientific words as require definition.

* Key to North American Birds, containing a concise account of every species of living and fossil Bird at present known from the Continent North of the Mexican and United States Boundary. Illustrated by six steel plates and upwards of 250 woodcuts. By Elliott Coues, Assistant Surgeon United States Army. Salem: Naturalists' Agency, 1872.

† Manual of the Vertebrates of the Northern United States, including the district east of the Mississippi River, and north of North Carolina and Tennessee, exclusive of marine species. By David Starr Jordan, Ph. D., M.D. Professor of Natural History in Butler University. Second edition, revised and enlarged. Chicago: Jansen, McClurg & Co., 1878.

‡ A History of North American Birds, by S. F. Baird, T. M. Brewer, and R. Ridgway. Land Birds. Illustrated by 64 plates and 593 woodcuts. Boston: Little, Brown & Co., 1874.

|| Field Ornithology, comprising a Manual of Instruction for procuring, preparing, and preserving Birds, and a Check List of North American Birds. By Elliott Coues, United States Army. Salem: Naturalists' Agency, 1874.

AVES—BIRDS.

"Birds are abbranchiate vertebrates, with the brain filling the cranial cavity, the cerebral portion of which is moderately well developed, the corpora striata connected by a small anterior commissure (no corpus callosum developed), prosencephalic hemispheres large, the optic lobes lateral, the cerebellum transversely multifissured; the lungs and heart not separated by a diaphragm from the abdominal viscera; aortic arch single (the right only being developed); blood with nucleated red corpuscles, undergoing a complete circulation, being received and transmitted by the right half of the quadrilocular heart to the lungs for aeration (and thus warmed), and afterwards returned by the other half through the system (there being no communication between the arterial and venous portions); skull with a single median convex condyle, chiefly on the basi-occipital (with the sutures for the most part early obliterated); the lower jaw with its rami ossifying from several points, connected with the skull by the intervention of a quadrate bone (homologous with the malleus); pelvis with ilia prolonged in front of the acetabulum, ischia and pubes nearly parallel with each other, and the ischia usually separated; anterior and posterior members much differentiated; the former modified for flight, with the humerus nearly parallel with the axis of the body and concealed in the muscles, the radius and ulna distinct, with two persistent carpal bones, and two to four digits; the legs with the bones peculiarly combined, (1) the proximal tarsal bones coalescing with the adjoining tibia, and (2) the distant tarsal coalescing with three (second, third, and fourth) metatarsals (the first metatarsal being free), and forming the so-called tarso-metatarsus; dermal appendages developed as feathers; oviparous, the eggs being fertilized within the body, excluded with an oval calcareous shell, and hatched at a temperature of about 104° F., (generally by the incubation upon them by the mother)."—(GILL).*

There is little to add to this almost exhaustive definition of the class. All of our birds, at least, have the jaws more or less covered with a horny membrane, and all have air spaces connected with the lungs, and the skeleton itself is more or less pneumatic.

All existing birds may be placed in two great groups or sub classes—*Ratitæ*, birds without a keeled breast-bone, ostriches, etc., and *Carinatæ*, those with a more or less well developed keel to the sternum. All North American birds belong to the latter group.

* North American Birds, Vol, I, xi.

This sub-class is divided into fourteen orders, all of which are represented in Ohio except the last—*Sphenisci*, Penguins, which are confined to the Southern Hemisphere. It is, however, to be understood that these orders do not take equal rank with the orders in other classes of animals, for the reason that birds want, in common, many of those characters, the possession or lack of which constitute orders in other animals. In other words, they want the characteristic differences which constitute orders elsewhere, and have no other differences of equal value or importance.

The following is Dr. Coues' arrangement and definition of the orders :

- A. PASSERES. Hallux invariably present, completely incumbent, separately movable by specialization of the *flexor hallucis longus*, with enlarged base and its claw larger than that of the middle digit. Neither second nor fourth toe versatile; joints of toes always 2, 3, 4, 5, from first to fourth. Wing coverts comparatively short and few; with the exception of the least covers upon the *plica alaris*, arranged in only two series, the greater of which does not reach beyond the middle of the secondary remiges. Retrices twelve (with rare anomalous exceptions). Musical apparatus present in greater or less development and complexity. Palate ægithognathous. Sternum of one particular mould, single-notched. Carotid single (*sinistra*). Nature highly altricial and psilopædic.
 - a. OSCINES. Sides of the tarsus covered in most or all of their extent with two undivided horny plates meeting behind in a sharp ridge (except in *Alaudidæ*; one of the plates imperfectly divided in a few other forms). Musical apparatus highly developed, consisting of several distinct pairs of syringeal muscles. Primaries nine only, or ten with the first frequently spurious, rarely over two-thirds the length of the longest, never equaling the longest.
 - b. CLAMATORES. Sides of the tarsus covered with divided plates or scales variously arranged, its hinder edge blunt. Musical apparatus weak and imperfect, of few or incompletely distinguished syringeal muscles (as far as known). Primaries ten with rare exceptions, the first usually equaling or exceeding the rest.
- B. PICARIÆ. Hallux inconsiderable, weak or wanting, not always incumbent, not separately movable by distinction of a special muscle, its claw not longer than that of the middle toe unless of exceptional shape. Second or fourth toe frequently versatile; third and fourth frequently with decreased number of joints. Wing-coverts for the most part larger and in more numerous series than in *Passeres*, the greater series reaching beyond the middle of the secondary quills (except in many *Pici*, and some others). Retrices commonly ten (eight to twelve). Primaries always ten, the first only exceptionally short (as in *Pici*). Musical apparatus wanting, or consisting of a muscular mass, of not more than three pairs of syringeal muscles. Palate desmognathous or ægithognathous. Sternum of non-passerine character, its posterior border entire or doubly notched or fenestrate. Carotid single or double. Nature completely altricial, but young sometimes hatched with down (e. g. *Caprimulgidæ*).

- a. **CYPSELL.** Palate ægithognathous. Wings lengthened in their terminal portions, abbreviated basally, with the first primary not reduced. Tail of ten retrices. Bill fissirostral or tenuirostral. Feet never zygodactyle nor syndactyle, small, weak, scarcely fitted for locomotion; hallux often elevated or lateral or reversed, front toes usually webbed at base, or with abnormal ratio of phalanges in length and number, or both. Sternum deep-keeled, usually entire or else doubly notched or perforate. Syringeal muscles not more than one pair.
- b. **CUCULI.** Palate desmognathus. Wings not peculiar in brevity of proximal or length of distal portions, and with first primary not reduced. Tail of eight to twelve retrices. Bill of indeterminate form, never cered; tongue not extensile. Feet variously modified by versatility or reversion of either first, second, or fourth toes, or by cohesion for a great distance of third and fourth, or by absence or rudimentary condition of first or second; often highly scansorial, rarely ambulatorial. Syringeal muscles two pairs at most.
- c. **PICI.** Palate "exhibiting a simplification and degradation of the ægithognathous structure" (Huxley); wings bearing out this passerine affinity in the common reduction of the first primary and the restriction of the greater coverts. Tail of ten perfect retrices and usually a supplementary pair. Rostrum hard, straight, narrow, sub-equal to head, with commonly extensile and vermiform but not furcate tongue. Feet highly scansorial. Fourth toe permanently reversed; basal phalanges of toes abbreviated. Sternum doubly notched. Salivary glands highly developed. Hyoidean apparatus peculiar.
- C. **PSITTACI.** Bill enormously thick, short, high, much arched from the base, the upper mandible strongly hooked at the end, cered at the base, and freely movable by complete articulation with the forehead, the under mandible with short, broad truncate symphysis. Feet permanently zygodactyle by reversion of the fourth toe, which articulates by a double facet. Tarsi reticulate. Syrinx peculiarly constructed of three pairs of intrinsic muscles. Tongue short, thick, fleshy. Sternum entire or fenestrate. Clavicles weak, defective, or wanting. Orbit more or less completed by approach or union of postorbital process and lachrymal. Altricial, pilopædic.
- D. **RAPTORES.** Bill usually powerful, adapted for tearing flesh, strongly decurved and hooked at the end, furnished with a cere in which the nostrils open. Feet strongly flexible, with large, sharp, much curved claws gradually narrowed from base to tip, convex on the sides, that of the second toe larger than that of the fourth toe, and the hinder not smaller than the second one. Feet never permanently zygodactyle, though fourth toe often versatile; anterior toes commonly with one basal web; hallux considerable and completely incumbent (except *Cathartidæ*). Legs feathered to the suffrago or beyond. Retrices twelve (with rare exceptions); primaries sinuate or emarginate (with rare exceptions). Sternum singly or doubly notched or fenestrate. Palate desmognathous. Carotids double. Syrinx wanting or developed with only one pair of muscles. Altricial; the young being weak and helpless, yet pilopædic, being downy at birth.
- E. **COLUMBÆ.** Bill straight, compressed, horny at the vaulted tip, which is sep-

arated by a constriction from the soft membranous basal portion. Nostrils beneath a soft, tumid valve. Tomia of the mandibles mutually apposed. Frontal feathers sweeping in strongly convex outline across base of upper mandible. Legs feathered to the tarsus or beyond. Hallux incumbent (with few exceptions), and front toes rarely webbed at base. Tarsus with small scutella in front, or often reticulate, the envelope rather membranous than corneous. Head very small. Plumage without after shafts. One pair of syringeal muscles. Sternum doubly notched, or notched and fenestrate on each side. Carotids double. Palate schizognathous. Monogamous, and highly altricial and psilopædic.

F. GALLINÆ. Bill generally short, stout, convex, with an obtuse vaulted tip, corneous, except in the nasal fossa, and without constriction in its continuity. Nostrils scaled or feathered. Tomia of upper mandible overlapping. Frontal feathers forming re-entrant outline at base of upper mandible. Legs usually feathered to the tarsus or beyond. Hallux elevated, with few exceptions, smaller than the anterior toes, occasionally wanting (as in the Hemipods). Tarsus, when not feathered, generally broadly scutellate. Front toes commonly webbed at base. Claws blunt, little curved. Wings strong, short, and concavo-convex. Retriees commonly more than twelve. Head small, plumage generally after-shafted. Carotids double (except *Turnicidæ* and *Megapodidæ*). No intrinsic syringeal muscles. Sternum very deeply, generally doubly, notched. Palate schizognathous. Chiefly polygamous. Præcocial and ptilopædic.

G. LIMICOLÆ. Tibia bare of feathers for a variable, sometimes very slight distance above the suffrago. Legs commonly lengthened, sometimes excessively so, and neck usually produced in a corresponding ratio. Tarsi scutellate or reticulate. Toes never coherent at base; cleft or united for a short distance by one or two small movable basal webs (palmate only in *Recurvirostra* lobate only in *Phalaropodidæ*). Hallux always reduced, obviously elevated and free, or wanting; giving a foot of cursorial character. Wings, with few exceptions, lengthened, pointed, and flat; the inner primaries and outer secondaries very short, forming a strong re-entrance on the posterior border of the wing. Tail shorter than the wing, of simple form and of few feathers, except in some certain snipes. Head globose, sloping rapidly down to the contracted base of the bill, completely feathered (except in *Philomachus*, male). Gape of bill short and constricted; tip usually obtuse; bill weak and flexible. Rostrum commonly lengthened, and more or less terete and slender; membranous wholly or in great part, without hard, cutting edges. Nostrils narrow, placed low down, entirely surrounded with soft skin; nasal fossæ extensive. Palate schizognathous. Sternum usually doubly, sometimes singly, notched. Carotids double. Pterylosis of a particular pattern. Nature præcocial and ptilopædic.

H. HERODIONES. Tibiæ naked below. Legs and neck much lengthened in corresponding ratio. Toes long, slender, never coherent at base, where cleft, or with movable basal webbing. Hallux (as compared with that of the preceding and following group) lengthened, free, and either perfectly incumbent or but little elevated, with a large claw, giving a foot of incessorial character. Wings commonly obtuse, but broad and ample, without marked re-entrance on posterior border, the intermediate remiges not being much

abbreviated. Tail short and few-feathered. Head narrow, conico-elongated, gradually contracting to the large, stout base of the bill. Gape of the bill deeply fissured: tip usually acute; tomia hard and cutting. Bill conico-elongate, always longer than the head, stout and firm. Nostrils small, placed high up, with entire bony and horny, or only slightly membranous, surroundings. Pterylosis nearly peculiar in the presence, almost throughout the group, of powder-down tracts, rarely found elsewhere; pterylæ very narrow. Palate desmognathous. Carotids double. Altricial.

- I. **ALECTORIDES.** Tibiæ naked below. Neck, legs, and feet much as in the last group, but hallux reduced and obviously elevated, with small claw, the resulting foot cursorial (natatorial and lobate in *Fulica*). Wings and tail commonly as in *Herodiones*. Head less narrowed and conic than in the last, fully feathered or with extensive baldness (not with definite nakedness of loreal and orbital regions). Bill of various shape, usually lengthened and obtuse, never extensively membranous. Rictus moderate. Nostrils lower than in *Herodiones*. Pterylosis not peculiar. Palate schizognathous. Carotids double. Nature præcocial and ptilopædic.

- J. **LAMELLIROSTRES.** Feet palmate; tibiæ feathered (except *Phanicopterus*). Legs near the centre of equilibrium of the body, its axis horizontal in walking; not lengthened except in *Phanicopterus*. Knee joint rarely exerted beyond general skin of the body. Wings moderate, reaching, when folded, to, but not beyond, the usually short and rounded (exceptionally long and cuneate) tail. Feet tetradactyle (except sometimes in *Phanicopterus*); hallux reduced, elevated and free, often independently lobate. Bill lamellate, i. e., furnished along each commissural edge with a regular series of mutually adapted laminae or tooth-like processes, with which correspond certain lancinate processes of the fleshy tongue, which ends in a horny tip. Bill large, thick, high at base, depressed towards the end, membranous to the broad, obtuse tip, which is occupied by a horny nail of various shape. Nostrils patent, never tubular, nasal fossæ slight. No gular pouch. Plumage dense, to resist water. Eyes very small. Head high, compressed, with lengthened, sloping frontal region. Palate desmognathous. Reproduction præcocial; young ptilopædic. Eggs numerous. Carotids double. Sternum single notched.

- K. **STEGANOPODES.** Feet totipalmate; hallux lengthened, nearly incumbent, semilateral, completely united with the second toe by a full web. Tibiæ feathered; position of legs with reference to axis of body variable, but generally far posterior; knee joint not free. Wings and tail variable. Bill of very variable shape, never lamellate, wholly corneous; its tomia often serrate; external nares very small or finally abortive. A prominent gular pouch. Tarsi reticulate. Sternum entirely or nearly so; furculum confluent with its keel. Carotids double. Palate highly desmognathous. Reproduction altricial; young psilopædic or ptilopædic. Eggs three or fewer.

- L. **LONGIPENNES.** Feet palmate. Tibiæ feathered. Legs at or near the center of equilibrium, affording horizontal position of axis of body in walking. Knee scarcely buried in common integument; tibia sometimes with a long apophysis. Hallux elevated, free, functionless; very small, rudimentary or wanting. Rostrum of variable shape, usually compressed and straight to the hooked end, sometimes entirely straight and acute, commonly lengthened, always corneous, without serration or true lamellæ. Nostrils of various

forms, tubular or simply fissured, never abortive. No gular pouch. Wings very long and pointed, surpassing the base, and often the end of the large, well formed, few-feathered tail. Carotids double. Palate schizognathous. Reproduction altricial; young ptilopædic. Eggs three or fewer. Habits highly volucral.

- M. PYGPODES. Feet palmate or lobate. Tibiæ feathered, often with a long apophysis, always buried in the common integument nearly to the heel joint, necessitating a more or less erect posture of the body on land, when progression is difficult. Hallux small, elevated or wanting. Bill of indeterminate shape, wholly corneous, never lamellate or serrate, nor with gular pouch. Nostrils not abortive. Wings very short, reaching scarcely or not to the base, never to the tip, of the short, rudimentary tail. Palate schizognathous. Carotid usually double, sometimes single (in *Podiceps* and *Mergulus*.) Nature altricial or præcocial; young ptilopædic. Highly natatorial.

These orders are divided into families With few exceptions, Ohio has representatives of all families of North American birds. The exceptional families are—in Passeres, *Cinclidæ*, which has a single North American species, *Cinclus mexicanus*, the Dipper or Water Ouzel, of the Rocky Mountain region; *Chamæidæ*, consisting of a single species, *Chamæa fasciata*, the Ground Tit of the Pacific coast region; *Cærebidæ*, represented by a single species, *Certhiola flaveola*, of rare occurrence in Florida only; in Gallinæ, *Cracidæ*, represented by a single species, *Ortalida vetula*, Guan or Chiacalaca of Texas; in Lammellirostres, *Phœnicopteridæ*, a single species, *Phœnicopterus ruber*, American Flamingo, found in Florida and on South Atlantic and Gulf coast; in Steganopodæ, *Plotidæ*, a single species, *Plotus aninga*, the Water Turkey, southern, north to Illinois; *Sulidæ*, the Gannets, two species; *Tachypetidæ*, one species, *Tachypetes aquila*, the Man-of-War Bird; and *Phaëthonidæ*, also one species; *Phaëthon flavirostris*, the Tropic Bird, all marine, and mainly southern; in Longipennes, *Procellaridæ*, Petrels, strictly marine; in Pygopodes, *Alcidæ*, the Awks, also strictly marine.

ORDER PASSERES. PERCHERS.

SUB-ORDER OSCINES. Singers.

FAMILY TURDIDÆ. THRUSHES.

Primaries ten. Nostrils oval. Bristles or bristly points around the mouth. Wings moderate, not reaching, when folded, beyond the middle of the tail, and not over one and one-third times as long as the latter; tip formed by third to sixth quill; outer secondary reaching in closed wing three-fourths or more the length of the longest primary. Spurious quill longer, sometimes one-half the second.

Sub-family TURDINÆ. TYPICAL THRUSHES.

Tarsus covered anteriorly with a continuous plate without scales.

GENUS TURDUS. Linnaeus.

Bill rather stout, both outlines curved, commissure straight to the tip, then abruptly decurved. Tarsus longer than middle toe. Tail nearly even or emarginate.

TURDUS MIGRATORIUS. Linn.

Robin.

Turdus migratorius, KIRTLAND, Ohio Geol. Surv., 1832, 163.—READ, Family Visitor (newspaper), iii, 1853, 399; Proc. Acad. Nat. Sci. Phila., vi, 1853, 395 —WHEATON, Ohio Agric. Rep. for 1860 (1861), 363; Reprint, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874 (1875), 562; Reprint, 2.—GARLICK, Am. Nat., ii, 1868, 492.—LANGDON, Cat. Birds of Cin., 1877, 3; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 169; Reprint, 3.

Robin, KIRTLAND, Fam. Visitor, 1, 1850, 1.—BALLOU, Field and Forest, iii, 1878, 136.

Turdus migratorius, LINNÆUS, Syst. Nat., i, 1766, 292.

Turdus (Planesticus) migratorius, BAIRD, Birds North Am., 1858, 218.

Turdus migratorius var. *migratorius*, BAIRD, BREWER, and RIDGWAY, N. A. Birds, i, 1874, 25.

Above dark olive gray, blackish on head and tail; below reddish brown, throat, vent and under tail coverts white, throat with black streaks. Outer pair of tail feathers white tipped. Bill dusky above, yellow below. Feet dark. Very young birds spotted above and below. Length $9\frac{1}{2}$ inches; wing $5\frac{1}{2}$; tail $4\frac{1}{2}$.

Habitat, North America at large. Greenland. Accidental in Europe.

Abundant summer resident. Breeds. In Southern Ohio the Robin arrives about the middle of February and remains till November. In Central Ohio they arrive a week or two later and depart earlier. Nesting commences soon after arrival. The nest is usually placed on trees, sometimes on fences. It is composed externally of grass, moss, leaves

and twigs, within which is a lining of mud, which is more or less completely lined with a thin layer of fine fibres. The nest is about five inches in outside diameter, and of the same height. The inside diameter is usually about two and one-fourth inches, the depth a little greater. The eggs vary from four to six in number, are of a uniform light bluish green, and their average measurement is 1.18 inches by .81.

Little needs be said of this welcome and well-known bird. The earliest to arrive in spring are solitary birds, but they are soon followed by scattering flocks which make their way along the warm banks of streams. In the fall they congregate in places where their favorite food is abundant in large companies. They feed upon insects and worms, small fruits and berries. Although sometimes destructive to cultivated fruits, they make ample payment for their raids by the destruction of noxious insects.

The Robin is justly celebrated for its song, but I do not think it is generally known that it possesses much capacity for mimicry. A young lady friend of mine obtained from some boys a young Robin which they had just removed from its nest in this city. She cared for it, and was rewarded by a varied song. Before it was a year old it was perfect in the execution of not only its own proper notes, but those of several other birds. Among those I recognized the notes of the Loggerhead Shrike and Yellow-breasted Chat, birds which do not visit the city, and which it could not have heard. It undoubtedly learned these notes from a neighboring caged Mocking-Bird.

TURDUS MUSTELINUS. Gm.

Wood Thrush.

Turdus mustelinus, KIRTLAND, Ohio Geolog. Surv., 1838, 163.—READ, Fam. Visitor, iii, 1853, 399; Proc. Acad. Nat. Sci. Philad., vi, 395, 1853.—WHEATON, Ohio, Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 3; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 169; Reprint, 3—JONES and SHULTZ, Illustrations of Nests and Eggs of Ohio Birds, Part 1, 1879, plate 2.

Turdus mustelinus, GMELIN, Syst. Nat., i, 1788, 817.

Above bright tawny, shading into olive on rump and tail. Beneath white, everywhere except throat and belly, with large distinct spots of dusky. Bill dusky above, yellowish below. Legs flesh-colored. Length $7\frac{1}{2}$ inches; wing 4; tail 3.

Habitat, United States east of Missouri plains, south to Guatemala. Mexico. Bermuda. Cuba.

Common summer resident. Arrives in Central Ohio the last week in April or the first in May. Frequents woodland, and is not often seen in cultivated places, at least during the breeding season. In some locali-

ties they are very abundant. Towards the close of summer afternoons they seem to delight in mounting the higher branches of trees and join in an extemporaneous concert. Their song is short, their notes exceedingly liquid and sweet.

I am indebted to Dr. Howard E. Jones, of Circleville, for an albino of this species, which he killed in August, 1879. The entire upper parts are white, washed with pearl gray. The lower parts were pure white, the spots of the breast obsolete, the breast washed with delicate cream color.

The nest is built in saplings and low trees, seldom more than twenty feet from the ground. It is constructed of leaves, sticks, and moss, mingled and cemented with mud, with which it is also lined. The eggs are usually four in number, of a deep greenish blue color, and measure 1 by .75 inch.

Misses Genevieve E. Jones and Eliza J. Shultze give an exquisite figure of the nest and eggs of this bird in the first number of their admirable "Illustrations of the Nests and Eggs of Ohio Birds."

TURDUS PALLASI. Cab.

Hermit Thrush.

Turdus minor, KIRTLAND, Ohio Geolog. Surv., 1838, 163.

Turdus solitarius, READ, Fam. Visitor, iii, 1863, 399; Proc. Acad. Nat. Sci. Philad., vi, 395, 1853.

Turdus pallasi, BAIRD, P. R. R. Rep., ix, 1858, 213.—WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agri. Rep. for 1874, 562; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 3; Jour. Cin. Soc. Nat. Hist., i, 1878, 111; Reprint, 2; Revised List, Jour. Cin. Soc. Nat. Hist., 1, 1879, 169; Reprint, 3.

Turdus solitarius, WILSON, Am. Orn., v, 1812, 95.

Turdus minor, BONAPARTE, Jour. Phila. Acad., iv, 1824, 33.

Turdus pallasii, CABANIS, Arch. f. Naturg., 1847, 595.

Above olive, shading into rufous on rump and tail. Below white, olive shaded on sides. Sides of head, eyelids, neck and breast strongly tinged with buff. Throat and breast marked with large dusky-olive spots. Length about 7½; wing 3½; tail 3.

Habitat, Eastern North America.

Spring and fall migrant in Central Ohio, possibly summer resident in some portions of Northern Ohio. Mr. Langdon states on the authority of Mr. Dury that the nest and eggs have been taken in the vicinity of Cincinnati. The Hermit Thrush is a common migrant in April and October. It arrives before the other small thrushes, and frequents sparse woodland, brush-heaps, and the wooded banks of streams. In its summer home it is said to have a sweet song, but with us its only note is a short

low cluck or chirp. The nest is placed on the ground. The eggs are of a uniform bluish-green color, and measure about .90 by .63 inch.

TURDUS SWAINSONI. Cab.

Olive-backed Thrush.

Turdus swainsoni, WHEATON, Ohio Agri. Rep. for 1860 (1861), 379 (probable); Reprint, 5; in Coues' Birds of N. W., 1874, 233; Food of Birds, etc., Ohio Agric. Rep. for 1874 (1875), 562; Reprint, 2.—LANGDON, Cat. Birds of Cin., 1877, 3; Jour. Cin. Soc. Nat. Hist., i, 1878, 111; Reprint, 2; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 169; Reprint, 3.

Turdus swainsonii, CABANIS, Fn. Pern, 1845-46, 187.

Above uniform greenish olive. Below white, olive shaded on sides. Sides of head, throat, neck and breast strongly tinged with buff; breast and throat thickly marked with large dusky olive spots. Length about 7; wing $3\frac{1}{2}$; tail 3.

Habitat, Eastern North America. Ecuador. Brazil.

Abundant. Migrant. The Olive backed Thrush is the most numerous of our migrant thrushes. It arrives about the first of May, and may be seen until the first of June. They frequent woodland, are less often seen along the open banks of streams than the Hermit Thrush. They usually appear in scattered flocks and search for food on the ground. When disturbed they alight upon the lower branches of neighboring trees, where they sit nearly motionless and are frequently quite successful in concealing themselves.

They make their appearance in the fall, about the middle of September, and the migration continues about a month. At this period the companies are more compact, and they are to be found in abundance feeding upon poke-berries (*Phytolacca*) and other small fruits. In some localities, I have noticed a variety of this bird which averages considerably smaller, extreme individuals being only $6\frac{1}{2}$ inches in length, and have the buffy tint emphasized, the back even being slightly suffused with tawny, and the buff of breast continued as a median yellowish line to the vent. These birds were confined to open, wet woodland with stumps and piles of brush. They appeared to be more terrestrial in habit, reminding one somewhat of the Water Thrushes. They were the last to appear in the spring and remained later. In fall they were the first to appear and to depart. I think they probably were of comparatively southern or local breeding, not entitled to be recognized as a distinct variety.

While with us the Olive-backed Thrush has no song, only the short low note of alarm common to others of the genus. At its breeding-places, which in the East are from Massachusetts and, perhaps, Connecticut

northward, it is said to have a singularly pleasing song. It may possibly be found breeding in north-eastern Ohio.

The nest is placed in a tree and constructed largely of dark moss; the eggs are greenish-blue, spotted with reddish-brown and other tints. They are four or five in number, and measure .88 by .66.

TURDUS SWAINSONI. Cab.

var. ALICIE (BD.), Cs.

Gray-cheeked Thrush.

Turdus alicie, BAIRD, Rev. N. A. Birds, 1864, 23; LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., 1879, 169; Reprint, 3.

Turdus swainsoni var. alicie, WHEATON, in Coues' Birds of N. A., 1874, 233; Food of Birds, Ohio Agri. Rep. for 1874, 562; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 3; Reprint, 2.

Turdus (swainsoni var.) alicie, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., 1874, 169; Reprint, 3.

Turdus alicie, BAIRD, Birds N. Am., 1858, 217.

Turdus swainsoni var. alicie, COUES, Key, 1872, 73.

Similar to the preceding, but without any buffy tint about head, nor yellowish ring around eye; averaging a trifle larger, with longer, slenderer bill.

Common spring and fall migrant. Arriving a few days earlier in spring and fall than the preceding. Ornithologists differ as to whether it should be considered as named above, a variety, or constitutes a good species. There is but little difference to be noted in their habits. With us the Gray-cheeked Thrush is less numerous, and apparently more solitary than the Olive-backed. Both frequent the same locations and have the same food, but the Gray-cheek Thrush is less active, and, if the expression can be used, more stupid than the Olive-back, making sometimes scarcely any effort at concealment except to turn his back to you, or if really frightened, flying wildly. The nest, eggs, and manner of breeding are said to be similar to those of the Olive-back, except that their breeding range is more northern. From my own observations, I incline to the opinion that the Olive back and Gray-cheek Thrushes are distinct species. I have never seen a bird whose markings left any doubt as to its place, but I retain the above nomenclature for the sake of uniformity.

TURDUS FUSCESCENS. Steph.

Wilson's Thrush. Veery.

Turdus wilsonii, KIRTLAND, Ohio Geolog. Surv., 1838, 163.—READ, Fam. Visitor, iii, 1853, 399; Proc. Philad. Acad. Nat. Sci., vi, 395, 1853.

Turdus fuscescens, WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; LANGDON, Cat. Birds of Cin., 1877; Rev. List, Journ. Cin. Soc. Nat. Hist., i, 1879, 169; Reprint, 3.

Turdus fuscescens, STEPHENS, Shaw's Gen. Zool., x, 1817, 182.

Turdus wilsonii, BONAPARTE, Journ. Phila. Acad., iv, 1824, 34.

Above uniform tawny. Below white, olive shaded on sides and strong fulvous tint on breast. Breast and sides of neck with small dusky spots. Length about 7; wing 4; tail 3.

Habitat, Eastern North America. Colorado. Utah. Brazil. Panama. Cuba.

Spring and fall migrant in Southern and Central Ohio. Summer resident in Northern Ohio. Possibly breeds in all sections of the State. Mr. Langdon has met with it as late as June. I have never seen it here in July. It arrives in Central Ohio about May 1, and remains through the month. Begins to return in August. The fall migration is over by the middle of September. Is found in small companies and couples in woodland and undergrowth, and is rather partial to low places. In this vicinity it seldom or never is in full song; but I have heard them occasionally singing a sweet continuous song in suppressed notes. At their breeding places their song is rich and varied, said to bear considerable resemblance to that of the Wood Thrush. The nest is loosely constructed, and placed on or near the ground. The eggs are light greenish-blue, unspotted, measuring .94 by .66.

Sub-family MIMINÆ. MOCKING THRUSHES.

Tarsi scutellate in front. Tail longer than wings.

GENUS MIMUS. Boie.

Bill shorter than head, distinctly notched near tip. Tarsus longer than middle toe and claw.

MIMUS POLYGLOTTUS (L.) Boie.

Mockingbird.

Turdus polyglottus, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 161.

Mimus polyglottus, READ, Fam. Visitor, iii, 1853, 333; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 365; Reprint, 1861, 7, 17; Food of Birds, Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—COUES, Birds of N. W., 1874, 8; Birds of Col. Val., Part First, 1878, 56.—LANGDON, Cat. Birds of Cin., 1877, 3; Journ. Cin. Soc. Nat. Hist., i, 1878, 111; Reprint, 2; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 169; Reprint, 3.

Turdus polyglottus, LINNÆUS, Syst. Nat., i, 1758, 169.

Mimus polyglottus, BOIE, Isis, 1826, 972.

Wings considerably shorter than tail. Above ashy gray. Below whitish; wings and tail blackish, the former with two white wing bars, and large white spot at base of primaries, latter with 1 to 3 outer feathers more or less white. Length 9-10; wing about 4; tail about 5. Nest in bushes, of briars, leaves, etc; eggs 3-6, greenish blue with brown spots.

Southern United States, north casually to Massachusetts, rare north of latitude 38°.

Rare summer resident. Accidental in winter. The Mockingbird so well known and admired as a cage bird and songster is of very rare occurrence in summer of late years in this State. I took one in 1855 in this vicinity. Mr. Charles Dury took two, a few years since, near Cincinnati. Mr. Langdon records a pair as breeding in Hamilton county in the same location for three successive years. He captured a specimen at Madisonville, January 1, 1877, when the ground was covered with snow. Dr. Kirtland stated that it was a frequent visitor in Southern Ohio. Mr. Read states that it is "rarely seen in Northern Ohio," but that "single pairs nested in particular localities nearly every season." Dr. Jno. Darby, of Cleveland, informs me that a pair of these birds built their nest and raised their young for several years near the residence of Dr. Kirtland, at Rockport. I have heard of a single specimen being in the vicinity of this city within a couple of years. Reports of the occurrence of this bird are generally to be received with caution. The name "Mockingbird" is often applied to the Brown Thrush, and the Loggerhead Shrike is often mistaken for it by the uninitiated, and its young sometimes brought to our market by the ignorant or designing, and sold for young Mockingbirds.

MIMUS CAROLINENSIS (L.) Gr.

Catbird.

Turdus felivox, KIRTLAND, Ohio Geol. Surv., 1838, 163.

Mimus felivox, READ, Fam. Visitor, iii, 1853, 399; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Mimus carolinensis, BAIRD, P. R. R. Rep., ix, 1858, 346.—WHEATON, Ohio Agri. Rep. for 1860, 365, 375; Reprint, 1861, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—LANGDON, Cat Birds of Cin., 1877, 3; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 169; Reprint, 3.

Catbird, KIRTLAND, Fam. Visitor, i, 1850, 1 —BALLOU, Field and Forest, iii, 1878, 136.

Turdus felivox, VIELLOT, Ois. Am. Sept., ii, 1807, 10.

Mimus felivox, BONAPARTE.

Mimus carolinensis, GRAY.

Galeoscoptes carolinensis, BAIRD, BREWER, and RIDGWAY, North Am. Birds, i, 1874, 52.

Wings but little shorter than tail. Dark slate color somewhat lighter below; crown of head, and tail black; under tail coverts dark chestnut. Length 8 to 9; wing 3½, tail 4.

Habitat, Nearly all the United States and British Provinces. North to 54°. West to Washington, Oregon, Wyoming, and Utah. South in winter to Panama, Mexico, and Cuba. Breeds throughout its range in North America.

Abundant summer resident from April to October. Breeds abundantly. This is one of our best known birds, but unfortunately he is notorious

rather than popular. Of unattractive colors and unpleasant note, his name seems to bring upon him only contempt. Although the nearest relation to the prized Mockingbird, and possessing many of his attractions, with those who know of the relation, he seems only to lose by comparison. Few who listen to his sweet and powerful song, as he sits almost erect on the highest branch, can feel the admiration which it inspired, when it closes with the mocking cat-call note, and with a saucy flirt of his tail he disappears in the deepest thicket. But little he cares for public opinion. He does not ask if his society is welcome, but unasked takes up his abode in our dooryards and helps himself to our berries and cherries. The good he does is untold, for he is always busy and not always in mischief. Worms, insects, and spiders form most of his daily fare. He has no favorite dwelling place, but in thickets, orchards, woods, and along streams of water his note is heard every few yards. His nest is built in some thick bush, constructed of coarse materials, mainly dead twigs. The eggs are usually four, light bluish-green, unspotted, and measure .99 by .75.

GENUS HARPORHYNCHUS. Cabanis.

Bill about as long as the head, unnotched; tail moderately longer than wings. Outer lateral toe a little longer than inner.

HARPORHYNCHUS RUFUS (L.) Cab.

Brown Thrush. Thrasher.

Turdus rufus, KIRTLAND, Ohio Geolog. Surv., 1838, 163.

Mimus rufus, READ, Fam. Visitor, iii, 1853, 399; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Harporthynchus rufus, WHEATON, Ohio Agri. Rep. for 1860, 365; Reprint, 1861, 7; Food of Birds, etc., Ohio Agri. Rep. for 1874, 562; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 3; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 169; Reprint 3.

Thrush, KIRTLAND, Fam. Visitor, i, 1850, 1.—BALLOU, Field and Forest, iii, 1878, 136.

Turdus rufus, LINNÆUS, Syst. Nat. i., 1758, 169.

Mimus rufus, GRAY.

Harporthynchus rufus CABANIS, Mus. Hein., i, 1850, 82.

Above reddish brown; below white, with more or less tawny tinge. Breast and sides spotted with dark brown. Throat and belly unspotted. Bill black above, yellow below, feet pale, iris yellow. Length 11; wing 4; tail 5 to 6.

Habitat, Eastern United States.

Common summer resident. Breeds. Arrives usually about the 10th of April and remains until September. The Brown Thrush or, as he is sometimes called, French Mockingbird is well known throughout the State. Though never so abundant as the Catbird, his size and eccentric

motions, together with his lofty position while singing, render him conspicuous and familiar. When on his northward migration he steals along cautiously through thickets and undergrowth, frequenting logs, brush heaps, and the banks of streams. At such times he is usually silent and shy, but arrived at his breeding grounds with his mate, he pours fourth his loud and rollicking notes from the tops of the highest trees. He sings sometimes by the hour with a volubility scarcely equalled. Morning and evening are his chosen hours for this exercise.

His nest is built on the ground, in brush heaps, on stumps, in bushes and trees almost indiscriminately. In the vicinity of Columbus the nest is rarely found on the ground, and then only at the first of the season, when, it would appear, other suitable spots did not furnish sufficient concealment. The eggs in these nests are frequently addled. I have never known a brood raised from a nest on the ground. In all cases the soil was cold, clayey and wet. Most commonly the nest is placed in a deep thicket, in the fork of small tree from three to six feet from the ground. The female frequently betrays its location on the approach of man by a sharp mournful "cluck" of alarm and warning. No birds are more brave in defense of their young, following their captor for a long distance with threats of violence accompanied with screams of distress. The nest is large and loosely constructed of leaves and small twigs and lined with leaves, fibres of bark, and rootlets. The eggs are usually four, sometimes five, having a ground color varying from white to light blue, thickly and uniformly speckled with reddish brown. They measure 1.05 by .81.

FAMILY SAXICOLIDÆ. BLUEBIRDS.

Primaries ten. Nostrils exposed, oval. First primary less than one-half the second. Wing long and pointed, reaching, when folded, beyond the middle of the short, square, or emarginate tail, and one and a half times or more the length of the latter; tip formed by the second, third, and fourth quills; outer secondary reaching only about two-thirds way to end of longest primary; spurious quill very short. Tarsi booted.

GENUS SIALIA. Swainson.

Bill short, stout, somewhat depressed at base, compressed toward tip, slightly notched. Rictus with short bristles. Tarsus about equal middle toe; claws considerably curved. Tail emarginate.

SIALIA SIALIS (L.) Halderman.

Eastern Bluebird.

Saxicola sialis, KIRTLAND, Ohio Geolog Surv., 1838, 163.

Sialia wilsonii, READ, Proc. Philad. Acad. Nat. Sci., vi. 1853, 395.

Sialia sialis, BAIRD P. R. R. Rep., ix, 1858, 222.—WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—INGERSOLL, Am Nat. iii, 1869, 391.—LANGDON, Cat. of Birds of Cin., 1877, 3; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 169; Reprint, 3.

Bluebird, KIRTLAND, Fam. Visitor, i, 1850, 1, 55.—BALLOU, Field and Forest, iii, 1876, 136.

Motacilla sialis, LINNÆUS, Syst. Nat., i, 1758, 187.

Saxicola sialis, BONAPARTE, Ann. Lyc. N. Y., ii, 1826, 98.

Sialia wilsonii, SWAINSON, Zool. Journ., iii, 1827, 173.

Sialia sialis, HALDERMAN, Trego's Geog. of Penna., iii, 1843, 77.

Male, uniform sky blue above, reddish brown below, belly white. Female, duller. Young, spotted.

Habitat, Eastern United States, Canada, Nova Scotia, Montana, Wyoming, Colorado, New Mexico, Bermudas, Cuba, Guatemala.

Very common. Summer resident in Middle and Northern Ohio. Resident in small numbers throughout the year in vicinity of Cincinnati. (*Langdon*.) Breeds.

The Bluebird is one of the best known birds, and a general favorite. It is generally the first of our summer birds to arrive, and is often seen in February when the ground is still covered with snow. At such times, flying high overhead, and almost invisible in the dazzling sun-light, it attracts attention by its familiar notes. The first comers are usually solitary birds, and are often forced to seek a refuge from succeeding storms or even to return southward. So soon as there is a prospect of continuous milder weather, these birds appear in pairs and small flocks, and are generally dispersed over the country. They make themselves equally at home and welcome in city and country. In many towns in this State, as elsewhere, they build their nest in boxes provided for birds. This is seldom the case in this city, though their frequent twittering warble is heard everywhere. In former years they were more abundant during the breeding season than at present. This was doubtless owing to the greater abundance of suitable breeding places. The nest is placed in a hole, either of tree, stump, or post, sometimes in crevices of houses. Sometimes queer places are chosen; a nest was found by Mr. Oliver Davie of this city in the interior of a wheel of a railroad car, during the strike a few years since. It is usually scantily constructed of grass. The eggs are four or five in number, light blue, unspotted, measuring .81 by .62. Very rarely they are white. An instance is recorded at Oberlin, Ohio, by Mr. Ingersoll (l. c.) as follows: "I found on the 17th of May a nest of eggs so peculiar that I wish you could know of them. I was hunting east of here when I saw a bluebird enter a small hole in an old stump. I noted her carefully, and also recognized a male near by. I found my hand would not enter, and that the bird would not come out, I pushed

the stump over, tearing away a part, and not till then did the bird come out. I am *certain* that it was a female bluebird, but every one of the five eggs were *pure white*. I also noticed that, unlike the Woodpecker's, the bottom of the cavity was well bedded with grass; strictly a bluebird's nest. The eggs were nearly ready to hatch, and I could save but four, poor specimens. I examined the embryos, however, carefully, and they had the bill and feet of a *sialia*. It is a variation entirely new to me, although I have seen hundreds of bluebird's eggs. I have no doubt, whatever, of its identity."

FAMILY SYLVIIDÆ. THE SYLVIAS.

Primaries ten; the first about half the length of second. Basal joint of middle toe shorter than that of the inner toe, united to the outer for about two-thirds, to the inner for about one-half its length. Tarsus longer than middle toe and claw. Gonyes more than half the length of the under jaw. Bill very weak and slender, little decurved or notched at tip. Nostrils exposed. Very small—under six inches long.

Sub-family REGULINÆ. KINGLETS.

Tarsus booted. Wings longer than the emarginate tail. Nostrils overhung by bristly feathers.

GENUS REGULUS. Cuvier.

Rictus well bristled. Tarsi elongated, exceeding considerably the middle toe. Lateral toes about equal. Claws much curved. Tail feathers acuminate.

REGULUS CALENDULA (L.) Licht.

Ruby-Crowned Kinglet.

Regulus calendula, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 183.—READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 3; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Motacilla calendula, LINNÆUS, Syst. Nat. i, 1776, 337.

Regulus calendula, "LICHTENSTEIN, Verz., 1823."

Above greenish olive, below whitish, wings and tail dusky, edged with greenish or yellowish, wing coverts whitish tipped. Crown with a rich scarlet patch in both sexes (but wanting in both the first year), no black about head, bill and feet black. Length 4-4½; wing 2½-2¾; tail 1½-1¾.

Habitat, North America.

Abundant. Spring and fall migrant. Said to remain in small numbers in Northeastern Ohio through the summer.

The Ruby-crowned Kinglet, or Wren as it is most frequently though

incorrectly called, makes its appearance from the south about the first of April and remains until the first week in May. It reappears the first of October and remains through November. Its food consists of hibernating insects and their eggs which it gleanes busily from the tops of the highest trees and lowest bushes. It is one of the tamest and most unsuspecting of our birds, allowing the presence of man within a few feet of it without manifesting any fear or annoyance. While thus engaged it frequently utters a short wheezing note resembling the syllables "*weese-weese-weese*." More rarely it sings a continuous song, which is noted for its clearness, sweetness and variety.

Mr. Read, speaking of their occurrence in Northern Ohio, says he has "shot them in pairs in the middle of summer, one answering the description of the male, the other plainer and without the ruby crown."

No authentic account of their nesting in Eastern North America is given, although they have been found through the summer in several localities in the Eastern States. Mr. Henshaw found them breeding in Colorado.

REGULUS SATRAPA Licht.

Golden-Crested Kinglet.

Regulus cristatus, KIRTLAND, Ohio Geolog. Surv., 1838, 163.

Regulus tricolor, KIRTLAND, Ohio Geolog. Surv., 1838, 163.—READ, Proc. Philad. Acad. Nat. Sci. vi. 1853, 395.

Regulus satrapa, WHEATON, Ohio Agric. Rep. for 1860, 313; Reprint, 1861, 5; Food of birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2—LANGDON, Cat. Birds of Cin., 1877, 3; Revised List, Journ. Civ. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Regulus cristatus, BARTRAM, Trav. Fla., 1791, 291.

Regulus satrapa, "LICHTENSTEIN, Verz., 1823."

Regulus tricolor, NUTTALL, Man., i, 1832, 420.

General color as in the preceding. Crown bordered in front and on sides by black, inclosing a yellow and flame-colored patch (in the male; in the female the scarlet is wanting.) Extreme forehead and line over the eye whitish. Young, if ever without traces of black on the head, may be told from the last species by smaller size and the presence of a tiny bristly feather overlying the nostril; this wanting in *calendula*. Size of the preceding.

Habitat, North America.

Abundant. Winter Resident. Appears late in October or early in November and remains until April. The description given of the habits of the Ruby-crowned Kinglet applies equally to this species. On the whole it appears to be more northern in its distribution both in summer and winter, though Mr. Read says of them, "like the preceding, remains in pairs throughout the summer." The nest and eggs are undescribed.

Dr. Kirtland describes the occurrence of another member of this family

(*Sylvia trochilus*), a bird which Dr. Coues says has not been seen in America, and that all American references to it are "doubtless more or less exclusively pertinent to *Dendroeca æstiva*." It is difficult to understand how so close an observer as Dr. Kirtland should have failed to identify the Yellow Warbler in any plumage, and the description which he gives, hardly conforms to the Yellow Warbler in habit. Be this as it may, Dr. Kirtland's note is probably the last reference to the occurrence of "*Sylvia trochilus*" in this country. As the article in which it appears is especially interesting to ornithologists, and rich in valuable facts, I reproduce it here entire.*

*Am. Journ. Sci. and Arts, XL, 1841, 19-24. Art. II. Fragments of Natural History, by J. P. Kirtland, M. D., Prof. Theo. and Prac. Phys., Medical College of Ohio.

"I write that which I have seen."—LE BAUM.

NO. II.—ORNITHOLOGY.

The feathered tribes of our country have been so thoroughly investigated by Wilson, Bonaparte, Nuttall, Audubon, and Townsend, that the young ornithologist can hardly expect to meet with a new species, unless it be some straggler or accidental visitor from other parts of the world. An ample field is, however, furnished him in which he may successfully employ his talents. The habits of some of our most interesting birds are but very imperfectly understood. If we take for instance the Migratory Sylviæ, we can obtain but little more than their names and scientific characters from those authors—and in regard to their habits, less than we have been able to discover by our own observations.

On investigating the subject, it may perhaps be discovered that in some instances, errors have been imbibed and perpetuated by mistaken accidental movement of individual birds under unusual circumstances, for the common habits of the whole species.

The term of life of no one person is of sufficient duration to allow him to complete a full history, even of our American species, from his own researches and observations; such a work must be the production of the joint labor of several ages and many individuals. Many facts remain to be supplied before it can be successfully completed. The opportunities for observing the movements, and obtaining a correct history of the habits and characters of the rare birds, are only occasional and fortuitous, and are as likely to fall in the way of one who knows not how to improve them, as of one who possesses the talent for correct observation that distinguishes the author of the "Birds of America."

It is not to be expected that the public generally will ever turn aside from their usual pursuits to make observations on matters relating to natural science. The energies of some idle gunner may, perhaps, be aroused sufficiently by the appearance of a new or rare bird to induce him to destroy its life; the carcass will be gazed upon with a momentary curiosity and then cast underfoot.

In every community there are, however, some individuals who have a natural taste for matters of this kind. If they would improve the opportunities as they occur for making themselves familiar with the rare birds, and would communicate the results of their observation to the public through the medium of some suitable publication, any deficiency in the history of our American birds would soon be supplied. Entertaining this

Sub-family POLIOPTILINÆ. GNATCATCHERS.

Tarsi scutellate. Wing not longer than the rounded tail.

GENUS POLIOPTILA. Sclater.

Bill attenuated, nearly as long as the head, depressed at base; rictus well bristled. Tarsi longer than middle toe; toes small, outer lateral longer than inner. Tail graduated, the feathers rounded at tip.

POLIOPTILA CÆULEA (L.) ScL.

Blue-Gray Gnatcatcher.

Sylvia cærulea, KIRTLAND, Ohio Geolog. Surv., 1833, 163.

Sylvania cærulea, NUTTALL, Man., 2nd Ed., i, 1840, 337.—READ, Fam. Visitor, iii, 1853, 367; Philad. Acad. Nat. Sci., vi, 1853, 395.

view, I am induced to offer for the pages of the Journal of Science, the following extracts from my notes and memorandums, made during the last three years.

A flock of Bohemian wax-chatterers (*Bombycilla garrula*,) consisting of fifty or sixty individuals, was frequently seen in a marsh at the old mouth of the Cuyahoga river, near the city of Cleveland during the month of March of the present year. They were usually engaged in feeding on the pulps and seeds of the swamp rose, and as they were mistaken by the sportsmen for the common cherry bird (*B. carolinensis*) they were permitted to pursue their occupation without interruption.

I procured a fine specimen which is preserved in my cabinet; another is in the cabinet of Prof. Ackley of this city.

We believe this to be the first instance in which this bird has been taken within the United States, or has been known to visit us in any considerable numbers; though we learn from the appendix to Nuttall's Ornithology, and also from Peabody's Report on the Birds of Massachusetts, that the younger Audubon once pursued an individual of this species in that State.

Nuttall says, "the wax-chatterer, hitherto in America, seen only in the vicinity of the Athabasca river, near the region of the Rocky mountains in the month of March, is of common occurrence as a passenger throughout the colder regions of the whole northern hemisphere. In spring and late in autumn they visit Northern Asia or Siberia and Eastern Europe in vast numbers, but elsewhere are only uncertain stragglers.

Their size, markings, and habits readily distinguish them from the cherry or cedar bird. Justice is by no means done to their colors and beauty of form, in the figure given of the species by Bonaparte, in the third volume of his American Ornithology.

An hyperborean phalarope (*Phalaropus hyperboreus*) was shot on Lake Erie, near the pier of Cleveland harbor, last November, by a young man in my employment, while pursuing a wounded gull.

The phalarope was a young bird in winter plumage. It is preserved in my cabinet. Little could be learned of its habits. It was a solitary individual, and when first discovered was resting on the water, where it seemed to be as much at home as any of the gulls with which it was associating.

The yellow throated gray warbler (*Sylvia pensilis*) must be considered not a rare annual visitor, even to the northern parts of Ohio, though Mr. Audubon informs his readers that "they confine themselves to the southern States, seldom moving further towards the middle district than North Carolina," and "do not ascend the Mississippi further

Poliophtila cærulea, WHEATON, Ohio Agric. Rep. for 1860, 365; Reprint, 1861, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—BAIRD, BREWER, AND RIDGWAY, N. A. Birds, i, 1874, 78.—LANGDON, Cat. Birds of Cin., 1877, 3; Journ. Cin. Soc. Nat. Hist. i, 1878, 111; Reprint, 3; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Motacilla cærulea, LINNÆUS, Syst. Nat., i, 1766, 337.

Sylvia cærulea, LATHAM, Ind. Orn., ii, 1790, 540.

Poliophtila cærulea, SCLATER, Proc. Zool. Soc., 1855, 11.

Above, ashy blue, bluer on the head, lighter on the rump. Forehead and line over eye black, wanting in the female. Ring around the eye and under parts whitish. Outer tail feather, except at base, two-thirds the second and tip of third, white, rest of tail black. Length $4\frac{1}{2}$, wing 2, tail $2\frac{1}{2}$.

Habitat, United States north to Mass.

than the Walnut Hills;" and Mr. Nuttall says, that they "very rarely venture as far north as Pennsylvania." I have in my possession a specimen that I shot on the banks of the Mahoning river, in Trumbull county, on the 5th of May, 1839; and during the last week in April of the present year, I killed three near the Cuyahoga river, three miles from Lake Erie. Early in July I saw an old one feeding her young on the banks of the Mahoning. They were two-thirds of their full size, and were perched on a small bush over the water. A full-grown individual was seen on the first of August on the shore of the Lake within the limits of the city. In every instance in which I have met with them, they seemed to have a strong predilection to the vicinity of water, and were generally engaged in capturing insects.

The *Sylvia rara* is common in the woods about the banks of the Cuyahoga, during spring and summer. Its habits are accurately described by Audubon.

The same locality is a favorite resort and breeding place for the purple breasted gross-beak (*Fringilla ludoviciana*).

A flock of unusual birds, which I suppose to be the willow wrens, (*Sylvia trochilus*), was discovered in September, 1839, on the shore of the Lake, near this city. They made only a momentary stop, for on firing at one of their number as they were settling down upon a bunch of thistles, the remainder suddenly darted away over the Lake and disappeared. The characters of the specimen taken, agree with the description of the Willow Wren. They are said to be far more common in Europe than in the United States.

The Florida gallinule (*Gallinula chloropus*) is not described by ornithologists as a western bird. Mr. Audubon says, "none are to be seen in the western country." Bonaparte informs his readers that "in the middle and southern United States it appears to be quite accidental; for, although a few well authenticated instances are known of its having been seen and shot even as far north as Albany, in the State of New York, it has escaped the researches of Wilson, as well as my own."

Mr. Nuttall gives us to understand that "in the middle and northern States, it appears to be quite accidental." Notwithstanding this weight of authority to the contrary, I am disposed to consider this bird as one of our annual visitors, and not as a mere straggler in these parts.

I have the best authority for saying that several pairs reared their young in a marsh not more than a mile from this city, during the last summer, and I know of at least half a dozen specimens that were shot there during the last spring. Broods of the young have been repeatedly seen during the summer.

Common summer resident. Breeds. Arrives about the middle of April and leaves about the middle of September. This interesting bird, the smallest of all our birds excepting the Hummingbird, is found throughout the State in woodland. On its first arrival it is seen in small companies, often in company with Titmice, Kinglets, and Nuthatches. They frequent the tallest trees, and are very active in search of food. A company of these birds thus engaged are a very attractive sight to the ornithologist. But little more shy and suspicious than the Kinglets, their titmouse like attitudes, as they trip from bough to bough, or, flying with expanded tail, sieze some

A mature male and female were recently sent me from Fairport, Geauga county, by the Hon. Ralph Grainger, and I am assured by a gentleman that one has been taken alive in the vicinity of Buffalo, in the State of New York. Another was taken at Warren, in Trumbull county, two years since, and became so far domesticated as to run about the barnyard in company with the fowls during the summer, but at the approach of autumn suddenly disappeared.

The late Dr. Ward informed me that he had occasionally met with them in Roscoe, Coshocton county, and Dr. Sager assures me that they visit Michigan. I have repeatedly heard of them in other sections of the western States.

In their habits they are so retiring and secluded that they may escape even the most active and sagacious observer.

The buff-breasted sandpiper (*Tringa rufescens*), which seems to be a rare species in most parts of our country, was seen in the vicinity of this city in three different instances during the last autumn. I secured two specimens, one of which I presented to the New York Lyceum of Natural History; the other is retained in my own collection. This bird was unknown to Wilson and Bonaparte, and also to Mr. Audubon, until he received a specimen from England. It seems to be extremely shy and wary in its habits, and when watched by a gunner, will skulk behind some little hillock or tufts of grass. The individuals seen by myself were on a sandy flat, not immediately contiguous to water. In one instance Dr. Terry met with it in the public highway near this city.

The dunlin, ox-bird, or purre (*Tringa alpina*), visited us in large flocks during three or four weeks last autumn, and it has again appeared in a few instances the present spring. I have specimens preserved both in the summer and winter plumage.

Mr. Audubon informs his readers that he has never found one far inland.

The Cape May warbler (*Sylvia maritima*) visits the northern parts of Ohio in small numbers every spring. A solitary individual may be seen here and there, busily employed in catching insects about the cherry and apple trees at the time they put forth their blossoms.

According to Mr. Nuttall, it "has only been seen near the swamps of Cape May, in New Jersey, and near Philadelphia."

The chestnut-sided warbler (*Sylvia icterocephala*) is not uncommon with us for a few days in spring, and in one instance I saw a pair in a cranberry marsh in Boardman, Trumbull county, on the first day of June. The male was warbling its soft notes from the top of a young maple, and the female skipping about the bushes below. I am convinced they were preparing for nesting in that vicinity. Its note is rather loud, but soft and pleasant to the ear. Mr. Audubon seems to have met with it only in one instance.

minute winged insect, their minature imitation of the Catbird's well-known note, and above all their sweetly modulated and well prolonged song, so rarely heard, combine to form a most delightful picture of bird life. In the breeding season each pair seems to confine itself to the immediate vicinity of the nest, and resent the appearance of another of their species with all the outcry and momentum so small a body is capable of. For their summer home they chose the side of a ravine, or a glen or glade in mixed woodland. The nest is placed on the horizontal branch of a tree usually about thirty feet from the ground, often at the base of an upright twig which supports it, and frequently overhanging a stream at the bottom of a ravine. It is only a slight exaggeration of that of the Hummingbird, constructed of vegetable down in which are placed a few small feathers, and neatly covered with lichen. The eggs are four in number, measuring but .56 by .44, rather thickly spotted with lilac and several shades of brown. The nest would oftener escape detection from its resemblance to a moss-covered knot, but for the incessant scolding notes with which the birds resent even an innocent intrusion.

The bay-breasted warbler (*Sylvia castanea*), is still more common with us in the spring, and in some seasons protracts its visit for two or three weeks. Its favorite resort is the tops of the highest beech trees, at the time the buds are bursting into leaves.

The willet (*Totanus semipalmatus*), Mr. Audubon says, "are very seldom met with far inland," and "I have very little doubt that those seen by Mr. Say on the banks of the Missouri, had accidentally visited that country."

This bird is a common visitor to the shores of Lake Erie, both in the spring and autumn. On the 3d of July, 1838, I shot an old specimen from a flock of more than twenty individuals, that were in the habit of visiting the marsh in Ohio City, at the mouth of the Cuyahoga, for a number of days in succession.

The young birds appeared here on the first of July of the present year, and considerable numbers have been shot by the sportsmen.

A few years since, they remained here during the whole of the summer, and probably reared their young in the neighborhood. They are very abundant about some of the upper lakes.

The marbled goodwit (*Limosa fedoa*) occasionally visits the shores of Lake Erie and the Ohio river. The Hon. Mr. Granger has furnished me with a beautiful pair, killed near his residence at Fairport. Several young specimens were shot in this vicinity about the first of August of the present season. They were associating with a flock of long-billed curlews (*Numenius longirostris*).

The Hudson curlew (*Numenius hudsonicus*) has been taken in a few instances in Ohio. I have a specimen in my cabinet that alighted in the garden of Mr. A. Hayden, of this city, and was shot by him three years since. Another was taken in the vicinity of Cincinnati.

The piping plover (*Charadrius melodus*) I have seen in two instances on the shore of Lake Erie, and have specimens in my cabinet both in their winter and summer plumage.

Mr. Audubon informs his readers that they never proceed any distance inland, even along the sandy margins of our largest rivers."

CLEVELAND, OHIO, June 4, 1840.

FAMILY PARIDÆ. THE TITMICE.

Primaries ten. Base of bill with two tufts of antrorse bristly feathers ending in simple filaments without lateral branches concealing the nostrils. Tip of bill mostly unnotched. Basal joint of middle toe united nearly all its length with the lateral. Sides of tarsus ungrooved. First primary less than half as long as the second. Small—under seven inches.

Body compressed. Bill shorter than head. Wings rounded, equal to or shorter than the rounded tail. Second quill as short as the tenth. Tarsus longer than the middle toe and claw, which are about equal to the hinder; soles of toes widened into a palm. Plumage rather soft and lax.

GENUS LOPHOPHANES. Kaup.

Crown with a conspicuous crest. Bill conical, both upper and lower outlines convex. Wings graduated, about equal to tail; first quill very short. Tail moderately long and rounded.

LOPHOPHANES BICOLOR (L.) Bp.

Tufted Titmouse.

Parus bicolor, KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Fam. Visitor, iii, 1853, 335; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Lophophanes bicolor, WHEATON, Ohio Agric. Rep. for 1860, 365; Reprint, 1861, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 4; Journ. Cin. Soc. Nat. Hist., i, 1878, 111; Reprint, 2; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4; Bull. Nutt. Orn. Club, iv, 1879, 116.

Parus bicolor, LINNÆUS, Syst. Nat., i, 1766, 340.

Lophophanes bicolor, BONAPARTE, Consph. Av., i, 1850, 228.

Above leaden gray, forehead black, below lighter or whitish; sides rusty brown. Bill black; feet leaden blue. Young: the crest less developed; little if any trace of the black frontlet; sides scarcely washed with rusty. Length, 6-6½; wing and tail, 3-3½.

Habitat, Eastern United States, from Texas and Nebraska to the Connecticut Valley.

Abundant. Resident. Breeds. This is the common Chickadee of Central and Southern Ohio. Although of plain colors, its well-developed crest, busy and sprightly habits, loud notes, and familiarity, make it rather conspicuous. It is found almost everywhere throughout the year. In winter especially it visits the city, but I am confident that it sometimes builds its nest in the holes and niches of buildings. I have seen them in this city throughout the breeding season, carrying materials for building, and feeding their scarcely fledged young. Its ordinary note is a monotonous *dee, dee, dee*, often repeated, as if from habit. Its song is a loud whistle, resembling the syllables *peto, peto, peto*, in addition to which it has numerous and varied notes, some of which are modifications, both of the ordinary notes and of the song, others appear to be an attempt to imitate other birds, the notes of the Blue Jay being frequently recognized.

I do not think it is generally known that the Crested Titmouse has the

singular habit of amusing itself somewhat as the House Wren is said to do. On two occasions I have found them employed in filling holes in trees with the flowers of forest trees. In the first instance I watched the birds, apparently a pair, for several days, and saw them carry for a considerable distance the blossoms of the ash, and deposit them in a hole in an ash tree about twenty feet from the ground. At length, tired of waiting, I mounted the tree, and found a dark hole only. A stick was thrust into it for a distance of four or five feet, and met no resistance. On the second occasion I met with a similar experience, except that disappointment was not unlooked for. A lady friend complained to me that a pair of these birds vexed her much by picking to pieces and carrying away the moss from her hanging baskets. A gaspost had been put in position in the vicinity, but no lantern or gaspipe had been attached. Into the cavity of this the birds carried the moss and any other articles which they found portable. Conjecture fails to account for such freaks.

The nest of the Crested Titmouse is placed in some natural cavity of a tree; a hollow in the fork of an apple tree is a favorite spot. The materials composing it are few, generally bits of moss, leaves, and grass. I have found the eggs on the bare floor of the cavity. The eggs are white, thickly sprinkled with reddish-brown, and sparsely with lilac spots. They measure .75 by .56 inch.

Mr. Langdon (l. c. Bull.) records two cases of partial albinism in Ohio specimens of this species.

GENUS PARUS. Linnæus.

Head not crested. Body and head stout. Upper and lower outlines of bill only slightly convex. Tarsus but little longer than middle toe.

PARUS ATRICAPILLUS L.

Black-capped Chickadee.

Parus atricapillus, KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Fam. Visitor, iii, 1853, 335; Proc. Philad. Acad. Nat. Sci., vi, 395, 1853.—WHEATON, Ohio Agric. Rep. for 1860, 365; Reprint, 1861, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 4; Journ. Cin. Soc. Nat. Hist., i, 1878, 111; Reprint, 2; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Parus atricapillus, LINNÆUS, Syst. Nat., i, 1766, 341.

Above brownish ash. Crown and nape, chin and throat black. Beneath white, brownish on sides. Wing and tail feathers more or less whitish edged. Length, 5; wing and tail, 2½.

North America; chiefly northern and eastern.

Abundant resident in Northern and probably Eastern Ohio. Not common winter visitor in Central and Southern Ohio. Twenty-five years

ago the Black-capped Titmouse was as abundant in Central Ohio as the Tufted. Since that time it has become quite rare, and a winter visitor only in the vicinity of Columbus. In some seasons none are seen. I have seen but two or three individuals in the city limits within ten years. Their note is the familiar *chick a-dee-dee*, common to all members of the family with us, but is less emphatic than that of the Tufted Tit. They are almost omnivorous in winter, eating the refuse from kitchens as readily as the sparrows. Their ordinary food consists of the insects which hide in the crevices of bark, spiders, and tender buds of trees. They seem to take particular delight in being present at "hog killing time," when they are as busy as any, and sieze upon many a titbit, seemingly unconscious of the presence of man.

The nest is built in a dead tree or stump, usually near the ground. The hole is excavated by the bird. The eggs are white, sprinkled with reddish brown. They average .58 by .47.

PARUS ATRICAPILLUS L.

VAR. CAROLINENSIS (AUD.), CS.

Carolina Chickadee.

Parus atricapillus var. *carolinensis*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 4; Journ. Cin. Soc. Nat. Hist., i, 1878, 111; Reprint, 2.

Parus carolinensis, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Parus carolinensis, AUDUBON, Orn. Biog., ii, 1834, 474.

Averaging smaller than *P. atricapillus*; wings and tail less edged with whitish. About $4\frac{1}{2}$ long; wing less than $2\frac{1}{2}$; tail 2.40.

Habitat, South Atlantic and Gulf region of the United States, north to Washington, D. C. Texas and the Mississippi Valley; north to Central Illinois.

Not common summer resident Breeds. Arrives about the middle of April, apparently departs for the south soon after the breeding season. Resident all the year in Southwestern Ohio. The Carolina or Southern Titmouse is doubtfully a variety of the Black-cap Tit, although the resemblance is so great, that a casual observer would fail to notice a decided difference. In "North American Birds" it is considered a variety of *P. meridionalis*, a species of Eastern Mexico.

It differs materially in its habits from the Black-cap Tit, although it has the same note, it is lower and suppressed in tone, and less frequently repeated. In the spring they appear in pairs only, and do not associate with their fellows, or with other birds to any considerable extent while with us. In selecting a site for a nest, they seem to prefer a willowy swamp or the border of a stream, sometimes high ground in the vicinity of water, and, more rarely, a solitary woodland. Though unsuspicious,

they are much less familiar than the Black-cap, seldom making an appearance in gardens or in the city limits. The nest, like that of the Black-cap, is a hole excavated by the bird, generally in a decaying stump, but a few feet from the ground. The eggs are slightly larger than those of the Black-cap, measuring .60 by .50. I have found the nest in this vicinity as early as the 18th of April, ready for the reception of eggs. The female sits very close, and is with difficulty driven from the nest.

FAMILY SITTIDÆ. NUTHATCHES.

The characters of this family agree with those of *Paridæ*, so far as they are given in the first paragraph of that definition. The body, however, is depressed. Bill about equal or longer than the head. Wing much pointed, much longer than the nearly even tail. Tarsus shorter than the middle toe and claw, which are about equal to the hinder. Plumage more compact than in *Paridæ*.

GENUS SITTA. Linnæus.

Bill unnotched, tail more than one-half the wing.

SITTA CAROLINENSIS Lath.

White-bellied Nuthatch.

Sitta carolinensis, KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Proc. Philad. Acad. Nat. Sci., vi, 395, 1853.—WHEATON, Ohio Agric. Rep. for 1860, 365; Reprint, 1861, 9; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Sitta carolinensis, LATHAM, Ind. Orn., i, 1790, 262.

Back, rump and middle tail feathers ashy blue. Crown and nape glossy black, restricted or wanting in the young and many females. Tail, except as above, black, spotted with white. Beneath and sides of head white. Flanks and under tail coverts rusty brown. Wings varied, black, blue, and white. Length 6, wing $3\frac{1}{2}$, tail 2.

Habitat, United States and British Provinces; west to the Valley of the Missouri.

Very common. Resident. Breeds. In summer in woodland, and in winter, almost everywhere. The White bellied Nuthatch and Downy Woodpecker are both commonly known as "Sapsuckers." The Nuthatch may always be distinguished from the Woodpeckers, by the fact that it decends the trunks of trees, head downward, which the Woodpecker cannot do. The Nuthatch obtains its food, which consists of insects in their various stages, and eggs, by creeping up, down and around the trunks and larger branches of trees, inspecting fences and other places likely to afford a morsel. They also devour seeds, and may often be seen hammering at a nut or acorn which they have fixed in a crevice. They are said to conceal articles of food in holes of trees; from this circumstance their name is probably derived.

The nest of the Nuthatch is a hole in a tree generally excavated by the bird to the depth of a foot or more, sometimes a natural cavity. It is lined abundantly with down, hair and feathers. Mr. H. C. Benson, of Gambier, informs me that he has known them to build in a crevice in the wall of a stone building. The eggs are from four to six, white, with a roseate tinge when fresh, thickly covered with spots and blotches of rusty brown and purplish. The young lack the black on the head.

SITTA CANADENSIS L.

Red-bellied Nuthatch.

Sitta canadensis, KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Proc. Philad. Acad. Nat. Sci., 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 365; Reprint, 1861, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 4.

Sitta canadensis, LINNÆUS, Syst. Nat., i, 1766, 177.

Above dark ashy blue, tail as in *carolinensis*. Below rusty brown. Wings plain. Crown and nape glossy black, bordered by a white superciliary line. A black line from bill through and widening beyond the eye.

Habitat, wooded portions of Temperate North America.

Rather common but irregular spring and fall migrant. Winter visitor in South-western Ohio. The Red-bellied Nuthatch arrives in this vicinity from the south about the middle of April, and may be found until the middle of May. Usually single birds are seen which accompany the Titmice, Creepers, and Blue birds. On one occasion, spring of 1874, I found them in large flocks in company with equally large flocks of Redstarts. While their habits are essentially the same as those of the White-bellied Nuthatch, they are more often seen on the smaller branches and twigs of trees than is the case with the latter.

Mr. Brewster describes (Bull. Nutt. Orn. Club, iii, 1878, 20) the breeding plumage of this bird as differing from that heretofore given, and as having the 'entire under parts *dirty white*, tinged *very slightly* with pale rusty on the breast, sides, abdomen, and crissum.' In the spring of 1874, I took a couple of these birds answering this description, but unfortunately having secured several others at the same time, in what I thought to be in higher plumage, they were not preserved.

Until lately little has been known of their breeding habits. The nest is excavated in the stub of a tree and is about eight inches in depth, with much the appearance of the nest of the Downy Woodpecker. The entrance to the nest is said to be frequently coated with the balsam of the fir. The hole is plentifully supplied with down and feathers. The red feathers from the breast of the bird are said to be especially noticeable.

It seems difficult to reconcile this with Mr. Brewster's description of the bird in breeding season, unless we suppose the birds to commence building before the completion of the vernal moult. This species sometimes visits the city, though much less frequently than the White-bellied Nuthatch. In the fall they are with us from late in September until the first really cold weather, usually the latter part of November, and frequently accompany the Bluebirds on their southern migration.

SITTA PUSILLA Lath.

Brown-headed Nuthatch.

Sitta pusilla. KIRTLAND, Ohio Geolog. Surv., 1838, 164, 183.—WHEATON, Ohio Agric. Rep., for 1860, 363, 375; Reprint, 1861, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 1875, 2.—BAIRD, BREW, and RIDG., N. A. Birds, i, 1874, 122.—COUES, Birds of Col. Val., Pt. 1st, 1878, 140.

Sitta pusilla, LATHAM, Ind. Orn., i, 1790, 263.

Back, wings and tail, much as in *canadensis*. Below pale rusty or brownish white. Crown, clear hair brown; a distinct whitish spot on nape. Length, 4 or less; wing, $2\frac{1}{2}$; tail, $1\frac{1}{2}$.

Habitat, South Atlantic and Gulf States. Ohio, KIRTLAND; Michigan, ATKINS.

Accidental. The only instance of its occurrence in this State, is recorded by Dr. Kirtland, who says, "I once killed a specimen in the northern part of Ohio." Dr. H. A. Atkins, of Locke, Ingham county, Michigan, writes me that he took one specimen in 1877, in that vicinity. These are the only instances where the bird is mentioned as wandering beyond its prescribed limits. In breeding habits it resembles the other species. Its eggs are described as being so completely covered with fine dots as to appear "almost of a uniform chocolate or brown color."

FAMILY CERTHIIDÆ. CREEPERS.

Primaries ten. Nostrils exposed. Tail scansorial, with rigid acute feathers. Whole bill slender, compressed, acute, decurved, unnotched, unbristled. Outer toe much longer than inner.

Subfamily CERTHIINÆ. TYPICAL CREEPERS.

Tarsus scutellate, shorter than the middle toe and claw, with the entire basal joint united to the lateral toes.

GENUS CERTHIA. Linnæus.

Tarsus not longer than outer toe. Hind toe longer than the middle; its claw more than half the total length. Claws all much curved and very sharp. Bill as long as the head. Plumage long and lax.

CERTHIA FAMILIARIS L

Brown Creeper.

Certhia familiaris, KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874 (1875), 563; Reprint, 3.—LANGDON, Cat. Birds of Cin., 1877, 4.

Certhia americana, WHEATON, Ohio Agric. Rep. for 1860 (1861), 365; Reprint, 7.

Certhia familiaris var. *americana*, LANGDON, Rev. List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Certhia familiaris, LINNÆUS, Syst. Nat., i, 1758, 118.

Certhia americana, BONAP. Geog. and Comp. List, 1838, 11.

Certhia familiaris var. *americana*, RIDGWAY, Bull. E-s. Inst., v, 1873, 180.

Plumage above singularly barred with dusky, whitish, tawny, or fulvous brown, and bright brown—latter chiefly on the rump; below, white, either pure or soiled, and generally brownish washed behind; wings dusky, oddly varied with tawny or whitish bars and spots; tail plain; about 5½; wing and tail about 2½.

Habitat, temperate North America, in wooded regions.

Common migrant and winter resident; most abundant during its migrations in April and October. This curious bird seems to mimic in its mottled dull colors the bark of the forest trees on which it secures its food. In the proper season it may be seen in the company of Titmice, Nuthatches, and Woodpeckers, creeping up and around the trunks of trees, seldom upon the branches. Its progress is always upward or circling, like that of the Woodpecker, with which it is brought in close affinity by its stiffened tail. It is an active, restless bird, and while climbing often repeats a peculiar, monotonous note, which bears some resemblance to that of the Kinglets. At their breeding places Mr. William Brewster has discovered that "their notes are varied and warbling, and somewhat confused; some of them are loud, powerful, and surpassingly sweet, others are more feeble and plaintive. Their song usually ends with their accustomed cry, which may be represented by *cree cree-cree-cp*."

During its stay with us, it often visits the city in company with its creeping cousins, the Nuthatches. At such times it shares with these birds that fearlessness of man, characteristic of many of our small birds that attend strictly to their own affairs.

The Creeper breeds north of the limits of this State, doubtfully in Northeastern Ohio. It selects for its nesting place a natural cavity in or on a tree, or a deserted Woodpecker's nest, which it lines with grasses lichens and feathers. The compliment of eggs is said to vary from five to nine. They are white, rather sparsely sprinkled with reddish brown dots, and measure .55 by .44 inch.

Some ornithologists claim a constant difference between the American and European Creeper, which accounts for the different synonyms given above.

FAMILY TROGLODYTIDÆ. THE WRENS.

Primaries ten. Nostrils wholly exposed, scaled. Tarsus distinctly scutellate. No rectal bristles, but loreal feathers with bristly points. Bill slender, not notched nor hooked. Wings and tail moderately rounded, neither very much shorter than the other. Size small, color brown, etc. The wings and tail barred or undulated.

First primary not less than half the second, and inner toe united to the middle by at least half the length of its basal joint.

GENUS THRYOTHORUS. Vieillot.

Bill decurved. Does not reaching to the end of tail. Tarsus longer than the middle toe. Wings about equal to the stretched, nearly even tail.

THRYOTHORUS LUDOVICIANUS (Lath.) Bp.

Great Carolina Wren.

Troglodytes ludovicianus, KIRTLAND, Ohio Geolog. Surv., 1832, 168, 183; Family Visitor, i, 1850, 412.—AUDUBON, B. Am. ii, 1841, 116—READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Thryothorus ludovicianus, BAIRD, P. R. R. Rep., ix, 1858, 362.—WHEATON, Ohio Agric. Rep. for 1860, 365, 375; Reprint, 1861, 7, 17; Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—DURY, Bull. Nutt. Orn. Club, ii, 1877, 50.—LANGDON, Cat. Birds of Cin., 1877, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Sylvia ludoviciana, LATHAM, Ind. Orn., ii, 1790, 548.

Troglodytes ludoviciana, "LICHT., Verz., 1823, 35"

Thryothorus ludoviciana, BONAPARTE, Geog. and Comp. List., 1823, 11.

Tail not longer than the wings, all its feathers with numerous fine black bars. Above clear reddish-brown, slightly grayer on head, brightest on rump; below tawny of varying shade; long conspicuous superciliary line white or tawny; wings edged with color of back, and dusky waved; wing coverts usually whitish spotted; under tail coverts usually blackish barred; sides of body unmarked. Length $5\frac{1}{2}$ to nearly 6; wings $2\frac{1}{2}$, tail rather less.

Habitat, Eastern United States, rather southern, north to New York; Connecticut and Massachusetts rare.

Abundant in Southern, common and resident in Middle, rare in Northern Ohio. This is the largest of our Wrens. It is to be found almost everywhere, but prefers the wooded or rocky banks of streams, piles of logs and brush heaps in woodland, ravines, windfalls, and wherever nature, accident or design has provided a place where it can make itself conspicuous one instant, and be entirely concealed the next. Its varied and powerful notes distinguished it from all others of its family with us. When busily searching on the ground or in a pile of logs for food it utters frequently a low complaining warble or twitter, as if for its own edification or that of its companion. Its ordinary call note or alarm is a loud *chirr-chirr* sometimes loud and harsh, sometimes low and soft, often prolonged. Its song is really a remarkable performance. Mounting to the end

of a fence rail, top of a stump, or even to the topmost branch of a solitary tree, it pours forth a succession of notes more varied and nearly as loud as those of the Brown Thrush. This song is prolonged until he seems to have silenced all the less gifted songsters in the neighborhood; then with a downward flight he seeks the retirement of his favorite thicket and the company of his approving mate. It has still another note, loud and emphatic, the most frequently heard of all, which an acquaintance renders "*Jäger chêts, Jäger chêts, Jäger chêts.*" I can vouch for the truthfulness of the paraphrase, the charge is doubtless unfounded. These notes are heard both in winter and summer, the prolonged performance is heard only in spring and early summer.

These birds have apparently been increasing in numbers, in this vicinity, in late years. Certainly more of them are seen, and breed, within the city limits than formerly. The nest is placed in the interior of a barn, shed or other building, or if in the woods, in the cavity of a log or stump. Sometimes quite a large cavity is filled with leaves, grass, feathers and other materials. The nest is frequently roofed over having an entrance on the side. The female lays from five to seven eggs, reddish white, thickly spotted with various shades of reddish brown. They vary in size and shape in the same nest, and measure from .75 to .70 by .65 to .60. Mr. Charles Dury, of Avondale, Ohio, records (l. c.) that one pair of birds built three nests, each containing five eggs, by the 19th of July, the male caring for the young while the female was engaged in building, laying and incubating for the succeeding brood. When breeding in the woods the old birds manifest considerable ingenuity in protecting their young, one of them attracting the attention of the intruder, and by various arts endeavoring to draw him from the spot, while the other stealthily escorts first one and then another of the fledglings to a place of safety.

The Carolina Wren frequently climbs trees. On the first occasion that I noticed this habit, a pair of them ascended the trunk of a large oak tree for more than fifty feet. They accomplished this exactly in the manner of the Creeper, now moving up and now circling around, only stopping a moment, now and then, to peer and pick in the crevices of the bark, and at short intervals uttering a single note like that of the Nuthatch, but lower and softer. I have several times witnessed the same actions.

There is a marked variation in color among these birds. Some have the brown of upper parts decidedly suffused with ashy, the under parts whitish or ashy without a trace of tawny on breast or abdomen; others have the upper parts rich dark red-brown with hardly a trace of ashy even on the head, while the under parts are bright uniform ferrugineous. Between these extremes every intermediate phase may be found. These

differences are not distinctive of age, sex or season. I have found both forms in the same brood of young before they were fully fledged, the contrast being as decided as in young birds of the Gray and Red varieties of the Mottled Owl.

GENUS TROGLODYTES.

Bill shorter than the head, compressed, decurved. Wings about equal to the tail. Hind claw shorter than the rest of toe. Toes reaching to the end of tail.

TROGLODYTES DOMESTICUS (Bartram) Cs.

House Wren.

Troglodytes aedon, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 396.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 365; Reprint, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 563; Reprint, 3.

Troglodytes aedon, LANGDON, Cat. Birds of Cin., 1877, 4; Journ. Cin. Soc. Nat. Hist., i, 1878, 111; Reprint, 2; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Motacilla domestica, BARTRAM, Trav. Fla., i, 1791, 931.

Troglodytes domestica, COUES, Proc. Phila. Acad., 1875, 351.

Troglodytes aedon, VIEILLLOT, Orn. Am. Sept., ii, 1807, 52.

Troglodytes aedon, PEABODY, Rep. Orn. Mass., 1839, 314.

Above brown, brighter behind; below rusty brown or grayish brown or even grayish white; everywhere waved with a darker shade, very plainly on wings, tail, flanks and under tail coverts; breast apt to be darker than either throat or belly. Length $4\frac{2}{3}$; wings and tail about 2.

Habitat, Eastern United States and British Provinces; west to Dakota, Nebraska, Kansas, etc.

THRYOTHORUS BEWICKII (Aud.) Bp.

Bewick's Wren.

Thryothorus bewickii, WHEATON, Ohio Agric. Rep. for 1860, 379 (probable); Reprint, 1861, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 562; Reprint, 3.—LANGDON, Cat. Birds of Cin., 1877, 4.

Thryothorus bewickii var. *bewickii*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Troglodytes bewickii, AUDUBON, Orn. Biog., i, 1831, 96.

Thryothorus bewickii, BUTCHER, Proc. Philad. Acad., 1868, 149.

Thryothorus bewickii var. *bewickii*, BAIRD, Rev. Am. Birds, 1864, 126.

Tail longer than the wings. Grayish brown; below ashy white; superciliary line white; wings dusky, faintly waved; under tail coverts dark barred; two middle tail feathers like back, with numerous fine black bars, others black, several of the lateral ones with white or gray spots or tips. Length $5\frac{1}{2}$; wing about 2; tail $2\frac{1}{2}$.

Habitat, United States, Southern.

Bewick's Wren was named as an Ohio bird by myself in 1861, on the supposed authority of Dr. Kirtland and Mr. R. K. Winslow, of Cleveland. It now seems that this was a mistake, the bird never having been taken in Northern Ohio. Mr. Langdon, very properly gives it in his list, one specimen having been taken and another seen by Mr. E. R. Quick at Brookville, Indiana, a few miles from the Ohio line. It almost certainly occurs in South-western Ohio, but must be positively identified before it can be considered an Ohio bird.

Common summer resident. In this vicinity it arrives about the middle of April and remains until October. Less common, or rare and migrant in South-western Ohio and in some isolated localities. When on its migrations it is found in woods and on the banks of streams. Sometimes a pair may be found in woodland during the breeding season, but this is rare. Most of them find a convenient building spot in the vicinity of man's habitation, often under the same roof. Their noisy, active, inquisitive and combative disposition renders them among the best known of our semi domesticated birds. His song is difficult to describe, yet once heard is not easily forgotten. It consists of a sharp chatter of wavering notes, so quickly uttered as almost to seem a prolonged and highly modulated, sometimes squeaky, trill, now soft and now piercing, it seem to change with every position of the bird. He often executes a pleasing fantasia on the wing.

The nest is built in all sorts of odd places; a half peck measure, an old seive, old hat, or the tattered habiliments of a scare-crow, all are acceptable to them, as well as boxes, holes in posts, chinks and crevices under rafters and cornices of buildings, and hollow branches of apple trees.

Right manfully does he resent intrusion on his premises, and assails with impetuous vim beast or bird who ventures near. Pussy herself is put upon the defense while she is meditating an attack, and when she raises her paw to strike, is forced to shut her eyes.

The nest is composed of leaves, cotton, feathers, hair and other stuff. The eggs are from seven to nine, nearly spherical, and so thickly covered with small spots of reddish brown as nearly to conceal the white ground. They measure about .62 by .55. The House Wren is very prolific usually raising three broods in a season.

GENUS ANORTHURA. Rennie.

Bill shorter than the head, slender, nearly straight, conical. Wings much longer than the very short tail. Tarsus reaching to end of tail.

ANORTHURA TROGLODYTES (L.) Cs.

VAR. HYEMALIS (Wils.) Cs.

Winter Wren.

Troglodytes europæus, KIRTLAND, Ohio Geolog. Surv., 1838, 163.

Troglodytes hyemalis, READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 365; Reprint, 1861, 7.

Anorthura troglodytes var. *hyemalis*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin. 1877, 4.

Troglodytes parvulus var. *hyemalis*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Sylvia troglodytes, WILSON, Am. Orn., i, 1803, 139.

Troglodytes hyemalis, VIEILLOT, Nouv. Dict. xxxiv, 1819, 514.

Anorthura troglodytes var. *hyemalis*, COUES, Key, 1872, 351.

Troglodytes parvulus var. *hyemalis*, RIDGWAY, Bull. Ess. Iast., v. 1873, 180.

Deep brown above, darkest on the head, brightest on the rump and tail, obscurely waved with dusky and sometimes with whitish also; tail like rump; wings dusky, edged with color of back, and dark barred: several outer primaries also whitish barred; a superciliary line, and obscure streaks on sides of head and neck whitish. Below pale brown, belly, flanks and under tail coverts strongly barred with dusky. Length about 4; wing 2 or less, tail $1\frac{1}{2}$ or less.

Habitat, United States.

Common winter resident. The little Winter Wren is given in Dr. Kirtland's list without comment. Mr. Read gives it as "mainly a winter resident, few spend the summer." I am of the opinion that it breeds in Northern Ohio, having taken a young individual in this vicinity, September 9th, 1874, in a plumage which indicated that it had left the nest only shortly before. In the vicinity of Columbus they are much more common during their migrations in March and April, October and November, than in the middle of winter. They frequent woodland thickets and spend much of their time on the ground and about the exposed roots of trees. While thus employed either in search of food or seeking concealment, their actions resemble those of a mouse rather than a bird. The only note I have heard is a low wren-like *chirr*, but at their breeding places they are said to have a remarkably sweet and prolonged song.

Mr. R. Deane describes (Bull. Nutt. Orn. Club, iv, 1879, 37) the nest from Maine, found under the upturned root of a cedar, in the dark. It was "composed mainly of very compact green moss, with a few hemlock twigs interwoven, and lined profusely with feathers of the Canada Jay, Blue Jay, and other species, which arch over the eggs so as to almost conceal them. The average measurement of these eggs is .65 by .49 of an inch. The ground color is pure white, and with fine spots of reddish-brown and a few blotches of a darker shade."

GENUS TELMATODYES. Cabanis.

Bill nearly as long as head. Hind claw longer than the rest of toe. Wings longer than the short, much graduated tail. Feet large; toes reaching to end of tail.

TELMATODYTES PALUSTRIS (Bart.) Henry.

Long-billed Marsh Wren.

Troglodytes palustris, KIRTLAND, Ohio Geolog. Surv., 1838, 163.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Cistothorus palustris, WHEATON, Ohio Agric. Rep. for 1860, 1861, 565; Reprint, 7.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 170; Reprint, 4.

Telmatodytes palustris, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 563; Reprint, 3.—LANGDON, Cat. Birds of Cin., 1877, 4.

Motacilla palustris, BARTRAM, Trav. Fla., 1791, 291.

Troglodytes palustris, BONAPARTE, Journ. Phila. Acad., iv. 1824, 30.

Cistothorus (Telmatodytes) palustris, BAIRD, Birds N. Am., 1868, 364.

Telmatodytes palustris, HENRY, Proc. Phila. Acad., xi, 1859, 107.

Above, clear brown unbarred; back with a black patch containing distinct white streaks, crown brownish black, superciliary line to nape white, wings not noticeably barred, but outer webs of inner secondaries blackish; tail brown, dusky barred; below, dull white, often quite pure, the sides alone brownish washed, and under tail coverts somewhat barred. Length $4\frac{3}{4}$ to $5\frac{1}{2}$; wing about 2, tail less, tarsus $\frac{3}{4}$ to $\frac{5}{8}$; bill $\frac{1}{2}$ or more.

Habitat, Temperate North America and Mexico; south to Guatemala; accidental in Greenland.

Common summer resident in suitable places, migrant in others. The Long-billed Marsh Wren is a common resident in the extensive marshes about St. Mary's and the Licking Reservoirs. It doubtless breeds in many other localities. In the vicinity of Columbus, I know it only as a migrant. Mr. Langdon gives it as a migrant in the vicinity of Cincinnati. It usually makes its appearance here shortly after the middle of April and remains until after the middle of May. In the fall it returns in September and may be found throughout October. While with us, they frequent the banks of streams, swamps, low meadows with willows and swamp roses. Like the Carolina Wren, it frequently climbs trees, but not to a very considerable height. Their only note is short, harsh, and unpleasant, so quickly uttered as hardly to denote from what spot it comes.

The nest is built in bushes, generally quite near the ground. It is composed of coarse grasses and mud. It is globular in shape, with an entrance on the side. The eggs number from six to nine, oval or spherical, so thickly marked with brown spots as to appear of a nearly uniform chocolate color. They measure .65 by .50.

GENUS CISTOTHORUS. Cabanis.

Bill much shorter than head. Hind claw equal to its digit. Other characters as in *Telmatodytes*.

CISTOTHORUS STELLARIS (Licht.) Cab.

Short-billed Marsh Wren.

Troglodytes brevirostris, READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Cistothorus stellaris, WHEATON, Ohio Agric. Rep. for 1860, 365, 375; Reprint, 1861, 7, 17; Food of Birds, etc., Ohio Agric. Rep. for 1874, 663; Reprint, 1875, 2.—LANGDON, Cat. Birds of Cin., 1877, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.

Troglodytes stellaris, LICHTENSTEIN

Troglodytes brevirostris, NUTTALL, Man., i, 1832, 436.

Cistothorus stellaris, CABANIS, Mus. Hein., i, 1850, 77.

Dark brown above, crown and middle of the back blackish, *nearly every where conspicuously streaked with white*; below buffy white, shading into pale brown on the sides and behind; wings and tail barred with blackish and light brown; flanks barred with dusky; throat and middle of belly whitish. Length $4\frac{1}{2}$; wing and tail about $1\frac{1}{4}$; bill not $\frac{1}{2}$ long and very slender; tarsus, middle toe and claw together $1\frac{1}{2}$.

Habitat, Eastern United States in reedy swamps and marshes.

Rare. Summer resident. Not given by Dr. Kirtland in 1838. Given by Mr. Read as not abundant in Northern Ohio in 1853. It has since been found breeding in the vicinity of Cleveland. Mr. Charles Dury informs me that he has taken it at St. Mary's Reservoir. Mr. Langdon includes it in his list of birds of probable occurrence. I think I have seen it on one or two occasions in September, but have never positively identified it.

The nest is said to be similarly located and of similar construction to that of the Long-billed Marsh Wren, but the eggs differ from those of all other North American birds of the family, in being white, unspotted.

FAMILY ALAUDIDÆ. LARKS.

Outside of tarsus covered with two series of scutella, one lapping entirely around in front, the other entirely around behind, and meeting at a groove on the inside; hind edge blunt. First primary spurious or apparently wanting. Hind claw much lengthened, scarcely curved. Nostrils with antrorse bristly feathers. Bill conico-elongate.

GENUS ALAUDA. Linæus.

Crown with a depressed soft crest of feathers, of normal structure; a spurious primary; tail deeply emarginate.

ALAUDA ARVENSIS. Linnæus.

European Skylark.

Alda arvensis, LANGDON, Journ. Cin. Soc. Nat. Hist., i, 1878, 111; Revised List, Journ.

Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.

European Skylark, HARRIS, Field Notes, i, 1861, 65.

Above grayish-brown, beneath whitish, with a buffy tinge across jugulum and along sides; every feather above with a medial streak of dusky; sides of throat, sides, and across jugulum streaked with dusky; the outer tail feathers partly white. Wing 4.90; tail 2.70; tarsus .80; hind claw .50.

Habitat, Europe; accidental in Greenland and the Bermudas.

Introduced. Resident in small numbers in the vicinity of Cincinnati only. Inserted here on the authority of Mr. Langdon, who states that it "breeds sparingly in the parks and suburbs of Cincinnati." It is doubtful if it succeeds in establishing a residence in this country. Several years since, they were introduced upon Long Island, but after a few

years became exterminated. Col. Harris says of their introduction in this city, (l.c.) "In the autumn of 1851, Mr. Bateham, on his return from England, brought a cage of the real English Skylarks, which, after keeping a few weeks at his residence, near the Lunatic Asylum, were set at liberty in the grove back of that institution. They very shortly disappeared entirely, and no doubt perished, either in the severe winter which followed, or by the hand of the fowler."

GENUS EREMOPHILA. Boie.

Bill shorter than the head, compressed. Nostrils circular. Primaries nine, the first apparently wanting. Wings long; tail medium, nearly square. A peculiar tuft of feathers over ear, like the "horns" of certain owls.

EREMOPHILA ALPESTRIS (Forst.) Boie.

Horned Lark; Shore Lark.

Alauda alpestris, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 183—READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Field Notes, i, 1861, 92.

Eremophila cornuta, BAIRD, P. R. R. Rep., ix, 1854, 405.—WHEATON, Ohio Agric. Rep. for 1860, 365, 375; Reprint, 1861, 7, 17.

Eremophila alpestris, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin., 1877, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.

Alauda alpestris, LINNÆUS, Syst. Nat., i, 1758, 166.

Eremophila alpestris, BOIE, Isis, 1822, 322.

Eremophila cornuta, BOIE, Isis, 1828, 322.

In spring: Above, pinkish brown, brightest on rump, nape and wing coverts, thickly streaked with dusky; below white, breasts and sides shaded with the color of the back; chin, throat, and superciliary line pale yellow, or yellowish-white; a pectoral crescent, and curved stripe through the eye, black; tail black, outer feathers white-edged and middle ones like the back. Winter birds much duller above, the black markings obscure. Length, 7-7½; wing, 4½; tail, 2¾-3; tarsus, ⅞; hind claw, ⅓-⅔; very slender and sharp.

Habitat, Northern Hemisphere; in the Eastern United States, south in winter to South Carolina.

Abundant winter resident. Arrives about the first of November and departs about the first of April. The first Shore-Larks to appear are solitary individuals who associate with the Tit-larks just before they depart southward. As soon as the first considerable snow appears, they arrive in force, frequenting fields and barnyards where cattle are fed, meadows, commons, old brick-yards, and the gravelly shores of streams. When their ordinary supply of food is cut off by a deep snow, they feed upon the seeds of the rag-weed (*Ambrosia*), which projects above it. Should this fail they gather in the beaten roads, and there obtain a scant sustenance from offal. The flocks vary in size from those of a dozen to those of a hundred or more birds, usually from thirty to fifty are found in a

suitable field. When feeding, one of their number mounts guard on the top of a low hummock. Usually they are not shy, but when approached they squat, and remain motionless; if the object of their caution remains still, they soon resume their feeding, but if too near an approach is made, first one and then another rises with a sharp note, until the whole move off in a scattered flock. After circling around for a short time they again alight usually at no great distance. When flying overhead they may be known by the contrast of their white abdomen with their black tail feathers. Sometimes their feet become so "balled" with ice that they are unable to walk in their usual manner when feeding, in which case they progress by jumps, either forwards or sidewise, and short flights. They frequently perch on fences.

The Shore-lark breeds from New York and Wisconsin northward. The nest is placed on the ground, and composed of grass. Their eggs average .90 by .65; they are of a light drab color, spotted with various shades of brown. During the breeding season the male is said to have short but pleasing song.

FAMILY MOTACILLIDÆ. THE WAGTAILS.

Bill very slender, acute; culmen rather concave at base. Longest secondary acuminate, nearly or quite equal to the primaries in the closed wing. Hind claw little curved, about twice as long as the middle claw. Hind toe and claw longer than middle toe and claw.

Sub family ANTHINÆ. TITLARKS.

Tail shorter than the wings, emarginate at end, the two central feathers shorter than the lateral; the feathers broadest near the end, rounding at the tip.

GENUS ANTHUS. Bechstein.

Wings much pointed and lengthened; hind toe and claw shorter than the tarsus; outstretched toes falling short of tip of tail.

ANTHUS LUDOVICIANUS (Gm) Licht.

Brown Lark; Titlark; Pipit.

Anthus spinoletta, KIRTLAND, Ohio Geol. Surv., 1838, 163, 182.

Anthus ludovicianus, READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. R.-p. for 1860, 363; Reprint, 1861, 5, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin. 1877, 5; Revised List, Jouru. Cin. Soc. Nat. Hist., i, 1879, 176, Reprint, 4.

Alauda ludoviciana, GMELIN, Syst. Nat., i, 1788, 793.

Anthus ludovicianus, LICHTENSTEIN, Verz. 1823, 37.

Anthus spinoletta, BONAPARTE, Ann. Lyc. N. Y., ii, 1826, 90.

Points of wings formed by the four outer primaries, the fifth being abruptly shorter. Hind claw nearly straight, nearly or quite equal to its digit. Above, dark brown, with a slight olive shade, most of the feathers with dusky centres; eyelids, superciliary line

and under parts pale buffy or ochrey brown, variable in shade; breast and sides of neck and body thickly streaked with dusky; wings and tail blackish, inner secondaries pale edged; one or more outer tail feathers wholly or partly white. Length about $6\frac{1}{2}$; wing $3\frac{1}{2}$; tail $2\frac{1}{2}$ -3.

Habitat, North America everywhere.

Common spring and fall migrant. The Titlark makes its appearance about the first of October and remains until the first really cold weather, usually about the middle of November. In spring its migration seems to be peculiar. From the tenth to the twenty-fifth of April a few individuals are seen, yet in winter plumage; none are then seen until the end of the first week in May, when small flocks appear until May 15; these are in breeding plumage. The winter and breeding plumages differ more than is usual with birds of so uniform coloration. In the breeding plumage all the feathers of upper parts are suffused with whitish, strongly suggesting that the bird has been dusted with plaster of Paris; the buff of under parts is decidedly of a pinkish tinge, and the streaks smaller, fewer and more sharply defined than in the fall plumage. In the fall they are quite abundant, frequenting the gravelly banks of streams, often wading in the shallows, in commons, fallow fields and old brick-yards. In spring they are less common, and found in meadows. They have many peculiarities; their flight is undulating, irregular and prolonged, usually high; their note is a plaintive prolonged "teep" uttered while on the wing, ending now with a rising and now with a falling inflection. It is difficult to resist the impression from their vacillating flight and plaintive note that they are confused or lost. When on the ground it has a constant habit of tipping its tail, its common name having probably arisen from this circumstance. It frequently alights on the dead limbs of trees. During the fall migration they sometimes visit the city alighting in the streets and on buildings, but are usually seen flying high overhead.

They breed in the mountains of Colorado in the west, and from Labrador northward in the East. The nest is large, built of grass, and placed on the ground. The eggs are four or five, averaging a little over .75 by .60, "of a dark chocolate color, indistinctly marked with numerous small spots and streaks of blackish."

FAMILY SYLVICOLIDÆ. WARBLERS.

Primaries nine. Bill variously conico-elongated and acute; culmen not concave at base. Longest secondary not acuminate, falling far short of primaries in the closed wing. Hind claw well curved, not nearly twice as long as middle claw; hind toe and claw not longer than middle toe and claw. Gape ample; tongue slightly bifid or brushy, if at all.

Sub-family SYLVICOLINÆ TYPICAL WARBLERS.

Bill conoid-elongate, shorter than the head, about as high as or higher than wide at the nostrils, not hooked, but with a slight notch, or none, at tip, commissure straight or slightly curved; a few rictal bristles, reaching little if any beyond the nostrils, or none, wings pointed, longer (except in *Geothlypis*) than the narrow, nearly even tail.

GENUS MNIOTILTA. Vieillot.

Bill nearly as long as the head, compressed, notched some distance from the tip. Rictus unbristled. Wings long, much longer than the slightly rounded tail. Tarsus rather short about equal to the middle toe, and but little longer than the hind toe which is very long, its digit nearly twice as long as its claw.

MNIOTILTA VARIA (L.) V.

Black-and-White Creeper.

Sylvia varia, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 182.

Mniotilta varia, AUDUBON, B. Am., ii, 1841, 105.—READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Motacilla varia, LINNÆUS, Syst. Nat., i, 1766, 333.

Sylvia varia, LATHAM, Ind. Orn., ii, 1790, 539.

Mniotilta varia, VIEILLOT, Anal., 1816, 45.

Entirely white and black, in streaks except on the belly. Tail white spotted; wings white barred. Length, about 5; wing, $2\frac{1}{2}$; tail, $2\frac{1}{4}$.

Habitat, Eastern North America. Mexico. Bogota. West Indies. Bermuda.

Common summer resident. Breeds. Arrives in the vicinity of Columbus the last week in April and remains until September. During the migrations generally dispersed in woodland, but retires to breed to secluded spots, preferably second growth, mixed woodland. With few exceptions those members of this family which breed in this latitude are the first to arrive in spring and the first to depart in fall. This bird is no exception to the rule.

The Black-and-White Creeper, as its name indicates, approaches more nearly in its habits to the true Creepers than any other member of the family. It is generally seen on the trunks of trees, climbing upwards, downwards, or laterally with ease. In May, August and September, it is a frequent visitor in the city, and during all these months its song, a sharp and not very pleasant warble may be heard.

The nest is placed on the ground, constructed of leaves, fibres of bark, and grass, lined with hair. The eggs are creamy-white spotted and blotched with reddish. The young are fully fledged the last week in June.

GENUS PARULA. Bonaparte.

Bill considerably shorter than the head, depressed at base, attenuated at tip; notch usually obsolete or wanting. Wings considerably longer than tail. Tarsus but little longer than its digit. Claw of hind toe nearly two-thirds its digit.

PARULA AMERICANA (L.) Bp.

Blue Yellow-backed Warbler.

Sylvia americana, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 142.

Sylvicola americana, READ, Fam. Visitor, iii, 1853, 423; Philad. Acad. Nat. Sci., vi, 1853, 395.

Parula americana, BAIRD, P. R. R. Rep. ix, 1853, 239.—WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Parus americana, LINNÆUS, Syst. Nat., i, 1758, 190,

Sylvia americana, LATHAM, Ind. Orn., ii, 1790, 520.

Parula americana, BONAPARTE, Comp. and Geog. List., 1833, 20.

Male in spring, above, blue, back with a golden brown patch, throat and breast yellow, with a rich brown or blackish patch, the former sometimes extending along the sides; belly, eye-lids, two wing bars and several tail spots white; lores black; upper mandible black, lower, flesh colored; female in spring, with the blue less bright, back and throat patches not so well defined; young, with these patches obscure or wanting, but always recognizable by the other marks and very small size. Length $4\frac{1}{2}$ – $4\frac{3}{4}$; wing $2\frac{3}{8}$; tail $1\frac{1}{2}$.

Habitat, Eastern North America, West to Nebraska and Colorado, North to British America, Greenland casually, South to West Indies, Mexico, and Guatemala.

Not common spring and fall migrant in Southern and Middle, summer resident in Northern Ohio. Mr. Read notes it as "common in the spring, a few spend the summer." Dr. Kirtland says, "I have repeatedly seen them feeding their young in July." It may breed in the vicinity of Columbus, as I saw a specimen in my garden, June 30, 1879. Mr. Ridgway says it breeds in Southern Illinois.

The Blue Yellow-back Warbler arrives early in May and returns in September. They frequent the tops of the tallest trees in the highest woods, and are especially noticeable on hickory, ash and oak trees, which, at the time of the spring migration, have not much foliage. They are actively engaged hopping and flying from twig to twig in search of food. Their movements combine those of the Titmice and Redstart. Their song is short and feeble.

The nest is constructed of long gray lichens, sometimes simply an excavation in a bunch of lichen. The eggs measure .63 by .49, are white, spotted with lilac, slate, and various shades of brown.

GENUS PROTONOTARIA Baird.

Bill conical, compressed towards the end, as long as the head, longer than middle toe, unnotched. Hind claw but little shorter than its digit; middle toe and claw only three-fourths the tarsus.

PROTONOTARIA CITRÆA (Bodd.) Bd.

Prothonotary Warbler.

Protonotaria citrea, WHEATON, Ohio Agri. Rep. for 1860, 363, 373; Reprint, 1861, 5, 15.—

LANGDON, Cat. Birds of Cin., 1877, 5.

Protonotaria citræa, COUES, Key, 1872, 93 — WHEATON, Food of Birds, etc., Ohio Agri. Rep.

for 1874 (1875), 563; Reprint, 3.—LANGDON, Journ. Cin. Soc. Nat. Hist., i, 1878, 112;

Reprint, 3; Rev. List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.

Motacilla citrea, BODDERT, Tab. Pl. El., 1783, 44.

Protonotaria citrea, BAIRD, Birds N. A., 1858, 239.

Protonotaria citræa, COUES, Key, 1872, 93.

Golden yellow, paler on the belly, changing to olivaceous on the back, thence to bluish ash on the rump, wings, and tail; most of the tail feathers largely white on the inner webs. Bill black. Length $5\frac{1}{2}$; wing $2\frac{1}{2}$ –3; tail $2\frac{1}{2}$.

Habitat, South Atlantic and Gulf States; north to Ohio, Illinois, Missouri, and Kansas. Accidental in Maine and New Brunswick.

The Prothonotary Warbler is only known in this State as a summer resident in Western Ohio, especially in the vicinity of St. Marys' Reservoir. It was first noted as an Ohio bird in 1861, by myself on the authority of Mr. Winslow, but by whom taken, and when, I have no information. Since then Mr. Charles Dury has discovered that it breeds in the above mentioned locality, having found its nest in a deserted Woodpeckers' hole in a willow tree.

From Mr. Brewster's admirable account of this bird, the best yet written (Bull. Nutt. Orn. Club, iii, 1878, 153), I gather that it is one of the most abundant and characteristic birds of the low portions of South-eastern Illinois and Southwestern Indiana. He describes its song as resembling the note of the Solitary Sandpiper, and its alarm note that of the Water Thrush. The nest is built in the deserted hole of a Woodpecker or Carolina Chickadee or in any suitable cavity in a tree or building. It is built largely of moss, but leaves and twigs are sometimes added. The eggs are five or six, sometimes seven. They measure about .70 by .58. "The ground color is clear, lustrous white, with a high polish. Eggs from different sets vary considerably in markings, but two types of coloration seem to prevail. In one, spots and dottings of dull brown with faint submarkings of pale lavender are generally and evenly distributed over the entire surface. In the other, blotches of bright reddish brown are so thickly laid on, especially about the larger ends, that the ground color is in some instances almost entirely obscured.

GENUS HELMITHERUS Rafinesque.

Bill large and stout, compressed, almost tanagrine, nearly as long as the head, unnotched, unbristled and on a line with the forehead. Wings rather long, considerably longer than the rounded tail.

WORM-EATING WARBLER.

HELMITHERUS VERMIVORUS (Gm.) Bp.

Worm-eating Warbler.

Sylvia vermirora, KIRTLAND, Ohio Geolog. Surv., 1833, 163, 182.

Helinaia vermivora, AUDUBON, ii, 1841, 86.

Vermivora pennsylvanica, READ, Proc. Acad. Nat. Sci. Philad., vi, 1853, 395.

Helmitherus vermivorus, WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—BAIRD, BREWER, and RIDGWAY, N. A. Birds, i, 1874, 188.—LANGDON, Cat. Birds of Cin., 1877, 5; Jour. Cin. Soc. Nat. Hist., i, 1878, 112; Reprint, 3; Revised List, Jour. Cin. Soc. Nat. Hist., 1, 1879, 171; Reprint, 5.—JORDAN, Man. Vert., 1878, 60.

Motacilla vermivora, GMELIN, Syst. Nat., i, 1788, 95.

Sylvia vermivora, LATHAM, Ind. Orn., ii, 1790, 544.

Vermivora pennsylvanica, "Swainson," BONAPARTE, List, 1833, 20.

Helmitheros vermivora, BONAPARTE, Consp. Av., i, 1850, 314.

Helmitherus vermivorus, BAIRD, Birds N. A. 1858, 252.

Above olive, below buffy, paler or whitish on the belly; head buff, with four sharp black stripes, two along sides of crown from bill to nape, one along each side of head through the eye; wings and tail olivaceous, unmarked. Bill and feet pale. Length $5\frac{1}{2}$; wing $2\frac{3}{4}$; tail 2.

Habitat, Eastern United States; north to Connecticut Valley, casually to Maine; west to Missouri, Kansas, and Indian Territory; south in winter to Florida, Cuba, Jamaica, Mexico, Central America.

Rare summer resident. Arrives the last week in April and departs in August. Of the Worm-eating Warbler, there is little to be said. During its spring migration it is sometimes seen in low woodlands, generally on the ground searching for food. When disturbed it flies to the lower branches of a tree and remains silent and quiet, much as a Thrush. Their favorite breeding places are solitary ravines or glens near water, usually where ferns and moss abound. When at home they may be seen scratching the leaves on the ground, or rustling the leaves of a fallen tree in search of worms and spiders. Sometimes they mount to the higher branches where their actions are much those of the Vireos. On the ground, or on the lower limbs of trees, they walk, and their appearance is much that of the Water Thrushes, except the tipping of the tail. They are rather unsuspicious and silent, the only note I have ever heard was a rather sharp 'chip.'

The nest is placed on the ground in a depression of a hillside or beside a fallen log. It is composed of leaves and lined with moss. The eggs are four, white, rather sparsely dotted with reddish-brown, and measure about .74 by .62.

The young in first plumage are described by Mr. Ridgway (Bull., iii, 1878, 23,) as being of a buff color, with two badly defined stripes of grayish-brown on the head and a narrow streak of the same behind the eye. Primaries and their coverts, and tail feathers, as in the adult.

After the breeding season is over they sometimes wander about before departing for the south. On one occasion I took a specimen in my garden.

GENUS HELMINTHOPHAGA Cabanis.

Bill slender and exceedingly acute, unnotched, unbristled. Wings long and pointed, the first quill nearly or quite the longest. Tail nearly even or slightly emarginate, short and rather slender. Tarsi longer than middle toe.

HELMINTHOPHAGA PINUS (L.) Bd.

Blue-winged Yellow Warbler.

Sylvia solitaria, KIRTLAND, Ohio Geol. Surv., 1838, 163, 182.

Vermivora solitaria, READ, Proc. Acad. Nat. Sci. Phila., vi, 1853, 395.

Helminthophaga pinus, WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 5.—LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Certhia pinus, LINNÆUS, Syst. Nat., i, 1766, 187.

Sylvia solitaria, WILSON, Am. Orn., ii, 1810, 129.

Vermivora solitaria, JARDINE, "Ed. Wils., 1832."

Helminthophaga pinus, BAIRD, Birds North Am., 1858, 254.

Crown and entire under parts rich yellow; upper parts yellow olive, becoming slaty blue on the wings and tail, the former with two white or yellowish bars, the latter with several large white blotches. Bill and line through the eye black. Female and young similar. Length 5; wing $2\frac{1}{2}$; tail $2\frac{1}{4}$.

Habitat, Eastern United States; north to Massachusetts and Minnesota; south to Guatemala; west to Iowa, Kansas, Indian Territory, and Texas.

Rather common summer resident from May 1st to September 1st. Breeds. The Blue-winged Yellow Warbler is a bird of the most retired woodland and swamps. Though considered by Audubon one of the swamp warblers, it is often found on high ground, but usually in the vicinity of water. Their ordinary note is a rather sharp chirp. The song is said to be a rapid chirrup, forcible and characteristic. I obtained specimens in the spring of 1874, in my garden, which had evidently spent some considerable time in pine woods, their plumage being soiled with pitch. The site chosen for a nest is usually in the edge of solitary woods, often the border of a swamp. The nest is described by Mr. Ridgway, as composed of thin strips of the inner bark of trees, and quite bulky. The eggs are white, sprinkled with a few reddish-brown spots, and measure .70 by .54.

HELMINTHOPHAGA CHRYSOPTERA (L.) Bd.

Blue Golden-winged Warbler.

Sylvia chrysoptera, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 182.

Vermivora chrysoptera, READ, Proc. Acad. Nat. Sci. Philad., vi, 1853, 395.

Helminthophaga chrysoptera, WHEATON, Ohio, Agric. Rep. for 1860, 363; Reprint, 1861, 5
Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—COUES, Birds
of N. W., 1874, 50 (nest).—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1-74, 193.—
LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Jour. Cin. Soc. Nat. Hist., i,
1879, 171; Reprint, 5.

Motacilla chrysoptera, LINNÆUS, Syst. Nat., i, 1766, 333.

Sylvia chrysoptera, LATHAM, Ind. Orn., ii, 1790, 541.

Vermivora chrysoptera, "SWAINSON."

Helminthophaga chrysoptera, CABANIS, Mns. Hein., i, 1850, 20.

Male, in spring: slaty blue, paler or whitish below, where frequently tinged with yellowish; crown and two wing bars rich yellow; broad stripe on side of head through eye, and large patch on the throat, black; both these bordered with white; several tail feathers white blotched. Bill black. Back and wings frequently glossed with yellowish olive in young birds in which the black markings are somewhat obscure. Size of *pinus*.

Habitat, Eastern United States and Canada. New Grenada. Central America. Cuba.

Rare summer resident from May to August. This beautiful bird is the rarest species of the genus breeding with us, and, with the exception of the Orange-crowned Warbler, the rarest at any time. It is usually found in swampy places, where the nest is built on the ground, frequently under the broad leaf of the Skunk Cabbage (*Simplocarpus fetidus*). The nest has been taken at Groveport, in this county, by Mr. Wm. R. Limpert. The eggs are four to five, white, sparsely marked with reddish brown.

HELMINTHOPHAGA RUFICAPILLA (Wils.) Bd.

Nashville Warbler.

Sylvia rubracapilla, KIRTLAND, Ohio Geolog. Surv., 1838, 168, 182.

Vermivora rubricapilla, READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Helminthophaga ruficapilla, WHEATON, Ohio Agri. Rep. for 1860, 363; Reprint, 1861, 5;
Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON,
Cat. Birds of Cin., 1877, 5; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 171;
Reprint, 5.

Sylvia ruficapilla, WILSON, Am. Orn., iii, 1811, 120.

Vermivora rubricapilla, BONAPARTE, Geog. and Comp. List, 1838, 21.

Helminthophaga ruficapilla, BAIRD, Birds N. Am., 1858, 256.

Above, olive green, brighter on the rump, changing to pure ash on the head; below bright yellow, paler on the belly, olive shaded on the sides; crown with a more or less concealed chestnut patch; lores and ring round the eye pale; no superciliary line; female and autumnal specimens have the head glossed with olive, and the crown patch may be wanting. Length $4\frac{1}{2}$ – $4\frac{3}{4}$; wing $2\frac{1}{2}$ – $2\frac{3}{4}$; tail $1\frac{1}{2}$ –2.

Habitat, Eastern North America. Mexico.

Regular spring and fall migrant. Common. The Nashville Warbler is to be found from the first to the twenty-fifth of May in woodland and along the banks of streams, sometimes singly at other times in small flocks. Its song is a short warble, more varied and less emphatic than that of other members of this genus. Its note is a sharp chirp, which Wilson compares to the noise made by striking pebbles together. In September when on its southern migration it is more common, frequenting weeds in woods and on the borders of streams and swamps. At this time it is much on or near the ground, and often associates with Tennessee Warblers, which exceed them in numbers in the fall. It breeds in the latitude of Massachusetts and northward. The nest is placed on the ground, composed of moss and grasses. The eggs measure .59 by .50 and are white, thickly marked with purplish brown spots.

HELMINTHOPHAGA CELATA (Say) Bd.

Orange-crowned Warbler.

Helminthophaga celata, WHEATON, Ohio Agric. Rep. for 1860, 363, 373; Reprint, 1861, 5, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.

Sylvia celata, SAY, Long's Ex. Rocky Mts., 1824, 169.

Helminthophaga celata, BAIRD, Birds N. A., 1858, 257.

Above, olive green, rather brightest on the rump, *never* ashy on the head; below, *greenish-yellow*, washed with olive on the sides; crown with a more or less concealed *orange-brown* patch (sometimes wanting); eye ring and obscure superciliary line yellowish. Size of *ruficapilla*.

Habitat, North America. Common in the west, more or irregular in the east.

Rare spring and fall migrant. I can record but three specimens taken in the State. Mr. R. K. Winslow took a fall specimen in the vicinity of Cleveland, previous to 1861. In May, 1875, I took two specimens. I was attracted to the first, which was perched upon the top of a vine-crowned stub, in a woodland thicket bordering a swamp, by its loud, emphatic, and rather monotonous song, resembling as nearly as I can describe the syllables *chicky-tick tick tick-tick*. This song was louder and more decidedly emphasized than that of any other member of the genus with which I am acquainted. Two or three days after, I took a female, in another locality, near this city. Others were seen in company with this last, but not secured.

In the State of Illinois they are said by Mr. Ridgway to be regular migrants, and further westward they are abundant. The nest and eggs were discovered by Mr. Kennicott, in the vicinity of Great Slave Lake. The nest, like those of all other members of this genus known, is placed on the ground. It is composed of strips of bark, stems and grasses. The

eggs are four to six in number, measuring about .65 by .47. "They have a clear white ground, marked with spots and blotches of reddish-brown and fainter markings of purplish slate."

HELMINTHOPHAGA PEREGRINA (Wils.) Cab.

Tennessee Warbler.

Sylvia peregrina, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 182.

Vermivora peregrina, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395

Helminthophaga peregrina, BAIRD, P. R. R. Rep. ix, 1858, 259.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 563; Reprint, 3 —LANGDON, Cat. Birds of Cin., 1877, 5; Journ. Cin. Soc. Nat. Hist., i, 1878, 112; Reprint, 3; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Helminthophaga peregrina (error), WHEATON, Ohio Agric. Rep. for 1860, 1861, 363; Reprint, 5.

Sylvia peregrina, WILSON, Am. Orn., iii, 1811, 83.

Vermivora peregrina, BONAPARTE, Geog. and Comp. List, 1838, 21.

Helminthophaga peregrina, CABANIS, Mus. Hein., i, 1850, 20.

Olive green, brighter behind, but never quite yellow on the tail coverts, more or less ashy towards and on the head; no crown patch; below white, often glossed with yellowish but never quite yellow; a ring round the eye, and superciliary line, whitish, frequently an obscure whitish spot on outer tail feathers; lores dusky; in the female and young the olivaceous glosses the whole upper parts. Length $4\frac{1}{2}$ – $4\frac{3}{4}$; wing about $2\frac{1}{2}$; tail 2 or less.

This comparative length of wing and tail, with other characters, probably always distinguishes this species from the foregoing.

Habitat, Eastern North America.

Rare and irregular migrant in spring, abundant and regular in the fall. The Tennessee Warbler, so named by Wilson from the place where he discovered it, as was also the Nashville Warbler, appears in spring about the middle of May and frequents woodlands and orchards. At this time I have heard them sing a singularly sharp, rather squeaky warble, less loud and more varied than the song of the Orange-crowned Warbler. They return early in September and remain during that month and part of October. At this time they frequent sparse woodland on the banks of streams and high weeds in upland woods. Usually they are associated with the Nashville Warbler and Green Black-cap Flycatcher.

The nest and eggs of this species have been taken in Massachusetts and northward. There seems to be no characteristic difference between them and those of other members of the genus.

Two other members of this genus have, within a few years, been discovered in the Eastern States, and may be looked for in Ohio. They are—

HELMINTHOPHAGA LEUCOBONCHIALIS. Brewster. WHITE-THROATED WARBLER.

Adult male; summer plumage. Crown, bright yellow, slightly tinged with olive on the occiput. Greater and middle wing coverts, yellow, not so bright as the crown. Superciliary line, cheeks, throat, and entire under parts silky white, with a slight

GENUS DENDRÆCA. Gray.

Bill conical, attenuated, depressed at base, compressed from the middle, distinctly notched. Rictal bristles short. Wings long. First primary nearly as long as the second. Tail slightly rounded. Tarsus long, slender, decidedly longer than the middle toe. Hind toe short, as long as the lateral, its claw as long as the digit.

DENDRÆCA ÆSTIVA (Gm.) Bd.

Summer Warbler.

Sylvia æstiva, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 182.

Sylvicola æstiva, READ, Fam. Vis., iii, 1853, 415; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Dendroica æstiva, WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6.

Dendroica æstiva WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin., 1877, 5; Journ. Cin. Soc. Nat. Hist., i, 1878, 112; Reprint, 3; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Motacilla æstiva, GMELIN, Syst. Nat. i, 17-8, 996.

Sylvia æstiva, LATHAM, Ind. Orn., ii, 1790, 551.

Sylvicola æstiva, SWAINSON and RICHARDSON, Fn. Bor. Am., ii, 1831, 211.

Dendroica æstiva, BAIRD, Birds N. A., 1858, 282.

Dendroica æstiva, SCLATER, Proc. Zool. Soc., 1859, 363.

Golden yellow; back olive yellow, frequently with obsolete brownish streaks; breast and sides streaked with orange brown; which sometimes tinges the crown; wings and tail dusky, the latter marked with yellow blotches. Bill dark blue; female and young paler; less or not streaked below. Length $5\frac{1}{2}$; wing $2\frac{3}{8}$; tail $2\frac{1}{4}$.

Habitat, North America.

tinge of pale yellow on the breast. Dorsal surface, exclusive of nape which is clear ashy—washed with yellow, as are also the outer margins of the secondaries. A narrow line of clear black passes from the base of the upper mandible, through and to a short distance behind the eye, interrupted, however, by the lower eyelid, which is distinctly white. No trace of black on the cheeks or throat, even upon raising the feathers. Bill black. Feet dark brown. Dimensions—length 5.19; extent 7.88; wing 2.45; tarsus .71; tail 1.86; culmen .53. (*Brewster*, Bull. Nutt. Club, i, 1876, 1)

Habitat, Massachusetts. Connecticut. New York. Michigan. Less than a dozen examples known.

HELMINTHOPHAGA LAWRENCII. Herrick. LAWRENCE'S WARBLER.

Upper parts and rump olive green, a shade darker than in *pinus*. Wing bluish gray, with two white bands, the upper not so clearly defined as in *pinus*. Tail bluish gray, the three outer feathers with most of the web white, also a small white spot on the end of the fourth feather. Crown and under parts, from breast to vent, orange. A broad black patch extends from the bill through and beyond the eye. Chin, throat, and fore part of the breast black. A yellow stripe, commencing under the bill, extends back between the black eye-and-breast-patches, and increases in width upon the shoulder. Length 4.50; wing 2.50; tail 2.00. Measurements from the mounted bird. (*Herrick*, Proc. Acad. Nat. Sci. Phila., 1874, 220.)

Habitat, New Jersey.

Abundant summer resident. Breeds. Arrives the last of April and remains until September. The Yellow Warbler or Summer Yellowbird, or, as it is frequently though incorrectly called, Yellow Wren, is the best known bird of this family. It frequents the banks of streams, orchards, gardens and groves, and is quite at home in the shade trees of the city. It is rarely seen in dense woodland. The males are in full song on their arrival.

The nest is placed in an upright fork of a small branch of a tree or bush; in gardens, the pear tree is a favorite situation. It is composed of vegetable fibers and down, and lined with hair. The eggs are usually four, white, with a greenish tinge, spotted with different shades of brown and lilac. Two broods are frequently raised in a season.

DENDRÆCA VIRENS (Gm.) ScL.

Black-throated Green Warbler.

Sylvia virens, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 181.

Sylvicola virens, READ, Fam. Visitor, iii, 1853, 415; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Dendroica virens, BAIRD, P. R. R. Rep., ix, 1858, 268.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 363; Reprint, 5.—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 263.

Dendroica virens, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 5; Reprint, 3 —LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Motacilla virens, GMELIN, Syst. Nat., i, 1786, 9c5.

Sylvia virens, LATHAM, Ind. Orn., ii, 1790, 537.

Sylvicola virens, RICHARDSON, Rep. Br. Ass. for 1836, 1837, 172.

Dendroica virens, SCLATER, Proc. Zool. Soc., 1859, 363.

Male, in spring: back and crown clear yellow-olive, forehead, superciliary line, sides of head rich yellow (in very high plumages, middle of back with dusky marks, and dusky or dark olive lines through eyes, auriculars, and even bordering the crown); *chin, throat and breast jet black*, prolonged behind in streaks on the sides; other under parts white usually yellow-tinged; wings and tail dusky, the former with two white bars and much white edging, the latter with outer feathers nearly all white; bill and feet blackish; male in the fall and female in the spring, similar, but black restricted, interrupted or veiled with yellow; *young* similar to the female, but the black more restricted or wanting altogether, except a few streaks along the sides. Length about 5; wing $2\frac{1}{2}$; tail $2\frac{1}{2}$.

Habitat, Eastern United States.

Abundant spring and fall migrant. Arrives in spring about May 1st, and may remain through the month. Mr. Read says some remain through

the breeding season in Northern Ohio. In the fall, it is here throughout September and the first two weeks in October. The highest colored specimens are to be looked for among the first arrivals in spring.

The nest of this bird is usually placed in high trees in dense woods. It is small and compact, constructed of twigs, grasses and vegetable down. The eggs are white, blotched and dotted with reddish and purplish brown. They measure .70 by .50.

DENDROICA CÆRULESCENS (Gm.) Bd.

Black-throated Blue Warbler.

Sylvia canadensis, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 182.

Sylvicola canadensis, READ, Fam. Visitor, iii, 1853, 423; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Dendroica canadensis, BAIRD, P. R. R. Rep., ix, 1858, 271—WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5.

Dendroica cærulescens, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Motacilla canadensis, LINNÆUS, Syst. Nat., i, 1766, 336,

Sylvia canadensis, LATHAM, Ind. Orn., ii, 1790, 539.

Sylvicola canadensis, RICHARDSON, Rep. Br. Ass. for 1836 (1837), 172.

Motacilla cærulescens, GÜELIN, Syst. Nat., i, 1788, 960.

Dendroica cærulescens, BAIRD, Rev. N. A. Birds, 1865, 186.

Dendroica cærulescens, SUNDVALL, Oefv. K. Vet.-akad., iii, 1869, 610.

Male, in spring: above, uniform slaty blue, the perfect continuity of which is only interrupted, in very high plumages, by a few black dorsal streaks; below pure white; the sides of the head to above the eyes, the chin, throat, and whole sides of the body continuously jet-black; *wing bars wanting*, (the coverts being black, edged with blue) *but a large white spot at the base of the primaries*; quill feathers blackish, outwardly edged with bluish, the inner ones mostly white on their inner webs; tail with the ordinary white blotches, the central feathers edged with bluish; bill black; feet dark. Young male, similar, but the blue glossed with olivaceous, and the black interrupted and restricted. Female entirely different; dull olive greenish, with faint bluish shade, below, pale soiled yellowish; recognizable by the white spot at the base of the primaries, which though it may be reduced to a mere speck, is always evident, at least on pushing aside the primary coverts; tail blotches small or obscure; feet rather pale. Size of *virens*.

Habitat, Eastern United States. West Indies.

Common spring and fall migrant. Arrives the first week in May and returns in September. Usually seen in small companies of from three to ten or twelve in woodland, often near the ground in shady wet places. Mr. Read states that it prefers dark evergreen woods. It is usually more common in spring than in the fall, and more terrestrial than many of the genus.

This beautiful species is aberrant in the decided difference in pattern of coloration and colors of the sexes, and in the sameness of colors in fall and spring plumage. In some young males the olive gloss is so marked as almost to constitute a green patch on the back. The white spot at base of primaries is not so diagnostic as stated in the above description. I have seen females in which no trace of it could be discovered on the closest inspection. While with us in spring the male has a short but varied song, rather a chant than a warble.

The Black-throated Blue Warbler has been found breeding in evergreen woods in New York, and in deep woods in Connecticut. In all cases the nest is placed in the fork of a bush or small tree within a few inches of the ground. It is composed of grape-vine bark, rootlets and vegetable down. They measure from .70 by .50 to .61 by .47; they are white with a "ring of brown and lilac spots and blotches around the larger end, and a few minute spots of the same scattered over the entire surface," often marked with a large spot of deep umber.

DENDRÆCA CÆRULEA (Wils.) Bd.

Cærulean Warbler.

Sylvia azurea, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 182.

Sylvia rara, KIRTLAND, Am. Journ. Sci. and Arts, xl, 1841, 21.

Dendroica cærulea, BAIRD, P. R. R. Rep., ix, 1858, 267, 280.—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 236.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 364, 374; Reprint, 6, 16.

Dendroica cærulea, WHEATON, in Coues' Birds N. W., 1874, 233; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 653; Reprint, 3.—LANGDON, Cat. Birds of Cin., 1877, 5; Journ. Cin. Soc., Nat. Hist., i, 1878, 113; Reprint, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 191; Reprint, 5.

Cærulean Warbler, KIRTLAND, Am. Journ. Sci. and Arts, xiii, 1852, 218.

Sylvia cærulea, WILSON, Am. Orn., ii, 1810, 141.

Sylvia rara, WILSON, Am. Orn., iii, 1811, 119.

Sylvia azurea, STEPHENS, Shaws' Genl. Zool., x, 1817, 653.

Dendroica cærulea, SCLATER, Cat. Am. Birds, 1862, 31.

Male, in spring: azure blue, with black streaks; below, pure white, breast and sides with blue or blue-black streaks; two white wing bars; tail blotches small, but occupying every feather, except, perhaps, the central pair; bill black; feet dark. Female and young with the blue strongly glossed with greenish, and the white soiled with yellowish; a yellowish eye ring and superciliary line. Length 4-4½.

Habitat, Eastern United States. Not common in most places.

Abundant summer resident. Breeds. The Blue or Cærulean Warbler is, perhaps, with the exception of the Yellow Warbler, the most abundant of the genus which remains in Central Ohio through the summer. It arrives usually during the last week in April and remains until the latter part of July, perhaps later. They are never seen in large flocks dur-

ing their migrations, but as is the case with other warblers breeding with us, appear in pairs and small companies of six or eight. They are sometimes found in orchards, but usually in high mixed woods. Mr. Brewster, who observed these birds in West Virginia from May 5-9, 1875, gives the following account*: "They inhabit exclusively the tops of the highest forest trees, in this respect showing an affinity with *D. blackburniæ*. In actions they most resemble *D. pennsylvanica*, carrying the tail rather high and having the same "smart bantam-like appearance." Were it not for these prominent characteristics, they would be very difficult to distinguish in the tree tops, from *Parula americana*, the songs are so precisely alike. That of the latter bird has, however, at least two regular variations; in one, beginning low down, he rolls his guttural little trill quickly and evenly up the scale, ending apparently, only when he can get no higher; in the other, the commencement of this trill is broken or divided into syllables, like, *zee, zee, zee, ze-ee-eeep*. The latter variation is the one used by *D. cœrulea*, and I could detect little or no difference in the songs of a dozen of individuals. At best it is a modest little strain, and far from deserving the encomium bestowed upon it by Audubon, who describes it as being "extremely sweet and mellow;" decidedly it is neither of them, and he must have confounded with it some other species. In addition to the song, they utter the almost universal Dendroicine lisp, and, also, the characteristic *tchep* of *D. coronata*, which I had previously supposed entirely peculiar to that bird." There is little to add to this accurate description of the habits of this bird, except to suggest, that had Mr. Brewster observed it a few days later, he would have discovered such a change in its song as to merit the description, "extremely sweet and mellow," of Audubon. At the height of the breeding season the song looses much of its aspirate, and gains in vocal character. I have been accustomed to represent it by the syllables *oie, oie, oie, oie, oie, chât, chât, chât, tu-wee*, the first part being much like a low whistling call to a dog, monotonous and rolling but very mellow and sweet, that following, quickly and sharply uttered, with a lower note and rising inflection at the end. Sometimes only the first part is given, and often the last half is repeated.

The Blue Warbler breeds in retired woods in all parts of the State where I have had an opportunity of observing them. I have found the young fledged the latter part of June. Dr. Kirtland states that it breeds in the vicinity of Cleveland. I have never found the nest, but long before any

*Some Observations on the Birds of Ritchie County, West Virginia, by William Brewster, Ann. Lyc. Nat. Hist., N. Y., xi, 1875, 135.

recent description of it was published, I was convinced that Audubon's statement, that it nested on low trees and bushes, was not true of the bird in this latitude. Three nests of this bird have been described; one, by Dr. Brewer, from Drummondsville, Ontario, Canada, the others, from East Penfield, Monroe Co. N. Y., and Mount Carmel, Illinois, by Prof. J. A. Allen. These were all in trees from 20 to 50 feet from the ground. They were constructed of grasses and fibres of bark, lined with fine grass, and more or less completely covered with lichen, bound on with spiders webs. The eggs are dull creamy white, more or less thickly covered with blotches of reddish brown. They measure .66 by .47 of an inch.

During the mating season the males have severe and long continued contests. I have seen them fight for hours, often resting from sheer exhaustion. To these contests the female appears to be not only a disinterested but uninterested spectator, and, keeping in the lower branches of the trees, eats and wipes her bill, and eats and wipes her bill, as if considerations of celibacy, monogamy or polygamy never entered her head. The young are fledged by the last of June.

DENDROICA CORONATA (L.) Gr.

Yellow-rumped Warbler.

Sylvia coronata, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 181.

Sylvicola coronata, READ, Fam. Visitor, iii, 1853, 407; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Dendroica coronata, WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5.

Dendroica coronata, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. of Birds of Cin., 1877, 5; Journ. Cin. Soc. Nat. Hist., 1878, 113; Reprint, 4; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Motacilla coronata, LINNÆUS, Syst. Nat., i, 1766, 333.

Sylvia coronata, LATHAM, Ind. Orn., ii, 1790, 538.

Sylvicola coronata, SWAINSON and RICHARDSON, Fn. Bor. Am., ii, 1831, 216.

Dendroica coronata, GRAY, List of Genera of Birds, App., 1842, 8.

Dendroica coronata, SCLATER, Proc. Zool. Soc., 1859, 362.

Male, in spring: slaty blue, streaked with black; breast and sides mostly black, throat and belly pure white, immaculate; *rump, central crown patch, and sides of breast sharply yellow*, there being thus four definite yellow places; sides of head black; eyelids and superciliary line white; ordinary white wing-bars and tail-blotches; bill and feet black; male in winter, and female in summer, similar, but slate color less pure, or quite brownish. Young, quite brown above, obscurely streaked below. Length $5\frac{1}{2}$ – $5\frac{3}{4}$; wing 3; tail $2\frac{1}{2}$.

Habitat, North America, but chiefly the Eastern Province.

Abundant spring and fall migrant. Arrives the latter part of April and returns in October. Frequents woodland and the borders of streams, generally in loose companies. The fall migration is sometimes prolonged

until considerable snow has fallen. They probably winter not very far south of us, as the first birds to arrive in spring are usually in winter dress, or moulting. Mr. Langdon saw them as early as March 4, and as late as November 29. They are the most hardy of all the warblers, wintering regularly at Washington, D. C., and occasionally in the Hudson River Valley.

The Yellow-rump Warbler breeds in the extreme northern States and northward. The nest is placed in a bush; the eggs are white, blotched and spotted with different shades of brown and purplish. According to Mr. Brewster, the young in first plumage are very different from the adult, bearing a considerable resemblance to the Pine Linnet.

DENDRÆCA BLACKBURNIÆ (Gmel.) Bd.

Blackburnian Warbler.

Sylvia blackburniæ, KIRTLAND, Ohio Geolog. Surv., 1833, 163, 181.

Sylvicola blackburniæ, READ, Fam. Visitor, iii, 1853, 415; Proc. Philad. Acad. Nat. Sci., 1853, 395.

Dendroica blackburniæ, BAIRD P. R. R. Rep., ix, 1858, 275.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 364; Reprint, 6.—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 234.

Dendroica blackburniæ, WHEATON, Food of Birds, Ohio Agric. Rep. for 1874, 1875, 563; Reprint, 3.—LANGDON, Cat Birds of Cin., 1877, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Motacilla blackburniæ, GMELIN, Syst. Nat., i, 1788, 977.

Sylvia blackburniæ, LATHAM, Ind. Orn., ii, 1790, 527.

Sylvicola blackburniæ, JARDINE, "Ed. Wils. 1832."

Dendroica blackburniæ, SCLATER, Proc. Zool. Soc., 1859, 363.

Male, in spring: back black, more or less interrupted with yellowish; crown black, with a central orange spot; a broad black stripe through the eye, enclosing the orange under eyelid; rest of head, with whole throat, most brilliant orange, or flame color; other under parts whitish, more or less tinged with yellow, and sides streaked with black; wing bars fused into a large white patch; tail blotches white, occupying nearly all the outer feathers; bill and feet dark. Female and young male: upper parts olive and black, streaked; superciliary line and throat clear yellow fading insensibly on the breast; lower eyelid yellow, confined in the dusky ear-patch; wing patch resolved into two bars; tail blotches nearly as extensive as in the adult male, the outer feathers showing white on the outer webs at base. Size of *æstiva*.

Habitat, Eastern North America. South to Mexico. Central and South America to Ecuador. Utah. New Mexico. Bahamas.

Regular spring and fall migrant. Abundant. This beautiful warbler, by many considered the most attractive of the family, arrives from the south about the end of the first week in May. The first to appear are males in high plumage. These frequent the wooded banks of streams and are usually solitary birds accompanying other species. In the course of another week females and less highly colored males arrive, often in large

flocks. These frequent the tops of trees in mixed woodland; oak and maple trees seem to be their favorite resorts for food. They remain for a few days only, though I have seen stragglers as late as the 30th of May, In the fall they return in flocks of larger size than those of spring, frequenting the same resorts, though keeping nearer the ground. Their fall migration occupies most or all of September.

The Blackburnian Warbler breeds in the United States from New York northward. Their nests are said to be placed in bushes, constructed of grass, and lined with fur and feathers; the eggs are white, spotted with purplish and brown.

DENDROICA STRIATA (Forst.) Bd.

Black-poll Warbler.

Sylvia striata, KIRTLAND, Ohio Geol. Surv., 1838, 163, 152.

Sylvicola striata, READ, Fam. Visitor, iii, 1853, 423; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Dendroica striata, BAIRD, P. R. R. Rep., ix, 1858, 291.—WHEATON, Ohio Agri. Rep. for 1860, 364, ; Reprint, 1861, 7.

Dendroica striata, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Muscicapa striata, FORSTER, Philos. Trans., lxii, 1772, 406, 428.

Sylvia striata, LATHAM, Ind. Orn., 1790, 527.

Sylvicola striata, SWAINSON and RICHARDSON, Fn. Bor. Am., ii, 1831, 218.

Male, in spring: upper parts thickly streaked with black and olivaceous ash; *whole crown pure black*; head below the level of the eyes, and whole under parts white, the sides thickly marked with black streaks crowding forward on the sides of the neck to form two stripes that converge to meet at base of the bill, cutting off the white of the cheeks from that of the throat; wing bars and tail blotches white; inner secondaries white edged; primaries usually edged externally with olive; feet and under mandible flesh color, or pale yellowish; upper mandible black. Female, in spring: upper parts, including the crown, greenish-olive, both thickly and rather sharply black-streaked; white of under parts soiled anteriorly with very pale olivaceous-yellow, the streaks smaller and not so crowded as in the male. Young, closely resembling the adult female, but a brighter and more greenish olive above, with fewer streaks, often obsolete on the crown; below more or less tinged with pale greenish yellow, the streaks very obscure, sometimes altogether wanting; under tail coverts usually pure white; a yellowish superciliary line; wing-bars tinged with the same color. Length $5\frac{1}{2}$ – $5\frac{3}{4}$; wing $2\frac{1}{2}$ –3; tail 2 – $2\frac{1}{2}$.

Habitat, Eastern North America; west to Nebraska and Colorado; north to Greenland; south to New Grenada. Cuba. Bahamas.

Migrant. Irregular or rare in spring, abundant and regular in the fall. The Black-poll Warbler is considered by Mr. Dury as the rarest of the genus in spring in the vicinity of Cincinnati. In this locality I have but once found them in full force, spring of 1874, when they were in company

with the Bay-breasted Warblers, in beech woodland. Usually but two or three are seen in spring, mostly males. They arrive from May 15 to 20. In the fall they are equally abundant with, and accompany the Bay-breasted Warblers, which at this time they so much resemble. The only difference in habit, that I have been able to notice, is that the Black-poll is sometimes to be found in hedges and open places, sometimes on the ground, while the Bay-breasted Warbler confines itself almost exclusively to the branches of forest trees. These two species are perhaps the most abundant of the genus in the fall, and they remain during nearly all of September and October.

The Black-poll Warbler breeds from the State of Maine northward. The nest is described by Dr. Brewer as placed in thick spruce trees, on the edges of woods, at a height of about eight feet from the ground. The nest is large and bulky for the size of the bird, built of twigs of evergreen trees fastened together with lichens and rootlets, lined with fine grass. The eggs are five, and measure .72 by .50. They are white, spotted with lavender, dark purple and reddish-brown.

DENDRÆCA CASTANEA (Wils.) Bd.

Bay-breasted Warbler.

Sylvia castanea, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 181; Am. Journ. Sci. and Arts, xl, 1841, 23.

Sylvicola castanea, READ, Fam. Visitor, iii, 1853, 423; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Dendroica castanea, BAIRD, P. R. R. Rep. ix, 1853, 277.—WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6.

Dendroica castanea, MAYNARD, Birds of Coos Co. N. H., and Oxford Co. Me., Proc. Boston Soc. Nat. Hist., xiv, 1871, 366; Reprint, 1872, 11.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Sylvia castanea, WILSON, Am. Orn., ii, 1810, 97.

Sylvicola castanea, RICHARDSON, Rep. Br. Ass. for 1836 (1837), 172.

Dendroica castanea, LAWRENCE, Ann. Lyc. N. Y., vii, 1861, 322.

Male in spring: back thickly streaked with black and grayish olive; forehead and sides of head black, enclosing a large deep chestnut patch; a duller chestnut (exactly like a blue bird's breast) occupies the whole chin and throat, and extends, more or less interrupted, along the entire sides of the body; rest of under parts ochrey or buffy whitish, a similar buffy area behind the ears; wing-bars and tail-spots ordinary; bill and feet blackish. The female in spring is more olivaceous than the male, with the markings less pronounced; but always shows evident chestnut coloration; and probably traces of it persist in all adult birds in the fall. The young, however, so closely resemble young

striata, that is sometimes impossible to distinguish them with certainty. *Castanea* is, however, tinged with buffy or ochrey below, instead of the clear pale yellowish of *striata*, moreover, *castanea* is usually not streaked on the sides at all. Size of *striata*.

Habitat, Eastern United States; north to Hudson Bay; south to Guatemala and Darien; west to the Plains.

Irregular migrant in spring, abundant and regular in the fall. I have found this warbler the most decidedly irregular of all our spring migrants which can be considered at any time common, having taken it but one season, spring of 1874, when, as stated, it accompanied the Black poll Warblers in great numbers, and frequented beech and mixed woodland. It appears to be less active than most of the genus. Dr. Kirtland mentions having secured numbers of them, and does not mention any irregularity. Mr. Read gives it as abundant, and states that he has "seen it as late as the last of June."

In the fall they are to be found in September and October, in great numbers, remaining, with the Black poll Warblers, later than any of the genus, excepting the Yellow-rump. Some fall specimens have the brown of the sides redder than in spring, though not so extensive; but by far the greater number of our fall birds cannot be distinguished at any distance, from *D. striata*, and a considerable proportion are difficult to distinguish from the young of *striata*. In addition to the diagnostic marks given in the above description, it may be stated that the greenish of the breast of young *striata* often shows obsolete streaks, while no streaks whatever are to be seen on the brownish or buffy-whitish of *castanea*, except perhaps, dusky centres on the under tail coverts. Mr. Langdon, in his Revised List, gives the following important structural marks of distinction. "A comparison of specimens of both species shows that the *chin*, or feathered space between the forks of the lower mandible, is considerably wider in *castanea* than in *striata* arguing a greater width of base of bill in the former species. The bill of *castanea* is generally the larger in every way, but its greater width at base is especially evident."

This warbler has been found breeding only in the most northern United States and northward. The nest is placed in a tree, and is said to be large for the size of the bird, and to resemble the nest of the Purple Finch. It is described as composed of fine twigs and moss, lined with rootlets, moss and hair. "The eggs varied in length from .71 to .65 of an inch, and in breadth from .53 to .50. Their ground color was a bluish green, thickly spotted with brown, and generally with a ring of confluent blotches of brown and lilac around the larger end."

DENDRÆCA PENNSYLVANICA (L.) Bd.

Chestnut-sided Warbler.

Sylvia icterocephala, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 181; Am. Jour. Sci. and Arts, xl, 1841, 23.

Sylvicola icterocephala, READ, Fam. Visitor, iii, 1853, 416; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Dendroica pennsylvanica, BAIRD, P. R. R. Rep., ix, 1858, 279.—WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6.

Dendræca pennsylvanica, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 563; Reprint, 1875, 3.—LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Chestnut-sided Warbler, READ, Fam. Visitor, iii, 1852, 68.

Motacilla pennsylvanica, LINNÆUS, Syst. Nat., i, 1766, 333.

Motacilla icterocephala, LINNÆUS, Syst. Nat., i, 1766, 334.

Sylvia icterocephala, LATHAM, Ind. Orn., ii, 1790, 538.

Sylvicola icterocephala, RICHARDSON, Rep. Br. Ass. for 1836 (1837), 172.

Dendræca pennsylvanica, SCLATER and SALVIN, Ibis, ii, 1860, 273.

Male, in spring: back streaked with black and pale yellow (sometimes ashy or whitish) *whole crown pure yellow*, immediately bordered with white, then enclosed in black; sides of head and neck and whole under parts *pure white*, the former with an irregular black crescent before the eye, one horn extending backward over the eye to border the yellow crown and be dissipated on the sides of the nape, the other reaching downward and backward to connect with a chain of pure chestnut streaks that run the whole length of the body, the under eyelid and auriculars being left white; wing-bands generally fused into one large patch, and, like the edging of the inner secondaries, much tinged with yellow; tail spots white, as usual; bill blackish; feet brown. Female in spring: quite similar; colors less pure; black loreal crescent obscure or wanting; chestnut streaks thinner. Young, above, including the crown, clear yellowish-green, perfectly uniform, or back with slight dusky touches; no distinct head-markings; below entirely white from bill to tail, or else showing a trace of chestnut streaks on the sides; *wing-bands clear yellow*, as in the adult; this is a diagnostic feature, shared by no other species, taken in connection with the continuously white under parts; bill light colored below. Length 5-5½; wing 2½; tail 2.

Habitat, Eastern United States and Canada; south to Panama. Bahamas.

Not very common spring and fall migrant in Middle Ohio. Mr. Langdon gives it as quite common in the fall, in the vicinity of Cincinnati. Summer resident in Northeastern Ohio, where it breeds. The Chestnut-sided Warbler is to be found early in May in small numbers in woods, rarely in the gardens of the city. It is one of the most beautiful birds of the family. Mr. Read states (l. c. Fam. Vis.) that it remains to breed in considerable numbers in Northern Ohio, and that he found the "nest in an almost impenetrable thicket, placed in the fork of a slender shrub, four or five feet from the ground," and that it contained three eggs, nearly white. It has since been found to breed regularly.

Dr. Brewer describes the nest as built of "strips of the bark of the smaller vegetables, strengthened by a few stems and bits of dried grasses, and lined with woolly vegetable fibres and a few soft hairs of the smaller animals." The eggs are "rich creamy-white, and are beautifully spotted, chiefly about the larger end, with two shades of purple and purplish-brown. They measure .65 by .49 of an inch."

DENDRÆCA MACULOSA (Gm.) Bd.

Black and Yellow Warbler.

Sylvia magnolia, WILSON, Am. Orn., iii, 1811, 63.

Sylvia maculosa, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 181.

Sylvicola maculosa, AUDUBON, B. Am., ii, 1841, 65.—READ, Fam. Visitor, iii, 1853, 415; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Dendroica maculosa, BAIRD, P. R. R. Rep., ix, 1858, 285.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 364; Reprint, 6.—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 233.

Dendroica maculosa, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 563; Reprint, 3.—LANGDON, Cat. Birds of Cin., 1877, 5; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Motacilla maculosa, GMELIN, Syst. Nat., i, 1788, 984.

Sylvia maculosa, LATHAM, Ind. Orn., ii, 1790, 536.

Sylvicola maculosa SWAINSON and RICHARDSON, Fn. Bor.-Am., ii, 1831, 213.

Dendroica maculosa, SCLATER, Proc. Zool. Soc., 1859, 363.

Male, in spring: back black, the feathers more or less skirted with olive; *rump yellow*; *crown clear ash*, bordered by black in front to the eyes, behind the eyes by a white stripe; forehead and sides of the head black, continuous with that of the back, enclosing the white under eyelid; entire under parts (except *white* under tail coverts) rich yellow, thickly streaked across the breast and along the sides with black, the pectoral streaks crowded and cutting off the definitely bounded immaculate yellow throat from the yellow of the other under parts; wing-bars white, generally fused into one patch; tail spots *small, rectangular, at the middle of the tail and on all the feathers except the central pair*; bill black; feet brown. Female, in spring: quite similar; black of back reduced to spots in the grayish olive; ash of head washed with olive; other head markings obscure; black streaks below smaller and fewer. Young quite different; upper parts ashy olive; no head-markings whatever, and streaks below wanting, or confined to a few small ones along the sides, but always known by the *yellow rump*, in connection with extensively or completely *yellow under parts* (except white under tail-coverts) and *small tail spots* near the middle of all the feathers except the central. Small, 5 inches or less; wing 2½; tail 2.

Habitat, Eastern Province of North America to Labrador, Hudson's Bay, Great Slave Lake, etc.; west to Colorado; south to New Granada. Cuba. Bahamas.

Abundant and regular spring and fall migrant in Middle Ohio; summer resident in small numbers in Northeastern Ohio. Wilson first saw this bird on the Little Miami, near its mouth. Given by Mr. Langdon as a spring and fall migrant; common in September. In this

locality the Black and Yellow Warbler arrives during the first week in May, and frequents woods and banks of streams, and sometimes visits the gardens of the city. It is usually found feeding in the undergrowth, and lower branches of trees, and is very active; its bright colors, and neat appearance, as it hops from branch to branch, make it one of the most attractive birds of the family. I have seen it here during the first week in June, which indicates its breeding at no great distance. Mr. Reed (l. c. Fam. Vis.) says "some linger with us and doubtless raise their young here, as I have observed it during the middle of summer, evidently procuring food for their young, though I was unable to find their nest."

They begin to return in August, and usually have all left this latitude by the 1st of October.

The Black and Yellow Warbler has been found breeding from Western New York northward to Labrador. The nest is usually placed in a low spruce, but a few feet from the ground. It is constructed of twigs, root-lets, and grass. The eggs are dull white, sparsely marked with lilac and umber. They measure .62 by .51.

DENDRÆCA TIGRINA (Gm.) Bd.

Cape May Warbler.

Sylvia maritima, KIRTLAND, Ohio Geolog. Surv., 1833, 163, 181; Am. Jour. Sci. and Arts, xl, 1841, 23.

Sylvicola maritima, READ, Fam. Vis., iii, 1853, 415; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Dendroica tigrina, WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6.

Dendroica tigrina, WHEATON, Food of Birds, etc., Ohio. Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 5.

Perissoglossa tigrina, LANGDON, Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Motacilla tigrina, GMELIN, Syst. Nat., i, 1788, 985.

Sylvia maritima, WILSON, Am. Orn., vi, 1812, 99.

Sylvicola maritima, JARDINE, "Ed. Wilson, 1832."

Dendroica tigrina, BAIRD, Birds N. Am., 1858, 286.

Dendroica tigrina, SCLATER, Proc. Zool. Soc., 1861, 71.

Perissoglossa tigrina, BAIRD, Rev. N. A. Birds, 1865, 181.

Male, in spring: back yellowish olive, with dark spots; crown blackish, more or less interrupted with brownish; *ear-patch orange-brown*; chin, throat, and posterior portion of a yellowish superciliary line, tinged with the same; a black loreal line; *rump and under parts rich yellow*, paler on belly and crissum, the breast and sides streaked with black; wing-bars fused into a large whitish patch; tail blotches large, on three pairs of retrices; bill and feet black. Female in spring: somewhat similar, but lacks the distinctive head markings; the under parts are paler and less streaked; the tail spots small or obscure; the white on the wing less. Young: an insignificant-looking bird, resembling an overgrown Ruby-crowned Kinglet without its crest; obscure greenish olive

above, rump olive yellow, under parts yellowish-white; breast and sides with the streaks obscure or obsolete; little or no white on wings, which are edged with yellowish; tail-spots very small. Length 5-5½; wing 2½; tail 2¼.

Habitat, Eastern United States and British America to Hudson's Bay; west to the Mississippi. West Indies.

Rare spring and fall migrant in May and September. But little can be said of the Cape May Warbler in this State. Dr. Kirtland observed it picking insects from cherry blossoms. I have taken it on two occasions only. In May a female was secured while on the ground in a grove of sycamore trees on the banks of the Scioto, and in September a young male was taken while feeding in low trees on the river bank. Both were solitary birds. I have seen specimens from Sandusky.

No North American examples of the nest and eggs are described. Prof. Baird makes this species the type of a new genus, *Perissoglossa*, the distinguishing characters of which are the slender, acute, and obsoletely notched bill, with its commissure gently arched or curved from the base; the tongue lengthened, narrow, deeply bifid, and deeply lacerated or fringed externally at the end; the edge, along the median portion, folded over on the upper surface, but not adherent.

DENDROICA DISCOLOR (V.) Bd.

Prairie Warbler.

Sylvicola discolor, AUDUBON, B. Am., ii, 1841, 68.—READ, Fam. Vis., iii, 1853, 423; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Dendroica discolor, WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6.

Dendroica discolor, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Sylvia discolor, VIEILLOT, Orn. Am. Sept., iii, 1807, 37.

Sylvicola discolor, JARDINE, "Ed. Wilson, 1832."

Dendroica discolor, BAIRD, Birds N. Am., 1858, 290.

Dendroica discolor, A. and E. NEWTON, Ibis, i, 1859, 144.

Yellow-olive; back with a patch of brick red spots; forehead, superciliary line, two wing-bars and entire under parts, rich yellow; a V-shaped black mark on side of head, its upper arm running through the eye, its lower arm connecting with a series of black streaks along the whole sides of the neck and body; tail blotches very large, occupying most of the inner web of the outer feathers. The sexes are almost exactly alike, and the young only differ in not being so bright, and in having the dorsal patch and head-markings obscure. Size small, 4½-5; wing 2½; tail 2.

Habitat, Eastern United States north to New England; west to Kansas. West Indies.

Rare spring and fall migrant in Southern and Middle Ohio. Summer resident in Northern Ohio. Audubon gives Lake Erie as the northern

limit of this bird in the interior. It is not given by Kirtland in his list in 1838, but in 1852 (see page 193) he states that it breeds regularly in the vicinity of Cleveland. Mr. Read (l. c. Fam. Vis.) includes it in his list, apparently on the authority of Audubon, and in Proc. Philad. Acad., says it "occasionally nests here," probably referring to Dr. Kirtland for authority. Mr. Langdon gives it as a "rare migrant in May." Dr. Jasper took a specimen in this vicinity several years since. I have never met with it. It appears to be rare everywhere west of the Alleghenies.

It is said to frequent old fields with cedars and scrub pines, and to be peculiar in its notes and manners. The nest is placed in a low bush; it is built of leaves, fibres of bark, and vegetables, and lined with fine fibres and horse-hair. The eggs are from three to five, white, spotted with lilac, purple, and umber, and measure .68 by .48.

DENDRÆCA DOMINICA (L.) Bd.

var. ALBILORA (Ridgway.)

White-browed Yellow-throated Warbler.

Sylvia pensilis, KIRTLAND, Am. Jour. Sci. and Arts, xl, 1841, 21.

Sylvicola pensilis, READ, Fam. Vis., iii, 1853, 415; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Dendroica superciliosa, BAIRD, P. R. R. Rep., ix, 1858, 290.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 364; Reprint, 6.

Dendroica dominica, BAIRD, Rev. N. A. Birds, 1865, 210.

Dendroica dominica, COUES, Key, 1872, 104; Birds of N. W., 1874, 66.—WHEATON, in Coues' Birds of N. W., 233.—LANGDON, Cat. Birds of Cin., 1877, 6.

Dendroica dominica, var *albilora*, RIDGWAY, Am. Nat., vii, 1873, 606.—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 241.

Dendroica dominica, var *albilora*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 564; Reprint, 4.—LANGDON, Jour. Cin. Soc. Nat. Hist., i, 1878, 113; Reprint, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 171; Reprint, 5.

Yellow-throated Wood Warbler, KIRTLAND, Am. Journ. Sci. and Arts, xiii, 1852, 218.

Motacilla dominica, LINNÆUS, Syst. Nat., i, 1766, 334.

Motacilla superciliosa, BODDERT, Tab. Pl. El., 1783, 43.

Motacilla pensilis, GMELIN, Syst. Nat., i, 1788, 960.

Sylvia pensilis, LATHAM, Ind. Orn., ii, 1790, 520.

Sylvicola pensilis, RICHARDSON, Rep. Br. Ass. for 1836 (1837), 172.

Dendroica dominica, BAIRD, Rev. N. A. Birds, 1865, 209.

Dendroica dominica, COUES, Proc. Ess. Inst., v, 1868, 270.

Upper parts ash-gray, without streaks, the forehead and sides of vertex black. A superciliary line extending from nostril to nape, wholly white. Chin and throat yellow, margined laterally with blackish, the yellow of chin bordered narrowly next to the bill with white. Cheeks black, separated from the ash of the neck by a white patch. Eye-

lids and infraocular crescent white. Other under parts and two bars on wings white, sides streaked with black. Bill (from nostril) 35, tarsus 60, wing 2.70, tail 2.20.

The above description is Mr. Ridgway's. Var. *dominica* differs from *albilora* in having the "superciliary stripe anterior to the bill wholly bright yellow, yellow of chin and maxillæ extending to the bill," and in the following measurements: bill (from nostril) .45, wing 2.60, tail 2.

Habitat, var. *albilora*, in summer, Mississippi region of United States, north to Lake Erie, and Detroit, Michigan; in winter, Mexico, Guatemala, Yucatan and Colima. Var. *dominica*, Atlantic United States north to Washington, D. C. Connecticut. Massachusetts. West Indies.

I apprehend that few of our specimens of var. *albilora* will be found to correspond exactly in coloration with the type described by Mr. Ridgway. I have never seen a spring specimen which had no trace of yellow in the loreal line. Some are entirely white on one side, but have yellow on the other. Usually the middle of the loreal line on both sides is yellow. The same remarks apply to the white bordering the maxillæ. Some young birds in August and September show the loreal line entirely white on both sides. On the other hand, the presence of some white in the loreal line of all our specimens, and the measurements, readily distinguish them from typical *dominica*.

Not rare summer resident; common during the spring migration. This is the first of the family to arrive in spring. It is always to be seen before the Yellow-rumped and Yellow Warblers make their appearance, sometimes before the last snow and ice. I have seen them in considerable numbers on the 13th of April, and have known of its occurrence as early as April 9th. When on their migrations they confine themselves almost exclusively to the trees which skirt the streams, and move northward by day with considerable rapidity. During the whole day their characteristic song, *tswee-a, tswee-a, tswee a, tswee, tswee, tswee, tu-wee*, may be heard, sometimes at a distance of a quarter of a mile, as the birds feed in the sycamore and elm trees. At such times their capture is a matter of some difficulty, as they spend most of their time in the topmost branches of the tall sycamores or far out over the water. They seem to delight in baffling pursuit by flying from one clump of trees to another on the opposite side of the stream. For this reason, the better plan is to wait for them in some sycamore grove or under a budding elm. They are seldom seen in woodland, though they not unfrequently visit the shade trees and gardens of the city. They are much more abundant during the spring migration than at any other time. In this locality it is not uncommon to see a dozen in a morning's walk, about one-third of which may be captured. I have had no opportunity of observing the bird elsewhere except at Cohocton, where the Walhonding and Tuscarawas Rivers unite to form the

Muskingum. Here, May 10, 1876, I found them abundant in the same situations as above described, and think it not unlikely that a considerable number of the birds breeding about Cleveland migrate by way of the Muskingum Valley.

During the breeding season they are to be found on the banks of the smaller streams and creeks, or if about larger rivers, near the swift channels forming islands, where the sycamore trees reach far over the water. In ravines where there is but little water they may also be found, but the necessary sycamore tree is always present. Though I have never discovered the nest and eggs, I have seen the parents feed their young in the latter week in June and first in July. I have no description of the nest and eggs of var. *albilora*. Mr. Brewster (Bull. Nutt. Orn. Club, ii, 1877, 102) gives an interesting account of var. *dominica*, from which I extract the following description of the nest and eggs. "This nest was placed at the height of thirty-five feet from the ground, on the stout horizontal branch of a southern pine, in a thinly scattered grove or belt that stretched along the side of a densely wooded hummock. It was set flatly on the limb—not saddled to it—nearly midway between the juncture with the main trunk and the extremity of the twigs, and was attached to the rough bark by silky fibres. It is composed externally of a few short twigs and strips of bark bound together by Spanish moss (*Tillandsia usneoides*) and a silky down from plants. The lining consists of a few hair-like filaments of moss and soft cottony vegetable down. The whole structure is neatly and firmly compacted, though essentially simple in appearance, and, from the nature of the component materials, of a grayish inconspicuous color. It measures externally 2.80 inches in diameter by 1.70 in depth; internally 1.77 inches in diameter by 1.30 in depth. The eggs, four in number, measure .69 by .53 of an inch. They are quite regularly ovate, with fine dottings of pale lilac scattered thinly and evenly over a grayish-white ground color. A few spots or blotches of burnt sienna occur about the larger ends, while occasional irregular pen-like lines of dark brown diversify the remaining surface." Other nests are described as being constructed in a mass of Spanish moss, the cavity being lined with moss, grasses, and plant down.

Young birds in September resemble adults, but are of a considerably lighter shade and softer tone in color, the black streaks somewhat obscured and softened by whitish edgings, and the whole bird presenting a richer and cleaner appearance.

DENDRÆCA KIRTLANDI Baird.

Kirtland's Warbler.

- Sylvicola kirtlandii*, BAIRD, ANN. LYN. N. Y., v, 1852, 217, pl. vi.—CASSIN, ILLUST., i, 1855, 278, pl. 47.—ZUCHOLD, J. F. O., 1854, 355 (copies described).
Dendroica kirtlandii, BAIRD, P. R. R. REP., ix, 1858, 267, 286; REV. A. BIRDS, 1865, 206. KIRKPATRICK (?), OHIO FARMER, ix, 1860, 179, June 9.—WHEATON, OHIO AGRIC. REP. for 1860, 1861, 364, 374; REPRINT, 6, 16.
Dendroica kirtlandii, COUES, KEY, 1872, 104; BIRDS N. W., 1874, 753. (Hamilton Co., O.)
Dendroica kirtlandii, BAIRD, BREWER and RIDGWAY, N. A. BIRDS, i, 1874, 231.
Dendroica kirtlandii, WHEATON, FOOD OF BIRDS, ETC., OHIO AGRIC. REP. for 1874, 1875, 564; REPRINT, 4; BULL. NUTT. ORN. CLUB, iv, 1879, 58.—LANGDON, CAT. BIRDS OF CIN., 1877, 6; REVISED LIST, JOURN. CIN. SOC. NAT. HIST., i, 1879, 172; REPRINT, 6.—COUES, BIRDS OF COL. VAL., 1878, 249.—JORDAN, MAN. VERT., 1878, 66.—PURDIE, BULL. NUTT. ORN. CLUB, iv, 1879, 185.

"Above slate blue, the feathers of the crown with a narrow, those of the back with a broader, streak of black; a narrow frontlet involving the lores, the anterior end of the eye and space beneath it, black; the rest of the eyelids white; under parts clear yellow, almost white on the under tail coverts, the breast with small spots and the sides with short streaks of black; greater and middle wing coverts, the quills and tail feathers, edged with dull whitish; two outer feathers with a dull white spot on the inner web; 5.50; wing 2.80; tail 2.67." (*Baird.*)

Habitat, Ohio and Michigan. Bahamas. Wisconsin?

Very rare. Known only as a spring migrant in the United States. Probably winter resident in the Bahamas. Mr. H. A. Purdie (Bull. Nutt. Orn. Club, iv, 1879, 185) records the last capture of a specimen, and enumerates the examples previously known, as follows:

"Mr. Adolphe B. Covert, of Ann Arbor, Michigan, writes me that on May 16 last he shot a female of this much desired warbler, his second capture of the species. This recent specimen I make to be the ninth known to science, viz:

"1. Male, caught on a vessel at sea off Abaco, Bahamas, by Dr. Samuel Cabot, of Boston, the second week in October, 1841. Not identified until several years after the type specimen was described.

"2. Male taken by Dr. J. P. Kirtland near Cleveland, Ohio, May 13, 1851. Type of the species.

"3. Male obtained by R. K. Winslow near Cleveland, Ohio, in June (May?), 1860.

"4. Male shot by Charles Dury at Cincinnati, Ohio, the first week in May, 1872.

"5. Female, collected by A. B. Covert, at Ann Arbor, Michigan, May 15, 1875.

"6 and 7. Male and female, taken by Messrs. William and John Hall, at Rockport, Cuyahoga county, Ohio, May, 1878.

"8. Female, collected by Charles R. Corey, on Andros Island, Bahamas, January 9, 1879.

"9. Mr. Covert's specimen above described.

"Three or four others, I believe, have been noted, but were not secured. This bird and *Helminthophaga leucobronchialis* have about an even record."

In regard to the first, second, and third specimens known, Professor Baird says (Rev. Am. Birds, 1865, 207) :

"Until recently the only authenticated and known specimen of this species was the type, No. 4,363, killed by Dr. Kirtland, near Cleveland, Ohio, May, 1851, and prepared by myself. I have, however, lately found a second skin in the collection of Dr. Samuel Cabot, Jr., of Boston, taken at sea between the island of Abaco and Cuba. The plumage is not quite so matured as in the type, and lacks the dark spots on the jugulum; it is, however, otherwise very similar. A third specimen (female) is reported in the Ohio Farmer for June 9, 1860, as killed that season near Cleveland, and preserved by Mr. R. K. Winslow, who states that the late Wm. Case, of Cleveland, also killed a specimen, but did not preserve it. Dr. Hoy also thinks that he has seen it at Racine. A careful search in the vicinity of Cleveland, about the middle of May, will probably be rewarded by the discovery of additional specimens."

The above reference to the Ohio Farmer, June 9th (ix, 1860, 179), presumably from the pen of Jno. Kirkpatrick, is as follows :

"A specimen of this rare bird (*Dendroica kirtlandii*) was shot a short time ago near the 'old river bed,' Cleveland, by Mr. Darby, of University Heights. It was identified by R. K. Winslow, preserved and mounted by him, and proved to be a female. Until now there was but one specimen of this bird known, that obtained by Dr. Kirtland, now in the collection of the Smithsonian, at Washington. It was first described by Mr. Baird in the Annals of the New York Lyceum (1852), and afterwards in Cassin's Illustrations.

"The present specimen is more lead-colored on the upper parts than Cassin's figure, but clearly resembles the coloring in another plate which we have not seen. Mr. Winslow informs us that Wm. Case, Esq., once shot a specimen, but it was so badly injured as to be unfit for preserving."

This specimen unaccountably disappeared from the possession of Mr. Winslow in a few days after its reception, and it has never been heard of since.

The fourth specimen, Mr. Dury's, is finely mounted, and ornaments his choice collection of Ohio birds.

The sixth and seventh specimens were recorded by myself (Bull. Nutt. Orn. Club, iv, 1879, 58), as follows :

"I have been informed by Mr. R. K. Winslow and other ornithologists of Cleveland, Ohio, that two specimens of *Dendroica kirtlandi* were taken at Rockport, Cuyahoga county, Ohio, by William and John Hall, during the past season. One of these is a female, the first of the sex taken. Both were captured within two miles of the spot where the original specimen was taken by Dr. Kirtland. A third specimen is said to have been taken in that vicinity about the same time, but I was unable to obtain any definite information concerning it."

If not mistaken, I was informed that these birds were observed near the ground, on brush-heaps and undergrowth.

Mr. Corey, in recording the specimen taken by him on Andros Island Bahamas (Bull. Nutt. Orn. Club, iv, 1879, 118), gives the only descr

tion furnished of the female in winter plumage. The only points of essential difference, compared with the description given above, are, "above bluish-ash, the feathers of the crown with a narrow, those of the middle of the back with a broad, streak of dark brown. A narrow semi-circular ring of black surrounds the eye, touching its anterior part; eye-lids white. Length, 5.50; wing, 2.75; tail, 2.50; tarsus, 80."

The place of breeding, nest, and eggs of this bird remain to be discovered.

DENDRÆCA PALMARUM (Gm.) Bd.

var. PALMARUM (Ridgway.)

Yellow Red-poll Warbler.

Sylvia petechia, KIRTLAND, Ohio Geolog. Surv., 1838, 163.

Sylvicola ruficapilla, READ, Fam. Visitor, iii, 1853, 407; Proc. Philad. Acad. Nat. Sci, vi, 1853, 395.

Dendroica palmarum, BAIRD, P. R. R. Rep., ix, 1858, 289.—WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6.

Dendroica palmarum, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 6.

Dendroica palmarum, var. *palmarum*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Motacilla palmarum, GMELIN, Syst. Nat., i, 1788, 95.

Sylvia petechia, WILSON, Am. Orn., vi, 1812, 19.

Sylvicola ruficapilla, BONAPARTE, Geog. and Comp. List, 1838, 22.

Dendroica palmarum, SCLATER, Proc. Zool. Soc., 1861, 71.

Dendroica palmarum, var. *palmarum*, RIDGWAY, Bull. Nutt. Orn. Club, i, 1876, 84.

In spring: brownish-olive, rump and upper tail coverts brighter yellowish-olive, back obsoletely streaked with dusky, *crown chestnut*; superciliary line and entire under parts rich yellow, breast and sides with reddish-brown streaks, somewhat as in the Summer Warbler; a dusky loreal line running through the eye; *no white wing-bars*, the wing coverts and inner quills being edged with yellowish-brown; tail spots *at very end* of inner webs of two outer pairs of tail feathers only, and *cut squarely off*—a peculiarity distinguishing the species in any plumage. Female not particularly different from the male. Young, an obscure looking species, brownish above like a young Yellow-rump, but upper tail coverts yellowish-olive, and under tail coverts apt to show quite bright yellow in contrast with the dingy yellowish-white or brownish-white of other under parts; crown generally showing chestnut traces; but in any plumage, known by absence of white wing-bars and peculiarity of tail spots. Length $5\frac{1}{2}$, wing $2\frac{3}{4}$, tail $2\frac{1}{2}$.

Very common, sometimes irregular, spring and fall migrant. Arrives with or shortly after the Yellow-rump in spring and fall; usually departs sooner in the fall. More of them are seen in spring than in fall. They frequent the borders of streams, weedy fields, and the edges of thickets, and are frequently in company with Yellow-rumps, Blue-birds, and Sparrows. They are decidedly terrestrial in their habits, and have the habit, in common with the members of the next genus, of tip-

ping their tails, like the Titlarks and Sandpipers, as they walk. They are rarely found in woodland, and, though in some localities they are said to visit towns and cities, I have never seen them except in the open fields. Another peculiarity is the situation of their nest, which differs from that of all other members of the genus, in being placed on the ground.

This species breeds from Maine northward. The site chosen is said usually to be the edge of a swampy thicket. The nest is small, constructed of grass, fibres of bark, and moss, and lined with down and feathers. The eggs are yellowish- or creamy-white, blotched, chiefly about the greater end, with lilac, purplish, and reddish-brown. They measure .70 by .55.

The description of the bird above given is sufficient to identify this species, but Mr. Ridgway finds certain constant differences between birds of the Atlantic and those of the Mississippi Valley region. In Bull. Nutt. Orn. Club, i, 1876, 81, he considers these differences and divides the species into two sub-species, *palmarum* and *hypochrysea*. The distinctive characters which he gives are as follows :

“Sub-species *palmarum*.—Wing, 2.35–2.65 (2.52); tail, 2.05–2.45 (2.24); bill, from nostril, .27–.32 (.29); tarsus, .71–.80 (.76). Yellow of lower parts interrupted by a whitish abdominal area; breast streaked uniformly across, the streaks being linear and dusky, with little, if any, tinge of chestnut; lower eyelid whitish; back dull olive-brown. Habitat, Mississippi Valley (north to the Great Slave Lake) and West Indies. Casual in certain Atlantic States.

“Sub-species *hypochrysea*.—Wing, 2.50–2.80 (2.69); tail, 2.25–2.55 (2.43); bill, from nostril, .28–.32 (.30); tarsus, .75–.80 (.79). Yellow of lower parts entirely continuous, and much brighter; streaks confined mostly, or wholly, to the sides of breast, broadly tear-shaped, wholly reddish-chestnut; lower eye-lid bright yellow; back greenish-olive. Habitat, Atlantic States, from East Florida to Nova Scotia.”

Dr. Coues gives as a diagnostic mark of this species, in any plumage, the presence of tail spots at the tip of the two outer tail feathers only, but this does not hold good with var. *palmarum*. All specimens of my collection have the third feather narrowly tipped with white. This may prove a constant character of var. *palmarum*.

DENDRÆCA PINUS (Wils.) Bd.

Pine-creeping Warbler.

Dendroica pinus, WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6.

Dendroica pinus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Sylvia pinus, WILSON, Am. Orn., iii, 1811, 25.

Dendroica pinus, BAIRD, Birds N. Am., 1858, 277.

Dendroica pinus, McILLWRAITH, Proc. Ess. Inst., v, 1866, 86.

Uniform yellowish-olive above, yellow below, paler or white on belly and under tail coverts, shaded and sometimes obsoletely streaked with darker on the sides; superciliary line yellow; wing-bars white; tail blotches confined to two outer pairs of feathers, large, oblique. Female and young similar, duller; sometimes merely olive-gray above and sordid whitish below. The variations in precise shade are interminable, but the species may always be known by the lack of any special sharp markings whatever, except the superciliary line; and by the combination of white wing-bars with large oblique tail spots confined to the two outer pairs of feathers. Length, $5\frac{1}{2}$ to nearly 6 inches.

Habitat, Eastern province of North America, north to Canada and New Brunswick; west to Missouri and Kansas. Bermudas. Bahamas.

Not common spring and fall migrant. April, May, and September. Not included in Dr. Kirtland's or Mr. Read's lists. Inserted in my list of 1861 on the authority of Mr. Winslow. Mr. Langdon gives it as a rare migrant in April. I know of but three specimens from this vicinity, taken by Dr. Theo. Jasper, Oliver Davie, and Arnold Boyle, in May. I have seen it but twice, once in spring in company with Yellow-rumps, and one individual in September in a garden of this city, on the ground.

This species, as its name indicates, prefers pine woods, which may be the reason why so few have been found in Southern and Middle Ohio. It is said to breed throughout its United States range, but no instance of its breeding in this State has been recorded.

The nest is said to be built in pine trees, and near the top. It is constructed of strips of the bark of cedar or other trees and fine grasses, and lined with down, hair, and feathers.

Dr. Brewer describes the eggs as of a rounded oval shape, with an average diameter of .72 of an inch, and a breadth of .55. "The ground-color is a bluish-white. Scattered over this are subdued tintings of a fine delicate shade of purple, and upon this are distributed dots and blotches of a dark purplish-brown, mingled with a few lines almost black."

GENUS SIURUS. Swainson.

Bill compressed, distinctly notched. Rictal bristles very short. Wings moderate, pointed, longer than the nearly even tail; first quill scarcely shorter than the second. Under tail coverts reaching within about one-half inch of end of tail. Tarsi about as long as the skull, considerably exceeding the middle toe. Hind toe short, equal to the lateral, its claw as long as the digit. Wings and tail immaculate.

SIURUS AURICAPILLUS (L.) Sw.

Golden Crowned Thrush.

Sylvia aurocapilla, KIRTLAND, Ohio Geol. Surv., 1838, 163.

Turdus aurocapillus, READ, Fam. Visitor, iii, 1853, 399; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Seiurus aurocapillus, WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.

Siurus auricapillus, LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Motacilla aurocapilla, LINNÆUS, Syst. Nat., i, 1766, 334.

Turdus aurocapillus, LATHAM, Ind. Orn., i, 1790, 328.

Sylvia aurocapilla, BONAPARTE, Journ. Philad. Acad., iv, 1824, 35.

Seiurus aurocapillus, SWAINSON, Zool. Journ., iii, 1827, 171.

Siurus auricapillus, MOORE, Proc. Zool. Soc., 1859, 55.—COUES, Bull. Nutt. Orn. Club, ii, 1877, 29.

Crown orange-brown, bordered with two black stripes, no superciliary line. Above, bright olive green; below pure white, thickly spotted with dusky on breast and sides; a narrow maxillary line of blackish; under wing coverts tinged with yellow; a white eye-ring; legs flesh color. Sexes alike; young similar. Length $5\frac{1}{2}$ – $6\frac{1}{2}$; wing 3; tail $2\frac{3}{4}$.

Habitat, Eastern North America; north to Alaska; south to West Indies and Central America; west to the Rocky Mountains.

Common summer resident. Arrives during the last week in April, and remains until September. Breeds. Prefers deep and solitary woods and ravines for its summer residence, but during the migrations may be found in almost any woodland. Sometimes during the spring migration it visits the gardens of the city.

The Golden-crowned Thrush or Oven Bird is noted for its loud, monotonous and emphatic song, which resembles the syllables *te cha*, *te cha*, *te cha*, *te cha*, repeated with a vehemence which is almost startling. It is also said to have a prolonged, finely modulated and very sweet song, but this I have never heard.

This species, with the other two members of the genus, are the most terrestrial of the family. They spend most of their time searching for food on the ground, where they do not hop, but walk, and have the habit of wagging their tails like the Titlark and Sandpiper.

The nest of this bird is placed on the ground, and is remarkable in being roofed over, having an entrance on the side. It is usually placed beside a fallen log, or in a depression on a hill-side. It is composed of twigs, leaves, and moss. The eggs are from four to six, creamy white, spotted with various shades of brown, red, and purple. They measure .82 by .55.

SIURUS NÆVIUS (Bodd.) Cs.

Water Wagtail; Water Thrush.

Sylvia noveboracensis, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 181 (in part).

Turdus noveboracensis, READ, Family Visitor, iii, 1853, 399, (in part); Proc. Philad. Acad. Nat. Sci., vi, 1853, 395 (in part).

Seiurus noveboracensis, WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.

Siurus nævus, LANGDON, Cat. Birds of Cin., 1877, 7; Journ. Cin. Soc. Nat. Hist., i, 1878, 113; Reprint, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Motacilla nævia, BODDÆRT, Tab. Pl. El., 1783, 47.

Motacilla noveboracensis, GMELIN, Syst. Nat., i, 1788, 958.

Sylvia noveboracensis, LATHAM, Ind. Orn., 1790, 518.

Turdus (Seiurus) noveboracensis, NUTTALL, Man., i, 1832, 353.

Seiurus noveboracensis, BONAPARTE, Geog. and Comp. List, 1838, 21.

Siurus noveboracensis, SCLATER and SALVIN, Ibis, i, 1859, 10.

Siurus nævius COUES, Bull. Nutt. Club, ii, 1877, 32.

Entire upper parts deep olivaceous brown; conspicuous superciliary line yellowish; below white more or less tinged with pale *yellowish*, thickly and *sharply* spotted with the color of the back, except on lower belly and crissum; feet dark. Length 5½-6; wing 2½; tail 2½; bill about ½.

Habitat, North America at large. Mexico, West Indies, Central, and much of South America.

Common spring and fall migrant. Arrives during the last week in April, and remains about a month. Returns in August and remains until October.

This and the following species have been confounded by the older ornithologists, and in consequence the earlier Ohio accounts of each of these birds is unsatisfactory. I have no authentic information of the breeding of this species in the State, and there is a discrepancy in the statements of the latest authorities as to its breeding range.

In this vicinity it is usually a solitary bird, migrating along the banks of streams, in swampy woods and open wet places. I have seen them in plowed fields on the edges of swamp thickets, and in one instance in my garden. I have never heard the fine song which the bird is said to have. Its ordinary note is a sharp chirp and when suddenly disturbed it flies from the ground to the lower branches of a tree or to a fence, uttering a sharp note not unlike the cry of the Solitary Sandpiper, with which it frequently associates. Their habits are much those of the Sandpipers, walking in the shallow water and running upon logs, wagging their tails constantly. This species appears to be the most terrestrial and aquatic of the genus. The nest, in location and construction, resembles that of the Golden-crowned Thrush. The eggs are oblong oval, measuring from .81 to .87 by .65 to .69. They are clear crystal white in color, with lines, dots and blotches of umber-brown.

SIURUS MOTACILLA (V.) Cs.

Large-billed Water Thrush.

Sylvia noveboracensis, KIRTLAND, Ohio Geol. Surv., 1838, 163, 181 (in part.)

Turdus noveboracensis, READ, Fam. Visitor, iii, 1853, 399 (in part); Proc. Acad. Nat. Sci., Phila., vi, 1853, 395 (in part.)

Seiurus ludovicianus, WHEATON, Ohio Agric. Rep. for 1860, 363, 374; Reprint, 1861, 5, 16; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.

Siurus motacilla, LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Turdus motacilla, VIEILLOT, Ois. Am. Sept., ii, 1807, 9.

Turdus ludovicianus, AUDUBON, Orn. Biog., i, 1832, 99.

Seiurus ludovicianus, BONAPARTE, Geog. and Comp. List, 1838, 21.

Siurus motacilla, COUES, Bull. Nutt. Club, ii, 1877, 33.

Very similar to the last; rather larger, averaging about 6, with the wing 3; bill especially longer and stouter, over $\frac{1}{2}$, and tarsus nearly 1. Under parts white, only faintly tinged, and chiefly on the flanks and crissum, with buffy yellow; the streaks sparse, pale and not very sharp; throat, as well as belly and crissum, unmarked; legs pale.

Habitat, Eastern United States; north to Massachusetts and Michigan; west to Kansas, Indian Territory, and Texas; south to Central America. Cuba. Jamaica.

Common summer resident, but of irregular distribution. Arrives about the middle of April or earlier, and departs in August.

The Large billed Water Thrush is one of the birds which are not uniformly distributed, either when migrating or breeding. In general, it may be said that as we approach the northern limit of the range of a species, the individuals representing it become fewer, and, during the breeding season, are only to be found in such localities as are preëminently suited to their taste and wants. This appears to be true in this State of the present species, the Yellow-throated, Prairie, and Pine-creeping Warblers, White eyed Vireo, Whip-poor-will, and perhaps others. When on their migrations they seem to pass rapidly from one breeding locality to another, seldom making a stop at intermediate points.

In the immediate vicinity of this city, I know the Large-billed Water Thrush only as a rare migrant, appearing sometimes as early as April 13, and, with the Yellow-throated Warblers, the first of the family to arrive. They are then found in wet woodlands and along the muddy wooded banks of streams, never in open places, as is the frequent habit of the Small-billed Water Thrush, nor are they as silent as that species.

The Large-billed Water Thrush was first introduced as an Ohio bird in my list of 1861, on the authority of Mr. John Kirkpatrick, who informed me that it was found in the vicinity of Cleveland. Dr. Kirtland and Mr. Read had confounded the two species. Mr. Langdon gives it as a rather common summer resident in the vicinity of Cincinnati, and I have seen specimens from Sandusky. My first acquaintance with the bird in the breeding season was made June 19, 1875, in the "glen" at Yellow Springs. Here I found them abundant, and busily engaged in feeding half-grown Cowbirds. I afterwards found them in the ravines above Worthington, in this county, where they were equally abundant,

and making preparations for nesting. Here they were indiscriminately in trees, on the ground, or wading on the level slaty bottoms of the shallow brooks. Frequently they mounted to the upper branches of high trees overhanging the ravines, from whence their loud and mellow song echoed along the winding banks with surpassing sweetness. But whether on the ground, in trees, or in the water, the constant tipping of the tail and balancing of the body is a reminder of the stiff jerk and nod of the Tattler, which reappears with added grace and style in several terrestrial and aquatic members of the higher groups.

I have never seen the nest and eggs of this bird, and copy the following from Mr. Brewster's account, in the Bulletin of the Nuttall Ornithological Club, iii, 1878, 133.

"The nest, taken with the female parent, May 6, contained six eggs, which had been incubated a few days. The locality was the edge of a lonely forest pool in the depths of a cypress swamp near White River (Indiana). A large tree had fallen into the shallow water, and the earth adhering to the roots, formed a nearly vertical, but somewhat irregular wall, about six feet in height and ten or twelve in width. Near the upper edge of this, in a cavity among the finer roots, was placed the nest, which, but for the situation and peculiar character of its composition, would have been exceedingly conspicuous. Its presence was first betrayed by the female, which darted off as one of our party brushed by within a few feet. She alighted on a low branch a few rods distant, uttering her sharp note of alarm, and vibrating her tail in the usual characteristic manner, but otherwise evincing no particular anxiety or concern. The nest, which is before me, is exceedingly large and bulky, measuring externally 3.50 inches in diameter by 8 inches in length, and 3.50 inches in depth. Its outer wall, a solid mass of soggy dead leaves, plastered tightly together by the mud adhering to their surfaces, rises in the form of a rounded parapet, the outer edge of which was nicely graduated to conform to the edge of the earthy bank in which it was placed. In one corner of this mass, and well back, is the nest proper, a neatly rounded, cup-shaped hollow, measuring 2.50 inches in depth. The inner nest is composed of small twigs and green mosses, with a lining of dry grasses and a few hairs of squirrels or other animals, arranged circularly. The eggs found in this nest are of a rounded-oval shape, and possess a high polish. The ground-color is white, with a fleshy tint. About the greater ends are numerous large but exceedingly regular blotches of dark umber, with fainter sub-markings of pale lavender, while over the remainder of their surface are thickly sprinkled dottings of reddish-brown. But slight variation of marking occurs, and that mainly with regard to the relative size of the blotches about the greater ends. They measure respectively .75 by .63, .78 by .64, .75 by .63, .76 by .62, .76 by .62, .75 by .61."

GENUS OPORORNIS. Baird.

Wings much longer than tail; the first primary nearly or quite equal the longest. Tarsi elongated; hind claw as long as its digit. Otherwise, with the generic characters of *Siurus*.

OPORORNIS AGILIS (Wils.) Bd.

Connecticut Warbler.

Sylvia agilis, KIRTLAND, Ohio Geolog. Surv., 1838, 162, 182.

Trichas agilis, READ, Fam. Visitor, iii, 1853, 423; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Oporornis agilis, WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Sylvia agilis, WILSON, Am. Orn., v, 1812, 64.

Trichas agilis, NUTTALL, Man., 2d ed., i, 1840, 463.

Oporornis agilis, BAIRD, Birds N. Am., 1858, 246.

Above, olive-green, becoming ashy on the head; below, from the breast yellow, olive-shaded on the sides; chin, throat and breast grayish-ash; a whitish ring round eye; wings and tail unmarked, glossed with olive; under mandible and feet pale; no decided markings anywhere. Length 5½; wing 2½; tail 2.

Habitat, Eastern United States.

Rare spring and fall migrant, probably summer resident in Northern Ohio.

The Connecticut Warbler, nearly everywhere considered a rare bird, has been taken, in varying numbers, from Virginia to Massachusetts in the east, and from Illinois to Wisconsin in the west, and in nearly all the intermediate States. It appears to be more common in the western portions of its range, Mr. Nelson regarding it as equally common in spring and fall in Northern Illinois. In most places it is particularly rare in fall, but, for several seasons, was found by Messrs. Henshaw and Brewster, abundant in the vicinity of Cambridge, Mass. It is usually found near the ground, in swamp thickets.

It is given by Dr. Kirtland, in 1838, he having taken a single specimen. Mr. Langdon mentions a single specimen, taken by Mr. Dury, in the vicinity of Cincinnati, in the spring of 1876. Dr. Darby, of Cleveland, has a specimen which flew in an open window of a house where he was visiting. I have taken two specimens, both in the same upland woods; one, a young male, September 16, 1874, was shot from a low branch of a young sapling, to which it flew, when alarmed, from a thicket of blackberry bushes, a few feet distant. Its actions, during the few moments that I observed it, were remarkably Thrush-like. It concealed its head behind the trunk of the sapling, and sat quiet in fancied security, while its body was entirely exposed. This specimen had the chin and throat soiled whitish-buff, passing insensibly into grayish on the auriculars, and brownish-olive on the breast, where it formed a tolerably well defined band; other under parts yellow, with more olive shading than in the adult; upper parts olive-green, tinged with brownish on the head, neck, and upper back. The second specimen

was secured May 22, 1875, within a few yards of the spot where the first was captured, in a low thicket of young blackberry bushes. It was catching insects on the wing in a rather awkward manner, its actions much resembling those of a Bluebird similarly engaged.

Mr. Read seems to have been more fortunate in an opportunity of observing the habits of this species in summer than other writers. His statement confirms that of Dr. Turnbull in regard to this species spending the summer in the latitude of Pennsylvania. He says (l. c. Fam. Vis.):

"This species is described as very rare, but for two summers past I have noticed it as very abundant in a field of dense brambles, in Andover, Ashtabula county. In its habits it resembles the preceeding (*Trichas marylandica*), or rather the peculiar habits of the genus are strikingly exhibited in this species. When first discovered, although there was no difficulty in finding it, it was several days before I could obtain a specimen fit for examination; from its restless, fickle movements it was difficult to shoot, and the first two or three obtained were torn completely to shreds from being within eight or ten feet of the muzzle of the gun when shot. This was indeed the greatest difficulty, for I could scarcely see one, so constantly were they at work beneath the thick foliage, unless it were almost under my nose. They undoubtedly nest with us in considerable numbers."

The nest and eggs have never been discovered.

OPORORNIS FORMOSUS (Wils.) Bd.

Kentucky Warbler.

Sylvia formosa, AUDUBON, Orn. Biog., i, 1831, 196.

Mytiodictes formosus, AUDUBON, B. Am., ii, 1841, 19.

Sylvicola formosa, READ, Fam. Visitor, iii, 1853, 42; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Oporornis formosus, WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—BAIRD, BREWER, and RIDGWAY, N. A. Birds, i, 1874, 293.—LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6; Bull. Nutt. Orn. Club, iv, 1879, 236.

Kentucky Warbler, KIRTLAND, Am. Journ. Sci. and Arts, xiii, 1852, 218.

Sylvia formosa, WILSON, Am. Orn., iii, 1811, 85.

Sylvicola formosa, JARDINE, "Ed. Wilson, 1832."

Mytiodictes formosus, AUDUBON, Syn., 1839, 50.

Oporornis formosus, BAIRD, Birds N. Am., 1858, 247.

Clear olive-green; entire under parts bright yellow, olive-shaded along sides; crown black, separated by a rich yellow superciliary line (which curls around the eye behind) from a broad black bar running from bill below eye, and thence down the side of the neck; wings and tail unmarked, glossed with olive; feet flesh color; 54; wing 24-3; tail 2-2½. Young birds have the black obscure, if not wanting; in the fall, the black feathers in the crown of the adult are skirted with ash.

Habitat, Eastern Province of the United States, especially in the Mississippi Valley; north to the Connecticut Valley; west to Kansas and the Indian Territory; south through Mexico and Central America. Cuba.

Rare summer resident; in particular localities only. Breeds. Audubon notes it as occurring in Southwestern Ohio. Dr. Kirtland (l. c., quoted on page 193) mentions its breeding in the vicinity of Cleveland. Mr. Langdon gives it as a rather common summer resident in the vicinity of Cincinnati, frequenting upland thickets from May to September. I have never met with it in this vicinity.

Mr. Ridgway (l. c.) says:

"It is a very common summer bird in Southern Illinois, where it arrives in the Wabash Valley towards the last of April. It is a wood-loving species of terrestrial habits, like the *Seiurus aurocapillus*, but generally frequents rather different situations from the latter bird, liking better the undergrowth of 'bottom' woods than that of dry forests. In all its manners it closely resembles the *Seiuri*, especially the two aquatic species, *ludovicianus* and *noveboracensis*, having the same tilting motion of the body, and horizontal attitude when perching, so characteristic of these birds.

"The usual note of this warbler is a sharp *tship*, almost precisely like that of the Pewee, uttered as the bird perches on a twig near the ground, continually tilting its body, or is changed into a sharp rapid twitter as one chases another through the thicket. Their song is very pretty, consisting of a fine whistle, delivered very much in the style of the Cardinal Grosbeak, though much finer in tone, and weaker."

Mr. Langdon (l. c. Bull.) gives the following interesting account of its nesting:

"Although the Kentucky Warbler has long been a well-known summer resident of Southwestern Ohio, its nest and eggs have hitherto eluded the vigilant search of our local ornithologists, and have, in consequence, been classed among their especial *desiderata*. As the nesting habits of this species have been recorded in but a few instances, and only once in Ohio (Kirtland, l. c.), a notice of a nest and eggs recently taken near Madisonville may be of interest to the readers of the Bulletin.

"The locality chosen for this nest was a gentle slope, well wooded and covered with undergrowth, situated within a short distance of a small woodland stream on the border of an open glade. The nest, which was placed on the ground at the root of a small elm sapling, was concealed by a sparse growth of weeds, and consisted of two distinct portions. The foundation was a saucer-shaped mass of beech and maple leaves loosely interwoven with a few weed stems, and retained its shape sufficiently well to permit careful handling without injury; surmounting this basal portion was the nest proper, a rather bulky and inelegant structure, elliptical in shape, composed of dark-brown rootlets and weed stems, with which were interwoven a few dried leaves. There was also a trace of an effort at horse-hair lining, a half-dozen hairs perhaps being disposed around its interior. Its measurements are as follows: Internal long diameter, $2\frac{1}{4}$ inches; internal short diameter, 2 inches; depth of cavity, $1\frac{1}{4}$ inches; average thickness of nest proper, about $\frac{3}{4}$ inch; ditto of foundation, about 1 inch. The eggs, which are four in number (exclusive of the Cowbird's egg which accompanies them), are oblong-oval in shape, spotted and speckled everywhere with reddish-brown and lilac on a glossy white ground, the markings on two specimens being massed, at the larger end, while those on the other two form a distinct 'wreath' around the rather blunt apex. They were far advanced in incubation (May 28), and measure, respectively, .72 by .54, .73 by .56, .75

by .56, .73 by .55. Their identification was perfectly satisfactory, the female being secured instantly after being driven from the nest."

GENUS GEOTHYLPIS. Cabanis.

Bill rather depressed, distinctly notched, rictal bristles very short or wanting. Wings short, rounded, about equal to the long graduated tail. Tarsi stout, as long as the head.

GEOTHYLPIS TRICHAS (L.) Cab.

Maryland Yellow-throat.

Sylvia trichas, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 182.

Trichas marylandica, READ, Fam. Visitor, iii, 1853, 423; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Geothlypis trichas, BAIRD, P. R. R. Rep., ix, 1858, 242.—WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 5; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Turdus trichas, LINNÆUS, Syst. Nat., 1766, 293.

Sylvia trichas, LATHAM, Ind. Orn., ii, 1790, 519.

Trichas marylandica, NUTTALL, Man., i, 1840, 454.

Geothlypis trichas, CABANIS, Mus. Hein., i, 1856, 16.

Male, in spring: olive-green, rather grayer anteriorly; forehead, and a broad band through the eye to the neck pure black, bordered above with hoary ash; chin, throat, breast, under tail coverts and edge of wing rich yellow, fading into whitish on the belly; wings and tail unmarked, glossed with olive; bill black; feet flesh-colored. Female, in spring: without the definite black and ash of the head; the crown generally brownish, the yellow pale and restricted. The young in general resemble the female, at any rate lacking the head markings of the male; but are sometimes buffy-brownish below, sometimes almost entirely clear yellow. Length $4\frac{1}{4}$ –5; wing and tail $1\frac{1}{4}$ – $2\frac{1}{4}$.

Habitat, United States at large; south through Mexico and Central America. West Indies.

Abundant summer resident. Breeds. Arrives during the last week in April and remains until the first of September. Frequents especially the borders of streams, but is very common in upland thickets. It is rarely seen in the gardens of the city. The Maryland Yellow-throat is terrestrial in its habits, comparatively seldom mounting to the higher limbs of trees. It frequents thickets, weeds, and brush-piles, where its active pert manners, as it hops in and out between logs and fence rails, resemble those of the Wren. It is rather a voluble bird, the loud, emphatic *whit-ti-tee-tee* of the male, frequently repeated, is well known to all observers. Besides this song it frequently utters a soft *whit, whit, whit, whit*, especially on the wing. It has, however, a prolonged song, which I have heard from the tops of trees, not loud, but varied and pleasant, having considerable resemblance in its modulations to the song of the Brown Thrush.

The nest of the Maryland Yellow-throat is usually placed on the ground, in weeds, in a grassy place. It is composed mainly of dead leaves and grass, with a lining of fine grasses. The eggs are white, rather thickly sprinkled with spots of reddish-brown. They are from four to six, and vary in size from .55 to .72 in length, by .48 to .58 in breadth.

GEOTHYLPIIS PHILADELPHIA (Wils.) Bd.

M. urning Warbler.

Geothlypis philadelphia, WHEATON, Ohio Agric. Rep. for 1860, 363, 373; Reprint, 1861, 5, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 172; Reprint, 6.

Sylvia philadelphia, WILSON, Am. Orn., iii, 1810, 101.

Geothlypis philadelphia, BAIRD, Birds N. Am., 1858, 243.

Bright olive, below clear yellow; on the head the olive passes insensibly into ash; in high plumage the throat and breast are black, but are generally ash, showing black traces, the feathers being black, skirted with ash, producing a peculiar appearance suggestive of the bird's wearing crape; wings and tail unmarked, glossed with olive; under mandible and feet flesh color; *no white about eyes*. Young birds have little or no ash on the head, and no black on the throat, thus nearly resembling *Oporornis agilis*. Length, 5½–5¾; wing and tail, each, about 2½.

Habitat, Eastern Province of the United States and British America; north casually to Greenland; west to Kansas and Dakota. New Granada. Costa Rica.

Rather rare spring and fall migrant. Arrives after the middle of May, and again in August and September. It has been taken in Northern Ohio by Mr. Winslow, Dr. Kirtland, and Dr. Darby. Mr. Langdon notes two or three specimens near Cincinnati. I have taken six specimens in this vicinity. When with us it is a shy, retiring, and silent bird, frequenting thickets and brush-heaps in woodland undergrowth. It has much less curiosity than the preceding species. All which I have seen were busily engaged searching for food on the ground, and when disturbed, flew but a short distance to a dense thicket for concealment. I saw one specimen in my garden on the ground beneath currant bushes. They very likely breed in this State. The only nest known was found by Mr. John Burroughs, in the State of New York, in ferns, about a foot from the ground, on the edge of a hemlock wood. It was quite massive, composed of stalks and leaves. The cavity was quite deep, and lined with fine black rootlets. The eggs were three in number, measuring .75 by .55. They "were of a light flesh color, uniformly speckled with fine brown specks." Young birds have the entire under parts yellow.

Sub-family ICTERIINÆ. Chats.

Bill conical, high and compressed, culmen and commissure much curved, without notch or bristles; wing much rounded, shorter than the tail.

GENUS ICTERIA. Vieillot.

The characters of this genus are those of the sub-family given above.

ICTERIA VIRENS (L.) Bd.

Yellow-breasted Chat.

Icteria viridis, AUDUBON, Orn. Biog., ii, 1834, 223; B. Am., iv, 1843, 160.—KIRTLAND, Ohio Geolog. Surv., 1838, 163.—READ, Fam. Vis., iii, 1853, 375; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 363; Reprint, 5.

Icteria virens, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 564; Reprint, 4.—LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Journ. Cin. Soc. Nat. Hist., 1879, 173; Reprint, 7.

Turdus virens, LINNÆUS, Syst. Nat., i, 1758, 171.

Muscicapa viridis, GMELIN, Syst. Nat., i, 1788, 936.

Icteria viridis, BONAPARTE, Journ. Philad. Acad., iv, 1825, 252.

Icteria virens, BAIRD, Rev. N. A. Birds, 1865, 228.

Bright olive-green; below, golden yellow, belly abruptly white; lore black, isolating the white under eyelid from a white superciliary line above and a short maxillary line below; wings and tail unmarked, glossed with olive; bill and feet blue-black. Length, 7-7½; wing, about 3; tail, about 3¼.

Habitat, Eastern United States; north to Massachusetts; west to the Plains, beyond which it is replaced by var. *longicauda*.

Very common summer resident; abundant in the southern, not very common in the northern portions of the State. Arrives in Middle Ohio about May 1, and remains until the last of August.

When migrating no bird is more shy and retiring than the Chat. They skulk along silently in thickets along the banks of streams, or on the edges of upland woods. But no sooner has pairing been effected, than their whole nature seems changed, and the silent bird becomes the noisiest of the wood. His shyness gives way to an audacity which is surprising. If he discovers the approach of a human being, even at a considerable distance, he prepares to resent the intrusion; and giving three short, loud whistles, very low in tone, as a warning, he advances toward him, all the while careful that he should be heard and not seen. Then follows a medley of sputtering, cackling, whispering and scolding notes, frequently interspersed with loud whistles, and continued as the bird runs, hops, or flies in the deepest thicket, with a pertinacity which knows no fatigue. He tells you that your gun won't shoot, that it is a flint-lock, that your ram-rod is broken, that you shot it at a buzzard, that you haven't got a gun; that you are a bald-headed cripple; that there is a horrid suicide in the bushes, and a big snake and a nasty skunk; that your baby is crying, your house is afire and the bridge broken down; at you have missed the road to the reform farm, and that the poor

house is over the creek, and he calls the dogs; says that you have gone to seed; go west and grow up with the country; that you are taking up too much of his valuable time, that you must excuse him for a moment. During all this time he remains invisible, or at most, his black eye and mask, or golden breast, appear for a moment as he peers at you from the tangled branches of the brambles, or flashes from branch to branch, dancing an accompaniment to his fantastic notes. At the last, he suddenly appears on the top of a bush not ten feet from you, makes a profound bow, and with a derisive whisk of his long tail, exposes his immaculate white crissum and dives again into the deepest thicket. You take a long breath and wipe your face, and he returns to the assault from the rear. Should you move on, he follows, and if you approach, he retires, and, keeping at a respectful distance, he laughs defiance, shouts mockery and tantalizing sarcasm. He is a fearful scold, and it is no wonder the inside of his mouth is black. But this is when he knows he has the advantage. Sometimes he may be surprised as he sings in the upper branches of a tree. He then sits motionless, continuing his song as if unaware of any intrusion upon his privacy, and so resonant and varying are his notes, that they confuse the ear as to the spot from which they come, while his yellow breast so completely harmonizes with the green leaves and sunlight, that he is with difficulty discovered. It is to his rapid and sonorous notes, quick motions or perfect quiet, with harmonious surroundings, that he owes the reputation for ventriloquism which he has obtained; and it may be said of his reputation for mimicry, that he has no need to borrow notes from any other bird, and does not knowingly do so.

Before the breeding season is over it becomes as silent as during the spring migration, and leaves for the south as stealthily as it came.

In this vicinity the Chats are very common, but of somewhat irregular distribution, showing a decided preference, during the breeding season, for upland thickets with a southern exposure. They are more social when breeding than most birds. I have found four or five nests on a single acre in a favorite locality. Usually the eggs are all laid by June 10. The nest is placed in the bushes of a thicket or in the perpendicular fork of a sapling, from three to six feet from the ground. It is rather large, but neatly constructed for the materials used, which are mainly leaves, strips of grape-vine bark, and grass. In this vicinity every nest has a few brownish-red tendrils of a creeping plant in the lining and about the rim, apparently for ornament. The eggs are almost uniformly four, often nearly spherical, glossy white, with spots of reddish-brown, usually pretty evenly distributed, but sometimes forming a ring

around the greater end, leaving the remaining surface immaculate. Their average measurement is .90 by .68.

Sub-family SETOPHAGINÆ. FLY-CATCHING WARBLERS.

Bill depressed, decidedly broader than high at base, notched, and usually hooked, at tip. Rictus with long stiff bristles, reaching beyond the nostrils.

GENUS MYODIOCTES. Audubon.

Rictal bristles reaching but little beyond nostrils. Wings longer than tail. Outer webs of exterior tail feathers narrow at base, widening at the tip. Middle toe, without claw, three-fifths the tarsus.

MYODIOCTES MITRATUS (Gm.) Aud.

Hooded Fly-catching Warbler.

Sylvania mitrata, READ, Fam. Visitor, iii, 1853, 367; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Myiodiotes mitratus, BAIRD, P. R. R. Rep., ix, 1858, 292.—WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 16; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—COUES, Birds N. W., 1874, 78.—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 314.—LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.—JORDAN, Man. Vert., 1878, 69.

Hooded Warbler, KIRTLAND, Am. Journ. Sci. and Arts, xiii, 1852, 218.

Motacilla mitrata, GMELIN, Syst. Nat., i, 1788, 977.

Sylvania mitrata, NUTTALL, Man., 2d ed., i, 1840, 333.

Myiodiotes mitratus, AUDUBON, Syn., 1839, 48.

Clear yellow-olive; below rich yellow shaded along the sides, whole head and neck pure black, enclosing a broad golden mask across forehead and through eyes; wings unmarked, glossed with olive; tail with large white blotches on the two outer pairs of feathers; bill black; feet flesh color. Female with no black on the head; that of the crown replaced by olive, that of the throat by yellow. Young male with the black much restricted and interrupted, if not wholly wanting, as in the female. Length, 5-5½; wing, about 2½; tail, about 2½.

Habitat, Eastern United States, rather southerly; north to the Connecticut Valley, casually to Lewis county, N. Y. (*Merriam*); west to Kansas; south to Mexico and Central America. West Indies.

Rare summer resident, apparently in restricted localities only. Dr. Kirtland notices its breeding in the vicinity of Cleveland. Mr. Read took a single specimen in Ashtabula county. Mr. Langdon gives it as a rare migrant in May. Mr. Dury tells me he has taken two or three specimens, and saw others. I have taken but two specimens, a young male August 25, 1874, and an adult female May 21, 1875. The young male was in a stage of plumage which has not been described: above, yellow-olive, concealed yellow from bill to eyes; feathers of crown and occiput with dark plumbeous bases and centres, some of the feathers of sides of

crown with scarcely concealed blackish tips; line from bill over and around eye, bright lemon yellow, separated from the uniform yellow of throat, breast, and abdomen, by dusky lores and olive-yellow auriculars; under tail coverts very light yellow. Tail spots as in the adult. Bill very pale, dusky shaded.

The description of Dr. Coues, given above, agrees with that of Prof. Baird in asserting that the female has no black on the head. Mr. C. H. Merriam (Rev. Birds of Connecticut, 1877, 25) describes a specimen of the female which "has the crown of the head or 'hood' deep black, as rich as in the male. The lores also in this specimen are black, and the auriculars lack the olive tinge, being bright yellow." He suggests that the female is "several years—at least three—in attaining its full plumage; and that the two sexes, when fully adult, can only be distinguished by the fact that, in the female, the throat, though strongly tinged with black, is never *pure black*, as in the male."

Mr. E. A. Mearns, of West Point, N. Y., (Bull. Nutt. Orn. Club, ii 1878, 71) endorses Mr. Merriam's views, and states that "the females of the second summer are entirely without black upon the head, and I have frequently found them sitting upon their eggs in that condition. Only in extreme examples does the black of the head and throat of the female approach the purity of those parts in the male." Mr. E. P. Bicknell (Bull., iii, 1878; 130) mentions a female in which "the black, though well defined in the region of the occiput, is scarcely detectible on the throat; while another, though less definitely marked, represents an almost opposite phase." My female specimen has the yellow of forehead extending to beyond the eyes, slightly obscured by olive tips; the rest of head and neck behind blackish, partially concealed by olive tips, but the sides of occiput just above the bright yellow superciliary line definitely dull black, entire under parts bright yellow, the feathers of chin and throat with white, those of breast with dusky bases. It seems to me probable that females of the same age are not always of the same pattern, or that they reach their final stage by varying steps.

The Hooded Warbler frequents thickets and undergrowth, and like other members of the genus, is very active in capturing insects on the wing, in the manner of the true Flycatchers. They have the habit of spreading out and closing the tail like the Redstart, and are very skillful in concealing themselves in thickets when pursued. The nest is placed in a bush or low tree, within a few feet of the ground. It is built of leaves and coarse grasses, and lined with fine grass and horse-hair. The eggs are white, tinged with flesh-color, spotted with red. They measure .70 by .50.

MYIODIOCTES PUSILLUS (Wils) Bp.

Green Black-capped Fly-catching Warbler.

Sylvia wilsonii, KIRTLAND, Ohio Geolog. Surv., 1833, 163, 182.

Myiodioctes pusillus, BAIRD, P. R. R. Rep., ix, 1868, 294.—WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4 —LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.

Muscicapa pusilla, WILSON, Am. Orn., iii, 1811, 103.

Sylvia wilsonii, BONAPARTE, Journ. Phila. Acad., iv, 1824, 179.

Myiodioctes pusilla, BONAPARTE, Con. Av., i, 1850, 315.

Myiodioctes pusillus, SCLATER, Proc. Zool. Soc., 1856, 291.

Clear yellow-olive; crown glossy blue-black; forehead, sides of head, and entire under parts, clear yellow; wings and tail plain, glossed with olive; upper mandible dark, under, pale; feet brown. Female and young similar; colors not so bright, the black cap obscure. Small; $4\frac{3}{4}$ –5; wing about $2\frac{1}{2}$; tail about 2.

Habitat, the whole of North America, Mexico, and Central America.

Not common migrant in spring; abundant in the fall. Arrives about the middle of May and returns about the middle of September. Frequent woodland undergrowth and willows along streams; in the fall in weedy woodlands, in company with Nashville and Tennessee Warblers, often in considerable flocks. Its song while with us is a low, short twitter, and its note a feeble "chip." Often takes its food after the manner of the Vireos, hopping from twig to twig. Fall specimens have the black patch of the crown more extensive and more definite than in spring, and the green of upper parts deeper. Not one in ten of the birds taken by me in the fall has been in the plumage of the young, as above described; sometimes the black-cap is entirely wanting in the young.

Little is known in regard to the breeding habits of the Black-cap Fly-catching Warbler. It is said to breed from the latitude of Massachusetts northward. The nest is composed of moss and small twigs, lined with vegetable fibres. The eggs are white, sprinkled around the larger end with brownish-red and lilac, and measure from .60 to .63, by from .45 to .49.

MYIODIOCTES CANADENSIS (L.) Aud.

Canada Fly-catching Warbler.

Sylvia pardalina, KIRTLAND, Ohio Geolog. Surv., 1833, 163, 181.

Sylvicola pardalina, READ, Fam. Visitor, iii, 1853, 415; Proc. Phila. Acad. Nat. Sci., vi, 1853, 335.

Myiodioctes canadensis, WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6; Food of Birds, etc., Ohio Agric. Rep. for 1874; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 6; Journ. Cin. Soc. Nat. Hist., i, 1878, 6; Reprint, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.

Muscicapa canadensis, LINNÆUS, Syst. Nat., i, 1766, 327.

Sylvia pardalina, BONAPARTE, Journ. Phila. Acad., iv, 1824, 179.

Sylvicola pardalina, BONAPARTE, Geog. and Comp. List, 1833, 22.

Myiodioctes canadensis, AUDUBON, Syn., 1839, 40.

Bluish ash; crown speckled with lauceolate black marks, crowded and generally continuous on the forehead; the latter divided lengthwise by a slight yellow line; short superciliary line and edges of eyelids yellow; lores black, continuous with black under the eye, and this passing as a chain of black streaks down the side of the neck, and prettily encircling the throat like a necklace; excepting these streaks and the white under tail coverts, the entire under parts are clear yellow; wings and tail unmarked; feet flesh-color. In the female and young the black is obscure or much restricted, and the black may be *slightly* glossed with olive. Length about $5\frac{1}{2}$; wing $2\frac{1}{2}$; tail $2\frac{1}{2}$.

Habitat, Eastern North America; south to Mexico, Central America, and Ecuador; west to the Plains.

Rather common migrant in spring; more rare in fall. Arrives about the middle of May and returns in September. The habits of this species are not essentially different from those of the two preceeding species, except that while with us it appears to be more decidedly arboreal. I have almost invariably found it well up in the branches of trees, and never about low bushes. I have never seen it in the fall, but Mr. Langdon records its capture in September. A spring specimen in my collection has the black necklace very faint or obsolete.

The Canada Fly-catcher breeds from Massachusetts northward. The nest is described by Dr. Brewer as placed in a tussock of grass in a swamp. It is large for the size of the bird, and composed of fibres of bark, leaves, and rootlets. The eggs are five, white, "beautifully marked with dots and small blotches of blended brown, purple, and violet, varying in shades and tints, and grouped in a wreath around the larger end."

GENUS SETOPHAGA. Swainson.

Bill much depressed. Rictal bristles reaching half way from nostrils to tip. Wings equal to tail. External tail feathers as in *Myiodioctes*. Tarsi long; toes short; middle toe without claw about half the tarsus.

SETOPHAGA RUTICILLA (L.) Sw.

Redstart.

Muscicapa ruticilla, KIRTLAND, Ohio Geolog. Surv., 1838, 163.

Setophaga ruticilla, READ, Fam. Visitor, iii, 1853, 367; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—BAIRD, P. R. R. Rep., ix, 1858, 298.—WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.—BREWER, Bull. Nutt. Orn. Club, iv, 1879, 113.

Muscicapa ruticilla, LINNÆUS, Syst. Nat., 1766, 326.

Setophaga ruticilla, SWAINSON, Zool. Journ., iii, 1827, 360.

Male: lustrous blue-black, belly and crissum white, sides of the breast, large spot at bases of the remiges, and basal half of the tail feathers (except the middle pair) *fiery orange*, belly often tinged with the same. Female: olivaceous, ashier on the head, entirely white below, wings and tail blackish, with the flame color of the male represented by yellow. Young male like the female, but browner, the yellow of an orange hne. From the circumstance that many spring males are shot in the general plumage of the female, but showing irregular isolated black patches it is probable that the species requires at least two years to gain its perfect plumage. Length $5\frac{1}{2}$; wing and tail about $2\frac{1}{2}$.

Habitat, the greater part of temperate North America, especially the Eastern Province; north to Fort Simpson; west to Utah; south in South America to Ecuador. West Indies.

Abundant summer resident, arriving the first week in May and remaining until September. The Redstart is the most abundant arboreal species of the family, and breeds with us abundantly. Sometimes they appear in large flocks, composed almost entirely of females and males in imperfect plumage. Usually they seem to migrate individually or in company with other species. The first to arrive are full plumaged males. During the migrations they are frequently seen about the fruit and shade trees in cities. They are decidedly birds of the forest, and during the breeding season are seldom seen except in rather extensive or retired woods. As its structure indicates, it is *par excellence* the fly-catcher of the family. As it hops from limb to limb, opening and closing its tail, or flies from its perch with clicking bill to secure its insect food, its emphatic and beautiful colors render it a very attractive sight.

The nest is placed in the fork of a sapling from six to fifteen feet from the ground. It is constructed of vegetable fibres, strips of grape-vine bark, and grasses, with a lining of fine grasses and horse-hair. The eggs are four, soiled grayish-white, dotted and blotched with brown, lavender, and purple. They vary in size, and average .66 by .49.

FAMILY TANAGRIDÆ. TANAGERS.

Apparently intermediate between *Sylvicolidæ* and *Fringillidæ*. Abundant in species in the tropics; in the United States represented by a single genus. Primaries nine; other family characters not well determined, but, for our purposes, are sufficiently set forth in the following description of the

GENUS PYRANGA. Vieillot.

Bill nearly straight, sub-conical, cylindrical, notched at tip; culmen moderately curved; commissure with a median acute lobe. Wings elongated, the four outer primaries about equal. Tail moderate, slightly forked.

PYRANGA RUBRA (L.) V.

Scarlet Tanager.

Tanagra rubra, KIRTLAND, Ohio Geolog. Surv., 1833, 164.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Pyrrangia rubra, AUDUBON, iii, 1841, 229.—BAIRD, P. R. R. Rep., ix, 1858, 301.—WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 7; Journ. Cin. Soc. Nat. Hist., i, 1878, 113; Reprint, 4; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 174; Reprint, 8.

Tanagra rubra, LINNÆUS, Syst. Nat., i, 1766, 314.

Pyrrangia rubra, VIEILLOT, Ois. Am. Sept., i, 1807, iv.

Male scarlet, with black wings and tail; bill and feet dark. Female *clear olive-green*, below *clear greenish-yellow*; wings and tail dusky, edged with olive. Young male, at first like the female; afterward variegated with red, green, and black. Length, 7-7½; wing, 4; tail, 3.

Habitat, Eastern United States and southern border of Canada; west to the Plains; south to Ecuador. Cuba. Jamaica.

Very common summer resident. Breeds. Arrives the last week in April and remains till the latter part of September. This beautiful bird, often known as the Black-winged Redbird, is chiefly an inhabitant of retired woods. On its migration it may be seen following the wooded banks of streams, and in groves. At such times it is usually rather shy, seeking concealment, if any is afforded, in the young foliage; otherwise it sits quiet, in a rather stupid manner, and feigns to ignore the presence of an intruder. Its ordinary note is a sharp "chuc," but when breeding the male has a peculiar song, given somewhat in the manner of the Robin, but of fewer notes. As a breeding resort, they prefer mixed woodland. The nest is placed on the horizontal branch of a low tree, from ten to twenty feet from the ground; it is flat, having but a slight depression, and composed of strips of bark, fibres, and rootlets, and lined with fine roots. The eggs are four or five, light-bluish, thickly spotted with brown and purple. They measure .90 by .65.

In the fall the males lose their bright colors, and become similar to the females, but with us, in August and September, the old males retain their black wings and tail. In the fall, they sometimes visit the gardens of the city.

PYRANGA ÆSTIVA (L.) V.

Summer Redbird.

Tanagra æstiva, AUDUBON, Orn. Biog., i, 1831, 232.—KIRTLAND, Ohio Geolog. Surv., 1833, 164, 183.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Pyrranga æstiva, AUDUBON, B. Am., iii, 1841, 222.—WHEATON, Ohio Agric. Rep. for 1860, 364, 374; Reprint, 1861, 6, 16; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 7; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 174; Reprint, 8.

Tanagra æstiva, GMELIN, Syst. Nat., i, 1788, 889.

Pyrranga æstiva, VIEILLLOT, N. D. d'H. N., 2d ed., xxviii, 1819, 291.

Male, rich rose-red or vermillion, including wings and tail; the wings, however, dusky on the inner webs; bill rather pale; feet darker. Female *dull brownish-olive*; below, *dull brownish-yellow*. Young male like the female; the male changing plumage, shows red and green confused in irregular patches, but no black. The female, with a general resemblance to female *rubra*, is distinguished by the dull brownish, ochre or buffy tinge, the greenish and yellowish of *rubra* being much purer; the bill and feet also are much paler in *æstiva*. Size of *rubra* or rather larger.

Habitat, Eastern United States; north regularly to the Connecticut Valley, casually to Massachusetts and Nova Scotia; west to Kansas, Indian Territory, and Texas; south to Ecuador and Peru. Cuba. Jamaica.

Common summer resident in southern, rare in Northern Ohio. Dr. Kirtland notes a specimen taken in Trumbull county. Mr. Read gives it as not uncommon. I have seen a single specimen, several years since, in this locality, and one specimen from Lancaster. Dr. Howard E. Jones informs me that it is not rare at Circleville, twenty five miles south of Columbus. Mr. Langdon states that, in the vicinity of Cincinnati, it is a common summer resident from May 1st to September 25th.

In habits this species resembles the Scarlet Tanager, except that it is less retiring, frequenting open groves and orchards, and often visiting towns and cities. The nest is placed on the horizontal or drooping branch of a tree, and is constructed of various vegetable substances, often so thin that the eggs may be seen from below.

The eggs vary in size from four-fifths of an inch to an inch in length, and average about two-thirds of an inch in breadth. "Their color is a bright light shade of emerald-green, spotted, marbled, dotted, and blotched with various shades of lilac, brownish-purple, and dark-brown. These are generally well diffused over the entire egg."

FAMILY HIRUNDINIDÆ. THE SWALLOWS.

Primaries nine. Bill triangular, depressed, about as wide at base as long; the gape twice as long as the culmen, reaching to about opposite the eyes; tomia straight or gently curved. No obvious rictal bristles. Tarsi not longer than the lateral toe and claw. Wings long and pointed, the first primary equal to or longer than the second. Central tail-feathers not half as long as the wing.

KEY TO THE GENERA OF HIRUNIDINIDÆ.

* Plumage above more or less lustrous blue-black or green; no tarsal tuft nor recurved hooks on outer primary.

† Tail deeply forked; outer feathers attenuate and blotched with white.

HIRUNDO.

†† Tail scarcely forked; rump and forehead not colored like back.

PETROCHELIDON.

††† Tail somewhat forked, unblotched; rump and forehead colored like back.

a Lustrous green or violaceous; pure white below; length less than 6½.

TACHYCINETA.

a a Lustrous blue-black; female paler and whitish below; length more than 6½.

PROGNE.

* * Plumage brownish-gray; scarcely lustrous, and without shades of blue or green.

‡ A little tuft of feathers on tarsus at base of hind toe; edge of wing smooth.

COTYLE.

‡‡ Outer web of first primary more or less saw-like, with a series of minute recurved hooks; no tarsal tuft.

STELGIDOPTERYX.

GENUS HIRUNDO. Linnæus.

Nostrils lateral. Tarsi short, not exceeding middle toe without its claw; the upper joint covered with feathers which extend a short distance along the inner face of the tarsus. Tail very deeply forked; the lateral feather much attenuated, twice as long as the middle. Basal joint of middle toe free for terminal fourth on outside, for half on inside.

HIRUNDO ERYTHROGASTRA Boddært.

Barn Swallow.

Hirundo rufa, KIRTLAND, Ohio Geolog. Surv., 1838, 162.—READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.—KIRKPATRICK, Ohio Farmer, viii, 1859, 227.

Hirundo horreorum, WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6; Food of Birds, Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 4.—LANGDON, Cat. Birds of Cin., 1877, 7.

Hirundo erythrogaster var. *horreorum*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.

Hirundo erythrogaster, BODDÆRT, Tab. Pl. El., 1783, 45.

Hirundo rufa, GMELIN, Syst. Nat., i, 1783, 1018.

Hirundo horreorum, BARTON, "Frag. N. H. Penna., 1799, 17."

Hirundo erythrogaster var. *horreorum*, COUES, Birds of N. W., 1874, 85.

Hirundo erythrogastra, COUES, Birds of Col. Val., 1878, 407.

Lustrous steel-blue; below, rufous or pale chestnut of varying shade; forehead, chin and throat deep chestnut; breast with an imperfect steel-blue collar. Tail with white spots on the inner web of all the feathers except the inner pair. Sexes alike, young less lustrous, much paler below, tail simply forked. Wing 4½–4¾; tail 2½ to 5.

Habitat, America.

Very abundant summer resident. Breeds. Arrives about the end of the first or during the second week of April, and remains until September 1st.

The Swallows are ærial Fly-catchers, never taking food except on the wing, for which their structure especially adapts them. The Barn Swallow is the best known, and, on the whole, the most abundant, and most universally semi-domesticated with us of the family. I have never known them to nest otherwise than in barns, sheds, under the roof of bridges or other buildings. In uninhabited regions they build their nests in caves, and Dr. Coues states that in the Northwest he found them nesting in small holes and crevices in a perpendicular bank.

The nest, as the name of the bird implies, is usually placed in the interior of a barn, under the roof, attached to the beams and rafters. Sometimes as many as fifty pairs occupy the same barn. The nest is composed of pellets of mud and bits of straw, sometimes with a projecting snelf, which serves as a roost for one or both of the parents. Several broods are raised in a season. The eggs are very variable in shape, averaging .78 to .56, white, spotted and blotched with bright reddish-brown.

GENUS TACHYCINETA. Cabanis.

Nostrils lateral, overhung or bordered internally by incumbent membrane. Tarsi about equal to middle toe without claw, with tibial extremity covered with overhanging feathers, adherent a short distance along inner face. Lateral toes equal. Adhesion of basal joint of middle toe variable. Tail emarginate only, or slightly forked, fork not exceeding half an inch in depth.

TACHYCINETA BICOLOR (V.) Cab.

White-bellied Swallow.

Hirundo bicolor, KIRTLAND, Ohio Geolog. Surv., 1838, 162.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—KIRKPATRICK, Ohio Farmer, viii, 1859, 243.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 364; Reprint, 6.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.

Tachycineta bicolor, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 565; Reprint, 5.—LANGDON, Cat. Birds of Cin., 1877, 7; Journ. Cin. Soc. Nat. Hist., i, 1878, 113; Reprint, 4.

White-bellied Swallow, BALLOU, Field and Forest, iii, 1878, 136.

Hirundo bicolor, VIEILLOT, Ois. Am. Sept., i, 1807, 61.

Tachycineta bicolor, CABANIS, Mus. Hein., i, 1850, 48.

Lustrous green; below, pure white. Young similar, not so glossy. Length, 6-6½; wing, 5; tail, 2½.

Habitat, Temperate America.

Very common summer resident. Somewhat irregular in its distribution during the breeding season. Arrives early in April and remains until September. The White-bellied Swallow is, in the vicinity of Columbus, rather rare except during the migrations; formerly they were

abundant, and nested in the holes of dead trees along the river banks. As these trees disappeared, the Swallows removed to some more suitable locality. I have never known them to breed in bird-boxes in this vicinity, though they sometimes do so in Northern Ohio. In the Eastern States they have almost forsaken their primitive manner of breeding, resorting to bird-boxes for that purpose. In Ohio the White bellied Swallows nest in the deserted hole of a Woodpecker, or natural cavity of a dead tree, always in the vicinity of water. Even during their migrations the birds are seldom seen far from running streams. The nest is built of leaves and grass, and thickly lined with down and feathers. The eggs are white, unspotted, and of oblong oval shape, measuring about .80 by .55.

GENUS PETROCHELIDON. Cabanis.

Bill stout and deep, somewhat as in *Progne*. Nostrils *entirely superior*, open, without overhanging membrane on the inner (or upper) side, but somewhat overhung by short bristles, seen also along the base of mandible and in chin. Legs stout, the tarsi short, not exceeding the middle toe exclusive of its claw; feathered all round for basal third or fourth, though no feathers are inserted on the posterior face. Tail falling short of the closed wings, nearly square or slightly emarginate; the lateral feathers broad to near the ends, and not attenuate.

PETROCHELIDON LUNIFRONS (Say) Lawrence.

Cliff Swallow; Eave Swallow.

Hirundo fulva, BONAPARTE, i, 1825, 65.—KIRTLAND, Ohio Geol. Surv., 1838, 162, 180.—

READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395

Hirundo lunifrons, KIRKPATRICK, Ohio Farmer, viii, 1859, 267.—WHEATON, Ohio Agric.

Rep. for 1860, 1861, 364; Reprint, 6, 16.

Petrochelidon lunifrons, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875,

565; Reprint, 5.—LANGDON, Cat. Birds of Cin., 1877, 7; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.

Hirundo lunifrons, SAY, "Long's Exp. Ry. Mts., ii, 1823, 47."

Hirundo fulva, DEWITT CLINTON, Ann. Lyc. N. Y., vii, 1824, 156.

Petrochelidon lunifrons, LAWRENCE, Ann. Lyc. N. Y., vii, 1861, 317.

Lustrous steel-blue; forehead whitish or brown, rump rufous, chin, throat, and sides of head chestnut; a steel-blue spot on the throat; breast, sides, and generally a cervical collar rusty gray, whitening on the belly. Young sufficiently similar. Length, 5; wing, 4½; tail, 2½.

Habitat, North America at large. Africa (*Layard*).

Very common summer resident. Breeds. Arrives about the middle of April and remains until September.

This Swallow, like the preceeding, migrates along the banks and over the beds of streams. They are very variable in their numbers in differ-

ent years, as well as erratic in their choice of a summer residence. It was formerly thought they had made their appearance at a comparatively late date in the Eastern United States, but it is now known that they had been seen in New York, New Hampshire, Vermont, and New Brunswick, about the time they were described from the Rocky Mountains by Say. Audubon states that he saw them at Newport, Kentucky, opposite Cincinnati, in 1819, which is the earliest notice we have of their almost certain occurrence in Ohio. Dr. Kirtland, in 1838, says that they had "recently extended their settlements to several buildings in the west part of the latter city. During the present summer they have built their nests on a barn in the north part of Columbiana county."

Their distribution is now general throughout the State. They are always to be found in colonies during the breeding season, and build their nests always on the outside of buildings, under the eaves. I have seen their nests several years since under the eaves of a mill on Alum Creek, near this city; under the eaves of a brick dwelling in the north-east portion of this city, and on the new frame dépôt building at Georgesville, a few miles southwest. But the outside of barns is their favorite location, a colony of these birds often occupying the eaves while Barn Swallows inhabit the interior. I have never known them to build on the same structure for more than three years successively. Whether they removed simply from a desire for change, or because the locality became unsuited from use for the safe fastening of their nests, I do not know. I have known efforts to drive them away from a building where they had located, to be long-continued and severe before they were finally persuaded to go.

This nesting on buildings, an acquired habit, exhibited to a greater or less extent by all the members of the family, except the Bank Swallow, shows an appreciation of the advantages of civilization, and is evidence that they possess reason as distinguished from instinct. In uninhabited regions the nest is placed against a vertical or overhanging rock.

The nests of the Eave Swallow are composed entirely of mud, tempered by the bill of the bird, and deposited in its position as a little pellet. They are retort-shaped, the nest proper being almost closed in between the top of the wall and the projecting eave or cornice, and the opening built out for several inches to form the neck of the flask or retort. In the Eastern States it is said that the nest is frequently built without the elongated entrance, but all the nests I have seen were uniform in possessing it. The cavity is large, and well lined with feathers, wool, and bits of straw. The eggs are white, usually less elongated than those

of the Barn Swallow, and the spots and blotches of reddish-brown, are larger. Two broods are usually raised in a season.

GENUS COTYLE. Boie.

Bill small; nostrils lateral, overhung by a straight-edged membrane. Tarsus about equal to middle toe without claw; feathered at upper end, especially on inner face, and having also a small tuft of feathers attached to posterior edge near the hind toe. Middle toe with basal joint adherent externally to near the end, half way internally; the claws comparatively little curved, the lateral reaching beyond the base of the middle. Tail slightly forked.

COTYLE RIPARIA (L.) Boie.

Bank Swallow; Sand Martin.

Hirundo riparia, KIRTLAND, Ohio Geolog. Surv., 1838, 162.—READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Cotyle riparia, KIRKPATRICK, Ohio Farmer, viii, 1859, 283.—WHEATON, Ohio Agri. Rep. for 1860, 364; Reprint, 1861, 6; Food of Birds, etc., Ohio Agric. Rep. for 1874, 565; Reprint, 1875, 5.—LANGDON, Cat. Birds of Cin., 1877, 7; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.

Hirundo riparia, LINNÆUS, Syst. Nat., i, 10th ed., 1758, 192.

Cotyle riparia, BOIE, Isis., 1826, —.

Lustreless gray, with a pectoral band of the same; other under parts white. Sexes exactly alike. Young similar, the feathers often skirted with rusty or whitish. Length $4\frac{1}{2}$ – $4\frac{3}{4}$; wing $3\frac{3}{4}$ –4; tail 2.

Habitat, Europe, Asia, Africa, America.

Rather common summer resident. Breeds. Arrives about the middle of April and remains until the first of September. In the immediate vicinity of Columbus the Bank Swallow is now but a migrant, but formerly it was a common resident. This is probably due in part to the increase in numbers of the next species, but largely to the want of suitable breeding places. Formerly our rivers ran here and there between more or less steep loamy banks, which remained comparatively unchanged from year to year, but as the country became more densely inhabited, and the forests cleared away, the streams were subject to more sudden freshets. While these freshets seldom occurred during the breeding season of these birds, yet during their absence in the colder portion of the year, the site of their former habitation often became entirely removed. They seem also to have forsaken the gravel pits in which they were accustomed to nest, because they were an unsafe residence, the layer of fine loam and sand in which they preferred to dig their holes being too frequently removed. On their spring migrations they linger lovingly about their old homes, as if reluctant to leave the spot which their traditions invest with so much interest.

A suitable site for nesting may be occupied by a colony of from twenty to fifty pairs of these birds. The holes are usually dug quite near the level of the ground, on the perpendicular face of a bank. They are excavated by the birds, and extend to the depth of from two to four feet. The termination of the excavation is usually somewhat enlarged, and the floor thinly covered with straw and feathers, on which the eggs are deposited. These are five in number, pure white, measuring .72 by .47.

GENUS STELGIDOPTERYX. Baird.

Bill rather small; nostrils oval, superior, margined behind but scarcely laterally by membrane, but not at all overhung; the axes of the outline converging. Frontal feathers soft, and, like chin, without bristles. Tarsus equal to middle toe without claw; the upper end covered with feathers all round, none at lower end. Basal joint of middle toe adherent externally nearly to end; internally scarcely half. Lateral toes about equal, their claws not reaching beyond base of middle claw. Tail slightly emarginate; the feathers broad and obliquely rounded at end. Edge of wing rough to the touch; the shafts of the fibrillæ of the outer web of the outer primary prolonged and bent at right-angles into a short, stiff hook.

STELGIDOPTERYX SERRIPENNIS (Aud.) Bd.

Rough-winged Swallow.

Cotyle serripennis, KIRKPATRICK, Ohio Farmer, viii, 1859, 290.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 374; Reprint, 6, 16.

Stelgidopteryx (error) *serripennis*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 565; Reprint, 5.

Stelgidopteryx serripennis, LANGDON, Cat. Birds of Cin., 1877, 7; Revised List, Journ. Cin. Soc. Nat. Hist, i, 1879, 173; Reprint, 7.

Hirundo serripennis, AUDUBON, Orn. Biog., iv, 1838, 593.

Cotyle serripennis, BOIE, Isis, 1844, 170.

Stelgidopteryx serripennis, BAIRD, Rev. Am. Birds, 1864, 314.

Lustreless brownish-gray, paler below, whitening on the belly. Rather larger than the last. Hooklets on outer web of outer primary wanting, or much weaker in the female.

Habitat, United States, from Atlantic to Pacific, and probably adjoining British Provinces. British Columbia. Rare or wanting in Northeastern States; south to Guatemala.

Abundant summer resident. Breeds. Arrives about the middle of April and remains until September.

Next to the Barn Swallow, this appears to be our most abundant species. It is generally confounded with the Bank Swallow, which it resembles, and with which it frequently associates, sometimes breeding in the same location. A little care will soon enable one to distinguish between the species at a considerable distance. The Rough-winged

Swallow is larger, and has a more labored flight than the Barn Swallow; it lacks the pure white of the under parts, and the pectoral collar is incomplete and obscured. Their notes also differ, the Rough-winged is more noisy, though less so than most other members of the family.

With us, although the greater number are found in the vicinity of water, the Rough-winged Swallow is a bird of general distribution. It was first detected in this State by Dr. Kirtland (Kirkpatrick, l. c.), who found them abundant and nesting in the banks of Rocky River, near his residence. In 1861, I found it common in the vicinity of Columbus, and discovered its nest on a beam under a low bridge. Since then they appear to be increasing in numbers, at least in the city. They nest abundantly in the banks of rivers and creeks, and in gravel pits, where they excavate holes, larger but not so deep as the holes of the Bank Swallow. They generally choose a spot where excavation is easy, an isolated pair often removing a decayed root; small colonies generally excavate their holes between a layer of loam and one of sand, in such a manner that the loam forms the roof, and the sand the floor of the excavation. These holes are dug varying distances from the top of the bank, and vary in depth from one to three feet. Usually a few straws and feathers arranged around the eggs, are the only apology for a nest. Their nests are often in the cracks in the rocks of stone-quarries, and very frequently in the crevices of the piers and abutments of bridges, the foundations of mills, and other masonry. In the city they frequently place their nest in the most frequented places. A pair nested for several successive years not more than thirty feet from the principal business street of this city, occupying a pudlock hole in a brick building, about ten feet from the ground, and below the windows of a telegraph office. Another pair nested in an alley, in a hole in a brick wall under a door in the second story, through which goods were daily raised and lowered by a hoist. They also build on the projecting caps of the large pillars in the porticos of the State House. Mr. Langdon states that they build in barns, but in this vicinity the beams under the floors of bridges are preferred to other wooden structures.

The eggs are five or six, pure white; they measure .75 by .53.

GENUS PROGNE. Boie.

Body stout. Bill robust, lengthened; lower or commissural edge of maxilla sinuated, decidedly convex for basal half, then as concave to the tip, the lower mandible falling within its chord. Nostrils superior, broadly open, and nearly circular; without any adjacent membrane, the edges rounded. Legs stout. Tarsus equal to middle toe without claw; the joint feathered; lateral toes about equal; the basal joint of middle toe half free internally, rather less so externally. Claws strong, much curved.

PROGNE SUBIS Linnæus.

Purple Martin.

Hirundo purpurea, KIRTLAND, Ohio Geolog. Surv., 1838, 162 — READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Hirundo purpurea, KIRKPATRICK, Ohio Farmer, viii. 1859, 299.—WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6; Food of Birds, etc., Ohio Agric. Rep. for 1874, 565; Reprint, 1875, 5.—LANGDON, Cat. Birds of Cin., 1877, 7.

Progne subis, BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 332.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.

Blue Martin, BALLOU, Field and Forest, iii, 1878, 136.

Hirundo subis, LINNÆUS, Syst. Nat., i, 1758, 192.

Hirundo purpurea, LINNÆUS, Syst. Nat., 1766, 344.

Progne purpurea, BOIE, Isis, 1826, 971.

Progne subis, BAIRD, Rev. Am. Birds, 1865, 274.

Lustrous blue black. The female and young are much duller above, and more or less white below, streaked with gray. Length 7 or more; wing nearly 6; tail $3\frac{1}{2}$, simply forked.

Habitat, North America to within Arctic Circle. Bermudas. Accidental in Europe.

Abundant summer resident. Breeds. Arrives about April 1st, and remains until September.

The Martin is so nearly universally an inhabitant of towns and cities that it is difficult to imagine how it found a home before the presence of man afforded a suitable nesting place. Yet some of these birds still adhere to their ancient customs, and rear their young in natural cavities of trees and deserted holes of Woodpeckers, almost within the limits of the city of Columbus. I have found them nesting in Woodpecker's deserted nests in a tall oak at the Columbus Arsenal, and in the cavities of the dead limbs of an elm standing on the bank of the Scioto within the present city limits, and in knot-holes of a walnut tree a few hundred yards south of the last named situation. Whether these were penal colonies, or simply "old fogies," could not be determined, but the young, as they cautiously and painfully crept from their holes to a trembling foothold on the dead limbs, strongly appealed to my sympathy.

Such are their usual nesting places when no human dwellings afford a better choice, and for want of trees they sometimes nest in crevices of rocks. In towns and cities they prefer to nest in Martin boxes or "bird houses" erected for their especial use, and in default of these any sheltered place about a building will do, though the higher the better.

The nest is loosely constructed of leaves, straw, bits of string and paper, lined with feathers. The eggs are pure white, and measure .94 by .79.

After the breeding season is over, these birds congregate towards night in large flocks, and having selected a suitable cornice on some high building, make preparations for spending the night. The retiring ceremony

is very complicated and formal, to judge from the number of times they alight and rise again, all the while keeping up a noisy chatter. It is not until twilight deepens into evening that all are huddled together in silence and slumber, and their slumbers are often disturbed by some youngster who falls out of bed, amid the derisive laughter of his neighbors, which is changed to petulant scolding as he clambers over them to his perch, tumbling others down. All at once the scene of last night's disturbance is quiet and deserted, for the birds have flown to unknown southern lands, where they find less crowded beds, and shorter, warmer nights.

FAMILY AMPELIDÆ. THE CHATTERERS.

Primaries ten, the first less than half the second. Basal joint of middle toe not shorter than that of inner toe; united to the outer for about two-thirds, to the inner for about one-half, its length. Tarsus not longer than middle toe and claw. Gonyes less than half the length of under jaw. Bill triangular, much depressed at base, moderately notched, and hooked at tip.

Sub-family AMPELINÆ. Waxwings.

Nostrils linear, more or less covered by frontal feathers. Wings long, acute, with ten primaries, but the first very short and displaced (on the outer side of the second), so as to be readily overlooked. Inner quills as a rule, and sometimes the tail feathers, tipped with horny appendages, like red sealing-wax. Tail short, square, the under coverts highly developed, reaching nearly to its end. Feet weak; tarsus shorter than middle toe and claw.

GENUS AMPELIS. Linnæus.

Head with a well developed broad soft crest.

AMPELIS GARRULUS Linnæus.

Bohemian Waxwing.

Bombycilla garrula, KIRTLAND, Am. Journ. Sci. and Arts, xl, 1841, 20.—STORER, Proc. Bost. Soc. Nat. Hist., ii, 1845, 52.—READ, Fam. Visitor, iii, 1853, 343; Proc. Phila. Acad. Nat. Sci., vi, 1853, 397.

Ampelis garrulus, BAIRD, P. R. R. Rep., ix, 1858, 317.—KIRKPATRICK, Ohio Farmer, viii, 1859, 339.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 364, 374; Reprint, 6; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 565; Reprint, 5.—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 397.—COUES, Birds of Col. Val., 1878, 461, 467.

Bohemian Waxwing, KIRTLAND, Am. Journ. Sci. and Arts, xiii, 1852, 218; Ohio Farmer, ix, 1860, 91.

Ampelis garrulus, LINNÆUS, Syst. Nat., i, 1758.

Bombycilla garrula, VIEILLOT, Ency. Meth., ii, 1823, 766.

General color brownish-ash, shading insensibly from the clear ash of the tail and its upper coverts and rump into a reddish-tinged ash anteriorly, this peculiar tint heightening on the head, especially on the forehead and sides of the head, into orange-brown.

A narrow frontal line, and broader bar through the eye, with the chin and throat, sooty-black, not sharply bordered with white. No yellowish on belly. Under tail-coverts orange-brown, or chestnut. Tail ash, deepening to blackish-ash towards the end, broadly tipped with rich yellow. Wings ashy-blackish; primaries tipped (chiefly on the outer webs) with sharp spaces of yellow, or white, or both; secondaries with white spaces at the ends of the outer webs, the shafts usually ending with enlarged, horny, red appendages. Primary coverts tipped with white. Bill blackish-plumbeous, often paler at base below. Feet black. Sexes alike. Length, 7 or 8 inches; wing, about $4\frac{1}{2}$; tail, $2\frac{1}{2}$.

Habitat, northerly portions of the Northern Hemisphere. In America, south regularly to the northern tier of States, and in the Rocky Mountains to Colorado; irregularly or casually to about 35° . (Pennsylvania, Ohio, Indiana, Illinois, Kansas, New Mexico and Arizona.)

Winter visitor in Northern Ohio only. Dr. Kirtland's account (l. c., quoted on page 217) is the first record of their appearance in the State, though not the first of their capture within the United States. He afterwards states (l. c., 1852, quoted on page 193) that they visit the vicinity of Cleveland, "almost every winter, and sometimes in large flocks." I am indebted to Mr. Langdon for the following, from Proc. Bost. Soc. Nat. Hist, ii, 1845, 52, Aug. 6:

Dr. D. H. Storer mentioned that he had received a letter from Prof. J. P. Kirtland, of Cleveland, Ohio, dated July 17, 1845, mentioning some facts which might be interesting to ornithologists. At the date of the letter, flocks of Pine Finch, *Fringilla pinea*, were flying about his garden and also the Bohemian Waxwing, *Bombycilla garrula*, thirty or forty specimens of which had been taken.

In 1860 (l. c. Ohio Farmer, quoted under *Hesperiphona*), Dr. Kirtland again mentions their occurrence, and says they are attracted by the berries of the mountain ash and red cedar, and fruit of the persimmon. Mr. Kirkpatrick adds the berries of the hawthorn to their bill of fare. Mr. Read repeats the statement that they are present nearly every year. Dr. Coues (l. c. Birds of Col. Val.) mentions their casual occurrence in severe winters in Southern Ohio, which I have not been able to verify.

This bird is known everywhere as a wanderer. Only in a few instances have its breeding places been discovered. In this country its nest has been found by Mr. Kennicott on the Yukon, and by Mr. McFarlane on the Anderson River. Dr. Coues (l. c.,) says:

"The bird undoubtedly nests in the United States. While in the Rocky Mountains, at latitude 49° , I secured a newly fledged bird, so young that there is no reasonable doubt that it was bred in the vicinity. The specimen was shot in thick coniferous woods, at an attitude of about 4,200 feet, on the 19th of August, 1874. No migration had been begun at the time, and no other individuals were observed, as would likely have been the case had they been roving away from their summer home."

"The egg obtained by Kennicott on the Yukon is smaller than the European speci-

men, measuring .90 by .65 of an inch. Its ground is more of a greenish-slate or stone-color, and the spots are of a dark-brown, with a deep violet shading." (*Brewer, l. c.*)

AMPELIS CEDRORUM (V.) Gray.

Cedar Bird; Cherry Bird.

Bombycilla carolinensis, KIRTLAND, Ohio Geolog. Rep., 1833, 162.—READ, Fam. Visitor, iii, 1853, 343; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Ampelis cedrorum, BAIKÖ, P. R. R. Rep., ix, 1858, 318.—KIRKPATRICK, Ohio Farmer, viii, 1859, 347.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 364; Reprint, 6; in *Cones' Birds of N. W.*, 1874, 233; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 565; Reprint, 5.—LANGDON, Cat. Birds of Cin., 1877, 7; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 174; Reprint, 8.

Cedar Bird, RALLOU, Field and Forest, iii, 1878, 136.

Bombycilla carolinensis, BRISSON, Orn., ii, 1760, 337. (Not binomial.)

Bombycilla cedrorum, VIEILLÖT, Ois. Am. Sept., i, 1807, 88.

Ampelis cedrorum, GRAY, Gen. of Birds, i, 1849, 278.

General color as *garrulus*. Under tail-coverts whitish; little or no orange-brown about head; no white on wings; chin black, shading gradually into the color of the throat; a black frontal, loreal and transocular stripe as in *garrulus*, but this bordered on the forehead with whitish; a white touch on lower eyelid; feathers on side of lower jaw white; abdomen soiled yellowish; tail tipped with yellow. Length, 7-7½; wing, about 3½.

Habitat, North America at large, to latitude 54° N. or beyond; south through Mexico and Central America. Bermudas. Jamaica. Cuba. Accidental in England.

Usually abundant resident. Breeds. The Cedar Bird, or Cherry Bird, as it is generally called in Ohio, though classed among the resident birds, is named as resident only from the fact that it appears at any time during the year. Usually more of them are to be seen in the month of May than at other times, when they appear in close flocks of usually from 20 to 50. At this time their food is insects, and they display excellent qualities as fly-catchers, flying farther from their perch to secure their prey than any other bird of fly-catching habits, except the Swallows. Their flight is easy, undulating, and swift, and the whole flock moves as if by the impulse of a single will. Their note is a short wheezy whistle, and they have no song. They continue in flocks until breeding commences, which is not till late in June, and as soon as their young are fledged they again assemble in companies. These birds are rather stupid, and very great gormandizers. In fact, their movements all seem prompted by their appetites. They are very fond of cherries, and a flock of them in a cherry tree is an entertaining sight to those who are not especially interested in the fruit. When a flock alights, they sit motionless and erect for a time, like parrots, then by a movement of the head and neck, each one takes a survey of his immediate

surroundings, and one by one they proceed to the chief business of their lives. They eat until they can eat no longer, and are hardly able to move. As Mr. Read says, they are "very polite, passing food to one another."

In the fall they feed on the berries of the gum tree and poke-berries; in the winter on the berries of the mountain ash and red cedar. I have never seen them on the ground. With us they are less common in winter.

The nest of the Cedar Bird is built on the horizontal branch of a tree, at varying distances from the ground. Sycamore trees furnish favorite sites, but they often breed in orchards. The nest is large, composed of twigs and vegetable fibres, and lined with grass. The eggs are usually five, grayish-blue, varying from a light slate to stone color, blotched with very dark brown and purplish. They measure about .85 by .65. While nesting the old birds are very silent.

In regard to "sealing-wax" tips to secondary quills of birds of this genus, Dr. Coues (Birds of Col. Val., 452) says they "have been subjected to chemical and microscopical examination by L. Stieda, and shown to be the enlarged, hardened, and peculiarly modified prolongation of the shaft itself of the feather, composed of central and peripheral substances, differing in the shape of the pigment cells, which contain abundance of red and yellow coloring matter." My own opinion has always been that these tips were both the end of the shaft and terminal laminæ of the vane, which were agglutinated together by a deposit of red coloring matter. These tips are sometimes found upon the tail-feathers of the Cedar Bird. In a spring male in high plumage before me, they are on all the feathers, not as well developed as on the secondaries, but the red coloring matter on the shaft forms a streak which extends nearly the width of the yellow tip of the tail-feathers, more distinct above than below. The terminal laminæ project at the end as if the feather had been trimmed to a small triangular point. This triangle is red, and the laminæ more or less adherent and stiff, though readily separated from each other by slight pressure. On most of the feathers there is a narrow red edging extending across the end of the feathers, and the *under tail-coverts* are distinctly *red-tipped*.

The tips to the secondaries vary in number and development at different times. They are most numerous and highly developed in spring, in the latter part of summer often entirely wanting. They may be present in young birds in first plumage.

FAMILY VIREONIDÆ. THE VIREOS.

Primaries ten, the first less than half the second, or rudimentary and displaced, concealed on the outer side of second. Basal joint of middle toe shorter than that of inner toe, and wholly adherent to both inner and outer toes. Tarsus longer than middle toe and claw. Gonys more than half the length of the lower jaw. Bill stout, high, compressed; notched and abruptly hooked at tip.

GENUS VIREO. Vieillot.

Wings pointed or rounded; longer than the even or rounded tail.

The following is compiled from Dr. Cones'

ANALYSIS OF SPECIES.

- * Primaries apparently only 9, the first being rudimentary or displaced (occasionally quite visible).
 † Throat and breast yellow, abdomen white. - V. FLAVIFRONS.
 †† No definite yellow below. *
 a Sides of crown with black streaks. V. OLIVACEUS.
 a a No black on crown. - V. PHILADELPHICUS.
 * * Primaries 10, the first short and "spurious."
 ‡ Wing bars wanting. V. GILVUS.
 ‡‡ Wing-bars present.
 b Length over five inches. - - V. SOLITARIUS.
 b b Length under five inches. V. NOVEBORACENSIS.

VIREO OLIVACEUS (L.) V.

Red-eyed Vireo.

Vireo olivaceus, KIRTLAND, Ohio Geolog. Surv., 1838, 163.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—BAIRD, P. R. R. Rep., ix, 1858, 312.—WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6; Food of Birds, etc., Ohio Agric. Rep. for 1874, 565; Reprint, 1875, 5.—LANGDON, Cat. Birds of Cin., 1877, 7.

Vireosylva olivaceus, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.

Red-eyed Vireo, BALLOU, Field and Forest, iii, 1878, 136.

Muscicapa olivacea, LINNÆUS, Syst. Nat., i, 1766, 327.

Vireo olivaceus, "Vieillot," BONAPARTE, Ann. Lyc. N. Y., ii, 1826, 71.

Vireosylva olivacea, BONAPARTE, Con. Av., 1850, 329.

Vireosylva olivaceus, BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 363.

Above olive green; crown ash, edged on each side with a blackish line, below this a white superciliary line, below this again a dusky stripe through the eye; under parts white, faintly shaded with olive along sides, and tinged with olive on under wing and tail coverts; wings and tail dusky, edged with olive outside, with whitish inside; bill dusky, pale below; feet leaden-olive; eyes red; no spurious quill. Large, $5\frac{2}{3}$ — $6\frac{1}{2}$; wing, $3\frac{1}{2}$ — $3\frac{3}{4}$; tail $2\frac{1}{2}$ — $2\frac{3}{4}$; bill, about $\frac{3}{8}$; tarsus, $\frac{3}{4}$.

Habitat, chiefly Eastern North America to Hudson's Bay; Greenland; west to Rocky Mountains, and even beyond; Washington Territory; Utah; south to New Granada and Trinidad. Cuba. Accidental in England.

Abundant summer resident from the last week in April to October. Breeds. The Red-eyed Vireo is the most abundant species of the family with us. It frequents woodland, though often seen in open places, and even in cities, especially during the migrations. Its song is shorter, louder, and more vigorous than that of the Warbling Vireo. Its call note is short and harsh. Both are heard during the whole day. The Red-eyed Vireo, like all others of the family, subsists chiefly upon insects which he captures on the wing like the true fly-catchers, and hunts for on the branches and leaves. In the fall, however, it becomes quite frugivorous, feeding upon various berries. Its plumage is frequently soiled with the red juice of the pokeberry.

The nest of this bird, as of all others of the family, is pensive, its rim being attached to the horizontal fork of a twig. It is usually placed from five to twenty five feet of the ground. The walls are thin, composed for the most part of vegetable fibres, which are bleached to a uniform wood color, and firmly felted together; the lining is of grass, sometimes mingled with horsehairs and bits of newspapers. The eggs are pure white, sparsely marked with small round spots of very dark brown. They measure about .85 by .56.

VIREO PHILADELPHICUS (Cassin) Bd.

Philadelphia Vireo.

Vireo philadelphicus, BAIRD, P. R. R. Rep., ix, 1858, 335.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 365, 374; Reprint, 7, 16; in Coues' Birds N. W., 1874, 233; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 565; Reprint, 5.—LANGDON, Cat. Birds of Cin., 1877, 7; Journ. Cin. Soc. Nat. Hist., i, 1878, 114; Reprint, 5.

Vireosylvia philadelphica, BAIRD, Rev. Am. Birds, 1865, 34.

Vireosylvia philadelphicus, BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 367.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 173; Reprint, 7.

Vireosylvia philadelphica, CASSIN, Proc. Phila. Acad., 1851, 153.

Above, dull olive-green, brightening on the rump, fading insensibly into ashy on the crown, which is not bordered with blackish; a dull white superciliary line; below, palest possible yellowish, whitening on throat and belly, slightly olive-shaded on sides; sometimes a slight creamy or buffy shade throughout the under parts; no obvious wing bars; no spurious quill. Length, $4\frac{1}{2}$ – $5\frac{1}{4}$; wing, about $2\frac{3}{8}$; tail, about $2\frac{1}{4}$; bill, hardly or about $\frac{1}{4}$; tarsus, $\frac{3}{8}$.

Habitat, Eastern North America, especially the Mississippi Valley; north to Hudson's Bay; south to Guatemala. Rare in the Atlantic States and New England.

Not very common but regular spring and fall migrant, in May and September. The Philadelphia Vireo is one of the most interesting of the family, because of its comparatively recent discovery and general rarity. It frequents woodland and the wooded borders of streams. I

have seen a single individual in my garden. In the spring they are found singly or in pairs, sometimes in high ash trees, but usually in the branches of undergrowth in beech woodland. In the fall I have found them in flocks, in company with Red-eyed Vireos and Bay-breasted Warblers. Fall specimens are decidedly yellow below. A little acquaintance will enable an observer to determine the species at sight as readily as the family to which it belongs. Its smaller size and olive-green, without marked ashyness of the upper parts, readily separate it from the Warbling Vireo, while the absence of wing-bars as readily distinguishes it from the White-eyed Vireo. So far as I can ascertain, they are mute when on their migrations.

The Philadelphia Vireo was first described by Cassin in 1851, from a single specimen taken in the vicinity of Philadelphia nine years before. An Ohio specimen was presented to the Museum of the Smithsonian Institution by Dr. Kirtland previous to 1858. It is reported common during the migrations in Wisconsin. Its place and manner of breeding are unknown.

I have seen at least three specimens which have a short exposed first primary; in one this feather was exposed for over one fourth of an inch, and normally situated with reference to the second quill; in the other two specimens the rudimentary first primary projected somewhat less beyond the greater coverts, but was somewhat displaced, though less so than is ordinarily the case. The presence of a spurious primary in *Vireo olivaceus* has been noted by Mr. C. F. Batchelor (Bull. Nutt Orn. Club, iii, 1878, 97). It should, however, be understood that birds of this genus described as having nine primaries, have been shown to have really ten, the first being short, rudimentary and displaced (lying in the same plane as, and concealed by the primary or greater wing-coverts). The discovery of this fact was made by Prof. Baird, and the subsequent researches of Dr. Coues render it probable that all so called nine-primaried birds really possess ten, the first rudimentary. On this subject Dr. Coues (Birds of Col. Val., 1878, 486) says:

Believing this to be an important matter deserving of further investigation, I was not long since led to examine the general question, with satisfactory results. I verified Professor Baird's observations in many more cases, extending them to include all our North American families excepting perhaps *Laniidæ* (in *Lanius*) and *Ampelidæ* (in *Ampelis*). The clue to the search for the apparently wanting primary was given by Baird (Review, pp. 160, 325), from which it appears that in all those Vireos which seem to have only nine primaries, two little feathers, distinct in size and shape, and somewhat so in position, are found at the base of the supposed first primary; while in Vireos, with obviously ten primaries, there is only one such little feather. With the possible exception of *Ampelis* and *Lanius*, in which I did not make out the state of the parts sat-

isfactorily, I find that in all of the numerous North American genera examined, those of ten primaries show but one of these little feathers, while the rest have two. In the family *Alaudidae*, as in *Vireonidae*, some genera have ten primaries, others apparently only nine; and in our genus *Eremophila*, in which only nine are developed, there are two of the little feathers just mentioned, the overlying one being exactly like one of the primary coverts, the other, though not very similar, more resembling an abortive primary. *Alauda arvensis*, which shows a minute but obvious spurious quill, has but one such little feather; and in *Galerita cristata*, with a spurious quill about two-thirds of an inch long, there is likewise but one. In Clamatorial *Passeres*, perhaps without exception, there are ten fully developed primaries, the first of which may equal or exceed the next in length; and in the single North American Clamatorial family, *Tyrannidae*, I find, as before, only one of these little feathers. In a Woodpecker, remarkable among Picarian birds for possessing only nine long primaries, the first being short or spurious, there is also but one.

It thus seems to be established that among supposed nine-primaried birds, the additional one, making ten in all, is normally represented by the second one of these tiny quills which overlie the base of the outermost fully developed feather; it being the same little quill which in ten primaried *Oscines*, in *Clamatores*, and probably other birds, comes to the front and constitutes the first regular primary, either remaining quite short, when it is the so-called "spurious" primary, or lengthening to equal or exceed the other primaries in extent.

It becomes an interesting question whether *both* of these minute quills be not rudimentary primaries, as one of them certainly is. I have failed to detect any material difference between the two in *size*, *shape*, or *position*. One overlies the other, indeed, as a covert should a primary, but the two are together inserted side by side on the upper side of the first fully developed quill; both are rigid and acuminate, more like primaries than like coverts, and both are abruptly shorter than the true primary coverts. So far, all the evidence favors the supposition that *both* are rudimentary primaries. On the other hand, coloration is against such hypothesis, as in the original case of *Vireo flavifrons*, in which Baird determined the underlying one of these two little feathers to be the missing primary, mainly because it was colored like the primaries, the overlying one resembling the coverts in coloration. But the color test is often inapplicable, coverts and primaries being usually like each other in this respect, and color sometimes points the other way. Thus, in *Sitta carolinensis*, a ten-primaried Oscine with spurious first primary, the single remaining little feather is white at base across both webs, like the primaries, the true primary coverts being white only on the inner web.

VIREO GILVUS (V.) Bp.

Warbling Vireo.

Vireo gilvus, KIRTLAND, Ohio Geolog. Surv., 1838, 183, 180 — READ, Fam. Visitor, iii, 1853, 383; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395. — WHEATON, Ohio Agric. Rep. for 1860, 364; Reprint, 1861, 6; Food of Birds, etc., Ohio Agric. Rep. for 1874, 565; Reprint, 1875, 5. — LANGDON, Cat. Birds of Cin., 1877, 7.

Vireosylvia gilvus, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 174; Reprint, 8.

Warbling Vireo, BALLOU, Field and Forest, iii, 1878, 136.

Muscicapa gilva, VIEILLLOT, Ois. Am. Sept., i, 1807, 65.

Vireo gilvus, BONAPARTE, Journ. Phila. Acad, iv, 1824, 174.

Vireosylva gilva, CASSIN, Proc. Phila. Acad., 1851, 153.

Vireosylva gilvus, BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 368.

Primaries ten, the exposed portion of the first of which is one-third or less of the second, no obvious wing-bars, no blackish stripe along the side of the crown, and no abrupt contrast between color of back and crown. Upper parts greenish, with an ashy shade, rather brighter on the rump and edgings of the wings and tail, anteriorly shading insensibly into ashy on the crown. Ash of crown bordered immediately by a whitish superciliary and loreal line; region immediately before and behind the eye dusky ash. Below, sordid white with faint yellowish (sometimes creamy or buffy) tinge, more obviously shaded along the sides with a dilution of the color of the back. Quills and tail-feathers fuscous, with narrow external edgings as above said, and broader whitish edging of the inner webs; the wing coverts without obvious whitish tipping. Bill dark horn-color above, paler below; feet plumbeous. Iris brown. Length, 5 inches, or rather more; wing, 2.80; tail, 2.25; bill, .40; tarsus, .67.

. Habitat, Temperate Eastern North America; west to the high central plains (beyond which replaced by var. *swainsoni*); south to Mexico.

Abundant summer resident from April 25th to October. Frequents especially the wooded banks of streams, groves, and the shade-trees of the city, breeding in all these locations; seldom in dense woodland. The ordinary note of this bird is short, querulous, and scolding, but its song is one of the most varied, prolonged, tender, and sweet of our summer birds.

The nest of this bird resembles that of the Red-eyed Vireo, both in the materials of which it is composed, and its general structure, but it is usually at a very considerable distance from the ground.

The eggs are five, white, sparingly spotted with dark brown, sometimes blotched with reddish-brown, and still more rarely immaculate. They measure from .75 to .70 of an inch in length, and average about .55 in breadth.

VIREO FLAVIFRONS V.

Yellow-throated Vireo.

Vireo flavifrons, KIRTLAND, Ohio Geolog. Surv., 1838, 163.—READ, Fam. Visitor, iii, 1853, 375; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—BAIRD, P. R. R. Rep., ix, 1858, 342.

WHEATON, Ohio Agric. Rep. for 1860, 365; Reprint, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 564; Reprint, 1875, 5.—LANGDON, Cat. Birds of Cin., 1877, 7.

Vireosylva flavifrons, BAIRD, Rev. N. A. Birds, 1866, 346.

Lanivireo flavifrons, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 174; Reprint, 8.

Vireo flavifrons, VIEILLOT, Ois. Am. Sept., i, 1807, 85.

Lanivireo flavifrons, LAWRENCE, Ann. Lyc. N. Y., ix, 1868, 96.

Above, rich olive-green, crown the same or even brighter, rump insensibly shading into bluish-ash; below, bright yellow, belly and crissum abruptly white, sides anter-

iorly shaded with olive, posteriorly with plumbeous; extreme forehead, superciliary line, and ring around eye, yellow; lores dusky; wings dusky, with the inner secondaries broadly white-edged, and two broad white bars across tips of greater and median coverts; tail dusky, nearly all the feathers completely encircled with white edging; bill and feet dark leaden-blue; no spurious quill. Length, $5\frac{1}{4}$ -6; wing, about 3; tail, only about $2\frac{1}{2}$.

Habitat, Eastern United States and British Provinces; west to Iowa and Kansas; south to Mexico, Central America, and British Columbia. Cuba.

Common summer resident, especially in Northern Ohio. Breeds. Mr. Langdon gives it as largely migrant in the vicinity of Cincinnati, where but a few remain and breed. In the immediate vicinity of Columbus, it is a not common spring and fall migrant in the last week of April, May, and September, but I have found them nesting in oak woods, ten or twelve miles distant. Mr. Read states that it is abundant in Northern Ohio.

The Yellow-throated Vireo frequents secluded woods and banks of ravines and streams, and appears to be partial to oak forests. They are generally seen high in the trees, usually singly or in pairs. The song of the male is shorter than that of the Warbling Vireo, less varied, and in a higher key. In Massachusetts its habits are described by Dr. Brewer as very different. He states that he has "found no one of the genus so common in the vicinity of dwellings, or more familiar and fearless in its intercourse with man." In our gardens it is a rare visitor in May.

The nest of this bird is constructed much like that of other members of this genus, except that it is profusely covered with moss. It is attached to a fork of one of the lower branches of a tree, from three to ten feet from the ground. The eggs are white, marked with spots of rosey-brown, and measure about .83 by .64.

VIREO SOLITARIUS (Wils.) V.

Blue-headed Vireo; Solitary Vireo.

Vireo solitarius, WHEATON, Ohio Agric. Rep. for 1860, 365, 375; Reprint, 1861, 7, 17; Food of Birds, etc., Ohio Agric. Rep. for 1874, 565; Reprint, 1875, 5.—LANGDON, Cat. Birds of Cin., 1877, 7; Journ. Cin. Soc. Nat. Hist., i, 1878, 114; Reprint, 5.

Lanivireo solitarius, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 174; Reprint, 8.

Muscicapa solitaria, WILSON, Am. Orn., ii, 1810, 43.

Vireo solitarius, VIELLOT, "Nouv. Dict. d'Hist. N.," xi, 1817.

Lanivireo solitarius, ALLEN, Am. Nat., iii, 1869, 507, 579.

Above, olive-green, crown and sides of head bluish-ash in marked contrast; a broad white line from nostrils to and around eye and a dusky loreal line; below white, flanks washed with olivaceous, and axillaries and crissum pale yellow; wings and tail dusky, most of the feathers edged with white or whitish, and two conspicuous bars of the same

across tips of middle and great coverts; bill and feet blackish horn-color. Length, $5\frac{1}{2}$ – $5\frac{3}{4}$; wing, $2\frac{1}{2}$ –3; tail, $2\frac{1}{4}$ – $2\frac{3}{8}$; spurious quill $\frac{1}{2}$ – $\frac{3}{8}$, about $\frac{1}{2}$ as long as second.

Habitat, United States and Canada; south to Central America. Cuba.

Not common spring and fall migrant in Southern and Middle Ohio, probably summer resident in Northern Ohio. I have taken it in May, September, and October. With us they are found usually in the lower branches of trees or the higher branches of undergrowth. They are quiet and shy, always solitary, and apparently fatigued, or at least not quite at home with us.

The Solitary or Blue-headed Vireo appears to be a bird of unequal distribution. Mr. Gentry, speaking of their presence in the vicinity of Philadelphia, where they breed, states that it had recently become much more abundant than formerly, and that during some seasons it was nearly as abundant as the Red-eyed Vireo. In Massachusetts, according to Dr. Brewer, it has been found in a few restricted localities. He describes its song as "a prolonged and very peculiar ditty, repeated at frequent intervals, and always identical. It begins with a pleasant warble, of a gradually ascending scale, which at a certain pitch suddenly breaks down into a falsetto note. The song then rises again in a single high note, and ceases."

The nest is described as being rather more loosely constructed than that of other Vireos, and as exhibiting more variety in the materials of which it is composed. It is usually placed within twelve feet of the ground. The eggs are five, of a less crystalline whiteness than those of most Vireos, and spotted uniformly with reddish-brown and dark red. They measure about .77 by .52.

VIREO NOVEBORACENSIS (Gm.) Bp.

White-eyed Vireo.

Vireo noveboracensis, KIRTLAND, Ohio Geol. Surv., 1838, 163.—READ, Fam. Visitor, iii, 1853, 375; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 365; Reprint, 1861, 7; Food of Birds, etc., Ohio. Agric. Rep. for 1874, 565; Reprint, 1875, 5.—LANGDON, Cat. Birds of Cin., 1877, 7; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 174; Reprint, 8.

Muscicapa noveboracensis, GMELIN, Syst. Nat., i, 1788, 947.

Vireo noveboracensis, BONAPARTE, Journ. Phila. Acad., iv, 1824, 176.

Above, bright olive-green, including crown; a slight ashy gloss on the cervix, and the rump showing yellowish when the feathers are disturbed; below, white, the sides of the breast and belly, the axillars and crissum, bright yellow; a bright yellow line from nostrils to and around eye; lores dusky; two broad yellowish wing-bars; inner secondaries widely edged with the same; bill and feet blackish plumbeous; eyes white. Length,

about 5 inches; wing, $2\frac{1}{2}$ – $2\frac{3}{4}$; tail, $2\frac{1}{4}$; spurious quill, $\frac{3}{4}$, half as long as the second, which about equals the eighth; tarsus, about $\frac{3}{4}$; middle toe and claw, $\frac{1}{2}$; bill, under $\frac{1}{2}$.

Habitat, Eastern United States, excepting perhaps parts of New England; west to Dakota, Kansas, and Western Texas; south to Guatemala. Bermudas. Cuba.

Common summer resident from the last week in April to the last of September, but of irregular distribution. In some localities apparently well suited to its habits, it is never seen. Breeds. Dr. Kirtland names it without comment. Mr. Read says it is abundant throughout the summer. Mr. Langdon gives it as a common summer resident. I have never been able to find it in the vicinity of Columbus.

This little bird, the smallest of the family breeding with us, has many peculiarities besides its white eyes. It is a frequenter of low thickets, while the others of the family are found in woodland. It is not a whit behind its relatives in reputation for courage in defense of itself when wounded, or of its nest and young. Dr. Coues (Birds Col. Val., 524) says of it:

"The White-eyed Vireo has always been notable, even in groups of birds whose spirit is high, for its irritable temperament; and during the breeding season, nothing can surpass the petulance and irascibility which it displays when its home is too nearly approached, and the fuss it makes when its temper is ruffled in this way. It skips about in a panicky state, as regardless of exposure as a virago haranguing the crowd on a street corner, seemingly at such loss for adequate expletives that we may fancy it quite ready to say "Thank you," if somebody would only swear a little. Like the Wrens and Titmice—like various birds, in fact, which live habitually in shrubbery, where they have to peer and pry about to see well—these Vireos show a good deal of curiosity and inquisitiveness when anything is going on that they do not quite understand; and if we take care not to frighten them into a flutter of excitement, they frequently come almost within arms' reach by slow and devious approaches, poising curiously on one twig after another, and soliloquizing the while in their quaint fashion. Their uneasiness, however, is chiefly exhibited during the breeding season, and all their vehemence is but the excess of their concern for their little families, which, as they seem to be aware, are peculiarly exposed to danger in their lowly homes; their ardor exhausts itself when the occasion is past, and what had been excessive solicitude gives way to the simple sprightliness and vivacity, which then appears as an agreeable trait. In the springtime they rival their relatives in brilliancy and versatility of song, which must be heard to be appreciated; it is a curious medley, delivered with great earnestness and almost endless variations, scarcely to be described in words."

The nest is suspended from a fork of a bush or low sapling, seldom more than six feet above the ground, and generally so low that its contents are visible to the passer by. It is composed of moss, fibres of bark, bits of leaves, grass, and such other articles as the birds may consider either useful or ornamental. Wilson nicknamed it "the Politician," because it frequently used bits of newspaper in the construction of its

nest. The eggs are usually five, white, with purple and reddish-brown dots. They measure .78 by .60.

FAMILY LANIIDÆ. THE SHRIKES.

Primaries ten. Tarsi distinctly scutellate. Nostrils overhung (not concealed) by bristly feathers. Rictal bristles present, strong. Bill powerful, compressed, strongly notched, toothed and hooked. Wings and tail moderate. Large. Colors black, white, and gray.

Sub-family LANIINÆ. Typical Shrikes.

Bill very powerful, much compressed, with a very prominent tooth behind the notch. Wings considerably rounded. Tail rather long and graduated. Sides of tarsi in part scutellate. Lateral toes about equal.

GENUS LANIUS (Linnaeus.) Coues.

Base of bill, including nostrils, covered by bristly feathers directed forwards. Tip of under mandible bent upward in a hook. Rictus with long bristles. Tail longer than wings, much rounded, the feathers broad. Claws sharp and much curved. Body robust.

LANIUS BOREALIS Vieillot.

Great Northern Shrike; Butcher bird.

Lanius septentrionalis, KIRTLAND, Ohio Geolog. Surv., 1838, 163, 181.—READ, Fam. Visitor, iii, 1853, 351; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Collyrio borealis, BAIRD, P. R. R. Rep., ix, 1858, 325.—WHEATON, Ohio Agric. Rep. for 1860, 364, 374; Reprint, 1861, 6, 16.

Collurio borealis, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 565; Reprint, 1875, 5.—LANGDON, Cat. Birds of Cin., 1877, 7; Revised List, Journ. Civ. Soc. Nat. Hist., i, 1879, 174; Reprint, 8.—MARSHALL, Journ. of Science (newspaper, Toledo, O.), new series, ii, 1879, No. 6 (nesting).

Northern Butcher Bird, KIRTLAND, Ohio Farmer, ix, 1860, 91.

Lanius borealis, VIEILLOT, Ois. Am. Sept., i, 1807, 90.—COUES, Birds Col. Val., i, 1878, 558.

Lanius septentrionalis, BONAPARTE, Ann. Lyc. N. Y., ii, 1826, 72, 438.

Collyrio borealis, BAIRD, Birds N. Am., 1858, 324.

Collurio borealis, BAIRD, Rev. Am. Birds, 1866, 440.

Clear bluish-ash, blanching on the rump and scapulars; below white, always vermiculated with fine wavy blackish lines; a black bar along side of the head, not meeting its fellow across forehead, interrupted by a white crescent on under eyelid, and bordered above by hoary white that also occupies the extreme forehead; wings and tail black, the former with a large spot near base of the primaries, and the tips of most of the quills white, the latter with nearly all the feathers broadly tipped with white, and with concealed white bars; bill and feet black. Length, 9-10; wing, 4½; tail rather more. The young are similar, but none of the colors are so fine or so intense; the entire plumage has a brownish suffusion, and the bill is flesh-colored at base.

Habitat, North America, northerly; south in winter to about 35°. Bermudas.

Irregular and not very common winter visitor from November to April. Neither Dr. Kirtland during the time embraced by his writings, nor Mr. Read, were aware of the presence in Ohio of any other species of this family. The former states that it is an occasional visitor in the cold season, and in the Ohio Farmer (l. c.) that none made their appearance in the mild winter of 1859-60. Mr. Read gives it as rare in his Catalogue, but in the Family Visitor states that it is "frequently seen at all seasons of the year," which may, I think, indicate the presence of the following species. I have been informed that this species breeds in the vicinity of Cleveland, but on an examination of specimens, the White-rumped Shrike had been mistaken for it. The only record of its breeding within the State is that of Mr. D. M. Marshall, of Oswego, N. Y., (l. c.) who says:

"The first specimen I ever obtained was about three miles west of Oswego, N. Y. I shot both the male and female of the birds, and also got the nest, which was in an apple tree, about fifteen feet from the ground. The nest was about the size of that of a robin, and was made from twigs and pieces of an old newspaper. It was very nicely lined with poultry feathers, and contained five eggs, of a light gray color, speckled with darker spots of a greenish-brown. * * * I found a nest of this kind about two weeks ago, three miles east of Toledo, O, in an orchard. The nest was about twenty feet from the ground, and was built upon the top of an old robin's nest. I have found two of their nests since then."

The above statement is sufficiently positive, but not sufficiently minute as to identification. Mr. Marshall writes from a locality where Dr. Brewer writes me the Northern Shrike breeds "sure enough," but I am not so sure that Mr. Marshall has not mistaken *excubitorides* for *borealis*, and have endeavored to obtain from him more definite information, thus far without success. Until we have more than a simple assertion to that effect, the case of the Northern Shrike breeding in Ohio must be considered as not proven.

The Shrikes are the "Bushwhackers" among birds. No others are so notorious for cruelty and rapacity. They kill not only for food, but apparently for the gratification of a blood-thirsty instinct, which has no parallel among our Birds of Prey. They alone, of all birds, impale their victims upon thorns and twigs. Their food consists of mice, small birds, beetles and grasshoppers. They capture mice and birds much in the manner of hawks, lying in wait for and pouncing upon them from an elevation. If their captive is not required for immediate use, it is impaled by the neck upon a thorn or sharp twig. Mr. Marshall says that he has seen a bird "flying towards its nest with a mouse hanging from the bill by the neck. The bird alighted on a twig, and holding

the mouse by the neck with the bill, pushed it upon a thorn, and after it was impaled, struck it two or three blows by the bill on the head to make its position secure; the thorn ran through the neck of the mouse. It was only five or six feet from the nest in the same tree." He also says that a friend once saw a Butcher Bird carrying a live garter snake in its bill, which the bird adroitly fastened upon a thorn. After the snake was impaled he took it still alive from the thorn. He examined several mice and small birds impaled upon thorns in this manner, and thinks that the Butcher Bird produces death by strangulation, as there were no marks of violence upon them.

In eastern cities these birds sometimes appear in considerable numbers, and prey upon the English Sparrows, and are so bold as frequently to fly into houses and attack caged birds. With us, however, they confine themselves to fields with solitary trees and fence rows. They exhibit great curiosity when first they discover a human being, but this is soon exhausted, and they become very shy and wary, exhibiting a tantalizing skill in evading capture.

They have a habit of pursuing small birds for the sole purpose of annoying and terrifying them, and in so doing exhibit a considerable acquaintance with their habits. Such birds as the Yellow-bird, they attempt to drive into thickets and prevent from flying, by keeping constantly above them, but such as naturally take refuge in low places, as most Sparrows, they drive into the upper branches of trees, following them from branch to branch, but keeping always below them. When engaged in this amusement, their actions strongly resemble those of the Jay.

Their flight is quick and varied, sometimes undulating and protracted, and at others accomplished by quick short strokes of partially extended wings, somewhat after the manner of the Spotted Sandpiper. When pursued, they often fly low, taking advantage of trees, fences, or inequalities of the ground for concealment.

Their notes are singular, sometimes loud and shrill, when they have been compared to the noise made by the creaking of a tavern sign; at other times finely modulated, and said, though the general appearance of the bird doubtless suggests the comparison, to resemble the notes of the Mocking-bird. They are also said to imitate the cries of other birds in distress, for the purpose of decoying them. The nest of the Butcher Bird is built in trees. It is large, and except the base of twigs and stalks, is composed of soft mosses, stems, and grasses, thoroughly felted together, and lined abundantly with down and feathers. "The egg measures 1.10 inches by .80, and is of a light greenish-ground, marbled

and streaked with blotches of obscure-purple, clay-color, and rufous-brown."

LANIUS LUDOVICIANUS Linnæus.

var. LUDOVICIANUS Cs.

Loggerhead Shrike.

Collyrio ludovicianus, WHEATON, Reprint Ohio Agric. Rep. for 1860, 1861, 21, (probable).

Collurio ludovicianus, WHEATON, in Coues' Birds of N. W., 1874, 233; Food of Birds, etc.,

Ohio Agric. Rep. for 1874, 565; Reprint, 1875, 5.—LANGDON, Cat. Birds of Cin., 1877, 8; Journ. Cin. Soc. Nat. Hist., i, 1878, 114; Reprint, 8.

Collurio ludovicianus, var. *ludovicianus*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 174; Reprint, 8; Bull. Nutt. Orn. Club, iv, 1879, 120.

Lanius ludovicianus, var. *ludovicianus*, COUES, Birds of Col. Val., i, 1878, 563.

Lanius ludovicianus, BRISSON, Orn., ii, 1760, 162 (not binomial).—LINNÆUS, Syst. Nat., i, 1766, 134.

Collyrio ludovicianus, BAIRD, Birds N. Am., 1858, 325.

Collurio ludovicianus, BAIRD, Rev. N. A. Birds, 1866, 443.

Slate colored, slightly whitish on the rump and scapulars; below, white, with a few obscure wavy black lines, or none; black bar on one side of the head, meeting its fellow across the forehead, not interrupted by white on under eyelid, and scarcely or not bordered above by hoary white; otherwise like *borealis* in color, but smaller; 8-8½; wing, about 4; tail rather more.

Habitat, South Atlantic and Gulf States; north to Mississippi and Ohio Valley, and recently (?) extending to New York, Connecticut, Massachusetts, and even Maine. California.

Common summer resident in Middle, less common in Northern and Southern Ohio. Arrives during the first week in March, noted March 4th for several consecutive years, and remains until September. First ascertained to occur in Ohio by myself in 1874, a female specimen, taken May 31, 1873, on which my note in Coues' Birds of the Northwest was in part based, proving a nearly typical specimen of this variety. Her mate was an equally well marked individual of var. *excubitoroides*. Since then it has continued to be our commonest bird of the family. Mr. Langdon gave it as rare in 1877, mentions its increasing numbers and breeding in 1878, and considers it an uncommon resident in 1879.

The recognized range of this species has changed greatly within a few years. As late as 1874, the highest authorities confined it to the Southern States, though it had previously been noted in Illinois by Holder in 1861, and in Wisconsin by Dr. Hoy in 1853, who also includes *excubitoroides* in his list. Since then the species, especially this variety, seems to have vastly extended eastward, having been found in most of the above named States breeding.

The habits of the Loggerhead are essentially the same as those of the

Northern Shrike. Probably fewer quadrupeds and birds compose its fare, with a greater proportion of insects and small reptiles. They are not less savage and bloodthirsty than the Northern Shrike. The young are frequently caught and sold to the uninitiated for young Mocking-birds, but if two of them be placed in the same cage, the doctrine of the "survival of the fittest" is speedily demonstrated. In this vicinity it is generally distributed in open country, never in woodland or in the city. It prefers rich bottoms, but is often found in upland fields. Thickets along railroads are a favorite resort, affording a constant supply of food, suitable breeding sites, and a favorite perch upon a telegraph wire. In other situations a fence-stake is a favorite perch, often beside a public road, for the curiosity of this species is not so easily satisfied as that of the Northern Shrike. They fly from their perch to the ground to secure insects, their actions in this respect resembling those of the Red-headed Woodpecker. They are generally in pairs on their arrival, and almost immediately proceed to the business of nesting. The nest is built in a tree or bush, often with no attempt at concealment, but frequently in the almost inaccessible branches of a honey locust, or in an osage-orange hedge. Usually they are within fifteen feet from the ground, sometimes not more than three. Until the young are hatched, their behaviour when the nest is approached or examined, does not differ from mild-mannered birds, but when the young are in danger they are exceedingly combative in resenting it, flying closely over head with open mouths and hoarse shrieks. Their cries attract birds of the same species from a great distance, but these remain idle though excited spectators. The nest is large and deep, and with us resembles the nest of the Northern Shrike, above described. When built near a railroad they frequently employ the cotton used in cleaning engines in its construction. Few birds form so compact a nest of similar materials. The birds occupy the nest for several days before laying commences. The eggs are often laid in April. They are of a light grayish color, spotted with lavender, yellowish- and pinkish-brown, and can not be distinguished from the eggs of var. *excubitorides*. More southern nests are described as smaller and much shallower. The average measurement of the egg is 1.05 by .75.

LANIUS LUDOVICIANUS Linnæus.

var. EXCUBITORIDES (Sw.) Cs.

White-rumped Shrike.

Collyrio excubitoroides, WHEATON, Ohio Agric. Rep. for 1860, 1861, addenda, 480; Reprint, 7.

Collurio ludovicianus var. *excubitoroides*, WHEATON, in Coues' Birds of N. W., 1874, 233; Food of Birds, etc., Ohio Agric. Rep. for 1874, 565; Reprint, 1875, 5.—COUES, Birds of N. W., 1874, 103.—MERRIAM, Bull. Nutt. Orn. Club, iii, 1878, 55.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist, i, 1879, 174; Reprint, 8; Bull. Nutt. Orn. Club, iv, 1879, 120.

Lanius ludovicianus var. *excubitorides*, COUES, Birds of Col. Val., i, 1878, 563.

Lanius excubitorides, SWAINSON and RICHARDSON, Fn. Bor.-Am., ii, 1831, 115.

Lanius excubitoroides, BAIRD, Rep. Gt. Salt Lake, 1852, 328.

Collyrio excubitoroides, BAIRD, Birds N. Am., 1858, 527.

Collurio ludovicianus var. *excubitoroides*, COUES, Key, 1872, 125.

With the size and essential characters of head stripe of var. *ludovicianus*, and the under parts, as in that species, not or not obviously waved, but with the clear light ashy upper parts, and hoary whitish superciliary line, scapulars and rump of *borealis*.

Habitat, middle province of North America, north to the Saskatchewan; east through Kansas, Iowa, Wisconsin, Illinois, Ohio, New York, and Canada West. Rhode Island, California.

Rare in Southern and Middle Ohio, probably more common in Northern-Ohio. Summer resident from March to September. Breeds. The history of this bird in Ohio is somewhat obscure. It was first noted in my catalogue of 1860 (1861) on the authority of Dr. Kirtland and Mr. Winslow. In 1862 and after, I found Shrikes not rare during summer in the vicinity of Columbus, which I suppose to have been of this variety. In 1873, with a single exception, the female mentioned on page 309, all specimens examined by me were clearly referable to this variety, but after this date they seem to have become darker yearly, only here and there a male falling on the *excubitorides* side of the line. Mr. Ridgway seems to have noticed the same change, for in "Notes on Birds observed at Mount Carmel, Southern Illinois, in the spring of 1878," (Bull. Nutt. Orn. Club, iii, 1878, 164), he says: "Although in previous papers I have given the White-rumped form (*excubitoroides*) as the Shrike of this portion of the country, all the specimens obtained during my recent visit were perfectly typical of the Southern race."

Have we here an admixture of races, or are the differences to be considered simply sexual or individual, or, to draw the line sharply, were the Loggerheads of 1874 the offspring of the White-rumped Shrikes of 1873?

Mr. C. Hart Merriam, in Bull. Nutt. Orn. Club, iii, 1858, 55, gives an excellent resume of this subject, which I give entire:

"Concerning the 'Loggerhead Shrike,' the case, though in some respects parallel with the above, is much more difficult of explanation, and has given rise to much confusion, owing to the complication arising from the close relationship existing between the Southern and Western forms. Coues, in his 'Key,' states that 'extreme examples of *ludovi-*

cianus and *excubitoroides* look very different, but they are observed to melt into each other when many specimens are compared, so that no specific character can be assigned,' and if the doctor had substituted the term *varietal* for *specific*, he would have hit equally near the truth. The fact is, there is so little difference between Eastern examples of *excubitoroides* and the Southern bird that they have often been confounded, and it is practically almost impossible to distinguish them. My own opinion is that the locality whence the specimen came furnishes the most valuable clew to its identity. In a young male taken by Mr. Dayan at Lyon's Falls, Lewis county, New York, September 4, 1877, the light ash of the upper parts contrasts strongly with the 'dark plumbeous-ash' of typical Southern examples of *ludovicianus* in the cabinet of Mr. George N. Lawrence, to whose kindness I am indebted for the comparison, and for many other favors. In other respects the bird more closely approaches the Southern form. The Western bird breeds abundantly in Ohio (Wheaton) and was first observed in Canada West (near Hamilton) by Mr. McIlwraith about the year 1860, since which date it has bred regularly in that locality. Allen, in 1869, published in the 'American Naturalist' (p. 579) the first record of its breeding in New York State (near Buffalo), and Rathbun gives it as breeding at Auburn, in the central portion of the State. Fred. J. Davis, Esq., informs me that he has taken several of its nests in the vicinity of Utica, and the fact of its breeding in Lewis county completes its range to the Adirondacks. Beyond this barrier it is not, to my knowledge, found, excepting as a rare straggler; and most of the New England specimens have commonly been regarded as accidental visitors from the South. Mr. Purdie, however, in this Bulletin (Vol. II, No. 1, page 21, 1877), records the capture of a 'typical' specimen of var. *excubitoroides* at Cranston, R. I., September 2, 1873, by Fred. T. Jencks. This is, so far as I am aware, the only recognized instance of the capture of the Western form in New England. As a pretty conclusive proof that our New York bird has been derived from the Western (*excubitoroides*) "type," we have the fact of the continuity of its range eastward from the Mississippi to the Adirondacks (through Ohio to Buffalo, Auburn, Utica, and Lewis county, New York); while, on the other hand, its entire absence from those portions of the State where the Carolinian Fauna is most marked (notably along the Hudson River, where such characteristic birds as *Icteria virens*, *Myiodiocetes mitratus*, *Helmitherus vermivorus*, and *Siurus motacilla* breed in abundance) is sufficient evidence that it is not the Southern bird. That it does not occur in the region above specified is pretty clearly shown by the fact that neither Edgar A. Mearns (of Highland Falls, near West Point) nor Eugene P. Bicknell (of Riverdale), two of our most enterprising young collectors, have ever met with even a single straggler of the genus, other than *C. borealis*, although they have both made the birds of the Hudson River Valley a special study."

Thus it appears that this variety has extended its range eastward from the Mississippi Valley mainly along the basin of the Great Lakes, though a comparison of the citations of both varieties of recent dates shows that not even the locality now furnishes a clew to assist in identification. Mr. Langdon, in Bull. Nutt. Club, iv, 1879, 120, gives the following note on this variety in Southwestern Ohio:

"On the 22d of August, 1878, I took a well-marked example of *Colturio ludovicianus* var. *excubitoroides* at Madisonville, which upon dissection proved to be a male 'young of the year.' It had attained its full plumage, however, the under parts being immaculate,

and the dorsal surfaces showing no traces of the buffy suffusion and transverse vermiculation usually observable in the young of this genus; the clear, pale bluish-ashy of its upper parts, with the conspicuously white rump and superciliary line, proclaimed its relationship at a glance. Its capture here will be regarded with interest by ornithologists, this being the southeasternmost point at which it has been recorded; and is of additional significance on account of the occurrence here of the typical *C. ludovicianus*, which is a regular though somewhat rare summer resident in this vicinity, where it has been found breeding on three occasions at least."

The habits, nest, and eggs, resemble those of the preceding variety.

FAMILY FRINGILLIDÆ. FINCHES, ETC.

Primaries nine. Bill truly conic, much shorter than the head, its commissure abruptly angulated near the base; no lobe along middle of the tomlia, but usually a notch at end. Nostrils placed very high. Rictal bristles usually obvious. Tarsus longer than lateral toe and claw.

GENUS HESPERIPHONA. Bonaparte.

Bill enormously large and stout. Wings very long and pointed, reaching beyond the middle of the tail. Primaries much longer than secondaries and tertials; outer two quills longest, the others rapidly graduated. Tail short, slightly forked, two-thirds the wing. Feet short; tarsus less than middle toe. Lateral toes nearly equal. Claws much curved, stout, compressed.

HESPERIPHONA VESPERTINA (Coop.) Bp.

Evening Grosbeak.

Hesperiphona vespertina, KIRTLAND, Ohio Farmer (newspaper), ix, 1860, 91.—WHEATON, Ohio Agric. Rep. for 1870, 365, 375; Reprint, 7, 17; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—COUES, Key, 1872, 127; Birds of N. W., 1874, 127; Bull. Nutt. Orn. Club, iv, 1879, 74.—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 452.—JORDAN, Man. Vert., 1878, 81.

Fringilla vespertina, COOPER, Ann. Lyc. N. Y., i, 1825, 220.

Hesperiphona vespertina, BONAPARTE, C. R., xxxi, 1850, 424.

Dusky olivaceous, brighter behind; forehead, line over the eye, and under tail-coverts yellow; crown, wings, tail and tibiae black; the secondary quills mostly white; bill greenish-yellow, of immense size, about $\frac{3}{4}$ of an inch long and nearly as deep. Length, $7\frac{1}{4}$ – $8\frac{1}{2}$; wing, 4 – $4\frac{1}{2}$; tail, $2\frac{1}{2}$. The female and young differ somewhat, but cannot be mistaken.

Habitat, Rocky Mountains to the Pacific; north to the Saskatchewan; south to Mexico; eastward along the northern tier of States to Lake Superior regularly; to Ohio, Canada, and New York City casually. Indiana (Jordan).

In my catalogue of 1860 (1861) I mentioned the capture of a specimen in the vicinity of Columbus in 1847. I am now certain that this was an error on the part of my informant; the only known occurrence of the

species in this State is that mentioned by Dr. Kirtland in the Ohio Farmer, March 24, 1860. The full text of his note is as follows :

Those of your readers who are interested in the Natural Sciences will no doubt be gratified to learn that so rare a bird as the Evening Grosbeak has made its appearance in these parts. Early last week a beautiful specimen of a female was secured by Charles Pease, Jr., and on the next day I saw several others of this species. It is known among ornithologists as the *Hesperiphona vespertina*, and has never before, I believe, been discovered east of Lake Michigan. Dr. Hoy, of Racine, Wisconsin, has occasionally met with it in that vicinity. From Lake Superior to Oregon is the usual limit of its locations. Its appearance is both neat and unique. The several species of northern birds which usually visit us during winter were scarce the past season. No white owls, very few white snow buntings, red-polls, and northern butcher-birds were seen. We secured a few Bohemian wax chatteringers, one pine grosbeak, and several purple finches. Robins have been with us all winter. The supplies of food influence the annual visits of these species. The wax-chatteringers and robins were evidently attracted by the abundance of mountain-ash and red-cedar berries, and the fruits of the persimmon; and the purple finches and pine grosbeaks by the numerous cones of the larch pines and spruces which are growing about my premises.

The Evening Grosbeak derives its common and scientific name from the erroneous belief that it sang only in the evening. They are described as occurring in loose flocks, and feeding on seeds and buds of trees. Their song is said to be a miserable failure. Nothing is known of its breeding habits.

GENUS PINICOLA. Vieillot.

Bill short, nearly as high as long, convex in all directions; basal third of upper mandible concealed by bristly feathers. Tarsi shorter than middle toe. Wings rather longer than the emarginate tail. First primary rather shorter than the second, third, and fourth.

PINICOLA ENUCLEATOR (L.) Cab.

Pine Grosbeak.

Corythus enucleator, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Pinicola canadensis, WHEATON, Ohio Agric. Rep. for 1860, 365, 375; Reprint, 1861, 7, 17.

Pinicola enucleator, COUES, Birds N. W., 1874, 105.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.

Pine Grosbeak, KIRTLAND, Am. Journ. Sci. and Arts, xiii, 1852, 218; Ohio Farmer, ix, 1860, 91.

Loxia enucleator, LINNÆUS, Syst. Nat., i, 1766, 299.

Corythus enucleator, CUVIER.

Pinicola canadensis, CABANIS, Mus. Hein., i, 1851, 167.

Pinicola enucleator, CABANIS, Mus. Hein., i, 1851, 167.

Male carmine-red, paler or whitish on the belly, darker and streaked with dusky on the back; wings and tail dusky, much edged with white, the former with two white bars. Female ashy-gray, paler below, marked with brownish-yellow on the head and rump. Length, 8-9; wing, 4½; tail, 4.

Habitat, British America south to the northern tier of States in winter, and occasionally to Maryland, Ohio, Illinois and Kansas. West Virginia (*Audubon*). Europe.

Winter visitor in Northern Ohio. The first record of its occurrence, inferentially, is that of Audubon, who states (*B. Am.*, iii, 1841, 179, that it appeared at the mouth of the Big Guyandotte, on the Ohio (a few miles above Ironton, Ohio), where several specimens were taken. Dr. Kirtland (quoted on page 193) makes the first record of its actual occurrence. Mr. Read gives it as "rare, though occasionally seen during most of the year." I have no recent information concerning it.

The Pine Grosbeak, as its name indicates, is a frequenter of pine woods, though not exclusively. Their food consists of the seeds of the pine and other coniferous trees, berries, and buds of various trees. They are irregular in their appearance in the Northern United States in winter, but when present are usually very numerous, and so tame and unsuspicious that they may be captured with an insect net. In the northernmost States it is found throughout the year, though but little is known in regard to its breeding habits. Dr. Brewer says "Mr. Boardman has found a nest, near Calais, about which there can be little doubt, although the parent was not seen. This was placed in an alder-bush in a wet meadow, and was about four feet from the ground. It was composed entirely of coarse green mosses. The eggs were two, and were not distinguishable from those of the European *enucleator*," which he describes as having "a light slate-colored ground with a marked tinge of greenish, broadly marked and plashed with faint, subdued cloudy patches of brownish-purple, and sparingly spotted, chiefly at the larger end, with blackish-brown and dark purple. They measure 1.02 inches in length by .70 in breadth."

GENUS CARPODACUS. Kaup.

Bill short, stout, vaulted. Nostrils concealed by bristly feathers. Tarsus shorter than middle toe. Hind claw much curved, shorter than the middle one. Wings long and pointed, reaching to the middle of the tail. Tail shorter than wings, forked.

CARPODACUS PURPUREUS (Gm.) Bp.

Purple Finch.

Fringilla purpurea, KIRTLAND, Ohio Geolog. Surv., 1838, 164, 184.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Carpodacus purpureus, WHEATON, Ohio Agric. Rep. for 1860, 365, 375; Reprint, 1861, 7, 17; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 174; Reprint, 8.

Purple Finch, KIRTLAND, Ohio Farmer, ix, 1860, 91.

Fringilla purpurea, GMELIN, Syst. Nat., i, 1788, 923.

Carpodacus purpureus, BONAPARTE, Con. Av., i, 1850, 533.

Male crimson, rosy, or purplish-red, most intense on the crown, fading to white on the belly, mixed with dusky streaks on the back; wings and tail dusky, with reddish edgings, and the wing-coverts tipped with the same; lores and feathers all round the base of the bill hoary. Female and young with no red; olivaceous brown, brighter on the rump, the feathers above all with paler edges, producing a streaked appearance; below white, thickly spotted and streaked with olive-brown, except on the middle of the belly and under tail-coverts; obscure whitish superciliary and maxillary lines. Young males show every gradation between these extremes in gradually assuming the male plumage, and are frequently brownish-yellow or bronzy below. Length, $5\frac{1}{4}$ – $6\frac{1}{4}$; wing, 3 – $3\frac{1}{4}$; tail, $2\frac{1}{2}$ – $2\frac{3}{4}$.

Habitat, United States from Atlantic to Pacific, excepting perhaps the Southern Rocky Mountain region.

Common spring and fall migrant in Middle, winter resident in Southern, and probably resident in Northern Ohio. Dr. Kirtland, in his catalogue, presumes it to breed, having taken it in June; he also mentions its occurrence in winter. Mr. Read says it "stops a few days in spring in large numbers," and that he had taken it in August. Mr. Langdon gives it as migrant in fall, winter, and spring, and says that it "feeds largely on the buds of the slippery elm, its flesh being strongly flavored thereby."

In the vicinity of Columbus it is to be found irregularly from October to the latter part of April, but is rare during December and January. In the fall it frequents weedy and swampy woodlands and borders of streams, feeding upon the seeds of plants. In spring it is found in flocks in woodland, where it feeds largely upon the buds of trees. At this time it has a sweet though not very powerful song.

The nest is usually placed in an evergreen tree, but sometimes in an orchard. It is described as being flat and shallow, composed of grass, strips of bark, and vegetable fibres. The eggs are pale emerald-green, spotted with very dark brown, chiefly about the greater end. They vary in size from .92 to .81 by .70 to .60.

GENUS LOXIA. Linnæus.

Mandibles much elongated, compressed, and attenuated, greatly curved or falcate, their points crossing or overlapping to a greater or less degree. Tarsi very short, claws long, hind claw longer than its digit. Wings very long and pointed, reaching beyond the middle of the narrow forked tail.

LOXIA CURVIROSTRA Forster.

var. AMERICANA Cs.

Common Crossbill.

Loxia curvirostra, KIRTLAND, Ohio Geolog. Surv., 1838, 164, 184.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 566; Reprint, 6; Bull. Nutt. Orn. Club, iv, 1879, 62.

Curvirostra americana, WHEATON, Ohio Agric. Rep. for 1860, 1861, 366, 375; Reprint, 7, 17.

Loxia curvirostra var. *americana*, LANGDON, Cat. Birds Cin., 1877, 8; Revised List, Journ.

Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

Loxia curvirostra, FORSTER, Phil. Trans., lxii, 1772, No. 23.

Curvirostra americana, WILSON, Am. Orn., iv, 1811, 44.

Loxia americana, BONAPARTE, List, 1838, 38.

Loxia curvirostra var. *americana*, COUES, Key, 1872, 351.

Male brick-red, wings blackish, unmarked; female brownish-olive, streaked and speckled with dusky, the rump saffron. Immature males mottled with greenish and greenish-yellow. Length, about 6; wing, $1\frac{1}{2}$; tail, $2\frac{1}{2}$.

Habitat, Northern North America; south into the United States in winter. Resident in Maine and in mountains to Pennsylvania.

Irregular and erratic visitor, usually in winter, perhaps breeds. Dr. Kirtland in 1838 had not met with it, but believed it to have occurred in Ashtabula county. Mr. Read gives it as an occasional winter visitor. I saw a specimen said to have been taken in this vicinity in the winter of 1859-60. In the winter of 1868-9 Mr. Dury found them abundant, feeding upon the seeds of the horse-weed in the vicinity of Cincinnati. Mr. C. J. Orton took a specimen at Yellow Springs a few years later. Mr. Langdon notes their occurrence in the vicinity of Cincinnati in the winter of 1874-5. In Bull. Nutt. Orn. Club, iv, 1879, 62, I noted its appearance as follows:

"On the 18th of June last Mr. Charles Hinman killed one of these birds out of a flock of eight or ten which visited the coniferous trees in his garden in this city. The specimen which came into my possession by the kindness of Mr. Oliver Davie was a male, not in full plumage. I have since learned that the Red Crossbill has remained during the season in the vicinity of Cleveland in considerable numbers, and is reported to have nested there."

I was unable to learn whether its nest had been actually discovered. It has been known to nest in Indiana within a few years.

The Crossbill subsists mainly upon the seeds of pine and coniferous trees, for obtaining which, their curious bills are said to be peculiarly adapted. They are commonly reported to breed in winter or early spring, while the weather is yet severe. But little is known of their breeding habits, only very few nests having been discovered. One described by Dr. Brewer, was taken by Mr. Chas. S. Paine, in East Randolph, Vermont; another by E. P. Bricknell, Riverdale, New York City, April 30, 1875. This nest and eggs are described by him in Bull. Nutt. Orn. Club, v, 1880, 7, as follows:

"The nest was placed in a tapering cedar of rather scanty foliage, about eighteen feet from the ground, and was without any single main support, being built in a mass of small tangled twigs, from which it was with difficulty detached. The situation could

scarcely have been more conspicuous, being close to the intersection of several roads (all of them more or less bordered with ornamental evergreens), in plain sight of as many residences, and constantly exposed to the view of passers-by. The materials of its composition were of rather a miscellaneous character, becoming finer and more select from without inwards. An exterior of bristling spruce twigs loosely arranged surrounded a mass of matted shreds of cedar bark, which formed the principal body of the structure, a few strips of the same appearing around the upper border, the whole succeeded on the inside by a sort of felting of finer material, which received the scanty lining of black horse-hair, fine rootlets, grass stems, pieces of string, and two or three feathers. This shallow felting of the inner nest can apparently be removed intact from the body of the structure, which, besides the above-mentioned materials, contained small pieces of moss, leaves, grass, string, cottony substances, and the green foliage of cedar. The nest measured internally two and one-half inches in diameter by over one and a quarter in depth; being in diameter externally about four inches, and rather shallow in appearance.

"The fresh eggs are in ground color of a decided greenish tint, almost immaculate on the smaller end, but on the opposite side with irregular spots and dottings of lavender-brown of slightly varying shade, interspersed with a few heavy surface-spots of dark purple-brown. There is no approach in the arrangement of these to a circle, but between the apex of the larger end, and the greatest diameter of the egg, is a fine hair like surface line; in two examples it forms a complete though irregular circle, and encloses the principal spots. In the other egg, which is the largest, this line is not quite complete, and the primary blotches are wanting, but the secondary markings are correspondingly larger and more numerous. In another egg there are two perfect figures of 3 formed on the sides by the secondary marks, one of them large and singularly symmetrical. The eggs measure respectively .74 by .56, 75 by .58, .78 by .59."

LOXIA LEUCOPTERA Gm.

White-winged Crossbill.

Curvirostra leucoptera, WHEATON, Ohio Agric. Rep. for 1860, 366, 346; Reprint, 1861, 8, 18.

Loxia leucoptera, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Journ. Cin. Nat. Hist., i, 1879, 175; Reprint, 9.

Loxia leucoptera, GMELIN, Syst. Nat., i, 1788, 844.

Curvirostra leucoptera, WILSON, Am. Orn., iv, 1811, 42.

Wings in both sexes with two conspicuous white bars; male rosey-red, female brownish-olive, streaked and speckled with dusky, the rump saffron. Length, about 6; wing, 3½; tail, 2½.

Habitat, Northern North America, south in winter to the United States. Greenland. Accidental in Europe.

Rare and irregular winter visitor. Not given by Dr. Kirtland or Mr. Reed. Inserted in my catalogue of 1861, on the authority of Mr. Kirkpatrick, who informed me that it had been taken at Willoughby, Lake county. Mr. Dury informs me that it was abundant in the vicinity of Cincinnati in the winter of 1868-9, in company with the preceding species, and even more numerous than they.

This species is generally considered more northerly in its range than the Red Crossbill. Its habitual breeding range is from Northern New England northward; it is also found in Wyoming in summer. Audubon mentions its breeding in Pennsylvania in summer, but this was exceptional. In its habits it resembles the preceding.

The nest is described as composed of spruce twigs and lichens, lined with hair and shreds of bark. The eggs are pale-blue, with fine dots of black and ashy-lilac at the larger end.

GENUS ÆGIOTHUS. Cabanis.

Bill very short, conical, extremely acute, the outlines even concave, base of upper mandible and nostrils concealed by bristly feathers, middle of mandible with several parallel ridges. Wings very long, reaching to the middle of the forked tail, second quill a little the longest. Middle toe and claw as long as the tarsus; inner lateral toe rather the longer; hind claw longer than its digit.

ÆGIOTHUS LINARIA (L) Cab.

Red-poll Linnet.

Fringilla linaria, KIRTLAND, Ohio Geolog. Surv., 1838, 164, 183; Fam. Visitor, i, 1850, 63.

—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Aegiothus linaria, BAIRD, P. R. R. Rep., ix, 1858, 429.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 366; Reprint, 8.

Aegiothus linarius, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 566; Reprint, 6.

Aegiothus linarius, BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 497.

Aegiothus (error) *linaria*, LANGDON, Cat. Birds of Cin., 1877, 8; Journ. Cin. Soc. Nat. Hist., i, 1878, 114; Reprint, 5.

Aegiothus (error) *linarius*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

Red-poll, KIRTLAND, Fam. Visitor, i, 1850, 120, 140, 148; Ohio Farmer, ix, 1860, 91.

Fringilla linaria, LINNÆUS, Syst. Nat., i, 1766, 322.

Aegiothus linarius, CABANIS, Mus. Hein., 1851, 161.

Upper parts streaked with dusky and flaxen in about equal amounts, rump white or rosey, streaked with dusky; below, streaked on the sides, belly dull white; bill mostly yellow; feet blackish. Length, $5\frac{1}{2}$ – $5\frac{3}{4}$; wing, $2\frac{1}{2}$ – 3 ; tail, $2\frac{1}{4}$ – $2\frac{1}{2}$.

Habitat, northern regions of both Hemispheres, ranging irregularly southward in winter to the Middle States or beyond, and to corresponding latitudes in the West.

Tolerably regular winter resident in Northern Ohio, casual in other portions of the State. Dr. Kirtland made their acquaintance about 1835–6, when he states that they appeared in flocks on his premises. He states that they were unusually abundant in the winter of 1849–50, when they were slow in taking their departure, remaining in large flocks until April. Mr. Read gives it as abundant during extremely cold weather. I have seen specimens from Sandusky, and Mr. Langdon

notes that Mr. Dury took a single specimen in the vicinity of Cincinnati in January, 1869. Dr. Brewer (l. c.) says :

"Dr. Kirtland informs me that early in the winter of 1863, his grandson picked up a wing-broken male Red-poll, and placed it in his green-house. It began at once to feed on crumbs of bread and hay-seed, and rapidly recovered. It soon acquired the habit of leaping from shelf to shelf, among the plants, and was finally seen climbing up some large *Pelargonium* shrubs, and suspending itself, parrot like, by its feet from the limbs, capturing aphides. From that time it took no other food, living exclusively on the parasitic insects of the plants. So active was it in capturing these, that for two months it was not necessary to fumigate the green-house to destroy them. From day to day a female Red-poll hovered over the building, and her calls were responded to by the invalid. Late in the season he escaped from his confinement, and was seen to join his faithful mate, which had remained with him all winter."

In habits the Red-poll is said to resemble greatly the Common Yellow-bird, and its flight is similar. The nest is built in low trees and bushes; it is constructed of moss, grass, and catkins of willow, and lined with vegetable down. The eggs are light bluish-white, finely dotted with rusty-brown. They average .65 by .53.

GENUS CHRYSOMITRIS. Boie.

Bill rather acutely conic. Nostrils concealed. Ridges on upper mandible obsolete. Tarsi shorter than middle toe, outer toe rather longer than inner. Claw of hind toe shorter than its digit. Wings and tail as in *Ægiothus*.

CHRYSOMITRIS PINUS (Wils.) Bp.

Pine Linnet.

Fringilla pinea, STORER, Proc. Bost. Soc. Nat. Hist., ii, 1845, 52.

Linaria pinus, KIRTLAND, Fam. Visitor, i, 1850, 140.

Chrysomitris pinus, BAIRD, P. R. R. Rep., ix, 1858, 425.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 365; Reprint, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 566; Reprint, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

Pine Finch, KIRTLAND, Fam. Visitor, i, 1850, 148, 164; Am. Journ. Sci. and Arts, xiii, 1852, 218.

Fringilla pinus, WILSON, Am. Orn., ii, 1810, 133.

Chrysomitris pinus, BONAPARTE, List, 1838, 33.

Bill extremely acute; continuously streaked above with dusky and olivaceous-brown or flaxen; below with dusky and whitish, the whole plumage in the breeding season more or less suffused with yellowish, particularly bright on the rump; the bases of the quills and tail feathers extensively sulphury yellow, and all these feathers more or less edged externally with yellowish. Length, 4½; wing, 2½; tail, 1½.

Habitat, North America generally. United States chiefly in winter; south in Rocky Mountains to Mexico.

Abundant, nearly resident, possibly breeding in Northern Ohio; winter visitor in other parts of the State.

First noted in Ohio by Dr. Storer, on the authority of Dr. Kirtland (quoted on page 295). Dr. Kirtland gives the following account in the pages of the *Family Visitor* of May 30, 1850:

"During the last three years large flocks of these birds, consisting of both old and young, have visited our grounds as early as the first of July, and since they appeared here last summer, we have observed them almost daily for a period of nine months and a half. At this time they are still common, and show no evidence of a disposition to depart for more northern haunts.

"At their first appearance in mid-summer, the young are immatured—portions of down still mixed with their feathers, and their quills bloodshot, and so weak that they could hardly sustain a flight of seventy miles across the Lake. They are then so tame that they can be readily approached. Several have been taken about my place by means of a butterfly net, and our Maltese cat has not failed to lay the flocks under heavy contributions. Their food, during the summer, seems to consist almost exclusively of aphides, which they collect in great numbers from the flowers, shrubs, and fruit trees in the immediate vicinity of the dwelling-house. During autumn and winter, they sustain themselves here on the seeds of weeds and grapes. Those of the catnip are a special favorite with them, and we have seen a dozen individuals congregate upon one of those plants.

"They frequently associate with the American Goldfinch during the summer, and the Red-poll during winter.

"From these facts we are induced to believe it is a permanent resident in this vicinity, and that it breeds here during the months of May and June, although we have not yet discovered its nest."

Under date of June 29th he says: "Numerous flocks of this interesting little bird are still common about our place, five miles west of Cleveland. They are now mating, and as they have been repeatedly seen here as early as the first of July in other years, it is probable they breed and rear their young in this vicinity." And, July 11th, "The Pine Linnet is still about our shrubbery, and will no doubt continue during the summer."

It appears, however, from his article in *American Journal of Science and Arts* (see page 193), that he never knew them to breed. They are not named in Mr. Read's list. In the vicinity of Columbus I have never been able to find them but on two occasions, and on each of these single birds, one solitary, on a tree in the edge of a wood, the other with Purple Finches in weeds on the bank of the river. Mr. Langdon states that Mr. Dury found them abundant in the vicinity of Cincinnati in the winter of 1868-9. None had been observed since.

The Pine Linnet breeds in Eastern North America as far south as Massachusetts, and in the Rocky Mountains to Mexico. The nest is described as built of small twigs of evergreen trees, grasses and rootlets, lined with

fine rootlets and hair. The eggs are light green, spotted chiefly about the larger end, with light rusty-brown. They measure .71 by .50.

CHRYSOMITRIS TRISTIS (L.) Bp.

American Goldfinch; Yellow-bird.

Fringilla tristis, AUDUBON, Orn. Biog., 1831, 172.—KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Carduelis tristis, AUDUBON, B. Am., iii, 1841, 129

Chrysomitris tristis, WHEATON, Ohio Agric. Rep. for 1860, 365; Reprint, 1861, 7; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 174; Reprint, 8. American Goldfinch, KIRTLAND, Fam. Visitor, 1850, 140.—BALLOU, Field and Forest, iii, 1878, 136.

Fringilla tristis, LINNÆUS, Syst. Nat., i, 1766, 320.

Carduelis tristis, BONAPARTE, Obs. Wils., 1825, No. 96.

Chrysomitris tristis, BONAPARTE, List, 1838, 33.

Male in summer rich yellow, changing to whitish on the tail coverts; a black patch on the crown; wings black, more or less edged and barred with white; lesser wing-coverts yellow; tail black, every feather with a white spot; bill and feet flesh-colored. In September the black cap disappears and the general plumage changes to a pale flaxen brown above, and whitey-brown below, with traces of the yellow, especially about the head; this continues till the following April or May. Female olivaceous, including the crown; below soiled yellowish; wings and tail dusky, whitish-edged; young like the female. Length, about $4\frac{1}{2}$; wing, $2\frac{1}{2}$; tail, 2.

Habitat, North America generally.

Abundant resident, less common in winter. Breeds. The Yellow-bird is almost too well known to require further description. Its bright colors, undulating flight, plaintive note, and fondness for the seeds of thistles, lettuce, and sunflowers, render it more conspicuous than many birds of larger size. It resembles more northern birds in its gregarious and erratic habits. In spring they are found in large flocks, especially delighting in willow trees, where they sing in concert a confusing melody of high notes. They are fond of water, and like the common yellow butterflies, gather in numbers on the borders of streams, and puddles of water by the roadside.

The Yellow-bird breeds late, with us, usually in July. The nest is built in trees. Often the shade trees or fruit trees in cities are chosen, and they appear to be the only birds breeding with us whose nest is ever placed in a peach tree. It is usually from fifteen to twenty feet from the ground, and built of moss, grass, and small vegetable fibres, thickly lined with vegetable down.

The eggs are five, light bluish-white, unmarked. They measure about .65 by .52.

GENUS PLECTROPHANES. Meyer.

Bill variable, blunted; lower mandible higher and wider at base than upper. Wings one-half longer than the nearly even tail, reaching nearly to its tip. First quill as long as the second. Tarsi longer than middle toe. Hind claw very long and acute, longer than its digit, less curved than the middle claw. Lateral toes equal.

PLECTROPHANES NIVALIS (L.) Meyer.

Snow Bunting.

Emberiza nivalis, AUDUBON, Orn. Biog., ii, 1834, 515.—KIRTLAND, Ohio Geolog. Surv., 1832, 164, 183 —READ, Phila. Acad. Nat. Sci., vi, 1835, 395.

Plectrophanes nivalis, AUDUBON, B. Am., iii, 1861, 56.—BAIRD, P. R. R. Rep., ix, 1858, 438. WHEATON, Ohio Agric. Rep. for 1860, 1861, 366; Reprint, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 566; Reprint, 6.—COUES, Birds of N. W., 1874, 118.—LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

White Snow Bird, KIRTLAND, Fam. Visitor, i, 1850, 63, 72, 120, 148; Ohio Farmer, ix, 1860, 91.

Emberiza nivalis, LINNÆUS, Syst. Nat., i, 1766, 308.

Plectrophanes nivalis, MEYER.

Bill small, truly conic, ruffed at base; hind claw decidedly curved. In breeding plumage pure white, the back, wings and tail variegated with black; bill and feet black. As generally seen in the United States, the white is clouded with warm, clear brown, and the bill is brownish. Length, about 7; wing, $4\frac{1}{2}$; tail, $2\frac{1}{2}$.

Habitat, Arctic America and Greenland, and corresponding latitudes in the Old World. Irregularly southward in winter in the United States to about 35° .

Irregular winter visitor, common in Northern, rare in Middle and Southern Ohio. Dr. Kirtland (Fam. Vis., April 18), speaking of the lateness of the spring of 1850, says:

"Several species of winter birds seem to have known that winter was likely to linger in the lap of May. Within a few days large flocks of Red-polls have been flitting about our fields, and the White Snow-bird has remained so late with us this season that it has moulted here and appeared in its summer plumage—an occurrence never before observed. We have never known them to continue here after the ice has left the Lake, and snow entirely disappeared."

In this vicinity I have met them on but three occasions. A single bird was found in April, 1863, whose departure had probably been delayed by some accident. In February, 1874, a single individual was seen in company with Shore Larks. In February, 1875, a flock of about two hundred birds appeared during a severe snow storm. Mr Langdon says it has not been seen in the vicinity of Cincinnati for several years.

The Snow Bunting appears in the United States in roving flocks only in severe cold weather. They appear to be more common near the coast

than in the interior, the contrary of which appears to be the case with the next species. They breed from latitude 62° northward.

The nest is placed on the ground; it is built of grass, with a lining of feathers. The eggs are five, dull white, sprinkled with yellowish-rufous, and measure .95 by .64.

PLECTROPHANES LAPPONICUS (L.) Selby.

Lapland Longspur.

Plectrophanes lapponicus, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Journ. Cin. Soc. Nat. Hist., i, 1878, 114; Reprint, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

Fringilla lapponica, LINNÆUS, Syst. Nat., 1, 1766, 317.

Plectrophanes lapponica, SELBY, Linn. Trans., xl, 156.

Bill moderate, unruffed, but with a little tuft of feathers at the base of the rictus; hind claw straightish, with its digit longer than the middle toe and claw. Adult male: whole head and throat jet black, bordered with buffy or whitish, which forms a postocular line, separating the black of the crown from that of the sides of the head; a broad chestnut cervical collar; upper parts in general blackish, streaked with buffy or whitish that edges all the feathers; below, whitish, the breast and sides black-streaked; wings dusky, the greater coverts and inner secondaries edged with dull bay; tail dusky, with an oblique white area on the outer feathers; bill yellowish, tipped with black; legs and feet black. Winter males show less black on the head, and the cervical chestnut duller; the female and young have no continuous black on the head, and the crown is streaked like the back, and there are traces of the cervical collar. Length, 6-6½; wing, 3¼-3½; tail, 2½-2¾.

Habitat, Arctic regions of both Hemispheres; in America south in winter to Pennsylvania, Kentucky, Kansas, and Colorado.

Common and tolerably regular winter visitor in the vicinity of Columbus from December 1 to March 20. Rare and irregular in the vicinity of Cincinnati.

The Lapland Longspur usually appears in this vicinity during the first/protracted cold weather. The first to appear are single birds, in company with Shore Larks. Afterwards they may be seen in compact flocks of from ten to thirty, frequenting old brick-yards, and fields where cattle are fed, in company with Shore Larks, with which they associate on the ground, but fly by themselves in close flocks. Frequently when first flushed they utter a rapid rattling note, somewhat like that of the Kingfisher, but less loud and harsh. Their food consists of the seeds of plants, which they are very industrious in collecting.

The Lapland Longspur breeds in the Arctic Regions. The nest is placed on the ground, built of mosses, grass, and a few feathers. The

eggs are greenish-gray, almost concealed by a mottling of chocolate-brown. They measure about .80 by .62.

GENUS PASSERCULUS. Bonaparte.

Outlines of bill nearly straight, lower mandible smaller than upper. Wings unusually long, reaching to middle of the short, nearly even, tail. Inner secondaries as long as the primaries, first primary longest. Tail feathers pointed, narrow. Tarsus about equal to middle toe. Hind toe much longer than the equal lateral toes, its claw reaching to middle of middle claw. Claws moderately curved.

PASSERCULUS SAVANNA (Wils.) Bp.

Savanna Sparrow.

Passerculus savanna, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 9. ? Sand Sparrow, BALLOU, Field and Forest, iii, 1878, 136.

Fringilla savanna, WILSON, Am. Orn., iii, 1811, 55.

Passerculus savanna, BONAPARTE, List, 1833, 33.

Above brownish-gray, streaked with blackish, whitish gray, and pale bay, the streaks largest on the interscapulars, smallest on the cervix, the crown divided by an obscure whitish line; superciliary line and edge of wing *yellowish*; sometimes an obscure yellowish suffusion about the head. Below, white, pure or with faint buffy shade, thickly streaked with dusky, the individual spots edged with brown, mostly arrow-shaped, running in chains along the sides, and often aggregated in an obscure blotch on the breast. Wings and tail dusky, the wing-coverts and inner secondaries black-edged and tipped with bay. Length, $5\frac{1}{4}$ – $5\frac{3}{4}$; wing, $2\frac{1}{2}$ – $2\frac{3}{4}$; tail, 2 – $2\frac{1}{4}$.

Habitat, North America at large.

Very common, spring and fall migrant in Southern and Middle, probably summer resident in Northern Ohio.

The Savanna Sparrow usually appears in Middle Ohio during the first week in April and remains until the latter part of May. In one instance only have I seen it in June. Mr. H. C. Benson informs me that he has found it breeding at Gambier. It appears to have been overlooked by Dr. Kirtland and Mr. Read. In the fall it returns late in September, and remains until late in October. It is a terrestrial species, usually found in fields and in weeds along the banks of streams, and sometimes in wet places. It is never found in woodland, though I have sometimes seen them perching on trees in orchards. In spring it has a curious squeaky song, which evidently has not the full power of its breeding notes; its ordinary note is a feeble chirp.

This Sparrow breeds from Massachusetts northward. The nest is placed on the ground, composed of grass, with a lining of hair and

feathers. The eggs are from four to six in number, greenish- or grayish-white, more or less thickly blotched with different shades of brown.

GENUS POOECETES. Baird.

Bill rather large; upper outline slightly decurved towards the end, lower straight. Wings unusually long and pointed, reaching to the middle of the tail, second and third quills longest, the first a little shorter. Inner secondaries lengthened. Tail feathers broad nearly to the end, where they are obliquely truncate. Tarsus about equal to middle toe; outer toe a little longer than inner, hind toe reaching to base of middle claw.

POOECETES GRAMINEUS (Gm.) Baird.

Bay-winged Bunting; Grass Finch.

Fringilla graminea, KIRTLAND, Ohio Geolog. Surv., 1835, 164.—READ, Phila. Acad. Nat. Sci., vi, 1853, 395.

Poocetes gramineus, WHEATON, Ohio Agric. Rep. for 1860, 1861, 366; Reprint, 8.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

Poecetes gramineus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 566; Reprint, 6.

Poocetes (error) *gramineus*, LANGDON, Cat. Birds of Cin., 1877, 8.

Fringilla graminea, GMELIN, Syst. Nat., i, 1788, 922.

Poocetes gramineus, BAIRD, Birds N. A., 1858, 449.

Poecetes gramineus, C. UES, Key, 1872, 136.

Thickly streaked everywhere above, on sides and across breast; no yellow anywhere; lesser wing-coverts chestnut, and one to three outer pairs of tail feathers party or wholly white. Above, grayish-brown, the streaking dusky and brown, with grayish white; below, white, usually buffy-tinged, the streaks very numerous on the fore part and sides; wing-coverts and inner quills much edged and tipped with bay; crown like back, without median stripe, line over, and ring round eye, whitish; feet pale. Length, $5\frac{1}{2}$ – $6\frac{1}{2}$; wing, $2\frac{7}{8}$ – $3\frac{1}{4}$; tail, $2\frac{1}{4}$ – $2\frac{3}{4}$.

Habitat, United States from Atlantic to Pacific; north to the Saskatchewan.

Abundant summer resident, from latter part of March to November. Breeds. The Grass Finch frequents commons, roadsides, fallow and weedy fields, seldom in woodland or well cultivated places. It is noted for its clear, sweet, and finely modulated song, which is heard throughout the day, but especially in the evening after most birds are silent, and in cloudy weather. The song lacks the vivacity and emphasis of that of the Song Sparrow, but excels it in sweetness. From the habit of singing in the evening it is often called the Vesper Bird.

This species varies considerably in its general coloration, and apparently in size. Individuals in March, in worn plumage, being lighter and apparently smaller than October birds in their new, long feathers. In the fall they migrate in companies, and sometimes are found in grassy woodland.

The Grass Finch builds its nest on the ground, usually in an exposed place, often under a thistle; it is composed of bits of weed-stalks and grass, with a little horse-hair for a lining. The eggs are usually four, grayish-white, spotted with reddish-brown, and more or less blotched and lined with dark brown. Their average measurement is .80 by .55.

GENUS COTURNICULUS. Bonaparte.

Bill short, targid, under mandible broader but lower than upper. Wings short, rounded, reaching to base of tail; the tertials almost as long as primaries; not much difference in length of primaries. Tail short and narrow, decidedly shorter than wing, graduated laterally, but slightly emarginate.

COTURNICULUS PASSERINUS (Wils.) Bp.

Yellow-winged Sparrow.

Tringilla passerina, KIRTLAND, Ohio Geolog. Surv., 1838, 164.

Coturniculus passerinus, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Journ. Cin. Soc. Nat. Hist., i, 1878, 114; Reprint, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

Tringilla passerina, WILSON, Am. Orn., iii, 1811, 76.

Coturniculus passerinus, BONAPARTE, List, 1838, 32.

Edge of wing conspicuously yellow; lesser wing coverts and short line over the eye yellowish; below, not or not evidently streaked, but fore parts and sides buff, fading to dull white on the belly. Above, singularly variegated with black, gray, yellowish-brown, and a peculiar purplish bay in short streaks and specks, the crown being nearly black, with a sharp median brownish-yellow line, the middle of the back chiefly black, with bay and brownish-yellow edgings of the feathers, the cervical region and rump chiefly gray, mixed with bay; wing-coverts and inner quills variegated like the back; feet pale. Young similar, not so buffy below, and with pectoral and maxillary dusky spots. Length, $4\frac{3}{4}$ – $5\frac{1}{2}$; wing, $2\frac{1}{2}$; tail, 2 or less, the outstretched feet reaching to or beyond its end.

Habitat, United States; south to Guatemala and Costa Rica. Cuba. Jamaica. Porto Rico.

Common summer resident from April to August. Breeds. Dr. Kirtland inserts it in his catalogue without comment. Mr. Langdon gives it as a rare summer resident, on the authority of Mr. Dury. In the vicinity of Columbus it is very common in meadows, clover and grass fields. In its habits it is shy and retiring, usually not observed until it is flushed, when it darts off rapidly, in a zig-zag flight, as if much alarmed, then pursues a short course, which deviates by angles rather than curves, and having reached a safe distance, drops quickly to the ground. Fields with a few stumps are favorite localities, and the male

mounts a stump or the top of a weed-stalk by the hour sometimes, singing at short intervals his peculiar song, *tsééééé*, so high and monotonous that it has been aptly compared to the note of the grasshopper. Later in the season, as if the bird, tired of the monotony of its breeding note, changes it to a shorter and less monotonous *se-ick*, the first syllable of which is prolonged, and after an interval the last is given quickly, abruptly, and strongly emphasized. More rarely a few short and rapid notes are heard, as if the bird was trying to learn to sing.

The nest is placed upon the ground, usually concealed by a bunch of weeds, and built of grass, with a lining of horse hair. The eggs are four or five, white, with reddish-brown spots, and measure .75 by .60.

COTURNICULUS HENSILOVII (Aud.) Bp.

Henslow's Sparrow.

Enderiza henslowi, AUDUBON, Birds Am., iii, 1841, 76, pl. 163.

Coturniculus henslowi, WHEATON, Ohio Agric. Rep. for 1860, 366, 376; Reprint, 1861, 8, 18; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

Coturniculus henslowi, BONAPARTE, List, 1833, 32.

Coturniculus henslowii, COUES, Birds N. W., 1874, 133.

Resembling the last; smaller; more yellowish above, and with sharp maxillary, pectoral and lateral black streaks below; tail longer, reaching beyond feet.

Habitat, Eastern United States to New Hampshire; west to the Loup Fork of Platte.

The specimen of this bird from which Audubon drew his description and figure, was taken at Newport, Kentucky, opposite Cincinnati. He states that it is "accidental in Ohio." The specimen obtained by me in 1856, in this vicinity, and which in 1861 I mentioned as being of this species, I now suppose to have been the young of the Yellow-winged Sparrow, a species with which I was not then acquainted. In all probability Henslow's Bunting will be found not uncommon in restricted localities, particularly in the southern and western portions of the State. In habits, nest, and eggs, it is hardly to be distinguished from the preceeding species.

GENUS MELOSPIZA. Baird.

Body stout. Bill conical, somewhat compressed. Feet stout, not reaching beyond the tail; tarsus a little longer than middle toe. Wings quite short and rounded, scarcely reaching beyond base of tail; the tertials considerably longer than the secondaries; the quills considerably graduated, the fourth longest. Tail moderately long and considerably graduated.

MELOSPIZA LINCOLNI (Aud.) Bd.

Lincoln's Finch.

Melospiza lincolni, WHEATON, Ohio Agric. Rep. for 1860, 379 (probable); Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Jour. Cin. Soc. Nat. Hist., i, 1878, 114; Reprint, 5; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.

Fringilla lincolni, AUDUBON, Orn. Biog., ii 1834, 539.

Melospiza lincolni, BAIRD, Birds N. Am., 1858, 453.

Below, white, breast banded and sides often shaded with yellowish; everywhere except on the belly, thickly and sharply streaked with dusky; above, grayish-brown, crown and back with blackish, brownish, and paler streaks; tail grayish-brown, the feathers usually showing blackish shaft lines; wings the same, the coverts and inner quills blackish, with bay and whitish edgings; no yellow on wings or head. Length, $5\frac{1}{2}$; wing and tail about $2\frac{1}{4}$.

Habitat, the whole of North America. Mexico. Guatemala.

Not uncommon spring and fall migrant in May and October. Frequents woodland undergrowth, brush-piles, and banks of streams in spring, weedy woodlands and high weeds and grass in swampy places in the fall. In the vicinity of Columbus it makes its way silently northward in spring, not associating with other sparrows, and seldom in the company of its own kind. It is rather shy and retiring, hiding in brush-heaps. Its flight is quick and straight, but low. In the fall it frequently associates with Swamp Sparrows, which it somewhat resembles in appearance and habits. I found them quite abundant at the Licking Reservoir, October 17, 1874, in the tall grass of the low borders of the Reservoir, in company with Swamp, White-throated, and White-crowned Sparrows. Mr. C. J. Orton has taken it at Sandusky, and Mr. W. H. Gaylord at Cleveland. I have seen one individual in my garden in May. With us it is the most silent of all the Sparrows. I do not remember to have ever heard it chirp. At its breeding places it is said to have a sweet song.

Lincoln's Finch is most abundant west of the Mississippi River, and though found in several of the Eastern States, is rare. It breeds from Wisconsin and Northern New York northward. The nest, which is placed upon the ground, is built of grass; the eggs are greenish-white, more or less thickly spotted and blotched with different shades of reddish-brown. They measure .74 by .56.

MELOSPIZA PALUSTRIS (Wils.) Bd.

Swamp Sparrow.

Fringilla palustris, KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Melospiza palustris, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.

Fringilla palustris, WILSON, Am. Orn., iii, 1811, 49.

Melospiza palustris, BAIRD, Birds N. Am., 1858, 483.

Crown bright bay, or chestnut, blackening on the forehead, often with an obscure median ashy line, and usually streaked with black; cervix, sides of head and neck, and the breast, strongly ashy, with vague dark auricular and maxillary markings, the latter bounding the whitish chin, the ashy of the breast obsoletely streaky; belly whitish; sides, flanks, and crissum strongly shaded with brown, and faintly streaked; back and rump brown, rather darker than the sides, boldly streaked with black and pale brown or grayish. Wings so strongly edged with bright bay as to appear almost uniformly of this color when viewed closed, but inner secondaries showing black with whitish edging; tail likewise strongly edged with bay, and usually showing black shaft lines. No yellowish anywhere; no tail feathers white; farther distinguished from its allies by the emphasis of the black, bay, and ash. Length, 5½-6; wing and tail 2¼-2½.

Habitat, Eastern and part of Middle Province of North America; north to Newfoundland and Labrador; west to Utah; south to Texas.

Common spring and fall migrant in April and May, October and November. Although it is very probably a summer resident in Northern Ohio, neither Dr. Kirtland or Mr. Read so state. Mr. Langdon gives it as a common migrant. In the vicinity of Columbus, though common, it is very retiring in its habits, especially in spring, frequenting swamp woodlands and the weedy banks of small brooks. In the fall it appears in the high grass of swamps and low borders of rivers, in companies of considerable numbers. It is not, however, entirely confined to wet places, for I have found them in upland woods quite distant from water. While with us it is very retiring and silent. Occasionally a single *chip* is heard. At its breeding grounds it is said to sing a pleasing and somewhat varied song. Its neat and trim form, tasteful colors, happily contrasting bright brown with black and ash, render it one of the handsomest of the smaller Sparrows.

The nest of the Swamp Sparrow is placed upon the ground, under a tussock of rank grass, in a low, moist place. The eggs are grayish- or bluish-white, so thickly speckled all over with different shades of brown as sometimes to conceal the ground color.

MELOSPIZA MELODIA (Wils.) Bd.

Song Sparrow.

Fringilla melodia, KIRTLAND, Ohio Geolog. Surv., 1838, 164.

Fringilla fasciata, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Melospiza melodia, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; in Coues' Birds of N. W., 1874, 233; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.

? *Fringilla fasciata*, GMELIN, Syst. Nat., i, 1788, 922.

Fringilla melodia, WILSON, Am. Orn., ii, 1810, 125.

Melospiza melodia, BAIRD, Birds N. A., 1858, 477.

Below, white, slightly shaded with brownish on the flanks and crissum, breast and sides with numerous dusky streaks, with brown edges, coalescing to form a pectoral blotch and maxillary stripes bounding the throat; crown dull bay, with fine black streaks, divided and bounded on either side by ashy-whitish lines; vague brown or dusky and whitish markings on the sides of the head; the interscapular streaks black, with bay and ashy-white edgings; rump and cervix grayish brown, with merely a few bay marks; wings with dull bay edgings, the coverts and inner quills marked like the interscapulars; tail obviously longer than the wings, pale brown, with darker shaft lines, on the middle feathers at least, and often with obsolete wavy markings. Length, 6-6½; wing, about 2½; tail, about 3.

Habitat, Eastern United States, with geographical varieties to the Pacific; north to Canada and Nova Scotia.

Abundant, resident at least in Middle and Southern Ohio. Breeds. Generally distributed, though most abundant along streams of water and in low places. Often seen in gardens of the city, and breeding commonly in the suburbs. This is probably, next to the Chipping Sparrow, the most familiar of all our native Sparrows, being generally known as the "Ground Chippy." It is less arboreal than the common Chippy, and a bird of considerable attractions as a vocalist. It is one of the earliest songsters of spring, or rather its song announces the closing of winter. It varies with the season, and with different individuals at the same time, but is always animated and vigorous.

In winter the Song Sparrow retires from the open country to sheltered glades in woods, and shrubbery on the banks of streams and ditches.

That this bird has a strong attachment to its nest, and also that it possesses mental qualities akin to reason, was happily illustrated by a pair of these birds observed by me in June, 1875. Their nest had been built upon the ground, within a few feet of the track of the Little Miami Railroad, about a mile west of this city. Some laborers, in clearing away the undergrowth and cutting the grass along the track, had discovered the nest and removed it, placing it very insecurely on a fork of a horizontal limb of a maple sapling, about three feet from the trunk. Instead of deserting the nest, as many birds would have done, or attempting to secure it to the limb on which it was placed, the birds gathered long stems of timothy grass and fastened them by twisting the tops together and around a limb extending over the nest at a distance of nearly one and a half feet. The lower ends of these stems were firmly fastened into the rim of the nest, and other stems were knitted in transversely, forming a pretty complete basket work. The whole structure

resembled an elongated hollow cone or inverted balloon. The only openings sufficiently large to admit the passage of the birds were an entrance over the limb, at the fork, and an exit directly opposite. In this remarkable structure the eggs were hatched and the young safely raised. After the nest was deserted I found the attachment of the grass stems sufficiently strong to support the nest after the limb on which it was placed was removed.

The nest is generally placed on the ground, but often on a low bush. It is composed mainly of leaves and grass, and lined with fine grass, rarely with horse-hair, perhaps with good reason, for I have found two unfortunate females who had ensnared themselves in attempting to use this material. The eggs are usually five. Their ground color varies from a grayish or pinkish-white to light bluish-green, more or less thickly spotted with dark reddish-brown. Their average measurement is .82 by .60.

GENUS JUNCO. Wagler.

Bill small, the lower mandible as high as the upper. Tarsus longer than middle toe; outer toe longer than inner, barely reaching to base of middle claw; hind toe reaching to middle of middle claw. Wings rather short; a little longer than the tail; primaries longer than the nearly equal secondaries and tertiaries.

JUNCO HYEMALIS (L.) Sol.

Snowbird.

Fringilla hyemalis, KIRTLAND, Ohio Geolog. Surv., 1:33, 164, 183.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Junco hyemalis, WHEATON, Ohio Agric. Rep. for 1860, 336; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6 —LANGDON, Birds of Cin., 1877, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9. Snow Bird, KIRTLAND, Fam. Visitor, i, 1850, 63.—READ, Fam. Visitor, iii, 1852, 68.

Fringilla hyemalis, LINNÆUS, Syst. Nat., i, 1758, 183.

Junco hyemalis, SCLATER, Proc. Zool. Soc., 1857, 7.

Blackish-ash, below abruptly pure white from the breast. Two to three outer tail feathers white. Bill flesh colored. In the female, and in fact in most fall and winter specimens, the upper parts have a more grayish, or even a decidedly brownish cast, and the inner quills are edged with pale bay. Length, 6-6½; wing and tail, about 3.

Habitat, Eastern Province of North America; in the United States west to the Black Hills, thence northwest to Alaska. Washington Territory. Utah. Colorado. Arizona.

Winter resident in Southern and Middle, and resident throughout the year in Northeastern Ohio. Dr. Kirtland says it "breeds in great numbers in the dark beech woods of the Connecticut Western Reserve." Mr. Read says it is "most abundant in winter, yet common throughout the year." I have seen it in July in Portage county. In the vicinity

of Columbus it makes its appearance in October, and remains until the first of May. It is most abundant in November and March. In very severe weather nearly most of them pass further south. They are to be found everywhere, but especially affect the undergrowth along the banks of streams, fence-rows, and thickets on the edges of woods. They are numerous in the gardens of cities, and become quite familiar. Their ordinary note is a short sharp emphatic *chip*, rapidly repeated as the bird is flushed, but in the spring as the days become warmer, they delight to set in the low branches of trees and sing a very sweet suppressed song, as if tuning up in anticipation of the approaching breeding season.

The nest is placed on the ground. It is composed of strips of bark, straw, rootlets, and hair, and lined with moss and fur. The eggs are creamy-white, spotted and blotched with reddish-brown. They measure .75 by .60.

GENUS SPIZELLA. Bonaparte.

Bill conical, its outlines slightly curved, the lower mandible decidedly larger than the upper. Feet slender; tarsus rather longer than middle toe; hind toe a little longer than outer lateral, which slightly exceeds the inner; outer claw reaching to base of middle claw, and half as long as its toe. Wings somewhat pointed, about equal to and reaching nearly to middle of the tail; tail rather long, moderately forked.

SPIZELLA MONTICOLA (Gm.) Bd.

Tree Sparrow.

Fringilla canadensis, KIRTLAND, Ohio Geolog. Surv., 1834, 164.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Spizella monticola, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

Fringilla monticola, GMELIN, Syst. Nat., i, 1788, 912.

Fringilla canadensis, LATHAM, Ind. Orn., 1790, 434.

Spizella monticola, BAIRD, Birds N. Am., 1858, 472.

Bill black above, yellow below; legs brown, toes black; no black on forehead; crown chestnut (in winter specimens the feathers usually skirted with gray), bordered by a grayish-white superciliary and loreal line, and some vague chestnut marks on sides of head; below, impurely whitish, tinged with ashy anteriorly, washed with pale brownish posteriorly; the middle of the breast with an obscure dusky blotch; middle of back boldly streaked with black, bay, and flaxen; middle and lesser wing-coverts black, edged with bay and tipped with white, forming two conspicuous cross-bars; inner secondaries similarly variegated; other quills and tail feathers dusky, with pale edges. Length, 6; wing and tail, nearly 3.

Habitat, North America at large, excepting, probably, the Gulf States.

Abundant winter resident from November to the latter part of April.

Mr. Read says "a few remain and spend the entire year with us; have raised them from the nest." With the exception that they have been found breeding at Calais, Maine, by Mr. Boardman, and the statement of Dr. Coues, that it breeds in mountains within our limits, this is the only record of its breeding in the United States.

This is one of the most hardy of all the Sparrows. With us they frequent willow thickets, shrubbery, and high weeds along the banks of streams, and weedy spots on the edges of woods. Not uncommonly they are found in gardens of cities. They are gregarious, sometimes feeding in flocks of a hundred. They are scarcely less terrestrial than the Snow Sparrow, but take their common name from the habit they have of flying from thickets into trees when disturbed. Their common note is a soft chirp, and when feeding they frequently utter an exceeding high and clear short twitter, like the tinkling of a tiny bell. Before leaving us the males sing a rather low but exceeding sweet song.

The Tree Sparrow nests on the ground or on low bushes; the nest is built of fibres of bark and grass, and lined with feathers. The eggs are light-green, rather sparsely marked with reddish-brown, and measure .85 by .65.

SPIZELLA SOCIALIS (Wils.) Bp.

Chipping Sparrow.

Fringilla socialis, KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Spizella socialis, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6 —LANGDON, Cat. Birds of Cin., 1877, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9. Chipping Sparrow, BALLOU, Field and Forest, iii, 1878, 1 6.

Fringilla socialis, WILSON, Am. Orn., ii, 1810, 127.

Spizella socialis, BONAPARTE, List, 1838, 33.

Adult: bill black; feet pale; crown chestnut, extreme forehead black, a grayish-white superciliary line, below this a blackish stripe through eye and over auriculars. Below, a variable shade of pale ash, nearly uniform and entirely unmarked; back streaked with black, dull bay and grayish-brown; inner secondaries and wing-coverts similarly variegated, the tips of the greater and lesser coverts forming whitish bars; rump ashy, with slight blackish streaks; primaries and tail dusky, with paler edges. Young, with crown streaked like the back, the breast and sides thickly streaked with dusky, the bill pale brown, and the head lacking definite black. Length, 5-5½; wing, about 2½; tail rather less.

Habitat, Temperate North America from Atlantic to Pacific.

Abundant summer resident from April to November. Breeds abundantly. Perhaps no bird is more familiar or better known. It rather seeks than shuns the society of man, and is especially abundant in cities

and towns. Although found in woodland, its preference is for the open country and sparsely wooded pasture fields. In the fall they become gregarious, but in spring, though numbers may be seen together, they are seldom seen in flocks. The common name is derived from its note. Its song is a rapid, prolonged, monotonous, but not unpleasant repetition of a single note.

On one occasion I found the nest of this bird on the ground. It was placed in a slight depression in the turf of a woodland pasture, and contained four eggs. I kept sight of it until the young were hatched and left the nest, which did not differ in construction from those placed in trees.

The nest of the Chipping Sparrow, so far as known, with the above single exception, is always placed in trees or bushes. It is indifferently fixed in a perpendicular or horizontal fork, and is for the most part composed of black horse-hair, with a loose foundation of grass and vegetable fibres. I have seen two nests composed entirely of white hairs. The eggs are four or five, bluish-green, rather sparsely spotted with purplish and blackish-brown. They measure about 70 by .55.

SPIZELLA PUSILLA (Wils.) Bp.

Field Sparrow.

Fringilla pusilla, KIRTLAND, Ohio Geolog. Surv., 1838, 164.

Fringilla juncorum, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Spizella pusilla, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6 — LANGDON, Cat. Birds of Cin., 1877, 9; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

Fringilla pusilla, WILSON, Am. Orn., ii, 1810, 121.

Fringilla juncorum, NUTTALL, Man., 1832, 499.

Spizella pusilla, BONAPARTE, List, 1838, 33.

Bill pale reddish; feet very pale; crown dull chestnut; no decided black or whitish about head. Below, white, unmarked, but much washed with pale brown on breast and sides; sides of head and neck with some vague brown markings; all the ashy parts of *socialis* replaced by pale brownish. Back bright bay, with black streaks and some pale flaxen edgings; inner secondaries similarly variegated; tips of median and greater coverts forming decided whitish cross-bars. Size of *socialis*, but more nearly the colors of *monticola*. Young, for a short time, streaked below as in *socialis*.

Habitat, Eastern United States.

Abundant summer resident from April to November. Frequents especially the edges of woodland and borders of fields; sometimes, while on its spring migration, visits the gardens of cities. Its song is rather mournful, but very sweet and pleasing. It is heard during the whole day, and is especially noticeable at midday, when most birds are silent.

Thickets along railroads are favorite resorts of this species, and a telegraph wire is a favorite perch while singing.

The nest of the Field Sparrow is placed on the ground, in a clump of grass, or in a low bush or tree but a few inches above the ground. It is composed of grass, with a foundation of dead leaves and a lining of hair. The eggs are four or five, white, more or less thickly spotted with reddish-brown.

GENUS ZONOTRICHIA. Swainson.

Body rather stout. Bill slightly notched, somewhat compressed, excavated inside. Wings moderate, rounded, not reaching to middle of tail; secondaries and tertials equal, shorter than the first primary. Tail rounded, about equal to the wings. Feet stout; tarsus rather longer than middle toe. Hind toe longer than lateral. Claws slender and considerably curved.

ZONOTRICHIA ALBICOLLIS (Gm.) Bp.

White-throated Sparrow.

Fringilla pennsylvanica, KIRTLAND, Ohio Geolog. Surv., 1838, 164, 183.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Zonotrichia albicollis, BAIRD, P. R. R. Rep., ix, 1858, 464 —WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 9; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

White-throated Finch, KIRTLAND, Fam. Visitor, i, 1850, 148, 164.

Fringilla albicollis, GMELIN, Syst. Nat., i, 1788, 926.

Fringilla pennsylvanica, LATHAM, Ind. Orn., 1790, 446.

Zonotrichia albicollis, BONAPARTE, Cousp. Av., 1800, 478.

Adult male, with the crown black, divided by a median white stripe, bounded by a white superciliary line and *yellow spot* from nostril to the eye; below this a black stripe through the eye; below this a maxillary black stripe bounding the definitely pure white throat, sharply contrasted with the dark ash of the breast and sides of the neck and head. *Edge of wing yellow*. Back continuously streaked with black, chestnut, and fawnish-white; rump ashy, unmarked. Wings much edged with bay, the white tips of the median and greater coverts forming two conspicuous bars; quills and tail feathers dusky, with pale edges. Below, white, shaded with ashy-brown on sides, the ash deeper

SPIZELLA PALLIDA (Sw.) Bp.

Clay-colored Sparrow.

Spizella pallida, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.

Emberiza pallida, SWAINSON and RICHARDSON, Fn. Bor.-Am., ii, 1831, 251.

Spizella pallida, BONAPARTE, List, 1838, 33.

Habitat, from Texas to the Upper Missouri and Saskatchewan; east to Iowa, Wisconsin, and Illinois. Given as a bird of Ohio by me in 1875, on what I now consider insufficient authority.

and purer on the breast; bill dark; feet pale. Female and immature birds with the black of head replaced by brown, the white of throat less conspicuously contrasted with the duller ash of surrounding parts, and frequently with obscure dusky streaks on the breast and sides. Length, $6\frac{1}{2}$ - $7\frac{1}{2}$; wings and tail each about 3.

Habitat, Eastern Province of North America; north to 65° ; west to the Indian Territory, Kansas, and Dakota.

Abundant and regular spring and fall migrant in April and May, September to November. Frequents woodland undergrowth and the banks of streams, and is generally seen in scattered flocks. In the spring the males arrive several days before the females, and disappear sooner. Late in spring many females are seen considerably streaked below; these are probably young birds. Dr. Kirtland mentions their remaining in Northern Ohio throughout the month of June, but they have never been known to breed with us. Mr. Merriam has discovered it breeding in the Adirondack region, Northern New York, while Mr. E. A. Mearns gives it as a regular winter resident in the lower Hudson River Valley.

In some sections, this Sparrow, which is one of the largest of the streaked Sparrows, is known as the Peabody Bird, from its clear but somewhat drawling notes, which strikingly resemble the syllables *pe-á-body*, *pe-á-body*, *á-body*, *á-body*, *á-body*. It is a tolerably regular visitor in spring in gardens of the city, where its song is sometimes heard at night. Its call note is a lisping *tseep*.

The nest is built upon the ground; it is composed of moss and grass, lined with fine grass, rootlets, hair, and a few feathers. The eggs vary from four to seven. They are of a pale-greenish color, more or less thickly spotted with rusty-brown, and measure .90 by .68.

ZONOTRICHIA LEUCOPHRYS (Forst.) Sw.

White-crowned Sparrow.

Fringilla leucophrys, AUDUBON, Orn. Biog., ii, 1834, 88; B. Am., iii, 1841, 159.—KIRTLAND, Ohio Geolog. Surv., 1838, 164, 183.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Zonotrichia leucophrys, BAIRD, P. R. R. Rep., ix, 1858, 460.—WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 568.—LANGDON, Cat. Birds of Cin., 1877, 9; Journ. Cin. Soc. Nat. Hist., i, 1878, 114; Reprint, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

White-crowned Finch, KIRTLAND, Fam. Visitor, 1850, 148, 161.

Emberiza leucophrys, FORSTER, Philos. Tr., lxii, 1772, 382, 403, 426.

Fringilla leucophrys, BONAPARTE, Syn., 1828, 107.

Fringilla (Zonotrichia) leucophrys, SWAINSON and RICHARDSON, Fn. Bor.-Am., ii, 1831, 255.

Zonotrichia leucophrys, BONAPARTE, List, 1838, 32.

Adults of both sexes with the crown pure white, enclosing on either side a broad black stripe that meets its fellow on the forehead and descends the lores to the level of the eyes, and bounded by another black stripe that starts behind the eye and curves around the side of the hind head, nearly meeting its fellow on the nape; edge of under eyelid white. Or, we may say, crown black, enclosing a median white stripe and two lateral white stripes, all confluent on the hind head. General color a fine dark ash, paler below, whitening insensibly on the chin and belly, more brownish on the rump, changing to dull brownish on the flanks and crissum, the middle of the back streaked with dark purplish-bay and ashy-white. No bright bay, like that of *albicollis*, anywhere, except some edging on the wing-coverts and inner secondaries; middle and greater coverts tipped with white, forming two bars; no yellow anywhere; bill and feet reddish. Young birds have the black of the head replaced by a very rich warm brown, the white of the head by pale brownish, and the general ash has a brownish suffusion, and the back is more like *albicollis*.

Habitat, Eastern North America north to the Arctic region; in the Rocky Mountain region replaced by var. *intermedia*, and on the Pacific slope by var. *gambeli*. Greenland. Cape St. Lucas.

Very common spring and fall migrant, but less uniform in numbers than the preceding species. Arrives a little later in spring and departs earlier in the fall. Dr. Kirtland mentions their remaining until July in the vicinity of Cleveland, in 1850. Mr. Langdon states, on the authority of Mr. Dury, that they were abundant during Christmas week, 1877, in the vicinity of Cincinnati. It is found in the same localities as the White-throated Sparrow, though oftener seen along the borders of fields than in woodland. In the fall it is less common, and irregular, frequenting high weeds on the banks of streams. Usually its song is not heard, but in seasons when they appear in very considerable numbers, and remain late, as in the spring of 1875, it is a constant singer. Like the preceding, its notes are very soft and sweet, a rather slow and mournful rendering of the syllables and melody of the old song, *Oh, de âr, de âr, what can the matter be?* Sometimes a dozen may be heard singing on the borders of a single field.

The large size, contrasted colors of its head, with plain body colors, neat, trim form, with a martial aspect which it sometimes wears, render it an attractive and rather imposing bird.

The White-crowned Sparrow seems to be rather more northern in its summer distribution than the White-throated. In but two instances, at Rutland, Vermont, and Potsdam, New York, do I find it recorded as breeding in the United States east of the mountains of Colorado.

The nest is placed upon the ground, built of weeds and grass, with a lining of fine grass. The eggs are usually four, pale bluish-green, thickly spotted, especially about the larger end, with reddish-brown. They measure about .92 by .70.

GENUS CHONDESTES. Swainson.

Bill swollen, both outlines curved. Lower mandible as high as, and broader than, the upper. Tarsi about equal to the middle toe; lateral toes equal and very short, not reaching base of middle claw. Wings long, pointed, reaching nearly to the middle of the tail. Tertiaries equal to secondaries. Tail long, rounded.

CHONDESTES GRAMMACA (Say.) Bp.

Lark Finch.

Chondestes grammaca, WHEATON, Field Notes, i, 1861, 129; Ohio Agric. Rep. for 1860, 1861, 366; Reprint, 8; in COUES' Birds of N. W., 1874, 234; Food of Birds, etc., Ohio Agric. Rep. for 1860, 1861, 566; Reprint, 6.—COUES, Birds of N. W., 1874, 159.—BAIRD, BREWER and RIDGWAY, N. A. Birds, i, 1874, 563.—LANGDON, Cat. Birds of Cin., 1877, 9 —RIDGWAY, Bull. Nutt. Orn. Club, iii, 1878, 43 —JORDAN, Man. Vert., 1878, 86.

Chondestes grammica, BREWSTER, Bull. Nutt. Orn. Club, iii, 1878, 122.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist, i, 1879, 175; Reprint, 9.

Fringilla grammaca, SAY, Long's Exp., i, 1823, 139.

Chondestes grammaca, BONAPARTE, List, 1838, 32.

Head curiously variegated with chestnut, black, and white; crown chestnut, blackening on the forehead, divided by a median stripe and bounded by two lateral stripes, of white; a black line through, and another below the eye, enclosing a white streak under the eye and the chestnut auriculars; next a sharp black maxillary stripe, not quite reaching the bill, cutting off a white stripe from the white chin and throat. A black blotch on middle of breast. Under parts white, faintly shaded with grayish-brown; upper parts grayish-brown, the middle of the back with fine black streaks. Central tail feathers like the back, the rest jet black, broadly tipped with pure white in diminishing amount from the lateral pair inward, and the outer web of outer pair entirely white. Length, 6½-7; wing, 3½; tail, 3.

"*First plumage.* Crown dark brown, faintly tinged with chestnut. A median and two lateral stripes of pale brownish-yellow. Rest of upper parts similar to the adult, but with the rump obscurely spotted, and the streaking on the feathers of the interscapular region much broader. Lores dull black. Beneath soiled white, thickly streaked everywhere, excepting upon the abdomen, with dull black. From a specimen in my collection obtained at Columbus, Ohio, by Dr. J. M. Wheaton." (*Brewster, l. c.*)

Habitat, Plains and prairies of the West; south to Mexico; west to the Pacific; north to Wisconsin and Iowa; east to Middle Ohio. Massachusetts. District of Columbia. Florida.

Common summer resident from the last week in April until August, less common in Southern Ohio, not known in Northern Ohio. Breeds. The Lark Finch was first known as an Ohio bird in 1861; during the spring and summer I saw three specimens. It has since appeared quite regularly, and in increasing numbers. On its first arrival it frequents stubble-fields and roadsides, and sometimes gravelly places, but selects for its summer home a sparsely wooded pasture, or neglected field bordered with low trees. It sings from the time of its arrival until after

the breeding season, and none of our Sparrows equal it in melody. Dr. Brewer says of it:

"The song of this species is described as composed of regularly divided parts, almost perfect in compass, in vigor and continuity unsurpassed, if not unequaled, by any other North American species. It begins with a series of chants, the style reminding one somewhat of the *Cyanospiza cyanea*, but each syllable loud, rich, and clear, and uttered with a peculiar emotional trill, the whole seeming delivered in a hurried manner, in one continuous gush of silvery notes, and accompanied by a metallic *tremolo*. As if exhausted the singer falters, and the notes become scarcely audible, then suddenly reviving, as if in great joy, the song is resumed in all its vivacity, until the bird at last really appears to be overcome with its efforts."

These birds have some other peculiar traits. On the ground they run instead of hop, as is the case with most Sparrows. Three or four may frequently be seen following each other after the manner of quails, running with lowered heads, drooping wings, and expanded tail. In some parts of Illinois they are known as Quail-heads, probably from a superficial resemblance which they bear to that bird in coloration, and the habit above mentioned. In some localities they are called Road Birds, from their habit of running along roadsides and feeding in roads.

Birds in trouble sometimes appeal to man for assistance. In the summer of 1875, I was attracted by the singular movements of one of these birds, which flew before me, frequently alighting, as if endeavoring to draw me away from its nest. Following it for a short distance, it circled several time around a garter snake, which I killed, when the bird perched upon a fence stake and filled the air with his grateful notes. I was still more than ever convinced that the nest or young of the bird were near, and commenced search. During my unsuccessful search the bird disappeared. Returning to the spot where the dead snake lay, I gave it a toss with my stick, which was immediately followed by the reappearance of the bird, which exhibited more anxiety than ever. It flew at the snake, which it seemed to understand was now harmless, picked at and attempted to drag it. Going to the spot, I found the nest, and the snake partially coiled around it. Another toss, and I was again rewarded with a song.

The nest of the Lark Finch is placed in a slight depression of the ground, sometimes, according to Mr. Ridgway, in trees and bushes. Dr. Brewer describes it as being nearly flat and very shallow, composed entirely of various grasses, loosely intertwined, but the nests which I have seen in this locality are neat, compact structures, with deep cavities, and composed almost entirely of fine dark rootlets, neatly lined with grass, and with some attempt at ornamentation about the rim. The

eggs are usually four, sometimes five. They are of a soiled white color, spotted with very dark brown, and marked with zigzag, straight, and wavy lines of blackish, as in the eggs of many of the *Icteridæ*. They measure .85 by .65. As soon as the young are able to fly they take to trees, and from this time until their departure, this species is more arboreal than in the spring and early summer.

GENUS PASSER. Brisson.

Bill shaped much as in the Purple Finch. Wings moderate, pointed, second quill longest, but scarcely exceeding the first and third, which are equal. Tail two-thirds as long as the wing, slightly forked; tarsus as long as the middle toe; lateral toes equal.

PASSER DOMESTICUS (L.) Degland and Gerbe.

English Sparrow.

Passer domesticus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 9.

Pyrgita domestica, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 175; Reprint, 9.

Fringilla domestica, LINNÆUS, Syst. Nat., i, 1766, 323.

Pyrgita domestica, CUVIER, Reg. An., 1829, 439.

Passer domesticus, DEGLAND and GERBE, Orn. Europ., i, 1867, 241.

Male: above reddish brown, the back streaked with black; the crown and under parts brownish ash, the chin and throat black; a white wing-bar. Female lacking the black on chin and throat. Length, 6½; wing, about 3; tail, 2½.

Introduced from Europe. Resident. Breeds. The English Sparrow has been introduced into most of the cities and larger towns, and many of the villages of the State, within the last ten years. They were at first supposed to be a deadly foe to insects injurious to fruit and shade trees, but this seems to have been an error, their only recommendation being that they are tolerable scavengers, but like most scavengers, they are dirty themselves, and make nearly as much dirt as they remove, and are noisy without melody or other attractive traits. They are familiar even to impudence, as might be expected from their having been naturalized without as much as making a "declaration of intention."

When first introduced in this city they put on aristocratic airs, occupied the cornices of the best hotels, business houses and palatial residences, and spent their leisure time only in the finest streets and parks. Now they are content with humbler quarters. They seem to be shunned by other birds, none but Cow-birds seeking their acquaintance.

Their nest is placed in bird-boxes, crevices about houses, and sometimes in vines and evergreen trees. When built in holes and bird-

boxes scarcely any art is shown in construction, or taste in the selection of material, but nests in trees have a foundation of twigs and a lining of grass, pieces of string and bits of soft material of various sorts. The eggs are from four to seven in number, bluish-ash, spotted and streaked with various shades of brown. They measure about .90 by .62. Several broods are raised in a season.

GENUS PASSERELLA. Swainson.

Body stout. Bill unnotched, the two jaws of equal depth; roof of upper mandible vaulted. Wings long, pointed, about equal to the even tail, and reaching to its middle. Inner secondaries not lengthened. Tarsus about equal to the middle toe. Lateral toes lengthened, the tips of their claws reaching far beyond base of middle claw.

PASSERELLA ILIACA (Merrem.) Sw.

Fox Sparrow.

Fringilla iliaca, KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Passerella iliaca, BAIRD, P. R. R. Rep., ix, 1858, 489.—WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 9; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.

Fringilla iliaca, MERREM, Beit. Gesch., ii, 1786-7, 49.

Passerella iliaca, SWAINSON, Class B, ii, 1837, 228.

General color ferrugineous or rusty red, purest and brightest on the rump, tail, and wings, on the other upper parts appearing as streaks laid on an ashy ground; below, white, variously but thickly marked except on the belly and crissum with rusty red, the markings anteriorly in the form of diffuse confluent blotches, on the breast and sides consisting chiefly of sharp saggitate spots and pointed streaks; tips of middle and greater coverts forming two whitish wing-bars; upper mandible dark, lower mostly yellow; feet pale. Length, 6½-7¼; wing and tail each 3 or more.

Habitat, Eastern Province of North America, north to mouth of Yukon; west to edge of great plains. Colorado.

Common spring and fall migrant in March and April, October and November. Frequents woodland and borders of streams. Rarely in gardens of cities.

This is one of the largest and finest of the Sparrows. Its long wings give it a flight which is more thrush-like than any other Sparrow, and it has the thrush-like habit of concealing itself behind the trunks and larger branches of trees when alarmed. Its only note while with us is a low but rather sharp *tschip*, but in the Eastern States and at his summer home his song is described as being exquisitely sweet.

The Fox Sparrow is not known to breed within the limits of the United States, but has been found nesting in Labrador and British America.

The nest is built either on the ground or in trees. It is constructed of grass, moss, and fibrous roots, with hair and feathers. The eggs are light bluish-white, thickly spotted with rusty-brown. They measure .92 by .70.

GENUS EUSPIZA. Bonaparte.

Bill large and strong, swollen; the lower mandible nearly as high as, and considerably broader than, the upper, the edges much inflected and shutting within the upper. Tarsus barely equal to middle toe; lateral toes equal, not reaching base of middle claw. Wings long, sharp pointed, longer than the emarginate tail, and reaching nearly to its middle. Inner secondaries lengthened, but much shorter than primaries.

EUSPIZA AMERICANA (Gm.) Bp.

Black-throated Bunting.

Fringilla americana, KIRTLAND, Ohio Geolog. Surv., 1838, 164, 183.

Emberiza americana, AUDUBON, Orn. Biog., iv, 1838, 579; B. Am., iii, 1841, 60.

Euspiza americana, WHEATON, Ohio Agric. Rep. for 1860, 366, 376; Reprint, 1861, 8, 18; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—COUES, Birds of N. W., 1874, 166.—BAIRD, BREWER and RIDGWAY, ii, 1874, 67.—LANGDON, Cat. Birds of Cin., 1877, 9; Journ. Cin. Soc. Nat. Hist., i, 1878, 114; Reprint, 5; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.—BREWSTER, Bull. Nutt. Orn. Club, iii, 1878, 122; iv, 1879, 41.

Emberiza americana, GMELIN, Syst. Nat., i, 1788, 872.

Fringilla americana, BONAPARTE, Syn., 1823, 107.

Euspiza americana, BONAPARTE, List, 1838, 32.

Male: above grayish-brown, the middle of the back streaked with black, the hind neck ashy, becoming on the crown yellowish-olive, with black touches; a yellow superciliary line, and maxillary touch of the same; eyelid white; ear-coverts ashy; chin white; throat with a large jet-black patch; under parts in general white, shaded on the sides, extensively tinged with yellow on the breast and belly; edge of wing yellow; lesser and middle coverts rich chestnut, the other coverts and inner secondaries edged with paler; bill dark horn-blue; feet brown. Female: smaller; above like the male, but head and neck plainer; below less tinged with yellow, the black throat patch wanting, and replaced by sparse sharp maxillary and pectoral streaks. Length, 6½-7; wing, 2½; tail, 2¾.

"*Autumnal plumage*: young. Crown, shoulder, and rump, with sides of head and neck, light olive-brown, the centres of the feathers slightly darker; a little concealed chestnut on the shoulders. Feathers of the interscapular region with dull black centres and brownish-fulvous edges. Wing-bands, with outer margins of wing-coverts and secondaries, dull brownish-fulvous. Superciliary line brownish-yellow, fading anteriorly to brownish-white. Throat, central area of the abdomen, and the crissum, pale brownish-white. Sides of breast and body brownish-olive, with dark brown streaking on the flanks. Breast dull reddish-orange, streaked with dark brown, and washed with obscure ashy-white. From a specimen in the collection of Dr. J. M. Wheaton, obtained at Circleville, O., August, 1878." (*Brewster*, l. c., 1879.)

"*First plumage*. Above pale fulvous, with broad markings of dark brown upon the feathers of the interscapular region, and narrower fainter ones of lighter brown upon

the crown. Bend of wing, middle and greater coverts, fulvous. Under parts delicate fawn-color, deepest upon the breast. No markings beneath, excepting a faintly indicated line of dusky spots upon the sides of the breast. From a specimen in my cabinet collected at Columbus, Ohio, by Dr. J. M. Wheaton. This bird is very young, scarcely large enough to fly." (*Brewster*, l. c., 1872.)

Habitat, Eastern United States; west to Kansas, Nebraska, and Colorado; north to Massachusetts; south to Mexico, Central America, and New Grenada.

Abundant summer resident from May to September, in Middle and Southern, less common in Northern Ohio. Frequents clover and grain fields. Probably has greatly increased in numbers with the increase of cultivation. Audubon states that it is rare in Ohio and Kentucky, and Dr. Kirtland says that he admits it to his list on insufficient authority. Mr. Read omits it. It is now the characteristic summer bird of fields throughout Middle and Southern Ohio.

No one of our Sparrows is more variable in plumage. Although the above description is correct for a large proportion of birds, yet many specimens are found which differ from it in several particulars. I am of the opinion that it is several years before they attain their highest plumage, and that the sexes can not be distinguished by their color alone. The size also varies considerably, and the males are not always larger than the females. Very highly colored males have the head decidedly glossed with yellow, and the breast decided, though not definite, rich yellow, prolonged as a broad median line to the lower belly. Some males, apparently adult, have the black throat-patch, instead of broad and shield-shaped, reduced to a small indefinite spot; in others the black of throat is entirely wanting, but the maxillary streaks are present, with or without pectoral streaks. Males without black on the throat show no lack of chestnut on the wing or yellow on the breast. In fact the chestnut on the wing sometimes appear in an inverse ratio to the black on the throat, but some males, in spring, have the chestnut reduced to a mere trace.

The same variations are seen in the females, some of whom have a small black spot on the breast, and more rarely a large definite shield, but these latter appear to be very old birds. Some without black on the throat are quite yellow below; some have well defined chestnut on the wings, while in others it is entirely wanting. In fact, no description can be framed which would accord with every variation, or separate the sexes.

The Black-throated Bunting, or Little Field Lark, as it is commonly called, to distinguish it from the Meadow Lark, usually arrives in the vicinity of Columbus during the first week in May. Sometimes a few

single males first appear, but usually the fields which were comparatively silent the day before, are filled with the monotonous notes of many birds. The females arrive a few days later, when pairing and breeding immediately begins. Two or three males pursue a female about the fields, as is the habit of the Bobolinks, singing as they fly. The female sometimes tires of this rapid courtship, and seeks refuge and rest in woodland. From the time of their arrival till the young are well fledged, the male, perched on the top of a stump, tall weed, or fence stake, sings his *chip, chip, che, che, che, che, che*, which Dr. Coues interprets as "Look! look! see me here! see," with wearisome monotony. Only occasionally some more talented vocalist conceives the happy idea of a variation, and renders it *che, che, che, chip, chip*. This is their only song, but sometimes when flying they utter a coarse guttural croak.

The nest is usually placed on the ground, but sometimes attached to the stems of tall weeds, or more rarely in trees and bushes. When placed on the ground it is composed for the most part of dead stalks of clover, and is so inartistic and fragile that it can with difficulty be taken up entire. When placed above the ground, it is comparatively neat and compact, and built of vegetable fibres. The eggs are generally four, light-blue, unspotted, and almost exactly like those of the Bluebird. They measure .90 by .70.

After the breeding season they are silent, and in August prepare to leave for the South. As in spring, their migrations are performed by night. Their coarse note is often heard as they fly over-head. Early in foggy September mornings these notes are frequently heard, and the birds seen as they descend to feed and rest in the thickets of young willows and wild cucumbers that cover the gravelly islands and low banks of our rivers. From the fact that I have never taken September birds with black on the throat, I am inclined to believe that in their winter plumage it is wanting. (?)

In their habits they seem to form a connecting link, if any were needed, between the families of *Fringillidæ* and *Icteridæ*, and their resemblance to the latter family is further seen in their smooth, short, and dense plumage.

GENUS GONIAPHEA. Bowditch.

Bill very large, nearly as high as long; the commissure conspicuously angulated just below the nostril. Lower jaw extending much behind the forehead. Rictus with a few long stiff bristles. A prominent knob in the roof of the mouth. Wings long, longer than the even tail, reaching to its middle. Tarsus shorter than middle toe. Outer lateral toe a little longer than inner.

GONIAPHEA LUDOVICIANA (L) Bowditch.

Rose-breasted Grosbeak.

- Fringilla ludoviciana*, AUDUBON, Orn. Biog., ii, 1834, 166.—KIRTLAND, Ohio Geolog. Surv., 1838, 164, 184; Am. Journ. Sci. and Arts, xl, 1841, 21.
- Coccochorus ludovicianus*, AUDUBON, B. Am., iii, 1841, 210.
- Coccothraustes ludovicianus*, NUTTALL, Man., i, 1840, 623.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.
- Guiraca ludoviciana*, WHEATON, Field Notes, i, 1861, 129; Ohio Agric. Rep. for 1860, 1861, 366, 376; Reprint, 8, 18.
- Goniaphea ludoviciana*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 566; Reprint, 6.—LANGDON, Cat. Birds of Cin., 1877, 9.
- Hedymeles ludovicianus*, BAIRD, BREWER and RIDGWAY, N. A. Birds, ii, 1874, 72.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.
- Loxia ludoviciana*, LINNÆUS, Syst. Nat., i, 1766, 306.
- Fringilla ludoviciana*, BONAPARTE, Am. Orn., ii, 1828, 79.
- Guiraca ludoviciana*, SWAINSON, Philos. Mag., i, 1827, 438.
- Coccothraustes (Guiraca) ludovicianus*, SWAINSON and RICHARDSON, Fn. Bor.-Am., ii, 1831, 271.
- Goniaphea ludoviciana*, BOWDITCH, "Excurs. in Madeira, 1825."
- Hedymelis ludovicianus*, CABANIS, Mus. Hein., i, 1851, 153.

Adult male with head and neck all round and most of the upper parts black, the rump, upper tail-coverts, and under parts white, the breast and under wing-coverts exquisite carmine or rose-red; wings and tail black, variegated with white; bill pale; feet dark. Female: above streaked with blackish and olive- or flaxen-brown, with median white coronal and superciliary line; below, white, more or less tinged with fulvous and streaked with dusky; under wing-coverts saffron-yellow; upper coverts and inner quills with a white spot at end; bill brown. Young males at first resemble the female. Length, $7\frac{1}{2}$ – $8\frac{1}{2}$; wing, about 4; tail, about $3\frac{1}{2}$.

Habitat, Eastern Provinces of North America, north to Labrador and the Saskatchewan; south through Mexico and Central America to Ecuador. Cuba.

Common summer resident in Northern Ohio, chiefly migrant in Southern and Middle Ohio, where but few remain and breed.

The Rose-breasted Grosbeak, one of the most handsome, showy, and musical of North American birds, arrives early in May and returns southward in September. It frequents both high and low woodlands and wooded swamps, and sometimes, though rarely, makes its appearance in the gardens of the city. Those which remain choose for their summer home thickets on the wooded borders of streams, especially in the vicinity of sycamore trees. While on their migrations, the males and females are very seldom seen together. Dr. Kirtland states that they frequent the cranberry marshes of Northern Ohio, and that it surpasses the Mocking-bird in the animation of its song. Mr. Read says that they nest in large numbers on the borders of streams and cranberry marshes.

In this vicinity they are rare during the breeding season; I have but once discovered their nest. This was placed in a low thorn-tree in a thicket on the edge of a sycamore grove on the bank of the Olentangy River. I was attracted to the locality by the loud, clear and flute-like voice of the male, who, perched high in the branches of the tall trees, sang by the hour his incomparable notes. Audubon states that he found their nest and eggs in the vicinity of Cincinnati.

The nest is placed in a low tree on the edge of woods or on the bank of a stream. It is composed of small twigs, vegetable fibres, and grass; the eggs vary from light green to greenish-white, thickly spotted with reddish-brown. They measure about 1.00 by .75. The males assist in, if they do not largely perform, the duties of incubation.

In the fall the males migrate in small companies of ten or twelve, and from the fact that all which I have seen resemble the females, except in having the under wing-coverts and spot on the breast carmine, I suspect that old males lose their black, and become streaked in the fall. (?)

GENUS CYANOSPIZA. Baird.

Bill deep at base, compressed; the commissure with an obtuse shallow lobe in the middle. Tarsus about equal to middle toe; outer toe barely longer than inner, its claw falling short of base of middle claw. Claws much curved, acute. Wings long and pointed, longer than the nearly even tail, and reaching to its middle.

CYANOSPIZA CYANEA (L.) Bp.

Indigo Bird.

Fringilla cyanea, KIRTLAND, Ohio Geolog. Surv., 1838, 164, 183.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

GONIAPHEA CÆRULEA (L.) Sclater.

Blue Grosbeak.

Guiraca cærulea, WHEATON, Ohio Agric. Rep. for 1860, 1861, 379; Reprint, 21 (probable).

—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 22 (probable).

Goniaphea cærulea, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 566; Reprint, 6.—LANGDON, Cat. Birds of Cin., 1877, 9.

Loxia cærulea, LINNÆUS, Syst. Nat., i, 1766, 306.

Guiraca cærulea, SWAINSON, Philos. Mag., i, 1827, 438.

Goniaphea cærulea, SCLATER, P. Z. S., 1856, 301.

Habitat, United States southerly, from Atlantic to Pacific. In the East, north to the Middle States regularly; to Connecticut Valley occasionally; to Maine casually. In the interior north to the Platte. In the West, north through California. South to Mexico and Central America. Cuba.

Given in my list of 1875 on what I now consider insufficient authority.

Cyanospiza cyanea, WHEATON, Ohio Agric. Rep. for 1860, 366, 376; Reprint, 1861, 8, 18; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 9; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.—JONES and SHULZE, Illus. Nests and Eggs of Ohio Birds, part 2, 1879, plate 4.

Tanagra cyanea, LINNÆUS, Syst. Nat., 1766, 315.

Fringilla cyanea, WILSON, Am. Orn., i, 1810, 100.

Cyanospiza cyanea, BAIRD, Birds N. Am., 1858, 505.

Adult male: indigo blue, intense and constant on the head, glancing greenish, with different lights on other parts; wings and tail blackish, glossed with greenish-blue; feathers around base of bill black; bill dark above, rather paler below, with a curious black stripe along the gonys. Female: above plain warm brown; below, whitey-brown, obsoletely streaky on the breast and sides; wing-coverts and inner quills pale-edged, but not whitish; upper mandible blackish, lower pale, with the black stripe just mentioned. The young male is like the female, but soon shows blue traces, and afterwards is blue, with white variegation below. Length, $5\frac{1}{2}$; wing, $2\frac{3}{4}$; tail, $2\frac{1}{2}$.

Habitat, Eastern Province of the United States; north to Canada and Maine; west to Kansas and Indian Territory; south to Texas, Mexico, and Central America.

Abundant summer resident from the first week in May to the latter part of October. Breeds. Found almost everywhere, but especially in woodland, thickets, and rank vegetation along streams; in cities frequently during the spring migration.

The male seems proud of his bright plumage, and loses no opportunity to render himself conspicuous, while the female is as decidedly modest and retiring. Their call or alarm note is a sharp *chip*, but the male is a vigorous and frequent, though not particularly gifted, songster.

The nest is built in low bushes, of leaves and grass. The eggs are four or five, white, with a bluish tinge, unspotted; or, rarely, thinly dotted with reddish-brown. They measure .75 by .58.

GENUS CARDINALIS. Bonaparte.

Conspicuously crested. Bill very large, lower jaw wider and about as deep as the upper. Tarsi longer than middle toe. Outer toe rather longer than inner, and longer than hind toe. Tail longer than the wings, both rounded.

CARDINALIS VIRGINIANUS (L.) Bp.

Cardinal Redbird.

Fringilla cardinalis, AUDUBON, Orn. Biog., ii, 1834, 366.—KIRTLAND, Ohio Geolog. Surv., 1838, 164, 184.

Pitylus cardinalis, AUDUBON, B. Am., iii, 1841, 199.

Cardinalis virginianus, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 9; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 10.

Loxia cardinalis, LINNÆUS, Syst. Nat., 1766, 300.

Fringilla (Coccothraustes) cardinalis, BONAPARTE, Obs. Wils., 1825, No. 79.

Cardinalis virginianus, BONAPARTE, List, 1838, 35.

Male: rich vermilion or rosy-red, obscured with ashy on the back; face black; bill reddish; feet brown. Female: ashy brown, paler below, with evident traces of the red on the crest, wings, tail, and under parts. Length, 8-9; wing, about $3\frac{3}{4}$; tail, 4.

Habitat, Eastern United States; west to Kansas, Nebraska, and Texas; north to the Middle States. rare in New York, casual in Connecticut, accidental in Massachusetts; represented by varieties in the Southwest.

Common resident. Breeds. Frequents thickets in woodland and swamps.

The Cardinal Grosbeak, or Redbird, as it is here generally called, is better known as a cage bird than in its native state. It is resident throughout the State, though not sedentary, but wandering in winter and collecting in great numbers in suitable sheltered localities. Mr. Read says that he has taken it in Northern Ohio when the thermometer stood at zero. Dr. Kirtland, in 1838, said it "was hardly known in the Western Reserve until within the last three or four years," but was then common and resident. Mr. Read also mentions their increasing numbers.

In this vicinity they are generally distributed during the breeding season, but in severe winters they collect in large companies in swamp thickets. In one such locality of about ten acres in extent, I have seen in an hour more than a hundred birds. They are also frequent visitors to the gardens of the city during the colder portions of the year.

In their habits and flight they bear considerable resemblance to the Brown Thrush. The call or alarm note of this bird is a loud sharp *chip*, and their song a highly modulated repetition of loud whistling notes of great variety. They often sing at night, and the song of the female, though weaker, is not less varied, and more pleasing than that of the male.

Considerable numbers are trapped and sold. In cold weather almost any form of trap baited with corn, buckwheat, or other seeds, will capture them; in spring they are generally taken in trap-cages, by the use of decoy birds. They are nearly always to be found in the markets of the city, where they sell at from one to two dollars per pair.

The nest is placed in a variety of situations, usually from three to ten feet from the ground. I have found them in low dense-topped trees, in thickets, on the top of vine-covered stumps, in wild-gooseberry bushes overhanging water, and in brush-heaps. I have found the nest ready for the reception of eggs as early as April 17. It is rather small and com-

nest, constructed of small twigs and rootlets, and lined with grass. The eggs are four in number, very rarely five, white, thickly spotted with dark reddish-brown, which often forms a ring around the larger end. They vary in size and shape, nearly as much as those of the Cowbird, which they somewhat resemble, and which is sometimes found in the same nest. They measure from .98 to 1.10 in length by from .78 to .80.

GENUS PIPILO. Vieillot.

Bill rather stout, the lower jaw not so deep as, but wider, than the upper. Feet large, tarsus about equal to middle toe; outer toe a little longer than inner, equal to hind toe. Claws stout, compressed, moderately curved. Wings short, much rounded, reaching to end of upper tail-coverts, outer four quills graduated. Tail longer than wings, graduated externally.

PIPILO ERYTHROPHthalmus (L.) V.

Towhe Bunting; Chewink.

Fringilla erythrophthalma, KIRTLAND; Ohio Geolog. Surv., 1838, 164.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Pipilo erythrophthalmus, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, c; Food of Birds, etc., Ohio Agric. Rep. for 1874, 566; Reprint, 1875, 6.—LANGDON, Cat. Birds of Cin., 1877, 9; Journ. Cin. Soc. Nat. Hist., i, 1878, 115; Reprint, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.

Fringilla erythrophthalmus, LINNÆUS, Syst. Nat., i, 1766, 318.

Pipilo erythrophthalmus, VIEILLOT, Gal. Ois., i, 1824, 109.

Adult male: black, belly white, sides chestnut, crissum fulvous-brown; primaries and inner secondaries with white touches on the outer webs; outer tail feathers, with the outer web, and nearly the terminal half of the inner web, white, the next two or three with white spots, decreasing in size; bill blackish; feet pale brown; iris red in the adult, white or creamy in the young, and generally in winter specimens. Female: rich warm brown where the male is black; otherwise similar. Very young birds are streaked brown and dusky above, below whitish, tinged with brown and streaked with dusky. Length: male, 8½; wing, 3½; tail, 4; female rather less.

Habitat, Eastern Province of North America to Minnesota, Canada, and Labrador; west to Kansas and Fort Randall; replaced in northern Dakota by var. *arcticus*.

Very common summer resident in Middle and Northern, resident throughout the year in Southern Ohio. Breeds. In the vicinity of Columbus the Towhe is abundant from the middle of March to the middle of November, and I have taken single birds in every month of the year. It frequents thickets and woodland undergrowth. Sometimes when migrating they visit the gardens of the city. The common names, Towhe and Chewink, are imitations of its ordinary note, which is quick, ringing, and somewhat petulant, though not unpleasant. Its song is quite different; mounting like the Chat to the middle branches of a tall

tree, it sits motionless, and sings at short intervals *pe ar, pe, che-che-che*. It is a restless, busy bird, and resents intrusion upon his premises by scolding notes, short contemptuous flights and disdainful flirtings of his fine tail, of which he is evidently proud. When his notes are not heard his presence is indicated by the noise he makes in running over and scratching among the dry leaves.

The nest is usually well sunken in a depression of the ground at the root of a bush or young sapling. Several instances, however, have been brought to my notice where it has been placed in trees and bushes eight or ten feet above the ground. It is composed almost entirely of stems of grass, upon a foundation of dead leaves. The eggs are white, thickly spotted with light ash-brown, and measure .98 by .80.

FAMILY ICTERIDÆ ORIOLES, ETC.

Primaries nine. Bill conic, but lengthened; little, if any, shorter than head; the angulation of tomia evident; no notch at end. Nostrils high. No rectal bristles.

Sub family AGELAINÆ. Marsh Blackbirds.

Bill stout, conical, acutely pointed, not longer than the head; the outlines nearly straight. Legs longer than the head, adapted for walking. Claws not much curved. Tail moderate, shorter than the wings, nearly even.

GENUS DOLICHONYX. Swainson.

Bill short, little more than half the head. Tarsus shorter than middle toe; inner toe longer than outer, not reaching base of middle claw. Wings long, pointed. Tail feathers acutely pointed at tip, with the shafts stiffened and rigid as in the Woodpeckers.

DOLICHONYX ORYZIVORUS (L.) Sw.

Bobolink; Reedbird; Ricebird.

Icterus agripennis, NUTTALL, Man, i, 1832, 185.—KIRTLAND, Ohio Geolog. Surv., 1838, 162.

—READ, Fam. Vis., iii, 1853, 319; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Dolichonyx oryzivorus, NUTTALL, Man, i, 2d ed., 1840, 198.—WHEATON, Ohio Agric. Rep. for 1860, 366, 376; Reprint, 1861, 8, 18; Food of Birds, etc., Ohio Agric. Rep. for 1874, 567; Reprint, 1875, 7.—LANGDON, Cat. Birds of Cin., 1877, 9; Journ. Cin. Soc. Nat. Hist., i, 1878, 115; Reprint, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.

Emberiza oryzivora, LINNÆUS, Syst. Nat., i, 1766, 311.

Icterus agripennis, BONAPARTE, Obs. Wils., 1824, No. 87.

Dolichonyx oryzivorus, SWAINSON, Zool. Journ., iii, 1827, 351.

Male in spring: black; cervix buff; scapulars, rump, and upper tail-coverts ash-white; interscapulars streaked with black, buff, and ash; outer quills edged with yellowish; bill blackish-horn; feet brown. Male in fall, female and young, entirely dif-

ferent in color; yellowish-brown above, brownish-yellow below, crown and back conspicuously, nape, rump, and sides less broadly, streaked with black; crown with a median and lateral light stripe; wings and tail blackish, pale edged; bill brown. The male changing, shows confused characters of both sexes. Length, $6\frac{1}{2}$ – $7\frac{1}{2}$; wing, $2\frac{1}{2}$ – 4 ; tail, $2\frac{3}{4}$ – 3 ; tarsus, about 1 ; middle toe and claw, about $1\frac{1}{2}$.

Habitat, Eastern North America; north to the Saskatchewan; west to the Rocky Mountains, Utah, Nevada, Wyoming, and Montana; south to Bolivia, La Plata, etc. West Indies. Gallipagos.

Abundant summer resident in Northern, very common spring and fall migrant, less common summer resident and breeding in Middle, and migrant only in Southern Ohio. Dr. Kirtland gives it without comment. Mr. Read gives it as very abundant, and breeding, and states that "years ago it was not found on the Reserve." Mr. B. F. Abell, of Welchfield, Geauga county, says that it was first observed in that place May 20, 1857. Mr. Langdon gives it as an "occasional migrant in May, usually in small flocks."

In this vicinity it was unknown to old residents. I first saw them in May, 1857, when I obtained a specimen which, with two or three others, was perched upon a tree on the bank of Alum Creek. Since then they have increased in numbers, and during the last six or seven years at least, a few have nested with us. They are also known to breed at Yellow Springs, about fifty miles south of west from this city. This appears to be their southernmost recorded limit during the breeding season. Dr. Brewer gives their breeding range from latitude 42° to 54° .

The Bobolink arrives in this vicinity during the first week in May, in companies of from six to thirty. On their first arrival they rather prefer wet meadows, but those which remain to breed choose dry and often elevated clover fields. Many of the males are in full breeding plumage when they arrive, but some have most of the black feathers skirted with buff or ashy. The females arrive a few days later than the males. During the fall migration they show a decided preference for fields and orchards in which stand crops of Hungarian grass, on the seeds of which they feed ravenously. They generally migrate by night, when their call note, a sharp *chink*, is heard overhead. Sometimes, however, they migrate during the day, as was the case with the first seen by me, and with a single male, which alighted on the top of an ash tree in my garden, and after resting awhile, flew away singing.

The song of the male is a most remarkable performance. Sitting upon the top of a bending weed, or perched upon a stump, bush, or fence, he sings such a variety of hasty, jolly, and gingling notes, that the ear is puzzled to receive them. From some of the syllables of his song he takes

his name. While singing he raises and depresses his feathers, seems to contract and expand his whole body, bows, nods, and shrugs, till he resembles a French dancing-master in uniform, singing, fiddling, dancing, and calling off at the same time. In the mating season, several males pursue the same female, flying rapidly and low, filling the air with their chorus of song.

Several pairs nest in the same field, and when this is entered by a human being, all the males resent the trespass by hovering about, singing and scolding, till he is convinced that a dozen nests are endangered by his every step.

The nest is placed on the ground, well concealed in the rank clover. It is built of clover and grass stems. The eggs are five or six, dull white, variously shaded, and spotted and blotched with reddish- and grayish-brown. They measure .90 by .70.

GENUS MOLOTHRUS. Swainson.

Bill short, stout, about two-thirds the length of the head; the culmen broad, rounded, convex, and running back on the head to a point. Lateral toes nearly equal, reaching to distal joint of the middle toe, which is shorter than the tarsus. Wings long, pointed, longer than the nearly even tail, first quill longest.

MOLOTHRUS ATER (Bodd.) Gr.

Cow-bird.

Icterus pecoris, KIRTLAND, Ohio Geolog. Surv., 1838, 162, 180.—READ, Fam. Visitor, iii, 1853, 319; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Molothrus pecoris, WHEATON, Ohio Agric. Rep. for 1860, 366, 376; Reprint, 1861, 8, 18.

Molothrus ater, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 567; Reprint, 1875, 7.—LANGDON, Cat. Birds of Cin., 1877, 9; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.

Cow Bird; Cow Blackbird; Cow Troupial, READ, Fam. Visitor, iii, 1852, 63.—KIRTLAND, Fam. Visitor, i, 1850, 71.—BALLOU, Field and Forest, iii, 1878, 136.

Fringilla pecoris, GMELIN, Syst. Nat., i, 1788, 910.

Icterus pecoris, BONAPARTE, Obs. Wils., 1824, No. 88.

Molothrus pecoris, SWAINSON and RICHARDSON, Fn. Bor.-Am., ii, 1831, 277.

Molothrus ater, GRAY, Hand List, ii, 1870, 36.

Male, iridescent black; head and neck purplish-brown. Female, smaller, an obscure looking bird, nearly uniform dusky grayish-brown, but rather paler below, and appearing somewhat streaky, owing to darker shaft lines on nearly all the feathers; bill and feet black in both sexes. Length, 7½–8; wing, over 4; tail, over 3.

Habitat, Temperate North America to latitude 68°, excepting perhaps the Pacific coast; in Arizona, Lower California, and southward replaced by var. *obscurus*.

Abundant summer resident from March to the last of October. Breeds. Apparently a late addition to our fauna, for Dr. Kirtland admitted it "on rather doubtful authority," and Mr. Read said, in 1853, that it had re-

cently greatly increased in numbers. Found everywhere, and notorious as the only Ohio bird which builds no nest, but lays its eggs in the nest of other birds, by whom they are hatched, and the young cared for. In selecting a nest in which to deposit her eggs, the female is not particular; the nest of almost any tree- ground- or bush-nesting bird will answer, whether it be that of a Vireo, Gnatcatcher, or Cardinal Grosbeak. I have never known them placed in the nest of any Swallow, Wren, Woodpecker, Nuthatch, or Titmouse (except the Tufted Titmouse). From the fact that their eggs are sometimes found on the ground, or even in the bed of small brooks, it is probable that they are not always able to find a nest in time to meet an emergency.

Dr. Coues gives a very full and interesting account of the bird and its habits, in his "Birds of the Northwest," from which I extract the following paragraphs:

"It is interesting to observe the female Cow-bird ready to lay. She becomes disquieted; she betrays unwonted excitement, and ceases her busy search for food with her companions. At length she separates from the flock, and sallies forth to reconnoitre, anxiously indeed, for her case is urgent, and she has no home. How obtrusive is the sad analogy! She flies to some thicket, or hedge-row, or other common resort of birds, where, something teaches her—perhaps experience—nests will be found. Stealthily and in perfect silence she flits along, peering furtively, alternately elated or dejected, into the depths of the foliage. She espies a nest, but the owner's head peeps over the brim, and she must pass on. Now, however, comes her chance; there is the very nest she wishes, and no one at home. She disappears for a few minutes, and it is almost another bird that comes out of the bush. Her business done, and trouble over, she chuckles her self gratulations, rustles her plumage to adjust it trimly, and flies back to her associates. They know what has happened, but are discreet enough to say nothing—charity is often no less wise than kind.

"Polygamy is rare among higher birds; in no creatures are the parental and conjugal instincts more strongly developed or beautifully displayed. But the Cow-bird illustrates this mode of life, and not in the lordly manner of the barn-yard cock, so devoted to his harem, so gallant and just to all. As in this species there is no love of offspring, neither can there be conjugal affection; all family ties are dispensed with. The association is a mere herding together in quest of food in similar resorts. The Cow-birds never mate; their most intimate relations are no sooner effected than forgotten; not even the decent restrictions of a seraglio are observed; it is a perfect community of free-lovers, who do as the original Cynics did. The necessary courtship becomes in consequence a curiously mixed affair. During the period corresponding to the mating season of orderly birds, patriarchs of the sorry crew mount up the trees and fences, to do what they call their singing. They posture and turn about, and ruffle their feathers to look bigger than Nature made them; if their skins were not tough they would certainly burst with vanity. They puff out their throats and pipe the most singular notes, perhaps honestly wishing to please their companions of the other sex—at any rate, to their own satisfaction. Meanwhile the females are perched near by, but without seeming very enthusiastic—rather taking it all as a matter of course, listening at times, it may be, but just as likely preening their plumage, with other thoughts and an ulterior purpose. The performance

over, it is a very little while afterward when the whole band goes trooping after food in the nearest cattle-yard or pasture."

During July these birds disappear for a season, and where they go and what they do, has never been certainly discovered. I am somewhat of the opinion, from having seen them in great numbers during that month in the mountains of Pennsylvania, that like many others without family cares, they go to the mountains to rusticate and keep cool. In September and October they reappear on their way south, often in immense close flocks.

The eggs of the Cow-bird are white, more or less thickly spotted or dotted with ashy-brown; they are generally of a rounded oval form, nearly equal in size at both ends. Usually a single egg is deposited, but as many as five have been found in a nest. How many eggs the female lays in a season would be an interesting but difficult fact to ascertain.

GENUS AGELÆUS. Vieillot.

Bill, with culmen parting the feathers of the forehead, as long as the head, shorter than tarsus. Wings pointed, reaching to end of lower tail-coverts, second primary longest. Tail rounded.

AGELÆUS PHENICEUS (L.) V.

Red-winged Blackbird.

Icterus phœniceus, KIRTLAND, Ohio Geolog. Surv., 1838, 162.—READ, Fam. Visitor, iii, 1853, 319; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Agelaius phœniceus, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8.—LANGDON, Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.

Agelæus phœniceus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 567; Reprint, 1875, 7.—LANGDON, Cat. Birds of Cin., 1877, 9.—JONES and SHULZE, Illus. Nests and Eggs of Ohio Birds, Plate 5, Part 2, 1879.

Red-winged Blackbird, BALLOU, Field and Forest, iii, 1878, 136.

Oriolus phœniceus, LINNÆUS, Syst. Nat., i, 1766, 161.

Agelaius phœniceus, VIEILLOT, "Analyse, 1816."

Icterus phœniceus, "DAUDIN," LICHT., Verz., 1823.

Agelæus phœniceus, COUES, Key, 1872.

Male uniform lustrous black; lesser wing-coverts scarlet, broadly bordered by brownish-yellow or brownish-white, the middle row of coverts being entirely of this color, and sometimes the greater row likewise are mostly similar, producing a patch on the wing nearly as large as the red one. Occasionally there are traces of red on the edge of the wing and below. The female smaller, under 8; everywhere streaked; above blackish-brown, with pale streaks, inclining on the head to form median and superciliary stripes; below whitish, with very many sharp dusky streaks; the sides of the head, throat, and the bend of the wing, tinged with reddish or fulvous. The young male at first like the female, but larger; apt to have a general buffy or fulvous suffusion, and bright bay edgings of the feathers of the back, wings, and tail, and soon showing black patches. Length, 8-9; wing, 4½-5; tail, 3¼-4.

Habitat, Temperate North America.

Abundant summer resident from March 1st to November. Breeds. The Red-winged or Swamp Blackbird frequents swamps and marshes, both of great and small extent. In the spring they appear in small flocks, but in the fall collect together sometimes by thousands. When perched on the low trees or high weeds of a marsh, it presents an attractive appearance, but its notes are, to say the least, unmusical, being a singular combination of clear and guttural sounds frequently repeated, as if he was intent on learning to sing, but failed at every effort.

The nest of the Red-winged Blackbird is usually placed in the low willows of a swamp, and frequently considerable numbers breed together. It is built chiefly of hempen fibres of plants, with strips of the leaves and outer covering of the stems of cat-tails. Usually it is placed in an upright fork, or firmly attached to several upright twigs. Sometimes it is placed on the ground. The eggs are of a light bluish color, very variable, lined and blotched with purplish and black. Their average measurement is one inch by three-fourths of an inch.

GENUS *XANTHOCEPHALUS*. Bonaparte.

Bill about twice as long as high, its outlines nearly straight. Claws all very long, much curved, the inner the longest, reaching beyond middle of middle claw. Tail narrow, nearly even, the outer web scarcely widening to the end. Wings long, much longer than the tail; first quill longest.

XANTHOCEPHALUS ICTEROCEPHALUS (Bp.) Bd.

Yellow-headed Blackbird.

Xanthocephalus icterocephalus, COUES, Birds of N. W., 1874, 189 (probable).—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 567; Reprint, 1875, 7.

Icterus icterocephalus, BONAPARTE, Am. Orn., i, 1835, 27.

Xanthocephalus icterocephalus, BAIRD, Birds N. Am., 1858, 531.

Male black, whole head (except lores), neck, and upper breast yellow, and sometimes yellowish feathers on the belly and legs; a large white patch on the wing, formed by the primary and a few of the outer secondary coverts. Female and young brownish-black, with little or no white on the wing, the yellow restricted or obscured. Female, much smaller than the male, about $9\frac{1}{2}$. Length, 10–11; wing, $5\frac{1}{2}$; tail, $4\frac{1}{2}$.

Habitat, Western North America; north to the Saskatchewan and Red River; east regularly to Iowa, Illinois, and Wisconsin, casually to Greenland, Massachusetts, Pennsylvania, and Florida; south to Mexico.

Accidental. My only authority for inserting this species here is Mr. W. R. Limpert, a competent ornithologist, who is familiar with this species in the West. He informs me that in the summer of 1873, a pair of these birds made their appearance in a low meadow, a few miles south of Groveport, in this county, where they probably bred.

In its habits this species resembles the preceding, being highly gregarious.

gamous, and social while breeding. They are said to place their nest, which is constructed of reeds and aquatic grasses, in tufts of reeds, and rank grasses. The eggs, from three to six in number, are pale grayish-green, thickly spotted with different shades of reddish-brown. They measure 1.10 by .75.

GENUS STURNELLA. Vieillot.

Body stout, toes reaching beyond the tail. Tail feathers narrow, acutely pointed. Bill long, slender, the culmen extending backward and parting the frontal feathers; longer than the head, shorter than the tarsus. Inner toe longer than outer, not reaching base of middle claw. Hind toe a little shorter than the middle, which is equal to the tarsus. Hind claw nearly twice as long as the middle. Feathers of head stiffened and bristly. Inner secondaries nearly equal to the primaries.

STURNELLA MAGNA (L.) Sw.

Fieldlark; Meadowlark.

Sturnus ludovicianus, KIRTLAND, Ohio Geolog. Surv., 1838, 162.

Sturnella ludoviciana, READ, Fam. Visitor, iii, 1853, 311; Proc. Phila. Acad. Nat. Sci., 1853, 395.

Sturnella magna, WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 567; Reprint, 1875, 7.—LANGDON, Cat. Birds of Cin., 1877, 9; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10; Field Notes, ib. iii, 1880, 125.

Alauda magna, LINNÆUS, Syst. Nat., i, 1758, 167.

Sturnus ludovicianus, LINNÆUS, Syst. Nat., i, 1766, 290.

Sturnella ludoviciana, SWAINSON, Fn. Bor.-Am., 1831, 232.

Sturnella magna, BAIRD, Birds N. Am., 1858, 535.

Above, the prevailing aspect brown. Each feather of the back blackish, with a terminal reddish-brown area, and sharp brownish-yellow borders; neck similar, the pattern smaller; crown streaked with black and brown, and with a pale median and superciliary stripe; a blackish line behind eye; several lateral tail feathers white, the others with the inner quills and wing-coverts barred or scolloped with black and brown or gray. Edge of wing, spot over eye, and under parts generally, bright yellow, the sides and crissum flaxen-brown, with numerous sharp blackish streaks; the breast with a large black crescent (obscure in the young); bill horn-color; feet light brown. Length, 10-11; wing, 5; tail, 3½; bill, 1½. Female similar, smaller, 9½.

Habitat, Eastern North America, north to Nova Scotia and latitude 53°; west to the prairie region, where it is gradually replaced by var. *neglecta*, and represented by other varieties in Cuba, Central America, Mexico, and South America.

Abundant. Summer resident in Northern, in part resident in Middle, and resident, but less numerous in winter, in Southern Ohio. In this vicinity the Meadow Lark is most abundant from the middle of March to the first of November, but a few spend the severest winters here. I have seen them when the thermometer had recorded a temperature of -20° the previous night, and the ground covered with snow, apparently wandering in search of food.

As its name implies, the Meadow Lark frequents meadows, fallow fields, and sparse grassy woodland. It is rather a rare visitor in cities, but in the country does not shun the vicinity of dwellings. In the fall they gather in flocks, and are more silent and shy. At this time they are somewhat esteemed as a game-bird, though few who eat them suspect their relationship to the despised Blackbirds, or discover that of all our birds they are the most frequently affected by internal parasites.

The flight of the Meadow Lark is strong and quick, sometimes rather heavy and jerky. Its song is loud, clear, and sweet, among the most pleasant of bird voices in early spring. Mounted on the stake of a fence, top of a stump or tree, he whistles *he-ar, cheer*, as if accompanying the action to the word. The notes are often followed by a rapid, monotonous chatter, not at all melodious, and which is often given alone when perching or flying.

The nest of the Meadow Lark is placed on the ground, by the side of a tussock of grass, often covered with a dome of grass, and sometimes approached by a grass-covered way. The eggs are usually five or six, white, more or less thickly spotted or dotted with reddish-brown of varying shade. They measure about 1.10 by .80. Two broods are often raised in a season.

Sub-family ICTERINÆ. Orioles.

Bill slender, acute, as long as the head. Feet adapted for perching.

GENUS ICTERUS. Brisson.

Tarsus about equal to middle toe; claws short and curved. Outer lateral toe a little longer than inner, reaching beyond base of middle claw.

ICTERUS SPURIUS (L.) Bp.

Orchard Oriole.

Icterus spurius, KIRTLAND, Ohio Geolog. Surv., 1838, 162.—AUDUBON, B. Am., iv, 1843, 50.—READ, Fam. Visitor, iii, 1853, 311; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 567; Reprint, 1875, 7.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.

Oriolus spurius, LINNÆUS, Syst. Nat., i, 1766, 162.

Icterus spurius, BONAPARTE, Syn., 1828, 51.

Male black, lower back, rump, lesser wing-coverts, and all under parts from the throat, deep chestnut; a whitish bar across the tips of greater wing-coverts; bill and feet blue-black. Tail graduated. Length, about 7; wing, $3\frac{1}{2}$; tail, 3. Female smaller, plain yellowish-olive above, yellowish below; wings dusky; tips of the coverts, and and edges of the inner quills, whitish; known from the female of the other species by its smaller size and very slender bill. Young male at first like the female, afterwards showing confused characters of both sexes; in a particular stage it has a black mask and throat.

Habitat, United States East of the Rocky Mountains; rare in Northern New England and only casually in the Canadas.

Common summer resident. The Orchard Oriole arrives usually a few days later than the following species, and is less generally distributed and less common. Its favorite resorts are the low banks of sparsely wooded streams and willow thickets, and though frequently found in orchards and gardens, does not, in this vicinity, exhibit the preference which its common name implies.

In this vicinity the Orchard Oriole builds a nest, which for compactness, neatness, care in the selection of materials, and adaptation to concealment and the safety of the young, is unexcelled even by the noted Baltimore Hangnest. The nest is composed entirely of long green blades of strong marsh grass, woven compactly together to form a deep purse or cup, only slightly contracted at the rim and nearly twice as deep as wide, and with or without a scant lining of vegetable down. It is attached by the rim, and sometimes by the sides, to slender twigs of willow trees, where its color, which becomes by bleaching a uniform light straw, renders it very difficult to discover. The eggs are usually four in number, pale bluish, marked with dots and zig-zig lines of light and dark brown.

ICTERUS BALTIMORE (L.) Daudin.

Baltimore Oriole.

Icterus baltimore, KIRTLAND, Ohio Geolog. Surv., 1838, 162.—READ, Fam. Visitor, iii, 1853, 311; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395; WHEATON, Ohio Agri. Rep. for 1860, 366; Reprint, 1861, 8; Food of Birds, etc., Ohio Agric. Rep. for 1874, 567; Reprint, 1875, 7.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10.—JONES and SHULTZ, Illustrations of Nests and Eggs of Ohio Birds, Part 1, 1879, Plate 1.

Oriolus baltimore, LINNÆUS, Syst. Nat., i, 1766, 162.

Icterus baltimore, DAUDIN, Trans. Orn., ii, 348.

Male with the head and neck all round, and the back, black; rump, upper tail coverts, lesser wing coverts, most of the tail feathers, and all the under parts from the throat, fiery orange, but of varying intensity according to age and season. Middle tail feathers black, the middle and greater coverts and inner quills, more or less edged and tipped with white, but the white on the coverts not forming a continuous patch; bill and feet blue black. Length 7½-8; tail 3. Female smaller, and much paler, the black obscured by olive, sometimes entirely wanting. The young entirely without the black on throat and head, otherwise colored nearly like the female.

Habitat, United States, west to the Rocky Mountains. North regularly to the British Provinces. Breeds chiefly toward the northern portions of its range, but generally dispersed in summer over the United States.

Abundant summer resident from the latter part of April to September. Breeds. Found everywhere, and everywhere well-known by the bril-

liant plumage of the male. In many households no bird is more familiar or welcome; though some arrive earlier, possess more musical voices, or are more confiding, none inspire the same emotions as this, when for the first time in the season he alights upon the topmost branches of the elm in the door-yard, peers curiously into his dilapidated nest which still swings from the drooping branch, and whistles for his lagging mate.

The Misses Jones and Shulze give us a faithful and beautiful illustration of the nest and eggs of this bird. From their description I take the following :

“The typical nest is truly pensive, and is suspended from the extreme branches of an overhanging limb, where, shaded from the sun by leaves above, it rocks to the gentlest breeze. At other times it is fastened to a perpendicular limb of considerable size, where the smaller branches put forth. Between these two positions various others are common and constantly met with; no two nests being hung in exactly the same manner. The distance from the ground varies from four to seventy feet.

During the period of nidification, any substance combining the proper length, thickness and strength is in demand; consequently the materials of construction are almost without number, and depend to a great extent upon locality.

In the woods, long grasses, strips of bark and vegetable fibres of different kinds make up the structure; but in cities and villages, or in the country, near houses, yarn, wrapping-twine, horse and cow hairs, rags, paper and such other substances as are ready prepared and accessible, are largely used. The lining is generally of hairs, vegetable down, and fibres.

The cavity varies in depth from two and three-fourths to six inches; inside diameter at the mouth, from two and three-fourths to three and three-fourth inches, increasing from one-half to one inch near the bottom.

The complement of eggs is from four to six. They measure 1.05 x .70 to .80 x .50; average, about .92 x .60. When blown, the ground is white, with the brightness dimmed by the faintest bluish or pinkish tint, and marked with dots, lines, scawls and blotches of dark brown or black, usually distributed irregularly over the surface; but often thickest about the crown, forming a wreath.

Sub-family QUISCALINÆ. Crow Blackbirds.

Bill slightly curved, the cutting edges inflected. Legs longer than head, fitted for walking.

GENUS SCOLECOPHAGUS. Swainson.

Bill slender, shorter than the head. Wings longer than the nearly even tail.

SCOLECOPHAGUS FERRUGINEUS (Gm.) Sw.

Rusty Grackle.

Quiscalus ferrugineus, KIRTLAND, Ohio Geolog. Surv., 1838, 162.—READ, Fam. Visitor, iii, 1853, 327; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Scolecophagus ferrugineus, WHEATON, Ohio Agric. Rep., 1860, 367; Reprint, 1861, 9; Food of Birds, etc., Ohio Agric. Rep. for 1874, 567; Reprint, 1875, 7.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 176; Reprint, 10; Field Notes, ib, iii, 1880, 125.

Rusty Blackbird, BALLOU, Field and Forest, iii, 1878, 136.

Oriolus ferrugineus, GMELIN, Syst. Nat., i, 1788, 393.

Quiscalus ferrugineus, BONAPARTE, Obs. Wils., 1824, No. 46.

Scolecophagus ferrugineus, SWAINSON and RICHARDSON, Fn. Bor.-Am., ii, 1831, 285.

Male in summer lustrous black, the reflections greenish, and not noticeably different on the head; but not ordinarily found in this condition in the United States; in general glossy black, nearly all the feathers skirted with warm brown above, and browish yellow below, frequently continuous on the foreparts; the male of the first season, like the female, is entirely rusty brown above, the inner quills edged with the same; a pale superciliary stripe; below, mixed rusty and grayish black, the primaries and tail above black; bill and feet black at all times. Length, male about 9; wing 4½; tail 3½; bill ½; female smaller.

Habitat, Eastern Province of North America, west to Kansas, Nebraska and Dakota; thence obliquely in British America to the Pacific in Alaska. Breeds from Northern New England northward. In winter generally dispersed over the Middle, Western and Southern States.

Common spring and fall migrant in March, April and October. In the spring they appear usually in small flocks making their way northward along streams and seldom seen at a distance from water. These are in winter plumage or moulting; later, during April, a considerable number linger about ponds and swamps, and before leaving us acquire their full breeding plumage. In the fall they have their rusty coats on their arrival.

Their nests are placed in low trees and bushes and the eggs are described as measuring a little over an inch in length by three-fourths of an inch in width. The ground color is light greenish or grayish, thickly dotted with reddish- and purplish-brown, without streaks or lines.

GENUS QUISCALUS. Vieillot.

Bill as long as the head, stout. Wings in the male shorter than the long, conspicuously graduated tail.

QUISCALUS PURPUREUS (Bart.) Licht.

var. *ÆNEUS* Ridgway.

Bronzed Grackle; Crow Blackbird.

Quiscalus versicolor, KIRTLAND, Ohio Geolog. Surv., 1838, 162, 180.—READ, Fam. Visitor, iii, 1853, 327; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 367; Reprint, 1861, 9.

Quiscalus purpureus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 567; Reprint, 1875, 7.—LANGDON, Cat. Birds of Cin., 1877, 10.

Quiscalus purpureus, var. *æneus*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11; Field Notes, ib, iii, 1880, 125.

Crow Blackbird, KIRTLAND, Fam. Visitor, i, 1850, 1.—BALLOU, Field and Forest, iii, 1878, 136.

Quiscalus purpureus, LICHTENSTEIN.

Quiscalus versicolor, VIEILLOT, Nouv. Dict., xxviii, 1819, 488.

Quiscalus purpureus, var. *æneus*, BAIRD, BREWER and RIDGWAY, N. Am. Birds, ii, 1874, 218.

Metallic tints rich, deep, and uniform. Head and neck all round rich silky steel-blue, this strictly confined to these portions, and abruptly defined behind, varying in shade from an intense Prussian blue to brassy greenish, the latter tint always, when present, most apparent on the neck, the head always more violaceous; lores velvety-black. Entire body, above and below, uniform continuous metallic brassy-olive, varying to burnished golden olivaceous-bronze, becoming gradually uniform metallic purplish or reddish-violet on wings and tail, the last more purplish; primaries violet-black; bill, tarsus and toes pure black, iris sulphur-yellow.

Length, 12.50 to 13.50; wing, 6.00; tail, 6.00; culmen, 1.26; tarsus, 1.32. Third and fourth quills longest and equal; first shorter than fifth; projection of primaries beyond secondaries, 1.28; graduation of the tail, 1.48. (Ridgway.)

I give above the nomenclature and description of Mr. Ridgway, who separates the Crow Blackbirds of the Mississippi Valley from those of the Atlantic slope into varieties *æneus* and *purpureus*. The points of difference are the color, which in var. *purpureus* is variegated purple, blue, and violet on the body; size, *æneus* being larger; and proportion, the first quill in *purpureus* nearly equal to second and third, which are longest, and the tail is proportionally less graduated.

Habitat, Mississippi region of the United States, east to the Allegheny Mountains, west to Fort Bridger; Saskatchewan Region, Hudson's Bay Territory. Maine. More or less abundant in all eastern States north of New Jersey.

Abundant summer resident from March to November. Breeds. Found everywhere, but is especially numerous in sycamore groves along streams, and in oak woodland. The habits of this bird are almost too well known to require further notice. The prejudice which, with or without cause, existed against them is apparently dying out, and they are less systematically persecuted than formerly. None of our birds present a more beautiful appearance than does the Blackbird in his stately walk over the lawn in search of his insect food. He has one bad habit, that of robbing the nests of smaller birds. I have repeatedly seen them destroy the nest and eggs of the Chipping Sparrow, built in my own garden. This appeared to be from mere love of mischief, as they were not content with destroying the eggs but returned to demolish the nest, and again pulled to pieces the half finished nest which the birds rebuilt.

The nest of the Crow Blackbird is built either on trees or in cavities. Misses Jones and Shultz give as an illustration a nest "built in a grove of thorn trees, in a piece of wet grass land not far from Columbus," a spot frequented by a colony of these birds. In former years these birds commonly nested in clumps of ornamental evergreens, and in large elm trees in the city, and these nests were generally placed in the branches of the trees and were often quite exposed. Now, however, by far the greatest

number of nests are placed in the holes of limbs and hollow trunks of trees, especially sycamore and oak. In some localities where oak trees have been "topped," the nest is placed on the end of the "stub."

The nest is composed of mud, with a foundation of grass and weeds, and a lining of fine grasses and frequently hair. The eggs are from four to six. Their "ground color is light greenish or smoky blue, with irregular dark-brown or black blotches, dots, lines, and scrawls distributed promiscuously over the surface, often resembling Japanese characters." They measure 1.13 by .83.

FAMILY CORVIDÆ. THE CROWS.

Primaries, 10; the first usually about half the second; the outer four sinuated on the inner edge. Nostrils concealed by stiffened bristles or bristly feathers directed forwards. Tarsus with scutella separated from the lateral plates by a narrow naked strip. Basal joint of middle toe united for about half its length to each lateral. Bill notched.

Sub-family CORVINÆ. Typical Crows.

Bill as long as head; wings long and pointed, longer than the short, nearly even tail.

GENUS CORVUS. Linnaeus.

Bill nearly as long as tarsus, very stout, higher than broad at base, much arched; tarsus longer than middle toe.

CORVUS CORAX L.

Raven.

Corvus corax, WILSON, Am. Orn., ix, 1825, 136.—KIRTLAND, Ohio Geolog. Surv., 1838, 162, 180.—AUDUBON, B. Am., iv, 1843, 86.—READ, Fam. Visitor, iii, 1853, 327; Proc. Acad. Nat. Sci., Phila., vi, 1853, 395.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 568; Reprint, 8.—COUES, Birds of N. W., 1874, 205.—LANGDON, Cat. Birds of Cin., 1877, 10; Journ. Cin. Soc. Nat. Hist., i, 1878, 115; Reprint, 6.

Corvus carnivorus, WHEATON, Ohio Agric. Rep. for 1860, 1861, 367; Reprint, 9.

Corvus corax var. *carnivorus*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11; Field Notes, ib, iii, 1880, 125.

Raven, KIRTLAND, Fam. Visitor, i, 1850, 1.

Corvus corax, LINNÆUS.

Corvus carnivorus, BARTRAM, Trav. Fla., i, 1793, 290.

Corvus corax var. *carnivorus*, BAIRD, BREWER, and RIDGWAY, N. A. Birds, ii, 1875, 234.

Entire lustrous black; throat feathers acute, lengthened, and disconnected. Length, about 2 feet; wing, 16-18 inches; tail, 10.

Habitat, North America. Rare east of the Mississippi.

Rare winter visitor. Early in the history of the State the Raven was not uncommon. Wilson speaks of it as entirely supplanting the Crow on the southern shores of Lake Erie. It soon became less numerous, and in the course of fifty years had disappeared as a regular visitor from all parts excepting the northern portions of the State, where it is now rare.

Mr. Read says that it was frequent in 1853. Mr. Langdon states that a specimen was taken September 3, 1879, near Marysville, Union county, which is now in the collection of Dr. Buffington of that place. This is the only record for several years.

The nest of the Raven is placed in trees, sometimes on rocks. It is composed of sticks, lined with hair, and is quite bulky. The eggs average six in number, light-green in color, marked with dots and blotches of purple and brown. They measure about two inches in length by one and one-third in width.

CORVUS AMERICANUS Aud.

Common Crow.

Corvus corone, KIRTLAND, Ohio Geolog. Surv., 1838, 162.—READ, Family Visitor, iii, 1853, 327; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Corvus americanus, WHEATON, Ohio Agric. Rep. for 1860, 367; Reprint, 1861, 9; Food of Birds, etc., Ohio Agric. Rep. for 1874, 568; Reprint, 1875, 8.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11; Summer Birds, ib., iii, 1880, 224.

Crow, KIRTLAND, Fam. Visitor, i, 1880, 1.—BALLOU, Field and Forest, iii, 1878, 136.

Corvus corone, WILSON, Am. Orn., iv, 1811, 79.

Corvus americanus, AUDUBON, Orn. Biog., ii, 1834, 317.

Habitat, Temperate North America, excepting, probably, most of the high central plains and the southern Rocky Mountains, where the Raven abounds.

Abundant. Resident in Southern, summer resident in Middle and Northern Ohio; a few remain in Central Ohio during mild winters. No one of our birds suffers more from a bad reputation than the Crow, yet none seem more likely to outlive their past notoriety. Hated and pursued by every boy who can command a gun, their sagacity often proves their only safety. In all places of this State they fear the gun or the semblance of it, while a human being unarmed is looked upon with suspicion only.

In the vicinity of Columbus, where, twenty years since they were abundant, they are now, except when migrating, hardly common. Whether this diminution in numbers is due to changes in environment, or from causes acting directly upon the birds themselves is not known. Doubtless the removal of trees along rivers and creeks, in which they were accustomed to roost, has assisted in lessening their numbers. It is asserted that they were attacked by a disease resembling the "chicken cholera," some fifteen years since, which decimated their ranks. But neither of these causes seem to be sufficient. In most parts of the State their numbers are undiminished. Mr. Read states that they were increasing in numbers in Northern Ohio in 1853.

The nest of the Crow is placed in trees, and built of sticks and twigs lined with moss or strips of bark. The eggs are green, more or less thickly spotted and blotched with blackish brown. Variations in ground color are sometimes met with, and, more rarely, the spots are wanting.

Sub-family GARRULINÆ. Jays.

Wing, short, rounded, less than the much graduated tail, reaching not much beyond the under tail coverts, its tip formed by the 4th-7th quills.

GENUS CYANURUS. Swainson.

Head crested; bill rather slender, somewhat depressed at base.

CYANURUS CRISTATUS (L.) Sw.

Blue Jay.

Corvus cristatus, KIRTLAND, Ohio Geolog. Surv., 1838, 162.

Garrulus cristatus, READ, Fam. Visitor, iii, 1853, 335; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Cyanurus cristatus, WHEATON, Ohio Agric. Rep. for 1860, 367; Reprint, 1861, 9; Food of Birds, etc., Ohio Agric. Rep. for 1874, 568; Reprint, 1875, 8.—LANGDON, Cat. Birds of Cin., 1877, 10.

Cyanura cristata, BAIRD, BREWER, and RIDGWAY, ii, 1874, 276.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11.

Blue Jay, BALLOU, Field and Forest, iii, 1878, 136.

Corvus cristatus, LINNÆUS, i, 1766, 157.

Garrulus cristatus, VIEILLOT, Ency. Meth., 890.

Cyanurus cristatus, SWAINSON, Fn. Bor.-Am., ii, 1831, 495.

Purplish blue, below pale gray, whitening on the throat, belly and crissum; a black collar across the lower throat and up the sides of the neck and head, behind the crest, and a black frontlet bordered with whitish; wings and tail pure rich blue, with black bars, the greater coverts, secondaries, and tail feathers, except the central, broadly tipped with pure white; tail much rounded, the graduation over an inch. Length, 11-12; wing, 5½; tail, 5¼.

Habitat, Eastern North America; north to 56°; west to Kansas and Dakota.

Abundant resident. The Blue Jay, or Jay Bird as it, perhaps, is oftenest called, is a striking exemplification of the saying, "Fine feathers do not always make fine birds." It seems to be a family inheritance to the *Corvidæ* to possess traits which render them obnoxious to the human race. Of our three representatives, the Raven has for ages been a bird of evil omen, the Crow the embodiment of mischievous cunning, while the Jay can not conceal his meanness with his beautiful plumage. His flight is that of a thief who dreads detection on all sides. His voice bewrays the meanness of his soul, while his vanity is only equalled by his domineering disposition. He possesses, to an eminent degree, the power of mimicry, and may frequently be seen heading the mob of

small birds in their assault upon a belated owl, himself the noisiest of the crowd; but no sooner does the unfortunate owl find a quiet retreat than our hero quickly disperses his army by imitating the cries of the Sparrow-hawk, and not seldom taking advantage of the confusion to plunder a nest. In this vicinity, for several years past, they have been less numerous than twenty years ago, but have apparently increased in numbers the past two or three years.

The nest of the Jay is built of twigs and fibrous roots. It is generally placed in a tree at varying distances from the ground, sometimes in bushes. The eggs are usually five, olive-drab, thickly spotted with olive-brown. They measure 1.10 by .85.

A remarkable instance of conservative adaptation, revealed by accident, and possible only among birds, is to be found in a communication to the Family Visitor, Vol. 1, 1850, 32, over the signature "C."

"A Blue Jay, with its wing broken, was brought to me one day to stuff, but as I was unable to do it then I kept it till the next day. It would hop about the room vociferating in its loud, harsh manner, skulking in corners, and trying to hide under chairs, but when caught biting fiercely the fingers exposed to it. Wishing to kill it without injuring the skin or disarranging its feathers, I attempted to strangle it by compressing its neck firmly so that the windpipe was entirely closed, and in this manner I held it for several minutes without its presenting any appearance of suffocation or inconvenience, and its thorax contracted and expanded regularly. Putting it down on the floor, it hopped off into a corner, screaming and scolding as usual. I was sadly puzzled to account for this, till at length I thought of its wing, and on examining it I found the large bone (humerus) broken, and through this it had breathed. After I stopped up this orifice, and compressed the windpipe again, it was suffocated in a few moments.

SUB-ORDER CLAMATORES.· NON-MELODIOUS PASSERES.

FAMILY TYRANNIDÆ. THE FLYCATCHERS.

First primary lengthened, often longest, at least over two-thirds as long as the longest. Bill broad at the base, much depressed, tapering to a fine point, which is abruptly de-

PERISOREUS CANADENSIS (L.) Bp.

Canada Jay.

Perisoreus canadensis, WHEATON, Ohio Agric. Rep. for 1860, 367 (error); Addenda, 480 (correction); Reprint, 1861, 21 (probable).

Corvus canadensis, LINNÆUS, Syst. Nat., i, 1766, 158.

Perisoreus canadensis, BONAPARTE, List, 1838, 27.

The Canada Jay was named as an Ohio bird, in my catalogue of 1861, by an error which was corrected in the appendix and reprint. Its nearest locality, so far as known to me, is Lewis Co., N. Y., where it has been found breeding in considerable numbers by Dr. Merriam.

curved. Culmen rounded or flattened. Gonys flattened. Commissure straight, or nearly so, to the tip. Nostrils small, circular, basal, overhung but not concealed by bristles. mouth capacious, with broad and deeply fissured rictus, beset with numerous long, strong bristles. Feet small and weak. Tail of twelve feathers.

GENUS TYRANNUS. Cuvier.

Wings long, the outer primaries rather abruptly attenuated near the end (in the adult), longer than the nearly even tail.

TYRANNUS CAROLINENSIS (Gm.) Temm.

Kingbird : Bee Martin.

Muscicapa tyrannus, KIRTLAND, Ohio Geolog. Surv., 1838, 163.

Tyrannus intrepidus, READ, Fam. Visitor, iii, 1853, 351; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—KIRKPATRICK, Ohio Farmer, viii, 1859, 355.

Tyrannus carolinensis, WHEATON, Ohio Agric. Rep. for 1860, 362; Reprint, 1861, 4; Food of Birds, etc., Ohio Agric. Rep. for 1874, 568; Reprint, 1875, 8.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11; Summer Birds, ib, iii, 1880, 224.—JONES and SHULZE, Illus. Nests of Ohio Birds, Part 2, 1879, Plate 6.

Lanius tyrannus, LINNÆUS, Syst. Nat., i, 1766, 136.

Lanius tyrannus var. *carolinensis*, et *ludovicianus*, GMELIN, Syst. Nat., i, 1788, 302.

Tyrannus carolinensis, TEMMINCK, Tabl. Meth., 24.

Muscicapa tyrannus, WILSON, Am. Orn., i, 1808, 66.

Tyrannus intrepidus, VIEILLOT, Gal. Ois., i, 1824, 214.

Two outer primaries obviously attenuate. Above blackish, darker on the head; crown with a flame colored patch; below pure white, the breast shaded with plumbeous; wings dusky, with much whitish edging; tail black, broadly and rather sharply tipped with white, the outer feather sometimes edged with the same. Bill and feet black. Young without the patch; very young birds show rufous edging of wings and tail. Length about 8 inches; wing $4\frac{1}{2}$; tail $3\frac{1}{2}$; bill under 1.

Habitat, North America at large, north to 57° or further; west to the Rocky Mountains, Oregon, Washington Territory, and British Columbia. South to Peru. Cuba.

Abundant summer resident. Breeds. Arrives late in April and remains till the middle of September.

The King-bird is noted for the audacious bravery with which it defends its nest. No bird is too large or too active to escape its determined attacks, and its pursuit is unrelenting till the intruder is driven to seek safety from its impetuous assailant in distant and often difficult flight. No sooner, however, is the breeding season over than our hero loses his combativeness, and becomes as meek and peaceable as other birds, not even sounding his jingling war note.

In the vicinity of this city the King-bird has increased in numbers with the removal of forests, in which it is seldom found. It frequents

the borders of streams, old fields and fence rows. Mr. Langdon mentions their especial abundance in "woods and groves" bordering marshes on the northern shore of Lake Erie. In this city they have evidently greatly increased in numbers, as well as others of the family, and I have thought this increase coincident with, and because of, the introduction of water works.

The nest of the King-bird is built in trees, very frequently a sycamore or elm near a stream, or an isolated tree in the middle of a field is chosen. Orchards afford favorite nesting sites. The nest is usually placed from twenty to thirty feet above the ground, on or in the fork of a limb. It is composed of coarse grasses, rootlets and vegetable fibers, well lined with fine grass, feathers, and hair. The eggs are generally four, sometimes six, of a rich creamy white color, spotted and blotched with dark rich brown. They measure .95 by .70. I once found the nest placed in the perpendicular fork of a small willow which grew up from the bottom of a pond. The nest was hardly a foot above water, and was much more neatly and compactly built than is ordinarily the case.

GENUS MYIARCHUS. Cabanis.

Head moderately crested. Wings about equal to the long, broad, even tail, scarcely reaching to its middle; 1st primary shorter than 6th. Tarsus equal to middle toe, which is decidedly longer than hind toe.

MYIARCHUS CRINITUS (L.) Cab.

Great Crested Flycatcher.

Muscicapa crinita, KIRTLAND, Ohio Geolog. Surv., 1838, 163.—AUDUBON, B. Am., i, 1840, 211; Orn. Biog., ii, 1834, 166.

Tyrannus crinitus, READ, Fam. Visitor, iii, 1853, 351; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Myiarchus crinitus, BAIRD, P. R. R. Rep., ix, 1858, 179.—KIRKPATRICK, Ohio Farmer, viii, 1859, 379.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362; Reprint, 4; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 568; Reprint, 8.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint 11; Summer Birds, ib, iii, 1880, 225.

Muscicapa crinita, LINNÆUS, Syst. Nat., 1776, 326.

Tyrannus crinitus, SWAINSON, Zool. Journ., xx, 1826, 271.

Myiarchus crinitus, CABANIS, J. f. O., 1855, 479.

Decidedly olivaceous above, a little browner on the head, where the feathers have dark centers; throat and fore breast pure dark ash, rest of under parts bright yellow, the two colors meeting abruptly; primaries margined on both edges with chestnut; secondaries and coverts edged and tipped with yellowish white; tail, with all the feathers but the central pair, chestnut on the whole of the inner web, excepting, perhaps, a very nar-

row strip next the shaft; outer web of outer feathers edged with yellowish; the middle feathers, outer webs of the rest, and wings, except as stated, dusky brown. Very young birds have rufous skirting of many feathers, in addition to the chestnut above described, but this soon disappears. Length, $8\frac{1}{2}$ – $9\frac{1}{2}$; wing and tail about 4; bill and tarsus, each, $\frac{1}{2}$.

Habitat, Eastern United States and British Provinces, but rarely beyond the Connecticut Valley; west to Eastern Kansas and Indian Territory. Guatemala, Costa Rica.

Common summer resident from May 1st to September. Breeds. Frequent open woodlands, orchards, and shrubbery.

In this species the courage which the King-bird displays in defending its nest is converted into a quarrelsomeness, which vents its spleen upon its own kindred. Its harsh, defiant notes are heard in nearly every grove and orchard, and frequent contests may be seen between members of this species.

This is the only species of the family, breeding with us, which finds a nesting place in cavities of trees. It is noted for using the cast off skins of snakes in the construction of its nest. Whether this strange custom is simply an eccentric fancy or a defensive procedure is not known.

In this city these birds have, within a few years, taken up their summer abode in moderate numbers, choosing for a nesting site a box put up for Bluebirds or Martins, and from which they have been known to expel settled occupants. This new habit is no doubt owing to the destruction of favorite breeding spots, and the increased supply of food which the city affords, by reason of the abundant water supply. In the cases which I have observed, these birds broke and carried out eggs of Bluebirds, making use of their nests, simply adding a few straws and shavings. The nest is usually placed in a natural cavity of the trunk or one of the larger limbs, sometimes, however, in the deserted hole of a Woodpecker. Into this they carry large quantities of leaves, straw, and rootlets, which they line with feathers. In all nests which I have seen, except those in boxes, snake skins were present, placed about the rim.

The eggs are remarkable for their coloration. They are light buffy brown, streaked longitudinally by lines and markings of purplish and darker brown. They measure 1. by .75.

GENUS SAYORNIS. Bonaparte.

Head moderately crested. Middle toe scarcely longer than hind toe, shorter than tarsus. Wings moderately pointed, equal to the broad, slightly forked tail. First primary shorter than sixth.

SAYORNIS FUSCUS (Gm.) Bd.

Pewee: Pewit: Phœbe.

Muscicapa fuscus, KIRTLAND, Ohio Geolog. Surv., 1838, 163.*Tyrannus fuscus*, READ, Fam. Visitor, iii, 1853, 359; Proc. Phila. Acad. Nat. Sci., 1853, 395.*Sayornis fuscus*, KIRKPATRICK, Ohio Farmer, viii, 1859, 403.—WHEATON, Ohio Agric. Rep., for 1860, 362; Reprint, 1861, 4; Food of Birds, etc., Ohio Agric. Rep. for 1874, 568; Reprint, 1875, 8.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11; Summer Birds, ib, iii, 1880, 225; JONES and SHULZE, Illust. Nests and Eggs, Pt. 4, 1880, Pl. X.

Pewee, BALLOU, Field and Forest, iii, 1878, 136.

Muscicapa fuscus, GMELIN, Syst. Nat., i, 1788, 93.*Tyrannus fuscus*, NUTTALL, Man., i, 1840, 312.*Sayornis fuscus*, BAIRD, Birds N. Am., 1858, 164.

Dull olivaceous brown; the head much darker fuscous-brown, almost blackish, usually in marked contrast with the back; below soiled whitish, or palest possible yellow, particularly on the belly; the sides, and the breast nearly or quite across, shaded with grayish-brown; wings and tail dusky, the outer tail feather, inner secondaries, and usually the wing coverts edged with whitish; a whitish ring around the eye; bill and feet black. Varies greatly in shade. The foregoing is the average spring condition. As the summer passes, the plumage becomes much duller and darker brown, from wearing of the feathers, and then, after the moult, fall specimens are much brighter than in spring, the under parts being frequently decidedly yellow, at least on the belly. Very young birds have some feathers edged with rusty, particularly on the edges of the wing and tail feathers. Length 6½-7; wing and tail, 3-3½.

Habitat, Eastern United States and British Provinces; west to Vermillion River, or further; south to Mexico.

Common summer resident. Breeds. Arrives very early, sometimes in February, oftener in March, and remains until late in November.

This is, or was, one of our best known birds. Its early appearance and characteristic note, a frequently repeated, emphatic *pe-wit*, *pe-wee*, now rendered with a falling and now with a rising inflection, made it, with the Robin and Bluebird, a "welcome harbinger of spring." This is still the case in many, perhaps most, portions of the State; but in the immediate vicinity of this city the bird is comparatively rarely seen except during its migrations. This decrease in numbers is probably due to the removal of favorite breeding places. Stone culverts have taken the place of old wooden bridges, and the "Bridge-bird," as it is sometimes called, is seldom willing to consider the former an improvement; old log houses, under the roof and against the beams of which they were accustomed to place their nests, are removed, and more modern structures furnish neither convenient nor secure nesting places. So the once familiar birds have become solitary and shy, seeking the stone quarry, ravine, or cliff, against the perpendicular rocks of which they place their nest. Sometimes a singular position is chosen

for the nest. Mr. Mebs, an ornithologist of this city, brought me a nest which he took from the beams of a freight car which had recently made a trip of forty-five miles. The five eggs which it contained were perfectly fresh, and, except one, unbroken.

The nest of the Pewee is built of clay, tempered by the bill of the bird, and attached to the face of rocks, beams, or walls. It is usually covered, sometimes very artistically, with moss, and lined with grass and feathers. The eggs are generally five, pure white. Not unfrequently, however, they are sparsely dotted with reddish-brown. They measure .80 by .60.

GENUS CONTOPUS. Cabanis.

Head slightly crested. Bill much depressed, very broad at base. Wings pointed, much longer than the emarginate tail, reaching beyond its middle. Feet very small, Tarsus shorter than middle toe and claw.

CONTOPUS BOREALIS (Sw.) Bd.

Olive-sided Flycatcher.

Contopus borealis, WHEATON, Ohio Agric. Rep. for 1860, 1861, 379, 480; Food of Birds, etc., Ohio Agric. Rep. for 1874, 568; Reprint, 1875, 8.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.—MERIAM, Trans. Conn. Acad., iv., 1877, 55.

Sayornis (error) *borealis*, WHEATON, Ohio Agric. Rep. Reprint, 1861, 4.

Tyrannus borealis, SWAINSON, Fn. Bor. Am., ii, 1831, 141.

Contopus borealis, BAIRD, Birds N. Am., 1858, 158.

Dusky olivaceous brown, usually darker on the crown, where the feathers have black centres, and paler on the sides; chin, throat, belly, crissum, and middle line of the breast white, more or less tinged with yellowish; wings and tail blackish, unmarked, excepting inconspicuous grayish-brown tips of the wing coverts, and some whitish edging of the inner quills; feet and upper mandible black, lower mandible mostly yellowish. The olive-brown below has a peculiar *streaky* appearance hardly seen in other species, and extends almost entirely across the breast. A peculiar tuft of white, fluffy feathers on the flanks. Young birds have the feathers, especially of the wings and tail, skirted with rufous. Length, 7-8; wing, $3\frac{3}{4}$ -4 $\frac{1}{2}$, remarkably pointed; second quill longest, supported nearly to the end by the first and third, the fourth abruptly shorter; tail about 3; tarsus, middle toe and claw together about $1\frac{1}{2}$.

Habitat, Temperate North America. Mexico. Central America. Greenland.

Rare migrant. The Olive-sided Flycatcher was first named as an Ohio bird in my catalogue (1861), on the authority of Mr. R. K. Winslow, who stated that it had been found at Cleveland. Mr. Dury informed me that he had taken one specimen at Cincinnati, and I am almost positive that I have seen one specimen here. On the other hand, Mr. Winslow is not now able to recall the particulars of its capture, and it is not given by

Mr. Kirkpatrick in his series of articles in the *Ohio Farmer*, 1860. Mr. Langdon, in 1877, gives it as a "rare migrant in spring," but in his *Revised List* gives it as "doubtfully identified."

The Olive-sided Flycatcher is much more common west than east of the Mississippi. Numerous instances of their breeding in New England are recorded. The nearest locality in which they are known to breed is Lewis county, N. Y., where Mr. Merriam has taken the nest and finds the birds not uncommon. It appears to be more numerous in New England at present than formerly, but has not been found in many instances south of New York. The Olive-sided Flycatcher frequents coniferous woods, and the nest is usually placed in an evergreen tree. The eggs are creamy white, marked about the greater end with a confluent ring of purple, lavender, and brown spots, and much resemble, except in size, those of the next species. They measure .82 by .62.

CONTOPUS VIRENS (L.) Cab.

Wood Pewee.

Muscicapa virens, KIRTLAND, *Ohio Geolog. Surv.*, 1838, 163.

Tyrannus virens, READ, *Fam. Visitor*, iii, 1853, 359; *Proc. Phila. Acad. Nat. Sci.*, vi, 1853, 395.

Contopus virens, KIRKPATRICK, *Ohio Farmer*, ix, 1860, 11; WHEATON, *Ohio Agric. Rep.* for 1860, 362; Reprint, 1861, 4; *Food of Birds*, etc., *Ohio Agric. Rep.* for 1874, 568; Reprint, 1875, 8.—LANGDON, *Cat. Birds of Cin.*, 1877, 10; *Revised List*, *Journ. Cin. Soc. Nat. Hist.*, i, 1879, 177; Reprint, 11; *Summer Birds*, ib. iii, 1880, 225.

Muscicapa virens, LINNÆUS, *Syst. Nat.*, i, 1766, 357.

Tyrannus virens, NUTTALL, *Man.*, i, 1840, 316.

Contopus virens, CABANIS, *J. f. O.*, iii, 1855, 479.

Olivaceous brown, rather darker on the head, below with the sides washed with a paler shade of the same nearly or quite across the breast; the throat and belly whitish, more or less tinged with dull yellowish; under tail coverts the same, usually streaked with dusky; tail and wings blackish, the former unmarked, the inner quills edged and the coverts tipped with whitish; feet and upper mandible black, under mandible usually yellow, sometimes dusky. Spring specimens are purer olivaceous. Early fall birds are brighter yellow below. In summer, before the now worn feathers are renewed, quite brown and dingy whitish. Very young birds have the wing-bars and pale edging of quills tinged with rusty, the feathers of the upper parts skirted, and the lower plumage tinged with the same; but in any plumage the species may be known from all the birds of the following genus by these dimensions: Length, 6-6½; wing, 3½-3¾; tail, 2½-3; tarsus, middle toe and claw together hardly one inch, or evidently less; tarsus, about ½, not longer than the bill.

Habitat, Eastern United States and British Provinces, west to border of central plains. South to New Grenada. Mexico.

Abundant summer resident from May to September. Frequents forests, groves, orchards and gardens. The Wood Pewee is the latest arriv-

ing of all members of the family breeding with us. It is one of our most familiar birds, and, by those whose acquaintance with birds is superficial, is confounded with the Pewee above described. It is, however, considerably smaller, slenderer, and rather darker. Their notes are much alike, but that of the Common Pewee consists of two syllables quickly and sharply repeated, while the note of the Wood Pewee consists of three syllables, *pe-to-wee*, less emphatic, much slower and softer. These notes are heard at all hours of the day, but especially after sunset, when the bird has regaled himself upon a plentiful supply of crepuscular insects, he delights in their repetition.

The nest of the Wood Pewee is a beautiful structure, equaled only by that of the Hummingbird and Gnatcatcher, which it resembles. It is placed on a horizontal limb, or on a horizontal fork, frequently quite near the ground. It is composed of fine grass and vegetable fibres with spider's webs and down, and the outside completely covered with bits of grayish lichens which give it a very neat and finished appearance, while they assist materially in its concealment. The eggs are four, creamy white, with a ring of lavender and purplish-brown confluent spots near the greater end. They measure .78 by .55.

GENUS EMPIDONAX. Cabanis.

Head slightly crested. Tarsus longer than middle toe and claw, which is decidedly longer than hind toe. Tail nearly even, a little shorter than the wings; first primary shorter or not obviously longer than 5th; 2d, 3d and 4th forming point of wing.

EMPIDONAX ACADICUS (Gm.) Baird.

Acadian Flycatcher.

Muscicapa acadica, KIRTLAND, Ohio Geolog. Surv., 1838, 163.

Tyrannus acadicus, (in part ?) READ, Fam. Visitor, iii, 1853, 359; Proc. Phila. Acad., vi, 1853, 395.

Empidonax acadicus, BAIRD, P. R. R. Rep., ix, 1858, 197.—KIRKPATRICK, Ohio Farmer, ix, 1860, 43.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362, 373; Reprint, 4, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 568; Reprint, 8.—HENSHAW, Bull. Nutt. Orn. Club, i, 1876, 14.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11.—BREWSTER, Bull. Nutt. Orn. Club, iii, 1878, 177, (first plumage).

Muscicapa acadica, GMELIN, Syst. Nat., i, 1788, 947.

Empidonax acadicus, BAIRD, Birds N. A., 1858, 197.

Above olive green, clear continuous and uniform (though the crown may show rather darker, owing to dusky centres of the slightly lengthened, erectile feathers); below, whitish, olive shaded on sides and nearly across breast, yellow-washed on belly, flanks, crissum and axillars; wings dusky, inner quills edged, and coverts tipped with tawny-yellow; all the quills whitish edged internally; tail dusky, olive-glossed, unmarked;

a yellowish eye-ring; feet and upper mandible brown, lower mandible pale. In midsummer rather darker; in early fall, brighter and more yellowish below, when very young, the wing markings more fulvous, the general plumage slightly buffy-suffused. Length $5\frac{1}{2}$ – $6\frac{1}{4}$; wing $2\frac{1}{4}$ –3 (rarely $3\frac{1}{2}$); tail $2\frac{1}{4}$ – $2\frac{3}{4}$; bill nearly or quite $\frac{1}{2}$, about $\frac{1}{4}$ wide at the nostrils; tarsus $\frac{3}{4}$; middle toe and claw $\frac{1}{2}$; point of wing reaching nearly an inch beyond the secondaries; 2d, 3d and 4th quills nearly equal and *much* ($\frac{1}{4}$ inch or more) longer than 1st and 5th, which about equal each other.

"*First plumage.* Above nearly pure olive, with indistinct narrow transverse bands of darker. Wing-bands pale reddish-brown. Under parts soiled yellowish-white, with an olivaceous cast on the sides and breast. From a specimen in my collection shot by Dr. J. M. Wheaton, at Columbus, Ohio, June, 1876" [July, 1875.] (*Brewster*, l. c.)

Habitat, Eastern United States; rarely north into New England and no authentic record beyond Massachusetts. Canada West. West to the Mississippi and slightly beyond. Cuba.

Abundant summer resident from May to September. Breeds. Frequent woodland, and is seldom seen far from its breeding spot except when migrating, when it is a frequent visitor in the gardens of this city, often remaining several days. The favorite retreats of this bird are beech woods of considerable extent. Here they are found perched on the lower branches of trees, or higher up on the border of a glade. Dark woods are preferred to high, open, mixed woodland. In such localities they form a striking feature in the bird-fauna. Their ordinary note is a sharp, quick, loud and emphatic *what-d'ye-see*, which, coming from an unseen and perhaps unsuspected performer, is really startling in the stillness. Frequently the bird utters a low rapid twittering note accompanied by a rapid movement of the wings, as if in ecstasy. A similar action is sometimes seen in the Wood Pewee, the noise resembling the rustling made by the Woodcock's flight.

The nest of the Acadian Flycatcher differs in position from all other species of the family breeding with us, in being invariably placed in a horizontal fork, usually not more than fifteen feet from the ground. In the manner of its attachment it resembles the nests of the Vireos, being fastened by the brim while the bottom is unsupported. In structure, however, it is very different. It is composed almost entirely of small stems and tops of the grass commonly known here as "roller grass." These are loosely thrown together forming a shallow cup bound to the fork with spider's web. When just finished they present a very slovenly appearance, considerable quantities of the grass hanging from the periphery of the nest, so that it looks like a tuft of hay, caught by the limb from a load driven under it. If the weather is damp this material soon falls off in the wind and the body of the nest becomes more compact. Frequently the nest is so thin that the eggs may be counted from below.

The eggs vary from two to four, and I have often seen nests with a single egg well advanced in incubation, or a single young bird, and believe from the position of the nest, towards the end of a long horizontal or declining limb, that eggs frequently fall from it when shaken by the wind. They are of a light yellowish-buff color, with a decided flesh colored tint when fresh, and rather sparsely spotted with light-brown. They measure .78 by .56.

The Acadian Flycatcher is a favorite nurse of the Cow-bird; most nests contain one egg of this parasite, and I have seen as many as four. On one occasion I saw a Cow-bird in the effort to deposit her egg in this nest, turn out all the eggs, the twig on which the nest was placed yielding to her weight.

EMPIDONAX TRAILLI (Aud.) Baird.

Trall's Flycatcher.

Tyrannus traillii, READ, Fam. Visitor, iii, 1853, 359; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Empidonax trailii, KIRKPATRICK, Ohio Farmer, ix, 1860, 107.

Empidonax trailii, WHEATON, Ohio Agric. Rep. for 1860, 1861, 362, 373; Reprint, 4, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 568; Reprint, 8.—HENSCHAW, Bull. Nutt. Orn. Club, i, 1876, 14.

Empidonax trailii, LANGDON, Cat. Birds of Cin., 1877, 10.—ALLEN, *apud* Cones, Bull. Nutt. Orn. Club, v. 1880, 24.

Empidonax pusillus var. *trailii*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11.

Trall's Flycatcher, KIRTLAND, Am. Journ. Sci. and Arts, xiii, 1852, 218.

Muscicapa trailii, AUDUBON, Orn. Biog., i, 1832, 236.

Tyrannus trailii, NUTTALL, Man. i, 1840, 323.

Empidonax trailii, BAIRD, Birds of N. Am., 1858, 193.

Empidonax pusillus var. *trailii*, BAIRD, BREWER and RIDGWAY, N. Am. Birds, ii, 1874, 369.

Above olive brown, lighter and duller brownish posteriorly, darker anteriorly, owing to obviously dusky centres of the coronal feathers; below, nearly as in *acadicus*, but darker, the olive-gray shading quite across the breast; wing-markings grayish-white with slight yellowish or tawny shade; under mandible pale; upper mandible and feet black. Averaging a little less than *acadicus*, $5\frac{1}{4}$ —6; wing, $2\frac{3}{4}$ — $2\frac{1}{2}$, more rounded, its tip only reaching about $\frac{2}{3}$ of an inch beyond the secondaries, formed by 2d, 3d and 4th quills as before, but 5th not so much shorter (hardly or not $\frac{1}{4}$ of an inch), the 1st ranging between 5th and 6th; tail, $2\frac{1}{4}$; tarsus, $\frac{2}{3}$ as before, but middle toe and claw, three-fifths, the feet thus differently proportioned owing to length of the toes.

Habitat, Eastern United States and British Provinces, west to the central plains, whence to the Pacific replaced by var. *pusillus*. South to New Grenada.

Common summer resident in Central Ohio from May to September. Breeds. Trall's Flycatcher, was first observed in this state by Dr.

Kirtland (l. c.) and Mr. Kirkpatrick subsequently mentions that he found it on the banks of the Rocky River near Cleveland. Mr. Langdon gives it as a rare migrant in the vicinity of Cincinnati. In this vicinity it arrives about the end of the first week in May, passing northward along the margins of streams. It is rather shy and more restless than others of the genus. Its presence is usually made known by a characteristic *whit-te-ar*, which is frequently repeated as the bird flits from bush to bush or across a narrow stream.

It was not known to breed in the state until its nest was discovered by me, June 5, 1874. This nest was placed in an elder bush beside a ditch, in Thomas' swamp on the west side of the Olentangy river, near this city. It contained four eggs. A few days afterwards, while in company with my friend, C. J. Orton, we discovered a nest without eggs in a wild plum thicket a short distance from the east bank of the same stream, near North Columbus. The next season numerous nests were found in low wet grounds, formed by an excavation along the Little Miami Railroad between the city and Insane asylum. This locality which was nearly a mile long by not more than fifty yards wide, proved to be a favorite resort for these birds for three or four years, and I have found as many as half a dozen nests in a couple of hours search. Here their nests were usually found in willows from two to eight feet from the ground. One or two nests were taken in grape vines, and one in a small tree of *Enonymus atropurpurea*, several in elder bushes. Those built in the acute forks of willows were less neat than those in the broader forks of other bushes, but all agreed in general character, and were widely different from nests of the same birds taken in Northern New England, as also are the eggs.

Mr. Henshaw (l. c.) describes the nests and eggs of this and the preceding species, giving for the first time, a correct description of their differences as found here. A portion of his article is here inserted :

"I shall briefly describe a nest of *Trailii*, one of a series of five, kindly presented by Dr. Wheaton, and taken near Columbus, Ohio.

"It may be fairly compared with the usual structure of the Summer Yellow Warbler (*Dendroica aestiva*), so well known to every one, but lacks something of the compactness and neatness shown by this species in its method of weaving together the materials that make up its home. Hempen fibres compose the exterior, or the bulk of the nest, while internally it is lined in true Flycatcher style with fine grasses, and a slight admixture of down from thistles; the main point of all, however, is its position with regard to the branches. It is built into an *upright* fork, the small twigs that surround it being made available to secure it more firmly in its place by being encircled with the stringy fibres. In this particular of position correspond all of the nests of this bird I have seen, as well as those of *pustillus* in the west.

"Taking now a nest of *E. acadicus*, and placing it beside the others, a very striking dif-

ference is at once seen. Instead of comparing it with the structures of the Warbler, or with those of the above species, we are at once reminded of the Vireos, though no one familiar with the elegant basket-like structure of these weavers would think of mistaking this for one of their masterpieces. The resemblance is but a superficial one, beginning and ending with the manner the nest is disposed in a *horizontal* fork.

"It is a slight structure made of fine grasses, interspersed more or less with the blossoms of trees, the whole disposed in a circular form, and fitted between two twigs; a firm support is derived from a binding of spiders' web, which are interwoven with the sides of the nest, and then carried over the twigs on either side, encircling them with strong bands. The entire base of the nest is without support, and so thin is the slight structure that the eggs might almost be seen from below. This nest was built in a small tree, perhaps twenty feet from the ground. In this respect the two species vary but little, both preferring to select the lower branches of tree or shrub as the site of their domicile, and only rarely departing from the rule. This last nest was taken near Washington, by Mr. P. L. Jouy, who kindly placed it at my disposal. The contrast between these two structures could indeed scarcely be greater, and those selected for description may, I think, be taken as fair samples of the styles of nest architecture that obtain with the two species, at least all of a considerable number I have seen, from several localities, correspond with the foregoing.

"A word as to the eggs. After examination of several sets of either species, of which the identity was unquestionable, I am certain that no decided differences of coloration exist between them; none at least that are constant and that can be made of use in the exact discrimination of the two. Dr. T. M. Brewer, in speaking of the eggs of *E. traillii*, describes them as possessing a 'white ground color with distinct roseate tinge,' and marked with large and well defined blotches of purplish-brown, while in his description of *acadicus*, he says in distinction, the eggs resemble more those of the *Contopti*, and are 'of a rich cream color with reddish-brown shading, marked at larger end with scattered and vivid blotches of red and reddish-brown.' The truth is, however, that the shade of the ground color of either species is extremely variable, not being alike in any two sets I have examined. The eggs of Traill's Flycatcher are frequently found to be a very decided cream color, approaching buff, while those of the Acadian, if anything, are more buffy, but will now and then be found to be fully as pale as some of the Traill's. The markings, too, are subject to considerable variation as to precise shade, number and size.

"On this point Dr. Wheaton remarks, that while he can discover no specific difference in the eggs of the two birds, he is of the opinion, that the eggs of *acadicus* average a little longer and slenderer than those of *Traillii*, and have perhaps a *yellowish* buff tinge.

"With reference to the habits of these two species, Dr. Wheaton has always observed a very decided difference, especially in the localities chosen as homes, and considers 'the locality as characteristic of the species as any of its other points.' He has always found Traill's Flycatcher a lover of the low grounds, and especially fond of the willow clumps along running streams, while of the Acadian he says: 'It is never found in company with, or in such localities as are frequented by the Traill's. In all cases it is found in upland woodland, preferably, and I might almost say as far as my observation extends in beech woodland. I have never seen it even during the migration in other places.'"

To this description I can add little except by way of qualification of my own opinion. In one locality, a swamp in an extensive forest about

four miles east of the city, I found both species together, Traill's Flycatcher, frequenting the swamp, and when disturbed flying to the forest trees, while the notes of the Acadian Flycatcher were heard at but a short distance beyond. Further observation convinces me that in this vicinity the eggs of *Trailli* are of a darker ground color, and spotted with darker brown than those of *acadicus*. The spots on *Trailli* look as if made with thick paint; many spots are surrounded with a halo of lighter brown as if the paint had run.

In the Bulletin of the Nuttall Ornithological Club, v, 1880, 20, Dr. Coues, with the object "to confirm and amplify his (Henshaw's) observations," describes the nests and eggs of these two species, from specimens sent him by Mr. O. Widmann, from St. Louis, Missouri. In so doing he quotes extensively from Mr. Widmann's letter of transmission, which shows this species with him to differ as much in its manners from Ohio birds as my description makes them differ from eastern examples. Dr. Coues' description of the nest and eggs is, but more minutely and emphatically, that of Mr. Henshaw. He concludes that the eggs of *Trailli* "are so similar to those of *acadicus* that no one should pretend to tell them apart with confidence." He further quotes a letter from Mr. Allen, relating to the same specimens, showing the difference between eastern and western nests of *Trailli* as follows:

"The New England nests (Maine, New Hampshire, and Vermont specimens) are scarcely distinguishable from the ordinary nest of *Cyanospiza cyanea*, and consequently suggest no comparison with the nest of *E. minimus*, they being bulky structures of coarse materials, which no one would think could belong to the species building the small, compact nests of soft materials that come to us from Ohio, through Dr. J. M. Wheaton, or from Missouri, through Mr. Widmann."

In this connection I may add that the description of the eggs by Dr. Brewer, referred to by Mr. Henshaw, is correct for eastern specimens, western eggs being much more buffy. I have surmised that our birds might be identical with the western variety, *pusillus*, but Mr. Brewster informs me that he can discover no difference between Ohio and New England birds.

Other localities frequented by these birds in the breeding season, are a willow-covered island in the Scioto River, a short distance below the city and the "starch-factory swamp," a recently drained region below the city, lying between the canal and river. In the former of these localities I have found but few nests, search for them being an almost hopeless task, for the reason that as the island is frequently flooded, nearly every willow fork is filled with a bunch of drift leaves. It is not impossible that such qualities may have been chosen for nesting places for the protection

which the great number of these bunches afford. No bird is more wary when its nest is approached, quitting it as soon as an intruder approaches within a dozen yards. I have very seldom been able to discover the female on the nest, but when disturbed she retires to a safe distance and utters a plaintive *whit*, expressive of her anxiety. During the breeding season the ordinary notes undergo some change, becoming a louder, deeper, *hoyt-te-ar*.

EMPIDONAX MINIMUS Baird.

Least Flycatcher.

Tyrannus acadicus, (in part ?), READ, Family Visitor, iii, 1853, 359; Proc. Phila. Acad., vi, 1853, 395.

Empidonax minimus, BAIRD, P. R. R. Rep., ix, 1858, 196.—KIRKPATRICK, Ohio Farmer, ix, 1860, 35.—WHEATON, Ohio Agric. Rep. for 1860, 362, 373; Reprint, 1861, 4, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 568; Reprint, 1875, 8.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11; Summer Birds, ib., iii, 1880, 225.—DURY and FREEMAN, Obs., ib., iii, 1880, —, Reprint, 4.

Tyrannus acadicus, NUTTALL, i, 1840, 320.

Tyrannula minima, W. M. and S. F. BAIRD, Proc. Phila. Acad., i, 1843, 284.

Empidonax minimus, BAIRD, Birds N. Am., 1853, 195.

Colors almost exactly as in *Trailli*; usually, however, olive-gray rather than olive-brown; the wing-markings, eye-ring and loreal feathers plain grayish-white; the whole anterior parts often with a slight ashy cast; under mandible ordinarily dusky; feet black. It is a smaller bird than *Trailli*, and not so stoutly built; the wing-tip projects only about $\frac{1}{2}$ an inch beyond the secondaries; the 5th quill is but very little shorter than the 4th, the 1st apt to be nearer the 6th than 5th; the feet are differently proportioned, being much as in *acadicus*; the bill is obviously under $\frac{1}{2}$ inch long. Length, 5-5.25; wing, 2.60 or less; tail about 2.25.

Habitat, Eastern North America to the high central plains; up the Missouri to Fort Union. Winters in Central America.

Common spring and fall migrant in May and September. Frequents edges of woods and thickets, and is often seen in gardens. Its note while with us is a short, low *whit*, repeated as the bird industriously pursues his winged prey.

The Least Flycatcher breeds from Southern New England northward. Dr. Merriam has taken its nest in Northern New York, and it may breed in Northern Ohio, as Mr. Langdon found the bird in Ottawa county about the first of July.

The nest is a neat structure of fibres of bark and grasses, lined with plant-down and hair, and placed in an upright fork of a sapling within a few feet of the ground. The eggs are pure white without spots. They measure .65 by .50.

EMPIDONAX FLAVIVENTRIS Baird.

Yellow-bellied Flycatcher.

Empidonax flaviventris, KIRKPATRICK. Ohio Farmer, ix, 1860, 139.—WHEATON, Ohio Agric. Rep. for 1860, 362, 373; Reprint, 1861, 4, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 568; Reprint, 1875, 8.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11.

Tyrannula flaviventris, W. M. and S. F. BAIRD, Proc. Phila. Acad., i, 1843, 283.

Empidonax flaviventris, BAIRD, Birds N. A., 1858, 198.

Above olive-green, clear continuous and uniform as in *acadicus*, or even brighter; below not merely *yellowish*, as in the foregoing, but emphatically *yellow*, bright and pure on the belly, shaded on the sides and anteriorly with a paler tint of the color of the back; eye-ring and wing-markings yellow; under mandible yellow; feet black. In respect of color, this species differs materially from all the rest; none of them even in their autumnal yellowest quite match it. Size of *Trailii* or rather less; feet proportioned as in *acadicus*; bill nearly as in *minimus*, but rather larger; 1st quill usually equal to 6th.

Habitat, North America at large. South through Mexico and Central America to New Grenada.

Common spring and fall migrant in May, August and September. Frequent thickets in woodland and gardens of the city. The Yellow-bellied Flycatcher, though rather shy and retiring in its habits presents several points of interest not shared by other members of the genus. It is seldom found perched near the extremity of limbs watching for or capturing flying insects, but is generally seen in the midst of a low thicket or fence row, and at the first intimation that it is an object of observation, seeks further concealment by hiding near the ground and remaining motionless. None of the family are such adepts at concealment, its habits in this respect resembling those of the Connecticut and Mourning Warblers.

On one occasion while walking in the woods, I discovered a pair of birds busily engaged in feeding on some elm saplings. Alighting near the bottom of the trunk they hopped from one to another of the alternate twigs, ascending spirally. Meantime they gathered their food, which I soon discovered to be small black ants. I watched this procedure for half an hour, unable to identify the birds. Hoping they might prove an extralimital species with which I was not acquainted, I returned in the afternoon with a gun. The birds were not feeding, but in the trees near by I detected what appeared to be the same species. Great was my surprise when securing them to find they were Yellow-bellied Flycatchers. An examination of their stomach revealed large quantities of the black ants, and I have no doubt they were the birds which I had seen feeding, in that heterodox way for flycatchers, in the morning. I am inclined to think these actions are not unusual to the birds, and

that they are better adapted for hopping from branch to branch by their tarsus, which is longer proportionally than in other members of the genus.

Another peculiarity of this species is its note, which is as much entitled to the name of song as that of most of the Warblers and many other *Oscines*. On two occasions I have heard peculiar, uninterrupted, soft whistling notes, from the top of a tree, so different from those of any bird with which I was acquainted, that the birds were shot for identification, and proved to be of the present species. Other observers have noticed this song, which it appears is rarely heard during the migration. Its ordinary note is described as a weak *pu*, but I have sometimes heard them utter a soft *p-teah*, at others a low but sharp *pe-wit*.

That the Yellow-bellied Flycatcher may possibly breed in this state is a supposition warranted by the appearance of the young in August. Comparatively little is known in regard to its breeding habits, in fact, until within a couple of years no perfectly satisfactory identification of the nest and eggs had been made. Mr. H. A. Purdie (Bull. Nutt. Orn. Club, iii, 1878, 167) thus describes a nest taken in Maine, and others have since been discovered placed on the ground :

"On a collecting trip made by Mr. Ruthven Deane and myself to Houlton, Aroostook county, Me., during the second and third weeks in June of this year, we were fortunate enough to secure the much-desired nest and eggs of the Yellow-bellied Flycatcher. For its possession we are under obligations to Robert R. McLeod, Esq., and to one of his collectors, Mr. James Bradbury, who discovered the nest, both surrendering all claim to the prize, but desirous that a description should be given for the benefit of all interested.

"Mr. Bradbury informed us that he had found, on June 15, a nest unknown to him with one egg. On the 18th he conducted us to the edge of a wooded swamp, and, pointing to the roots of an upturned tree, said the nest was there. We approached cautiously, and soon saw the structure and then the sitting bird, which appeared to be sunken in a ball of green moss. Our eager eyes were within two feet of her, thus easily identifying the species, when she darted off; but, to make doubly sure, Mr. Deane shot her. There was no mistake; we at last had a genuine nest and eggs of the Yellow-bellied Flycatcher. A large dwelling it was for so small and trim a bird. Built in and on to the black mud clinging to the roots, but two feet from the ground, the bulk of the nest was composed of dry moss, while the outside was faced with beautiful fresh green mosses, thickest around the rim or parapet. The home of the Bridge Pewee (*Sayornis fuscus*) was that at once suggested. But no mud entered into the actual composition of the nest, though at first we thought so, so much was clinging to it when removed. The lining was mainly of fine black rootlets, with a few pine needles and grass-stems. The nest gives the following measurements: depth inside, one and one-half inches; depth outside, four and a quarter inches; circumference inside, seven and a quarter inches.

"The eggs, four in number, were perfectly fresh, rounded oval in shape, and of a beautiful rosy-white tint, well spotted with a light reddish shade of brown."

ORDER PICARIÆ. PICARIAN BIRDS.

SUB-ORDER CYPSELLI. Cypseliform Birds.

FAMILY CAPRIMULGIDÆ. GOATSUCKERS.

Feet semipalmate, the anterior toes connected at base by movable webbing. Hind toe very small, elevated, semilateral. Middle toe produced, its large claw pectinate. Bill fissirostral, with very small, triangular, depressed horny part and immense rictus, reaching below the eyes, furnished with bristles. Rather large. Plumage soft and lax, much variegated.

Sub-family CAPRIMULGINÆ. TRUE GOATSUCKERS.

Outer toe with four phalanges only. Sternum with one pair of shallow posterior fissures.

GENUS ANTROSTOMUS. Gould.

Nostrils tubular; gape with long stiff bristles reaching beyond the bill. Wings slightly rounded, primaries emarginate; tailed rounded.

ANTROSTOMUS VOCIFERUS (Wils.) Bonap.

Whippoorwill; Night Jar.

Caprimulgus vociferus, KIRTLAND, Ohio Geolog. Surv., 1838, 162, 180.—READ, Proc. Phila. Acad. Nat. Sci., vi., 1853, 395.

Antrostomus vociferus, KIRKPATRICK, Ohio Farmer, viii, 1859, 195.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362, 373; Reprint, 4, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 568; Reprint, 8.—LANGDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12.

Whippoorwill, WHEATON, Field Notes, i, 1861, 92.

Caprimulgus vociferus, WILSON, Am. Orn., v., 1812, 71.

Antrostomus vociferus, BONAPARTE, List, 1838, 8.

Habitat, Eastern United States and British Provinces. North to about 50°. West to the Plains. South through portions of Mexico to Guatemala.

Common summer resident in some localities, rare or absent in others. In the immediate vicinity of Columbus the Whippoorwill is quite rare. I have never heard its note, and have seen but two specimens. These were found in low woods in May, and were evidently on their spring migration. Ten miles west of this city at Georgesville and West Jefferson they are rather common, and breed. In Eastern and Southeastern Ohio they are more numerous. Mr. Langdon gives it as uncommon in the vicinity of Cincinnati. During the breeding season they seem to prefer the more hilly portions of the State, and I am of the opinion that the geological structure determines their distribution at this time, as is per-

haps the case with several of our ground-nesting birds. I have never found the birds in summer on a limestone or clay soil, and the localities in which I have mentioned their occurrence are all on an outcrop of sandstone.

The name of this bird is a tolerably accurate rendering of its note, which is frequently and quickly uttered in the evening, both when the bird is on the wing in pursuit of nocturnal insects which constitute its food, or at rest. It is seldom seen in day time when it retires to the seclusion of deep undergrowth. Its plumage is soft and blended like that of the owls, while the disposition of its colors resembles that of many nocturnal lepidoptera.

When wounded, and capture is threatened, the Whippoorwill will sometimes raise and depress its feathers, throw back its head, and opening its wide mouth in a threatening manner, utter a short blowing sound somewhat like the hiss of a snake. This may be the note which some writers have mentioned as made by the bird while perching at night.

The eggs of the Whippoorwill are two in number, about 1.25 inches in length by .88 in width. The ground color is white, singularly marked and mottled with gray and brown lines and spots. They are laid in a depression of the ground upon a few leaves, but no attempt is made toward the construction of a nest.

GENUS CHORDEILES. Swainson.

Bill very small, the gape with short feeble bristles. Wing very long and pointed; 1st primary equal to 2d; tail long, slightly forked.

CHORDEILES VIRGINIANUS (Gm.) Bp.

Nighthawk.

Caprimulgus virginianus, KIRTLAND, Ohio Geolog., Surv., 1838, 162.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Chordeiles popetue, KIRKPATRICK, Ohio Farmer, viii, 1859, 211.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362; Reprint, 4; in Coues' Birds N. W., 1874, 234.

Chordeiles virginianus, WHEATON, Food of Birds, Ohio Agric. Rep. for 1874, 1875, 568; Reprint, 8.—LANGDON, Cat. Birds of Cin., 1877, 11.

Chordeiles popetue, var. *popetue*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12.

Nighthawk, WHEATON, Field Notes, i, 1861, 92.

Caprimulgus virginianus, GMELIN, Syst. Nat., i, 1788, 1028.

Caprimulgus popetue, VIEILLLOT, O. A. S., i, 1807, 56.

Chordeiles virginianus, BONAPARTE, List, 1838, 8.

Chordeiles popetue, BAIRD, Birds N. A., 1858, 151.

Chordeiles popetue var. *popetue*, BAIRD, BREWER and RIDGWAY, N. A. Birds, ii, 1874.

Above mottled with black, brown, gray, and tawny, the former in excess; below from the breast transversely barred with blackish and white or pale fulvous; throat in the

male with a large white, in the female tawny, cross-bar; tail blackish, with distant pale marbled cross-bars and a large white spot (wanting in the female) on one or both webs of all the feathers toward the end; quills dusky, unmarked except by one large white spot on five outer primaries about midway between their base and tip; in the female this area is restricted or not pure white. Length, about 9; wing, 8; tail, 5.

Habitat, entire temperate North and Middle America. North to Hudson's Bay. Cuba, Jamaica and the Bahamas. South to Brazil.

Common summer resident, from May to September. The Nighthawk is a much better known bird throughout the State than the Whippoorwill. It arrives in this vicinity early in May, when it may be seen perched upon the limb of a tree, motionless and apparently asleep. In a few days pairing is effected, and one or both birds may be seen flying high over a locality which they have chosen for nesting, even in the brightest noonday sun. At such times attention is called to the bird by its loud and singular note, which is heard while it is at a great height.

Some writers have asserted that the birds of this family are unable by reason of the smallness of their feet to sit upon a limb in the ordinary fashion of birds, but must place the long axis of the body parallel with the limb. Reasonable as this may appear, some birds in this neighborhood contemptuously disregard the teachings of wise men, and perch crossways upon limbs without apparent inconvenience. I have shot several for so doing, as has also my friend, Dr. O. Frankenberg, and we hope to put an end to this provokingly unscientific habit.

The Nighthawk and Whippoorwill are frequently confounded, or considered as birds of the same species. A careful comparison with each other or with the descriptions will at once show a very decided difference. The Nighthawk is also known as the Goatsucker, a name given to its European relative, from the belief that it did as the name implied. Doubtless its habit of frequenting pastures and fields where cattle feed, in search of insects which abound in such places, led to this superstition. I have elsewhere noted (Birds N. W., l. c.) that in skinning, these birds exhale a strong goatlike odor, which may have added a fanciful reason for this long exploded idea.

In the latter part of summer the Nighthawks collect in large companies towards night and frequent fields in search of food. Their southern migration is performed in the latter part of August and September. During this period they may be seen in very loose flocks, toward evening, making their way southward, and feeding as they fly. At such times they fly over, rather than around obstacles, and do not turn aside for cities. Their flight is high or low, according to the dryness or dampness of the atmosphere, which governs the flight of the insects on which they feed. Flocks of thousands are sometimes seen.

The eggs of the Nighthawk, like those of the Whippoorwill, are placed on the ground, with this distinction, that the Nighthawk seeks no shelter, but selects an open field or bare rock. No nest is constructed. The eggs are two, grayish, thickly mottled with varied tints of darker gray. They measure about 1.30 by .90.

FAMILY CYPSELIDÆ. SWIFTS.

Feet neither syndactyle nor zygodactyle, scarcely or not semipalmate, of frequently abnormal ratio of phalanges (middle or outer toe, or both, with fewer joints than usual among birds). Hind toe very small, elevated, frequently lateral or versatile. Middle toe not produced nor its claw pectinate. Bill much as in *Caprimulgidae*, but rictus unbristled. Small. Plumage compact, of few simple subdued colors.

Sub-family CHÆTURINÆ. Spine-tailed Swifts.

Hind toe scarcely versatile. Tarsus covered with naked skin. Tail feathers stiffened and mucronate by the projection of their shafts.

GENUS CHÆTURA. Stephens.

First primary longest; tail very short, about two-fifths the wing, slightly rounded. Tarsus longer than middle toe; lateral toes equal, nearly as long as the middle; hind toe and claw less than the middle toe without the claw.

CHÆTURA PELAGICA (L.) Baird.

Chimney Swift.

Hirundo pelagica, WILSON, Am. Orn., v. 1812, 48.

Cypselus pelagius, KIRTLAND, Ohio Geolog. Surv., 1838, 162.

Chætura pelagica, NUTTALL, Man., i, 1840, 736.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—KIRKPATRICK, Ohio Farmer, ix, 1860, 203.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362; Reprint, 4; in Coues' Birds of N. W., 1874, 234; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 569; Reprint, 9.—LANGDON, Cat. Birds of Cin., 1877, 11.

Chætura pelagica, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12; Summer Birds, iii, 1880, 225.

Chimney Swift, BALLOU, Field and Forest, iii, 1878, 136.

Hirundo pelagica, LINNÆUS, Syst. Nat., i, 1758, 192.

Hirundo pelagica, LINNÆUS, Syst. Nat., i, 1766, 345.

Cypselus pelagius, BONAPARTE, Syn., 1828, 63.

Chætura pelagica, STEPHENS, Shaw's Gen'l. Zool., xiii, 1825, 76.

Chætura pelagica, BAIRD, BREWER, and RIDGWAY, N. A. Birds, ii, 1874, 432.

Sooty-brown with faint greenish gloss above, below paler, becoming gray on the throat; wings black. Length, about 5; wing the same; tail, 2 or less.

To the above description of Dr. Coues', which is sufficient for purposes of identification, it may be added that the feathers of the crown are so short as to resemble scales, and form a projecting arch or cornice over the eyes. The eye-lids and a small circumorbital space are naked and purplish. A broad line of soft thick-set velvety feathers extends

from the nostrils along the upper mandible to the gape, across the lores in front of and above the eye. On the under surface of the wing a linear bare space may be noticed extending from the carpal joint to the base of the first primary. Mr. Ridgway informs me that this space is found in the Hummingbirds.

Abundant summer resident from April to October. Breeds. This singular bird, commonly called Chimney Swallow, presents many peculiarities which pass unnoticed because the bird is familiar. It is the only representative of its family in America east of the Rocky Mountains, and the only bird which has forsaken its natural breeding resorts to nest in chimneys. So sombre is its plumage, so well adapted for not "showing dirt," that, as an illustration of the theory of natural selection, the bird seems to be adapted to the chimney and not the chimney to the bird. Not many years since the birds were here and the chimneys were not, and we find historical evidence that they formerly occupied the hollow trunks of trees for breeding as well as roosting purposes.

T. M. Harris in his *Tour into the North-west Territory, 1805*, gives the following account of their occupation of trees for roosting purposes, which came under his observation within the limits of this State. The paragraph is quoted by Wilson, vol. v, 1812, 52:

"I may mention a large collection of feathers found within a hollow tree, which I examined, with the Rev. Mr. Story, May 18th, 1803. It is in the upper part of Waterford, about two miles distant from the Muskingum. A very large sycamore, which through age, had decayed and fallen down, contained in its hollow trunk, five and a half feet in diameter, and for nearly fifteen feet upward, a mass of decayed feathers, with a small admixture of brownish dust, and the exuviae of various insects. The feathers were so rotten, that it was impossible to determine to what kind of birds they belonged. They were less than those of the Pigeon; and the largest of them were like the pinion and tail feathers of the Swallow. I examined carefully this astonishing collection, in the hope of finding the bones and bills, but could not distinguish any. The tree, with some remains of its ancient companions lying around, was of a growth preceding that of the neighboring forest. Near it and even out of its mouldering ruins grew thrifty trees, of a size which indicate two or three hundred years of age."

"Such, continues Wilson," are the usual roosting places of the Chimney Swallow in the more thinly settled parts of the country. In towns, however, they are differently situated; and it is a matter of curiosity to observe that they frequently select the court-house chimney, for their general rendezvous, as being usually more central, and less liable to interruption during the night."

In this city, thirty years ago, the Chimney Swifts like the Martins roosted under the cornices of high buildings, and were not a whit behind their distant relatives, in the formal manoeuvring and noisy clatter, which preceded their retiring. Now, many of them rendezvous in the large chimneys of mills and factories, but, true to their ancient predilection, the greater number congregate in the large chimneys of the State

House. About sundown they seem to come from all directions, and, as if driven by a whirlwind, circle around in the air high above the chosen spot. One by one, they drop into the opening, almost as if shot. Not unfrequently some disturbance drives them out again, and the formal circling is repeated until, at last, going to bed is comfortably accomplished.

The nest of the Chimney Swift, which, as above stated, was formerly placed in hollow trees, is now with very few exceptions fastened to the inside of a chimney, sufficiently below its top to be protected from the rays of the sun. In a deep woods about three miles east of this city I have known the cavity of a tall tree to be visited by these birds, for three successive seasons, and I have no doubt they nested there. Whether this habit had been unbroken by their ancestors from the time antedating chimneys, or was a retrograde movement, I cannot venture an opinion. Since the introduction of smaller flues to chimneys, and the almost universal use of coal in this city, the birds seem to be less generally distributed and, perhaps, less numerous.

A beautiful nest of this bird was presented to me by my friend, Arnold Boyle of this city. He took it from the inside of a barn in Wyandot county, where its position was similar to that of the Barn Swallow.

The nest of the Chimney Swift is built of small dead twigs which are broken from the trees by the birds while on the wing. In cities, locust twigs are preferred. These are glued together and to the side of the chimney by the saliva of the bird. In this basket-like structure from four to six pure white eggs are laid, which measure .75 by .50.

FAMILY TROCHILIDÆ. HUMMINGBIRDS.

Secondaries only six. Bill tennirostral, longer than head, nearly cylindrical. Gape constricted. Tongue filiform, extensile, bi-tubular. Wings, long in terminal portion abbreviated proximally, acute. Plumage compact, of metallic sheen. Size smallest of all birds.

Sub-family TROCHILINÆ. Typical Hummingbirds.

Anterior toes not connected at base. Plumage brilliant, with more or less metallic lustre, at least in the males.

GENUS TROCHILUS. Linnæus.

Feathers of throat but little elongated laterally; tail forked (in males), its lateral feathers but little narrower than the others, lanceolate-acute.

TROCHILUS COLUBRIS Linnæus.

Ruby-throated Hummingbird.

Trochilus colubris, KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—KIRKPATRICK, Ohio Farmer, ix, 1860, 163.—WHEATON, Ohio Agric. Rep. for 1860, 362; Reprint, 1861, 4; Food of Birds, etc., Ohio Agric. Rep. for 1874, 569; Reprint, 1875, 9.—LANGDON, Cat. Birds of Cin., 1877, 11; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12.

Hummingbird, BALLOU, Field and Forest, iii, 1878, 136.

Trochilus colubris, LINNÆUS, Syst. Nat., i, 1766, 191.

Male with the tail forked, its feathers all narrow and pointed; no scales on crown; metallic gorget reflecting ruby-red, etc.; above golden-green; below white, the sides green; wings and tail dusky-purplish. The female lacking the gorget; the throat white; the tail somewhat double-rounded, with black bars, and the outer feathers white-tipped. Length, $3\frac{1}{2}$; wing, $1\frac{3}{8}$; bill, $\frac{3}{8}$.

Habitat, North America, east of the Rocky Mountains. North to 57° at least. South to Brazil. Cuba.

Very common summer resident. Breeds. Arrives in May and departs in October. The Hummingbird, so well-known as the smallest of all our birds, and whose iridescent plumage, peculiar structure, and swift flight seem to us to separate it from all other birds, is in Eastern North America, the only representative of a numerous family, confined to this continent, and most numerous in South America. About a dozen species are found in North America, all but the present confined to the region west of the Mississippi.

The food of Hummingbirds consists for the most part of small insects which they obtain from the interior of deep flowers, and which are there secure from the pursuit of other birds. Their nearest relative, with us, is the Chimney Swift, and like that bird they take their food while on the wing. No object can be more graceful or beautiful than one of these birds poised in air, before a favorite flower, the body surrounded by the misty halo of their rapidly vibrating wings. Their flight is very swift, direct and prolonged, resembling that of an insect rather than a bird. In some locations, as a flowery woodland, or low bank of a stream where rank vegetation is blooming, they appear in flocks to feed both before and after the breeding season.

The nest of the Hummingbird is a remarkably beautiful structure. It is placed on a horizontal limb of a forest tree, or in an orchard, and is composed of soft down from the stems of plants, covered artistically with bits of gray lichen from the trunks of trees. Seen in position, it resembles a moss covered knot. The eggs are two only, pure white, nearly spherical, and measure but .50 by .35.

SUB-ORDER CUCULI. Cuculiform Birds.

FAMILY ALCEDINIDÆ. KINGFISHERS.

Secondaries more than six. Feet syndactyle by connection of outer and middle toes. Outer toe much longer than inner, united for half its length with the middle, forming a broad sole. Tibiæ naked below. Bill longer than head, straight, acute, with hard cutting edges and ample rictus. Tongue rudimentary, fixed. Wings pointed, much longer than the short square tail. Tail feathers twelve. Plumage compact, oily.

CERYLE ALCYON (L.) Boie.

Belted Kingfisher.

Alcedo alcyon, WILSON, Am. Orn., iii, 1811, 59.—KIRTLAND, Ohio Geolog. Surv., 1838, 162.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Ceryle alcyon, KIRKPATRICK, Ohio Farmer, ix, 1860, 243.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362; Reprint, 4; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 569; Reprint, 9.—MARCH, Am. Nat., ii, 1868, 490.—LANSDON, Cat. Birds of Cin., 1877, 10; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 177; Reprint, 11; Summer Birds, iii, 1880, 225.

Kingfisher, BALLOU, Field and Forest, iii, 1878, 225.

Alcedo alcyon, LINNÆUS, Syst. Nat., i, 1766, 180.

Ceryle alcyon, BOIE, Isis, 1828, 316.

Upper parts, broad pectoral bar, and sides under wings, dull blue with fine black shaft lines; lower eyelid, spot before eye, a cervical collar and under parts, except as said, pure white; the female with a chestnut belly band, and the sides of the same color, quills and tail feathers black, speckled, blotched and barred with white on the inner webs; outer webs of the secondaries and tail feathers like the back; wing-coverts frequently sprinkled with white; bill black, pale at the base below; feet dark. Length, 12 or more; wing about 6; tail, $3\frac{1}{2}$; whole foot, $1\frac{1}{2}$; bill about $2\frac{1}{2}$.

Habitat, North and Middle America and many of the West India Islands.

Abundant. Resident in Southern Ohio, and retiring from Middle and Northern Ohio, only when the streams and ponds are covered with ice. In this vicinity Kingfishers usually arrive during the month of February and remain until December. Their food consisting exclusively of fish, they are seldom seen except in the immediate vicinity of water. They prefer for feeding places the rapid shallows of streams. Here they may be seen in pairs flying up and down the stream or hovering over a spot where they expect to secure their prey. The lower branches of a tree overhanging the water, or the top of a dead stub, furnish a favorite lookout, from which they plunge beneath the surface of the water. A fish secured, they fly off quickly to a secure spot to swallow their captive. Their note is a loud, coarse rattle, frequently repeated.

The nest of the Kingfisher is an excavation in the face of a high bank of a stream or side of an artificial excavation. The entrance is usually

within a couple of feet below the top of the bank and extends inwards, usually straight, but sometimes with an angle, from three to six feet. Usually no nest is made, but near the extremity the eggs are deposited in the midst of fish bones disgorged and excreted. The eggs are from five to seven, usually six, nearly spherical, clear shining white, and of very dense texture. They measure 1.30 by 1.05. The birds are very much attached to their nesting site. One nest on the bank of a gravel pit, I have dug down upon for several successive years, and the birds are not yet inclined to desert the spot. Another bank occupied by these birds was removed by a freshet, and a large sycamore tree which stood upon it was carried into the middle of the stream, where it remained with large quantities of earth adhering to the roots. In this earth the birds made a tortuous and difficult excavation, and successfully raised their young.

FAMILY CUCULIDÆ. THE CUCKOOS.

Feet zygodactyle by reversion of outer or fourth toe. Not scansorial; tail of eight or ten long soft feathers. Bill with decurved tip, not formed for hammering; rictus ample. Tongue not extensile nor vermiform nor barbed. Salivary glands and hyoidean apparatus not peculiar. No nasal tufts of feathers. Arboreal and terrestrial.

GENUS COCCYZUS. Vieillot.

Wings pointed, shorter than the tail; the 1st and 2d quills shortened. Bill about equal to the head, stout at base, then compressed, curved throughout. Tibial feathers full, as in the hawks; tarsus not longer than toes.

COCCYZUS ERYTHROPHthalmus (Wils.) Bp.

Black-billed Cuckoo.

Coccyzus erythrophthalmus, AUDUBON, Orn. Biog., i, 1831, 170; B. Am., iv, 1842, 300.

—KIRTLAND, Ohio Geolog. Surv., 1838, 162.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 569; Reprint, 9.—LANGDON, Cat. Birds of Cin., 1877, 11.—

JONES and SHULZE, Illustrations of Nest and Eggs of Ohio Birds, Part I, 1879, Plate 3.

Coccyzus dominicus, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Coccygus erythrophthalmus, KIRKPATRICK, Ohio Farmer, ix, 1860, 195.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 361, 371; Reprint, 3, 13.—LANGDON, Revised List, Journ.

Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12.

Black-billed Cuckoo, BALLOU, Field and Forest, iii, 1878, 136.

Cuculus erythrophthalmus, WILSON, Am. Orn., iv, 1811, 16.

Coccyzus erythrophthalmus, BONAPARTE, Obs., Wils., 1825, No. 48.

Coccyzus dominicus, NUTTALL, Man., i, 1832, 550.

Coccygus erythrophthalmus, CABANIS, J. f. O., 1856, 104.

Above uniform satiny olive-gray, or "quaker color," with bronzy reflections. Below pure white, sometimes with a faint tawny tinge on the fore parts. Wings with little or no rufous. Lateral feathers not contrasting with the central, their tips for a short distance

blackish, then obscurely white. Bill blackish except occasionally a trace of yellowish below. Eye-lids red; bare circum-ocular space purplish. Length, 11-12; wing, 5-5½; tail, 6-6½; bill under 1.

Habitat, North America to the Rocky Mountains. North to Labrador. South through Mexico and Central America to the Valley of the Amazon. Cuba, rarely. Accidental in Europe.

Very common summer resident. Breeds. Arrives in May and remains until late in September. As soon as the leaves on forest trees are sufficiently advanced to afford concealment, the Black-billed Cuckoo makes its appearance in woods and gardens. The first intimation of his arrival, for he is very shy and retiring in his habits, is his peculiar note. This is a prolonged, monotonous, guttural sound, which has been likened to the noise made by water running from the mouth of a jug. It is from this rapid croaking note, and the belief that it was premonitory of wet weather, that these birds have obtained their common name of Rain Crows.

Some seasons they are much more abundant during the spring migrations than others. During the latter part of May, 1873, when a white moth was exceedingly abundant, the Black-billed Cuckoo appeared in great numbers, and fed upon them.

The Black-billed Cuckoo is more frequently found in upland woods than its Yellow-billed relative, though it shares with the latter its favorite haunts, the sunny thickets on the borders of streams.

Although near relatives of the notorious Cuckoo of Europe, which, like our Cow-bird, lays its eggs in the nest of other birds, our Cuckoos generally respect the marriage tie, and endeavor to perform all the duties consequent. Still there are occasions when they adopt the less reputable custom of their distant relatives and deposit their eggs in the nest of other birds and delegate paternal duties to them.

The eggs of Cuckoos have been found in the nest of the Cedar Bird, Robin and Wood Thrush, all of which birds lay eggs resembling those of the Cuckoo in color, and an anonymous writer in the "Oologist" (1877) records the finding of two eggs of a Cuckoo in the nest of a "Redbird" near Gambier, Ohio.

Misses Jones and Shulze figure beautifully the nest and eggs of this species, with the following account of its nesting habits:

The place usually selected for the nest is a wood where there is a thick undergrowth, and where the grape, ivy, and other climbing vines are found.

While no particular tree or shrub seems, more than another, adapted to its use, the low, damp places near rivers and smaller streams are more likely to be chosen than the high lands, probably owing to the greater luxuriance of suitable vegetation near the water-courses.

The nest is built either upon a horizontal or in a perpendicular fork of a tree, upon a cluster of small branches, the top of a stump, the stems of the stronger climbing vines or a similar position affording a suitable resting-place, and is always surrounded by thick foliage.

Its height varies from one foot to about thirty feet, but is rarely, if ever, found directly upon the ground. The nests of low position, are usually built in the perpendicular forking of stunted elms, thorns or other small trees. The higher nests are built among the vines.

The materials of construction are sticks, twigs, thorns, grasses, rootlets, strips of bark, blossoms and catkins.

The sticks are variable in size, and with the thorns form the foundation; the whole is loosely thrown together and is a miniature of the hawk's nest. Catkins of the oak, poplar, etc., or grape blossoms, with grasses, weed fibres and rootlets, form the lining and are often worked into the foundation. Frequently strips of bark, leaves or lichens, are added to the usual twigs, thorns and catkins.

The complement of eggs is from two to five, usually four. They are of a light bluish-green color when blown, sometimes mottled with a darker shade, and vary exceedingly in shape; some are elliptical while others only approach that form, and have an average measurement of $1.12 \times .83$.

They are usually deposited one every day, but quite an interval may elapse, so that young birds and almost fresh eggs may be found in the same nest.

The nests and eggs of the Yellow and Black-billed Cuckoos resemble each other closely, and it is not always possible to differentiate the two. Nests of the former are often found which could not not be mistaken for those of the Black-billed on account of the coarseness of the nest, larger size and paler color of the eggs; but the nest and eggs of the latter have no characteristics which might not belong to the former. However, as a rule, the nest of *C. erythrophthalmus* may be known from that of the *C. americanus* by the fact that it is constructed with more care, the sticks being somewhat smaller, the catkins less numerous, and the whole woven together in a firmer manner. The eggs are smaller, less elliptical, and of a slightly darker green. There are no nests or eggs of other birds in the limits of the state, with which these may be confounded by any moderately careful observer.

COCCYZUS AMERICANUS (L.) Bonap.

Yellow-billed Cuckoo.

Coccyzus americanus, KIRTLAND, Ohio Geolog. Surv., 1838, 162.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 569; Reprint, 9.—LANGDON, Cat. Birds of Cin., 1877, 11.—JONES and SHULZE, Illust. Nest and Eggs, Pt. 5, Pl. 14.

Coccygus americanus, KIRKPATRICK, Ohio Farmer, ix, 1860, 179.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 361, 371; Reprint, 3, 13.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12; Summer Birds, ib, iii, 1880, 225.

Yellow-billed Cuckoo, BALLOU, Field and Forest, iii, 1878, 136.

Cuculus americanus, LINNÆUS, Syst. Nat., i, 1766, 170.

Coccyzus americanus, BONAPARTE, Obs. Wils. 1825, No. 47.

Coccygus americanus, CABANIS, J. f. O., 1856, 104.

Above as in the last; below pure white. Wings extensively cinnamon rufous on inner webs of the quills. Central tail feathers like the back, the rest black with large

white tips, the outermost usually edged with white. Bill extensively yellow below and on the sides. Size of the last.

Habitat, Eastern United States and British Provinces. West to the Rocky Mountains. California. South through Mexico and various West India Islands, and Central America into South America as far as Buenos Ayres. Accidental in Europe.

Common summer resident. Breeds. Arrives and departs with the last species and frequents the same resorts, but is rather more confined to the wooded banks of streams. Not unfrequent in orchards, and in gardens of the city. The following paragraph from the pen of Dr. Coues (Birds N. W. p. 277) is a happy description of the manners of the Cuckoos :

"The peculiar notes of this bird, sounding like the syllables *koo-koo-koo*, indefinitely repeated, are probably uttered more frequently during the atmospheric changes preceding falling weather, and have given rise to the name "Rain Crow," by which both our species are universally known to the vulgar. The Yellow-billed is rather the noisier bird of the two, and its voice is more forcible. It is a rather shy and unfamiliar species, inhabiting high, open woods, as well as the large shade-trees of parks and cities, and generally remains high among the branches. When dashing about, in active pursuit of the various large-winged insects that form its chief food, they are conspicuous objects, the metallic olive-gray flashing in the sun, and the snowy under parts contrasting with the verdure. But ordinarily they are hidden birds, oftener heard than seen; they pass from one tree to another stealthily, with a rapid, gliding, noiseless flight, and often rest motionless as statues for a long time, especially when crying out, or when they have detected a suspicious object. They court the seclusion of the thickest foliage. Their curiosity is not small, and they may be observed to frequently peer down with inquisitive looks through the dense foliage, trying to make out some unusual object. Although not parasites, like the European species, devoid of parental instinct, they have their bad traits, being even worse enemies of various small, gentle birds; for they are abandoned thieves, as wicked as Jays in this respect, continually robbing birds of their eggs, and even, it is said, devouring the helpless nestlings."

The nest and eggs of the Yellow-billed Cuckoo resemble so much those of the other species that the same description answers for both. The eggs of this species are generally a shade lighter in color and average somewhat larger, 1.30 by .85. Dr. Jones states that he has found the eggs of this bird in the nest of the Cardinal Grosbeak, and of one the Cuckoos in that of the Catbird. One peculiarity in the nesting habits of these birds is, that no sooner is an egg laid than the female begins incubation, and it is a common thing to find young of different ages or young and eggs in the same nest.

SUB-ORDER PICI. Piciform Birds.

FAMILY PICIDÆ. WOODPECKERS.

Feet zygodactyle by reversion of the outer or fourth toe. Highly scansorial; tail of twelve rigid acuminate feathers, whereof the outer pair are short and spurious, concealed

between the bases of the next two pairs. Bill stout, straight, with the tip truncate or acute, not decurved (except in *Colaptes*) an efficient chisel for hammering or boring wood. Tongue vermiform, extensile (except in *Sphyrapicus*) and barbed. Salivary glands large; hyoidean apparatus peculiar. Nasal tufts usually present. Arboreal.

GENUS HYLOTOMUS. Baird.

Bill with a lateral ridge extending from base to tip. Outer posterior toe shorter than outer anterior. Nostrils linear.

HYLOTOMUS PILEATUS (L.) Baird.

Pileated Woodpecker; Logcock.

Picus pileatus, KIRTLAND, Ohio Geolog. Rep., 1838, 162.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—TREMBLY, Field Notes, i, 1861, 65.

Hylotomus pileatus, KIRKPATRICK, Ohio Farmer, ix, 1860, 315.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362, 373; Reprint, 4, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 569; Reprint, 9.—LANGDON, Cat. Birds of Cin., 1877, 11; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12.

Pileated Woodpecker, KIRTLAND, Fam. Visitor, i, 1850, 1.—WHEATON, Field Notes, i, 1861, 92.

Picus pileatus, LINNÆUS, Syst. Nat., i, 1776, 173.

Hylotomus pileatus, BAIRD, Birds N. A., 1858, 107.

Black; the head, neck and wings much varied with white or pale yellowish; bill dark; male, scarlet crested, scarlet moustached; female with the crest half black, half scarlet, and no maxillary patches. Length, 15–19; wing, $8\frac{1}{2}$ –10; tail, 6–7.

Habitat, timbered regions of North America at large.

Not common resident in most parts of the State. The Pileated Woodpecker, Logcock, or Woodcock as sometimes erroneously called, was, forty years since, a common bird in all parts of the State. Comparatively few now remain in the western and especially northwestern portions, still fewer in the hilly southern and eastern portions. In the vicinity of any of our larger towns and cities it may be considered accidental. I have

CAMPEPHILUS PRINCIPALIS (L.) Gray.

Ivory-billed Woodpecker.

Campephilus principalis, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12.

Picus principalis, LINNÆUS, Syst. Nat., i, 1776, 173.

Campephilus principalis, GRAY, Genera, 1840.

Habitat, Southern Atlantic and Gulf States. North to North Carolina and mouth of the Ohio.

The Ivory-billed Woodpecker is very properly included in his "Revised List" of Cincinnati Birds, by Mr. Langdon, on the authority of Dr. Haymond, who states that they were formerly found in Franklin county, Indiana, a locality not far from the western boundary of Ohio. Doubtless they were once residents of this State, but in default of any direct and positive evidence to that effect, they should not be admitted to our list.

never seen but one of these birds in this county, and that about twenty years since. One was shot when hammering on the roof of a church in this city about the same time. Old citizens smile as they tell of the fun they had trying to kill with sticks, these birds which frequented the trees on the grounds of the "first school house."

The nest of the Pileated Woodpecker is an excavation dug out by the bill of the bird in a large limb or trunk of a high tree either living or dead. The eggs are of a rounded oval shape, glistening white, unmarked, and measure 1.25 by 1.02.

GENUS PICUS. Linnæus.

Bill with a lateral ridge extending from base to tip. Outer posterior toe longer than outer anterior. Nostrils linear.

PICUS VILLOsus Linnæus.

Hairy Woodpecker.

Picus villosus, KIRTLAND, Ohio Geolog. Surv., 1833, 162.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—KIRKPATRICK, Ohio Farmer, ix, 1860, 267.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362; Reprint, 4; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 569; Reprint, 9.—LANGDON, Cat. Birds of Cin., 1877, 11; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12.

Picus rubricapillus, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Hairy Woodpecker, BALLOU, Field and Forest, iii, 1878, 136.

Picus villosus, LINNÆUS, Syst. Nat., i, 1766, 175.

Picus rubricapillus, NUTTALL, Man., i, 1840, 685.

Back black, with a long white stripe; quills and wing coverts with a profusion of white spots; four middle tail feathers black, next pair black and white, next two pairs white; under parts white; crown and sides of head black; with a white stripe over and behind the eye, another from the nasal feathers running below the eye to spread on the side of the neck, and a scarlet nuchal band in the male, wanting in the female; young with the crown mostly red or bronzy, or even yellowish. Length, 9-10; wing nearly 5; tail, 3½.

Habitat, the entire wooded portions of North America—the typical form east of the Rocky Mountains, reaching the Pacific, however, in Alaska. Var. *harrisii* from the Rocky Mountains to the Pacific. Each variety grading in size according to latitude.

Rather common resident, more frequent in fall, winter, and early spring than in summer. Breeds.

The Hairy Woodpecker though most numerous along the edges of woodlands, is a frequent visitor during the colder months, in gardens of the city and in orchards.

It is less inclined to accept the society of other species than its miniature, the Downy Woodpecker, and maintains a dignified manner, as it busies itself searching for the larva of insects in decaying trees, and spiders and eggs of insects in crevices of the bark.

The nest of the Hairy Woodpecker is often excavated in a terminal limb of a lofty beech, sometimes in the trunk of an apple tree, more rarely in a dead stub. The eggs are five or six in number, and like those of all other birds of this family, are pure crystal white with an ivory texture. They are an inch in length by nearly three-fourths in width.

PICUS PUBESCENS Linnæus.

Downy Woodpecker.

Picus pubescens, KIRTLAND, Ohio Geolog. Surv., 1838, 162, 179.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395—KIRKPATRICK, Ohio Farmer, ix, 1860, 299—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362, 372; Reprint, 4, 14; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 569; Reprint, 9.—LANGDON, Cat. Birds of Cin., 1877, 11; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12; Summer Birds, ib., iii, 1880, 225.

Picus medianus, KIRTLAND, Ohio Geolog. Rep., 1838, 162, 179.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Downy Woodpecker, BALLOU, Field and Forest, iii, 1878, 136.

Picus pubescens, LINNÆUS, Syst., Nat., i, 1776, 136.

Picus (Dendrocopus) medianus, SWAINSON, Fn. Bor. Am., ii, 1831, 308.

Picus medianus, NUTTALL, Man., ii, 1834, 601.

Coloration exactly as in *P. villosus* except the outer tail feathers are barred with black and white. Length, 6-7; wing under 4; tail under 3.

Habitat, entirely correspondent with that of *P. villosus*. Var. *gairdneri* from the Rocky Mountains to the Pacific.

Common resident. Breeds. More numerous during the colder months than in summer.

The Downy Woodpecker is the smallest of our members of the family. It is frequently misnamed "Sapsucker," a term which can only be applied with any propriety to the Yellow-bellied Woodpecker.

It is much more humble and social than the Hairy Woodpecker, being generally found in company with Titmice, Wrens, and Nuthatches, keeping near the ground, searching the branches of low trees or saplings, in the tops of fallen trees, in hedge-rows, brush heaps or on fences. It is quite unsuspicious of man, and continues its busy chiseling, unheeding his near approach.

The nest of the Downy Woodpecker is excavated in the trunk of a small dead tree, often in the dead limb of an apple tree, sometimes in the post or rail of a fence, seldom more than twenty feet from the ground, often within reach. The eggs, generally five, white, unmarked, measure .83 by .72.

GENUS *PICOIDES*. Lacepede.

Bill much depressed at base, with lateral ridges much nearer commissure than culmen; gonyes very long, equal to distance from nostrils to tip. Feet with only three toes, the first or inner hind toe wanting, outer front toe a little longer than inner, slightly exceeded by hind toe. Wings very long, reaching beyond middle of tail.

PICOIDES ARCTICUS (Sw) Gr.**Black-backed Woodpecker.**

Picoides arcticus, WHEATON, Ohio Agric. Rep. for 1860, 379, (probable); Reprint, 1861, 22, (probable).—BAIRD, BREWER and RIDGWAY, ii, 1874, 521.

Picus (*Apternus*) *arcticus*, SWAINSON, Fn. Bor. Am. ii, 1831, 313.

Picoides arcticus, GRAY, Gen. of Birds, ii, 434.

Crown with a yellow patch in the male. Back uniform black, sides of head striped, of body barred, with black and white; under parts otherwise white; quills with white spots; tail feathers unbarred, the outer white, the central black. Length, 8-9; wing, 4½-5; tail, 3½-4.

Habitat, Northern North America. into the northern United States in winter, and in all probability resident along our northern frontier, as well as further south in mountainous regions.

Rare or accidental, and probably in winter only, in Northern Ohio. Mr. Kirkpatrick informed me in 1861, that it was said to have occurred in Ashtabula county, but with his characteristic caution, added "not having seen the specimen I cannot vouch for the truth of the statement." It was accordingly mentioned in my catalogue in the list of probabilities. It was omitted from a subsequent list, no further evidence of its occurrence having been obtained.

Dr. Brewer in the work cited, says: "It has been found as far south as Massachusetts, New York and Ohio, but rarely," and in correspondence with me in regard to its occurrence, wrote that his statement was based upon one specimen sent to him with other birds, by a local collector, of Akron, Summit county, Ohio, and that, as the birds were sent to him for identification, he had no doubt they were shot in that vicinity.

The nearest locality to us in which this Woodpecker is known to be a permanent resident is Lewis county, New York, where both it and the Banded Three-toed Woodpecker (*P. americanus*) have been discovered to breed by Dr. C. H. Merriam. The eggs measure .91 by .70.

GENUS *SPHYRAPICUS*. Baird.

Bill as in *Picus*, but the very prominent lateral ridge terminating at the middle of the commissure; lateral outline of bill concave to near the tip. Outer toes longest, the inner posterior toe very short, less than inner anterior without claw. Wings long and pointed. Tail feathers very broad, abruptly acuminate, with a very long linear tip. Tongue, scarcely extensible.

SPHYRAPICUS VARIUS (L.) Baird.

Yellow-bellied Woodpecker.

Picus varius, WILSON, Am. Orn., i, 1808, 147.—KIRTLAND, Ohio Geolog. Surv., 1838, 162, 179.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Sphyrapicus varius, KIRKPATRICK, Ohio Farmer, ix, 1860, 307.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362; Reprint, 4; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 569; Reprint, 9.—LANGDON, Cat. Birds of Cin., 1877, 11; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12.

Sphyrapicus varius, var. *varius*, BAIRD, BREWER and RIDGWAY, N. A. Birds, ii, 1874, 540.

Picus varius, LINNÆUS, Syst. Nat., i, 1766, 176.

Sphyrapicus varius, BAIRD, Birds N. A. 1858, 103.

Crown crimson, bordered all around with black; chin, throat and breast black, enclosing a large crimson patch on the former in the male, in the female this patch white; sides of head with a line starting from the nasal feathers and dividing the black of the throat from a trans-ocular black stripe, this separated from the black of crown by a white post-ocular stripe; all these stripes frequently yellowish; under parts dingy yellow, brownish, and with sagittate dusky marks on the sides; back variegated with black and yellowish-brown; wings black with large oblique white bar on the coverts, the quills with numerous paired white spots on the edge of both webs; tail black, most of the feathers white edged, the inner webs of the middle pair and the upper coverts, mostly white. Young birds lack the definite black areas of the head and breast, and the crimson throat patch, these parts being mottled gray. About, $8\frac{1}{2}$; wing, $4\frac{1}{2}$ –5; tail, $3\frac{1}{2}$.

Habitat, the typical form in Eastern North America north to 64° at least. South to Guatemala. Mexico. Cuba. Bahamas. Greenland. Var. *nuchalis* from the Rocky Mountain region and Great Basin. Var. *ruber* from Cascade Mountains and Sierra Nevada to the Pacific.

Common spring and fall migrant in March, April, October, and November. Mr. Langdon gives it as a not common winter visitor in the vicinity of Cincinnati.

The Yellow-bellied Woodpecker, one of the most singular and attractive members of the family, is a regular migrant in spring and fall, and while it never occurs in great numbers in this vicinity it may frequently be seen in small companies of five or six in mixed woodland. The individuals of these little companies pay but little regard to each other, and their association may for the most part be purely accidental. They are the most silent of all our Woodpeckers, though not at all suspicious or shy. When not in a hurry, they visit our orchards and gardens, searching for insects in the crevices of bark. The ornamental evergreens of cities, especially pine trees, are favorite resorts, and I suspect they have a preference for pine woods, as on their arrival they are frequently soiled by gum from these trees.

This is the only Woodpecker to which the term "Sapsucker" can

with any propriety be applied. It lacks the long extensile tongue which enables the other Woodpeckers to probe the winding galleries of wood-eating larvæ, and is known to feed largely upon the green inner bark of trees. In some localities it is said to destroy many trees by stripping off the bark. In this locality its numbers are never so great as to prove destructive, on the other hand, its visits are of great benefit to our gardens and orchards. It destroys great numbers of pupæ of *Ægerians*, which inhabit our maple, peach and pear trees, as well as currant-bush borers, and coddling moths of our apple trees.

No one seems to have discovered for what purpose the tongue of birds of this genus differs so greatly from those of other members of the family, and the suggestion offers that their food is not obtained from the interior of trees, but from the bark and small pithy branches.

The breeding range of this bird is not clearly made out. The older writers gave it as breeding where it is now recognized as migrant only. Perhaps it breeds in Northern Ohio; I once observed a pair digging an excavation about fifty feet from the ground in a tall ash on the edge of woods, in May. This they deserted, however, before it was completed. They are known to breed from Northern New York, northward. The nest is described as high up in some dead tree, and the eggs as pure white, measuring .95 by .70.

GENUS CENTURUS. Swainson.

Bill with lateral ridges not extending to tip or commissure. Nostrils very broadly oval. Posterior outer toe shorter than anterior outer.

CENTURUS CAROLINUS (L.) Sw.

Red-bellied Woodpecker.

Picus carolinus, WILSON, Am. Orn., i, 1808, 113.—KIRTLAND, Ohio Geolog. Surv., 1838, 162.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Centurus carolinus, KIRKPATRICK, Ohio Farmer, ix, 1860, 331.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 362; Reprint, 4; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 569; Reprint, 9.—LANGDON, Cat. Birds of Cin., 1877, 11; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12.

Red-bellied Woodpecker, BALLOU, Field and Forest, iii, 1878, 136.

Picus carolinus, LINNÆUS, Syst. Nat., i, 1766, 174.

Centurus carolinus, SWAINSON, Class B., ii, 1837, 310.

Back and wings, except larger quills, closely banded with black and white; primaries with large white blotches near the base, and usually a few smaller spots. Whole crown and nape scarlet in the male, partly so in the female; sides of head and under parts grayish-white, usually with a yellow shade, *reddening* on belly; flanks and crissum with sagittate-black marks; tail black, one or two outer feathers white barred;

inner web of central feathers white with black spots, outer web of the same black with a white space next the shaft for most of its length; white predominating on the rump. Length, 9-10; wing about 5; tail about $3\frac{1}{4}$.

Habitat, Eastern United States to the Rocky Mountains. North rarely to southern New England. Canada West.

Common resident. Breeds. The Red-bellied Woodpecker, known to many as the "Zebra Bird," is the most retiring of all our species. In the colder months of the year it is frequently found on the edges of heavy woodland and in partially cleared land, less often in fields or near habitations. In summer, however, it retires to the deepest and most unfrequented forests to breed. Mr. Kirkpatrick, as the result of his observations near Cleveland, suggests that it may be a summer resident only in Northern Ohio, which would account for their greater abundance, apparently, in other parts of the State in winter. It does not differ much in habits from the Hairy Woodpecker.

When engaged in hammering for insects, it frequently utters a short singular note, which Wilson, who mentions finding the bird at Chillicothe, Ohio, likens to the bark of small dog. The note is usually twice repeated and resembles the hoarse utterance of the syllables *chow, chow*.

The nest is excavated in the dead limb or trunk of a high tree. The eggs are five, white, and measure 1.02 by .88.

GENUS MELANERPES. Swainson.

Ridge of upper mandible not extending to tip or commissure of bill. Nostrils broadly oval. Outer pair of toes equal.

MELANERPES ERYTHROCEPHALUS (L.) Sw.

Red-headed Woodpecker.

Picus erythrocephalus, KIRTLAND, Ohio Geolog. Surv., 1838, 122.—READ, Proc. Phila Acad. Nat. Sci., vi, 1853, 395.

Melanerpes erythrocephalus, KIRKPATRICK, Ohio Farmer, ix, 1860, 339.—WHEATON, Ohio Agric. Rep. for 1860, 362, 373; Reprint, 1861, 4, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 569; Reprint, 1875, 9.—LANGDON, Cat. Birds of Cin., 1877, 11; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 178; Reprint, 12; Summer Birds, ib., iii, 1880, 225.

Red-headed Woodpecker, BALLOU, Field and Forest, iii, 1878, 174.

Picus erythrocephalus, LINNÆUS, Syst. Nat., i, 1766, 174.

Melanerpes erythrocephalus, SWAINSON, Fn. Bor. Am., ii, 1831, 316.

Glossy blue-black; rump, secondaries and under parts from the breast pure white; primaries and tail feathers black; whole head, neck and breast crimson in both sexes, grayish-brown in the young; about 9; wing, $5\frac{1}{4}$; tail, $3\frac{1}{4}$.

Habitat, Temperate North America to the Rocky Mountains. Now rare in New England. Utah. California.

Abundant summer resident from April to October. A few remain in Middle Ohio throughout the year.

This in the most abundant and best known of all our Woodpeckers. It frequents forests and groves, orchards and solitary trees in fields. With the ordinary food habits of Woodpeckers, it combines a taste for grasshoppers and beetles, and is moreover an expert flycatcher, often capturing insects on the wing after the manner of the true Flycatchers. It is more often seen seeking food on the ground than any other of the family, except the Golden-winged Woodpecker. Nor is its food entirely insectivorous, for, as farmers and gardeners well know, it invades gardens and orchards, eating, carrying off and mutilating the finest apples, pears, cherries, and other fruits. It also visits the corn-fields and feeds upon the tender corn and the worms which attack it.

In this vicinity only a few remain through the winter, and these retire to the deepest woods or wooded ravines, where they find a limited protection from the severity of the weather. About the middle of April they return in great numbers from the south, and leave again in September and October.

They are very noisy and quarrelsome, not only among each other, but frequently with other birds. Should a bird of another species be inclined to resent their impertinent assault, they retire to a dead limb or fence stake, and treat their irritated enemy to an aggravating game of bo-peep.

The nest of the Red-headed Woodpecker varies greatly in position, being located from ten to a hundred feet above the ground. It is generally in a dead limb or trunk, but not unfrequently excavated in living wood. The eggs are usually five, pure white, and measure from 1.10 to 1.15 inches in length by .80 to .90 in breadth.

GENUS COLAPTES. Swainson.

Bill curved, pointed, without ridge on upper mandible. Nostrils oval. Posterior outer toe shorter than the anterior.

COLAPTES AURATUS (L.) Sw.

Golden-winged Woodpecker; Flicker.

Picus auratus, KIRTLAND, Ohio Geolog. Surv., 1838, 162.

Colaptes auratus, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—KIRKPATRICK, Ohio Farmer, ix, 1860, 347.—WHEATON, Ohio Agric. Rep. for 1860, 362, 373; Reprint, 1861, 4, 15; Food of Birds, etc., Ohio Agric. Rep. for 1874, 569; Reprint, 1875, 9.—LANGDOM, Cat. Birds of Cin., 1877, 11; Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 13 Summer Birds, ib., iii, 1880, 225; Field Notes, ib., ii, 1880, 125.

Yellow-spotted Woodpecker, BALLOU, Field and Forest, iii, 1878, 136.

Cuculus auratus, LINNÆUS, Syst. Nat., i, 1758, 112.

Picus auratus, LINNÆUS, Syst. Nat., i, 1766, 174.

Colaptes auratus, SWAINSON, Zool. Journ., iii, 1827, 353.

Back, wing coverts, and innermost quills olivaceous-brown thickly barred with black. Rump snowy-white. Quills and tail golden-yellow underneath, and shafts of this color. A scarlet nuchal crescent and large black pectoral crescent in both sexes; male with black maxillary patches, wanting in the female, head and nape ash, chin, throat and breast lilac-brown; under parts with numerous round black spots; sides tinged with creamy-brown, belly with yellowish. About 10 inches long; wing about 6; tail, 4½.

Habitat, Eastern North America, to the slopes and foot-hills of the Rocky Mountains, where in many localities it becomes mixed with *C. americanus*. Alaska. Greenland. accidental in Europe.

Abundant summer resident, and in part resident during the whole year throughout the State. The Golden-winged Woodpecker arrives in great numbers early in April, and is then in flocks in woods. A considerable number pass on to the north, while those which remain become generally dispersed over the country. The majority depart for the South in November, those which remain through the winter do not congregate in considerable flocks, but, in small companies, roam the fields and woods in search of food.

This bird is known by a number of names besides the ones above given, High-hole, Wake-up and Yellow-hammer, in allusion to its nesting, note, and color, respectively.

Its ordinary note is singular, and suggests a violent hiccough, if it is possible for birds to be so affected, and in addition it often sounds a subdued, rolling, guttural chirrup. Its habits as to food differ somewhat from all others of the family. It is very fond of corn both green and ripe, and is a great devourer of ants, indeed it seems to be specially adapted for obtaining these insects. Its long, curved, pickaxe-like bill, is employed in breaking down decayed logs and stumps, where these insects abound, and which it collects upon its long and slimy tongue. They may often be seen probing an ant-hill, for these insects.

Albinos of this bird, are, perhaps, more frequent than among other species of the family. Mr. Langdon (Obs.) says: "A beautiful Albino has been taken at Valley Junction, by Mr. Harry Hunt, and is now in his collection. It is of a delicate cream color, but the red nape shows plainly, and the pectoral crescent obscurely." A specimen, perhaps darker buff, but the other markings corresponding to the above description, was taken by Mr. W. R. Limpert, near Groveport, in this county, several years since, and is now in my keeping. Mr. Joseph Sullivant,

of this city, has a specimen, locality unknown, nearly pure white, with scarlet nape and yellow shafts to quills.

The nest of the Flicker is most frequently in a dead trunk at a considerable height from the ground. It is generally excavated by the birds, though not unfrequently the eggs are laid within a natural cavity. These are from five to seven or even more in number, pure white, often varying in size even in the same nest. Their average measurement is 1.09 by .88.

ORDER PSITTACI. PARROTS.

FAMILY PSITTACIDÆ. PARROTS.

With the characters of *Psittaci*, given on page 200.

Sub-family SITTACINÆ. Parroquets.

Head plain, tail long or lengthened, wedge-shaped or graduated.

GENUS CONURUS. Kuhl.

Culmen rounded. Face entirely feathered, except a curve around the eye. Tail shorter than wings.

CONURUS CAROLINENSIS (L.) Kuhl.

Carolina Parroquet.

Psittacus carolinensis, WILSON, Am. Orn., iii, 1811, 89.—KIRTLAND, Ohio Geolog. Surv., 1838, 62, 179.

Psittacus carolinensis, AUDUBON, Orn. Biog., i, 1831, 135.

Centurus (error) *carolinensis*, AUDUBON, B. Am., iv., 1842, 309.

Conurus carolinensis, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—KIRKPATRICK, Ohio Farmer, ix, 1860, 251.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 361, 371; Reprint, 3, 13; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 570; Reprint, 10.—BAIRD, BREWER and RIDGWAY, N. A. Birds, ii, 1874, 589.—COUES, Birds N. W., 1874, 295.—LANGDON, Cat. Birds of Cin., 1877, 11; Journ. Cin. Soc. Nat. Hist., i, 1878, 115; Reprint, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 13.

Parroquet, ATWATER, Hist. Ohio, 1838, 96.

Psittacus carolinensis, LINNÆUS, Syst., Nat., 1766, 141.

Conurus carolinensis, "KUHLE, Nov. Act. Acad. Caes. Leop. Car.," 1830.

Green; head yellow; face red; bill white; feet flesh-color; wings more or less variegated with blue and yellow. Young, simply green. Length, 13; wing, 7½; tail, 6.

Habitat, Southernmost Atlantic and Gulf States; up the Mississippi to Missouri; up the Missouri River to the Platte. Colorado. Iowa. Wisconsin. Nebraska. Formerly north in the Eastern United States to Pennsylvania and the Lakes. Albany, N. Y.

Formerly a visitor, in probably all parts of the State in summer, and breeding in the southern if not other portions, but has not made its appearance for several years.

Wilson, after mentioning their occurrence near Lake Michigan in latitude 42°, and twenty-five miles northwest of Albany, N. Y., says :

"In descending the Ohio, by myself in the month of February, I met with the first flock of Parroquets at the mouth of the Little Scioto. I had been informed by an old and respectable inhabitant of Marietta, that they were sometimes, though rarely, seen there. I observed flocks of them, afterwards, at the mouth of the Great and Little Miami, and in the neighborhood of the numerous creeks that discharge themselves into the Ohio."

In 1831, Audubon says :

"Our Parakeets are very rapidly diminishing in number, and in some districts, where twenty-five years ago they were plentiful, scarcely any are now to be seen. At that period they could be procured as far up the tributary waters of the Ohio as the Great Kanawha, the Scioto, the heads of Miami, the mouth of the Manimee [Maumee] at its junction with Lake Erie, on the Illinois River, and sometimes as far northeast as Lake Ontario, and along the Eastern districts as far as the boundary-line between Virginia and Maryland. At the present day very few are to be found higher than Cincinnati, nor is it until you reach the mouth of the Ohio that Parakeets are met with in considerable numbers. I should think that along the Mississippi there is not now half the number that existed fifteen years ago.

In 1838, Atwater writes :

"A few years since Parroquets, in large flocks, lived in the woods along the Ohio River from Millers' Bottom downwards, and along the Scioto River, upward from its mouth to where Columbus now stands. They are still in the bottoms below Chillicothe, near the river, where there is the proper food for them to eat, and birds enough for them to torment by their squalling noise."

Dr. Kirtland in 1838, notes :

"The Parakeets do not usually extend their visits north of the Scioto, though I am informed, perhaps on doubtful authority, that thirty years since flocks of them were seen on the Ohio at the mouth of Big Beaver, thirty miles below Pittsburgh."

Mr. Read in 1853, says :

"A few years ago a flock of these birds appeared in Talmadge, Summit Co., as I was informed by my friend, Rev. Sam'l. Wright. Have myself never seen them in the Reserve."

Mr. Langdon says :

"Mr. Joseph Settle tells me that Parroquets occurred in large numbers near Madisonville, during the summer of 1837, '38 and '39. Few were seen in 1840, and none after that year. He describes them as a "green bird," appearing in flocks, like Blackbirds, making a loud chattering noise, and destroying a considerable amount of fruit. Mr. Dury notes, on the authority of Giles Richards, Esq., their occurrence at Matson's Mills, near

Venice, Butler Co., Ohio; Mr. Richards pointing out the identical sycamores in which they had nested many years ago."

Finally, the late Wm. S. Sullivant, L.L.D., a well informed ornithologist, as well as eminent botanist, who was well acquainted with these birds in earlier years, informed me that in July, 1862, a flock numbering from twenty-five to thirty made their appearance in the Capitol Square of this city and remained in the elm trees opposite his residence for a couple of hours, greatly to his enjoyment and the delight of numerous small boys.

According to Audubon, the Parroquet nested in natural cavities of trees, the compliment of eggs being two. This was not accurately determined for the reason that more than one female was believed to occupy the same nest. He describes the eggs as greenish-white. Dr. Brewer describes an egg as of a rounded oval form, dull white color, measuring 1.40 by 1.10.

ORDER RAPTORES. BIRDS OF PREY.

FAMILY STRIGIDÆ. OWLS.

Feet highly raptorial, with large, strong, sharp, curved contractile claws adapted for grasping. Hallux perfectly incumbent, lengthened (more than half as long as the fourth toe), with large claw. Front toes with slight basal webbing between outer and middle toe, or none. Nostrils imperforate. Bill short, stout, not notably contracted in its continuity, with strongly hooked tip. Head feathered wholly or in greatest part. Lower larynx developed with one pair of muscles. Cæca present, as a rule, if not always.

Physiognomy peculiar by reason of great lateral expansion and lengthwise shortening of the cranium, causing the eyes to be directed forward. Eyes surrounded by a disc of radiating bristly feathers, in front closely appressed to and hiding the base of the bill, elsewhere bounded by a rim of differently formed feathers. Tomia never toothed or lobed. Nostrils usually at the edge of the cere. Outer toe completely versatile, shorter than inner toe. Basal phalanx of middle toe not longer than the second, and much shorter than the next. Legs commonly feathered or bristly to or on the toes. Plumage peculiarly soft and lax, without after-shafts; flight perfectly noiseless. Cranial walls widely separated by intervention of spongy diploë. Sternum commonly doubly notched. Chiefly nocturnal.

GENUS STRIX. Linnæus.

No ear tufts; facial disc highly developed, not circular; ears very large, operculate. Tarsi long, scant feathered, bristly below like the nearly naked toes. Middle claw usually serrate or jagged. Plumage downy.

STRIX FLAMMEA Linnæus.

var. AMERICANA (Aud.) Cs.

Barn Owl.

Strix pratincola, KIRKPATRICK, Ohio Farmer, viii, 1859, 35; Ohio Agric. Rep. for 1858, 1859, 373 (probable).—WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3. *Strix flammea*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.

Strix flammea, var. *americana*, LANGDON, Cat. Birds of Cin., 1877, 12; Journ. Cin. Soc. Nat. Hist., i, 1878, 115; Reprint, 6.—WHEATON, Bull. Nutt. Orn. Club, iv, 1879, 62.

Strix flammea, var. *pratincola*, LANGDON, Revised List, Journ. Cin., Soc. Nat. Hist., i, 1879, 179; Reprint, 13; Field Notes, ib., ii, 1880, 126.

Strix flammea, LINNÆUS, Syst. Nat., i, 1766, 133.

Strix pratincola, BONAPARTE, List, 1838, 7.

Strix flammea, var. *americana*, COUES, Key, 1872, 201.

Strix flammea, var. *pratincola*, RIDGWAY, B. B. & R., N. A. Birds, iii, 1874, 13.

Tawny or fulvous brown, delicately clouded or marbled with ashy or white, and speckled with brownish-black; below, a varying shade from nearly a pure white to fulvous, with sparse sharp blackish speckling; face white to purplish-brown, darker or black about the eyes, the disk bordered with dark-brown; wings and tail barred with brown, and finely mottled like the back; bill whitish; toes yellowish. Length, female, 17; wing, 13; tail, $5\frac{1}{2}$; male rather less.

Habitat, North America and Mexico; not beyond the United States; rarely north to New England and the Columbia. New York. Maine.

Rare visitor. Not over half a dozen individuals recorded. Mr. Kirkpatrick in 1859, mentions the probable occurrence of the Barn Owl in Southern Ohio. Two years later, Mr. Kirkpatrick having positive information of its occurrence and capture, I included it in my catalogue. Mr. Dury subsequently informed me that Ohio specimens were in his collection. Mr. Langdon in 1878, mentions Mr. Dury's two specimens, and in 1880, says: "Mr. Shorten informs me of the capture of our third recorded specimen of this species on April 14, 1880, at Foster's Landing, on the Ohio River, 36 miles above Cincinnati."

The only specimens from this vicinity are noted by me in the Nuttall Bulletin (l. c.), as follows:

"Mr. Oliver Davie, of this city, has a specimen of this bird killed in this vicinity, November 2, 1878. This is its northernmost appearance in the interior, except on one occasion, recorded by Mr. E. W. Nelson (Bull. Ess. Ins., 1876, Vol. VIII, p. 116), of two taken in a trap near Chicago. Dr. Howard E. Jones informs me that he killed a specimen twenty-five miles south of Columbus, near Circleville, in the summer of 1873, which is now in the Museum of Hobart College, Geneva, New York."

The dates of these captures indicate that the bird is at least a summer resident of the State. The eggs, from three to six in number are

white, and measure 1.80 by 1.25. They are deposited in nooks of buildings or crevices of rocks, sometimes in burrows in bluffs. No attempt is made toward the construction of a nest.

GENUS BUBO. Cuvier.

Size large. Ear tufts large and prominent. Eyes large. Facial discs complete. Ears not operculate. Tarsi and toes densely feathered, claws very strong.

BUBO VIRGINIANUS (Gm.) Bp.

Great Horned Owl.

Strix virginianus, WILSON, Am. Orn. vi, 1812, 52.—KIRTLAND, Ohio Geolog. Surv., 1838, 161 179.—READ, Fam. Visitor, iii, 1853, 303; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Bubo virginianus, KIRKPATRICK, Ohio Farmer, viii, 1859, 35; Ohio Agric. Rep. for 1858, 1859, 375.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 361; Reprint, 3; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 570, Reprint, 10.—LANGDON, Cat. Birds of Cin., 1877, 12; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 13.

Strix virginianus, GMELIN, Syst. Nat., i, 1788, 287.

Bubo virginianus, BONAPARTE, List, 1838, 6.

Distinguished by its large size, in connection with the conspicuous ear tufts; the other species of similar dimensions are tuftless. The plumage varies interminably, and no concise description will meet all its phases; it is a variegation of blackish, with dark and light-brown, and fulvous. A white collar is the most constant color mark. Length about 2 feet; wing, 14-16 inches; tail, 9-10.

Habitat, the Western Hemisphere. Common and generally distributed in wooded regions in the United States.

Common resident. Breeds. This is the largest of all the Owls with ear tufts, and perhaps the only one of sufficient size and abundance to cause much damage by its depredations upon hen-roosts. It frequents most especially deep woods and swamps, and may frequently be seen flying or perching in day time, when it sees tolerably well. On such occasions it is usually attended by an unfriendly escort of Crows, Jays and smaller birds, who pester it relentlessly.

Sometimes it is taken in traps set for itself or other wild animals, and when wounded, fights fiercely both with bill and claws; even the snapping of its bill is sufficient to induce caution on the part of those approaching.

The food of the Great Horned Owl consists of small quadrupeds such as rats, mice, squirrels and occasionally rabbits, birds, reptiles and fish.

The nest is placed either in the fork of a high tree or in a cavity. Sometimes they occupy the deserted nest of a hawk. The eggs are two, dull white, nearly spherical, and measure 2.30 by 2.00.

GENUS SCOPS. Savigny.

Size small; ear tufts moderate. Facial discs complete. Tarsi feathered; toes, in our species, covered with short bristly feathers.

SCOPS ASIO (L) Bp.

Screech Owl; Mottled Owl.

Strix asio, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 179.—READ, Fam. Visitor, iii, 1853, 303; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Strix nœvia, READ, Fam. Visitor, iii, 1853, 296; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Scops asio, KIRKPATRICK, Ohio Farmer, viii, 1858, 43; Ohio Agric. R.p. for 1858, 1859, 375.—BREWER, N. A. Oology, Smithsonian Contributions, xi, 1869, 63.—WHETON, Ohio Agric. R.p. for 1860, 1861, 361; Reprint, 3; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 570; Reprint 10.—LANGDON, Cat. Birds of Cin., 1877, 12; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 13; Summer Birds, ib., iii, 1880, 225.

Strix *asio*, LINNÆUS, Syst. Nat., i, 1766, 132.

Scops asio, BONAPARTE, Comp. List, 1838, 6.

Strix *nœvia*, GMELIN, Syst. Nat., i, 1788, 289.

One plumage: General aspect gray, paler or whitish below. Above speckled with blackish, below patched with the same; wings and tail dark-barred; usually a lightish scapular area.

Another: General aspect brownish-red, with sharp black streaks; below rufous-white, variegated; quills and tail with rufous and dark bars. These plumages shade insensibly into each other and it has been determined that they bear no definite relations to age, sex or season. Length about 10; wing, 7; tail, $3\frac{1}{2}$.

Habitat, North America at large.

Common resident, but more numerous during the warmer portion of the year. Breeds.

This is the smallest of our Owls with ear tufts. It presents, more strikingly than any other species of our birds, the variation in color known as dimorphism. Many early ornithologists considered the red and the gray birds to constitute two species, and this opinion still obtains among those whose acquaintance with them is casual. It has been sufficiently proven, not only that birds of each plumage mate, but also that the young brood while in the nest, may consist of birds of both colors. I once discovered a pair of these birds caring for six newly fledged young; the female was of the red and the male of the gray type of coloration; while of three of the young which I secured, one only was red. The color is thus seen to be an individual character, and not governed by age, sex or season.

None of our Owls are more frequently seen or heard about houses, or even in the midst of large cities. Nearly every one is familiar

with its wailing screech. In this city it is not a frequent visitor, and confines its visits to the colder portions of the year. At such times it often appears to be driven to desperation to procure food. Mr. C. H. Wetmore informed me that some bird, probably an Owl, attempted for several successive nights to capture the shadow of a canary bird, which fell upon a white window curtain, near which its cage was suspended. Hoping the bird might prove to be an Acadian Owl, I requested that if possible he procure the specimen, which he did, it proving to be of this species. While the bird was lying in my office, it was seen by other gentlemen, who reported that presumably the same bird had made the same attempt at their respective residences. As might be expected in a bird which developed a hobby for so rare an article of diet, it was reduced to a shadow itself. Its ordinary food consists of large insects, mice and small birds.

The nest of the Mottled Owl is placed in a hollow stump or trunk, often in a decaying apple tree. The eggs are from five to seven in number, pure white and nearly round. They measure 1.38 by 1.19.

GENUS OTUS. Cuvier.

Size medium. Ears very large, with semi-circular flap. Ear tufts long and conspicuous; facial disc complete. Tarsi and toes feathered.

OTUS VULGARIS Fleming.

var. WILSONIANUS (Less.) All.

Long-eared Owl.

Strix otus, AUDUBON, Orn. Biog., iv, 1833, 572.

Otus vulgaris, AUDUBON, B. Am., i, 1840, 136.

Otus wilsonianus, KIRKPATRICK, Ohio Farmer, viii, 1859, 27; Ohio Agric. Rep. for 1858, 1859, 377.—WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3.

Otus vulgaris, var. *wilsonianus*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 12; Jour. Cin. Soc. Nat. Hist., i, 1878, 115; Reprint, 6; Revised List, Journ. Cin. Soc. Nat. Hist., 1879, 179; Reprint, 13.

Otus vulgaris, FLEMING, Brit. An., 56.

Otus wilsonianus, LESSON, Tr. Orn., i, 1831, 110.

Otus vulgaris, var. *wilsonianus*, ALLEN, Bull. M. C. Z., iii, 1872, 180.

General plumage above a variegation of dark-brown, fulvous and whitish, in small pattern; breast more fulvous, belly whiter, the former sharply striped, the latter striped and elaborately barred, with blackish; quills and tail mottled and closely barred with fulvous and dark-brown; face pale; with black touches and eye patches; bill and claws blackish. Ear tufts of 8-12 feathers. Length, 14-15; wing, 11-12; tail, 5-6.

Habitat, Temperate North America at large.

Resident. Common in winter, rare in summer. Probably breeds. The Long-eared Owl, which Audubon found "not rare in Ohio," is, curiously enough, not named in the catalogues of Dr. Kirtland and Mr. Read. It is, perhaps, a somewhat irregular, but at times abundant winter visitor. So far as my observations extend it appears to be most common in winters when the next species is least numerous. Mr. Kirkpatrick, the first local writer who mentions it, says "it is an inhabitant of the woods from which it seldom ventures far. It is extremely abundant in the eastern States, on the seaboard, but is much scarcer west of the Alleghenies. In Ohio it occasionally occurs, and is in all likelihood a constant resident with us, and specimens are sometimes obtained, and it is, however, rather more plentiful than formerly." Mr. Langdon reports, "full fledged young of the year taken by Mr. Dury, at Avondale, in July, 1878—this first evidence of the breeding of this species in this vicinity."

Forests of evergreens are said to be the favorite resorts of this species for breeding purposes. The nest is composed of sticks with a more or less complete lining of feathers. The same nest is occupied for several years. Sometimes an old Hawk's or Crow's nest is occupied. In some localities they are said to nest on the ground or on low bushes. The eggs are generally two, sometimes four, white, and measure from 1.65 to 1.50 in length and from 1.35 to 1.30 in breadth.

GENUS BRACHYOTUS. Gould.

Ear tufts small and inconspicuous; otherwise like *Otus*.

BRACHYOTUS PALUSTRIS (Bechst.) Bp.

Short-eared Owl.

Strix brachyotus, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 179.—READ, Fam. Visitor, iii, 303; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Brachyotus cassinii, WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3.

Brachyotus palustris, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin. 1877, 12.

Otus brachyotus, KIRKPATRICK, Ohio Farmer, viii, 1859, 1; Ohio Agric. Rep. for 1858, 1859, 376.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 13.

Strix brachyotus, GMELIN, Syst. Nat., i, 1788, 283.

Otus brachyotus, AUDUBON, Syn., 1839, 28.

var. *ii*, BREWER, Proc. Bost. Soc., 1856.

palustris, BECHSTEIN, V. D., iii, 344.

Brachyotus palustris, BONAPARTE, List, 1838.

Fulvous or buffy-brown, paler or whitey-brown below; breast and upper parts dusky streaked with dark brown; belly usually sparsely streaked with the same, but not barred crosswise; quills and tail buff, with few dark bands and mottling;

facial area, legs and crissum pale, unmarked; eye-patch blackish; ear tufts of from 3-6 feathers. Size of *Otus*.

Habitat, Europe. Asia. Greenland. America. West Indies.

Resident. Very common in winter, rare in summer. Breeds. The Short-eared Owl frequents swamps, borders of streams and fields. In winter they sometimes appear in considerable flocks and hunt in company. A dozen or more are sometimes seen in fields and mounted on fences, on cloudy days, watching for mice or other prey. Mr. Kirkpatrick says it "is believed to breed in the swamps of Sandusky," Mr. Langdon gives it as a fall, winter and spring visitor, but Dr. Howard E. Jones informs me that he has discovered the nest and eggs on the ground near Circleville.

The Short-eared Owl usually nests on the ground, sometimes without any attempt at nest building, but generally collecting together a few sticks with feathers and grass. In some distant localities it excavates short burrows in banks. The eggs are four or five, white, more oval than in most of this family, and measure 1.50 by 1.25.

GENUS SYRNIUM. Savigny,

Size large. No ear tufts. Ears moderate, operculated. Eyes small. Facial discs large, complete. Tarsi and toes full feathered.

SYRNIUM CINEREUM (Gm.) Bonap.

Great Grey Owl.

Syrnium cinereum, KIRKPATRICK, Ohio Farmer, viii, 1859, 107; Ohio Agric. Rep. for 1858, 1859, 379.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 361; Reprint, 3.—COUES, Birds of N. W., 1874, 308.—LANGDON, Jour. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 6; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.

Syrnium lapponicum, var. *cinereum*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 570; Reprint, 10.

Strix cinerea, GMELIN, Syst. Nat., i, 1788, 291.

Syrnium cinereum, BONAPARTE, List, 1838, 6.

Syrnium lapponicum, var. *cinereum*, RIDGWAY, in Cones' Key, 1872, 204.

Above, cinereous-brown, mottled in waves with cinereous white; below, these colors rather paler, disposed in *streaks* on the breast, in *bars* elsewhere; quills and tail with five or six darker and lighter bars; the great disk similarly marked in regular concentric rings. An immense owl, one of the largest of all, much exceeding any other of this country. Length, 2½ feet; wing, 1½; tail a foot or more.

Habitat, Northern North America, south in winter to Massachusetts, Illinois and California.

Extremely rare winter visitor. Mr. Kirkpatrick, adds this largest of North American Owls, "to our fauna in consequence of an Owl answer-

ing the description of this species, having been shot some years ago at Huntsburg, Geauga county." Mr. Langdon states that it has been "identified by Mr. Dury in Clarke county, Ohio; and Mr. Quick is confident that he has seen a specimen taken at Brookville, Indiana."

Dr. Brewer describes the nest of this bird as placed in trees, and composed of sticks and moss with a lining of down. An egg in his possession "is small for the size of the bird, and is of a dull soiled-white color, oblong in shape, and decidedly more pointed at one end than at the other." It measures 2.25 inches in length by 1.78 in breadth.

SYRNIUM NEBULOSUM (Forst.) Boie.

Barred Owl.

Strix nebulosa, KIRTLAND, Ohio Geolog. Surv., 1838, 161.—READ, Fam. Visitor, iii, 1853, 303; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Syrnium nebulosum, KIRKPATRICK, Ohio Agric. Rep. for 1858, 378.—WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3; Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 12; Revised List, Cin. Soc. Nat. Hist, i, 1879, 179; Reprint, 13.

Strix nebulosa, FORSTER, Tr. Philos. Soc., lxii, 386, 424.

Syrnium nebulosum, "BOIE."—GRAY, Genera of Birds.

Above cinereous-brown, barred with white, often tinged with fulvous; below similar, paler, the markings in bars on the breast, in streaks elsewhere; quills and tail feathers barred with brown and white with an ashy or fulvous tinge. Length about 18; wing, 13-14; tail, 9.

Habitat, North America, east of the Rocky Mountains. Chiefly United States.

Common resident. The Barred Owl, or, as frequently called, the Round-headed Owl is common in all parts of the State. It frequents woods and wooded swamps, not unfrequently visiting towns and cities. Like the Great Horned Owl, it sometimes visits chicken-roosts and causes great devastation, but its ordinary food consist of squirrels, rats, mice and small birds.

The nest of the Barred Owl is frequently placed in the cavity of a tree or in the deserted nest of a Hawk or Crow; less frequently it constructs for itself a nest of sticks. The eggs are white and measure 2. by 1.65.

GENUS NYCTEA. Stephens.

Size large. No ear-tufts; facial disc incomplete. Eyes and ears moderate. Tarsi and toes densely covered with long hair-like feathers.

NYCTEA SCANDIACA (L.) Newton.

Snowy Owl.

- Strix nyctea*, WILSON, Am. Orn., iv., 1812, 53.—AUDUBON, Orn Biog., ii, 1834, 135.—NUTTALL, Man., i, 1832, 116.—KIRTLAND, Ohio Geolog. Surv., 1838, 161, 179.—READ, Fam. Visitor, iii, 1853, 295; Proc. Phila. Acad. Nat. Sci. vi., 1853, 395.
- Surnia nyctea*, AUDUBON, B. Am., i, 1840, 113.
- Nyctea nivea*, KIRKPATRICK, Ohio Farmer, viii, 1859, 51; Ohio Agric. Rep. for 1858, 1859, 382.—BREWER, N. A. Oology, Smith. Contrib., xi, 1859, 80.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 361; Reprint, 3; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1-75, 570; Reprint, 10.—LANGDON, Cat. Birds of Cin. 1877, 12.
- Nyctea scandiaca*, var. *arctica*, BAIRD, BREWER and RIDGWAY, N. A. Birds, iii, 1874, 71.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 13.
- White Owl, KIRTLAND, Am. Journ. Sci. and Arts, xiii, 1852, 218; Ohio Farmer, ix, 1860, 91.
- Strix scandiaca*, LINNÆUS, Syst. Nat., i, 1766, 132.
- Strix arctica*, BARTRAM, Trav. Fla., 1791, 269.
- Strix nyctea*, LINNÆUS, Syst. Nat., i, 1766, 132.
- Surnia nyctea*, SELBY, Ill. Br. Orn., i, 1833, 95.
- Nyctea nivea*, GRAY, Gen. of Birds, i, 1844, 34.
- Nyctea scandiaca*, NEWTON, 4th Ed. Yarr. Br. Birds, pt. iii, 1872, 187.

Pure white with more or fewer blackish markings. Length nearly 2 feet; wing, 17 inches; tail, 10.

Habitat, northern portion of Northern Hemisphere, ranging irregularly southward in winter. In North America, resident from the Canadas and probably from Maine, northward. Regularly enters the Northern States in winter, frequently wandering to the Middle States, casually to the Southern States, even to Texas. Kansas. Kentucky and South Carolina. Bermuda.

Common winter visitor in Northern Ohio, more rare and irregular in Middle and Southern Ohio.

This large northern Owl, commonly called the White Owl, is described by Mr. Kirkpatrick as often quite abundant on the southern shore of Lake Erie, both in mild and severe winters. In this vicinity, and further south, they have never appeared in considerable numbers, and are quite irregular. It is quite likely that the more uniform and equally mild climate of the Lake basin affords them a comfortable winter residence, and that the birds going further south are in search of information and adventure rather than driven by climate or want of food.

In the Eastern States it seems to be rather more abundant and regular than in the interior, often visiting the larger New England cities in great numbers.

This Owl frequently flies by day. It feeds upon rabbits and partridges, and is said to be an expert fisher.

The nest of the Snowy Owl is placed on the ground. The eggs are three or four, white, and measure 2.37 by 2.

Mr. Read relates:

"This relic of superstition was exhibited during the winter of 1851, in a township of Ashtabula county, by a visit of this bird under circumstances well calculated to work upon this feeling. The Owl came by his usual noiseless flight and perched himself upon a house where lay a corpse, around which the friends had assembled to bear it to its long resting place. On being disturbed it flew direct to the church in which the funeral services were to be held, and behind which lay the graveyard with the open grave. It thus seemed to herald the first victim to the tomb, and many an old lady imagined that the pestilence that walketh at noonday was about to visit that devoted town. The bird, however, was shot and perhaps its power for evil was thereby destroyed."

GENUS SURNIA. Dumeril.

Size medium. No ear-tufts. Facial disc obsolete. Tarsi and toes densely feathered. Tail long, graduated.

SURNIA ULULA (L.) Bp.

var. HUDSONIA (GM.) RIDG.

Hawk Owl; Day Owl.

Surnia ulula, KIRKPATRICK, Ohio Farmer, viii, 1859, 67; Ohio Agric. Rep. for 1858, 383.—WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3; Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.

Surnia ulula var. *hudsonica*, LANGDON, Cat. Birds of Cin., 1877, 12.

Surnia ulula, var. *hudsonia*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 13.

Strix ulula, LINNÆUS, Syst. Nat., i, 1766, 133.

Strix hudsonia, GMELIN, Syst. Nat. i, 1788, 295.

Surnia funerea, DUMERIL, Zool. Anal., 1806, 34.

Surnia ulula, var. *hudsonia*, RIDGWAY, in Cones, Key, 1872, 205.

Dark-brown above more or less thickly speckled with white; below closely barred with brown and whitish, the throat alone streaked; quills and tail with numerous white bars; face ashy, margined with black. Length about 16 inches; wing, 9; tail, 7, graduated, the lateral feathers 2 inches shorter than the central.

Habitat, Northern North America. Breeds from Maine northward. In winter occasionally south to Pennsylvania and Illinois. Bermudas. Not yet observed west of the Rocky Mountains.

Rare winter visitor. The Hawk Owl is more northern in its distribution in winter than the preceeding species and is even more diurnal, having the form and appearance of a Hawk with the soft plumage of an Owl.

Mr. Kirkpatrick is our chief authority for its insertion here. He says :

"This species is rare in Ohio. With us it is in all probability a winter visitor only. It breeds, however, in some of the more Northern States and in Canada, and is said to feed on small quadrupeds, grouse and ptarmigan, and often endeavors to seize the small game shot by the hunter."

Mr. Langdon thinks that he has seen this species at St. Mary's Reservoir.

It is said to breed in the hollows of trees, or more rarely in the branches, in which case the nest is constructed of sticks, grass and feathers. The eggs are said to number from five to eight, and measure about 1.50 by 1.20.

GENUS NYCTALE. [Brehm.

Size small. No ear-tufts; facial disc perfect; ears operculate; tarsus and toes densely feathered.

NYCTALE ACADICA (Gm.) Bp.

Acadian Owl; Saw-whet Owl.

Strix acadica, AUDUBON, Orn. Biog., ii, 1834, 537.—KIRTLAND, Ohio Geolog. Surv., 1838, 161, 179.—READ, Fam. Visitor, iii, 1853, 303; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Ulula acadica, AUDUBON, B. Am., i, 1840, 124.

Nyctale acadia, (error) KIRKPATRICK, Ohio Farmer, viii, 1859, 9; Ohio Agric. Rep. for 1858, 1859, 381.

Nyctale acadica, BREWER, N. A. Oology, Smithsonian Contributions, xi, 1859, 74, 132, pl. 45.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 361; Reprint, 3; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 570; Reprint, 10.—COUES, Birds of N. W., 1874, 316.—BAIRD, BREWER and RIDGWAY, N. A. Birds, iii, 1874, 45.—LANGDON, Cat. Birds of Cin., 1877, 12; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 13.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5,

Strix acadica, GMELIN, Syst., Nat., i, 1788, 296.

Nyctale acadica, BONAPARTE, Comp. List, 1838, 7.

Size small. Bill, black, the cere tumid, the circular nostrils presenting anteriorly. Above chocolate-brown, spotted with white, the tail with transverse white bars; facial area and forehead variegated with white, the face and superciliary line grayish-white; the lower parts white with streaks of the color of the back. Length, 7½-8; wing, 5½; tail, 2¾.

Habitat, Temperate North America from Atlantic to Pacific; chiefly, however, Northern United States and adjoining British territory; ranging southward, in wooded mountainous regions, into Mexico.

Not uncommon resident in Northern, resident or winter visitor in Middle and Southern Ohio. Breeds.

The Acadian Owl is the smallest member of the family found with us. It is more nocturnal than many others of the family, and this, together with its size, renders its discovery difficult. Mr. Read gives it as not uncommon, being more frequently seen than the red variety of the Mottled Owl. Mr. Winslow considers it by no means rare, and Mr. Kirkpatrick says, "it is not plentiful with us, but may occasionally be found." Mr. Langdon records but three specimens taken in the vicinity of Cincinnati, and considers it a winter visitor only. To this record Messrs. Dury and Freeman, add one, and perhaps two, individuals, one of which was taken May. Audubon says "in Cincinnati, I had one brought to me which had been taken from the edge of a cradle in which a child lay asleep, to the no small astonishment of its mother."

In this vicinity it is very rare; I have never seen it alive. On the 11th of January 1879, my neighbor, Mr. B. J. Loomis, brought me a specimen, a present from his little daughter, who found it dead, probably frozen, in their garden. Two specimens were taken in this vicinity late in November of the present year (1880).

It seems to be rather partial to evergreen woods, and the lack of these may account in part for its rarity here. *Nyctale albifrons* and *Nyctale kirtlandi* which were once supposed to be distinct species, and also to be the young of Tengmalm's Owl, are now known to be the young of this species. Mr. Winslow has a specimen of *albifrons*, and Dr. Brewer men-

NYCTALE TENGMALMI (Gm.) Bp.

var. RICHARDSONI (Bp.) RIDG.

Tengmalm's Owl.

Nyctale tengmalmi, *var. richardsoni*, COUES, Birds of N. W., 1874, 314, "Northern Ohio (Winslow)."

Strix tengmalmi, GMELIN, i, 1788, 291.

Nyctale richardsoni, BONAPARTE, Comp. List, 1838, 7.

Nyctale tengmalmi, *var. richardsoni*, RIDGWAY, Am. Nat., vi, 1872, 295.

Habitat, the typical form, Europe, Asia and Northern Africa. *Var. richardsoni* from North America; south regularly to the United States frontier; in winter rarely through New England, beyond which there is no record on the Atlantic. Northern Ohio (Winslow.)

The above range is given to this bird by Dr. Coues, but upon inquiry of Mr. Winslow for particulars respecting its occurrence, he was unable to give me any information, and Dr. Coues was unable to recall his authority.

The accrediting of this bird to this fauna is, doubtless, an error, which possibly may have arisen from the capture of specimens of so-called *albifrons* and *kirtlandi* mentioned above.

tions a specimen of *kirtlandi*, both of which were taken in the vicinity of Cleveland

The nest of the Acadian Owl is placed in holes of trees, and the eggs, pure white, globular, measure 1.13 by .87. Dr. Brewer says, "it has been said to breed near Cleveland, Ohio, and its nest and eggs have been secured."

FAMILY FALCONIDÆ. DIURNAL BIRDS OF PREY.

With the characters given in the first paragraph of the definition of Family *Strigidæ*, but contrasting with the second paragraph of that definition as follows:

Physiognomy not peculiar in any lateral expansion of the cranium; the eyes lateral in direction. No complete facial disc; base of bill not hidden by appressed bristles. Nostrils wholly in the cere. Outer toe rarely versatile, except *Pandion*, etc.; not shorter than the inner. Basal phalanx of middle toe longer than the second. Legs commonly naked and scutellate or reticulate in some portion of their length; toes always bare and scaly. Plumage compact, usually with after-shafts; flight audible. Cranial walls with little diploë. Sternum commonly single-notched or fenestrate, sometimes entire. Diurnal.

GENUS CIRCUS. Lacedpede.

Face with a ruff forming an imperfect facial disc, as in the owls; nostrils oval; wings, tail and tarsi very long, the latter twice as long as the middle toe, scutellate in front and behind.

CIRCUS CYANEUS (L.) Lacép.

var. HUDSONIUS (L.) All.

Marsh Hawk; Harrier.

Falco cyaneus, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.

Circus hudsonius, KIRKPATRICK, Ohio Farmer, vii, 1858, 395; Ohio Agric. Rep. for 1858, 361.—WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3.

Circus cyaneus, var. *hudsonius*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 12; Jour. Cin. Soc. Nat. Hist., i, 1878, 115; Reprint, 6; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint, 14.

Falco cyaneus, LINNÆUS, Syst. Nat., i, 1766, 126.

Falco hudsonius, LINNÆUS, Syst. Nat., i, 1776, 128.

Circus hudsonius, VIELLOT, Ois. Am. Sept., i, 1807, 36.

Circus cyaneus, var. *hudsonius*, ALLEN, Bull. M. Z. C., 1872, 181.

Adult male pale bluish-ash, nearly unvaried, whitening below and on upper tail coverts; quills blackish towards the end. Length, 16-18; wing, 14-15; tail, 8-9; female larger, above dark-brown streaked with reddish-brown, below the reverse of this; tail banded with these colors; immature male is like the female though redder, but in any plumage the bird is known by its white upper-tail-coverts and generic characters.

Habitat, Europe, Asia. Var. *hudsonius* throughout North America. Var. *cinereus* in South America.

Common and resident in some portions of the State, rare and migrant in others. Dr. Kirtland, in 1838, had not met with this bird but named

it in his catalogue on the authority of Dr. Sager, who had taken it in the Maumee Valley. Mr. Read does not name it. Mr. Kirkpatrick says, "it is quite common in Ohio and abounds around Sandusky Bay, in the marshes of which it obtains a rich supply of food. Along the Cuyahoga bottoms it may often be seen, and it no doubt breeds in these localities." Mr. Dury has found it breeding at the Mercer county Reservoir. Mr. Langdon gives it as a rare spring and fall migrant in the vicinity of Cincinnati. In the vicinity of Columbus it was once rather common, and bred in the swamp prairies south of the city. A few remained here during the winter but they were more numerous in summer. Now it is comparatively rare; in some seasons none are seen. It is always found in the vicinity of water, and at present is most frequently seen in late summer or early fall, sweeping slowly over the bottoms in pursuit of mice, birds and large insects.

The nest of the Marsh Hawk differs from that of all others of the family, breeding with us, in being placed on the ground. It is composed of scant materials or none, and contains from three to six eggs. These are dull white more or less shaded with green or blue, often spotted with different shades of brown, lilac and lavender. They measure about 1.80 by 1.45.

GENUS ELANOIDES. Vieillot.

Bill moderately strong. Nostrils broadly oval. Wings long and pointed; tail long, deeply forked; feet small; tarsi reticulate, feathered half way down in front; toes barely webbed.

ELANOIDES FORFICATUS (L.) Ridgway.

Swallow-tailed Kite.

Falco furcatus, WILSON, Am. Orn., vi, 1812, 70.—KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.—READ, Fam. Visitor, iii, 1852, 228; Proc. Acad. Nat. Sci., Phila., vi, 1853, 395.

Nauclerus furcatus, KIRKPATRICK, Ohio Farmer vii, 1858, 363.—WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3; Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 12; Journ. Cin. Soc. Nat. Hist., i, 1878, 116.

Elanoides forficatus, WHEATON, Bull. Nutt. Orn. Club, iv, 1877, 12.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint, 14.

Swallow-tailed Hawk, KIRTLAND, Fam. Visitor, i, 1850, 1.

Falco forficatus, LINNÆUS, Syst. Nat., i, 1758.

Falco furcatus, LINNÆUS, Syst. Nat., i, 1766, 129.

Nauclerus furcatus, VIGORS, Zool. Journ., ii, 1825, 387.

Elanoides yetapa, VIEILLOT, Ency. Meth., iii, 1823, 1205.

Elanoides forficatus, RIDGWAY, Bull. U. S. Geolog. and Geog. Surv., ii, No. 2, 1876, 181.

Head, neck and under parts white; back, wings and tail lustrous black; feet greenish blue, claws pale. Length, female, 23-25; wing, 16-17½; tail, 14; male a little smaller.

Habitat, South Atlantic and Gulf States. On the Atlantic coast not regularly beyond Virginia, but casually to Massachusetts. Up the whole Mississippi Valley, however, to latitude 47°. Up the Missouri to Fort Leavenworth at least. Cuba. South to Brazil. Accidental in Europe.

Formerly an abundant summer resident; now a rare visitor. Wilson says of this elegant Hawk that it "is very abundant in South Carolina and Georgia, and still more so in west Florida, and the extensive prairies of Ohio and the Indiana Territory."

In 1838, Dr. Kirtland says:

"A few years since the Swallow-tailed Hawk was to be seen during the summer, in considerable numbers in Portage and Stark counties. From some unknown cause it has of late, ceased to visit these localities. They were probably the northernmost verge of its summer migrations, and the late cold and wet seasons have driven it back into warmer climates."

Mr. Read does not appear to have seen it, and adds nothing to Dr. Kirtland's statement. Mr. Kirkpatrick, 1858, adds that "the prairies of Crawford county were formerly a favorite place of resort, and occasionally a specimen may be found there still." Nothing more is heard of the bird in this State until 1878, when a specimen was taken, as noted by me in the Bulletin (l. c.) as follows:

"This bird, which has not been recorded from Ohio for over twenty-five years, was taken in Licking county, near the town of Pataskala, seventeen miles east of Columbus, August 22, 1878. It is reported to have been killed when in the act of pursuing chickens. On being brought to the town of Pataskala, it excited considerable remark, no one being acquainted with it. It was finally decided to be a Bald Eagle escaped from Barnum's Show, and thrown away. It was recovered and identified by Rev. C. H. Permott, who carefully removed the skin from the decomposed remains and presented it to me. It is in high plumage, the dark area iridescent with purple-bronze and green."

In habits the Swallow-tailed Hawk differs from most other members of the family, in that it is gregarious, great numbers sometimes associating and feeding together, and breeding in the same neighborhood. Dr. Kirtland, 1850, speaking of their former appearance in considerable numbers, says they "might be seen moving in graceful circles, at no great height, watching for the garter snake, that then infested our meadows."

Their food consists of snakes, lizards and large insects which they devour while on the wing. It rarely alights on the ground.

The nest of the Swallow-tailed Hawk is said to be placed on a high tree, in the vicinity of water, and to resemble that of the Crow. The eggs are dirty-whitish, with blotches of different shades of brown, most numerous about the smaller end. They measure 1.90 by 1.50.

GENUS ACCIPITER. Brisson.

Bill at base higher than long. Wings short; tail long; tarsi long, slender, feathered at base; toes padded underneath.

ACCIPITER FUSCUS (Gm.) Bp.

Sharp-shinned Hawk; Pigeon Hawk.

Falco velox, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.

Falco fuscus, READ, Fam. Visitor, iii, 1852, 220; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Accipiter fuscus, KIRKPATRICK, Ohio Farmer, vii, 1858, 155; Ohio Agric. Rep. for 1858, 352.
—WHEATON, Ohio Agric. Rep. for 1860, 360; Reprint, 1861, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 12.

Nisus fuscus, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint, 14; Summer Birds, ib., iii, 1880, 225.

Falco fuscus, GMELIN, Syst. Nat., i, 1788, 220.

Falco velox, WILSON, Am. Orn., v, 1812, 280.

Accipiter fuscus, BONAPARTE, Comp. List., 1838, 5.

Nisus fuscus, KAUP, Mon. Falc. Cont. Orn., 1850, 64.

Feet extremely slender; bare portion of tarsus longer than middle toe; scutellæ frequently fused, tail square. Above dark-brown (deepest on the head, the occipital feathers showing white when disturbed) with an ashy or plumbeous shade which increases with age, till the general cast is quite bluish-ash; below white or whitish, variously streaked with dark-brown and rusty, finally changing to browish-red (palest behind and slightly ashy across the breast) with the white then only showing in narrow cross-bars; chin, throat and crissum mostly white with blackish pencilling; wings and tail barred with ashy and brown or blackish, the quills white-barred basally, the tail whitish tipped; bill dark; claws black; cere and feet yellow. Male, 10-12; wing, 6-7; tail, 5-6; female, 12-14; wing, 7-8; whole foot, 3½ or less.

Habitat, the whole of North America. South to Panama.

Common resident in Northern, less common in Middle and Southern Ohio. Dr. Kirtland and Mr. Read give this Hawk as common. Mr. Kirkpatrick gives us to infer that it does not remain in the vicinity of Cleveland during winter, but states that it breeds. Mr. Langdon gives it as rare in the vicinity of Cincinnati, and cites Mr. Dury as authority for its breeding there. In this vicinity it is rather rare, though, I believe, a resident throughout the year.

The Sharp shinned Hawk is one of the most daring and dashing of the family, frequently and successfully visiting the barn-yard for food, and often attacking birds of nearly its own weight. Sometimes, however, he fails to obtain his prey, either from over confidence in his own abilities, or under estimation of the powers of his victim. I once saw an adult bird of this species pounce upon a Meadowlark, quietly feeding upon

the ground. By some means the attack was only partly successful, and the Lark hopped about for a few moments with the Hawk upon his back. The ridiculousness of his position seemed to disconcert the Hawk, who relaxed his grip, only to find himself attacked by bill and claws of his victim. Then followed a fierce fight with claws, bills and wings, in which both contestants appeared equally active and determined. Finally the combatants separated, the Hawk flying in one direction disappointed, dejected and disgusted, the Lark in another, recovering his breath by extraordinary cries of alarm and distress.

The nest of the Sharp-shinned Hawk is usually placed in trees, sometimes on rocks. The eggs are white, variously shaded, thickly marked with different shades of brown. They measure about 1.45 by 1.15.

ACCIPITER COOPERI Bp.

Cooper's Hawk; Chicken Hawk.

Falco cooperi, KIRTLAND, Ohio Geolog. Surv., 1838, 164, 179.

Astur cooperi, READ, Fam. Visitor, iii, 1852, 220; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Accipiter cooperi, KIRKPATRICK, Ohio Farmer, viii, 1858, 147; Ohio Agric. Rep. for 1858, 315.—BREWER, N. A. Oology, Smithsonian Contributions, xi, 1859, 20.—WHEATON, Ohio Agric. Rep. for 1860, 360; Reprint, 1861, 2; Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 12.

Nisus cooperi, BAIRD, BREWER, and RIDGWAY, iii, 1874, 233 —LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint 14; Summer Birds, ib., iii, 1880, 225.

Cooper's Hawk, KIRTLAND, Fam. Visitor, i, 1850, 1.

Falco cooperi, BONAPARTE, Am. Orn., ii, 1828, 1.

Accipiter cooperi, GRAY, List B. Br. Mus. ii, 38.

Nisus cooperi, RIDGWAY, Proc. Bost. Soc., xvi, 1873, 59.

Feet moderately stout; bare portion of tarsus shorter than middle toe; scutellæ remaining distinct; tail a little rounded. Colors and their changes as in *A. fuscus*; larger, male, 16-18; wing, 9-10; tail, 7-8; female, 18-20; wing, 10-11; tail, 8-9. Whole foot 4 or more.

Habitat, Temperate North America and southward.

Very common resident in Southern and Middle, more rare in Northern Ohio. Breeds. Dr. Kirtland; 1850, mentions it as breeding abundantly in former years. Neither Mr. Read nor Mr. Kirkpatrick indicate that they were personally acquainted with it. Mr. Langdon gives it as a rather common summer resident in the vicinity of Cincinnati. In this vicinity it is one of the most abundant Hawks, especially in winter, when it approaches human habitations, and road-sides. It is extremely methodical and regular in its habits at this season, and the

same individual is to be found at the same locality, at the same hour, day after day.

The two birds of this genus are perhaps the boldest depredators of the family. They do not hesitate to attack chickens in the presence of their owners and frequently continue their visits until they have exterminated the young broods, often, however, paying for their audacity with their life. At the same time they feed largely upon small quadrupeds, snakes and other reptiles, and are very destructive to game.

The nest of Cooper's Hawk is built in trees. The eggs, from three to five in number, are white, sometimes blotched with yellowish-brown. They measure 1.94 by 1.56.

GENUS ASTUR. Lacedæd.

Size large; tarsi feathered half way to the toes in front; other characters much like *Accipiter*.

ASTUR ATRICAPILLUS (Wils.) Bp.

Goshawk.

Falco palumbarius, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.

Astur atricapillus, KIRKPATRICK, Ohio Farmer, vii, 1858, 139; Ohio Agric. Rep. for 1858, 349.

BREWER, N. A. Oology, Smithsonian Contributions, ix, 1859, 17, 18, 131, pl. 5, (error); American Naturalist, i, 1868, 121 (correction).—WHEATON, Ohio Agric. Rep. for 1860, 560; Reprint, 1861, 2; Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—COUES, Birds of N. W., 1874, 339.—LANGDON, Cat. Birds of Cin., 1872, 12; 121.

Astur palumbarius, var. *atricapillus*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint, 14.

Falco atricapillus, WILSON, Am. Orn., vi, 1812, 80.

Astur atricapillus, JARDINE and SELBY, Illust., 1825.

Falco palumbarius, BONAPARTE, Syn., 1828, 28.

Astur palumbarius, var. *atricapillus*, RIDGWAY, Proc. Bost. Soc., xvi, 1874, 571.

Adult dark bluish-slate blackening on the head, with a white superciliary stripe; tail with four broad dark bars; below closely barred with white and pale-slate, and sharply streaked with blackish. Young dark-brown above, the feathers with pale edges, streaked with tawny-brown on the head and cervix; below fulvous-white with oblong brown markings. Female, 2 feet long; wing, 14 inches; tail, 11; male smaller.

Habitat, British America, and the Northern half of the United States—the latter chiefly in winter; farthest south along the Rocky Mountains and Sierra Nevada.

Rare winter visitor. This large and handsome Hawk, which is now known to breed from Northern New England northward, sometimes appears in considerable numbers in winter both northeast and west of us. In this State, however, no record of such appearance is known to me, only a few individuals being noted.

Dr. Kirtland named it in his list on the implied authority of Audubon. Mr. Read refers to it, but not as an Ohio bird. Mr. Kirkpatrick mentions a specimen taken by Dr. Sterling in the vicinity of Cleveland. Mr. Langdon, on the authority of Mr. Dury, notes: "A single specimen, female in immature plumage, taken twenty miles east of Cincinnati, in November, 1878." Doubtless this bird is of not unfrequent occurrence in northwestern Ohio. I have never met with it in this vicinity.

The nest of the Goshawk is placed in trees. The eggs, usually four, are dull greenish-white, sometimes faintly spotted with yellowish-brown. They measure about 2.30 by 1.80.

GENUS FALCO. Linnæus.

Bill with a distinct notch and prominent tooth. Nostrils circular, with a central tubercle. Wings long and pointed; tail rather long and wide; tarsi short, robust; claws long and sharp.

FALCO COMMUNIS Gm.

var. ANATUM (Bp.) Ridgway.

Peregrine Falcon; Duck Hawk.

Falco peregrinus, KIRTLAND, Ohio Geolog. Surv., 1833, 161, 178.—READ, Fam. Visitor, iii, 1852, 212; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Falco anatum, KIRKPATRICK, Ohio Farmer, vii, 1858, 379; Ohio Agric. Rep. for 1858, 345.—WHEATON, Ohio Agri. Rep. for 1860, 360; Reprint, 1861, 2.

Falco communis, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 12.

Falco communis, *var. anatum*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.

Falco communis, GMELIN, Syst. Nat., i, 1788, 270.

Falco anatum, BONAPARTE, List, 1838, 4.

Falco communis, *var. anatum*, RIDGWAY, Proc. Bost. Soc, 1873, 45.

Tarsus feathered but little way down in front, elsewhere irregularly reticulated in small pattern, not longer than middle toe; 1st quill alone decidedly emarginate on inner web, not shorter than the 3d. Above blackish-ash, with more or less evident paler waves; below, and the forehead, white with more or less fulvous tinge, and transverse bars of blackish; conspicuous black ear-patches. Young with the colors not so intense and tending to brown; the tawny shade below stronger, the lower parts longitudinally striped. Length, about 18; wing, 13-14; tail, 7-8.

Habitat, nearly cosmopolitan. *Var. anatum*, generally distributed in America. *Var. communis*, from most parts of the Old World. *Var. melanogenys*, from Australia and Java. *Var. minor*, from South Africa.

Not rare in Northern and Northwestern Ohio, rare in Middle and not identified in Southern Ohio. This large Hawk, the largest of the typical Falcons with us, is not uncommon in the vicinity of Cleveland, where

it appears to be chiefly a migrant, and perhaps a winter visitor. Mr. Dury, as stated by Mr. Langdon, procured specimens from the St. Mary's Reservoir, where it may possibly breed, as it has been found breeding in corresponding latitudes in Illinois. In the vicinity of Columbus it is rare. I have seen a single specimen, and Mr. Jasper has one, which he took in the immediate vicinity of the city.

The Great-footed or Duck Hawk, is noted for its swiftness of flight and great daring. It follows ducks and other water fowl on their migrations, pursuing and striking them down, while on the wing. It is sometimes very bold, seizing the bird, which the gunner has killed, and carrying it off, when almost within his reach. This temerity is often fatal.

The nest of the Duck Hawk is usually placed in nearly inaccessible places on rocks, sometimes in trees. The eggs are four, variable in color, some being white sparingly spotted with light reddish-brown, others with the light color obscured with chocolate brown, and with blotches of still darker brown. Eggs in the same nest sometimes present these extremes of coloration. They measure about 2.20 by 1.70.

FALCO COLUMBARIUS Linnæus.

Pigeon Hawk.

Falco columbarius, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.—READ, Family Visitor, iii, 1852, 204; Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 360; Reprint, 2; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 570; Reprint, 10.—LANGDON, Cat. Birds of Cin., 1877, 12.

Hypotriorchis columbarius, KIRKPATRICK, Ohio Farmer, viii, 1858, 387; Ohio Agric. Rep. for 1858, 1859, 347.

Falco lithofalco, var. *columbarius*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 10.

Falco columbarius, LINNÆUS, Syst. Nat., i, 1766, 128.

Hypotriorchis columbarius, GRAY, Gen. of Birds.

Falco lithofalco, var. *columbarius*, RIDGWAY, Proc. Bost. Soc., 1873, 46.

Tarsus scarcely feathered above, with the plates in front enlarged, appearing like a double row of alternating scutellæ (and often with a few true scutellæ at base); 1st and 2d quill emarginated on inner web.

Adult male, above ashy-blue, sometimes almost blackish, sometimes much paler; below pale fulvous or ochraceous, whitish on the throat, the breast and sides with large oblong dark-brown spots with black shaft lines; the tibiæ reddish, streaked with brown; inner webs of primaries with about eight transverse white or whitish spots; tail tipped with white, and with the outer feather whitening; with a broad subterminal black zone and 3-4 black bands alternating with whitish; cere greenish-yellow, feet yellow. Female with the upper parts ashy-brown; the tail with 4-5 indistinct whitish bands; about, 13; wing, 8; tail, 5; male smaller.

Habitat, North America, ranging into Mexico, Central America and northern portions of South America. Ecuador. Jamaica.

Not common spring and fall migrant in March, April, September, October and November in most portions of the State, rare resident near Cleveland where it sometimes breeds. Mr. Langdon gives it as a rare migrant in the vicinity of Cincinnati, and it is far from common in the vicinity of Columbus. It is usually seen in the vicinity of streams and low grounds, pursuing flocks of Blackbirds and other migrants. It receives its name from its size and color, rather than from any habit of preying upon pigeons.

Dr. Kirtland speaks of it as of frequent occurrence in Northern Ohio, and Mr. Read notes its occurrence in midsummer. Mr. Kirkpatrick says:

"This handsome little Hawk is of pretty common occurrence in this State. Dr. Kirtland says it is a permanent resident. A pair have built their nests for several years past near his house at Rockport, and he has observed them during the whole season. They visit his barn and out-houses in pursuit of mice and other small prey. He shot two young specimens, but the old are too shy to be approached within shot. They are now in very fine dark plumage; the young being much lighter colored."

This is perhaps its most southern breeding record, and will surprise many ornithologists, as no other authentic and specific account exists of its breeding in the Eastern United States, south of Maine. It is hardly possible that so accurate an observer as Dr. Kirtland should have failed to properly identify the birds breeding with him.

The nest is said to be placed in trees or on rocks. The eggs vary in size "from 1.50 by 1.30 to 1.80 by 1.30. Coloration ranges from a nearly uniform deep rich brown to whitish or white, marked with a few indistinct dots of dull grayish or drab."

FALCO SPARVERIUS Linnæus.

Sparrow Hawk.

Falco sparverius. KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.—READ, Fam. Visitor, iii, 1852, 212; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395 —WHEATON, Ohio Agric. Rep. for 1860, 360; Reprint, 1861, 2; Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 12; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 13; Summer Birds, ib, iii, 1880, 225.

Tinnunculus sparverius, KIRKPATRICK, Ohio Farmer, vii, 1858, 171; Ohio Agric. Rep. for 1858, 348.

Falco sparverius, LINNÆUS, Syst. Nat., i, 1766, 128.

Tinnunculus sparverius, VIRILLOT, Ois. Am. Sept., i, 1807, 48.

Tarsus and quills as in *columbarius*. Crown ashy-blue, with a chestnut patch, sometimes small or altogether wanting, sometimes occupying nearly all the crown; conspicuous black maxillary and auricular patches, which with three others around the nape make seven black places in all, but a part of them often obscure or wanting; back cinnamon-brown, in the male with a few black spots or none, in the female with num-

erous black bars; wing coverts in the male ashy-blue, with or without black spots, in the female like the back; quills in both sexes blackish with numerous pale or white bars on inner webs; tail chestnut, in the male with one broad black subterminal bar, white tip, and outer feather mostly white with several black bars; in the female the whole tail with numerous imperfect black bars; below white variously tinged with buff, or tawny, in the male with a few small black spots or none, in the female with many brown streaks; throat and vent nearly white and immaculate in both sexes; bill dark-horn, cere and feet yellow to bright orange; 10-11; wing, 7; tail, 5, more or less.

Habitat, the whole of North America and southward.

Abundant summer resident from April to November, and in part resident throughout the year.

This Hawk, the smallest and most beautiful of the family, is further distinguished from most if not all the others by the color differences between the sexes. It is the most abundant species of the family, and does not appear to be decreasing with cultivation, as is the case with most others. It is found almost everywhere, though most abundantly along the borders of streams where the high sycamore trees furnish suitable nesting places, or about low fields. The telegraph wires along railroads furnish favorite perches from which they may watch for and pounce upon small birds, mice and large insects, which constitute their food.

Dr. Coues, from whom I have culled many pleasant paragraphs, thus moralizes over the Sparrow Hawk:

"Few, if any, of our birds are more widely dispersed, few are better known, and certainly no Hawk is regarded with less disfavor. Too small of frame—though stout hearted enough, I warrant—to commit depredations in the farm-yard; subsisting on small insectivorous birds, it is true, but also destroying countless field-mice and noxious insects, he is to be held a benefactor to the agriculturist. The prettiest and jauntiest of our Hawks, and yet no prig; a true Falcon, if a little one, with as noble mien and as much pluck as the best among his larger brethren, we can but admire him. No Hawk is more abundant in the West. Go where we may, in summer or winter, we shall see him hovering over the fields, or perched, erect and motionless, on his outpost, sweeping the ground below with keen, audacious eye. It is a treacherous calm; the ardor of the Falcon grows with restraint. An unlucky Sparrow flirts in yonder bush, and gives a flippant chirp—whish! and it is all over. Poor, little, rollicking Sparrow! this is no easier for *you* to bear, because it is a "law of nature," as we say. Who is ever quite ready for the last? What pang is taken away when the cry it extorts is drowned in a sea of like lamentation? We theorize best before the Falcon's talon strikes."

Solitary individuals, and these, so far as my observation extends, always females, are not unfrequently seen here throughout the winter, remaining in the same neighborhood through the season.

The nest of the Sparrow Hawk is placed in cavities of high trees, either natural or holes deserted by Woodpeckers. The eggs, usually five in

number, measure 1.38 by 1.13, being nearly spherical. Their ground-color is a buffy-cream, usually spotted with light or dark-brown.

GENUS BUTEO. Cuvier.

Bill short, wide; edge of upper mandible lobed; wings long, wide, 4th and 5th quills longest; three or more quills emarginate; tarsi robust, scutellate in front and behind, reticulate on sides; toes moderate; claws strong.

BUTEO AQUILINUS (Barton) Coues.

Red-tailed Buzzard; Hen Hawk.

Falco borealis, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.—READ, Fam. Visitor, iii, 1852, 228; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Buteo borealis, KIRKPATRICK, Ohio Farmer, vii, 1858, 99; Ohio Agric. Rep. for 1858, 353.—BREWER, N. A. Oology, Smithsonian Contributions, xi, 1859, 22 —WHEATON, Ohio Agric. Rep. for 1860, 360; Reprint, 1861, 2; Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 13; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint, 14; Summer Birds, ib., iii, 1880, 225.

Red-tailed Hawk, KIRTLAND, Fam. Visitor, i, 1850, 1.

Falco borealis, GMELIN, Syst. Nat., i, 1788, 266.

Buteo borealis, VIEILLOT, Nouv. Dict. d'Hist. Nat., iv, 1816, 478.

Falco aquilinus, BARTON, "Frag. Nat. Hist. Penna.," 1799, 11.

Buteo aquilinus, COUES, Birds Col. Val., i, 1878, 593.

Four outer quills emarginate on inner web. Adult dark-brown above, many feathers with pale or tawny margins, and upper tail coverts showing much whitish; below white or reddish-white, with various spots and streaks of different shades of brown, generally forming an irregular zone on the abdomen; tail above bright chestnut-red, with subterminal black zone and narrow whitish tip, below pearly-gray; wing coverts dark; young with the tail grayish-brown barred with darker, the upper parts with tawny streaking. A large stoutly built Hawk. Female, 23; wing, 15½; tail, 8½; male, 20; wing, 14; tail, 7.

Habitat, the whole of North America. Mexico. Cuba. Jamaica.

Common resident. Breeds. The Hen Hawk, as this and the following species are usually termed, is the most common of the large Hawks in this portion of the State. This is especially the case in summer, when its numbers greatly exceed those of the next species. It is a frequent visitor in barn-yards, and though lacking much of the pluck and dash of the members of most of the preceeding genera, it has the equally successful quality of perseverance. During the summer they are generally seen in pairs, soaring high above the woods in which their nest is built, or the adjacent fields. Their food consists of rabbits, squirrels, partridges, mice and reptiles. They are less retiring than other members of this genus, and frequently breed in the immediate vicinity of cities.

For a number of years, sportsmen reported a *pair* of *Albino Hawks* in the vicinity of Shadeville, in this county. For some time all attempts to capture them were unavailing, but one was shot about three years since, which proved to be of this species. It was pure white, with a single normal-colored tail feather, the only color-mark by which the species could be distinguished. Last winter its mate was winged and captured. This bird was entirely white. Nothing is known of their progeny, and it is probable they did not inherit the peculiarity of their parents.

The nest of the Red-tailed Buzzard is placed in high trees. The eggs are usually three in number, white, blotched with light reddish-brown. They measure about 2.40 by 2.00.

BUTEO LINEATUS (Gm.) Jardine.

Red-shouldered Buzzard.

Falco hyemalis, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.—READ, Fam. Visitor, iii, 1852, 228; Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Falco buteodes, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.

Falco lineatus, READ, Proc. Philad. Acad. Nat. Sci., vi, 1853, 395.

Buteo lineatus, READ, Fam. Visitor, iii, 1852, 235.—KIRKPATRICK, Ohio Farmer, vii, 1858, 115; Ohio Agric. Rep. for 1858, 1859, 356.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 360; Reprint, 2; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 570; Reprint, 10.—LANGDON, Cat. Birds of Cin., 1877, 13; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint, 14.

Red shouldered Hawk, KIRTLAND, Fam. Visitor, i, 1850, 1.

Falco lineatus, GMELIN, Syst. Nat., i, 1788, 263.

Falco hyemalis, GMELIN, Syst. Nat., i, 1788, 274.

Falco buteodes, NUTTALL, Man., i, 1832, 100.

Buteo lineatus, JARDINE, Am. Orn., ii, 1832, 290.

Four outer primaries emarginate on inner web. General plumage of the adult of a rich *fulvous* cast; above, reddish-brown, the feathers with dark-brown centres; below a lighter shade of the same, with narrow dark streaks and white bars; quills and tail blackish conspicuously banded with pure white; *the bend of the wing orange-brown*. Young plain dark-brown above, below white with dark streaks; quills and tail barred with whitish. Nearly as long as *B. borealis*, but not nearly so heavy; tarsi more naked. Female, 22; wing, 14; tail, 9; male, 19; wing, 13; tail, 8 (average).

Habitat, United States and British Provinces. Nova Scotia. Var. *elegans*, westward.

Common resident. Breeds. The Red-shouldered Buzzard, Hen Hawk or Winter Falcon, is common in all parts of the State, though in many places it appears complementary to the last species. In this vicinity it is more numerous in winter than in summer, returning northwardly in spring or to the most retired localities to breed.

For a number of years adult and young birds were supposed to be of different species, as will be seen by the nomenclature and references above. The common name, Winter Falcon, more properly belongs to the young of this species.

The Red-shouldered Hawk, like the preceding, visits the barnyard, but, as a rule, his diet is more humble, and he seeks his food in swamps and retired places. In winter he sometimes visits the roadside, or perches upon fences in fields, by the hour.

The nest of the Red shouldered Buzzard is built of sticks and twigs, lined with moss and a few feathers, and placed in high trees. The eggs resemble those of the preceeding species in color, but measure about 2.20 by 1.75.

BUTEO PENNSYLVANICUS (Wils.) Bp.

Broad-winged Buzzard.

Falco pennsylvanicus, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Buteo pennsylvanicus, KIRKPATRICK, Ohio Farmer, vii, 1858, 107; Ohio Agric. Rep. for 1858, 354 —WHEATON, Ohio Agric. Rep. for 1860, 360; Reprint, 1861, 2; Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 13; Journ. Cin. Soc. Nat. Hist., i, 1878, 116; Reprint, 7; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint, 14.

Broad-winged Hawk, KIRTLAND, Fam. Visitor, i, 1850, 1.

Falco pennsylvanicus, WILSON, Am. Orn., vi, 1812, 92.

Buteo pennsylvanicus, BONAPARTE, Osserv. Cuv. R. A. 55.

Three outer primaries emarginate on inner web. Above, umber-brown, the feathers with paler, or even with fulvous, or ashy-white edging, those of the hind head and nape cottony-white at base; quills blackish, most of the inner webs white, barred with dusky; tail with three broad dark zones alternating with narrow white ones, and white tipped; *conspicuous dark maxillary patches*; under parts white or tawny, variously streaked, spotted or barred with rusty or rufous, this color usually predominating in adult birds, when the white chiefly appears as oval or circular spots on each feather; throat generally whiter than elsewhere, narrowly dark-lined. In the young the upper parts are duller brown, varied with white, the under parts tawny whitish with linear and oblong dark spots, the tail grayish-brown with numerous dark bars. Female, 18; wing, 11; tail, 7; male, less.

Habitat, Temperate Eastern North America. South to Costa Rica, Panama, and Ecuador. Cuba.

Not common resident, except, perhaps, in winter. Breeds. This Hawk is much less abundant than the other members of the genus, and appears to be of much milder disposition than they. In the vicinity of this city it is quite rare, and only found in the most retired situations, generally in wooded swamps. In some portions of the State it appears to be more common. Dr. Kirtland says that it is common and breeds in Northern Ohio,

Mr. Read, that it is frequently seen. Mr. Langdon says that it is not rare in the vicinity of Cincinnati. Fully identified nest and eggs have been taken at Yellow Springs by Mr. W. M. Wilson. The nest was built of sticks and placed in the fork of a moderately large tree. The eggs were white, rather sparsely blotched with light reddish-brown. The complement of eggs is four, and they vary in size from 2.15 by 2.00 to 1.72 by 1.70.

GENUS ARCHIBUTEO. Brehm.

Large hawks; tarsi feathered in front to the toes, partly bare behind. Four outer primaries emarginate on inner web. Other characters much as those of *Buteo*.

ARCHIBUTEO LAGOPUS (Gm.) Gr.

var. SANCTI-JOHNANNIS (Gm.) Ridgway.

Rough-legged Buzzard.

Falco sancti-johannis, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.

Archibuteo sancti-johannis, KIRKPATRICK, Ohio Farmer, vii, 1858, 123; Ohio Agric. Rep., for 1858, 357.—WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3.

Archibuteo lagopus, KIRKPATRICK, Ohio Farmer, vii, 1858, 131; Ohio Agric. Rep. for 1858, 1859, 395.—WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3.

Archibuteo lagopus, var. *sancti-johannis*, WHEATON, Food of Birds, etc., Ohio Agric. Rep., for 1874, 570; Reprint, 1875, 18.—LANGDON, Cat. Birds of Cin., 1877, 13; Journ. Cin. Soc. Nat. Hist., i, 1878, 116; Reprint, 7; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint, 14.

Falco sancti-johannis, GMELIN, Syst. Nat., i, 1788, 270.

Archibuteo sancti-johannis, BONAPARTE, Consp., 1850, 18.

Archibuteo lagopus, CASSIN, Illust., 1854, 104.

Archibuteo lagopus, var. *sancti-johannis*, RIDGWAY, Proc. Phila. Acad., 1870, 142.

Below, white, variously dark marked, and often with a broad black abdominal zone; but generally no ferrugineous. Above, brown varying from dark-chocolate in the adult to light-umber in the young; the back, scapulars and shorter quills strongly cinereous. The head above more or less white, dark streaked; upper tail coverts and tail at base white, the former tipped with blackish; the latter barred near the tip with one, and sometimes several bands of black or dark-brown. In this plumage the bird has been known as *A. lagopus*, the Rough-legged Buzzard, while to a melanotic variety of the same, found in this country only, the name *sancti-johannis*, has been given. This variety is entirely glossy-black except the occiput, forehead, throat, inner webs of quills, base of tail and broad tail-bars, white. As it is now generally conceded that these are varieties of the same species, the original name, *lagopus* is retained and the American form considered a geographical variety of the European, characterized as variety *sancti-johannis*. Length, about 2 feet; wing, 16-18; tail, 8-10.

Habitat, typical *lagopus*, Europe. Var. *sancti-johannis* in North America at large; rather northerly. The melanotic condition chiefly observed in the Middle Atlantic States, New England and northward.

Rather common but irregular winter visitor in Northern, rare in Middle and Southern Ohio. Dr. Kirtland named this bird as Ohioan in 1838, one specimen of the black variety having been taken by him. Mr. Kirkpatrick states that in the winter of 1858-9, they were quite numerous in the vicinity of Cleveland. I have seen specimens taken in the vicinity of Sandusky, and one individual in this city. Mr. Langdon cites Mr. Dury as authority for a single specimen in the vicinity of Cincinnati.

The Rough-legged Buzzard frequents swamps, marshes and the vicinity of lakes and rivers. It appears to be more numerous near the coast than in the interior east of the Mississippi. It is less active than most Hawks and approaches the Owls in the habit of hunting by twilight. Its food consists of mice and frogs.

This Hawk breeds from New England northward. The nest is placed in trees or on rocks. The eggs measure about 2.18 by 1.75. The ground color is generally creamy-white, and the blotches dark-brown.

GENUS PANDION. Savigny.

Wings very long; general form heavy. Bill short, compressed; tarsi very thick and strong, covered with small circular scales; toes very rough beneath.

PANDION HALIAETUS (L.) Savigny.

Fish Hawk; Osprey.

Falco haliæetus, KIRTLAND, Ohio Geolog. Surv., 1838, 161.

Pandion carolinensis, KIRKPATRICK, Ohio Farmer, vii, 1858, 91; Ohio Agric. Rep. for 1858, 369.—WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3.

Pandion haliæthus, AUDUBON, Orn. Biog., i, 1831, 415; B. Am., i, 1840, 68.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.—LANGDON, Cat. Birds of Cin., 1877, 13; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 179; Reprint, 13.

Falco haliæetus, LINNÆUS, Fn. Snec., 22.

Pandion haliæetus, CUVIER, Reg. An., i, 1817, 316.

Pandion carolinensis, BONAPARTE, List, 1838, 3.

Plumage lacking after-shafts, compact, imbricated, oily to resist water; that of the legs short and close, not forming the flowing tufts seen in most other genera, that of the head lengthened, acuminate; primary coverts stiff and acuminate. Feet immensely large and strong, the tarsus entirely naked, granular-reticulate, the toes all of the same length, unwebbed at base, very scabrous underneath, the outer versatile; claws very large, rounded underneath. Hook of the bill long, nostrils touching edge of cere. Above dark-brown; most of the head and neck and the under parts white, latter sometimes with a tawny shade, and streaked with brown. Length, 2 feet; wing, 16-18 inches; tail, 8-10.

Habitat, Cosmopolitan. The American and Australian, respectively, under names of *P. carolinensis* and *P. leucocephalus*, have been currently regarded as distinct races or species.

Common summer resident in many portions of the State, rare in others. Mr. Kirkpatrick says of it:

"The Fish Hawk is widely distributed over the whole country, and at one time was quite plentiful in Ohio. When Dr. Kirtland resided at Poland, Mahoning county, these birds built their nests in the vicinity of the village, and could be seen every day during the summer season. Now they are rare. A few pairs are generally to be found fishing in Sandusky Bay; but they are somewhat shy, and it is difficult to get a shot at them. Occasionally a specimen will make its appearance near the shore of the Lake near Cleveland. The last we saw of them was about ten years since, although others have seen individuals more recently. We are not aware that this Hawk breeds near this place; but in the less frequented parts of our State, and in the neighborhood of water, the nests may sometimes be seen."

In this immediate vicinity the Fish Hawk appears only as a spring and fall migrant in May, August and September. At such times it proceeds leisurely along our rivers. I have observed it at the Licking Reservoir, in the vicinity of which it doubtless breeds, as also at St. Mary's Reservoir in Mercer county.

The food of this bird consists exclusively of fish, and, as is well known, it is often obliged to catch, not only for itself and family, but for the White-headed Eagle.

The nest of the Fish Hawk is a large structure occupied by it for several years. The eggs are creamy-white marked with various shades of brown; the complement is from two to four, and they measure from 2.56 to 2.24 by 1.88 to 1.69.

GENUS AQUILA. Auctorum.

Size large. Bill compressed, hooked at tip, straight at the base, wing long, pointed; tarsi strong, feathered to the toes.

AQUILA CHRYSÆTUS Linnæus.

Golden Eagle.

Falco fulvus, KIRTLAND, Ohio Geolog. Surv., 1858, 67, 177.—READ, Fam. Visitor, iii, 1852, 236.

Falco chrysaetus, READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Aquila chrysaetos, KIRKPATRICK, Ohio Farmer, vii, 1858, 67; Ohio Agric. Rep. for 1858, 1859, 362.

Aquila canadensis, WHEATON, Ohio Agric. Rep. for 1860, 361; Reprint, 1861, 3.

Aquila chrysaetus WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 570; Reprint, 1875, 10.

Aquila chrysaetus, LANGDON, Cat. Birds of Cin., 1877, 13.

Aquila chrysaetus, var. *canadensis*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist, i, 1879, 180; Reprint, 4.

Golden Eagle, KIRTLAND, Fam. Visitor, i, 1850, 15.

Falco fulvus, LINNÆUS, Syst. Nat., i, 1766, 125.

Falco chrysaetos, LINNÆUS, Syst. Nat., i, 1766, 125.

Aquila chrysaetos, BRISSON, Orn., i, 431.

Aquila canadensis, CASSIN, Birds, N. Am., 1858, 41.

Aquila chrysaetos, var. *canadensis*, RIDGWAY, B. B. & R., N. A. Birds, iii, 1874, 314.

Dark-brown with a purplish gloss; lanceolate feathers of head and neck golden-brown; quills blackish; in the young, tail white with a broad terminal black zone. About 3 feet long; wing, upwards of 2 feet; tail a foot or more.

Habitat, North America, northerly. South, ordinarily to about 35°. Europe. Asia.

Rare winter visitor, formerly more common, and, perhaps, rare resident throughout the year. Dr. Kirtland mentions its occasional visits to the shores of Lake Erie, and says that Mr. Dorfeuille had seen a specimen taken in the State. Mr. Read says:

"It is often seen on the [Lake] shore, and it is said that a pair have nested for several years in a high tree on a woody point of the shore near Sandusky Bay. The Rev. Sam'l Wright of Toledo, now deceased, wrote me in the winter of 1852, that he then had a young bird of this species, which was quite tame, and a very interesting pet. It fully answered the description of the 'Ring-tailed Eagle.' After the death of Mr. Wright it was promised to the writer, but, escaping from confinement, though accustomed to obey the voice of its old master, it could not be recaptured, and at last accounts was still lingering about the neighborhood of the city."

Mr. Kirkpatrick says:

"In 1810, when Dr. Kirtland first came to this State, Eagles were plentiful, and were to be seen flying along the lake shore. Among these, Golden Eagles were occasionally to be seen, but as all the large predacious birds have become comparatively scarce, it is somewhat doubtful if this species now visits Ohio."

Mr. Langdon gives it as a rare spring and fall migrant in the vicinity of Cincinnati. A specimen in my collection, for which I am indebted to Mr. J. L. Stelzig, was wounded in Hocking county in the fall of 1877, and presented to the City Park of this city. It died in February, 1878. Another specimen, mounted by Mr. Oliver Davie, of this city, was said to have been taken alive in this State, but the exact locality could not be ascertained.

The Golden Eagle, in this country, usually places its nest on inaccessible rocks, rarely on trees. The nest is composed of large sticks, and is a massive structure, from four to six feet in height and six or seven feet in diameter. The same eyrie is occupied by the same pair for many years. The eggs are usually three, soiled whitish, marked and spotted with various shades of dark-brown. They are nearly spherical, measuring from 2.65 to 3.00 by from 2.35 to 2.15.

GENUS HALIAETUS. Savigny.

Tarsus naked, scutellate in front ; other generic characters much as in *Aquila*.

HALIAETUS LEUCOCEPHALUS (L.) Savigny.

White-headed Eagle; Bald Eagle.

Falco leucocephalus, WILSON, Am. Orn., iv, 1812, 890.—KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395 ; Fam. Visitor, iii, 1852, 252.

Falco washingtonianus, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 178.

Falco washingtonii, READ, Proc. Phila. Acad., vi, 1853, 395.

Haliaetus washingtonii, READ, Fam. Visitor, iii, 1852, 244.—KIRKPATRICK, Ohio Farmer, vii, 1858, 83 ; Ohio Agric. Rep. for 1858, 1859, 366.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 361 ; Reprint, 3.

Haliaetus leucocephalus, KIRKPATRICK, Ohio Farmer, vii, 1858, 75 ; Ohio Agric. Rep. for 1858, 1859, 366.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 361 ; Reprint, 3 ; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 570 ; Reprint, 10 —LANGDON, Cat. Birds of Cin., 1877, 13 ; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180 ; Reprint, 14 ; Summer Birds, ib., iii, 1880, 226 ; Field Notes, ib., ii, 1880, 126.

Washington Eagle, KIRTLAND, Fam. Visitor, i, 1850, 1, 15.

Bald Eagle, KIRTLAND, Fam. Visitor, i, 1850, 15, 148.—BALLOU, Field and Forest, iii, 1878, 136.

Falco leucocephalus, LINNÆUS, Syst. Nat., i, 1766, 124.

Haliaetus leucocephalus, SAVIGNY.

Falco washingtoniana, AUDUBON, Loudon's Mag., i, 1828, 115.

Falco washingtonii, AUDUBON, Orn. Biog., i, 1831, 58.

Haliaetus washingtonii, BONAPARTE, List, 1838, 3.

Dark-brown ; head and tail white after the third year ; before this, these parts like the rest of the plumage. About the size of the last species. Immature birds average larger than adults.

Habitat, the whole of North America. Greenland. Casual in Europe.

Common and resident in some localities, irregular winter visitor or migrant in others. The American or White-headed Eagle is most abundant near large bodies of water, and is more common on the Lake Shore than in other portions of the State. Wilson gives the following account of his observations of them in the State :

"In one of those partial migrations of tree squirrels that sometimes takes place in our western forests, many thousands of them were drowned in attempting to cross the Ohio ; and at a certain place, not far from Wheeling, a prodigious number of their dead bodies were floated to the shore by an eddy. Here the Vultures assembled in great force, and had regaled themselves for sometime, when a Bald Eagle made his appearance, and took sole possession of the premises, keeping the whole Vultures at their proper distance for several days. He has also been seen navigating the same river on a floating carrion, though scarcely raised above the surface of the water, and tugging at the carcass, regardless of snags, sawyers, planters, or shallows. He sometimes carries his tyranny to great extremes against the Vultures. In hard times, when food happens to be scarce,

should he accidentally meet with one of these who has his craw crammed with carrion, he attacks it fiercely in the air; the cowardly Vulture instantly disgorges, and the delicious contents are snatched up by the Eagle before they reach the ground."

From Dr. Brewer's description I take following paragraph respecting the habits of this Bird:

"The White-headed Eagle appeared to be equally adapted by nature for the endurance of heat or cold, and is apparently indifferent to either. Its residence is influenced only by its abundance of food, especially that of fish; and it seems to matter very little whether that plenty is procurable within the Arctic Circle or on the coast and rivers of Florida and Texas. In places like the Falls of Niagara, where the stream is ever liable to contribute the remains of animals destroyed by the descent of the torrent, this Eagle is especially abundant. Unscrupulous, greedy, voracious, not select in its choice of food, and capable of providing for itself when necessity compels, we find this not altogether unsuitable emblem of our country, now enacting the tyrant and robber and plundering the Fish Hawk of the fruits of its industry, now sharing with the Raven and Vulture the dead Salmon of the Columbia, and in other places diving for and catching its own fish. The impetuosity with which it pursues, overtakes, and robs the Fish Hawk, bearing off a fish it has just taken, must be witnessed to be appreciated; and the swiftness with which the Eagle can dart down upon and seize the booty, which the Hawk has been compelled to let fall, before it reaches the water, is not the least wonderful feature of this striking performance. On the banks of the Columbia where [when] there are no Fish Hawks to depend upon, the bird finds an easy subsistence on the vast numbers of dead salmon which abound; and in Florida, Mr. Allen has observed it dive and catch its own fish. This is also confirmed by statements of other naturalists, Wilson also accuses this Eagle of destroying great numbers of young pigs in the Southern States, young lambs and even sickly sheep; and in one instance it attempted to carry off a child, which was only saved by its dress giving way."

Of the breeding habits of the White-headed Eagle in this State, Dr. Kirtland (Fam. Visitor, l. c.), gives the following account:

"For many years a pair of Eagles resorted to a nest in a stately oak tree standing on the high precipice near the shore of the Lake in Rockport, five miles west of this city. Nothing occurred to interrupt them until five years ago—during a severe storm their favorite tree was prostrated to the ground in the month of November or December. Early in the ensuing spring they were observed constructing a new nest in the top of another very large and lofty oak, in the same vicinity, in which to rear their young that season. The following spring the female was shot by a hunter. The male immediately disappeared, and was not again seen here until the next winter, when he appeared accompanied by a new mate. The pair took possession of the deserted nest, made extensive repairs, and prepared to raise their brood. Since then we have watched their habits with great interest. * * * During summer they may be seen daily perched upon some high tree hanging over the precipitous shores of the lake. From that altitude they can readily discover any dead fish floating upon the surface of the water for a great distance. From this source they obtain their food so long as the lake remains free from ice, but when this freezes over, and the weather becomes severely cold, they forage the country in search of dead carcasses about the farm."

He again speaks of these birds as follows :

“ Our old favorites alluded to in the third number of the Family Visitor, have again occupied their old eyrie, and at this time evidently have young in it. This is inferred from the watchfulness and anxiety shown by the parent birds at the approach of any one towards their resort, and from the circumstance that they are frequently carrying fish from the lake into their nest. It is situated so high in the branching top of a large oak that nothing can be seen within it by a person on the ground. During the present season its size has been greatly augmented by the addition of dry sticks.

A few days since four of those biped nuisances, termed hunters, which are constantly swarming from this city commenced shooting at these birds but fortunately their attack was unsuccessful.”

Mr. Kirkpatrick, writing in 1858, says the nest was still occupied by this pair of birds.

The Washington Eagle (*H. washingtonii*), to which so frequent reference is made, is now held, without dissent, to be the young of the White-headed Eagle, which is known to exceed the adult in size.

In the immediate vicinity of Columbus, the white headed Eagle is rare, and migrant or winter visitor. I have not seen one for twenty years, but a fine adult specimen was observed on Alum Creek, about four miles from the city, by my friends, Doctors Fullerton and Landis, in September last. I have seen it in October, at the Licking County Reservoir, and have been informed that it remains through the summer and probably breeds there. About thirty years since, when a fatal epidemic prevailed among cattle, Eagles appeared in considerable numbers in the northern part of this county and fed upon the carcasses of the victims.

In the vicinity of Cincinnati, Mr. Langdon states that they are sometimes common in winter. In Union county they appear every winter, and doubtless there are many localities in the grazing portions of the State where they are regular visitors if not residents.

The eggs are from two to four in number, white, unspotted, nearly spherical, measuring about 3 inches by 2.75.

FAMILY CATHARTIDÆ. AMERICAN VULTURES.

Feet scarcely raptorial, with lengthened, little curved or contractile, weak, short claws. Hallux elevated, shortened, not more than half as long as the fourth toe, with small claw. Front toes all webbed at base; middle toe lengthened; outer not reversible. Basal phalanx of middle toe longer than either of the succeeding. Nostrils perforate. Bill lengthened and comparatively weak, little hooked, contracted in its continuity; tomia not toothed or lobed. Head naked of feathers in greatest part; sparsely bristly. No lower larynx developed. No cœca. After-shafts absent.

GENUS CATHARTES. Illiger.

Crop feathered. Male without fleshy crest, or other appendages on the head. Only the upper half or less of the neck bare; plumage commencing gradually with normal broad feathers; feathers of breast and abdomen broad and normal. Head only moderately elongated, the upper outline irregular, the forehead elevated above the dorsal outline of the cere. Bill strong, the terminal hook well developed, its outlines only moderately convex; cere nearly equal to the head in length. Sexes alike.

Mr. Ridgway places our two species in separate genera, which for convenience may here be considered sub-genera, as follows:

Rhinogryphus. Nostril occupying the whole of the nasal cavity, its anterior end broadly rounded; cere as deep as broad, the upper and lower outlines divergent posteriorly, the former considerably arched; lower mandible much less deep than upper. Skin of the neck without corrugations; a semi-circular tuft of antrorse radiating bristles in front of the eye. Wing very long, the primaries reaching to or beyond the end of the tail. Tail much rounded. (*R. aura* and *R. burrovianus*.)

Catharista. Nostril occupying only the posterior half of the nasal cavity, its anterior end contracted and acute; cere depressed, much wider than deep, its upper and lower outlines parallel, the former not perceptibly arched; lower skin of the neck transversely corrugated; no tuft of bristles in front of the eye. Wings short, the primaries reaching scarcely to the middle of tail. Tail even, or slightly emarginate. (*C. atratus*.)

CATHARTES AURA (L.) Illiger.

Turkey Buzzard.

Vultur aura, WILSON, Am. Orn., iv, 1812, 89.

Cathartes aura, KIRTLAND, Ohio Geolog. Surv., 1838, 161, 176.—READ, Proc. Phila. Acad.

Nat. Sci., vi, 1853, 395.—KIRKPATRICK, Ohio Farmer, vii, 1858, 59; Ohio Agric. Rep. for 1858, 343.—WHEATON, Ohio Agric. Rep. for 1860, 360; Reprint, 1861, 2; Food of Birds, etc., Ohio Agric. Rep. for 1874, 571; Reprint, 1875, 11.—LANGDON, Cat. Birds of Cin., 1877, 13; Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 226.

Rhinogryphus aura, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint, 14.

Turkey Buzzard, KIRTLAND, Fam. Visitor, i, 1850, 1.

Vultur aura, LINNÆUS, Syst. Nat., i, 1766, 122.

Cathartes aura, ILLIGER, Prod., 1811, 236.

Rhinogryphus aura, BAIRD, BREWER and RIDGWAY, N. A. Birds, iii, 1874, 344.

Blackish-brown; quills ashy-gray on their under surface; head red; feet flesh-colored; bill white. Skin of the head corrugated, sparsely beset with bristle-like feathers; plumage commencing in a circle on the neck; tail rounded. Length, about $2\frac{1}{2}$ feet; extent, 6; wing, 2; tail, 1.

Habitat, The whole of the United States and adjoining British Possessions. South through Central and most of South America.

Common summer resident in Southern and Middle, less common in

Northern Ohio. Breeds. Formerly abundant and perhaps in part resident throughout the State. Dr. Kirtland, in 1838, says :

“The Turkey Buzzard is common during the summer, but does not continue in the northern parts of our State during the winter. It formerly nested in considerable numbers on the banks of the Big Beaver, near the line of Pennsylvania and Ohio, within the limits of the former State. Its numbers have greatly diminished within a few years.”

In 1850, speaking of changes in the fauna of the State, and referring to previous years, he observes :

“Turkey Buzzards and Ravens collected in numerous flocks about every dead carcass, while the Crow was less abundant than it is in more recent times.”

In this vicinity a notable diminution in number has taken place in the last twenty-five years. Now they may be seen from March to December, but in former years they remained, in small numbers, though the winter. Dr. Howard E. Jones informs me that they still remain through the winter at Circleville, only twenty five miles south of Columbus.

Turkey Buzzards are essentially gregarious, not only flying and feeding in company, but resorting to the same spot to roost. These roosts are not uncommon, and generally a sycamore grove in the bend or fork of a stream is chosen. Here they resort about sunset in considerable numbers.

In general they are very silent birds, their only notes being a hiss of defiance or warning to their neighbors when feeding, or a low, guttural croak of alarm when flying low overhead.

Dr. Coues' gives the following general account of their movements, and breeding habits :

“Except when flying, the birds show to little advantage. The color is dull ; the form uncomely ; the gait is constrained, and the attitudes are negligent and slothful. They walk or hop indifferently, and sometimes move with a succession of leaps, accelerated with the wings. When about to take flight from the ground, they stoop for an instant till the breast almost touches, and then, unfolding the wings, give a vigorous spring into the air ; with a few powerful, hurried flaps, they are fairly off. They soon begin their gyrations with set wings, only beating at intervals, when they are forced to rise rapidly away from some obstacles ; and, circling thus, they are shortly in the upper air.

The Turkey Buzzard breeds sometimes in communities and sometimes by single pairs, depositing its eggs on the ground, on rocks, or in hollow logs and stumps. The situation is generally in thick woods ; and when numbers breed together, the foulness of the resort is beyond description—vegetation may be entirely destroyed over large areas. Even single nests are offensive from their noisome deposits, not only of excrementitious matters, but of others, disgorged by the parents to feed the young. The eggs are generally two in number, often only one ; they measure about $2\frac{1}{2}$ in length by 2, or rather less, in breadth, being thus notably shorter and of less capacity than those of the Black

Vulture They are creamy or yellowish-white, variously blotched and splashed with different shades of brown and usually showing other smaller spots of lavender and purplish-drab. The young are said to be covered at first with a whitish down and to be fed for some time with half-digested carrion disgorged by the parents."

CATHARTES ATRATUS (Bartr.) Less.

Black Vulture; Carrion Crow.

Cathartes iota, AUDUBON, Orn. Biog., ii, 1834, 33.

Cathartes atratus, AUDUBON, B. Am., i, 1840, 17.—KIRKPATRICK, Ohio Farmer, vii, 1858, 59; Ohio Agric. Rep. for 1858, 344.—BREWER, N. A. Oology, Smithsonian Contributions, xi, 1859, 5.—WHEATON, Ohio Agric. Rep. for 1860, 360; Reprint, 1861, 2; Food of Birds, etc., Ohio Agric. Rep. for 1874, 571; Reprint, 1875, 11.—COUES, Key, 1872, 222.—LANGDON, Bull. Nutt. Ornith. Club, ii, 1877, 109; Cat. Birds of Cin., 1877, 13.

Catharista atrata, BAIRD, BREWER and RIDGWAY, iii, 1874, 352.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 180; Reprint, 14.

Vultur atratus BARTRAM, Trav., 1792, 289.

Cathartes atratus, LESSON, Man., i, 1828, 73.

Cathartes iota, BONAPARTE, Syn., 1828, 23.

Blackish; quills very pale, almost whitish, on the under surface; head dusky; bill and feet grayish-yellow. Skin of the head as in last species, but plumage running up the back of the neck to a point on the hind head; tail square. Smaller than *aura* but a heavier bird. Length, about 2 feet; wing, $1\frac{1}{2}$; tail, $\frac{3}{4}$.

Habitat, Tropical and Sub-tropical America. On the Atlantic coast, north regularly to North Carolina, casually to Massachusetts and Maine; resident from South Carolina, southward.

Rare or accidental winter visitor in South-western Ohio only. For a long time the following statement of Audubon was the only authority for considering it an Ohio bird:

"This bird is a constant resident of all our southern States, extends far up the Mississippi Valley, and continues the whole year in Kentucky, Indiana, Illinois and even in the State of Ohio as far as Cincinnati."

Mr. Langdon gives the following, the only recent note of its occurrence:

"On or about December 20, 1876, I came upon three individuals of this species (*Cathartes atratus*, Less.) feeding on the carcass of a hog, in a wooded ravine near Madisonville; one of them I shot at and wounded, but lost sight of it in the woods, and the other two remained in the immediate vicinity long enough to give me an excellent opportunity to observe their peculiarities of form and flight, although I could not approach within gunshot of them. On January 1, 1877, however, I found a specimen that had been killed a few days previous, in the same locality, by Mr. Edwin Leonard, of Madisonville, under circumstances rendering it probable that was the one I had wounded; its skin is now in my collection.

"The occurrence of this bird in Ohio, or in fact anywhere in the Mississippi Valley

north of the Ohio River, has heretofore rested solely on Audubon's account of its range, which has been quoted by all subsequent writers; and, being essentially a southern species, its capture here, at a time when the Ohio River was frozen over and the ground covered with several inches of snow, seems worthy of remark. I have identified this species here satisfactorily to myself, on two previous occasions, *both in winter*, but have never seen the 'Turkey Buzzard' (*C. aura*) at that season, although it is quite common during the summer."

The Black Vulture, like the Turkey Buzzard, breeds on or near the ground. The eggs are two in number, yellowish-white or cream-color, blotched with dark reddish-brown. They measure about 3.50 by 2 inches, and are said to average a pound in weight.

ORDER COLUMBÆ. COLUMBINE BIRDS.

FAMILY COLUMBIDÆ. PIGEONS.

In addition to ordinal characters, given on page 200, the feathers with thickened, spongy rachis loosely inserted in the skin. Head completely feathered, excepting sometimes a circum-orbital space. Tarsi naked or only feathered a little way above. Tail of twelve feathers, or lengthened, cuneate, and of fourteen.

GENUS ECTOPISTES. Swainson.

Tarsi shorter than lateral toes; feathered above; inner toe longer than outer; tail of 12 feathers, very long, cuneate, about equal the wing; 1st primary longest.

ECTOPISTES MACRURA (L.) COUES.

Wild Pigeon.

Columba migratoria, WILSON, Am. Orn., i, 1808, 102.—KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Ectopistes migratoria, KIRTLAND, Family Vistor, i, 1850, 133.—WHEATON, Ohio Agric. Rep., 1860, 367; Reprint, 1861.—BAIRD, BREWER and RIDGWAY, iii, 1874, 373.

Ectopistes migratorius, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 571; Reprint, 1875, 11 —LANGDON, Cat. Birds of Cin., 1877, 13.

Ectopistes macroura, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 181; Reprint, 15.

Columba macroura, LINNÆUS, Syst. Nat., i, 1758, 164.

Columba migratoria, LINNÆUS, Syst. Nat., i, 1760, 285.

Ectopistes migratoria, SWAINSON, Zool. Journ., iii, 1827, 355.

Ectopistes macroura, COUES, Birds N. W., 1874, 766.

Ectopistes macrura, COUES, Bull. U. S. Geolog. and Geog. Surv., iv, No. 3, 1878, 628.

Adult male dull blue above with olivaceous tinge on back, below dull purplish-red, whitening on vent and crissum; sides of neck golden and ruby; some wing-coverts black-spotted; quills blackish, with slaty, whitish and rufous edging; middle tail feathers bluish-black, the others white or ashy, the inner webs basally black with chestnut patch; bill black; feet coral-red; female and young duller and more brownish or

olivaceous above, below dull grayish, with a tawny tinge anteriorly, or quite gray; very young have the feathers skirted with whitish; length, 15-17; wing, 7-8; tail about the same.

Habitat, the greater portion of North America, but scarcely west of the Rocky Mountains. Pacific coast near latitude 49°. Nevada. Cuba. Accidental in Europe.

Formerly an extremely abundant summer resident and migrant, appearing in all seasons. Now, much less abundant and irregular. Not known to breed at present, though it probably does so. Until about 1855, Pigeons were extremely abundant in Central Ohio, having at and before this time a roost and breeding place near Kirkersville, Licking county. Then, for weeks at a time, they might be observed flying over this city or around its suburbs. In the morning soon after sunrise until 9 o'clock or after, their flight was westward, from the roost. In the afternoon, from four o'clock till sundown they were returning. During these periods, they were never out of sight, and often dozens of flocks were in view at once. These flocks were not of large size, but may be estimated to consist of from five hundred to fifty thousand birds, and it was their daily habit to leave their roost in search of food, in this manner. Whether those leaving in the morning invariably returned the same evening, or how far their journeys for food extended is not known. At such times they fed both in beech and oak woods and cornfields. When feeding upon acorns they were rather quietly dispersed among the branches of the trees, but beech nuts were generally collected from the ground. In their flight over the city, they were usually at long gun-shot range or higher, but in the country they flew nearer the ground, and following the plane of any inequalities. Vast numbers were shot, killed with poles on their roosts, or captured in nets. Dr. Kirtland states that near Circleville, in 1850, 1,285 were caught in a single net in one day. And even this number was not exceptional if the price at which they were sold is any indication. Many thousands were offered for sale in the market of this city. Most of them were brought alive in coops, and the purchaser had the choice of carrying them home alive or having them killed on the spot. If he chose the latter, the seller by a dexterous movement fractured or dislocated the bird's neck between his teeth. The average price at this time was five or six cents a dozen.

Mr. Read states that in the spring of 1851, they appeared "in vast numbers in the fields feeding upon the dead grasshoppers, the remains of the countless hordes, which well nigh devoured 'every green thing' during the preceeding summer and fall," a statement which will surprise ornithologists who have been accustomed to consider birds of this family as exclusively vegetarian.

On several occasions we have been favored with a general migration of these birds, when they have appeared, as described by Wilson, in "congregated millions." This was the case in 1854, when the light of the sun was perceptably obscured by the immense, unbroken, and apparently limitless flock which for several hours passed over this city. In the fall of 1859 I witnessed a similar migration near Granville, Licking county, since which time the birds have been much less numerous. On this occasion I had an opportunity of observing a large flock while feeding. The flock, after a little circling by the foremost ranks, alighted upon the ground, presenting a front of over a quarter of a mile, with a depth of nearly a hundred yards. In a very few moments those in the rear, finding the ground already stripped of mast, arose above the tree tops and alighted in front of the advance column. This movement soon became continuous and uniform, birds from the rear flying to the front so rapidly that the whole presented the appearance of a rolling cylinder having a diameter of about fifty yards, its interior filled with flying leaves and grass. The noise was deafening and the sight confusing to the mind.

During the last ten years Pigeons have appeared irregularly, but usually in spring and fall, in small flocks. Sometimes these linger about swampy woodlands for several days. Possibly they may breed in detached parties, but no such instance is known to me.

The Wild Pigeon breeds in vast communities. The nest of sticks is placed in a small tree; the eggs, two, pure white, measure 1.45 by 1.05.

GENUS ZENÆDURA. Bonaparte.

Tarsi stout, longer than lateral toes, bare of feathers; inner toe longer than outer; tail of 14 feathers, long, graduated; 2d primary longest. Circum-orbital space naked.

ZENÆDURA CAROLINENSIS (L.) Bp.

Carolina Dove.

Columba carolinensis, KIRTLAND, Ohio Geolog. Surv., 1838, 164.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Zenaidura carolinensis, BAIRD, P. R. R. Rep., vol. ix, 1858, 605.—WHEATON, Ohio Agric. Rep. for 1860, 367; Reprint, 1861, 9.—LANGDON, Cat. Birds of Cin., 1877, 13; Jour. Cin. Soc. Nat. Hist., i, 1878, 116; Reprint, 7; Revised List, Journ. Cin. Soc. Nat. Hist. i, 1879, 181; Reprint, 15.

Zenædura carolinensis, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 571; Reprint, 1875, 11.—LANGDON, Summer Birds, ib., iii, 1880, 226.

Carolina Dove, BALLOU, Field and Forest, iii, 1878, 136.

Columba carolinensis LINNÆUS, Syst. Nat., i, 1766, 286.

Zenaidura carolinensis, BONAPARTE, Consp., ii, 1854, 84.

Brownish-olive, glossed with blue on the crown and nape; below purplish-red, becoming tawny-white on the vent and crissum; neck metallic-golden; a velvety-black spot on the aniculars and others on the wing-coverts and scapulars; middle tail feathers like the back, the rest ashy-blue at the base, then crossed by a black bar, then white or ashy-white; bill very slender, black; feet carmine; the female and young differ as in the wild pigeon; length, 11-13; wing, 5-6; tail, 6-7.

Habitat, United States from Atlantic to Pacific. Canada West. Cuba. South to Panama.

Abundant throughout the State. Resident in Southern, resident in part in Middle and Northern Ohio. Breeds.

The Carolina Dove, also called Turtle and Mourning Dove, is one of our best known and familiar birds. Its amiable conjugal disposition and sweet but mournful cooing, have made it typical of several pleasing attributes in song and story.

Except during the breeding season this species is highly gregarious, though flocks of them never attain the magnitude of those of the Wild Pigeon. They are to be found everywhere, both in woodland and open places. During the breeding season they are found in pairs. The nest is placed in horizontal branches of trees, on stumps, rocks, or on the ground; in the latter situation rarely, in this vicinity, for the soil being clayey and cold, the eggs are often addled, and this applies to other partially ground-nesting birds which nest early, the Brown Thrush, for instance.

None of our birds except a few Hawks and Owls breed as early as the Dove. I have found the nest with young as early as the middle of April. They continue breeding until September. The nest varies in construction with its location. When placed in trees it is composed of a few sticks somewhat after the fashion of the Cuckoo, but if on a large limb, it is often but a sufficient rim of twigs and straw to retain the eggs. When on the ground a few straws and dead leaves are the only indications of an attempt at construction. The eggs are two in number, pure white, elliptical, and measure about 1.05 by .86.

ORDER GALLINÆ. GALLINACEOUS BIRDS.

FAMILY MELEAGRIDÆ. TURKEYS.

Hind toe shortened, elevated. Tarsi, toes and nasal fossæ naked. Head bare of feathers, sparsely bristly, with wattles and caruncles. A pectoral tuft of bristly feathers. Tarsi usually spurred in the male. Plumage iridescent. Size large.

GENUS MELEAGRIS. Linnæus.

Tarsi scutellate in front and behind, reticulate on the sides. Tail of 18 feathers. Forehead with a depending fleshy cone. Head and half of neck without feathers.

MELEAGRIS GALLOPAVO L.

var. AMERICANA (Bartr.) Coues.

Common Wild Turkey.

Meleagris gallopavo, BONAPARTE, Am. Orn., i, 1825, 80.—KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1838, 67; Ohio Geolog. Surv., 1838, 164.—NUTTALL, Man. 2d edition, i, 1840, 773.—AUDUBON, B. Am., v, 1842, 42.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 367; Reprint, 9.—LANGDON, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 226; Field Notes, ib., 1880, 126.

Meleagris gallipavo, *var. americana*, WHEATON, Food of Birds, Ohio Agric. Rep. for 1874, 1875, 571; Reprint, 11.

Meleagris gallopavo, *var. americana*, LANGDON, Cat. Birds of Cin., 1877, 13.

Meleagris gallopavo, *var. gallopavo*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 181; Reprint, 15.

Wild Turkey, KIRTLAND, Fam. Visitor, i, 1850, 1.

Meleagris gallopavo, LINNÆUS, Fn. Suec., No. 198.

Meleagris americana, BARTRAM, Trav., 1791, 290.

Meleagris gallopavo, *var. americana*, COUES, Key, 1872, 222.

Meleagris gallopavo, *var. gallopavo*, BAIRD, BREWER and RIDGWAY, iii, 1874, 404.

Naked skin of head and neck livid-blue; general color copper-bronze with copper and green reflection, each feather with a narrow black border; all the quills brown closely barred with white; tail chestnut barred with black and a broad subterminal black bar. Tip of tail feathers and upper tail coverts lighter chestnut. Length, 3-4 feet.

Habitat, of *var. americana*, the Eastern Province of the United States and portions of Canada. Of true *gallopavo*, the southern portions of the Middle Province and southwards.

Formerly abundant and resident, breeding throughout the State. Now exterminated in the more thickly settled portions, but still common in some northwestern counties. Breeds. Dr. Kirtland (1850) speaks of the time when Wild Turkeys were more common than tame ones are now. Mr. Read said, in 1853, that it was still common. Thirty years since it was quite common in Middle Ohio, but rapidly decreased in numbers, until it has been extremely rare in this county during the last ten years.

The few which remain exhibit great intuitive or acquired cunning in avoiding detection. As if aware that their safety depended on their preserving an incognito when observed, they effect the unconcern of their tame relatives so long as a threatened danger is passive or unavoidable. I have known them to remain quietly perched upon a fence while a team passed by; and one occasion knew a couple of hunters to be so confused by the actions of a flock of five, which deliberately walked in front of them, mounted a fence and disappeared leasurably over a low hill before they were able to decide them to be wild. No sooner were they out of sight than they took to their legs and then to their wings, soon placing

a wide valley between them and their now amazed and mortified pursuers.

The nest of the Wild Turkey is made on the ground; the eggs are from ten to fifteen in number, dark-buff or cream color thickly sprinkled with dark umber-brown. They measure about two and a half inches in length by one and three-fourths in breadth.

FAMILY TETRAONIDÆ. GROUSE.

Size medium. Hind toe shortened, elevated. Tarsi wholly or in great part, sometimes, also, the toes, and always the nasal fossæ, feathered. Head completely feathered excepting a definite papillate strip over the eye. Tail feathers sixteen or more. Sides of neck usually with lengthened feathers, or a naked distensible area, or both. No spurs. Plumage without iridescence.

GENUS CUPIDONIA. Reichenbach.

Legs feathered to the lower end of tarsus. Tail very short, truncate, but laterally graduated, half the wings. Sides of neck with long, pointed, or lanceolate, stiff feathers. Nasal fossæ scarcely one-third the culmen.

CUPIDONIA CUPIDO (L.) Bd.

Pinnated Grouse; Prairie Hen.

Tetrao cupido, KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1833, 67; Ohio Geolog. Surv., 1838, 165.

Cupidonia cupido, WHEATON, Ohio Agric. Rep. for 1860, 367; Reprint, 1861, 9, 19; Food of Birds, etc., Ohio Agric. Rep. for 1874, 571; Reprint, 1875, 11; Bull. Nutt. Orn. Club, i, 1879, 62.—LANGDON, Cat. Birds of Cin., 1877, 13; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 181; Reprint, 15.

Tetrao cupido, LINNÆUS, Syst. Nat., i, 1766, 274.

Cupidonia cupido, BAIRD, Birds N. Am., 1858, 627.

Above variegated with black, brown, tawny or ochrey, and white, the latter especially on the wings; below pretty regularly barred with dark brown, white and tawny; throat

TETRAO CANADENSIS Linnaeus.

Canada Grouse; Spruce Partridge.

Tetrao canadensis, KIRTLAND, Ohio Geolog. Surv., 1838, 165.—WHEATON, Ohio Agric. Report for 1860, 1861, 367 (error); addenda, 480 (correction); Reprint, 21, (probable).

This bird was named as an Ohio bird by Dr. Kirtland who says: "I have been informed that a bird answering the description of the Canada Grouse has been killed on the shores of Lake Erie, but have not been to obtain a specimen or even any very authentic account of it."

The Canada Grouse is resident from Northern New York, northwards. It has been found breeding in Lewis county, by my friend, Dr. C. H. Merriam. It is not probable that it ever visits this State.

tawny a little speckled, or not; vent and crissum mostly white; quills fuscous with white spots on the outer webs; tail fuscous, with narrow or imperfect white or tawny bars and tips; sexes alike in color, but the female smaller with shorter neck-tufts. Length, 16-18; wing, 8-9; tail, about 5.

Habitat, fertile prairie country of the United States, nearly to eastern foot-hills of the Rocky Mountains in some latitudes—especially Illinois, Iowa, Missouri, eastern half of Minnesota, Southeastern Dakota, Middle and Eastern Kansas and Nebraska, Arkansas and Eastern Texas. Var. *pallidicinctus* from Western Texas. Still lingers in certain localities in the Middle States and New England.

Rare resident in Northwestern and Central Ohio. Probably breeds. In the Bulletin of the Nuttall Ornithological Club (l. c.) I noted the capture of the only specimen taken in this county for many years, as follows:

"A male Pinnated Grouse was killed by a gunner, seven miles west of Columbus, November 16, 1878. By the kindness of Mr. A. B. Stevenson, who purchased the bird, the skin is now in my collection. As long ago as 1838 Dr. Kirtland wrote: 'The Prairie Hen is found in considerable numbers in the northwestern parts of the State.' It is now very rare, though a few remain in the vicinity of Toledo, and in Erie, Ottawa, Crawford and Marion counties. Mr. R. E. Neil informs me that a few years since a few remained at Radnor, Delaware county."

Since the above was published I have learned that Messrs. Al. Buttlers and Charles Wagner, well-known sportsmen of this city, flushed a pair of these birds a few years since, not far from the locality in which the above mentioned specimen was secured, but did not succeed in taking them. I learn that they also remain in Wyandot county, and in the vicinity of Venice, Sandusky county, though in very limited numbers; and on perhaps less reliable authority that they have been seen in Fairfield and Pickaway counties. It seems not impossible that they may be now on the increase after having once been nearly exterminated or driven from the State. It is to be hoped that proper legislation may afford to the birds of this family an opportunity of recovering their diminished numbers so far as can be done by protection from pursuit and capture, at all seasons, for a sufficient number of years.

The nest of the Prairie Hen is placed on the ground. The eggs, usually from eight to twelve, are pale gray or brown, usually unmarked, but sometimes uniformly sprinkled with brown. They measure about 1.75 by 1.25 inches.

GENUS BONASA. Stephens.

Lower half of tarsus bare, with two rows of scutellæ anteriorly. Sides of neck with a ruff of broad, truncate soft feathers. Tail very broad, square, as long as the wings.

BONASA UMBELLUS (L.) Steph.

Ruffed Grouse; Partridge; Pheasant.

Tetrao umbellus, KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1838, 67; Ohio Geolog. Surv., 1838, 165.—AUDUBON, Orn. Biog., i, 1831, 211; B. Am., v. 1842, 74.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Bonasa umbellus, WHEATON, Ohio Agric. Rep. for 1860, 367, 377; Reprint, 1861, 9, 19; Food of Birds, etc., Ohio Agric. Rep. for 1874, 571; Reprint, 1875, 11.—LANGDON, Cat. Birds of Cin., 1877, 14; Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 226.

Bonasa umbellus, var. *umbellus*, BAIRD, BREWER and RIDGWAY, iii, 1874, 450.—LANGDON, Revised List, Journ. Soc. Nat. Hist., i, 1879, 181; Reprint, 15.

Partridge, KIRTLAND, Fam. Visitor, i, 1850, 1.

Tetrao umbellus, LINNÆUS, Syst. Nat., i, 1766, 275.

Bonasa umbellus, STEPHENS, Shaw's Gen. Zool., xi, 1824, 300.

Sexes nearly alike; variegated reddish- or grayish-brown; the back with numerous oblong, pale, black-edged spots; neck-tufts glossy-black; below, whitish barred with brown; tail with a broad subterminal black zone, and tipped with gray. Length, 16-18; wing, 7-8.

"Habitat, the typical form, the United States to the high central plains, in wooded districts. Canada and the interior of the fur countries, to Nulato, Alaska (*Dall*). But I am informed by Mr. Ridgway that British American—even Canadian—specimens are all more or less referable to var. *umbelloides*, being grayer than those of the United States). Of var. *umbelloides*, the Rocky Mountain region. Of var. *sabini*, the Pacific provinces, from the northern border of California to Sitka." (*Coues*.)

Common resident in many localities, rare or absent in others. Breeds. It was formerly much more numerous and widely distributed than now, but has decreased in numbers with the rapid clearing away of timbered lands. It is now most abundant, and probably always has been, in the hilly portions of the State, less frequent or almost exterminated in level woodlands. It is not found in prairie regions, its distribution being complementary to that of the last species.

Very few remain in the immediate vicinity of Columbus, where, fifteen or twenty years since, they were not uncommon in some localities. Mr. Langdon gives no record of its capture in the vicinity of Cincinnati, within this State. In the Hocking Hills and their continuation northward, and in the hilly region of Eastern Ohio, they are still common. Ohio birds, present color-characters approaching types of both var. *umbellus* and *umbelloides*. In the same localities, decidedly red and comparatively gray birds are taken. But my observations have not been sufficiently extended to determine whether these differences are dependent on age or sex, though they certainly are not on season.

To avoid confusion it is necessary to say to those who know this or the next species by the name of Partridge, that this bird is not a Partridge,

neither is it a Pheasant, the former name being most appropriately applied to the birds of a Sub-family of *Perdiciidæ* found in the Old World, and which is more nearly applicable to the bird commonly called Quail, than to the Ruffed Grouse. On the other hand it is still farther removed from the Old World family of *Phasianidæ* which embraces the Pheasants.

The nest of the Ruffed Grouse is placed on the ground. It is composed of a few leaves, without any attempt at construction. The eggs are from seven to ten in number. They are usually of a uniform dark cream color, but sometimes blotched with a darker shade of the same. They measure 1.60 by 1.15.

FAMILY PERDICIDÆ. THE PARTRIDGES.

Size small. Tarsi, toes, and nasal fossæ naked. Head completely feathered. No peculiar feathers or tympanum on sides of neck. No spurs. Plumage not iridescent.

Sub-family ODONTOPHORINÆ. AMERICAN PARTRIDGES.

Bill stout. the lower mandible more or less bidentate on each side near the end.

GENUS ORTYX. Stephens.

Head without crest. Tail not much more than half the wings; outstretched feet reaching beyond tail.

ORTYX VIRGINIANUS (L.) Jardine.

Virginia Partridge; Quail; Bob-white.

Perdix virginiana, WILSON, Am. Orn., vi, 1812, 21.—AUDUBON, Orn. Biog., i, 1831, 388.—

KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1838, 67; Ohio Geolog. Surv., 1838, 164.

Ortyx virginiana, AUDUBON, B. Am., vi, 1812, 21.—READ, Proc. Phila. Acad. Nat. Sci., vi, 1853, 395.

Ortyx virginianus, WHEATON, Ohio Agric. Rep. for 1860, 1861, 367; Reprint, 9; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 571; Reprint, 11.—LANGDON, Cat. Birds of Cin., 1877, 14; Journ. Cin. Soc. Nat. Hist., i, 1878, 116; Reprint, 7; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 181; Reprint, 15; Summer Birds, ib, iii, 1880, 226 —JONES and SHULZE, Illust. Nests and Eggs, Pt. 6, Pl. XVIII.

Quail, KIRTLAND, Fam. Visitor, i, 1850, 1.

Tetrao virginianus, LINNÆUS, Syst. Nat., i, 1776, 277.

Perdix virginianus, LATHAM, Ind. Orn., ii, 1790, 650.

Ortyx virginianus, JARDINE, Nat. Lib. Birds, iv. —, 110.

Coronal feathers erectile but not forming a true crest. Forehead, superciliary line and throat white, bordered with black; crown, neck all round and upper part of breast brownish-red, other under parts tawny-whitish, all with more or fewer doubly crescentic black bars; sides broadly streaked with brownish-red; upper parts variegated with chestnut, black, gray and tawny, the latter edging the inner quills. Female known

by having the throat buff instead of white, less black about the fore-parts, and general colors less intense, rather smaller than the male. Length, 9-10; wing, 4½-5; tail, 2½-3.

Habitat, Eastern United States. North to Massachusetts and slightly beyond; Canada West; Minnesota. West to high central plains. Up the Missouri to White River. Salt Lake Valley, introduced. Var. *texanus* in Texas. Var. *floridanus* in Florida, and very similar specimens up the Mississippi Valley to Southern Illinois. Introduced in Bahamas and Santa Cruz.

Abundant resident. Breeds. This well-known bird is an exception to all others of the order, in that it was probably absent or at least confined to but few localities in the State at the time of its first settlement, and has steadily increased in numbers as the forest has been cleared away, while others have diminished. It is practically sedentary in its habits, yet during the fall months often changes its locality by more or less complete migrations. During this period the birds sometimes appear in considerable numbers in unexpected places, not unfrequently in the streets, on the houses and in gardens of large cities.

The following account from the beautiful work of Misses Jones and Shulze, from the pen of Dr. Howard E. Jones, an enthusiastic sportsman and naturalist, presents so many interesting and important facts that I reproduce it nearly entire :

"The Bob-White is a permanent resident of Ohio. The greater portion of the year the old birds with the family increase are found in coveys. In early spring this general attachment is broken up by pairing, each pair selecting a locality where they remain during the breeding season. When mating has taken place it is known by the demonstrations of the male, who gives the whole neighborhood due notice of his domestic intentions by frequent repetitions at short intervals, of his cheerful and well-known notes—*Bob-White, Bob-White*. Nesting begins as early as the first of May. Two and sometimes three broods are raised during the season. Corners of worm-fences and stumps, in garden patches or in cultivated fields, having tall grass or weeds about them are favorite sites for the nest. Sometimes it is placed in a field with no protection except the growing grain or grass. Rarely it is built in thick woods, in a tussock, or beside a stump or logs. But wherever the locality, either highland or lowland, cultivated or wild, a spot well covered by a luxuriant growth of grass is usually selected. Though at times concealment as a means of security seems to be abandoned, and the nest is placed under the protection of man. I have frequently seen nests built within a few yards of a farm house, in the short blue-grass near a much frequented path; and only a few seasons since, I found a nest alongside a tie on sandy ground within five feet of a railroad track.

The nest, which always rests upon the ground, is placed in a slight concavity, either natural or prepared by the mother-bird. Sometimes the materials are so arranged with the surrounding tufts of grass as to form an arched covering having a side opening, but generally it is quite free from any attempt at artificial concealment.

The materials of construction consist of dry grass, straws, leaves, weed stems, or like substances found in the immediate vicinity. The average diameter of the structure is about four and one-half inches.

The complement of eggs is from fifteen to twenty-five, usually about eighteen. Occasionally a nest is discovered which contains thirty or forty, and even more. Such a set is without doubt the joint labor of two or three hens. The eggs are pure white, unless stained by the bed of grass upon which they rest. At one end they are quite pointed, at the other obtusely rounded, and measure about $1.18 \times .98$ of an inch.

At the time of the first settlements in Ohio, it is quite probable Quail were scarce, and found only in certain localities. The extensive and dense forests, covering almost the entire territory, made it ill-adapted to their nature; and those which were enabled to perpetuate their existence occupied only some of the limited open tracts of land then found here and there over the country. In support of this conclusion I will here refer to the facts contained in a statement made by my great-grand-father who emigrated to this State directly after peace with the Indians was affected by General Wayne under Washington, and, in the Spring of 1793, located with his family on what was then named and since known as the 'High-bank Prairie,' near Chillicothe. In this seemingly favorable locality he resided several years before the voice of the Quail was heard; so long that he abandoned the anticipation of Quail shooting, and questioned if it would ever be recognized as a sport in Ohio. One day in early summer he thought he heard a well-recognized though suppressed sound, '*Bob-White*.' Somewhat doubting the sense of hearing, he immediately made observations and procured additional evidence, that of sight. Yes, he actually heard and saw the bird. Elated with the good news he proceeded to the cabin and told his discovery with so much excitement and enthusiasm that it created a laugh at his expense. He excused his manner, however, by saying it was sufficient to excite any one, to know that a highly esteemed and familiar bird had found its way through such an interminable wilderness, and announced his arrival in that modest and meaning way.

Bob-White is really a bird of civilization. He flourishes best near the abodes of man. The cultivation of the soil and settlement of the country increase their number seemingly by lessening their dangers, and giving an easy mode of subsisting. With no friend but agriculture, with no protection but fields of grass and grain, they become abundant in spite of the Hawk, the Owl, the Crow, the Blue Jay, the Opposum, the Raccoon, the Polecat, the Weasel, the Norway Rat, the Snake, the Dog, the Cat, the mowing machine, the sportsman, the trapper, the summer rains, and the winter snows, each of which has an influence in circumscribing their wonderful capacity for increase.

The Quail regards man as his friend, although he is not a stranger to man's treachery and cruelty. If not for the ill-treatment so often received from those whose friendship he courts, he would soon become quite as domestic as the barn-yard poultry. In fact, he frequently presses his claims so perseveringly in this line, that they are received and recognized. Some years since, early in May, I discovered a nest being built by a pair of these birds, in a lot only a short distance from the house. Each day, for several days, they added a little to the appearance of the structure, and when completed, an egg was deposited daily until nineteen filled the nest, and incubation began. Up to this time I had been extremely cautious in my observations, especially those approaching familiarity. But now I made myself quite at home, going to the nest frequently every day; until the birds became so accustomed to my presence, and so well assured that in this confidence there was no danger, that the female would even permit my hand under her and to remove an egg, without being disturbed or getting off the nest. A week before the expected arrival of the little ones, I made a tight fence of boards, about two feet high, inclosing a space twelve feet square. After hatching, the family remained in the enclosure and were fed the same as domestic chickens, neither the old nor young

showing the least fear at my approach. They soon grew strong enough to get over the fence, and I turned them all out.

I have known a number of instances where these birds, having been reared with the farm poultry, became completely domesticated. In one instance, nine beautiful full-grown ones, that had been hatched and cared for by a common hen, with some of her own chickens, had the liberty of all-out-doors, yet they remained constantly about the house and garden, seldom using their wings, and at the call to feed the poultry, they were the first to respond, and not until completely satisfied with the repast, was a chicken, turkey, or other fowl permitted by these pugnacious little fellows to intrude or take a crumb. A slight attempt was made to induce this brood to roost upon a perch, after the manner of their relatives, the chickens. The success was, however, only partial; their attachment to the old methods was too great, or their feeling of security so much increased by placing themselves together in a circle with heads outward, as they naturally do at night, that only a compromise was effected. A board was placed in the chicken house five or six feet from the ground, and wide enough to admit the number to place themselves tail to tail in a circle. On this they spent the night with the other fowls. I have no doubt, however, the habit of sleeping on the ground could readily be changed to that of roosting on trees or other more secure places; as I instanced once in a bird reared with some chickens, which, after being instructed a few times, readily took the perch by the side of his foster-mother, and seemed as much at home as any of the chickens which were now old enough to roost.

Birds from the field, under certain circumstances, as fear or want of suitable selection of ground, will roost singly upon trees and other elevated places. This I have seen quite often in the case of the overflow of lands by high water, and when bewildered in an attempt to adopt city life. Every year, in the fall season, large coveys come into this city and are heard constantly whistling for each other, and may be seen running about the streets. These birds often roost on the house tops, the tops of chimneys, and on the branches of the street trees, one, and sometimes two in a place, and continue the practice for weeks, or until they become destroyed or leave for the country. As they always get together on foot, it becomes almost impossible, when once scattered in a city, to find each other, and so long as one of their number remains absent and makes it known by the signal whistle, the other birds will remain and endeavor to make themselves heard; and in doing this they again become dispersed and divided by houses, walls and fences; and thus day after day is occupied in these fruitless efforts to collect the family, each day lessening their number, until few, if any, reach the field again.

The social relations existing between Bob-white and the barn-yard fowl are generally very friendly. I have frequently found hens' eggs and Quails' eggs in one nest; and have known a common hen and a Quail to deposit daily, each an egg in the same nest; until the complement was full, at the end of which time the Quail submitted the incubation to her larger companion. The disposition of these birds is only moderately good. They are always amiable and gentle in their family relations, and rarely domineering or vindictive towards their friendly associates. They are cowardly towards their enemies; and while in coveys, seem to maintain a sense of security by keeping close together; and so strong is this feeling, that wounded birds, unable to fly, will follow after their companions on foot, as long as able to go. When paired, the two are constant companions, ever watchful over the welfare of each other. They share equally the duties and responsibilities of wedded life, and from the birth of the first offspring to their settlement in the world, as faithful father and mother, are unceasing protectors and providers for the family. This extraordinary strength of attachment, and exhibition of natural affection,

has often attracted my attention. I once discovered by accident, a nest nicely concealed by some tufts of grass, after being placed under the projecting end of a fence rail. At this time there were in it five eggs. This number increased daily until twenty-three eggs filled the nest, and incubation began. All went happily, until one morning there was evidently great distress in this little household. The male bird was sounding his anxious alarm—he went hurriedly from one part of the farm to that of every other—sometimes running—sometimes flying—stopping a moment here—a moment there—calling at the top of his voice for his mate, in that peculiar tone which denotes distress. His unanswered cry soon told the tale—some accident—some ruthless Hawk—some sneaking cat, or some other enemy had captured and destroyed his faithful companion. He kept up his call for several hours, sometimes coming close after me, making a low, *chittering* noise, as if suspicious something could be told—that I could tell him where his love had gone. Far from it, I was also in search—in search of anything that could give a clue to the unfeeling wretch that had done the bloody deed. I was excited, and would have executed the severest penalty known, if the guilty one could have been found. I had been to the nest several times, with merely the thought she might be testing the affections of her lord, or playing him a practical joke; but no, the eggs were bare. About noon of that day he ceased his noise, and, hoping his mate had returned, I hastened to the nest again; but in this again disappointed. The reason, however, for his stillness was explained. He was on the eggs, keeping life in the prospective family. For several days he left his charge frequently, to make further search for the missing partner. One morning I stopped as usual to see how the little widower was getting along, and found nothing but a bundle of egg shells. Every egg had been hatched. Not far from the nest I heard a low *chit-chit-chit*, and soon discovered Bob with his brood. He continued to care for the young, as I can testify from our frequent meetings, and reared a fine large covey, which received protection and sympathy, during the following winter, of all the farm hands and sportsmen who knew him and his well-behaved family.

Quail are not strictly granivorous in their notions of diet. In autumn and winter, they subsist chiefly upon grain, berries, grapes, black-haws, and seeds of weeds and vines. But in the spring and early summer, their food is almost exclusively composed of ants, bugs, and other insects. While Henry William Herbert justly extols the benefits the agriculturist derives from the consumption of weed-seeds by these birds; he omits to give them credit for their insectivorous qualities. He says: when it is taken into consideration that each individual Quail consumes daily nearly two gills of weed-seed, it will be at once evident that a few beves of these little birds, carefully and assiduously preserved on a farm, will do more toward keeping it free of weeds, than the daily annual labor of a dozen farm servants. With the endorsement of the above it is highly important to add, that a few coveys carefully preserved would protect the farmer against the ravages of many destructive insects, which are by far greater pests and more to be feared than the ragweed, the dock, or the brier. As an insect exterminator, the Quail may be placed in the front ranks of our native birds. I examined the crop of one that was killed by flying against a white house, having been frightened from a potato-patch near by, which contained seventy-five potato-bugs. This is only one of many instances illustrating the practical usefulness of these birds to the farmer.

Quail are pursued by man and beast and bird and reptile; but with a fair opportunity and timely warning, they manifest a wonderful faculty for evading their foe. Excepting against the pot-hunter, they are provided with ample means for self-preservation. He who steals upon them while enjoying the sunshine by the side of some old log or

stump or fence-corner, all seated in a space less than the circumference of a half bushel measure, or even closer on a cold winter day, and betrays their confidence by firing upon them in this unsuspecting attitude, filling his bag with the dead, and marching off, having the brand of "sneak-thief" upon his brow, is a pot-hunter. He too, who with a show of indifference, rides about, pretending to be overseeing his own affairs, whistling around and around, until the poor unsuspecting birds, in order to get out of his way, unconsciously walk into a net prepared for them, and as a reward for their confiding freindship, triumphantly pinches their heads, is a pot-hunter. Against such they have no protection. When these birds have warning of danger and wish to evade detection, or when closely pursued, they will conceal themselves against the observation of their foes in the most magical manner; and if satisfied they are unobserved, will not move sometimes until they have suffered themselves to be captured on the spot. It is quite amusing to witness the changes that come over the dreams of the amateur sportsman when he fails to put up his expected birds. He knows where they are, for he marked them all down in the meadow of short grass, within a few yards of a stump or tree. Then, it is such a commentary on his dogs, for he knows they are all right—never better, truer noses; still they go, over and over, round and round, without coming to a point. There, that dog has flushed a bird. Now he is assured they are all within twenty feet of that place; and he renews his search, and keeps his dogs going over and over the same ground, until both dogs and gunner disgusted, quit the place. How they got away, and where they all went to, and why that single bird remained where the covey went down, and why the dogs did not point that bird, all pass through the mind of the hunter as he leisurely marches on in search of better luck. He perhaps meets his experienced friend, to whom he relates his disappointment, and who, in turn, proposes after a given time to return to the meadow, stump or tree. They do so, and every dog comes to a point. Down come three birds. The dogs move cautiously, in a moment again stand. This repeated until the last bird has gone the gantlet. Experience of this kind is not a novelty, but occurs frequently. A few years since I was out with a friend, and we flushed a very large covey, and marked them down accurately on an elevated piece of ground in a woodland pasture. The grass was short, and there was not even a weed or brier, and but here and there a large tree. We moved forward with three dogs, expecting to bring on an engagement at once. We made the dogs approach cautiously, giving them warning that game was in the immediate vicinity, but they arrived at the identical spot where we saw as many as thirty birds alight, without making the least demonstration whatever that there was anything unusual about the place. We knew better, and made them go over and over, crossing and re-crossing, until it seemed every foot and even every inch of ground had been most thoroughly examined. We did this until two sportsmen and three good dogs gave up the pursuit. It was now past noon, and we sat down on the grass and uncorked our canteens and opened up the lunch. We were eating, talking and laughing, occasionally rewarding the dogs with a cracker, when my friend, by way of sport, said, "Look at old Tom, he is on a point." The dog was half standing, half down, with his nose thrown down under his chest, between his front legs. Sure enough he was on a point, for there was the bird, with its bright black eyes, only partially concealed by a leaf, almost under the dogs body. My friend placed his hat over it and caught it, without moving from the dinner-table. At that instant another dog made a point within six inches of my feet. I saw the bird at once, and attempted to capture it with my hand but it made its escape. This was the signal for a general move, and the whole covey rose from all around and about us. The concert of their actions in the manner of going down, retaining scent, remaining still under the most

trying circumstances, and the mode of leaving—all indicated an understanding, an education by command, how to act in time of great danger.

The ability to evade the perception of the sharpest and most experienced dog, has been accounted for in various ways by sportsmen and authors; some claim that through fear they retain their scent by alighting and not moving after touching the ground, and compressing the plumage in a way to check the emanations. Others deny most emphatically that they possess the power to withhold the scent, and say the manifestations are accounted for by the scent being confined and covered up; while others assert knowingly that the reason the dogs are unable to find the birds at the spot where they are seen to settle is they are not there to flush; that they run away, and that after a given time will return to the place where the sportsman expected, but failed, to find them. I am satisfied, however, that ordinary observation and a little patience will convince anyone that these birds do possess the power, and do frequently exercise it in a way that deprives the dog of not only the ability to locate them by scent, but also of the entire knowledge of their presence; and that the birds appear to fully understand when they are in this relation to the dog. That they do not always 'run away and come back again' I have frequently tested to my entire satisfaction. A few years since, I flushed a covey of about one dozen birds and marked them down very correctly in some broom-corn stubble. My dog was beyond question, but I was compelled to give them up without finding a bird. The cover was not heavy, and I put this down as possibly an instance where they had all escaped by running 'like race horses.'

A short time after, about three inches of snow fell in the night, and in the morning I concluded to look after this covey a little further. The dog came to a stand near the same place I found them a few days before. When flushed, they all took their old route, settling close together; I was soon there with the dog, and hunted the place over and over, but could not find even a track or imprint in the unbroken snow. I now made several circles around the place, to render assurance doubly sure that the birds had not run away, and were at the point where I saw them go down. Yes, the evidence was conclusive. They were all there within a short distance of each other. This was enough, I walked away and remained long enough to quiet their fears, and then returned, and the dog made point after point until probably every bird was found, although not one had moved from the spot at which he touched the snow-covered ground.

Quail shooting is the great field sport of the country. It is by far the most exciting, as the bird is the most troublesome to follow up, and, when flushed, the most difficult to kill. It may have its faults, but when restricted by proper legislation, it has its benefits and advantages. While it diminishes the aggregate number of birds by subtracting from each covey, it seldom destroys the whole family, and in this way insures the preservation of an abundance to propagate another season. Wing shooting also draws from the destructive spoils of the pot-hunter and trapper, making the birds coy, suspicious, and not easily seen. True, there is a possibility that the sportsman with dog and gun may destroy a whole family unintentionally or by accident, for it once fell to my lot to be the author of a chapter of this kind. While riding along the road in a buggy with a friend, I discovered my dog on a stand near the road some distance in front, with nose and tail parallel to the line of fence. As I moved up, the birds rose by concert, in line along the fence, and I fired at the rear bird and for a few seconds saw nothing but smoke, then a wounded bird making his way on foot into a sorghum patch on the opposite side of the road, I attempted to intercept his passage but failed, and he escaped into the dense cover. Where the other birds were I did not yet know, for the smoke stood at the muzzle so long it was impossible to see a feather fall. My friend,

who had charge of the conveyance and sat in the buggy, declared that every bird fell, I walked over the ground and picked up twelve dead birds; from the first to the last the distance was about twenty yards. The next day, on passing the place the dog came to a point; not expecting a repetition of the slaughter, I walked up, but no bird flushed. I now moved some dead grass, and found the one I had winged the day before, and which was so badly wounded that I killed him as a kindness. Here the whole covey was exterminated; but as I felt sorry for the act, did not intend it, and would never do it again, it should not be considered unpardonable. Experience, however, sustains the position taken by sportsmen, that the judicious use of the gun merely diminishes by drawing upon the yearly increase, and does not oppose the preservation and healthy propagation of these birds.

Still, if unmolested, they would not, perhaps, under the most favorable circumstances, become in excess of their usefulness to the agriculturist. Yet, however plentiful they may be, it seems an inexcusable cruelty to take their lives either for gain or amusement, and I agree with Mr. Herbert: 'were I a farmer, I would hang it over my kitchen fireplace, inscribed in goodly capitals—Spare the Quail! If you would have clean fields and goodly crops, spare the Quail! So shall you spare your labor.'

ORDER LIMICOLÆ. SHORE BIRDS.

FAMILY CHARADRIIDÆ. PLOVER.

Legs moderate. Tarsus shorter than tail, reticulate. Hind toe wanting (except in *Squatarola*, where very small, and in *Aphriza*). Bill short, straight, not exceeding the head (generally shorter), shaped like a pigeon's, with short, broad, soft nasal fossæ separated by a constriction from the enlarged, obtuse, horny terminal part. Head large, globose, contracting suddenly to the bill. Neck short.

Sub-family CHARADRIINÆ. True Plover.

Size moderate or small; body plump; neck thick. Gape very short, reaching little beyond base of culmen. Tarsus reticulate, longer than middle toe. Tail of twelve feathers, nearly even, or rounded.

GENUS SQUATAROLA. Cuvier.

Hind toe rudimentary. Legs reticulated with elongated hexagons anteriorly, of which there are five or six in a transverse row, fewer behind. Tail slightly rounded.

SQUATAROLA HELVETICA (L.) Brehm.

Black-bellied Plover.

Charadrius helveticus, KIRTLAND, Ohio Geolog. Surv., 1838, 165, 185.

Squatarola (error) *helvetica*, WHEATON, Ohio Agric. Rep. for 1860, 368; Reprint, 1861, 10.

Squatarola helvetica, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin.

Soc. Nat. Hist., i, 1879, 181; Reprint, 15.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5.

Tringa helvetica, LINNÆUS, Syst. Nat., i, 1763, 250.

Squatarola helvetica, BREHM, V. D., 554.

Adult in breeding season (rarely seen in the United States); face and entire under parts black; upper parts variegated with black, and white or ashy; tail barred with black and white; quills dusky with large white patches. Adults at other times and young: below white more or less shaded with gray, the throat and breast more or less speckled with dusky; above blackish, speckled with white or yellowish; the rump white with dark bars, legs dull bluish. Old birds changing show every grade, from a few isolated feathers on the under parts, to numerous large black patches. Length, 11-12; wing, 7 or more; tail, 3; bill, 1-1½; tarsus, 2; middle toe and claw, 1½; hind toe, hardly ¼.

Habitat, nearly Cosmopolitan.

Rather rare spring and fall migrant. More frequently seen on the lake shore than elsewhere. Dr. Kirtland says that it is sometimes seen in company with the Kildeer. Mr. Langdon gives it as rare in the vicinity of Cincinnati, where Messrs. Dury and Freeman note its occurrence in September. I met with a single specimen here in August, 1875. Mr. Oliver Davie took a specimen in May, which was in breeding plumage, but their spring migration ordinarily takes place in April. Both these specimens were solitary birds, feeding on the gravelly shores of the Scioto River, a short distance from this city.

The Black-bellied Plover breeds in the Arctic regions, and possibly further south on the Pacific coast. The nest, like that of all members of the order, so far as known, is placed on the ground. The eggs are four, brownish-clay color, thickly marked with spots of brownish-black, larger and irregular about the greater end. They measure about 2 by 1.40 inches.

GENUS CHARADRIUS. Linnaeus.

Tarsi and naked tibiæ uniformly reticulated.

CHARADRIUS FULVUS Gm.

var. VIRGINICUS, (Borck.) Cs.

Golden Plover.

Charadrius pluvialis, KIRTLAND, Ohio Golog. Surv., 1838, 165, 184.

Charadrius virginicus, WHEATON, Ohio Agric. Rep. for 1860, 368; Reprint, 1861, 10.

Charadrius fulvus, var. *virginicus*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 181; Reprint, 15.

Charadrius fulvus, GMELIN, Syst. Nat., i, 1788, 687.

Charadrius pluvialis, WILSON, Am. Orn., vii, 1813, 71.

Charadrius virginicus, "BORCK, Mus. Berol."

Charadrius fulvus, var. *virginicus*, COUES, Key, 1872, 243.

Plumage speckled above, and in the breeding season black below, as in the last species, but much of the speckling bright yellow, and the rump and upper tail-coverts like the

back; forehead, and a broad line over the eye to the nape white; tail feathers grayish-brown, with imperfect white or ashy bars; axillars gray or ashy. At other times, the under parts nearly as in the last species. Length, 10-11; wing, 7 or less; tail, under 3; bill, 1 or less.

Habitat, Var. *fulvus*, Asia and Pacific regions generally. Prybilov Islands. Var. *virginicus*, all of North America. Greenland. Accidental in Europe.

Migrant; usually abundant in spring, common in the fall. The Golden Plover is the most abundant of the strictly migrant species of the family. In April it usually appears in flocks of from thirty to one hundred birds, in high meadows and pastures. Their flight is very swift, and the flocks are very close. All movements, when on the wing, are performed with wonderful rapidity and unanimity. They run quickly in the grass, and, while rather shy, exhibit sometimes considerable curiosity and some degree of confidence. Their voice is a pleasant mellow whistle, frequently repeated while on the wing. During the spring migration while with us they are changing from winter to breeding plumage. Generally the colors of winter predominate, but sometimes specimens are taken with the under parts nearly uniform black. In September they return in full winter plumage, and now frequent the gravelly and muddy borders of streams, sometimes in large flocks, and sometimes in pairs or as single birds, solitary or in company with Tattlers and Sandpipers. At this season their habits are less active than in spring. They are the only birds of the family whose size, abundance, and other qualities entitle them to any consideration as a game bird. As such they are generally esteemed.

The Golden Plover breeds in the Arctic regions. The nest is composed of a few leaves within a natural depression of the ground. The eggs resemble those of the preceeding species in color, but measure about 1.90 by 1.38.

GENUS ÆGIALITIS. Boie.

Front of tarsus with plates arranged vertically of which there are two or three in a transverse series.

ÆGIALITIS VOCIFERA (L.) Bonap.

Kildeer Plover.

Charadrius vociferus, KIRTLAND, Ohio Geolog. Surv., 1838, 165.

Aegialitis vociferus, WHEATON, Ohio Agric. Rep. for 1860, 368; Reprint, 1861, 10.

Aegialitis vociferus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin.

Soc. Nat. Hist., i, 1879, 182; Reprint, 16; Summer Birds, iii, 1880, 226.

Kildeer, BALLOU, Field and Forest, iii, 1878, 136.

Charadrius vociferus, LINNÆUS, Syst. Nat., i, 1776, 253.

Aegialitis vociferus, BONAPARTE, Comp. List, 1838, 45.

Aegialitis vocifera, COUES, Birds N. W., 1874, 452.

Above quaker-brown with a greenish tinge, sometimes most of the feathers tipped and edged with orange-brown; rump and upper tail coverts orange-brown; most of tail feathers white at base and tip, suffused with orange-brown in part of their length and with 1-3 black bars; secondaries mostly white, and primaries with a white space; a black bar across the crown and two black bands on the neck and breast; forehead and entire under parts except as stated white; bill black; feet pale; eyelids scarlet.

Length, 9-10 inches; wing, 6 or more; tail, $3\frac{1}{2}$ much rounded; tarsus, about $1\frac{1}{2}$.

Habitat, Temperate North America. West Indies. Central and South America in winter. Accidental in Europe.

Abundant summer resident. Breeds. Arrives during the first week in March, usually, sometimes during the latter part of February, and remains until the last of October or later. No sooner are the streams permanently open, even before the fields are free from snow, than the characteristic note, from which it takes its name, is heard. Commonly single birds are first seen flying high, afterwards they appear in pairs and soon set about breeding. They frequent both high and low grounds, pastures, fallow fields and old brick yards, as well as borders of streams. The nest is placed on the ground, usually in the vicinity of a stream or pond, and often on a elevated spot; when it is approached by man or other suspicious object, the birds manifest great alarm and anxiety, hovering overhead with shrill cries, or, if the danger is imminent, tumbling upon the ground, affecting all manner of injuries to draw the intruder away, as is the habit of many others of this order, as well as the Quail and Dove.

After the breeding season is over, both young and old collect in flocks of from ten to fifty, and seek the muddy or gravelly shores of streams, where they feed, augmenting their numbers daily until they depart for the south. At this time the note, *Kildeer, Kildeer*, is less frequently heard, unless the flock has become scattered, but a lower alarm note, a rapid *té é é é é t*, is frequently sounded as they run stiffly but swiftly over the gravel and in the shallows.

The eggs of the Kildeer are four in number, drab or clay-color rather thickly spotted and blotched with blackish-brown. The smaller end is quite pointed, as is commonly the case with birds of this order. They measure 1.50 by 1.12.

ÆGIALITIS SEMIPALMATA Bonaparte.

Semipalmated Plover; Ringneck.

Charadrius semipalmatus, KIRTLAND, Ohio Geolog. Surv., 1838, 168, 184.

Ægialitis semipalmatus, WHEATON, Ohio Agric. Rep. for 1860, 368; Reprint, 1861, 10

Ægialitis semipalmatus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 9.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 16.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5.

Charadrius semipalmatus, BONAPARTE, Obs., Wils., 1825, No. 219.

Aegialitis semipalmatus, BONAPARTE, Comp. List, 1833, 45.

Aegialitis semipalmatus, COUES, Birds, N. W., 1874, 453.

Above dark ashy-brown with an olivaceous shade; below white; very broad coronal and pectoral black bars in the adult in spring, in fall and in the young the coronal bar hardly evident, the pectoral grayish-brown; edges of eyelids bright orange; bill moderately short and stout, orange or yellow, black tipped; legs yellowish; toes conspicuously semipalmate. Length, about 7 inches; wing, $4\frac{1}{2}$; tail, about $2\frac{1}{2}$ rounded.

Having taken fall specimens with the coronal bar and pectoral band as distinct and black as in spring birds, I am of the opinion that the above description errs in regard to adults in fall.

Habitat, North America, breeding chiefly in high latitudes, wintering from our southern border to Brazil.

Not common migrant in spring, more abundant in the fall. I have seen the Semipalmated Plover in spring but on one occasion, May, 1880, when a pair, in company with Kildeers, lingered for several days about the wet places in an old brick-yard near this city. They are common and regular in the fall, however, arriving the last week of July or first of August, frequenting gravelly and muddy shores of streams in small flocks of from eight to twenty birds, or less, single birds frequently associating with Least and Semipalmated Sandpipers. Their habits resemble those of the Kildeer, and their note is a soft mellow whistle.

The eggs of this bird resemble those of the Kildeer, except in size, they measure about 1.25 by .93.

It is not unlikely the breeding range of this species will be found to extend southward farther than has been heretofore supposed. It is recorded as breeding in Massachusetts, and Mr. Nelson has found both young and old near Chicago early in July, under circumstances making it almost certain that they nested in that vicinity.

ÆGIALITIS MELODA (Ord.) Bp.

Piping Plover; Ringneck.

Charadrius melodus, KIRTLAND, Am. Journ. Sci. and Arts, xl, 1841, 24.

Aegialitis melodus, WHEATON, Ohio Agric. Rep. for 1860, 1861, 368, 377; Reprint, 10, 19.

Aegialitis melodus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 572; Reprint, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Journ. Cin. Soc. Nat. Hist., i, 1878, 116; Reprint, 7.

Aegialitis meloda, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 16.

Piping Plover, KIRTLAND, Am. Journ. Sci. and Arts, xiii, 1852, 218.

Charadrius melodus, ORD, ed. Wils. Am. Orn., v, 1812, 30.

Aegialitis melodus, BONAPARTE, Comp. List, 1838, 45.

Aegialitis meloda, COUES, Birds N. W., 1874, 455.

Above, very pale ashy-brown; the black bands narrow, often imperfect; bill colored as in the last, but shorter and stumpy; edges of eyelids colored; no evident web between

inner and middle toes, and only a slight one between middle and outer. Length, about 7 inches; wing, $4\frac{1}{2}$; tail 2.

Habitat, United States and British Provinces, east of the Rocky Mountains. Abundant along the Atlantic coast of the United States, breeding north to the St. Lawrence, and wintering from the Carolinas southward. Cuba. Bahamas. Jamaica.

Rather common spring and fall migrant, and in part summer resident on Lake Erie, not common migrant in the interior of the State. This little bird was probably first recorded as occurring inland by Dr. Kirtland, above cited. Mr. Winslow informs me that he has found them on the lake shore, where their actions indicated the immediate presence of the nest or very young birds, but he was unable to discover either. They have been found breeding on Lake Michigan, within the State of Illinois, by Mr. Nelson and others.

Mr. Ridgway describes as a geographical race of this species, var. *circumcinctus*, from the Missouri region. To this variety Mr. Nelson refers the birds taken by him in Illinois, and doubtless Ohio birds are the same. But specimens of *circumcinctus* have been taken in various localities on the Atlantic coast, and doubtless, as held by Mr. Brewster, the variety is untenable.

The eggs of the Piping Plover, are clay-colored, sparsely but uniformly dotted and speckled with blackish-brown. They measure 1.25 by 1.

FAMILY HÆMATOPODIDÆ. TURNSTONES, ETC.

Legs moderate, stout. Tarsus shorter than tail. Bill hard, more or less contracted at base, with short nasal fossæ, gonydeal angle, and ascending gonyes, the tip either compressed and truncate, or depressed and acute. Feet three-toed and with basal webbing (*Hæmatopus*), or four-toed and cleft (*Strepsilas*).

GENUS STREPSILAS. Linnæus.

Bill sharp pointed not longer than the tarsus, which is scutellate in front; four-toed with no obvious webbing; hind toe lengthened.

STREPSILAS INTERPRES (L.) Ill.

Turnstone.

Strepsilas interpres, KIRTLAND, Ohio Geol. Surv., 1838, 165, 184.—WHEATON, Ohio Agric. Rep. for 1860, 363, 377; Reprint, 1861, 10, 19; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—COUES, Birds of N. W., 1874, 459.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1870, 184; Reprint, 16.

Tringa interpres, LINNÆUS, Fn. Suec., 63.

Strepsilas interpres, ILLIGER, Prod., 1811, 263.

Adult in summer pied above with black, white, brown and chestnut red, the latter color wanting in winter and in young birds; below from the breast (which is more or less completely black) throat, most of the secondaries, bases of the primaries, and bases

and tips of the tail feathers white; bill black; feet orange; length, 8-9 inches; wing, $5\frac{1}{2}$ -6; tail, $2\frac{1}{2}$; bill, $\frac{3}{4}$, almost recurved; tarsus, 1; tibiae bare but a little way.

Habitat, sea coasts of nearly all countries. Less frequent in the interior.

Not common migrant on the shores of Lake Erie; rare in other portions of the State.

The Turnstone, of which Audubon in 1838, said, "never in the interior," was the same year, stated to visit the shores of Lake Erie by Dr. Kirtland. It has been occasionally taken in the vicinity of Cleveland, by Mr. Winslow and others. Judge Potter, of Toledo, informs me that a considerable flock appeared, several year since, in the vicinity of that city, several being secured by a sportsman, most of which were preserved by him. Mr. Langdon gives it in his list, it having been identified by Dr. Haymond, in Indiana, near Cincinnati. I have never seen it alive, or from this vicinity.

The Turnstone is not known to breed within the limits of the United States, at least in the interior. Mr. Sinnett, observed them on the coast of Texas in the breeding season, and believes them to breed there. The eggs are described as of an olive-green ground-color, with brown spots.

FAMILY RECURVIROSTRIDÆ. STILTS AND AVOCETS.

Legs extremely long; the tarsus equalling or exceeding the tail, and feet either four-toed and palmate (*Recurvirostra*) or three-toed and semipalmate (*Himantopus*); with the bill much longer than the head, very slender, acute, and curved upward.

GENUS RECURVIROSTRA. Linnæus.

Toes 4, full webbed; bill decidedly recurved, flattened, tapering to a very sharp point; body depressed, plumage underneath thickened as in water birds.

RECURVIROSTRA AMERICANA Gm.

Avocet.

Recurvirostra americana, KIRTLAND, Ohio Geolog. Surv., 1837, 166, 185.—WHEATON, Ohio Agric. Rep. for 1860, 368, 377; Reprint, 1861, 10, 19; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 16.

Recurvirostra americana, GMELIN, Syst. Nat., i, 1788, 693.

White; back and wings with much black; head and neck cinnamon-brown in the adult, ashy in the young; bill black, $3\frac{1}{2}$ to gape; legs blue; eyes red. Length, 16-18; wing, 7-8; tail, $3\frac{1}{2}$; tarsus, $3\frac{1}{2}$.

"The young Avocet has the head and neck white, with an ashy or plumbeous shade, instead of chestnut or cinnamon-red. In this condition it constitutes the *R. occidentalis* of authors. Of the adult, the bill is black; the iris, bright red; the legs and feet clear,

pale blue, with part of the webs flesh-colored. The plumage is white, changing, to cinnamon or chestnut on the neck and head; the back, wing-coverts, and primaries black, contrasting with the white of the scapulars and rump. In size the bird is extremely variable; perhaps seventeen inches in total length by thirty in extent represents average measurements. Contrary to the rule among waders, the female is smaller than the male." (Cones, Birds N. W., 462.)

Habitat, United States and British Provinces. North to the Saskatchewan and Great Slave Lake. Rare or casual in New England. Breeds throughout. Winters on our southern border and beyond (to Guatemala).

Extremely rare visitor; the only record of its occurrence is that of Dr. Kirtland, who says: "This unique bird has been killed by sportsmen in the vicinity of Cincinnati."

Dr. Coues gives the following general account of their habits, and of his observations of them on the plains in June, 1864:

"In the United States and northward the Avocet is chiefly a summer visitor, entering our limits from the South in spring, though many winter along our border. A part of the birds scatter over the United States, and others go farther north, to breed; for they raise their young with equal facility from the latitude of the Middle States—or even further south, especially in the West—to that, for instance, of Great Slave Lake."

"The Avocets were in full plumage, with the head and neck cinnamon color; and, from their actions, I had no doubt they had nests somewhere about the ponds. They were quite gentle and familiar, and not at all disturbed by my approach, displaying a characteristic of theirs during the breeding season, at least in regions where they are not often molested, and have, therefore, not learned a wholesome dread of man. They walked leisurely about, up to the belly in the water, with graceful, deliberate steps, each of which was accompanied by a swaying of the head and neck, as usual with birds of similar form. When approached too closely, they rose lightly from the water, uttering their peculiar cries, flapped leisurely to a little distance, and again alighted to pursue their peaceful search for food, forgetting, or at least not heeding, their recent alarm. As they rose from the water, their singular, long legs were suffered to dangle for a few moments, but were afterward stretched stiffly backward, as a counterpoise to their long necks; and, thus balanced, their lithe bodies were supported with greatest ease by their ample wings. When about to realight, they sailed without flapping for a little distance, just clearing the water, their legs again hanging loosely; as they touched the ground, their long wings were held almost upright for an instant, then deliberately folded and settled in place with a few slight motions."

The eggs of the Avocet are described as varying in ground-color from dark-olive to buff, uniformly spotted with chocolate-brown and neutral tint. They measure about 2.00 by 1.40.

GENUS *IMANTOPUS* Brisson.

Hind toe absent; anterior toes semipalmate; bill nearly straight, not flattened.

HIMANTOPUS NIGRICOLLIS V.

Stilt.

Himantopus nigricollis, WHEATON, Ohio Agric. Rep. for 1860, 380 (probable), 480; Reprint, 1861, 10; Food of Birds, etc, Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 16.

Himantopus nigricollis, VIELLOT, Nouv. Dict. d'Hist. Nat., x, 1817, 42.

Glossy-black above; forehead, sides of head and neck, rump and under parts white; tail white or ashy; bill black; legs carmine; young with back and wings brown. Length, 13-15; wings, 8-9; tail, 3; tarsus, 4.

Habitat, United States generally. Mexico, part of West Indies, Central America, and South America to Peru and Brazil.

Rare summer visitor. Perhaps breeds. The Stilt has been repeatedly taken on Lake Erie, as I am informed by Mr. Winslow. Mr. Langdon notes a specimen from near Cincinnati on the authority of Mr. Dury. I have never met with it, though birds answering to its description have been reported as occurring here.

Dr. Coues gives the following description of their habits and eggs:

"Avocets and Stilts correspond with each other in habits as closely as they do in form. One of the most marked physical differences is found in the structure of the feet. Avocets have a hind toe, which the Stilts have not, and their feet are almost completely webbed, so that they are among the best swimmers of the long-legged fraternity. Stilts, on the contrary, scarcely swim at all, and never except on an emergency. When the Avocets are wading about, it often happens that they get beyond their depth, when, instead of rising on wing, they keep on as if nothing had happened to take them off their feet. If they are wounded, they sometimes escape by diving as well as swimming."

"The wings of the Stilt are very long and pointed, as well as ample in width; its flight, in consequence, is firm, vigorous, and swift. When folded they reach beyond the tip of the tail, and as the under-coverts reach to the end, the bird tapers off behind to a fine point. The black shorter quills and secondaries meet across the back, hiding the white rump and tail. On the ground, whether walking or wading, the bird moves gracefully, with measured steps; the long legs are much bent at each step (only at the joint, however!), and planted firmly, perfectly straight; excepting under certain circumstances, as those Wilson narrates, there is nothing vacillating, feeble or unsteady, either in the attitudes or movements of the birds. When feeding, the legs are bent backward with an acute angle at the heel-joint, to bring the body lower; the latter is tilted forward and downward over the centre of equilibrium, where the feet, and the long neck and bill reach the rest of the distance to the ground. Its food consists of aquatic insects of all sorts, probably also of the ova or smallest fry of fish, and various kinds of lacustrine vegetation; in seeking it, the whole head is frequently immersed in the water. The eggs appear very large for the size of the bird; they are pyriform in shape, broad at one end and pointed at the other; four constitute a nest-full. But both size and shape vary a good deal. Two specimens I selected as representing the extremes in a large series measured, respectively, 1.85 by 1.15, and 1.70 by 1.25; the former being long and narrow, the latter short and comparatively blunt. The color is dark ochraceous,

or pale brownish-olive, blotched all over with spots and splashes of brown and blackish-brown, of irregular size and shape."

FAMILY PHALAROPODIDÆ. PHALAROPES.

General characters of *Scolopacidae*. Body depressed; the under plumage thickened and duck-like. Toes lobate. Tarsi compressed. Habits natatorial.

GENUS STEGANOPUS. Vieillot.

Membranes of toes straight-edged; bill very slender, awl-shaped, longer than the head.

STEGANOPUS WILSONI (Sab.) Cs.

Wilson's Phalarope.

Phalaropus wilsoni, KIRTLAND, Ohio Geolog. Rep., 1838, 165, 185.—WHEATON, Ohio Agric. Rep. for 1860, 363, 377; Reprint, 1861, 10, 19.

Steganopus wilsonii, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.

Steganopus wilsoni, LANGDON, Cat. Birds of Cin., 1877, 12; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.

Wilson's Phalarope, KIRTLAND, Fam. Visitor, i, 1850, 164.

Phalaropus wilsoni, SABINE, App. Franklin's Journ., 1823, 691.

Steganopus wilsoni, COUES, Ibis, Apl., 1865.

Adult ashy; upper tail-coverts and under parts white; a black stripe from the eye down the side of the neck spreading into rich purplish-chestnut, which also variegates the back and shades the throat; young lacking these last colors. Length, 9-10; wing, 5; tail, 2; bill, tarsus and middle toe, each over 1, black.

Habitat, United States and British Provinces, generally. North to the Saskatchewan. Rare or casual in the Eastern United States. Common in the Mississippi Valley and westward. Breeds in Western United States and in the interior of the fur countries in the lower latitudes. Mexico, Central and South America, in winter.

Not common spring and fall migrant. Probably breeds in Northwestern Ohio. Dr. Kirtland notes the visit of a flock to Mill Creek, in Trumbull county. It is reported by Mr. Winslow as having been repeatedly taken in the vicinity of Cleveland. It is not included in Mr. Langdon's last list, though I have been informed that it has been taken in the vicinity of Cincinnati. I have never seen it in this vicinity. It is a common summer resident in Northern Indiana (*Brayton*), abundant in Northern Illinois, and undoubtedly is a not uncommon resident throughout the summer in some localities in Northwestern Ohio.

To Mr. E. W. Wilson, we are indebted for the most complete biography of this bird yet written. I quote from his paper in Bull. Nutt. Orn. Club, i, 1877, 58:

"In Northern Illinois, where the following observations were made, Wilson's Phalarope is the most common summer resident, occurring about grassy marshes and low prairies

and is not exceeded in numbers by even the ever-present Spotted Sand-piper. As is the case with several other species of birds, Lake Michigan appears to form a limit to its common occurrence in the eastern portion of its range. On the west it extends to the Rocky Mountains, and between these limits it has been recorded during the breeding-season from the Saskatchewan to the Arkansas (Cones) and to the city of Mexico (Nuttall). It is more closely confined to its favorite haunts than most water-birds, and this may, in a measure, account for the little hitherto known regarding its habits. During the first two weeks of May, the exact date varying with the season, this beautiful bird first makes its appearance in Northeastern Illinois. Its arrival is heralded by a few females, which arrive first, and are found singly about the marshes. At this time the females have a peculiar harsh note, which I have heard but a few times, and only from solitary individuals before the arrival of the main body.

A few days later small flocks, embracing both sexes, may be found along the borders of grassy pools, or lying at midday on the sunny side of some warm knoll in the marsh. As the breeding-season approaches they become more restless, flying from place to place, and finally separate into small parties of two or three pairs. About the middle of May their love-making commences, and is at first indicated by the increasing solicitude they show for each other's welfare. The appearance of a person in their vicinity at this time is the signal for all the birds near to come circling about, though generally not within easy gunshot. By a careful approach one may now and then find a small party swimming about in some secluded pool. The charming grace of movement exhibited at such times, combined with their tasteful elegance of attire, form one of the most pleasing sights one could witness, as they swim buoyantly from side to side of the pool, gracefully nodding their heads; now pausing an instant to arrange a feather, or to daintily gather some fragment of food, and now floating idly about, wafted by the slight breeze which at intervals ripples the surface of the water. A more common, but scarcely less pleasing sight is presented when, unconscious of observation, they walk sedately along the border of the water, never departing from their usual easy grace of movement. Their food is generally found in such places, where the receding water furnishes a bountiful supply. The only demonstrations I have observed during the pairing-time consist of a kind of solemn bowing of the head and body; but sometimes, with the head lowered and thrust forward, they will run back and forth in front of the object of their regard; or again a pair may often be seen to salute each other by alternately bowing or lowering their heads; but their courtship is characterized by a lack of the rivalry and vehemence usually exhibited by birds. A male is often accompanied by two females at first, but as soon as his choice is made the rejected bird joins her fortunes with some more impressible swain.

The nesting-site is usually in some thin tuft of grass on a level spot, but often in an open place concealed by only a few straggling blades of small *carices*. The male scratches a shallow depression in the soft earth, which is usually lined with a thin layer of fragments of old grass blades, upon which the eggs, numbering from three to four, are deposited about the last of May or first of June. Owing to the low situations in which the nests are placed, the first set of eggs is often destroyed by a heavy fall of rain, causing the water to rise so as to submerge the nest. In this case the second set, numbering two or three, are often deposited in a depression scratched in the ground, as at first, but with no sign of any lining. Accidents of this kind caused the second set of eggs to be sometimes deposited as late as the last of June.

The young usually appear about the third week of June, and are able to fly in about three weeks. Generally a number of pairs nest upon the same marsh. In some in-

stances as many as fifty may be counted within the radius of a mile ; but, notwithstanding this, their nests are extremely difficult to discover, the material and the color of the eggs correspond so closely to the appearance of the surrounding surface. If they are disturbed while building, the nest is usually abandoned. Incubation is attended to by the male alone. The female, however, keeps near, and is quick to give the alarm upon the approach of danger. The females are frequently found at this time in small parties of six or eight ; and should their breeding-ground be approached, exhibit great anxiety, coming from every part of the marsh to meet the intruder, and, hovering over his head, utter a weak nasal note, which can be heard to only a short distance. This note, which is possessed by both sexes, is nearly always made while the birds are in the air, and its production requires apparently considerable effort ; the head and neck being inclined downward, and then suddenly raised as the note is uttered, the flight being at the same time momentarily checked. The movements of the birds usually render it an easy matter to decide whether or not they have nests in the immediate vicinity. After the first alarm, those having nests at a distance disperse, while the others take their course in the form of an ellipse, sometimes several hundred yards in length, with the object of their suspicion in the centre ; and, with long strokes of their wings, much like the flight of a Kildeer, they move back and forth. As their nests are approached the length of their flight is gradually lessened, until at last they are joined by the males, when the whole party hover low over the intruder's head, uttering their peculiar note of alarm. At this time they have an ingenious mode of misleading the novice, by flying off to a short distance and hovering anxiously over a particular spot in the marsh, as though there were concealed the objects of their solicitude. Should they be followed, however, and a search be there made, the manoeuvre is repeated in another place still farther from the real location of the nest. But should this ruse prove unavailing, they return and seem to become fairly desperate, flying about one's head almost within reach, manifesting great distress. If possible, still greater agitation is shown when they have unfledged young—they even betraying their charge into the hands of the enemy by their too obvious solicitude, they then hovering directly over the young, and uttering their notes of distress. The young have a fine, wiry peep, inaudible beyond a few feet. They are very pretty little creatures, covered with yellowish-buff-colored down, with black spots on the upper surface of the body. Even when first hatched they are quite lively and difficult to capture.

About the middle of July the females suddenly disappear, and a little later the males and the young also leave, with the exception of a few stragglers, which occasionally remain until the last of August. The main portion rarely remain as late as the 10th, and are usually gone by the 5th. The males commence their fall moult before they leave ; but I have never taken a specimen in which the winter plumage was very evident."

GENUS LOBIPES. Cuvier.

Membranes scalloped ; bill very slender, awl-shaped.

LOBIPES HYPERBOREUS (L.) Cuv.

Northern Phalarope.

Phalaropus hyperboreus, KIRTLAND, Am. Journ. Sci. and Arts, xl, 1841, 21.—WHEATON, Ohio Agric. Rep. for 1860, 380 ; Reprint, 1861, 10.

Lobipes hyperboreus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572 ; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14 ; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188 ; Reprint, 22.

Tringa hyperborea, LINNÆUS, Syst. Nat., i, 1766, 249.

Phalaropus hyperboreus, LATHAM, Ind. Orn., ii, 1790, 775.

Lobipes hyperboreus, CUVIER, Reg. An., i, 1829, 532.

Adult, dark opaque-ash or grayish-black, the back variegated with tawny; upper tail-coverts and under parts mostly white; side of the head and neck with a broad stripe of rich chestnut, generally meeting on the jugulum; breast otherwise with ashy-gray; young lacking the chestnut. Length, about 7 inches; wing, $4\frac{1}{2}$; tail, 2; bill, tarsus, and middle toe each, under 1, black.

Habitat, Northern Hemisphere, penetrating to very high latitudes to breed, migratory sometimes into the tropics in winter. Generally distributed, but more particularly maritime.

Rare spring and fall migrant. Dr Kirtland, quoted on page 217, notes the capture of a pair in winter plumage on Lake Erie. Mr. Winslow and others have since taken it on the lake shore. Dr. Jasper took a pair in winter plumage on the Scioto River, in the immediate vicinity of this city, a few years since, one of which is now in my collection, the other in that of Mr. Oliver Davie.

The eggs are described as having a ground-color of various shades of brown or olive, spotted with darker-brown. They measure about 1.20 by .80.

GENUS PHALAROPUS. Brisson.

Membranes scalloped, bill comparatively stout, flattened, with lancet shaped tip.

PHALAROPUS FULICARIUS (L.) Bp.

Red Phalarope.

Phalaropus fulicarius, WHEATON, Ohio Agric. Rep. for 1860, 1861, 380 (probable); addenda, 480; Reprint, 10.—COUES, Birds of N. W., 1874, 472.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.

Lobipes (error) *fulicarius*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 572; Reprint, 12.

Tringa fulicaria, LINNÆUS, Syst. Nat., i, 1777, 249.

Phalaropus fulicarius, BONAPARTE, Journ. Philad. Acad., iv, 1825, 232.

Adult with the under parts purplish-chestnut of variable intensity, white in the young; above variegated with blackish and tawny. Length, 7-8 inches; wing, 5; tail, $2\frac{1}{2}$; bill, 1, yellowish, black-tipped; tarsus, $\frac{1}{2}$, greenish.

Habitat, essentially the same as that of *L. hyperboreus*.

Rare migrant. The Red Phalarope was named as an Ohio bird by myself in 1861, on the authority of Mr. R. K. Winslow, of Cleveland, who informed me that two or three specimens had been taken on Lake Erie. Although Mr. Langdon names it in his Catalogue, he omits it from his later List, doubtless for want of positive identification. It is named by Mr. Ridgway as a bird of Illinois, and Mr. Nelson gives it as an occasional

migrant on Lake Michigan. It appears to be more exclusively maritime than other species of this family.

The eggs of the Red Phalarope cannot with certainty be distinguished from those of the last species.

FAMILY SCOLOPACIDÆ. SNIPE, ETC.

Legs moderate. Tarsus shorter than tail, scutellate. Hind toe present (except in *Calidris*). Bill long, equalling, or often exceeding, frequently several times longer than the head, softish and membranous to the very tip, without constriction in its continuity; straight or variously curved.

GENUS PHILOHELA. Gray.

Wing short; first three primaries attenuate; tail feathers 12; tibiae feathered to the joint; tarsi shorter than the middle toe; toes slender, unwebbed; bill much longer than the head, stout and deep at base, grooved nearly the whole length, the tip knobbed; gape very short and narrow; ear under the eye, which is set in the upper back corner of the head.

PHILOHELA MINOR (Gm.) Gr.

American Woodcock.

Scolopax minor, KIRTLAND, Ohio Geolog. Surv., 1833, 165.

Philohela minor, WHEATON, Ohio Agric. Rep. for 1860, 363; Reprint, 1861, 10; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 16; Summer Birds, ib., iii, 1880, 226.

Woodcock, CHUBB, Forest and Stream, xiv., 1880, 307.

Scolopax minor, GMELIN, Syst. Nat., i, 1788, 661.

Philohela minor, GRAY, Gen. of Birds, 1849.

Above variegated and harmoniously blended black, brown, gray and russet; below pale warm brown of variable shade. Length, male, 10-11; female, 11-12; extent, 16-18; wing, 4½-5; bill, 2½-3; tarsus, 1½; middle toe and claw, 1½; weight, 5-9 ounces.

Habitat, Eastern United States and British Provinces. North to Nova Scotia and Canada. Northwest to Fort Rice, Dakota. West to Kansas and Nebraska.

Very common summer resident from March to October. Breeds.

The Woodcock, one of the most, if not the most highly esteemed of our game birds, may be found at almost any season of the year when the ground is not frozen. I have seen them the first of March, when the ground was covered with snow, turning over the wet leaves in high woodlands. Also in the latter part of November when the ground was frozen hard except about boggy springs, where they lingered probing the moist earth for insects. On their arrival in spring they appear to be already mated. Mr. Chubb has seen the young at Cleveland on April 9. Some, however, are not hatched until the middle of May.

The Woodcock, during the breeding season, frequents dense woods, and swampy thickets, more rarely high woods, even hill sides, but in this case in the vicinity of water. After the breeding season they are often found in more open wet places, especially at night, for their habits are quite nocturnal. Corn-fields, pastures and commons with a rich loamy soil are favorite places of resort after sunset.

When disturbed from the nest or the young are endangered, the parent exhibits remarkable sagacity in attracting attention to herself and from the objects of her affection, and feigns lameness in limb and wing, often leading the observer to a hopeless and comical pursuit.

The nest of the Woodcock is placed upon the ground, at the root of a tree, in a clump of weeds, or without any attempt at concealment, in retired woodland. It composed of a few dead leaves. The eggs are four in number, light grayish-brown with brownish blotches and shading; they measure 1.50 by 1.15.

GENUS GALLINAGO. Leach.

Bill much longer than the head, straight, soft to the end where it is somewhat widened and grooved on top; gape short and narrow; ear under eye; tibiae feathered nearly to the joint; tarsus a little shorter than the middle toe and claw; toes unwebbed.

GALLINAGO WILSONI (Temm.) Bp.

American Snipe: Wilson's Snipe.

Scolopax wilsonii, KIRTLAND, Ohio Geolog. Surv., 1838, 165.

Gallinago wilsonii, WHEATON, Ohio Agric. Rep. for 1860, 368; Reprint, 1861, 10; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Summer Birds, Journ. Cin. Soc. Nat. Hist. iii, 1880, 226.

Gallinago wilsoni, LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 16.

Snipe, CHUBB, Forest and Stream, xiv, 1880, 307.

Scolopax wilsoni, TEMMINCK, Pl. Color., v, *litr.* lxviii.

Gallinago wilsoni, BONAPARTE, Comp. List, 1838, 52.

Crown black with a pale middle stripe; back varied with black, bright bay and tawny, the latter forming two lengthwise stripes on the scapulars; neck and breast speckled with brown and dusky; lining of wings barred with black and white; tail, usually of 16 feathers, barred with black, white and chestnut; sides waved with dusky; belly dull white; quills blackish, the outer white-edged. Length, 9-11; wing, $4\frac{1}{2}$ - $5\frac{1}{2}$; bill, about $2\frac{1}{2}$; whole naked portion of leg and foot, about 3.

Habitat, the whole of North America, and southward to South America. Mexico. West Indies. Breeds from Northern New England northward.

Abundant spring and fall migrant in March, April and often in May, September, October. Occasional summer resident in Northern Ohio, though no authentic instances of its breeding have been recorded.

This well-known game bird is a regular migrant, often in great num-

bers, especially in spring. It frequents low open places, such as wet meadows and marshes, and muddy banks of streams.

They are found in small companies of from three to twelve, technically called "wisps." Solitary birds are not unfrequently met with.

No other game birds, are more erratic and eccentric than these. They are extremely fickle in the choice of their feeding ground; one day they may swarm in a certain locality, and the next none are to be discovered. Their flight is strong, but, especially at the beginning, erratic. They almost invariably fly against the wind, and lie closest on clear still days. Occasionally they alight on trees or fences. Their note, uttered as they rise, resembles the word "escape."

The nest of the Snipe, as of all others of this family so far as known, is placed on the ground. The eggs, three or four in number, measure about 1.55 by 1.10. They are grayish-olive blotched with dark-brown, sometimes with lines of blackish.

GENUS MACRORHAMPHUS. Leach.

Bill as in *Gallinago*; legs long; tibia bare upwards of three-quarters of an inch; tarsus longer than the middle toe and claw; outer and middle toes connected by an evident membrane; tail feathers 12.

MACRORHAMPHUS GRISEUS (Gm.) Leach.

Red-breasted Snipe.

Scolopax grisea, KIRTLAND, Ohio Geolog. Surv., 1838, 165.

Macrorhamphus (error) *griseus*, WHEATON, Ohio Agric. Rep. for 1860, 1861, 368, 480; Reprint, 10; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 572; Reprint, 12.

Macrorhamphus griseus, LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 16.

Macrorhamphus (error) *griseus*, var. *scolopaceus*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 572; Reprint, 12.

Scolopax grisea, GMELIN, Syst. Nat. i, 1788, 658.

Macrorhamphus griseus, LEACH, Cat. Brit. Mus., 1816, 31.

Tail and its coverts, at all seasons, conspicuously barred with black and white (or tawny), lining of wings and axillars the same; quills dusky, shaft of first primary, and tips of the secondaries, except long inner ones, white; bill and feet greenish-black. In summer, brownish-black above, variegated with bay; below brownish-red, variegated with dusky; a tawny superciliary stripe, and a dark one from the bill to the eye. In winter plain gray above, and on the breast, with few or no traces of black and bay, the belly, line over eye and under eyelid white. Length, 10-11; wing, 5-5½; tail, 2½; bill, about 2½; tarsus, 1½; middle toe and claw, 1½. A variety of this bird (*M. scolopaceus*, Lawrence) is almost a foot long, the bill upward of three inches.

Habitat, the whole of North America. Greenland. Mexico. West Indies. Central America. Much of South America. Brazil. Breeds in high latitudes. Chiefly migratory in the United States. Winters in the South, and beyond, as above. Of frequent occurrence in Europe.

Not common migrant. The Red-breasted Snipe is named by Dr. Kirtland without comment, and given by Mr. Langdon as a rare spring and fall migrant. I have never met with it in this vicinity.

This bird, which greatly resembles the Common Snipe in structure and general appearance, differs from it in habit. It is described as migrating in flocks, often of large size, and as being so unsuspicious as to allow a near approach.

The eggs of this bird resemble those of the Common Snipe so closely as not to be with certainty distinguished. They average about 1.62 by 1.12. It is known to breed only in high latitudes.

GENUS MICROPALAMA. Baird.

Bill much as in *Gallinago*, but shorter; less widened at the end, and less distinctly furrowed above, sometimes perceptibly curved; legs very long; tibia bare an inch; tarsus as long as the bill; feet semipalmate; tail feathers 12.

MICROPALAMA HIMANTOPUS (Bp.) Bd.

Stilt Sandpiper.

Micropalama (error) *himantopus*, WHEATON, Ohio Agric. Rep. for 1860, 380, 480; Reprint, 1861, 11.

Micropalama himantopus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 22.

Tringa himantopus, BONAPARTE, Ann. Lyc. N. Y., ii, 1826, 157.

Micropalama himantopus, BAIRD, Birds N. A., 1858, 726.

Adult in summer, above blackish, each feather edged and tipped with white and tawny or bay, which on the scapulars becomes scalloped; auriculars chestnut; a dusky line from bill to eye, and a light reddish superciliary line; upper tail coverts white with dusky bars; primaries dusky with blackish tips; tail feathers ashy-gray, their edge and a central field white; under parts mixed reddish, black, and whitish, in streaks on the jugulum, elsewhere in bars; bill and feet greenish-black. Young and adult in winter, ashy-gray above, with or without traces of black and bay, the feathers usually with white edging; line over the eye and under parts white; the jugulum and sides suffused with the color of the back, and streaked with dusky; legs usually pale. Length, 8-9 inches; wing, 5; tail, 2½; bill and tarsus, both 1½-1¾; middle toe, 1.

Habitat, North America generally. Not observed west of the Rocky Mountains. Rare in the United States. West Indies. Central America and most of South America.

Very rare migrant. The Stilt Sandpiper was given as a bird of Ohio by me in 1861, on the authority of Mr. R. K. Winslow, who informed me that specimens had been taken on Lake Erie, where it was very rare. Mr. Ridgway gives it as a bird of Illinois, and Mr. Nelson mentions two specimens on Lake Michigan, near Chicago.

No description of their nesting or eggs is known to me.

GENUS EREUNETES. Illiger.

Bill, tarsus and middle toe with its claw, about equal, but bill very variable and apt to be shorter; feet semipalmate; tail doubly emarginate the central feathers projecting.

EREUNETES PUSILLUS (L.) Cass.

Semipalmated Sandpiper.

Ereunetes petrificatus, WHEATON, Ohio Agric. Rep. for 1860, 369; Reprint, 1861, 11.

Ereunetes pusillus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Journ. Cin. Soc. Nat. Hist., i, 1878, 116; Reprint, 7; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 16.

Ereuntes (error) *pusillus*, LANGDON, Cat. Birds of Cin., 1877, 14.

Tringa pusillus, LINNÆUS, Syst. Nat., i, 1766, 252.

Ereunetes petrificatus, ILLIGER, Prod., 1811, 262.

Ereunetes pusillus, CASSIN, Birds N. Am., 1858, 724.

Adult in summer: above variegated with black, bay and ashy or white, each feather with a black-field, reddish edge and whitish tip; rump and upper tail coverts, except the lateral ones, blackish; tail feathers ashy-gray, the central darker; primaries dusky, the shaft of the first white; a dusky line from the bill to the eye, and a white superciliary line; below, pure white, usually rufescent on the breast, and with more or less dusky speckling on the throat, breast and sides, in young birds usually wanting; in winter the upper parts mostly plain ashy-gray; but in any plumage and under any variation the species is known by its small size and semipalmated feet. Length, $5\frac{1}{2}$ – $6\frac{1}{2}$ inches; wing, $4\frac{1}{2}$ – $3\frac{3}{4}$; tarsus, and middle toe and claw, about 1; bill variable from $\frac{1}{2}$ to $1\frac{1}{2}$, averaging, $\frac{3}{4}$.

Habitat, the whole of North and Central, and most of South America. West Indies.

Very common spring and fall migrant in May, August and September.

The Semipalmated Sandpiper is a regular migrant in this vicinity, though more abundant in the fall than in spring. They usually appear in small flocks of from eight to twenty birds, and frequent the gravelly and sandy shores of streams or muddy banks of ponds. They are rather more shy than the next species, which they greatly resemble, and with which they are usually confounded under the common name of "Peeps."

The Semipalmated Sandpiper breeds only in high latitudes. The eggs are four, measuring about 1.22 by .83. Their ground-color is a variable shade of drab, dotted and blotched with dark brown.

GENUS TRINGA. Linnæus.

Bill averaging about as long as the head, never twice as long; toes unwebbed; hind toe present; tail without bars.

(Sub-genus *Actodromas*—Bill, tarsus, and middle toe with claw of about equal length; tibiæ naked below.)

TRINGA MINUTILLA V.

Least Sandpiper.

Tringa wilsonii, KIRTLAND, Ohio Geolog. Surv., 1833, 165.—WHEATON, Ohio Agric. Rep. for 1860, 369; Reprint, 1861, 11.

Tringa minutilla, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 16; Summer Birds, ib., iii, 1880, 226.

Tringa minutilla, VIEILLOT, Nouv. Diet. d'Hist., Nat., xxxiv, 1819, 452.

Tringa wilsoni, NUTTALL, Man., ii, 1834, 121.

Upper parts in summer with each feather blackish centrally, edged with bright bay, and tipped with ashy or white; in winter and in the young simply ashy; tail feathers gray with whitish edges, the central blackish, usually with reddish edges, crown not conspicuously different from hind neck; chestnut edgings of scapulars usually scalloped; below white, the jugulum with dusky streaks and an ashy or browish suffusion; bill black; legs dusky greenish. Smallest of the Sandpipers; length, 5½–6 inches; wing, 3½–3¾; tail, 2 or less; bill, tarsus and middle toe with claw, about ¾.

Habitat, North, Central and South America, and West Indies. Accidental in Europe.

Migrant, not common in spring, abundant in the fall. In this vicinity the Least Sandpiper is of rather rare occurrence in small flocks in spring, but in the fall they are more abundant than the last species. I have never seen them in the winter plumage as above described. They arrive a few days earlier than their Semipalmated cousins, and depart for the south sooner. But they have the same habits, frequent the same localities, and flocks of birds are often composed of both species. When this is the case, the Semipalmated Sandpipers even if largely in the minority, take the lead, as their somewhat larger size, stronger flight and louder note fit them for doing.

When not in company with other species none of our shore birds are more confiding and unsuspecting than these, considerable flocks continuing their search for food almost under the feet of the observer.

The Least Sandpiper breeds from Canada northward, and has been found nesting in the vicinity of Chicago, Illinois, by Mr. E. W. Nelson.

TRINGA BAIRDII COUES.

Baird's Sandpiper.

Tringa bairdii, WHEATON, Food of Birds, etc., Ohio Agric. Rep., for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5.

Actodromas bairdii, COUES, Proc. Phila. Acad., 1861, 194.

Tringa bairdii, SCLATER, P. Z. S., 1867, 332.

“Adult male: bill wholly black, small and slender, slightly shorter than the head, just as long as the tarsus or as the middle toe and claw, slightly expanded or lancet shaped

at the end, the point acute; grooves long, narrow, deep; feathers on side of lower mandible evidently reaching further than those on upper. Upper parts brownish-black (deepest on the rump and middle upper tail-coverts, and lightest on the neck behind), each feather bordered and tipped with pale brownish-yellow, the tipping of the scapulars broadest and nearly white, their marginings broad and brightest in tint, making several deep ecallops toward the shafts of the feathers. Only the outer series black, the others plain gray, with paler margins. Jugulum tinged with light, dull yellowish-brown, spotted and streaked with ill-defined blackish markings, as are also the sides under the wings. Throat and the other under parts white, unmarked. Feet black, like the bill. Length, 7.25; extent, 15.25; wing, 4.90; bill, .85; tarsus, and middle toe and claw, the same. The female is entirely similar, but slightly larger. The *young* have the upper parts wholly light brownish-ash, darker on the rump, and all the feathers with a dark field, and pale or whitish edging; waves of brownish-black on the scapulars. Jugulum and breast suffused with dull, light reddish-brown; the spotting small, sparse, and very indistinct.

T. fuscicollis is a little larger, on an average; the bill noticeably stouter, flesh-colored at base below; the feathers on the sides of the lower mandible do not extend noticeably beyond those on the upper; the scapular edging is bright chestnut; the jugulum is white, or barely perceptibly ashy with numerous narrow, distinct streaks; and the upper tail-coverts are white. *T. bairdii* is exactly intermediate in size between *T. maculata* and *T. minutilla*, and is almost identical with the latter in pattern of coloration, but the markings upon the breast are not thick and heavy, and the edging of the scapulars not bright chestnut. The species scarcely requires comparison with *maculata*; the latter is much larger; it differs in the colors and proportions of the bill; the pattern (plain, unscaloped) of coloration of the scapular edgings, the abrupt transition from the color of the crown to that of the hind neck; the heavy pectoral markings, etc. *T. bairdii*, like all its allies, is subject to a partially melanotic condition of plumage." (Coues.)

Habitat, North America, chiefly in the interior. Rare on the Atlantic coast. Mexico. Central and South America. Africa (Layard).

Rare spring and fall migrant in March, September, and October. None of our Shore-birds seem to have had as much difficulty in placing themselves in the proper light before ornithologists as this. It was unknown until within the last thirty years, and when discovered, and for sometime after, confounded with other species. Dr. Coues first gave it rank and name in 1861.

I am quite certain that I met with this species in March, 1857, and took one specimen, firing, at long range, into the largest flock of Sandpipers I ever beheld, as they rose from the borders of a pond in a corn-field. Since which time I have taken a single specimen in September, on the gravelly shores of the Scioto river in the immediate vicinity of this city. This bird was in the company of Semipalmated Plovers and Least Sandpipers. Mr. Oliver Davie has a specimen taken in the same locality in the following October. Mr. Winslow has a specimen taken near Cleveland, and Messrs. Dury and Freeman note one specimen, October, 27, 1878, at Cincinnati.

Baird's Sandpiper is only known to breed in the Arctic regions. The eggs are clay-colored, spotted with umber-brown. They measure about 1.30 by .90.

TRINGA MACULATA Vieillot.

Pectoral Sandpiper.

Tringa maculata, WHEATON, Ohio Agric. Rep. for 1860, 369; Reprint, 1861, 11; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 15.

Tringa maculata, VIEILLOT, Nouv. Dict. d'Hist. Nat., xxxiv, 1819, 465.

Coloration much as in last species, but crown noticeably different from cervix; chestnut edging of scapulars straight-edged; chin whitish, definitely contrasted with the heavily ashy-shaded and sharply dusky-streaked jugulum. Large. Length, 8½-9 inches; wing, 5-5½; bill, tarsus and middle toe with claw, about 1½; bill and feet greenish.

Habitat, North, Central and South America. West Indies. Greenland. Europe.

Very common spring and fall migrant, apparently most numerous in spring. Arrives in March and returns in September, October and November. It is frequently seen in large flocks in spring, but oftener in small companies, or sometimes single birds. At this time it frequents wet corn-fields and meadows. In the fall solitary individuals are the only ones I have observed frequenting the shores of streams and ponds, often associating with the smaller species of this and the preceeding family. It is generally a shy and suspicious bird, and is said to have some of the desirable qualities of a game bird, especially as it will lie to a dog better than most species of this family.

Spring specimens differ somewhat in plumage. In addition to birds as above described, I have taken specimens after the middle of April in which the bay skirting of the feathers is broadly replaced by ashy except on the innermost scapulars, while birds earlier in the season presented the normal coloration.

TRINGA FUSCICOLLIS Vieillot.

White-rumped Sandpiper.

Tringa bonapartii, WHEATON, Ohio Agri. Rep. for 1860, 369; Reprint, 1861, 11.

Tringa bonapartei, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 14.

Tringa fuscicollis, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22; Field Notes, ii, 1880, 127.

Tringa fuscicollis, VIEILLOT, Nouv. Dict. d'Hist. Nat., xxxiv, 1819, 461.

Tringa bonapartii, SCHLAGEL, Rev. Crit. Ois., Eur., 1844, 89.

Size, medium. Upper tail-coverts white; feet black; bill black, light colored at base below; coloration otherwise much as in the preceeding species. An ashy wash on the

jugulum is hardly perceptible except in young birds, and then it is slight; the streaks are very numerous, broad and distinct, extending as specks nearly or quite to the bill, and as shaft lines along the sides.

Habitat, North America, east of the Rocky Mountains. Not observed in Alaska. Breeds in the far North. Migratory through the United States, in the eastern Province. Winters in the Southern States. Greenland. West Indies. Central and South America. Europe, rarely.

Not uncommon spring and fall migrant on Lake Erie, rare in the interior of the State. The White-rumped Sandpiper was given as an Ohio bird by me in 1861, on the authority of Mr. Winslow. I have met with it but once, in a locality known as the "Broom corn fields," near Shadeville, in this county, late in October, 1875, and Mr. Langdon notes two specimens taken near Cincinnati, September 6, 1879.

No reliable description of their nest and eggs is known to me.

(Sub genus *Arquatella*. Tarsus shorter than middle toe; tibiæ feathered.)

TRINGA MARITIMA Brunnich.

Purple Sandpiper.

Tringa maritima, WHEATON, Ohio Agric. Rep. for 1860, 380 (probable); addenda, 480; Reprint, 1861, 10; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.

Tringa maritima, BRUNNICH, Orn. Bor., 1764, 54.

Bill little longer than the head, much longer than the tarsus, straight or nearly so; tibial feathers long, reaching to the joint; though the legs are really bare a little way above; adult, above ashy-black with purplish and violet reflections, most of the feathers with pale or white edgings; secondaries mostly white; line over eye, eyelids and under parts white, the breast and jugulum a pale cast of the color of the back, and sides marked with the same. In winter, and most immature birds, the colors are similar but much duller; very young birds have tawny edgings above, and are mottled with ashy and dusky below. Length, 8-9 inches; wing, 5; tail, $2\frac{3}{4}$, rounded; bill, $1\frac{1}{4}$; tarsus, $\frac{3}{4}$; middle toe, 1, or a little more.

Habitat, North America, northerly and chiefly coastwise. South to the Middle States in winter. Great Lakes. Greenland. Europe. Asia.

Very rare visitor on Lake Erie. Mr. Winslow informed me that a specimen was taken, many years since, in the vicinity of Cleveland, which was preserved in the Museum of the Cleveland Academy of Natural Sciences. Mr. Ridgway in 1874, gives it as a bird of Illinois, and Dr. Coues says "it is said to be common on Lake Michigan." This is probably a mistake, for Mr. Nelson in 1876, gives as the only instance of its occurrence known to him, a single male, in the collection of Dr. J. W. Velie, taken on the lake shore near Chicago, November 7, 1871. Dr. Hoy

met with it in Western Missouri. No other record of its occurrence in the interior is known to me. Dr. Coues says (Birds N. W., p. 489):

"This species is included in the present work on the strength of its occurrence in Western Missouri, attested by Dr. P. R. Hoy, as above cited. Its presence, however, may be regarded exceptional. As its scientific name implies, it is chiefly a coastwise bird, though also occurring on the larger inland waters. It is said to be common on the shores of Lake Michigan. It is eminently a boreal bird, breeding very far to the northward, and only rarely reaching the coast of the Middle States in winter, beyond which its occurrence is open to question. It is rather plenty along the New England coast in autumn, winter and spring, when it frequents chiefly rocky shores covered with seaweed, rather than the bare sand beaches.

"The egg of *Tringa maritima* is of the usual pyriform shape, and measures about 1.40 by 1.00. The ground is clay color, shaded with olivaceous; the markings are large, numerous and distinct, of rich umber-brown of different depths and intensity, occurring all over the shell, but being most numerous as well as largest on the major half. With these spots are associated shell-markings of pale purplish-gray, and light neutral tint."

(Sub-genus *Pelidna*.—Bill slightly decurved, much longer than tarsus; tibiæ bare below; tarsus not shorter than middle toe.)

TRINGA ALPINA L.

var. AMERICANA Cass.

American Dunlin.

Tringa schinzii, (Brehm.) KIRTLAND, Ohio Geolog. Surv., 1838, 165, 185.

Tringa alpina, KIRTLAND, Am. Jour. Sci. and Arts, xl, 1841, 123.—WHEATON, Ohio Agric.

Rep. for 1860, 380, 480; Reprint, 1861, 10.

Tringa alpina, var. *americana*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ.

Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 16.

Tringa alpina, LINNÆUS, Fn. Sæc., 64.

Pelidna schinzii, BREHM.

Tringa alpina, var. *americana*, CASSIN, Baird's B. N. A., 1858, 719.

Adult in summer; above, chestnut, each feather with a central black field, and most of them whitish tipped, rump and upper tail-coverts blackish, tail feathers and wing-coverts ashy-gray, quills dusky with pale shafts, secondaries mostly white, and inner primaries edged with the same; under parts white, belly with a broad jet-black area, breast and jugulum thickly streaked with dusky; bill and feet black. Adult in winter, and young; above, plain ash-gray, with dark shaft lines, with or without red or black traces; below white, little or no trace of black on the belly; jugulum with a few dusky streaks and an ashy suffusion. Length, 8-9 inches; wing, $4\frac{1}{2}$ -5; tail, $2-2\frac{1}{2}$; bill, $1\frac{1}{2}$ - $1\frac{3}{4}$, longer than head, compressed at base, rather depressed at the end; tibia bare about $\frac{1}{2}$; tarsus, 1, or rather less.

Habitat, North America, especially coastwise. Migratory and wintering in the United States. Breeds in high latitudes only.

Common spring and fall migrant on Lake Erie, rare in spring and rather common in the fall in the interior of the State. In this vicinity, where I have seen the Dunlin only in the fall, it appears in October, in flocks of six or eight, frequenting the gravelly shores of streams. Single specimens are often seen with flocks of other Sandpipers. The number of specimens which are sometimes brought from the vicinity of Shadeville and the Licking Reservoir induce me to believe that it not unfrequently occurs in considerable flocks. Specimens in the collections of Mr. H. E. Chubb and others, from Cleveland, are in full breeding plumage.

(Sub genus *Tringa*. Bill perfectly straight, tibiæ bare below, tarsus not shorter than middle toe).

TRINGA CANUTUS L.

Red-breasted Sandpiper; Gray-back; Knot.

Tringa canutus, WHEATON, Ohio Agric. Rep. for 1860, 380 (probable); addenda, 480, Reprint, 1861, 10; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—COUES, Birds of N. W., 1874, 491.—LANGDON, Cat. Birds of Cin., 1877, 14; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.

Tringa canutus, LINNÆUS, Syst. Nat., i, 1766, 251.

Bill equalling or rather exceeding the head, comparatively stout; adult in summer: above, brownish-black, each feather tipped with ashy-white, and tinged with reddish on scapulars; below, uniform brownish-red, much as in the robin, fading into white on the flanks and crissum; upper tail-coverts white with dusky bars, tail feathers and secondaries grayish-ash with white edges; quills blackish, gray on the inner webs and with white shafts; bill and feet blackish. Young: above clear ash, with numerous black and white semicircles; below white, more or less tinged with reddish, dusky speckled on breast, wavy barred on sides. Length, 10-11; wing, 6-6½; tail, 2½, nearly square; bill about 1½ (very variable).

Habitat, Northern Hemisphere. Australia. New Zealand. South America.

Rare spring and fall migrant, in May and September. Mr. Winslow notes this "maritime species" as not rare on Lake Erie. I have met with it but once near this city, a solitary individual standing motionless on a sandy shore. Mr. Ed. Savage, of this city, captured a fine male, of a pair in full breeding plumage, at the Licking Reservoir, May 27, 1878. Prof. Snow gives it as common in Kansas and Mr. Nelson says it is a regular but not common migrant on Lake Michigan. Its distribution is chiefly coastwise, where it is abundant, and it breeds only in high latitudes.

GENUS CALIDRIS. Cuvier.

No hind toe; otherwise like sub-genus *Tringa*.

CALIDRIS ARENARIA (L.) III.

Sanderling; Ruddy Plover.

Calidris arenaria, WHEATON, Ohio Agric. Rep. for 1860, 380, (probable); addenda, 480; Reprint, 1861, 11; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 132; Reprint, 16; Field Notes, ib., ii, 1880, 127.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5.

Tringa arenaria, LINNÆUS, Syst. Nat. 1766, 251.

Calidris arenaria, ILLIGER, Prod., 1811, 249.

Adult in summer; head, neck and upper parts varied with black, ashy and bright reddish; below from the breast pure white; tail except central feathers light-ash, nearly white; primaries gray with blackish edges and tips, the shafts of all and bases of most white; secondaries white except a space at the end, and greater coverts broadly white tipped; bill and feet black. Adult in winter, and young, no reddish; speckled with black and white, sometimes tawny tinged on the jugulum. Length, 7½-8; wing, 4½-5; tail, 2½; bill, about 1; tarsus, 1 or rather less; middle toe and claw, ¾.

Habitat, Sea-coasts of nearly all countries.

Common spring and fall migrant on Lake Erie, less common in the interior of the State. The Sanderling, until a few years since considered an exclusively maritime species, is common on the Great Lakes. Mr. Nelson says it is met with on Lake Michigan in flocks of from five to seventy-five birds, frequenting the sandy beaches in company with the Piping Plover. Mr. Chubb informs me that it is common on Lake Erie near Cleveland.

Mr. Langdon in 1877, mentions a specimen, from the vicinity of Cincinnati, in the collection of Dr. Byrnes; in 1879 he notes its capture on several occasions, and mentions additional specimens in the collection of Charles Dury, and in 1880, a specimen taken on the Ohio, opposite Cincinnati, by Mr. Shorten, in September, 1879. Messrs. Dury and Freeman note its occurrence September 15, 1878. I have seen it but once from this vicinity, in October, 1874, when I obtained a specimen from a sportsman, who informed me they were at that time not uncommon in the vicinity of Shadeville, associating with Pectoral Sandpipers.

GENUS LIMOSA. Brisson.

Bill longer than tarsus, slender, and curving gently upwards, grooved to near the tip. Gape not extending beyond base of furrowed culmen. Tarsus scutellate in front and behind, reticulate laterally; a short basal membrane between middle and outer toes. Tail short, even.

LIMOSA FEDOA (L.) Ord.

Great Marbled Godwit.

Limosa fedoa, KIRTLAND, Ohio Geolog. Surv., 1838, 165, 185; Am. Journ. Sci. and Arts, xl, 1841, 24.—WHEATON, Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 19; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 1875, 12.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 182; Reprint, 16.

Great Marbled Godwit, KIRTLAND, Fam. Visitor, i, 1850, 164.

Scolopax fedoa, LINNÆUS, Syst. Nat., i, 1766, 224.

Limosa fedoa, ORD, ed. Wils., vii, 1825.

Tail barred throughout with black and rufous, rump and upper tail-coverts like the back; no pure white anywhere. General plumage rufous or cinnamon-brown; below, nearly unmarked and of very variable shade, usually deepest on the lining of the wing; above, variegated with black and brown or gray; quills rufous and black; bill flesh-colored, largely tipped with black; feet dark. Large; length, 16–22; wing, about 9; tail, about $3\frac{1}{2}$; bill, 4–5; tibia bare $1-1\frac{1}{2}$; tarsus, $2\frac{1}{2}-3\frac{1}{2}$; toes, $1\frac{1}{2}$, stout.

Habitat, entire temperate North America; Central and South America. Breeds in the Missouri and Upper Mississippi regions, and thence to the Saskatchewan. Winters in Southern States and southward.

Not common spring and fall migrant. Dr. Kirtland notes its capture in several instances in Northern Ohio, in addition to that mentioned on page 220, and in connection with the Glossy Ibis following. Mr. Langdon states, on the authority of Mr. Dury, that thirty-three were “shot in one day, near the mouth of the Little Miami, some years ago by Charles Weeks, Esq.” A specimen was taken by a son of Dr. Jasper in the immediate vicinity of this city, April 21, 1879.

Dr. Coues says (Birds N. W., p. 493):

“Comparatively little has been learned of the breeding resorts and habits of this Godwit, though it is such a common and generally distributed bird during its migrations and in winter. Audubon surmises that it may breed in South Carolina and perhaps in Texas, where, as Mr. Dresser found it in summer, it probably does. Occurring in abundance along most of the Atlantic coast, it nevertheless appears less common north of Massachusetts, and has not, it would appear, been observed much, if any beyond New England in that longitude. The centre of its abundance in summer, and its main breeding ground, is, apparently, the Northern Mississippi and Eastern Missouri regions, and thence to the Saskatchewan; for, unlike its relative (*L. hudsonica*), it does not proceed very far north to nest. It breeds in Iowa, and in Minnesota and Eastern Dakota, where I observed it in June, and where the eggs have been procured. I found it on the plains bordering the Red River, in company with Long-billed Curlews and great numbers of the Bartramian Sandpipers, nesting, like these species, on the prairie near the river and about the adjoining pools, but not necessarily by the water's edge. In its habits at this season it most nearly resembles the Curlew, and the two species, of much the same size and general appearance, might be readily mistaken at a distance where the difference in the bill might not be perceived. On intrusion near the nest, the birds

mount in the air with loud, piercing cries, hovering slowly around with labored flight in evident distress, and approaching sometimes within a few feet of the observer.

The only perfect set of eggs of the Godwit I have seen were taken June 1, 1871, fifty miles northwest of Saint Paul, Minnesota; both parents were secured and deposited in the Saint Paul Academy, where I examined them; so that the identification is unquestionable. There are three eggs in this set, measuring 2.30 by 1.60, 2.28 by 1.56, and 2.25 by 1.62. The color is a clear, light olivaceous drab; the markings are small and numerous, but not very strongly pronounced—there is nothing (in this set) of the heavy blotching and marking usually seen in waders' eggs. The spots are pretty evenly distributed, though rather larger in two instances, and more numerous in the other instance, about the butt than elsewhere. These markings are of various umber-brown shades, with the usual stone-gray shell spots."

LIMOSA HÆMASTICA (L.) Coues.

Hudsonian Godwit.

Limosa hudsonica, KIRTLAND, Ohio Geo. og. Surv., 1838, 165, 185.—WHEATON, Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 572; Reprint, 12.—LANGDON, Cat. Birds of Cin., 1877, 15.
Limosa hæmastica, LANGDON, Revised List, Jour. Cin. Soc. Nat. Hist., i, 1879, 183; Reprint, 17.

Scolopax hæmastica, LINNÆUS, Syst. Nat., 1758, 147.

Limosa hudsonica, SWAINSON and RICHARDSON, Fn. Bor.-Am., ii, 1831.

Limosa hæmastica, COUES, Birds, N. W., 1874, 760.

Tail black, largely white at base, its coverts mostly white; rump blackish; lining of wings extensively blackish; under-parts in the breeding season intense rufous (chiefly barred) with dusky; head, neck and upper-parts brownish-black, variegated with gray, reddish and usually some whitish speckling; quills blackish, more or less white at the base. Young and apparently winter specimens much paler, tawny-whitish below, more gray above. Considerably smaller than the foregoing, about 15; wing, 8 or less; bill, $3\frac{1}{4}$ or less; tarsus, $2\frac{1}{2}$ or less.

Habitat, Northern and Eastern North America. West Indies. South America. Breeds far northward. Not noted west of the Rocky Mountains. Rare along the Atlantic.

Rare spring and fall migrant. Dr. Kirtland notes its capture in the vicinity of Cincinnati, and Mr. Winslow mentions its occurrence near Cleveland. I met with a flock of eight birds, in the spring of 1858, wading in a shallow pond in an old brick-yard within the city limits, but was not so fortunate as to secure specimens. In the spring of 1861, a fine specimen was taken below the State dam, near the city, by a sportsman and taxidermist, which was preserved until recently.

The eggs of the Hudsonian Godwit are of a very dark olive-drab color, with blotches of still darker drab. They measure about 2.18 by 1.40.

GENUS TOTANUS. Bechstein.

Bill nearly straight, about equal to or shorter than the tarsus, not grooved in its terminal fourth. Gape of mouth extending beyond base of culmen. Tarsi scutellate in front and behind.

Sub-genus *Symphemia*. Toes with two subequal webs; legs bluish or dark.

TOTANUS SEMIPALMATUS (Gm.) Temm.

Semipalmated Tattler; Willet.

Totanus semipalmatus, KIRTLAND, Ohio Geolog. Surv., 1838, 165; Am. Journ. Sci. and Arts, xl, 1841, 24.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 572; Reprint, 12.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 183; Reprint, 17; Field Notes, ib., ii, 1880, 127.

Symphemia semipalmata, WHEATON, Ohio Agric. Rep. for 1860, 1861, 369; Reprint, 11.

Scolopax semipalmata, GMELIN, Syst. Nat., i, 1788, 659.

Totanus semipalmatus, TEMMINCK, Man. Orn., ii, 637.

Symphemia semipalmata, HARTLAND, R. Z., 1845, 342.

Bill straight, comparatively stout, grooved little if any more than half its length. In summer, gray above, with numerous black marks, white below, the jugulum streaked, the breast, sides and crissum barred or with arrow shaped marks of dusky (in winter, and in young birds, all these dark marks few or wanting, except on jugulum); upper tail-coverts, most of the secondaries, and basal half of primaries, white; ends of primaries, their coverts, lining of wings, and axillars, black; bill blueish or dark. Toes with two conspicuous basal webs. Length, 12-16; wing, 7-8; tail, $2\frac{1}{2}$ -3; bill or tarsus, 2- $2\frac{1}{2}$; tibia bare, 1 or more, middle toe and claw, $1\frac{1}{2}$ -2.

Habitat, Temperate North America, north to 56°, but chiefly United States. Breeds throughout its United States range. Resident in the Southern States. Common in the interior but more so along the coast. West Indies. Central America. Accidental in Europe.

Not common spring and fall migrant, probably breeds in northern Ohio. Dr. Kirtland mentions their occurrence on the lake shore in 1838, and, as quoted on page 220, their residence during summer. Mr. Langdon gives it as a rare spring and fall migrant. I have never seen it in this vicinity.

Dr. Coues gives the following description of their nesting and habits:

"The nest is placed near the water of some secluded pool, or in the midst of a marsh, whether fresh or salt, in a tussock of grass or rushes. It is a rude structure, of the simplest materials, raised a little way from the ground, and with a shallow indentation. The eggs are very variable in all respects. As to size and shape, the following measurements show the differences: 2.90 by 2.45; 1.95 by 1.50; 2.00 by 1.50; 2.05 by 1.55; 2.12 by 1.50; averaging about 2.00 by 1.50. They are less pointedly pyriform than the eggs of the smaller Tattlers and Sandpipers. The ground is sometimes brownish-olive, or drab, or clay-color; sometimes, again, quite buffy-brown; in a few cases greenish or grayish-white. The spotting is bold and distinct, but little massed even at the greater end, where, though the spots are largest and most numerous, they generally remain distinct. The spots are mostly clean-edged and sharp, of moderate size, but sometimes quite fine and scratchy. They are of various umber-brown shades, and accompanied with the usual obsolete shell-markings.

Under ordinary circumstances Willets are notoriously restless, wary, and noisy birds; but their nature is changed, or, at any rate, held in abeyance, during and for a short

time after incubation. They cease their cries, grow less uneasy, become gentle, if still suspicious, and may generally be seen stalking quietly about the nest. When Willets are found in that humor—absent-minded, as it were, absorbed in reflection upon their engrossing duties, and unlikely to observe anything not directly in front of their bill—it is pretty good evidence that they have a nest hard by. It is the same with Avocets, and probably many other waders. During incubation the bird that is "off duty" (both parents are said to take turns at this) almost always indulges in revery, doubtless rose tinted, and becomes in a corresponding degree oblivious to outward things. If then they are not set upon in a manner entirely too rude and boisterous, the inquiring ornithologist could desire no better opportunity than he will have to observe their every motion and attitude. But once let them become thoroughly alarmed by too open approach, particularly if the setting bird be driven from her nest, and the scene quickly shifts; there is a great outcry, violent protest and tumult, where was quietude. Other pairs, nesting near by, join their cries till the confusion becomes general. But now, again, their actions are not those they would show at other times; for instead of flying off with the instinct of self-preservation, to put distance between them and danger, they are held by some fascination to the spot, and hover around, wheeling about, flying in circles a little ways to return again, with unremitting clamor. They may be only too easily destroyed under such circumstances, provided the ornithologist can lay aside his scruples and steel himself against sympathy.

The half webbing of the toes renders this species something of a swimmer, if necessity arise; but it only takes to water beyond its depth under urgent circumstances. In size as well as in plumage it is very variable; the length of the legs, particularly, varies in different individuals to a surprising degree."

Sub-genus *Glottis*. Toes with inner web very small; legs yellow.

TOTANUS MELANOLEUCUS (Gm.) V.

Greater Tell-tale.

Totanus melanoleucus, KIRTLAND, Ohio Geolog. Surv., 1832, 165.—AUDUBON, Orn. Biog., iv, 1838, 68.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 570; Reprint, 12.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 183; Reprint, 17; Summer Birds, ib, iii, 1880, 227.

Totanus vociferus, AUDUBON, B. Am., v, 1842, 317.

Gambetta melanoleuca, WHEATON, Ohio Agric. Rep. for 1860, 1861, 369; Reprint, 11.

Scelopax melanoleuca, GMELIN, Syst. Nat., i, 1788, 659.

Totanus melanoleucus, VIEILLOT, N. D. d'H. N., 1816.

Gambetta melanoleuca, BONAPARTE, Comp. Rend., 1856.

Bill straight or slightly bent upwards, very slender, grooved half its length or less, black; legs long and slender, yellow. In summer, ashy-brown, above varied with black and speckled with whitish, below white, jugulum streaked, and breast, sides and crissum speckled or barred with blackish, these latter marks fewer or wanting in winter and in the young; upper tail-coverts white with dark bars; tail feathers marbled or barred with ashy or white; quills blackish. Large; length, over 12; wing, over 7; tail, 3 or more; bill, 2 or more; tarsus, about $2\frac{1}{2}$; middle toe and claw, $1\frac{1}{2}$; tibia bare, $1\frac{1}{2}$.

Habitat, Western Hemisphere. In the United States, chiefly migratory, and in winter. Breeds mostly in high latitudes. Abundant.

BIRDS—SCOLOPACIDÆ.

Common spring and fall migrant, but more numerous in fall than in spring. The Greater Telltale is generally found in pairs, less often in small flocks, on the gravelly or rocky banks of streams. Its association with other Sandpipers is merely accidental. In the Eastern States it appears to be much more wary than with us, and it is said to give warning to ducks and other game birds of the approach of the gunner. With us it is not difficult to approach, while its large size, harsh scream, and singular habit of tipping or jerking its body backward and forward on its long legs, render it a conspicuous object.

Mr. Nelson (Bulletin of the Essex Institute, viii, 1876, 128), gives the following, the only account of their nesting which I have seen. The locality is in the State of Illinois:

"In June, 1875, I found several pairs of these birds about the Calumet Marshes, where, from their actions, I was certain they were breeding, but was not fortunate enough to find their nests. The 10th of June, 1876, Mr. Rice observed a pair about a prairie slough near Evanston. A few days later a set of four eggs were brought him from a similar situation a few miles northwest of that place, and from the description of the parent bird—driven from the nest—he decided they must belong to this species. I perfectly agree with Mr. Rice's decision, for the prominent characteristics noticed by the collector are obviously applicable to this bird.

The nest was situated in a slight depression at the base of a small hillock near the border of a prairie slough, and was composed of grass stems and blades. The eggs measure respectively 1.70 by 1.20; 1.72 by 1.31; 1.74 by 1.31; 1.80 by 1.38 inches. The ground color is a deep grayish-white, marked on three eggs with spots of dark-brown, and on the other egg with spots and well-defined blotches of a considerably lighter shade of the same. In addition there are shell markings and obscured spots of lilac. The markings are disposed quite abundantly over the surface of the egg, but are more numerous about the large end."

TOTANUS FLAVIPES (Gm.) Vieillot.

Yellow-shanks.

Totanus flavipes, KIRTLAND, Ohio Geolog. Surv., 1838, 161.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin. 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 183; Reprint, 17; Summer Birds, ib., iii, 1880, 227.

Gambetta flavipes, WHEATON, Ohio Agric. Rep. for 1860, 369; Reprint, 1861, 11.

Scolopax flavipes, GMELIN, Syst. Nat., i, 1788, 659.

Totanus flavipes, VIEILLOT, Nouv. Dict. d'Hist. Nat., 1816, 400.

Gambetta flavipes, BONAPARTE, Comp. Rend., 1856.

A miniature of the last; colors precisely the same; legs comparatively longer; bill grooved rather further. Length, under 12; wing, under 7; tail, under 3; bill, under 2; tarsus, about 2; middle toe and claw, and bare tibia, each 1½.

Habitat, Western Hemisphere. Breeds from the Northern States northward. Many winter in the Southern States. Accidental in Europe.

Very common spring and fall migrant. The Lesser Tattler is rather more extensively distributed while with us than the former species. It is not confined to stony banks of streams, but may be found about muddy banks of ponds or in any situation resorted to by Sandpipers or Plover. They are often found in flocks of from five to six, or in pairs, or as single birds, either solitary or associated with other Sandpipers. Usually they are quite tame and unsuspicious.

They are not known to breed within the State, but Mr. Nelson reports their breeding in Illinois. The eggs are described as three or four in number, light-brown or clay-color, blotched with very dark-brown. They measure about 1.65 by 1.16.

Sub-genus *Rhyacophilus*. Toes with inner web rudimentary; legs blackish.

TOTANUS SOLITARIUS (Wils.) Aud.

Solitary Tattler.

Totanus chloropygius, KIRTLAND, Ohio Geolog. Surv., 1838, 165.

Rhyacophilus solitarius, WHEATON, Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11.

Totanus solitarius, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—COUES, Birds of N. W., 1874, 449 (eggs?).—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 183; Reprint, 17; Summer Birds, ib., iii, 1880, 227.

Totanus chloropygius, VIELLOT, Nouv. Dict. d'Hist., Nat., vi, 1816, 401.

Tringa solitaria, WILSON, Am. Orn., 1790, 730.

Totanus solitarius, AUDUBON, Syn., 1839, 242.

Rhyacophilus solitarius, CASSIN, Birds N. Am., 1858, 733.

Bill perfectly straight, very slender, grooved little beyond its middle. Dark lustrous olive-brown, streaked on the head and neck, elsewhere finely speckled with whitish; jugulum and sides of neck with brownish suffusion and dusky streaks; rump and upper tail-coverts like the back; tail, axillars and lining of wings beautifully barred with black and white; quills entirely blackish; bill and feet very dark olive-green; young duller above, less speckled, jugulum merely suffused with grayish-brown. Length, 8-9; wing, 5; tail $2\frac{1}{2}$; bill, tarsus, and middle toe, each about $1\frac{1}{2}$; tibiae bare $\frac{1}{4}$.

Habitat, Western Hemisphere. North to Alaska. Breeds in Northern United States and northward, if not also throughout most of the United States range. Winters chiefly or altogether beyond our limits, in Mexico, Central and South America, and West Indies. Accidental in Europe.

Common migrant, and in part summer resident. The Solitary Sandpiper is well named, when its personal habits or the localities which it frequents are considered. It is found, except during and shortly after the breeding season, about small ponds in woods, remote shaded ditches or small brooks, just such localities as are frequented by the Water Thrush.

In nearly every instance, during their migration, single birds are met with, though late in the fall they sometimes frequent the muddy borders of streams in the company, apparently unsolicited by them, of other Sandpipers. On most occasions, with us, they are rather shy and wary, taking flight while the intruder is at long gun-shot range, and usually flying to a considerable distance before alighting. Sometimes, however, if no desirable feeding spot is near, they return to the same spot and resume their occupation as if they had forgotten the interruption. Very often the first indication of their presence is their alarm note which resembles that of the Water Thrush, but is shriller and louder, sounded as they mount to their high and rapid flight.

I have seen the Solitary Sandpiper here during all the summer months, and once found the young in the care of their parents, on the borders of a small pond, in a pasture surrounded by woodland, four or five miles south of this city. An egg, presented to me by Mr. O. Davie, which was taken in an open field bordering the Scioto River, near this city, though without any positive claims, possesses characters which entitle it to consideration, as possibly that of this species. It is of a pointed oval shape, and not nearly so pyriform as are the eggs of most of this family, and measures 1.25 by .88, so that it is smaller than the eggs of the Spotted Sandpiper. The ground-color is clay-color with a reddish tinge, thickly marked with reddish and blackish-brown. The nest was on the ground in as exposed a locality as is ever frequented by this bird. It contained two eggs, both far advanced in incubation, only one of which was preserved. The fragments of this egg are now in the collection of the Smithsonian Institution. Concerning the eggs of this bird, Dr. Coues (Birds of the Northwest, p. 499) says:

"The only eggs supposed to be of the Solitary Tattler I have seen, are two in the Smithsonian collection from Cleveland, Ohio (Dr. Kirtland). The size 1.50 by 1.05; the shape ordinarily pyriform. The ground is clay-colored, without olivaceous or other shades. The markings are heavy and numerous on the larger half of the egg, smaller and fewer elsewhere. They are very dark—quite blackish-brown—lacking the slightest shade of the rich umber or chocolate which most waders show more or less evidently. The shell-spots are similarly of a darker neutral tint than usual. The identification of these eggs, however, is open to question: they may be those of the Killdeer."

Dr. Brewer (Bull. Nutt. Orn. Club, iii, 1878, 197), gives the following description, the only authoritative account which I have seen:

"The egg of this species has remained, to the present time, an unknown and much-desired addition to our cabinets. From time to time eggs claimed to be of this bird have been described, or have had a nominal existence in collections. But these claims have always been open to suspicion and doubt. The eggs have all either had so strong a resemblance to either the Spotted Tattler (*Tringoides macularius*) or to that of the

Killdeer (*Agialitis vociferus*) as to cause the belief that their identification could not be correctly made. During the last year eggs were sent to me for verification from five different parties, and all were deemed not worthy of credence. A few days ago, hearing of a Solitary Tattler having been shot near her nest, and an egg obtained, in Castleton, Vermont, I at once wrote to the party, and have obtained from him a temporary loan of both parent and egg, with permission to describe the same in the Bulletin.

The bird and egg were taken by Mr. Jenness Richardson about the middle of May,—I have not the exact date,—1878, at Lake Bomaseen, on the ground, in a pasture bordering on a swamp. The bird was on her nest when first discovered, but fluttered off when approached, ran a short distance, then stood still, watching him until she was secured. There was no actual nest, only a small depression in the ground. I am informed by Mr. Richardson that the bird is quite common in that locality, but very shy. This egg resembles no egg in my possession, and in its appearance there is something suggestive of an egg prematurely cut from its parent. It is smaller than I anticipated, measuring only 1.37 by .95, while the egg of *Totanus ochropus*, which bird closely corresponds in size and appearance with our Solitary, measures 1.50 by 1.10. The ground-color is a light drab, similar to that of the egg of *Agialitis melodus*. Over this are scattered small rounded markings of brown, some of these quite dark, nowhere confluent, and never large enough to be called blotches. At the larger end there are a few faint purplish or lilac discolorations or shell-marks. In shape it is an elongated pyriform."

GENUS TRINGOIDES. Bonaparte.

Bill short, straight, grooved nearly to the tip, about equal to tarsus and middle toe. Gap extending but little beyond base of culmen. Outer toe webbed, inner cleft. Tail much round-d, more than half the wing.

TRINGOIDES MACULARIUS (L.) Gr.

Spotted Sandpiper.

Totanus macularius, KIRTLAND, Ohio Geolog. Surv., 1838, 165.

Tringoides macularius, WHEATON, Ohio Agric. Rep. for 1860, 369; Reprint, 11; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 183; Reprint, 17; Summer Birds, iii, 1880, 227.

Spotted Sandpiper, BALLOU, Field and Forest, iii, 1878, 138.

Tringa macularia, LINNÆUS, Syst. Nat., i, 1766, 249.

Totanus macularius, TEMMINCK, Man., 1815, 422.

Tringoides macularius, GRAY, Gen. of Birds, iii, 1849, 574.

Above, olive (quaker-color, exactly as in the Cuckoo), with a coppery lustre, finely varied with black; line over eye, and entire under parts pure white, with numerous sharp circular black spots, larger and more crowded in the female than in the male, entirely wanting in very young birds; secondaries broadly white-tipped, and inner primaries with a white spot; most of the tail feathers like the back with sub-terminal black bar and white tip; bill pale-yellow, tipped with black; feet flesh-color. Length, 7-8; wing, about 4; tail, about 2; bill, tarsus and middle toe, each about 1.

Habitat, North America at large. Breeds nearly throughout its North American range. Winters in the Southern States and beyond. Central and South America to Brazil. West Indies. Casual in Europe.

The Spotted Sandpiper, generally known by the vernacular name of "Peet-weet" or "Teeter-tail," in allusion to its frequent note or curious motion, is the most abundant summer resident of its tribe from April to October. Industrious and noisy, it frequents sandy shores, retiring usually to the shelter of high weeds under which it constructs its nest. Its flight, owing to the changed proportion of wings and tail, differs from that of any other of our Sandpipers, being slower and more laborious. It usually takes its course horizontally above the water, moving in straight lines or gentle curves, with frequent vacillating strokes of wings. Oftener than other birds of the family it is seen mounted on a rail fence, prostrate log or dead limb, where its singular attitude and motions arouse the risible sympathy of the spectator. Dr. Coues (*Birds N. W.*, p. 500), thus describes its habits:

"As often as the Tip-up or "Teeter-tail," as it is also called, stops in its pursuit of insects, the fore part of the body is lowered a little, the head drawn in, the legs slightly bent, whilst the hinder parts and tail are alternately hoisted with a peculiar jerk, and drawn down again, with the regularity of clock-work. The movement is more conspicuous in the upward than in the downward part of the performance; as if the tail were spring-hinged, in constant danger of flying up, and needing constant presence of mind to keep it down. It is amusing to see an old male in the breeding season busy with this operation. Upon some rock jutting out of the water he stands, swelling with amorous pride and self-sufficiency, puffing out his plumage till he looks twice as big a natural, facing about on his narrow pedestal, and bowing with his hinder parts to all points of the compass. A sensitive and fastidious person might see something derisive, if not actually insulting, in this, and feel as Crusoe may be presumed to have felt when the savages who attacked his ship in canoes showed the signs of contumacious scorn that DeFoe records. But it would not be worth while to feel offended, since that is only the entirely original and peculiar way the Tip-up has of conducting his courtships. Ornithologists are not agreed upon the useful purpose subserved in this way, and have as yet failed to account for the extraordinary performance."

The nest of the Spotted Sandpiper, as above said, is usually built in the shelter of high weeds on a sandy island or border of a cultivated field or meadow near water. It consists of a few dead leaves, lining a slight depression. The eggs are four, of a creamy or clay-colored ground, blotched with blackish-brown.

GENUS PHILOMACHUS. Moehring.

Bill nearly straight, grooved nearly to the tip, as long as the head. Gape extending a little further back than culmen; feathers of lower mandible extending further forward than on upper, those of chin still further. Legs slender, tarsus longer than middle toe. Outer and middle toes webbed, inner toe cleft. Tail rather long, barred.

PHILOMACHUS PUGNAX (L.) Gr.

Ruff; Reeve.

Philomachus pugnax, WHEATON, Bull. Nuttall Orn. Club, ii, 1877, 83.

Tringa pugnax, LINNÆUS, Syst. Nat., 1766, 247.

Philomachus pugnax, GRAY, Genera.

Male in the breeding season with the face bare and beset with papillæ, and the neck with an extravagant ruff of elongated feathers; plumage endlessly variable in color; length, about 10; wing, $6\frac{1}{2}$ -7; tail, $2\frac{1}{2}$ -3; bill, $1\frac{1}{4}$; tarsus, $1\frac{1}{2}$; middle toe and claw, $1\frac{1}{2}$; female, smaller, the head fully feathered and no ruff.

Habitat, Northern Europe and Asia. Accidental in United States.

Less than a dozen instances of the occurrence of this bird in North America are recorded. In 1858, Mr. Cassin gives it as accidental on Long Island. Mr. Brewer (Am. Nat. 1872, 306), records its occurrence in Massachusetts, and 1876 (Bull. Nutt. Orn. Club, i, 1876, 19), its capture in Maine. The only record of its occurrence in Ohio, is my own, above cited, as follows:

"Dr. Theodore Jasper, of this city, obtained, November 10, 1872, at the Licking Reservoir, thirty miles east of Columbus, a Wader which remained unidentified till recently. I was of the opinion that it would prove to be either *Philomachus pugnax*, or a non-descript. On communicating my views to Mr. H. W. Henshaw, of Washington, he kindly offered to compare the specimen with others in the National Museum. He writes that the bird, which was a male (probably young), is positively identical with specimens of that species in the collection of the National Museum."

GENUS ACTITURUS. Bonaparte.

Bill short, straight, about as long as the head, grooved three-fourths its length, the gape very deep reaching to nearly below the eyes, the feathers extending on the upper mandible beyond those on the lower, which do not fill the interramal space; tail very long, more than half the wing, graduated; tarsi much longer than middle toe and claw; tibiæ bare near the length of the latter.

ACTITURUS BARTRAMIUS (Wils.) Bp.

Bartramian Sandpiper; Upland Plover.

Totanus bartramius, AUDUBON, Orn. Biog., iv, 1838, 24.—KIRTLAND, Ohio Geolog. Surv., 1838, 165, 185.

Tringa bartramia, AUDUBON, B. Am., v, 1842, 248.

Actiturus bartramius, WHEATON, Ohio Agric. Rep. for 1860, 1861, 360; Reprint, 11; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 573; Reprint, 13.—COPE, Zoolog. Sketch of Ohio, Walling and Gray's Atlas of Ohio, 1872, 25.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1878, 183; Reprint, 17.

Tringa bartramia, WILSON, Am. Orn., vii, 1813, 63.

Totanus bartramius, TEMMINCK, Man., ii, 1820, 650.

Actiturus bartramius, BONAPARTE, Saggio, 1831.

Above blackish with a slight greenish reflection, variegated with tawny and whitish; below, pale tawny of varying shade, bleaching on throat and belly; jugulum with streaks, breast and sides with arrowheads and bars of blackish; axillars and lining of wings pure white, black-barred; quills blackish, with white-bars on the inner webs; tail varied with tawny, black and white, chiefly in bars, bill and legs pale, former black-tipped. Length, 11-13; wing, 6-7; tail 3-4; bill, 1-1½; middle toe and claw about the same; tarsus, about 2.

Habitat, North America. North to the Yukon. Not observed in the United States west of the Rocky Mountains. Atlantic coast to Nova Scotia. Breeds from the Middle districts northward. Winters in Mexico, West Indies, Central and South America to Brazil. Casual in Europe.

Bartram's Sandpiper or the Field Plover, as it is commonly termed with us, is an abundant migrant and common summer resident, being found from the middle of April to the latter part of September. It frequents, in large flocks, plowed fields, meadows and retired fields; more rarely is seen in pairs along the banks of streams, never, however, according to my observation, wading in the water. When on its migrations it is very wary and difficult to approach, but during the breeding season its whole nature seems to be changed in this respect. In the protection of its nest and young it resorts to various devices to attract and hold the attention of the intruder to itself, mimicking lameness of leg and wing, tumbling in the air and on the ground, much after the manner of the Woodcock at similar times. After the breeding season is over it often imitates the smaller hawks in its flight, soaring, sailing and hovering, so as to entirely mislead one who is not familiar with this habit. This latter habit has been noticed by Mr. Wm. Brewster in the Ruff (*Philomachus*), to which he supposed it to be peculiar.

It has also the frequent habit in spring of alighting on the tops of fences, after the manner of the Meadow-lark. Individuals thus perched seem to be acting as sentinels for the flock feeding below. During the breeding season, they often perch on the tops of willow trees, when an intruder makes his appearance.

Its ordinary note is a loud pleasing whistle, but in summer it often utters a loud, tremulous, piercing scream, which for wierdness is not surpassed by the cry of the Screech Owl or Loon.

The eggs are four, pale clay-color or drab, thickly spotted with umber-brown in small pattern for birds of this family. They measure 1.75 by 1.28.

GENUS TRYNGITES. Cabanis.

Bill very small, straight, stout, shorter than tarsus or middle toe with claw, feathered above as far as the nostrils, still farther below. Gape extending considerably beyond culmen. Webbing of toes rudimentary. Tail not half as long as wing, rounded, with central feathers projecting.

TRYNGITES RUFESCENS (V.) Cab.

Buff-breasted Sandpiper.

Tringa rufescens, KIRTLAND, Ohio Geolog. Surv., 1838, 165; Am. Journ. Sci. and Arts, xl, 1841, 23.

Tryngites rufescens, WHEATON, Ohio Agric. Rep. for 1860, 369; Reprint, 1861, 11; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 138; Reprint, 22.

Tringa rufescens, VIEILLLOT, Nouv. Dict. d'Hist. Nat. xxxiv, 1819, 470.

Tryngites rufescens, CABANIS, J. f. O., iv, 418.

Quills largely white on the inner web, and with beautiful black marbling or mottling, best seen from below; tail unbarred, gray, the central feathers darker, all with subterminal black edging and white tips; crown and upper parts blackish, the feathers with whitish or tawny edging, especially on the wings; sides of the head, neck all round and under parts pale rufous, or fawn color, speckled on the neck and breast with dusky; bill black; feet greenish-yellow. Length, 7-8; wing, 5-5½; tail, 2½; tarsus, 1½; middle toe and claw, and bill, under an inch.

Habitat, North America. Migratory in the United States. Rather uncommon along the eastern coast. Breeds in the interior of the fur countries, and in Alaska. South America. Accidental in Europe.

Rare migrant, only noted in the fall. In addition to its occurrence noted by Dr. Kirtland, quoted on page 219, it has since been taken on several occasions near Cleveland. A specimen was taken in the immediate vicinity of this city, August 31, 1876, which is now in the museum of the Ohio State University. This bird was in company with Semipalmated Plover and Semipalmated Sandpipers, on a gravelly bank of the Scioto River.

The Buff-breasted Sandpiper is said to resemble the preceeding species in frequenting upland fields and meadows.

The eggs are four, pointedly pyriform, measuring about 1.45 by 1.05. They are clay-colored, of various shades, sharply spotted and blotched with rich umber-brown.

GENUS NUMENIUS. Linnaeus.

Tarsi scutellate in front only, which distinguishes this genus from all others of the family. Bill much longer than the head, decurved.

NUMENIUS LONGIROSTRIS Wils.

Long-billed Curlew.

Numenius longirostris, KIRTLAND, Ohio Geolog. Surv., 1838, 165, 185; Am. Journ. Sci. and Arts, xl, 1841, 24.—WHEATON, Ohio Agric. Rep. for 1860, 369; Reprint, 1861, 11; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 183; Reprint, 17.

Numenius longirostris, WILSON, Am. Orn., viii, 1814, 26.

Bill of extreme length and curvature, measuring from 5 to 8 or 9 inches; total length, about 2 feet; wing, a foot or less; tail, about 4; tarsus, $2\frac{1}{2}$ – $2\frac{3}{4}$. Plumage very similar to that of the Godwit, prevailing tone rufous, of varying intensity in different birds and in different parts of the same bird, usually more intense under the wing than elsewhere; below, the jugulum streaked, and the breast and sides with arrow-heads and bars of dusky; above, variegated with black, especially on the crown, back and wings; tail barred throughout with black and rufous; secondaries rufous; primaries blackish and rufous; no pure white anywhere; bill black, the under mandible flesh-colored for some distance; legs dark.

Habitat, United States and British Provinces. Breeds nearly throughout its range, and resident in the South. South to Mexico. Guatemala. Cuba.

Formerly not uncommon and probably summer resident; of late rare and known only as a migrant. Dr. Kirtland mentions its capture in 1837, and in 1841, quoted on page 220, speaks of it as if of common occurrence. Mr. Langdon notes three or four specimens from the vicinity of Cincinnati. I have seen specimens captured at Licking Reservoir. It may sometimes breed at St. Mary's Reservoir and other localities of Northwestern Ohio, as it is known to breed in Northern Illinois.

"The eggs of the Long-billed Curlew are not often so pyriform as among the smaller waders, being in shape not unlike hen's eggs. Different specimens measure: 2.45 by 1.85; 2.60 by 1.80; 2.65 by 1.80; 2.70 by 1.90; 2.80 by 1.90. They are clay-colored, with more or less olivaceous in some instances, and in others decidedly buffy shade. The spotting is generally pretty uniformly distributed and of small pattern, though in many cases there is larger blotching and even massing about the great end. The color of the markings is sepia or umber, of different shades, in the buffy-tinged specimens, rather tending to chocolate. The shell-markings, are commonly numerous and evident." (Cones, Birds N. W. p., 509).

NUMENIUS HUDSONICUS Lath.

Hudsonian Curlew.

Numenius hudsonicus, KIRTLAND, Ohio Geolog. Surv., 1838, 165, 185.—WHEATON, Ohio Agric. Rep. for 1860, 369; Reprint, 1861, 11; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188; Reprint, 22.

Numenius hudsonicus, LATHAM, Ind. Orn., ii, 1790, 712.

Bill medium, 3 or 4 inches long; length, 16–18; wing, 9; tail, $3\frac{1}{2}$; tarsus, $2\frac{1}{2}$ – $2\frac{3}{4}$. Plumage as in the last species in pattern, but general tone much paler; quills barred.

Habitat, North America. Greenland. Central and South America. Breeds in high latitudes. Migratory through the United States, wintering in the Southern States and far beyond.

Rare spring and fall migrant. Dr. Kirtland says that a specimen was taken in the vicinity of Cincinnati which was preserved in Dorfeuille's Museum, and that he possessed a specimen from Cleveland. Mr. Langdon omits it from his list, but cites the above reference to Dr. Kirtland

as pertaining to the next species. The birds spoken of by Dr. Kirtland are *N. hudsonicus*, Latham, which he calls Esquimaux Curlew. There has been confusion in regard to this and the next species, both the scientific and common names having been transposed by several writers. Mr. Winslow, in a list of birds of this family furnished me in 1861, gives both this and the following species as found in the vicinity of Cleveland. I have never seen it or known of its capture in this vicinity. It appears to be everywhere less numerous than the other members of this genus.

The eggs of the Hudsonian Curlew are always larger than those of the following species but cannot be distinguished from them with certainty, by any other character. They measure from 2.12 to 2.30 in length, in width about 1.60.

NUMENIUS BOREALIS (Forst.) Lath.

Esquimaux Curlew.

Numenius borealis, WHEATON, Ohio Agric. Rep. for 1860, 380, 480; Reprint, 1861, 11.

Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 183; Reprint, 17.

Scelopax borealis, FORSTER, Philos. Trans., lxii, 1772, 411.

Numenius borealis, LATHAM, Ind. Orn., ii, 1790, 713.

Bill small, under 3 inches long; length, 12-15 inches; wing, under 9; tail, 3; tarsus, 2. Plumage in tone and pattern almost exactly as in the last species, but averaging more rufous, especially under the wings, and primaries not barred.

Habitat, North and Middle America. Not recorded west of the Rocky Mountains. Alaska. Breeds within the Arctic Circle. Migratory though the United States, where rarely if ever observed in winter, never to breed. Extraordinarily abundant in Labrador in August. Winters in Middle and South America. No West Indian record. Accidental in Europe.

Not common spring and fall migrant. Mr. Winslow gives it as not rare in the vicinity of Cleveland. Mr. Langdon, states on the authority of Mr. Shorten, that a specimen was taken in the vicinity of Cincinnati, in September, 1878. In this vicinity of this city it is very rare; I have seen a single specimen accompanying a flock of Golden Plover, in autumn, several years since.

Dr. Coues (Pr. Phila. Acad. Nat. Sci., 1861, 236), gives the following observations of their habits in Labrador:

"The Curlews associate in flocks of every size, from three to as many thousand, but they generally fly in so loose and straggling a manner that it is rare to kill more than half a dozen at a shot. When they wheel, however, in any of their many beautiful evolutions, they close together in a more compact body, and offer a more favorable opportunity to the gunner. Their flight is firm, direct, very swift, when necessary much

protracted, and is performed with regular rapid beats. They never sail, except when about to alight, when the wings are much incurved downward, in the manner of most waders. As their feet touch the ground, their long, pointed wings are raised over the back, until the tips almost touch, and then deliberately folded, much in the manner of the Solitary Sandpiper (*Rhyacophilus solitarius*). Their note is an often-repeated, soft, mellow, though clear, whistle, which may be easily imitated. By this means they can readily be decoyed within shot, if the imitation is good and the gunner is careful to keep concealed. The smaller the flock the more easily are they allured, and a single individual rarely fails to turn his course toward the spot whence the sound proceeds. When in very extensive flocks, they have a note which, when uttered by the whole number, I can compare to nothing but the chattering of a flock of Blackbirds. When wounded and taken in hand, they emit a very loud, harsh scream, like that of a common hen under similar circumstances, which cry they also utter when pursued.

"Their food consists almost entirely of the cow-berry (*Empetrum nigrum*), which grows on all the hill-sides in astonishing profusion. It is also called the 'bear-berry' and 'curlew-berry.' It is a small berry, of a deep purple color, almost black, growing upon a procumbent, running kind of heath, the foliage of which has a peculiar moss-like appearance. This is their principal and favorite food, and the whole intestine, the vent, the legs, the bill, throat, and even the plumage, are more or less stained with the deep purple juice. They are also very fond of a species of small snail that adheres to the rock in immense quantities, to procure which they frequent the land-washes at low tide. Food being so abundant, and so easily obtained, they become excessively fat. In this condition they are most delicious eating, being tender, juicy, and finely flavored; but, as might be expected, they prove a very difficult job for the taxidermist.

"Although the Curlews were in such vast numbers, I did not find them so tame as might be expected, and as I had been led to suppose by previous representations. I was never able to walk openly within shooting distance of a flock, though I was told it was often done. The most successful method of obtaining them is to take such a position as they will probably fly over in passing from one feeding ground to another. They may then be shot with ease, as they rarely fly high at such time. The pertinacity with which they cling to certain feeding grounds, even when much molested, I saw strikingly illustrated on one occasion. The tide was rising and about to flood a muddy flat, of perhaps an acre in extent, where their favorite snails were in great quantities. Although six or eight gunners were stationed upon the spot, and kept up a continual round of firing upon the poor birds, they continued to fly distractedly about over our heads, notwithstanding the numbers that every moment fell. They seemed in terror lest they should lose their accustomed fare of snails that day. On another occasion, when the birds had been so harassed for several hours as to deprive them of all opportunity of feeding, great numbers of them retired to a very small island, or rather a large pile of rocks, a few hundred yards from the shore, covered with sea-weed and, of course, with snails. Flock after flock alighted on it, till it was completely covered with the birds, which there, in perfect safety, obtained their morning meal."

Of their nest and eggs, he says (Birds N. W., p. 512):

"This species breeds in great numbers in the Anderson River region, usually making up its nest complement of four eggs by the third week in June. The nest is generally in an open plain, and is a mere depression of the ground, lined with a few dried leaves or grasses. The eggs vary to the great extent usually witnessed among waders. The ground is olive-drab, tending either to green, gray, or brown in different instances.

The markings, always large, numerous and bold, are of different depths of dark chocolate, bistre, and sepia brown, with the ordinary stone-gray shell spots. They always tend to aggregate at the larger end, or, at least, are more numerous on the major half of the eggs; though in a few instances the distribution is nearly uniform. Occasionally the butt end of the egg is almost completely occupied by confluence of very dark markings. Eggs vary from 1.90 by 1.40 to 2.12 by 1.33, averaging about 2.00 by 1.45."

ORDER HERODIONES. HERONS AND THEIR ALLIES.

FAMILY TANTALIDÆ. IBISES, ETC.

Hallux somewhat reduced, less perfectly incumbent than in *Ardeidæ*. Tarsi commonly reticulate. Middle claw not pectinate. Lores, gular space and usually more of the head, naked. Bill variously curved or with expanded tip.

Sub-family TANTALINÆ. Wood Ibises.

Bill extremely stout at base, where as wide as the face, gradually tapering to the decurved tip. Tarsus reticulate.

GENUS TANTALUS. Linnaeus.

With characters of its sub-family.

TANTALUS LOCULATOR L.

Wood Ibis.

Tantalus loculator, WHEATON, Reprint, Ohio Agric. Rep. for 1861, 21, (probable).—COUES, Key, 1872, 263; Birds of N. W., 1874, 513.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 183; Reprint, 17.—JORDAN, Man. Vert., 1878, 134.

Tantalus loculator, LINNÆUS, Syst. Nat., i, 1766, 240.

Adult with the head and part of the neck naked, corrugate, bluish; legs blue; bill pale greenish; plumage entirely white excepting the quills, tail, primary coverts and alula which are glossy black: young with the head downy-feathered, the plumage dark-gray, the quills and tail blackish; length, about 4 feet; wing, 18-20 inches; bill, 8-9; tarsus, 7-8.

Habitat, South Atlantic and Gulf States, and across in corresponding latitudes to the Colorado River. North to Ohio, Illinois, and the Carolinas. Accidentally to Wisconsin, Pennsylvania, and New York. Cuba. Mexico. Central and South America.

Rare visitor in spring, late summer and early fall. In 1861, I included the Wood Ibis in my list of birds of probable occurrence on the authority of Mr. Kirkpatrick, of Cleveland, who informed me that it had "perhaps been shot in Southern Ohio." Dr. Coues, in his Key, gives its range "North to Ohio and the Carolinas," apparently ignorant of the fact that

Dr. Hoy had recorded it from the vicinity of Milwaukee, Wisconsin. I have been unable to verify Dr. Cones' statement as to its occurrence in Ohio at or before the date of his writing, and consequently omitted it from my List of 1875, though the probability of its occurrence began to approach a certainty. In 1878, Mr. Langdon added this bird to his List of Birds of the vicinity of Cincinnati on the authority of Dr. Haymond, who says (Indiana Geolog. Surv., 1869):

"These large and curious birds occasionally visit the Whitewater Valley in the month of August. Some years ago, I kept one (which had a broken wing) about six weeks. In that time it became very tame, learned its name and would come when called.

We fed it upon living fish, which it would swallow with amazing rapidity, except catfish, which required labor and time to dispose of. It died from having eaten a Mackerel which had been placed in a basin to soak."

This is satisfactory in showing that this species occurs very near to our borders. Mr. Langdon, further writes me under date of February 23, 1879:

"If I am not very much mistaken, I have at last cleared up the much-agitated "Wood Ibis question," and I herewith proceed to give you the results of my investigations and also to answer your letter of the 17th, inst.

In looking over the Indiana Index to Cones' Bibliography, I found two references to Haymond, as you will see, and, as I had never before heard of but one (1869), I at once proceeded to look up the other, which was as follows: 'Birds of South-eastern Indiana, by Rufus Haymond, M.D., Proc. Phil. Acad., viii, November, 1856.' About 135 specimens are given and among them the Wood Ibis, from his account of which I make the following extract verbatim, which you will observe differs somewhat, though not essentially, from his account of the same specimen in the Indiana Agricultural Report, 1869. The main difference is, that in his 1856 List, he mentions specifically and definitely the visit of a flock of the birds to South-eastern Indiana.

You will remember that the Whitewater River, where the birds were found, is not far from the Ohio line (perhaps 12 or 15 miles), also that the Whitewater after flowing less than 20 miles from Brookville, Indiana, enters Ohio, and after traversing its South-western corner for several miles it joins the Great Miami within the State of Ohio. Now Haymond's account speaks of them as remaining along the river (Whitewater) and canal for some weeks and although he does not say Ohio once, yet there is abundant room for the inference that the birds reached Ohio in following the Whitewater. Here is the copy of Haymond's record:

"The first day of August, 1855, a large flock of these birds made their appearance in this neighborhood. They remained along the river and Whitewater canal for about a month or six weeks. A son of one my neighbors broke the wing of one them and caught it. After keeping it three or four weeks, feeding it upon fish, he gave it to me. I kept it until near the first of November when it fell a victim, as many another biped has done, to its appetite."

Here follows the account of its eating a mackerel, and dying in convulsions the next day; also, the statement that it learned its name, *Tantalus*, and would come when called if it was hungry, etc.

He also mentions that it would stand for hours perfectly still, with its long bill hanging straight down its neck. When tired of this position it would lay the tarsus flat upon the ground and stand upon the end of the tibia.

Both Dr. Coues and Mr. Kirkpatrick may have referred to the same specimens actually taken in Ohio at the time the flock described by Dr. Haymond made its appearance on our Indiana border. Fortunately I am not obliged to question the above authorities in adding this bird to our list: just as this goes to press, Mr. H. E. Chubb, of Cleveland, a well-known taxidermist and naturalist, writes me that: "A young male, which I have in my collection, was shot last spring ten miles west of Cleveland. There were no others with it."

I extract the following from Dr. Coues' extended account of its habits (Birds, N. W., page 513):

"The Wood Ibis is a remarkable and interesting bird. In its general size, shape and color, it might be likened to a Crane, being about four feet long, and standing still higher when erect; white in color, with black-tipped wings and black tail. The head is peculiar, being entirely bald in the adult bird, and having an enormously thick, heavy bill, tapering and a little decurved at the end. In Florida it is sometimes called the "Gannet"; on the Colorado it is known as the Water Turkey.

The carriage of the Wood Ibis is firm and sedate, almost stately; each leg is slowly lifted and planted with deliberate precision, before the other is moved, when the birds walk unsuspicious of danger. I never saw one run rapidly, since on all the occasions when I have been the cause of alarm, the bird took wing directly. It springs powerfully from the ground, bending low to gather strength, and for a little distance flaps hurriedly with dangling legs, as if it was much exertion to lift so heavy a body. But fairly on wing, clear of all obstacles, the flight is firm, strong, and direct, performed with continuous moderately rapid beats of the wing, except when the birds are sailing in circles as above noted. When proceeding in a straight line the feet are stretched horizontally backward, but the head is not drawn closely in upon the breast, as is the case with Herons, so that the bird presents what may be called a top-heavy appearance, increased by the thick large bill.

The eggs of the Wood Ibis are like Heron's, in being nearly ellipsoidal, but differ from these, as well as from those of the Bay Ibis, in color, which is uniform dull white, without markings. The shell is rather rough to the touch, with a coating of softish, flaky, calcareous substance. A specimen that I measured was exactly $2\frac{1}{2}$ inches in length by $1\frac{1}{2}$ in breadth. Two or three are said to be a nest-complement."

Sub-family IBIDINÆ. True Ibises.

Head partially naked. Bill very long and slender, curved throughout, and grooved nearly to the tip.

GENUS PELGADIS. Kaup.

With the characters of the sub-family, and tarsus scutellate.

PELGADIS FALCINELLUS (L.) Kaup (?).

Glossy Ibis.

Ibis ordii, WHEATON, Ohio Agric. Rep. for 1860, 368, 377 ; Reprint, 1861, 10.

Ibis falcinellus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 473 ; Reprint, 1875, 13.

Ibis falcinellus, var. *ordii*, COUES, Birds of N. W., 1874, 517.—LANGDON, Cat. Birds of Cin., 1877, 15.

Plegadis falcinellus, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 188 ; Reprint, 22.

Glossy Ibis, KIRTLAND, Fam. Visitor, i, 1850, 164.

Ibis falcinellus, BONAPARTE, Obs. Wils., 1825, No. 199.

Ibis ordii, BONAPARTE, List, 1838, 49.

Ibis falcinellus var. *ordii*, COUES, Key, 1872, 263.

Pelgadis falcinellus, ———, Ibis, 1873, 112.

Plumage rich dark-chestnut, changing to glossy dark-green with purplish reflections on the head, wings and elsewhere ; bill dark ; young similar, much duller, or grayish-brown, especially on the head and neck which are white streaked. Claws slender, nearly straight ; head bare only about the eyes and between the forks of the jaw. Length, about 2 feet ; wing, 10-11 ; tail, 4 ; bill, 4½ ; tarsus, 3½ ; middle toe and claw, 3.

Habitat, United States, southerly, straying north to Massachusetts and Ohio.

Extremely rare or accidental, only one record of its occurrence known to me. Dr. Kirtland, after quoting from the Boston Traveler, [June] 28, 1850, an account of the capture of this species at Cambridge and Middleboro, Massachusetts, and Middletown, Connecticut, says :

"To the above we would add that two of these interesting birds, probably a pair, were seen two years since, near Fairport, Lake county. One of them, a beautiful male, was shot by Mr. Prugen, and forwarded to us. It was duly skinned and mounted, and may now be seen standing along side of a Scarlet Ibis, from the banks of the Amazon, in the second case south of the door, in the cabinet of Nat. Hist., at the Cleve. Med. Coll.

Mr. Prugen has furnished us with several rare birds ; among others a fine specimen of *Wilson's Phalarope*, and a pair of *Great Marbled Godwits*."

Dr. Coues gives the following brief account of this bird (Birds N. W., 517), to which may be added that later investigations have shown it to be not uncommon at Utah Lake and other localities in the Western United States, where it is known as the "Black Snipe" and "Black Curlew ;" and Mr. Ridgway describes two other species of this genus in the United States, one at least of which is tenable :

"The Glossy Ibis is not figured in Wilson's Ornithology, and remained an unknown inhabitant of the United States up to the termination of that author's labors. In 1817 a specimen was taken in New Jersey, and announced by Mr. Ord under the the name of *Tantalus mexicanus*. Since that time it has been found at irregular intervals along our coast, chiefly in the Southern and Middle districts, but occasionally as far north as Massachusetts ; where, however, its occurrence must be considered as accidental. Audubon says that he found it in flocks in Texas, but gives only a meagre account of its

habits. Nuttall's article is mainly an account of Ibises in general, devoted principally to mention of ancient, and particularly Egyptian, chronicles and superstitions regarding them. The United States species was first separated under the name of *ordii* by Bonaparte, 1838.

The eggs of Ibises are very different from those of Herons. The shell is heavier, rougher, and more granular, the difference in texture being very apparent; and are ovoidal, not ellipsoidal, with considerable difference in the degree of convexity of the two ends. Those of the Glossy Ibis measure from 1.90 by 1.45 to 2.10 by 1.50, and are of a dull greenish-blue color, without markings. The number usually deposited is believed to be three."

FAMILY ARDEIDÆ. THE HERONS.

Hallux lengthened, perfectly incumbent with large claws. Tarsi scutellate. Middle claw pectinate. Bill perfectly straight, tapering, acute. Loral region definitely naked, continuous with covering of the bill. Head narrow, elongate, tapering.*

*Mr. Ridgway in his studies of North American Herodiones adheres to the old division of this family and gives the following synopsis of its Ohio members:

ARDEIDÆ.—THE TRUE HERONS.

Sub-family ARDEINÆ.—Outer toe equal to or decidedly longer than the inner. Claws short, generally strongly curved. Three pairs of powder-down tracts. Rectrices lengthened, stiffish, twelve in number (except *Zebrilus*).

Sub-family BOTAURINÆ.—Outer toe decidedly shorter than the inner. Claws long, slender, slightly curved. Two pairs, only, of powder-down tracts. Rectrices very short, soft, only ten in number.

Sub-family ARDEINÆ.

A.—Rectrices twelve; tibiae with the lower portion more or less naked.

a. Pectoral and inguinal powder-down tracts widely separated.

§. Malar region completely feathered (except in *Ptilerodius*, where anterior part is bare). Bill shorter than the tarsus and middle toe (usually shorter than, or about equal to, the tarsus).

1. ARDEA.—Size very large. Adult with scapular plumes elongated, narrowly-lanceolate, and with compact webs; in the breeding season, the occiput with two long, slender, compact-webbed, pendant plumes. Color mainly plumbous- or slate-blue (rarely—e. g. white phase of *A. occidentalis*—wholly pure white). Culmen shorter than middle toe.
2. HERODIAS.—Size large, but smaller than the species of the preceding genus. Adult with the scapular plumes greatly elongated, reaching far beyond the end of the tail, the shafts thick and rigid, the webs decomposed, hair-like, and distinct. Color entirely pure white.
3. GARZETTA.—Size small. Adult with occipital, jugular, and scapular plumes, the latter reaching to or a little beyond the end of the tail; the shafts moderately rigid, and recurved terminally; the webs decomposed, with long, hair-like, but not distant fibres. Other plumes varying in structure, according to the species. Color entirely pure white.

GENUS ARDEA. Linnæus.

Decomposing feathers (" powder-down-tracts "), on back over hips, belly under hips, and on breast. Back and head in adult in breeding season, with elongated feathers or plumes. Tail feathers twelve. Tibia bare the lower third or more. Sexes similar.

ARDEA HERODIAS L.

Great Blue Heron.

Ardea herodias, KIRTLAND, Ohio Geolog. Surv., 1838, 165; Family Visitor, i, 1850, 124.—COPE, Zool. Sketch of Ohio, Walling and Grays' Atlas of Ohio, 1872, 25.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc., Nat. Hist., i, 1879, 183; Reprint, 17; Summer Birds, ib., iii, 1880, 227.

Ardea herodia, WHEATON, Ohio Agric. Rep. for 1860, 368, 377; Reprint, 1861, 10.

Ardea herodias, LINNÆUS, Syst. Nat., i, 1766, 247.

Back without peculiar plumes at any season, but scapulars lengthened and lanceolate; an occipital crest, two feathers of which are long and filamentous; long loose feathers on the lower neck. Length, about 4 feet; extent, 6; bill, $5\frac{1}{2}$ inches; tarsus, $6\frac{1}{2}$; middle toe and claw, 5; wing, 18-20; tail, 7. Female much smaller than male. Adult of both sexes grayish-blue above, the neck pale purplish-brown with a white throat-line, the head black with a white frontal patch; the under parts mostly black, streaked with white; tibia, edge of wing and some of the lower neck feathers orange-brown; bill and eyes yellow, culmen dusky, lores and legs greenish. The young differ considerably but are never white and cannot be confounded with any of the succeeding.

Habitat, North America. North to Hudson's Bay and Sitka. South to Guatemala and Galapagos. West Indies. Breeds throughout its range, and winters in the South.

Common summer resident, somewhat restricted during the breeding season, but at other times generally distributed in all suitable locations, from March or earlier to November or later. In December, 1880, a specimen was brought me which was killed on a rapid shallow of Walnut

4. BUTORIDES.—Size small. *Adult* with scapular plumes elongated, compact-webbed, lanceolate, but with rounded tips. Feathers of the pileum elongated, lanceolate. Jugular plumes broad, blended. Culmen longer than tarsus; middle toe almost equal to tarsus. Color much variegated.
5. NYCTIARDEA.—Size medium. *Adult* with several extremely elongated linear, compact-webbed occipital plumes. No scapular plumes. Jugular feathers broad, blended. Culmen about equal to tarsus; tarsus slightly longer than middle toe. Lateral outlines of bill concave; gonys nearly straight. *Adult* and young exceedingly different in plumage.

Sub-family BOTAURINÆ.

6. BOTAURUS.—Size medium, or rather large. Sexes similar; young similar to adult.
7. ARDETTA.—Size extremely small (the smallest of Herons). Sexes dissimilar (in all species?); young slightly different from adult.

Creek. The temperature for several days had ranged below zero. This bird was in good condition.

The food of this species, and in general of the family, consists of fish, frogs and other reptiles, small mollusks and aquatic larvæ. These they secure by patient watching while standing in the water, with extended necks; when the desired prey comes within reach, the head and neck are so suddenly withdrawn preparatory to making a successful dart, that the eye can hardly follow the action.

The nest of this species is placed in high sycamore trees, along rivers, or in the depths of a retired swamp. In localities destitute of trees the nest is placed on rocks. Sycamore trees are especially affected by them, the light color of the limbs, and the peculiar tint of the foliage harmonizing so well with their plumage, as to render their presence, when at rest, difficult of detection.

The eggs are two or three in number, elliptical in outline, and light, dull greenish-blue in color. They measure about 2.50 by 1.50.

ARDEA EGRETTE Gmelin.

Great White Egret.

Ardea egretta, KIRTLAND, Ohio Geolog. Rep., 1833, 165, 185.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 573; Reprint, 13.—LANGDON, Cat. Birds of Cin., 1877, 15.

Herodias egretta, WHEATON, Ohio Agric. Rep. for 1860, 1861, 368, 377; Reprint, 10, 19.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18; Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 227.

Ardea egretta, GMELIN, Syst. Nat. i, 1748, 629.

Herodias egretta, GRAY, Gen. of Birds, iii, 1849.

No obviously lengthened feathers on the head at any time; in the breeding season, back with very long plumes of decomposed feathers drooping far beyond the tail; neck closely feathered; plumage entirely white at all seasons; legs and feet black. Length, 36-42 inches (not including the dorsal train); wing, 16-17; bill, nearly 5; tarsus, nearly 6.

Habitat, United States, southerly, straggling northward to Nova Scotia. Massachusetts, Canada West, and Minnesota. West Indies; Mexico; Central and South America.

Rather common visitor in July, August and September. Perhaps breeds in Western Ohio, but I have no record of its occurrence in spring or in the breeding season, nor seen any except young birds. Dr. Coues, in connection with this bird, Birds N. W. p, 521, observes "that a certain *northward* migration of some southerly birds at this season (summer) is nowhere more noticeable than among the Herons and their allies, the migrants consisting chiefly of birds hatched that year, which unaccountably stray in the wrong direction."

ARDEA CANDIDISSIMA Gmelin.

Little White Egret.

Garzetta candidissima, WHEATON, Ohio Agric. Rep. for 1860, 368, 377; Reprint, 1861, 10; 19.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18.

Ardea candidissima, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 15; Journ. Cin. Soc. Nat. Hist., i, 1878, 117; Reprint, 8.

Ardea candidissima, GMELIN, Syst. Nat., i, 1768, 633.

Garzetta candidissima, BONAPARTE, Cons. Av., ii, 1855, 118.

Adult with a long occipital crest of decomposed feathers and similar dorsal plumes, latter *recurved* when perfect; similar, but not *recurved* plumes on the lower neck, which is bare behind; lores, eyes and toes yellow; bill and legs black, former yellow at base, latter yellow at the lower part behind. Plumage always entirely white. Length, 24; wing, 11-12; bill, 3; tarsus, 3½-4.

Habitat, United States, southerly. North regularly to the Middle States, casually to Massachusetts and even to Nova Scotia. Kansas. Mexico. West Indies. Central and South America to Chili. Breeds throughout the regular United States range, and resident in the Gulf States and further south.

Very rare or accidental. Mr. M. C. Reed, of Hudson, captured a specimen several years since in Ashtabula county. This bird had been previously wounded. Mr. Winslow records it from Northern Ohio, but may refer to the same individual. Late in the summer of 1859, I saw five of these birds at Granville, Licking county. These were apparently all young. Mr. Langdon, on the authority of Mr. Dury notes one specimen taken in the vicinity of Cincinnati.

Although Dr. Coues states that the range of the last species and this

ARDEA CÆRULEA L.

Little Blue Heron.

Florida cærulea, WHEATON, Reprint, Ohio Agric. Rep. for 1861, 21 (probable).

Ardea cærulea, LANGDON, Cat. Birds of Cin., 1877, 15 (probable).

Ardea cærulea, LINNÆUS, Syst. Nat., i, 1766, 239.

Florida cærulea, BAIRD, P. R. R. Rep., ix, 1858, 671.

The Little Blue Heron probably occurs in the southern portion of the State, but I am not aware that it has been positively identified within our limits, though it occurs in Southern Illinois, and has been seen by Mr. Brewster in West Virginia. The following is Dr. Coues description: Head of the adult with lengthened decomposed feathers, those of the lower neck and scapulars, elongate and lanceolate; no dorsal plumes; neck bare behind, below. Size of the Snowy Heron. Adult slaty-blue becoming purplish on the head and neck; bill and loreal space blue, shading to black at the end; eyes yellow, legs black. Young *pure white*, but generally showing blue traces, by which it is distinguished from Snowy Heron, as well as by the color of the bill and feet, though at first the legs are greenish-blue with yellow traces.

smaller but more elegant and showy one, appears to be nearly or quite coincident, it would appear that the larger bird is much the most numerous in this State, as well as regular in its visits.

ARDEA VIRESCENS Linnæus.

Green Heron.

Ardea virescens, KIRTLAND, Ohio Geolog. Surv., 1838, 165.—COPE, Zool. Sketch of Ohio, Walling and Gray's Atlas of Ohio, 1872, 25.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 573; Reprint, 13.—LANGDON, Cat. Birds of Cin., 1877, 15. *Butorides virescens*, WHEATON, Ohio Agric. Rep. for 1860, 1861, 363.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18; Summer Birds, ib., iii, 1880, 227.

Ardea virescens, LINNÆUS, Syst. Nat., i, 1766, 238.

Butorides virescens, BONAPARTE, Consp. Av., ii, 1855, 128.

Adult in the breeding season with the crown, long soft occipital crest, and lengthened narrow feathers of the back lustrous dark-green, sometimes with a bronzy iridescence, and on the back often with a glaucous cast; wing-coverts green, with conspicuous tawny edgings; neck purplish-chestnut, the throat line variegated with dusky or whitish; under parts mostly dark brownish-ash, belly variegated with white; quills and tail greenish-dusky with a glaucous shade, edge of the wing white; some of the quills usually white tipped; bill greenish-black, much of the under mandible yellow; lores and iris yellow; legs greenish-yellow; lower neck with lengthened feathers in front, a bare space behind. Young with the head less crested, the back without long plumes, but glossy greenish, neck merely reddish-brown, and whole under parts white, variegated with tawny and dark-brown. Length, 16-18; wing, about 7; bill, $2\frac{1}{2}$; tarsus, 2; middle toe and claw, about the same; tibia bare 1 or less.

Habitat, United States generally, breeding throughout and wintering in the South. Mexico. West Indies. Central America to Venezuela.

Abundant summer resident, from April 1, to October. Breeds. The most numerous of the family in the State. Everywhere a well-known and unpopular bird. It has numerous common names, among which Fly-up-the-creek is probably the most refined. It is much less abundant in this immediate vicinity than formerly, where, once unsuspecting, it has become quite shy and wary.

The nest of the Green Heron is composed of twigs, placed in small tree in a swamp or on the border of a stream, not unfrequently in an orchard at a distance from water. The eggs are light greenish-blue.

GENUS NYCTIARDEA. Swainson.

Powder-down-tracts as in *Ardea*. No elongated or peculiar feathers of neck or back at any season. Tail feathers twelve. Sexes similar.

NYCTIARDEA GRISEA (L.) Steph.

var. NÆVIA (Bodd.) Allen.

Night Heron.

Ardea discors, KIRTLAND, Ohio Geolog. Surv., 1838, 165, 184.*Nyctiardea gardeni*, WHEATON, Ohio Agric. Rep. for 1860, 368, 377; Reprint, 1861, 10, 19.*Nyctiardea grisea*, var. *nævia*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 15; Journ. Cin. Soc. Nat. Hist., i, 1878, 117; Reprint, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18; Field Notes, ib., ii, 1880, 127.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5.*Ardea discors*, NUTTALL, Man. ii, 1834, 54.*Ardea nævia*, BODDÆRT, Planch. El., 1784, 939.*Nyctiardea gardeni*, BAIRD, Birds N. Am., 1858, 678.*Nyctiardea grisea*, var. *nævia*, ALLEN, Bull. M. C. Z., iii, 1872, 182.

No peculiar feathers excepting two or three very long filamentous plumes springing from the occiput, generally imbricated in one bundle; bill very stout; tarsi reticulate below in front; length, about 2 feet; wing, 12-14 inches; bill, tarsus, and middle toe, about 3. Crown, scapulars and inter-scapulars very dark glossy-green; general plumage bluish-gray, more or less tinged with lilac; forehead, throat line and most underparts whitish; occipital plumes white; bill black; lores greenish; eyes red; feet yellow. Young very different; lacking the plumes; grayish-brown, paler below, extensively speckled with white; quills chocolate-brown, white-tipped.

Habitat, United States and British Provinces. Breeds abundantly in New England. Winters in the South and beyond. Part of the West Indies. Mexico. Central America. South America.

The Night Heron is not an uncommon bird in all suitable localities in the State, probably breeding in retired swamps. I do not know positively of its breeding within the State, but Mr. Langdon records the capture of full fledged young at Madisonville, in June and July. In this vicinity it is most common in the fall. As its name indicates it is more nocturnal in its habits than other members of this family, and on that account more frequently heard than seen. Its note is a loud hoarse squawk.

GENUS BOTAURUS. Stephens.

No peculiar crests or plumes. Sexes similar. Tail of ten feathers. Tarsi shorter than middle toe.

BOTAURUS MINOR (Gm.) Boie.

Bittern; Indian Hen.

Ardea minor, KIRTLAND, Ohio Geolog. Surv., 1838, 165.*Botaurus lentiginosus*, WHEATON, Ohio Agric. Rep. for 1860, 368; Reprint, 1861, 10; Field Notes, i, 1861, 129.—TREMBLY, ib., i, 1861, 180.*Botaurus minor*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18; Summer Birds, ib., iii, 1880, 227.

Ardea minor, WILSON, Am. Orn., viii, 1814, 35.

Botaurus minor, BOIE, Isis, 1826, 979.

Botaurus lentiginosus, STEPHENS, Shaw's Gen. Zool., xi, 1819, 596.

Ardea stellaris, var. *minor*, GMELIN, Syst., Nat., i, 1788, 635.

Plumage of upper-parts singularly freckled with brown of various shades, blackish, tawny and whitish; neck and under-parts ochrey or tawny-white. Each feather marked with a brown dark-edged stripe, the throat line white, with brown streaks; a velvety-black patch on each side of the neck above; crown dull-brown, with buff superciliary stripe; tail brown; quills greenish-black, with a glaucous shade, brown tipped; bill black and yellowish, legs greenish, soles yellow; length, 23-28; wing, 10-13; tail, 4½; bill, about 3; tarsus, about 3½.

Habitat, entire temperate North America (up to 58° or 60°). Cuba. South to Guatemala. Breeds chiefly from the middle districts northward, wintering thence southward. Regularly migratory. Accidental in Europe.

Summer resident from March to November, but usually seen in this vicinity during the spring and fall migrations. Like the Blue Heron it is an early and late migrant, often seen after severe frosts in the fall. It is apparently more numerous than any others of the family except the Green Heron. But, unlike any of the preceding, it is usually seen in weedy and bushy swamps and not along running streams, preferring, if it must have company, that of the Snipe and Rail, to that of its immediate relatives.

A friend describes to me a bird which he saw stalking along the bank of a creek in spring, as of a freckled mulatto color, about two feet long, slender and graceful in its movements, which he calls "Nelly Bly," for

"When she walks she lifts her foot

And then she puts it down."

A description which better applies to this species than to any other of this family.

The nest of the Bittern is placed on the ground; the eggs, three to five in number, are brownish-drab, measuring about 2.00 by 1.50.

GENUS ARDETTA. Gray.

Generic characters as in *Botaurus*, but sexes differently colored.

ARDETTA EXILIS (Gm.) Gr.

Least Bittern.

Ardea exilis, KIRTLAND, Ohio Geolog. Surv., 1838, 165.—AUDUBON, B. Am., vi, 1843, 100.

Ardetta exilis, WHEATON, Ohio Agric. Rep. for 1860, 1861, 368; Reprint, 10; Field Notes, i, 1861, 129; Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 573; Reprint, 13.—TREMBLY, Field Notes, i, 1861, 180.—LANGDON, Cat. Birds of Cin., 1877, 15; Journ. Cin. Soc. Nat. Hist., i, 1878, 117; Revised List, ib., iii, 1879, 184; Reprint, 18; Summer Birds, ib., iii, 1880, 227; Field Notes, ib., ii, 1880, 127.—DURY and FREEMAN, ib., ii, 1880, 184; Reprint, 5.

Ardea exilis, GMELIN, Syst. Nat., i, 1788, 645.

Ardetta exilis, GRAY, Genera of Birds, iii, 1849.

No peculiar feathers, but those of the lower neck, long and loose, as in the Bittern; size very small; 11-14 inches long; wing, 4-5; tail, 2 or less; bill, 2 or less; tarsus, about 1½. Male with the slightly crested crown, back and tail, glossy greenish-black; neck behind, most of the wing-coverts, and outer edges of inner quills, rich chestnut, other wing-coverts, brownish-yellow; front and sides of neck and under-parts, brownish-yellow, varied with white along the throat line, the sides of the breast with a blackish-brown patch; bill and lores mostly pale yellow, the culmen blackish; eyes and soles yellow; legs greenish-yellow; female with the black of the back entirely, that of the crown mostly or wholly replaced by rich purplish-chestnut, the edges of the scapulars forming a brownish-white stripe on either side.

Habitat, United States and British Provinces. Breeds throughout its United States range, wintering in the South. Cuba. Jamaica. Central America.

Not common summer resident especially in the higher portions of the State. In swampy districts it is not uncommon. Prefers wooded swamps but is often seen along water-courses, generally singly, though not so averse to the society of its fellows as the Bittern. During the migrations it often becomes confused and may turn up in most unexpected localities. Audubon narrates the following:

"One morning while I was in the Cincinnati Museum, a woman came in holding in her apron one of this delicate species alive, which she said had fallen down the chimney of her house under night, and which, when she awoke at day-break, was the first object she saw, it having perched on one of the bed-posts."

It is the most tame and unsuspicious of the family. On the 14 of May, 1876, my friends, Oliver Davie and Arnold Boyle discovered one of these birds on the bank of the Scioto River within the city limits; being without a gun, they gave chase with stones and succeeded after an hour's pursuit in securing a fine specimen for their collection. On this subject Dr. Coues says (Birds of Northwest, p., 520), "Speaking in general terms, and without considering the artificial frame of mind brought about by man's interference, the shyness of the Heron corresponds exactly to its size; and it is so with many other birds, particularly Gulls—the larger the species, the more wary."

Mr. Langdon, (Summer Birds, l. c.) says that in Ottawa county they are "quite common, frequenting and nesting amongst the 'deer-tongue' and 'saw-grass,' at a considerable distance from land. Judging from the depth of water in the situations where they were most numerous, we inferred that they spend much of their time clinging to tall aquatic grasses, and walking about on the lily 'pads' in search of food. They uttered no sound when flushed, and flew as noiselessly as owls. The nest is rather a bulky affair for the size of the bird, composed entirely of 'saw-grass,' a platform being constructed by bending a number of green blades toward a common center, so that they cross each other at a height of fifteen or twenty inches from the water; this platform is slightly depressed in the center and the depression lined with a few blades of dried grass of the same species

as that used in the foundation. Four eggs, of a very faint greenish-blue tint and rounded oval in shape, constitute a full set; those taken were incomplete, containing from two to three eggs, which were fresh and probably the second laying of the season. They evidently build an entire new nest for the second brood, as the grass was still fresh and green in those observed."

ORDER ALECTORIDÆ. CRANES, RAILS, ETC.

FAMILY GRUIDÆ. CRANES.

Of great stature, with extremely long neck and legs. Part or all of the head bare. Toes much shorter than the tarsi; with basal webbing, but without lobation; hallux very short, highly elevated. Bill equalling or exceeding the head, compressed, perfectly straight, contracted about the middle, with enlarged acute terminal portion; nasal fossæ wide and deep, with large perforate nostrils.

GENUS GRUS. Linnæus.

With the characters of the family.

GRUS AMERICANA (L.) Temm.

White Crane; Whooping Crane.

Grus americana, KIRTLAND, Ohio Geolog. Surv., 1838, 165.

Grus americanus, WHEATON, Ohio Agric. Rep. for 1860, 368, 377; Reprint, 1861, 9, 19; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin, 1877, 15; Journ. Cin. Soc. Nat. Hist., i, 1878, 117; Reprint, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18.

Ardea americana, LINNÆUS, Syst. Nat., i, 1776, 234.

Grus americana, TEMMINCK, Analyse.

Adult with the bare part of head extending in a point on the occiput above, on each side below the eyes, and very hairy. Bill very stout, convex, ascending, that part of the under mandible as deep as the upper opposite it. Adult plumage pure white with black primaries, primary coverts and alula; bill dusky-greenish; legs black; head carmine, the hair-like feathers blackish. Young with the head feathered; general plumage gray (?) varied with brown. Length, about 50 inches; wing, 24; tail, 9; tarsus, 12; middle toe, 5; bill, 6.

Habitat, temperate North America. Up the Mississippi Valley, spreading through the fur countries. Texas to Florida, and occasionally upon the coast to the Middle States.

Rare. Spring and fall migrant. Dr. Kirtland, who, following Audubon, did not distinguish between this and the following species, says:

"The Sandhill or Whooping Crane, the adjutant bird, occasionally visits Ohio. Dr Ward informs me that two were killed near Roscoe, in Coshocton county in 1837, and the Hon. Calvin Pease also informs me that he once saw a flock of them in Fairfield county."

Mr. Langdon includes it in his Revised List, two or three specimens

having been taken in the vicinity of Cincinnati. Mr. Mapes, a competent ornithologist, informed me that he saw a flock of over fifty of these birds flying over this city on the 26th of November, 1876. Dr. Coues describes the eggs as follows:

"Two eggs of the Whooping Crane are in the Smithsonian from Great Slave Lake, where they were taken by Mr. J. Lockhart. Though from the same nest, one is noticeably more elongated than the other, measuring about 3.90 by 2.65, the other being about 3.60 only, with the same width. The shell is much roughened with numerous elevations, like little warts, and is, moreover, punctulate all over. The ground is a light brownish-drab; the markings are sparse, except at the great end; they are large irregular spots of a pale dull chocolate-brown, with still more obscure or nearly obsolete shell-markings."

GRUS CANADENSIS (L.) Temm.

Brown Crane; Sandhill Crane.

Grus canadensis, WHEATON, Ohio Agric. Rep. for 1860, 370, 480; Reprint, 1861, 9; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13 — LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18.

Ardea canadensis, LINNÆUS, Syst. Nat., i, 1766, 234.

Grus canadensis, TEMMINCK, Analyse.

Adult with the bare part of head forking behind to receive a pointed extension of the occipital feathers, not reaching on the sides below the eyes, and sparsely hairy. Bill moderately stout, with nearly straight and scarcely ascending gonys, that part of the under mandible not so deep as the upper at the same place. Adult plumage plumbeous-gray never whitening; primaries, their coverts, and alula, blackish. Young with head feathered, and plumage varied with rusty brown. Rather smaller than the last.

Habitat, United States from Florida and the Mississippi Valley to the Pacific, and interior of the fur countries. North to the Yukon and west coast of Baffin's Bay. Cuba. Breeds apparently nearly throughout its range.

Rare migrant; probably occasional summer resident. The quotation from Dr. Kirtland above, may refer to this species. Mr. Winslow includes it in his list of birds of Northern Ohio, and it has been reported to me as breeding within a few years in the vicinity of Toledo. Mr. Langdon mentions two specimens taken in the vicinity of Cincinnati. I have never seen the bird in this vicinity, and though I have frequently heard of its occurrence, the identification has never been unquestionable. Both this bird and the Blue Heron are sometimes confounded under the common name of Blue Crane.

FAMILY RALLIDÆ. RAILS, GALLINULES, ETC.

Size moderate and small; neck and legs comparatively short. Head completely feathered, excepting, in the Coots and Gallinules, a broad horny frontal plate. Toes

equalling or exceeding tarsi, simple or lobate. Bill not constricted in the middle, rather shorter than head, straight and quite stout; or much longer, regularly slender and decurved, with long nasal fossæ. Nostrils incompletely or not perforate.

Sub-family RALLINÆ. Rails.

Feet simple; head without frontal plate.

GENUS RALLUS Linnæus.

Bill longer than the head, curved.

RALLUS ELEGANS Aud.

Fresh-water Marsh Hen.

Rallus elegans, WHEATON, Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 20; Food of Birds, etc., Ohio Agric. Rep., for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 189; Reprint, 18; Summer Birds, ib., iii, 1880, 227.

Rallus elegans, AUDUBON, Orn. Biog., iii, 1835, 27.

Above brownish-black; variegated with olive-brown, becoming rich chestnut on the wing-coverts; under-parts rich rufous or cinnamon-brown, usually paler on the middle of the belly and whitening on the throat; flanks and axillars blackish, white-barred. Length, about 16; wing, 5-6; tail, 2-2½; bill, 2½; tarsus, 2; middle toe and claw, 2½. Female smaller.

Habitat, United States, rather southerly. North on the Atlantic coast regularly to the Middle States, casually to Connecticut; in the interior to Kansas and Missouri at least; on the Pacific side to Oregon and Washington. Cuba. Mexico. Winters in the Southern States.

Not an uncommon migrant, most frequently seen in spring. Probably a summer resident breeding in extensive swamps and marshes. Dr. Howard E. Jones informs me that he has taken the young in the vicinity of Circleville. It is frequently confounded with and known as the Clapper Rail, but the latter is confined to the vicinity of salt water, and is a bird of duller plumage.

The eggs measure about 1.66 by 1.10. The color varies from dull white to cream or pale buff, with reddish-brown markings.

RALLUS VIRGINIANUS L.

Virginia Rail.

Rallus virginianus, NUTTALL, Man. ii, 1835, 205.—KIRTLAND, Ohio Geolog. Surv., 1838, 165, 185.—WHEATON, Field Notes, i, 1861, 153; Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18.

Virginia Rail, BALLOU, Field and Forest, iii, 1878, 136.

Rallus virginianus, LINNÆUS, Syst. Nat., i, 1766, 283.

Coloration exactly as in *elegans* of which it is a perfect miniature. Length, $8\frac{1}{2}$ – $10\frac{1}{2}$; wing about 4; tail about $1\frac{1}{2}$; bill, $1\frac{1}{2}$ – $1\frac{3}{8}$; tarsus, $1\frac{1}{2}$ – $1\frac{1}{4}$; middle toe; $1\frac{1}{2}$ – $1\frac{1}{4}$.

Habitat, United States and British Provinces. Winters in the Southern States and beyond. South to Guatemala. Cuba.

Common summer resident, most abundant during the migrations. This and the Carolina Rail are the common species. Of the two, the Virginia Rail is the most retiring and least numerous. It is found in all extensive swamps and marshes of the State and breeds from Central Ohio northward to the lakes. It is given as a migrant only, in the vicinity of Cincinnati, by Mr. Langdon.

Eggs 1.25 by .95, similar to those of the preceeding species.

GENUS PORZANA. Vieillot.

Bill shorter than the head, stout and straight.

PORZANA CAROLINA (L.) Cab.

Carolina Rail; Sora; Ortolan.

Rallus carolinus, KIRTLAND, Ohio Geolog. Surv., 1838, 165, 185.

Porzana carolina, WHEATON, Field Notes, i, 1861, 153; Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18; Summer Birds, ib., iii, 1880, 227.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5.

Rallus carolinus, LINNÆUS, Syst. Nat., i, 1766, 263.

Porzana carolina, CABANIS, Journ., 1856, 428.

Above, olive-brown, varied with black, with numerous sharp white streaks and specks; flanks, axillars and lining of wings, barred with white and blackish; belly whitish; crissum rufescent. Adult with the face and central line of the throat black, the rest of the throat, line over eye, and especially the breast more or less intensely slate-gray, the sides of the breast usually with some obsolete whitish barring and speckling; young without the black, the throat whitish, the breast brown. Length, 8–9; wing, 4– $4\frac{1}{2}$; tail, about 2; bill, $\frac{3}{8}$ – $\frac{1}{2}$; tarsus, $1\frac{1}{2}$; middle toe and claw, $1\frac{1}{8}$.

Habitat, entire temperate North America; especially abundant along the Atlantic coast during the migrations. Breeds from the Middle districts northward. Winters in the Southern States and beyond. South to Venezuela. Various West Indian Islands. Greenland. Accidental in Europe.

Abundant spring and fall migrant in April, October and November, and common summer resident, breeding in suitable locations throughout the State.

This is the most abundant species of the family with us, and, especially on tide-water, is a highly esteemed game bird. In spring it is often found in quite exposed localities, such as the borders of brooks and ponds. In the fall they are much more numerous and frequent high weeds on the

dried bottoms of ponds, cornfields, and marshy places. In their habits, like all others of this family, they are retiring, skulking like rats in run-ways at the roots of grass and weeds. They are with difficulty flushed, and when on the wing, their flight is short, extremely slow and labored, just clearing the tops of the grass or weeds. In alighting they drop suddenly as if shot, and conceal themselves or quickly run for safety to a considerable distance.

The nest of this species, as of all others of the family, is placed on the ground. The eggs are eight or ten in number, greenish or olive-drab, with markings of reddish-brown. They measure about 1.20 by .90.

PORZANA NOVEBORACENSIS (Gm.) Cass.

Yellow Rail.

Rallus noveboracensis, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 185.

Porzana noveboracensis, WHEATON, Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin. 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18; Field Notes, ib., ii, 1880, 127.

Fulica noveboracensis, GMELIN, Syst. Nat., i, 1788, 701.

Rallus noveboracensis, BONAPARTE, Sp. List, 1827, 213.

Porzana noveboracensis, CASSIN, Birds, N. Am., 1858, 750.

Above, varied with blackish and ochrey-brown, and thickly marked with narrow white semicircles and transverse bars; below, pale ochrey-brown, fading on the belly,

PORZANA JAMAICENSIS (Gm.) Cass.

Black Rail.

Porzana jamaicensis, LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 189; Reprint, 23.

Rallus jamaicensis, GMELIN, Syst. Nat., i, 1788, 718.

Porzana jamaicensis, CASSIN, Birds N. Am., 1858, 749.

Blackish, head and under-parts dark-slaty, paler or whitening on the throat; above speckled with white, the cervix and upper back varied with dark-chestnut; lower belly, crissum, flanks and axillars, white-barred; quills with white spots. Very small, about $5\frac{1}{2}$; wing, $2\frac{2}{3}$; tail, $1\frac{1}{8}$; tarsus, $\frac{3}{4}$.

Habitat, South America to Chili. Central America. West Indies. In North America to New Jersey and Kansas, rare. Illinois, breeding (*Nelson*).

Mr. Langdon introduces this bird to our acquaintance in his Catalogue of the Birds of the Vicinity of Cincinnati, in which he says, "a Rail shot by myself, near Madisonville, several years ago, I now think was this species." In addition to this, Dr. Howard E. Jones is almost positive that he has killed it in the vicinity of Circleville. It is also reported from Northern Ohio but of this I have not as yet obtained positive evidence. As Mr. Langdon omits it from his later list, we must wait more positive identification than the above.

deepest on the breast where many feathers are dark tipped; flanks with numerous white bars; crissum varied with black, white and rufous. Small, about 6 long; wing, $3\frac{1}{2}$; tail, $1\frac{1}{2}$; bill, $\frac{1}{2}$; tarsus, $\frac{2}{3}$; middle toe and claw, $1\frac{1}{2}$.

Habitat, Eastern North America. North to Hudson's Bay, but in New England not observed beyond Massachusetts. Apparently nowhere abundant. Winters in the Southern States.

Not common spring and fall migrant; probably summer resident. The Yellow Rail, otherwise known as the Yellow-breasted Rail or Upland Rail, is the least common of all species positively identified in this State.

It has been taken in the vicinity of Cleveland, where it is known as the Upland Rail, frequenting higher ground than that usually affected by members of this family. Mr. Langdon gives it as rare in the vicinity of Cincinnati. Dr. Howard E. Jones, to whom I am indebted for specimens, has taken it frequently at Circleville, both in fall and spring, and considers it nearly as common as other species and believes that it breeds there, which is probably the case throughout the State.

Eggs rich, warm, buffy-brown, marked at the greater end with a cluster of reddish-chocolate dots and spots, and measuring 1.10 by .82.

Mr. Maynard describing a Massachusetts specimen taken on *high land* twenty or thirty rods from a meadow at the foot of a hill, says, "It is a female and differs from any which I have seen, having a *broad white edging to the secondaries*." A specimen obtained at Circleville, by Dr. Howard E. Jones and presented to me, has the outer secondaries white-tipped for an inch or more and the adjacent quills barred with white, the under tail-coverts deep purplish chestnut. Either these markings have been overlooked by previous describers or the species varies much in color and pattern in these particulars. Nuttall describes the bird as uniformly having white-tipped secondaries.

Sub-family GALLINULINÆ. Gallinules.

General form much as in *Rallinae* but body less compressed. Forehead shielded by a broad, bare, horny plate. Toes longer than the tarsus.

GENUS GALLINULA. Brisson.

Toes margined with a thin, though evident, membrane. Nostrils linear.

GALLINULA GALEATA Bon.

Florida Gallinule.

Gallinula chloropus, KIRTLAND, Ohio Geolog. Surv., 1838, 165, 185; Am. Journ. Sci., and Arts, xl., 1841, 22.

Gallinula galeata, WHEATON, Field Notes, i, 1861, 153; Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18; Summer Birds, ib., iii, 1880, 228.

Florida Gallinule, TREMBLY, Field Notes, i, 1861, 180.—WHEATON, Bull. Nat. Club, ii, 1877, 83.

Crex galeata, LICHTENSTEIN, Verz. Doubl., 1823, 80.

Gallinula chloropus, BONAPARTE, Syn., 1828, 336.

Gallinula galeata, BONAPARTE, Am. Orn., iv, 1832, 128.

Head, neck and under-parts, grayish-black, darkest on the former, paler or whitening on the belly; back brownish-olive; wings and tail dusky; crissum, edge of wing, and stripes on the flanks, white; bill, frontal plate, and ring around tibiae red, the former tipped with yellow; tarsi and toes greenish; 12-15 long; wing, $6\frac{1}{2}$ - $7\frac{1}{2}$; tail, $3\frac{1}{2}$; gape of bill, about $1\frac{1}{2}$; tarsus, about 2.

Habitat, United States, southerly. Resident in the Southern States. Northward to Massachusetts rarely, to Canada West, Kansas, Minnesota, and San Francisco. West Indies. Central America. South America to Chili.

The Florida Gallinule, first noticed as an Ohio bird by Dr. Kirtland, quoted on page 218, is a not uncommon summer resident in extensive swamps and marshes throughout the State. It is equally retiring in its habits with the Rails, but unlike them it often takes to water from choice, and swims with ease and buoyancy. When swimming it presents a very duckish or rather cootish appearance, its body being vastly distended by large air sacks, which inflated change the aspect of the bird entirely.

On its migrations it sometimes makes its appearance in barnyards, associating with domestic fowls, and in other unexpected places.

A nest and nine eggs of this bird were taken at Sandusky Bay, in 1874, by my friend, C. J. Orton. These eggs were brownish-buff, rather thickly spotted with dark reddish-brown and umber. In shape they were an elongated oval.

Mr. Langdon (Summer Birds, l. c.) gives the following account of this species as observed by him in Ottawa county:

"A very common species, breeding abundantly in the more open portions of the marsh. The nests are situated amongst the 'saw-grass,' and constructed of its dried blades. Their height varies, some almost resting on the water, while others are placed a foot or more above it and have an incline eight or ten inches in width, made of dried grass, extending from the water's edge, which makes them a conspicuous object where the surrounding vegetation is not too dense. The dozen or so sets of eggs taken were in various stages of incubation, and a few young were observed following their parents. The young, when a day or two old, are about the size of a newly hatched domestic chicken, and when found in the open water are easily captured; they present a curious sight paddling for dear life, with their bright red and orange bills standing out in strong contrast with their sooty-black, down-covered bodies."

GENUS PORPHYRIO. Temminck.

Toes without marginal membrane. Nostrils oval.

PORPHYRIO MARTINICA (L.) Temm.

Purple Gallinule.

Gallinula martinica, WHEATON, Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 20.

Porphyrio martinica, WHEATON, Bull. Nutt. Orn. Club, ii, 1877, 83.—LANGDON, Cat.

Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18.

Head, neck and under-parts beautiful purplish-blue, blackening on the belly, the crissum white; above olivaceous-green, the cervix and wing-coverts tinted with blue; frontal shield blue; bill red, tipped with yellow; legs yellowish. Young with the head, neck and lower back brownish, the under-parts mostly white, mixed with ochrey. Length, 10-12; wing, 6½-7; tail, 2½-3; bill from gape, about 1½; tarsus, about 2½; middle toe and claw, about 3.

Habitat, South Atlantic and Gulf States, north casually to New England. (Maine, Nova Scotia).

Rare in spring. The Purple Gallinule was given in my Catalogue of Ohio Birds (1861) and afterward omitted from a subsequent list for reasons below stated. Mr. Langdon restores it to its place with abundant authority as follows:

"Dr. Hunt informs me of the capture of this species near the mouth of the Big Miami River, on March 31, 1877"; and further in foot note, "Two specimens of the Purple Gallinule have since been taken at Madisonville, one by the writer in the latter part of April, and another by Mr. William H. Whetsel, early in May. Mr. John W. Shorten also reports one killed May 1st, at Jones' Station, Ohio (about thirty miles from Cincinnati), by J. H. Kelly, Esq.

"Being a species of rare occurrence so far north, the capture of four specimens here in one season is worthy of note."

In the Bulletin of the Nuttall Ornithological Club, July, 1877, I had the pleasure of recording another specimen as follows:

"I have just received from my friend, Dr. Howard E. Jones, a fine skin of the Purple Gallinule (*Porphyrio martinica*), killed by him at Circleville, Ohio, May 10, 1877. This bird is now recorded for the first time on unimpeachable authority, as a visitor of the State. Dr. Jones tells me that it has been seen before in the vicinity of Circleville. In my Catalogue of the Birds of Ohio (Ohio Agric. Rep. 1860), it was inserted on what I afterwards discovered to be insufficient authority, and for that reason it was omitted from a subsequent list (Food of Birds, etc., 1875). I have several times been favored with reports, and once or twice with skins, presumed to be of this species, which proved, however, to be those of the Florida Gallinule, which is not a rare summer resident throughout the State."

I have no authentic account of the eggs of this species, nor of its breeding in the State. Careful observation will be necessary to determine whether its occurrence here, in such numbers as the above notes would indicate, is exceptional or regular.

Sub-family FULICINÆ. Coots.

Body rather depressed, plumage compact, tarsus shorter than middle toe. All toes lobate, furnished with membranous flaps. Aquatic.

GENUS FULICA. Linnæus.

Characters of the sub-family.

FULICA AMERICANA Gm.

Coot.

Fulica americana, WHEATON, Ohio Agric. Rep. for 1860, 369; Reprint, 1861, 11; Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 13.—LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 184; Reprint, 18; Summer Birds, ib., iii, 1880, 228.

Fulica americana, GMELIN, Syst. Nat., i, 1788, 704.

Dark slate, paler or grayish below, blackening on the head and neck, tinged with olive on the back; crissum, whole edge of wing, and top of the secondaries white; bill white or flesh-colored, marked with reddish-black near the end; feet dull olivaceous; young similar, paler and duller. Length, about 14; wing, 7-8; tail, 2; bill from the gape, $1\frac{1}{2}$ - $1\frac{1}{4}$; tarsus, about 2; middle toe and claw, about 3.

Habitat, Temperate North America. Alaska. Greenland. Mexico. West Indies. Central America.

Abundant spring and fall migrant in all parts of the State, most frequently seen in spring, and very common summer resident in extensive swamps or weedy lakes. This bird forms the connecting link between the Rails and Gallinules and the swimming birds proper. It has the general structure of the birds of its family so modified that it is more aquatic in habit than any of them, being better adapted for swimming and diving than for locomotion on land. They are considered a nuisance by sportsmen and a fraud by amateurs who sometimes mistake them for ducks.

In this vicinity they are abundant in March and April, especially when the streams are full, and again in early fall they frequent reedy and weedy marshes, where their presence might not be suspected, so dense is the cover. But if a stone or stick be thrown into the rushes, an instant alarm is sounded, and the cackle of countless Mud Hens, as they are commonly called, is heard from all parts of the marsh.

The nest of the Mud Hen is built near or on the water. The eggs are ten or twelve in number, clay-colored, uniformly dotted with dark brown. They measure about 2.00 by 1.25.

ORDER LAMELLIROSTRES. ANSERINE BIRDS.

FAMILY ANATIDÆ. GEESE, DUCKS, ETC.

Of moderate size; the neck short, or, when lengthened, not accompanied by co-ordinately lengthened legs, these being always shorter than the wing. Bill straight. Tibiæ feathered below. Hind toe present, well developed, and functional, though short.

Subfamily CYGNINÆ. Swans.

Skin between eye and bill naked; tarsi reticulate; sexes alike; size very large. Neck very long.

GENUS CYGNUS. Linnæus.

Characters of sub-family.

CYGNUS BUCCINNATOR Richardson.

Trumpeter Swan.

Cygnus buccinator, WHEATON, Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—COUES, Birds of N. W., 1874, 545.—LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Cygnus buccinator, RICHARDSON, F.B. Bor-Am., ii, 1831, 464.

Adult plumage entirely white; younger, the head and neck washed with a rusty-brown; still younger, gray or ashy. Bill and feet black. Length, 4-5 feet. Tail (normally) of twenty-four feathers. No yellow spots on bill, which is rather longer than the head, the nostrils fairly in its basal half.

Habitat, chiefly the Mississippi Valley, and northward to the Pacific. Hudson's Bay. Canada. Casually on the Atlantic coast. Breeds from Iowa and Dakota northward. In winter south to the Gulf. Said to have occurred in England.

Rare migrant and winter visitor. The Trumpeter Swan was first mentioned as an Ohio bird by myself in 1861, on the authority of Mr. Winslow, who informed me that it was occasionally taken at Sandusky Bay and other points on the lake shore. Mr. Langdon records one specimen taken and three seen on the Ohio River, near Cincinnati, in December, 1876, and informs me the captured specimen is preserved by M. Woche, Esq.

CYGNUS AMERICANUS Sharpless.

Whistling Swan.

Cygnus musicus, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.

Cygnus americanus, WHEATON, Ohio Agric. Rep. for 1860, 369; Reprint, 1861, 11; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879; Reprint, 14.

Cygnus musicus, BONAPARTE, Syn., 1823, 379.

Cygnus americanus, SHARPLESS, Doughty's Cab. N. H., i, 1830, 185.

Size and color of the last species, except a yellow spot on bill near base. Bill not longer than the head; nostrils median. Tail (normally) of twenty feathers.

Habitat, Continent of North America; breeding only in the far North; wintering in the United States. Accidental in Scotland.

Not common, spring and fall migrant, perhaps also winter resident. More numerous on Lake Erie than elsewhere, though occurring generally throughout the State. Mr. Langdon gives it as a rare migrant. In March, 1877, I saw several specimens from Western Ohio, and the Scioto and Muskingum River. Most of these were in full plumage, a few with reddish-brown on head and neck. Young birds of this species sometimes want the yellow spot at the base of the bill.

Sir John Richardson, quoted by Dr. Coues, says:

"Common all along the Yukon. Arrives with the Geese about May 1, but in a contrary direction, coming down instead of up the Yukon. Breeds in the great marshes near the Yukon mouth. The eggs, two in number, vary from pure white to fulvous, as do the parents on the head and neck, apparently without regard to age. The eggs are usually in a tussock quite surrounded with water, so that the female must sometimes set with her feet in the water. They are usually laid about May 21 at Nulato, but later at the Yukon mouth. In July the Swans moult and cannot fly, and the Indians have great sport spearing them with bone tridents. They are very shy birds, and usually shot on the wing or with a bullet. This species, if hung long enough, is tender, well-flavored, and excellent eating."

Sub-family ANSERINÆ. Geese.

Head completely feathered, tarsi reticulate; neck shorter than in Swans, and legs longer than in Ducks. Bill rather short, high, compressed, tapering. Sexes alike. Size large.

GENUS ANSER. Linnæus.

Bill as long as the head, the laminae prominent. Hind toe long, its tip reaching to the ground. Bill and feet bright colored.

ANSER ALBIFRONS Gm.

var. GAMBELI (Hartl.) Cs.

American White-fronted Goose.

Anser albifrons, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.

Anser gambelii, WHEATON, Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 20.

Anser albifrons, *var. gambeli*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 16; Journ. Cin. Soc. Nat. Hist., i, 1878, 117; Reprint, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

White-fronted Goose, KIRTLAND, Fam. Visitor, i, 1850, 72.

Anas albifrons, GMELIN, Syst., Nat., i, 1788, 509.

Anser albifrons, BECHSTEIN, Naturg., iv., 898.

Anser gambeli, HARTLAUB, R. M. Z., 1852, 7.

Anser albifrons, *var. gambeli*, COUES, Key, 1872, 282.

Laminae of bill moderately exposed; tail normally of sixteen feathers. Under-parts white or gray, extensively blotched with black; back dark-gray, with paler or brownish edgings of the feathers; upper tail-coverts white; head and neck grayish-brown, the forehead conspicuously pure white (in the adult; dark in some states); bill pale lake; feet orange, with pale claws. Length, about 27 inches; wing, 16-18; tail, 5-6; tarsus, 2½-3; middle toe and claw about the same. Only differs from the European in an average longer bill (1½-2 instead of 1¼-1½).

Habitat, Continent of North America; breeding in the far north; wintering in the United States. Cuba.

Not common spring and fall migrant, perhaps a not infrequent winter resident in some localities. The White-fronted Goose is more common on the lake and reservoirs than elsewhere, but is occasionally found on the Ohio River and streams in the interior of the State. Mr. Langdon notes its capture in the vicinity of Cincinnati. A specimen in my collection was taken by Mr. Warren Clark, in Fairfield county, and I have seen specimens from Western Ohio.

The eggs of this species are dull greenish-yellow with obscure darker tints. They measure 3.00 by 2.00.

ANSER HYPERBOREUS. Pall.

Snow Goose.

Anser hyperboreus, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.—WHEATON, Ohio Agric. Rep. for 1860, 369, 378; Reprint, 1861, 11, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1876, 13.—LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Snow Goose, KIRTLAND, Fam. Visitor, i, 1854, 72.

Anser hyperboreus, PALLAS, Spic. Zool., viii, 1767, 80, 25.

Bill with laminae very prominent, owing to arching of the edges of the bill. Adult plumage pure white, but in most specimens the head washed with rusty-red; primaries broadly black-tipped; bill lake-red with white nail; feet the same with dark claws. "Young dull bluish or pale lead colored on the head and upper part of the body" (Cassin). Length, about 30; wing, 17-19; tail, 5½-6; bill, 2½; tarsus, 3½.

Habitat, the whole of North America. Breeds in high latitudes, migrating and wintering in the United States; abundant in the interior and along the Pacific Coast, rare on the Atlantic. Greenland, transient. Cuba. Rare or casual in Europe.

Occasional spring and fall migrant. Not rare on Lake Erie; rare in the vicinity of Columbus. Mr. Langdon records three specimens taken on the Little Miami, near Madisonville, February, 1878. In the spring of 1874, a flock of about twenty visited this vicinity. These were all old birds. It is said that the old and young migrate in separate flocks, the young not attaining their full plumage until the fourth year.

Eggs yellowish-white, 3 by 2 inches.

The Lesser Snow Goose (var. *albatus*) undoubtedly occurs here, as it is

found in Illinois, in equal numbers with the larger variety (Nelson), but I am not aware that it has been properly identified.

ANSER CÆRULESCENS (L.) Vieill.

Blue Goose.

Anser cærulescens, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574, Reprint, 1875, 14.—LANGDON, Cat. of Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Anas cærulescens, LINNÆUS, Syst. Nat., i, 1766, 198.

Anser cærulescens, VIEILLOT, Ency. Meth., i, 1823, 115.

With nearly the size, and exactly the form of the last species, but the plumage ashy, varied with dark-brown, the head, upper neck, tail-coverts and most of the under-parts white, the wing-coverts silvery ash.

Habitat, North America generally.

Rare. The Blue Goose was first introduced as an Ohio bird by myself, in 1875, two specimens having been identified at Columbus. Until lately it has been considered by many ornithologists as the young of the Snow Goose. The specimens above referred to have a peculiar history which is as follows: In the fall of 1875, a strange bird associated with a flock of tame geese about four miles south of this city, followed them into a barn at night, and was secured. Under the impression that it was a "Brant" (a common name for all wild geese, except the Canada Goose) it was brought alive to the City Park of this city. It was kept for a year, associating with swans and becoming quite domesticated. It would frequently fly away considerable distances, but was readily retaken. On the 27th of October, a goose was wounded in the river a few hundred from the City Park and secured. Under the impression that it was the escaped bird, it was returned to the park, but much to the surprise of all concerned, it was found that there were now *two* geese almost precisely alike. The superintendent of the park, Mr. J. L. Stelzig, made the new comer as comfortable as possible, but the next day but one goose remained and this the wounded bird captured the previous day. The other had probably flown to the south, its instinct perhaps quickened by the acquaintance which it had so recently renewed with its own species. In a few days the wounded specimen died, and came into my possession by the kindness of Mr. Stelzig. The following is its description: Head and upper neck white, with an interrupted line of dark gray-brown on the nape and occiput (this line wanting on the other and probably older individual). Lower neck, upper breast, and back grayish-brown, becoming lighter on belly and under tail coverts. Lesser wing coverts, primary coverts, lower back, rump, and tail pearl-gray of varying shade, with lighter or whitish tips or edging to the feathers; quills, inner secondaries

and secondary coverts brownish-black, the latter with broad whitish edging. Bill light lake red, the arched edges blackish, nail light horn-color. Feet darker-red. Length, $27\frac{1}{2}$; wing, $17\frac{1}{2}$; tarsus and middle toe with claw, each $3\frac{1}{8}$; bill, $2\frac{3}{8}$.

Mr. Langdon gives this species as a migrant on the Ohio and its tributaries, and notes its identification at Brookville, Indiana. A specimen which I saw in Cincinnati was said to have been taken on Sandusky Bay.

GENUS BRANTA. Scopoli.

Bill shorter than the head, the laminae of upper mandible concealed. Hind toe elevated, rudimentary, not reaching the ground.

BRANTA BERNICLA (L.)

Brant Goose.

Anas bernicla, KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1838, 67.

Anser bernicla, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.

Bernicla brenta, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12.

Branta bernicla, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 16; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Anas bernicla, LINNÆUS, Syst. Nat., i, 1766, 19.

Branta bernicla, SCOPOLI, Bemerck. Naturg., 1770, 73.

Anser bernicla, ILLIGER, Prod., 1811, 277.

Bernicla brenta, STEPHENS, Gen. Zool., xii, pt. ii, 1824, 46.

Head, neck, body anteriorly, quills and tail black; a small patch of white streaks on the middle of the neck, and usually white touches on the under eyelid and chin; upper tail coverts white; back brownish-gray, under parts the same but paler, and fading into white on lower belly and crissum; black of jugulum well-defined against the color of the breast; length, 2 feet; wing, 13; tail, 5; bill, $1\frac{1}{8}$; tarsus, $2\frac{1}{4}$.

Habitat, Europe and North America, rare or casual on the Pacific.

Rare migrant. "The Brant Goose is not unfrequently seen passing over us in the spring of the year, and it is frequently seen on the lake shore during a few days in spring" (Kirtland). I have never identified this bird; it is given by Mr. Langdon as "migrant on the Ohio and tributaries."

It is with considerable hesitation that I permit the Brant to remain as unquestionably a bird of Ohio. Dr. Kirtland's note is, when carefully considered, rather vague, and Mr. Langdon's very general. Audubon says the Brant is never found far inland. Mr. Winslow informs me that it has not to his knowledge been taken on Lake Erie. Dr. Haymond has identified it in Brookville, Indiana, and Mr. Nelson says: "Probably a rare visitant, but the only instances known to me of its capture in

this portion of the country is a specimen taken by Dr. Hoy, from a flock of three, upon the lake shore near Racine (Wisconsin). Dr. Coues mentions observing them in vast numbers on the Missouri river in October, 1872.

BRANTA CANADENSIS (L.) Gray.

Canada Goose; Wild Goose.

Anser canadensis, AUDUBON, Orn. Biog., iii, 1835, 1; B. Am., 1834, 179.—KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.—COLLINS, Ohio Agric. Rep. for 1860, 3c7.

Anas canadensis, KIRTLAND, Preliminary Rep. Ohio Geolog. Surv. 1838, 67.

Bernicla canadensis, WHEATON, Ohio Agric. Rep. for 1860, 370, 378; Reprint, 1861, 12, 20.

Branta canadensis, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19; Summer Birds, ib., iii, 18c0, 228.

Canada Goose, KIRTLAND, Fam. Visitor, i, 1850, 72.

Anas canadensis, LINNÆUS, Syst. Nat., i, 1766, 198.

Anser canadensis, VIEILLOT, Nouv. Dict. d'Hist., Nat., —.

Bernicla canadensis, BOIE, Isis, 1826, 921.

Branta canadensis, GRAY.

Tail normally eighteen feathered. Grayish-brown, below paler or whitish-gray, bleaching on the crissum, all the feathers with lighter edges; head and neck black, with a broad white patch on the throat mounting each side of the head; tail black, with white upper coverts. Length, about 36; wing, 18-20; tail, $6\frac{1}{2}$ - $7\frac{1}{2}$; bill, $1\frac{1}{2}$ -2; tarsus, usually over 3.

Habitat, the whole of North America, breeding in the United States, as well as further north. Accidental in Europe.

Common spring and fall migrant; winter resident in part, and, perhaps still, though rarely, a summer resident, breeding in retired locations. Dr. Kirtland says: "I learn from Dr. Ward that the Wild Goose frequently spends the winter in the Scioto Valley and becomes so tame as to visit the corn-fields in search of food." At the time Dr Kirtland wrote (1838) the fact that Wild Geese visited the corn-fields may have been an evidence of their tameness, but if so, it must also point to the vast changes which have since taken place. At the present time the Geese find no more secure feeding grounds than the vast corn-fields of the Scioto Valley. However, these birds are less numerous than formerly, at least in the vicinity of this city. They seem to retain for a long time an attachment for places, and visit each year a favorite locality on the Olentangy River, so near this city, that I have known amateur sportsmen to refrain from shooting them, for the reason that "they were too near town to be *wild* geese."

BRANTA CANADENSIS (L.)

var. HUTCHINSII (Rich.) Cs.**Hutchins' Goose.**

Bernicla hutchinsii, WHEATON, Ohio Agric. Rep. for 1860, 370, 378; Reprint, 1861, 12, 20.
Branta canadensis, *var. hutchinsii*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17.

Anas canadensis, LINNÆUS, Syst. Nat., 1766, 198.

Anser hutchinsii, SWAINSON and RICHARDSON, Fn. Bor-Am., iii, 1831, 198.

Bernicla hutchinsii, WOODHOUSE, Sitgr. Rep., 1823, 102, 70.

Branta hutchinsii, BANNISTER, Proc. Phila. Acad., 1870, 131.

Branta canadensis, *var. hutchinsii*, COUES, Key, 1872, 284.

Tail sixteen-feathered. Colors exactly as in the Canada Goose, but size less. Length, about 2½ feet; wing, 15-17; tail, 5-6; bill, 1½-1¾; tarsus rather under 3.

Habitat, North America, but chiefly northern and western.

Rare migrant, only recognized on Lake Erie. Mr. Winslow informs me that several specimens have been taken at Sandusky Bay.

Mr. Nelson, Bull. Essex Ins., viii, 1876, 138, speaking of a series of eight Canada Geese examined by him says:

"In the lot were typical representatives of the two forms above named (*B. canadensis* and *hutchinsii*). In addition were several specimens which formed a direct chain in which it was impossible to tell where one variety ended and the other commenced. The size of the specimens, the coloration, and indeed every particular, aided in perfecting the series, except the number of tail feathers, which was eighteen throughout. In *hutchinsii* I have found this to be a very variable character, as a large portion of the specimens which agree perfectly with the dimensions of the latter possess the eighteen tail feathers, instead of sixteen, as given by authors."

Sub-family ANATINÆ. River Ducks.

Neck and legs shorter than in geese. Tarsi scutellate in front, hind toe simple, feet small. Sexes dissimilar. The genera of this sub-family based upon form and relative proportion of bill to head and foot.

GENUS ANAS Linnæus.

Bill broad, rather larger than foot. Tail two-fifths the wing.

ANAS BOSCHAS L.

Mallard.

Anas domestica, KIRTLAND, Prelim. Rep., 1838, 67.

Anas boschas, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.—WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19; Summer Birds, iii, 1880, 228.

Mallard, KIRTLAND, Fam. Visitor, i, 1850, 1, 72.

Anas boschas, LINNÆUS, Syst. Nat., i, 1766, 205.

Male with the head and upper neck, glossy green, succeeded by a white ring; breast purplish-chestnut; tail feathers mostly whitish; greater wing-coverts tipped with black and white, the speculum violet; feet orange red; female with the wing as in the male; head, neck and under-parts pale ochrey, speckled and streaked with dusky. Length, about 24; wing, 10-12.

Habitat, nearly cosmopolitan, and nearly every where domesticated. Wild throughout the whole of North America, breeding sparingly throughout the United States as well as further north. Very rare and scarcely found in New England beyond Massachusetts, where replaced by the Dusky Duck.

Abundant spring and fall migrant. One of the most highly esteemed ducks. Some remain through the summer and breed in the reservoirs and secluded swamps.

Dr. Kirtland, writing in 1850, speaks of the changes in the aquatic fauna of the State as follows:

"Wild geese, swans, ducks and wading birds literally swarmed about every lake, pond and creek, during spring and autumn. Many species also bred on the Reserve.

Forty years since, while travelling from Buffalo to Ohio, along the immediate shore of the lake, the scene was constantly enlivened by the presence of ducks, leading their young on the margin of the water, or hastily retreating to it on our approach. It often happened that on doubling some point of land or fallen tree, we placed ourselves in a position to cut off their communication with their favorite element. The instructive expedients to which the thoughtful mother would resort to extricate her charge from impending danger, was to us a matter of amusement and interest. The *Goosander*, *Mallard* and *Summer Duck*, were among the most common species we observed."

The nest of the Mallard is placed on the ground, in a clump of weeds or grass, near water. The eggs are pale, dirty yellowish-drab in color, and average 2.35 by 1.75 inches.

ANAS OBSCURA Gm.

Dusky Duck.

Anas obscura, KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1838, 67; Ohio Geolog. Surv., 1838, 166, 186.—AUDUBON, Orn. Biog., iv, 1828, 15; B. Am., vi, 1843, 249.—WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Black Duck, KIRTLAND, Fam. Visitor, i, 1850, 72.

Anas obscura, GMELIN, Syst. Nat., i, 1788, 541.

Size of the Mallard and resembling the female of that species, but darker and without decided white anywhere except under the wings. Tail 16-18 feathered.

Habitat, Eastern North America, especially along the Atlantic coast from Labrador to Texas.

Not uncommon spring and fall migrant; not common summer resident in Northern Ohio. The Dusky Duck or Black Duck, as commonly called, is

much less common in the interior than along the Atlantic coast. Sometimes they appear in considerable numbers on the lake and reservoirs. On the streams they are more seldom seen, and so far as my observation extends, never in large flocks.

The eggs of the Dusky Duck are not distinguishable from those of the Mallard.

GENUS DAFILA. Leach.

Neck very long. Bill longer than the foot, narrow. Tail in adult male much pointed, three-fourths or more the wing.

DAFILA ACUTA (L.) Bonap.

Pintail: Springtail.

Anas acuta, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.

Dafila acuta, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Anas acuta, LINNÆUS, Syst. Nat., i, 1766, 202.

Dafila acuta, BONAPARTE, List, 1833, 56.

Tail cuneate, when fully developed the central feathers projecting and nearly equaling the wing; much shorter and not so narrow in the female and young, four to nine inches long; wing, 11; total length, about 24. Bill black and blue, feet grayish-blue, head and upper neck dark-brown, with green and purple gloss, sides of neck with a long white stripe, lower neck and under parts white, dorsal line of neck black, passing into the gray of the back, which, like the sides, is vermiculated with black; speculum greenish-purple, anteriorly bordered by buff tips of the greater coverts, elsewhere by black and white; tertials and scapulars black and silvery; female and young with the whole head and neck speckled or finely streaked with dark-brown and grayish or yellowish-brown; below dusky-freckled; above blackish, all the feathers pale-edged; only a trace of the speculum between the white or whitish tips of the greater coverts and secondaries.

Habitat, North America and Europe. Breeds chiefly in high latitudes. In winter south to Panama. Cuba.

Abundant spring and fall migrant. Sometimes remains through the winter, and is one of the earliest to return in spring. The Pintail is one of the shyest of our ducks. It is seldom seen in ponds, being partial to running streams.

The eggs are dull grayish-olive in color, and measure 2.25 by 1.50.

GENUS CHAULELASMUS. Gray.

Bill as long as the head, shorter than foot; longer than tarsus. Tail about two-fifths the wing.

CHAULELASMUS STREPERUS (L.) Gray.

Gadwall; Gray Duck.

Anas strepera, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.

Chaulelasmus streperus, WHEATON, Ohio Agric. Rep. for 1860, 370, 378; Reprint, 1861, 12, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 189; Reprint, 23.

Gadwall, KIRTLAND, Fam. Visitor, i, 1850, 72.

Anas strepera, LINNÆUS, Syst. Nat., i, 1766, 200.

Chaulelasmus streperus, GRAY, 1838.

Male with most of the plumage barred or half-ringed with black and white or whitish; middle coverts chestnut, greater coverts black, speculum white; female known by these wing marks. Length, 19-22; wing, 10-11.

Habitat, North America generally. Europe. Asia. Africa. Generally distributed in this country.

Not very common spring and fall migrant, in part summer resident.

The Gadwall is one of the least common of all the ducks which may be looked for throughout the State during their migrations. I have never met with it in summer. Mr. Dury informs me that it breeds at the reservoir in Mercer county.

The eggs are creamy-buff and measure about 2.00 by 1.50.

GENUS MARECA Stephens.

Bill shorter than head or foot, equal to tarsus or inner toe. Tail not more than half the wing.

MARECA AMERICANA (Gm.) Steph.

American Widgeon; Baldpate.

Anas americana, KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1838, 67; Ohio Geolog. Surv., 1838, 165.

Mareca americana, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 15; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Anas americana, GMELIN, Syst. Nat., i, 1788, 659.

Mareca americana, STEPHENS, Shaw's Gen. Zool., xii, 1824, 185.

Bill and feet grayish-blue, top of head white or nearly so, plain or speckled, its sides and the neck, more or less speckled; a broad green patch on sides of head; fore breast light-brownish; belly pure white; crissum abruptly black, middle and greater coverts white, the latter black-tipped; speculum green, black bordered; length, 20-22; wing, 11; tail, 5; tarsus, 2; bill, $1\frac{1}{2}$ - $1\frac{1}{2}$; female known by the wing markings.

Habitat, North America. South to Guatemala. Breeds in various parts of the United States. Cuba. Accidental in Europe.

Abundant spring and fall migrant, usually in considerable flocks in

spring, when it is shy and suspicious; in fall less abundant and less wary. Perhaps a few remain through the summer and breed.

The eggs are of a pale buff-color and measure 2.00 by 1.50.

NOTE.—The European Widgeon (*Marca penelope*) may yet be detected as an accidental visitor. It is of casual occurrence on the Atlantic coast, and has been taken in Wisconsin, Illinois and California.

Similar to the above, but head and neck reddish-brown, scarcely varied, top of head creamy or brownish-white, its sides with mere traces of green.

GENUS QUERQUEDULA. Stephens.

Bill a little longer than head or foot, tail not one-half wing.

Sub-genus *Nettion*. Head sub-crested.

QUERQUEDULA CAROLINENSIS (Gm.)

Green-winged Teal.

Anas crecca, AUDUBON, Orn. Biog., iii, 1835, 219.—KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.

Anas carolinensis, AUDUBON, B. Am., vi, 1843, 243.

Nettion carolinensis, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12.

Querquedula carolinensis, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ.

Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Teal, KIRTLAND, Fam. Visitor, 1850, 72.

Anas crecca, WILSON, Am. Orn., vii, 1814, 101.

Anas carolinensis, GMELIN, Syst. Nat., i, 1788, 533.

Nettion carolinensis, BAIRD, Birds N. A., 1858, 777.

Querquedula carolinensis, STEPHENS, Shaw's Gen. Zool., xii, 1824, 128.

Head and upper neck chestnut, with a broad glossy green band on each side, uniting and blackening on the nape; under parts white or whitish, the fore-breast with circular black spots; upper parts and flanks closely waved with blackish and white; a white crescent in front of the wing; crissum black, varied with white or creamy; speculum rich green bordered in front with buffy tips of the greater-coverts, behind with light tips of secondaries; no blue on the wing; bill black; feet gray. Female differs in the head markings, but those of the wing are the same. Small; length, 14-15; wing, 7½; tail, 3½; bill, 1½; tarsus, 1½.

Habitat, North America. Greenland. Mexico. Cuba. South to Honduras. Breeds from the northern border of the United States northward.

Abundant spring and fall migrant. Frequently found in small brooks and ponds as well as in larger waters.

Eggs, pale dull greenish, 1.75 to 1.90 in length by 1.20 to 1.30 in breadth.

Sub-genus *Querquedula*. Head not crested.

QUERQUEDULA DISCORS (L.) Steph.

Blue-winged Teal.

Anas discors, KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1838, 67; Ohio Geolog. Surv., 1838, 166, 186.

Querquedula discors, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19; Summer Birds, ib., iii, 1880, 228.

Teal, KIRTLAND, Fam. Visitor, i, 1850, 72.

Anas discors, LINNÆUS, Syst. Nat., i, 1766, 205.

Querquedula discors, STEPHENS, Shaw's Gen. Zool., xii, 1824, 149.

Head and neck of the male blackish-plumbeous, darkest on the crown, usually with purplish iridescence; a white crescent in front of the eye; under parts thickly dark-spotted; wing coverts sky-blue, the greater white-tipped; speculum green, white-tipped; axillars and most under wing-coverts white; scapulars striped with tawny and blue, or dark-green; fore-back barred; rump and tail dark, plain; crissum black; bill black, feet dusky yellow; female with head and neck altogether different; under parts much paler and obscurely spotted; but known by the wing marks.

Habitat, North America, chiefly east of the Rocky Mountains. To the Pacific coast in Alaska. West Indies. Mexico. Central and South America to Ecuador. Accidental in Europe.

Abundant spring and fall migrant, not common summer resident in Northern Ohio. Mr. Langdon mentions its breeding in Ottawa county. This is the first Duck to return in fall, usually making its appearance early in September. It frequents still waters, especially muddy and gravelly shallows and ponds, and spends much time sitting on muddy banks. A well-known and highly esteemed game bird.

Eggs similar to but lighter than those of the Green-winged Teal.

GENUS SPATULA. Boie.

Bill much longer than head or foot, widening rapidly to the end where it is twice as wide as at the base.

SPATULA CLYPEATA (L.) Boie.

Shoveller.

Anas clypeata, KIRTLAND, Ohio Geolog. Surv., 1838, 166.

Spatula clypeata, WHEATON, Ohio Agric. Rep. for 1860, 570; Reprint, 1861, 12; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Anas clypeata, LINNÆUS, Syst. Nat., i, 1766, 249.

Spatula clypeata, BOIE, Isis, 1822, 564.

Bill as above with very numerous and prominent laminae. Head and neck of male, green; fore-breast white, belly purplish-chestnut; wing-coverts blue; speculum green bordered with black and white; some scapulars blue, others green, all white-striped; bill blackish; feet red. Female known by bill and wings.

Habitat, North America. Europe. Asia. Australia. In this country throughout the continent, breeding from Texas to Alaska, and wintering abundantly from the Middle districts southward to Guatemala, Mexico, Cuba, and Jamaica.

Very common spring and fall migrant, summer resident in part. This beautiful bird is more frequently seen in this vicinity singly or in pairs than in flocks, and as often in ditches and wet places as in streams; not unfrequently found in wet woodland. Breeds in some portions of the State and in the vicinity of Columbus where it is not known to breed, often remains in spring for weeks after all others have left.

GENUS AIX. Swainson.

Bill shorter than the head, elevated at base. Tail half the wing.

AIX SPONSA (L.) Boie.

Summer Duck: Wood Duck.

Anas sponsa, AUDUBON, Orn. Biog., iii, 1835, 52; B. Am., vi, 1843, 277.—KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1838, 67; Ohio Geolog. Surv., 1838, 166, 186.

Aix sponsa, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12; Food of Birds, etc. Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Summer Duck, KIRTLAND, Fam. Visitor, i, 1850, 1, 72.

Anas sponsa, LINNÆUS, Syst. Nat., i, 1766, 207.

Aix sponsa, BOIE, Isis, 1826, 329.

Crested; head iridescent green and purple, with parallel curved white superciliary and post-ocular stripes, and a broad white throat-patch; length, 18-20; wing, $8\frac{1}{2}$ - $9\frac{1}{2}$; tail, $4\frac{1}{2}$ -5; tarsus, $1\frac{1}{2}$ - $1\frac{1}{4}$; bill, $1\frac{1}{4}$. Female with the head mostly gray.

Habitat, North America, especially United States, breeding throughout in suitable places, and wintering chiefly in the south. Cuba.

Summer resident. Common migrant, and breeding throughout the State. The above description, while it answers all purposes for identification, gives no conception of the coloring of this most beautiful of all our ducks. In fact the variety, richness and lustre of its plumage are such that no description can give an adequate conception.

Nest in holes of trees; eggs greenish buff, 2.00 by 1.50.

It is frequently for a time domesticated, of which Dr. Kirtland gives the following account (Family Visitor, l. c.):

"In answer to your queries respecting the domestication of the Summer or Wood Duck, I would state that H. T. Kirtland, Esq., of Mahoning county, succeeded on several occasions in domesticating that beautiful bird, many years since; and at one time had . . . on hand a considerable flock.

"He had trained a small dog so thoroughly that it would pass along the shores of the creeks and bayous in the vicinity during the summer, where flocks of the old and young ducks were congregating, and before the latter were sufficiently fledged to take to the wing. Alarmed at the approach of an enemy, the old ones would sound their peculiar

notes and fly away, and the ducklings stealthily run on shore and conceal themselves among the weeds and grass. The faithful dog would trace them out, one by one, and as soon as he had detected one, would place it between his two fore-paws and retain it without injury, till my brother would secure it.

"In this way he could take any desirable number. At one time, he had a large flock that were full-grown and in their full plumage, which in the males is more beautiful than the peacocks, or any American bird.

"They were restrained within the enclosure of his garden and door-yard, containing perhaps an acre of ground, and were apparently as tame as our common domestic Mallards.

"At a time when some of them were preparing their nests, in hollow logs furnished them for the purpose, a mischievous pole-cat found his way into the premises, and destroyed several of the females. This interrupted them for that season. The survivors were neglected and permitted to escape to a creek in the vicinity, and before the return of another season were destroyed by hunters. Since that time he has not renewed the attempt to domesticate them; but his efforts convinced me of its feasibility. The faithful dog has long since been dead, and the ducks are now very rare in that neighborhood.

"A few years since, while engaged in taking insects with a light net, I unexpectedly came across an old duck with her brood, consisting of perhaps half a dozen individuals. They were feeding in an artificial ditch, with nearly perpendicular banks. The mother sounded an alarm and flew away—the young could not creep up the sides of the ditch, and therefore attempted to escape by swimming. I threw the millinet bag over two of them which I secured without injury. After amusing myself with them and observing their trepidation I let them take their way.

"Not only this species but many others might be successfully tamed and introduced into our poultry yards. There is no obstacle to the accomplishment of this purpose with the Black, Gadwall, Pochard, Teals and Canvas-back Ducks. Their habits are no more unfavorable than those of the Mallard which was the parent of the domestic kind.

"We doubt not that the Snow and the White-fronted Geese, which are still common in some parts of the west, could be reduced to the same condition. I know that the Canada Goose has often bred about the farm-yard, and that the Sandhill Crane may become one of the most familiar pets."

Sub-family FULIGULINÆ. Sea Ducks.

Tarsi scutellate anteriorly; feet large; hind toe with a broad membranous lobe.

GENUS FULIGULA. Stephens.

Bill with feathers extending in a short obtuse angle upon forehead, and as a crescent on sides, leaving an acute basal process uncovered superiorly and laterally on each side. Nail of bill small, narrow, distinct, forming only central part of tip. Tail short, rounded, about one-third the wing.

Sub-genus *Fulix*. Bill broad, about equal to inner toe and claw, its sides parallel to the end or widening, the nostrils in its posterior two-fifths.

FULIGULA MARILA (L.) Stephens.

Greater Black-head.

Fuligula marilla, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.—WHEATON, Food of Birds, etc., Ohio Geolog. Rep. for 1874, 1875, 574; Reprint, 14.

Fuligula marila, LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19.

Fulix marila, WHEATON, Ohio Agric. Rep. for 1860, 1861, 370; Reprint, 12.

Anas marila, LINNÆUS, Syst. Nat., i, 1766, 196.

Fuligula marila, STEPHENS, Shaw's Gen. Zool., xii, pt., ii, 1824, 198.

Fulix marila, BAIRD, Birds N. Am., 1858, 791.

Male with the head, neck, and body anteriorly black, the former with a green gloss; back and sides whitish, finely waved in zig-zag with black; below, and speculum of wing white; bill dull blue with black nail; legs plumbeous. Female with the head and anterior parts brown, and other black parts of the male, rather brown; face pure white. Length, about 20 inches; wing, 9.

Habitat, the whole of North America. Greenland. Europe. Asia.

Not common spring and fall migrant in the interior of the State, where generally found in small numbers in company with the two following species or the Golden-eye; more common on Lake Erie, but nowhere abundant.

FULIGULA AFFINIS Eyton.

Lesser Black-head.

Fuligula affinis, AUDUBON, B. Am., vi, 1843, 316.

Fulix affinis, WHEATON, Ohio Agric. Rep. for 1860, 1861, 370; Reprint, 12.

Fuligula affinis, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 574; Reprint, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 19; Summer Birds, ib., iii, 1880, 228.

Fuligula affinis, EYTON, Monog. Anat., 1838, 157.

Fulix affinis, BAIRD, Birds N. Am., 1858, 791.

Extremely similar to the preceding but smaller, about 16; wing, 8; gloss of head chiefly purple; flanks and scapulars less closely waved with black(?). It is very difficult to define this bird specifically, and it may be simply a small southern form; but it appears to preserve its characters though constantly associated with the last.

Habitat, North America, and south to Guatemala in winter. Breeds in high latitudes and southward at least to the United States border. Part of the West Indies.

Abundant spring and fall migrant, rare summer resident, perhaps breeding in Northern Ohio. No one of the Ducks of this sub-family are more abundant or regular than this, which, at the proper season, is generally dispersed throughout the State, frequenting equally the lake, reservoirs, rivers and ponds. Individuals occasionally are seen, both on the lake and in the interior, during summer, and usually a few remain through the winter.

FULIGULA COLLARIS (Donovan) Bp.

Ring-necked Duck.

Fuligula rufitorques, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.

Fulix collaris, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12.

Fuligula collaris, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 185; Reprint, 20.

Anas collaris, DONOVAN, Br. Birds, vi.

Fuligula ruftorques, BONAPARTE, Syn., 1828, 393.

Fuligula collaris, BONAPARTE, List Eur. Birds, 1842.

Fulix collaris, BAIRD, Birds N. Am., 1858, 792.

Similar to the foregoing, but an orange-brown ring round the neck; speculum gray; back nearly uniform blackish; bill black, pale at base and near tip; female with head and neck brown, and no collar, but loreal space and chin whitish, as is a ring round eye; bill plain dusky. In size between the foregoing.

Habitat, North America, breeding far north, wintering in the United States and beyond. South to Cuba. Jamaica. Accidental in Europe.

Abundant spring and fall migrant, but less regular in great numbers than the preceding. Frequents the same localities and has the same habits.

Sub-genus *Aythya*. Bill narrower, longer than inner toe; the nostrils nearer middle.

FULIGULA FERINA (L.) Sw.

var. AMERICANA (Eyton) Coues.

Red-head: Pochard.

Fuligula ferina, KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1838, 67; Ohio Geolog. Surv., 1838, 166, 187.—AUDUBON, Orn. Biog., iv., 1838, 197; B. Am., vi, 1843, 311.

Aythya americana, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12.

Fuligula ferina, var. *americana*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 20; Summer Birds, ib., iii, 1880, 228.

Pochard, KIRTLAND, Fam. Visitor, i, 1850, 72.

Fuligula ferina, BONAPARTE, Syn., 1828, 392.

Fuligula americana, EYTON, Monog. Anat., 1838.

Aythya americana, BONAPARTE, Comp. Rend., 1858,

Fuligula ferina, var. *americana*, COUES, Key, 1872, 289.

Bill dull blue with a black belt at end, broad and depressed, shorter than head (2 or less) the nostrils within its basal half; color of head rich, pure chestnut, with bronzy or red reflections, in the female, plain brown; body anteriorly, rump and tail coverts black, in the female dark-brown, back, scapulars and sides plumbeous-white, finely waved with unbroken black lines, less distinct in the female; speculum, bluish-ash. Length, about 20; wing, 9-10; tarsus, 1½-1¾.

Habitat, North America, but more particularly Eastern North America. Breeds in the Fur countries. Bahamas.

Common spring and fall migrant on the lake and reservoirs; less common on the rivers and ponds, where usually seen singly or in pairs in company with Ring-necks and Black-heads or Widgeons. Frequently confounded with the following species.

FULIGULA VALLISNERIA (Wils.) Steph.

Canvas-back Duck.

Fuligula vallisneria, KIRTLAND, Prelim. Rep. Ohio Geolog. Surv., 1838, 67; Ohio Geolog. Surv., 1838, 166, 187.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 20; Summer Birds, ib., iii, 1880, 229.
Aythya vallisneria, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12.
 Canvass-back Duck, KIRTLAND, Fam. Visitor, i, 1850, 72.

Anas vallisneria, WILSON, Am. Orn., viii, 1814, 103.

Fuligula vallisneria, STEPHENS, Shaw's Gen. Zool., xii, pt. ii, 1824, 196.

Aythya vallisneria, BOIE, Isis, 1826, 980.

Similar to the preceding, but bill blackish, high at the base and narrow throughout, not shorter than head (two and a half or more), the nostrils at its middle; head much obscured with dusky; black waved lines of the back sparse and much broken up into dots, the whitish thus predominating.

Habitat, North America. Breeds from the Northern States northward. Winters from the Middle States southward to Guatemala.

Common spring and fall migrant on the lake, less common on the Reservoirs, and rather rare generally throughout the State. The Canvas-back, the most highly esteemed duck for the table in the Eastern States, ranks less highly in the interior, where it would seem that Mallards, Widgeons, Wood Duck and Teal, loose little by comparison. As stated above, this and the preceding species are frequently confounded. Dr. Coues gives the following differential diagnosis which will enable any one to separate these species:

"Some persons experience difficulty in discriminating between the Canvas-back and Red-head, but there is no occasion for this, at least in the case of males. In the Red-head, the whole head is clear chestnut-red, with coppery or bronzy reflections, and the bill is clear pale grayish-blue, with a dark tip. In the Canvas-back, nearly all the head is obscured with blackish-brown, and the bill is dusky throughout. There is also a marked difference in the shape of the head and bill; in the Red-head, the head is puffy and globose, sloping abruptly down to the base of the bill; in the Canvass-back, the head is longer and narrower, and slopes gradually down to the bill, which rises high on the forehead. These distinctions of form hold with the females, though less evident in that sex. In the Canvas back, moreover, the back has much more light than dark color, instead of an equal amount or less, the fine black lines being very narrow and mostly broken up into minute dots."

GENUS BUCEPHALA. Baird.

Bill feathered as in *Fuligula*, shorter than the head, about equal to tarsus, compressed and somewhat tapering, nostrils near the middle. Tail longer and more pointed than in *Fuligula*, about half the wing.

BUCEPHALA CLANGULA (L.) Gr.

Golden-eyed Duck.

Fuligula clangula, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.

Bucephala americana, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12.

Bucephala clangula, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 20.

Anas clangula, LINNÆUS, Syst. Nat., i, 1766, 201.

Fuligula clangula, BONAPARTE, Syn., 1828, 393.

Bucephala americana, BAIRD, Birds N. Am., 1858, 796.

Bucephala clangula, COUES, Key, 1872, 290.

Male with the head and upper neck glossy green, and a white oval or rounded loreal spot, not touching the base of the bill throughout; lower neck all round, lower parts including sides, most of the scapulars, wing-coverts and secondaries, white; the white of outer surface of wings continuous; lining of wings and axillars dark; most of upper parts black; no waving on the back or sides; bill black with pale or yellow end, with nostrils in anterior half; feet orange, webs dusky; eyes yellow; head uniformly puffy. Female with head snuff-brown, and no white patch in front of eye, and white of wings not always continuous. Length, 16-19: wing, 8-9.

Habitat, North America. Cuba. Europe.

Not very common spring and fall migrant and winter resident. The Golden-eye or Whistler, as commonly called from its noisy flight, is most frequently seen in small flocks or singly, in swift streams, where the water remains unfrozen. They are among the shyest of our ducks.

BUCEPHALA ALBEOLA (L.) Bd.

Buffle-headed Duck.

Fuligula albeola, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.

Bucephala albeola, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 20; Summer Birds, ib., iii, 1880, 229.

Anas albeola, LINNÆUS, Syst. Nat., i, 1766, 199.

Fuligula albeola, BONAPARTE, Syn., 1828, 394.

Bucephala albeola, BAIRD, Birds N. Am., 1858, 797.

Somewhat similar to the foregoing, but, male with the head particularly puffy, of varied rich iridescence, with a large white auricular patch confluent with its fellow on the nape; small; length, 14-16; wing, 6-7; bill, 1, with nostrils in its basal half; female still smaller, an insignificant looking duck, with head scarcely puffy, dark-gray with traces of the white auricular patch.

Habitat, North America. Mexico. Cuba. Greenland. Accidental in Europe.

Abundant spring and fall migrant, and winter resident in part. Mr. Langdon mentions its frequent occurrence in summer on the lake. The

Buffle-head, or, as more frequently called, the Dipper Duck or Butter-ball, is more abundant on the streams than in ponds. No species is better known to the amateur sportsman than this, which frequently prefers to avoid danger by diving rather than by flight. They are usually seen in small flocks of from six to ten, among which the males frequently outnumber the females. Both sexes, however, are often seen singly or in company with other species.

Dr. Coues (Birds N. W., 575) describes the nest of this duck as placed in the hollow of a dead tree, and composed of feathers. The eggs are described as varying from buff to a creamy-white or grayish-olive color, and measuring from 1.67 to 2 in length by from 1.25 to 1.50 in breadth.

GENUS HARELDA. Leach.

Bill without lateral and superior extension of feathers and consequently without superior and lateral basal processes; the lateral outline of feathers oblique. Bill not swollen at base, shorter than head or tarsus, high, tapering to the tip. Nostrils linear, in the posterior half of bill. Tail feathers long and pointed, in the male equal to the wing.

HARELDA GLACIALIS (L.) Leach.

Long-tailed Duck.

Harelda glacialis, WHEATON, Ohio Agric. Rep. for 1860, 370, 378; Reprint, 1861, 12, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—MERRIAM, Trans. Conn. Acad., iv, 1877, 127.

Anas glacialis, LINNÆUS, Syst. Nat., i, 1766, 203.

Harelda glacialis, "LEACH."—STEPH., Gen. Zool., xii, pt. ii, 1854, 175.

Tail of fourteen narrow, pointed feathers, in the male in summer the central ones very slender and much elongated, nearly or quite equalling the wing; nail of bill occupying the whole tip; seasonal changes remarkable. Male in summer with the back and the long narrowly lanceolate scapulars varied with reddish-brown, wanting in winter, when this color is exchanged for pearly-gray or white; general color blackish or very dark brown, below from the breast abruptly white; no white on the wing; sides of head plumbeous-gray; in winter the head, neck and body anteriorly, white, but the gray cheek-patch persistent, and a large dark patch below this; bill at all seasons black, broadly orange-barred. Female without lengthened scapulars or tail feathers, the bill dusky greenish, and otherwise different; but recognized by presence of head- and neck-patches, and absence of white on the wing. Length, 15-20 or more, according to tail; wing, 8-9.

Habitat, Northern Hemisphere. Chiefly maritime. Also on the Great Lakes.

Not common winter visitor on Lake Erie, and rare in the interior of the State. Mr. Winslow informed me in 1861, that the Long-tailed Duck was of not unfrequent occurrence on the lake, and I have since seen several specimens from Sandusky Bay.

My friend, Dr. T. C. Hoover captured a fine male in a small creek near Bellaire, Ohio, February 9, 1877, and Chas. J. Orton secured a female in

breeding plumage at Licking Reservoir the following April. Both are now in my collection. Mr. H. E. Chubb informs me of its capture in Medina county, in the winter of 1880-1, and writes under date of February 7, 1881 :

"Since receiving your letter, a male was brought in alive, having been captured in a creek near this city [Cleveland]. A Buffalo friend tells me that they are very abundant on the Niagara River at times, and only yesterday a Canadian from the North shore of lower Lake Ontario told me of their being with them in immense numbers. They are frequently caught in the fisherman's nets, becoming entangled when diving for fish."

GENUS SOMATERIA. Leach.

Bill narrow, compressed, tapering to the end. Feathers of the forehead running forward in a long narrow point, and of cheeks extending along the lower edge of bill, so that the two strips embrace between them a linear portion of the bill, one-half the length of culmen, and which extends back further than the lower edge of mandible. Nostrils beyond the middle of commissure. Nail very broad, thickened, and greatly overlapping tip of lower mandible. Tail short, rounded; about two-fifths the wing.

Sub-genus *Somateria*. Bill with frontal processes, not feathered to the nostrils.

SOMATERIA SPECTABILIS (L.) Leach.

King Eider.

Somateria spectabilis, WHEATON, Ohio Agric. Rep. for 1860, 370, 378; Reprint, 1861, 12, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—COUES, Birds N. W., 1874, 581.—ALLEN, Bull. Nutt. Orn. Club, v, 1880, 62.

Anas spectabilis, LINNÆUS, Fn. Suec., 39.

Somateria spectabilis, BOIE, Isis, 1822, 564.

Bill with broad squarish, nearly vertical frontal processes bulging angularly out of line with culmen. Male in breeding attire, black, including a forked chin-patch, a frontal band, and small space round eye; the neck and fore-parts of the body, part of interscapulars, of wing-coverts and of lining of wings, and a flank patch, white, creamy on the jugulum, greenish on sides of head; crown and nape fine bluish-ash. Female resembling that of the Common Eider, but bill different. Size of the last or rather less.

Habitat, northern North America and Europe. Chiefly coastwise. South to New Jersey. In the interior to Lake Erie.

HISTRIONICUS TORQUATUS (L.) Bp.

Harlequin Duck.

Histrionicus torquatus, WHEATON, Ohio Agric. Rep. for 1860 (1861), addenda, 480; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.

This duck was admitted to my lists of 1861 and 1875, on what I now deem insufficient authority. It was then believed to be of rare occurrence on Lake Erie, but was not mentioned in Mr. Winslow's list of ducks of Northern Ohio. Several specimens are said to have been taken by Dr. Hoy, of Racine, Wisconsin, and Dr. Coues' has discovered it breeding in Dakota.

Very rare winter visitor. Mr. Winslow informed me that one was taken many years since at Cleveland and one at Sandusky Bay. A specimen in the possession of Mr. Langdon was obtained there in the winter of 1877-8. This is an immature bird.

On November 4th, 1880, I found a bird of this species in process of preparation for the table by a market dealer in this city, who informed me that he had obtained it, together with a female Mallard, from a sportsman who shot for him in the vicinity of Harrisburg, about fifteen miles southwest of this city. He stated that the bird was killed on Darby Creek. I have no reason to doubt this statement. I obtained a stay of proceedings for sufficient time to make a partial description of the bird and secure the head and foot. The dealer was kind enough afterwards to say that he was very sorry I did not discover the bird before he sold it or agreed to dress it for the table, and the gentleman who graced his table with the only King Eider ever identified in the interior of Ohio, remarked to me that he hoped it might be the last that he ever attempted to dine upon.

The sex of this specimen was not determined; the following is the description: Head, neck and breast tawny-ashy, deepening to dull chestnut on top of head, each feather with a short streak of dusky; back of neck and sides as far as wings more decidedly ashy; each feather with a subterminal dusky bar; belly nearly uniform dusky; shoulders and lesser coverts dusky with lighter edgings; quills plain, no speculum. Scapulars and lower sides with tawny-rusty tips.

Being in doubt as to the specific identification of this specimen, I forwarded it to Mr. Ridgway, who kindly writes the following:

"The head is that of *S. spectabilis*, beyond question—perhaps a young male—which might account for the difference in color to which you refer; the color varies much, however, in both species, and I am of opinion that the specimen is a female. I enclose two rude sketches showing a very radical difference between *S. spectabilis* and *S. mollissima* in the anterior outline of the feathering of the head, by which you can invariably distinguish the two."

Mr. Ridgway's sketches show clearly the very considerable anatomical difference between *spectabilis* and *mollissima*. From them it appears that in *spectabilis* the feathers of the culmen extend forward as far as the posterior end of nostril, those of side of bill falling far short of this. In *mollissima* the reverse is the case, the lateral feathers reaching nearly to middle of nostril, while the feathers of culmen do not extend farther forward than the lateral ones in *spectabilis*.

It has been taken at Chillicothe, Illinois, and Milwaukie, Wisconsin. Their occurrence on Lake Erie, though not positively within the limits of Ohio is noted by Mr. J. A. Allen (Bull. Nutt. Orn. Club., v, 1880, 62):

"Although the King Eider (*Somateria spectabilis*, has been recorded as occurring at Lake Erie, and as a 'rare winter visitant' to Lake Michigan, its presence near Buffalo, N. Y., in such numbers as the following communication indicates, seems worthy of record. Mr. Charles Linden, of that city, in a letter dated November 26, 1879, writes: 'I send you a fresh-shot specimen of what appears be *Somateria spectabilis*, young. * * * * Several flocks of them have, for the first time, made their appearance in the Niagara; they are very tame, allow approach to within a few yards, dive readily, and appear again a long distance from where they dove. They are evidently not used to the lurking dangers of the gun, and have probably found their way up the St. Lawrence, up Lake Ontario, and across to Lake Erie. There have been to my knowledge at least eighteen of them shot. They are generally found in small flocks of three or four birds.'"

GENUS *CEDEMIA*.

Bill without lateral and superior basal processes; but much swollen or gibbous at base (in adult males); then depressed, and broad. Nail very large, forming the tip. Nostrils anterior to middle.

Sub-genus *Cedemia*. Bill scarcely encroached upon by the frontal feathers, shorter than head, the gibbosity superior, circumscribed; nostrils at its middle; tail normally sixteen-feathered.

CEDEMIA AMERICANA SW.

American Black Scoter.

"*Cedemia americana*, MERRIAM, Trans. Conn. Acad., iv, 1877, 127.

Oidemia americana, SWAINSON and RICHARDSON, Fn. Bor. Am., ii, 1831, 450.

Plumage of male entirely black; bill black, the gibbosity orange. Female sooty-brown, paler below, becoming grayish-white on the belly, there dusky-speckled, on the sides and flanks dusky-waved; throat and sides of head mostly continuous whitish; bill all black; feet livid olivaceous, with black webs. Male, nearly 2 feet; wing, about 10 inches;

SOMATERIA MOLLISSIMA (L.) Leach.

var (?). *DRESSERI* Sharpe.

Eider Duck.

Bill with long club-shaped frontal processes extending in a line with the culmen upon the sides of the forehead, divided by a broad feathered interspace. Male in breeding attire, white, creamy-tinted on breast and washed with green on the head; under-parts from the breast, lower back, rump, tail, quills, and large forked patch on the crown, black. Female with the bill less developed, general plumage an extremely variable shade of reddish-brown or ochrey-brown, speckled, mottled and barred with darker; male in certain stages resembling the female. Length, about 2 feet; wing, 11-12 inches.

Habitat, Atlantic and Arctic coasts.

Mr. Nelson gives the Common American Eider as a not very rare winter visitor on Lake Michigan, where it is more numerous in winter than the King Eider. Careful observation will no doubt prove it to be an occasional winter visitor to Lake Erie.

female, 18-19 inches; wing, 8-9; gape, 2; culmen, 1½. Differs from the European in shade and coloration of the protuberance on the bill.

Habitat, North America, both coasts, and large inland waters.

Rare winter resident or visitor. I can record but three instances of its capture. A young male was taken at Licking Reservoir, December, 1876, and preserved by Dr. Jasper, of this city. This is the specimen referred to by Dr. Merriam, above cited. Mr. Winslow has since informed me that it has been taken on Portage River, in Northern Ohio, and Mr. Chubb writes me that he shot one of a flock of three on Lake Erie, in the fall of 1880.

Dr. Merriam has taken it on Black River, N. Y., and Mr. J. A. Allen reports its capture at St. Louis, Missouri.

Sub-genus *Melanetta*. Bill broadly encroached upon by the frontal feathers, on the culmen nearly or quite to the nostrils, and on its sides to a less extent, shorter than head; nail broad and truncate; gibbosity superior, circumscribed.

ŒDEmia FUSCA (L.) SW.

(var?.) VELVETINA CASSIN.

Velvet Scoter.

Melanetta velvetina, WHEATON, Ohio Agric. Rep. for 1860, 370, 378; Reprint, 1861, 12, 20.

Œdemia fusca, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 20.

Anas fusca, LINNÆUS, Fn. Suec., 39.

Œdemia fusca, FLEMING, Phil. of Zool., ii, 1823, 260.

Melanetta velvetina, BAIRD, Birds N. A. 1858, 805

Male black with a large white wing-patch, and another under the eye; feet orange-red, with dusky-webs. Bill black, broadly orange-tipped; size of the last or rather larger; female smaller, sooty-brown, pale-grayish below, with much whitish about head, but showing white speculum; bill all black.

Habitat, Europe and America, chiefly maritime, but also on inland waters.

Rare winter visitor in the interior, probably more frequent on Lake Erie. Mr. Winslow states that this duck sometimes occurs on the lake both in the vicinity of Cleveland and Sandusky Bay. Many years since I saw an adult bird said to have been taken on the Scioto River, near this city. An immature bird was taken at the Licking Reservoir in December, 1876, in company with the last species.

Mr. J. A. Allen records two specimens from St. Louis, Missouri, and Mr. Nelson gives it as rather common on Lake Michigan and occurring throughout the State of Illinois, and Dr. Haymond notes it as "numerous in winter" in Franklin county, Indiana.

NOTE.—A third and only remaining species of this genus, *Cedemic perspicillata*, Steph., Surf Duck, is recorded as taken at Mt. Carmel, Illinois, by Mr. Ridgway, at St. Louis, Missouri, by Mr. J. A. Allen, and as common on Lake Michigan, by Mr. Nelson. There is no record of its occurrence in Ohio, though it may be confidently looked for.

GENUS ERISMATURA. Bonaparte.

Tail feathers eighteen, narrow, rigid, spinous, and almost entirely exposed; the coverts much abbreviated. Bill broad, high at base and depressed at tip. Upper lateral angle running back on forehead farther than the lower edge of bill. Nostrils rather small, reaching to middle of bill. Nail from above very narrow, bent abruptly downwards and backwards at the tip. Tarsus scarcely more than one-third the long feet.

ERISMATURA RUBIDA (Wils.) Bp.

Ruddy Duck.

Fuligula rubida, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.

Erismatura rubida, WHEATON, Ohio Agric. Rep. for 1860, 370, 379; Reprint, 1861, 12, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 20.

Anas rubida, WILSON, Am. Orn., viii, 1814, 128.

Erismatura rubida, BONAPARTE, List, 1838, 59.

The male in perfect plumage with neck all round, and the upper-parts brownish-red, the lower-parts silky-white watered with dusky, the chin and sides of the head dead-white, the crown and nape black, but not often seen in this condition in the United States; as generally observed, and the female at all times, brown above, finely dotted and waved with dusky, paler and duller below with darker undulations and sometimes a slight tawny tinge, as also occurs on the side of head; crown and nape dark-brown; crissum always white. Length, 14-17; wing, 5-6; tarsus, 1½.

Habitat, North America at large. South to Guatemala, where found breeding at Duenas. Cuba.

Rather irregular, but sometimes abundant migrant in the fall; not common in spring. The Ruddy Duck is often seen in the fall on rivers and small streams in flocks of from fifteen to twenty birds, when they are frequently shot in considerable numbers, as they fly low and compactly at such times. When in the water no Duck excels them in diving, and they are hardly surpassed by the Grebes in this respect. The spring migration usually brings one or two males to notice in this vicinity each year, those first passing being in moult, those later in full breeding plumage. It may perhaps breed in Northern Ohio, as they are believed, by Mr. Nelson, to breed in Northern Illinois. Dr. Coues discovered them breeding in Montana and Dakota.

Sub-family MERGINÆ. Mergansers.

Bill more or less nearly cylindrical, the nail hooked and overhanging, the lamellæ highly developed into prominent retrorse serrations.

GENUS *MERGUS*. Linnæus.

With characters of the sub-family.

Sub-genus *Mergus*. Bill not shorter than the head. Head with a depressed crest. Tarsus two-thirds the middle toe.

MERGUS MERGANSER Linnæus.*Merganser; Goosander.*

Mergus merganser, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 20; Summer Birds, ib., iii, 1880, 229.

Mergus americanus, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12. Goosander, KIRTLAND, Fam. Visitor, i, 1850.

Mergus merganser, LINNÆUS, Syst. Nat., i, 1766, 209.

Mergus americanus, CASSIN, Proc. Phila. Acad., 1853, 187.

Nostrils nearly median; frontal feathers reaching beyond those on sides of bill; male with the head scarcely crested, glossy green; back and wings black and white, latter crossed by one black bar; under parts salmon-colored; length, about 24; wing, 11; female smaller, occipital crest better developed, but still flimsy; head and neck reddish-brown; black parts of the male ashy-gray; less white on the wing; under-parts less tinted with salmon.

Habitat, North America. Europe. Asia.

Common spring and fall migrant, but in most parts of the State winter resident as well, and in Northern Ohio summer resident, formerly breeding commonly. Perhaps breeds in Middle Ohio, as I have met with them in pairs in June.

Most modern writers have omitted mention of a point in the structure of the birds of this sub-family, which can not escape the notice of the taxidermist. I refer to the structural difference in the cesophagus and integument of the throat and neck as compared with other ducks. In this sub-family the skin is loose, and the gullet enormously distensible, this peculiar looseness of the skin is as strongly marked as in the Kingfisher, and evidenced by the ease with which the head is withdrawn in skinning a specimen. I once took a male bird in winter, which had, to my surprise, the tail of a fish protruding from its mouth. As the bird did not appear to have been choking when killed, I made a careful examination and discovered that it had made a meal of an ordinary white sucker, the head of which had been so nearly digested by the stomach, that the bones were separated, and the undigested portion from the occiput to end of tail, which lay in the gullet and mouth measured seven inches.

MERGUS SERRATOR Linnæus.

Red-breasted Merganser.

Mergus serrator, KIRTLAND, Ohio Geolog. Surv., 1835, 166, 187.—WHEATON, Ohio Agric. Rep. for 1860, 370, Reprint, 1861, 120; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 18; Summer Birds, ib., iii, 1880, 229.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5.

Mergus serrator, LINNÆUS, Syst. Nat., i, 1766, 208.

Nostrils sub-basal; frontal feathers not reaching beyond those on sides of bill; a long, thin, pointed crest in both sexes. Smaller than the last; wing, 8-9; general coloration, and sexual difference the same, but the male with the jugulum rich reddish-brown, black-streaked, the sides conspicuously finely waved with black, a white, black-bordered mark in front of the wing, and the wing crossed by two black bars.

Habitat, Northern Hemisphere.

Not common. Spring and fall migrant and winter resident; much the rarest of the three species with us, as appears to be the case in other places in the interior, and it appears to be more common in fall and winter than in spring. I have never seen more than half a dozen adult males.

Sub-genus *Lophodytes*. Bill shorter than head. Head with an erect crest. Tarsus one-half the middle toe.

MERGUS CUCULLATUS. Linnæus.

Hooded Merganser.

Mergus cucullatus, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875; 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 0.

Lophodytes cucullatus, WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12.

Mergus cucullatus, LINNÆUS, Syst. Nat., i, 1766, 238.

Lophodytes cucullatus, REICHENBACK, Syst. Av., 1852, ix.

Nostrils sub-basal; frontal feathers reaching beyond those on sides of bill; a compact erect, semicircular, laterally-compressed crest in the male, smaller and less rounded in the female; male, black, including two crescents in front of wing, and bar across speculum; under parts, centre of crest, speculum and stripes on tertials, white; sides chestnut, black-barred; length, 18-19; wing, 8; female smaller; head and neck brown; chin whitish; back and sides dark-brown, the feathers with paler edges; white on the wing less, bill reddish at base below.

Habitat, North America. Cuba. Europe.

Very common spring and fall migrant, probably a not common summer resident. The Hooded Merganser is the most abundant species of the genus with us, and is about equally common in spring and fall. It is usually found singly or in pairs, sometimes in small flocks, in rivers

and ponds. It is an expert diver, and often resorts to diving rather than flight to escape danger. This species has in common with the Goose the habit of hiding under the exposed roots of trees on the banks of streams. From the fact that it may frequently be discovered in such places, sometimes at quite a distance from water, I incline to think they are ordinarily rather nocturnal in their habits, and commonly conceal themselves in the middle of the day.

Audubon speaks of their breeding on the Ohio and the lakes, and Mr. Brewster notes their breeding in Florida.

ORDER STEGANOPODES. TOTIPALMATE BIRDS.

FAMILY PELECANIDÆ. THE PELICANS.

Bill several times longer than the head, slender but strong, depressed, perfectly straight, with small distinct hooked nail at end. Nostrils very small. Gular sac enormous. Mandibular rami meeting only at tip. Wing extremely long, with upward of forty remiges. Tail short, rounded, of twenty or more feathers. Legs beneath centre of equilibrium, extremely short and stout.

GENUS PELECANUS. Linnæus.

With the characters of the family.

PELECANUS TRACHYRHYNCHUS Lath.

White Pelican.

Pelecanus onocrotalus, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.

Pelecanus erythrorhynchus, WHEATON, Ohio Agric. Rep., for 1860, 371; Reprint, 1861, 13, 21.

Pelecanus trachyrhynchus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 14.—LANGDON, Cat. Birds of Cin., 1877, 17; Journ. Cin. Soc. Nat. Hist., i, 1878, 117; Reprint, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 20; Summer Birds, ib., iii, 1880, 229.

Pelecanus erythrorhynchus, GMELIN, Syst. Nat., i, 1788, 571.

Pelecanus trachyrhynchus, LATHAM, Ind. Orn., ii, 1790, 884.

Pelecanus onocrotalus, BONAPARTE, Syn., 1828, 400.

White; occiput and breast yellow; primaries, their coverts, bastard quills and many secondaries black; bill, sac, lores and feet yellow. Length, about 4 feet; expanse, 7-9; wing, 2; bill, 1 or more; tail, $\frac{1}{2}$; normally 24-feathered.

Habitat, North America, up to latitude 61° at least. Rare or casual in the Middle States and New England. Abundant in the interior, especially west of the Mississippi. Texas and Florida. South to Central America.

Not rare spring and fall migrant, occurring most frequently in the fall. Dr. Kirtland mentions the Pelican as an occasional visitor. Several years ago the skin of a specimen in full breeding plumage was in the possession of Mr. Jos. Sullivant, of this city; this was taken in this State,

and is the only specimen I have seen in spring plumage. In the fall of 1861 quite a large flock made their appearance in this vicinity, of which about a dozen were captured, one which is now preserved in the museum of Starling Medical College. One morning, during the time of their visit, I laid behind a bank of the Scioto river near this city, waiting the rising of a heavy fog, to shoot some Teal who were heard feeding in the shallows. The favorable moment came and both barrels were discharged. Apparently from the smoke of my gun, but really from the bank below its muzzle, sprang three of these birds, enlarged to colossal size by the deceptive agency of the fog. I was greatly astonished.

Four or five years since a specimen was taken in Fairfield county, near the Licking Reservoir, which was preserved by Dr. Jasper, of this city. Mr. Langdon gives it as an occasional migrant on the Ohio, and in Summer Birds says, "one or two instances of the occurrence of this species in summer are noted by Mr. Porter" (Northern Ohio).

Mr. H. E. Chubb writes me, under date of February 7th, 1881, concerning a specimen recently captured, as follows :

"The specimen I had alive was shot and captured in Sandusky Bay. I do not know whether there were others with it or not. One shot struck it in the neck, and it was then chased down by men in a boat. I could hardly get it to eat at first, but before I had it a week it would follow me all over the room for a fish, and took its three pounds of fish a day with great relish."

The nest of the Pelican is said to be simply a low mound of dirt scraped together by the bird. A single egg is the complement.

FAMILY GRACULIDÆ. THE CORMORANTS.

Bill about as long as head, stout, straight, scarcely tapering, strongly hooked. Nostrils abortive. Gular sac moderate, but evident; mostly naked. Wings short. Tail large, fan-shaped, scansorial, of twelve to fourteen broad stiff feathers exposed to the base. Legs inserted far behind centre of equilibrium.

GENUS GRACULUS. Linnæus.

With the characters of the family.

GRACULUS DILOPHUS (Sw.) Gray.

Double-crested Cormorant.

Graculus dilophus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18.

Pelecanus (Carbo) dilophus, SWAINSON and RICHARDSON. Fn. Bor.-Am., ii, 1831, 473.

Graculus dilophus, GRAY, Gen. of Birds, iii, 1849.

Tail of twelve feathers; gular sac convex or nearly straight-edged behind. Glossy greenish-black; feathers of the back and wings coppery-gray, black-shafted, black-edged; adult with curly black lateral crests, and in the breeding season other filamen-

tous white ones, over the eyes and along the sides of the neck; white flank-patch not observed in the specimens examined, but probably occurring; gular sac and lores orange. Eyes green. Length, 30-33 inches; wing, 12 or more; tail, 6 or more; bill along gape, $3\frac{1}{2}$; tarsus a little over 2. Young, plain dark-brown, paler or grayish (even white on the breast) below, without head plumes.

Habitat, North America at large, in the interior as well as coastwise.

Not common spring and fall migrant. This variety of the Cormorant is perhaps not now to be found breeding in the State, though it is said to have nested years ago at the Licking Reservoir. I have seen specimens of this variety taken there recently, during the migrations. It appears to be the only variety found throughout the State during the spring migration.

GRACULUS DILOPHUS (Sw.) Gray.

var. FLORIDANUS (Aud.) Coues.

Florida Cormorant.

Graculus dilophus var. *floridanus*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—COUES, Key, 1872, 303.—LANGDON, Cat. Birds of Cin., 1877, 18; Journ. Cin. Soc. Nat. Hist., i, 1878, 117; Reprint, 8; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 20; Summer Birds, ib., iii, 1880, 229; Field Notes, ib., ii, 1880, 127.

Phalacrocorax floridanus, AUDUBON, Orn. Biog., iii, 1835, 387.

Graculus floridanus, BONAPARTE, Consp. Av., 1855, 172.

Graculus dilophus var. *floridanus*, COUES, Key, 1872, 303.

Similar to the preceding, smaller (wing, 12 or less; tail, 6 or less; tarsus a little under 2), but bill as large if not larger; gape nearly 4. The plumage is exactly the same, excepting, probably, that white plumes are not developed. There are said to be certain differences in the life-colors of the bills (blue instead of yellow on under mandible and edges of upper.—Audubon). This is simply a localized southern race of *dilophus*, smaller in general dimensions, with relatively larger bill, as usual in such cases; the sac seems to be more extensively denuded.

Habitat, South Atlantic and Gulf States, ranging north to the Ohio and to North Carolina.

Spring and fall migrant in Western Ohio, summer resident in some localities. Breeds. I have never known of the occurrence of this variety in spring in the vicinity of Columbus or eastward, but it sometimes occurs on our river and canal in late summer and fall. Mr. Langdon (Summer Birds, l. c), notes its capture in June, at Sandusky Bay, and in his Observations on Cincinnati Birds gives the following:

“Mr. Dury has favored me with an exceedingly interesting account of the former abundance of this species at St. Mary's Reservoir, in which he says: ‘On the south side of the Reservoir, about seven miles from Celina, was the ‘Water Turkey’ Rookery. Here I used to go to shoot them, with the natives who wanted them for their feathers; I have helped kill a boat load.

“‘One season I climbed up to their nests and got a cap full of eggs. The nests were

made of sticks and built in the forks of the branches. The trees (which were all dead) were mostly oaks, and covered with excrement. I found from two to four eggs or young to a nest. The young were queer little creatures—looked and felt like India rubber. The old birds flew around in clouds, and made their croaking notes, indicative of their displeasure at my presence. Some of the trees had ten or twelve nests on them. As the timber has rotted and blown down, the birds have become less and less numerous.'

"The above circumstances occurred during the month of June, 1867, since when, as Mr. Dury states, these birds have rapidly decreased in numbers. The many specimens examined by him were, without exception, var. *floridanus*.

"My own observation of the species in Ohio is limited to a single specimen found floating in the Reservoir late in October, 1874, when its comrades had probably migrated. It has also been tolerably well identified on both Miamis during the migrations."

ORDER LONGIPENNES. LONG-WINGED SWIMMERS.

FAMILY LARIDÆ. GULLS, TERNS, ETC.

Nostrils not tubular, lateral, perforate. Bill with continuous covering, or only broken by a sort of cere, hooked or straight to the end. Hallux small and elevated but always present.

Sub-family LESTRIDINÆ. Jaeger or Skua Gulls.

Covering of bill discontinuous, the upper mandible being saddled with a large horny "cere" beneath which the nostrils open (unique among water birds); bill epignathous. Tail nearly square, but the middle pair of feathers long-exserted. Feet strong, tarsi scutellate in front, rough behind; toes full-webbed.

GENUS STERCORARIUS. Brisson.

With characters of the sub-family.

STERCORARIUS POMATORHINUS (Temm.) Vieillot.

Pomarine Jaeger.

Lestris pomarinus, TEMMINCK, Man, 1815, 514.

Stercorarius pomarinus, VIEILLOT, Nouv. Dict. d'Hist., Nat., xxxii, 1819, 1b8.

Stercorarius pomatorhinus, NEWTON, Ibis, 1865, 509.

Middle tail feathers finally projecting about four inches, *broad to the tip*. Length, about 20 inches; wing, 14; bill, 1½-1¾; tarsus about 2. *Adult*:—Back, wings, tail, crissum and lower belly brownish-black; below from bill to belly, and neck all round, pure white, excepting acuminate feathers of sides of neck, which are pale yellow; quills whitish basally, their shafts largely white; tarsi above blue, below, with the toes and

GRACULUS CARBO (L.) Gray.

Common Cormorant; Shag.

Graculus carbo, WHEATON, Ohio Agric. Rep. for 1860, 1861, 480.

This species was erroneously given by me, as above. It is probably strictly maritime.

webs black. *Not quite adult* :—As before, but breast with dark spots, sides of the body with dark bars, blackish of lower belly interrupted; feet black. *Younger* :—Whole under parts, with upper wing and tail-coverts variously marked with white and dark; feet blotched with yellow. *Young* :—Whole plumage transversely barred with dark-brown and rufous; feet mostly yellow. *Dusky stage* (coming next after the barred plumage just given ?) : fuliginous, unicolor; blackish-brown all over, quite black on the head, rather sooty-brown on the belly; sides of the neck slightly gilded.

Habitat, seas and sea-coast of Europe, Asia, and America. Interior of North America.

Extremely rare or accidental visitor in winter on Lake Erie; now first named as a bird of this State. Mr. H. E. Chubb, of Cleveland writes me, February 7, 1881, as follows :

“Two were seen at our breakwater last fall, one of which I have. My friend, who shot it, brought it in for a *hawk*, saying that it was chasing the sparrows in a field when he killed it. Both this and its mate had previously been making it lively for the small Gulls and Terns, as the books say they should, but I never heard of one which attempted to change its diet in this manner.”

Mr. Nelson records two specimens as having been identified on Lake Michigan near Chicago.

Sub-family LARINÆ. Gulls.

Covering of bill continuous, horny throughout; bill more or less strongly epignathous, compressed, with more or less protuberant gonyes; nostrils linear-oblong, median or sub-basal, pervious. Tail even or nearly so, rarely forked or cuneate, without projecting middle feathers.

GENUS LARUS. Linnæus.

With the general characters of the sub-family.

Sub-genus *Larus*. Large or medium size, robust; bill stout, more or less strongly hooked and protuberant at the symphysis; under parts never rosy-tinted, nor head with dark hood; tail of *adult* entirely white. Hind toe well developed, bearing a perfect claw.

LARUS LEUCOPTERUS Faber.

White-winged Gull.

Larus leucopterus, WHEATON, Ohio Agric. Rep. for 1860, 370, 379; Reprint, 1861, 12, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—RIDGWAY, Ann. Lyceum, N. Y., x, 1874, 393.—COUES, Birds, N. W., 1874, 622.

Larus leucopterus, FABER, Prod. Isl. Orn., 1822, 91.

Primaries entirely white, or palest possible pearly-blue, fading insensibly into white at some distance from the end, their shafts straw-color; mantle palest pearly-blue; bill yellow, with vermilion spot on lower mandible; feet flesh colored or pale yellowish. In winter, head and neck slightly touched with dusky. *Young* :—Impure white with or without traces of pearly on the mantle; head, neck and upper parts mottled with pale brownish, sometimes quite dusky on the back, the under parts a nearly uniform but very

faint shade of the same, the quills and tail often imperfectly barred with the same; bill greenish-yellow. Length, about 24 (rather less than more); wing, 16-17; bill, 1½-2; tarsus, 2-2½.

Habitat, Northern and Arctic seas, circumpolar; south in winter on the Atlantic coast to Long Island.

Rare winter visitor on Lake Erie. Mr. Winslow states that two or three specimens have been taken in Cleveland harbor. Mr. Nelson gives it as a regular and not uncommon winter visitor on Lake Michigan.

NOTE.—The Glaucous Gull (*L. glaucus*) may occur in winter on the Lake. Mr. Nelson states that three specimens have been taken and others seen on Lake Michigan, by Dr. Hoy. It is extremely similar to *L. leucopterus*, but larger, length, 30; wing, 18½.

LARUS MARINUS Linnæus.

Great Black-backed Gull.

Larus marinus, AUDUBON, Orn. Biog., iii, 1835, 98; B. Am., vii, 1844, 152, 181.—KIRTLAND, Ohio Geolog. Surv., 1838, 166, 185.—WHEATON, Ohio Agric. Rep. for 1860, 370, 379; Reprint, 1861, 12, 20; Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 189; Reprint, 23.

Larus marinus, LINNÆUS, Syst. Nat., i, 1766, 225.

Feet flesh-colored; bill yellow with red spot. Mantle blackish slate-colored; first primary with the end white for 2-3 inches; second primary with a white sub-apical spot, and, like the remaining ones that are crossed with black, having the tip white (when not quite mature, the first, with small white tip and sub-apical spot, the second with white tip alone). In winter, head and neck streaked with dusky. *Young*.—Whitish, variously washed, mottled and patched with brown or dusky; quills and tail black, with or without white tips; bill black. Very large; length, 30 inches; wing, 18½; bill above 2½.

Habitat, American and European coast of the Atlantic. South in winter to Long Island (to Florida, *Aud.*). Great Lakes and the Mississippi (*Aud.*).

Like the preceding, a rare winter visitor on Lake Erie. Audubon (l. c.) says:

"Lake Erie supplies with food the *L. marinus*, *L. argentatus*, *L. atricilla*, and some others, as well as the Great, the Arctic, the Roseate, and Black Terns, and some others, all of which pass at times over to the Ohio, and from thence to the ocean."

Mr. Winslow gives it as an occasional visitor to the vicinity of Cleveland in later years. Mr. Langdon (1877) notes its probable identification on the Ohio, at Cincinnati. Many years since I saw a very large Gull flying high overhead, in this vicinity, which must have been this bird or *L. glaucus*.

LARUS ARGENTATUS Brunn.

var. SMITHSONIANUS Coues.

American Herring Gull.

Larus argentatus, AUDUBON, Orn. Biog., iii, 1835, 98; B. Am., vii, 1844, 152, 167.—KIRTLAND, Ohio Geolog. Surv., 1838, 166, 185.—WHEATON, Ohio Agric. Rep. for 1860, 370; Reprint, 1861, 12.

Larus argentatus, var. *smithsonianus*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 20.

? *Larus occidentalis*, TREMBLY, Field Notes, i, 1861, 129, 180.

Herring Gull, BALLOU, Field and Forest, iii, 1878, 136.

Larus argentatus, BRUNNICH, Orn. Bor. 1764, 44.

Larus smithsonianus, COUES, Proc. Phila. Acad., 1862, 296.

Larus argentatus, var. *smithsonianus*, COUES, Check List, 1874, 103.

Feet flesh-color; bill yellow with red spot; mantle pale dull blue (darker than in *leucopterus*, but nothing like the deep slate of *marinus*, much the same as in all the rest of the species); primaries marked as in *marinus* (but the greater majority of specimens will be found to have the not quite mature or final condition); length, 22-27; wing, 15-18; tarsus, $2\frac{1}{2}$ - $2\frac{3}{4}$; bill, about $2\frac{1}{2}$ long, about $\frac{3}{4}$ - $\frac{1}{2}$ deep at base, and about the same at the pre-tubercle. In winter: head and hind neck streaked with dusky. *Young*:—At first almost entirely fuscous or sooty-brown, the feathers of the back, white-tipped or not; size at the minimum above given. As it grows old, it gradually lightens; the head, neck and under parts are usually quite whitish, before the markings of the quills are apparent, and before the blue begins to show, as it does in patches mixed with brown; the black on the tail narrows to a bar, at the time the primaries are assuming their characters, but this bar disappears before the primaries gain their perfect pattern. At one time the bill is flesh-color or yellowish, black-tipped.

Habitat, North America generally; especially on the Atlantic coast. Cuba to Labrador; breeding from New England northward. Also in the interior, and occasionally on the Pacific coast.

Common spring and fall migrant on Lake Erie, less common on the Ohio; common but irregular, most frequent in spring, on the streams of the interior of the State. In the vicinity of this city, the Herring Gull is, in spring, the most frequently seen of all the Gulls, though usually occurring singly or in small companies of six or eight, and never in considerable numbers as is sometimes the case with Bonaparte's Gull. They frequent the swift shallows below dams, flying up, down and across the stream hunting for fish, which they pounce upon, somewhat in the manner of the Kingfisher, occasionally alighting in the water, apparently to rest. These birds are generally more shy and wary than they are found in the cities of the lake shore, where they spend much of their time among the shipping of the rivers or harbor apparently as unconcerned in the presence of man as are domestic pigeons. Occasionally an

adult bird, probably accustomed to such surroundings, visits the still waters in the limits of this city, cruising about for floating fragments, or resting buoyantly upon the water, apparently somewhat flattered to find himself an object of interest.

The Herring Gull, like most of the members of this family, breeds in communities. The nest is placed on the ground, and is said to be large and bulky, composed of grass and moss. The eggs are generally three, measuring about 2.80 by 1.90; the ground color is a varying shade of bluish, greenish or brownish-olive, with dark markings, very variable in shape, size and distribution.

LARUS DELAWARENSIS Ord.

Ring-billed Gull.

Larus zonorhynchus, AUDUBON, Orn. Biog., iii, 1835, 98; B. Am., vii, 1844, 152.—KIRTLAND, Ohio Geolog. Surv., 1838, 166, 185.

Larus delawarensis, WHEATON, Ohio Agric. Rep. for 1860, 371, 379; Reprint, 1861, 13; Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186; Reprint, 190.

Larus delawarensis, ORD, Guthrie's Geog., ii, 1815, 319.

Larus zonorhynchus, RICHARDSON, Fn. Bor-Am., ii, 1831, 421.

Adult plumage precisely like that of the last species, and its changes substantially the same; bill *greenish-yellow*, encircled with a *black band* near the end, usually complete, sometimes defective, the tip and most of the cutting edges of the bill yellow; in high condition, the angle of the mouth and a small spot beside the black, red; *feet olivaceous*, obscured with dusky or bluish, and partly yellow; the webs bright chrome. Notably smaller than *argentatus*; length usually 18-20 inches; extent, about 48; wing, about 15; bill under 2, and only about $\frac{1}{2}$ deep at the protuberance; tarsus, about 2, obviously longer than the middle toe.

Habitat, North America generally; throughout the interior as well as coastwise. Cuba.

Common spring and fall migrant, perhaps formerly summer resident on Lake Erie; less common in the interior of the State than the preceding species. In this vicinity I have seen but two individuals of this species in spring and in fall. Mr. Langdon notes a single specimen taken in the vicinity of Cincinnati. My friend, C. J. Orton obtained specimens from a considerable flock, in April, 1874, at the Licking Reservoir.

Sub-genus *Bissa*. Like sub-genus *Larus*, but hind toe rudimentary or minute, usually without a perfect claw.

LARUS TRIDACTYLUS Linnæus.

Kittiwake Gull.

Bissa tridactylus, WHEATON, Ohio Agric. Rep. for 1860, 371, 379; Reprint, 1861, 13, 21.—RIDGWAY, Ann. Lyc., N. Y., x, 1874, 393.

Larus tridactylus, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 575 ; Reprint, 1875, 15.

Larus tridactylus, LINNÆUS, Fn. Suec., 55.

Rissa tridactyla, BONAPARTE, List, 1838, 62.

Larus (Rissa) tridactylus, COUES, Birds N. W., 1874, 644.

Hind toe only appearing as a minute knob, its claw abortive. Mantle rather dark grayish-blue ; first primary with the whole outer web, and the entire end for about two inches, black ; next one, with the end black about as far, but outer web elsewhere light, and a white speck at extreme tip ; on the rest of the primaries that have black, this color decreases in extent proportionally to the shortening of the quills, so that the base of the black on all is in the same line when the wings are closed (a pattern peculiar to the species of *Rissa*) ; and these all have white apex. Bill yellow, usually clouded with olivaceous ; feet dusky olivaceous. Rather small ; 16-18 ; wing, 12 ; bill, $1\frac{1}{3}$ - $1\frac{1}{2}$; tarsus about the same ; middle toe and claw longer ; tail usually slightly emarginate. In winter, nape and hind neck shaded with the color of the mantle. *Young* :—Bill black ; a black bar on the tail, another across the neck behind ; wings and tail variously patched with black ; dark spots before and behind the eyes ; quills mostly black.

Habitat, Arctic regions of both hemispheres. South in winter on the Atlantic coast to the Middle States.

Very rare or accidental winter visitor on Lake Erie. Mr. Winslow notes the occurrence of three specimens in Cleveland harbor many years since. This appears to be the only record in the interior, except that of Mr. Nelson, who records one individual identified, but not captured, by Dr. Hoy, on Lake Michigan, in 1870.

Sub-genus *Chroicocephalus*. Form less robust and bill more slender than in sub-genus *Larus* ; in the breeding season the white of under-parts rosy-tinted, and the head enveloped in a dark-colored hood.

LARUS PHILADELPHIA (Ord) Coues.

Bonaparte's Gull.

Larus bonapartii, AUDUDON, Orn. Biog., iv, 1838, 212 ; B. Am., vii, 1844, 131.—TREMBLY, Field Notes, i, 1861, 120.

Larus capistratus, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 185.

Choicocephalus philadelphia, WHEATON, Ohio Agric. Rep. for 1860, 371 ; Reprint, 1861, 13.

Larus philadelphia, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 575 ; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18 ; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 186 ; Reprint, 20.

Sterna philadelphia, ORD, Guthrie's Geog., ii, 1815, 319.

Larus capistratus, BONAPARTE, Am. Orn., iv, —.

Larus bonapartei, RICHARDSON, Fn. Bor-Am., ii, 1831, 425.

Chroicocephalus philadelphia, LAWRENCE, Birds N. Am., 1858, 852.

Larus philadelphia, GRAY, List Br. Birds, 1863, 235.

Larus (Chroicocephalus) philadelphia, COUES, Birds N. W., 1874, 655.

Tarsus about equal to middle toe and claw. Small ; 12-14 ; wing, $9\frac{1}{2}$ - $10\frac{1}{2}$; tarsus, $1\frac{1}{2}$; bill, $1\frac{1}{3}$ - $1\frac{1}{2}$, very slender, like a Tern's. Adult in summer :—Bill black ; mantle pearly

blue, much paler than in *atricilla*; hood slaty-plumbeous, with white touches on the eyelids; many wing-coverts white; feet chrome-yellow, tinged with coral red; webs vermillion. Primaries finally:—The first 5-6 with the shafts white except at tip; first white, with outer web and extreme tip black; second white, more broadly crossed with black; 3d to 6th-8th with the black successively decreasing. In winter no hood, but a dark auricular spot. *Young*:—Mottled and patched above with brown or gray, and usually a dusky bar on the wing; the tail with a black bar, the primaries with more black, the bill dusky, much of the lower mandible flesh-colored or yellowish, as are the feet.

Habitat, North America. Casual in Europe.

Common spring and fall migrant on Lake Erie; less common and rather irregular in the interior of the State.

Bonaparte's Gull is perhaps the most numerous of all the Gulls in the interior of the State, where it sometimes appears in spring in consid-

LARUS ATRICILLA Linnæus.

Laughing Gull.

Larus atricilla, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 185.—AUDUBON, B. Am., vi, 1844, 152 (under *L. zonorhynchus*).—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—COUES, Birds of N. W., 1874, 650.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 189; Reprint, 23.

Chroicocephalus atricilla, WHEATON, Ohio Agric. Rep. for 1860, 371, 379; Reprint, 1861, 13, 21.

Larus atricilla, LINNÆUS, Syst. Nat., i, 1766, 225.

Chroicocephalus atricilla, LAWRENCE, Birds N. Am., 1858, 850.

Larus (*Chroicocephalus*) *atricilla*, COUES, Birds N. W., 1874, 650.

Probably never identified as an Ohio bird. Audubon's statement, quoted on page 547, on which Dr. Kirtland named this species as Ohioan, is contradicted by his other statements (B. Am., vii, p. 138): "I never met with them on the Mississippi, above New Orleans," and (ib., p. 142): "Up the Mississippi to New Orleans." My own identification in 1861, I am convinced was an error, the specimen in question being *philadelphia* in breeding plumage. On submitting this matter with others to Mr. Robert Ridgway, he kindly favored me with the following, under date of March 31, 1881:

"As to the occurrence of *L. atricilla* and *Sterna macrura*, I do not know but that taking the character of the evidence into consideration, it would be best to expunge, both from the list. I know of no record which I could rely on for the occurrence of either of these species anywhere in the Mississippi or Ohio Valleys, not excepting my own for *L. atricilla* on the Wabash. Black-headed Gulls much larger than *L. philadelphia* have been repeatedly seen there, but they may have been *L. franklini*. Still, all the birds of this family are great wanderers occasionally, and there is of course a reasonable probability of the occurrence, more or less often of both of these species far from their usual haunts. Since the publication of my Catalogue of Illinois Birds I have become 'autoptically' acquainted with *L. atricilla* in a region where it abounds (coast of Virginia) and now more than ever doubt having seen it in Southern Illinois, *L. franklini* being more probably the species noticed."

erable flocks ; in fall it is rather more regular, but in less numbers than in spring, single birds or pairs often lingering for several days about favorite feeding places.

Audubon first saw this bird when crossing the Ohio from Cincinnati to Newport, Kentucky, to view the nests of the Cliff Swallows, in 1819.

GENUS XEMA. Leach.

Like sub-genus *Chroicocephalus*. Tail forked.

XEMA SABINEI (Sab.) Leach.

Fork-tailed Gull.

Xema sabini, WHEATON, Ohio Agric. Rep. for 1860, 371, 379 ; Reprint, 1861, 13, 21.

Xema sabinei, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 575 ; Reprint, 1875, 15.—RIDGWAY, Ann. Lyc. N. Y., x, 1874, 393.

Larus sabinei, J. SABINE, Linn. Trans., xii, 1818, 522.

Xema sabinei, LEACH, App. Ross. Voy., 1825.

Adult :—White, including inner primaries, most of secondaries, and greater coverts ; head enveloped in a slate-colored hood, succeeded by a velvety-black collar ; mantle slaty-blue, extending quite to the tips of the tertiaries ; whole edge of the wing, and first five primaries black, their extreme tips, and the outer half of their inner webs to near the end, white ; bill black, tipped with yellow ; feet black ; length, 13-14 ; wing, 10-11 ; bill, 1 ; tarsus, $1\frac{1}{4}$; tail, 5, forked an inch or more. The changes of plumage are correspondent with those of *L. philadelphia* ; in the young the tail is often simply emarginate.

Habitat, Arctic regions of both hemispheres. Spitzbergen. In America, south in winter to New York, and Great Salt Lake, Utah.

Accidental in winter on Lake Erie. Mr. Winslow informs me that he took an immature bird of this species in Cleveland harbor many years since. The specimen was preserved and mounted, and placed in the museum of Cleveland Medical College. He has since informed me that from lack of care it has been destroyed by vermin. Mr. Nelson killed a specimen in full breeding dress on Lake Michigan, near Chicago, in April, 1873, but unfortunately it was not secured.

Sub-family STERNINÆ. Terns.

Covering of bill continuous (no cere) hard and horny throughout ; bill *paragnathous*, relatively longer and slenderer than in the Gulls, very acute, the commissure straight or nearly so to the end ; nostrils generally linear. Tail never square, almost invariably forked (often deeply forficcate). Wings extremely long and pointed. Feet small and weak.

Sub-genus *Gelochelidon*. Bill remarkably short, stout and obtuse, hardly or not half as long again as the tarsus.

STERNA ANGLICA Montague.

Gull-billed Tern ; Marsh Tern.

Sterna aranea, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 185.—WHEATON, Ohio Agric. Rep. for 1860, 371 ; Reprint, 1861, 13.

Sterna anglica, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 573; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin. 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 189; Reprint, 23.

Sterna anglica, MONTAGUE, Orn. Dict. Suppl., 1813.

Sterna aranea, WILSON, Am. Orn., viii, 1814, 143.

Bill and feet black; mantle pearly grayish-blue, this color extending on the rump and tail; primaries with the white stripe restricted to their base, their shafts white. Length, 13-15; extent, about 34; wing, 10-12; tail, 4, forked only 2 or less, the lateral feathers little narrowed; tarsi, 1-1½; bill, 1½.

Habitat, nearly cosmopolitan. In North America, chiefly Eastern United States; not detected on the Pacific side. Patagonia.

Rare visitor in the vicinity of Cleveland, where taken by Mr. Winslow. Given as an exceedingly rare summer visitor in the vicinity of Chicago by Mr. Nelson.

Sub-genus *Sterna*. Bill of ordinary Sternine character; occiput not crested; feet not black. Medium and small.

STERNA FLUVIATILIS Naumann.

Common Tern; Sea-swallow.

Sterna hirundo, NUTTALL, Man., ii, 1834, 271.—KIRTLAND, Ohio Geolog. Surv., 1838, 166, 185.—AUDUBON, Orn. Biog., iv, 1838, 75; Birds Am., vii, 1844, 98.—WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 1875, 575; Reprint, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 189; Reprint, 23; Summer Birds, ib., iii, 1880, 229.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5.

Sterna wilsonii, TREMBLY, Field Notes, i, 1861, 129.—WHEATON, Ohio Agric. Rep. for 1860, 1861, 371; Reprint, 13.

? Great Tern, AUDUBON, Orn. Biog., iii, 1835, 98; B. Am., vii, 1844, 152.

Sterna hirundo, LINNÆUS, Fn. Suec., 158.

Sterna fluviatilis, NAUMAUNN, Isis, 1820.

Sterna wilsoni, BONAPARTE, List, 1838, 61.

Bill red, blackening on the terminal third, the very point usually light; feet coral-red. Mantle pearly grayish-blue; primary shafts white except at the end; below white, washed with pale pearly plumbeous, blanching on throat and lower belly. Tail mostly white, the outer web of the outer feather darker than inner web of the same. Length of male, 14½ (13-16); extent, 31 (29-32); wing, 10½ (9½-11½); tail, 6 (5-7); tarsus, ½ (¾-¾); bill, 1½-1¾; whole foot, averaging 1¾; female rather less; averaging toward these minima; young birds may show a little smaller, in length of tail particularly, and so of total length; length, 12 or more; wing, 9 or more; tail, 4 or more; bill, 1½ or more. In winter this species does not appear to lose the black-cap, contrary to a nearly universal rule. *Young*:—Bill mostly dusky, but much of the under mandible yellowish; feet simply yellowish; cap more or less defective; back and wings patched and barred with gray and light brown, the bluish showing imperfectly if at all, but this color shading much of the tail; usually a blackish bar along the lesser coverts, and several tail feathers dusky on the outer web; below, pure white, or with very little plumbeous shade.

Habitat, Europe. Eastern North America generally. Bahamas. Breeds variously in its North American range; winters in the United States north to 57°; passes beyond Texas.

Common spring and fall migrant, perhaps not common summer resident on Lake Erie, less common or irregular throughout the State. In this vicinity the Common Tern is most frequently seen in spring, when it sometimes appears in considerable flocks on our river. In the fall a solitary individual sometimes lingers for several days. Mr. Langdon mentions its rather common occurrence on Sandusky Bay in summer.

The appearance of any of the birds of this family in the interior of the State is so irregular and transient, as to render their study a matter of uncertainty, if not accident, except upon the shore of Lake Erie. Mr. William Brewster (Bull. Nutt. Orn. Club, iv, 1879, 13) is so felicitous in his paper "On the Terns of the New England Coast," that I trust I need make no apology for giving it here entire:

"Among all the sea-birds that with the changing seasons visit our New England shores there are none half so beautiful as the Terns, or Sea-Swallows. Family *Laridæ*, sub-family *Sterninæ*, genus *Sterna*,—thus they are classed in the books. What a pity their names could not have been more aptly chosen! There is much in a name, and *Sterna* sounds hard and cold. Nor is the English appellation, Tern, a whit more appropriate or beautiful. Why could not these birds of graceful motion and faultless coloring have borne the name of Aphrodite? Perhaps like her they were evolved from the sea-foam. No sea-foam can be purer than their spotless breasts, and the softest tints of the summer sky are impressed upon their pearly mantles. If ever birds were born of the sea surely they are these. The delicate rosy blush of at least one species must have been borrowed from some rare shell. But Science, plodding and realistic, frowns upon such imagery, and her solid columns of facts and figures are resistless.

"Occurring more or less regularly along the coast of New England, we find eleven species of Terns, all of which, with one possible exception (*Sterna caspia*), are either summer residents or migratory during the spring or fall months. Of this number five species may be set down as accidental visitors, which are either blown from their course by adverse winds or wander beyond the usual range. The Royal Tern (*Sterna maxima*), the Marsh Tern (*S. anglica*), the Sandwich Tern (*S. cantiaca*), and the Sooty Tern (*S. fuliginosa*) are stragglers from the South, while the Forster's Tern (*S. forsteri*), breeding in the interior well up into the fur countries, probably strikes across to the coast and follows its indentation southward. The last-named species, though rare, is of perhaps too regular occurrence to be classed among the accidentals, for one or two specimens are reported nearly every season, usually during the month of September.

"The Caspian Tern—all previous statements to the contrary—must be considered a regular visitor every season, and by no means uncommon. They come down from their northern breeding-grounds during the latter part of September and for several weeks, at least, are to be found in moderate numbers all along our seaboard. I have observed them at various points from Ipswich to Nantucket. At the latter place, upon one occasion, six individuals were seen fishing in the harbor near the town. As to their wintering within New England limits, I can offer only negative evidence, but that points to the inference that they pass farther south with the approach of severe weather. During

the first week of May, 1875, I found them quite numerous at Chatham, Mass. They frequented the sand-bars near the shore, and kept apart from the Herring and Black-backed Gulls, the only other species of *Laridæ* present at the time. The Short-tailed Tern (*Hydrochelidon nigra*) can likewise no longer be regarded as a rare or accidental visitor. Their numbers vary considerably in different years, but they are always to be found during the fall migration. At Nantucket they were fairly numerous in August and September of 1878. I know of but one instance of the capture of this Tern in spring.

"Four species only out of the number accredited to New England are known to breed along its coast. They may be given in the order of their comparative abundance as follows: The Wilson's or Common Tern (*S. fluviatilis*); the Roseate Tern (*S. dougalli*); the Arctic Tern (*S. macrura*) (the choice of precedence between the last two species will vary as different localities are considered); and the Least Tern (*S. antillarum*). Of these the Roseate and Least Terns are for the most part confined to the waters of Cape Cod, while the Arctic and Common Terns breed along the entire coast, and range northwards to unknown latitudes. Formerly a small colony of Least Terns nested annually upon the Ipswich sand-hills, but they have been entirely driven away by persecution. This point was probably about the extreme limit of their northern range upon the Atlantic coast. I have also upon one occasion found the Roseate Tern as far north as Casco Bay, Maine, where a small flock was observed upon the Green Island. They certainly were not nesting there, though the date, July 20, renders it not impossible that they had eggs or young on some of the neighboring islands.

"Spring comes over the sea later than upon the land, and fewer tokens are given of its presence. There is no freshening grass; no budding foliage, nor springing up of green things in sheltered places. Summer may be close at hand, but as yet the sea gives no sign. When the wind is from the north, the waves in the bay have that steely glint that they have borne all winter. The sand drifts drearily over the wind-swept beach-ridges, and the marshes are bleak and brown, while in the interior Robins may be hopping about upon green lawns, and violets blooming in every woodland nook. The Ducks and Geese, it is true, are marshalling their cohorts and stretching out in long lines northward, but the breath of ocean is still chill and cold. Indeed, the season is commonly far advanced, and the apple orchards in bloom inland, ere the winter Gulls are gone to their distant breeding-grounds. Scarcely has the rear guard of their legions departed, when the Terns begin to appear. And what a fitness is there in the changing season! The larger Gulls, that enliven our shores through the colder months, seem born to breast the fiercest gusts of winter and to wrest a living from icy seas. Bold, hardy, vigorous, they delight in the cold, and their every motion bespeaks conscious power and strength. The Terns, on the other hand, are characterized by a delicate perfection of outline and a swift grace of movement, that seems ill-adapted to stern, pitiless surroundings. They are like swift yachts that winter in southern seas, and come back to us on the first warm breezes of summer. Yet the significance is perhaps only local, after all, for both Gulls and Terns herald the opening summer to the inhabitant of Labrador and Greenland.

"The Least Terns, although the smallest and seemingly the most delicate of their tribe, arrive first. By the middle of May they appear in certain favored spots,—for they are not anywhere very numerous,—and small colonies of from ten to fifty pairs are soon formed at various points along the shores of Cape Cod and upon some of the more sandy islands in the Vineyard Sound.

"A few days after the advent of the 'Little Strikers,' as the Least Terns are called by the 'longshoremen of Virginia, the Wilson's and Roseate Terns begin to appear.

They are already paired, but judging by the occasional bickerings and jealousies that arise, even the more sedate females are not above a little harmless flirtation. It is a pretty sight to see the mated birds sitting side by side upon some long sand-spit, all with their breasts turned to the soft morning breeze, and each little glossy black cap glistening in the sunlight. Forty or fifty there may be altogether, with others continually arriving from the distant fishing-grounds. As the incoming birds settle among their fellows, a low murmur of welcome runs through the assembled throng, and fifty pairs of wing are simultaneously raised above their owner's backs. It is like the greeting offered by men to one whom they delight to honor, save that among these simple sea-birds even the humblest are rarely neglected. Those individuals occupying the higher portion of the bar are squatted on the warm sand, or lying with wings partially extended to the grateful rays of the sun, while along the water's edge many are washing and pluming themselves, scattering the salt spray in every direction, or toying with the lapping waves. As the rising tide encroaches on their domain, numbers of the more careless are floated off their feet, when they take wing and alight again among the rest. In this way the area continually narrows, until the birds are massed in a compact body upon the highest point. When this at length becomes submerged they all take wing and remove to some other spot. The same bar is apt to be resorted to daily, and if sufficiently elevated to be beyond the reach of the tides, it is all the more likely to be chosen.

"About the middle of June—the time varying somewhat with different localities—the Terns repair to their breeding-grounds and begin to deposit their eggs. Muskegat, the outermost of a group of low, sandy islands that with Nantucket form the breakwater of Vineyard Sound, is, and has been since time immemorial, the largest breeding station of the Terns on the New England coast. It is crescentic in shape, three miles long by one across at the broadest part, and uninhabited. The beach along the eastern shore is steep and bold, and in the calmest summer weather the heavy surges from the open ocean break upon the shifting sands with an incessant sullen roar. Upon the Sound side shallows and sand-bars extend for miles in every direction, and it is said that at low tide one may wade across to Tuckernuck, more than a mile distant. The interior of the island rises in rolling sand-hills, which are sparsely clothed with beach-grass and a stunted growth of poison ivy, while a few scattered clumps of bayberry-bushes afford the nearest approach to arboreal vegetation. Were it not for man,—who, alas! must be ranked as the greatest of all destroyers,—the Terns would here find an asylum sufficiently secure from all foes. But season after season the poor birds are daily robbed of their eggs by fishermen, while frequent yachting parties invade their strongholds and shoot them by hundreds, either in wanton sport or for their wings, which are presented to fair companions. Then the graceful vessel spreads her snowy sails and glides blithely away through the summer seas. All is gayety and merriment on board, but among the barren sand-hills, fast fading in the distance, many a poor bird is seeking its missing mate; many a downy little orphan is crying for the food the dead mother can no longer supply; many a speckled egg lies cold and deserted. Buzzing flies settle upon the bloody bodies, and the tender young pine away and die. A graceful pearly-tinted wing surmounts a jaunty hat for a brief season, and then is cast aside, and Muskegat lies forgotten, with the bones of the mother and her offspring bleaching on the white sand. This no fancy sketch; all over the world the sad destruction goes on. It is indeed the price of blood that is paid for nodding plumes. Science may be, nay, certainly is, cruel at times, but not one tithe of the suffering is caused by her disciples that votaries of the fickle goddess Fashion yearly sanction.

"My first visit to Muskegat was in 1870. It was about the 25th of June when we

landed on the island, and three days were spent in investigating its fauna. Although the fishermen told us that the Tern had been diminishing for years, their numbers at that time, nevertheless, were astonishing. The Arctic Terns were breeding apart in a separate colony, on a long, narrow strip of sand, while the Common or Roseate Terns intermingled freely, often times placing their nests side by side. Little preference seemed to be accorded by the last two species to any given locality. Their eggs were as often laid upon the windrows of sea-weed at high-water mark, as among the ivy-vines on the sand-hills. Indeed, they were scattered everywhere, and the birds that were breeding there must have been numbered by hundred of thousands. The sight was a novel and impressive one. Overhead, at varying heights, swarms of Terns were passing and repassing, crossing each other's flight in mazy lines. From the birds just skimming the crests of the sand-hills to the white specks floating thousands of feet above the earth in the blue sky, the air was filled with their countless numbers. Hundreds were continually rising from their nest and making out to sea, or returning from the fishing-grounds, each with a small fish held crossways in its bill.

"On one occasion that I remember, a black thunder-cloud rose out of the sea, in the north, and the white birds hovering over the island were brought out in striking contrast to the dark background. It was as if the air were filled with snowflakes. The noise was simply deafening, especially when the birds became aware of our presence. As we advanced, their sitting mates rose from the nests in clouds, swelling the throng of anxious parents over our heads, each bird adding its shrill voice to the general din. Yet amid all this confusion they took good care to keep beyond gun range. Occasionally, however, an exception to this occurred, and a daring bird darted down into our very faces. High overhead all the time a number of Black-headed Gulls (*L. atricilla*) floated in graceful circles, adding their shrill demonical laughter to the weird chorus.

"If a Tern wereshot, the effect was instantaneous and startling. Every voice was at once hushed, hundreds of long narrow wings were set, and troops of gliding arrowy forms swept down in silence to the fallen victim. From the sky above, from every nook and corner of the neighboring sand-hills, they came hurrying to the spot. Then, as if at a given signal, every bird burst out afresh in cries of rage, protest, and despair. The effect was indescribable. As the graceful birds came whirling down in perfect silence, they seemed like dread avengers seeking to bear away their dead comrade and to overwhelm his destroyer. If another bird was killed, the tumult continued and the excitement became even more intense; but if no further molestation were offered, they gradually departed one by one. This habit of hovering over their slain companions, though undoubtedly prompted by sympathy and social affection, is a most unfortunate one, as it is constantly taken advantage of, and dozens are frequently killed at a time.

"Upon Muskegat the Terns have, or had at the time of which I write, another enemy, which, though second in importance to man, nevertheless destroyed large numbers of these birds. This was the Short-eared Owl (*Brachyotus palustris*). A small colony of these birds had established itself upon a certain elevated part of the island, spending the day in a tract of densely matted grass. Scattered about in this retreat were the remains of at least a hundred Terns, that they had killed and eaten. Many of these were fresh, while others were in every stage of decomposition, or dried by the sun and wind. In each case the breast had been picked clean, but in no instance was any other portion disturbed. Every day, at a certain time, these Owls sallied forth in search of fresh prey. We used regularly to see them about sunset, sailing in circles over the island or beating along the crests of the sand-hills. They were invariably followed by vast mobs of enraged Terns, which dived angrily down over the spot where the Owl had

alighted, or strung out in the wake of his flight like the tail of a comet. The Owl commonly paid little attention to this unbidden following, and apparently never tried to seize his persecutors while on the wing, but on several occasions we saw a sitting bird pounced upon and borne off. Sometimes in the middle of the night a great outcry among the Terns told where a tragedy was being enacted.

"I found the Terns sadly diminished in numbers when I last visited Muskegat, in July, 1874. Their persecutors were ravishing their stronghold more relentlessly than ever, and nearly every day fishermen came from far and near to collect their eggs. So cleanly had they swept the island that we could find scarcely a nest with eggs, and at that comparatively late date not a single young bird was to be seen. In fact, the poor Terns were kept laying like hens through the whole summer. We were told by the fishermen that quite as many eggs were obtained by them in August as in June; it is doubtful if one pair in a hundred succeeded in raising offspring that year. Under such conditions the result is inevitable. If prompt legislation be not brought to bear on the matter, the time is near at hand when the waters of Vineyard Sound will no longer be enlivened by these innocent birds. The inconsiderable destruction of small fishes, a reason that has been given for withholding protection, is of little moment, and those barren sandy shores can ill afford to lose the presence of the graceful Sea-swallow.

"Of the eggs of the three species of Terns which breed upon Muskegat, little need be said save that they vary to an almost endless degree, and cannot specifically be distinguished. The Wilson's and Roseate Terns usually build nests, some of which are quite bulky, with a lining of dry grasses, upon a foundation of coarse twigs or sea-weed. In many cases, however, the eggs were simply laid in a slight depression in the sand. We fancied that the Roseate Terns built more substantial domiciles than the other species, but the difficulty of satisfactorily identifying any considerable number of nests rendered a positive conclusion hopeless. The Arctic Terns, as before stated, bred apart from the others, and laid their eggs upon the bare sand.

"The notes of the Wilson's and Arctic Terns vary, if at all, only slightly in modulation. The ordinary cry of anger or protest is a harsh vibrating *te-ar-r-r*, that of contentment or recognition a soft *chick*. They utter various other sounds, all more or less discordant. The usual note of the Roseate Tern is a soft mellow *haw-it*, repeated at frequent intervals. It has, in addition, when excited or angry, a cry which can be closely imitated by forcibly tearing a strong piece of cotton cloth.

"One who has never held in his hand a freshly killed Tern can scarcely imagine its wonderful beauty. The delicate faultless outlines; the long, slender, graceful wings; the pearly blue-gray back; the soft tinting beneath, set off by the bright coral red of the feet and bill, all go to make up a whole that must satisfy the most æsthetic eye. The delicate blush that suffuses the breast of the Roseate Tern can only be seen in its perfection for a brief period after death, for either it fades altogether, or turns to a dull salmon tint before the bird becomes cold. Like an ethereal grace, it shrinks and perishes before the gaze of vulgar eyes.

"When the cares of incubation are over,—and sad, unprofitable cares they must be in most cases for these poor birds,—the Terns resort again to the sand-bars nearest their chosen fishing-grounds. The waters about Nantucket are a favorite haunt, and through the month of September they swarm about every bay and cove that indents the shore. Their movements, however, depend largely upon those of the blue-fish. Those voracious creatures prey upon the smaller fishes, and, hunting always in schools, by their combined action drive the feeble fry to the surface, when they are seized by the Terns. The fishermen rely almost wholly upon the actions of the latter to discover the presence of

fish in the Sound, and when a flock of Terns is seen hovering over a certain spot, a school of blue-fish is pretty sure to be at work beneath.

"It is an interesting sight to watch the birds collect. A moment before, perhaps only a few were to be seen, leisurely winnowing their way along the shore; but in an incredibly short space of time the lucky discoverer of a school is surrounded by hundreds of his fellows, and a perfect swarm of eager, hungry birds poises over the spot. Dozens dash down at once, cleaving the water like darts, and, rising again into the air, shake the salt spray from their feathers by a single energetic movement, and make ready for a fresh plunge. Every bird among them is screaming his shrillest, and the excitement waxes fast and furious. Beneath, the blue-fish are making the water boil by their savage rushes, and there is fun and profit for all save the unfortunate prey. Their position is perhaps the best exemplification of the 'frying-pan and the fire' that can be found in nature.

"The descent of a Tern upon its victim is performed with inimitable ease and grace. The bird frequently disappears entirely beneath the surface, and occasionally even swims a short distance under water before reappearing. The flight of the Roseate Tern is especially dashing and beautiful, with the long cleft tail streaming out behind, or inclining, rudder-like to either side, as the bird suddenly changes its course. I have seen the Wilson's Tern picking up floating garbage from the surface in the manner of a Gull, but the food is ordinarily small fishes, which are taken alive.

"In clear calm weather in September few Terns will be seen along shore. They probably wander farther out to sea at such times, or congregate upon the sand-bars to rest and plume themselves. The cleanliness of these birds is remarkable. Not only is the plumage invariably spotless, but I have on more than one occasion seen a wounded one, which had been taken into the boat, begin to arrange its disordered feathers, and its feeble efforts to remove the blood-stains from its fresh wounds were truly touching.

"When the wind blows hard the Terns spend much of their time on the wing, and then display great restlessness and activity. They seem to exult with the freshening breeze, like ships that have been becalmed. At such times I have seen them play for many minutes with a fish which one of their number had captured. The holder would drop it, evidently by design, and the whole troop go sweeping down in pursuit. The foremost was sure to seize it before it reach the water, when it was taken up into the air and again dropped. In this manner the prize would be in turn passed from one to another. The game was apparently well understood by all, as no attempt was made by any of them to devour the fish. Swallows will frequently play with a feather in a similar manner.

"The ease with which sea-birds find their way through the densest fog is as astonishing as it is inexplicable. I have seen the Terns passing between the fishing-grounds and Muskeget when it was impossible for human eyes to discern an object many yards away, and yet their course was as direct and decided as in the clearest weather. Indeed, at such times the fishermen are often guided by their flight.

"The Least Terns usually leave for the south in the latter part of August, and the Short-tailed species commonly departs before the close of the succeeding month. But the Wilson's, the Roseate, and the Arctic Terns linger about Nantucket through the first half of October. After that their numbers thin rapidly, and by the 25th all are gone. The fishermen say that they follow the blue-fish in their southward migration. However that may be, when the chilling blasts of early November sweep across the sea, the Herring and Black-backed Gulls have taken their places upon the sand-bars about Nantucket; the Eider Duck, the Scoter, the Whistler, and the Sheldrake flock to

fish among the Muskegat 'tide-rips'; and troops of Snow-Buntings whirl over the bleak sand-hills."

STERNA FORSTERI Nutt.

Forster's Tern.

Sterna forsteri, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 515; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 187; Reprint, 21.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5.

Sterna forsteri, NUTTALL, Man., ii, 1834, 274.

Like the last; larger, tail longer than wings. Wing of adult, $9\frac{1}{2}$ – $10\frac{1}{2}$; tail, $6\frac{1}{2}$ –8, thus often beyond the extreme of *fluvialtilis*, and nearly as in *macrura*; bill, $1\frac{1}{2}$ ($1\frac{1}{2}$ – $1\frac{3}{4}$), and about 2.5 deep at base (in *fluvialtilis* rarely if ever so deep); tarsus seldom down to $\frac{1}{2}$; whole foot, about 2. Little or no plumbeous wash below; inner web of the outer tail feather darker than outer web of the same. Young and winter birds may be distinguished from *fluvialtilis* at gunshot range; the black cap is almost entirely wanting, and in its place is a broad black band on each side of the head through the eye; several lateral tail feathers are largely dusky on the inner webs; their outer webs are white.

Habitat, North America at large. Middle America. South America to Brazil. Only known to breed in the higher latitudes.

Not very common spring and fall migrant. Not recorded from the lake shore. Mr. Langdon gives it as a rare migrant in the vicinity of Cincinnati, where Messrs. Dury and Freeman note six specimens taken May 4, 1879. My own acquaintance with the bird in this vicinity is limited to a single specimen taken in the fall of 1861 or 1862. Doubtless it has been confounded with other species, as no adequate and generally accessible description of the adult was had until 1858 (*Lawrence*), or of the young until 1862 (*Coues*).

This Tern may possibly breed in Northern Ohio, as it has been discovered breeding in Northern Illinois by Mr. Nelson, who gives the following description of its nesting and eggs:

"Although I have been aware that *S. forsteri* nested in this vicinity for several years, it was not until the middle of June, 1876, that I had the pleasure of examining one of their nests. While we were collecting eggs among the wild rice patches, on Grass Lake, June 14th, Mr. Douglas observed a pair of these Terns hovering near a small patch of *Sagittaria* leaves growing in several feet of water, and rowing to the spot found the nest, which was a loosely built structure of coarse pieces of reeds resting upon a mass of floating plants and concealed from view by the surrounding leaves. Upon the nest was a single young bird, about to scramble into the water, but upon seeing Mr. Douglas it crouched to avoid being observed, and was captured. A thorough search at the time failed to reveal any other young ones, so the adults, which had been darting and screaming about this heap, were secured, with a second pair which had espoused the cause of their companions. Their anxiety we afterwards found to be the proximity of an unfinished nest, similarly situated. That evening we found and secured two more young

upon the nest found in the morning. The next morning fortune favored me, and, while passing between several floating masses of decaying vegetable matter I observed four small heaps of wild rice stalks resting upon one of these masses, and on a near view, to my delight they proved to be the desired nests containing eggs. The nests were situated in a line, and the two outer ones were not over twenty-five feet apart. The only materials used were pieces of wild rice stems, which were obviously brought from some distance, as the nearest patch of rice was several rods distant. The nests were quite bulky, the bases being two feet or more in diameter. The greatest depth was about eight inches, and the depression in the centre so deep that while sitting in the boat a rod away the eggs were not visible. Two of the nests contained three eggs, and two contained two eggs, each. The following are the measurements of three of the eggs, representing the amount of variation: 1.70 by 1.25; 1.75 by 1.20 and 1.60 by 1.25. The ground color varies from a pale greenish to a warm brownish drab. The spots and shell markings are of a varying shade of brown, distributed much as in the other small Tern's eggs."

STERNA DOUGALLI Mont.

Roseate Tern.

Sterna paradisæa, WHEATON, Ohio Agric. Rep. for 1860, 371; Reprint, 1861, 13.

Sterna paradisæa, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 15.

Sterna dougalli, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 187; Reprint, 21.

Roseate Tern, AUDUBON, Orn. Biog., iii, 1835, 98; B. Am., vii, 1844, 152.

Sterna dougalli, MONTAGUE, Orn. Dict. Suppl., 1813.

Sterna paradisæa, KEYSERLING and BLASIUS, Wirl. Eur., 1840, 97.

Bill black, usually orange at base below. Mantle very pale pearly-blue; primaries with the white band broad and usually extending to the very tip; below, pure white, or rosy-tinted; feet coral-red. Changes of plumage as in other species. Length, 12-16; wing, 9-10; tail, 5-8; bill, 1½-1¾, very slender; tarsus, ¾-1.

STERNA MACRURA Naumann.

Arctic Tern.

Sterna arctica, KIRTLAND, Ohio Geol. Surv., 1838, 166, 185.

Sterna macroura, WHEATON, Ohio Agric. Rep. for 1860, 371; Reprint, 1861, 13; Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—RIDGWAY, Ann. Lyc., N. Y., x, 1874, 393.—LANGDON, Cat. Birds of Cin., 1877, 18.

Arctic Tern, AUDUBON, Orn. Biog., iii, 1835, 98; B. Am., vii, 1844, 152; BALLOU, Field and Forest, iii, 1878, 136.

Sterna macrura, NAUMANN, Isis, xii, 1819, 1847.

Sterna arctica, TEMMINCK, Man., ii, 1820, 742.

The statement of Audubon, quoted on page 547, is the only authority for citations of this as an Ohio species, except that of Mr. Ballou. On page 108 of the same volume, Audubon says: "The Arctic Tern is found on the Eastern coast of the United States only," thus annulling the former statement. Mr. Nelson does not give it as a bird of Illinois, nor do I find any other record of its occurrence in the Mississippi Valley or in the interior; see also Mr. Ridgway's views on page 551.

Habitat, Europe. In North America, observed from Massachusetts to Florida, thence to Central America. Various West Indian Islands. Breeds apparently throughout its range. No United States record of wintering.

Not common spring and fall migrant. Named by Audubon as above cited, and by Mr. Winslow as occurring on Lake Erie. Mr. Langdon notes a single example from the vicinity of Cincinnati.

STERNA ANTILLARUM (Less.) Coues.

Least Tern.

Sterna minuta, AUDUBON, Orn. Biog., iv, 1838, 175; B. Am., vii, 1844, 119.

Sterna frenata, WHEATON, Ohio Agric. Rep. for 1860, 371; Reprint, 1861, 13.

Sterna superciliaris, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18.

Sterna superciliaris, var. *antillarum*, LANGDON, Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879; Reprint, 21.

Sterna superciliaris, VIEILLOT, Nouv. Dict. d'Hist., Nat., xxxii, 1819, 126.

Sterna minuta, WILSON, Am. Orn., vii, 1813, 80.

Sternula antillarum, Lesson, Descr. Mam. et Ois., 1847, 256.

Sterna frenata, GAMBEL, Proc. Phila. Acad., iv, 1848, 128.

Sterna superciliaris, var. *antillarum*, COUES, Birds N. W., 1874, 692.

Bill yellow, usually tipped with black. Mantle pale pearly grayish-blue, unchanged on the rump and tail; a white frontal crescent, separating the black from the bill, bounded below by a black loreal stripe reaching the bill; shafts of two or more outer primaries black on the upper surface, white underneath; feet orange. Young:—Cap too defective to show the crescent; bill dark, much of the under mandible pale; feet obscured. Very small, only 8-9; wing, 6-6½; tail, 2-3½; bill, 1-1½; tarsus, ¾.

Habitat, Temperate North America, especially along the Atlantic coast of the United States, but also on the larger inland waters. Up the Pacific coast to California. South into the Antilles and Middle America generally. Apparently winters beyond the United States.

Not common and apparently very irregular spring and fall migrant. Audubon states that it "is extremely abundant at times on the lakes and on the Ohio," which is not confirmed by recent observations. Mr. Winslow does not give it as a bird of Northern Ohio, but Mr. Langdon notes several specimens taken in the vicinity of Cincinnati. I saw a pair on the canal below this city several years since.

GENUS HYDROCHELIDON. Brehm.

Webs deeply incised (feet little more than semipalmate). Tail merely emarginate, hardly or not half as long as the wing.

HYDROCHELIDON LARIFORMIS (L.) Coues.

Black Tern.

Sterna nigra, AUDUBON, Orn. Biog., iii, 1835, 535; B. Am., viii, 1844, 16.—KIRTLAND, Ohio Geolog. Surv., 1838, 166, 185.

- Hydrochelidon plumbea*, WHEATON, Ohio Agric. Rep. for 1860, 371; Reprint, 1861, 13.
Hydrochelidon fissipes, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 14.
Hydrochelidon lariformis, LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 187; Reprint, 21; Summer Birds, ib., iii, 1880, 229.—DURY and FREEMAN, ib., iii, 1880, 104; Reprint, 5.
 Black Tern, AUDUBON, Orn. Biog., iii, 1835, 98.
 Short-tailed Tern, BALLOU, Field and Forest, iii, 1878, 136.
Rallus lariformis, LINNÆUS, Syst. Nat., i, 1758, 153.
Sterna nigra, BRISSON, Orn., vi, 1860, 211.
Hydrochelidon nigra, BOIE, Isis, 1822, 563.
Sterna plumbea, WILSON, Am. Orn., vii, 1813, 83.
Hydrochelidon plumbea, LAWRENCE, Birds Am., 1858, 864.
Sterna fissipes, LINNÆUS, Syst. Nat., i, 1766, 228.
Hydrochelidon fissipes, COUES, Proc. Phil. Acad., 1862, 554.
Hydrochelidon lariformis, COUES, Birds N. W., 1874, 704.

Adult in breeding plumage; head, neck and under parts, uniform jet-black; back, wings and tail plumbeous; primaries unstriped; crissum pure white; bill black. In winter and young birds, the black is mostly replaced by white on the forehead, sides of head and under parts, the crown, occiput and neck behind, with the sides under the wings, being dusky-gray; a dark auricular patch and another before the eye; in a very early stage, the upper-parts are varied with dull brown. Small; wing, 8-9, little less than the whole length of the bird; tail, $3\frac{1}{2}$, simply forked; bill, $1-1\frac{1}{2}$; tarsus, $\frac{3}{4}$; middle toe and claw, $1\frac{1}{2}$.

Habitat, Europe, &c. North America generally. Alaska. Middle America. South America and Chili. Breeds at large in North America. Winters chiefly or entirely extralimital.

Common summer resident in Northern Ohio, and common spring and fall migrant in other parts of the State.

In this vicinity the Black or Short-tailed Tern is the most numerous and regular species of the sub-family while on the migrations, and may be seen on the rivers, ponds or canals. I have never known it to breed here, however. Mr. Langdon gives the following observations of them in the breeding season, in Ottawa county (Summer Birds, l. c.):

"A very common summer resident in the marsh; nesting, or rather laying its eggs on the islands of decaying vegetation and mud formed by sunken muskrat houses. Three eggs constitute a full set, and they are apparently rolled about in the mud purposely, until well coated, so as to hide the markings and thereby make them less conspicuous. In two or three instances only did we observe any attempt at a nest, and these would not have been recognized as such without the eggs, consisting as they did of merely a few fragments of grass or bulrushes so disposed as to prevent the eggs from rolling; in most cases the eggs rested in a slight depression on the bare mud. The sun appears to be their chief incubator, although the decaying vegetation of which the abandoned muskrat houses consist, doubtless plays some part in the process. In no instance did we succeed in flushing a bird from the eggs, although they would appear in pairs to the number of twenty or thirty and hover about within a few feet of our heads making a great

outery when we approached their property, which was soon to be ours by right of discovery. At other times the birds were not at all gregarious, being usually observed foraging singly or in pairs. Several young of the year were taken, thus confirming the statement of the resident who informed us that he had taken numbers of eggs of the first brood in May. Of the dozen or more sets of eggs taken by us early in July, more than half were fresh or nearly so."

ORDER PYGOPODES. DIVING BIRDS.

FAMILY COLYMBIDÆ. LOONS.

Feet four-toed, palmate. Hallux lobate, connected at base with base of inner toe. Tail perfect. Head closely and completely feathered. Nostrils with a depending lobe or flap. Bill straight, compressed, acute.

GENUS COLYMBUS. Linnaeus.

With characters of the family.

COLYMBUS TORQUATUS Brunn.

Loon; Great Northern Diver.

Colymbus glacialis, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 186.

Colymbus torquatus, WHEATON, Ohio Agric. Rep. for 1860, 371; Reprint, 1861, 13; Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 187; Reprint, 21; Summer Birds, ib., iii, 1880, 230.

Loon, BALLOU, Field and Forest, iii, 1878, 136.

Colymbus torquatus, BRUNNICH, Orn. Bor., 1764, No. 134.

Colymbus glacialis, LINNÆUS, Syst. Nat., i, 1766, 221.

Black; below from the breast white, with dark touches on the sides and vent; back with numerous square white spots; head and neck iridescent with violet and green, having a patch of sharp white streaks on each side of the neck and another on the throat; bill black. Young:—Dark gray above, the feathers with paler edges; below white from the bill, the sides dusky; bill yellowish-green and dusky. Length, $2\frac{1}{2}$ –3 feet; extent, about 4; wing, about 14 inches; tarsus, 3 or more; longest toe and claw, 4 or more; bill, 3 or less, at base 1 deep and $\frac{1}{4}$ wide, the culmen, commissure and gonys all gently curved.

Habitat, Northern Hemisphere. In winter generally dispersed in the United States.

Common spring and fall migrant and winter resident. Mr. Langdon notes its occasional occurrence in Northern Ohio in summer, and it is still probably, as it certainly was formerly, a summer resident. Dr. Kirtland mentions its having been picked up on land after a storm. I have known it to be taken in the streets of this city under the same circumstances. In this vicinity it often appears in companies of from six to ten, and furnishes ample shooting to sportsmen who find them the most expert of all divers, generally escaping by this means when their cap-

ture seems almost certain. On the Ohio river I have seen them in great numbers when they seemed to take pleasure in accompanying steam-boats, swimming along side, and often diving under. When diving their movements are more like those of a turtle than those of a bird, the legs moving in the horizontal plane of the body, and the wings assisting with short flaps, executed by moving the proximal joints only.

COLYMBUS ARCTICUS Linnæus.

Black-throated Diver.

Back and under-parts much as in the last species; upper part of head and hind neck, *bluish-ash* or hoary-gray; fore neck purplish-black. The young resemble those of that species but will be known by their inferior size. Length, under $2\frac{1}{2}$ feet; extent, about 3; wing, 13 or less; tarsus, 3; bill, about $2\frac{1}{2}$.

Habitat, Northern Hemisphere.

Very rare or accidental visitor, now first given as a bird of Ohio. Mr. H. E. Chubb writes: "I mounted one specimen for a gentleman in Garrettsville last fall [1880]. It was shot in Sandusky Bay. This is the only specimen I have seen."

COLYMBUS SEPTENTRIONALIS Linnæus.

Red-throated Diver.

Colymbus septentrionalis, WHEATON, Ohio Agric. Rep. for 1860, 371, 379; Reprint, 1861, 13, 21; Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 187; Reprint, 21.

Colymbus septentrionalis, LINNÆUS, Syst. Nat., i, 1766, 220.

Blackish; below white, dark along the sides and on the vent and crissum; most of head and fore neck bluish-gray, the throat with a large *chestnut* patch; hind neck sharply streaked with white on a blackish ground, bill black. Young have not these marks on the head and neck, but a profusion of small, sharp, circular or oval white spots on the back. Size of the last, or rather less.

Habitat, Northern Hemisphere.

Spring and fall migrant; not rare on Lake Erie, especially in the fall, rare in other portions of the State. Mr. Langdon mentions two or three individuals taken in the vicinity of Cincinnati. I have never met with it.

FAMILY PODICIPIDÆ. GREBES, ETC.

Feet four-toed, lobate. Hallux lobate, free. Tail rudimentary. Head with a naked loreal strip and bristly or variously lengthened feathers. Bill straight or decurved at end, compressed, acute.

GENUS PODICEPS. Latham.

Bill slender or moderately stout, paragnathous, acute. Nostrils narrow or linear. Loral bare strip narrow. Frontal feathers normal. Tarsus generally but little, if any, shorter than the middle toe—at least three-fourths as long. Semipalmation of toes moderate. Lobe of hallux broad. Usually conspicuous crests or ruffs during the breeding season.

PODICEPS GRISEIGENA (Bodd.) Gray.

var. HOLBOLLI (Reinh.) Coues.

Red-necked Grebe.

Podiceps rubricollis, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.

Podiceps griseigena, WHEATON, Ohio Agric. Rep. for 1860, 371; Reprint, 1861, 13.

Podiceps griseigena, *var. holbolli*, WHEATON, Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 189; Reprint, 23.

Colymbus griseigena, BODDERT, Tab. Pl. El., 55.

Podiceps griseigena, GRAY, Gen. of Birds, iii, 633.

Podiceps holbolli, RHEINHART, Ibis, iii, 1861, 14.

Podiceps griseigena var. holbolli, COUES, Key, 1872, 327.

Podiceps rubricollis, BONAPARTE, Syn., 1828, 417.

Tarsus about four-fifths the middle toe and claw; bill little shorter than tarsus; crests and ruff moderately developed. Length, about 18; wing, 7-8; bill, $1\frac{3}{4}$ to nearly 2; tarsus, 3; middle toe and claw, $2\frac{3}{4}$. Adult:—Front and sides of neck rich brownish-red; throat and sides of head ashy, whitening where it joins the dark color of the crown, the feathers slightly ruffed; top of head with its slight occipital crest, upper-parts generally, and wings dark-brown, the feathers of the back paler edged; primaries brown; part of

PODICEPS CRISTATUS (L.) Lath.

Crested Grebe.

Podiceps cristatus, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.—WHEATON, Ohio Agric.

Rep. for 1860, 371; Reprint, 1861, 13; Food of Birds, etc., Ohio Agric. Rep. for 1874, 574; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 189; Reprint, 23.

Colymbus cristatus, LINNÆUS, Syst. Nat., i, 1766, 222.

Podiceps cristatus, LATHAM, Ind. Orn., ii, 1790, 78.

I was not less surprised than most amateur ornithologists by the assertion of Dr. Brewer (Bull. Nuttall Orn. Club, iii, 1878, 52), respecting this species, that "not a specimen is in existence of American origin, and that there is no authentic record of the capture of a single specimen in America. Every specimen that has been referred to this species, when in existence, proved to be either immature examples of *P. griseigena*, or to be foreign examples." On investigation the four or five supposed instances of its capture in this State, all proved to be, as Dr. Brewer says, immature Red-necked Grebes, while the only skin of a Crested Grebe which I could obtain for comparison (kindly lent me by Dr. Jasper), and which was labeled Labrador, was almost as unquestionably an European bird.

inner quills white; lower parts pale silvery-ash, the sides watered or obscurely mottled, sometimes obviously speckled with dusky; bill black, more or less yellow at base. The young will be recognized by these last characters, joined with the peculiar dimensions and proportions.

Habitat, the typical form, Europe. Var. *holbölli* from Greenland and North America; with this Asiatic and Japanese specimens are said to agree.

Rare spring and fall migrant, perhaps also winter resident. It has been taken several times on the lake, at the St. Mary's and Licking Reservoirs and on the Scioto River, at Circleville, by Dr. Howard E. Jones.

PODICEPS CORNUTUS (Gm.) Lath.

Horned Grebe.

Podiceps cornutus, AUDUBON, Orn. Biog., iii, 1835, 429; B. Am., vi, 1843, 318.—KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.—WHEATON, Ohio Agric. Rep. for 1860, 371; Reprint, 1861, 13; Food of Birds, etc. Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 187; Reprint, 21; Summer Birds, ib., iii, 1880, 230.

Colymbus cornutus, GMELIN, Syst., Nat., i, 1788, 519.

Podiceps cornutus, LATHAM, Ind. Orn., ii, 1790, 783.

Tarsus about equal to the middle toe without its claw; bill much shorter than the head, little more than half the tarsus, *compressed*, higher than wide at the nostrils, rather obtuse; crests and ruffs highly developed. Small, length, about 14; extent, 24; wing, 6 or less; bill, about $\frac{3}{4}$; tarsus, $1\frac{1}{2}$. Adult:—Above, dark-brown, the feathers paler edged; below, silvery-white, the sides mixed dusky and reddish; most of the secondaries white; fore neck and upper breast brownish-red; head glossy black, including the ruff; a broad band over the eye, to and including the occipital crests, brownish-yellow; bill black, yellow-tipped. The young differ as in other species, but always recognizable by the above measurements and proportions.

Habitat, North America. Europe. Asia.

Rather common spring and fall migrant and summer resident, most frequently seen in the fall. Audubon states that it breeds in Northern Ohio, and Mr. Langdon gives the following regarding their supposed nesting in Ottawa county at the present time:

"Two sets of eggs taken July 2d, I refer, with a query, to this species as the birds were not seen in either instance. They present such differences, however, in shape, coloration and complementary number, that they can hardly be credited to *P. podiceps*, and I therefore prefer to consider them under the head of *P. cornutus*, for the present at least.

"These eggs are chalky-white, with a faint, though definite, tinge of pale bluish-green, much like the tint of the Least Bittern's eggs, and very unlike the pale whitey-brown of the eggs of *P. podiceps* observed by us; they are also more elongated in shape than the ordinary egg of *P. podiceps*, and taper nearly equally toward both ends, which are decidedly pointed, rather more so than the eggs of *P. podiceps*; another important point of distinction is the number in a full set, which is apparently but two,

the complement of *P. podiceps* being from four to eight. That our sets were probably full is indicated by the fact that one of them contained fully developed young, which swam, and even attempted to dive, on being placed in the water after removal from the egg. The nests were similar to those of *P. podiceps* described below, and the eggs were covered in like manner with decaying vegetation during the day and left for the sun to incubate,

"The young removed from these eggs presented slight, but constant differences in the head and neck-markings, and the size of the bill, as compared with the young of *P. podiceps*, obtained in the same manner, those supposed to be *P. cornutus* being smaller, with more slender bills, less blotching about the head and neck, and none in the median line of throat.

"Mr. Porter has repeatedly taken similar eggs, two in a set, during the past four or five years, but owing to the absence of the parent bird during the day, and its shyness at night, has been unable to identify it."

GENUS PODILYMBUS. Lesson.

Bill stout, epignathous, obtuse. Commissure decurved abruptly at end. Nostrils broadly oval. Loral bare strip broad. Frontal feathers bristly. Tarsus not three-fourths the middle toe. Semipalmation of toes extensive. Lobe of hallux moderate. No decided crests or ruffs.

PODILYMBUS PODICEPS (L.) Lawr.

Pied-billed Dabchick.

Podiceps carolinensis, KIRTLAND, Ohio Geolog. Surv., 1838, 166, 187.

Podilymbus podiceps, WHEATON, Ohio Agric. Rep. for 1860, 371; Reprint, 1861, 13; Food of Birds, etc., Ohio Agric. Rep. for 1874, 575; Reprint, 1875, 15.—LANGDON, Cat. Birds of Cin., 1877, 18; Revised List, Journ. Cin. Soc. Nat. Hist., i, 1879, 187; Reprint, 11; Summer Birds, ib., iii, 1880, 231; Field Notes, ib., ii, 1880, 127.

Colymbus podiceps, LINNÆUS, Syst. Nat., i, 1766, 223.

Podilymbus podiceps, LAWRENCE, Birds N. Am., 1858, 898.

Podiceps carolinensis, LATHAM, Ind. Orn., ii, 1790, 785.

Length, 12-14; wing, about 5; bill, 1 or less; tarsus, 1½. Adult: Bill bluish, dusky on the ridge, encircled with a black bar; throat with a long black patch; upper-parts blackish-brown; primaries ashy-brown, secondaries ashy and white; lower-parts silky-white, more or less mottled or obscured with dusky; the lower neck in front, fore breast and sides, washed with rusty. Young lacking the throat patch and peculiar marks of the bill, otherwise not particularly different; in a very early plumage with the head curiously striped.

Habitat, North, Central and part of South America.

Abundant spring and fall migrant, and in many portions of the State summer resident. Breeds. This bird is commonly known as the Dipper, Water-witch or Devil-diver, and under one of these names is known to every boy who has wandered with a gun along any of our creeks and rivers. Their skill in diving is proverbial, as well as their awkwardness when on land, which is very seldom. It is a popular error that they are unable to fly. I have seen them rise from the

water and fly heavily though not laboriously for some distance, and that, too, when they were not pressed for diving-room. With us they are more numerous in spring, migrating singly or in small scattered flocks of six or eight. In the fall flocks consisting of apparently a single brood, keeping closely together, are sometimes seen.

Mr. Langdon in *Summer Birds*, (l. c.), gives the following interesting and valuable notes upon the nesting habits of this species as observed by him in Northern Ohio.

"As more or less doubt appears to prevail in regard to the building of floating nests by members of the Grebe family, I desire here to testify to the fact that the nests of the present species *does* float, notwithstanding the skeptical '*it is said*' of Dr. Cones, in his remarks on the nidification of the family.

"The little floating island of decaying vegetation held together by mud and moss, which constitutes the nest of this species, is a veritable ornithological curiosity. Imagine a 'pancake' of what appears to be mud, measuring twelve or fifteen inches in diameter, and rising two or three inches above the water, which may be from one to three feet in depth; anchor it to the bottom with a few concealed blades of 'saw-grass,' in a little open bay, leaving its *circumference entirely free*; remove a mass of wet muck from its rounded top and you expose seven or eight soiled brownish-white eggs, resting in a depression the bottom of which is less than an inch from the water; the whole mass is constantly damp. This is the nest of the Dabchick, who is out foraging in the marsh, or perhaps is anxiously watching us from some safe cover near by.

"The anchoring blades of coarse saw-grass or flags, being always longer than is necessary to reach the bottom, permit of considerable lateral and vertical movement of the nest, and effectually provide against drowning of the eggs by any ordinary rise in the water-level such as frequently occurs during the prevalence of strong easterly winds on the lake. A small bunch of saw-grass already growing in a suitable situation is evidently selected as a nucleus for the nest, and the tops bent so as to form part of it.

"During the day we invariably found the eggs concealed by a covering of muck as above described, but, as we ascertained by repeated visits at night and in the early morning, they are uncovered at dusk by the bird who incubates them until the morning sun relieves her of her task.

"The complement of eggs is usually seven, but we took one set of eight.

"The above description applies equally well to any of the six nests observed by us, and to the dozens observed by Mr. Porter at the same locality, during the past four or five years; he notes, however, a few instances in which the nest, instead of being entirely free at its circumference, as above described, was held in place by the surrounding 'deer-tongue' (*Sagittaria*?)."

APPENDIX.

[A.] CHECK LIST OF OHIO BIRDS, WITH DATES OF THEIR OCCURRENCE.

As stated in the introduction, the nomenclature of Dr. Coues's Check List is that adopted in the preceding pages. Since the publication of that list, many changes have been made by Dr. Coues and others, affecting the nomenclature of our birds. Such changes as were generally accepted prior to 1880 have been adopted.

In the following pages I have adopted the nomenclature and order of Mr. Ridgway's Check List.*

In this list not only the nomenclature but the order will be found changed from that of the foregoing pages, but in no case is this believed to be so complete as to prevent a ready recognition.

The number following the common name is the number in Mr. Ridgway's list. No systematic attempt to record the arrival and departure of birds has been made, the dates being simply the records of ordinary observation and collections. Unless otherwise noted these dates apply to birds observed in the vicinity of Columbus, so that, excluding the birds unnoted, we have a list of the birds of Franklin county.

Two birds in the list being introduced species, and not indigenous to the United States, are not numbered. Species whose occurrence must be considered purely accidental are numbered in brackets.

The list gives 292 species, 4 of which are represented by additional varieties, and 2 introduced species, making a total of 298 species and varieties. Of these 6 are considered accidental.

* Nomenclature of North American Birds, chiefly contained in the United States National Museum. By Robert Ridgway. Bulletin of the United States National Museum. No. 21. Published under the direction of the Smithsonian Institute. Washington: Government Printing Office, 1881.

CHECK LIST AND DATES.

1. *Hylocichla mustelina* (Gm.) Baird. April 29—, 75; May 5—, 76; April
Wood Thrush. 1. 20—, 78; 18—, 80.
2. *Hylocichla fuscescens* (Steph.) Baird. May 2—21, Sept. 23, 73; April 20,
Wilson's Thrush. 2. Aug. 25, 74; May 5—19, 75; 5,
76; 5, 77; 7, 78; April 22, 80.
3. *Hylocichla aliciae* Baird. May 3—12, Sept. 15, 73; May 7,
Gray-cheeked Thrush. 3. Sept. 13—28, 74; May 8—21, 75; 7,
76; 4, 77; 5, 78.
4. *Hylocichla ustulata swainsoni* (Caban.) Ridgw. May 9, Sept. 3—19, 73; May 8, Sept.
Olive-backed Thrush. 4a. 7—29, 74; April 28—May 19, 75;
May 5, 76; 16, 77; 5, Aug. 26,
78.
5. *Hylocichla unalascae pallasi* (Caban.) Ridgw. April 5, Oct. 12, 73; Mar. 26—May
Hermit Thrush. 5b. 2, Sept. 30, 74; April 3, 75; 19,
76; 15—23, 77.
6. *Merula migratoria* (Linn.) Sw. and Rich. Dec. 10, 73; Feb. 27—, 75; 26—,
Robin. 7. 76; Jan. 28—, 77; Feb. 27—,
78; Mar. 5—, 79; wintered, 79—
80.
7. *Mimus polyglottus* (Linn.) Boie. Mockingbird. 11.
8. *Galeoscoptes carolinensis* (Linn.) Caban. April 27—, 73; 29—Sept. 25, 74;
Catbird. 12. May 1—, 75; April 21—Sept.
25, 76; April 23—, 77; 19—,
78; 18—, 80.
9. *Harporhynchus rufus* (Linn.) Caban. April 14—, 73; Oct. 7, 74; April
Brown Thrasher. 13. 7—, 75; 7—, 76; 16—, 77;
23—, 79.
10. *Sialia sialis* (Linn.) Haldem. Feb. 14—, 74; 22—, 75; 26—, 76;
Bluebird. 22. Jan. 28—77; Feb. 38—78, win-
tered, 78—79; do. 79—80.
11. *Poliophtila caerulea* (Linn.) ScL. April 13—, 73; 18—, 74; 10—, 75;
Blue-gray Gnatcatcher. 27. 7—, 76; 14—, 78.
12. *Regulus calendula* (Linn.) Licht. April 13, Sept. 29, 74; April 12—
Ruby-crowned Kinglet. 30. May 19, 75; Oct. 8, 76; April 3,
77.
13. *Regulus satrapa* (Linn.) Bp. April 4, Oct. 6, 73; Mar. 24, Oct.
Golden-crowned Kinglet. 33. 18, 74.
14. *Lopophanes bicolor* (Linn.) Bp. Resident.
Tufted Titmouse. 36.
15. *Parus atricapillus* Linn. Dec. 19, 73; Nov. 9—Dec. 10, 74;
Black-capped Chickadee. 41. Nov. 12, 77.
16. *Parus carolinensis* Aud. June 27, 73; April 18—July 23, 74;
Carolina Chickadee. 42. April 20—, 76; 24—77; 25—,
78; 13—, 79.
17. *Sitta carolinensis* Gm. Resident.
White-bellied Nuthatch. 51.
18. *Sitta canadensis* Linn. Sept. 3—24, 74; May 7—15, 75.
Red-bellied Nuthatch. 52.

- [19.] *Sitta pusilla* Lath.
Brown-headed Nuthatch. 53.
20. *Certhia familiaris rufa* (Bartr.) Ridgw.
Brown Creeper. 55. April 4, Dec. 10, 73; Jan. 31, Sept. 28-Dec. 12, 74; Nov. 17, 76, Jan. 27, 77.
21. *Thryothorus ludovicianus* (Gm.) Bp.
Carolina Wren. 60. Resident.
22. *Thryothorus bewicki* (Aud.) Baird.
Bewick's Wren. 61. See Appendix.
23. *Troglodytes aëdon* Vieill.
House Wren. 63. April 27—, 73; May 1—, 74; 4—, 75; April 22—, 76; May 4—, 77; April 19—, 78; 23—, 79; 20—, 80.
24. *Anorthura troglodytes hyemalis* (Vieill.) Coues.
Winter Wren. 65. Oct. 13, 73; May 9, Sept. 30-Oct. 13, 74; April 1-May 1, 75; April 5-19, 77; 2, Nov. 2, 78.
25. *Telmatodytes palustris* (Wils.) Baird.
Long-billed Marsh Wren. 67. April 28, 73; Oct. 13, 74; May 11, Oct. 18, 76.
26. *Cistothorus stellaris* (Licht.) Caban.
Short-billed Marsh Wren. 68.
27. *Anthus ludovicianus* (Gm.) Licht.
American Titlark. 71. Oct. 7, 73; May 4-6, Oct. 3-23, 74; April 12-28, Sept. 26, 75; May 3-8, Oct. 9, 76; April 8-May 10, Oct. 1, 77; April 19, 78.
28. *Mniotilta varia borealis* (Nutt.) Ridgw.
Small-billed Creeper. 74a. June 27, 73; April 27-Sept. 17, 74; April 29—, 75; 26—, 76.
29. *Protonotaria citrea* (Bodd.) Baird.
Prothonotary Warbler. 75.
30. *Helminthoherus vermivorus* (Gm.) Salv. & Godm.
Worm-eating Warbler. 77. April 23—, 74; 25—, 78.
31. *Helminthophaga cincinnatiensis* Langdon.
Cincinnati Warbler. 78.* See appendix—Additions.
32. *Helminthophaga pinus* (Linn.) Baird.
Blue-winged Yellow Warbler. 79. June 27, 73; May 8—, 74; July 13, 77.
33. *Helminthophaga chrysoptera* (Linn.) Baird.
Golden-winged Warbler. 81. May 17, 75.
34. *Helminthophaga ruficapilla* (Wils.) Baird.
Nashville Warbler. 85. Sep. 10, 73; May 9, Sept. 15-Oct. 1, 74. May 12-19, 75.
35. *Helminthophaga celata* (Say) Baird.
Orange-crowned Warbler. 86. May 15-17, 75.
36. *Helminthophaga peregrina* (Wils.) Baird.
Tennessee Warbler. 87. Sept. 15-26, 73; May 14-18, Sept. 2-Oct. 7, 74; Sept. 5-25, 76.
37. *Parula americana* (Linn.) Bp.
Blue Yellow-backed Warbler. 88. May 15, Sept. 15, 74; May 14, 77; June 30, 79.
38. *Perisoglossa tigrina* (Gm.) Baird.
Cape May Warbler. 90. May 8-17, 75; Sept. 25, 76.
39. *Dendroica aestiva* (Gm.) Baird.
Summer Yellowbird. 93. April 30—, 73; May 1— Aug. 74; May 2—, 75; April 28—, 76; 15—, 78; 23—, 79; 19—, 80.

40. *Dendroica caerulescens* (Linn.) Baird.
Black-throated Blue Warbler. 94. May 19, 73; 9, Sept. 4, 74; May 10-19, 75; 17, 76; 14-21, 77.
41. *Dendroica coronata* (Linn.) Gray.
Yellow-rump Warbler. 95. Oct. 13, 73; May 2, Sept. 2-Oct. 23, 74; May 8-18, 75; April 21, Oct. 18-Nov. 5, 76; April 26, 77; 19, 78.
42. *Dendroica maculosa* (Gm.) Baird.
Black-and-yellow Warbler. 97. May 20, Sept. 15, 73; May 8, Sept. 2-28, 74; May 11-22, 75; 7, Sept. 10-25, 76; May 14, 77.
43. *Dendroica caerulea* (Wils.) Baird.
Cerulean Warbler. 98. May 21-June 27, 73; May 8-, 74; 9-, 75; 14-, 76; 14-, 77; April 19-, 78.
44. *Dendroica pennsylvanica* (Linn.) Baird.
Chestnut-sided Warbler. 99. May 19, 73; 8, Sept 2-20, 74; May 12-21, 75; 18, 76.
45. *Dendroica castanea* (Wils.) Baird.
Bay-breasted Warbler. 100. Sept. 15, 73; May 17, Sept. 7-Oct. 16, 74.
46. *Dendroica striata* (Forst.) Baird.
Black-poll Warbler. 101. May 26, Sept. 23, 73; May 17, Sept. 14-Oct. 17, 74; May 17, 75; 18-26, Oct. 16, 76.
47. *Dendroica blackburnia* (Gm.) Baird.
Blackburnian Warbler. 102. May 13, Sept. 25, 73; May 8, Sept. 5-36, 74; May 12-19, 75; 14, 77.
48. *Dendroica dominica albilora* Baird.
White-browed Yellow-throated Warbler. 103a. April 19, Sept. 23, 73; Sept. 7, 74; May 8-Aug. 22, 75; April 19-Aug. 16, 76. April 7-, 77; 14-, 78; 13-, 79.
49. *Dendroica virens* (Gm.) Baird.
Black-throated Green Warbler. 107. May 9-20, 73; 5, Sept. 7-30, 74; May 17, 76; April 18, 80.
50. *Dendroica kirtlandi* Baird.
Kirtland's Warbler. 110.
51. *Dendroica pinus* (Wils.) Baird.
Pine-creeping Warbler. 111. May 8, 75.
52. *Dendroica palmarum* (Gmel.) Baird.
Red-poll Warbler. 113. Nov. 7, 74; May 6-15, 75; April 26, Oct. 27, 76.
53. *Dendroica discolor* (Vieill.) Baird.
Prairie Warbler. 114. May 15, 75.
54. *Siurus auricapillus* (Linn.) Swains.
Golden-crowned Thrush. 115. May 18-Sept. 18, 73; April 20-Oct. 1, 74; April 29-, 75; May 4-, 76; Aug. 26, 78; April 23-, 80.
55. *Siurus naevius* (Bodd.) Coes.
Small-billed Water Thrush. 116. Oct. 17, 74; April 26-May 13, 75; 4, Sept. 25, 76; April 15-30, 77; 19, 78.
56. *Siurus motacilla* (Vieill.) Coes.
Large-billed Water Thrush. 117. July 25, 74; June 19, 75; April 15-, 77; 21-, 78.
57. *Oporornis agilis* (Wils.) Baird.
Connecticut Warbler. 118. Sept. 16, 74; May 22, 75.
58. *Oporornis formosa* (Wils.) Baird.
Kentucky Warbler. 119.
59. *Geothlypis philadelphia* (Wils.) Baird.
Mourning Warbler. 120. Sept. 2-30, 74; May 21-26, 75; 16, 76.

60. *Geothlypis trichas* (Linn.) Caban. Maryland Yellow-throat. 122. May 5—, 73; 11—, 74; 7—, 75; 1—, 76; April 28—, 78.
61. *Icteria virens* (Linn.) Baird. Yellow-breasted Chat. 123. June 6—, 73; May 6—, 74; 7—, 76; 14—, 77; 7—, 78.
62. *Myiodioides mitratus* (Gmel.) Aud. Hooded Warbler. 124. Aug. 25, 74; May 21, 75.
63. *Myiodioides pusillus* (Wils.) Bp. Black-capped Yellow Warbler. 125. May 22, Sept. 18, 73; Sept. 2-28, 74; 8-22, 75; 16, 76; 18, 77.
64. *Myiodioides canadensis* (Linn.) Aud. Canadian Flycatching Warbler. 127. May 13, 73; 11, 74; 8-22, 75; 23, 76; 5, 78.
65. *Setophaga ruticilla* (Linn.) Swains. American Redstart. 128. May 5—, 73; 11—, 74; 9—, 75; 5—, 76; April 23—, 77.
66. *Vireosylva olivacea* (Linn.) Bp. Red-eyed Vireo. 135. April 30—, 73; May 7—Sept. 28, 74; May 8—, 75; 1—, 76; 16—, 77; April 25—, 78.
67. *Vireosylva philadelphia* Cass. Philadelphia Vireo. 138. Sept. 16, 73; May 8, Sept. 29-30, 74; May 18-19, 76.
68. *Vireosylva gilva* (Vieill.) Cass. Warbling Vireo. 139. May 2—Sept. 14, 74; May 8—, 75; 1—, 76; April 23—, 77; 19—, 78; 23—, 79; 22—, 80.
69. *Lanivireo flavifrons* (Vieill.) Baird. Yellow-throated Vireo. 140. May 5—Sept. 15, 74; May 8—, 75.
70. *Lanivireo solitarius* (Vieill.) Baird. Blue-headed Vireo. 141. May 1, Sept. 23, 73; Sept. 23-30, 74; May 13-14, 75.
71. *Vireo noveboracensis* (Gmel.) Bp. White-eyed Vireo. 143.
72. *Lanius borealis* Vieill. Great Northern Shrike. 148. April 14-27, 73; March 30, 74; Feb. 27, 75; Nov. 7, 76.
73. *Lanius ludovicianus* Linn. Loggerhead Shrike. 149. May 16—, 73; April 7—Aug. 31, 74; Mar. 23—, 75; Mar. 4—, 76; 4—, 77.
- 73a. *Lanius ludovicianus excubitorides* (Sw.) Coues. White-rumped Shrike. 149a. May 16, 73.
74. *Ampelis garrulus* Linn. Northern Wax-wing. 150.
75. *Ampelis cedrorum* (Vieill.) Baird. Cedar Wax-wing. 151. April 4—, 73; May 25— 74; 14—, 76; Nov. 2, 78; wintered, 80-81.
76. *Progne subis* (Linn.) Baird. Purple Martin. 152. March 30—, 73; April 13—Aug. 74; April 7—, 75; 7—, 76; 1—, 77; 2—, 78; March 28—, 79.
77. *Petrochelidon lunifrons* (Say.) Lawr. Cliff Swallow. 153. May 10—, 75; 2—, 76; April 21—, 77; April 21—, 78.
78. *Hirundo erythrogastra* Bodd. Barn Swallow. 154. April 12—, 75; 22—, 76; 15—, 77; 9—, 78.
79. *Tachycineta bicolor* (Vieill.) Caban. White-bellied Swallow. 155. April 8—Aug. 74; April 19—, 76; March 28—, 77; April 9—, 78; 14—, 79.

80. *Cotile riparia* (Linn.) Boie. May 6—, 75; April 23—, 76; 23—, 77.
Bank Swallow. 157.
81. *Stelgidopteryx serripennis* (Aud.) Baird. April 18—Aug. 74; May 6—, 75;
Rough-winged Swallow. 158. April 22—, 76; 21—, 77; 16—, 78; 20—, 79.
82. *Pyrranga rubra* (Linn.) Vieill. May 2—, 73; 7—, 74; 16—, 75; 12—, 76; April 26—, 77; May 5—, 78.
Scarlet Tanager. 161.
83. *Pyrranga aestiva* (Linn.) Vieill.
Summer Redbird. 164.
- [84.] *Hesperiphona vespertina* (Cooper.) Bp.
Evening Grosbeak. 165.
85. *Pinicola enucleator* (Linn.) Vieill.
Pine Grosbeak. 166.
86. *Carpodacus purpureus* (Gm.) Baird. Feb. 12—April 18, Oct. 13—Nov. 7, 74; April 7, 75; Jan. 19, 77; Nov. 2, 78.
Purple Finch. 168.
87. *Loxia curvirostra americana* (Wils.) Coes. June 18, 78.
American Crossbill. 172.
88. *Loxia leucoptera* Gm.
White-winged Crossbill. 173.
89. *Aegiothus linaria* (Linn.) Caban.
Common Redpoll. 179.
90. *Astragalinus tristis* (Linn.) Caban. Resident.
American Goldfinch. 181.
91. *Chrysomitris pinus* (Wils.) Bp. Nov. 29, 73; Dec. 19, 76; Nov. 2, 78.
Pine Goldfinch. 185.
92. *Plectrophanes nivalis* (Linn.) Meyer. Feb. 19, 75; Jan. 27, 77.
Snow Bunting. 186.
93. *Centropus lapponicus* (Linn.) Caban. Feb. 8, 74; 19-27, Nov. 28—, 75; Nov. 7, 76; Jan. 6-13, 77.
Lapland Longspur. 187.
- [—] *Passer domesticus* Linn. Imported. Resident.
English Sparrow.
94. *Passerculus sandwichensis savanna* (Wils.) Ridg. Sep. 27, 73; April 6-May 6, Sep. 11, 74; April 8-May 24, 75; April 20-May 3, 76.
Savannah Sparrow. 193a.
95. *Poæetes gramineus* (Gm.) Baird. March 28—, 73; 22—, 75; April 6—, 76; 2—, 77; March 22—, 78.
Grass Finch. 197.
96. *Coturniculus passerinus* (Wils.) Bp. May 6—Sept., 74; April 30—, 75; May 3, 76; April 26—, 77.
Yellow-winged Sparrow. 198.
97. *Coturniculus henslowi* (Aud.) Bp.
Henslow's Sparrow. 199.
98. *Chondestes grammica* (Say.) Bp. April 30—, 73; May 7—Sep. 28, 74; April 30—, 75; 19—, 76; 22—, 77; 21—, 78.
Lark Finch. 204.
99. *Zonotrichia leucophrys* (Forst.) Swains. May 1, Nov. 1, 73; May 2, Oct. 13-17, 74; May 8-11, 75; 4-7, Oct. 18-27, 76; April 23, 77; 28, 78.
White-crowned Sparrow. 206.

100. *Zonotrichia albicollis* (Gm.) Bp.
White-throated Sparrow. 209. April 15, Sept. 16, 73; April 23,
Sept. 29, 74; April 26, 75; 20,
Oct. 18, 76; April 23, 77; 19, 78;
20, 79.
101. *Spizella montana* (Forst.) Ridgw.
Tree Sparrow. 210. Nov. 2, 73—Jan. 31, Nov. 7—, 74;
9—, 77.
102. *Spizella domestica* (Bart.) Coues.
Chipping Sparrow. 211. April 3—, 73; 1—, Nov. 4, 74; Mar.
30—, 75; April 10—, 76; April
2—, 77; Mar. 27—, 78; 24—, 79.
103. *Spizella pusilla* (Wils.) Bp.
Field Sparrow. 214. April 16—, 73; Mar. 30—, 74; 25—,
75; April 15—, 76; 8—, 77; Mar.
28—, 78.
104. *Junco hyemalis* (Linn.) Sol.
Black Snowbird. 217. Oct. 12, 73—May 9, Sept. 28, 74—
May 8, 75; Oct. 1, 76.
105. *Melospiza fasciata* (Gmel.) Scott.
Song Sparrow. 231. Resident.
106. *Melospiza palustris* (Wils.) Baird.
Swamp Sparrow. 233. May 1, Sept. 29—Oct. 17, 74; April
21, 76; 13, 79.
107. *Melospiza lincolni* (Aud.) Baird.
Lincoln's Finch. 234. May 15, 73; Oct. 17, 18, 74; May
10—24, 75; 17, 77.
108. *Passerella iliaca* (Merrem.) Sw.
Fox-colored Sparrow. 235. Oct. 29, 73; Mar. 7—24, Oct. 13—
Nov. 7, 74; Mar. 18, 75; 13, 76;
Feb. 27, 77; Mar. 9, 79.
109. *Pipilo erythrophthalmus* (Linn.) Vieill.
Chewink; Towhee. 237. Mar. 19—, Dec. 10, 73; Mar. 24—,
74; 18—, 75; April 11—, 77;
Mar. 15—78.
110. *Cardinalis virginianus* (Briss.) Bp.
Cardinal Grosbeak. 242. Resident.
111. *Zamelodia ludoviciana* (Linn.) Coues.
Rose-breasted Grosbeak. 244. May 4, 73; 3—June 3, Sept. 12—23,
74; May 11—19, 75; 14—, 76;
5—, 78.
112. *Passerina caerulea* (Linn.) Swains.
Indigo Bunting. 248. May 11—, 73; 10—, 74; 10—, 75;
7—, 76; April 30—, 77; May 5—,
78.
- iza americana* (Gm.) Bp.
 Black throated Bunting. 254. May 11—, 73; 4, 74; 6—, 75; 4—,
76; 7—, 77; April 28—, 78.
114. *Dolichonyx oryzivorus*, (Linn.) Swains.
Bobolink. 257. May 4—, 73; 2—Aug. 13, 74; 7—,
76; April 30—, 77; May 5—, 78.
115. *Molothrus ater* (Bodd.) Gray.
Cowbird. 258. April 14—Oct. 13, 73; Mar. 30—,
74; Oct. 18, 76.
- [116.] *Xanthocephalus icterocephalus* (Bp.) Baird.
Yellow-headed Blackbird. 260.
117. *Agelaius phoeniceus* (Linn.) Vieill.
Red-and-buff-shouldered Blackbird. 261. Mar. 6—Oct. 17, 74; Mar. 25—, 75;
Feb. 25—Oct. 18, 76; Feb. 20—,
77; Mar. 10—, 79.
- Sturnella magna* (Linn.) Swains.
 Meadow Lark. 263. Mar. 16—, 73; Feb. 12—Oct. 13, 74;
Mar. 12—, 75; Feb. 26—, 76;
wintered 76, 77; Feb. 24—, 80.

119. *Icterus spurius* (Linn.) Bp.
Orchard Oriole. 270. May 4—Aug., 74; May 8—, 75;
7—, 76; 4—, 77; 5—, 78.
120. *Icterus galbula* (Linn.) Cones.
Baltimore Oriole. 271. April 30—, 73; May 1—, Sept. 24,
74; May 4—, 75; April 29—, 76;
23—, 77; 19—, 78; 22—, 80.
121. *Scolecophagus ferrugineus* (Gm.) Swains.
Rusty Blackbird. Sept. 9, 73; April 18, Oct. 17, 74;
March 12—April 24, 75; April 30,
77.
122. *Quiscalus purpureus ceneus* Ridgw.
Bronzed Grackle. 278b. Oct. 5, 73; Mar. 2—, 74; Mar. 12—,
75; Feb. 26— Nov. 7, 76; Feb.
20—, 77; Mar. 9—, 79.
123. *Corvus corax carnivorus* (Bartr.) Ridgw.
American Raven. 280.
124. *Corvus frugivorus* Bartr.
Common Crow. 282. Feb. 14—Oct. 17, 74; Jan. 28—, 77;
Mar. 9—, 79.
125. *Cyanocitta cristata* (Linn.) Strickl.
Blue Jay. 289. Resident.
- [] *Alauda arvensis* Linn.
Sky Lark. 299.
126. *Eremophila alpestris* (Forst.) Boie.
Shore Lark. 300. Nov. 9—, 74; Oct. 31—, 75; 18,
76—Mar. 28, 77; Nov. 1—, 77.
127. *Tyrannus carolinensis* (Linn.) Temm.
Kingbird; Bee Martin. 304. May 4—, 73; 1—, 74; 6—, 75; 1—,
76; April 21—, 78.
128. *Myiarchus crinitus* (Linn.) Caban.
Great Crested Flycatcher. 312. May 4—, 73; 3—, 74; 8—, 75; 1—,
76; 14—, 77; April 25—, 78.
129. *Sayornis fuscus* (Gmel.) Baird.
Phoebe Bird; Pewee. 315. Nov. 3, 74; Mar. 14—, 75; 13—,
76; 24—, 77; 27—, 78; 9—, 79.
130. *Contopus borealis* (Swains.) Baird.
Olive-sided Flycatcher. 318.
131. *Contopus virens* (Linn.) Caban.
Wood Pewee. 320. May 12—, 73; 10—, 74; 9—, 75;
8—, 76; 14—, 77; 5—, 78.
132. *Empidonax flaviventris* Baird.
Yellow-bellied Flycatcher. 322. May 2—22, 75; 16—20, 76; 18, 77.
133. *Empidonax acadicus* (Gmel.) Baird.
Acadian Flycatcher. 324. May 21—, 73; Aug. 26, 74; May
14—, 76; 17—, 77; 5—, 78.
134. *Empidonax pusillus trailli* (Aud.) Baird.
Traill's Flycatcher. 325a. May 18—Aug., 74; May 15—, 75;
13—, 76; 21—, 77; 8—, 78.
135. *Empidonax minimus* Baird.
Least Flycatcher. 326. May 12, 73; 6, 74; 7—24, Aug. 22,
75; Aug. 28, 76; May 7—9, 77.
136. *Trochilus colubris* Linn.
Ruby-throated Hummingbird. 335. May 6—Oct. 2, 73; May 5—Sept. 27,
74; May 10—Oct. 16, 75; May
13—, 76; 9—, 77; 5—, 78.
137. *Chaetura pelagica* (Linn.) Baird.
Chimney Swift. 351. April 18—Oct. 13, 74; April 14—,
76; April 18—, 78.
138. *Caprimulgus vociferus* Wils.
Whippoorwill. 354. May 5, 74; 2, 76; 25, 77.

139. *Chordeiles popetue* (Vieill.) Bd.
Nighthawk. 357. May 20—, 73; 11, 74; 13—, 75;
7—, 76; 15, 77; Aug. 26, 78.
140. *Picus villosus* Linn.
Hairy Woodpecker. 360. Resident.
141. *Picus pubescens* Linn.
Downy Woodpecker. 361. Resident.
142. *Picoides arcticus* (Swains.) Gray.
Black-backed Three-toed Woodpecker.
367.
143. *Sphyrapicus varius* (Linn.) Baird.
Yellow-bellied Woodpecker. 369. April 4, 73; 5, 75; 20, 76; 2-16, 77;
19, 78; 13, 79.
144. *Hylotomus pileatus* (Linn.) Baird.
Pileated Woodpecker; Logcock. 371. April —, 1861.
145. *Centurus carolinus* (Linn.) Bp.
Red-bellied Woodpecker. 372. Resident.
146. *Melanerpes erythrocephalus* (Linn.) Swains.
Red-headed Woodpecker. 375. April 13—Dec. 19, 73; Mar. 30—,
74; April 30—, 75; 21—, 77;
19—, 78.
147. *Colaptes auratus* (Linn.) Swains.
Yellow-shafted Flicker. 378. Resident.
148. *Ceryle alcyon* (Linn.) Boie.
Belted Kingfisher. 382. Mar. 17—Oct. 28, 74; Mar. 13—,
76; April 3, 77; 6—, 79.
149. *Coccyzus americanus* (Linn.) Bp.
Yellow-billed Cuckoo. 387. May 13—, 78; 10—, 74; 19—Sept.
16, 76.
150. *Coccyzus erythrophthalmus* (Wils.) Baird.
Black-billed Cuckoo. 388. May 21—, 73; 13—, 74; 8—, 75,
3—, 78.
151. *Conurus carolinensis* (Linn.) Kuhl.
Carolina Parakeet. 392. July —, 1862. Observed by W. S.
Sullivant.
152. *Aluco flammeus americanus* (Aud.) Ridgway.
American Barn Owl. 394. Nov. 2, 78; May 1, 1881.
153. *Asio americanus* (Steph.) Sharpe.
American Long-eared Owl. 395. Oct. 29, 74; Dec. 17, 76.
154. *Asio accipitrinus* (Pall.) Newton.
Short-eared Owl. 496. Nov. 4, 73.
155. *Strix nebulosa* Forst.
Barred Owl. 397. Feb. 11, Nov. 26, 74; 12, 77.
156. *Ulula cinerea* (Gmel.) Bp.
Great Gray Owl. 399.
157. *Nyctale acadica* (Gmel.) Bp.
Saw-whet Owl. 401. Jan. 11, 79.
158. *Scops asio* (Linn.) Bp.
Little Screech Owl. 402. Resident.
159. *Bubo virginianus* (Gm.) Bp.
Great Horned Owl. 405. Resident.
160. *Nyctale scandiaca* (Linn.) Newt.
Snowy Owl. 406. Jan. —, 1858.

161. *Surnia funerea* (Linn.) Sw. & Rich.
American Hawk Owl. 407.
162. *Falco peregrinus navius* (Gm.) Ridgw. Dec. —, 1869.
Peregrine Falcon; Duck Hawk. 414.
163. *Asalon columbarius* (Linn.) Kaup. Dec. 19, 73; Nov. 7. 76.
Pigeon Hawk. 417.
164. *Tinnunculus sparverius* (Linn.) Vieill. Oct. 5, 74; Mar. 23—, 75; 75-76,
Sparrow Hawk. 420 wintered.
165. *Pandion haliaetus carolinensis* (Gm.) Ridgw. Sept. 4, 76.
American Osprey; Fish Hawk. 425.
166. *Elanoides forficatus* (Linn.) Ridgw. Aug. 22, 78; Licking county.
Swallow-tailed Kite. 426.
167. *Circus hudsonius* (Linn.) Vieill. Aug. 21, 78; 20, 79.
Marsh Hawk. 430.
168. *Accipiter cooperi* Bonap. Resident.
Cooper's Hawk. 431.
169. *Accipiter fuscus* (Gmel.) Bp. Jan. 19, 77; April 25—Nov. 2, 78.
Sharp-shinned Hawk. 432.
170. *Astur atricapillus* (Wils.) Bp.
American Goshawk. 433.
171. *Buteo borealis* (Gm.) Vieill. Resident.
Red-tailed Hawk. 436.
172. *Buteo lineatus* (Gm.) Jard. Resident.
Red-shouldered Hawk. 439.
173. *Buteo pennsylvanicus* (Wils.) Bp. Resident.
Broad-winged Hawk. 443.
174. *Archibuteo lagopus sancti-johannis* (Gm.) Ridgw. Mar. 14, 75.
American Rough-legged Hawk. 447.
175. *Aquila chrysaetus canadensis* (Linn.)
Golden Eagle. 449.
176. *Haliaeetus leucocephalus* (Linn.) Savig. Oct. 17, 74; Jan. 11, 77.
Bald Eagle; Gray Eagle. 451.
177. *Cathartes aura* (Linn.) Illig. Mar. 15—, 75, April 6—, 76.
Turkey Buzzard. 454.
178. *Catharista atrata* (Wils.) Less. Black Vulture; Carrion Crow. 455.
179. *Ectopistes migratoria* (Linn.) Sw. Oct. 13, 73; March 24, Sept. 10—Oct.
Passenger Pigeon. 459. 1, 74.
180. *Zenaidura carolinensis* (Linn.) Bp. Mar. 2—, 74; 22—, 75; winters.
Mourning Dove. 460.
181. *Meleagris gallopavo americana* (Bartr.) Coues. May 28, 66.
Wild Turkey. 470a.
182. *Bonasa umbellus* (Linn.) Steph. Sept. —, 1868.
Ruffed Grouse. 473.
183. *Cupidonia cupido* (Linn.) Bp. Nov. 16. 78.
Prairie Hen. 470.

184. *Ortyx virginiana* (Linn.) Bp. Resident.
Bob-white; American Quail. 480.
185. *Ardea herodias* Linn. March 21—Oct. 17, 74; June 5, 77.
Great Blue Heron. 487
186. *Herodias alba egretta* (Gm.) Ridgw. Aug. 8, 73; 1, 77.
American Egret. 489.
187. *Garzetta candidissima* (Gm.) Bp.
Snowy Heron. 490.
188. *Butorides virescens* (Linn.) Bp. April 14—, 73; 18—, 74; 24—, 75.
Green Heron. 494.
189. *Nyctiardea grisea navia*, (Bodd.) Allen. Oct. 17, 74.
Black-crowned Night Heron. 495.
190. *Botaurus lentiginosus* (Montag.) Steph. Oct. 28—Nov. 20, 73; April 21—, 78.
American Bittern. 497.
191. *Ardetta exilis* (Gm.) Gray. May 14, 76.
Least Bittern. 498.
192. *Tantalus loculator* Linn.
Wood Ibis. 500.
193. *Plegadis falcinellus* (Linn.) Kaup.
Glossy Ibis. 503.
194. *Streptilas interpres* (Linn.) Illig.
Turnstone. 509.
195. *Squatarola helvetica* (Linn.) Cuv. May 12, 76.
Black-bellied Plover. 513.
196. *Charadrius dominicus* Mull. Sept. 2, 73; May 6, 74; April 21—29,
American Golden Plover. 515. Oct. 30, 75; April 16, 77.
197. *Oxyechus vociferus* (Linn.) Reich. Mar. 3—, 74; Feb. 25—, 75; 26—,
Kildeer. 516. 76; Mar. 8—, 77; 5, 79; Feb.
24—, 80.
198. *Ægialitis semipalmatus* Bp. Aug. 16, 73; July 25, 74; Aug. 28,
Semipalmated Plover. 517. 75; 16, 76; 11, 77; May 17—19,
80.
199. *Ægialitis melodus* (Ord.) Bp. Aug. —, 1856.
Piping Plover. 520.
200. *Philohela minor* (Gm.) Gray. Mar. 3—, 74; April 16—, 77.
American Woodcock. 525.
201. *Gallinago media wilsoni* (Temm.) Ridgw. Mar.—May 5, 73; Mar. 27, Oct. 17,
Wilson's Snipe. 526a. 74; April 5—May 7, 75; April 19,
76; May 4, 77.
202. *Macrorhamphus griseus* (Gm.) Leach.
Red-bellied Snipe; Gray Snipe. 527.
- 202a. *Macrorhamphus griseus scolopaceus* (Say) Coues.
Red-bellied Snipe; Greater Gray-
back. 527a.
203. *Micropalama himantopus* (Bp.) Baird.
Stilt Sandpiper. 528.
204. *Tringa canutus* Linn. May 27, 78. Licking Reservoir.
Knot; Robin Snipe. 529.

205. *Arquatella maritima* (Brunn.) Baird.
Purple Sandpiper. 530.
206. *Actodromas maculata* (Vieill.) Coues.
Pectoral Sandpiper. 534. Aug. 14, 73; Oct. 19, 74; April 10,
Sept. 26, 75; Aug. 29, 76; April
20, 77; 19, 78.
207. *Actodromas fuscicollis* (Vieill.) Ridgw.
Bonaparte's Sandpiper. 536. Oct. —, 75.
208. *Actodromas bairdi* Coues.
Baird's Sandpiper. 537. Sept. 1, 76; Nov. 9, 77.
209. *Actodromas minutilla* (Vieill.) Bp.
Least Sandpiper. 538. Aug. 14, 73; 10, 74; 16, 76; 14, 77.
210. *Pelidna alpina americana* Cass.
Red-backed Sandpiper. 539a. Oct. 18, 76.
211. *Ereunetes pusillus* (Linn.) Cass.
Semipalmated Sandpiper. 541. Aug. 16, 73; July 24, 74; Aug. 28—
Oct. 30, 75; Aug. 16, 76; 7, 77;
25, 78.
212. *Calidris arenaria* (Linn.) Illig.
Sanderling. 542. Oct. 7, 74.
213. *Limosa fœda* (Linn.) Ord.
Marbled Godwit. 543. April 21, 1879.
214. *Limosa hæmastica* (Linn.) Coues.
Hudsonian Godwit. 545. April —, 1857; May —, 1862.
215. *Totanus melanoleucus* (Gm.) Vieill.
Greater Yellow-legs; Tell-tale. 548. Sept. 4, 73; April 18, Aug. 6—Oct.
17, 74; April 21, 75; Aug. 16—
Nov. 14, 76; Aug. 30, 77.
216. *Totanus flavipes* (Gmel.) Vieill.
Yellow-legs. 549. April 14—May 16, Aug. 16, 73; Aug.
—Oct. 17, 74; May 8, 76; Aug.
30, 77.
217. *Rhyacophilus solitarius* (Wils.) Cass.
Solitary Sandpiper. 550. April 24—July 29, 73; May 28—July
25, 74; April 18, 76.
218. *Symphemia semipalmata* (Gm.) Hartl.
Willet. 552.
- [219.] *Machetes pugnax* (Linn.) Cuv.
Ruff. 554. Nov. 10, 72. Licking Reservior.
220. *Bartramia longicauda* (Bechst.) Bp.
Bartram's Sandpiper; Field Plover. 555. Aug. 14, 73; April 27—Aug. 31, 74;
April 10—, 75.
221. *Tryngites rufescens* (Vieill.) Caban.
Buff-breasted Sandpiper. 556. Aug. 31, 76.
222. *Tringoides macularius* (Linn.) Gray.
Spotted Sandpiper. 557. April 27—, 73; 18—Oct. 8, 74;
April 10—, 75; 18—, 76; 21—,
77; 19—, 78.
223. *Numenius longirostris* Wils.
Long-billed Curlew. 558.
224. *Numenius hudsonicus* Lath.
Hudsonian Curlew. 559.
225. *Numenius borealis* (Forst.) Lath.
Eskimo Curlew. 560. October, 1869.

226. *Phalaropus fulicarius* (Linn.) Bp.
Red Phalarope. 563.
227. *Lobipes hyperboreus* (Linn.) Cuv.
Northern Phalarope. 564. Columbus, fall of —; Dr. Jasper.
228. *Steganopus wilsoni* (Sab.) Cones.
Wilson's Phalarope. 565.
229. *Recurvirostra americana* Gmel.
American Avocet. 566.
230. *Himantopus mexicanus* (Mull.) Ord.
Black-necked Stilt. 567.
231. *Rallus elegans* Aud.
Red-breasted Rail. 569. May 5, 74; April 19, 76.
232. *Rallus virginianus* Linn.
Virginian Rail. 572. April 10, 75.
233. *Porzana carolina* (Linn.) Baird.
Sora Rail. 574. May 4—Nov. 1, 73; May 2—Oct. 17,
74; April 17 —, 76.
234. *Porzana noveboracensis* (Gm.) Baird.
Little Yellow Rail. 575. April 24, 79.
235. *Ionornis martinica* (Linn.) Reich.
Purple Gallinule. 578. May 10, 77; Circleville.
236. *Gallinula galeata* (Licht.) Bp.
Florida Gallinule. 579. April 20, 76.
237. *Fulica americana* Gmel.
American Coot. 580. Nov. 1, 73; Oct. 17, 74; Mar. 25 —,
75.
238. *Grus americana* (Linn.) Temm.
Whooping Crane. 582. Nov. 26, 76.
239. *Grus canadensis* (Linn.) Temm.
Sandhill Crane. 583.
240. *Olor americanus* (Sharpless) Bp.
Whistling Swan. 588. March 19, 77.
241. *Olor buccinator* (Rich.) Wagl.
Trumpeter Swan. 589.
242. *Chen caerulescens* (Linn.) Ridgw.
Blue-winged Goose. 590. Oct. 28, 76.
243. *Chen hyperboreus* (Pall.) Boie.
Snow Goose. 591. March 19, 74.
244. *Anser albifrons gambeli* (Hartl.) Cones.
American White-fronted Goose. 593a.
245. *Bernicla canadensis* (Linn.) Boie.
Canada Goose. 594. Oct. 17, 74; March 1-2, 77.
- 245a. *Bernicla canadensis hutchinsii* (Sw. & Rich.)
Ridgw.
Hutchins' Goose. 394a.
246. *Bernicla brenta* (Pall.) Steph.
Brant. 595.
247. *Anas boschas* Linn.
Mallard. 601. April 18, 73; Oct. 17, 74; Feb. 20-
April 26, 77; March 11, 79.

248. *Anas obscura* Gmel.
Black Mallard. 602. Oct. 17, 74; March 5, 79.
249. *Chaulelasmus streperus* (Linn.) Gray.
Gadwall. 604. March 28, 77.
250. *Dafla acuta* (Linn.) Bp.
Pintail. 605. Feb. 27, 75; 20, 77; March 5, 79.
251. *Mareca americana* (Gmel.) Steph.
Bald-pate. 607. Oct. 3, 74; March 19, 77.
252. *Spatula clypeata* (Linn.) Boie.
Shoveller. 608. April 15, 75; March 4, 76; 27, 77;
11, 79.
253. *Querquedula discors* (Linn.) Steph.
Blue-winged Teal. 609. April 18, Oct. 17, 74; April 20, 75;
7, 76; May 8, 76; April 20, 77;
14, 78.
254. *Nettion carolinensis* (Gmel.) Baird.
Green-winged Teal. 612. April 20, 75.
255. *Aix sponsa* (Linn.) Boie.
Wood Duck; Summer Duck. 613. March 28, 77.
256. *Fulix marila* (Linn.) Baird.
Scaup Duck. 614. April 7-23, 76; March 11, 77.
257. *Fulix affinis* (Eyt.) Baird.
Little Blackhead. 615. March 23, 75; 11, 77; 6, 79.
258. *Fulix collaris* (Donov.) Baird.
Ring-billed Blackhead. 616. March 25, 75; 11, 77; 6, 79.
259. *Aithya vallisneria* (Wils.) Boie.
Canvas back. 617. March 30, 77.
260. *Aithya americana* (Eyt.) Bp.
Redhead. 618. March 25, 75.
261. *Clangula glaucium americana* (Bp.) Ridgw.
American Golden-eye. 620. March 23, Dec. 20, 75; 12-15, 76.
262. *Clangula albeola* (Linn.) Steph.
Butterball; Bufflehead. 621. March 25, 75; 6, 77; April 14, 78.
263. *Harelda glacialis* (Linn.) Leach.
Long-tailed Duck; Old Squaw. 623.
264. *Somateria spectabilis* (Linn.) Boie.
King Eider. 629. Dec. 4, 1880.
265. *Edemia americana* Sw. & Rich.
American Scoter. 630. Dec. 11, 76; Licking Reservoir.
266. *Melanetta velvetina* (Cass.) Baird.
American Velvet Scoter. 632. Dec. 13, 76; Licking Reservoir.
267. *Erismatura rubida* (Wils.) Bp.
Ruddy Duck. 634. April 27, 73.
268. *Mergus merganser americanus* (Cass.) Ridgw.
American Sheldrake. 636. March 19, Nov. 12, 77.
269. *Mergus serrator* Linn.
Red-breasted Sheldrake. 637. Nov. 4, 78.
270. *Lophodytes cucullatus* (Linn.) Reich.
Hooded Sheldrake. 638. March 25, 75; 4, 76; 19, 77; Nov. 2,
78.

271. *Pelecanus erythrorhynchus* Gmel. Oct. -, 61.
American White Pelican. 640.
272. *Phalacrocorax dilophus* (Sw. & Rich.) Nutt. April 1, 78; Licking Reservoir.
Double-crested Cormorant. 643.
- 272a *Phalacrocorax dilophus floridanus* (Aud.) Ridgw. Sept. -, 61.
Florida Cormorant. 643a.
273. *Rissa tridactyla* (Linn.) Bp. Kittiwake Gull. 658.
274. *Larus leucopterus* Faber. White-winged Gull. 661.
275. *Larus marinus* Linn. Great Black-backed Gull. 663.
276. *Larus argentatus smithsonianus* Coues. March 25, 73; April 22, 75; March
American Herring Gull. 666a. 30, 76; 2-30, 77; Nov. 4, 78.
277. *Larus delawarensis* Ord. March 3, 77.
Ring-billed Gull. 669.
278. *Larus philadelphicus* (Ord.) Gray. April 21, 75; Nov. 4, 78.
Bonaparte's Gull. 675.
- [279.] *Xema sabinei* (J. Sabine) Leach. Sabine's Gull. 677.
280. *Sterna anglica* Montag. Gull-billed Tern. 679.
281. *Sterna forsteri* Nutt. Oct. -, 62.
Forster's Tern. 685.
282. *Sterna fluviatilis* Naum. May -, 72; Oct. 19, 75.
Common Tern.
283. *Sterna dougalli* Montag. Roseate Tern. 688.
284. *Sterna antillarum* (Less.) Coues. May -, 62.
Least Tern. 690.
285. *Hydrochelidon lariformis surinamensis* (Gm.) Aug. 4, 75; May 9, 77.
Ridgw. Black Tern. 693.
- [286.] *Stercorarius pomatorhinus* (Temm.) Vieill. Pomarine Jaeger. 697.
287. *Podiceps holbolli* Reinh. American Red-necked Grebe. 731.
288. *Dytes auritus* (Linn.) Ridgw. April 30, 74; Nov. 30, 78.
Horned Grebe. 732.
289. *Podilymbus podiceps* (Linn.) Lawr. April 14, 73; March 25, 75; April
Thick-billed Grebe. 735. 5, 77.
290. *Colymbus torquatus* Brunn. May 7, 77.
Loon. 736.
291. *Colymbus articus* Linn. Black-throated Diver. 738.
292. *Colymbus septentrionalis* Linn. Red-throated Diver. 740.

[B.] LIST OF BIRDS OBSERVED IN MY GARDEN.

For the purpose of illustrating the extent to which ornithological observations be made in densely inhabited places, I give the following list of species which I have observed alight in my garden in the central part of the city of Columbus, a lot $187\frac{1}{2}$ by 75 feet.

1. *Hylocichla mustelina*. Wood Thrush. Common. May.
2. *Hylocichla fuscescens*. Wilson's Thrush. Common. May.
3. *Hylocichla alicæ*. Gray-cheeked Thrush. Common. May.
4. *Hylocichla ustulatus swainsoni*. Olive-backed Thrush. Common. May.
5. *Hylocichla unalascae pallasi*. Hermit Thrush. Common. April.
6. *Merula migratoria*. Robin. Abundant. Breeds.
7. *Galeoscoptes carolinensis*. Catbird. Abundant. Breeds.
8. *Harporhynchus rufus*. Brown Thrasher. Not common. April.
9. *Sialia sialis*. Bluebird. Common. Breeds.
10. *Poliophtila cærulea*. Gnatcatcher. Not common. May.
11. *Regulus calendula*. Ruby-crowned Kinglet. Common. April, October.
12. *Regulus satrapa*. Golden-crowned Kinglet. Common. March, November.
13. *Lophophanes bicolor*. Tufted Titmouse. Common.
14. *Parus atricapillus*. Black-capped Chickadee. Not common. December.
15. *Sitta carolinensis*. White-bellied Nuthatch. Common. October—April.
16. *Sitta canadensis*. Red-bellied Nuthatch. Not common. September, April.
17. *Certhia familiaris rufa*. Brown Creeper. Common. March, April, May.
18. *Thryothorus ludovicianus*. Carolina Wren. Common. Resident.
19. *Troglodytes ædon*. House Wren. Common. Breeds.
20. *Anorthura troglodytes hyemalis*. Winter Wren. Not common. April 1—May 1, 1875.
21. *Anthus ludovicianus*. American Titlark. Rare. October 20, 74.
22. *Mniotilta varia borealis*. Small-billed Creeper. Not common. April, May, July.
23. *Helmitherus vermivorus*. Worm-eating Warbler. Rare.
24. *Helminthophaga pinus*. Blue-winged Yellow Warbler. Rare.
25. *Helminthophaga peregrina*. Tennessee Warbler. Common. October.
26. *Parula americana*. Blue Yellow-backed Warbler. Rare. June 30, 1879.
27. *Dendræca æstiva*. Summer Yellow Bird. Abundant. Breeds.
28. *Dendræca cærulescens*. Black-throated Warbler. Not common. May.
29. *Dendræca coronata*. Yellow-rumped Warbler. Not common. May, November.
30. *Dendræca maculosa*. Black-and-yellow Warbler. Not common. May.
31. *Dendræca cærulea*. Cerulean Warbler. Rare. May 8, 1874.
32. *Dendræca pennsylvanica*. Chestnut-sided Warbler. Rare. May 8, 1874.
33. *Dendræca castanea*. Bay-breasted Warbler. Not common. September.
34. *Dendræca striata*. Black-poll Warbler. Common. September.
35. *Dendræca blackburniæ*. Blackburnian Warbler. Rare. May 10, 1875.
36. *Dendræca dominica albilora*. White-browed Yellow-throated Warbler. Not common. May.

37. *Dendroica virens*. Black-throated Green Warbler. Not common. May, Oct.
38. *Siurus auricapillus*. Golden-crowned Thrush. Not rare. April-May.
39. *Siurus naevius*. Small-billed Water Thrush. Rare. May.
40. *Geothlypis philadelphia*. Mourning Warbler. Rare. May 26, 1875.
41. *Geothlypis trichas*. Maryland Yellow-throat. Not common. May.
42. *Setophaga ruticilla*. Redstart. Not common. May, August.
43. *Vireosylva olivaceus*. Red-eyed Vireo. Common. May, September.
44. *Vireosylva philadelphia*. Philadelphia Vireo. Rare. May 8, 1874.
45. *Vireosylva gilva*. Warbling Vireo. Common. Breeds.
46. *Lanivireo flavifrons*. Yellow-throated Vireo. Not common.
47. *Ampelis cedrorum*. Cedar Wax-wing. Common. Breeds.
48. *Progne subis*. Purple Martin. Abundant.
49. *Petrochelidon lunifrons*. Cliff Swallow. Not common.
50. *Hirundo erythrogastra*. Barn Swallow. Abundant.
51. *Tachycineta bicolor*. White-bellied Swallow. Not common.
52. *Cotyle riparia*. Bank Swallow. Rare. May.
53. *Stelgidopteryx serripennis*. Rough-winged Swallow. Abundant.
54. *Pyrranga rubra*. Scarlet Tanager. Rare.
55. *Astragalinus tristis*. Yellowbird. Abundant. Breeds.
56. *Passerculus sandwichensis savanna*. Savannah Sparrow. Not common. October.
57. *Zonotrichia leucophrys*. White-crowned Sparrow. Not common. October.
58. *Zonotrichia albicollis*. White-throated Sparrow. Very common.
59. *Spizella montana*. Tree Sparrow. Formerly common in winter. Now rare.
60. *Spizella domestica*. Chipping Sparrow. Abundant. Breeds.
61. *Spizella pusilla*. Field Sparrow. Not common. April.
62. *Junco hyemalis*. Black Snow-bird. Abundant. October—April.
63. *Melospiza fasciata*. Song Sparrow. Common.
64. *Melospiza palustris*. Swamp Sparrow. Rare. April 26, 1881.
65. *Melospiza lincolni*. Lincoln's Finch. Rare. May 17, 1877.
66. *Passerella iliaca*. Fox-colored Sparrow. Rare.
67. *Passer domestica*. English Sparrow. Introduced. Resident. Breeds.
68. *Pipilo erythrophthalmus*. Chewink; Towhee. Not common. March-April.
69. *Cardinalis virginianus*. Cardinal Grosbeck. Rather common in winter.
70. *Zamelodia ludoviciana*. Rose-breasted Grosbeck. Rare.
71. *Passerina cyanea*. Indigo Bird. Not common.
72. *Spiza americana*. Black-throated Bunting. Rare. August 13, 1877.
73. *Dolichonyx oryzivorus*. Bobolink. Rare. May 18, 1873.
74. *Molothrus ater*. Cowbird. Common in summer.
75. *Icterus spurius*. Orchard Oriole. Common.
76. *Icterus galbula*. Baltimore Oriole. Common.
77. *Quiscalus purpureus aeneus*. Bronzed Grackle. Common.
78. *Cyanurus cristatus*. Blue Jay. Common.
79. *Tyrannus carolinensis*. Kingbird. Common of late.
80. *Tyrannus crinitus*. Great-crested Flycatcher. Rather common.
81. *Sayornis fuscus*. Phoebe Bird; Pewee. Not common.
82. *Contopus virens*. Wood Pewee. Common. Breeds.
83. *Empidonax flaviventris*. Yellow-bellied Flycatcher. Common. May, August.
84. *Empidonax acadicus*. Acadian Flycatcher. Common.
85. *Empidonax pusillus trailli*. Traill's Flycatcher. Common.

86. *Empidonax minimus*. Least Flycatcher. Common.
87. *Trochilus colubris*. Hummingbird. Common.
88. *Chætura pelagica*. Chimney Swift. Abundant. Breeds.
89. *Picus villosus*. Hairy Woodpecker. Not common in winter.
90. *Picus pubescens*. Downy Woodpecker. Common in winter.
91. *Sphyrapicus varius*. Yellow-bellied Woodpecker. Common. April.
92. *Melanerpes erythrocephalus*. Red-headed Woodpecker. Not common.
93. *Colaptes auratus*. Yellow-shafted Flicker. Rare.
94. *Coccyzus americanus*. Yellow-billed Cuckoo. Common.
95. *Coccyzus erythrophthalmus*. Black-billed Cuckoo. Common.
96. *Strix nebulosum*. Barred Owl. Rare in winter.
97. *Scops asio*. Little Screech Owl. Not common. October—March.
98. *Zenaidura carolinensis*. Mourning Dove. Rare.
99. *Ortyx virginiana*. Bob-white; American Quail. Common in October.
100. *Butorides virescens*. Green Heron. Accidental. August 28, 1874.
101. *Tringoides macularius*. Spotted Sandpiper. Accidental. July 17, 1874.

The following species not included in the preceding list, have been noticed flying over.

- Agelaius phœniceus*. Red-and-buff-shouldered Blackbird. March.
Sturnella magna. Meadow Lark. April.
Scolecophagus ferrugineus. Rusty Blackbird. October.
Corvus frugivorus. Crow. March, November.
Eremophila alpestris. Shore Lark.
Chordeiles popetue. Night Hawk. August.
Æsalon columbarius. Pigeon Hawk. October.
Tinnunculus sparverius. Sparrow Hawk. May.
Buteo borealis. Red-tailed Hawk.
Cathartes aura. Turkey Buzzard. March, May.
Oryechus, vociferus. Kildeer. March.
Bernicla canadensis. Canada Goose.

The following have been found in the gardens of my neighbors:

- Centrophanes lapponicus*. Lapland Longspur. March 30, 1881. Frozen.
Nyctale acadica. Saw-whet Owl. January 11, 1876. Frozen.
Colymbus torquatus. Loon. March, 1862.

[C.] ADDITIONS, ADDITIONAL REFERENCES AND
CORRECTIONS.

Page.

204. *Turdus migratorius*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 221.
205. *Turdus mustelinus*, Dury and Freeman, Observations on Birds, Journ. Cin. Soc. Nat. Hist., ii, 1879, 100.—Langdon, Summer Birds, ib., iii, 1880, 221.
206. *Turdus pallasi*, Dury and Freeman, Observations, Journ. Cin. Soc. Nat. Hist., ii, 1879, 100.
207. *Turdus swainsoni*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 100.
208. *Turdus aliciae*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 100.
208. *Turdus fuscescens*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 100.
209. *Mimus polyglottus*, Langdon, Field Notes, Journ. Cin. Soc. Nat. Hist., iii, 1880, 121.
210. *Galeoscoptes carolinensis*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 221.
211. *Harporhynchus rufus*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 221.
212. *Sialia sialis*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 221.
214. *Regulus calendula*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 100.
217. *Poliophtila caerulea*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 100.—Langdon, Summer Birds, ib., iii, 188, 221.
221. *Lopophanes bicolor*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 100.
223. *Parus carolinensis*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 221.
224. *Sitta carolinensis*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 221.
225. *Sitta canadensis*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 100.
227. *Certhia familiaris americana*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., 1879, 100.
228. *Troglodytes ludovicianus*, Audubon, Orn. Biog., i, 1831, 76.—*Thryothorus ludovicianus*, var. *ludovicianus*, Langdon, Field Notes, Journ. Cin. Soc. Nat. Hist., iii, 1880, 122.
230. *Thryothorus bewicki*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101. Note of the capture of two specimens of this species in the vicinity of Cincinnati. This is the first authentic record of the occurrence of this bird in our limits, and for this reason, though considered as probable on page 230, I have given it its proper place in our check-list.
230. *Troglodytes ædon*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.—*Troglodytes domesticus*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 222.

232. *Cistothorus palustris*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.—*Telmatodytes palustris*, Langdon, Summer Birds, ib., iii, 1880, 222 (nesting).
235. *Eremophila alpestris*. Mr. Chubb informs me that this species breeds in the vicinity of Cleveland.
238. *Certhia varia*, Audubon, Orn. Biog., i, 1831, 76.—*Mniotilta varia*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.
239. *Parula americana*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.
241. *Sylvia vermivora*, Audubon, Orn. Biog., i, 1831, 177.—*Helminthus vermivorus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.

HELMINTHOPHAGA CINCINNATIENSIS Langdon.

Cincinnati Warbler.

Helminthophaga cincinnatiensis, LANGDON, Journ. Cin. Soc. Nat. Hist., iii, 1880, 119; Field Notes, ib., 122; Bull. Nutt. Orn. Club., v, 1880, 208.—RIDGWAY, Bull. Nutt. Orn. Club., v, 1880, 237; Nomenclature N. A. Birds, 1881, 85.

This new species was discovered by Dr. Frank W. Langdon, with whose name the readers of this report have become familiar in the preceding papers. His original description was reprinted in the Bulletin, as above cited, and is as follows:

"Adult male; spring plumage. Entire upper parts excepting forehead, clear, bright, olive green, with a tinge of yellowish in certain lights, quills and retrices dark plumbeous brown, their outer webs fringed with olive green like that of the back. Below, including crissum, bright cadmium yellow, of nearly the same shade throughout. Forehead bright yellow, this color bounded anteriorly by very narrow black line from lores, and behind gradually merging into the clear olive-green of crown; feathers of vertex with a median concealed area of black. Lores velvety black; auriculars black, tipped with yellowish-green, giving them a mottled appearance. A yellow area beneath the eye separates the black of lores from that of auriculars.

"Greater and lesser wing coverts tipped with greenish-yellow, forming two indistinct wing-bars; outer primary edged with whitish. Inner webs of two outer tail feathers narrowly margined with white near the tip.

"Bill, in the flesh, black, excepting extreme tip, and base of lower mandible, which are bluish horn-color; culmen slightly decurved, with trace of a notch at tip. Rictus with fairly developed bristles extending nearly or quite to nostrils, here differing from any other species of the genus. Eyes, dark brown; tarsi and toes, pale brownish; claws, paler. Dimensions: Length, 4.75; wing, 2.50; tail, 1.85; culmen, .44, from nostrils, .34; tarsus, .70.

"The discovery of additional specimens may modify the above description somewhat, for, as Dr. Coues suggests to me, the concealed black of vertex would seem to indicate that this specimen had not quite attained its full spring dress.

"The species is described from a single specimen, taken by the writer at Madisonville, Hamilton County, Ohio, on May 1, 1880. It has been submitted to Dr. Elliott Coues for examination, and by him in company with Messrs. Ridgway and Henshaw, pronounced to be undoubtedly new. Its relations, according to Dr. Coues, are mainly with *Helmin-*

thophaga pinus, although in the concealed black of vertex and auriculars it slightly resembles certain plumages of *Oporornis formosa*. From *H. pinus*, its nearest ally it differs in its decidedly larger size, the presence of rectal bristles, the concealed black of vertex and the black auriculars; negatively, in the total absence of white wing bars, white tail blotches, and ashy blue on wings and tail. With *O. formosa* it seems hardly necessary to compare it; its smaller size, dissimilar proportions, short tarsi, yellow forehead, and white margin to outer tail feathers, sufficiently distinguish it from that species. A suspicion of hybridism between the two genera is, in the present state of our knowledge, inadmissible.

"Of its habits nothing is known except that it was shot while searching for insects at the end of a maple limb about fifty feet from the ground.

"It is a little remarkable that this should be the third new species of this genus announced from the eastern United States during the past six years; such, however, is the fact, and in all three instances the discovery has been made in an already thoroughly explored section. Whether this has any significance as indicating a special tendency of the genus to differentiation on account of changes in its environment, or is merely a coincidence, is of course problematical; the question of an extension of range from some heretofore unexplored habitat would also come in here for consideration."

Mr. Ridway (l. c.) expresses his views in regard to its validity and relations to other species as follows:

"Having had, through Dr. Cones' courtesy, the pleasure of examining the type specimen of Mr. Langdon's new *Helminthophaga*, recently described in the Journal of the Cincinnati Society of Natural History, July, 1880, I feel constrained to offer a few remarks concerning it, as an expression of my own views regarding its validity as a species. At first sight, the bird impresses one with its unique coloration, which on further examination is found to be a perfect combination of the plumage of *Helminthophaga pinus* and *Oporornis formosa*. The wings and tail are plain-colored, as in the latter, but the wings show a faint suggestion of the wing-bands of the former, in the pale olivaceous tips to the middle and greater coverts. The forehead is yellow, as in *H. pinus*, but behind and along the postero-lateral edge of this yellow is seen a portion of the black cap which characterizes *O. formosa*. The black markings of the side of the head are intermediate in extent between the narrow and postocular streak of the *Helminthophaga*, and the broader loreal patch with suborbital continuation, as seen in the *Oporornis*. In form, the bird is as nearly intermediate between the two as could well be imagined, the bill inclining more to that of *Oporornis* in size and shape, the feet more like those of *Helminthophaga*. The bird may eventually prove to be a distinct species; but it certainly suggests a hybrid between those named above, with quite as good (in fact exactly the same) reason as that between *Hirundo erythrogastra* and *Petrochelidon lunifrons*, recorded in a former number of the Bulletin (Vol. III, pp. 135, 136). This view of the matter is strengthened by the circumstance that in many, if not most, parts of the Mississippi Valley, especially in the latitude of Cincinnati, the two species bred very abundantly in the same localities, both nesting on the ground, and often having their nests situated only a few feet apart."

242. *Helminthophaga pinus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.

243. *Helminthophaga chrysoptera*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.—Langdon, Field Notes, ib., iii, 1880, 122.

244. *Helminthophaga celata*. Mr. Chubb writes me February 7, 1881, that this species "has not been uncommon the last two falls."
245. *Helminthophaga peregrina*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.
246. *Dendræca æstiva*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.—Langdon, Summer Birds, ib., iii, 1880, 222.
247. *Dendræca virens* Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.
249. *Dendræca cærulea*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.
252. *Dendræca blackburniæ*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.
253. *Dendræca striata*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.
254. *Dendræca castanea*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.
256. *Dendræca pennsylvanica*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.
257. *Dendræca maculosa*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101.
258. *Perissoglossa tigrina*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 101. Mr. Chubb informs me this species is common in fall, near Cleveland.
259. *Sylvia discolor*, Audubon, Orn. Biog., i, 1831, 76.—*Dendræca discolor*, Dury and Freeman, Obs., Journ. Soc. Nat. Hist., ii, 1879, 102.—Langdon, Field Notes, ib., iii, 1880, 123.
263. *Dendræca kirtlandi*, Langdon, Field Notes, ib., iii, 1880, 123.

Mr. Langdon notes the capture by Mr. H. E. Chubb, of Cleveland, of two specimens of this very rare warbler, a male and female, on May 4th and 12th, respectively. Mr. Chubb furnishes me the following interesting notes of their capture:

"Both were in shrubby fields not over three feet from the ground. The male was under my eye for probably five minutes. I was after a Chat, the first of the season I had heard, and while cautiously trying to get sight of him through the bushes I noticed what I supposed was one of the small Flycatchers, perch near me. From this base of operations he made several sallies after insects, returning to the same perch. Not finding the Chat, and it being about time to return home, I thought best to empty my barrel at the Flycatcher, as he was showing some peculiar motions. You can imagine my delight when nearing him, in seeing the pale yellow belly of a *Kirtland Warbler* which I recognized at once. I shot the female, half suspecting what it was, and the fear of losing her cut short my opportunity for study. She was about two feet from the ground working up from the roots of a shrub. I am inclined to think they are rather terrestrial in their habits, frequenting bushy fields near woods."

265. *Dendræca palmarum*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.
267. *Siurus auricapillus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.
268. *Siurus naevius*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1879, 102.

272. *Oporornis agilis*. "Not as rare as some other warblers here [Cleveland]. Shot four last season, another was picked up just outside my office." (*Chubb*.)
273. *Oporornis formosus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.—Langdon, Field Notes, ib., iii, 1880, 123.
275. *Geothlypis trichas*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.—Langdon, Summer Birds, ib., iii, 1880, 222.
276. *Geothlypis philadelphia*. "Not rare, I have killed as many as eight in one morning." (*Chubb*.)
279. *Myiodioides nitratus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.
281. *Myiodioides canadensis*, Dury and Freeman, Obs., Journ. Soc. Nat. Hist., ii, 1879, 102.—*Wilsonia nitrata*, Langdon, Field Notes, Journ. Cin. Soc. Nat. Hist., iii, 1880, 123.
282. *Setophaga ruticilla*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.
284. *Pyranga rubra*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.
285. *Pyranga aestiva*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.
286. *Hirundo erythrogastra*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 223.
287. *Tachycineta bicolor*, Langdon, Field Notes, Journ. Cin. Soc. Nat. Hist., iii, 1880, 123; Summer Birds, ib., iii, 1880, 223.
288. *Petrochelidon lunifrons*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 223.
293. *Progne subis*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 223.
298. *Vireo olivaceus*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 223.
299. *Vireo philadelphicus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.
301. *Vireo gilvus*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 223.
302. *Lanivireo flavifrons*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.
303. *Lanivireo solitarius*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 102.
304. *Vireo noveboracensis*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.
306. *Lanius borealis*. I have recently received satisfactory evidence that the record of this bird breeding in Northern Ohio was an error.
310. *Lanius ludovicianus excubitorides*, Langdon, Field Notes, Journ. Cin. Soc. Nat. Hist., iii, 1880, 123; Summer Birds, ib., 223.
316. *Loxia curvirostris americana*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.
320. *Chrysomitris pinus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.
322. *Chrysomitris tristis*, Langdon Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 223.
323. *Plectrophanes nivalis*, Langdon, Field Notes, Journ. Cin. Soc. Nat. Hist., iii, 1880, 124.
326. *Poocetes gramineus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, Langdon, Summer Birds, ib., iii, 1880, 224.

327. *Coturniculus passerinus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.
329. *Melospiza palustris*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.
330. *Melospiza melodia*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 224.
332. *Junco hyemalis*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.
334. *Spizella socialis*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 224.
335. *Spizella pusilla*, Langdon, Field Notes, Journ. Cin. Soc. Nat. Hist., iii, 1880, 124.
336. *Zonotrichia leucophrys*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.
341. *Pyrgita domestica*, Langdon, Field Notes, Journ. Cin. Soc. Nat. Hist., iii, 1880, 124.—*Passer domesticus*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 223.
343. *Euspiza americana*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 224.
347. *Cyanospiza cyanea*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.—Langdon, Summer Birds, ib., iii, 1880, 224.
348. *Cardinalis virginianus*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 224.
350. *Pipilo erythrophthalmus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.—Langdon, Summer Birds, ib., iii, 1880, 224.
351. *Dolichonyx oryzivorus*, Langdon, Field Notes, Journ. Cin. Soc. Nat. Hist., iii, 1880, 125; Summer Birds, ib., 224.
353. *Molothrus ater*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 224.
355. *Agelaius phoeniceus*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 224.
357. *Sturnella magna*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 224.
358. *Icterus spurius*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.—Langdon, Summer Birds, ib., iii, 1880, 224.
359. *Icterus baltimore*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 224.
361. *Quiscalus purpureus cæneus*, Langdon, Summer Birds, Journ. Cin. Soc. Nat. Hist., iii, 1880, 224.
367. *Tyrannus carolinensis*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., ii, 1879, 103.
390. *Coccygus erythrophthalmus*, Dury and Freeman, Obs., Journ. Cin. Soc. Nat. Hist., 1879, 104.
406. *Strix flammea americana*. By the kindness of Mr. Oliver Davie I examined in the flesh a fine specimen of the Barn Owl, in very light plumage, taken by Mr. Theo. Heischman, at Gahanna, about seven miles from this city, May 1, 1881.
460. *Streptopelia interpres*. "Shot two last fall on the lake shore, and one was shot the preceding autumn."—(Chubb, 1881.)
479. *Calidris arenaria*. "Could be found last fall on any of the beaches near here."—(Chubb.)

497-8. For *PELGADIS* wherever found, read *PLEGADIS*.

498. *Plegadis falcinellus*. Dr. H. C. Wann informed me several months since of the reported capture of an Ibis in Greene county, several miles from Xenia. He was unable to give any particulars or identification, except that the bird was taken alive and partly domesticated. Dr. Wann referred me to H. McQuiston, Esq., of Xenia, as possibly able to obtain definite information. He kindly furnishes the following, under date of April 30, 1881:

"The party who captured the bird spoken of by Dr. Wann is Mr. Edward Ferguson, a farmer living six and a half miles south of this city.

"He says he found the bird in his house-yard immediately after a storm of rain, etc., in May or June of 1878, and kept it for some weeks, when it died. He says it would eat crumbs from the table, worms, etc., and from his description I would say it was a young Glossy Ibis, the marks, color, curved bill, etc., convince me it is that bird. I read your description of each of the Ibis family to him, and he at once said that of the young Glossy Ibis was a good description of the bird; he says it was not quite two feet long, but otherwise the description was perfect; and I suppose it being a young bird, and he says it certainly was a young one, would account for the difference in length. He did not preserve the bird or any part of it."

511. *Porzana noveboracensis*. "Is not so rare as generally supposed. For the last four years I have secured one or two each season. They are extremely difficult to move, and unless you have a good Rail dog you may pass within two or three yards of them without making them fly. Two of my specimens were caught by dogs, seemingly preferring capture to flight."—(Chubb.)

The following changes in Families and Family Nomenclature, affecting the nomenclature and arrangement of groups represented in Ohio, are adopted by Mr. Ridgway. Changes are indicated by comparing with the corresponding group of Dr. Coues.

Coues, 1872.

SYLVICOLIDÆ=
TANTALINÆ=
IBIDINÆ=
HÆMATOPODIDÆ excl. STREPSILAS=
STREPSILAS=
GRACULIDÆ=
LARIDÆ excl. LESTRIDINÆ=
LESTRIDINÆ=
PODICIPIDÆ=

Ridgway, 1881.

MNIOTILTIDÆ.
CICONIDÆ.
IBIDIDÆ.
HÆMATOPODIDÆ.
STREPSILIDÆ.
PHALACROCORACIDÆ.
LARIDÆ.
STERCORARIIDÆ.
PODICIPITIDÆ.

[D.] BIBLIOGRAPHY OF OHIO ORNITHOLOGY.

In the preparation of the following pages I am indebted to Dr. Elliott Coues, U. S. A., J. J. Barber, Esq., of this city, and Dr. Frank W. Lang-

don, of Madisonville for valuable papers otherwise inaccessible to me, and to the latter gentleman for much timely and laborious assistance.

Species for the first time given as Ohioan are in *italics*. Only such species are given as synonyms (Syn.) as occur elsewhere in the same paper under another name. Names of species, now rejected as Ohioan, or rejected upon the then evidence, are inclosed in parentheses.

- 1808-14. WILSON, A. American Ornithology; or, the Natural History of the Birds of the United States: Illustrated with plates engraved and colored from original drawings taken from nature. By Alexander Wilson. Vol. I [-IX.] Philadelphia: Published by Bradford and Inskeep.

Names the following birds, as observed in Ohio:

Vol. I, 1808.—*Picus carolinus*, *P. varius*.

Vol. III, 1811.—*Alcedo alcyon*, *Sylvia magnolia*, *Psittacus carolinensis*.

Vol. IV, 1811.—*Strix nyctea*, *Falco leucocephalus*.

Vol. V, 1812.—*Hirundo pelagica*, *Columba migratoria*.

Vol. VI, 1812.—*Perdix virginianus*, *Strix virginiana*, *Falco furcatus*.

Vol. IX, 1814.—*Vultur aura*, *Corvus corax*. 14 species.

- 1825-33. BONAPARTE, C. L. American Ornithology; or, the Natural History of Birds inhabiting the United States, not given by Wilson, with figures drawn, engraved, and colored, from nature. By Charles Lucian Bonaparte. Vol. I [-IV.] Philadelphia: Carey, Lea & Carey—Chestnut street. London:—John Miller, 40 Pall Mall.

Names the following as occurring in Ohio:

Vol. I, 1825.—*Hirundo lunifrons*, *Meleagris gallopavo*.

- 1831-39. AUDUBON, J. J. Ornithological Biography, or an account of the habits of the Birds of the United States of America; accompanied by descriptions of the objects represented in the work entitled The Birds of America, and interspersed with delineations of American scenery and manners. By John James Audubon, F. R. S. S. L. & E. Edinburg: Adam Black.

Names the following species as Ohioan:

Vol. I, 1831. *Sylvia discolor*, *Psittacus carolinensis*, *Coccyzus erythrophthalmus*, *Fringilla tristis*, *Sylvia vermivora*, *S. formosa*, *Tetrao umbellus*, *Tanagra æstiva*, *Falco haliæetus*, *Perdix virginiana*, *Troglodytes ludovicianus*, *Certhia varia*.

Vol. II, 1834. *Cathartes iota*, *Strix nyctea*, *Fringilla leucophrys*, *F. ludoviciana*, *Muscicapa crinita*, *Icteria viridis*, *Fringilla cardinalis*, *Emberiza nivalis*, *Strix acadica*.

Vol. III, 1835. *Anser canadensis*, *Anas sponsa*, *Larus zonorhynchus*, *L. argentatus*, *L. marinus*, (*L. atricilla*), *Anas crecca*, *Podiceps cornutus*, (*Arctic Tern*), *Black Tern*.

Vol. IV, 1838. *Totanus bartramius*, *Anas obscura*, *Totanus melanoleucus*, *Sterna hiruudo*, *S. minuta*, *Fuligula ferina*, *Larus bonapartei*, *Strix otus*, *Emberiza americana*. 40 species, 35 new,

- 1832-34. NUTTALL, T. A Manual of the Ornithology of the United States and of Canada. By Thomas Nuttall, A. M., F. L. S. [Vol. I.] The Land Birds. Cambridge: Hilliard and Brown, booksellers to the University. MDCCCXXXII. [Vol. II.] The Water Birds. Boston: Hilliard, Gray, and Company. MDCCCXXXIV.

Records the occurrence in Ohio of [Vol. I] *Strix nyctea*, *Icterus agripennis*, *Muscicapa cærulea*, *Meleagris gallopavo*, [Vol. II] *Ballus virginianus*, *Sterna hiruudo*. New species, 5.

1838. ATWATER, CALEB. A History of the State of Ohio, natural and civil. By Caleb Atwater, A. M., Member, etc., etc. First edition. Cincinnati. pp. 93-96.

Mentions by common name, and sometimes very indefinitely, about seventy-five species of birds. Notes the Sandhill Crane on the Scioto nearly all the year; Paroquette, as quoted on page 404; closes with a highly laudatory and histrionic description of the Brown Thrush and his vocal powers.

1838. KIRTLAND, JARED P. Report of Dr. Kirtland, Second Assistant Geologist. < First Annual Report on the Geological Survey of the State of Ohio. By W. W. Mather, Principal Geologist, and the several assistants. Columbus: Samuel Medary, Printer to the State. 1838, pp. 65-69.

Presents the plan and economic importance of the Zoological Survey of the State. Names *Meleagris gallopavo*, *Anas domestica* *Anas canadensis*, *Anas bernicla*, *Anas americana*, *Anas obscura*, *Anas sponsa*, *Anas discors*, *Anas crecca*, *Fuligula vallisnera*, *Fuligula ferina*, *Tetrao cupido*, *Tetrao umbellus*, *Perdix virginiana*. New species, 7.

1838. KIRTLAND, J. P. Report on the Zoology of Ohio. By Professor J. P. Kirtland, M. D. < Second Annual Report on the Geological Survey of the State of Ohio. By W. W. Mather, Principal Geologist, and the several assistants. Columbus: Samuel Medary, Printer to the State. pp. 160-6 and 177-187.

As it is expected that this report will be reprinted as an appendix to the whole volume no further comments are necessary than to state that this is the first systematic attempt to enumerate the birds of Ohio. Two hundred and twenty-two (222) (by error in numbering 223) species are named. The list includes all given as Ohioan by Wilson, Bonaparte, Nuttall, and himself in the preliminary report, and all given by Audubon except *Sylvia discolor*, *S. formosa*, *Cathartes iota*, *Sterna minuta*, and *Strix otus*.

The new species are *Turdus migratorius*, *T. mustelinus*, *T. minor*, *T. wilsonii*, *T. polyglottus*, *T. felixox*, *T. rufus*, *Saxicola sialis*, *Regulus calendula*, *R. cristatus*, (*R. tricolor* Syn.) *Parus bicolor*, *P. atricapillus*, *Sitta carolinensis*, *S. canadensis*, *S.*

pusilla, *Certhia familiaris*, *Troglodytes europeus*, *T. palustris*, *Alauda alpestris*, *Anthus spinoletta*, *Sylvia americana*, *S. solitaria*, *S. chrysoptera*, *S. rubracapilla*, *S. peregrina*, *S. æstiva*, *S. virens*, *S. canadensis*, *S. azurea*, *S. coronata*, *S. blackburniæ*, *S. striata*, *S. castanea*, *S. icterocephala*, *S. maratima*, *S. petechia*, *S. aurocapilla*, *S. noveboracensis*, *S. agilis*, *S. trichas*, *S. wilsonii*, *S. pardalina*, *Muscicapa ruticilla*, *Hirundo rufa*, *H. bicolor*, *H. riparia*, *H. purpurea*, *Bombycilla carolinensis*, *Vireo olivaceus*, *V. gilvus*, *V. flavifrons*, *V. noveboracensis*, *Lanius septentrionalis*, *Fringilla purpurea*, *Loxia curvirostra*, *Fringilla linaria*, *F. graminea*, *F. passerina*, *F. palustris*, *F. melodia*, *F. hyemalis*, *F. canadensis*, *F. socialis*, *F. pusilla*, *F. pennsylvanica*, *F. iliaca*, *F. cyanea*, *F. erythrophthalma*, *Icterus peccoris*, *I. phæniceus*, *Sturnus ludovicianus*, *Icterus spurius*, *I. baltimore*, *Quiscalus ferrugineus*, *Q. versicolor*, *Corvus corone*, *C. cristatus*, *Muscicapa tyrannus*, *M. fusca*, *M. virens*, *M. acadica*, *Caprimulgus vociferus*, *C. virginianus*, *Trochilus colubris*, *Coccyzus americanus*, *Picus pileatus*, *P. villosus*, *P. pubescens*, *P. medianus* (Syn.), *P. erythrocephalus*, *P. auratus*, *Strix asio*, *S. brachyotus*, *S. nebulosa*, *Falco cyaneus*, *F. velox*, *F. cooperii*, *F. palumbarius*, *F. peregrinus*, *F. columbarius*, *F. sparverius*, *F. borealis*, *F. hycemalis*, *F. buteoides* (Syn.), *F. pennsylvanicus*, *F. sancti-johannis*, (*F. washingtonianus*, Syn.), *F. fulvus*, *Columba carolinensis*; (*Tetrao canadensis*), *Charadrius helveticus*, *C. pluvialis*, *C. vociferus*, *C. semipalmatus*, *C. melodus*, *Streptopelia interpres*, *Recurvirostra americana*, *Phalaropus wilsonii*, *Scolopax minor*, *S. wilsonii*, *S. grisea*, *Tringa wilsonii*, *T. schinzii*, *Limosa hudsonica*, *L. fedoa*, *Totanus semipalmatus*, *T. flavipes*, *T. chloropygius*, *T. macularius*, *Tringa rufescens*, *Numenius longirostris*, *N. hudsonius*, *Ardea herodias*, *A. egretta*, *A. virescens*, *A. discors*, *A. minor*, *A. exilis*, *Grus americana*, *Rallus carolinus*, *R. noveboracensis*, *Gallinula chloropus*, *Cygnus musicus*, *Anser albifrons*, *A. hyperboreus*, *Anas acuta*, *A. streperus*, *A. clypeata*, *Fuligula marilla*, *F. rufitorques*, *F. clangula*, *F. albeola*, *F. rubida*, *Mergus merganser*, *M. serrator*, *M. cuculatus*, *Pelecanus onocrotalus*, *Sterna aranea*, *Colymbus glacialis*, (*Podiceps cristatus*), *P. rubricollis*, *P. carolinensis*. New species, 163, less 4 synonyms, 159. These, with those mentioned previously, give 222 birds recorded as Ohioan in 1838.

1841. KIRTLAND, J. P. Fragments of Natural History. By J. P. Kirtland, M. D., Prof. Theo. and Prac. Phys. Medical College of Ohio. "I write that which I have seen." Le Baum. No. II, Ornithology. < Am. Jour. Sci. and Arts, XL, 1841, pp. 19-24.

Desultory notes on seventeen species, dated June 4, 1840. *Bombycilla garrula*, *Phalaropus hyperboreus*, *Sylvia pensilis*, *S. rara*, *Fringilla ludovicianus*, (*S. trochilus*), Florida gallinule, *Tringa rufescens*, *Tringa alpina*, *Sylvia maratima*, *S. icterocephala*, *S. castanea*, *Totanus semipalmatus*, *Limosa fedoa*, *Numenius hudsonicus*, *Charadrius melodus*, New species, 4.

- 1840-44. AUDUBON, J. J. The Birds of America, from drawings made in the United States and their Territories. By John James Audubon. Philadelphia: J. B. Chevalier. 1840-1844. 7 vols.

In addition to species given in Ornithological Biography, mentions as Ohioan, *Sylvicola maculosa*, *Emberiza henslowi*, *Corvus corax*, *Tanagra rubra*, *Icterus spurius* and *Fuligula marila* (= *affinis*.) New species, 2.

1845. STORER, D. H. [Occurrence of *Fringilla pinea* [*pinus*], and *Bombicilla garrula*, in Ohio in July.] < Proc. Bost. Soc. Nat. Hist., ii, 1845, 52.

Statement as above in letter from Dr. J. P. Kirtland. New species, 1.

1850. KIRTLAND, J. P. Fragments of Natural History. < Family Visitor (weekly newspaper), Vol. I, No. 1, 1850, 1.

Notes on twenty-one species, chiefly regarding their relative abundance compared with former years. Washington Eagle, Red-tailed, Red-shouldered, Broad-winged, Cooper's and Swallow-tailed Hawks, Goosander, Mallard, Summer Duck, Wild Turkey, Partridge, Quail, Pileated Woodcock, Turkey Buzzard, Raven, Crow, Crow Blackbird, Robin, Blue Bird, Thrush, Catbird.

1850. [KIRTLAND, J. P.] The Eagle. < Family Visitor, No. 2, 1850, 15.

Golden Eagle, an occasional visitor; Washington Eagle, a doubtful species; White-headed Eagle, breeding in Rockport, Ohio.

1850. [KIRTLAND, J. P.] The Blue Bird. < Family Visitor, i, No. 7, 1850, 55.

A popular account of the bird.

1850. [KIRTLAND, J. P.] Birds of Winter. < Family Visitor, i, No. 8, 1850, 63.

Fringilla linaria, *F. hiemalis*, *Emberiza nivalis*.

1850. [KIRTLAND, J. P.] Troupial or Cow-blackbird. < Family Visitor, i, No. 9, 1850, 71.

A popular description.

1850. J. P. K. [KIRTLAND, J. P.] Editorial Correspondence. < Family Visitor, i, No. 10, 1850, 72.

Domestication of the Summer Duck, and other water fowl.

1850. [KIRTLAND, J. P.] Instinct. < Family Visitor, i, No. 15, 1850, 120.

Owing to late season Redpolls and White Snowbirds remain until April, the latter in breeding plumage.

1850. [KIRTLAND, J. P.] The Wild Pigeon. < Family Visitor, i, No. 17, 1850, 133.

A popular account.

1850. [KIRTLAND, J. P.] Pine Linnet. < Family Visitor, i, No. 18, 1850, 140.

Fringilla linaria, arriving July 1, and remaining until May 30.

1850. [KIRTLAND, J. P.] White-crowned and White-throated Finches. < Family Visitor, i, No. 19, 1850, 148.

Remaining till June 1.

1850. [KIRTLAND, J. P.] Pine Finch. < Family Visitor, i, No. 19, 1850, 148.

Still remains (June 29) and mating.

1850. [KIRTLAND, J. P.] White-headed Sparrow.< Family Visitor, i, No. 19, 1850, 148.

Still remains (June 27).

1850. [KIRTLAND, J. P.] White-headed Eagle.< Family Visitor, i, No. 19, 1850, 148.

Nesting at Rockport, Ohio, in 1850.

1850. [KIRTLAND, J. P.] The Glossy Ibis.< Family Visitor, i, No. 21, 1850, 164.

Copies account in Boston Traveller (May ?) 28th, one specimen recently taken near Cambridge, and one at Middleboro, Mass., and one at Middletown, Conn., and records two specimens of the *Glossy Ibis* two years previously (1848) near Fairport, Lake county, Ohio, one captured. Also records taking of Wilson's Phalarope and Great Marbled Godwit by the same collector.

1850. [KIRTLAND, J. P.] White-throated and White-headed Sparrow.< Family Visitor, i, No. 21, 1850, 164.

Remained at Sandusky, until June [July] 3; Pine Linnet still remains [July 11].

1851. [KIRTLAND, J. P.] A Rare Bird.< Family Visitor, i, 1851, 412.

Troglodytes ludovicianus taken at Rockport, Ohio, April 30, 1851.

1852. BAIRD, S. F. Description of a new species of *Sylvicola*. *Sylvicola kirtlandii*.< Ann. Lyc. N. Y., v. 1852, 217.

1852. KIRTLAND, J. P. Peculiarities of the Climate, Flora, and Fauna of the South Shore of Lake Erie, in the vicinity of Cleveland, Ohio; by J. P. Kirtland.< Am. Journ. Sci. and Arts, 2nd Series, xiii, 1872, pp. 215-19. Reprinted in Proc. Cleveland Acad. Nat. Sci., 1874, 1875, 171, and in Family Visitor, 1851-2.

Reprinted in this Report p. 191. Notes on the Hooded, Kentucky, Yellow-throated Wood, Cærulean and Prairie Warblers, *Trail's Flycatcher*, Piping Plover, *Pine Grosbeak*, White Owl, Bohemian Wax-wing and Pine Finch. New species 3.

1852. [READ, M. C., Editor.] The Cow Blackbird.< Family Visitor, iii, No. 9, 1852, 68.

List of 18 species foster parents of the Cow Blackbird; Snowbird (Junco) and Chestnut-sided Warbler breeding in Ashtabula county, Ohio.

- 1852-3. [READ, M. C.] Birds of Ohio.< Family Visitor, iii, 1852.

The first systematic attempt to describe the birds of the State. Ordinal, family, generic, and specific descriptions, with notes on habits of about a dozen families are given. No choice is expressed as to specific nomenclature, several synonyms being sometimes given; I have adopted the nomenclature of his Catalogue (1853), below. No. 25, p. 196, "Birds." General introduction and nomenclature of parts; No. 26, p. 204, *Falco columbarius*; No. 27, p. 212, *Falco sparverius*, *F. peregrinus*; No. 28, p. 220, *Astur cooperi*,

Falco fuscus, *F. furcatus*, *F. hyemalis*, *F. borealis*; No. 30, p. 236, *Buteo lineatus* (Syn.), *Falco fulvus*, *Haliaetus washingtonii* (Syn.); No. 32, p. 252, *Falco lucocephalus*; No. 37, p. 295, 1853, *Strix nyctea*, *S. nœvia* (Syn.), No. 38, p. 303, *Strix asio*, *S. virginiana*, *S. brachyotus*, *S. nebulosa*; *S. acadica*, No. 39, p. 311, *Sturnella ludoviciana*, *Icterus baltimore*, *I. spurius*; No. 40, p. 319, *Icterus phœniceus*, *I. pecoris*, *I. agripennis*; No. 41, p. 317, *Quiscalus versicolor*, *Q. ferrugineus*, *Corvus corax*, *C. corone*; No. 42, p. 335, *Garrulus cristatus*, *Parus bicolor*, *P. atricapillus*; No. 43, p. 343, *Bombycilla garrula*, *B. carolinensis*; No. 44, p. 351, *Lanius septentrionalis*, *Tyrannus intrepidus*, *T. crinitus*; No. 45, p. 359, *Tyrannus fuscus*, *T. virens*, *T. acadicus*, *T. traillii*; No. 46, p. 367, *Setophaga ruticilla*, *Sylvania mitrata*, *Sylvia œrœulea*; No. 47, p. 375, *Icteria viridis*, *Vireo flavifrons*, *V. noveboracensis*; No. 48, p. 383, *Vireo gilvus*, *V. olivaceus*, *Mimus polyglottus*; No. 50, p. 399, *Mimus rufus*, *M. felivox*, *Turdus migratorius*, *T. mustelinus*, *T. solitarius*, *T. wilsonii*, *T. noveboracensis*; No. 51, p. 407, *Turdus aurocapillus*, *Sylvicola coronata*, *S. ruficapilla*; No. 52, p. 415, *Sylvicola æstiva*, *S. maculosa*, *S. pardalina*, *S. maritima*, *S. pensilis*, *S. virens*, *S. blackburniæ*, *S. icterocephala*; No. 53, p. 423, *Sylvicola castanea*, *S. striata*, *S. discolor*, *S. americana*, *S. canadensis*, *S. formosa*, *Trichas marylandica*, *T. agilis*. Species 74—2 synonyms, 76, none new.

1853. READ, M. C. Catalogue of the Birds of Northern Ohio. < Proc. Acad. Nat. Sci. Phila., vi, 1853, pp. 395—402.

Falco columbarius, *F. sparverius*, *F. peregrinus*, *F. cooperi*, *F. fuscus*, *F. furcatus*, *F. hyemalis*, *F. borealis*, *F. pennsylvanicus*, *F. lineatus* (Syn.), *F. chrysæetus*, *F. washingtonii* (Syn.), *F. leucocephalus*, *Cathartes aura*, *Strix nyctea*, *S. nœvia* (Syn.) *S. asio*, *S. virginiana*, *S. brachyotus*, *S. nebulosa*, *S. acadica*, *Sturnella ludoviciana*, *Icterus baltimore*, *I. spurius*, *I. phœniceus*, *I. pecoris*, *I. agripennis*, *Quiscalus versicolor*, *Q. ferrugineus*, *Corvus corax*, *C. corone*, *Garrulus cristatus*, *Parus bicolor*, *P. atricapillus*, *Bombycilla garrula*, *B. carolinensis*, *Lanius septentrionalis*, *Tyrannus intrepidus*, *T. crinitus*, *T. fuscus*, *T. virens*, *T. acadicus*, *T. traillii*, *Setophaga ruticilla*, *Sylvania mitrata*, *S. œrœulea*, *Icteria viridis*, *Vireo flavifrons*, *V. noveboracensis*, *V. gilvus*, *V. olivaceus*, *Mimus polyglottus*, *M. rufus*, *M. felivox*, *Turdus migratorius*, *T. mustelinus*, *T. solitarius*, *T. wilsonii*, *T. noveboracensis*, *T. aurocapillus*, *Sylvicola coronata*, *S. ruficapilla*, *S. æstiva*, *S. maculosa*, *S. pardalina*, *S. maritima*, *S. pensilis*, *S. virens*, *S. blackburniæ*, *S. icterocephalus*, *S. castanea*, *S. striata*, *S. discolor*, *S. americana*, *S. canadensis*, *S. formosa*, *Trichas marylandica*, *T. agilis*, *Vermivora pennsylvanica*, *V. solitaria*, *V. chrysoptera*, *V. peregrina*, *V. rubricapilla*, *Troglodytes aëdon*, *T. hyemalis*, *T. ludovicianus*, *T. brevirostris*, *T. palustris*, *Regulus calendula*, *R. tricolor*, *Sialia wilsonii*, *Anthus ludovicianus*, *Alauda alpestris*, *Emberiza nivalis*, *Tanagra rubra*, *T. æstiva*, *Fringilla cyanea*, *F. leucophrys*, *F. pennsylvanica*, *F. graminea*, *F. fasciata*, *F. canadensis*, *F. socialis*, *F. juncorum*, *F. iliaca*, *F. hyemalis*, *F. palustris*, *F. tristis*, *F. linaria*, *F. erythrophthalmia*, *F. purpurea*, *Cardinalis virginianus*, *Coccothraustes ludovicianus*, *Corythus enucleator*, *Loxia curvirostra*, *Conurus carolinus*, *Coccyzus americanus*, *C. dominicus*, *Colaptes auratus*, *Picus pileatus*, *P. erythrocephalus*, *P. carolinus*, *P. varius*, *P. villosus*, *P. rubricapillus* (Syn.),

P. pubescens, *P. medianus*, (Syn.), *Sitta carolinensis*, *S. canadensis*, *Certhia americana*, *Mniotilta varia*, *Trochilus colubris*, *Alcedo aleyon*, *Hirundo purpurea*, *H. rufa*, *H. fulva*, *H. bicolor*, *H. riparia*, *Chætura pelasgia*, *Caprimulgus vociferus*, *C. virginianus*, *Columba carolinensis*, *C. migratoria*, *Meleagris gallopavo*, *Ortyx virginiana*, *Tetrao umbellus*. Species, 146—synonyms, 5, new species, 2.

1854. ZUCHOLD, —. < Journal für Ornithologie, vi, 1854, 355.

Copies Baird's description of *Sylvicola kirtlandi*.

1855. CASSIN, J. Illustrations, etc., i, 1855, 278; pl. xlvii.

Sylvicola kirtlandi from the original.

1858. BAIRD, SPENCER F. Birds. < [Pacific R. R. Report], ix, 1858.

Mentions several specimens of Ohio birds in the National Museum. *Vireo philadelphicus*, *Empidonax minimus*. New species, 2.

1859. BREWER, T. M. North American Oology. < Smithsonian Contributions, xi, 1859.

Names seven species of Raptores as Ohioan.

1859. KIRKPATRICK, JOHN. Birds of Ohio. < Ohio Farmer (newspaper, Cleveland), 1859.

Vol. vii, 1858, p. 59, *Cathartes aura*, *C. atratus*; p. 67, *Aquila chrysaetos*; p. 75, *Haliaetus leucocephalus*; p. 83, *H. washingtonii* (Syn.); p. 91, *Pandion carolinensis*; p. 97, *Buteo borealis*; p. 107, *B. pennsylvanicus*; p. 115, *B. lineatus*; p. 123, *Archibuteo sancti-johannis*; *A. lagopus* (Syn.); p. 139, *Astur atricapillus*; p. 147, *Accipiter cooperi*; p. 155, *A. fuscus*; p. 171, *Tinnunculus sparverius*; p. 363, *Nauclerus furcatus*; p. 379, *Falco anatum*; p. 387, *Hypotriorchis columbarius*; p. 395, *Circus hudsonius*.

Vol. viii, 1859, p. 11, *Otus brachyotus*; p. 27, *O. wilsonianus*; p. 35, *Bubo virginianus*; p. 43, *Scops asio*; p. 51, *Nyctea nivea*; p. 59, *Nyctale acadica*; p. 67, *Surnia ulula*; p. 75, *Syrnium nebulosum*; p. 107, *S. cinereum*, *Strix pratineola* (probable); p. 195, *Antrostomas vociferus*; p. 211, *Chordeiles popetue*; p. 227, *Hirundo rufa*; p. 243, *H. bicolor*; p. 267; *H. lunifrons*; p. 283, *Cotyle riparia*; p. 290, *C. serripennis*; p. 299, *Progne purpurea*; p. 339, *Ampelis garrulus*; p. 347, *A. cedrorum*; p. 355, *Tyrannus intrepidus*; p. 379, *Myiarchus crinitus*; p. 403, *Sayornis fuscus*.

Vol. ix, 1860, p. 11, *Contopus virens*; p. 35, *Empidonax minimus*; p. 43, *E. acadicus*; p. 197, *E. trailli*; p. 139, *E. flaviventris*; p. 163, *Trochilus colubris*; p. 179, *Coccyzus americanus*; p. 195, *C. erythrophthalmus*; p. 203, *Chaëtura pelasgia*; p. 267, *Picus villosus*; p. 299, *P. pubescens*; p. 307, *Sphyrapicus varius*; p. 315, *Hylotomus pileatus*, p. 331, *Centurus carolinus*; p. 339, *Melanerpes erythrocephalus*; p. 347, *Colaptes auratus*. New species, 4.

1859. KIRKPATRICK, JOHN. Rapacious Birds of Ohio. < Ohio Agric. Report for 1858 [1859], pp. 341–383.

Reprint of Raptores from the Birds of Ohio, Ohio Farmer (above).

1860. KIRTLAND, J. P. An Addition to the Fauna of Ohio. < Ohio Farmer, ix, 1860, 91.

Notice of occurrence of *Hesperiphona vespertina*, new species, and comments on rarity of various birds during the winter.

1860. ANON. [KIRKPATRICK, JOHN] Kirtland's Warbler. < Ohio Farmer ix, 1860, 179.

Note of a specimen of *Dendroica kirtlandi* taken by Mr. Darby, at Cleveland, in the spring of 1860.

1861. TREMBLY, J. B. Bird Talk. < Field Notes. [Agricultural Newspaper, Columbus, O.], i, 1861, 65.

Note on *Picus pileatus* as observed about Toledo.

1861. WHEATON, J. M. Bird Notes. < Field Notes, i, 1861, 65.

Note on distribution of Pileated Woodpecker, Whippoorwill, Night-hawk and Shore Lark.

1861. EDITOR [S. D. HARRIS]. Field Notes, i, 1861, 65.

Note on the introduction of the English Skylark, at Columbus, in 1851.

1861. TREMBLY, J. B. Ornithological Inquires. < Field Notes, i, 1861, 129.

Larus occidentalis (= *argentatus*, immature), *L. bonapartei*, *Sterna hirundo*, at Toledo in April.

1861. WHEATON, J. M. Rare Birds. < Field Notes, i, 1861, 153.

Notes on the capture at Columbus, in May, of *Porzana carolina*, *Rallus virginianus*, *Guiraca ludoviciana*, *Ardetta exilis*, *Gallinula galeata*, and *Chondestes grammacus*. New species, 1.

1861. WHEATON, J. M. Ornithological Inquiries. < Field Notes, i, 1861, 152.

Suggestions as to proper identification of *L. occidentalis* (above), and hints towards laws of migration.

1861. TREMBLY, J. B. Gulls. < Field Notes, i, 1861, 180.

Continued discussion of so-called *L. occidentalis*, with interesting notes upon the breeding habits of the Florida Gallinule, and upon *Ardetta exilis* and *Botaurus lentiginosus*.

1861. WHEATON, J. M. Catalogue of Birds of Ohio. By J. M. Wheaton of Columbus. < Ohio Agricultural Report for 1860 (1861), pp. 359-380.

Prepared with the assistance of Messrs John Kirkpatrick, R. K. Winslow, and Dr. J. P. Kirtland. Two hundred and eighty-five species are given with annotations.

The new species are *Turdus swainsonii*, (*Thryothorus bewickii*), *Protonotaria citrea*, *Helminthophaga celata*, *Dendroica pinus*, *Seiurus ludovicianus*, *Geothlypis philadelphia*, *Vireo solitarius*, *Collyrio excubitoroides*, *Curvirostra leucoptera*, *Plectrophanes lapponicus*, *Passerculus savanna*, *Contopus borealis*, *Strix pratincta*, *Himantopus nigricollis*, *Phalaropus fulicarius*, *Micropalma himantopus*, *Ereunetes petrificatus*, *Tringa maculata*, *T. bonapartei*, *T. maritima*, *T. canutus*, *Calidris arenaria*, *Numenius borealis*, *Garzetta candidissima*, *Grus canadensis*,

Ballus elegans, (*Gallinula martinica*), *Fulica americana*, *Cygnus buccinator*, *Bernicla hutchinsii*, *Harelda glacialis*, (*Histrionicus torquatus*), *Somateria spectabilis*, *Melanetta velvetina*, (*Graculus carbo*), *Larus leucopterus*, *Rissa tridactylus*, *Xema sabinii*, *Colymbus septentrionalis*.—40. Species of probable occurrence, 3.

1861. WHEATON, J. M. Catalogue of the Birds of Ohio. Reprinted from the Ohio Agricultural Report for 1860 (1861), pp. 1-21.

Reprint of the last, repaged and with its addenda distributed in place; 3 species added to list of probabilities. Sayornis (error) for Contopus (borealis).

1861. COLLINS, W. O. Report of Senate Select Committee, upon Senate Bill No. 12, "For the protection of Birds and Game." < Fifteenth Ann. Rep. Ohio State Board of Agriculture for 1860 (1861), 381-390.

Facts in the natural history of Ohio Birds, with recommendations for legislative action.

1864. HOUGH, F. B. House of Representatives, 36th Congress, 1st Session, Ex. Doc. No. 55. Results of Meteorological Observations made under the direction of the United States Patent Office and Smithsonian Institution, from the year 1854-1859, inclusive, being a report of the Commissioners of Patents made at the first session of the Thirty-sixth Congress, Vol. II. Part 1. Washington. Government Printing Office. 1864. Observations upon Periodical Phenomena in Plants and Animals, from 1851 to 1859, with tables of dates of opening and closing of Lakes, Rivers, Harbors, etc. Arranged by Franklin B. Hough, M. D. Dates of First Appearance of Birds, pp. 183-206.

Tables of dates of spring appearance of *Turdus migratorius*, *Mimus felivox*, *Sialia sialis*, *Troglodytes aedon*, *Hirundo horreorum*, *Progne purpurea*, *Dolichonyx oryzivorus*, *Agelaius phoeniceus*, *Quiscalus versicolor*, *Tyrannus intrepidus*, *Tyrannula fusca*, *Antrostomus vociferus*, *Chaetura pelagica*, *Pandion carolinus*, and *Bernicla canadensis* at the following stations: Cincinnati, Mt. Healthy, Ripley, Hockingport, Marietta, Hamilton, Germantown, Troy, Belle Centre, Savannah, Bowling Green, Hiram, Edinburg, Windham, Poland, Cleveland, Rockport, Madison, Welchfield, Jefferson and Ashtabula.

1864. BAIRD, S. F. Smithsonian Miscellaneous Collections. 181. Review of American Birds in the Museum of the Smithsonian Institution. By S. F. Baird. Part I. North and Middle America. Washington. Smithsonian Institution.

p. 23. First mention of *Turdus aliciae* from Ohio. New species, 1.

1867. BREWER, T. M. Some errors regarding the habits of our Birds. By T. M. Brewer, M. D. < The American Naturalist, i, 1867, 113.

Corrects error in "North American Oology" respecting the breeding of *Astur atricapillus* in Ohio.

1868. MARCH, P. G. Kingfishers Nest again. < Am. Naturalist, ii, 1868, 490.

Description of two Ohio Nests of this bird.

1868. GARLICK, T. Migrations of Birds. < Am. Naturalist, ii, 1868, 492.

Observation on an Albino Robin at Cleveland.

1869. INGERSOLL, ERNEST. Variation of Bluebird's Eggs. < Am. Naturalist, iii, 1869, 391.

Pure white eggs of Bluebird, at Oberlin, Ohio.

1872. COUES, ELLIOTT. Key to North American Birds: containing a concise account of every species of living and fossil bird at present known from the continent north of the Mexican and United States Boundary. Illustrated by 6 steel plates, and upwards of 250 woodcuts. By Elliott Coues, Assistant Surgeon, United States Army. Salem: Naturalists Agency. New York: Dodd and Mead. Boston: Estes and Lauriat. 1872.

Mentions several species as Ohioan, and on page 263, *Tantalus loculator* "north to Ohio." New species, 1.

1872. COPE, E. D. Zoological Sketch of Ohio. By E. Cope, A. M., Sec. Acad. Nat. Sci. Phila. < New Typographical Atlas of the State of Ohio with descriptions, Historical, Scientific, and Statistical, together with maps of the United States and Territories. By H. F. Walling and O. W. Gray, Civil Topographical Engineers. Published by Stedman, Brown & Lyon. Cincinnati, 1872.

Gives the number of Ohio Birds as 263, grouped as follows: Passeres, 132; Syndactyli, 5; Scansores, 12; Psittaci, 1; Raptores, 25; Pullastræ, 2; Gallinæ, 4; Grallæ, 45; Natatores, 37. Short notes on a few of the commoner species, p. 25.

1874. RIDGWAY, ROBERT. Catalogue of the Birds ascertained to occur in Illinois. < Ann. Lyc. Nat. Hist. N. Y., x, 1874, pp. 364-394.

Incidentally names a few species as Ohioan probably on earlier Ohio authorities.

1874. BAIRD, BREWER and RIDGWAY. A History of North American Birds. By S. F. Baird, T. M. Brewer, and R. Ridgway. Land Birds Illustrated by 64 colored plates and 593 woodcuts. Vol. I [—III]. Boston. Little, Brown and Company. 1874.

Names several birds as occurring in Ohio, and vol. II, p. 531, first authentic record of *Picoides arcticus* as Ohioan. New species, 1.

1874. COUES, ELLIOTT. Department of the Interior. United States Geological Survey of the Territories. F. V. Hayden, U. S. Geologist-in-Charge. Miscellaneous Publications No. 3. Birds of the Northwest: a Hand-book of the Ornithology of the Region drained by the Missouri River and its Tributaries. By Elliott Coues; Captain and Assistant Surgeon U. S. Army. Washington: Government Printing Office. 1874.

Mentions several species as Ohioan, with notes. (*Nyctale tengmalmi*, var. *richardsoni*), p. 314. New species, 1.

1874. WHEATON, J. M. Notes. < Birds of the Northwest, 1874, 223-4.

Notes on *Turdus swainsoni*, *T. aliciae*, *Dendroica corulea*, *D. dominica*, *Ampelis cedrorum*, *Vireo philadelphicus*, *Collurio ludovicianus*, *Melospiza melodia*, *Chondestes grammaca*, *Chordeiles popetue*, *Chaetura pelagica*. New species, 1.

1874. KIRTLAND, J. P. Peculiarities of Climate, Flora and Fauna of the South Shore of Lake Erie, in the vicinity of Cleveland, Ohio. < Proc. Cleveland Acad. Nat. Sci., 1874, pp. 200-287.

Read 1851, and originally published, as above, in *Am. Journ. Sci.*, xiii, 1852, also in *Family Visitor*, 1853(?).

1874. KIRTLAND, J. P. Mounted Birds from Northern Ohio, in the Academy's Museum. < Proc. Cleveland Acad. Nat. Sci., 1874, pp. 200-287.

"The article includes only the *Accipitres* and a few *Incessores*, but is quite full, as far as it goes, with characters of the genera and higher groups, and descriptions and biographies of the species. It is annotated by Thomas Brown, editor of the *Ohio Farmer*, in which the descriptions originally appeared, and was prepared in 1858-9," Coues, Bibliographical Appendix, *Birds Col. Val.*, 1878, 705.

This I think is an error, probably on the part of the editors of *Proc. Cleve. Acad. Nat. Sci.* The paper in question is undoubtedly a reprint of "The Birds of Ohio," by John Kirkpatrick, *Ohio Farmer*, 1868-9-60. No article with the above title, or any extended ornithological paper by Dr. Kirtland appeared in the *Ohio Farmer*, at any time. The Editor was not an ornithologist.

1873. WHEATON, J. M. The Food of Birds as related to Agriculture. < Ohio Agricultural Report for 1874 (1875), pp. 561-578 (Sept. 1875). Also Reprint, repaged but otherwise unchanged, pp. 1-18.

"This is in effect a corrected and completed list of the birds of Ohio, briefly annotated, and with the general food regimen of each family given; being a well-conceived essay of much practical utility." Coues, Bibliographical Appendix, *Birds of Colorado Valley*, 1878, 716.

288 species with 6 additional varieties given. The new species and varieties are, *Parus atricapillus*, var. *carolinensis*, *Melospiza lincolni*, (*Spizella*

pallida,) *Passer domesticus*, (*Goniaphea cœrulea*,) *Xanthocephalus icterocephalus*, *Tringa bairdi*, *Anser cœrulescens*, *Graculus dilophus*, *Graculus dilophus* var. *floridanus*, and *Sterna forsteri*.—11.

1876. JORDAN, D. S. Manual of the Vertebrates of the Northern United States, including the district east of the Mississippi River, and north of North Carolina and Tennessee, exclusive of marine species. By David Starr Jordan, Ph. D., M. D. Professor Natural History in U. W. C. University, and in Indiana State Medical College. Chicago: Jansen McClurg and Company. 1876.

Names definitely as Ohioan, *Dendroica kirtlandi*, *Myiodioides mitratus*, *Hesperiphona vespertina*, and *Tantalus loculator*. 2nd Edition, 1878, *Chondestes grammacus*.

1876. HENSHAW, H. W. On two *Empidonax*, *traillii*, and *acadicus*. < Bulletin of the Nuttall Ornithological Club, i, 1876, pp. 14-17.

Description of nest of *E. trailli* from Ohio, and notes of both species in Ohio.

1877. LANGDON, F. W. A Catalogue of the Birds of the Vicinity of Cincinnati [Ohio], with Notes. By Frank W. Langdon. Salem, Mass: The Naturalists' Agency. 1877. 8 vo. pamph. pp. 18.

"279 spp. with notes; breeders indicated by asterisk; species included on strength of their known range have their numbers in parentheses.—A good list." Coues, Bibliographical Appendix, Birds of Col. Val., 1878, 732.

Recent captures of *Cathartes atratus*, *Porphyrio martinica* and (*Porzana jamaicensis*). New species, 1

1877. DURY, CHARLES. Fecundity of the Carolina Wren (*Thryothorus ludovicianus*). < Bulletin Nuttall Ornithological Club, ii, 1877, 50.

Carolina Wren with four broods in one season.

1877. WHEATON, J. M. The Ruff and the Purple Gallinule in Ohio. < Bull. Nutt. Orn. Club, ii, 1877, 50.

First authentic record of *Philomachus pugnax* and *Porphyrio martinica* in Ohio. New species, 2.

1877. LANGDON, F. M. Occurrence of the Black Vulture or Carrion Crow in Ohio. < Bull. Nutt. Orn. Club, ii, 1877, 109.

Capture of this species at Madisonville, Dec. 1876.

1877. MERRIAM, C. H. A Review of the Birds of Connecticut, with Remarks on their Habits. < Trans. Conn. Acad., iv, July-Oct., 1876, pp. 1-165. Also separate, pamphlet and bound, A Review of the Birds of Connecticut. By C. Hart Merriam. New Haven. Tuttle, Morehouse and Taylor, Printers. 1877. Large 8vo. pp. 1-166.

"An important article, very critical, complete and workmanlike, bringing the subject up to date. * * * I hold it for a model of this sort of work."—*Coues*. Names as Ohioan, *Contopus borealis*, *Harelda glacialis*, and *Edemia americana*. New species, 1.

1878. BALLOU, W. H. The Natural History of the Islands of Lake Erie. < Field and Forest, iii, 1878, pp. 135-137.

Thirty-eight species given by their common names, 30 breeding.

1878. COUES, ELLIOTT. Department of the Interior. United States Geological Survey of the Territories. F. V. Hayden, U. S. Geologist-in-Charge. Miscellaneous Publications.—No. 11. Birds of the Colorado Valley, a repository of scientific and popular information concerning North American Ornithology. By Elliott Coues. Part First. Passeres to Laniidæ. Bibliographical Appendix. Seventy Illustrations. Washington. Government Printing Office. 1878.

Mentions *Sitta pusilla*, *Dendroica kirtlandi*, *Ampelis garrulus* and *Lanius ludovicianus* as Ohioan.

1878. LANGDON, F. W. Observations on Cincinnati Birds. By Frank W. Langdon. < The Journal of the Cincinnati Society of Natural History, Oct., 1878.

Interesting and valuable notes on 54 species, *Alauda arvensis*, introduced, acclimated and breeding.

- 1878-9. BREWSTER, W. Descriptions of the First Plumage in various species of North American Birds. < Bull. Nutt. Club, Vol. III-IV, 1878, 1879.

"Describes from Ohio specimens, Vol. iii, p. 121, *Chondestes grammacus*, first plumage; p. 122, *Euspiza americana*, first plumage; p. 177, *Empidonax acadicus*, first plumage; Vol. iv, p. 41, *Euspiza americana*, autumnal plumage, young. The same (1859) reprinted and repaged, pp. 1-39.

- 1878—. JONES, G. E. and SHULZE, E. J. Illustrations of the Nests and Eggs of the Birds of Ohio with text. By Genevieve E. Jones and Eliza J. Shulze. Circleville, Ohio.

"Too late for the fuller notice we may hope to give hereafter comes to us the first number of a beautiful work, which we sincerely hope may be successfully completed according to the announced design of the lady authors. Part I contains figures of the nests and eggs of *Icterus baltimore*, *Turdus mustelinus*, and *Coccyzus erythrophthalmus*, colored by hand, printed on Whatman's antiquarian drawing-paper, and forming three of the most exquisite pictures of bird-homes we have ever seen. Each plate has its sheet of letterpress, which fitly illustrates these artistic plates. The work is to appear, if it meets with sufficient support, in parts of three plates each, to be completed in about thirty parts; it is published by subscription,

at \$5.00 for colored, and \$2.00 for uncolored, impressions. The objects are represented of life size, in their natural surroundings, calling for the large folio form in which the work appears. To judge by the first Part, the work is one of very unusual merit, deserving that hearty recognition and support which we trust will be accorded by all who can appreciate the combination of great artistic excellence and fidelity to nature. The authors are be congratulated upon their taste and evident ability; we hope in due time to be able to felicitate them upon the complete success of their undertaking."—E. C. Bull. Nutt. Orn. Club, iv, 1879, 52.

"It became our sad duty to pen for the last number of the Bulletin a notice of the death of the leading author of this work, on the very threshold of the great undertaking with which her name properly continues to be associated. The hope then expressed, that, notwithstanding this most melancholy occurrence, the enterprise would not be abandoned by Miss Shulze and other co-workers, has been fulfilled in the recent appearance of Part II. A slip printed with this number briefly refers to Miss Jones' death, and announces that in future numbers Miss Shulze will be assisted in the illustrations by Mrs. Virginia E. Jones, and that the text will be prepared by Howard E. Jones, A. M., M. D. This promises well for the continuance of a work so seriously interrupted at the outset; and the number now in hand shows no falling off either in the beauty of the plates or in the appropriateness of the text. No illustrated work to compare with the present one has appeared in this country since the splendid Audubonian period closed; and it is not too much to say of the Misses Jones and Shulze's pictorial work, that it rivals in beauty and fidelity of illustration the production of Audubon's pencil and brush, pronounced by Cuvier the greatest monument every erected by art to nature. We would not be thought to have lost our critical faculty in mere admiration, nor seem to use words of praise without fully recognizing their weight; but it is useless to attempt the formality of mere criticism in a case where our enthusiasm is instinctive. Judged from a standpoint of the highest art culture, these colored lithographs have of course only a certain degree of excellence, determined rather by the limited possibilities of the means employed than by the ability of the artists; measured by the highest standard of similar efforts to represent nature in lithography, these illustrations compare favorably with the best that have ever appeared. Though a gentle hand has faltered but too soon, and the spirit that guided it has passed on, yet is assuredly erected to her memory the 'monument more lasting than brass.'

"It would be superfluous to recall the attention of working ornithologists to a publication whose merits are obvious and so fully recognized already. We would rather seek to interest the larger class of persons who are lovers of nature, and have the means and leisure to gratify their tastes. So highly ornate a work is necessarily expensive, and its successful completion would seem contingent upon the support it receives. Too many cheap, flashy books on natural history find a place in parlors, and even in libraries, where we should expect to find the evidences of a more cultivated

taste, and where a work like the present could most desirably replace others so inferior. The position which the 'Illustrations' may finally secure in the archives of science can only be told hereafter, when the work is completed; but, meanwhile, the beauty of each number is its own 'excuse for being,' and its own recommendation to favor.

"Part II, which appeared last October, contains Plates IV, V, and VI, being illustrations of the nests and eggs of *Cyanospiza cyanea*, *Agelæus phœniceus*, and *Tyrannus carolinensis*, with the text of these species, and also of *Quiscalus æneus*—the plate of the latter, we presume, being in preparation for the next number. Some delay in the appearance of the Part was doubtless unavoidable under the circumstances; but we shall look for further installments to be published with regularity, and as rapidly as may be consistent with their faithful execution."—E. C.—Bull. Nutt. Orn. Club, v, 1880, 39.

Part 1, July, 1879, *Icterus baltimore*, Pl. I; *Turdus mustelinus*, Pl. II; *Coccyzus erythrophthalmus*, Pl. III.

Part 2, Oct., 1879, *Cyanospiza cyanea*, Pl. IV; *Agelæus phœniceus*, Pl. V; *Tyrannus carolinensis*, Pl. VI.

Part 3, Jan., 1880, *Turdus migratorius*, Pl. VII; *Collurio ludovicianus*, Pl. VIII; *Quiscalus purpureus* var. *æneus*, Pl. IX.

Part 4, April, 1880, *Sayornis fuscus*, Pl. X; *Thryothorus ludovicianus*, Pl. XI; *Sialia sialis*, Pl. XII.

Part 5, July, 1880, *Hirundo erythrogaster*, Pl. XIII; *Coccyzus americanus*, Pl. XIV.

Part 6, Oct., 1880, *Dendroica æstiva*, Pl. XV; *Spizella pusilla*, Pl. XVI; *Mimus carolinensis*, Pl. XVII; *Ortyx virginianus*, Pl. XVIII.

Part 7, Jan., 1881, *Empidonax acadicus*, fig. 1, *Contopus virens*, fig. 2, Pl. XIX; *Icteria virens*, Pl. XX; *Geothlypis trichas*, Pl. XXI.

Part 8, April, 1881, *Cardinalis virginianus*, Pl. XXII; *Vireo olivaceus*, fig. 2, Pl. XXIII; *Zenaidura carolinensis*, Pl. XXIV.

1879. WHEATON, J. M. Kirtland's Warbler again in Ohio. < Bull. Nutt. Orn. Club, iv, 1879, 58.

Male and female *D. kirtlandi* taken at Rockport, by William and John Hall, in 1878.

1879. WHEATON, J. M. Occurrence of Birds rare to the vicinity of Columbus, Ohio. < Bull. Nutt. Orn. Club, iv, 1879, 62.

Loxia curvirostra (in June), *Elanoides forficatus*, *Strix flammea* var. *americana*, *Cupidonia cupido*.

1879. COUES, E. History of the Evening Grosbeak. < Bull. Nutt. Orn. Club, iv, 1879, pp. 65-75.

Mentions the occurrence of the Evening Grosbeak at Cleveland and Columbus, the latter an error on my authority.

1879. BREWER, T. M. The Eggs of the Redstart. < Bull. Nutt. Orn. Club, iv, 1879, 118.

Measurement of eggs of *Setophaga ruticilla* from Ohio.

1879. LANGDON, F. W. Albinism in the Tufted Titmouse. < Bull. Nutt. Orn. Club, iv, 1879, 116.

Describes partially albino specimens of *Lophophanes bicolor*.

1879. LANGDON, F. W. The White-rumped and Loggerhead Shrikes in Ohio. < Bull. Nutt. Orn. Club, iv, 1879, 120.

Occurrence of both varieties at Madisonville.

1879. MARSHALL, D. M. The Butcher Bird. < The Journal of Science (newspaper, Toledo, O.), new series, ii, 1879, No. 6.

The Northern Shrike breeding near Toledo. (Error,—see Appendix).

1879. LANGDON, F. W. A Revised List of Cincinnati Birds. By Frank W. Langdon. < Journ. Cin. Society Nat. Hist., Vol. I, No. 4, Jan. 1879, pp. 167–193.

Also reprint, repaged, 8 vo. pamph., pp. 27.

“About two years ago Mr. Langdon published a catalogue of the birds of the vicinity of Cincinnati, with notes, including 279 species. The present revision of the subject gives the numerous additional facts which have meanwhile become known to the author, and in recognition of which the list has been entirely remodelled, ‘to represent the present state of our knowledge of ‘Cincinnati Birds,’ so far as their local distribution is concerned, as well as the later conclusions of the most approved authorities in respect to classification and nomenclature.’ The list is chiefly based upon collections and observations made at two or three points between the Great and Little Miami Rivers, within ten or twelve miles of the Ohio. The breeders, known or inferred, are marked with the asterisk or obelisk. The 256 identified species are of the following categories: Constant residents, 27; summer residents, 62; winter visitants, 10; regular migrants, 82; irregular migrants, 37; casual visitants, 31; species that have disappeared within forty years, 7. There are also included 26 ‘species of probable occurrence, not yet identified,’ nearly or quite all of which seem likely to be found. The List is annotated throughout with the usual and proper comments on each species, and is concluded with some general observations suggested by the writer’s experience. It is very good piece of work, based in greatest part on original personal observations, very carefully elaborated, with attention not only to the material facts presented, but to those niceties of workmanship which are too often neglected.” * * * E. C.—Bull. Nutt. Orn. Club, Vol. iv, 1879, 112.

This is the most accurate and reliable list yet published of Ohio Birds. Dr. Langdon’s limits encroach somewhat upon the State of Indiana, but except in the case of one or two species this does not affect his Catalogue as an Ohio list.

1879. PURDIE, H. A. Another Kirtland’s Warbler. < Bull. Nutt. Orn. Club, iv, 1879, 185.

Enumerates nine examples of *Dendroeca kirtlandi* known, four of which are Ohioan.

1879. LANGDON, F. W. Nesting of the Kentucky Warbler in Ohio.
 <Bull. Nutt. Orn. Club, iv, 1879, 236.
 Description of an Ohio nest and eggs of *Oporornis formosa*.
1879. DURY, CHARLES and FREEMAN, L. R. Observations on Birds.
 <Journ. Cin. Soc. Nat. Hist., ii, 1879, pp. 100-104.
 Also separate, pamph., repaged, pp. 1-5.
 A list of 69 species with dates of observation, with generally brief notes of peculiarities in nesting, etc. First authentic record of *Tringa bairdii* and *Sterna hirundo* in the vicinity of Cincinnati and first authentic record of *Thryothorus bewickii* in Ohio, 2 specimens, March 27, 1879. New species, 1.
1880. CHUBB, H. E. Spring Field Notes. < Forest and Stream, (newspaper,) Vol. 14, No. 12, May 20, 1880, 307.
 Notes on the arrivals and captures, at Cleveland, from Feb. 12 to May 4, 1880, 87 species. Among them, Yellow-throated Green Warbler, Florida Gallinule, April 19; Large-billed Water Thrush, Long-billed Curlew and Little Yellow Rail, April 24; Red-throated Diver and Horned Grebe, April 30; Kirtland's Warbler, May 4.
1880. INGERSOLL, SEYM. Unusual Nesting Places. < Forest and Stream, Vol. 14, No. 12, April 22, 1880, 224.
 Robin nesting on railway bridge; Chipping Sparrow nesting in a hanging basket of plants.
1880. INGERSOLL, SEYM. [Spring arrivals]. < Forest and Stream, Vol. 14, No. 12, April 22, 1880, 22.
 About twenty species noted from Feb. 10 to April 3.
1880. LANGDON, F. W. Description of a New Warbler of the Genus *Helminthophaga*. By Frank W. Langdon. < Journ. Cin. Soc. Nat. Hist., iii, 1880, pp. 119, 120, with plate.
 Also reprinted with plate, Bull. Nutt. Orn. Club, v, 1880, 208-210.
 Description of *Helminthophaga cincinnatiensis*. New species, 1.
1880. LANGDON, F. W. Ornithological Field Notes, with five additions to the Cincinnati Avian Fauna. By Frank W. Langdon. < Journ. Cin. Soc. Nat. Hist., iii, 1880, 121-127.
 "These notes relate to the bird fauna of the immediate vicinity of Cincinnati, and virtually form a supplement to the same author's excellent "Revised List of Cincinnati Birds," published in 1879. They add five species to the number there given, and bring the total thus far identified to 263. They relate to 40 species, giving records of further captures of many of the rarer ones, and of the nesting, etc., of others. Among the points of special interest are the capture of two specimens (male and female) of Kirtland's Warbler (*Dendroica kirtlandi*) near Cleveland, May 4 and 12, 1880, and the replacement of a colony of several hundred Rough-winged

and Cliff Swallows, formerly nesting about the piers and under the floors of a bridge, by 'that much regretted addition to our fauna,' the House Sparrow."—J. A. A.—Bull. Nutt. Orn. Club, v, 1880, 232.

The species new to the vicinity of Cincinnati are *Cistothorus stellaris*, *Helminthophaga cincinnatiensis*, *Helminthophaga celata*, *Melospiza lincolni*, and *Tringa fuscicollis*. Notes the recent capture of *Corvus corax* *carnivorus* in Union county, and of two specimens of *Dendroica kirtlandi* by Mr. Chubb, at Cleveland, May, 1880.

1880. RIDGWAY, R. Note on *Helminthophaga cincinnatiensis*. < Bull. Nutt. Orn. Club, v, 1880, 237.

Considers it as probably a hybrid between *Helminthophaga pinus* and *Oporornis formosa*.

1880. LANGDON, F. W. Summer Birds of a Northern Ohio Marsh. By Frank W. Langdon. < Journ. Cin. Soc. Nat. Hist., iii, 1880, pp. 220-232.

A list of 95 species, for the most part briefly annotated or not, of Birds observed "on the grounds of the Wynous' Point Shooting Club, near Port Clinton, Ottawa county, Ohio, during the week ending July 4, 1880." Especially valuable for full notes of the nesting of *Ardetta exilis*, *Gallinula galeata*, *Hydrochelidon lariformis*, *Podiceps cornutus* (?) and *Podilymbus podiceps*.

1872. MAYNARD, C. J. A Catalogue of the Birds of Coos Co., N. H., and Oxford Co., Me., with annotations relative to their breeding habits, migrations, etc. By C. J. Maynard. With notes by William Brewster. < Proc. Boston Soc. Nat. Hist., xiv, for Oct., 1871, pub. 1872, pp. 356-385.

Dendroica castanea noted as occurring in Ohio, p. 366.

1878. MERRIAM, C. H. Remarks on some of the Birds of Lewis County, Northern New York. < Bull. Nutt. Orn. Club, iii, 1878, p. 52.
Collurio ludovicianus var. *excubitoroides* breeding in Ohio.

1878. RIDGWAY, R. Eastward range of *Chondestes grammacus*. < Bull. Nutt. Orn. Club, iii, 1878, 43.

Notes its occurrence in Ohio in 1860 (1861).

[E.] ON THE RELATION BETWEEN LATITUDE AND THE
PATTERN OF COLORATION IN OHIO BIRDS*.

At the last meeting of the Society I expressed an opinion somewhat adverse to the universal application of the laws of latitudinal variation among birds, at least to their availability for the purpose of determining whether certain forms should be considered species or varieties †.

At the same meeting I expressed myself as doubtful of the correctness of the opinion there advanced that white wing-bars and white tips to tail feathers should be considered as simply ornamental. A few words will give my reason for dissenting from such a view. Without attempting to show that tail spots or wing-bars are not peculiar to that sex which is most highly ornamented among birds, let us first examine into the structural relation of the feathers bearing these marks to the marks themselves. In the case of white tail tips, I am of the opinion that the presence or absence of these spots has largely to do with the form of the tail, of which there are two strongly marked types, *forked* and *rounded*. In the former the lateral feathers are the longest, in the latter the central. Among all our Ohio birds, I find none with forked tails and white tips to the tail feathers, all white tail tips being combined with more or less rounded tails. The King-bird has a white tipped tail all the tips being nearly equal, while the tail as a whole is nearly square. In other birds with a rounded tail and white tips the white increases in the same or in an increasing proportion to the shortening of the lateral feathers. I do not wish it to be understood that all birds with rounded tails have white-tips for this is not the case, but that there is a definite correlation between these characters is evident. In the Hummingbird, the male has a forked tail of uniform color, while the female has a rounded tail with white tips.

In tail feathers then we find white tips associated with the feathers of less development as to length, and I might add that in many birds the white of the tip extends towards the base of the outer feathers along the outer, that is to say the *shorter*, web of the feather.

In the case of wing-bars the same relation may be seen, though perhaps there are more exceptions to the rule than in the case of tail-tips. Wing-bars, that is white tips to the greater or lesser row of wing-coverts are in their greatest perfection in Passeres, in which order, the coverts are not more than half as long as the secondary quills, while in all other orders, with few exceptions (e. g. Picidæ), the wing-coverts are more than half the secondaries. I find a single reason, and this a negative one, to suppose that wing-bars may be simply ornamental, as follows; Most birds in the Order Passeres which have wing-bars nest in trees, while in many instances the lack of wing-bars is associated with the habit of ground nesting. The relations between this habit and the presence or absence of this color-mark are well seen in family Sylvicolidæ, where, with the exception of one or two species of Helminthophaga, all the ground nesting

* Read before the Columbus Society of Natural History, Aug. 29, 1874.

† The laws of latitudinal variation have been given on page 194-196 of this report and need not be again presented here.

species are without wing-bars, while in *D. palmarum*, so far as known the only ground-nesting Dendroica, the wing-bars are wanting. In this family the presence or absence of wing-bars seems to be associated with the presence or absence or more or less perfect development of tail spots (not tail-tips, however, in the sense used above), except in the case of *Myiodioetes mitratus* where wing-bars are wanting but tail spots are well developed.

It may be further said with regard to the presence of wing-bars that they seem to be more perfectly developed in the northern than in the southern birds of a genus.

I have brought before you many specimens of our Ohio Birds for the purpose of inquiring into relations which exist between the color or pattern of coloration and the mean annual temperature to which these birds are subjected. In this investigation, I shall assume that birds which are only winter visitors with us are subject to the lowest temperature; that those which are resident throughout the year with us are next in order in this respect, while summer residents may be considered as subjected to the highest average temperature, and spring and fall migrants to an average temperature higher than that of residents.

There is a well-known law that when the adult male and female of a species resemble each other the young differ from either parent; and, when the adult male and female are unlike, the young resemble the female. I wish now to make a series of comparisons showing the relations between young of different species, or the young of one species with the adult of another. But first I will call your attention to a few birds for the purpose of illustrating the law of resemblance or difference between the young and old of the same species. We have here the male and female of one of our most common birds, the Robin, *Turdus migratorius*, and they will be seen to resemble each other very closely both as to pattern of coloration and color. Their young, however, differ both in color and pattern. In the other case, we have the Purple Finch, *Carpodacus purpureus*, the male of which is adorned with bright though shaded or blended colors, while the female is much plainer, lacks the bright color and is thickly dusky-streaked. The sex of the young male could not be determined by the markings or color, as in both these the resemblance to the female is almost perfect. In some cases the male and female differ in color but not in pattern, as here in the case of the Towhee Bunting (*Pipilo erythrophthalmus*). In this case the young bird differs from either parent.

There appear to be among young birds three distinct primary patterns of plumage, the spotted, barred, and streaked; in the development of the individual these may remain permanently, and more or less completely, or be transformed into another pattern by the blending of two of these, or into definite or indefinite color areas.

In making the following comparisons between birds of our own State, our point of observation, in this city, is favorable, being central and very near the fortieth degree of latitude.

I have here six birds, all of them True Thrushes and all of different species. Five of these present on their under parts a more or less distinctly spotted pattern while the sixth is uniform or nearly so in the region where the others are spotted. You recognize this sixth specimen as the Robin, *Turdus migratorius*, of which I made use in illustrating the differences between old and young birds. On comparing the young of the Robin with the other five Thrushes, the pattern of coloration is seen to be the same.

If now we arrange these birds, placing that bird first whose southern breeding limit, so far as known, is most northerly, and the others following in the same order we have:

1. *Turdus aliciae*,
2. *Turdus swainsoni*,

3. *Turdus pallasi*,
4. *Turdus wilsoni*,
5. *Turdus mustelinus*,
6. *Turdus migratorius*.

Of these the first four breed north of us, the last two breed with us and southward. Of the spotted Thrushes, the most southern one, *T. mustelinus*, has the spots darkest and most definite; and comparing all of them with the young Robin, we are forced to the conclusion that the first four species are of the same pattern of plumage and nearly equal developement of that pattern, while the Wood Thrush is of the same pattern in a higher state of developement. In the case of the adult Robin, it is plainly seen that it has out-grown a pattern of coloration which is permanent in the other species.

Of the Wrens, we have five or six species, all of which exhibit the barred type of plumage in greater or lesser degree of perfection. I arrange them as the Thrushes were arranged.

1. *Anorthura troglodytes*, var. *hyemalis*,
2. *Cistothorus stellaris*,
3. *Telmatodytes palustris*,
4. *Troglodytes ædon*,
5. *Thryothorus ludovicianus*,
6. *Thryothorus bewickii*.

Of the six species inhabiting this State the last, Bewick's Wren, *T. bewickii*, is not known to extend so far northward as this city. The first named, the Winter Wren, *A. troglodytes*, is not positively known to breed within our limits though it probably does so in northern Ohio. Of the other four the House Wren, *T. ædon*, and the Carolina Wren, *T. ludovicianus*, both breed here, the latter being at or near its northern limit and a constant resident, while the former is migratory. The Long- and Short-billed Marsh Wrens, *T. palustris* and *C. stellaris* probably both breed in suitable places in this latitude, though not known to do so here or southward in this State; both breed in northern Ohio.

In the Winter Wren the barred plumage extends over the back, belly, wings and tail. In the two migratory Marsh Wrens the barring is confined to wings, tail and under tail-coverts. In the House Wren it is present on wings, tail, back, flanks and under tail-coverts. In the Carolina Wren and Bewick's Wren confined to wings, tail and under tail-coverts, while in the last species the barring becomes a definite deepening and extension of the colors into black and white areas on the outer tail feathers. So that while all the birds of this family are barred, the more southern forms have only partly outgrown the pattern which remains permanent in northern species.

In the Sparrows (*Fringillidæ*) we have a large family, one of the characteristics of which is that most of its members have temporarily or permanently a *streaked* plumage. Of the members of this family found in the State, all the young, so far as known, are more or less streaked except those of *Pinicola enucleator*, *Chrysomitris tristis* and *Cardinalis virginianus*. The adults of these three species are never streaked.

In the following we have a different *color* and *pattern* according to sex, the adult males having passed through and beyond the condition permanent in the female, which is always streaked.

1. *Carpodacus purpureus*,
2. *Loxia curvirostra*,
3. *Loxia leucoptera*,
4. *Goniaphea ludoviciana*,

Of these the first three are winter visitors only, and it is to be noticed that the male is at least two years in acquiring its full plumage which is of blended character. The fourth finds its southern breeding limit with us and acquires its final pattern during its first year though it is not perfected in color until later.

The two following breed with us and southward, acquire their adult plumage in the first year, and their females lose their streaks, having the same pattern though they differ in color from their males.

1. *Cyanospiza cyanea*,
2. *Pipilo erythrophthalmus*.

The following species more or less streaked both *above* and *below*, in both sexes, are winter visitors or migrants breeding exclusively to the north of us.

1. *Ægiothus linaria*,
2. *Chrysomitris pinus*,
3. *Plectrophanes lapponicus*,
4. *Passerculus savanna*,
5. *Melospiza lincolni*,
6. *Passerella iliaca*.

The following species streaked *above* and *below* breed with us; the first a migrant and near or at its southern breeding limit, and the second nearly resident; both nest upon the ground.

1. *Poocetes gramineus*,
2. *Melospiza melodia*.

The following species, streaked *above* but not streaked *below*, breed exclusively to the north of us.

1. *Plectrophanes nivalis*,
2. *Melospiza palustris*,
3. *Spizella monticola*,
4. *Zonotrichia albicollis*,
5. *Zonotrichia leucophrys*.

Of these it may be remarked that *M. palustris* breeds within the limits of this State, and the same has been asserted of *S. monticola*. *Z. albicollis* often presents tolerably distinct streaking below in the female.

The following breeds north of us, but within the limits of this State; the male and female resemble each other in color and pattern.

1. *Junco hyemalis*,

The following, streaked *above* but *unstreaked below*, breed with us and southward.

1. *Coturniculus passerinus*,
2. *Spizella socialis*,
3. *Spizella pusilla*,
4. *Chondestes grammacus*,
5. *Euspiza americana*.

RECAPITULATION OF FRINGILLIDÆ.

Breeding northward:

Both sexes streaked above and below	6
Female streaked above and below	3
Both sexes streaked above	5
Adults not streaked	1
	<hr/>
	15

Breeding here and northward :

Both sexes streaked above and below	2
Female streaked above and below	1
Both sexes streaked above.....	-
Adults not streaked	-

3

Breeding here and southward :

Both sexes streaked above and below	-
Female streaked above and below	-
Both sexes streaked above.....	5
Adults not streaked	2

7

In Family Icteridæ, though we have not the same type of plumage throughout, the arrangement may be as follows :

1. *Sturnella magna*,
2. *Scolecophagus ferrugineus*,
3. *Dolichonyx oryzivorus*,
4. *Agelæus phœniceus*,
5. *Molothrus ater*,
6. *Icterus baltimore*,
7. *Icterus spurius*,
8. *Quiscalus purpureus*, var. *æneus*.

The first exhibits the streaked type of plumage in both sexes, and is nearly resident with us. The second, the only species breeding exclusively to the north of us, presents in the fall a change of plumage similar to that of the young. The third, whose southern breeding range is with us, presents a highly developed plumage in the male while the female resembles the young, retaining the streaked plumage, to which the male returns in the fall. The fourth, presents the same difference in sex as the third, except that the male retains its spring pattern of plumage permanently. In the fifth species the male and female have both outgrown a streaked plumage in the young, but the male acquires a higher developement of plumage than the female, and breeds both to the north and south of us. In the two Orioles the males differ from the females in brighter colors and more definite pattern, and undergo no marked change of plumage in the fall. The Orchard Oriole is more southern in its breeding range than the Baltimore. The last species presents but little difference in the plumage of the male and female, and the young, as is also the case with the Orioles, is not streaked.

We have now considered the relations existing between young and old and different species of birds of the spotted, barred and streaked type of plumage, using for this purpose the largest families in which these types are especially noticeable; fortunately they are the larger families of the Oscines. I have made no mention of the large family Sylviolidæ, for the reason that it presents different types of plumages in different genera, and, among those of streaked pattern, few birds which afford comparison by reason of marked differences in southern breeding limits. Of the Sylviidæ, Paridæ, Sittidæ, Tanagridæ, Vireonidæ, Ampelidæ and Corvidæ, it may be said that they possess no pattern of coloration, the body plumage being generally of uniform, dull or neutral tint in which the young and adult resemble each other. The same is true of sub-order Clamatores. Family Hirundinidæ presents no marked variations to confirm or

oppose our views, for, though quite varied in plumage, their range during the breeding season is nearly coextensive.

Of the remaining Families, the Blue-bird, *Sialia sialis*, resembles the Robin in developing color areas from the spotted type. The Brown Creeper, *C. familiaris*, Shore Lark, *E. alpestris*, Titlark, *A. ludovicianus*, retain the streaked type of plumage and all breed north of us.

In some instances interesting comparisons may be made between two species of the same or allied genera. In Family Laniidæ we have two species and one variety. The Northern Shrike, *C. borealis*, differs in color from the Loggerhead, *C. ludovicianus* in having its under-parts waved, the black bar of the side of the head not meeting its fellow across the forehead and bordered above by a hoary white line, the extreme forehead in the Loggerhead Shrike being black, not bordered above with white, and the under-parts unbarred white. The young of *ludovicianus*, however, like the young of *borealis*, is barred above and below. This barring disappears first from the upper parts, but specimens otherwise in adult plumage are sometimes plainly barred below. Young *ludovicianus* often lacks any indication of the black frontlet, and sometimes it is developed on one half the forehead only. The base of the bill is light colored below, and altogether the young of the Loggerhead bears a greater resemblance to the adult Northern Shrike than to its own parents.

In a comparison between the Red-headed Woodpecker, *M. erythrocephalus*, a species of southern distribution, and with the exception of the Yellow-bellied Woodpecker, *P. varius*, the most migratory in habit, and the Flicker, *C. auratus*, a species of more northern distribution, and more nearly resident with us, we find some unexpected points of resemblance. The adult Red-headed Woodpecker has well defined color areas and both sexes are alike. The Flicker presents a spotted plumage below and bars above, both types in their most perfect development. In the young of the Red-headed Woodpecker we find the under-parts spotted and the upper-parts obviously barred. The spots and bars soon disappear from the under and upper-parts of the body but on the distal half of the secondaries the bars remain for one or two years, acquiring the individual perfection attained by the bars on the secondaries of the Flickers, the most distal bar being the last to disappear. The red of the Red-headed Woodpecker first appears as a narrow crescent on the nape, which is followed by a spot on the breast, and another extending from the auriculars a short distance down the side of the neck. These red spots occupy respectively the situation of the nuchal crescent, the pectoral crescent and the maxillary patches of the male Flicker. Soon after this development of plumage the young leave for the south and the changes immediately following are unknown to me. In the spring the birds return with a red head and more or less perfect black pectoral crescent, traces of which are seen until it arrives at its highest plumage, if not sometimes permanently, and one or two black bars on the secondaries. So that it appears the Red-headed Woodpecker passes through a pattern of plumage similar to that which is permanent in the Flicker.

We have considered the relation of the spotted, barred and streaked patterns of plumage in connection with young and adult birds, and northern and southern birds. The question may now be asked, Is there a similar relation of development between the patterns themselves? We have examined them in the order of the families in which we found the most extensive presentation of each pattern. Is there anything to indicate that the spotted pattern is a more highly developed pattern than the streaked? In other words is there any reason, from the pattern of plumage alone, why the typical thrushes with ten primaries should stand first in the arrangement of our birds, or should

that place, as intimated by some, be occupied by the streaked sparrows with nine primaries?

Presuming upon the inference to be drawn from one of the laws above mentioned, that where males and females differ in plumage, the male is more highly developed, and has passed through a type of plumage which remains permanent in the female, it follows that if we find an adult male of any species presenting one of these patterns of plumage and the adult female another, we may decide that the male presents the higher type of plumage. We discover such an example in the Sparrow Hawk, *F. sparverius*, the female of which is streaked below and barred above while the male presents distinct spots below, while the bars are wider and fewer above, and on the wing-coverts are distinct spots. For this reason we conclude that the spotted pattern of plumage is a higher development than the streaked or barred. Instances of the barred pattern succeeding streaks are not infrequent among the Raptores.

We think then that our investigations have shown that *the pattern of coloration in the adults of our Northern Birds is the same as that found in the young of allied Southern Birds.*

The cause or reason for such a law is unknown, but I believe the germ of the correct idea is contained in the following from Audubon's Journal in Labrador (Life of Audubon, p. 349):

"Aug. 4. It is wonderful how quickly every living thing in this region whether animal or vegetable, attains its growth. In six weeks I have seen the eggs laid, the birds hatched, and their first moult half gone through; their association in flocks begun, and preparations for leaving the country.

"That the Creator should have ordained that millions of diminutive, tender creatures, should cross spaces of country, in all appearance a thousand times more congenial for all their purposes, to reach this poor, desolate, and deserted land, to people it, as it were, for a time, and to cause it to be enlivened with the songs of the sweetest of the feathered musicians, for only two months at most, and then, by some extraordinary instinct, should cause them all to suddenly abandon the country, is as wonderful as it is beautiful and grand.

"Six weeks ago this whole country was one sheet of ice; the land was covered with snow, the air was filled with frost, and subject to incessant storms, and the whole country a mere mass of apparently useless matter. Now the grass is abundant, and of rich growth, the flowers are met with at every step, insects fill the air, and the fruits are ripe. The sun shines, and its influence is as remarkable as it is beautiful; the snow banks appear as if about to melt, and here and there there is something of a summerish look. But in thirty days all is over; the dark northern clouds will come down on the mountains; the rivulets and pools, and the bays themselves will begin to freeze; weeks of snow-storms will follow, and change the whole covering of these shores and country, and nature will assume not only a sleeping state, but one of desolation and death. Wonderful! wonderful! But it requires an abler pen than mine to paint the picture of this all-wonderful country.

"Aug. 5. This has been a fine day; we have had no new hurricanes and I have finished the drawings of several new birds. It appears that northern birds come to maturity sooner than southern birds; this is reversing the rule in the human species."

[F.] GLOSSARY OF TECHNICAL TERMS USED IN THE
PRECEDING DESCRIPTIONS.

The following definitions are compiled from Dr. Coues' Glossary, in Baird, Brewer and Ridgway's History of North American Birds, iii, 1874, pp. 535-560.

A

- Abdomen.* Belly; part of gastræum between sternum and anus.
- Aberrant.* Deviating from ordinary character.
- Abortive.* Suppressed; remaining or becoming imperfect.
- Acuminate.* Tapering gradually to a point.
- Ægithognathous.* Having the palate bones disposed as in a Sparrow or other passerine bird.
- After-shaft.* Scape or stem of the supplementary plume springing from many feathers, or, oftener, such plume itself.
- Albinism.* State of whiteness, complete or partial, resulting from deficiency or entire lack of pigment in the skin and its appendages.
- Albino.* An animal affected with albinism.
- Altrices.* Birds reared in the nest and fed by the parents.
- Altricial.* Having the nature of Altrices.
- Alula.* Literally little wing. The bastard wing, composed of the feathers that are set on the so-called thumb.
- Antæ.* Frontal points; projection of feathers on either side of base of culmen.
- Anus.* Outlet of refuse of digestion. In birds the same orifice discharges the products of the genito-urinary organs.
- Arcuate.* Bow-shaped; bent regularly and gradually.
- Attenuate.* Growing gradually slenderer towards an extremity; or, narrowly produced for a long distance; in either case necessarily sharp-pointed which would be rather *acuminate*.
- Aural or Auricular.* Pertaining to the ear.
- Auriculars.* Peculiar feathers covering the ear-opening.
- Autumnal Plumage.* That ensuing from the first moult, if any, or prior to the spring moult, from which it is different in many birds.
- Axillar or Axillary.* Pertaining to the arm-pit.
- Axillaries.* Lengthened or otherwise distinguished feathers growing from the axillary region.
- Azygos.* Single, in the sense of not paired.

B

- Back.* Upper surface of body proper.
- Band or bar.* Any cross-wise color mark, transverse to long axis of the body.
- Bel.* Bar or band of color more or less completely encircling the body.
- Bend of Wing.* Angle or prominence formed at carpus in the folded wing.

- Booted.* Having the tarsal envelope entire, i. e. undivided in most or all of its extent, by fusion of the usual scales or plates.
- Breast.* Anterior portion of lower part of trunk between jugulum and abdomen; properly the region overlying and containing the breast-bone, but generally restricted to the more forward *swelling* portion of such region.
- Bristle.* Small, stiff, hair-like feather, especially about the mouth or eyes.

C

- Cæcum.* Intestinal cul-de-sac at junction of smaller and larger intestines, usually present paired in birds; sometimes a foot long.
- Calcareous.* Chalky.
- Canthus.* Corner of eye where the lids meet; commissural point of eyelids.
- Caput.* Head.
- Carinate.* Keeled; ridged beneath as if keeled; having a keel, as the sternum of most birds.
- Carneous.* Fleishy.
- Carotid.* The principle blood vessel of the neck, single in most birds, sometimes paired as in mammalia.
- Carpal Angle.* Prominence formed at the wrist joint when the wing is closed. It is an important point regionally, since the universally used measurement "length of wing," is from this point to the end of the longest quill.
- Cere.* Fleishy, cutaneous or membranous, often feathered, covering of base of bill of many birds, as parrots, hawks and owls.
- Cervical.* Pertaining to the hind-neck, as, a *cervical* collar.
- Cervix.* The hind-neck; from occiput to interscapulium, including nape and scruff.
- Cheek.* Outside of base of lower jaw; also the corresponding region of upper jaw.
- Chin.* Space between forks of lower jaws.
- Ciliated.* Bristly, furnished with bristles or small bristle-like feathers; fringed.
- Clavicle.* Collar-bone. In birds the two clavicles usually unite to form the furculum, merry-thought or wish-bone.
- Collar.* Ring of color around neck.
- Coloration.* Coloring; pattern or mode of coloring, or the colors collectively.
- Commissure.* Line of closure of the two mandibles; track or trace of their opposed edge when the jaws are closed.
- Compressed.* Narrowed sidewise; higher than wide.
- Coracoid.* A large stout bone connecting shoulder with sternum.
- Crest.* Any lengthened feathers on top or sides of head.
- Crissum.* Properly the under tail-coverts collectively. Oftener used to designate the circum-anal plumage.
- Crown.* Pileus; top of head, especially the vertex.
- Culmen.* Ridge of upper mandible; highest median lengthwise line of the bill.
- Cuneate, cuneiform.* Wedge-shaped. A cuneate tail has the middle feathers longest, the rest successively regularly shortened.

D

- Deciduous.* Temporary; falling early. The dorsal plumes of the egret are deciduous.
- Decomposed.* Separate; standing apart. A *decomposed* crest has the feathers standing away from each other.

Decurved. Gradually curved downward.

Dentirostral. Having the bill notched as if toothed.

Depressed. Flattened vertically. Opposite of *Compressed*.

Desmognathous. Having the palate bones united.

Diagnostic. Distinctively and exclusively characteristic.

Diaphragm. Midriff; musculo-tendinous partition between thorax and abdomen, rudimentary or wanting in birds.

Dichromatic. Of two colors, as the "red" and "gray" plumages of *Scops asio*.

Divaricate. Branching off; spreading apart, curving away.

Dorsal. Pertaining to the back.

Dorsum. Back; upper surface of trunk from neck to rump.

Down. Small soft feathers of plumulaceous structure, generally growing about the roots of *plumæ* and concealed by them.

Dusky. Of any undefined dark color.

E

Eared. Having lengthened or highly colored auricular or other feathers on the side of the head.

Emarginate. Notched at the end; slightly forked, especially in case of a tail so shaped; also notched, or abruptly narrowed along the edge in its continuity, as the border of many a wing-quill.

Epignathous. Hook-billed.

Erectile. Susceptible of being raised, as a crest.

Erythrism. A particular state of plumage characterized by excess of red pigment.

Even. Having all the feathers of equal length.

F

Falcate. Sickle-shaped; scythe-shaped.

Family. Systematic group of the grade between order and genus, generally distinguished or denoted by the termination *-idæ*.

Femoral. Pertaining to the thigh, or part of leg from hip to knee.

Fenestrate. Furnished with openings.

Ferrugineous or Ferruginous. Rusty-red.

Filiform. Thread-like.

Fissipalmate. Lobed and semipalmate as a grebe's foot is.

Fissiped. Having cleft toes Opposed to *Palmiped*.

Fissirostral. Having the bill cleft far beyond the base of its horny part.

Flank. Hinder part of side of trunk.

Forehead. Front of head from bill to crown.

Foreneck. Whole front of collum, from chin to breast; whole throat.

Forficte. Deeply forked.

Forked (tail). Having the outer feathers longest, the rest gradually successively shortening to the middle pair; when these are again lengthened somewhat, the tail is said to be *doubly forked*.

Fossa, fossæ Used chiefly in the plural to denote the pits or grooves in which most birds' nostrils open.

Fossorial. Digging into the earth for its habitation.

Free. Said of the leg when not enclosed to the knee in the common integument of the body.

Fuliginous. Sooty-brown ; dark smoky brown.

Fulvous. Of a brownish-yellow color.

Furcate. Forked ; forficcate.

Fuscous. Of a dark-brown color.

G

Gape. Opening of the mouth ; area of the open mouth.

Gastræum. The whole under part of the bird.

Genus. An assemblage of species, or a single species, constituting a taxonomic group of value next below that of the family.

Gibbous. Swollen ; protuberant ; humped.

Gonydeal. Pertaining to the mandibular symphysis.

Gonys. Keel or lower outline of the bill as far as the mandibular rami are united.

Gorget. Throat-patch, distinguished by color or texture of the feathers.

Graduated. Changing length at regular intervals, in regular succession ; said chiefly of the tail when its feathers regularly shorten successively by more and more from the middle to the outer.

Granulate. Roughened with numerous small elevations.

Greater Wing-coverts. The single, longest, most posterior series of the secondary set.

Ground-color. The color of the general surface of the egg-shell, as distinguished from its markings.

Gular. Pertaining to the upper foreneck.

Guttate. Having drop-shaped spots.

H

Habitat. Locality or region frequented by a species ; its geographical distribution.

Hallux. The hind toe. The name is retained even when the hind toe is brought around to the front. When the toes are in pairs it is the inner of the two hind ones except in *Trogonidæ*. In the genus *Picoides* the actual single hind toe is not the hallux but the fourth toe reversed, there being no hallux. This too may always be recognized by presence of not more than two joints. It is the one usually wanting in three-toed birds, and is frequently rudimentary or functionless, even when present. Its large size, with largest claw, and specialization of its flexor muscle, marks the passerine or highest group of birds.

Hexagonal. Having six sides and edges.

Hoary. Of a pale silvery-gray.

I

Identification. Act or process of determining to what species a specimen or a name belongs ; the determination so made.

Imbricated. Fixed shingle-wise with overlapping edge or end.

Immaculate. Unspotted ; not marked with different colors.

Immature. Not having yet assumed final size, shape, color, or other conditions of the adult.

Imperforate. Not pierced through ; also closed up (said chiefly of the nostrils).

Incised. Cut out ; cut away.

Incumbent. Depressed or bending down upon something ; laid at full length ; chiefly said of the hind toe when its whole length rests upon the ground or other support owing to its low insertion on the level of the rest.

Inner toe. In most birds the second is the inner anterior toe; in the trogons, the third or middle toe becomes inner anterior by reversion of the second, which is then inner posterior. In several birds the hallux or first or hinder toe is reversed, and becomes inner anterior. But in any position the *inner toe*, properly speaking, is the second, that one with only three joints.

Insistent. Said of the hind toe when its base is so elevated that its tip only touches the ground.

Interramal. Between the forks or rami of the lower jaw.

Interscapular. Between the shoulders. The plural *interscapulars* or interscapularies is used to denote the feathers of such region collectively.

Iridescent. Glittering with many colors, which change in different lights.

J

Jugulum. Lower throat; lower foreneck.

L

Lamella, Lamina. A thin plate or scale; plate-like process. The processes inside a duck's bill are lamellæ; the individual barbs of a feather are laminæ.

Lamellirostral. Having a lamellate bill.

Lanceolate. Lance-head shaped; tapering narrowly at one end, less so at the other.

Larynx. Adam's-apple; hollow cartilaginous organ, a modification of the windpipe either at the top or bottom, but especially the former; the lower larynx being called *Syrinx*.

Lesser Wing-coverts. The smaller anterior set of secondary coverts in several series upon the *plica alaris*.

Linear. Narrow with straight parallel sides; uniformly narrow for a long distance.

Lobate, Lobed. Furnished with membranous flaps (said chiefly of toes).

Lobe. Membranous flap (generally curved, but may be straight-edged).

Long-exserted. Said of tail-feathers abruptly much longer than the rest.

Loral. Pertaining to the lore.

Lore. Space between eye and bill.

Lower Wing-coverts. See *Tetrices*.

Lower Tail-coverts. See *Crissum*.

Lunulate. Narrowly crescentic.

Luteous. Clay-colored.

M

Maculate. Spotted.

Mandible. Jaw. Properly the *under jaw*, the upper jaw being *maxilla*.

Marbling. Fine spotting and streaking intermixed; variegation like marble.

Maxilla. Jaw, especially the upper jaw.

Maxillar, Maxillary. Pertaining to the upper jaw.

Melanism. State of coloration resulting from excess of black or dark pigment; a frequent condition of hawks.

Melanistic, Melanotic. Affected with melanism.

Membrane. Soft skinny covering of the bill of many birds is said to be *membranous*.

Webbing of toes is the interdigital membrane.

Mental. Pertaining to the chin.

Mentum. Chin. Soft parts between the branches of the lower jaw.

Metagnathous. Cross-billed; having the points of the mandibles passing each other on the right and left.

Middle Toe. The third toe in order of reckoning, with few exceptions four-jointed. When the fourth toe is reversed, it becomes the *outer* anterior toe; in a few birds in which the true inner or second toe is wanting, it becomes the inner anterior toe. It is never versatile. It rarely has only three joints like the second toe.

Middle Wing-coverts or Median Coverts. The series of upper coverts of the secondary set, situate in one or more rows between the greater and lesser coverts. They are usually recognized by their overlapping each other in the reverse direction (i. e. inner border of one overlapping outer border of the next one) from the others, whence they are sometimes called *teatrices perversæ*.

Migration. Periodical (but sometimes irregular) journeyings, or changes of abode, of birds at certain seasons, to secure food, climate, or other physical conditions of environment best suited to their wants. Migration is generally meridional (north-south) and believed by some to be mainly accomplished along a magnetic meridian; but it is often quite otherwise, influenced by topography, etc., or altogether capricious. In the Northern Hemisphere, vernal migration is northward, the autumnal in the opposite direction.

Monogamous. Pairing; mating with a single one of the opposite sex. Birds of which the male assists in incubation and care of the young are called *doubly* monogamous.

Mucronate. Spine-tipped, as the tail of a swift.

N

Naris, pl. Nares. The nostril.

Nasal. Pertaining to the nostril.

Natatorial. Capable of swimming; belonging to swimming birds.

Nidification. Nest building; mode of nesting.

Nomenclature. The sum of the words or terms peculiar to any department of knowledge; as, ornithological *nomenclature*; in this sense equivalent to terminology. Also, the naming of objects according to some fixed principle; as, the binomial *nomenclature*. It is essential to the integrity of nomenclature that it should rest upon classification or *taxonomy*.

Nucha. Nape; upper part of cervix, next to occiput.

Nuchal. Pertaining to the nape.

O

Obscure. Dark; not evident; little known; faintly marked.

Occipital. Pertaining to the hind head.

Occiput. The hind head.

Ochrey, Ochreous. Color of yellow ochre.

Œsophagus. Gullet; tube conveying food from mouth to stomach.

Olivaceous. Of a mixed green and brown color.

Oölogy. Science of birds' eggs.

Order. In classification a group between family and class.

Ordinal. Having the taxonomic rank or value of an order.

Oscines. A group of singing-birds, possessing a complex vocal organ of numerous syringeal muscles, conferring musical ability. These are regarded as the highest or most perfectly developed of their class.

P

Palæarctic. Indigenous to the northern parts of the Eastern Hemisphere.

Palæogean. Indigenous to the Eastern Hemisphere, or "Old World."

Palatal, Palatine. Pertaining to the palate; *palatine* is said especially of certain bones.

Palate. Roof of mouth.

Palmate, Palmated, Palmiped. Web-footed; having the anterior toes full-webbed.

Palpebral. Pertaining to the eyelids.

Papilla. Small fleshy, nipple-like prominences.

Papillate, Papillose. Having papillæ.

Paragnathous. Having both mandibles of equal length, their tips meeting.

Parasitic. Habitually making use of other birds' nests.

Parotid. Pertaining to the ear. Especially a salivary gland situated near the ear.

Passeres. A group of birds including sparrows and all the higher birds.

Pectinate. Having tooth-like projections like those of a comb.

Pectoral. Pertaining to the breast.

Perforate. Pierced through (especially of the nostrils when without a septum).

Perforious. Open. Used synonymous with *perforate* in respect of the nostrils, but better restricted to the opposite of impervious or closed (as to an *external* opening).

Phalanx, pl. phalanges. Commonly any bone of a finger or toe.

Pinnated. Having little wing-like tufts of feathers on the neck.

Polygamous. Mating with more than one female, like the domestic cock.

Postorbital. Situate behind the eye.

Powder-down Feathers. Peculiar imperfect feathers, in a matted *patch*, which grow continually, and as constantly break down, with a scurfy exfoliation, and pervaded with a greasy substance; they are especially conspicuous in the heron tribe but are found elsewhere.

Præoces. An obsolete group of birds, able to run about and feed themselves at birth.

Primary, pl. primaries. Any one of the (usually ten, often nine, rarely eleven) large stiff quills growing upon the pinion or hand-bone, as distinguished from the secondaries which grow upon the forearm. They form the tip of the wing and much of its surface.

Protractile, Protrusile. Susceptible of being thrust forward or out, as the tongue of most woodpeckers.

Psilopædes. A group of psilopædic birds, distinguished by being born weak and helpless, fed and reared in the nest.

Psilopædic. Having down growing only from the future pteryæ, as the precursor of the future plumage, to which it is subsequently affixed for a while and then falls off.

Pterylosis. Plumage, considered with reference to its distribution on the skin.

Ptilopædic. Clothed at birth with floccus.

Punctate. Dotted; pitted; studded with points.

Pygopodes. A group of birds distinguished by the far backward position, and deep burial, in common integument, of the legs.

R

Recurved. Bent regularly and gradually upward.

Reflected. Turned backwards.

Reflection. Play of color changing in different lights.

Remiges. Quills of the wing.

- Reticulate.* Marked with a network of lines.
- Retractile.* Susceptible of being drawn back and driven forward as a hawk's claw.
- Retrices.* Quills of the tail.
- Rictus.* Gape of the mouth.
- Rounded (tail).* Having the central feathers longest, the rest successively gradually and slightly shorter. A tail is *double-rounded* when, with central feathers shorter than the next, the rest are graduated as before.
- Rudimentary.* Undeveloped; imperfectly elaborated; existing only in its beginnings.
- Ruff.* Set of lengthened or otherwise modified or peculiarly colored feathers around the throat or whole neck.
- Rugose.* Wrinkled.
- Rump.* The lower back.

S

- Saggitate.* Arrow-head shape; an elongated cordate figure with pointed lobes.
- Scabrous.* Scabby; scurfy; scaly. Said of a surface roughened as if in such manner.
- Scansorial.* Capable of climbing, as a woodpecker.
- Scapular, Scapulars.* The feathers growing in an oblique line across the humerus. They fill what would otherwise be an interval between the wing and the body.
- Schizognathous.* Having the palate bones separated.
- Scutellum, pl. Scutella.* Any one of the divisions into which the podotheca may be broken up by regular lines of impression; especially such divisions when large and in regular vertical series; various smaller divisions being called *reticulations*. *Scutella* occur especially on the anterior face of the tarsus and top of the toes; often also on the back of the tarsus; sometimes they completely encircle the tarsus. When thus large, some ornithologists call them *scuta*; then using *scutella* for the smaller irregular reticulations. *Scutella* are sometimes obsolete.
- Secondary-coverts.* The small wing-feathers growing from the forearm and its region, overlying the bases of the secondary quills.
- Secondary Quills or Secondaries.* Quills growing upon the forearm.
- Semipalmate.* Half-webbed; having a basal webbing between the front toes not reaching to their ends.
- Serrate.* Toothed like a saw.
- Speculum.* Mirror; brightly colored area on the secondaries, especially of ducks.
- Spurious.* False; bastard; imperfect; rudimentary.
- Spurious Quill.* The first primary when very short.
- Steganopodous.* Having all four toes fully webbed.
- Suffrago.* The tibio-tarsal joint; the heel joint.
- Sulcus.* A groove or channel.
- Superciliary.* Pertaining to region of eye-brow, as a streak of color over the eye.
- Syndactyle.* Having two toes immovably coherent for a considerable distance.
- Synonym.* A different word of the same or similar meaning.
- Syrinx.* The lower larynx, situate at the bottom of the trachea, at the fork of the bronchi. The vocal organ of birds.

T

- Tail-coverts.* The small feathers underlying or overlying the base of the tail.
- Tarso-metatarsus.* The morphologically correct term for the segment, commonly called the tarsus in descriptive ornithology—that bone reaching from the tibia to the toes, and which is really nearly all metatarsus, but has at its top one of the small tarsal

bones confluent with it, so that in itself it comprehends part of tarsus as well as all of metatarsus.

Tarsus. The ankle bones collectively. In birds there are no persistently separate tarsal bones, since the two proximal ones are confluent with the extremity of the tibia, forming its so called malleoli, and the distal one anchyloses with the metatarsus, leaving the tarsal joint between them, as in reptiles, not between the tarsal bones and the tibia, as in mammalia. But in descriptive ornithology, the whole segment between the tibia and the toes, commonly called the shank, is usually called *tarsus*.

Tectrices. Coverts; the smaller feathers, either of wing or tail, but especially of the former.

Tenuirostral. Slender-billed.

Tertials, Tertiaries. Large inner quills of wings growing from humerus or elbow. The two or three longer inner true secondaries are often incorrectly called tertials, especially when distinguished by size, shape, and color from the rest of the secondaries.

Tibia. Principal and inner bone of leg between knee and heel; the shin bone.

Tomium, pl. tomia. The cutting edge of the bill.

Totipalmate. Having all four toes webbed.

Truncate. Cut squarely off.

Type. Way; plan; mode. Also, sign or symbol. The *type*, or *typical form*, of a group is that which exhibits a given set of characters most perfectly. But the type of a genus is usually the species, if any, from which the generic characters were especially drawn up, without reference to such qualification; while, furthermore, the *type* of a species, in current acceptation, is merely the specimen from which the species was originally described; even though it may very inadequately represent such species.

Typical. Of most usual structure; adhering strictly to a given plan of structure.

V

Variety. A nascent species. Practically, the term designates a set of objects incompletely distinguished from the others of the same species by reason of slightness of the difference, or presence of connecting links.

Versatile. Reversible; susceptible of turning either way.

Vertex. Crown. Highest central portion of top of head.

W

Washed. As if overlaid with a thin layer of different color.

SECTION III.

REPORT ON THE
REPTILES AND AMPHIBIANS
OF OHIO.

BY W. H. SMITH, M. D., PH.D.

LETTER OF TRANSMISSAL.

Professor J. S. NEWBERRY, Chief Geologist :

DEAR SIR: I have the honor herewith to transmit the following synoptical and descriptive catalogue of the Reptiles and Amphibians of Ohio.

While the aim has been to make this a fair presentation of the fauna of the State, it has also been an object to render the facts pertaining to these animals as accessible as possible to persons desiring to gain information. The data upon which this catalogue is founded are not only the collections received from Ohio but also the works of previous writers on Herpetology, the results of whose researches have often been employed.

Under the head of habitat is given the range of each animal outside of the State, so far as specimens present would admit, or as was found recorded in the writings of some competent authority. Whenever there was a reasonable degree of doubt as to an animal occurring in a region it has been indicated by an interrogation or quotation mark; and though in other cases there might be the best of reasons for believing the range of the animal more extensive than here given, in the absence of a recorded observation or specimen it has not been indicated.

While it is hoped that the lists here given will prove reasonably complete, it is undoubtedly true that a more careful survey of the State by one versed in Herpetology would add other and very desirable facts to the results herein contained. To enable any one using this synopsis to recognize species not now recorded from Ohio in case they occur there, as well as to render this catalogue more valuable for comparison with neighboring States, various references to, as well as lists of, extralimital species occurring nearest to our limits are given. It is also hoped that the references to other authors may prove an aid to at least some students of Herpetology.

Finally, the writer takes pleasure in rendering acknowledgements first of all, to Prof. Tuttle, of the Ohio State University, who generously placed a fine set of Reptiles collected in the State at his disposal. Considering that he and Prof. Tuttle had never met, but were entire strangers, and that the latter gentlemen could have been actuated solely by a desire to aid science, his action is worthy of high commendation. The collection thus forwarded to the writer was of value in that it contained two specimens which otherwise he would not have been able to locate in the State. The author also received a like generous treatment from Oberlin College and Michigan University, both of which institutions place their entire collections at his disposal. He is also under obligations to the various authors who have written upon this subject, but without attempting to enumerate them in detail he will simply say that among the best of these may be mentioned Baird and Girard's excellent Catalogue of N. A. Serpents,

Agassiz's Contributions to Natural History, Dumeril and Bibron's Erpetologie, the Catalogues of the British Museum, DeKay's Reptiles of New York, Prof. Cope's Check List, and Mitchell's Researches upon Crotalus Poisoning. With this acknowledgement of obligation and with gratitude for all favors received.

I am, sir, very respectfully yours,

W. H. SMITH.

ST. CLAIR, MICH., *April*, 13, 1881.

REPORT

ON THE

REPTILES AND AMPHIBIANS OF OHIO.

BY W. H. SMITH, M. D., PH. D.

INTRODUCTION.

There are in the State at least thirty-six species of Reptiles and twenty-five Amphibians. That vulgar prejudice exists against many of these animals, which leads to their being killed wherever met, is a common place truth. To show how ill-founded is this prejudice it is only necessary to say that there are probably in the State but three animals, *Crotalus durissus*, Banded Rattlesnake, *Crotalophorus terginus*, Massassauga, and *Ancistrodon contortrix*, the Copperhead, which are at all venomous. The remainder are perfectly harmless.

However, these creatures do not simply fail of doing evil. They often do positive good. Thus the office of such animals as frogs, salamanders, lizards and some snakes, in devouring noxious insects and other vermin, is a very important one, and has a direct bearing upon the agricultural interests of the State. It remains then a question whether farmers will continue to misunderstand and destroy these true friends of theirs or whether they shall be protected.

The food of some of these animals furnishes an interesting object for study. Thus the common Bull Frog, *Rana catesbiana*, has been known to eat insects, helices, worms, mice, spiders preserved in alcohol, and even their own species. Two instances of this came under my personal observation. In one case having placed two frogs in a jar over night I was surprised in the morning to find the smaller one, which was about one-third the size of the other, had disappeared. To avoid the possibility of mistake, the remaining one was killed, opened, and the other found in his stomach in a semi-digested state, In the other case a large frog was seen in the

very act of swallowing one about half his own size. I have subsequently seen snakes in the stomachs of other snakes, salamanders in other salamanders, and it may be an interesting question as to how far this cannibalistic habit obtains throughout the animal kingdom.

In the stomach of this same species, Allen* found a *Chrysemis picta* or Painted Tortoise, one and a half inches long, and saw it seize a cedar bird which he had shot, and which the frog proceeded to swallow, although the wings and tail projected from its mouth, and there it sat waiting quietly for the lower end to digest. The same gentlemen, as well as Dr. Brewer,† states that they have seen it swallow young ducks, and it is a common belief of Massachusetts farmers that it robs them of their young chickens. The story by Dr. Jones‡ of finding a grass snake in the stomach of a large bull frog is so remarkable that we may reasonably hesitate about accepting it until confirmed by other observers.

Other frogs probably use similar food; in fact, the writer has observed the *Rana halecina* or Leopard Frog in the act of swallowing its own species, and has found the elytra of beetles in their stomachs. And as these animals, as well as toads, lizards, salamanders, and some snakes subsist chiefly upon insects, they aid in keeping down the multiplicity of these pests, and are thus beneficial.

The tadpoles or young of frogs, and probably also of salamanders live almost, or entirely, upon vegetable matter. However, in some cases they are said to have eaten decomposing animal matter, and even other tadpoles. Prof. Baird states that this may be taken advantage of to clean skeletons by placing the two together in water. The larval *Rana sylvatica* he found to be the most effective, as these devoured the macerated flesh, leaving a ligamentous skeleton. Their food primarily is vegetable, and it is probable that they never attack their own species unless driven by hunger or after they have attained a good degree of development.

The frog is, usually at least, very cautious in regard to its method of taking food. It ordinarily approaches and first touches the prey with its tongue, then retires and afterwards returning with a spring, seizes, holds, and manipulates it dextrously with the fingers of its anterior feet, then closes its eyes, and forces the animal head foremost downwards into the stomach. During this operation, if interrupted, it jerks and kicks vigorously so long as the intruder continues its annoyance.

The toad is a voracious feeder. It has been observed to eat nine wasps, one after the other, but would take no more. The same afternoon it

* Proc. Boston Soc. Nat. Hist., Vol. 12, pp. 185-197.

† Proc. Boston Soc. Nat. Hist., Vol. 5, p. 211.

‡ Chemical and Physical Investigations, Smithsonian Contributions, Vol. 8.

greedily devoured eight additional ones. It eats worms and insects of every kind, but prefers bees and wasps. It will not touch a dead animal, even though just killed, but waits for its prey to stir before seizing it. On taking bees and wasps, instead of swallowing them immediately, it presses them between its jaws until death occurs, and thus avoids their sting.

When an insect drops before a toad at rest, the latter immediately arouses from its torpor, and with animation moves towards its prey. It halts, pointer-like, at a proper distance, and finally with lightning-like swiftness darts out its tongue and brings the animal into its mouth. A miss of its mark is not followed by a second attempt until the insect begins to move.

As these animals hybernate, are cold blooded and sluggish, they can go for a long time without food. Hallowell kept a *Proteus anguinus* thirteen months without nourishment, and, so far as observed, the animal suffered no inconvenience. And yet there is a limitation to their powers of endurance. The stories so often repeated about finding them immured in rocks cannot be sustained; in all these cases probably some cavity, by which they had entered when small, and through which they continued to receive air and food, had probably been overlooked. At all events it has been experimentally proved that toads cannot live twelve months when deprived of air, nor two years without food.

In regard to the tailed Amphibians, they are all insectivorous, *Spelerpes porphyriticus* having been observed in the very act of eating flies, while the contents of the stomach in others leaves no doubt as to their diet. Thus, in *Notophthalmus viridescens* or Crimson Triton was found insects, spiders, physa, and lymnea; in *Plethodon erythronotus* were small mollusks; while in *Spelerpes ruber* or Red Salamander occurred worms, elytra of beetles, and the remains of other salamanders. In like manner *Salamandra maculosa* has been shown to eat flies, beetles, young snails, and worms. *Menobanchus lateralis* undoubtedly feeds upon Annelids and Libellula larvæ, while *Menopoma alleghaniensis*, the Alleghany Hellbender eats worms, fish, crawfish, and the like.

Lizards are insectivorous, though as to their additional articles of diet the writer as yet has no information.

Turtles undoubtedly vary in their food. *Cistudo clausa* has been seen to eat insects and an Agaric or mushroom; the Green and Gopher Turtles are vegetarian, the latter being fond of sweet potatoes, melons, and bulbous roots, and injuring gardens; *Chrysemys picta*, the Painted Turtle, and *Nanemys guttatus*, the Spotted Tortoise, eat worms, insects, frogs, aquatic reptiles, and probably also the water plantain; *Chelydra serpentina*,

the Snapping Turtle, preys upon frogs, fishes, and young ducks; while *Trionyx ferox* is said to feed upon fish and small aquatic reptiles.

Serpents vary full as much as turtles in regard to food. For instance *Liopeltis vernalis*, the Green Snake, is insectivorous; *Diadophis punctatus* the Ring-necked Snake, eats worms, insects, and grubs; *Storeria dekayi*, the Little Brown Snake, has been found with the elytra of beetles in its stomach; *Eutænia sirtalis* feeds upon frogs, toads, and small quadrupeds; *Abastor erythrogrammus* takes rats; *Bascanion flagelliforme*, the Coach-whip Snake, preys upon birds; *Boa Constrictors* and *Pythons* swallow their species; *Ancistrodon contortrix*, the Copperhead, eats mice, Ranidæ, and small birds; *Ptygophis melanoleucus* takes mice, rats, rabbits, and young chickens; *Ophibolus triangulus* uses frogs and toads; *Bascanion constrictor*, the Blue Racer, consumes frogs, small birds, and other snakes, having been observed swallowing a dead *Eutænia*; while in the stomach of *Tropidonotus sipedon*, the Water Snake, I have found frogs and small fishes, and in *Ophibolus getulus*, the Chain Snake, the remains of other serpents; *Crotalus durissus*, the Rattlesnake, is said to live upon insects, frogs, lizards, mice, moles, young birds, and chickens. Toads are ordinarily believed to be eaten by serpents. However, the writer's experience, having in vain endeavored to feed them to *Bascanion constrictor* and *Crotalophorus tergeminus*, leads him to believe that toads are rarely preyed upon by snakes, but that they are sometimes eaten by *Eutænia sirtalis* and *Ophibolus triangulus* is, it appears, beyond question. The former he has himself seen in the act of swallowing a *Bufo americanus*.

The fangs of the venomous serpents* are firmly soldered to the lower side of the maxillary bone, which joins the lachrymal above by a ginglymoid articulation. Posteriorly it is in contact with the external pterygoid and palate bones. A muscle, the spheno-ptyergoid, which has no analogue in other animals, extends from the base of the cranium in the middle line, backward and outward, to be inserted into the external pterygoid, which by contraction it draws forward, pushing the maxillary before it and causing the fangs to be erected. At the same time, other muscles cause the mouth to be widely opened and the anterior portion of the body to be thrown forward, downward, or backward toward the object aimed at. If the enemy is missed, the venom may spirt several feet, but if struck, another pair of muscles, the external pterygoid, which run from the point of articulation of the lower jaw forwards, and are spread out as a fascial layer over the gland, and inserted by two slips

*For a fuller treatise upon *Crotalus* poisoning, its venom and antidotes, see the excellent article by Dr. S. Wier Mitchell, Smithsonian Cont., vol. xii, to which the author is largely indebted for facts here given.

into the base of the fang, contract, drawing the point of the latter backward, thus deepening the wound, and in part forcing out the venom. This is followed by still another motion or rather two other movements, a rolling outward of the two upper maxillary bones and with them the fangs, so that if the animal misses its aim it may not bite itself, and the closure of the mouth. The latter is effected by various muscles, among which the anterior temporal lies over the posterior two-thirds of the poison sac, and in contracting, forcibly compresses the glands and compels the venom to flow out through the duct and tooth into the wound. That the duct does not enter the tooth is true, but the sheath falling at the base completes the channel, though in rare cases not perfectly, but permits the fluid to escape alongside the fang. After having thus struck its victim, deepened the wound, and injected a sufficient quantity of venom, the animal opens its mouth and lets go its hold. Occasionally it happens that the teeth of the lower jaws become entangled, and the serpent is unable to get away. It will then shake its head from side to side, not as is ordinarily supposed on account of rage, but in its efforts to escape. At times, also, only one of the fangs penetrates the wound, and the victim receives only half the usual amount of venom. In such a case, or in case the venom was spilled outside the fang, or the serpent's supply was exhausted by its having previously bitten an enemy, a physician might be seriously misled as to the effects of a remedy.

In structure, as Prof. Owen* has shown, the fang may be likened unto a simple tooth, flattened and then turned up so as to bring the edges together, thus forming a cylinder or rather a cone open at both ends. The suture is along the anterior or convex side of the tooth, thus bringing the veniferous canal in front of the pulp cavity. The venom is secreted by the glands, and the only cavities for its storage are the ducts, hence the terms poison sacs, vesicles, etc., are misnomers, and ought be abolished.

The average amount of venom thrown out at once by a serpent, three or four feet long, is from two to four drops, though in some cases as much as fifteen drops has been given off through a single fang. By filling the glands with water their capacity has been estimated at from eleven to twenty-nine drops. The color of the venom varies from pale green to orange; its specific gravity is from 10.30 to 10.44; it is tasteless, acid, dries slowly, and is then adhesive, and its virulence is not affected by heat or cold. Heat, however, produces an albuminous precipitate which is harm-

*Comp. Anatomy, Vol. I, p. 396.

less, and if, after filtration, alcohol be added to the liquid part another precipitate will be obtained, containing all its virulent property. The material to which its virulence is due is, therefore, not precipitated by heat, but is by alcohol, and yet this re-agent does not render it inert, as has been shown by injecting the alcoholic precipitate under the skin of animals.

In the treatment of venomous snake-bites it is obvious that any means taken to prevent the poison gaining full egress into the system must be very serviceable. Thus, if the bitten part be a limb, a ligature above the wound will interrupt the circulation and exclude a large portion of the venom. For a similar purpose, scarifying or sucking the wound, or burning it with caustics may be of service. However, any such means to be available must be used speedily after the injury, and their value lessens as we recede from that period. As the venom is supposed to operate by depressing the heart and inducing putrefactive changes in the blood, muscles, and other parts of the system, it is evident that stimulants are always indicated, and in fact, alcohol in some of its forms is among the best remedies; also bathing the wound in ammonia, and ammonia and arsenic internally given, are said to have excellent antidotal effects.

After all, the danger from serpent bites, though serious, is not so bad as is generally believed. In the first place, they are of rare occurrence, and it is only exceptionally that we know of a person who has met with such an accident; and then in the second place, it is exceptional for a person bitten by a venomous serpent to die. The rule is for them to get well. In Dr. Mitchell's sixteen cases there were only four deaths, and this is a fair average mortality. The danger, of course, varies with the amount of poison injected, and the surgical means used to prevent its complete passage into the system. The belief that hogs are not injured can probably be explained on the ground that the virulent matter is absorbed by the adipose tissue and does not enter the circulation.

The question of the virulence of the venom upon the serpent itself has been settled by experiment, and also by Dr. Dearing's* case of a *Crotalus* that accidentally bit himself. The result was the death of the snake. Thus we see that the venom exerts its deadly power, not only upon cold and warm-blooded vertebrates, but upon the animal which produces it. In other words, it is a liquid secreted from the blood, which becomes fatal on being introduced back into the very same source.

Another interesting fact in regard to these animals, to which, I believe,

* Proc. Boston Soc. Nat. Hist., vol. iv, p. 313.

attention has not hitherto been properly directed, is the various modes of protection furnished them by nature. We find the Turtles, for the most part, provided with a union of the cuticle and skeleton into which they can retreat, and which can be closed about them. To see the value of this mode of protection, it is but necessary to endeavor to draw out the head of one, which will be found to be a very difficult task. In a similar manner, the scales, plates, and spines, so common as a dermal covering, have a profound significance, and their color is a matter of too great a value to be overlooked. The Rattlesnakes and Copperheads are provided with fangs, for injecting venom, and the former with a caudal rattle, by the vibration of which it may aid in frightening away its foes. But the color has an important bearing. The young of the venomous *Crotalophorus tergeminus*, and of the harmless *Tropidonotus sipedon* and *Ophibolus triangulus*, bear such a resemblance to each other that it might be considered a case of mimicry. However, the color of these animals is more or less adapted to their surroundings. The Green Snake resembles closely the grass through which it crawls, and the same is true also of the *Storerias* and Striped Snakes. Unless closely examined they could easily escape the eye of the observer. In like manner the markings of frogs furnishes an excellent illustration of adaptation. The green of the Bull-frog and the spots on the Leopard Frog need but be mentioned to be appreciated. *Rana temporaria* var. *sylvatica*, when pursued, conceals itself in grass or leaves, which it resembles so closely as to be discovered with difficulty. The Common American Toad (*Bufo americanus*), might not at first seem to have its colors most suitable for protection, and yet when we see it in its secluded retreats, under stones and in odd corners, and consider its nocturnal habits, the conviction forces itself upon me, that probably no better shades could have been chosen. As desert animals are sand colored, and arctic are white, like the snow, so these animals show a decided adaptation to their surroundings.

The best illustration is furnished by the common Tree Toad. (*Hyla versicolor*). Like the Chameleon, this little animal can change its color, and thus transform itself into a being resembling the limb or branch on which it sits. As Milne Edwards* found in the Chameleon, so in this there are two sets of cutaneous glands, the one superficial and the other deep. The former of these gives it a green coloration, with a golden reflection; the latter are much thicker and dark. They contain many brush-shaped cavities, and the expansion of these towards the circumference determines the color and causes the green tint to disappear, not

*Ann. des Sci. Nat., 1834, p. 46.

only by diminishing its cavities but by expanding its own. In this manner the deep meshes sometimes appear white while the exterior network takes on a pearly aspect. The animal in this manner, by blending in a different degree two or three primitive colors, changes its shade so much that it comes to resemble the object upon which it happens to be. A similar power to vary these colors at will is present to a greater or less extent in all the *Hylidæ*. The advantages of this, in enabling these animals to escape their enemies, and to approach their prey unobserved, is too obvious to be considered here.

In this connection it may be mentioned, that tadpoles sometimes show a mimetic coloring. A case of this kind is recorded by Miss Monk,* in which, being kept in an aquarium with Water Purslane, *Ludwigia palustris*, they imitated almost precisely the color of the leaves. So perfect was the resemblance that a friend visiting her was actually deceived and mistook a leaf for a tadpole. Personally I have seen such cases of imitation, but none sufficiently marked to justify a person being misled in this manner.

Again, the serpents have a remarkable power of enlarging their bodies by the inhalation of air. To understand how this is done it is but necessary to dissect a snake, and observe the situation and length of the lungs. By thus enlarging his body the serpent renders himself more formidable in appearance, and has thus a tendency to frighten away an enemy. Add to this the peculiar blowing sound with which the air is emitted, sometimes as in *Heterodon*, suggesting the rattle of the *Crotalidæ*, and again, as in *Ptyophis*, said to imitate the roaring of a bull, and this matter of exhalation, as well as inhalation, has a profound significance.

Another mode of protection is in the secretion of some of these animals. Thus the frog on being caught usually ejects a quantity of fluid, and also becomes more or less swollen. The use of this ejection was to me a mystery until seeing Mr. Aldrick's† account of a snake gliding upon a frog, when the latter simultaneously jumped and threw this liquid into the mouth and eyes of the serpent. The latter was apparently blinded by the discharge, sprung wildly from side to side, and lost track of his intended prey. This incident seems to indicate that the ejection of this fluid in the frog accomplishes the same purposes as the discharges in the Bombardier Beetles, and enables the Batrachian to escape its enemies.

However this may be, the cutaneous secretions of some Reptiles, and Amphibians are admirably adapted to the purpose of protection.

*Am. Naturalist, vol. xii, p. 695.

†Am. Naturalist, vol. xii, p. 473.

The Musk Tortoise, Serpents, Tree and Common Toad are illustrations of this. No person has ever handled the Common Garter Snake alive without finding his hands for sometime afterwards tainted with a very disgusting odor. Rattlesnakes, on sufficient irritation, have been known to emit a yellow or brownish fluid, and a very offensive smell. In like manner the consequences of annoying the Spreading Adder are very unpleasant to one's olfactory organs. Also, *Pityophis* is said to emit an odor equally disagreeable, and the Tree Frogs have an acrid excretion.

According to Rainey's* experiments the secretions of the Common Toad are irritating, acrid, and capable of producing a smarting sensation like aconite. Dr. Blick's account of the half drunken man, who, in a wager, bit off the head of a toad, and paid for his experiment by an alarming swelling of lips, tongue, and throat, and Dumeril and Bibron's† observation that the emanations from these animals seemed to have an ill-effect upon others when confined together with them, with the fact that a dog will not touch a toad, render it probable that they secrete a matter by the glands on their exterior, which is very important to them as a means of protection. While this is true, the common belief that handling them is productive of warts or other deleterious effects is utterly without foundation, and has its counterpart in the belief of the common people of Great Britain, that if a person afflicted with warts handles a toad it will effect a cure. There is, however, according to Escobar‡ a South American toad, *Phyllobates melanorhina*, which secretes a venom of so great virulence that it is extracted and used by the Indians for poisoning their arrows. This venom is sufficient to effect the death of large animals, like the Jaguar, and is equally fatal to man, exerting its toxic effect by acting upon the organs of sensibility and motion.

The ordinary course of development is for Frogs and Toads, when about to deposit their eggs, to seek the water of some pond, ditch, or brook, and there they pair, the eggs being fecundated as they are emitted. The young when hatched are gill breathing animals, and hence incapable of existing without water. However, the young sometimes appear in cellars and gardens with high walls, which, as Lowe, Jenyns,|| and

* Micros. Journ., London, 1858, p. 457.

† Erpetologie Generale, Suite a Buffon, Tome 8, p. 184.

‡ Comptes Rendus, Tome 68, p. 1488.

|| Ann. and Mag. Nat. Hist., 1853, pp. 341 and 483.

Bennett* observe, can hardly be explained on the supposition that they had passed through the larval state. It is probable, therefore, that as the *Salamandra atra*, which lives high up the Alps, is ovoviviparous, and *Hylodes martinicensis*, of Guadaloupe, † comes forth mature from the egg, so our Amphibians, in part at least, under certain circumstances, bring forth their young in a perfect condition.

Again, physical agents exert an important influence upon the developments of the animals. Thus the larvæ if kept in too deep water will not develop. They grow, but continue in the tadpole state, unless the liquid be shallow. Temperature also plays an important part, it having been found that at 60° F. the ova of frogs will develop most rapidly, and any diminution of temperature is followed by a corresponding retardation of development. The effect of light is rather a mooted question, and yet it is probable, from the experiments of Edwards, Higginbottom ‡ and Thury,|| that its presence hastens and its absence retards their progress; the latter showing that in a green jar, with other conditions equal, tadpoles would not develop, while they did in one constructed of ordinary glass, thus rendering this conclusion highly probable.

Some very recent interesting experiments are recorded on the *Salamandra atra*, an ovoviviparous animal, by Madame von Chauvin.§ It was believed that if the young were removed prematurely from the mother and placed in water they would adapt themselves to an aquatic life. The experiment proved entirely successful, in that one individual lost its gills, developed a new pair suited to respiration, and, after fourteen weeks residence in water, underwent transformation and became a land Salamander. This would seem to indicate, that, at some not very distant day, the *Salamandra atra* and *maculosa* had diverged from a common stock, and that while one continued on in its aquatic mode of reproduction, the other had, owing to changed conditions, become terrestrial.

As regards the geographical distribution of Reptiles, much might be written, but a few facts will only be referred to here. That these animals, like the birds, increase in beauty and variety of markings, and in their venomous properties as they approach the tropics, is an old observa-

* Proc. Am. Ass. for Adv. Sci., 1853, p. 230.

† Am. Naturalist, vol. viii, p. 438.

‡ Ann. and Mag. Nat. Hist., 3d Ser., vol. 15, p. 376.

|| Ibidem, 4th Ser., vol. 15, p. 376. See also Proc. Acad. Nat. Sci., 1867, p. 169.

§ Am. Naturalist, vol. xii, p. 468.

tion. Another important factor, to which Prof. Cope* has directed attention, is the amount of terrestrial and atmospheric moisture. In the Amphibians, which spend nearly or all their life in water, and the aquatic turtles and serpents, the dependence of the species upon this element for distribution is sufficiently manifest. The well-watered eastern border and the Mississippi Valley are the homes of the aquatic Reptilian and Amphibian life, while the dry and almost barren region from Mexico to Arizona and Nevada is characterized by the predominance of Lizards, Toads, and Snakes with an extraordinary development of the rostral shield. The latter characteristic, seen in our Hog-nose Snake, probably is in some way useful to the animal in removing the sand in which it either burrows for concealment or seeks for food. A peculiar foot structure, or movable spines on the side of the leg, may find a similar explanation, while the prolongation of the nostrils forward in our *Trionychidæ*, or Soft-shelled Turtles, is a character adapted to their habits of life, they living buried in mud, and only bringing this proboscis to the surface to accomplish the work of respiration.

In a similar manner may be traced a relation between the powers of endurance of these animals and the extent of their distribution. Thus Amphibians will endure more cold than the Ophidians, and hence extend farther northward. In the writer's, and, so far as his knowledge goes, other's efforts to keep serpents over the winter, they, if once frozen stiff, invariably failed to resuscitate, but a frog, even when taken out of the ice and gradually thawed, comes forth to an apparently new life. The modes of progression, serpents being limbless, the scarcity or abundance of food, the enemies of a species, and the method of reproduction, have important bearings. It cannot be expected that snakes which propagate only when several years old, oviposit usually in the hotter parts of summer, and then lay only a few eggs, should compete with the more enduring frogs and toads, which have such a numerous progeny. Owing to such causes one would expect what is actually found to be the case, that the Amphibians are far more abundantly distributed over the earth than are the Ophidians.

In the Western Continent, Dr. Günther has shown that we have two apparently distinct creations, the one radiating from the Valley of the Amazon; the other from that of the Mississippi. That these faunas meet and mingle along Northern Mexico, Western Texas, Arizona, and Nevada, is a fact abundantly attested. To these might perhaps be added the mixed life of the Pacific region, and that radiating from the Mississippi

* Proc. Am. Ass. Adv. Sci., 1875, B. p. 197.

Valley, as first pointed out by Agassiz for Turtles, and afterwards divided by Cope, into an Eastern, Southern, and Western fauna.

Finally, in regard to classification, the study of these animals has been rendered needlessly complicated. Naturalists have seemed so eager to append their names to a new species that, instead of examining to see what others had done before them, they affixed a new name to a large per cent, at least, of the animals met. The truth of this statement is evident from the abundant synonyms by which nearly all these animals are known. In some cases again, the most careful and conscientious observers have been misled, and considered varietal differences specific characteristics. Such a principle followed out in regard to the human race would give us numerous species of men founded on as valid grounds as have been many of the species of animals. Moreover, in regard to the separation of these animals into genera, families, sub-orders, etc., naturalists have changed each others names and arrangement, often for better, but too many times apparently for the sake simply of a change, and to the disadvantage of science.

In selecting marks of species, families, and orders, much difficulty must be experienced. To any one who has made a careful and thoughtful study of osteological characters, these, though among the best, are insufficient. Thus the bones of the same animal vary, not only in the extent of ossification, but in number with age. Nor are the anatomical relations of the soft parts any more valid. Let a person examine the structure of a frog and tadpole, and he would unquestionably pronounce them to be distinct species. On the other hand the teeth, their shape, presence or absence, the matter of having a grooved or hollow poison fang, indicate a habit of the animal, and are, to a certain extent at least, valuable grounds of classification. The same remark will apply to the presence or absence of a tongue in the Amphibians, its shape and attachments, and whether protrusible or not, so as to become an instrument of prehension. In a similar manner the palmation of the toes indicating an aquatic animal, and the dilatation of the tips showing an arboreal habit, the projecting rostral in *Heterodon*, the soft shell and prolonged nostrils in the *Trionychidæ*, the presence of parotoids, the granulation of the abdomen, the covering of the head, the scales whether carinate or not, the presence of spines or thorns, and femoral pores, as well as the transverse lamellæ seen on the feet of *Anolis*, seem to be tolerably constant and consequently valuable in classification. These should be combined with osteological and other characters carefully used, and also taken with a diligent study of the animal's habits, and thus in time we may hope to get a valuable and permanent arrangement. Until such a redistribution can be made,

the following classifications of Dumeril and Bibron of Ophidia and Lacertilia, and Günther of Anoura, and Agassiz, as modified by Cope, of Testudinata, are perhaps the best attainable.

That many of the marks used in describing species in this treatise are not constant, the writer and every student of Herpetology well knows. Thus the presence and absence of a loreal or ante-orbital plate may both be seen in the same animal on opposite sides of the head; the number of rows of dorsal scales varies in different individuals of a species; the coloration and arrangements of the spots and stripes, the number of the upper and lower labials, in fact the cephalic plates are liable to become more or less fused and run together; the number and arrangement of the shields in the carapax, and even the shape of the head is more or less variable. In using such marks, for the purposes of description, the writer but acknowledges the imperfections of this branch of Zoology, and hopes that after this suggestion, no one will be misled by any of these variable characters at times used in the synopses, but that they may be found of service in the identification and study of the species.

One of the most difficult things about the study of these animals is that their colors change so much when placed in alcohol. Thus yellow becomes white; green, blue; and red, brownish-black; while brown and metallic tints remain for some time unchanged. However, exposure to the sun for a season will often enable us to form an idea of the original shade.

Sex may be told in most if not all Turtles by the males having convex plastra, and in the Anoura by the males, in the greater portion of the species, being supplied with vocal vesicles.

REPTILIA.

Vertebrate animals characterized by having the blood cold with oval nucleated corpuscles; heart usually with three chambers; circulation incomplete; venous and arterial blood intermingled; aortic arches two, which coalesce or anastomose in front of the dorsal vertebræ; reproduction oviparous or ovoviviparous; embryo with amnion and allantois; respiration pulmonary in young and adult; lungs with few cells; metamorphoses none; occipital condyles one; rami of the lower jaw in several pieces; os quadratum present; nervous system cerebro-spinal; brain small; lateral lobes of cerebellum, corpus callosum, and pons varolii wanting; corpora bigemina upon the upper surface of the brain; epidermal covering in the form of scales or plates. Excrementitious and reproductive organs opening into a cloaca.

Exclusive of the extinct orders, the following synopsis will refer an animal to its proper place:

KEY TO THE ORDERS OF REPTILES.

- Epidermal covering in the form of plates, not united with the skeleton; anal slit longitudinal; teeth conical, in sockets. CROCODILIA.
- Epidermal covering united with the skeleton forming a carapax and plastron; teeth none. TESTUDINATA.
- Epidermal covering in the form of scales, rarely plates, distinct from the skeleton; anal slit transverse; teeth conical. *a.*
 - a.* Eyelids usually present; mouth not dilatable; body usually lacertiloid with four well developed feet. LACERTILIA.
 - a.* Eyelids none; mouth very dilatable; body always serpentiform, without feet; abdomen usually covered with large, entire, transverse scutellæ. OPHIDIA.

CROCODILIA. (Extralimital.)

Body lacertiloid, of large size; dermal armor composed of scutes and overlapping scales; *anal slit longitudinal*; limbs four, well developed, anterior pair shorter, posterior feet more or less palmate; fingers five, toes four; nails on the three preaxial digits usually present; eyelids three, distinct; auditory openings with valves; external nares capable of closure; teeth in a single row, in sockets; tongue thick, fleshy, adherent its entire length, and not protrusible; heart quadrilocular, but with the pulmonary artery and aorta connecting; quadrate bone large; palatines excluding the vomer from the

orbit; parietal foramen none; alisphenoids large; orbitosphenoid rudimentary or wanting; vertebræ completely ossified, procœlous except atlas, dentatus, the two sacra, and first caudal; in extinct species amphi- or opisthocœlous; cervical vertebræ with small ribs; ribs articulating with the vertebræ by means of a head and tubercle; always oviparous.

Inhabit fresh water in hot countries.

The Crocodilians are all extra-limital. The existing forms may be divided as follows:

Muzzle large and flat. *a.*

Muzzle elongated, rounded and dilated at the end. GAVIALIDÆ.

a. Fourth tooth in lower jaw received into a notch on the side of the upper maxillary; hind legs with a toothed fringe, and toes completely palmated.

CROCODILIDÆ.

a. Fourth or canine tooth in lower jaw received into a fossa in the upper; hind legs simply rounded and toes semipalmate. ALLIGATORIDÆ.

Gavialidæ, the Gavials, comprise two genera, *Gavialis*, one species, *G. gangeticus*, inhabiting the Ganges, and *Somiotoma*, two species, in the rivers of Borneo and North Australia.

Crocodilidæ, the Crocodiles, has one genus, *Crocodylus*, with four American, three African, four Asiatic, and one Australian species. On this continent they are not found north of Yucatan, Guatemala, or Cuba, except one species, *Crocodylus americanus*, which occurs in Florida.

Alligatoridæ, the Alligators or Caimans, comprise also but a single genus, *Alligator*, with ten species, and are limited to the New World.

Alligator mississippiensis or *lucius* is the common Alligator of our Southern States. It is dark ash-brown above, paler beneath; dorsal plates with elevations forming disconnected longitudinal ridges; four of these carinate plates upon the neck are arranged quadrately.

CHARACTERS OF REPTILIANS.

	Ophidia.	Testudinata.	Lacertilia.	Crocodylia.
Covering.	Scales.	Carapax and Plastron.	Corneous scales.	Scales and bony plates.
Body.	Serpentiform.	Short and thick.	Lacertiloid or serpentiform.	Lacertiloid.
Limbs.	None.	Four, flexible.	Four, rarely none.	Four.
Teeth.	Not in sockets.	None.	Not in sockets.	In sockets.
Heart.	Trilocular.	Trilocular.	Trilocular.	Quadrilocular.
Pectoral and pelvic arches.	None.	Within ribs.	Outside of ribs or none.	Outside of ribs.
Eyelids.	None.	Present.	Present.	Present.
Rami of the lower jaw.	Unanchylosed.	Anchylosed.	Anchylosed.	
Urinary bladder.	None.	Large.	Present.	
Orbitosphenoïd.	Wanting.	Wanting.	Rudimentary or wanting.	Rudimentary or wanting.
Alisphenoid.	Wanting.	Wanting.	Rudimentary or wanting.	Large.
Anal slit.	Transverse.	Nearly circular.	Transverse.	Longitudinal.

ORDER LACERTILIA. LIZARDS.

Sauria, MIVART, MILNE EDWARDS.

Body usually lacertiloid, in some species serpentiform; *feet usually four*, sometimes two, and occasionally none; *anal slit transverse*; body covered with scales, tubercles, or spines; top of head with plates; eyelids usually movable; teeth conical, not in sockets; heart with auricles and a ventricle, the septum in the latter incomplete; urinary bladder present; vertebræ procœlous except in the Geckos and Sphenodon where they are amphicœlous; sacrales separate, sometimes one, and never exceeding two in number; head of ribs simple, undivided; sternum present except in the serpentiform species; quadrate bone somewhat movable; rami of the lower maxillary usually firmly united; alisphenoids and orbitosphenoids absent or rudimentary; parietal foramen usually distinct; parotic processes long; hyoid a median rod.

The Lacertilia comprise a large order, with numerous species and families. Those inhabiting North America may be arranged as follows:

- * Bones of skull grown together; dorsal region covered with square plates; generative organs simple; feet rudimentary or none. AMPHISBAENIDÆ.
- * Bones of skull distinct; dorsal region usually scaly; penis and vagina bifid; feet usually well developed. *a.*
- a.* Tongue flat, elongate and bifid. *b.*
- a.* Tongue thick, convex, attached at base to œsophagus. *c.*
- b.* Abdominal region covered with roundish scales, quincuncially arranged and resembling those of the back. *d.*
- b.* Abdominal region covered with square plates. *e.*
- c.* Dorsal scales granular; eyes large, almost without lids. GECKOTIDÆ.
- c.* Dorsal scales imbricated; eyes moderate; lids distinct. IGUANIDÆ.
- d.* Eyes and eyelids nearly or quite concealed. *f.*
- d.* Eyes and eyelids prominent. SCINCIDÆ.
- e.* Teeth solid; cephalic shields large. *g.*
- e.* Teeth hollow or grooved behind. *h.*
- f.* Head conical; rostral cup-shaped. TYPHLINIDÆ.
- f.* Head depressed; rostral elongated. TYPHLOPSIDÆ.
- g.* Sides flattened, without lateral fold. *h.*
- g.* Longitudinal lateral fold or stripe present. *i.*
- h.* Cephalic shields small. HELODERMIDÆ.
- h.* Cephalic shields large, regular. *l.*
- i.* Ear distinct. *j.*
- i.* Ear concealed. CHALCIDÆ.
- j.* Limbs two or none; body serpentiform; no femoral pores. ANGUIDÆ.
- j.* Limbs four; body more or less lacertiloid. ZONURIDÆ.
- l.* Supraorbital plate bony. LACERTIDÆ.
- l.* Supraorbital plate horny. TEIDÆ.

Of these families, Amphisbaenidæ has one genus *Rhineura*, with one species, *floridana*, inhabiting Florida; Geckotidæ has four, *Coleonyx*, *Sphærodactylus*, *Phyllodactylus*, and *Diplodactylus*, of which *Sphærodactylus notatus* occurs in Florida, the remainder range from Texas to the Pacific coast; Typhlinidæ has *Aniella pulchra* in California; Typhlopsidæ, one genus, *Stenostoma*, with two species ranging from Texas to the Pacific; Teidæ has *Cnemidophorus* and *Verticaria*; Helodermidæ has *Heloderma horridum* in Mexico;

Lacertidæ has *Xantusia vigilis* in California; Chalcidæ has *Brachypus cuvieri* in British Columbia; Anguidæ, one species, *Ophisaurus ventralis*; Zonuridæ, two genera, *Gerrhonotus* and *Barissa*, the former with six, the latter with a single species, *olivacea*, which range from Texas to California. None of the preceding families occur in the State, but the Iguanidæ and Scincidæ are represented in our limits.

FAMILY SCINCIDÆ. THE SKINKS.

Body lacertiloid; dorsal and ventral region covered with similar imbricated scales, quincuncially arranged; head subtriangular, tapering gradually into the neck; back rounded, without crest or spines; tongue fleshy, squamous, flat, emarginate, and free anteriorly; cephalic plates present; nostril opening into a solitary nasal; prefrontal single; temporal fossa arched; premaxillaries two; mesosternum cruciform; feet four, well developed.

* Supranasals none; lower eyelid with a transparent disk. LYGOSOMA.

* Supranasals a pair; lower eyelid scaly. EUMECES.

GENUS EUMECES. Wiegmann.

Head short, approximately cuneiform; nasal plates one on each side, just behind the rostral; a small pair of supranasals just above; supercillaries above each eye four; occipitals five; post-frontals two; vertical pentagonal; teeth in both jaws in a marginal row; anterior margin of ear dentate; both eyelids scaly; scales smooth and imbricated; toes five on each foot, distinct and provided with claws; tail long, conical, and covered with scales similar to the body.

EUMECES QUINQUELINEATUS Linnæus.

Blue-tailed Skink.

Lacerta fasciata, LINNÆUS, SHAW, LATREILLE.

Lacerta quinquelineata, LINNÆUS, GMELIN, GREEN, SAY.

Scincus tristatus, DAUDIN.

Scincus quinquelineatus, SCHNEIDER, LATREILLE, DAUDIN, KÜHL, MERREM, HARLAN, SCHLEGEL.

Scincus bicolor, HARLAN, CUVIER.

Euprepis tristatus, WAGLER.

Tiliqua bicolor, GRAY.

Scincus fasciatus, HOLBROOK, STORER, DEKAY.

Plestiodon quinquelineatus, DUMERIL and BIBRON, GÜNTHER.

Color bluish-black above with five yellow lines, the vertebral one of which bifurcates on the head, giving off a branch to the right, and another to the left side of the vertical plate; both branches extend to the nostrils where they unite with the nearest lateral lines; the lower lateral line passes from the snout through the auditory opening just above the limbs to the tail; all these lines become indistinct on the caudal extremity, and all disappear with age; abdomen light-bluish; extremities brownish above, bluish or light colored beneath; throat and gular region creamy white; tail deep blue; toes long, anteriorly the second and third of equal length, and posteriorly the second the longest; nostrils small and situated near the muzzle; scales of the body and limbs imbricated, and plates on the head well developed; supranasals and post-frontals

not contiguous. Length, $7\frac{1}{2}$ inches; fore limbs, 1; head to axilla, $1\frac{1}{4}$; body, from muzzle to anus, 3; hind limbs, $1\frac{1}{2}$; tail, $4\frac{1}{2}$; diameter of head, $\frac{5}{8}$; diameter of body, $\frac{1}{2}$.

Habitat, Massachusetts, New York, to Georgia, Florida, and Mississippi, north to Ohio, Michigan, and Illinois.

In the young the yellow stripes are very distinct, and disappear with age, as well as other marks of coloration, which, taken with a slight variation in the cephalic plates, would lead one to suspect a distinct species. The female also probably differs from the male by the retention of the characteristics of the young longer, it may be to an adult state. The blue color of its tail may be due to its having been broken off and reproduced, but it is probably its natural tint.

The Blue-tailed Skink is found under bark in May; it is very active in its movements and difficult to capture. It lays nine ova eggs at a time; is occasionally seen sunning itself, and when alarmed makes a rapid retreat.

GENUS LYGOSOMA. Gray.

Head sub-quadrangular; palate edentulous; nasals nearly contiguous; supranasals wanting; rostral erect, triangular; lower eyelid with a transparent disk in the center; body fusiform; scales smooth; external auditory meatus distinct.

LYGOSOMA LATERALE Say.

Ground Lizard.

Scincus lateralis, SAY, HOLBROOK, GRAY, KIRTLAND, DUMERIL and BIBRON.

Scincus unicolor, HARLIN.

Oligosoma laterale, COPE, JORDAN.

Mocca lateralis, GUNTHER.

Lygosoma laterale, DEKAY, BAIRD.

General color olivaceous with black dots, and a dark stripe margined with white on each side; abdomen and under parts yellowish; tail blue, twice the length of the body; ear very large, circular, the anterior edge simple and rounded; prefrontal plate very long, narrowed anteriorly; post-frontals double; two preanal scales largest. Length, 6 to 8 inches.

Habitat, Florida. Georgia. South Carolina and Texas to "Illinois and Ohio."

This species I find mentioned in Dr. Kirtland's report as having been sent to him by Mr. Dorfeuille, and said to have been taken in Ohio. I have not seen it from the State.

Breeds in Georgia in the middle of March.

FAMILY IGUANIDÆ. THE IGUANAS.

Body lacertiloid or raniform; scales imbricated, usually not in whorls; ventral region covered with small plates or scales; cephalic plates various or irregular; tongue papillose, simple, thick, fleshy, convex, emarginate, and slightly free anteriorly, but not

protrusible; maxillary teeth sometimes in a common alveolus, and sometimes soldered to the jaw; gular region often provided with a pouch; back sometimes crested; feet four, with distinct toes; premaxillary bone single; mesosternum anchor shaped.

The *Iguanidæ* are all extralimital except *Sceloporus*, but the following synopsis of those inhabiting North America may be of service in referring the animals to their appropriate genera:

Dorsal scales carinated; infraorbital plate long. *a*.

Dorsal scales smooth or tuberculated; nape without spine. *c*.

Dorsal region and nape more or less spinose; body raniform. *b*.

- a*. Cephalic plates smooth; occipital as broad as long. SCELOPORUS.
- a*. Cephalic plates rugose; occipital much longer than broad. HALOTREPIS.
- b*. External ear opening present. PHRYNOSOMA.
- b*. External ear opening none. DOLIOSAURUS
- c*. Infraorbital region with one long plate. *d*.
- c*. Infraorbital region with row of short plates or scales; occipital small. *i*.
- d*. Interorbital plates in two rows. AMA.
- d*. Interorbitals in one or three series. *e*.
- e*. Occipital the largest of the cephalic plates. *f*.
- e*. Occipital plates no larger than the others. *h*.
- f*. Caudal scales smooth; anterior limbs very long. *g*.
- f*. Caudal scales above carinate; anterior limbs moderate. UTA.
- g*. Ear distinct. CALLISAURUS.
- g*. Ear invisible. HOLBROOKIA.
- h*. Rostral plate triangular; a row of scales like a crest extending along the back from nape to tip of tail. DIPLOSAURUS.
- h*. Rostral oblong; no trace of a dorsal crest. CROTAPHYTUS.
- i*. Toes enlarged under the antepenultimate phalanges forming a suboval, transversely lamellate space. ANOLIS.
- i*. Toes not thus enlarged. *j*.
- j*. Tail blunt; rostral plate transversely oblong. EUPHRYNE.
- j*. Tail pointed; rostral small, scale-like. CROTAPHYTUS.

GENUS SCELOPORUS. Wiegmann.

Head short; cephalic plates smooth, the occipital largest; a row of moderately large plates begins on each side of the occipitals, passes forwards, and between the orbits becomes a single row, which is bounded on each side by a very small row; superciliary region with one row of large plates; eyelids scaly; infraorbital plate long, sometimes with smaller ones at the end; internasal region with small irregular plates; inframaxillary plates small; external auditory meatus very distinct; nape without spines; gular pouch not marked; dorsal scales carinated, ventral smooth, imbricated; tail long and pointed; caudal and dorsal crests wanting; toes on each foot five, unguiculate; femoral region with a series of distinct pores.

SCELOPORUS UNDULATUS Harlan.

The Brown Swift.

Lacerta undulata, DAUDIN.

Uromastix undulata, MERREM.

Lacerata hyacinthina, et facia, GREEN.

Agama undulata, HARLAN.

Tropidolepis undulatus, CUVIER, HOLBROOK, GRAY, DUMERIL and BIBRON, DEKAY, STORER.

Sceloporus undulatus, GRAVENHORST, BAIRD, COPE, JORDAN.

General color above brownish, with irregular transverse undulating bands of black; gular region and sides greenish blue; abdomen and under surface of limbs and tail greenish to yellowish with dark spots; toes whitish; rostral plate depressed, making a triangle of slight altitude; nasals large; skin upon the throat thrown into a partial fold; dorsal scales imbricated, with the carinae on their posterior portion not denticulated; thighs behind the femoral pores covered with small scales; tail and toes long and slender. Length, 6 inches; head to gular fold, 8 lines; head to anus, $2\frac{1}{2}$ inches; fore limb, $\frac{1}{2}$; hind limb, $1\frac{1}{2}$; transverse diameter of head $\frac{1}{2}$ inch; of neck, $\frac{1}{2}$ inch; vertical of head, $5\frac{1}{2}$ lines; circumference of body, 2 to 3 inches.

Habitat, Connecticut, New York, Pennsylvania, Ohio, Illinois, Arkansas to Georgia and the Gulf of Mexico.

Extralimital North American Lacertilia, whose range is such as to render their occurrence in Ohio possible.

ANGUIDÆ.

Ophisaurus ventralis, Daud.

HOLBROOK, N. A. Herp., ii, p. 135.—GUNTHER, Cat. Liz. Brit. Mus., p. 56.—Proc. Acad. Nat. Sci., Phila., 1856, p. 239.

Habitat, Virginia, Georgia, Florida, Alabama, Mississippi, Louisiana, Tennessee, and Kansas. "Michigan".

TEIDÆ.

Cnemidophorus sexlineatus, Linn.

Proc. Acad. Nat. Sci. Phil., 1854, p. 192.—HOLBROOK, N. A. Herp., ii, p. 109.—GUNTHER, Cat. Liz. Brit. Mus., p. 21.—U. S. Geolog. Surv., 100 Meridian, v., p. 557.

Habitat, Virginia, Florida, Illinois, New Mexico, Mexico, Arizona, Nevada, and Utah.

SCINCIDÆ.

Eumeces septentrionalis, Bd.

Proc. Acad. Nat. Sci. Phila., 1858, p. 256.

Habitat, Minnesota, Nebraska.

Eumeces anthracinus, Bd.

Jour. Acad. Nat. Sci. Phila., 1850, p. 294.

Habitat, Pennsylvania to Texas, in mountains.

Eumeces inornatus, Bd.

Proc. Acad. Nat. Sci. Phil., 1858, p. 256.

Habitat, Nebraska.

IGUANIDÆ.

Anolis principalis, Linn.

HOLBROOK, N. A. Herp., ii, p. 77.—GUNTHER, Cat. Liz. Brit. Mus., p. 202.—Proc. Acad. Nat. Sci. Phila., 1856, p. 232.

Habitat, South Carolina, Florida, to Louisiana and Texas. "Cuba."

The Brown Swift, known also as *Pine-tree Lizard*, and *Brown Scorpion*, is a very active little animal; it prefers sandy and rocky soils, especially regions of pine forests; and, though harmless when disturbed, elevates its scales so as to give to its body a more formidable appearance. It may be seen on sunny days on fences and the sides of houses, and apparently does not occur in wet places. It probably hibernates beneath old bark; does not become adult until two years of age; and in Georgia breeds in April.

ORDER TESTUDINATA. TURTLES.*

Chelonia, GRAY, MIVART, HUXLEY, and MILNE EDWARDS.

Body-covering in the form of a dorsal and ventral shield; carapax and plastron formed by a union of the epidermis and skeleton; head, neck, feet, and tail free; jaws in the form of a horny beak, edentulous; tongue thick and fleshy; rami of lower mandible anchylosed; bones of the cranium immovably united; alisphenoid unossified; nasoethmoid cartilage present; premaxillæ small and united; quadrate bone large, immovable; caudal vertebræ procœlous; sacral vertebræ two; thoracic walls immovable; legs four, with the pectoral and pelvic arches inside the skeleton; lungs voluminous, with exceedingly large cells; heart with two auricles and a ventricle, the latter with an imperfect septum; urinary bladder large.

KEY TO THE FAMILIES OF TESTUDINATA.

- * Limbs in the form of paddles. CHELONIDÆ.
- * Feet palmate; usually fluviatile. *a*.
- * Feet clavate; terrestrial; carapax very convex. TESTUDINIDÆ.
- a*. Carapax composed of hard osseous plates. *b*.
- a*. Carapax leathery, without osseous plates. TRIONYCHIDÆ.
- b*. Sternal shields 12 or more. *c*.
- b*. Sternal shields less than 12. CINOSTERNIDÆ.
- c*. Jaws usually not strongly hooked; plastron oval or oblong. *d*.
- c*. Jaws strongly hooked; plastron cruciform. CHELYDRIDÆ.
- d*. Plastron with a movable transverse suture; carapax short and high. CISTUDINIDÆ.
- d*. Plastron usually without such suture; carapax depressed or elongated. EMYDIDÆ.

* For classification and reproduction, see Agassiz's Cont. Nat. Hist. U. S., and also Proc. Zool. Soc. London, 1869, p. 165.

Family *Chelonidæ*, extralimital, Atlantic and Pacific coasts, is easily recognized by its limbs being in the form of flappers; plastron somewhat cruciform; the vertebral costal plates each often with a prominent scale or tuberos projection. It has four genera, *Chelonia*, two species, Agassiz's Cont., i, p. 377, and Holbrook's N. Am. Herp., ii, p. 25; DeKay's Rept., p. 2; *Thalassochelys*, one species, *caouana*, Holbrook's Herp., ii, p. 33; Agassiz's Cont., i, p. 384; *Eretmochelys*, two species, Agassiz's Cont., i, p. 380, and Holbrook's Herp., ii, p. 39; and *Sphargis*, one species, *coriacea*, Storer's Rep., p. 216; Holbrook's Herp., ii, p. 45, and Agassiz's Cont. i, p. 317.

Testudinidæ, extralimital, has carapax short and very convex; plastron with a somewhat movable transverse hinge; limbs clavate; claws blunt and short, and toes firmly united by the integument; one genus *Testudo*, three species, *agassizii*, Proc. Cal. Acad. Sci., 1870, p. 67; *carolina*, Agassiz's Cont. i, p. 447; Holbrook's Herp., p. 25; and *berlandieri*, Agassiz's Cont. Nat. Hist., i, p. 317.

FAMILY CISTUDINIDÆ. BOX TORTOISES.

Carapax and dorsal disk of bones consolidated completely, the shell thus formed being short, high, and broad; sternal bones united with the epidermis to form a plastron with a transverse movable suture; sternal shields twelve, the gular, post-gular, and pectoral in front of the suture, the abdominal, preanal, and anal behind; plastron and carapax united by a ligamentous articulation; jaws somewhat hooked; feet slightly palmate; claws moderate; tail very short; head and neck long.

GENUS CISTUDO. Fleming.

Plastron rounded or truncate anteriorly and posteriorly; lobes unequal, the forward one shorter: hind feet elongated; toes unequal, the second longest; scales of the feet subequal, rounded posteriorly.

CISTUDO CLAUSA Gmelin.

Common Box Turtle or Checkered Tortoise.

Cistudo carolina, KIRTLAND, STORER, DEKAY.

Cistudo virginea, *et triunguis*, AGASSIZ.

Cistudo virginea, ALLEN.

General color of carapax black, variegated with yellow, sometimes the conditions give rise to well defined spots, bands or blotches; upper part of head and neck brown, often mingled with red or yellow especially upon the sides; gular and inframaxillary region varying from a speckling or spotting of black and white to a uniform reddish-yellow; plastron varying from black or spotted to a uniform reddish or yellowish; carapax notched in front; marginal plates twenty-four or twenty-five; costals four on each side; last vertebral rounded superiorly, the first pentagonal, projecting in front, often notched behind as are the second and third, all the plates with concentric striæ; young with a median dorsal keel; second and third costals nearly quadrilateral; hind toes three or four. Length of carapax, 6 inches; height of carapax, 3 inches; tail from anus, 5 lines.

This species has been confounded with the *Testudo carolina*, a southern animal, which probably does not extend north of the Carolinas. They differ in the feet of the latter being club-shaped, with only the blunt claws projecting, while our Turtle has its feet

somewhat palmate with sharp pointed claws. The color markings being very variable are of no value as furnishing points of distinction.

Habitat, Massachusetts, New York, Ohio and Michigan, to Missouri, and South.

This species is rare, but occurs in every part of the State. Their favorite resorts are dry sandy hills, being rarely found in damp places. They cannot endure rain, but retire to their holes on the approach of a storm. They attain a great age, a specimen mentioned by Allen* must have been at least sixty years old. They probably do not migrate to any great distance from their birth-place, and go into winter quarters by burrowing into the ground in September.

FAMILY CHELYDRIDÆ. SNAPPING TURTLES.

Head and neck large and powerful; jaws strong, horny, the apex of upper with a distinct downward curve; tail long, with a caudal crest of prominent, laterally compressed tubercles; feet palmate with long claws; plastron small, cruciform, composed of twelve shields; aquatic animals of great strength and exceeding ferocity.

† Head covered with plates; a row of three scales on each side between the costal and marginal plates; extralimal. † MACROCHELYS.

‡ Head covered with skin. CHELYDRA.

GENUS CHELYDRA. Schweigger.

Head large, but smaller than in *Macrochelys*, and covered with soft skin; upper and hinder part of the orbit projecting beyond the skull; mouth very broad; commissure sinuous; nostrils large; tympanum often concealed; carapax highest medially with ridges on the vertebral and costal plates, which disappear with age; under side of tail with two rows of large, smooth scales; no scales between the costal and marginal rows of plates

CHELYDRA SERPENTINA Linnæus.

Snapping Turtle.

Testudo serpentina, LINNÆUS, DAUDIN, LECONTE.

Chelonura serpentina, SAY, HOLBROOK, KIRTLAND, DEKAY.

Emys serpentina, GRAY, MERREM.

Emysaurus serpentina, STORER, DUMERIL and BIBRON.

Chelydra serpentina, GRAY, COPE, ALLEN, JORDON.

Color olivaceous or dirty brown above; plastron, under part of legs, neck, and tail yellow, becoming dull with age; color more or less disguised by the mud adherent to the animal and carapax; vertebral shields nearly quadrate, the first with a rounded, sinuous or jagged edge behind; last neural pointed posteriorly; second and third

* Proc. Bost. Soc. Nat. Hist. vol. 12, p. 176.

† One species, *Macrochelys iacertina* (*Gyechelys*, Ag.) Holbrook's N. A. Herp., i, p. 147; Agassiz's Cont., i, p. 414, ranges from Georgia, Alabama, Mississippi, Louisiana, and Texas, north to Illinois and Missouri.

costals very large, nearly quadrilateral, the lower edge rounded, the first costal largest, almost triangular; marginal plates twenty-four or twenty-five; of sternal shields, the abdominal much the largest. Length of carapax, 1 foot; length of head and neck, 7 inches; height of carapax 4 inches.

Habitat, Ecuador, Florida and Louisiana; north to Missouri, Indiana, Michigan, Canada and Maine.

This species is not only common in all parts of the State, but is frequently met with throughout its whole range. It is usually known as the Snapping Turtle, though called also Land Turtle, Snake, and Ser-rated Tortoise in the north, and Loggerhead and Alligator Terrapin in the south.

It is a ferocious animal; when annoyed it throws itself into an attitude of defence, snaps violently with its mandibles inflicting a severe wound, and will not let go its hold even after the cutting off of its head. They live in ponds and muddy streams, but are occasionally found at a distance from water. Oviposition occurs the latter part of June, a hole being scooped out in the sand, and from sixty to seventy elliptical eggs deposited therein. These eggs as well as the turtles, are by some esteemed a luxury for food, in fact the writer has known persons to keep the animals for a long time in a barrel with dish water, sour milk, and refuse from the table generally, in order to fatten and prepare them for use. The young are considered preferable. In advanced life the meat becomes rank, and at times emits a musky odor, rendering it unpalatable. Those found around Ann Arbor, Michigan, have a large number of fresh water algæ growing upon their carapax.

This species is well marked, being characterized by its powerfully hooked jaws, its spinous caudal crest and small cruciform plastron composed of twelve plates. The only species with which it can be confounded is *Macrochelys lacertina*, which probably is not found in the State.

FAMILY EMYDIDÆ. POND TURTLES.

Head, neck, and feet moderate, the latter more or less palmate; mandibles horny, the upper not hooked; carapax oval or oblong, broadest posteriorly, usually depressed, but highest medially, and composed of hard osseous plates, never soft and leathery; sternal shields twelve, usually soldered immovably together and to the carapax, forming a large, oval or oblong plastron; knees and elbows not slipping in naked among the viscera; animals living for the most part in marshes, and in or along the edges of ponds, pools, and streams; young living almost exclusively in water, much more so than the adult.

KEY TO GENERA OF EMYDIDÆ.

- * Upper jaw notched anteriorly. *a.*
- * Upper jaw not notched anteriorly, or with only a sinuous indentation. *b.*
 - a.* Carapax not carinate. *c.*
 - a.* Carapax carinate. CHELOPUS.
 - b.* Vertebral keel persistent in the adult; lower jaw with a spoon-shaped dilatation. GRAPTEMYS.
 - b.* Vertebral line in adult tuberculated; horny sheath of jaws straight; extralimal. * MALACOCLEMMYS.
 - c.* Carapax considerably arched, and usually more or less spotted on the vertebral and costal plates. *d.*
 - c.* Carapax depressed; vertebral and costal plates not spotted. *e.*
 - d.* Plastron without a movable transverse hinge; costal and vertebral plates with isolated, round, nonconfluent yellow spots. NANEMYS.
 - d.* Plastron with a movable transverse suture; vertebral, and usually the costal plates, without round yellow spots. EMYs.
 - e.* Alveolar surface of jaw not divided by a longitudinal ridge; neck, legs and tail often with bright red stripes. CHRYSEMYS.
 - e.* Alveolar surface of jaw with a ridge parallel to cutting edge; no scarlet stripes. PSEUDEMYS.

GENUS CHELOPUS. Rafinesque.

Upper jaw with a distinct notch anteriorly; lower jaw straight except at tip, or arched upward; horizontal alveolar surface narrow; sides of head compressed; plastron immovably soldered together and to the carapax; head compressed laterally; carapax elongated, considerably arched, and provided with a keel.

* A dark orange blotch on each side of the neck extending over the temporal muscles; extralimal, New York, New Jersey, and Pennsylvania. . . † C. MUHLENBERGII.

* Sides of neck without such spots. C. INSCULPTUS.

CHELOPUS INSCULPTUS LeConte.

Sculptured Tortoise.

Testudo insculptus, LECONTE, HARLAN.

Emys scabra, SAY.

Emys insculptus, LECONTE, HOLBROOK, DEKAY, STORER.

Emys pulchella, DUMERIL and BIBRON.

Emys speciosa, GRAY.

Glyptemys insculptus, AGASSIZ, VERRILL, ALLEN.

Chelopus insculptus, COPE, JORDON.

* One species *Malacoclemmys palustris* (*Emys palustris*, et *terrapin*, DeKay), Agassiz's Cont., i, p. 437; Holbrook's N. A. Herp., i, p. 27; DeKay's Rept. N. Y., p. 10, ranges along the Atlantic coast, in salt marshes, from New York to Texas and South America.

† Agassiz's Cont., i, p. 443; Holbrook's N. A. Herp., i, p. 45; DeKay's Rept., p. 17.

Color above brown, often tinged with reddish; neck often with a yellow line upon side, but not a prominent blotch; plastron yellow, with black blotches; under side of neck, legs, and tail reddish, sprinkled with black; plates of the carapax with concentric and radiating striæ on each, strongly marked, often with fine tuberculous points within; vertebral plates transversely oblong, hexagonal, and alternating with the costals; the first pentagonal, the last irregularly sub-hexagonal; marginal plates twenty-five, with a wave-like indentation, and a distinct notch behind; plastron with a deep notch between the two anal plates; preanal plates broader than the pectoral; all the plates of the plastron quadrilateral except the gular, which are triangular; sternal shields often with visible concentric striæ. Length, 8-10 inches.

Habitat, Maine, Massachusetts, New York, New Jersey, and Pennsylvania; west to Eastern Ohio.

Rare in the State.

The Sculptured Tortoise, called also Wood Turtle, and Fresh Water Terrapin, occurs usually in dry fields, but I have seen them in meadows and along the borders of streams in spring. They are much less aquatic than any of the other genera of the family, and in early spring the males and females seemed to be together in damp localities. Later I was able to find only females, and these were uniformly filled with eggs. I had an opportunity from April to June, 1878, of observing them near Poughkeepsie, N. Y., and in numerous cases found their flanks covered with leaches, also saw small Helicidæ adhering to their limbs, thus showing one of the means of distribution of the latter group of animals. They repair in autumn to streams and ponds, and prepare to hibernate by burying themselves in mud. They are timid and retiring animals, but when excessively irritated will snap at the offensive object, their means of defence being a withdrawal into, and closure of the shell around them. They emit a piping note, and feed upon the low field blackberry and other vegetables.

GENUS EMYS. Brogniart.

Carapax elongated, keelless, oval, considerably arched, and broadest posteriorly; plastron with a more or less movable transverse hinge between the pectoral and abdominal plates, and joined to the carapax by a ligamentous suture; head depressed; tympanum distinct; upper mandible notched; alveolar margins narrow; eyes and nostrils large.

EMYS MELEAGRIS Shaw.

Blanding's Box Tortoise.

Testudo meleagris, SHAW.

Lutremys meleagris, GRAY, LECONTE.

Cistudo blandingii, HOLBROOK, DEKAY, STORER.

Emys meleagris, AGASSIZ, COPE, JORDAN.

Carapax above jet black, with numerous, irregular, yellow, more or less confluent blotches, giving it in places the appearance of a black and yellow marbling, but often the yellow is entirely wanting; plastron sometimes yellow, but usually black, each plate usually with its inner and anterior border somewhat yellow; head and nape black, often with reddish or yellow blotches; lower mandible yellow; gular region yellow, usually more or less clouded with dark; head above covered with a soft skin; feet and tail scaly; tympanum and nostrils large; lower jaw with a small hook; commissure of mouth much curved; neck long; eyes large; marginal plates twenty four or twenty-five; costals large, the first largest, the second and third nearly quadrilateral, the fourth rhombic; first vertebral four-sided, broadest anteriorly, last septagonal, the four lower sides short, to articulate with the four posterior marginals, the remaining three sides about twice as long, the upper border rounded or projecting; the remaining neural plates hexagonal, the anterior and posterior borders nearly twice the length of the lateral; costal and vertebral plates alternating; carapax entire in front, notched behind; plastron elliptical, entire anteriorly but broadly notched posteriorly; sternal shields all four-sided except the gular, which are triangular, with the most acute angle posteriorly; tail rather small; toes five in front and four behind. Length of carapax, 9 inches; length of neck and head, $5\frac{1}{2}$ inches; height of carapax, $2\frac{1}{2}$ inches; tail from anus, 2 inches.

Habitat, New Hampshire, Massachusetts, Michigan, Wisconsin, Indiana, and Illinois.

The *Emys melegris* seems to be rare everywhere. It was described by Dr. Holbrook as coming from the prairies of Illinois, and afterwards noted by Dr. Storer as found along the Fox River. It has been subsequently seen in various parts of the states named, and, though as yet I have no knowledge of its having been observed in Ohio, its range is such, having been found at Ann Arbor, Michigan, among other places, that I doubt not it will be detected in the State. The most northern limit at which it has been observed is, I believe, Haverhill, New Hampshire, and Racine, Wisconsin, the former being in latitude 41° .

Being somewhat longer than its European analogue, *Emys lutaria*, it has been needlessly confounded with *Cistudo clausa*, from which it may readily be distinguished by its upper mandible being notched at the apex, and the absence of a downward curve or hook of the beak. The carapax is also much longer and devoid of the keel, and the plastron with its transverse movable suture less marked, and its posterior end broadly notched or truncated, thus rendering the anal plates four-sided instead of triangular.

A specimen before me had the carapax marked eleven years ago, and has lost one limb, the wound of which has healed perfectly.

GENUS NANEMYS. Agassiz.

Upper jaw with a notch at apex; lower mandible arched upwards; snout rounded, not laterally compressed; carapax ecarinate, considerably arched and elongated; plates of plastron immovable, united together and to the carapax; neck and legs scaly.

NANEMYS GUTTATUS. Schneider.

Speckled or Spotted Tortoise.

Testudo guttata, SCHNEIDER, SHAW.

Testudo punctata, SCHNEIDER, SCHCEFF, LATREILLE, DAUDIN, LECONTE.

Emys punctata, MERREM, SAY, HARLAN, KIRTLAND.

Emys guttata, SCHWEIGER, HOLBROOK, STORER, GRAY, DEKAY, DUMERIL and BIBRON.

Clemys punctata, WAGLER.

Chelopus guttatus, COPE.

Nanemys guttatus, AGASSIZ, JORDAN.

Color of carapax black, with here and there an isolated round or nearly round yellow spot; plastron yellow, with more or less black, sometimes almost or entirely black; marginal plates yellow, or yellow and black beneath; head, neck, and chin brown or black, with reddish-yellow spots; feet dark colored, reddish or yellowish beneath; marginal plates twenty-five, nuchal narrow, elongated; first vertebral pentagonal, the anterior margins shorter; last neural septagonal, rarely hexagonal, the remaining vertebral shields nearly hexagonal; costals four, the first, second, and third largest; costal and vertebral plates alternating; a groove in the plastron and carapax in front for the neck; gular shields triangular, the remaining sternals with four sides; plastron behind broadly notched, carapax nearly or quite entire; sternal shields often with concentric striæ. Length of carapax, 5 inches; height of carapax, $1\frac{1}{2}$ inches; length of tail, $1\frac{1}{2}$.

Habitat, Massachusetts, New York, Pennsylvania, and North Carolina, to Michigan and Indiana.

Agassiz states that this species "does not extend south of North Carolina, nor west of New York and Pennsylvania," but the Museum of Michigan University contains a specimen taken in Ionia county, Michigan, by Prof. J. B. Steere; it has also been found at Ann Arbor, and Dr. Levette of the Indiana Geological Survey reports it as occurring in the northern part of that State. Dr. Kirtland reports it as rare in Ohio, and hence, though not having myself seen it, I think, without question, it should be included in the fauna of the State.

The Spotted Turtle frequents sluggish streams, ponds, and ditches with muddy bottom, but I have never seen them where the water itself was muddy. I have observed them in New York inhabiting the same ponds as *Chrysemys picta*, and about as numerous. They never left the water except to lay their eggs, which they did in June or July. They were frequently observed sitting upon the edges of ponds and upon logs, but in all cases plunged suddenly when approached. They go into winter quarter in the fall by burying themselves in mud. The yellow spots are very characteristic and appear earlier than the lungs or family characters.

GENUS GRAPTEMYS. Agassiz.

Head, neck, and feet rather slender; upper mandible curved, sometimes with a bare trace of a notch at the apex, lower jaw with a spoon-shaped dilatation; carapax de-

pressed with a persistent keel; plastron immovably soldered together and to the carapax; outer side of fore legs with a row of scales; toes five in front and four behind; posterior feet with the toes broadly palmate.

* Head and neck with yellow lines, often reticulated, and a single spot on each side or none; keel not very prominent. G. GEOGRAPHICA.

* Head with large yellow blotches or stripes; keel very prominent. G. LESUEURII.

GRAPTEMYS GEOGRAPHICA LeSueur.

Geographic or Map Turtle.

Testudo geographica, LESUEUR, LECONTE, HOLBROOK.

Emys geographica, LECONTE, KIRTLAND, DEKAY.

Emys macrocephala et megacephala, HOLBROOK.

Emys labyrinthica, LESUEUR.

Graptemys geographica, AGASSIZ.

Malacoclemmys geographica, COPE, JORDAN.

Color of carapax olivaceous to brown, with a network of yellow stripes interlacing in such a manner as to give a cellular appearance, these markings not so prominent in the center, and in some specimens nearly or quite obsolete; plastron yellow, often black in the center; head above dark olive, with numerous yellow longitudinal lines, and often a small spot of the same color as above, and with similar lines; legs and tail olivaceous, with yellow stripes; under sides of marginal plates yellow, with brown spots containing yellow lines within; plastron and carapax hollowed out in front to fit the neck, and notched behind; marginal plates twenty-five, the anterior narrow, but broadest behind; costal and vertebral plates alternating; first neural nearly quadrilateral, with a projection backwards, the last septagonal, irregular; gular triangular; the remaining sternal shields four-sided, abdominal much the largest; anterior angle of anals received into a depression between the two preanals; tail short and thick; tympanum not prominent. Length of carapax, 9 inches; height of carapax, $2\frac{1}{2}$ inches; tail from anus, $1\frac{1}{2}$ inches.

Habitat, New York, Pennsylvania, Michigan, Ohio, Indiana, Illinois, and Arkansas.

The Geographic Tortoise probably occurs in every part of the State, having been obtained at Toledo, Rockport, and Cincinnati. They are very bold, active, vigorous animals, approaching even the Chelydridæ in disposition, and their flesh is said to be very palatable.

A specimen before me shows an abnormality, having an extra vertebral and two extra costal plates, one on each side.

GRAPTEMYS LESUEURII Gray.

Pseudogeographic Tortoise or LeSueur's Map Turtle.

Testudo geographica, var. *b*, LESUEUR.

Emys geographica, GRAY, var. *a*, LECONTE.

Emys lesueurii, GRAY.

Emys pseudogeographica, HOLBROOK, DEKAY.

Graptemys lesueurii, AGASSIZ.

Malacoclemmys pseudogeographicus, COPE, JORDAN.

Color of carapax, plastron, limbs and tail, same as the preceding, but the yellow

markings upon the shell are usually more intense; head brownish, with longitudinal lines and lateral blotches of yellow, one of these blotches in front and another behind the ear, a third between the eye and the angle of the mouth; costal and vertebral plates alternating; first neural pentagonal, last almost triangular, the remaining vertebral hexagonal; plastron elliptical, broadly emarginate behind; gular triangular, the remaining sternal shields quadrilateral; carapax higher than in the preceding species, more strongly carinated. Length of carapax, $5\frac{1}{2}$ inches.

Habitat, Michigan, Ohio, Wisconsin, Missouri, Iowa, Kansas, Arkansas, and Louisiana.

This species, which seems to have a range of the whole Mississippi Valley from the Sault St. Marie on the north to Louisiana on the south, is occasionally, though rarely, found in the State. It is usually known under the specific name of *pseudogeographica*, but Gray's name, *lesueurii*, is older, and hence entitled to precedence.

GENUS CHRYSEMYS. Gray.

Head moderate; upper jaw curved laterally, and notched at the apex; mandibles narrow; legs and tail scaly; toes five in front and four behind; hind feet broadly palmate; carapax depressed; plastron elliptical, shields immovable, soldered together and to the carapax.

* Costal and vertebral shields in transverse lines of three each. C. PICTA.

* Costal and vertebral shields alternating. C. MARGINATA.

CHRYSEMYS PICTA Herm.

Painted Turtle.

Testudo picta, HERM, SCHNEIDER, GMELIN, SCHCEFF, SHAW, DAUDIN.

Testudo cinerea, SCHNEIDER, SHAW, SCHCEFF.

Emys picta, SCHWEIGGER, MERREM, SAY, FITZINGER, GRAVENHORST, LeCONTE, HARLAN, GRAY, DUMERIL and BIBRON, HOLBROOK, KIRTLAND, STORER, DeKAY.

Emys cinerea, SCHWEIGGER, MERREM.

Chrysemys picta AGASSIZ, ALLEN, COPE, JORDAN.

Chrysemys dorsalis, AGASSIZ.

Color of carapax olive to brown, with irregular yellow lines margined with black; vertebral line narrow, yellow; plastron orange or yellow, often black in places; head brown, with yellow spots; neck, feet, and tail dark brown, with bright yellow and scarlet spots or bands; gular region brownish, with red and yellow stripes; eyes moderate; pupils black; irides golden, with a dark line passing through their center; costal and vertebral plates in transverse rows three in each, never alternating; first neural quadrilateral, last heptagonal; middle vertebral shield quadrangular; second and fourth hexagonal; marginal plates twenty-five, with a bright red blotch in their center and two red lines above it; a broad yellow band margined with black along the anterior margin of each row of costal and vertebral plates; gular and anal plates triangular, the remaining sternal shields quadrilateral; pectoral much the largest. Length of carapax, 6 inches; height of carapax, $2\frac{1}{2}$ inches; tail to anus, $1\frac{1}{2}$ inches.

Habitat, New Brunswick, Maine, Massachusetts, New York, North Carolina, South Carolina, Georgia, Mississippi, and Louisiana, to Lake Superior, and Eastern Ohio.

This is a very beautiful Turtle, the markings varying considerably, and the young being more brilliant than the adult. They inhabit still, never running water, occurring in ponds and muddy places, where they may be seen setting upon the banks or upon logs, but plunging suddenly, if approached. They are decidedly aquatic animals, and are unable to survive many days, if removed from the water. They are timid and inoffensive, emit a piping note; and after attaining her eleventh year the female, in a June evening, digs a perpendicular hole in which she deposits her elliptical eggs.

CHRYSEMYS MARGINATA Agassiz.

Lady Turtle or Agassiz Turtle.

Chrysemys marginata, AGASSIZ.

Chrysemys b. llii, GRAY.

Chrysemys picta, var. *marginata*, COPE, JORDAN.

Color above of carapax varying from bronze green to brown, usually with a narrow vertebral line of yellow margined with black; anterior margin of each plate usually with a similar line; second or third costal at times with a bright yellow or red spot; marginal plates brown to black, with various yellow or red markings; head brownish, with yellow spots or lines; neck, legs, and tail with red lines; plastron yellow, with a central dark blotch; carapax flatter, broader, and more rounded than in *Chrysemys picta*; vertebral and costal plates alternating, never forming transverse rows of three each; first neural quadrangular, with sinuous sides, last heptagonal, the lower sides shorter; the three central vertebral shields hexagonal; lateral margin of costal, first and last neural shields often with parallel ridges; plastron with the gular and anal plates triangular, the remainder quadrilateral; abdominal the broadest, and pectoral narrowest. Length of carapax, 6 inches; height of carapax, $2\frac{1}{2}$ inches; tail to anus, $1\frac{1}{2}$.

Habitat, New York †, Michigan, Ohio, Indiana, Wisconsin, Iowa, and Missouri.

This species seems to replace *Chrysemys picta* in the west, and in Michigan it is quite common, while *picta* is very rare, if at all. In Ohio, *picta* is found occasionally in the eastern part of the State, never so far as I know in the west, while *marginata* occurs in the western portion.

A specimen before me from Waterloo, New York, which from general appearance I take to be a variety of *Chrysemys marginata*, has six costal shields on one side and seven on the other. It has in the center of the carapax, apparently a large vertebral plate, replaced by four small ones, in addition to which it has five, the normal number, median dorsal shields; the four central plates are arranged in pairs of unequal size, the posterior one on the right side being much the smaller. Such an abnormality I do not find recorded of any turtle.

This species and *C. picta* are about equally abundant in Ohio, and

their habits are remarkably similar. *C. marginata* ranges as far north as Lake Superior, and, in the latitude of Ann Arbor, Michigan, has been found out of winter quarters as late as October 22, and in the spring on March 31. They undoubtedly attain to a good age. A plastron before me of this species was discovered in Sharon, Wastenaw county, Michigan, in 1838, by Dr. C. B. Porter, who inscribed the date and his name upon it. The animal was again discovered within half a mile of same spot in 1868. The size of the letters and figures show that the plastron could not have grown perceptibly during this period of thirty years. From this and other cases where people have inscribed their names and dates upon them, we may safely conclude that some, if not all, of our land and fresh water turtles wander to but a short distance, grow slowly, if at all, after attaining a length, in this species, of eight inches. In the case of *Cistudo clausa*, sixty years elapsed between the time of the inscription and its rediscovery, and it then, as in this species, was found within half a mile of the place where it was originally marked.

FAMILY CINOSTERNIDÆ. THE CINOSTERNOID TURTLES.

Feet palmate; toes four or five, fingers five; carapax high, narrow and composed of hard osseous plates; plastron small, between cruciform and elliptical, with only seven, nine or eleven shields; marginal plates twenty-three, vertebrals five, narrow, becoming broader posteriorly; costals large, four on each side; margins of carapax turning downward and inward instead of outward; head pointed; sockets of eyes deep.

† Plastron oval with movable hinge between the pectoral and preanal plates, allowing it to close the shell. CINOSTERNUM.

‡ Plastron cruciform; no movable hinge behind; incapable of closing the shell.

AROMOCHELYS.

GENUS CINOSTERNUM. Spix.

Head sub-quadrangular, pyramidal and broad; superior maxillaries rather widely separated behind; jaws slightly hooked with an inframarginal papilla; cranium with a single rhomboidal plate; plastron oval; pectoral and preanal plates articulated by a movable suture allowing the animal to close the shell; vertebral plates somewhat imbricate; tail long, and unguiculate in the males.

CINOSTERNUM PENNSYLVANICUM Bosc.

Mud Tortoise.

Testudo pennsylvanica, GMELIN, SCHCEPF, LATREILLE, SHAW, DAUDIN, EDWARDS.

Emys pennsylvanica, SCHWEIGGER, HARLAN.

Terrapene pennsylvanica, MERREM, SCHINZ.

Cistudo pennsylvanica, SAY.

Kinosternon pennsylvanicum, BELL, BONAPARTE, LECONTE, HOLBROOK, DEKAY, GRAY.

Cinosternon pennsylvanicum, WAGLER, DUMERIL and BIBRON.

Thyrosteronum pennsylvanicum, AGASSIZ.

Color of carapax dusky brown, of plastron yellow or orange with dark blotches; sometimes having the sutures margined with black; head and neck brownish, with whiter stripes and spots; feet and tail chestnut, lighter beneath; carapax oval, emarginate behind; first vertebral shield triangular, its apex posterior and truncate; second, third, and fourth hexagonal; costals large; marginals elevated; plastron notched behind; abdominal plates articulating with the pectorals and preanals by more or less movable sutures; sternal shields all deeply sculptured with parallel and angular lines; head large; upper and lower jaw with a curved tooth-like projection; anterior limbs with two scaly folds above, small scales beneath, and terminating in five short claws; tail short with lateral tubercular processes and terminating in a horny point. Length of carapax, 4 inches; height of carapax, 1 4-5 inches; length of tail, 7 lines.

Habitat, New York, Pennsylvania, New Jersey, Florida, Alabama, Louisiana, Ohio, and Michigan.

This animal is found in ditches and muddy ponds; it feeds upon fish and small aquatic reptiles, and emits a strong musky odor.

GENUS AROMOCHELYS. Gray.

Head sub-quadrangular, pointed, and very large; jaws powerful; plastron cruciform, with a transverse more or less movable suture anterior to pectoral plates, but immovable behind; posterior end of plastron broadly notched or truncate; toes five; fingers five; tail moderate; carapax somewhat carinated at least in the young; chin with warts; supplemental plates between the plastron and carapax contiguous to both.

AROMOCHELYS ODORATUS Latreille.

Musk Tortoise.

Testudo odorata, LATREILLE, DAUDIN, LECONTE.

Testudo pennsylvanica, SCHCEPFF.

Cistudo odorata, SAY.

Emys odorata, SCHWEIGGER, HARLAN, KIRTLAND.

Sternotherus odoratus, BELL, HARLAN, HOLBROOK, STORER, DEKAY.

Sternotherus bosci, BELL.

Kinosternon odorata, GRAY, LECONTE.

Kinosternum shavianum, BELL.

Staurotypus odoratus, DUMERIL and BIBRON.

Ozotheca odorata, et tristycha, AGASSIZ.

Ozotheca odorata, ALLEN.

Aromochelys odoratus, COPE, JORDAN.

Color of carapax olive to brown or green; head and neck similarly colored, with yellow stripes on each side; plastron black and yellow; colors very much obscured by the adhering mud; pupils black; irides golden; anterior marginal plate very narrow, broadest behind; first costal very large, the second and third pentagonal, the two upper sides much the shortest, the anterior and posterior margins longest; four hinder mar-

ginals much the higher, making an upward curve or indentation into the posterior costal on each side; last vertebral quadrangular, broadest behind, with a slight projection downward between the two posterior marginals; first neural elongated, broadest anteriorly; vertebrae slightly imbricated, alternating with the costals; carapax slightly emarginate behind, arched upward over the neck; gular plate nearly triangular, the remaining sternal shields more or less quadrilateral; abdominal much the largest; tail short, with several rows of pointed warts; neck, legs, and feet granulated; fore legs with scaly plates, and bases of feet with scales; no plates on the posterior limbs. Length of carapax, $4\frac{1}{2}$ inches; height of carapax, $1\frac{1}{2}$ inches; breadth of carapax, 3 inches; length of tail, 1 inch.

Habitat, Maine, Massachusetts, New York, South Carolina, Georgia, Florida, Alabama, and Louisiana, to Tennessee, Ohio, Michigan, Indiana, and Missouri.

The Musk Tortoise inhabits ditches and ponds, burying itself in mud. It is an active animal, and bites with considerable vigor if irritated. It has a very disgusting odor from which, with its habits, it has received not only its specific, but also its various common names, such as *Musk Turtle* and *Stinkpot* in the north, and *Mud Terrapin* in the south. It occurs in Northern Ohio and probably also occasionally through the whole State. It oviposits in June and July.

FAMILY TRIONYCHIDÆ. THE SOFT-SHELLED TURTLES.

Carapax in the form of a flattened orbicular disk, never completely ossified, its margins soft and flexible, and in some species with the ribs projecting; costal plates when visible eight pairs; posterior margin of carapax extending much beyond the body; sternum composed of four pairs of bones and one odd one; plastron a leathery covering with or without the sternal bones being visible externally; feet broadly palmate; head and neck very long and flexible; nostrils carried forwards by a long tubular projection; temporal arch narrow; parietal bones slightly if at all projecting outward; pterygoids broad, with slight depressions on their external edges; sphenoids extending forward between the pterygoids to the palatines; inner nares large, and situated far back.

The *Trionychidæ* are usually found at the bottom of shallow water buried in mud. They remain thus buried, raising their head and long flexible snout to the surface for the purpose of respiration. Thus the long flexible neck, head, and snout as well as the soft covering correspond to the habits of the animal, as a hard carapax and plastron are unnecessary for the purposes of protection to them while buried in the mud. In burrowing they go under a thin layer horizontally by digging with the fore feet, bracing and pushing the body under with the hind ones.

* Septum of nose without any internal ridges on each side. AMYDA.

* Septum of nose with a ridge on each side. ASPIDONECTES.

GENUS AMYDA. Schweigger.

Head long, narrow, and pointed anteriorly; horizontal alveolar surface of jaw narrow, broadest behind, and with a downward curve of the upper under the eye; lower

mandible compressed laterally, and extended forward; mandibular edges sharp; nostrils situated under rather than at the end of the proboscis; nasal septum smooth or without any transversely projecting ridge.

AMYDA MUTICA LeSueur.

Leathery Turtle.

Trionyx muticus, LESUEUR, LECONTE, KIRTLAND, DEKAY, GRAY.

Gymnopus mutica, DUMERIL and BIBRON.

Amyda mutica, AGASSIZ, COPE, JORDAN.

Color of upper parts olivaceous to brown, with darker spots upon the carapax; beneath more or less whitish without spots or mottled marks; carapax oval, smooth, depressed along the vertebral line instead of carinate; anterior margin of carapax naked, that is without spines or tubercles; anterior feet with three broad scales which are acute above and anteriorly, and with two oblong tubercles behind; tail short; young with band on the head and neck. Length, 8 inches.

Habitat, New York, Pennsylvania, Ohio, Indiana, Michigan, Iowa, and Missouri.

This species seems to have its range over the waters of the Mississippi, and also of the Great Lakes, being according to LeSueur common in Lakes Erie and Ontario. In the State it also occurs in the Ohio River. The tail in the males is longer than in the females; in the latter it does not extend beyond the margin of the carapax.

GENUS ASPIDONECTES. Wagler.

Head broader than in *Amyda*, curving rapidly downward from a line between the orbits; mandibles corneous, narrow, and nearly straight; nostrils terminal, with a transverse projection upon each side of the septum; mouth broader and rounder than in *Amyda*; feet very broadly palmate, with three claws on each exerted.

ASPIDONECTES SPINIFER LeSueur.

Soft-shelled Turtle.

Trionyx spiniferus, LESUEUR.

Trionyx ocellatus, LESUEUR.

Trionyx ferox, KIRTLAND, DEKAY, not of Schweigger and others.

Aspidonectes ferox, WAGLER.

Gymnopus spiniferus, DUMERIL and BIBRON.

Aspidonectes spinifer, AGASSIZ, COPE, JORDAN, COUES, YARROW.

Color of carapax dark slate, with ocellate spots above, and often with black dots along the margin; plastron creamy white; head and neck dark above, light brown, or a marbling of black and white beneath; a light stripe extends from the eye backward; carapax with a vertebral ridge slightly elevated, its center hard, its margins soft with the ribs projecting; costal plates eight on a side, distinct in adult; anterior margin of carapax with a row of spines or denticulated; fore limbs with transverse elevations; feet large and very broadly palmate; claws on each, three; tail anterior to anus very thick, beyond

narrow and short; shoulders broad, on a line with anterior portion of carapax; eyes prominent and almost vertical; cleft of mouth extending behind the eyes; shell above with numerous minute tuberculations or depressions.

The young differs from the adult by having the shell lighter colored, in some nearly cream, its anterior margin denticulated, the costal plates not separable, and the hard shields of plastron not discernable. Length of carapax, $9\frac{1}{2}$ inches; height of carapax, 3 inches; breadth of carapax, $8\frac{1}{2}$ inches; length of head and neck, 6 inches.

Habitat, New York, Pennsylvania, Michigan, Ohio, Indiana, Illinois, Wisconsin, Missouri, Iowa, and Montana.

This species is said to be the most delicious and nourishing as food of any of the *Testudinata*. They may be caught with a hook, but are usually speared. They are abundant in all the streams flowing into the Ohio and Lake Erie. Dr. Kirtland observed them in calm weather floating near the surface of the water, and followed by several Black Bass. The statements about its ferocity vary, probably owing to its having been confounded with *Aspidonectes ferox*.

Extralimital North American Testudinata, not previously mentioned in this work.

Aspidonectes (Paltypeltis, Ag.) ferox, Schweigger.

HOLBROOK, N. A. Herp., ii, p. 11.—AGASSIZ, Cont. Nat. Hist. U. S., i, p. 401.

Habitat, Georgia, Florida, Alabama, Mississippi, and Louisiana.

Aspidonectes asper, Agassiz.

AGASSIZ, Cont., i, p. 405.

Habitat, Mississippi and Louisiana.

Aspidonectes nuchalis, Agassiz.

AGASSIZ, Cont., i, p. 506.

Habitat, Cumberland and Upper Tennessee Rivers.

Aspidonectes emoryi, Agassiz.

AGASSIZ, Cont., i, p. 407.

Habitat, Texas.

Armocheilus carinatus (Goniocheilus triquetra, et minor, Ag.) Gray.

AGASSIZ, Cont., Nat. Hist., U. S. p. 423.—U. S. Geolog. Surv., 100th Meridian, vol. v., p. 582.

Habitat, Missouri to Louisiana, Texas, and Arizona.

Cinosternum sonoriense, LeConte.

Proc. Acad. Nat. Sci. Phila., 1854, p. 184.—U. S. Geolog. Surv., 100th Meridian, v., 5, p. 89.—AGASSIZ, Cont., Nat. Hist. U. S., i, p. 428.

Habitat, Arizona and Mexico.

Cinosternum integrum, LeConte.

Proc. Acad. Nat. Sci., Phil., 1854, p. 183.—AGASSIZ, Cont. Nat. Hist. U. S. i, p. 430.

Habitat, Mexico.

Cinosternum (Platythyra, Ag.) flavescens, Agassiz.

AGASSIZ, Cont. Nat. Hist., U. S., i, 430.

Habitat, Arkansas, Texas, and Arizona.

Cinosternum henrici, LeConte.

Proc. Acad. Nat. Sci. Phil., 1859, p. 4.—U. S. Geolog. Surv., 100th Meridian, vol. v, p. 583.

Habitat, New Mexico and Arizona.

Pseudemys (Ptychemys, Ag.) rugosa, Shaw.

AGASSIZ, Cont. Nat. Hist. U. S., i, p, 431.—HOLBROOK, N. A. Herp., i, p. 55.—DEKAY, Rept. N. Y., p. 16, as *Emys rubriventris*.

Habitat, New Jersey to Virginia.

Pseudemys concinna, LeConte.

HOLBROOK, N. A. Herp., i, pp. 119-68.—AGASSIZ, Cont. Nat. Hist. U. S., i, p. 432.

Habitat, North Carolina, Georgia, Florida, Mississippi, Louisiana, Texas and Arkansas.

Pseudemys mobiliensis, Holbrook.

HOLBROOK, N. A. Herp., i, p. 71.—AGASSIZ, Cont. Nat. Hist. U. S., i, p. 433.

Habitat, Florida, Alabama, Louisiana, Texas.

Pseudemys hieroglyphica, Holbrook.

HOLBROOK, N. A. Herp., i, p. 3.—AGASSIZ, Cont. Nat. Hist. U. S., i, p. 434.

Habitat, "Indiana," and Tennessee to Georgia.

Pseudemys (Trachemys, Ag.) scabra, Linnæus.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 434.—HOLBROOK, N. A. Herp., i, p. 123.

Habitat, North Carolina to Georgia.

Pseudemys troostii, Holbrook.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 436.—HOLBROOK, N. A. Herp., i, p. 123.

Habitat, Missouri, Illinois, Tennessee, and Mississippi.

Pseudemys elegans, Wied.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 435.—HOLBROOK, N. A. Herp., i, p. 115.—COUES and YARROW, Herp. Dakota and Montana, p. 260.

Habitat, Texas to Illinois, Missouri, Iowa, and Dakota.

Chrysemys oregonensis, Harlan.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 259.—COUES and YARROW, Herp. Dakota and Montana, p. 259.—U. S. Geolog. Surv., 100th Meridian, v, p. 583.

Texas and Arizona, to Minnesota, Nebraska, and Dakota.

Chrysemys (Dierochelys, Ag.) reticulata, Bosc.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 44.—HOLBROOK, N. A. Herp., i, p. 59.

Habitat, North Carolina, Florida, and Alabama, to Louisiana.

Chelopus (Actinemys, Ag.) marmoratus, Baird and Girard.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 434.—Proc. Acad. Nat. Sci. Phila., 1852, p. 177.—Proc. Acad. Nat. Sci. Phila., 1854, p. 91 as *Emys nigra*.—U. S. Pac. R. R. Surv., vol. 12, p. 292.—WILLIAMSON, Report, p. 3.

Habitat, California to Puget Sound.

Cistudo ornata, Agassiz.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 445.—COUES and YARROW, Herp. Dakota and Montana, p. 266.

Habitat, Iowa to Upper Missouri.

Cistudo major, Agassiz.

AGASSIZ, Cont. Nat. Hist. U. S., i, p. 445.

Florida to Alabama.

ORDER OPHIDIA. SERPENTS.*

Body long and slender, serpentiform; limbs none, but rudiments of the pelvic arch present in Pythons, Boas, and Tortrices; epidermal covering above in the form of scales, which are periodically cast off and renewed; head often with plates, under surface usually covered with scutellæ; integument very extensible; anal slit transverse; eyelids wanting; tympanum none; tongue long, bifid, sheathed at base, and capable of protrusion; teeth conical, not in sockets, situated upon the jaws and palate; mouth very dilatable owing to the presence of a quadrate bone; jugal, quadrato-jugal, sternum, orbito-and alisphenoids absent; post-frontals, nasals, and lachrymals well developed; rami of lower jaw composed of several pieces; vertebrae numerous, the dorsal procœlous; hear t trilocular, composed of two auricles and a ventricle, the latter with a partial septum; lungs usually one, when two asymmetrical; urinary bladder wanting.

* An erectile poison fang in front part of the mouth; deep pit between the eye and nostril. CROTALIDÆ.

* A permanently erect poison fang in front part of mouth; lachrymal pit wanting; extralimal. ELAPIDÆ.

* No poison fang in front part of mouth; lachrymal pit wanting. . COLUBRIDÆ.

FAMILY CROTALIDÆ. CROTALID SNAKES.

Teeth in upper jaws few; *erectile poison fangs in front*; head usually triangular, plainly separable from the body; a deep pit between the eye and nostril; dorsal scales carinated; urosteges undivided anteriorly; species all venomous.

Tail provided with a rattle. *a.*

Tail without rattle; cephalic plates large as in *Colubridæ*. *b.*

a. Top of head covered with scales, plates if any not reaching further back than the eyes. CROTALUS.

a. Cephalic plates large, and arranged as in *Colubridæ*. . . CROTALOPHORUS.

b. Loral plate present. ANCISTRODON.

b. Loral plate absent. TOXICOPHIS.

GENUS CROTALUS. Linnæus.

Cephalic region above covered with scales, a few large plates may be present anterior to a transverse line between the eyes; caudal rattle always present and well developed; body large and strong; pupil of eye vertical; lachrymal or nasal fossa very distinct; rostral plate large, temporals and labials small; the two anterior inframaxillaries large.

* For plates of heads, see U. S. P. R. R. Rep., vol. x; on classification of extralimal N. A. species, see Baird and Girard's Catalogue.

CROTALUS DURISSUS Linnaeus.

Banded Rattlesnake.*Tropsophus durissus*, GRAY.*Urocrotalon durissus*, FITZINGER.*Tropsophus triseriatus*, WAGLER.*Crotalus durissus*, HOLBROOK, DUMERIL and BIBRON, BAIRD and GIRARD, STOKER, DEKAY*Crotalus horridus*, COPE.

General color sulphur-brown and darker brown, arranged in blotches or transverse bands; head very triangular, abruptly separable from the neck; superciliary plates small and numerous; upper labials 12-14, lower 13-15; rostral large, triangular, rounded above, anteorbitals two, elongated longitudinally; dorsals in 23 to 25 rows; gastrosteges 170 to 180; urosteges 23 to 28. Length, $3\frac{1}{2}$ feet; head, $1\frac{1}{2}$ inches; tail, 5 inches; transverse diameter of head, 1 inch; transverse diameter of neck, $\frac{4}{5}$ inch; circumference of body, $3\frac{1}{2}$ inches.

Habitat, Maine, Massachusetts, New York, Pennsylvania, West Virginia, South Carolina, Mississippi, Alabama, Kansas, and Arkansas.

The Banded Rattlesnake inhabits rocky mountains and hills, its venom is very virulent, but to its favor may be said that it rarely or never strikes unless stepped upon or interfered with in a serious manner, and then apparently acts only in self-defence. It also usually, though not always, gives warning and thus enables a person to get out of its way.

They are at times gregarious, being occasionally found collected together, especially in winter, but more usually they are alone. They are inactive, sluggish animals of slow locomotion, and in this respect contrast strangely with the rapidity of the vibrations of their tail, and the instantaneous quickness with which they strike an enemy. They have been known to live a year without food, but need water especially at the time of shedding their skin. The fangs are, in some cases at least, shed at the same time as the integument, and reproduced in a few days. They are believed to be most virulent at this time, which may be true, and may be

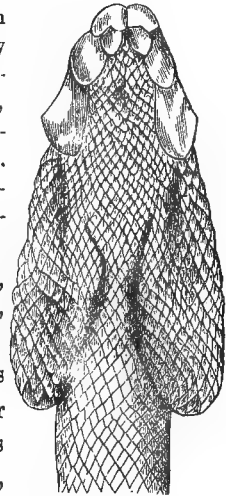


FIG. 1.—*Crotalus durissus*, head covered above with scales.

* The plates which accompany this catalogue have been drawn from the specimens by Miss Lilly E Chase, of Ann Arbor, Michigan.

It has not been my aim to insert a large number of illustrations, as this has already been done in the writings of Holbrook, DeKay, Agassiz, and the various United States Reports; and yet it is believed that the few given on the mouths of Salamanders and head of *Crotalus* and *Crotalophorus* will be very serviceable in the identification of genera.

explained by supposing that the venom accumulates owing to the fangs being shed.

Various theories have been advanced as to the use of the rattle, none of them being entirely satisfactory. One supposition is that it has resulted in time from the agitation of the highly nervous tail, and has no special function. *Pityophis melanoleucus*, the Bull Snake shows such an agitation, and its tail when in motion is said to somewhat resemble the rattle of this species. Again, it has been conjectured to be of use in calling the sexes together, and thus aiding in the preservation of the species. Another hypothesis is that, as it resembles the noise made by a grasshopper, it might be of service in decoying insectivorous birds within reach of the animal. The rattle is said to be heard often when there is no cause of irritation. If such be the case, it probably does not occur with the *Crotalidæ* in our limits. A fourth suggestion is that it serves to alarm the higher species, giving them warning, and thus enabling them to escape its bite. Such a hypothesis is contrary to all analogy, since nature's mode is to provide the animal with that which is best for its individual wants without regard to others. A last supposition is that it is of use to the serpent in terrifying its enemies. Probably this last is more worthy of credence, and is not to be set aside by the fact that it sometimes attracts the attention of enemies in such a way as to induce them to destroy it. In other cases it renders the snake more frightful, and enables it to paralyze its foes or desired prey with fear. It may also be of some use in the other ways mentioned, especially in bringing about the union of the sexes.

A popular belief is that one rattle is added each year; however, this cannot be true, as Dr. Holbrook knew a case of two rattles being added in a year, and Dr. Bachman observed a species in which four were developed in twelve months. Thus, we may see that the number of rattles is, as Dr. Holbrook observed, dependent upon the condition of the animal as regards liberty, nourishment, etc., and is no test of age.

The oil of this species is said to be very valuable.

GENUS CROTALOPHORUS. Linnæus.

Cephalic region above covered with plates, which are seen posterior to a transverse line between the eyes; caudal rattle always present, though smaller than in Crotalus; body moderately strong; pupil vertical; rostral plate moderately large, temporals and labials small; the two anterior inframaxillaries large, the remainder small.

Dorsal rows of scales 26.	. . . . .	C. TERGEMINUS.
Dorsal rows of scales 23.	. . . . .	C. MILIARIUS.

CROTALOPHORUS TERGEMINUS Holbrook.

Prairie Rattlesnake or Massasauga.*Crotalus tergeminus*, SAY, HARLAN, DUMERIL and BIBRON.*Crotalophorus kirtlandii*?, HOLBROOK, DEKAY, COPE.

General color varying from ash to brown, spots of dark-brown margined with black, and exterior to this a still lighter circle; vertebral blotches 34 in number, almost quadrate, notched in front and behind, and extending from the neck to the tail; two or three series of lateral blotches on each side varying from circular to oblong; a light line begins upon the neck and, passing forwards, bifurcates, giving a branch to the upper and one to the lower jaw; a transverse line of light crosses the vertical plate; a white or yellowish line begins upon the neck, runs forward, bifurcates, and again nearly or quite meets in front so as to almost or quite enclose a dark blotch situated for the most part upon the occipital plates; beneath light colored to black; dorsal scales in 25 rows; gastraltes 140-150; urosteges 25-30, the last three to five bifid; vertical plate sub-hexagonal, sometimes divided so as to leave a small triangular one behind; labials 11-12 below, 12-14 above; anteorbitals elongated longitudinally; rostral irregularly hexagonal. Length, 2 1-6 feet; head, 1½ inches; tail, 2½ inches; transverse diameter of head, ¾ inch; of neck, ½ inch; circumference of body, 4 inches.

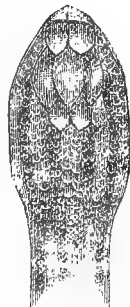


FIG. 2.—*Crotalophorus tergeminus*, showing cephalic region covered with plates.

Habitat, Michigan, Ohio, Illinois, Wisconsin, Kansas, Nebraska, Montana, Georgia, and "Indian Territory."

In the State I have only seen specimens from Warren county, but presume it occurs in all parts of Ohio. It lives in marshes, though I have seen it on elevated and dry grounds. Its bite is justly dreaded by persons compelled to frequent such places. It rarely, if ever, strikes without warning, and never unless disturbed.

Var. *kirtlandii*, also an inhabitant of Warren county, differs from this by being of a nearly uniform black with brown blotches above in the adult.

The specimen of *C. tergeminus* which I have seen from Wisconsin have a broader head, and the transition from head to neck is more abrupt than in Illinois or Ohio specimens, while a specimen from Lenawee county, Michigan, shows a head scarcely broader than the neck. It will thus be seen that the shape of the head as well as the coloration varies materially in this species.

CROTALOPHORUS MILIARIUS Linnæus.

Ground Rattlesnake.*Crotalus miliarius*, LINNÆUS, GMELIN, MERREM, SCHLEGEL, HARLAN, HOLBROOK, DUMERIL and BIBRON.*Caudisona miliarius*, FITZINGER, WAGLER.*Crotalophorus miliarius*, HOLBROOK, GRAY, DEKAY, BAIRD and GIRARD, COPE.

GENUS ANCISTRODON. Beauvois.

Cephalic region covered with nine large plates arranged as in Colubridæ; vertical and superciliaries on a line with the eye, occipitals farther back; anteorbitals two, elongated longitudinally; nasals two; loreal present, excluded from the orbit; head flattened, triangular; dorsal scales in 23 rows, carinated; tail rather short, tapering to a point, and without rattle; urosteges divided posteriorly.

ANCISTRODON CONTORTRIX Linnæus.

Copperhead.

Boa contortrix, LINNÆUS, GMELIN.

Agkistrodon mokason, BEAUVOIS.

Cenchris contortrix, DAUDIN.

Cenchris mokeson, HARLAN.

Scytalus cupreus, RAFINESQUE, HARLAN.

Toxicophis, TROOST.

Trigonocephalus cenchris, SCHLEGEL.

Trigonocephalus contortrix, HOLBROOK, HALLOWELL, KIRTLAND, DEKAY, DUMERIL and BIBRON.

Ancistrodon contortrix, BAIRD and GIRARD, COPE, ALLEN.

Copper-colored above, brighter upon the flanks; reddish-brown transverse bands upon the back, about 16 in number, dilated upon the sides; rounded spots of a similar color between these bands; lateral blotches from 30-38, varying from round to sub-quadrate, dusky; beneath pale cupreous; postorbital plates two, continuous under the eye with two small infraorbitals; superciliaries broad and long; vertical slightly longer than the occipitals, the latter notched posteriorly; labials, 8 above, 9 below; inframixillaries small; gastrosteges, 150-155; urosteges, 40-50; tail terminating in a horny point, the analogue of the rattle in the *Crotalidæ*. Length, 29 inches; head, $1\frac{3}{4}$ inches; tail, $3\frac{1}{2}$

General color grayish ash, vertebral blotches varying from circular to triangular or elliptical, from 37 to 45 in number, each with a yellow border; a reddish-purple vertebral line extending from head to tail through the blotches; lateral blotches in two or three series; nape with a grayish to yellowish longitudinal band, with a black blotch on each side anteriorly; a narrow line of white extends from the angle of the mouth to the eye; vertical plate irregularly sub-hexagonal; labials, 10-11 on a side above, 11-12 below; anteorbitals two, elongated longitudinally; loreal one on each side; nasals two; rostral large, irregular, urn-shaped, smallest above; dorsal scales in 23 rows; gastrosteges, 130-140; urosteges, 30-40, usually not well marked. Length, 17 inches; head, $\frac{7}{8}$ inch; tail, $2\frac{1}{2}$ inches; transverse diameter of head, $\frac{1}{2}$ inch; of neck, 3-16 inch; circumference of body, 2 inches.

Habitat, South Carolina, Georgia, Florida, Mississippi, Louisiana, and Arkansas.

DeKay records this species in Michigan, on what authority I am unable to determine. If it is a resident of that State it will doubtless yet be found in Ohio. However, its extreme southern range leads me to believe that its reference to the fauna of Michigan is a mistake, and that it probably does not occur within our limits.

inches; transverse diameter of head $1\frac{1}{2}$ inches; of neck, $\frac{3}{8}$ inch; circumference of body, 4 inches.

Habitat, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, South Carolina, Florida, Alabama, Louisiana, Kansas and Ohio.

GENUS TOXICOPHIS. Troost.

Cephalic region covered with eleven plates, prefrontal and superciliaries in a line with eyes, the occipital situated more posteriorly; anteorbitals two, elongated longitudinally; nasals two; loral absent; head triangular; dorsal scales carinated, in 25 rows; tail moderate, tapering to a corneous point; caudal rattle none; urosteges bifid posteriorly. Extralimital.

TOXICOPHIS PISCIVORUS Lacepede.

Water Moccasin.

Crotalus piscivorus, LACEPEDE.

Scytalus piscivorus, LATREILLE, DAUDIN, HARLAN.

Coluber aquaticus, SHAW.

Natrix piscivorus, MERREM.

Acontias leucostomus, TROOST.

Trigonocephalus piscivorus, HOLBROOK, GRAY, DUMERIL and BIBRON, DEKAY.

Toxicophis piscivorus, BAIRD and GIRARD.

Ancistrodon piscivorus, JORDON.

Color above brown, with dark vertical bars of black and red; head purplish black; beneath black, blotched with dirty yellow; a yellow band in occipital region; vertical plate as long as occipitals; labials 8 above, 11 below; gastrosteges, 135-140; urosteges, 42-46. Length, 28 inches; head, $1\frac{3}{8}$; tail, $4\frac{1}{2}$; transverse diameter of head, $1\frac{1}{2}$ inches; of neck, $\frac{3}{8}$ inch; circumference of body 4 inches.

Habitat, North Carolina, South Carolina, Mississippi, Louisiana, Tennessee, Southern Illinois, and Arkansas.

The Water Moccasin is more aggressive than the Rattlesnakes, attacking everything that comes within reach. Its mode of attack is to erect its head, open its mouth, and strike without warning. It is decidedly aquatic, being always found near or in water, and in swampy places.

FAMILY ELAPIDÆ.

Teeth in both jaws; small poison fangs in front; body colubiform; head oval, not separable from the neck, and covered with plates; pit between the eye and nostril wanting; dorsal scales smooth; urosteges bifid; tail pointed, without rattle. Extralimital.

GENUS ELAPS. Schneider.

Cleft of mouth moderate; cephalic and temporal region with plates; postorbitals two; anteorbitals one; nasals two; labials and inframaxillaries large; post-abdominal scutella entire.

ELAPS FULVIUS Cuvier.

Bead Snake.

Jet black, yellow and red bands alternating render this species easily recognizable.

Habitat, Virginia, Georgia, Florida, Mississippi, Texas, and Arkansas.

In the State it occurs along the waters of the Mahoning, Big Beaver, and Muskingum rivers, and also in the neighborhood of Cleveland.

The Copperhead is one of our most venomous species. It differs from the Rattlesnakes in that it strikes without warning. It is an indolent, sluggish animal, but when approached raises its head, thrusts out its tongue, and strikes at the intruder. It has various common names such as Hazel-head, Chunkhead, Red Viper, Copperbelly, Cotton-mouth, Dumb Rattlesnake, Red and Deaf Adder, but it is more usually designated as Copperhead. They, at least the pregnant females, are gregarious and occur in meadows or elevated grounds. They are, however, terrestrial, and appear to be ovoviviparous; at least according to Allen, five females out of seven, caught in the latter part of July in Massachusetts, contained slightly developed embryos, while of six females killed in September the ovaries of each contained seven or nine young, six inches long.

FAMILY COLUBRIDÆ. THE COLUBRINE SNAKES,

Conical teeth in both jaws; head oblong or oval, covered with large plates; poison fangs wanting; pupil of eye circular; lachrymal or nasal pit absent; body colubriform; head tapering gradually into the neck; dorsal scales carinated or smooth; no anal appendages; urosteges bifid; tail conical, without rattle, tapering gradually to a point; species all believed to be harmless.

The following excellent table, fashioned after the Smithsonian Catalogue of Reptiles, by Baird and Girard, and Jordan's Manual, it is believed will enable anyone to readily refer a species to its proper genus.

Dorsal scales carinated. *a.*

Dorsal scales smooth. *i.*

a. Post-abdominal scutella entire. *b.*

a. Post-abdominal scutella bifid. *c.*

b. Dorsal rows of scales not exceeding 23. EUTÆNIA.

b. Dorsal rows exceeding 25. PITYOPHIS.

c. Loral and anteorbital plates both present. *d.*

c. Anteorbitals absent; extralimal. HALDEA.

c. Lorals absent. STORERIA.

d. Dorsal rows of scales 17 or less. CYCLOPHIS.

d. Dorsal rows of scales 19 or more. *e.*

e. Cephalic plates typical. *f.*

e. Cephalic plates not typical. *h.*

f. Postorbitals three, rarely two; anteorbitals usually one; dorsal rows of scales 23-29. TROPIDONOTUS.

f. Postorbitals two; dorsal rows of scales 19-21. REGINA.

h. Muzzle projecting and recurved. HETERODON.

h. Muzzle not projecting. COLUBER.

i. Anteorbital plates both present. *j.*

i. Anteorbitals absent. *m.*

j. Post-abdominal scutella entire, or bifid with 25 rows of dorsal scales.

OPHIBOLUS.

- j.* Post-abdominal scutella bifid; dorsal rows of scales not exceed 21. *k.*
k. With a yellow ring round the neck. DIADOPHIS.
k. Without cervical ring. *l.*
l. Dorsal scales in 15 rows. LIOPELTIS.
l. Dorsal scales in 17 or more rows. BASCANIUM.
m. Dorsal scales in 19 rows. *n.*
m. Dorsal rows of scales not exceeding 17. *o.*
n. Prefrontals one. FARANCIA.
n. Prefrontals two. ABASTOR.
o. Postorbitals two; dorsal scales in 15 or 17 rows. . . . VIRGINIA.
o. Postorbitals one; dorsal scales in 13 rows. . . . CARPHOPHIS.

GENUS EUTÆNIA. Baird and Girard.

Body varying from long and slender to strong and moderately thick; cephalic plates normal; anteorbitals one; postorbitals usually three; loral present; nasals two; prefrontals two; labials and inframaxillaries moderately large; dorsal scales strongly carinated, in 19-21 rows; gastrosteges, 140-170; post-abdominal scutella entire; urosteges, 50-120, all bifid; ground color dark, with a vertebral and two lateral stripes; habits terrestrial; species ovoviviparous.

Lateral stripe on the third and fourth rows of scales; body slender; tail nearly one-third of total length. *a.*

Lateral stripe on second and third rows of scales; body stouter; tail one-fourth of total length. E. SIRTALIS.

a. Urosteges less than 110. E. PROXIMA.

a. Urosteges 115 or more. E. SAURITA.

EUTÆNIA PROXIMA Say.

Say's Garter Snake.

Coluber proximus, SAY, HARLAN.

Tropidonotus proximus, BOIE.

Eutænia proxima, BAIRD and GIRARD, COPE, JORDAN.

General color above black; vertebral band varying from yellow to brown; lateral stripes green or yellowish to white; occipital plates with a yellow spot about the center of the commissural line; abdomen and under parts varying from dingy white to olivaceous or green; vertical plate elongated, pentagonal, the posterior sides much the shorter, the lateral edges longest and arcuate to receive the projecting part of superciliaries; nasals two; rostral broad, but not very high; upper labials eight, lower nine or ten; temporal region covered with large plates; inframaxillaries reaching to the eighth lower labial; loral rhomboidal; eye over the fourth and fifth upper labial; dorsal rows of scales nineteen, all carinated; vertebral band covering one and two half rows of scales; lateral stripes on the third and fourth rows from the abdomen; color below the lateral stripes somewhat lighter than above; body stouter than *Eutænia saurita*; tail about two sevenths the total length; gastrosteges, 170-180; urosteges, 80-85. Length, 2½ feet; head, 1 inch; tail, 9 inches; transverse diameter of head 7½ lines; of neck 5½ lines; circumference of body 2½ inches.

Habitat, "California," Montana, and Arkansas, to Wisconsin, Ohio, North Carolina, Louisiana, Texas, and Mexico.

Rare in the State.

EUTÆNIA SAURITA Linnæus.

Swift Garter or Ribbon Snake.

Coluber saurita, LINNÆUS, HARLAN, STORER, KIRTLAND, THOMPSON.

Leptophis sauritus, HOLBROOK, DEKAY.

Tropidonotus sauritus, SCHLEGEL, DUMERIL and BIBRON, GUNTHER, PUTNAM, VERRILL, ALLEN.

Eutænia saurita, *et faireyi*, BAIRD and GIRARD.

Body very slender, elongated, tapering very gradually to an exceeding long, pointed tail; upper labials seven on each side, lower ten; inframaxillaries extending to seventh lower labial; vertical plate elongated, hexagonal; eyes large; general color above dark-brown, with three longitudinal stripes, extending from the head to tip of tail, sometimes these stripes become indistinct after passing the anus, the vertebral one is very narrow, covering slightly more than one row of scales, and terminating in front on the posterior margin of the occipital plates, the lateral lines are somewhat broader, extending forward to the posterior labials, and situated upon the third and fourth rows of scales from the abdomen; orbital plates, lower part of head, and gular region yellowish-white; both sides of vertebral line and upper edge of lateral stripes margined with black; abdomen and under part of tail greenish-white, without spots; gastrosteges, 175-180; urosteges, 115-120; dorsal scales in 19 rows, all strongly carinated. Length, 3 feet; head, $\frac{3}{4}$ inch; tail, 9 inches; transverse diameter of head, $\frac{1}{2}$ inch; of neck, $\frac{3}{8}$ inch; circumference of body 2 inches.

Habitat, Maine, Massachusetts, Connecticut, New York, Pennsylvania, Virginia, Ohio, Michigan, Wisconsin, Mississippi, Texas, Mexico, and Honduras."

Var. *faireyi*, Baird and Girard, has two small yellow spots on the occipital plates, a black lateral band bordered by two rows of black scales, thus making the color below the lateral stripe the same as that above, and the tail somewhat less than one-third the total length.

Habitat, Louisiana, Illinois, and Wisconsin.

The typical *Eutænia saurita* is common in Ohio, though I have as yet no record of the variety *faireyi* having been found in the State. It seeks damp or wet retired woods for its residence, is very nimble, climbs trees, and at times takes to water and swims readily. It has been popularly confounded with the next species, but is less active, and of a much slenderer form than *E. sirtalis*.

EUTÆNIA SIRTALIS Linnæus.

Striped or Garter Snake.

Coluber sirtalis, LINNÆUS, HARLAN, KIRTLAND, STORER.

Tropidonotus bipunctatus, SCHLEGEL, DUMERIL and BIBRON.

Tropidonotus tænia, DEKAY.

Tropidonotus sirtalis, HOLBROOK, VERRILL, ALLEN.

Eutainia sirtalis, *parietalis*, *et dorsalis*, BAIRD and GIRARD.

Eutainia haydenii, *et cooperi*, KENNICOTT.

† *Coluber ordinatus*, LINNÆUS.

? *Tropidonotus ordinatus*, HOLBROOK, PUTNAM, GUNTHER.

Eutainia ordinata, BAIRD and GIRARD.

? *Eutainia radix*, BAIRD and GIRARD.

Body moderately strong; general color above black or dark-brown, with a vertebral and two lateral stripes of yellow; abdomen greenish-white, often with black spots upon the sides; under jaw and gular region yellowish-white to greenish-yellow; vertebral and lateral bands begin at the posterior of the head and become insensibly lost upon the tail; occipital plates often with two small yellow spots; ante- and postorbitals, labials, and lower half of rostral yellowish-green; nasals two; upper labials seven or eight, lower eight or nine; inframaxillaries reaching to sixth lower labial; dorsal scales strongly carinated, in 19 rows; gastrosteges, 137-170; urosteges, 55-80 lateral stripe upon the second and third rows of scales; vertebral band about the width of a scale, though situated upon one and two half rows, color below the lateral stripe somewhat lighter than above; tail one-fourth of total length. Length, 2½ feet; head, 1½ inches; tail, 5½ inches; transverse diameter of head, ⅔ inch; of neck, ⅔ inch; circumference of body 3 inches.

Habitat, Maine to Virginia, South Carolina, Georgia, Mississippi, Illinois, Oregon, Minnesota, Michigan, Isle Royale in Lake Superior, and Lake Winnipeg.

In the State I have specimens from Yellow Springs, Columbus, and Lancaster, though it is common everywhere. Some of the Ohio specimens show a much duller coloration than is ordinarily observed, probably owing to their having been captured a short time prior to the period at which they would shed their skin. A specimen kept by me in confinement changed from such dull to the ordinary bright markings on casting off its epidermis. I have observed a similar fact in regard to the Blue Racer, *Bascanium on constrictor*, and also upon the *Eutænia saurita*.

Eutænia sirtalis is our commonest snake. They are clumsy and sluggish animals, found in low, marshy, or comparatively dry places, take to water readily, and when irritated, elevate their scales, giving the body a roughened appearance, and when handled exude a very disagreeable and offensive odor. After swallowing a frog, if one seize the animal by the tail and pass the foot along its back, it can be made to disgorge, and the frog escape in a living condition.

They are popularly believed to swallow their young to shield the latter from danger; in fact unscientific observers report having cut them open and found the little ones within, a fact which can be readily accounted for when it is remembered that this genus brings forth its young alive, and the parties observing undoubtedly saw them in the ovaries rather than in the stomach. Possibly a similar mode of reproduction obtains in other species reported to swallow their young; or the fact that some snakes prey upon others may explain the origin of such reports.

The Garter Snake takes to water quite readily, and retires to winter quarters in October, and issues forth again the following spring, in May.

Occasionally owing to open or very mild weather they re-appear, for a few days at a time, earlier, and then seem to again hibernate. They are gregarious in winter quarters, having been frequently ploughed up in bunches, are sometimes found under peat, and in company with rattlesnakes. Dr. Kirtland reports that they are eaten by hawks, owls, swine, and in some instances, by fowls, ducks, and turkies. The females in July and August are usually found pregnant with from twenty-five to forty young, and in September and October the sexes have been seen in copulation.

Var. dorsalis, Baird and Girard, has a broader vertebral stripe, margined on each side for one scale in width with black, as are also the sides of the abdominal scutellæ and upper basal edge of the scales in the exterior dorsal row; a row of spots above the lateral stripe, and the outer row of dorsal scales acutely emarginate.

Var. parietalis, Baird and Girard, has a moderately broad dorsal stripe, and the spaces about and between the lateral dark spots brick red. It is probably extralimital, ranging from Indiana to Texas and West.

Var. radix, Baird and Girard, has the scales rough, the outer row broad, the stripes narrow, the lateral ones being less than a scale in width though situated upon two rows, often upon the third and fourth, and has six series of distinct black spots. It is extralimital, ranging from Illinois and Wisconsin, to Minnesota, Dakota, Oregon, and Washington Territory.

Another variety occurring in the State is characterized by the entire absence of the dorsal stripe, it might appropriately be called *melanota*.

GENUS REGINA. Baird and Girard.

Body rather slender; size moderately small; teeth isodont; cephalic plates normal; anteorbitals two or one; postorbitals two, sometimes three; labials and inframaxillaries moderate; nasals one or two; loreal present; prefrontals two; dorsal scales carinated in 19-21 rows; gastrosteges 130-164; urosteges 50-85, all divided; post-abdominal scutellabifid; general color light beneath, dark above, usually with longitudinal bands; habits mostly aquatic; reproduction ovoviviparous.

Anteorbitals two. *a.*

Anteorbitals one. R. KIRTLANDII.

a. Vertical plate as broad at posterior edge of superciliaries as in front. *b.*

a. Vertical plate less broad at posterior edge of superciliaries than in front; extralimital; Texas. R. CLARKII.

b. Abdomen unicolor or with bands. *c.*

b. Abdomen with two series of black spots; extralimital; Pennsylvania and South. R. RIGIDA.

c. Vertical plate notched upon the sides to receive the projecting angle of the superciliaries. R. GRAHAMI.

c. Sides of vertical plate not notched. R. LEBERIS.

REGINA LEBERIS Linnæus.

Yellow-bellied or Leather Snake.

Coluber leberis, LINNÆUS, GMELIN, KALM, SHAW, DAUDIN.

Coluber septemvittatum, SAY, HARLAN.

Tropidonotus leberis, HOLBROOK, DEKAY, DUMERIL and BIBRON, GUNTHER, COPE.

Regina leberis, BAIRD and GIRARD.

Color olive-brown above, beneath yellow, with four longitudinal bands of greenish-brown, of these bands the two inner at times looking somewhat like series of dots; the yellow upon the sides appears as bands above the brown; sides of vertical plates parallel, the plate itself being hexagonal, with the posterior apex more acute than the anterior; anteorbitals two; upper labials seven, lower eight; inframaxillaries reaching to the end of the sixth lower labial; postorbitals over the fourth and fifth upper labials; dorsal scales 19; gastrosteges 140-150; urosteges 65-80; yellow bands upon the sides on first and second rows of scales; tail moderately long, becoming unicolor by the confluence of the lines. Length, 22 inches; head, $\frac{3}{4}$ inch; tail, $5\frac{1}{2}$ inches; transverse diameter of head, $\frac{1}{2}$ inch; of neck, 7-16 inch; circumference of body, $1\frac{1}{2}$ inches.

Habitat, New York, New Jersey, Pennsylvania, Maryland, Virginia, Tennessee, Michigan, Ohio, and Illinois.

In the State I have specimens from Highland county, and also from Columbus. It is aquatic, and probably occurs elsewhere, though it is not very common.

REGINA KIRTLANDII Kennicott.

Little Red Snake.

Regina kirtlandii, KENNICOTT, Proc. Acad. Nat. Sci. Phil., 1865. p. 75.

Tropidoclonion kirtlandii, COPE, Proc. Acad. Nat. Sci. Phil., 1860, p. 340.

General color above purplish brown, with four rows of sub-circular to triangular blotches, the outer larger than the inner, being from two to five scales in width; *color beneath brick red*, with a well defined series of dark blotches near the exterior of the scutellæ; dorsal scales in 19 rows, all carinate; vertical plate hexagonal, the posterior angle more acute, *the sides nearly parallel*; anteorbitals one on each side; nasals one, with an indented line giving it the appearance of two; upper labials six, lower seven; postorbitals above the fourth upper labials, and inframaxillaries reaching to sixth lower labials; gastrosteges 130-135; urosteges 55-60; post-abdominal scutella bifid. Length $17\frac{1}{4}$ inches; head, $\frac{3}{4}$ inch; tail, $4\frac{1}{4}$ inches; transverse diameter of head, 5-16 inch; of neck $\frac{1}{2}$ inch; circumference of body, $1\frac{1}{2}$ inches.

Habitat, New Jersey, Ohio, Michigan, and Illinois.

Regina kirtlandii is a terrestrial animal, being found in woods, generally under old logs. It is sluggish, not very pugnacious, and in the State has been detected in Columbus.

In naming this species, Mr. Kennicott pays the following compliment to the Ohio Herpetologist: "In giving to this serpent the name

of Dr. Kirtland, as a slight token of the respect due him to whose enthusiastic and untiring devotion to Science the West owes so much, I would also make some expression of my personal gratitude to the honored teacher, whose kind encouragement and instruction led me to study Nature, by dedicating to him his pupil's first contribution to Science."

GENUS TROPIDONOTUS. Kuhl.

Body thick and stout; size large; cephalic plates normal; anteorbitals one, sometimes two; postorbitals three, rarely two; labials and inframaxillaries large; nasals two; loreal present; prefrontals two; dorsal scales in 23-29 rows, carinated; gastrosteges 130-155; urosteges 65-85 all divided; postabdominal scutella bifid; general color three to five series of dark blotches upon a lighter ground; habits aquatic; reproduction ovoviviparous.

Dorsal scales in 23, rarely 25 rows. *a.*

Dorsal scales in 25 rows; upper labials 9, lower 11; extralimital. . T. WOODHOUSII.

Dorsal scales in 27 rows. T. RHOMBIFER.

Dorsal scales in 29 rows; extralimital, North Carolina to Georgia. . T. TAXISPILOTA.

a. Abdomen usually spotted with dark. *b.*

a. Abdomen unicolor. *c.*

b. Gastrosteges 137-145. T. SIPEDON.

b. Gastrosteges 128-133. T. FASCIATUS.

c. Anteorbitals one or two. T. ERYTHROGASTER.

TROPIDONOTUS SIPEDON Linnæus.

Water Snake or Water Adder.

Coluber sipedon, LINNÆUS, SHAW, MERREM, HARLAN, KIRTLAND, STORER.

Tropidonotus sipedon, HOLBROOK, DEKAY, DUMERIL and BIBRON, VERRILL.

Coluber pædogaster, WIED.

REGINA GRAHAMII Baird and Girard.

Graham's Snake.

Tropidonotus grahami, GUNTHER, COPE, JORDAN.

Regina grahamii, BAIRD and GIRARD.

General color above brown, with a light vertebral line margined with black; lateral line yellow, with a black margin situated upon the first, second, and third rows of scales; abdomen yellowish, without spots; vertical plates nearly pentagonal, with the sides notched a little behind the center; anteorbitals two; nasals one; upper labials seven, lower eight; postorbitals above the line of union of the fourth and fifth upper labials; inframaxillaries reaching to the anterior end of the seventh lower labials; dorsal scales in 19 rows; gastrosteges 160-162; urosteges 57. Length, $20\frac{1}{2}$ inches; head, $\frac{3}{4}$ inch; tail, 4 inches; transverse diameter of head, 5-16 inch; of neck, $\frac{1}{4}$ inch; circumference of body, $1\frac{1}{2}$ inch.

Habitat, Mississippi Valley from Western Mexico, Texas and Louisiana, to Illinois and Michigan.

Although I have no record of this species having been observed in the State, its range is such as to render its occurrence in Ohio probable.

Tropidonotus niger, HOLBROOK.

Nerodia sipedon, et *transversa*, BAIRD and GIRARD.

Tropidonotus fasciatus, var. *sipedon*, GUNTHER.

General color above brownish, with three series of darker, more or less distinct, approximately quadrilateral blotches, the vertebral row much the larger, covering from two to three scales before backwards, and nine to ten scales in width; abdomen yellowish, with dark blotches, or a marbling of yellow and brown; the general color is sometimes in old specimens so predominant as to render the markings obscure; vertical plate pentagonal, nearly or quite as long as commissural line of occipitals, the latter truncate behind; upper labials 8, lower 10; anteorbitals 1; postorbitals 3, over the commissural line of the fifth and sixth upper labials; inframaxillaries reaching to the posterior end of seventh lower labial; dorsal scales in 23, rarely 25, rows; gastrosteges 137-145; urosteges 60-80; body attaining a large size; tail short.

The young of this species show the coloration very decidedly; a light line reaching back from the posterior edge of, and two light spots upon the occipitals; head also variously marked or marbled with lighter. Length, $2\frac{1}{2}$ feet; head, $1\frac{1}{2}$ inches; tail, $7\frac{1}{2}$ inches; transverse diameter of head, $\frac{3}{4}$ inch; of neck, 9-16 inch; circumference of body $4\frac{1}{2}$ inches.

Habitat, Canada, Maine, Massachusetts, New York, Pennsylvania, Maryland, Virginia, Ohio, Michigan, Illinois, Wisconsin, and Upper Missouri, "Louisiana and Mexico."

In the State, as in the extralimital part of its range, *Tropidonotus sipedon* is the commonest aquatic snake. It may be seen along the shores of ponds, and streams, and upon logs, basking in the sun. It is found only in wet places, and when disturbed takes to water and glides rapidly away. Although a formidable looking animal, the Water Snake is destitute of poison fangs, and perfectly harmless.

TROPIDONOTUS FASCIATUS Linnæus.

Coluber fasciatus, LINNÆUS, DAUDIN, HOLBROOK.

Coluber porcatus, HARLAN.

Tropidonotus fasciatus, HOLBROOK, DEKAY, DUMERIL and BIBRON, GUNTHER.

Nerodia fasciata, BAIRD and GIRARD.

? *Coluber porcatus*, KIRTLAND.

General color brown above, with transverse dark spots in the young; sides with from 30-38 sub-triangular red patches; abdomen reddish-white, with dark blotches; head broader behind, and more triangular than *Tropidonotus sipedon*; vertical plate pentagonal, broader in front than behind; upper labials 8, lower 9; anteorbitals 1; dorsal scales in 23 rows, the exterior as well as the others carinated; gastrosteges 128-233; urosteges 40-75.

Habitat, South Carolina, Florida, Mississippi, Louisiana, Mexico, Central America.

Dr. Kirtland refers the *Coluber porcatus* to Ohio, and states that it is found upon the shores of rivers and creeks, and that it was popularly confounded with *Tropidonotus sipedon*, under the name of Water Snake. I have not seen it from the State, and think owing to its southern range, that his identification was probably erroneous.

TROPIDONOTUS ERYTHROGASTER Shaw.

Red-bellied Water Snake.*Coluber erythrogaster*, SHAW, HOLBROOK.*Tropidonotus erythrogaster*, HOLBROOK, DEKAY, DUMERIL and BIBRON.*Nerodia erythrogaster*, et *agassizii*, BAIRD and GIRARD.

General color bluish to reddish black above, without spots or blotches; beneath coppery red; body attaining a great size; head large, triangular; muzzle obtuse or truncate; vertical, occipital, temporal, and labial shields large, of the latter the sixth and seventh upper, and the fifth and sixth lower the largest; vertical plate pentagonal, broadest in front, about as long as commissural line of occipitals; anteorbitals one; upper labials 8, lower 10; inframaxillaries large, extending to eighth lower labial; dorsal scales in 23 rows, all carinated except the exterior in which it has become obsolete; gastrosteges 150-155; urosteges 67 to 80. Length, 3 11-12 feet; head, $1\frac{7}{8}$ inches; tail, $10\frac{1}{4}$ inches; transverse diameter of head, $1\frac{1}{2}$ inches; of neck, $\frac{3}{4}$ inch; circumference of body, 7 inches.

Habitat, Michigan, Illinois, Kansas, Arkansas and South.

I have never seen *Tropidonotus erythrogaster* from Ohio. Dr. Wheaton informs me that in the vicinity of Columbus a large serpent of this genus, with a coppery belly is not uncommon. It is doubtless this species, in which opinion I am confirmed by the fact that it has been found at Lake Erie, near Brest, Monroe county, Michigan.

GENUS HETERODON. Beauvois.

Size large; neck and body capable of great dilatation by inhalation of air which is afterwards emitted with a peculiar hissing sound, hence the name Blowing Vipers; head short, large, triangular, resembling somewhat the venomous *Crotalidæ*; cephalic region covered with large plates, of which the rostral forms a trihedral pyramid, with a promi-

TROPIDONOTUS RHOMBIFER Hallowell.

Holbrook's Water Snake.*Tropidonotus rhombifer*, HALLOWELL, COPE.*Nerodia rhombifer*, et *holbrookii*, BAIRD and GIRARD.

General color brown, with quadrangular black blotches, about 50 in number, from head to end of tail; lateral transverse bars alternating with the preceding; head elongated, slightly swollen at the temples; muzzle truncated; vertical plate elongated, slightly notched on the sides, and its length greater than commissural line of occipital: upper labials 8, lower 10; inframaxillaries reaching about to end of seventh lower labials; dorsal scales in 27 rows, the outer smooth; gastrosteges 142-143; urosteges 63-73. Length, $2\frac{3}{4}$ feet; head, $1\frac{1}{2}$ inches; tail, $6\frac{1}{2}$ inches; transverse diameter of head, 10 lines; of neck, 8 lines; circumference of body 3 inches.

Habitat, Michigan, Illinois, Arkansas, and Louisiana.

Probably not in our limits, but its range is such that it may easily extend into Ohio.

nent ridge or keel above; small *infraorbitals*, above the *labials*, continuous with the *ante-orbitals* in front and *postorbitals* behind; nasals two; *lorals* one or two; *prefrontals* enclosing an azygos plate with or without other small plates along side; two *posterior maxillary teeth* much the longest; dorsal scales in 23 to 27 rows, carinated; *gastrosteges* 125-150; *urosteges* 30-58; post-abdominal scutella, bifid.

Azygos and frontals separated by small plates. *a.*

Azygos and frontals contiguous. H. PLATYRHINUS.

a. Interfrontal region with from 4-8 small plates; extralimal. . . H. SIMUS.

a. Interfrontal region with from 11-15 small plates; extralimal. . H. NASICUS.

HETERODON PLATYRHINUS Latreille.

Hog-nose Snake or Spreading Adder.

Coluber heterodon, DAUDIN, SAY, HARLAN.

Heterodon platyrhinus, LATREILLE, HOLBROOK, STORER, KIRTLAND, DEKAY, DUMERIL and BIBRON, GUNTHER, COPE.

Heterodon annulatus, TROOST.

Heterodon platyrhinos, cognatus, niger, et atmodes, BAIRD and GIRARD.

General color light-brown above, with three series of dark blotches varying from quadrate to circular, and becoming half rings upon the tail, alternating with light yellow; a black band crossing the anterior part of the vertical and superciliary plates and posterior half of the postfrontals, and continuing through the eye to the angle of the mouth; upper part of the neck and back with the scales between the black spots brown centrally and surrounded with orange-yellow, as can be seen by stretching the skin; under part of tail varying from yellow to flesh-red; abdomen slate color, becoming greenish-yellow under the neck; *inframaxillary* region greenish-white; vertical and superciliary crossed by a greenish band; upper labials yellow, eight in number, lower nine; vertical pentagonal, cuneiform, broadest in front, and longer than commissural line of occipitals; superciliaries broad; azygos elongated, acute behind, contiguous with the prefrontals and postfrontals, reaching to about the middle of the commissural line of the latter; *inframaxillaries* extending to fourth lower labial; dorsal scales in 25, rarely 23, rows; *gastrosteges* 125-149; *urosteges* 46-58. Length, 2½ feet; head, 1½ inches; tail, 7 inches; transverse diameter of head, 1½ inches; of neck, 1 inch; circumference of body, 3½ inches.

Habitat, New Hampshire, Massachusetts, New York, Pennsylvania, New Jersey, Virginia, North Carolina, South Carolina, Georgia, Florida, Texas, Tennessee, Illinois, Ohio, Michigan, and "California."

The Hog-nose Snake is occasionally found in the northeastern part of State, and in the Scioto Valley. It is usually met with in sandy soils, and, it is said, also in low, wet meadows. Its breeding has been observed in Georgia in April, but probably is later in our more northern climate. *Heterodon platyrhinus* rejoices in a multitude of common names, such as Spreading, Deaf, and Blowing Adder, Flat-head, Hog-and Buckwheat-nose Snake, Blauser, Blowing, and Sand Viper, etc.

Considerable discussion has been going on lately in the Science News*

*Vol. I, Nos. 1, 2, 3, and 4.

as to the effect of the bite of this *Heterodon*. Dr. Yarrow of Washington, D. C., called attention to it, and also since stated the fact that he had a fine specimen brought to him the past summer, which the slayer called the "Mountain Moccasin," and declared it to be the most venomous of all snakes. A similar belief prevails among the Indians and common people generally. On the other hand, Messrs. H. S. Reynolds, Urbana, Illinois, C. C. Abbott, Trenton, New Jersey, and R. M. W. Gibbs, Kalamazoo, Michigan, state that they had each been bitten by *Heterodon platyrhinus*, and had known it to bite animals without serious results. Mr. H. E. Heighway, Cincinnati, Ohio, states that, while on a scientific expedition last summer, Prof. A. S. Wetherby and six students from Cincinnati University, found under old logs a "Puffing Adder" of the genus *Heterodon*. The Professor picked it up fearlessly, and while preparing to put it into a bottle of alcohol, was bitten upon the thumb, but no attention was paid to the bite, and no harm resulted. On the other hand, it may be stated, that the *Heterodon* has at the posterior end of the maxillary bone two or four teeth, much larger than the others, and resembling fangs in appearance. They are still farther enveloped in a sheath similar to that in the venomous serpents, and separated by a short interval from the ordinary teeth. These teeth are firmly soldered to the bone, and not loosely set in grooves as the ordinary ones. That the animal could use them for the purpose of striking seemed to me impossible, until Prof. Steere informed me of their peculiar power of apparently dislocating their jaw, which may enable them to do so. The question therefore must be settled by observations made upon the actual bite of the animal. These thus far seem to point to its harmless character, and yet it is hardly safe from them to infer positively that the general opinion is wrong, and that naturalists are right. My own impression is that *Heterodon* is harmless, and yet its general appearance, and more especially the shape of its head strikingly resembles that of the venomous reptiles.

HETERODON PLATYRHINUS Latreille.

var. NIGER Catesby.

Black Viper.

Vipera nigra, CATESBY.

Coluber cacodemon, SHAW.

Scytale niger, DAUDIN, HARLAN.

Coluber thraso, HARLAN.

Heterodon niger, TROOST, HOLBROOK, KIRTLAND, BAIRD and GIRARD, DUMERIL and BIBRON, GUNTHER.

This variety differs from the typical *Heterodon platyrhinus* by being of a uniform black or brown above, without spots, and having a slate colored abdomen.

Habitat, Connecticut, Pennsylvania, South Carolina, Georgia, Mississippi, Tennessee. In the State, Dr. Kirtland reports it as having been found at Legionville and the Ohio hills.

The Black Viper is apparently more ferocious than the typical *platyrhinus*. When disturbed it flattens its head, hisses, throws its mouth wide open, giving it the appearance of a dislocated lower jaw (which remains fixed for some time), and darts at the object. If unable thus to frighten away its foes, and is in turn a little roughly treated, such as being pushed with a stick, it will feign death, as was observed by Troost and also by Prof. Steere of Michigan University. The former of these gentlemen was so far deceived that he laid down his snake for a short time, when it made its escape, and was found again with difficulty. He also found in one which he dissected twenty-five oval eggs, each three-quarters of an inch long, and without a calcareous cover.

GENUS PITYOPHIS. Holbrook.

Body rather long and moderately slender; head elongated; teeth equal, smooth; cephalic plates not normal; rostral high, projecting forwards in some species; prefrontals two; postfrontals four or five; nasals two; loreal small; anteorbitals one or two; postorbitals three or four; dorsal scales in 25 to 35 rows, middle ones slightly carinated; gastrosteges 210-244; urosteges 44-72; post-abdominal scutella entire.

Dorsal scales in 29 rows. P. MELANOLEUCUS.

Dorsal scales in 29 rows; extralimital. P. SAYI.

PITYOPHIS MELANOLEUCUS Daudin.

Pine or Bull Snake.

Coluber melanoleucus, DAUDIN, HARLAN.

Pituophis melanoleucus, HOLBROOK, BAIRD and GIRARD, DUMERIL and BIBRON, GUNTHER, COPE, JORDAN.

General color white to yellowish, with a dorsal series of large chestnut blotches, which are margined with black; abdomen unicolor, with sides irregularly mottled; vertical plate sub-pentagonal; postfrontals four, the internal pair sub-triangular, external polygonal; upper labials 8, lower 14; nostrils two, vertically oblong; rostral convex, projecting forwards and reaching to the internal post-frontals behind; tail about one-seventh of total length; urosteges 60-65; gastrosteges 215-230; dorsal scales in 29 rows. Length, 4 feet; tail $8\frac{1}{2}$ inches.

Habitat, New Jersey, South Carolina and Florida, to Ohio.

Rare in the State. Usually, if not always, the Bull Snake is found in pine woods. It lays from seven to twelve eggs in July, and prior to oviposition the female is very irritable. They emit an odor which is believed to be of use in attracting the opposite sex.*

*For habits of this animal see Am. Naturalist, Jan., 1875, p. 1.

GENUS OPHIBOLUS Baird and Girard.

Body moderately elongated; head slightly, if at all, separable from the neck; cephalic plates normal; *vertical very broad*; superciliaries narrow; postfrontals and prefrontals, each a pair, of moderate size; occipitals large; postorbitals two; anteorbitals one; nasal one, with an indented line giving it the appearance of two; labials and infra-maxillaries rather large; dorsal scales in 21-25 rows, smooth, not imbricated; gastrosteges, 180-220; urosteges, 44-65; post-abdominal scutella entire or bifid.

† Dorsal scales in 21 or 23 rows; anal plate entire. *a.*

† Dorsal scales in 25 rows; anal plate bifid. O. CALLIGASTER.

a. Gastrosteges, 180-210. *b.*

a. Gastrosteges, 210-225; extralimital, Maryland to Louisiana; east of Alleghanies.

O. GETULUS.

b. Red, with black rings; head red. O. DOLIATUS.

b. Gray, with brown blotches margined with dark; head gray and black.

O. TRIANGULUS.

OPHIBOLUS CALLIGASTER Say.

Say's Chain Snake.

Coluber calligaster, SAY, HARLAN.

Ablabes triangulum, var. *calligaster*; *Ophibolus evansii*, KENNICOTT.

Ophibolus calligaster, COPE, JORDAN.

General color above grayish-brown, with a vertebral series of from forty to sixty chocolate to black sub-quadrangular, emarginate blotches, margined with still darker; head greenish-brown, with darker spots; upper labials yellow; lateral blotches alternating with the vertebral series, often not very distinct; abdomen maculated with approximately quadrilateral dark blotches; vertical plate pentagonal, nearly as long as commissural line of occipitals; upper labials, 7-8, lower, 9-11; *dorsal scales in 25 rows; anal plate bifid*; gastrosteges, 232; urosteges, 60-70. Length, 3½ feet; head, 10 lines; tail, 5 inches; transverse diameter of head, 8 lines; of neck, 7 lines; circumference of body, 3 inches.

Habitat, Arkansas, Kansas, Missouri, Illinois, and Ohio.

I am indebted to Prof. Tuttle, of the Ohio State University for the single specimen of this species which I have seen from the State. It came from Lancaster, in Fairfield county.

OPHIBOLUS TRIANGULUS Boie.

Milk Snake.

Coluber triangulum, BOIE.

Coluber eximius, DEKAY, HARLAN, HOLBROOK, KIRTLAND, STORER, GUNTHER.

Coluber guttatus, SCHLEGEL.

Ophibolus eximius, et *clericus*, BAIRD and GIRARD.

Ablabes triangulum, DUMERIL and BIBRON, var. *clericus*, et *eximius*, HALLOWELL.

Lampropeltis triangula, et *Ophibolus doliatus*, sub-species *triangulus*, COPE.

Lampropeltis triangula, VERRILL.

General color grayish white; a vertebral series of transversely elliptical, brown margined with black blotches extends from the neck to the tail, each blotch covering from four to five scales in length and fifteen to twenty in width; lateral spots of the same color in two rows on each side, each spot from three to four scales in width and two to three in length, with smaller spots between; ventral spots quadrangular on one, two, and sometimes three scutellæ, longest transversely; the white upon the back arranged somewhat in transverse bands about one and a half to two scales in width; head with two elliptical blotches reaching from the occipitals backwards, that on the left side the larger, causing the white or creamy-white on the neck above to appear as a longitudinal band between the blotches, and this band bifurcates just behind the occipitals; a dingy white spot on the anterior of the occipitals surrounded by a sub-quadrangular spot of black or brown; a transverse dark band crossing the vertical and postfrontals just in front of the eye; a longitudinal brown blotch running from the eye backward and forward; eyes moderate; pupils black; irides red; *vertical plate nearly an equilateral triangle*; occipitals rather large, truncate behind; upper labials, 7, lower, 8; infra-maxillaries reaching to posterior end of fifth lower labial; *dorsal scales in 21 rows*; gastrosteges, 200-210; urosteges, 48-55. Length, $3\frac{1}{2}$ feet; head, $1\frac{1}{2}$ inches; tail, $5\frac{1}{2}$ inches; transverse diameter of head, $\frac{1}{2}$ inch; of neck, $\frac{1}{8}$ inch; circumference of body $3\frac{1}{2}$ inches.

Habitat, Canada, Maine, Massachusetts, Rhode Island, New York, Pennsylvania, Maryland, Ohio, Michigan, Wisconsin and Iowa.

Common in all parts of the State.

The Museum of Michigan University contains a double-headed *O. triangulus*, of which the remainder of the body appears to be perfectly normal. Another case is recorded by Prof. Wyman* of a *Tropidonotus sipedon* with two heads and two tails, and a similar case as well as an instance of a five legged frog is reported by Mr. Kingsley.† Mr. Ryder‡ also calls attention to a specimen of *Rana palustris* with five limbs or rather an additional pair of hind legs fused together. This limb had six toes, and its digital formula might be written 5, 4, 3, 3, 4, 5, and the outer or dark colors prevailed just as they should in case of two limbs united. Cases of monstrosities among serpents have been observed by various parties from the time of Aristotle and Redi to the présent, and they, as well as the occurrence of monsters in general, may be due to shock.

The Milk Snake called also Chicken Snake, Thunder and Lightning Snake, Chequered or Spotted Adder, is found in dry woods and frequently also in outhouses and dairies, which it is said to visit in order to get at the milk. It is a perfectly harmless animal, climbs readily and glides with grace and rapidity over smooth places.

Mr. C. Hart Merriam‡ on the authority of Mr John M. Howey, of Canandaigua, N. Y., gives an instance of an *Ophibolus* (probably this.

*Proc. Bost. Soc. Nat. Hist., vol. ix, p. 183.

†Am. Naturalist, vol. xii, p. 594-751.

‡Science News, Dec., 15, 1878, p. 69.

species) swallowing an *Eutænia* or Striped Snake. He (Howey) struck the snake with the scythe, cutting it in two about three inches from its head, when to his surprise a tail stuck out. He drew it out, and then discovered it to be an *Eutænia*, about two-thirds as long as the *Ophibolus*. It had, of course, been swallowed head foremost, and the head was nearly digested.

OPHIBOLUS DOLIATUS Linnæus.

Red or Corn Snake.

Coluber doliatus, LINNÆUS, GMELIN, HARLAN.

Coluber coccineus, BLUMENBACH, KIRTLAND.

Coronella coccinea, SCHLEGEL.

Coronella doliata, HOLBROOK, GUNTHER.

Ophibolus doliatus, et *gentilis*, BAIRD and GIRARD.

Lampropeltis doliata, et *Ophibolus doliatus*, COPE.

Rhinostoma coccinea, BAIRD and GIRARD.

General color red, with from twenty-two to twenty-five pairs of transverse black bands, each inclosing a yellow spot; head in front red, with a black ring on posterior of occipitals, passing forward on each side across the superciliaries and vertical to meet on the postfrontals, thus inclosing a large nearly triangular spot with the apex anteriorly; a black spot upon the sides of the head, upon the temporals and posterior upper labials; abdomen red, with dark spots; vertical plate nearly an equilateral triangle; upper labials, 7, lower, 8; inframaxillaries reaching to posterior edge of fifth lower labial; dorsal scales in 21 or 23 rows; gastrosteges, 185-208; urosteges, 45-50. Length, 2½ feet; head, ¾ inch; tail, 3¼ inches; transverse diameter of head, 6 lines; of neck, 5 lines; circumference of body, 2 inches.

Habitat, Delaware, Maryland, Mississippi, Arkansas, Kansas, and Illinois.

Dr. Kirtland mentions having had a specimen sent to him labelled by Mr. Dorfeuille, which was said to have been taken in Ohio. It is accordingly inserted here, though it must be rare in the State.

GENUS COLUBER. Linnæus.

Scotophis, BAIRD and GIRARD.

Body large, attaining a length of four or five feet; head elongated; vertical plate large and very broad; postfrontals attaining a great size; prefrontals two, large; rostral large, not projecting; nasals two; loreal present; anteorbitals one; postorbitals two; upper and lower labials large; mouth deeply cleft; dorsal scales in 23 to 29 rows, the middle ones slightly carinated, the outer smooth; gastrosteges, 200-235; urosteges, 65-93; post abdominal scutella bifid.

*Dorsal scales in 25 rows. *a*.

*Dorsal scales in 27, rarely 25 rows. *b*.

*Dorsal scales in 29 rows. *d*.

a. Gastrosteges, 200-210; tail at anus, large, tapering rapidly to a point.

C. VULPINUS.

- a. *Gastrosteges*, 230-240; tail at anus moderate, tapering gradually to a point; extralimital, South Carolina, Louisiana, and Missouri. . . . C. *CONFINIS*.
- b. Dorsal region greenish-yellow, with four longitudinal brown bands; extralimital, North Carolina to Florida. . . . C. *QUADRIVITTATUS*.
- b. Dorsal region without bands. c.
- c. *Gastrosteges*, 230-235; vertical plate longer than broad; black above. . . . C. *OBSOLETUS*.
- c. *Gastrosteges*, 210-230; vertical plate about as long as broad; red dorsal blotches; extralimital, Virginia, South Carolina, Georgia, Florida, to Mississippi. . . . C. *GUTTATUS*.
- d. Vertical plate about as long as broad; extralimital, Texas to Arkansas. . . . C. *LINDHEIMERII*.
- d. Vertical plate longer than broad; extralimital, Texas, Arkansas, Kansas, and Illinois. . . . C. *EMORYI*.

COLUBER OBSOLETUS Say.

Pilot Black Snake or Racer.

Coluber obsoletus, SAY, HOLBROOK, KIRTLAND.

Coluber obsoletus, et *alleganiensis*, DEKAY.

Scotophis alleganiensis, BAIRD and GIRARD.

Elaphis alleganiensis, ALLEN.

Coluber obsoletus, et *Scotophis alleganiensis*, COPE.

Color black, sometimes with the scales margined with yellowish-white, giving the appearance of lighter blotches; head black above; upper labials greenish-yellow; abdomen dark or a mottled black and yellow, or black and white; gular and lower maxillary region either mottled or dirty yellow; vertical plate sub-pentagonal, longer than broad; occipitals large, truncate behind; postfrontals and nostrals large; upper labials, 8, the two posterior the largest, lower, 11, fifth and sixth largest; inframaxillaries extending to eighth lowerlabial; dorsal scales in 27, rarely 25 rows; *gastrosteges*, 230-235; *urosteges*, 80-86. Length, 5 feet; head, $1\frac{3}{4}$ inches; tail, 10 inches; transverse diameter of head, 1 inch; of neck, 9 lines; circumference of body, $4\frac{1}{4}$ inches.

Habitat, Massachusetts, Connecticut, New York, Pennsylvania, Virginia, North Carolina, South Carolina, Ohio, Michigan, Illinois, Missouri, and Arkansas.

In the State I have seen but one specimen of the Pilot Snake. It came from Yellow Springs, Clarke county, and was sent to me by Prof. Tuttle, of the Ohio State University. It differed from the typical *Coluber obsoletus* by having 25 instead of 27 rows of scales, and a slightly broader vertical plate, approaching in these respects the southern variety, *confinis*. It is said to dwell for the most part in damp places, crawling upon the hills in autumn previous to hibernation, and is an animal of "prodigious velocity," probably rare in our limits. It resembles and is liable to be confounded with the Blue Racer, *Bascanion constrictor*, from which it can be readily distinguished by its darker color, and having the central dorsal scales carinated instead of smooth.

GENUS BASCANION. Baird and Girard.

Body elongated, attaining a length of five or six feet; head elongated, passing gradually into the neck; vertical plate elongated; superciliaries wide; occipitals large; postfrontals moderately large; postorbitals two; anteorbitals two; loreal large; nasals two; labials large; inframaxillaries well developed; mouth deeply cleft; dorsal scales in 17, rarely 19 rows, all smooth; gastrosteges, 170-210; urosteges, 80-110; anal plate bifid; color above black, olive, or blue.

BASCANION CONSTRICTOR Linnæus.

Blue Racer or Black Snake.

Coluber constrictor, LINNÆUS, GMEZIN, HARLAN, SCHLEGEL, STORER, HOLBROOK, THOMPSON, KIRTLAND, DEKAY.

Hierophis constrictor, BONAPARTE.

Coryphodon constrictor, DUMERIL and BIBRON, GUNTHER.

Bascanion constrictor, BAIRD and GIRARD, ALLEN, COPE, JORDAN.

? *Bascanion foxii*, BAIRD and GIRARD.

? *Coluber flaviventris*, SAY, HARLAN, HOLBROOK.

? *Bascanion flaviventris*, BAIRD and GIRARD.

General color above in our specimens, varying from uniform azure blue to blue-black; below greenish-blue; gular region, lower jaw, labial, and rostral region of upper jaw whitish; a light line passing from the rostral just above the loreal and eye, to the anterior edge of the superciliaries; vertical plate pentagonal, with irregular sides, broadest anteriorly, in length about equal to commissural line of occipitals; upper

COLUBER VULPINUS Baird and Girard.

Fox Snake.

Scotophis vulpinus, BAIRD and GIRARD.

Coluber vulpinus, COPE.

Elaphis spiloides, DUMERIL and BIBRON.

Coluber spiloides, GUNTHER.

General color above light-brown, with a vertebral and two lateral rows of chocolate colored blotches, the vertebral very large, covering from five to nine scales in length and about twelve in width, the lateral much smaller, about three scales in length and from three to five in width; these blotches extending upon the tail, but smaller; head light-brown to yellow; abdomen with four series of approximately quadrilateral black blotches; vertical plate nearly an equilateral triangle; occipitals large, rounded behind; upper labials, 8, the sixth and seventh largest, lower, 11, the fifth much the largest; inframaxillaries reaching to the sixth lower labial; dorsal scales in 25 rows; gastrosteges, 300-310; urosteges, 65-70; tail large at base. Length, 5 feet; head, 1½ inches; tail, 9½ inches; transverse diameter of head, 1½ inches; of neck, 10 lines; circumference of body, 5 inches.

Habitat. Massachusetts, New York, Michigan, Wisconsin, Illinois, Kansas, Minnesota.

Although this species has not yet, so far as I know, been observed in Ohio, its range is such as to render its occurrence in the northern part of the State very probable.

labials, 7, lower, 9; inframaxillaries extending to sixth lower labial; temporal region covered with two rows of plates, three or four in each; rostral large, triangular, projecting between the prefrontals; dorsal scales in 17, rarely 19 rows; gastrosteges, 175-190; urosteges, 80-110. Length, 6 feet; head, $1\frac{1}{2}$ inches; tail, 18 inches; transverse diameter of head, 1 inch; of neck, $\frac{1}{2}$ inch; circumference of body, 5 inches.

Habitat, Canada, Massachusetts, New York, Pennsylvania, Maryland, North Carolina, South Carolina, Georgia, Florida, Mississippi, Louisiana, Tennessee, Illinois, Indiana, Michigan, and Ohio. "St. Domingo."

From the State I have seen specimens from London and Lancaster, and the portion adjoining Michigan, though it is probably moderately common everywhere. Dr. Kirtland observed that it seemed to be upon the increase, as the State became cleared.

The western Blue Racer differs very markedly in color from the Black Snake of the east. In the latter the color is a lustrous pitch black, while in ours, in the adult state, it is a light azure, and a very pale blue or almost white beneath. The scales in our serpents are somewhat broader than in any of the eastern specimens which I have seen. These differences are sufficient to constitute what Prof. Cope calls a "sub-species" or geographical variety, to which the name *cæruleus* may very properly be applied.

The Blue Racers are gregarious animals during hibernation and in spring, having been ploughed up in bunches of seventy to eighty, but in summer they seem to be solitary, as they are then found singly or in pairs, a male and female being together. They inhabit woods, are sometimes found under and around barns, and climb trees and bushes in order to reach birds' nests, and obtain the young birds and eggs. They also prey upon mice and frogs, and although non-venomous, are said to pursue an enemy who retreats before them. Allen remarked that in Massachusetts *Bascanion constrictor*, like the field mice, was more numerous some years than others, possibly the result of the same cause in both instances, viz. the relative degree to which the ground was protected by snow during winter. The same gentleman saw one alive during a break in the cold weather on January 29, 1864.

GENUS LIOPELTIS. Fitzinger.

Body long and slender; head elongated; teeth equal, smooth; cephalic plates normal; postfrontals and prefrontals each a pair; postorbitals two; anteorbitals one or two; nasals one; loreal present, occasionally fused with the nasal; occipitals large; mouth deeply cleft; dorsal scales in 15 rows, all smooth; gastrosteges, 129-140; anal plate bifid.

LIOPELTIS VERNALIS DeKay.

Green or Grass Snake.

Coluber vernalis, DEKAY, HARLAN, STORER, KIRTLAND, HOLBROOK, THOMPSON.

Chlorosoma vernalis, BAIRD and GIRARD.

Herpetodryas vernalis, HALLOWELL.

Cyclophis vernalis, GUNTHER, COPE.

Liopeltis vernalis, COPE, JORDAN.

Color uniform bright dark-green above; paler beneath, sometimes nearly white; color in alcohol pale-blue; vertical plate elongated pentagonal; rostral large; upper labials, six, lower, eight; eyes large, above the third and fourth upper labials; inframaxillaries reaching to the sixth lower labial; gastrosteges, 129-140; urosteges, 70-95. Length, 1½ feet; head, ¾ inch; tail, 4½ inches; transverse diameter of head, 5 lines; of neck, 4 lines; circumference of body, 1½ inches.

Habitat, Maine, Massachusetts, Rhode Island, New York, Pennsylvania, New Jersey, Ohio, Michigan, Illinois, Nebraska, Montana and Colorado, to Florida and New Mexico.

This beautiful little snake frequents marshes, is quick and lively in its movements, and is occasionally found in every part of Ohio.

GENUS CYCLOPHIS. Günther.

Body long and slender; head moderately large; teeth equal, smooth; eye rather large; cephalic plates normal; postfrontals and prefrontals each a pair; postorbitals two; anteorbitals one; nasals one; loreal present; occipitals large; vertical elongated; inframaxillaries long; dorsal scales sub-elliptical, in 17 rows, carinated; gastrosteges, 155-165; urosteges, 110-135; anal plate bifid.

CYCLOPHIS ÆSTIVUS Linnæus.

Summer Green Snake.

Coluber æstivus, LINNÆUS, HARLAN.

Leptophis æstivus, BELL, HOLBROOK.

Herpetodryas æstivus, SCHLEGEL, DUMERIL and BIBRON, HALLOWELL.

Anguis viridis, CATESBY.

Cyclophis æstivus, GUNTHER, COPE, JORDAN.

Opheadrys æstivus, FITZINGER, COPE.

Leptophis æstivus, et majalis, BAIRD and GIRARD.

General color above reddish-green, in alcohol changing to blue; beneath yellowish to greenish-white; upper labials and lower jaw for the most part white; vertical plate sub-pentagonal, longer than broad, but not equal to commissural line of occipitals; upper labials, 7, lower, 8; mouth deeply cleft; commissure curved; eye over third and fourth upper labial; inframaxillaries extending to seventh lower labial; scales in 17 rows, all carinated except the three outer; gastrosteges, 155-158; urosteges, 125-135. Length, 25 inches; head, 8 lines; tail, 11 inches; transverse diameter of head, 4 lines; of neck, 3 lines; circumference of body, 15 lines.

Habitat, Massachusetts?, Pennsylvania, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Mississippi, Louisiana, Texas, New Mexico, Arkansas, Ohio, Illinois, Missouri, "California, Michigan, West Indies."

A single specimen of this beautiful little serpent was sent to me by Prof. Tuttle, of the Ohio State University. It was captured at Ironton, Lawrence county, and is likely to be confounded with the preceding species, from which its seventeen rows of carinated scales at once distinguish it. Prof. Cope found that in confinement "instead of climbing over caladia, ferns, etc., it lived mostly under ground. It had a curious habit of projecting its head, and two or three inches of its body above the ground, and holding them for hours rigidly in a fixed attitude." In this position its resemblance to a small sprout or plant might easily lead to its being mistaken for such, or overlooked by other animals.

GENUS DIADOPHIS. Baird and Girard.

Body slender, elongated; head rather short and broad; teeth equal, smooth; cephalic plates normal; postfrontals and prefrontals each a pair; loreal present; nasals two; postorbitals two; labials and inframaxillaries rather small; occipitals of fair size; rostral comparatively small, not projecting; dorsal scales in 15-17 rows; gastrosteges, 142-240; urosteges, 35-60; anal plate bifid; occipital region generally with a yellowish-ring.

Dorsal scales in 15 rows. D. PUNCTATUS.

Dorsal scales in 17 rows; abdomen spotted and mottled with black; extralimital.

D. ARNYI.

DIADOPHIS PUNCTATUS Linnæus.

Ring-necked Snake.

Coluber punctatus, LINNÆUS, GMELIN, HARLAN, KIRTLAND, STORER, HOLBROOK, DEKAY.

Coluber torquatus, SHAW.

Natrix edwardsii, et punctatus, MERREM.

Homalosoma punctatum, WAGLER.

Spiletes punctatus, SWAINSON.

Calamaria punctata, SCHLEGEL.

Ablabes punctatus DUMERIL and BIBRON, GUNTHER, HALLOWELL,

Diadophis punctatus, BAIRD and GIRARD, COPE, VERRILL, ALLEN, JORDAN.

General color above bluish to brownish-black, without spots; a yellow transverse band in the occipital region, sometimes this ring is replaced by yellow spots transversely arranged; beneath orange colored to whitish, either uniform or with a medial row of spots; labial region yellowish-white; vertical plate nearly triangular, not as long as commissural line of occipitals; upper labials, 8, lower, 9; occipitals long and not truncate behind; inframaxillaries reaching to sixth lower labial; eye above the fourth and fifth upper labials; dorsal scales in 15 rows; gastrosteges, 148-163; urosteges, 35-56. Length, 15 inches; head, 6 lines; tail, 3 inches; transverse diameter of head, $3\frac{1}{4}$ lines; of neck, $2\frac{1}{4}$ lines; circumference of body 1 inch.

Habitat, Canada, Maine, Massachusetts, New York, Pennsylvania, North Carolina, South Carolina, Georgia, Florida, Mississippi, Louisiana; north to Ohio and Michigan, and west to the plains.

The Ring-necked Snake is occasionally found in Ohio, but it is rare. It occurs under stones, but more commonly under the bark of decayed trees, and, like the *Eutainia*, when handled, emits a strong and disagreeable odor.

Var. *amabilis*, Baird and Girard, may be distinguished from the above by having the eye over the third and fourth labials, the abdomen crowded with black spots, and a narrow occipital ring. It ranges from California to Texas and eastward as far as our limits, being occasionally found in Ohio.

GENUS STORERIA. Baird and Girard.

Body small; head rather short, easily separable from the neck; teeth smooth and equal; cephalic region covered with plates; loreal absent, rarely present; postfrontals and prefrontals each a pair; nasals two; anteorbitals one or two; postorbitals two; occipitals large; labials and inframaxillaries of good size; rostral rather small; dorsal scales in 15-17 rows, carinated; gastrosteges, 120-140; urosteges, 40-55; anal plate bifid; ovoviparous.

Anteorbitals one; dorsal scales in 17 rows. S. DEKAYI.

Anteorbitals two; dorsal scales in 15 rows. S. OCCIPITO-MACULATA.

STORERIA DEKAYI Holbrook.

Little Brown Snake.

Coluber dekayi, HOLBROOK.

Coluber ordinatus, LINNÆUS, STORER.

Tropidonotus dekayi, HOLBROOK, DEKAY.

Storeria dekayi, BAIRD and GIRARD, COPE, JORDAN.

Ischnognathus dekayi, DUMERIL and BIBRON, GUNTHER.

General color above grayish-brown, with a somewhat lighter vertebral band margined by dotted lines; a black bar extending from the occipitals to the angle of the mouth; two black spots below the eye; abdomen and under parts greenish to grayish white; vertical plate broad, sub-pentagonal, shorter than commissural line of occipitals; *anteorbitals one*; upper and lower labials each seven on a side; inframaxillaries reaching to sixth lower labial; eye small, above the fourth upper labial; *dorsal scales in 17 rows*; gastrosteges, 120-150; urosteges, 40-60. Length, 1 foot; head, $5\frac{1}{2}$ lines; tail, $2\frac{1}{2}$ inches; transverse diameter of head, 3 lines; of neck, 2 lines; circumference of body $3\frac{3}{8}$ inches.

Habitat, Maine, Massachusetts, New York, Pennsylvania, Maryland, South Carolina, Georgia, Mississippi, Louisiana, Texas, Illinois, Ohio, Michigan.

In the State the Little Brown Snake occurs at Cleveland and in north-western and central Ohio, and probably is met with occasionally in all parts. It is an aquatic little animal, feeding upon insects, and perfectly

harmless. An anomaly sometimes occurs in regard to the cephalic plates, as in the case of a specimen before me, which has four postorbitals on one side and two on the other, and also has a couple of labials united.

STORERIA OCCIPITO-MACULATA Storer.

Red-bellied Storeria.

Coluber occipito-maculata, STORER.

Coluber venustus, HALLOWELL.

Storeria occipito-maculata, BAIRD and GIRARD, COPE, JORDAN.

Ichnognathus occipito-maculata, GUNTHER.

General color above grayish to dark-brown, with at times dark spots arranged in longitudinal band; *three light spots in the nuchal region*; beneath red or salmon-color to white, sometimes with red upon the flanks and white between; vertical plate sub pentangular, longer than broad, nearly or quite equal to commissural line of occipitals; *anteorbitals two*; nostril in the anterior nasal; upper labials, 5-6, lower, 6-7, on a side; *dorsal scales in 15 rows*; gastrosteges, 125-130; urosteges, 40-50. Length, 10 inches; head, 4 lines; tail, 2 inches; transverse diameter of head, 2 lines; of neck, $1\frac{1}{2}$ lines; circumference of body 1 inch.

Habitat, Maine, New York, Pennsylvania, South Carolina, Georgia, Kentucky, Illinois, Ohio, Michigan, Wisconsin, Minnesota.

Not rare about Columbus. It is somewhat nocturnal, and lives chiefly under logs and stones.

GENUS CARPHOPHIS. Gervais.

Body slender, cylindrical, of nearly uniform thickness; head and neck not separable, the former *tapering to a pointed snout*; teeth equal, smooth; vertical plate very broad; superciliaries exceedingly narrow; occipitals moderate; postorbitals one; anteorbitals one; frontals one or two pairs; inframaxillaries small; *dorsal scales in 13 rows*, all smooth; gastrosteges, 120-135; anal plate bifid.

Frontal plates in two pairs. *a.*

Frontal plates a single pair; abdomen flesh-colored; extralimal. . . C. HELENÆ.

a. Color above lustrous purplish-black; abdomen flesh-colored, extending over the third row of scales; extralimal. C. VERMIS.

a. Color above chestnut-brown. C. AMCENUS.

CARPHOPHIS AMCENUS Say.

Ground or Worm Snake.

Coluber amœnus, SAY, HARLAN, STORER.

Calamaria amœna, SCHLEGEL.

Brachyorrhos amœnus, HOLBROOK.

Celuta amœna, BAIRD and GIRARD.

Carphophis amœna, GERVAIS, DUMERIL and BIBRON, GUNTHER.

Carphophiops amœnus, COPE, JORDAN.

General color above brown, without spots or bands; beneath salmon-red; head small; vertical plate irregular, hexagonal, pointed behind, about as broad as long, and equal

to commissural line of occipitals; temporal shields well developed; frontal plates in two pairs; nostril in anterior part of nasal plate; rostral rounded anteriorly; loreal quadrilateral, entering the orbit; postorbital rhomboidal; upper labials, five, lower, six; eyes over the third and fourth labial; urosteges, 120-132. Length, 11 inches; head, $4\frac{1}{2}$ lines; tail, $1\frac{1}{2}$ inches; transverse diameter of head, $2\frac{1}{2}$ lines; of neck, $2\frac{1}{2}$ lines; circumference of body, 1 inch.

Habitat, Massachusetts?, New York, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Mississippi, Illinois, Western Missouri, and Ohio.

This species is inserted here upon the authority of Dr. J. M. Wheaton, of Columbus, who informs me that some years ago a specimen was captured by Prof. Tuttle, at Ironton, on the bank of the Ohio river. The animal was sent to the Smithsonian Institution, hence its absence from the collection which that gentleman so kindly placed in my hands. Dr. Wheaton, however, informs me that it had the peculiarity of a single pair of frontals. This would make it correspond, in that respect at least, to *Carphophis helenæ* which is probably only a variety of *C. amœnus*.

The following species of Ophidians, though not yet reported from the State, have such a range as to render their occurrence in our fauna possible:

Farancia abacura, Holb.

BAIRD and GIRARD, Cat., p. 123.

Habitat, South Carolina and Louisiana, and according to Nelson, Illinois.

Abastor erythrogrammus, Daud.

BAIRD and GIRARD, Cat., p. 125.

Habitat, North Carolina and Georgia, to Alabama, and Nelson says, Illinois.

Virginia valeria, Baird and Girard.

BAIRD and GIRARD, Cat., p. 127.

Habitat, Maryland and North Carolina, to Illinois.

Virginia elegans, Kenn.

Proc. Acad. Nat. Sci. Phila., 1859, p. 99.

Habitat, Illinois to Arkansas.

Carphophis helenæ, Kenn.

Proc. Acad. Nat. Sci. Phila., 1859, p. 100;

Habitat, Illinois and Tennessee, to Mississippi.

Carphophis vermis, Kenn.

Proc. Acad. Nat. Sci. Phila., 1859, p. 99.

Habitat, Missouri, Kansas.

Ophibolus getulus, var. *sayi*, Holb.

BAIRD and GIRARD, Cat., p. 84.

Habitat, Illinois, Missouri, Arkansas, to Mississippi and Louisiana.

Diadophis arnyi, Kenn.

Proc. Acad. Nat. Sci. Phil., 1859, p. 99.

Habitat, Illinois to Kansas.

Coluber emoryi, Baird and Girard.

Proc. Acad. Nat. Sci. Phil., 1859, p. 98. As *S. calligaster*.

Proc. Acad. Nat. Sci. Phila., 1856, p. 244.

BAIRD and GIRARD, Cat., p. 157.

Habitat, Texas to Arkansas, Kansas, and Illinois.

Pityophis sayi, Schl.

BAIRD and GIRARD, Cat., p. 151.

Habitat, Wisconsin, Illinois, Missouri, Kansas, and Nebraska.

Regina (Microps, Hal.) lineata, Hallowell.

Proc. Acad. Nat. Sci. Phil., 1856, p. 241.

Habitat, Kansas to Texas.

Tropidonotus woodhousii, Baird and Girard.

BAIRD and GIRARD, Cat., p. 59.

Habitat, Texas to Missouri, and Arkansas.

Heterodon simus, Linn.

BAIRD and GIRARD, Cat., p. 59.

Habitat, North Carolina, South Carolina, to Mississippi, Illinois and Wisconsin.

Heterodon nasicus, Baird and Girard.

Proc. Acad. Nat. Sci. Phila., 1856, p. 249.

BAIRD and GIRARD, Cat., p. 59.

U. S. Geolog. Surv., 100th Meridian, v. 611.

Proc. Bost. Soc. Nat. Hist., 1874, p. 69.

Habitat, Mexico, New Mexico, Utah and California, to Kansas, Arkansas, Nebraska and Montana.

AMPHIBIA.*

Metamorphosis after birth; respiration branchial in young, pulmonary or pulmonary and branchial in the adult, but always feeble in the lungs, while active from the skin; lungs with few and coarse cells; blood cold; corpuscles oval, nucleated; circulation incomplete; heart in adult with two auricles and a ventricle†; reproduction oviparous or ovoviparous; foetus anamniote; allantois wanting, unless the urinary bladder represents it‡; skin usually naked or unarmed; skeleton incomplete, internal; cranium with two occipital condyles; nasal sacs and pharynx connected; nervous system cerebro-spinal; brain small; cerebellum scarcely visible; excrementitious and reproductive organs opening into a cloaca.

The living forms are divided into three orders, as follows :

Feet present, at least in front; body not vermiform.	a.	
Feet wanting; body vermiform; extralimital.	. . . . .	OPIOMORPHA.
a. Adult tailless; body short and thick.	. . . . .	ANOURA.
a. Tail always present; body lacertiloid.	. . . . .	URODELA.

ORDER ANOURA. TAILLESS AMPHIBIANS.

Metamorphosis complete; young fish-like, herbivorous, with a long intestinal canal; gills external at first; teeth and limbs wanting; adult without branchial arches; body short, depressed, raniform, tailless; feet four, posterior longer; tongue large, fleshy, free posteriorly, and capable of protrusion; ear provided with an eustachian tube; fenestra rotunda present; nasal sacs and pharynx connected; hyoid bone with but one pair of cornua; radius and ulna ankylosed as are also the tibia and fibula; astragalus and calcaneum replaced by two elongated, cylindrical bones; vertebrae ten, without any distinct atlas; ureters opening into the oviducts; fecundation after exclusion of the eggs.

* For the anatomy of these animals, see Brown's *Klassen und Ordnung des Thier-Reiches*, and Duges' *Recherches sur l'Osteologie et la Myologie des Batraciens a leurs differens Ages*.

† A question has been raised in regard to the structure of the heart in the Perenni-branchiata. Proteus, and also the Axolotl in all probability have only a single auricle.

‡ Prof. Wyman, *Proc. Boston Soc. Nat. Hist.*, p. 58, states from his observations that he considers the urinary bladder of frogs to structurally resemble that of fishes and scaly reptiles. From its anatomical relations to the intestine and vascular system he regards it as a rudimentary allantois.

* Maxillary teeth present in the upper jaw. *a.*

* Maxillary teeth wanting. *b.*

a. Tips of toes undilated. *c.*

a. Tips of toes dilated, forming disks. *HYLIDÆ.*

b. Parotoids present; toes palmate. *BUFONIDÆ.*

b. Parotoids none; toes distinct. *ENGYSTOMIDÆ.*

c. Parotoids present. *ALYTIDÆ.*

c. Parotoids none. *RANIDÆ.*

Alytidæ, extralimital, characterized by a stout, toad like body; parotoids present; upper maxillary and vomer dentigerous; tongue rounded, nearly entire, slightly, if at all, free behind; ear perfect; pupil of eye vertical; toes undilated, palmate; sacral diapophyses dilated; vertebræ pro- or opisthocœlian; manubrium cartilaginous, and usually the cuneiform bone developed into a kind of shovel, an adaptation to their fossorial habits, has two North America genera, *Spea* and *Scaphiopus*; the latter, with three species, of which *Scaphiopus holbrookii*, Proc. Acad. Nat. Sci. Phil., 1863, p. 54, and DeKay's Reptiles of N. Y., p. 66, ranges from Massachusetts, Connecticut, New York, Maryland, to South Carolina, Florida, and Mississippi. It digs with celerity and soon buries itself, pairs and oviposits within a few hours after awaking in spring.

Engystomidæ, extralimital, has no maxillary teeth, no parotoid, no epicoracoid, but with a perfect ear, undilated distinct toes, and dilated sacral diapophyses, is represented in North America, by one species *Engystoma carolinense*, Holbrook, North American Herp., v. p. 23, which ranges from South Carolina, Georgia, and Florida, to Louisiana, and Mississippi. "Mexico."

FAMILY BUFONIDÆ. THE TOADS.

Posterior feet scarcely as long as the body; fingers four; toes five, palmate and undilated; skin usually warty; parotoids very large; ear perfectly developed; mouth edentulous; tongue large, fleshy, attached in front, entire and free behind, and capable of being used as an instrument of prehension; sacral diapophyses dilated; acromion and coracoid connected by a cartilaginous arch; cuneiform bone usually prolonged into a distinct plantar tubercle; terrestrial and nocturnal.

GENUS BUFO. Laurenti.

Body very rough and warty; head short; crown flat, or with slight ridges; tongue elliptical; muzzle rounded or truncated; males generally with an internal vocal sac, which communicates with the mouth by two orifices; lateral cutaneous folds wanting; parotoid with distinct pores.

BUFO LENTIGINOSUS Shaw.

American Toad.

Rana terrestris, CATESBY.

Rana musica, LINNÆUS.

Bufo lentiginosus, SHAW, GUNTHER, COPE.

Bufo musicus, LATREILLE, DAUDIN, MERREM, GRAVENHORST.

Telmatobius lentiginosus, LECONTE.

Bufo americanus, HOLBROOK, DEKAY, STORER.

Bufo musicus, et americanus, HARLAN, DUMERIL and BIBRON.

Bufo fowleri, PUTNAM.

Bufo cognatus, SAY.

Bufo frontosus, COPE.

General color above cinereous to dark slate, speckled with whitish-gray and brown; beneath yellowish or dirty white; gular region and under side of legs darker; head small; nostrils vertical, smaller and closer together than the inner nares; eyes moderate; pupil black; irides golden; tympanum small, its color rendering it not very apparent; feet each with two plantar tubercles, the one large and the other small; hind legs obscurely barred with darker; above granulate or speckled over with small warts; forehead with two long ridges swollen behind; very variable, owing to age, season, sex, and will of the animal. Length, $3\frac{1}{2}$ inches; hind limb, $3\frac{1}{2}$ inches; fore limb, $1\frac{1}{2}$ inches; breadth of head, $1\frac{1}{2}$ inches; depth of head, $\frac{1}{2}$ inch; head to axilla, $1\frac{1}{2}$ inches.

The typical *Bufo lentiginosus* is extralimital, having its habitat South Carolina, Florida, Alabama, Mississippi; but our fauna includes var. *americanus*, LeConte, which differs from the above by having the bony ridges moderate and not much swollen behind; the small warts upon the back replaced by much larger ones, and a yellowish vertebral line extending from the occipital region backwards.

Habitat, Labrador, Nova Scotia, Maine, New Hampshire, Massachusetts, Connecticut, New York, Virginia, Michigan, Ohio, Indiana, Illinois, Arkansas, Kansas, Dakota, "Great Bear Lake."

The American Toad, including its varieties, is the analogue of *Bufo vulgaris* of the old world, and, like that species, has a remarkably wide distribution, ranging from the Esquimaux River and Okak, Labrador, to Florida and Texas and Mexico, and north to Dakota and Lake Winnipeg; and Gunther in his catalogue mentions a specimen sent by Sir J. Richard on from the Great Bear Lake. In brief, this genus appears to be almost world wide, with the exception of Australia, in their distribution, and a striking fact is that the Japanese specimens of *Bufo vulgaris* approach more nearly to the American Toad than do the European. They also attain a large size in elevated regions.

Our toad during the day remains in concealment, crouched in cavities under stones, dead or decaying trees, or stumps, and is sometimes in cellars, or drowned in wells. They have been found in the latter situation buried in the mud at the bottom, but still alive, and are supposed to have been interred for some time. They are mild and timid animals, which oviposit in May, and begin to disappear the last of August or forepart of September. Like the frogs, they repair to ponds and hibernate in mud, where they have been found a foot below the surface. Bell states that they eat their skin as soon as cast, and, in Massachusetts, Allen found frogs and toads under stones in an unfrozen spring in February.

Mr. W. K. Higley, of Ann Arbor, Michigan, informs me that he has seen the common American Toad, in April, repair in great numbers to

ponds in order to copulate, the male seizing the female just behind the arms. A short time after he noticed the pond to contain a great number of dead animals, which he explains on the supposition that the males while mounted upon the females, pressed the latter under water so long as to cause death from drowning, and this view was corroborated by his finding, in some cases, the male still clasping the dead female.

FAMILY HYLIDÆ. TREE TOADS.

Head short; parotoids none; tongue attached in front, free and usually notched behind; ear well developed, with a distinct tympanum; maxillary and vomero-palatine teeth present in upper jaw; abdominal integument areolate, or with tubercular granulations; toes palmate, with the tips of the digits dilated, forming disks or pellets; vertebræ procœlian; sacral diapophyses dilated or undilated; arboreal or aquatic.

This family are most abundant in the Neotropical, but absent from the Ethiopian region, and our North American genera may be divided as follows:

* Toes distinct or slightly webbed at base; fingers nearly or quite distinct; disks small. CHOROPHILUS.

* Toes webbed nearly to tips; fingers nearly or quite distinct; disks small. ACRIS.

* Toes prominently webbed; fingers partially palmate; disks large; body often short and thick. HYLÆ.

GENUS CHOROPHILUS. Baird.

Body slender and very delicate, smooth or granulated above; tongue nearly orbicular, emarginate behind; vomerine teeth posterior to or between the inner nares; fingers and toes distinct or with basal web reaching to phalanges; tips slightly dilated; sacral diapophyses expanded; males with a vocal vesicle, vomerine teeth between the inner nares; skin above granulated. C. TRISERIATUS.

Vomerine teeth posterior to inner nares; skin above smooth or warty, not granulated; web entirely wanting between the two outer toes; color above black, with spots or stripes. C. NIGRITUS.

CHOROPHILUS TRISERIATUS Wiedman.

Little Tree Frog.

Hyla triseriatus, MAX. PRINZ VON WIEDMAN.

Helocates triseriatus et feriarum, BAIRD.

Chorophilus triseriatus, JORDAN, COPE.

General color above, bluish ash to black, with a vertebral and two lateral lines, often with five distinct stripes in front; spots wanting, or present only upon the head; femur about as long as, or somewhat shorter than, the tibia; toes with a slight trace of web at the base of each; second toe very long, fifth short; hind legs long, about two and a half to three times the anterior; skin granulated above and below, without warts; vomerine teeth in two elevated circular patches, between the inner nares.

Length, 1 inch; hind leg, 1½ inches; head to axilla, 5 lines; transverse diameter of head, ¾ lines; vertical diameter of head, 1½ lines; transverse diameter of body, 3 lines.

Habitat, Pennsylvania, Michigan, Wisconsin, Illinois, New Mexico, Kansas, Nebraska, Colorado, and Dakota.

Rare in Ohio.

GENUS ACRIS. Dumeril and Bibron.

Head short and broad; eyes prominent; tongue cordiform; vomerine teeth in two groups, between the inner nares; tympanum scarcely perceptible; skin upon the back smooth or slightly granular; digital disks small; toes webbed almost to tips; fingers nearly or quite distinct; males with an interior subgular vocal sac.

ACRIS GRYLLUS LeConte.

var. CREPITANS Baird.

Cricket Frog.

Rana gryllus, LECONTE, HARLAN.

Rana dorsalis, HARLAN.

Acris gryllus, DUMERIL and BIBRON, GUNTHER.

Hyla gryllus, HOLBROOK.

Hylodes gryllus, HOLBROOK, DEKAY.

Acris crepitans, BAIRD, LECONTE.

Acris gryllus, subgenus, *crepitans*, COPE.

Color above varying from cinereous to olivaceous or brown, often with a triangular dark spot, margined with white in the occipital region; another dark spot, sometimes extending from the axilla backwards, with white on its under side; back often with minute points of black, and frequently with a vertebral stripe; lips usually whitish, speckled with darker; chin and gular region varying from white to yellow; abdomen whitish, often varied with dusky; inner and posterior part of thighs granulated; femur slightly shorter than tibia; second toe longest; posterior limbs three and a half to four times as long as the anterior, the latter with a transverse cutaneous fold across the breast between them.

Length, $1\frac{1}{2}$ inches; head to axilla, 5 lines; hind leg $1\frac{1}{2}$ inches; transverse diameter of head, $4\frac{1}{2}$ lines; vertical diameter of head, 3 lines; transverse diameter of body, $5\frac{1}{2}$ lines.

Habitat, New York, Pennsylvania, Michigan, Ohio, Illinois, Arkansas, Georgia, Florida and Texas.

This is a lively and noisy little aquatic animal, frequenting the grass on the borders of ponds, and never found upon trees.

GENUS HYLA. Laurenti.

Head short, not separable from the body, and covered with a soft skin; eyes prominent; vomerine teeth between the nares; toes long and broadly palmate; fingers more or less webbed; digital disks prominent; tongue large, nearly orbicular, entire or slightly emarginate behind; males with one or two sublingual vocal sacs; arboreal in summer; hibernating in mud or old logs; color changeable.

Chorophilus nigrilus. Proc. Acad. Nat. Sci., Phil., 1855, p. 427, Holbrook's N. Am., Herp. IV, p. 107. This animal, which I had supposed to be a Southern species, limited to South Carolina and Georgia, is recorded by Günther, Cat. British Museum, p. 97, under the name of *Pseudacris nigrila*, as coming from the Great Bear Lake. Should this species be found to have so wide a range, it will doubtless yet be found in our limits.

* Patches of vomerine teeth not elevated; tongue truncate or entire behind; reddish to blackish brown, with dark rhomboidal spots and lines, sometimes showing a cruciform arrangement. H. PICKERINGII.

* Patches of vomerines slightly elevated; tongue emarginate behind; color varying from green to brown, with irregular spots. H. VERSICOLOR.

HYLA VERSICOLOR LeConte.

Common Tree Toad.

Hyla versicolor, LECONTE, HARLAN, HOLBROOK, STORER, DEKAY, DUMERIL and BIBRON, GUNTHER, VERRILL, ALLEN, COPE, JORDAN.

Hyla verrucosa, DAUDIN.

Dendrohyas versicolor, Tschudi.

Hyla squirrella, STORER, ALLEN, JONES.

Hyla richardii, BAIRD.

General color above varying from green to brown, with irregular darker blotches; dark upon the legs, usually in the form of bars; inframaxillary region as far back as the gular fold, of the same color as the back; skin above rough, with numerous small elevations; abdomen and under part of the thighs whitish to yellow, strongly granulated; femur longer than tibia; tarsus much shorter; toes palmate to the base of the distal phalanges, and these with a web-like expansion on each side; fingers distinctly webbed at base, the fourth opposable to the other three; hind leg two to two and a half times the length of the anterior; tongue very thick and fleshy, slightly notched behind; inner nares more widely separated than the outer; vomerine teeth in two approximately transverse, slightly elevated lines between the inner nares.

Length, $1\frac{1}{2}$ inches; head to axilla, $7\frac{1}{2}$ lines; hind limb, $2\frac{1}{2}$ inches; transverse diameter of head, 7 lines; vertical diameter of head, $4\frac{1}{2}$ lines; transverse diameter of body, $7\frac{1}{2}$ lines.

Habitat, Nova Scotia, Maine, Massachusetts, New York, Pennsylvania, Virginia, Georgia, Louisiana, Tennessee, Ohio, Michigan, "Great Bear Lake, California, and Mexico."

This beautiful little animal is very common in all parts of the State. It has ventriloquial powers, and is especially clamorous in damp weather and towards evening. It is found on trees and old fences, to the color of which it assimilates itself in a striking degree. It has an acrid secretion. In fine weather it climbs the highest trees after insects; and Harlan* records a case of one in winter, dug up at the root of an apple tree several feet under ground. Burroughs† also relates that he has heard them piping late in November in an apple tree, and was quite confident that they hybernated therein. The ground at this time was frozen, and on the first warm day in April he found one in a cavity of the trunk of the tree. It is improbable that it had come from the

* Medical and Physical Researches, p. 109.

† Science News, November 1, 1878, p. 8.

marshes thus early in the season, and he therefore thought that the animal had hybernated in that situation. Whether they spend the winter in mud or old logs, they are found in marshes in early spring, where they lay their eggs. Afterwards, in the latter part of April or in May, they betake themselves to the woods.

The Tree Toad is also reported to be useful as a barometer. It is said that, if they are placed in a tall jar, with a ladder in it, in fair weather they will climb towards the top, but descend on the approach of a storm. How true this may be, not having tried it, I have no means of judging, and shall refrain from expressing any opinion on the subject.

HYLA PICKERINGII Holbrook.

Pickering's Tree Toad.

Hylodes pickeringii, HOLBROOK, STORER, DEKAY.

Hyla pickeringii, LECONTE, COPE, JORDAN.

Color quite variable at the will of the animal: in general, reddish brown to fawn above, with lines and spots or specks of darker, arranged upon the back in the form of a cross; upper lip yellowish; legs above with transverse dark bars; posterior of the body with a dusky blotch; under parts white, with numerous dark spots; gular and inframaxillary region yellowish; dark markings upon the animal often becoming indistinct; eyes large; pupils black; irides golden; tympanum small; nostrils small, nearer the muzzle than the eye; inner nares more widely separated than the outer; a transverse fold of the skin connecting the fore limbs on the under side; body rather slender; hind legs long; femur a trifle shorter than the tibia; thighs granulated beneath.

Length, 1 inch; head to axilla, 10 lines; hind leg, $1\frac{1}{2}$ inches; fore leg, $6\frac{1}{2}$ lines; transverse diameter of head, 4 lines; vertical diameter of head, $2\frac{1}{2}$ lines; transverse diameter of body, $4\frac{1}{2}$ lines.

Habitat, Maine, New Hampshire, Vermont, Massachusetts, New York, Pennsylvania, Michigan to Cook county, Illinois.

I have not seen this species from the State, and have included it here solely on the extent of its extralimital range. It is found on bark of dead trees and on leaves, such as Indian corn and grape vines, and in green-houses. It has been observed in Maine to deposit its eggs in water in April, and at other seasons occurred in upland or damp woods among fallen leaves.

FAMILY RANIDÆ. THE FROGS.

Posterior feet much longer than the anterior, in length exceeding the body; fingers four; toes five, simple, undilated at tips and broadly palmate; skin smooth; parotoids none; tongue large, fleshy, attached in front, emarginate and free behind; vomero-palatine teeth present; maxillaries, a single row in the upper jaw; ear well developed; tail in young long and compressed; sacral diapophyses cylindrical; epicoracoid present; cuneiform bone somewhat prolonged, but not forming a spur; animals aquatic in the main, inhabiting every region of the globe.

GENUS RANA. Linnæus.

Tongue oblong, deeply notched behind, and free posteriorly and laterally; vomerine teeth between the inner nares; eustachian tubes large; tympanum prominent; eyes large; fingers distinct, fourth not opposable to the others; males usually with two lateral vocal sacs.

The eggs in our species are almost mature in the fall, so that animals can and do pair and oviposit in one to two days after awaking from hybernation.

* Dorsal region, with large, distinct spots. *b*.

* Dorsal region, with small spots, or none. *a*.

a. Tympanum small, seven or less millimeters in diameter. *c*.

a. Tympanum usually, eight or more millimeters in diameter, and when smaller, temple without black band, and back not vermiculated with white or yellow. *d*.

b. Males with an internal vocal sac on each side; dorsal spots roundish and usually arranged somewhat irregularly. *R. HALECINA*.

b. Males without vocal sacs; dorsal and lateral spots usually quadrate and arranged in four distinct rows, with other external ones irregular.

R. PALUSTRIS.

c. Temple with a large black spot. *R. TEMPORARIA*.

c. Temple without such spot; color above, greenish olive, with sinuations or vermiculations of white or yellow; extralimital; New York, Okak, Labrador and Yukon River to Minnesota, Montana and Utah.

R. SEPTENTRIONALIS.

d. Dorso-lateral cutaneous folds distinct. *R. CLAMITANS*.

d. Dorso-lateral cutaneous folds wanting or indistinct, *R. CATESBYANA*.

RANA HALECINA Kalm,**Leopard Frog.**

Rana halecina, KALM, DAUDIN, MERREM, HARLAN, TSCHUDI, DUMERIL and BIBRON, HOLBROOK, HALL, WELLS, LAURENTI, STORER, DEKAY, ALLEN, COPE, JORDAN, GUNTHER, VERRILL.

Rana pipiens, GMELIN, SHAW, SCHNEIDER, LECONTE.

Rana palustris, GMELIN.

Rana berlandieri, BAIRD.

Rana melanotus, RAFINESQUE.

Rana areolata, BAIRD and GIRARD (?).

Rana capito, LECONTE.

Rana utricularia, HARLAN.

Color above varying from light to dark green or brown; dorsal and lateral spots large, black, often margined with yellow, sub-circular or elongated, quadrate, and often arranged in two, but rarely more, distinct rows, and when in more than two rows, then with spots placed irregularly between; abdomen varying from white to yellow or dusky; legs above with transverse bars or blotches of black, which often have a yellow margin; thighs granulated posteriorly; femur shorter than tibia; toes and fingers, with tubercles at the joints; tympanum, green, about seven millimeters in diameter; vomerine teeth in two, almost circular, slightly elevated patches; inner nares large, more widely separated than the outer; snout rather pointed; nostrils lateral, about midway between

the muzzle and the eye. Length, $3\frac{1}{2}$ inches; head to axilla, $1\frac{1}{2}$ inches; hind leg, $5\frac{1}{2}$ inches; transverse diameter of head, 1 inch; vertical diameter of head, 8 lines; transverse diameter of body, $1\frac{1}{2}$ inches.

Habitat, Nova Scotia to Lake Winnipeg, Maine, Massachusetts, New York, Pennsylvania, South Carolina, Georgia, Mexico, New Mexico, Arizona, Arkansas, Utah, Colorado, Montana, Ohio and Michigan.

Common in all parts of the State.

The Leopard or Shad Frog is usually found in wet places in marshes and upon the borders of streams, though it is said to have been found in summer in fields at a distance from water. They are active animals, very difficult to capture, leaping from eight to ten feet, emit a peeping note, and lay their eggs in April. This is the analogue, and it may be a variety of the European *Rana esculenta*, or Green Frog, which it resembles.

RANA PALUSTRIS LeConte.

Marsh, Pickerel, or Tiger Frog.

Rana palustris, LeConte, Harlan, Holbrook, Dumeril and Bibron, Hallowell, Storer, Kirtland, DeKay, Gunther, Verrill, Allen, Cope, Jordan.

Rana pardalis, Harlan.

Color above light to dark green, with four distinct rows of usually large quadrate, black spots, which at times are confluent, producing the appearance of longitudinal bands; outside of these rows are other spots arranged irregularly; upper part of legs with transverse bars or blotches of black; abdomen and under parts varying from white to orange yellow; thighs granulated posteriorly; femur shorter than tibia; toes and fingers, usually with tubercles at the joints; tympanum green, lighter than the body, and small, from two to four millimeters in diameter; vomerine teeth, in two, nearly circular, slightly elevated patches; inner nares moderate, more distant than the outer; snout roundly pointed; nostrils somewhat nearer the muzzle than the eye; vocal vesicle always wanting; cutaneous folds not prominent. Length, $2\frac{1}{2}$ inches; head to axilla, 11 lines; hind leg, 4 inches; fore leg, $1\frac{1}{2}$ inches; transverse diameter of head, $\frac{1}{2}$ inch; vertical diameter of head, $\frac{3}{8}$ inch; transverse diameter of body, $\frac{7}{8}$ inch.

Habitat, Maine, Massachusetts, New York, Pennsylvania, Virginia, Ohio and Michigan.

The habits of this little animal are very similar to those of *Rana hylecina*, and there is considerable doubt in my mind whether it should be retained as a distinct species, and not considered a variety of young *Rana hylecina*; while the typical *hylecina* differs strikingly from the typical *palustris*, the varieties of these closely approach, if they do not shade into each other.

The Marsh Frog is usually found in the vicinity of ponds and marshes, though occasionally, in the morning, after a heavy dew, it is seen at some distance from water. Its note is a prolonged, grating sound, and its odor strong and offensive.

RANA TEMPORARIA Linnæus.

Rana muta, LAURENTI.*Rana scotica*, BELL.*Rana oxyrhinus*, et *platyrhinus*, STEENSTRUP.*Rana arvalis*, NILSSON.*Rana japonica*, SCHLEGEL.

Habitat, England, Scotland, Germany, and Sweden, to Japan.

(American Specimens.)

a. var. CANTABRIGENSIS Baird.

Yellowish-brown above, with a lateral fold, and a vertebral line from snout to anus, light colored; posterior of thigh and leg with a narrow light line.

Habitat, Massachusetts to Rocky Mountains; north of the Great Lakes.

Not yet observed in Ohio.

b. var. SYLVATICA LeConte.

Wood Frog.*Rana sylvatica*, LECONTE, HOLBROOK, KIRTLAND, STORER, DEKAY, DUMERIL and BIBRON, ALLEN, VERRELL.*Rana sylvatica*, et *pennsylvanica*, HARLAN.*Rana temporaria*, var. *sylvatica*, GÜNTHER, JORDAN.

Color above green to greenish-brown; no vertebral band; lateral cutaneous folds of about the same color as the back; a dark spot passing through the tympanum, eye and usually also the nostril, margined below with white; legs above usually barred or blotched with dark; abdomen cream-colored to white; gular region and under parts of legs yellowish; lower jaw often with darker markings; thighs granulated posteriorly; femur and tibia of nearly equal length, the latter somewhat longer; toes and fingers with tubercles under part of the joints; head small; muzzle obtusely rounded; tympanum small, not exceeding three and a half millimeters in diameter; nostrils a little nearer the muzzle than the eye, and nearly as widely separated as the inner nares.

The young differs from the adult by having the colors more intense, the back is olivaceous brown, the spot on the temple black, and the under parts a more pronounced yellow. Length, 2 inches; head to axilla, 9 lines; hind legs, $3\frac{1}{2}$ inches; fore limb, $1\frac{1}{2}$ inches; transverse diameter of head, 9 lines; vertical diameter of head, 4 lines; transverse diameter of body, 9 lines.

Habitat, Nova Scotia, Maine, Massachusetts, New York, Pennsylvania and Virginia, to Ohio, Michigan and Wisconsin.

The Wood Frog is very abundant in the woods of Ohio, where it is found among damp fallen leaves, which it resembles so closely as to be overlooked. They appear in March or April, and go into winter quarters the last of October or forepart of November. They probably do not resort to ponds but hibernate in woods, and in spring lay their eggs,

in some cases, at least, in springs. They prefer thick oak or maple forests as a habitation, and in Maine their notes may be heard as early as April, but in our limits earlier. They are never found in the southern states. Their color is quite variable being darker in spring, but becoming paler after exposure for sometime to light. The young are eight lines in length immediately after the loss of their tail.

An interesting fact meets us by comparison of the specimens of *Rana temporaria* of the Old World with those of the New. That it is exceedingly variable is evident from the different varieties often mistaken for different species in this country and on the eastern continent. The most noteworthy fact, however, is that those of Japan and eastern Asia, in the size of the tympanum and coloration, are intermediate between those of Europe and our American varieties.

Some at least of the other Amphibia show the same relations, thus indicating, as pointed out by Prof. Marsh in regard to the extinct vertebrata, that there had probably once, if not oftener, been an interchange of faunas between the two continents through the region of Behring's Straits.

RANA CLAMITANS Daudin.

Green or Spring Frog.

Rana clamata, DAUDIN, DUMERIL and BIBRON, GUNTHER

Rana clamata, et *flaviviridis*, HARLAN.

Rana clamitans, MERREM, HOLBROOK, ALLEN, VERRILL, COPE, JORDAN.

Rana fontinalis, LECONTE, STORER.

Rana clamitans, *fontinalis*, et *horiconensis*, DEKAY.

? *Rana nigrescens*, AGASSIZ.

Color above green to brown, without any large spots; legs and sides irregularly spotted or speckled with darker; beneath silvery white to yellow; gular region often irregularly spotted with darker; thighs granulated posteriorly; femur nearly as long as tibia; toes and fingers with small tubercles at most of the joints; tympanum of medium size or large, usually about eight or ten millimeters in diameter, but sometimes not over four, its color green, with a central nucleus of lighter green; eyes black; irides yellow; muzzle rounded somewhat; nostrils latero-vertical, half way between the eye and snout; inner nares medium, slightly more widely separated than the outer; vomerine teeth small, in two patches; dorso-lateral cutaneous fold well marked, reaching from the eye backwards. Length, 3 inches; head to axilla, 1½ inches; hind leg, 4 inches; fore leg, 1½ inches; transverse diameter of head, 1½ inches; vertical diameter of head, 7¼ lines; transverse diameter of body, 1½ inches.

Habitat, Nova Scotia, Maine, Massachusetts, New York, Pennsylvania, North Carolina, South Carolina, Georgia, Ohio, Michigan, Illinois, Arkansas.

The Green Frog is common along brooks and around ponds, sitting upon the banks, and plunging at the approach of danger. In wet weather

they leave the water and wander to some distance. They are among the earliest to awaken from their winter sleep, having been observed in March and April.

**RANA CATESBYANA* Shaw.

Bull Frog.

Rana catesbyana, SHAW, ALLEN, COPE, JORDAN.

Rana mugiens, MERREM, WAGLER, TSCHUDI, DUMERIL and BIBRON, GUNTHER.

Rana pipiens, HALLOWELL, HOLBROOK, KIRTLAND, STORER, DEKAY.

Rana pipiens, et scapularis, HARLAN.

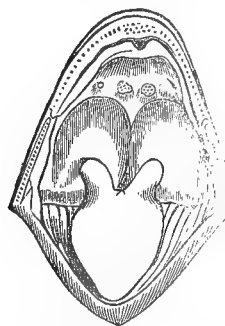


FIG. 3.—*Rana catesbyana*, head, $1\frac{1}{2}$ inches; transverse diameter of body, 3 inches.

mouth open, showing inner nares, teeth, and tongue. Habitat, Canada, Maine, Massachusetts, New York, Pennsylvania, Delaware, North Carolina, Louisiana, Arkansas, Texas, Kansas, Ohio, Michigan.

The Bull Frog, called also by the boys Cow Frog, is very common, not only in the State, but also throughout its whole range. Its hoarse voice, low bass notes, supposed by some to be its love songs or call of the male to the female, have been compared to the roaring of a bull, hence the common name. They are aquatic animals, being found in ponds, ditches, and pools, occasionally coming to land, but only passing to any distance from the water in wet weather and at night.

Prof. Rogers states that "the frog is very susceptible to the enticements of motion." He has often caught them at the South by "agitating a hook and line baited with red tape," at which they would bite and entangle their teeth. Dr. Corse states that he has observed the spawn of frogs to develop on the fourth day, and has also known *Rana catesbyana* to pass a whole year in the tadpole State.

The Bull Frog is the one more commonly eaten, though any of them

* For anatomy of nervous system see Smithsonian Contributions, vol. 5.

may be used as articles of diet. Frequently only the hams are taken, but in some cases the animal is captured, killed, the viscera removed, and the body fried in eggs and bread crumbs. They are then said to be delicious, and it is reported that they are much used in this manner in certain places.

*ORDER URODELA. TAILED AMPHIBIANS.

Caudata, LEUCKART.

Body elongated, naked or without exoskeletal plates; tail compressed or cylindrical, persistent throughout life; feet usually two pairs, rarely only one; radius and ulna, as well as tibia and fibula, not united into a single piece; external opening of the cloaca a longitudinal slit.

Gills persistent throughout life. PERENNIBRANCHIATA.

Gills caducous. CADUCIBRANCHIATA.

SUB-ORDER PERENNIBRANCHIATA.

Amphipneusta, OPPEL.

Proteides, LEUCKART, HARLAN, MULLER, DUMERIL and BIBRON.

Phanerobranches, DUMERIL and BIBRON.

Pseudophydiens, DEBLAINVILLE.

Sirenideæ, TENNEY.

Ichtyoides, LATREILLE.

Branchiæ persistent; prefrontal, nasal and maxillary bones wanting; premaxillæ not anchylosed together; pterygoid absent or united with the palatines; vertebræ amphicoelous; carpus and tarsus cartilaginous, the latter sometimes absent; eyes without lids, in some cases surrounded by circular ring resembling a lid.

Pelvic arch and limbs wanting; extralimital. TRACHYSTOMIDÆ.

Pelvic arch and limbs present. PROTEIDÆ.

FAMILY PROTEIDÆ. THE MUD PUPPIES.

Skull elongated; parasphenoid edentulous; vomer with teeth along its anterior margin; premaxillæ and dentaries dentigerous; pterygoid present and anchylosed with the palatines; occipital condyles sessile; first two ceratohyals connate; branchæ, branchial apertures, and three pairs of arches persistent; eyelids wanting; pelvic and pectoral arches and limbs developed; anterior digits three or four, fourth finger, or in this case the third, the first being absent, with a single phalanx.

* Toes, two or three on each foot; trunk very much elongated; extralimital.

PROTEUS.

* Toes, four on each foot; trunk, short and thick. MENOBRANCHUS.

*The classification and descriptions of this order are taken from the author's printed thesis on the Urodela and Cæcilia, to which any persons desiring information on extralimital species may refer.

* GENUS *MENOBRANCHUS*. Harlan.

Necturus, RAFINESQUE, WAGLER, COPE, GRAY.

Phanerobranchus, FITZINGER.

Upper jaw with two curved rows of teeth, the posterior row nearly parallel with, and much longer than the anterior, situated upon the front edge of the vomer and lateral processes of the pterygoid; lower jaw with a single series of teeth, which lock between the two upper; tongue ovate, large, fleshy, free anteriorly and laterally; toes distinct, four in front and four behind; body short and thick; tail short, much compressed.

† *MENOBRANCHUS LATERALIS* Say.

Mud Puppy, Water Dog or Dog Fish.

Protie tetradactyle, LACEPEDE.

Triton lateralis, SAY.

Necturus maculosus, *maculatus*, *luteus*, and *fuscus*, RAFINESQUE.

Necturus lateralis, COPE, JORDON.

Menobranchus lateralis, HARLAN, DEKAY.

Sirena maculosa, RAFINESQUE.

Phanerobranchus cepedii, FITZINGER.

Siredon hyemalis, KNEELAND, and the following probably:

Necturus maculatus, BAIRD.

Proteus maculatus, BARNES.

Menobranchus maculatus, HOLBROOK.

Menobranchus punctatus, GIBBES.

Necturus punctatus, COPE.

Body cylindrical, smooth, brownish, with darker spots and often a lateral line; head broad, depressed; eyes moderate; nostrils small; muzzle truncate; teeth large and conical; gular fold very strongly developed; gills red, three on each side. Length, 1½ feet.

Habitat, Santee River?, Ohio, Alleghany, and Hudson Rivers, the Great Lakes, Lake Champlain and Portage Lake. "Arkansas."

This species has not been heretofore reported from the Hudson River, but last spring while visiting the Natural History Society, at Poughkeepsie, N. Y., my friend, Dr. W. G. Stevenson, called my attention to

* Although this genus had been previously called in a vague manner by various names such as *Proteus*, *Salamandra*, *Triton*, and *Necturus*, Dr. Harlan first clearly elucidated its characters, and as his name has become well-known its retention is deemed proper and it is accordingly inserted here.

† Dr. Barton considered this to be a young *Menopoma alleghaniensis*, to which its skull bears such a relation as might be expected between larva and adult, but its geographical distribution is quite different and it is hardly possible that the adult, if existing in the region of the lakes could have been overlooked.

Cope, Journ. Acad. Nat. Sci. Phila., 1866, vol. vi, expresses the opinion that this is a larval *Spelerpes*, and changes to that as *Siredon* to *Amblystoma*. However, it has never yet been transformed.

one of these animals caught in the Hudson. He also informed me that one had previously been captured in that river. It had probably passed thence through the Erie canal or the one connecting the river with Lake Champlain.

Kneeland* states that this animal is nocturnal, feeds upon living worms, never dead ones unless very hungry, swallowed but could not digest minnows two and half inches long, has its gills nibbled off by small fish, and hence can survive by cutaneous and pulmonary respiration. Smith † confirms Kneeland's view of the pulmonary, as well as branchial respiration, in that he succeeded in inflating one of the pulmonary sacs. He also found a *Libellula* larva in the animal's stomach.

Their motions are very active when in the water, and are performed by the body and tail. They seem to be ill at ease when placed in the sun, and attempt to get out by retiring into a shady part. They have been known to live in water that froze a half inch every night for three months, but died in about four hours when removed from the liquid. When in water they may be observed crawling about over the bottom, rising to the surface at times and expelling a globule of air or effecting the same under water. They eat a number of worms a day, or go several months without food. At times they are found with parasitic worms near their gills. The flesh of this animal is said to be excellent eating.

SUB-ORDER CADUCIBRANCHIATA.

Branchiæ not present in the adult state; maxillary and nasal bones large; prefrontals usually present; premaxillæ separate or anchylosed, and always dentigerous.

*Branchial apertures upon the neck open. (DEROTREMATA) a.

*Branchial apertures closed in adult. b.

a. Anterior metacarpal bones three; extralimital. AMPHIUMIDÆ.

a. Anterior metacarpals four. MENOPOMIDÆ.

b. Anterior metacarpals four. SALAMANDRIDÆ.

FAMILY MENOPOMIDÆ. THE MENOPOMES.

Protonopsidæ, COPE.

Skull broad; parasphenoid edentulous; vomer with teeth along its anterior margin; premaxillæ and dentaries dentigerous; maxillæ and nasals large; pterygoid present and very broad; two separate premaxillary bones; prefrontals and parietals prolonged so as to embrace the frontals; fronto-temporal arch absent; occipital condyles sessile; basihyal cartilage present; gill holes open or closed; branchial arches may be reduced to two; upper and lower eyelids distinct; vertebræ amphicelous; carpus and tarsus

* Proc. Bost. Soc. Nat. Hist., vol. vi, pp. 152, 371, and 429.

† Ann. Lyc. Nat. Hist., N. Y., vol. ii, p. 259.

cartilaginous; pelvic and pectoral limbs well developed; anterior digits four; fourth finger with three phalanges.

*Branchial apertures persistent. MENOPOMA.

*Branchial apertures closed in adult; extralimal. CRYPTOBRANCHUS.

GENUS MENOPOMA. Harlan.

Palatine teeth in a parabolic curve between the inner nares, almost parallel to those of the maxillary; tongue transversely oval; head depressed; eyes small; parotids none; branchial apertures upon the side of the neck persistent; skin naked; limbs short and thick; toes four in front and five behind, the latter membranous; tail compressed, shorter than the body.

*MENOPOMA ALLEGHANIENSIS Harlan.

Hell-Bender or Mud-Devil.

Protonopsis horrida, BARTON, BARNES, COPE.

Abranchus alleghaniensis, HARLAN.

Cryptobranchus salamandroides, LEUCKART.

Eurycea macronata, RAFINESQUE.

Molge gigantea, in part, MERREM.

† *Menopoma fusca*, HOLBROOK.

Salamandria horrida, et gigantea, or maxima, BARTON.

Salamandra alleghaniensis, MICHAUX.

Menopoma alleghaniensis, COPE.

Body somewhat elongated, thick and strong; color slate with dark spots; toes five; fingers four; two outer toes with large membranous fringes; a broad expansion of the skin on the outer side of each limb; body with a cutaneous longitudinal fold on each side; tail long, very much compressed laterally, presenting a blade form appearance; head very broad and strongly depressed; muzzle rounded; nostrils small, well defined; inner nares large; mouth a parabolic curve; tongue large, fleshy, broad, filling the whole lower jaw, and free anteriorly. Length, 2 feet.

Habitat, Ohio and Alleghany Rivers, and North Carolina, "all tributaries of the Mississippi." Not of the Great Lakes.

The Hell-bender is said to be very voracious, and feeds upon worms, cray-fish, fishes, and aquatic reptiles. They also shed a membrane probably corresponding to the external layer of the skin. Grote observed them with this rolled up in the mouth as if in the act of swallowing it, and he believed that he perceived in another case the animal doing the swallowing.

A similar shedding of the epidermis having been observed in *Spelerpes porphyriticus*, *Dactylethra*, and *Cyclorhamphus*, it becomes probable that the remaining forms of this order also undergo a periodical moult-

*For Myology see Mivart's article, Proc. Zool. Soc., London, 1869.

† Cope makes *Menopoma fuscum* distinct with headwaters of the Tennessee as its habitat.

ing. The individuals observed by Grote all had an intermittent swaying motion in the aquaria during July and August, which he conjectured might be either connected with the animal's effort to cast the skin or a movement to attract the opposite sex. The *Menopoma* oviposits in August and September, probably for this purpose visiting the muddy banks of rivers. The eggs are at first about the size of a pea, enveloped in a glairy albuminous fluid. They are connected in strings, and increase after oviposition by imbibition of water. The Hell-bender at the time of pairing, changes its appearance, the tail becoming broader and the folds upon the sides varying.

FAMILY SALAMANDRIDÆ. THE SALAMANDERS.

Gracientia, OPPEL, GRAY.

Pseudo-sauriens, DEBLAINVILLE.

Atretoderes, DUMERIL and BIBRON.

Myctodera of some authors.

Gill-slits perfectly closed in the adult state; skull broad; palatines present in the young, and arranged as in *Trachystoma* and *Proteida*, but change their relations with the growth of the animal; nasal bones usually large; dentaries and premaxillæ bearing teeth; limbs four, well developed; anterior toes four; fourth finger with three phalanges; eyelids two, an upper and a lower, very distinct.

Dumreil and Bibron contrasted the term *Atretoderes*, from *Atratos*, without a foramen, and *Deras* neck, with *Trematoderes*, which they applied to the remainder of the Urodela. The latter name etymologically considered seems to be a good one, but unnecessary, as is also its synonym, *Immutabilia* of Fitzinger.

*Vomero-palatine teeth in two longitudinal rows divergent behind, or sphenoidals present in two elongated groups, and thus divergent. *a.*

*Vomero-palatine teeth transversely arranged, or wanting, or convergent posteriorly.

AMBLYSTOMA.

a. Hind toes four on each foot. *b.*

a. Hind toes five. *c.*

b. Tongue attached in front by a membrane. HEMIDACTYLUM.

b. Tongue free all around, boletoid; extralimal. BATRACHOSEPS.

c. Sphenoidal teeth in two longitudinal groups of several rows each; vomero-palatines in a transverse series. *d.*

c. Sphenoidal teeth wanting; vomero-palatines in two longitudinal rows, never in a transverse series. NOTOPHTHALMUS.

d. Tongue attached in front by a membrane. *e.*

d. Tongue free all around, boletoid. SPELERPES.

e. Vomero-palatine teeth in a continuous transverse row; commissure much curved; extralimal. ANAIDES.

e. Vomero-palatine series more or less interrupted medially; commissure nearly straight. PLETHODON.

GENUS AMBLYSTOMA. Tschudi.

Plagiodon, DUMERIL and BIBRON, includes *Xiphonura*, TSCHUDI, and *Heterotriton*, GRAY.

Palatine teeth in a transverse, often interrupted row, sometimes in the form of an arch or

crochet; toes, four in front, five behind, never palmate; tongue fleshy, round or long, centrally attached, with lateral and anterior margins free; quadrato-jugal bone wanting; skin smooth, slimy, perforated with mucous pores, especially above the orbits and in the parotid region; costal furrows strongly marked; tail short, round to oval at the base, but compressed towards the extremity; vertebrae amphicelous; parasphenoid not dentigerous; orbitosphenoid and pro-otic separated by membranes; posterior margins of palatines bearing the teeth; carpus, tarsus, and basi-hyal ossified in adults.

Spots large, very different from the usual color. *a.*

Spots none, minute, or nearly uniform with the ground color. *l.*

- a.* Plantar tubercles two. *h.*
- a.* Plantar tubercles indistinct or none. *b.*
- b.* Costal grooves 14; vomerine series of teeth two. *f.*
- b.* Costal grooves 12. *e.*
- b.* Costal grooves 11; vomerine series of teeth 3. *c.*
- b.* Costal grooves 10; vomerine series of teeth 3; extralimal, Georgia, Louisiana, and Illinois. *A. TALPOIDEUM.*
- c.* Color black; spots or bands large; median series of teeth concave behind or straight. *d.*
- c.* Color plumbeous; spots small; median series of teeth convex behind; extralimal. *A. CONSPERSUM.*
- d.* Back with transverse bands of gray. *A. OPACUM.*
- d.* Back without transverse bands of gray. *A. PUNCTATUM.*
- e.* Vomerine series of teeth 3; canthus rostralis distinct; back with a gray line. *A. MACRODACTYLUM.*
- e.* Vomerine series of teeth two; canthus rostralis none; no gray dorsal line; extralimal. *A. TENEBROSUM.*
- f.* Canthus rostralis wanting. *g.*
- f.* Canthus rostralis distinctly marked; extralimal. *A. TEXANUM.*
- g.* Back and tail with gray rings or bands; extralimal, South Carolina. *A. CINGULATUM.*
- g.* Back plumbeous; sides spotted. *A. MICROSTOMUM.*
- h.* Costal grooves twelve, *i.*
- h.* Costal grooves eleven; vomerine series of teeth three; extralimal, New Jersey. *A. BICOLOR.*
- i.* Tail shorter than body; canthus rostralis wanting. *j.*
- i.* Tail longer than body; canthus rostralis distinct. *A. XIPHIAS.*
- j.* Vomerine teeth in a nearly continuous line. *k.*
- j.* Vomerine teeth in four distinct patches; extralimal; New Mexico. *A. TRISRUPTUM.*
- k.* Nares inequidistant; yellow spots usually small. *A. TIGRINUM.*
- k.* Nares equidistant; yellow spots large; extralimal, Dakota, Montana, California, Nebraska, New Mexico, and Mexico. *A. MAVORTIUM.*
- l.* Plantar tubercles indistinct or none. *m.*
- l.* Plantar tubercles two, distinct; extralimal, Iowa. *A. OBSCURUM.*
- m.* Costal grooves twelve or more. *n.*
- m.* Costal grooves eleven; extralimal, Vancouver's Island and Washington Territory. *A. PAROTICUM.*
- n.* Vomerine series of teeth three, extending to exterior of nares. *A. JEFFERSONIANUM.*

- n. Vomerine series of teeth two, extending only to interior of nares; extra-limital, Northern Rocky Mountains. . . . A. ATERRIMUM.

AMBLYSTOMA PUNCTATUM Linnæus.

Large Spotted or Violet Colored Salamander.

Amblystoma subviolaceum, TSCHUDI.

Salamandra subviolacea, DEKAY, HOLBROOK, HARLAN, SCHLEGEL, KIRTLAND.

Salamandra punctata, LACEPEDE, WAGLER.

Salamandra venenosa, BARTON, DAUDIN.

Lacerta subviolacea, BARTON.

Lacerta punctata, LINNÆUS.

Lacerta maculata, SHAW.

Amblystoma punctatum, BAIRD, COPE, JORDON.

Color black, at least above, sometimes slightly purplish, changing to brown in alcohol; two sets of bright yellow spots arranged somewhat in rows on each side of the back; legs also spotted, spots unequal and change to white in alcohol; tail oval, compressed at the end; body cylindrical; head large, depressed; muzzle rounded, skin smooth, perforated with pores; two patches of these on each side of the head, one reaching from nostril backwards, above and somewhat around the eye, the other in the parotid region; cervical fold strong; another fold present behind the eye, the two connected by a ridge; costal furrows eleven, strongly marked, sometimes with others less marked; furrows behind the leg in the anal region four, and others less prominent upon the tail; back with a longitudinal groove; tail indistinctly furrowed lengthwise upon the side; eyes prominent; nostrils small, distinct. Total length, 6 inches; length at loss of branchiæ, 1 5-6 inches; body $3\frac{1}{4}$ inches; head to gular fold, $\frac{1}{2}$ inch; diameter of head, $\frac{1}{4}$ inch.

Habitat, Nova Scotia, Canada, Maine, Massachusetts, New York, Pennsylvania, Virginia, South Carolina, Louisiana, Arkansas, Tennessee, Ohio, Michigan, Wisconsin, and Illinois.

The Violet Colored Salamander is found under rocks and decaying matter in damp forests and sometimes in cellars. It appears to be nocturnal, and like the rest of these animals is perfectly harmless.

AMBLYSTOMA OPACUM Gravenhorst.

The Opaque or Blotched Salamander.

Salamandra opaca, GRAVENHORST.

Salamandra gravenhorstii, LEUCKART.

Salamandra fasciata, GREEN, HARLAN, HOLBROOK, STORER, WAGLER, DEKAY.

Amblystoma opaca, BAIRD, COPE, JORDAN.

Color above light clay or ash, with transverse, dark brown or bluish bands, sometimes in blotches, and extending from head to tail; below, dark slate; head with a triangular spot; in alcohol the animal is a grayish ash, with transverse bands of dark brown or brownish black; tail oval, with indistinct lateral furrows; body nearly cylindrical, thickest in the middle; head large, depressed; muzzle round; mucous pores of the skin numerous, about equally distributed, hence no special patches above the eye and in the

parotid region; cervical fold, fold behind the eye and connecting groove, costal furrows, and furrows in the anal and caudal region, as in *A. punctatum*; dorsal longitudinal groove less marked than in that species, but still distinct; eyes small yet prominent; nostrils minute. Total length at loss of branchiæ, 2 1-6 inch; length, 3½ inches; tail, 1½ inches; body, 2 inches; head to cervical fold, ½ inch; diameter of body, ½ inch; diameter of head, 15-16 inch.

Habitat, Massachusetts, New York, Pennsylvania and Florida, to Texas, Wisconsin, Michigan and Ohio.

Cope says, "The principal difference in form and structure between this species and *A. punctatum* is seen in the absence of any dorsal furrow, or a less prominence of that on the side of the tail. The limbs are more feeble, the head narrower, etc." In the eight specimens before me, however, all of which came from Southern Illinois, the dorsal groove is very distinct. In a specimen from Ann Arbor it is barely visible. In these the most prominent mark of the species is its color, which differs very strikingly from that of *A. punctatum*.

Mann* states that this animal lays its eggs in the beds of small ponds, and in some cases the number of these amounts to one hundred and eight. He found them in this situation in summer, and also in November, and always with the male and female curled up over the eggs as if in the process of incubation.

AMBLYSTOMA TIGRINUM Green.

The Tiger Salamander.

Salamandra tigrina, GREEN, HARLAN.

Salamandra ingens, GREEN.

Salamandra lurida, SAGER.

Triton tigrinus, HOLBROOK, DEKAY.

Amblystoma episcopus, HALLOWELL, BAIRD.

Amblystoma luridum, BAIRD, HALLOWELL.

Amblystoma tigrinum, BAIRD, COPE, JORDAN.



FIG. 4.—*Amblystoma tigrinum*, mouth open.

Color in alcohol varying from brown to lurid above, plumbeous and yellowish white below, the yellowish white in blotches, between the brown and plumbeous, sometimes connected longitudinally; spots varying from reddish brown to white, yellow in fresh specimens, extending from the head to the tail, and scattered irregularly; tail, oval; body cylindrical in some, in others thickest in the middle and tapering both ways; head depressed; muzzle round; skin smooth, with numerous mucous pores; gular fold and fold behind the eye, with connecting parotid ridge; costal furrows eleven strongly marked, and others becoming indistinct; furrows behind the legs gradually ceasing, so that the tip of the tail is smooth; back with a longitudinal groove; tail without any indications of lateral furrows; eyes prominent; nostrils small, distinct; plantar tuber-

* Smithsonian Reports, 1854, page 294.

cles two, well developed. Length at loss of branchiæ $3\frac{3}{4}$ inches. Adult, length, 7 inches; tail 3; body, 4 inches; head to cervical fold, 1 inch; diameter of body, 1 inch; diameter of head, $\frac{3}{8}$ inch.

Habitat, Michigan, Wisconsin, Minnesota, Nebraska, Missouri, Illinois, Ohio, Louisiana, New Jersey, and New York.

Hoy* states that this animal moves very slowly upon land, but is very active in water. Insults offered to its mouth or eyes are resented by strokes of the tail. They are nocturnal in habits, and usually remain in concealment during the day. They have been observed in great numbers in the Cathole, at Ann Arbor, Michigan, swimming vigorously on March 10th, and their eggs were found a few days later, after which they disappeared, passing into the woods and excavating burrows, in which they awaited their prey, being concealed, all but their heads. In the fall they wander about in search of a suitable place in which to hibernate, and at this time often stray into cellars during a wet night.

AMBLYSTOMA JEFFERSONIANUM Green.

The Granulated Salamander.

Salamandra granulata, DEKAY.

Triton niger, DEKAY.

Xiphonura jeffersoniana, TSCHUDI, GRAY.

Salamandra jeffersoniana, GREEN, HOLBROOK, HARLAN, SCHLEGEL.

Amblystoma fuscum, † HOLBROOK.

Amblystoma laterale, † HALLOWELL.

Amblystoma jeffersonianum, BAIRD, COPE, JORDAN.

Amblystoma platineum, † COPE.

Color black to greenish in alcohol, above, greenish slate, without blotches or spots, below, of a grayish green tinge; cervical fold white; tail roundish oval; body cylindrical, much longer and slimmer than *A. punctatum*; head elongate, apparently not separable from the body; muzzle round; mucous pores of the skin distributed over the body generally, and not collected in special groups; cervical fold indistinct, but its place marked by a white band; fold and connecting ridge behind scarcely discernible; costal furrows thirteen, less marked than in *A. punctatum*, but nevertheless distinct, or at least their place represented by a whiter color; furrows behind the leg also less prominent, and extending almost to the tip of the tail; dorsal longitudinal groove nearly or quite indistinct; lateral caudal furrows wanting, but a sub-caudal extends from anus to tip; eyes small but prominent; nostrils minute; adult, length at loss of branchiæ, 1 3-5 inches; length, $3\frac{3}{4}$ inches; tail, 1 9-16 inches; body, 2 1-16 inches; head to cervical fold 7-16 inch; diameter of body, $\frac{3}{8}$ inch; diameter of head, 2-16 inch.

Habitat, Vermont, New York, Pennsylvania, Southern Illinois, Wisconsin, Missouri, Ohio, Michigan to north shore of Lake Superior, and the country included.

* Smithsonian Report, 1854, page 295.

† Cope makes three sub-species, viz., *laterale*, *fuscum*, and *platineum*.

AMBLYSTOMA MICROSTOMUM Cope.**Small-Mouthed Salamander.***Triton porphyriticus*, (?) HOLBROOK.

Color in alcohol brownish black, paler beneath; plumbeous spots of indefinite outline scattered thickly and irregularly over the sides, sometimes wanting, at others licheniform; tail round or nearly so at the base, but becoming ensiform towards the end; body slender; length about thirteen times its greatest diameter; head narrower than and not separable from the body; projection of upper jaw not as great as that of the lower; dorsal furrow present, but not deeply indented; mucous pores of the head not different from those of the body; lingual longitudinal furrow present; length at loss of branchiæ, 2.5 inches; length, 4 inches; tail, 1½ inches; body, 2¼ inches; head to cervical fold, .45 inch; diameter of head, .31 inch.

Habitat, Illinois, Missouri, Arkansas, and Ohio to Louisiana.

This species very closely resembles *Plethodon glutinosus*, but is distinguished from it by the arrangement of the teeth in a transverse uninterrupted row, arched in front instead of being separated by a wide interval, and also by the tail being very much compressed laterally; while in *P. glutinosus* it is cylindrical, or only slightly compressed. *Triton porphyriticus* of DeKay is probably *Plethodon glutinosus*.

AMBLYSTOMA XIPHIAS Cope.**Long-Tailed Salamander.**

Color yellowish olive, brighter yellow beneath; sides and back with brown anastomosing or reticulating bands; head small; cheeks swollen; eyes rather small, but distinct; mandible projecting; outer nares nearer together than the inner; tongue large; vomerine teeth V-form, at an obtuse angle, interrupted along the median line

GENUS HEMIDACTYLIUM. Tschudi.*Desmodactylus*, DUMERIL and BIBRON.

Vomerine teeth in two rows, one on each side behind the inner nares, sphenoidals also in two groups, separated from the former and each other; tongue oval, adherent in front; parietal bones osseous; premaxillaries two; fontanelle wanting; toes rudimentary, palmate at base, four in front and four behind.

HEMIDACTYLIUM SCUTATUM Schlegel.**Four-toed Salamander.**

Salamandra fusca, GREEN, Jour. A. N. Science, Phil., 1818, page 357, not of Rafinesque.

Salamandra scututa, SCHLEGEL.

Salamandra melanostica, GIBBES.

Desmodactylus melanosticus, DUMERIL and BIBRON.

Hemidactylum scutatum, TSCHUDI, BAIRD, COPE, JORDAN.

and limbs of the V curve; tail, oval, crestless, grooveless, longer than the body, compressed from the base and not elevated; digits triangular, depressed; length, $11\frac{1}{2}$ inches; tail, 6 inches; head to cervical fold, 1 inch; breadth of head, .88 inch.

Habitat, Columbus, Ohio.

GENUS PLETHODON. Tschudi.

Phatnomatorhina, BIBRON.

Plethodon and *Desmognathus*, BAIRD, COPE.

Vomerine teeth in two patches, one behind each of the inner nares, rarely wanting; sphenoidals numerous in two almost quadrilateral groups; tongue large, round, or oval, entire or slightly notched behind, adherent in front, and centrally, laterally and posteriorly free; skin, smooth; body, cylindrical; tail, round, tapering to the tip; toes, four in front and five behind; premaxillaries, two.

With the exception of *Plethodon persimilis*, the exact position of which is doubtful, the following table will serve for the determination of the species:

* Sphenoidal teeth in two medially contiguous groups; vomerine patches separated by a distinct interval. *a*.

* Sphenoidal teeth in two not contiguous groups; vomerines often approximated. *d*.

a. Color cinereous; dorsal band red, rarely wanting. *b*.

a. Color black; dorsal band always wanting. *c*.

d. Costal furrows thirteen or less; muzzle truncate; vomerine series of teeth medially approximated. *e*.

d. Costal furrows fourteen or more; muzzle round; vomerines few or none. *f*.

b. Costal furrows sixteen or more. *P. ERYTHRONOTUS*.

b. Costal furrows fourteen, extralimital; California to Vancouver's Island.

P. INTERMEDIUS.

c. Costal furrows fourteen, with irregular gray blotches. *P. GLUTINOSUS*.

c. Costal furrows twelve; color uniform black; extralimital, Massachusetts, New York, Pennsylvania, Virginia, South Carolina, Georgia, and Louisiana. *P. NIGER*.

e. Plantar tubercles two, in front; spots minute; extralimital; Oregon to California. *P. OREGONENSIS*.

e. Plantar tubercles none; spots large, orange; extralimital; Lower California.

P. CROCEATER.

f. Dorsal band wanting; dots red or none; toes long; body marbled below.

P. FUSCUS.

Color above, brown, muzzle yellowish, limbs and tail orange brown; upper surface with black spots on each side scattered irregularly; beneath white, with pitchy black spots, especially numerous in the gular region; head large; muzzle obtuse; eyes not very prominent; iris yellow; pupil black; gular fold well developed; costal furrows well marked; skin of the back similarly cut, making it resemble scutæ; body cylindrical, short; limbs slender; tail round at base, compressed distally, equal to and sometimes twice the length of the body. Length 2 3-5 inches.

Habitat, Rhode Island to South Carolina, Illinois, and the Gulf of Mexico.

Not yet recorded from Ohio, but inserted here on account of its extralimital range. It has been found in April under old logs and rails in open woods, at some distance from the water, and was very quick and lively in its movements.

- f.* Dorsal band yellowish; dots brown; toes short; body dirty white below; extralimital; New York, Pennsylvania to Georgia. . . P. OCHROPHÆUS.

* PLETHODON ERYTHRONOTUS Green.

The Red-Backed Salamander.

Salamandra erythronota, GREEN, STORER, DEKAY, HOLBROOK, HARLAN.

Salamandra agilis, SAGER.

Plethodon cinereus, TSCHUDI.

Amblystoma erythronotum, GRAY.

Sauropsis, FITZINGER.

Spelerpes erythronotus, KENNICOTT.

Plethodon cinereus, COPE.



Color upon the sides cinereous; dorsal stripe extending from the occiput to the extremity of the tail of deep or light red; head brown above; lower jaw and gular region whitish, ventral part of the body light, but not as much so as the throat and chin; sides in alcohol sometimes reddish brown, and dorsal stripe cream colored; eyes large, black; head somewhat depressed, scarcely separable from the body; canthus rostralis none; costal grooves sixteen to nineteen; caudal furrows about twenty; cervical fold indistinct, its place represented by a white line; nostrils laterally situated; length, $3\frac{1}{2}$ inches; tail, $1\frac{1}{2}$ inches; head to cervical fold, 9-16 inch; width of head, 7-32 inch.

Habitat, Nova Scotia, Maine, Massachusetts, New York, Pennsylvania, South Carolina, Kentucky, Ohio, and Michigan, as far as the northern shore of Lake Superior.

FIG. 5—*Plethodon erythronotus*, mouth open.

Very common.

Haldeman † states that, while Herpetologists have supposed that *P. erythronotus* and *cinereus* are different sexes of the same species, from their having been so often found associated together, yet he, as a result of careful examination, came to the conclusion they were not. Four *cinereus* opened by him contained gravid ovaries, and hence were females; on the other, hand, two *erythronotus* contained only seminal matter and spermatozoa, imperfectly developed. Two others were found, however, with gravid ovaries, hence we have of the *erythronotus* both male and female. Prof. Green, however, concluded, after careful revision, that the *cinereus* was probably only an aged individual, in which the dorsal stripe had become obsolete.

The Red-backed Salamander is the first of this group seen in spring, having been observed in the middle of April. I found them near Vassar College, in New York State, on April 6, 1878. It oc-

* Proc. Acad. Nat. Sci. Phil. 1874, page 315.

† Cope recognizes three sub-species, *erythronotus*, *cinereus*, and *dersalis*.

curs in moist, woody places, hiding under stones and old logs, and when these are upturned it, if alone, quickly disappears in the decaying wood, moss, leaves, or earth; but, if accompanied by its young, neither it nor the little ones attempt to escape until touched. It climbs glass by adhering with its abdomen, is frequently curled up on herbs, and, if disturbed, springs away by a sudden uncoiling. They are very agile in their motions, walk rapidly, run by sudden and irregular jerks, and have been kept alive an entire year by allowing them dead leaves constantly moistened. Their food appears to be small snails. When the young are found, as a rule, they are accompanied, and often apparently being fed, by their parents, but are occasionally alone. Their little ones, as well as their eggs, occur under the moss and bark of decayed trees. The latter are found in bunches of from six to eleven each, and individually are about three-twentieths of an inch in diameter, and have been found in June at Ann Arbor, Michigan, Fitchburg, Massachusetts, and in August in the White Mountains.

The young are supplied with branchiæ, but lose them early, that is, in about three or four days after hatching. The little ones usually have the same markings as the adult, but are often bright red, spotted with black. The younger larvæ are nearly white; the older olive, with dark spots. As age advances, the color deepens, becoming a brown, and very old specimens often have a purplish tint.

PLETHODON GLUTINOSUS Green.

The Gray Spotted or Viscid Salamander.

Salamandra glutinosa, GREEN, SCHLEGEL, KIRTLAND, HARLAN, HOLBROOK, STORER, DEKAY.

Salamandra variolata, GILLIAMS.

Salamandra cylindracea, HARLAN, KIRTLAND.

Plethodon variolosum, TSCHUDI, DUMERIL and BIBRON.

Cylindrosoma glutinosum, DUMERIL and BIBRON.

Triton porphyriticus? DEKAY.

Plethodon granulatum, GRAY.

Salamandra elongata, VALENCIENNES.

Plethodon glutinosus, TSCHUDI, BAIRD, COPE, JORDAN.

Color above glossy black, with numerous minute gray spots, larger upon the sides, in some almost confluent, in others licheniform patches; color below plumbeous, with small spots of gray in the gular region; legs also spotted; cervical fold and a narrow strip on each side of anus of a yellowish tinge; costal furrows fourteen; nares equidistant; vomerine series of teeth extending to the exterior of inner nares; canthus rostralis none; nostrils small, laterally situated; head and body scarcely or not at all separable; cervical or gular fold distinct; body with a dorsal longitudinal furrow; tail

long, round, tapering; legs moderately long, slender, and not very strong; head, depressed; eyes not as prominent as in *P. erythronotus*. Length, $4\frac{1}{2}$ inches; tail, 2 inches; head to cervical fold, $\frac{1}{2}$ inch; breadth of head, $\frac{3}{8}$ inch.

Habitat, Massachusetts, New York, Pennsylvania, Georgia, Florida, Mississippi, Louisiana, Illinois, Ohio, and the country included, Straits of Belle Isle.

This animal conceals itself under rocks and logs in moist places, but has been found upon dry, elevated ground. The color seems to vary much with age, the young being much more thickly spotted than the adult. In the specimens before me, this variation is not influenced by locality. They hibernate beneath wet logs, and go into the water to breed in April, in Georgia, and probably a little later in our limits.

PLETHODON FUSCUS Rafinesque.

Dusky Salamander.

Salamandra picta, HARLAN, STORER, DEKAY.

Salamandra intermixta, GREEN, KIRTLAND.

Salamandra quadramaculata, HOLBROOK.

Triturus fuscus, RAFINESQUE.

Desmognathus fusca, BAIRD, VERRILL, COPE.

Salamandra auriculata, HALLOWELL, GRAY, BAIRD.

Cylindrosoma auriculatum, DUMERIL and BIBRON.

Salamandra haldemani, ? HOLBROOK.

Spelerpes haldemani, ? HALLOWELL.

Plethodon fuscus, HALLOWELL.



FIG. 6.—*Plethodon fuscus*, mouth open.

Color brown marbled with pink; vertebral region not so dark; laterally and ventrally still lighter, sometimes yellowish or very light orange, but generally brown and white marbled; chin and gular region almost white; head very much depressed; muzzle round, not truncate; parasphenoidal teeth not contiguous; vomerines few in a row on each side, often wanting; eyes prominent; dorsal longitudinal furrow present; cervical fold, postorbital and parotid grooves well marked; costal furrows thirteen to fifteen, usually fourteen, limbs small; toes long and slender; vertebrae opisthocœlous; tail compressed, carinate above, sometimes terminating in a fin, but usually pointed. Length, $3\frac{1}{2}$ inches; tail, $1\frac{1}{8}$ inches; head to cervical fold, $\frac{1}{2}$ inch; breadth of head, 5-16 inch.

Habitat, Maine, Massachusetts, New York, Pennsylvania, New Jersey, Virginia, North Carolina, South Carolina, Georgia, Alabama, Mississippi, Tennessee, Indiana, and Ohio.

Var. *auriculatus* differs from this by being black or nearly so above, with a reddish spot between and below the eye, and minutely punctate with red upon the sides; extralimital.

Habitat, South Carolina to Louisiana.

Lives in shallow brooks, and emits its eggs in a string connected by albuminous matter, which is afterwards wound around the body by one of the pair.

GENUS SPELERPES. Rafinesque.

Vomerine teeth in a transverse row, behind the inner nares, interrupted medially; sphenoidals in two elongated groups; separated from each other, usually narrower in front and diverging behind; tongue boletoid; head short, depressed; body cylindrical, slender; digits free, four in front and five behind; tail long, tapering and distally compressed.

Body with distinct spots or bands. a.

Body spotless, or with minute dots; extralimital, Arkansas. . S. MULTIPLICATUS.

a. Costal furrows 15-17. b.

a. Costal furrows 14 or less. c.

b. Color in the main red. S. RUBER.

b. Color cinereous and white, with black; extralimital, Georgia.

S. MARGINATUS.

c. Color above yellow. f.

c. Color above cinereous, lines black. S. BILINEATUS.

c. Color above brown. S. PORPHYRITICUS.

f. With dark spots; no vertebral line. S. LONGICAUDUS.

f. With black vertebral line; extralimital, North Carolina, South Carolina, and Georgia, to Alabama. S. GUTTOLINEATUS.

SPELERPES BILINEATUS Green.

Striped-back Salamander.

Salamandra bilineatus, GREEN, HOLBROOK, HARLAN, CUVIER, DEKAY.

Salamandra flavissima, HARLAN, HOLBROOK.

Salamandra cirrigera, GREEN, HARLAN.

Spelerpes cirrigera, BAIRD, GRAY, HALLOWELL.

Bolitoglossa bilineata, DUMERIL and BIBRON.

Spelerpes bilineatus, BAIRD, ALLEN, COPE, JORDAN.



Color above cinereous, with two or three longitudinal black lines; vertebral line narrow, but broader in front, sometimes nearly or quite effaced; below yellow or yellowish white; color very much obscured by alcohol; head oval; eyes ovate; irides yellow; postorbital and parotid folds distinct, gular only marked by a cicatrix; costal grooves fourteen, in most specimens indistinct; limbs slender; digits long, excepting the first and last; tail nearly or quite as long as the body and sometimes longer. Length, $2\frac{3}{4}$ inches; tail, $1\frac{1}{4}$ inches; head to gular fold, $\frac{3}{8}$ inch; breadth of head, 3-16 inch.

Fig. 8.—*Spelerpes bilineatus*, mouth open.

Habitat, Maine, Massachusetts, New York, Pennsylvania, Georgia, Florida, Louisiana, Ohio, and Wisconsin.

Common. Lives under stones and decaying matter in woods and moist places, especially along the banks of brooks and in shallow water, and is very active.

Var. *cirrigera* seems to differ from this mainly in the possession of two barbels between the nostrils and lip in the male; they are not present in the female. Green says, "when these animals were alive the

cirrho or nasal appendages were about one-fourth of an inch long. From the situation where they were found, and from their general appearance, they must be placed among the Land Salamanders; but their fleshy cirrho seem conclusively to prove that their principal resort must be in the water."

SPELERPES LONGICAUDUS Green.

Cave or Long-tailed Salamander.

Salamandra longicauda, GREEN, HOLBROOK, KIRTLAND, DEKAY, HARLAN.

Spelerpes lucifuga, RAFINESQUE.

Cylindrosoma longicaudatum, TCHUDI, DUMERIL and BIBRON.

Saurocerus longicaudus, FITZINGER.

Spelerpes longicaudus, BAIRD, COPE, JORDAN.

Color yellow; body, head, chin, and gular region cream-colored, belly yellowish white; spots dark colored, numerous, and irregular in form, scattered thickly over the upper and lateral surface; below immaculate; head nearly oval, more depressed than in the preceding species; vomerine teeth and sphenoidal groups not contiguous; eyes elongated, not very prominent; nostrils lateral and minute; postorbital fold invisible, parotid well marked, but the place of the gular represented by a scar; limbs slender; digits moderate, widely separated; tail very long, nearly equalling and sometimes exceeding twice the length of the body; back without a longitudinal groove, but with the spots here and upon the sides arranged somewhat in rows. Length, 5 inches; tail 3 1-5 inches; head to gular fold, $\frac{3}{8}$ inch; breadth of head, $\frac{1}{2}$ inch.

Habitat, Maine, New York, Pennsylvania, Florida, Louisiana, Kentucky, Ohio, and Wisconsin.

From the State I have seen but one specimen, which was captured near Lancaster. It frequents running water in deep caverns, and thus resembles the *Proteus* of Carniola. Its subterranean habits prepare us to expect what we actually find it to be, one of our most beautiful species of Salamander.

SPELERPES RUBER Daudin.

The Red Salamander.

Salamandra rubra, DAUDIN, HOLBROOK, DEKAY.

Salamandra maculata, GREEN, STORER, HARLAN.

Salamandra rubriventris, GREEN, KIRTLAND.

Salamandra subfusca, GREEN.

Salamandra fusca, HARLAN.

Pseudotriton subfuscus, TCHUDI.

Mycetoglossa ruber, BIBRON.

Mycetoglossus subfuscus, BONAPARTE.

Siren operculata, PALISSOT BEAUVOIS.

Proteus neo-cæsariensis, GREEN.

Pseudotriton ruber, BAIRD.

Pseudotriton sticticeps,* BAIRD.

Pseudotriton montanus, BAIRD.

Pseudotriton flavissimus, HALLOWELL.

Color above red, with numerous nearly circular small black spots; beneath less vivid and immaculate, except in the gular region; in alcohol the color is dark yellowish or light brownish, and the spots brown; head in perpendicular longitudinal sections nearly a perfect triangle, in width equal to the body and not separable from it; muzzle round; *sphenoidal and vomerine teeth contiguous* at the anterior margin of the former, the latter continuing outwardly to posterior of inner nares; eyes prominent; nostril minute; postorbital and parotid grooves indistinct; gular fold strongly marked; costal furrows fourteen to sixteen; tail and anal region with numerous circular folds indistinct above and disappearing distally; a longitudinal groove runs from the anus towards the extremity of the tail; skin upon the back forming a longitudinal ridge from the nape backwards; limbs moderate, hind ones much the stronger; inner toes longest; tail round at the base, but compressed distally. Length, 5 inches; tail, 1½ inches; head to gular fold, ⅔ inch; breadth of head, ⅓ inch.

Habitat, Maine, Massachusetts, New York, Pennsylvania, Georgia, Florida, Texas, Minnesota, and Ohio.

The Red Salamander is found under stones or in shallow water and marshes very early in the spring. On April 6, 1878, I found two near Vassar College in New York State, under a stone. When discovered they seemed to be alarmed and endeavored to get away, but when in marshes showed no disposition to stir. They are apparently nocturnal animals, remaining in concealment during the day and at night sallying forth in search of prey. Their food is mainly small worms, though Hallowell found in the stomach of one a coleopterous insect, and the tail and posterior limbs of a Salamander, probably *Plethodon niger*, and they are themselves devoured by the American Bittern, and doubtless many other animals in like manner prey upon them. In confinement they rarely leave the water in the daytime, but usually do so at night.

The little ones may readily be confounded with the young of *Plethodon erythronotus* to which in color it bears a marked resemblance, but the attachment of the tongue is quite different.

SPELERPES PORPHYRITICUS Green.

Salmon-colored or Purple Salamander.

Salamandra porphyritica, GREEN, KIRTLAND, HOLBROOK.

Salamandra salmonea, STORER, HOLBROOK, DEKAY.

Pseudotriton salmoneus, BAIRD, HALLOWELL, ALLEN.

*Cope makes *sticticeps* a sub-species with habitat South Carolina, and *montanus* also a sub-species with a range from Pennsylvania to South Carolina in Alleghany Mountains.

Spelerpes salmonæus, GRAY, COPE.

Gyrinophilus porphyriticus, COPE.

Amblystoma salmonæum, DUMERIL and BIBRON.

Color yellowish-brown above; sides salmon color, with a tinge of yellow; upper surface irregularly marked with gray, below white; tail yellowish, head large, flattened; muzzle truncate; eyes prominent, and distant from each other; inner nares large; nostrils small; gular fold strongly marked; canthus rostralis prominent; dorsal longitudinal groove present; costal furrows usually fourteen; limbs moderate; digits entirely distinct; tail compressed and carinate. Length, 5.7 inches; tail, 2.3 inches.

Habitat, Maine, Vermont, Massachusetts, New York, Pennsylvania, Alabama, and Ohio.

The Salmon-colored Salamander is found on moist land, under logs in damp woods, and in still water. It attempts self-defense, snaps savagely, and throws its body into contortions when disturbed. In confinement it appeared healthy for a year, and lived upon flies.

Prof. Baird* calls attention to this animal being much more easily discovered in a larval than in the mature condition near Carlisle, Pennsylvania, stating that he had caught hundreds of larvæ before finding a single adult. It is included in this list as coming from Ohio on authority.

GENUS NOTOPHTHALMUS. Rafinesque.

Teeth in two longitudinal series, closely approximated in front, divergent behind; tongue attached anteriorly and posteriorly, and with only a small portion of its lateral margins free; postorbital arch long and strong, formed by the union of the tympanic and frontal bones; palatine processes cuneiform; spinous process of vertebræ quadrangular; ribs rudimentary; tail small, compressed from the base; toes four in front and five behind, the first and fifth rudimentary.

NOTOPHTHALMUS VIRIDESCENS Rafinesque.

Newt, Evet, Eft or Crimson Spotted Triton.

Triturus viridescens,† RAFINESQUE.

Diemyctylus viridescens, RAFINESQUE, HALLOWELL, VERRILL, COPE, ALLEN.

Diemyctylus miniatus,† RAFINESQUE, HALLOWELL, VERRILL, COPE, ALLEN

Salamandra stellio, SAY.

Salamandra symmetrica, HARLAN, HOLBROOK, KIRTLAND, DEKAY, STORER.

Salamandra punctatissima, WOOD.

Salamandra dorsalis, HARLAN, HOLBROOK, KIRTLAND, STORER.

Salamandra millipunctata, STORER.

Salamandra coccinea, ? DEKAY.

Notophthalmus miniatus, STORER.

*Journ. Acad. Nat. Sci. Phil., 1850.

†Cope makes two sub-species, *viridescens* and *miniatus*.

Triton millepunctatus, DEKAY.

Triton dorsalis, HALL.

Triton symmetricus, punctatissimus, et dorsalis, DUMERIL and BIBRON.



Fig. 7.—*Notophthalmus viridescens*, mouth open.

Color varying from olive to scarlet above, from orange to red beneath, the two colors abruptly separated; sides with five or more ocellate spots, often arranged in a line and sometimes with other similar but smaller spots lower down; entire under surface punctate with black dots, which sometimes cover the back and tail as well; head oval; muzzle rounded at the apex; commissure of the mouth not extending behind the posterior canthus of the eye; gular and postorbital folds wanting; costal grooves about fourteen, indistinct; back usually with a dorsal crest; tail strongly carinated above and below. Length, $3\frac{1}{2}$ inches; tail, $1\frac{3}{4}$ inches; head to axilla, $\frac{1}{2}$ inch;

breadth of head, $\frac{1}{2}$ inches.

Habitat, Canada, Maine, Vermont, Massachusetts, Connecticut, New York, Pennsylvania, Georgia, Florida, Illinois, Ohio and Michigan.

The Crimson Triton is found under stones, and decayed wood and leaves, and also in brooks and pools. Holbrook observed them swimming with vivacity under ice an inch thick. Storer found fragments of *Lymnea*, *Physa*, insects, and spiders in their stomachs, and also ascertained that they cast their skin in June, and that the new cuticle was in every respect similar to the old. They are not so rapid in their motions as *Plethodon erythronotus*. In confinement they thrive well if allowed a daily supply of fresh water and a sufficient quantity of flies, which they seized by a sudden spring, and swallowed apparently by several continued efforts. Their eggs are laid attached to weeds and grass in shallow water, in albuminous masses, looking somewhat like those of frogs, and the young does not lose its branchiæ until late in development.

Mr. Howard A. Kelly* relates that he has taken the "Red Eft," *Notophthalmus miniatus*, found in Sullivan County, Pennsylvania, and kept them in a dark box filled with moss and saturated with water; and that all the specimens thus treated changed from the vermilion of the *miniatus* to the dull or olive of the *Notophthalmus viridescens*, that upon being thrown into water they struggled to land, but soon returned to the water, coming to the surface at intervals for air. They were kept for sometime and always appeared satisfied with their aquatic residence. Such an observation would seem to indicate that instead of specific or even varietal differences in this species, we have simply the changes due to age and condition.

*Am. Naturalist, Vol. xii, p. 399.

TABULAR LIST OF THE REPTILIA AND AMPHIBIA OF OHIO.

The following list or renumeration is subjoined, believing that it will be convenient for reference.

REPTILIA.

LACERTILIA.

SCINCIDÆ.

Eumeces fasciatus, Linn. Blue-tailed Skink.

Lygosoma laterale, Say. Ground Lizard.

IGUANIDÆ.

Sceloporus undulatus, Harlan. Brown Swift.

OPHIDIA.

CROTALIDÆ.

Crotalus durissus, Linn. Banded Rattlesnake.

Crotalophorus tergeminus, Holb. Prairie Rattlesnake.

Crotalophorus tergeminus var. *kirtlandii*. Massassauga.

Ancistrodon contortrix, Linn. Copperhead.

COLUBRIDÆ.

Eutania saurita, Linn. Ribbon Snake.

Eutania proxima, Say. Say's Garter Snake.

Eutania sirtalis, Linn. Garter Snake.

Eutania sirtalis, var. *dorsalis*, Baird and Girard.

Regina leberis, Linn. Leather Snake.

Regina kirtlandii, Kenn. Little Red Snake.

Tropidonotus sipedon, Linn. Water Snake.

Tropidonotus erythrogaster, Shaw. Red-bellied Water Snake.

Heterodon platyrhinus, Latr. Hog-nose Snake.

Heterodon platyrhinus, var. *niger*, Cat. Black Viper.

Ptyophis melanoleucus, Daud. Bull Snake.

Ophibolus calligaster, Say. Say's Chain Snake.

Ophibolus triangulus, Boie. Milk Snake.

Ophibolus doliiatus, Linn. Red Snake.

Coluber obsoletus, Say. Pilot Black Snake.

Bascanion constrictor, Linn. Blue Racer.

Liopeltis vernalis, DeKay. Green Snake.

Cyclophis æstivus, Linn. Summer Green Snake.

Diadophis punctatus, Linn. Ring-necked Snake.

Diadophis punctatus, var. *amabilis*, Baird and Girard.

Storeria dekayi, Holb. Little Brown Snake.

Storeria occipito-maculata, Storer. Red-bellied Storeria.

Carpophis amœnus, Say. Ground Snake.

AND AMPHIBIANS.

TESTUDINATA.

CISTUDINIDÆ.

Cistudo clausa, Gmel. Box Turtle.

CHELYDRIDÆ.

Chelydra serpentina, Linn. Snapping Turtle.

EMYDIDÆ.

Chelopus insculptus, LeConte. Sculptured Tortoise.

Nanemys guttatus, Schn. Spotted Turtle.

Graptemys geographica, LeSueur. Map Turtle.

Graptemys lesueurii, Gray. LeSueur's Map Turtle.

Chrysemys picta, Herm. Painted Turtle.

Chrysemys marginata, Ag. Lady Turtle.

Cinosternum pennsylvanicum, Bosc. Mud Tortoise.

Aromochelys odoratus, Latr. Musk Tortoise.

Amyda mutica, LeSueur. Leathery Turtle.

Aspionectes spinifer, LeSueur. Soft-shelled Turtle.

AMPHIBIA.

ANOURA.

BUFONIDÆ.

Bufo lentiginosus, var. *americanus*. American Toad.

HYLIDÆ.

Chorophilus triseriatus, Wied. Little Tree Frog.

Acris gryllus, var. *crepitans*, Baird. Cricket Frog.

Hyla versicolor, LeConte. Common Tree Toad.

RANIDÆ.

Rana halecina, Kalm. Leopard Frog.

Rana palustris, LeConte. Marsh Frog.

Rana temporaria, var. *sylvatica*, LeConte. Wood Frog.

Rana clamitans, Daud. Green Frog.

Rana catesbyana, Shaw. Bull Frog.

URODELA.

PROTEIDÆ.

Menobranchus lateralis, Say. Mud Puppy.

MENOPOMIDÆ.

Menopoma alleghaniensis, Harl. Hell-bender.

SALAMANDRIDÆ.

Amblystoma punctatum, Linn. Large Spotted Salamander.

Amblystoma opacum, Grav. Blotched Salamander.

Amblystoma tigrinum, Green. Tiger Salamander.

Amblystoma jeffersonianum, Green. Granulated Salamander.

Amblystoma microstomum, Cope. Small-mouthed Salamander.
Amblystoma xiphias, Cope. Long-tailed Salamander.
Plethodon erythronotus, Green. Red-backed Salamander.
Plethodon glutinosus, Green. Gray-spotted Salamander.
Plethodon fuscus, Raf. Dusky Salamander.
Spelerpes bilineatus, Green. Striped-back Salamander.
Spelerpes longi caudus, Green. Cave Salamander.
Spelerpes ruber, Daud. Red Salamander.
Spelerpes porphyriticus, Green. Salmon-colored Salamander.
Notophthalmus viridescens, Raf. Crimson Triton.

Species doubtfully referred to Ohio :

OPHIDIA.

CROTALIDÆ.

Crotalophorus miliarius, Linn.

COLUBRIDÆ.

Regina grahami, Baird and Girard. Graham's Snake.
Tropidonotus fasciatus, Linn.
Tropidonotus rhombifer, Hol. Holbrook's Water Snake.
Coluber vulpinus, Baird and Girard. Fox Snake.

TESTUDINATA.

EMYDIDÆ.

Emys meleagris, Shaw. Blanding's Box Tortoise.

AMPHIBIA.

ANOURA.

HYLIDÆ.

Chorophilus nigratus, LeConte.
Hyla pickeringii, Holb. Pickering's Tree Toad.

URODELA.

SALAMANDRIDÆ.

Hemidactylium scutatum, Schl. Four-toed Salamander.

Whole number of species reported from the State :

Lacertilia	3
Ophidia	23
Testudinata	11
Anoura	9
Urodela	16
Total	62

Number of species doubtfully referred to Ohio :

Ophidia	5
Testudinata	1
Anoura	2
Urodela	1
Total	9

SECTION IV.

REPORT ON THE FISHES OF OHIO.

BY DAVID L. JORDAN, M. D.

DR. J. S. NEWBERRY, *State Geologist* :

DEAR SIR : The following report, which I have the honor to submit to you, contains descriptions of all the fishes known to inhabit the waters of the State of Ohio, with notes on the habits, distribution, and value of each species.

I desire to acknowledge my obligations to Professor Spencer F. Baird, Secretary of the Smithsonian Institution, and to Professor G. Brown Goode, Curator of the United States National Museum, for the privilege of examining the various collections made in Ohio by Professors Baird, Putnam, Milner, and others, and preserved in the National Museum. To Professors Theodore Gill and E. D. Cope, I am indebted for various useful suggestions, and to Dr. John Sloan, Mr. J. H. Klippart and others, for specimens of rare fishes. I am also indebted to my former colleague, the late Professor H. E. Copeland, for many valuable observations, especially on the *Etheostomatidae*, and to my assistant, Mr. Chas. H. Gilbert, for various aids.

Very respectfully yours,

DAVID S. JORDAN.

BUTLER UNIVERSITY, IRVINGTON, IND., December 10, 1878.

REPORT

ON THE

FISHES OF OHIO.

BY DAVID L. JORDON, M. D.

PREVIOUS PUBLICATIONS ON THE FISHES OF OHIO.

Before proceeding to the discussion of the Fishes of Ohio, a brief survey of the earlier publications treating wholly or chiefly of the local fish fauna may be interesting :

The earliest of these which has come to my notice is a brief paper by Rafinesque, entitled "Discoveries in Natural History, made during a journey through the Western Region of the United States, by Constantine Samuel Rafinesque, Esq. Addressed to Samuel L. Mitchill, President, and other members of the Lyceum of Natural History, in a letter dated at Louisville, Falls of the Ohio, 20th July, 1818," in the American Monthly Magazine and Critical Review, September, 1818.

In this article the following catalogue of fishes of the Ohio River is given, and nine of the species are described at some length. Many of the names adopted were merely provisional, and were changed when the species were finally described :

<i>Perca salmonea</i>	Salmon.
<i>Perca chrysops</i>	Rockfish.
<i>Sciæna grunniens</i>	White Perch.
<i>Sciæna caprodes</i>	Hog Fish.
<i>Bodianus calliurus</i>	Bass.
<i>Sparus cyanelus</i>	Sun Fish.
<i>Sparus nigropunctatus</i>	Bachelor Perch.
<i>Silurus punctatus</i>	Mud Cat Fish.

<i>Silurus olivaris</i>	Yellow Cat Fish.
<i>Silurus ambodon</i>	Black Cat Fish.
<i>Catostomus bubalus</i>	Buffaloe Fish.
<i>Catostomus erythrus</i>	Red Horse.
<i>Catostomus macropterus</i>	Carp,
<i>Catostomus duquesnei</i>	Sucker.
<i>Clupea heterurus</i>	Gizzard.
<i>Clupea alosoides</i>	Shad.
<i>Glossodon harengoides</i>	Spring Herring.
<i>Glossodon heterurus</i>	Summer Herring.
<i>Hydrargyra dinema</i>	Minny.
<i>Hydrargyra notata</i>	Chub.
<i>Hydrargyra amblops</i>	White Chub.
<i>Lepisosteus fluviatilis</i>	Gar Fish.
<i>Polyodon folium</i>	Shovel Fish.
<i>Polyodon pristiis</i>	Spade Fish.
<i>Acipenser platyrhynchus</i>	Sturgeon.
<i>Silurus pallidus</i>	White Cat.
Not seen yet : Pike, Eels, Lamprey, Black Perch, Yellow Perch, Red Perch.	

Soon after this appeared a supplemental paper, recording 22 more species, and describing three of them. This was in the October number of the journal, and was entitled "Further discoveries in Natural History, made during a journey through the Western Region of the United States, by Constantine Samuel Rafinesque, Esq."

The following are the species added to the catalogue in this paper :

<i>Lepisosteus platostomus</i>	Alligator Fish.
<i>Lepisosteus stenorrhynchus</i>	Gar Fish.
<i>Anguilla laticauda</i>	Ohio Eel.
<i>Cyprinus fasciolaris</i>	Mullet.
<i>Cyprinus trachiaphas</i>	Brown Mullet.
<i>Exoglossum argentum</i>	White Chub.
<i>Olmerus albula</i>	White Fish.
<i>Bodianus calliops</i>	Bride Perch.
<i>Pogostoma leucops</i>	White Eye.
<i>Esox vittatus</i>	Jack Pike.
<i>Esox fasciolaris</i>	Salmon Pike.
<i>Catostomus amiopterus</i>	Perch Buffalo.
<i>Catostomus ambodon</i>	Black Buffalo.
<i>Catostomus velifer</i>	Sailor Fish.
<i>Glossodon chrysops</i>	Gold Eye Herring.
<i>Clupea chrysochloris</i>	Golden Shad.
<i>Silurus pallidus</i>	White Cat Fish.
<i>Silurus cerulescens</i>	Blue Cat Fish.
<i>Glanis limosus</i>	Mud Cat Fish.
<i>Accipenser hepripus</i>	Brown Sturgeon.
<i>Dinoctus truncatus</i>	Blunt-nose Sturgeon.
<i>Litholephias adamantinus</i>	Diamond Fish or Devil Jack.

A third paper, in the November number of the same journal is called "Further account of Discoveries in Natural History in the Western States, by Constantine Samuel Rafinesque, Esq. Communicated in a letter from that gentleman to the editor, Lexington, October 5, 1818."

In this are described the following new species, and the genera to which they belong :

Pomoxis annularis, *Noturus flavus*, *Sarchirus vittatus*.

A fourth paper by Rafinesque on Ohio animals was published in the Journal de Physique, de Chymie et d'Histoire Naturelle, Paris, June, 1819. It is entitled "Prodrome de 70 nouveaux Genres d'Animaux découverts dans l'intérieur des Etats-Unis d'Amérique durant l'année 1818."

The genera of fishes there noticed are the following: *Aplodinotus*, *Etheostoma*, *Pogostoma*, *Aplocentrus*, *Calliurus*, *Lepomis* with its sub-genera, *Pomotis* and *Apomotis*, *Notemigonus*, *Amphiodon*, *Ambiodon*, *Cycleptus*, *Noturus*, *Pilodictis*, and *Litholepis*. The species added to the list are :

<i>Aplodinotus grunniens</i> ,	<i>Calliurus punctulatus</i> ,	<i>Ambiodon niger</i> ,
<i>Etheostoma flabellaris</i> ,	<i>Lepomis cyanellus</i> ,	<i>Cycleptus nigrescens</i> ,
<i>Etheostoma caprodes</i> ,	<i>Lepomis macrochirus</i> ,	<i>Noturus luteus</i> ,
<i>Etheostoma blennioides</i> ,	<i>Notemigonus auratus</i> ,	<i>Pilodictis limosus</i> ,
<i>Pogostoma leucops</i> ,	<i>Amphiodon alveoides</i> ,	<i>Litholepis adamantinus</i> .
<i>Aplocentrus calliops</i> ,	<i>Ambiodon bubalus</i> ,	

The fifth paper by Rafinesque on Ohio Fishes is "Description of the Silures or Cat-fishes of the River Ohio, by C. S. Rafinesque, Professor of Botany in the Transylvania University of Lexington, Kentucky," from Quarterly Journal of Science, Literature and Arts, Royal Institution, London, 1820, ix.

Here are described the following species.

<i>Silurus maculatus</i> ,	<i>Silurus cerulescens</i> ,	<i>Silurus lividus</i> ,
var. <i>erythroptera</i> ,	var. <i>melanurus</i> ,	var. <i>fuscatus</i> ,
<i>Silurus pallidus</i> ,	<i>Silurus argentinus</i> ,	<i>Silurus melas</i> ,
var. <i>marginatus</i> ,	<i>Silurus nebulosus</i> ,	<i>Silurus cupreus</i> ,
var. <i>lateralis</i> ,	<i>Silurus viscosus</i> ,	<i>Silurus xanthocephalus</i> ,
var. <i>leucoptera</i> ,		<i>Silurus limosus</i> .

Rafinesque now desired to gather together these scattered papers, with their confused and often contradictory nomenclature into one coherent work, and so he began the publication of a series of descriptions of the fishes of the Ohio River in the "Western Review and Miscellaneous Magazine," published at Lexington, Kentucky. This publication began December, 1819 and closed November, 1820.

Oversheets of this series of articles were bound and repaged as a small volume under the following title :

Ichthyologia *Ohiensis* | or | *Natural History* | of | the *Fishes Inhabiting the* | *River Ohio* | and its *Tributary Streams* | Preceded by a physical description of the Ohio and its branches | by C. S. Rafinesque, | — | Professor of Botany and Natural History in Transylvania University, Author of the *Analysis of Nature*, &c., &c., member of the Literary and Philosophical Society of New York, the Historical Society of New York, the Lyceum of Natural History of New York, the Academy of Sciences of Philadelphia, the American Antiquarian Society, the Royal Institute of Natural Sciences of Naples, the Italian Society of Arts and Sciences, the Medical Societies of Lexington and Cincinnati, &c., &c., | — | The art of seeing well, or of noticing and distinguishing with accuracy the objects which we perceive is a high faculty of the mind, unfolded in few individuals, and despised by those who can neither acquire it, nor appreciate its results | — | Lexington, Kentucky | printed for the Author by W. G. Hunt (price one dollar). | — | 1820 | (1 vol., 8vo, 90 pp.).

On the reverse of the title page :

These Pages | and the Discoveries which they contain | in one of the principal Branches | of Natural History, | are respectfully Inscribed | by the Author | To his fellow-labourers in the same field of Science | Prof. Samuel L. Mitchill, M. D | who has described the Atlantic Fishes of New York, | and to | C. A. LeSueur, | who was the first to explore the Ichthyology of the Great American Lakes, &c. | In token | of Friendship, Respect, and Congratulation.

This singular work has been for several reasons a stumbling block in the progress of the study of American Ichthyology. This has been partly owing to errors of observation on the part of the author, partly to the admixture of statements derived from memory, imagination, or hearsay with statements of fact, and, finally, in no slight degree to the fact that Rafinesque's accounts were taken from the living fishes, and hence were not to be readily interpreted by workers in the closet with preserved specimens.

The difficulty of obtaining the volume, and the fact that several writers of authority, especially French and English, have set the bad example of ignoring Rafinesque's works altogether, because in their limited knowledge of the local fauna, they have been unable readily to determine his species, have also helped to cause confusion.

Rafinesque's work has been well summed up by Professor Agassiz :

"Nothing is more to be regretted for the progress of natural history in this country than that Rafinesque did not put up somewhere a collection of all the genera and species he had established, with well-authenticated labels, or that his contemporaries did not follow in his steps, or at least preserve the tradition of his doings, instead of decrying him and appealing to foreign authority against him. Tracing his course as a naturalist during his residence in this country, it is plain that he alarmed those with whom he had intercourse, by his innovations, and that they preferred to lean upon the authority of the great naturalist of the age, then residing in Europe, who, however, knew little of the special history of this country, than to trust a somewhat hasty man who was living among them, and who had collected a vast amount of information from all parts of the States, upon a variety of objects then entirely new to science. From

what I can learn of Rafinesque, I am satisfied that he was a better man than he appeared. His misfortune was his prurient desire for novelties and his rashness in publishing them, and yet both in Europe and America he has anticipated most of his contemporaries in the discovery of new genera and species in those departments of science which he has cultivated most perseveringly, and it is but justice to restore them to him, whenever it can be done." (Am. Journ. Sc Arts, 1854, p 354.)

Without further discussion of this subject, which the writer has elsewhere treated in full (Review of Rafinesque's memoirs on North American Fishes, Bull., ix, U. S. Nat. Mus., 1877), I may say that Rafinesque's work as a whole is bad enough, and bad in a peculiarly, original, and exasperating way, but that it is much better than some of its critics have considered it, and that the trouble it has occasioned in nomenclature is due to a large extent to causes not inherent in the character of the work. A certain amount of conservative odium always attaches to a writer who attempts to form natural genera out of time-honored artificial combinations.

I now turn with pleasure to the writings of one, who, though perhaps, not so good an ichthyologist as his predecessor, Rafinesque, was a much more satisfactory writer on Fishes.

The earliest paper of Dr. Jared Potter Kirtland on the Fishes of Ohio, to be found in his "Report on the Zoölogy of Ohio, in the second annual report of the Geological Survey of this State, by W. W. Mather, in 1838."

This paper consists of a catalogue of 72 species, with notes on their habits, distribution, and value as food.

Later, Dr. Kirtland undertook a much more important work entitled, "Descriptions of the Fishes of Lake Erie, the Ohio River and their tributaries."

This was published as a serial in the Boston Journal of Natural History, vols. iii, iv, and v, (1840 to 1846).

In this work, 66 species are described belonging to 32 genera. Each species is accompanied by a figure drawn by Dr. Kirtland himself. These figures are very unequal, some of them, especially of the later ones, are very good, while others are scarcely recognizable. It should be remembered that scientific draughtsmen were more difficult to obtain in Ohio then than now, and that the author of the paper drew the fishes himself because he could find no one else competent to do it.

The faults of this paper are exactly the reverse of those of the Ichthyologia Ohiensis. They are principally two fold: (a) in an undue conservatism, whereby several really distinct species (as *Pomoxys annularis* and *Pomoxys nigromaculatus*) are confounded, and numerous smaller minnows and darters are treated as the young of their larger relatives, and (b) in an undue reliance on the opinion of certain other authors, whose

knowledge of Western fishes was much less than his own. A good result of this conservatism is, however, seen in the fact that, while out of the 111 species described in the *Ichthyologia Ohiensis*, upwards of 43 are either spurious or redundant; in the "Fishes of Lake Erie and the Ohio River," out of 66 species none are spurious, and only three *Semotilus dorsalis*, *Platirostra endentula*, and *Ammocetes concolor*, are redundant. Of these, the first was correctly suspected by Dr. Kirtland to be identical with his *Semotilus cephalus*. The second he had not seen, but had followed LeSueur, who was one of the best ichthyologists of his day, in considering it as a distinct species, instead of what it really was, an old individual of *Polyodon folium*. As regards the *Ammocetes*, the discovery that these eyeless forms were simply larval Lampreys is a very recent one, made, if I am not mistaken, by Professor Huxley.

Later, in the Cleveland "Annals of Science" and "Family Visitor," the plates of his Fishes of Ohio were reproduced, and some new species described and figured. As I have not these papers at hand I forbear further remark on them.

Dr. Kirtland once told the writer that he abandoned the idea of continuing his ichthyological writings with the flood of new genera poured out by Agassiz, Girard, and others, which swept away his landmarks, and which in many cases he was unable to identify or understand, and he said that if he could have his way, he would have us "all turned back to the Linnæan classification." It will be noticed that while Rafinesque "discovered" upwards of 70 new genera and sub-genera in America, Dr. Kirtland declined to establish even one.

Since the time of Dr. Kirtland the only paper of importance especially relating directly to the Fishes of Ohio is the "First Annual Report of the Ohio State Fish Commission, to the Governor of the State of Ohio, for the years 1875 and 1876," and the "Second Annual Report" of the same for the year 1877.

The part pertaining to the habits and value of the fishes was written by the late Mr. John H. Klippart, a close observer and excellent amateur ichthyologist. The descriptions of genera and species in the first report were arranged by Mr. Chas. H. Gilbert, and the second by Dr. Ernest Copeland from manuscript of the present writer.

These papers contain a catalogue of 185 species supposed to occur in Indiana and therefore in Ohio. This list, except in some minor matters of nomenclature, and in the inclusion of some Illinois species, is substantially that which forms the basis of the present report. The accounts of the food fishes, contained in Mr. Klippart's paper, are readable and valuable.

The following table will be interesting as showing the progress of our knowledge of Ohio fishes, and the changes which have taken place in the nomenclature.

In it are included the species described from Ohio by (*a*) Rafinesque in the "*Ichthyologia Ohiensis*," and by (*b*) Kirtland in his "*Fishes of Lake Erie, the Ohio River and their tributaries*. For the purpose of comparison I add (*c*) the list of species contained in the present report, and (*d*) a list of names given by Dr. Günther to the same species in his *Catalogue of the Fishes of the British Museum* (8 vols., 1859-1870), the most valuable general work yet published on Ichthyology.

FOUR LIST OF OHIO FISHES.

JORDAN, 1879.	GUNTHER, 1859-1870.	KIRTLAND, 1840-1846.	RAFINESQUE, 1820.
Ammocetes niger.....	.....	.....	Petromizon nigrum.
Scolecospoma argenteum.....	.....	{ Petromyzon argenteus. Ammocetes concolor.	{ Polyodon folium. Planiostra edentula. Acipenser platiorhynchus.
Polyodon folium.....	Polyodon folium.....	Polyodon folium.....	
Scaphirhynchops platyrhynchus.....	Scaphirhynchus cataphractus.....	{ Platiostra edentula..... Acipenser platiorhynchus.....	
Acipenser rubicundus.....	{ Acipenser rubicundus..... Acipenser hepsetus.....	Acipenser rubicundus.....	
Acipenser maculosus.....	Acipenser maculosus.....	.....	{ Acipenser maculosus. Acipenser serotinus. Acipenser ohioensis. Acipenser macrostomus. Lepisosteus oxyurus. Lepisosteus longirostris. Lepisosteus platostomus. Lepisosteus ferox. Litholepis adamanthinus.
Lepisosteus osseus.....	Lepisosteus osseus.....	Lepisosteus oxyurus.....	
Lepisosteus platystomus.....	Lepisosteus platystomus.....	Lepisosteus platostomus.....	
Litholepis spatula.....	Lepisosteus viridis.....	Lepisosteus ferox.....	
Amia calva.....	Amia calva.....	Amia calva.	{ Anguilla laticauda. Anguilla aterrima. Anguilla xanthomelas. Anguilla lutea.
Anguilla vulgaris.....	Anguilla vulgaris, bostoniensis, etc.	Anguilla lutea.....	
Ichthælarus furcatus.....	{ Amiurus furcatus. Amiurus affinis.	.....
Ichthælarus robustus.....	Amiurus caudafurcatus.....	Pimelodus ceruleus.....	{ Pimelodus maculatus. Pimelodus pallidus. Pimelodus ceruleus.
Ichthælarus punctatus.....	.....	.....
Amiurus nigricans.....	Amiurus natalis.....	Pimelodus cupreus.....	{ Pimelodus lividus. Pimelodus cupreus.
Amiurus natalis.....	{ Amiurus natalis..... Amiurus nigricans.....	.....
Amiurus vulgaris.....	Amiurus catus.....	.....
Amiurus catus.....	.....	.....
Amiurus marmoratus.....	.....	.....
Amiurus melas.....	.....	.....	Pimelodus melas.

Amiurus xanthocephalus.....	.....	Pimelodus catus.....	Pimelodus xanthocephalus. Pimelodus viscosus.
Pelodichthys olivaris	{ Hopladelus sp..... Pimelodus punctulatus.....	Pimelodus limosus	Pimelodus nebulosus. Pimelodus limosus. Pylodictis limosus.
Noturus flavus.....	{ Noturus flavus..... Noturus platycephalus	Noturus flavus	Noturus flavus.
Noturus exilis. Noturus miurus. Noturus sialis.	.....	.....	.....
Icthyobus bubalus	Sclerognathus cyprinella .....	.....	Catostomus bubalus.
Bubalichthys urus	{ Sclerognathus urus.	Catostomus bubalus.	Catostomus carpio.
Bubalichthys bubalus .....	.....	.....	.....
Carpiodes carpio .....	.....	Sclerognathus cyprinus.	Catostomus velifer.
Carpiodes thompsoni .....	.....	.....	.....
Carpiodes cyprinus.....	.....	.....	.....
Carpiodes bison .....	.....	.....	.....
Carpiodes velifer .....	.....	.....	.....
Carpiodes cutisanterinus .....	.....	.....	.....
Carpiodes difformis .....	.....	.....	.....
Cycleptus elongatus	Sclerognothus elongatus.....	Catostomus elongatus	{ Catostomus elongatus. Cycleptus nigrescens.
Catostomus longirostris.....	{ Catostomus hudsonius. Catostomus griseus. Catostomus teres.	.....	.....
Catostomus teres	{ Catostomus aureolus.....	Catostomus communis.....	Catostomus flexuosus.
Catostomus nigricans	Catostomus nigricans	Catostomus nigricans	{ Catostomus xanthopus. Hypentetium macropteryum.
Erimyzon succetta.....	{ Moxostoma oblongum. Moxostoma tenue.....	.....	Catostomus fasciolaris.
Minytrema melanops	Catostomus fasciatus.....	Catostomus melanops	Catostomus melanops.
Myxostoma velatum .....	.....	Catostomus anisurus	Catostomus anisurus.
Myxostoma anisura.....	.....	Catostomus aureolus.	.....
Myxostoma aureolum.....	Catostomus macrolepidotus.....	.....	.....
Myxostoma macrolepidotum	Catostomus duquesnii.....	Catostomus duquesnii.....	{ Catostomus erythrurus. Catostomus melanurus.
Myxostoma carpio	Catostomus carpio.	.....	.....
Placopharynx carinatus.	.....	.....	.....
Quasilabia lacera.	.....	.....	.....
Campostoma anomalum.....	Campostoma dubium.....	Exoglossum dubium.....	{ Rutilus anomalus. Catostomus melanotus.

FOUR LISTS OF OHIO FISHES—Continued.

JORDAN, 1879.	GUNTHER, 1859-1870.	KIRTLAND, 1840-1846.	RAFINESQUE, 1820.
Chrosomus erythrogaster	Leuciscus erythrogaster	Leuciscus erythrogaster	Chrosomus erythrogaster.
Hybognathus nuchalis	Hybognathus nuchalis.	.....	.....
Pimephales promelas	Pimephales promelas	Pimephales promelas	Pimephales promelas.
Hyborthynchus notatus	Hyborthynchus notatus .....	.....	.....
Exoglossum maxillilingua	Exoglossum maxillilingua.	.....	.....
Hudsonius storerianus	Leuciscus storerianus	Leuciscus storerianus.	.....
Hudsonius volucellus	Leuciscus volucellus.	.....	.....
Hudsonius stramineus .....	.....	.....	.....
Hudsonius fretensis.	.....	.....	.....
Hudsonius hamaturus	Leuciscus hamaturus.	.....	.....
Hudsonius analostanus	Leuciscus analostanus	Leuciscus kentuckiensis.	.....
Chirope heterodon	Leuciscus heterodon.	.....	.....
Mimilus rubrifrons	Leuciscus rubrifrons.	.....	.....
Mimilus photogenis	Leuciscus photogenis.	.....	.....
Mimilus dinemus	{ Leuciscus rubellus.	.....	.....
Mimilus ariommus.	{ Leuciscus copii .....	.....	Mimilus dinemus.
Mimilus scabriceps.	.....	.....	.....
Lythrurus diplæmius	Leuciscus diplæmius	Leuciscus compressus (female)	{ Semotilus diplæmius.
.....	.....	{ Leuciscus plagyrus	{ Rutilus ruber.
.....	Leuciscus cornutus	{ Leuciscus diplæmius	{ Luxilus chrysoccephalus.
Ericymba buccata	Ericymba buccata.	.....	{ Rutilus piargyrus (?).
Phenacobius teretulus.	.....	.....	.....
Rhinichthys cataraactæ	Rhinichthys nasutus.	.....	.....
.....	{ Rhynchichthys atronasus.	.....	.....
Rhinichthys atronasus	{ Rhynchichthys obtusus.	Luxilus dissimilis.	Rutilus amblops.
.....	Ceratichthys dissimilis .....	.....	.....
.....	Ceratichthys hyalinus	Semotilus biguttatus.	.....
.....	Ceratichthys biguttatus .....	.....	.....
.....	Ceratichthys plumbeus.	.....	.....
.....
.....	Leucosomus corporalis	{ Semotilus dorsalis	{ Semotilus dorsalis.
Semotilus corporalis .....	.....	{ Semotilus cephalus	{ Semotilus cephalus.
Telestes elongatus	Leuciscus elongatus	Luxilus elongatus.	.....
Phoxinus neogæus	Phoxinus neogæus.	.....	.....

Notemigonus chrysolenus	Abramis americana	Leuciscus chrysolenus	Notemigonus auratus.
Dorosoma cepedianum notatum	Ceatoiscus cepedianus	Chaetiscus ellipticus	Dorosoma notata.
Pomolobus chrysochloris .....	.....	Alosa chrysochloris	Pomolobus chrysochloris.
Hyodon tergus	Hyodon tergus .....	.....	{ Hyodon tergus.
Coregonus quadrilateralis	{ Coregonus quadrilateralis.	.....	{ Hyodon clodalis.
Coregonus clupeiformis	{ Coregonus novæ-angliæ.	.....	{ Hyodon vernalis.
Coregonus hoyi	{ Coregonus albus .....	.....	{ Hyodon heterurus.
Coregonus artedi	{ Coregonus richardsoni.	.....	{ Hyodon amphiodon.
Coregonus nigripinnis.	{ Coregonus clupeiformis.	.....	.....
Coregonus tullibee	{ Coregonus harengus .....	.....	.....
Salvelinus fontinalis	{ Coregonus lucidus.	.....	.....
Cristivomer nanyoush	Coregonus tullibee.	.....	.....
Percoopsis guttatus	{ Salmo (Hucho) fontinalis .....	.....	{ Salmo nigrescens.
Amblyopsis spelæus	{ Salmo hudsonicus .....	.....	{ Salmo aliegheniensis.
Typhlichthys subterraneus.	Salmo nanyoush .....	.....	.....
Chologaster agassizii.	Percoopsis guttatus.	.....	.....
Fundulus diaphanus	Amblyopsis spelæus.	.....	.....
Zygonectes notatus	Fundulus multifasciatus.	.....	.....
Zygonectes dispar.	{ Haplochilus pulchellus .....	.....	.....
Melanura limi	{ Haplochilus aureus.	.....	.....
Esox salmoneus	Umbra limi	Hydrargyra limi.	Semotilus notatus.
Esox cypho	Esox salmoneus	Esox umbrinus .....	.....
Esox lucius	Esox cypho.	Esox reticulatus.	Esox salmoneus.
Esox nobilior.	{ Esox lucius	Esox estor.	.....
Labidesthes sicculus.	{ Esox estor .....	.....	.....
Aphododerus sayanus	Aphredoderus sayanus.	.....	.....
Pomoxis annularis	Centrarchus nictus .....	.....	Pomoxis annularis.
Pomoxis hexacanthus	Centrarchus nictus .....	.....	.....
Centrarchus iridens	Centrarchus hexacanthus	Centrarchus hexacanthus.	.....
Copelandia eriarcha.	Centrarchus iridens.	.....	.....
Eupomotis aureus	Pomotis auritus	Pomotis vulgaris.	.....
Eupomotis pallidus.	.....	.....	.....

FOUR LISTS OF OHIO FISHES—Continued.

JORDAN, 1879.	GUNTHER, 1859-1870.	KIRTLAND, 1840-1846.	RAFINESQUE, 1820.
Xenotis megalotis.....	.....	Pomotis nitida.....	Icthelis megalotis.
Xenotis lythochloris.....	.....	Pomotis macrochira (part).	Icthelis auritus.
Xenotis aureolus.....	.....	.....	.....
Xenotis inscriptus.....	.....	.....	.....
Xenotis peltastes.....	.....	.....	.....
Lepomis macrochirus.....	.....	.....	Icthelis macrochira.
Lepomis anagallinus.....	.....	.....	.....
Lepomis pallidus.....	.....	.....	.....
Apomotis cyanellus.....	Pomotis incisor.	.....	.....
.....	Bryttus punctatus.....	.....	.....
Chenobryttus gulosus.....	{ Centrarchus gulosus.	.....	{ Icthelis cyanellus.
.....	{ Bryttus melanops.	.....	{ Icthelis melanops.
Ambloplites rupestris.....	Centrarchus æneus.....	Centrarchus æneus.....	.....
.....
Micropterus salmoides.....	{ Grystes salmonoides.....	.....	{ Icthelis erythrops.
.....	{ Centrarchus fasciatus.....	.....	{ Lepomis ichtheloides.
.....	{ Centrarchus obscurus.....	Centrarchus fasciatus.....	{ Callurus punctulatus.
.....	.....	.....	{ Lepomis trifasciata.
Micropterus pallidus.....	.....	.....	{ Lepomis flexuolaris.
Roccus chrysops.....	Huro nigricans.....	.....	{ Lepomis salmonea.
Morone interrupta.....	Labra multilineatus.....	Labrax multilineatus.....	{ Lepomis notata.
.....	.....	.....	{ Etheostoma callinura.
Perca fluviatilis americana.....	{ Perca flavescens.....	Perca flavescens.	{ Lepomis pallidus.
.....	{ Perca gracilis.	.....	Lepibema chrysops.
Stizostethium canadense.....	{ Lucioperca canadensis.	.....	.....
.....	{ Lucioperca grisea.	.....	.....
Stizostethium vitreum.....	Lucioperca americana.....	Lucioperca americana.....	Stizostedion salmoneum.
Pleurrolepis pellucidus.....	.....	.....	.....
Diplesium blennioides.....	.....	.....	Etheostoma blennioides.
Inostoma shumardi.....	.....	.....	.....
Rheocrypta copelandi.....	Boleosoma tessellatum.	.....	.....
Boleosoma olmstedii.....	Boleosoma maculatum.	.....	.....
Boleosoma nigrum.....	.....	.....	.....

<i>Percina caprodes</i>	<i>Pileoma semifasciatum</i>	<i>Etheostoma caprodes</i>	<i>Etheostoma caprodes</i> .
<i>Percina manitou.</i>	{ <i>Pileoma zebra.</i>		
<i>Alvordius aspro</i>		<i>Etheostoma blennioides.</i>	
<i>Alvordius macrocephalus.</i>			
<i>Alvordius phoxocephalus.</i>		<i>Etheostoma variatum.</i>	
<i>Alvordius variatus</i>			
<i>Ericosma evides.</i>			
<i>Hadropterus tessellatus.</i>			
<i>Nothonotus camurus.</i>		<i>Etheostoma maculatum.</i>	
<i>Nothonotus maculatus</i>			
<i>Nanostoma zonalis.</i>			
<i>Peciliichthys ceruleus.</i>			
<i>Peciliichthys spectabilis.</i>			
<i>Etheostoma squamiceps.</i>			{ <i>Etheostoma flabellata.</i> <i>Etheostoma fontinalis.</i> <i>Pegedictis icatalops.</i>
<i>Etheostoma flabellare</i>			
<i>Boleichthys eos.</i>			
<i>Vaillantia canura.</i>			
<i>Microperca punctulata.</i>			
<i>Haplodonotus grunniens</i>	<i>Corvina oscula</i>		
<i>Uranidea gracilis</i>	<i>Cottus gracilis.</i>	<i>Corvina oscula</i>	<i>Amblodon grunniens.</i>
<i>Uranidea hoyi.</i>			
<i>Uranidea meridionalis.</i>			
<i>Uranidea wilsoni.</i>	<i>Cottus bairdi</i>	<i>Cottus gobio.</i>	
<i>Uranidea bairdi</i>			
<i>Uranidea spilota.</i>	<i>Ptyonotus thompsoni.</i>		
<i>Trigloporus thompsoni</i>	<i>Lota vulgaris</i>	<i>Lota maculosa.</i>	
<i>Lota maculosa</i>		<i>Gasterosteus inconstans.</i>	
<i>Eucalia inconstans</i>	<i>Gasterosteus concinnus.</i>		
<i>Pygosteus occidentalis concinnus</i> ..			

The State of Ohio includes two well defined faunal areas, so far as its fishes are concerned. These are Lake Erie and its tributaries on the north, and the Ohio River and its tributaries on the south. Of about 163 species found in the waters of the State, about 40 may be considered characteristic of the Lake fauna, seldom being found in tributaries of the Ohio. A large number, about 67, belong properly to the Ohio River fauna, the remaining 56 being common to both. The species found in the lake number therefore about 96, and those in the river, about 123. In nearly every case where a species is common to both faunæ, northern or lake specimens will be found to be deeper in body and deeper in color than the southern or river specimens. Some of the species belonging properly to the lake region occur in the headwaters of the Scioto, Miami, etc. I suppose this to be due to the fact that the watersheds in the State are sometimes low and swampy, permitting at times the interchange of fishes. Why these species do not spread southward is not explained, but this is probably due to something in the water or the climate.

Of species belonging especially to the Lake fauna, we may enumerate the following :

<i>Acipenser rubicundus</i> ,	<i>Coregonus tullibee</i> ,
<i>Amiurus catus</i> ,	<i>Cristivomer namaycush</i> ,
<i>Carpiodes thompsoni</i> ,	<i>Percopsis guttatus</i> ,
<i>Catostomus longirostris</i> ,	<i>Esox nobilior</i> ,
<i>Couesius prothemius</i> ,	<i>Eucalia inconstans</i> ,
<i>Rhinichthys cataractæ</i> ,	<i>Pygosteus occidentalis</i> ,
<i>Hudsonius storerianus</i> ,	<i>Lota maculosa</i> ,
<i>Telestes elongatus</i> ,	<i>Uranidea spilota</i> ,
<i>Coregonus quadrilateralis</i> ,	<i>Triglopsis thompsoni</i> ,
<i>Coregonus clupeiformis</i> ,	<i>Eupomotus aureus</i> ,
<i>Coregonus hoyi</i> ,	<i>Perca americana</i> ,
<i>Coregonus artedi</i> ,	<i>Microperca punctulata</i> ,
<i>Coregonus nigripinnis</i> ,	<i>Boleichthys eos</i> .

Of species characteristic of the Ohio River fauna, the following may be mentioned :

<i>Scaphirhynchops platyrhynchus</i> ,	<i>Minnilus ariommus</i> ,
<i>Polyodon folium</i> ,	<i>Minnilus scabriceps</i> ,
<i>Litholepis spatula</i> ,	<i>Lythrurus diplæmius</i> ,
<i>Noturus flavus</i> ,	<i>Hudsonius stramineus</i> ,
<i>Pelodichthys olivaris</i> ,	<i>Pomolobus chrysochloris</i> ,
<i>Amiurus xanthocephalus</i> ,	<i>Dorosoma cepedianum</i> ,
<i>Amiurus melas</i> ,	<i>Centrarchus viridens</i> ,
<i>Ichthælurus robustus</i> ,	<i>Xenotis lythrochloris</i> ,
<i>Ichthælurus furcatus</i> ,	<i>Lepomis anagallinus</i> ,
<i>Ichthyobus bubalus</i> ,	<i>Lepomis macrochirus</i> ,
<i>Bubalichthys urus</i> ,	<i>Etheostoma squamiceps</i> ,

<i>Bubalichthys bubalus</i> ,	<i>Pœcilichthys cœruleus</i> ,
<i>Carpiodes carpio</i> ,	<i>Nothonotus camurus</i> ,
<i>Carpiodes cutisanserinus</i> ,	<i>Nanostoma zonale</i> ,
<i>Cycleptus elongatus</i> ,	<i>Rheocrypta copelandi</i> ,
<i>Myxostoma anisura</i> ,	<i>Imostoma shumardi</i> ,
<i>Ceraticthys amblyops</i> ,	<i>Ericosma evides</i> ,
<i>Ericymba buccata</i> ,	<i>Pleurolepis pellucidus</i> .
<i>Minnilus rubrifrons</i> ,	

The following are species of general distribution, occurring probably in every suitable stream in the State:

<i>Amiurus natalis</i> ,	<i>Melanura limi</i> ,
<i>Catostomus teres</i> ,	<i>Labidesthes sicculus</i> ,
<i>Catostomus nigricans</i> ,	<i>Pomoxys nigromaculatus</i> ,
<i>Erimyzon sucetta</i> ,	<i>Pomoxys annularis</i> ,
<i>Minytrema melanops</i> ,	<i>Xenotis megalotis</i> ,
<i>Myxostoma macrolepidotum</i> ,	<i>Lepomis pallidus</i> ,
<i>Ceraticthys biguttatus</i> ,	<i>Apomotis cyanellus</i> ,
<i>Semotilus corporalis</i> ,	<i>Ambloplites rupestris</i> ,
<i>Chrosomus erythrogaster</i> ,	<i>Micropterus salmoides</i> ,
<i>Notemigonus chrysoleucus</i> ,	<i>Micropterus pallidus</i> ,
<i>Minnilus rubellus</i> ,	<i>Roccus chrysops</i> ,
<i>Hudsonius analostanus</i> ,	<i>Etheostoma flabellare</i> ,
<i>Luxilus cornutus</i> ,	<i>Boleosoma nigrum</i> .
<i>Hyborhynchus notatus</i> ,	<i>Percina caprodes</i> .

As an illustration of the character of the local fauna of the smaller streams of the interior, I give the following list of the species taken by Professor H. E. Copeland and myself in the White River, near Indianapolis, Indiana. This stream is in all essential respects similar to the Miami, and other rivers of Western Ohio:

ETHEOSTOMATIDÆ.

<i>Microperca punctulata</i> Putn.....	Rare.
<i>Etheostoma flabellare</i> Raf.....	Rare.
<i>Nothonotus camurus</i> (Cope) Jor.....	Rare.
<i>Pœcilichthys variatus</i> (Kirt.) Ag.....	Common.
<i>Pœcilichthys spectabilis</i> Ag.....	Frequent.
<i>Pleurolepis pellucidus</i> (Baird) Ag.....	Frequent.
<i>Boleosoma nigrum</i> (Raf.) Jor.....	Common.
<i>Alvordius aspro</i> Cope and Jor.....	Frequent.
<i>Ericosma evides</i> Jordan and Copeland.....	Rare.
<i>Rheocrypta copelandi</i> Jor.....	Rare.
<i>Diplesium blennioides</i> (Raf.) Jor.....	Common.
<i>Percina caprodes</i> (Raf.) Grd.....	Common.

CENTRARCHIDÆ.

<i>Pomoxys nigromaculatus</i> (LeS.) Grd.	Rare.
<i>Pomoxys annularis</i> Raf.	Uncommon.
<i>Ambloplites rupestris</i> (Raf.) Gill.	Common.
<i>Micropterus pallidus</i> (Raf.) Gill and Jor.	Common.
<i>Micropterus salmoides</i> (Lac.) Gill.	Common.
<i>Apomotis cyanellus</i> Raf.	Common.
<i>Lepomis macrochirus</i> Raf.	Frequent.
<i>Lepomis pallidus</i> (Mit.) Gill and Jor.	Common.
<i>Xenotis inscriptus</i> (Ag.) Jor.	Frequent.
<i>Xenotis megalotis</i> (Raf.) Jor.	Common.
<i>Xenotis lythrochloris</i> Jor.	Frequent.
<i>Xenotis aureolus</i> Jor.	Frequent.

SCIENIDÆ.

<i>Haploidonotus grunniens</i> Raf.	Uncommon.
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COTTIDÆ.

<i>Potamocottus wilsonii</i> , (Grd.) Gill.	Uncommon.
<i>Potamocottus carolinæ</i> Gill.	Rare.

ATHERINIDÆ.

<i>Labidesthes sicculus</i> Cope.	Common.
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CYPRINODONTIDÆ.

<i>Zygoneetes notatus</i> (Raf.) Jor.	Common.
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UMBRIDÆ.

<i>Melanura limi</i> (Kirt.) Ag.	Rare.
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ESOCIDÆ.

<i>Esox salmoneus</i> Raf.	Common.
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DOROSOMATIDÆ.

<i>Dorosoma cepedianum</i> (LeS.) Gill.	Uncommon.
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CYPRINIDÆ.

<i>Campestoma anomalum</i> (Raf.) Ag.	Common.
<i>Hyborhynchus notatus</i> (Raf.) Ag.	Common.
<i>Hybognathus nuchalis</i> Ag.	Rare.
<i>Ericymba bucatta</i> Cope.	Common.
<i>Semotilus corporalis</i> (Mit.) Putn.	Common.
<i>Ceraticthys biguttatus</i> (Kirt.) Grd.	Common.
<i>Ceraticthys amblops</i> (Raf.) Grd.	Common.

<i>Erimystax dissimilis</i> (Kirt.) Jor.	Frequent.
<i>Rhinichthys obtusus</i> Ag.	Common.
<i>Hudsonius stramineus</i> (Cope) Jor.	Frequent.
<i>Chrosomus erythrogaster</i> Raf.	Common.
<i>Lythrurus diplæmius</i> (Raf.) Jor.	Common.
<i>Luxilus cornutus</i> (Mit.) Jor.	Common.
<i>Hudsonius analostanus</i> (Grd.) Jor.	Common.
<i>Episema scabriceps</i> Cope.	Locally abundant.
<i>Episema ariomma</i> Cope.	Frequent.
<i>Minnilus dinemus</i> Raf.	Frequent.
<i>Minnilus rubrifrons</i> (Cope) Jor.	Common.
<i>Notemigonus chrysoleucus</i> (Mit.) Jor.	Common.

CATOSTOMIDÆ.

<i>Catostomus teres</i> (Mit.) LeS.	Common.
<i>Catostomus nigricans</i> LeS.	Common.
<i>Erimyzon sucetta</i> (Lac.) Jor.	Common.
<i>Minytrema melanops</i> (Raf.) Jor.	Common.
<i>Myxostoma macrolepidotum</i> (LeS.) Jor.	Common.
<i>Carpiodes carpio</i> Raf.	Rare.

SILURIDÆ.

<i>Ichthælurus punctatus</i> (Raf.) Jor.	Rare.
<i>Aminurus melas</i> Raf.	Uncommon.
<i>Aminurus cupreus</i> (Raf.) Gill.	Common.
<i>Aminurus xanthocephalus</i> Raf.	Common.
<i>Noturus sialis</i> Jor.	Common.
<i>Noturus flavus</i> Raf.	Frequent.
<i>Noturus miurus</i> Jor.	Common.

LEPIDOSTEIDÆ.

<i>Lepidosteus osseus</i> (L.) Ag.	Uncommon.
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POLYDONTIDÆ.

<i>Polyodon folium</i> Lacep.	Uncommon.
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PETROMYZONTIDÆ.

<i>Ammocætes niger</i> (Raf.) Jor.	Locally abundant.
<i>Scolecossoma argenteum</i> (Kirtland) Jor.	Rare.

FISHES.

A fish in the popular sense of the word is a member of any one of the four classes of aquatic or fish-like vertebrates, the *Pisces* (True Fishes), the *Elasmobranchii* (Sharks, Skates, etc.), the *Marsipobranchii* (Lampreys), and *Lep'ocardi* (Lancelets). A fish in this comprehensive and rather indefinite sense may be defined as a cold-blooded vertebrate, adapted for life in the water, breathing by means of gills, the limbs if present developed as fins, the fingers and toes being represented by cartilaginous rays connected by membrane, the exoskeleton obsolete or developed as scales or bony plates, and one or more fins developed on the median line of the body, usually composed of rays connected by membrane.

Of a fish, in the popular sense, one could hardly say more, without the necessity of the constant introduction of exceptions. Of a "true fish, *i.e.*, a member of the Class *Pisces*, a definition will be given further on.

Of the four classes of fish-like vertebrates only two are represented in the waters of Ohio. These are the Lampreys (*Marsipobranchii*) and the True Fishes (*Pisces*). These two may be compared as follows:

* Skull imperfectly developed, without lower jaw or membrane bones (opercula, etc.); paired fins (pectorals and ventrals) undeveloped, with no shoulder girdle or pelvic elements; gills purse-shape, usually with several external openings; nostril single, on the median line of the head; body eel-shaped, scaleless. . . . MARSIPOBRANCHII.

** Skull well-developed, with a lower jaw and membrane bones; paired fins more or less developed, with a shoulder girdle (serriform or furcula-shaped) curved forwards and with its respective sides connected below; and with distinct pelvic elements; gills not purse-shaped, their external openings single on each side; nostrils one on each side, their openings often double; body variously formed, usually scaly. . . . PISCES.

Beginning with the lowest, or least complicated of these groups we come now to the consideration of

CLASS I. MARSIPOBRANCHII. THE MYZONTS.

Skeleton cartilaginous; the skull imperfectly developed, not separate from the vertebral column; no ribs; no true jaws; no limbs; no shoulder girdle nor pelvic elements; gills in the form of fixed sacs, without branchial arches, six or seven in number on each side; a single nasal aperture; mouth subinferior, nearly circular, adapted for sucking; heart

without arterial bulb; alimentary canal straight, simple, without cœcal appendages, pancreas or spleen; generative outlet peritoneal; vertical fins with feeble rays, continuous around the tail; naked, eel-shaped animals, inhabiting all waters. (*Marsipion*, a small pouch or purse; *bragchia*, gills.)

This class is divided into two orders, the *Hyperotreta* or Hag-fishes, in which the nasal duct is tube-like with cartilaginous rings, penetrating the palate, and *Hyperoartia* or Lampreys, with the nasal duct developed in the form of a blind sac not penetrating the palate. The former order is not numerous in species, and none of its members are found in fresh water, so that in the fauna of Ohio, we have to consider only

ORDER 1. HYPEROARTIA. THE LAMPREYS.

Marsipobranchii with the nasal duct in the form of a blind sac, not penetrating the palate. This order is equivalent to the single family *Petromyzontidæ*. (*Huperos*, palate; *artios*, complete or entire.)

FAMILY I. PETROMYZONTIDÆ. THE LAMPREYS.

Eel-shaped, naked, sub-cylindrical anteriorly, compressed behind; mouth nearly circular, suctorial, armed with horny teeth which are simple or multicuspid, and rest on papilla; of these teeth several standing behind the opening of the oesophagus are more or less united, forming a semi-circular plate, known as the mandibular plate; in front of the opening of the oesophagus are either two large separate teeth, or else two or three teeth coalescent into a crescent shaped plate; these are the so-called maxillary teeth; eyes present, in the adult; gill openings seven, arranged in a linear series along the sides of the chest; nostril above the head; lips present, sometimes fringed; dorsal fin with its posterior part usually continuous with the anal around the tail, the anterior part more or less distinctly separated by a notch; intestines with a spiral valve; eggs small.

Some species of Lamprey build large circular nests, as large as a cart-wheel, a foot or two in height, sometimes raising half a foot above the surface of the water. They collect these stones, of the size of a hen's egg with their mouth, and are said to fashion them into circles with their tail. Whether our Ohio species build conspicuous nests, I do not know.

These animals undergo a metamorphosis, the young forms being usually toothless, with the eyes rudimentary. Until quite recently, these larval forms have been considered as separate genera. Genera five or six, species about twenty, found in all waters in temperate regions. They attach themselves to the bodies of fishes, and feed on their flesh, which they scrape off with their rasp-like teeth. The marine species of the genus *Petromyzon* reach a considerable size and are valued as food. The fresh water species are, however, too small for such use. Two genera are represented in Ohio. They are easily distinguished by the difference in the teeth.

ANALYSIS OF GENERA OF PETROMYZONTIDÆ.

*Maxillary teeth coalescent, forming a crescent shaped plate, with a distinct cusp at each end, between which is sometimes a small median cusp; dorsal fin continuous.

AMMOCETES. 1.

**Maxillary teeth double or triple, composed of two or three pointed cusps close together, and not forming a crescent-shaped plate; dorsal fin continuous.

SCOLECOSOMA. 2.

GENUS 1. AMMOCETES. Dumeril.

Ammocetes, DUMERIL, Faune Française, 1828, (based on larval forms.)

Ichthyomyzon, GIRARD, U. S. Pac. R. R. Surv., 1858.

Type, *Ammocetes branchialis*, L., the larval form of *Petromyzon planeri*, BLOCH, an European species closely related to *A. niger*.

Etymology, *ammos*, sand; *koite*, to lie.

Small Lampreys with the dorsal fin continuous, sometimes emarginate, but not divided into fins, the posterior portion continuous with the anal around the tail, and with the maxillary tooth single, forming a broad crescentic plate, with a large bluntish cusp at each end, and sometimes a small cusp between them. But one American species is known, very closely allied to the European Pride or Small Lamprey.

1. AMMOCETES NIGER (Rafinesque) Jordan.

Small Black Lamprey.

Petromyzon nigrum, RAFINESQUE (1820), Ichthyologia Ohiensis, 84.

Petromyzon niger, JORDAN (1878), Man. Vert., first edition, 315.

Ammocetes niger, JORDON (1878), Man. Vert., second edition, 349.—JORDON (1878), Bull.

Ills. Lab. Nat. Hist., 2, 70.

Description.—Head moderate, nearly as long as the chest (i. e. space occupied by the gill openings); mouth comparatively small; lips with a conspicuous fringe of papillæ; dorsal fin high, considerably depressed in front of the vent, but not divided into fins, the posterior part highest; anal fin evident; anal tube conspicuously protruded in the spring; eyes moderate; maxillary tooth with its cusps large, triangular, well separated, a small pointed median cusp usually present in the adult; in younger specimens the median cusp is obsolete, and in half grown individuals the tooth forms a curved plate, without distinct cusps; mandibular plate curved with eight to ten well developed subequal, tooth-like lobes, inside of which is a plate bearing three teeth; a plate on each side of the opening of the œsophagus, the remaining teeth inconspicuous. Bluish-black above, silvery below; size small. Length, 6 to 10 inches.

Habitat, Ohio Valley, Upper Mississippi, and Great Lake region.

Diagnostic marks.—This species may be known to be a Lamprey by its sucking mouth and numerous gill openings. From the other Ohio Lamprey, the form of the maxillary tooth will distinguish it at sight. The larvæ of the two without eyes or teeth are very similar, but the present species is smaller and darker than *Scolecossoma argenteum*.

Habits.—This Lamprey is usually seen in the spring, when it ascends small clear brooks, in large numbers for the purpose of depositing its spawn. They are often found clinging to stones and clods of earth, in which position they are readily destroyed by the small boy. Later in the season they disappear, probably returning to deeper water, and are seldom caught except when attached to some unlucky fish. As they are rarely seen on their way down stream, "it is thought by fishermen that they never return, but waste away and die, clinging to rocks and stumps of trees for an indefinite period; a tragic feature in the scenery of the river bottoms worthy to be remembered with Shakespeare's description of the sea floor." (*Thoreau*.)

They probably occur throughout Ohio, but are more abundant further northwest. They have, of course, no economic value.

GENUS 2. SCOLECOSOMA. Girard.

Scolecossoma, GIRARD, U. S. Pac. R. R. Surv., x, 384, 1859.

Type, *Ammocetes concolor*, KIRTLAND, which is the larval form of *Petromyzon argenteus*, KIRTLAND.

Etymology, *skolēx*, worm; *soma*, body.

Lampreys of rather small size, having the dorsal fin high and continuous, with only a shallow emargination; the teeth nearly equal over the large buccal disk, the maxillary teeth two in number, pointed and set close together, without interspace and not forming a crescent shaped plate; mandibular plate with numerous close-set pointed cusps, which resemble distinct teeth. This genus differs from *Petromyzon* in the continuous dorsal, there being two distinct dorsal fins in the latter genus. Its known species inhabit the Great Lake region and the Mississippi Valley. The group was originally intended to include only those blind species (i. e. larvæ) which had a single dorsal fin, those larvæ with two dorsal fins being called by Girard *Ammocetes*. The type of *Scolecossoma* really seems to be a representative of a distinct genus, for which the name is of course to be retained in spite of the erroneous views entertained as to its relations by its author.

2. SCOLECOSOMA ARGENTEUM (Kirtland) Jordan.

Silvery Lamprey; Mud Eel.

Petromyzon argenteus, KIRTLAND (1840), Bost. Journ. Nat. Hist., iii, 342.

Ichthyomyzon argenteus, JORDAN (1876), Man. Vert., first edition.

Ammocetes argenteus, JORDAN (1878) Man. Vert., second edition.

Ammocetes concolor, KIRTLAND (1840), Bost. Journ. Nat. Hist., iii, 473 (*larva*).

Ichthyomyzon hirudo, GIRARD, (1859), U. S. Pac. R. R. Surv., x, 342.—GUNTHER (1870),
• Cat. Fishes Brit. Mus., viii, 507.

Ammocetes hirudo, JORDON, Man. Vert., second edition, 350.

Ammocetes epyptera, ABBOTT (1860), Proc. Acad. Nat. Sci. Phila., 327 (*larva*).

Description.—Body stoutish, compressed behind; head broad, with large buccal disk the edges of which are fringed but not conspicuously; teeth pretty strong and nearly uniform, the two maxillary cusps being very similar to the other teeth; mandibular cusps seven in number, connivent, the middle ones the longest; color bluish, sides silvery; often mottled; a small dusky spot above each gill opening, usually conspicuous. Length about a foot.

Habitat. Great Lake region and Mississippi and Ohio Valleys, mostly in deep water but ascending small streams to spawn in the spring.

Diagnosis.—The presence of two teeth close together, and similar to the other teeth, in the mouth in front of the opening of the gullet will distinguish this Lamprey from the other species found in Ohio. This species is larger and paler colored.

Habits.—This Lamprey is rather common, both in Lake Erie and in the Ohio River. It is not often found in small streams, excepting in the spawning season. I have obtained several specimens, with Perch from Lake Erie, both *external*, feeding on the Perch, and *internal*, having been devoured by the fish. Dr. Kirtland's original type was found fastened to a Wall-eyed Pike (*Stizostethium*). Probably all of our larger fishes sometimes are victims to its voracity. The species seems to reach nearly its full size before dropping its larval peculiarities, as blind and toothless specimens of six or eight inches in length are occasionally taken.

According to Professor Milner, this Lamprey frequently is parasitic on the Lake Sturgeon, producing circular scars or raw sores. "It is probable that their natural food is the slime or mucus exuded in abundance from the pores, but they frequently retain their hold upon a spot until they have eaten through to the flesh, and deep ulcerous cavities occasionally result from the sore" (Milner, Rept. U. S. Fish Comm., 1872-73, p. 74). According to Dr. C. C. Estes and others, this species likewise finds "green pastures" on the naked skin of *Polyodon*.

CLASS II. PISCES. THE TRUE FISHES.

Excluding the Chimæras, Skates, Sharks, Lampreys, Lancelets and their allies, fish-like vertebrates, which are not fishes in a strict zoological sense a fish may be defined as follows:

A fish is a cold blooded vertebrate, adapted for life in the water, having the limbs developed as fins, the dactyls being represented by cartilaginous rays connected by membrane (rarely obsolete); exo-skeleton, if present, of scales, spines, or bony plates; one or more fins on the median line of the body composed of rays connected by membrane; skull developed,

with membrane bones (opercula, etc.) in connection with it, and containing a brain of several differentiated ganglia; shoulder girdle developed, lyriiform or furcula shaped; a distinct lower jaw; branchiæ, with the outer edge free, attached to about five bony arches, which are connected with the hyoid bone and parallel with the shoulder girdle, the hindmost pair modified into tooth-bearing "pharyngeals;" gill openings a single cleft on each side behind the operculum, either confluent below or else separated by an isthmus; heart (typically) with two cavities and an arterial bulb. In most fishes there is a membranous air bladder lying immediately beneath the back bone, answering homologically to the lungs of the higher vertebrates. In a few Ganoids the air bladder is cellular and more or less functional, and connected by a glottis with the œsophagus; in most of the soft-rayed species (Suckers, Minnows, Salmon, Catfishes, etc.) there is a slender duct connecting the air bladder with the alimentary canal; in the spinous fishes (Perch, etc.) this is wanting. Reproduction by eggs of small size, which are usually fertilized after exclusion; the members of a few groups (*Cyprinodontidæ*, *Amblyopsidæ*, etc.) are ovoviviparous, the young being developed in a sort of uterus. (Latin *piscis*, a fish.)

NOTE.—The terms used in the description of fishes may perhaps best be made clear to one not familiar with them by a sort of object lesson. The reader is supposed to have at hand a specimen of the Common Brook Sucker (*Catostomus teres*) and a Black Bass (*Micropterus salmoides*). The general form of the body is, in this memoir, usually first indicated in general terms, as *elongate*, *oblong*, *short*, *deep*, etc.; more specific terms are *compressed* (flattened laterally); *depressed* (flattened from above); *fusiform* (spindle-shaped, tapering each way from the shoulders); *terete* (nearly cylindrical, i. e., the vertical and horizontal diameters about equal. The *depth* of the body is described by comparison with the *length*, along the side from the tip of the snout to the base of the caudal fin. The depth is measured at the deepest point, and is proportionately greater in old fishes than in young. The general form of the head is next noted; then the form and position of the mouth; the mouth is *terminal* when its opening is forwards, and the two jaws are not very unequal in length, as in the *Black Bass*; it is *inferior*, when, by the shortness of the lower jaw, its position is entirely underneath the snout, as in the *Sucker*; it is *oblique* when its cleft slants backward and downward when the mouth is closed; it is *horizontal* when the reverse is the case. The bones of which the jaw is composed are the following: The two *dentary* bones joined by a *symphysis* in front, forming the *mandible* or *lower jaw*; the *pre-maxillaries*, or *inter-maxillaries*, forming *always* the middle of the front part of the upper jaw, and in some cases forming its entire edge, as is the case in the *Black Bass*. Attached to the pre-maxillaries, either behind them, as in the *Black Bass*, or below them, as in the case of the *Trout*, are the *maxillaries* or *supra-maxillaries*. In the *Black Bass* these are conspicuous and flat, extending back below the eye; in the *Sucker* they are hardly recognizable without dissection; in some fishes there is attached to the upper posterior edge of the maxillaries and parallel with it a very small bone called the *supplemental maxillary*. The relative size of the mouth is conveniently indicated by describing how far back the maxillary extends; thus "max-

llary extending to posterior border of pupil," indicates that the maxillary reaches a *vertical line* passing through that point. In the same way, the position of the mouth may be fixed by stating on what level as compared with the eye, the pre-maxillary or upper lip is placed.

The jaws are sometimes provided with lips. These may be *plain*, *plicate*, *puckered*, or *pappilose* (with little tubercles, as is the case with the Brook Sucker). At the angle of the mouth, attached to the maxillary, is sometimes a fleshy appendage, called a *barbel*. This may be extremely short and scarcely visible, as in the Chub, or very long and conspicuous, as in the Catfish. Sometimes the nostrils or the chin, or both, may have barbels.

The upper jaw is said to be *protractile*, when there is a deep furrow in the skin, separating it from the skin of the forehead, as in the Sucker, and *not protractile*, when the skin of the upper lip, in the middle at least, is continuous with that of the forehead, as in the Log Perch.

The *membrane* bones of the head may be readily recognized by taking a Sucker. The large "gill cover," occupying most of the side of the head behind the eye is the *operculum* or *opercle*; below this and extending up obliquely behind it is the *subopercle*; in front of the opercle, nearly parallel with it and separating it from the *cheek*, is the *preopercle*, and below the angle of the preopercle, wedged in between it and the subopercle, is the narrow *interopercle*: below the eye is the series of *suborbital* bones, and in front of it, below the double opening of the nostril, is the *preorbital*. On the top of the head in the Sucker, and rather posterior, is a characteristic hole in the skull covered by skin, known as the *fontanelle*. The presence of the fontanelle may be verified with a pin.

The eye is proportionately much larger in a young fish than in an old one; its relative size is usually expressed by comparing its diameter with the length of the *muzzle* (distance from front of eye to the tip of the snout), with the length of the *head* (measured from the tip of the snout along the side of the head to the posterior border of the opercle), and with the width of the *interorbital space* (distance between the eyes above). Thus eye five in head, is a concise way of stating that the diameter of the eye is one-fifth the length of the side of the head.

The tooth-bearing bones of the mouth can be recognized in the Black Bass. The principal of these are,

1. *Dentary*, the bones of the lower jaw.
2. *Premaxillary*, above described.
3. *Maxillary*, above described. This bone is usually toothless, or merely toothed on its edge.
4. *Vomer*, the bone on the middle line of the palate, immediately *behind* the upper jaw. This bone has a patch of teeth in the Black Bass.
5. *Palatines*, a bone extending outward and backward on each side from the vomer, provided each with a band of teeth in the Black Bass.
6. *Pterygoids*, behind the palatines on each side, without teeth in the Black Bass; but armed with a small patch in the Rock Bass (*Ambloplites*).
7. *Tongue*, toothless in the Black Bass, but with a patch of teeth in the Rock Bass.
8. *Hypoid bone*, the base of the tongue, on each side of which the gill arches are attached.
9. *Gill rakers*, the stiffened appendages of the anterior pair of gill arches; the gills are on the outer or convex edge, the gill rakers on the interior or concave side of the arch.

10. *Upper pharyngeals*, two sets of bones, usually rounded, placed on the upper side of the œsophagus, behind the gill arches.

11. *Lower pharyngeals*, one on each side of the median line, below the œsophagus, and behind the gill arches. These bones are modified gill arches, and their forms vary much with the different suborders of fishes, and their structure is of great importance in the system of classification. In the Black Bass they are flattish and somewhat triangular; in the Sucker they are sickle-shaped.

The comparative size of the head is described by noticing how many times its length (along the side, from the snout to the posterior edge of the opercle), is contained in the length of the body (measured along the side from the tip of the snout to the middle of the base of the caudal fin). Thus "head $4\frac{1}{4}$ in length" (as is the case in the Sucker) indicates that the length of the head is a little less than one-fourth that of the head and the body. The length of the head is proportionately rather greater in young fishes than in adults.

Below the subopercle and interopercle, and nearly parallel with them are the bony *branchiostegal rays* enveloped in the *gill membranes*. These are three in number on each side in the Sucker, six in number in the Black Bass, and their number often furnishes important characters.

The *scales* when normally developed, are either *Ctenoid* (with the exposed or posterior edge rough or ciliated as in the Perch or Black Bass), or *Cycloid* (smooth as in the Sucker). In most cases, there is a series of scales along each side, each of which is provided with a mucous tube, these forming a conspicuous raised line known as the lateral line. In many scaleless fishes this chain of mucous tubes is developed.

The relative size of the scales is indicated by counting them. Of course, the smaller they are proportionately, the more numerous they are. The number forming the lateral line is one of the most valuable and constant of specific characters, being subject to but slight variations. "*Scales 10-65-7*," the formula of our Sucker, signifies ten series of scales between the dorsal fin and the lateral line; 65 scales in the lateral line, and seven series between the lateral line and the ventrals.

The fins are (*a*) the *paired fins*, which are the *pectorals* (corresponding to the anterior limbs or arms) situated immediately behind the gill openings, and the *ventrals* (corresponding to the posterior limbs) placed either behind or below the pectorals; and (*b*) the *vertical fins*, or fins on the median line of the body. These are the *dorsal* (on the back), *caudal* (on the end of the tail), and the *anal* (on the lower side, behind the vent).

The dorsal is sometimes divided into two fins, in which case the anterior is called *first dorsal*, the posterior, *second dorsal*.

The position of the fins is a matter of much importance. The ventrals are said to be *abdominal* when they are inserted on the belly, notably behind the pectorals, as in the Sucker, thoracic when inserted under the pectorals or close behind them, as in the Black Bass, jugular when in advance of the pectorals, as in the Cod fish.

The rays of which the fins are composed may be either *spines* or *soft rays*.

The *spines* are usually stiff and pointed, and are never jointed or articulated, and are never branched. In those fishes which have spines there is commonly one in each ventral fin, none in the pectoral or caudal fins, one or more in the front part of the anal fin and several in the anterior part of the dorsal fin, constituting the whole first dorsal when there are two dorsal fins.

The *soft rays* are always articulated or jointed towards their tips, and most of them are also branched. They are therefore usually wider at their tips than at their bases, and are seldom rigid, unless rendered so by drying. In all cases where the dorsal and

anal fins are composed of soft rays only, there are at the anterior edge of the fin, from one to three undeveloped or rudimentary rays, usually closely adherent to the first developed ray. Some writers enumerate these in their descriptions, but in the present memoir they are not counted except in a few cases, where the fact is specified. The short spines should, however, never be omitted. The last ray of the dorsal and anal fins is usually split to the base. This is counted as *one* not as *two*.

In certain fishes, as the Trout and Cat fish, there is on the median line of the back behind the dorsal fin a fleshy expansion known as the *adipose* fin. It has of course, no rays, and is not strictly a fin.

In the present paper the number of spines is indicated by the use of Roman figures; the number of soft rays, by Arabic figures. When a fin has both spines and soft rays, if the two kinds are united by a membrane, a comma (,) separates the number of spines from the number of soft rays. In case the spines are separated as a distinct fin a dash (—) divides the two in the enumeration. Thus, in the Black Bass, "D. X,13" indicates a continuous dorsal fin, with ten spines and thirteen soft rays. In the White Bass, "D. IX—I,12" indicates two dorsals, whereof the first has nine spines, the second has one spine and twelve short rays.

The number of rays in the *pectoral* and *caudal* fins is seldom of any value in the classification of fishes.

The abbreviations, D., dorsal fin; A., anal; C., caudal; P., pectoral; V., ventral; B., branchiostegals, and lat. l., lateral line, are frequently used, especially in enumerating the number of fin rays or scales.

ARTIFICIAL KEY TO THE ORDERS OF PISCES REPRESENTED IN OHIO.

*Tail evidently heterocercal; ventral fins abdominal; no true spines, but some of the fins usually provided with fulera, (*Ganoidei*).

a. Skeleton cartilaginous; body naked or with series of bony bucklers.

bb. Mouth narrow, inferior, toothless, preceded by four barbels.

CHONDROSTEI. 3.

bb. Mouth terminal, broad, with minute deciduous teeth; snout prolonged into a spatulate process. SELACHOSTOMI. 2.

aa. Skeleton bony; body scaly.

cc. Scales ganoid, i. e. rhombic enamelled plates; dorsal fin short; no gular plates. GINGLYMODI. 4.

cc. Scales cycloid; dorsal fin very long; a broad gular plate.

HALECOMORPHI. 5.

**Tail not evidently heterocercal, (*Teleostei*).

d. Maxillaries wanting, or confluent with the palatines; body serpentiform; no ventral fins; vertical fins confluent, or nearly so around the tail.

ENCHELYCEPHALI. 6.

dd. Maxillaries present, rudimentary, each forming the base of a long barbel; no scales; dorsal and pectoral fins each with a single strong spine.

NEMATOGNATHI. 7.

ddd. Maxillaries, complete, not forming the base of a long barbel.

e. Ventral fins (in our species) composed each of a strong spine and a rudimentary ray; dorsal with free spines; body scaleless, naked or mailed.

HEMIBRANCHII. 9.

ee. Ventral fins if present, not as above. TELEOCEPHALI. 8.

SUB-CLASS GANOIDEI. THE GANOID FISHES.

Skeleton bony or cartilaginous; optic nerves forming a chiasma; arterial bulb rhythmically contractile, provided with several rows of valves; intestine usually with a spiral valve; ventral fins, if present, abdominal; tail more or less heterocercal. Of this important sub-class, few species are now extant, and these few vary widely from one another. Of the earlier fossil fishes, a very large proportion are ganoids (*ganos*, splendor, many of the species being provided with shining enamelled plates).

ORDER 2. SELACHOSTOMI. THE PADDLE FISHES.

No subopercle, preopercle, interopercle or maxillary bones; a single broad branchiostegal; ventral fins abdominal, with an entire series of basilar segments; branchiostegals cartilaginous; premaxillaries forming the border of the large mouth; snout dilated, prolonged; skin smooth or nearly so; tail heterocercal. This order contains but a single family, *Polyodontidæ*. (*Selachos*, a shark; *stoma*, mouth.)

FAMILY II. POLYODONTIDÆ. THE PADDLE FISHES.

Body elongate, fusiform, subterete; skin smooth or with minute roughnesses; sides of the upturned part of tail with bony plates; mouth very wide, terminal but overhung by the long snout, which is produced into a long and thin spatula-like process, reticulate above and below, thin and flexible at its edges; jaws and palate with minute deciduous teeth; no barbels; gill openings wide; opercle rudimentary, striate, produced into a long skinny flap; no tongue; spiracles present; air bladder large, communicating with the œsophagus; intestine with a well-developed spiral valve; stomach cœcal, with a broad divided pyloric appendage; dorsal far back, between ventrals and anal; caudal with its lower lobe well-developed, nearly as long as the upper; pectoral fins large, inserted low; lateral line present.

There are two species of this singular family known, representing two genera, *Polyodon* from America and *Psephurus* from China. They are large shark-like fishes, living in fresh-waters, and feeding on mud and minute Crustacea.

*Gill rakers long and fine, exceedingly numerous; upper caudal fulcra narrow, 15 to 20 in number. POLYODON. 3.

GENUS 3. POLYODON. Lacepede.

Polyodon, LACEPEDE, Hist. Nat. des Poissons, i, 403, 1798.

Spatularia, SHAW, General Zoology, v, 362, 1804.

Platirostra, LESŒUR, Journ. Acad. Nat. Sci. Phila., i, 223, 1818 (adult without teeth).

Type, *Polyodon feuille*, LACEPEDE, *Polyodon folium*, Auct.

Etymology, *polus*, many; *odon*, tooth.

Polyodontidæ with each branchial arch furnished with a double series of very long setiform gill rakers, the two series being divided by a broad membrane; upper caudal fulcra not enlarged. American.

3. POLYODON FOLIUM Lacepede.

Paddle Fish; Spoon-bill; Shovel Fish; Bill Fish; Duck-billed Cat.

Polyodon feuille (folium), LACEPEDE (1798), Hist. Nat. des Poiss., i, 403.

Polyodon folium, KIRTLAND, Bost. Journ. Nat. Hist., iv, 21.—GUNTHER, Cat. Fishes, Brit.

Mus., viii, 346.—JORDAN (1878), Man. Vert. E. U. S., 2d. Ed., 344 (and of authors generally).

Spatularia reticulata, SHAW (1844), Gen. Zool., v, 362 (and of some authors).

Platirostra edentula, LESUEUR (1818), Journ. Acad. Nat. Sci. Phila., i, 223 (based on old and toothless specimens).—KIRTLAND, Bost. Journ. Nat. Hist., v, 22.

Planirostra spatula, OWEN, Osteol. Catal., i, 83.

Body moderately elongated, the disproportionately large head and long snout forming nearly half of the total length, the prolonged opercular flap extending about to the ventrals; spatula largely developed, nearly as broad as the head, forming more than one third of the total length in the young, and about one-fourth in the adult; fins large, all more or less falcate; color grayish, pale below. D., 55 to 60. A., 56. Length, 2 to 6 feet.

Habitat, entire Mississippi Valley. Abundant in the larger streams, seldom entering small ones.

Diagnosis.—This species is known at once by the broad leaf-like projection of the snout. It bears little resemblance to any other American fish.

Habits.—This large fish abounds in the lower parts of the Ohio River and its principal tributaries, whence it is often taken in nets, but its tough shark-like flesh is but little esteemed.

The character of its food has been first made known by Prof. S. A. Forbes (Bull. Ills. Lab. Nat. Hist., 2., 82), who remarks:

“This is by far the most remarkable fish in our rivers, and is not less remarkable in its food than in its structure. By the fishermen it is supposed to live on the mud and slime of the river bottom. The alimentary canal of each of the five specimens examined was found full of a brownish, half fluid mass, which, when placed under the microscope, was seen to be made up chiefly (in one case almost wholly) of countless myriads of entomostraca, of nearly every form known to occur in our waters, including many that have been seen as yet nowhere but in the stomachs of these fishes. Mixed with these, in varying proportion, were several undetermined and probably undescribed species of water worms (*Annulata*), most of them belonging to the family *Naididæ*. Sometimes as much as a fourth of the mass was composed of vegetable matter—largely algæ, but included fragments of all the aquatic plants known by me to occur in the waters of the Illinois, except *Ceratophyllum*. Occasional leeches (*Clepsine*), water beetles (*Coptotomus interrogatus*, etc.), a few larvæ of *Diptera* and *Ephemera* and water bugs (*Corixa*) were noticed. Among the crustacea several specimens of the remarkable *Leptodora hyalina* were found.

“I have not had time for anything more than a general examination of the mass of matter presented—sometimes more than a pint from a single fish—and cannot, therefore, give a list of the species. Curiously, very little mud was mixed with the food.

"The remarkably developed gill-rakers of this species thus receive their explanation. These are very numerous and fine, arranged in a double row on each gill arch, and are twice as long as the filaments of the gill. By their interlacing they form a strainer scarcely less effective than the fringes of the baleen plates of the whale, and probably allow the passage of the fine silt of the river bed when this is thrown into the water by the shovel of the fish, but arrest everything as large as a *Cyclops*. The fish is said by the fishermen to plow up the mud in feeding with its spatula-like snout, and then to swim slowly backward through the muddy water. Its mouth, it may be noticed, is very large, even for a fish.

"It is possible that this wholesale destruction of entomostraca may affect the food supply of other and more valuable fishes, especially of the very young of the predaceous species. We cannot yet say, however, where the *stress* of the struggle comes in the life of any given species, and consequently are unable either to relieve or heighten it at will, or to perceive the full effect of the forces already at work. Fuller knowledge must precede any but the most cautious and conservative recommendations."

Synonymy.—This species was first described by Lacepede, under the generic name of *Polyodon*, in reference to the very numerous teeth in the jaws and palate, which character was considered to distinguish the genus from its relatives, the Sharks and the Sturgeons. Lacepede's description, which is a very minute and excellent one, was made up from numerous young specimens preserved in the French Museum under the name of "Chien de mer feuille". The original locality of these specimens was unknown, as Lacepede remarks, "Nous ne pouvons cependant rien conjecturer relativement à ses habitudes; sur lesquelles nous n'avons reçu aucun renseignement, non plus que sur les mers qu'elle habite; tout ce que nous pouvons dire, c'est que, par une suite de la conformation de ce *Polyodon*, elles doivent, pour ainsi dire tenir le milieu entre celles des squales et celles des acipensires."

A few years later, this fish was again described under the name *Spatularia reticulata* Shaw, and this name has been, of late years, occasionally employed by writers in spite of the unquestionable priority of *Polyodon folium*, on the ground of the inappropriateness of the latter name, the adult fish being often without teeth. There is, however, no good ground for setting aside *Polyodon*, even if *Spatularia* seems a more pleasing name. The fish *does* have many teeth, even if they ultimately fall out, and *Polyodon* it must remain.

Still later, old specimens received the name of *Platirostra edentula*, they being considered to form a genus distinct from *Polyodon*, on account of their toothlessness, and of certain alleged differences in form. The identity of *Platirostra* with *Polyodon* remained undiscovered until comparatively recently.

Lastly comes the name *Planirostra spatula*, apparently given with full

knowledge of the priority of other names, and therefore worthy of notice only for censure of its author.

ORDER 3. CHONDROSTEI. THE CHONDROSTEANS.

Body elongated, covered with a series of bony plates; tail heterocercal; skeleton cartilaginous; mouth small, inferior, without teeth; no branchiostegal rays; ventral fin with an entire series of basilar segments; no subopercle or preopercle; interopercle and maxillary present; branchiyls osseous. This group contains but the single family, Sturgeons or *Acipenseridæ*. (*Chondros*, cartilage; *osteon*, bone).

FAMILY III. ACIPENSERIDÆ. THE STURGEONS.

Body elongated, subterete, protected by five rows of large bony shields, the lower row sometimes deciduous in old specimens; the shields are usually provided each with a hooked spine; between these rows are usually smaller rough plates; snout produced; mouth entirely inferior, much behind the tip of the snout, protractile, toothless; four barbels in a transverse row in front of the mouth; vertical fins with fulera; dorsal fin placed far back, nearly opposite the anal; ventral fins present, posterior; pectoral fins large, inserted low; air bladder large, not cellular; stomach not cœcal, with pyloric appendages; intestine with a spiral valve. Young Sturgeons have the scales rougher and the snout longer and more pointed than it is in the adult.

Large fishes, inhabiting the fresh waters of northern regions, some of them marine and entering the rivers. Genera two, species twenty-five or more. Most of them are valued as food.

ANALYSIS OF GENERA OF ACIPENSERIDÆ.

- *Rows of bony bucklers distinct from head to tail; spiracles present; snout sub-conical, rather narrow. ACIPENSER. 4.
- **Rows of bony bucklers all confluent on the tail; no spiracles; snout rather broad, triangular, depressed. SCAPHIRHYNCHIOPS. 5.

GENUS 4. ACIPENSER. Linnaeus.

Acipenser, LINNÆUS, Syst. Naturæ, 1858.

Type, *Acipenser sturio*, L., the Common Sea Sturgeon.

Etymology, Latin *Acipenser*, a Sturgeon, said to be from *acus*, sharp, and *pinna* fin.

Sturgeons with the tail subterete, the rows of bony bucklers not being confluent on it; spiracles present; snout sub-conic, narrowed; tail not ending in a filament. This genus as here understood comprehends all but one of the known species of Sturgeons. Some of them are marine; others are confined to the fresh water lakes and rivers.

4. ACIPENSER RUBICUNDUS LeSueur.

Lake Sturgeon; Rock Sturgeon.

Acipenser rubicundus, LESUEUR (1818), Trans. Am. Philos. Soc., i, 388.—GUNTHER, Cat. Fishes, Brit. Mus., vii, 338.—KIRTLAND, Bost. Journ. Nat. Hist., iv, 303.—MILNER, Rept. Comm. Fisheries, 1872-73, 67, and of authors generally.

Acipenser rupertianus, RICHARDSON (1836), Fauna Bor.-Am., Fishes, 311, and of several authors.

Acipenser loipeltis, GUNTHER, Cat. Fishes Brit. Mus., viii, 341.

Description.—Snout rather short and bluntish, forming less than half the length of the head in the adult, longer and more pointed in the young; barbels long, nearer the snout than the eye; bony shields moderate, rather smooth; shields with the pointed keel nearly central, and directed rather upwards than backwards; skin with numerous prickles and stellate ossifications; about 13 shields in the dorsal row (before dorsal fin); 34 in the lateral series and 9 in the ventral; the plates becoming smoother with age, and in very old specimens, most of them finally falling off; anal fin mostly below the dorsal; caudal fulcra, not remarkably developed. Length, two to six feet.

Habitat, Great Lakes, Upper Mississippi and northward, very abundant in the Upper Lakes, ascending the tributary rivers in large numbers to spawn in the spring.

Diagnosis.—The Lake Sturgeon is distinguished from the Sea Sturgeon (*A. sturio*, L.), by its smaller size and the greater number of plates in the lateral series (about 34 instead of 28). From the Ohio River Sturgeon, it may, perhaps, be known by the central position of the spinous keel to the plates. This character (first noticed by Professor Milner), may be simply due to the greater age of the specimens examined, as the plates certainly grow smoother, and the spines more central with increased age.

Habits.—In Ohio this species occurs only in Lake Erie and its larger tributaries, the Sturgeon of the Ohio River being considered, whether correctly or not, as belonging to another species. The following account is abridged from the notes of Prof. Milner (Rept. Commr. Fish and Fisheries, 1872-73):

"This Sturgeon attains the largest size of any fish of the lakes. They are taken only within comparatively shoal waters, and in some of the bays and among the islands they are very abundant. The largest specimen it has been my fortune to see did not quite attain the length of six feet, though there are traditions in localities on the lakes of nine foot Sturgeons. The average of the mature ones taken is less than five feet. In numbers they will not compare favorably with any of the staple food-fishes. At Sandusky, Ohio, where they are more numerous than in any other locality, except, perhaps, Green Bay, Wis., there were about 14,000 mature Sturgeons handled, weighing about 700,000 pounds, obtained from about 85 pound-nets."

Their food consists almost entirely of the shell-fish of the lakes, principally Gasteropods, the thinner-shelled kinds of the genera *Physa*, *Planorbis*, and *Vulvata* being found broken in the stomachs, while *Limnæa* and *Melantho* remain whole. Eggs of fishes are sometimes found, but it is probable that they are not extensively spawn eaters.

The spawning season in Lake Erie occurs in June. They then ascend the various tributary rivers as far as the depth of the water and the various obstructions will permit, in large schools, and may often be seen

in the evening, leaping from the surface, throwing their bulky forms entirely out of the water.

In regard to the game qualities of this species, Mr. Hallock says (Sportsman's Gazetteer, 4th Ed., 339):

"The long projecting sucker mouth situated almost under the center of the head will sometimes suck in from the bottom the anglers baited hook, in which case, one may as well try to snub an old log. It is possible, however, to coax him to move occasionally, and then you may, or you may not, succeed in bringing him to gaff." * * "As a game fish, the sturgeon is not a success."

5. ACIPENSER MACULOSUS LeSueur.

Ohio River Sturgeon.

Acipenser maculosus, LESUEUR, Trans. Am. Philos. Soc., New Series, i, 393.—GUNTHER, Cat. Fishes, Brit. Mus., viii, 339, and of authors generally.

Description.—This species is very similar to the preceding, and all the specimens which the writer has had the opportunity to examine, seem to him to be the young of the preceding. The snout is more pointed than in the Lake Sturgeon; the skin rougher; the scutes are more strongly keeled and their spinous points are placed much behind the middle of the shield, and are directed backward more than is the case in the preceding. As observed long ago by Dr. Kirtland (Bost. Journ. Nat. Hist., iv, 1842, p. 304.), "These characters are not, however, permanent, and therefore are not to be relied upon. If the *maculosus* of LeSueur, be not the young of the others, their young have never been discovered."

Habitat, Ohio and Mississippi Rivers.

Habits.—The habits of this fish are essentially similar to those of the preceding, and a more careful comparison of the two must be made before any important specific differences (if such exist) be pointed out.

GENUS 5. SCAPHIRRHYNCHOPS. Gill.

Scaphirhynchus, HECKEL, Ann. Wiener Museum, i, 1835, 71 (preoccupied in Ornithology).

Scaphirhynchops, GILL, Mss., in Jordan and Copeland's Check List Fishes N. A., Bull. Buff. Soc. Nat. Hist., 1876, 161.

Type, *Acipenser platyrhynchus*, RAFINESQUE.

Etymology, *skaphe*, spade; *rugchos*, snout; *ops*, appearance.

Sturgeons with the tail broad, depressed, wider than deep, entirely covered by the confluent series of bony plates; no spiracles; snout depressed, triangular, having almost the form of a spade; tail ending in a long filament (at least in the young); anal fin inserted behind the dorsal. A single species.

6. SCAPHIRRHYNCHOPS PLATYRHYNCHUS (Rafinesque) Gill.

Shovel-nosed Sturgeon.

Acipenser platyrhynchus, RAFINESQUE (1820), Ichthyologia Ohiensis, 79.—KIRTLAND, Bost. Journ. Nat. Hist., v. 25.

Scaphirhynchus platyrhynchus, GIRARD (1858), U. S. Pac. R. R. Surv., x, 357, and of most authors.

Scaphirhynchops platyrhynchus, JORDON (1878), Man. Vert. E. U. S., 2d. Ed., 346.

Acipenser cataphractus, GRAY (1834), Proc. Zool. Soc. London, 122.

Scaphirhynchus cataphractus, GUNTHER (1870), Cat. Fishes, Brit. Mus., viii, 345.

Scaphirhynchus rafinesquii, HECKEL (1835), Ann. Wiener Museum, i, 71.

Description.—Body rather long and slender, tapering anteriorly into a depressed spade-shaped snout, and posteriorly into the long and slender tail, which is much depressed, considerably broader than deep, and from the dorsal fin backward completely encased in a coat of mail formed by the coalescence of the lateral series of scutes; shields all somewhat obcordate, the spine quite posterior and nearly horizontal; the edges of the scutes rough; lateral scutes higher than long; anal fin almost entirely behind dorsal; dorsal rays about 25 in number, dorsal series of shields of about 16 scutes; lateral series 43; ventral series 11; color plain brownish. Length, one to eight feet (*Kirtland*).

Habitat, Ohio Valley to the Upper Missouri, and southwest to the Rio Grande; not recorded from the Great Lakes.

Diagnosis.—This species may be known at once from the other Sturgeons by the flattened tail, the surface of which is *entirely bony*.

Habits.—This fish is common in the Ohio River, and some of its larger tributaries. It is taken in seines in considerable numbers, and is used for food, though it does not seem to be highly valued. Nothing distinctive is on record of its habits which are probably essentially like those of the Lake Sturgeon.

ORDER 4. GINGLYMODI. THE RHOMBOGANOIDS.

Parietals in contact; pterotic simple; symplectic present; mandible with coronoid, opercular, angular articular, and dentary bones; basis of cranium simple; third superior pharyngeal bone small, lying on fourth; upper basihyal wanting; maxillary subdivided; a præcoracoid arch; vetrebræ opisthocælian; pectoral fins with mesopterygium and five other basal elements; skeleton generally ossified; præcoracoid cartilaginous; one axial hyoid, and three basal branchiyls; tail heterocercal; dorsal short, inserted far back; ventrals abdominal; pectorals inserted low; scales rhombic, enamelled; air bladder cellular, partly functional. (*Ægglumos*, hinge; *odous*, tooth.)

This order includes but one family, the Gar Pikes or *Lepidosteidæ*.

FAMILY IV. LEPIDOSTEIDÆ. THE GAR PIKES.

Body elongate, covered with hard diamond-shaped enamelled scales, arranged in regular oblique series; head more or less elongate, the jaws depressed and produced, the upper jaws projecting somewhat beyond the lower; mouth with the cleft rather narrow but very long; most of the margin of upper jaw formed by premaxillaries; each jaw with one or two series of very strong teeth, set vertically, between these are numerous smaller teeth; middle portion of each jaw with bands of fine rasp-like teeth, which

grow larger backward; top and sides of head bony and rugose; opercula well-developed; gill openings rather large; branchiostegals three; fins without spines, but all preceded by fulcra: dorsal short and rather high, rather behind the anal fin and similar to it; ventral fins large, abdominal; pectorals inserted very low; air bladder large, cellular, having somewhat the functions of a lung, communicating with the pharynx by a sort of glottis; stomach not cæcal, but with numerous pyloric appendages; intestine with a rudimentary spiral valve.

Fishes of large size, inhabiting the fresh waters of North America, from the Great Lakes to Central America and Cuba, the last relics of the Ancient Ganoid Fauna, "left to show us what the ancient Fishes were like, as Saturn's rings to show us how the world was made." There are but two genera now extant, and the number of species is small, perhaps not exceeding three. Numerous fossil genera and species are known.

ANALYSIS OF THE GENERA OF LEPIDOSTEIDÆ.

- *Large teeth of the jaws in a single series. LEPIDOSTEUS. 6.
 **Large teeth of the jaws in two series; snout broad, depressed, about as long as the rest of the head. LITHOLEPIS. 7.

GENUS 6. LEPIDOSTEUS. Lacepede.

Lepisosteus, LACEPEDE (1803), Hist. Nat. des Poiss., v, 331.

Lepisosteus, AGASSIZ, Poissons Fossiles, ii, 2.

Cylindrosteus, RAFINESQUE (1800), Ich. Ohiensis, 72.

Type, *Lepisosteus gavalis*, Lac.; *Esox osseus*, L.

Etymology, *lepis*, scales; *osteon*, bone.

Sub-genus *Lepisosteus*. Snout very slender, much longer than the rest of the head.

7. LEPIDOSTEUS OSSEUS (Linnæus) Agassiz.

Long-nosed Gar Pike; Bill Fish.

Esox osseus, LINNÆUS, Syst. Nat., i, 516.—BLOCH and SCHNEIDER, 392.—MITCHILL, Trans. Lit. and Phil. Soc., i, 44; Am. Monthly Mag., ii, 321.—SHAW, Gen. Zool., v, 115.

Lepisosteus osseus, AGASSIZ, Poissons Fossiles, ii, 2.—STORER, Synopsis, 465.—COPE, Proc. Phil. Acad. Sci., 1864, 27.—PUTNAM, Bull. M. C. Z., 1863, 2.—GUNTHER, Cat. Fishes, viii, 330.—DUMERIL, Hist. Nat. des Poissons, 1870.—JORDAN, Ind. Geol. Surv., 1874, 226; Bull. Buff. Soc. Nat. Hist., 1876, 96; Man. Vert., 1876, 308, and of many writers.

? *Esox viridis*, GMELIN, L. I., 1789, (after Catesby).

Lepisosteus gavalis, LACEPEDE, v, 333, 1803.—GUICHENOT, Mag. Zool., 1839, Poissons, 5.

Sarchirus vittatus, RAFINESQUE, Ich. Oh., 1820, 79.

Lepisosteus oxyurus, RAFINESQUE, Ich. Oh., 73.—KIRTLAND, Rept. Zool. Ohio., 170, 186; Bost. Journ. Nat. Hist., iv, 16.—THOMPSON, Hist. Vt., 145, 1842.

Lepisosteus oxyurus, AGASSIZ, Amer. Journ. Sci. and Arts., 1854, 360.—PUTNAM, Bull. M. C. Z., 1863, 2.—COPE, Proc. Phil. Acad. Sci., 1865, 87.

Lepisosteus longirostris, RAFINESQUE, Ich. Oh., 1820, 70 (based on the species described by Mitchell "under the obsolete name of *Esox osseus*").

Lepisosteus longirostris, RICHARDSON, F. B. A., iii, 237.—DEKAY, Fishes N. Y., 274.

- Lepidosteus huronensis*, RICHARDSON, l. c.—AGASSIZ, l. c.—COPE, l. c., 86.—DUMERIL, l. c.
Lepidosteus rostratus, RICHARDSON, l. c., 238.
Lepidosteus gracilis, AGASSIZ, Poissons Fossiles, ii, 3.—RICHARDSON, l. c., 240.
Lepidosteus semiradiatus, AGASSIZ, l. c., ii, 2.—MULLER, Abhandl. Akad. Wiss. Berl., 1844, pl. 2.
Lepidosteus lineatus, THOMPSON, Hist. Vermont, 145, 1842.
Lepidosteus bison, DEKAY, Fishes, N. Y., 271.
Lepidosteus leptorhynchus, GIRARD, Pac. R. R. Surv., x, 351, 1859.
Lepidosteus crassus, COPE, Proc. Phil. Acad. Sci., 1865, 86.
Lepidosteus otariius, COPE, l. c.
Lepidosteus louisianensis AUGUST DUMERIL, Hist. Naturelle des Poissons, 1870.
Lepidosteus harlani, DUMERIL, op. cit.
Lepidosteus smithii, DUMERIL, op. cit.
Lepidosteus ayresii, DUMERIL, op. cit.
Lepidosteus clintonii, DUMERIL, op. cit.
Lepidosteus piquotianus, DUMERIL, op. cit.
Lepidosteus elisabeth, DUMERIL, op. cit.
Lepidosteus copii, DUMERIL, op. cit.
Lepidosteus lamarii, DUMERIL, op. cit.
Lepidosteus troostii, DUMERIL, op. cit.
Lepidosteus lesueurii, DUMERIL, op. cit.
Lepidosteus treculii, DUMERIL, op. cit.
Lepidosteus milbertii, DUMERIL, op. cit.
Lepidosteus horatii, DUMERIL, op. cit.
Lepidosteus thompsoni, DUMERIL, op. cit.

Description.—Body elongate, subterete; head very long, forming about one third the length, its depth about one twelfth; snout more than twice the length of the rest of the head; ventral fins about midway between pectorals and anal; olivaceous, white below; sides with round black spots, which are more distinct posteriorly; in old fishes these are faint, but in the young they are very conspicuous, and in very young individuals they are confluent, forming a black lateral band; all the fins except the pectorals with similar round black spots. D. 7, A. 9, lat. l. 65. Length, two to five feet.

Habitat, New York to Missouri river, south to Florida and the Rio Grande, abundant in all large bodies of water, but not ascending small streams.

Diagnosis.—From the other Bony Gars this species may be known at once by the great length and slenderness of the snout, the distance from the eye to the tip of the snout being *more than twice* the length of the rest of the head.

Habits.—The Gar Pike is abundant in the state of Ohio, inhabiting the Lake and the Ohio River, and ascending all the larger tributaries of both. It frequents lakes and quiet places in the rivers and is a fish of usually quiet or somnolent habits. Dr. Kirtland remarks, "It may be seen, apparently sleeping, on the surface, and gently carried around on an eddy, for an hour at a time." Notwithstanding the prevalent idea of its great voracity, it rarely takes the hook, and I have never seen it

attempt to take food, although I have frequently seen them basking in a school of minnows, and have kept them in aquaria. I have never found any fish in the stomach of the Gar, and out of eight examined by Prof. Forbes, the stomachs of all but one were empty, that one containing a single craw-fish.

The fishermen generally have a great dislike for this fish, destroying it without mercy when taken. Its flesh is said to be rank and tough, and it is seldom or never used for food. Even "the dogs will not eat it", say some writers, but the average dog prefers a beef-bone even to Trout or Grayling.

This fish is interesting to the comparative anatomist from its combining certain reptilian characters with the ordinary traits of fishes, and to the geologist, as it is intimately connected with certain Ganoid groups now extinct, and the study of its embryology, which no one has yet been able fully to trace, is expected to throw much light on the relations of the Ganoids to ordinary fishes and to Reptiles and Batrachia. The youngest specimens now known have the caudal fin developed as a second dorsal and anal, separated by a slender tail.

Since the above was written, Prof. Alexander Agassiz has read a paper before the National Academy of Sciences, detailing his recent studies of the Embryology of this species. The following abstract of this paper is from Science News, vol. i, pp. 19-20.

"Some knowledge of the embryology of the Gar Pike (*Lepidosteus*) has long been needed, but no one has been able to raise the young, until Mr. Agassiz succeeded in doing so last summer. This fish is one of the few living survivors of those vast extinct orders of geologic ages; and it is thus especially important to compare its embryology with that of modern fishes, in the hope of revealing more fully the structure of the fossil races, and of throwing light upon modern questions of evolution. The *Limulus*, which holds a similar position among the crabs, has had its embryology worked out by Packard, while Morse has studied the development of the brachiopods—an almost extinct group of mollusks dating back to the early rocks.

The Gar Pike comes up the St. Lawrence in May, laying its eggs about the 20th, and then disappears. The eggs are large, viscous, stick fast in an isolated way to whatever they fall upon, and look much like those of toads, having a large outer membrane and a small yolk. Mr. Agassiz sent his assistant, Mr. S. W. Garman, to obtain these eggs, and also arranged to have a series collected at all stages of growth and preserved. Artificial fecundation failed, but Mr. Garman brought to Cambridge about 500 naturally-laid eggs, of which all but 30 perished through mold. The young began to hatch in six days and Mr. Agassiz began his examinations, the misfortune to the eggs precluding any study previous to the birth of the young. Out of the 30 young hatched, 27 lived until July 15th, when they were as old as those observed by Prof. Wilder. Mr. Agassiz found that these little Gar Pikes were not so different from the young of the bony fishes as he had expected; the interesting development of the lung was not made out, but judging by external characters the difference is small. Connection with the Sharks appears in

the similarity of the branchial arches and by the presence of the lateral fold in which the pectoral fins are formed; the way the tail is developed is very like that of the bony fishes. Among the ganoids, it appears, as well as in ordinary fishes, the dorsal cord is straight at first, then assumes a slight upward curve at the extremity, when finally there appears the beginning of a lobe underneath pointing toward the complete heterocercal tail. All this is as in the bony fishes; but this is the permanent condition of the Gar Pike, while in the bony fishes the extremity of the dorsal cord becomes extinct. The mode of development of the pectoral lobe (very large in this species) furnishes another resemblance. In the brain, and in the mode of formation of the gills, a likeness to the sharks is noticeable. The young Gar Pikes move very slowly, and seem to float quietly save an exceedingly rapid vibration of the pectorals and the tip of the tail. They do not swim about much, but attach themselves to fixed objects by an extraordinary horse-shoe-shaped ring of sucker-appendages about the mouth. These appendages remain even after the snout has become so extended that the ultimate shape is hinted at; and furthermore it is a remnant of this feature which forms the fleshy bulb at the end of the snout in the adult. The summing up of Mr. Agassiz's investigations thus far is, that the young Gar Pike has many characteristics in common with the sharks and skates, but is not so different from the bony fishes as has been supposed."

None of our species, unless it be the Eel has been made the subject of so many useless nominal species as the Gar Pike. This work began with an unfortunate remark of Professor Agassiz (Am. Journ. Sci. and Arts, 1854, 360), "I have now in my own collection, not less than twenty-two well characterized species of this genus." For the naming of these twenty-two and about as many more we are indebted to Professor August Dumeril, yet only three, or at most five or six of them all are really distinguishable.

Sub-genus *Cylindrosteus*. Rafinesque. Snout moderate, about as long as the rest of the head.

8. LEPIDOSTEUS PLATYSTOMUS Rafinesque.

Short-nosed Gar Pike.

- Lepisosteus platostomus*, RAFINESQUE, Ich. Oh., 72.—KIRTLAND, Rept. Zool. Ohio, and Bost. Journ. Nat. Hist., iv, 20.
- Lepisosteus platystomus*, AGASSIZ, Amer. Journ. Sci. and Arts, 1854, 360.—GUNTHER, Cat. Fishes, vii, 329.—STORER, Synopsis, 466.—WILDER, Proc. Am. Ass. Adv. Sci., 1875, B. 151, and of anatomists generally.
- Cylindrosteus platystomus*, AUGUST DUMERIL, Hist. Nat. des Poissons, 1870.—JORDAN, Ind. Geol. Surv., 1874, 227; Bull. Buff. Soc., 1876, 96; Man. Vert., 308.
- Lepisosteus albus*, RAFINESQUE, Ich. Oh., 73.
- Cylindrosteus albus*, COPE, Proc. Phil. Acad. Sci., 1865, 86.
- Lepisosteus platyrhynchus*, DEKAY, Fishes N. Y., 273, 1842.
- Cylindrosteus platyrhynchus*, DUMERIL, op. cit.
- Lepisosteus grayi*, AGASSIZ, Poissons Fossiles, ii, 2. 3.
- Lepisosteus (Cylindrosteus) latirostris*, GIRARD, Pac. R. R. Rept., x, 353.
- Cylindrosteus latirostris*, COPE, l. c.
- Lepisosteus (Cylindrosteus) oculatus*, WINCHELL, Proc. Phil. Acad. Sci., 1864, 163.

Cylindrosteus oculatus, COPE, l. c.

Cylindrosteus productus, COPE, Proc. Phil. Acad., 1865, 86.—DUMERIL, op. cit.

Cylindrosteus agassizii, DUMERIL, op. cit.

Cylindrosteus rafinesquei, DUMERIL, op. cit.

Cylindrosteus bartonii, DUMERIL, op. cit.

Cylindrosteus castelnandii, DUMERIL, op. cit.

Cylindrosteus zadockii, DUMERIL, op. cit.

Description.—The Short-nosed Gar is very similar to the preceding species in size, color, dentition, etc. The body is, however, rather deeper, and the snout is notably shorter, being only about as long as the rest of the head. Different specimens vary considerably in the length of the snout, and some specimens are very pale, while others are dusky or more or less distinctly spotted. Length, 2 to 5 feet.

Habitat, Great Lakes to Florida and Texas, abundant in most large bodies of water, most common southward.

Diagnosis.—From the Alligator Gar, this species may be known by the presence of a single row of teeth on each side of the jaw. From the Long-nosed Gar, the shortness of its snout will distinguish it.

Habits.—This species is not common anywhere in Ohio, and it is more often found in the Ohio River than in Lake Erie. In habits, food, etc., the two fishes are so far as known precisely identical.

This species like the preceding, has been frequently made the type of new species, but being less common in collections, it has suffered somewhat less.

GENUS 7. LITHOLEPIS. Rafinesque.

Litholepis, RAFINESQUE, American Monthly Magazine, iii, 1818, 447.

Atractosteus, RAFINESQUE, Ichthyologia Ohiensis, 1820, 72.

Type, *Litholepis adamantinus*, RAFINESQUE, 1818; *Lepisosteus ferox*, RAFINESQUE, 1820,
= *Lepisosteus spatula*, LACEPEDE, 1803.

Etymology, *lithos*, stone; *lepis*, scale.

Gar Pikes with jaws comparatively short and broad, the snout rather wide, about as long as the rest of the head, and the large teeth of the jaws in two rows on each side. Species reaching a very large size. The name *Atractosteus* has been most frequently employed for this genus, but as will be seen by the above synonymy, the preferable name *Litholepis* is two years the older. But one species is known from the United States, but two others, perhaps identical with ours, are described from tropical America.

9. LITHOLEPIS SPATULA (Lac.) Jordan.

Alligator Gar; Great Gar; Manjuri.

? *Esox tristæchus*, BLOCH and SCHNEIDER, Syst. Ichthyol., 395, 1801 (Cuba).

? *Atractosteus tristæchus*, POEY, Synopsis Piscium Cubensium, 1868, 445 (from Cuba; possibly distinct from ours).

Lepisosteus spatula, LACEPEDE, Hist. Nat. des Poiss., v, 333, 1803, and of some authors.

Atractosteus spatula, DUMERIL, Hist. Nat. des Poiss., 1870.

Litholepis spatula, JORDAN, Man. Vert., 2d Ed., 342, 1878.

Litholepis adamantinus, RAFINESQUE, Am. Monthly Mag., 1818, iii, 447; Ich. Oh., 76.—

JORDAN, Bull. Buff. Soc. Nat. Hist., 1876, 96; Man. Vert., 1st Ed.

Lepisosteus (Atractosteus) ferox, RAFINESQUE, Ich. Oh., 1820, 75.—GIRARD, Pac. R. R. Surv., x, 353, 1858.

Lepisosteus ferox, KIRTLAND, Rept. Zool. Ohio, 1838, 170, 196; Bost. Journ. Nat. Hist., iv, 18.—STORER, Synopsis, 466.

Atractosteus ferox, DUMERIL, Hist. Nat. des Poissons, 1870.—JORDAN, Ind. Geol. Surv., 1874, 227.

Lepisosteus (Atractosteus) berlandieri, GIRARD, Pac. R. R. Surv., x, 353.

Atractosteus lucius, DUMERIL, op. cit.

Lepisosteus viridis, GUNTHER, Cat. Fish. Brit. Mus., viii, 329, 1870 (probably not *Esox viridis*, Gmelin).

Description.—Body comparatively stout, subterete; head moderate, forming more than one-fourth the length; snout broad, depressed, its length being about half of the total length of the head; general color olivaceous, the young being more or less spotted, especially posteriorly and on the fins. D., 8; A., 8; lat. L., 60. Length, 8 feet or more when adult.

Habitat, warmer parts of America. Central America, Mexico, Cuba, Gulf States ascending the Mississippi and its tributaries to Kansas, Illinois and Ohio.

Diagnosis.—The great Alligator Gar may be known from the other species by its broad, depressed snout, and by the presence of *two series of large teeth* on each side of the jaw.

Habits.—The habits of this species are doubtless similar to those of the other Gars, except that its greater size may enable it to feed upon larger animals. The fish is essentially a tropical species and is probably now very rarely seen in the Ohio River. I have never seen a specimen from the Ohio River. Dr. Kirtland knew of but two or three having been taken in its waters, and Rafinesque apparently saw but the jaws of one. Specimens from the Lower Mississippi, Texas and Florida are however, not rare in collections.

This fish, with its coat of mail and long, sharp teeth is, doubtless, a formidable one, but its ferocity has probably been somewhat exaggerated by newspaper correspondents and other irresponsible writers.

Rafinesque's remarks on his "*Litholepis adamantinus*" are worth quoting:

"This may be reckoned the wonder of the Ohio. It is only found as far up as the falls, and probably lives also in the Mississippi. I have seen it, but only at a distance, and have been shown some of its singular scales. Wonderful stories are related concerning this fish, but I have principally relied upon the description and figure given me by Mr. Audubon. Its length is from 4 to 10 feet. One was caught which weighed 400 pounds. It lies sometimes asleep or motionless on the surface of the water, and may be mistaken for a log or a snag. It is impossible to take it in any other way than with the seine or a very strong hook, the prongs of the gig cannot pierce the scales which are as

hard as flint, and even proof against lead balls! Its flesh is not good to eat. It is a voracious fish. Its vulgar names are Diamond Fish (owing to its scales being cut like diamonds), Devil Fish, Jack Fish, Garjack, etc. The snout is large, convex above, very obtuse; the eyes small and black; nostrils small, round before the eyes; mouth beneath the eyes, transversal with large angular teeth. Pectoral and abdominal fins trapezoidal. Dorsal and anal fins equal, longitudinal, with many rays. The whole body covered with large stone scales, lying in oblique rows; they are conical, pentagonal and pentadral, with equal sides from half an inch to one inch in diameter, brown at first but becoming of the color of turtle shell when dry. They strike fire with steel! and are ball proof!"—(Rafinesque, Ich. Ohiensis, 91.)

If our species is identical with the Cuban Manjuari, which is not improbable, the older name, *L. tristachus* (Bloch), must be substituted for *L. spatula*.

ORDER V. HALECOMORPHI. THE CYCLOGANOIDS.

Parietals in contact; pterotic simple; basis of cranium, and anterior vertebræ simple; mandible with opercular and coronoid; maxillary not segmented, forming part of the border of the mouth; third superior pharyngeal lying on the enlarged fourth; upper basihyal wanting; vertebræ amphicellic; pectoral fins with mesopterygium and eight other elements, body covered with thick, cycloid scales; tail heterocercal; dorsal fin long; ventral fins abdominal; skeleton mostly ossified: precoracoid cartilaginous; one axial and four basal branchiostegals; air bladder cellular, with partial functions of a lung.

This order contains but a single family, the *Amiidæ*, with no near relatives among recent fishes. (Latin, *halecomorphous*, having the form of a shad.)

FAMILY V. AMIIDÆ. THE GRINDLES.

Body oblong, moderately compressed posteriorly; the head broad, narrowed forwards, its upper surface bony and rugose; membrane bones of head extremely hard; a broad radiated bony plate between the branches of the lower jaw; maxillary broad, with a supplemental bone, forming part of the margin of the upper jaw; jaws with strong teeth; similar teeth on vomer, palatine and pterygoid bones; eye rather small; anterior nostrils each with a barbel; branchiostegals about nine; gill openings very wide, not separated by an isthmus; gill rakers short, body covered with cycloid scales; lateral line present; dorsal fin occupying most of the back, its rays rather low, of nearly uniform length; anal fin short; ventral fins small; pectoral fins inserted rather high; fins all without fulcra; tail heterocercal; air bladder large, cellular, lung-like, communicating by a glottis with the œsophagus; stomach large; coloration dark, the male fishes with an ocellated black spot on the tail. A single species is known, among recent fishes.

GENUS 8. AMIA. Linnaeus.

Amia, LINNÆUS, Systema Naturæ, Ed. xii, 1766.

Type, *Amia calva*, LINNÆUS.

Etymology, *amia*, an ancient name of the marine Bonito (*Sarda pelamys*) transferred by Linnaeus to this very different fish.

The characters of the genus are included above, with those of the family.

10. *AMIA CALVA* Linnæus.

Grindle Fish; Grindle; John A. Grindle; Bow-fin; Dog-fish; Mud-fish; Brindle-fish; Poisson de Marais; Lawyer.

Amia calva, LINNÆUS (1758), Syst. Naturæ.—KIRTLAND, Bost. Journ. Nat. Hist., iii, 479.

GUNTHER, Cat. Fish. Brit. Mus., viii, 325.—JORDAN, Man. Vert. E. U. S., 2d Ed., 340.

Amia ocellicauda, RICHARDSON (1836), Fauna Bor.-Am., iii, 246, 1836 (adult female).

Amia occidentalis, DEKAY (1848), New York Fauna, Fishes, 269, 1842 (adult female).

Amia ocellicauda, *occidentalis*, *marmorata*, *ornata*, *viridis*, *canina*, *lentiginosa*, *subcærulea*, *cinerea*, and *reticulata* (1846), CUV. et VAL., Hist. Nat. des Poiss., xix, 412-431, 1846.

Amia ornata, *marmorata*, *ocellicauda*, *thompsoni*, *canina*, *lentiginosa*, *occidentalis*, *reticulata*, *piquotii*, *cinerea*, *subcærulea*, and *viridis*, AUGUST DUMERIL, Hist. Nat. Des Poissons, 1870.

Description.—Dark olive or blackish above, nearly white below; sides with traces of greenish markings; lower jaw and gular plate with round blackish spots; fins mostly blackish; male fishes smaller than the females, marked by a roundish black spot near the base of the caudal fin, above; this spot is surrounded by a pale orange ocellation; this spot is wanting in the females; depth of body from four to four and one half times in its length; length of head nearly four; eye small, contained eight times in head. Dorsal, about 46; anal, 11; lat. 1., 68. Length of male, 1½ feet; female, 2 to 2½.

Habitat, Great Lake region to Virginia, Florida, and Texas, very abundant in the larger or more sluggish rivers, and in the bayous and lakes.

Diagnosis.—Either as “Grindle” or “Dog-fish” this species is known to every fisherman in the regions where it occurs. From all other Ohio fishes it may be known by the presence of the broad plate between the branches of the lower jaw.

Habits.—This species occurs in Ohio, both in Lake Erie and in the Ohio River, more abundantly in the lake, however, than in the rivers. It is one of the most powerful and most voracious of our fishes. It is more tenacious of life than any other, living longer out of water than any, even the species of *Amiurus*. I once kept a specimen alive, out of water, in a warm room, for a whole afternoon, in order to make a water-color sketch of it. Its lung-like air-bladder enables it to breathe air, so long as its air passages are kept moist, and when out of water, it dies only after the shrinkage of its gelatinous and pasty muscles due to the evaporation of the water they contain. The susceptibility to evaporation of the fleshy parts is one of the peculiar characteristics of this fish. The flesh is never used for food, and is said to be very disagreeably flavored, even if it did not almost wholly disappear in the process of frying.

Concerning the “gamey” qualities of this fish, the following from a correspondent of the Chicago Field (1878, p. 403), from Jackson, Miss., may be interesting to anglers who are not exclusively pot-fishers:

"We have a fish here that we call 'John A. Grindle', but what his other names may be in different parts, if they are found there, I do not know. They grow up to ten pounds weight, and are perfectly worthless except for sport, but for the latter they are grand. They are far ahead of our trout, I beg your pardon, you say we must not call them trout any more but black bass. Well our black bass then, or any other fish I know of.

"Grindle or John A., as we familiarly term them, are my favorite fish when I want a day's sport, for they are dead game, never giving up until tired out, and it takes a long time to tire him. Of course the man who fishes for the pot swears when he gets a John A., and then breaks his head, but the pot-fisher don't want gameness or sport, though he thinks he wants the latter; meat is what he is after and a John A. bothers him. A favorite place for our fish is across the river and through the thickets to Lawrence lake, which is so surrounded by swamp that it is difficult to approach, but which is much frequented by anglers in season. Our manner of taking the Grindle is usually with a reed pole, with or without a reel, and with a strong hook and line baited with a live minnow, which we cast and troll.

"John A. is a terrific biter, and as fierce a fighter as I ever knew, and he lasts. One day last week I killed fourteen, weighing from three to seven pounds apiece, and one of these fish fought me over half an hour. Think of that! half an hour's exciting fun, alternating between hope and fear and then crowned with success. This is a delight that the pot-fisher never felt with his stiff pole twitching out his little fish before he fairly feels them, in his haste to get another. Having told you so much about them, I will now try and give you a description of the fish as far as I am able, not being a scientist; but hope that you may be able to recognize it and tell us something of it.

"John A. is a soft-finned fish, not a spine about him. His body is round and long, like a pike or jack, and has heavy scales, which are round, that is have no prickles like a perch or bass. His tail is rounded, but not evenly; it is as if the lower portion was worn off, but the young ones are so, and I think it natural. His head is covered with hard plates, and looks like the head of a reptile; it has two sets of teeth, with some on the roof of the mouth and others back near the gullet. There is but one fin on his back, but it runs nearly the whole length of it, and is soft and of even height. The lower fins are large and a pair in the middle of its belly. There is sometimes a black spot as big as a quarter of a dollar on its tail, and we call them John A.'s and 'Spotted Grindle,' according as they have or are without the spot. They live a long time out of water. There, that is as near as I can come to his likeness, unless I add that it has an expression of ferocity in its whole look."

Mr. Hallock (*Sportsman's Gazetteer*, 324), thus remarks concerning this fish:

"They take frogs, minnows, and sometimes the spoon. Their habitat is deep water, when they drive everything before them. Their teeth are so sharp and their jaws so strong that they have been known to bite a two-pound fish in two the very first snap. The young when about six inches long make a famous bait for Pickerel and Pike. Put a hundred in a rain barrel and you can keep them all summer without change of water. For the aquarium, the young have no equal, but nothing else but snails can live in the tank. He will kill a lizard or any other living thing the instant it touches the water."

According to Dr. C. C. Estes (Hallock, l. c.):

"While the parent remains with the young, if the family becomes suddenly alarmed,

the capacious mouth will open, and in rushes the entire host of little ones; the ugly maw is at once closed, and off she rushes to a place of security, where again the little captives are set at liberty."

As indicated in the synonymy above, this fish has been made the subject of many nominal species, most of them based on specimens in the Museum at Paris. The discovery that the differences in color and size are merely sexual differences, which, by the way, was the first piece of ichthyological work attempted by the present writer, has caused them to fall into the synonymy. After laboriously distinguishing twelve "species", among the thirty or so specimens at his disposal, M. Dumeril very naïvely remarks, "I am unable to determine for which, among the species with a black caudal spot, the name *Amia calva* was intended."

The Vernacular names of this species are rather interesting. Some of its earlier describers called it Mud-fish, and this name is frequently met with in anatomical works. It is very rarely heard among the fishermen. Throughout the Great Lake Region the prevailing name is Dog-fish, which name is there also applied to *Melanura limi*, most fishermen supposing the latter to be the young of *Amia*. In Lake Champlain it is said to be called "*Bow-fin*". In the Western States, the name "*Lawyer*" is frequently applied to it, often with the remark that "this is not the real Lawyer" (*Lota maculosa*). The alleged reason for the application of this name, as Dr. Kirtland once told me, is that "it will bite at anything, and is good for nothing when caught." A correspondent of the Chicago Field informs us that "these ornary customers are called Lawyers because they are bull-headed and slippery."

Of wider range than any of these names is the name *Grindle*, with its variations Grinnel, Grindle-fish, Brindle-fish and John A. Grindle. This name is applied to the fish in the Dismal Swamp Region of Virginia, where I have found the species abundant, and in Southern Illinois, as well as in all the streams of the low country of the South where the fish is known. No hint has yet been given as to its origin. The following remarks from the pen of Mr. Fred. Mather on this name are very pertinent:

"We fancy the Southern name of 'Grindle' for the *Amia* for several reasons, one of which is that no other fish bears it, and another is its striking oddity. The fish bears this name, as we have seen, in nearly all the Southern states and also parts of Illinois and Ohio. Its other names are all shared with other fishes, for instance, 'dog-fish' is applied to a kind of Shark, 'mud-fish' is shared with the little Mud Minnow, *Melanura*, and 'lawyer', with the Ling or Eel-pout, *Lota*. Besides, 'grindle' covers more territory, and is consequently less local than any of the trivial names. But who was old Grindle, anyway?"

SUB-CLASS TELEOSTEI. THE BONY FISHES.

Skeleton more or less ossified; tail homocercal, or at least not evidently heterocercal; optic nerves simply crossing, without chiasma; arterial bulb simple, with two opposite valves at its origin; air bladder if present, not cellular. This group comprises the great majority of recent fishes (*teleos*, perfect; *osteon*, bone).

ORDER 6. ENCHELYCEPHALI. THE EELS.

This order is framed by Professor Cope for the reception of those Eel-like fishes which have the following osteological characters.

Parietals in contact; lower pair of basihyals wanting; scapular arch suspended to an anterior vertebra; no post temporal; no symplectic; maxillary bone absent, or connate with the premaxillary, which forms the border of the mouth. Premaxillaries separated on the median line by the ethmoid; superior branchiyls and inferior and superior pharyngeals well developed, the latter of four bones. Of these the fourth is largest and supports the third which, with the second, is directed forwards. (*Cope*.)

Among the fresh water fishes, the Eels may be known by the serpentiform body, the absence of ventral fins and the long and low dorsal and anal which meet around the tail; the jaws are well developed and provided with teeth. But one species occurs in the waters of Ohio. (*Egchelus*, eel; *kephale*, head.)

ANALYSIS OF FAMILIES OF ENCHELYCEPHALI.

*Pectoral fins present; teeth of sides of jaw separated, not forming a continuous cutting edge. ANGUILLIDÆ. 6.

FAMILY VI. ANGUILLIDÆ. THE EELS.

Body much elongated, anteriorly cylindrical, compressed behind, covered with minute scales which are imbedded in the skin; mouth rather large, horizontal, the upper jaw not projecting; teeth small, in bands, not forming a uniform cutting edge; gill openings rather narrow; dorsal fin beginning at a considerable distance behind the head, continuous with the anal around the tail. A single genus, with probably less than ten species, although several hundred have been described. The Eels are cosmopolitan, and inhabit all sluggish or still waters, whether brackish or fresh, in warm or temperate regions.

GENUS 9. ANGUILLA. Thunberg.

Anguilla, THUNBERG. * * *

Muræna, (LINNÆUS) BLEEKER, Atl. Ich. Mur. I. (not of authors generally.)

Type, *Muræna anguilla* L., equal to *Anguilla vulgaris*, TURTON.

Etymology, Latin, *anguilla*, Greek, *egchelus*, an eel.

The characters of this genus are included above.

11. ANGUILLA VULGARIS Turton.

Common Eel.

EUROPEAN SYNONYMY. (var. *vulgaris* ?)

- Muræna anguilla*, LINNÆUS, Syst. Nat., i, 426.—BLOCH and SCHNEIDER, Systema Ichthyol., 486, and of all early writers.
- Anguilla vulgaris*, TURTON, British Fauna, 87.—FLEMING, British Animals, 199.—GUNTHER, Cat. Fishes Brit. Mus., viii, 28, and of European authors generally.
- Anguilla canariensis*, *callensis*, *acutirostris*, *mediorostis*, *oxyrhina*, *pekinensis*, *migratoria*, *fluviatilis*, *cuvieri*, *bibronii*, *savignyi*, *morena*, *marginata*, *microptera*, *altirostris*, *platycephala*, *latirostris*, *nilotica*, *ægyptiaca*, *hibernica*, and many other names of European species-makers.

AMERICAN SYNONYMY. (var. *rostrata* ?)

- Muræna anguilla*, SCHOPFF, Beobacht. Naturforscher, Berlin, viii, 138.
- Anguilla vulgaris*, MITCHILL (1814), Trans. Lit. and Phil. Soc., i, 360; Am. Mo. Mag., ii, 241.—GUNTHER (1870), Cat. Fishes, viii, 30.—“DARESTE, Monograph of Anguilliform Fishes,”—fide BAIRD (unites into one, all the species of *Anguilla* described from the Northern Hemisphere).
- Muræna rostrata*, LESUEUR, Journ. Phil. Ac. Sc. i, 81.—RICH., F. B. A., iii, 267.
- Anguilla rostrata*, DEKAY, Fishes N. Y., 312.—STORER, Synopsis, 485.—JORDAN (1876), Bull. Buff. Soc. Nat. Hist., 96; Man. Vert., 304, sec. ed., 338.
- Muræna bostoniensis*, LESUEUR, Journ. Acad., i, 81.—STORER, Rept. Fishes Mass., 158.—THOMPSON (1842), Hist. Vt., 148.
- Anguilla bostoniensis*, DEKAY, Fishes N. Y., 313.—AYRES, Bost. Journ. Nat. Hist., iv, 279.—STORER, Synopsis, 485; Fishes Mass., 1855, 408.—GILL, Cat. Fishes East Coast, 1861, 56; Can. Nat., Aug., 1865, 20; Rept. U. S. Fish Commission, 1871-72, 811.—GUNTHER, Cat. Fishes, 1870, viii, 31, and of late authors generally.
- Anguilla serpentina*, STORER, Synopsis, 486.—GILL, Cat. Fishes E. Coast, 1861, 56.
- Muræna serpentina*, LESUEUR, l.c., i, 82.—STORER, Rept. Fishes, 158.—THOMPSON, Hist. Vt., 1842, 148.
- Anguilla argentea*, DEKAY, Fishes N. Y., 313.—STORER, Synopsis, 485.—GILL, l.c.
- Muræna macrocephala*, LESUEUR, l.c., 82.
- Anguilla macrocephala*, DEKAY, l.c., 313.—STORER, Synopsis, 486.—GILL, l.c., 82.
- Anguilla laticauda*, RAFINESQUE, Ich. Oh., 77.
- Anguilla aterrima*, RAFINESQUE, l.c., 78.
- Anguilla xanthomelas*, RAFINESQUE, l.c., 78.
- Anguilla lutea*, RAFINESQUE, l.c., 78.—KIRTLAND, Bost. Journ. Nat. Hist., iv, 234.—STORER, Synopsis, 486, and of some Western writers.
- Anguilla tenuirostris*, DEKAY, Fishes N. Y., 310.—“KAUP, Cat. Apodal Fish, 44.”
- Anguilla novæorleanensis*, KAUP, l.c., 43.
- Anguilla punctatissima*, KAUP, l.c., 44.
- Anguilla texana*, KAUP, l.c. 45.—GUNTHER, Cat. Fishes, viii, 32.
- Anguilla novæ terræ*, KAUP, l.c., 45.—GILL, l.c., 1861, 56.
- Anguilla wabashensis*, KAUP, l.c., 46.
- Anguilla tyrannus*, GIRARD, U. S. and Mex. Bound. Surv., 1859, 75.

Body cylindrical, compressed behind, ending in a point; head long, flattened above; mouth horizontal, extending to beyond the eye, the lower jaw rather the longer; eye

small, well forward; anterior nostrils with a slight barbel; pectorals about half as long as head, rounded; color olive-brown, or yellowish, sometimes almost black, the color extremely variable; head ten in length. D. & A. 455; length two to four feet.

Habitat, throughout the Northern Temperate Zone, in bays, and ascending all streams.

Diagnosis.—A person that does not know an eel at sight will not look to this paper for information.

Habits.—In the State of Ohio the Eel is not a very common fish, although there are few streams in the State in which they are not sometimes found. It is supposed that their presence in Lake Erie is due to the opening of canals. They are native, however, in the Ohio. Whether they breed in the State, or in fact in any fresh water, is still uncertain. I am inclined to think that they *do* breed in fresh water, if for no other reason than that I have found young Eels, less than an inch long, in the head waters of the Alabama River, some 500 miles from the sea. The habits of the Eel and its excellent qualities as a food fish are too well known to require special notice here.

The question as to the sexual characters and relations of the Eel has long remained a standing puzzle to naturalists. The following account of the recent final settlement of this question, from the *New York Times*, will be of interest in this connection :

When Prof. Baird announced to the American Fish Culture Association, in February last [1878], that he had within the six weeks previous received Eels with ripe ovaries, it started a ripple of excitement in the room, which in a few days reached every naturalist in the land, and awakened new interest in the old question of the mode by which this mysterious fish perpetuated its race, one which had baffled all inquirers since man first sought to penetrate the secrets of creation, and which had almost by common consent been relegated to the category of "things which no fellow can find out."

In commenting on this discovery, writers have ransacked history from Aristotle down, and have given all the theories which have been entertained by people who framed them in order to hide their ignorance, and who had not the moral courage to confess that they really did not know how the fish did breed. Aristotle, after roasting the intestines of Eels, and recording that he heard the eggs crack, afterward doubted the evidence, and, for want of something better, declared that they were born of mud. This was improved upon by Pliny, who solemnly attributed their origin to particles rubbed from mature Eels by contact with rocks, etc. Later conjectures of fishermen and others have credited their existence to the "hair worm" or "hair snake," *Gordius*, who in its turn is absurdly said to originate from a hair. Mussels, lampreys, carrion, and other objects, animate or inanimate, have been charged with their maternity, but since the statement made by Prof. Baird, last season, many persons have been on the lookout for the ovaries of the Eel, but without success, until recently, and now, since Mr. Eugene G. Blackford, of Fulton Market, has shown them to the fishermen, fish-dealers, and others, they all say: "Oh, yes, that is what we call 'Eel fat,' it is always plenty at

this time of the year." And now the wonder is that no one has discovered this before, for during all these long centuries, in which the question of the generation of Eels has been an open one, the eggs have been in plain sight; in fact, right under the noses of the investigators. It is also singular that all the Eels observed so far in the markets have been females. Mr. Blackford, after showing the ovaries to his eel-dressers, directed them to watch for any departure from this appearance, and some interest was being awakened in the old assertion of their being hermaphrodites, although no spermatozoa had been found in connection with the ovaries, until the recent discovery of a male Eel by Prof. Packard set the question of their unisexuality at rest. These discoveries were being discussed in Mr. Blackford's office a short time ago by a few gentlemen, among whom was Mr. Frederick Mather, the well known fish culturist, when a specimen was brought from an Eel weighing six pounds.

A portion was placed under the microscope, when the eggs appeared to be in shape of octogons, but which, Mr. Blackford stated, was caused by their pressing upon each other. Mr. Mather took the ovary home, and, after carefully examining the eggs, confirms Mr. Blackford's statement of their globular form when separated, but finds that the eggs, like those of all fishes before exclusion, are flaccid, and is of the opinion that an increase in size and solidity would occur after they had been deposited by the fish and the absorption of water and milt had taken place. The eggs varied so much in size that a measurement by the micrometer of one or two did not give as fair an idea of their dimensions as to place a number in a line, measure them, and count them under a low power, by which means, with three different lots, Mr. Mather found that they measured eighty to the inch, and when separated on the glass slide could be readily discerned by the naked eye. Mr. Mather then proceeded to estimate the number of eggs contained in this six-pound Eel, which was done by carefully subdividing the mass until a small portion contained a quantity which could be counted, and which was then multiplied by the number of divisions, thus: The mass was halved, quartered, etc., seventeen times, making the last section 1-131,072 of the whole. To avoid error, this was done three times, giving the first time sixty-eight eggs, or 8,912,896 in the whole. The second trial gave seventy-seven eggs, or a total of 10,092,544, while the third yielded seventy-one eggs, which showed the mass to contain 9,306,112.

Considering the minuteness of the eggs, these different results are remarkably near each other, and Mr. Mather fixes the numbers contained in this individual fish at 9,000,000, which, when we consider that each of the ovaries was nearly a foot in length, and about half an inch in diameter at the thickest part, does not seem to be at all exaggerated.

The wonderful fecundity of Eels is shown in the immense numbers seen ascending the streams in early summer, when each little elver of three inches probably represents one hundred eggs, which, from being devoured, infertility, and other causes, have failed to arrive at his length.

ORDER VII. NEMATOGNATHI. THE CAT-FISHES.

This order, easily recognizable at sight by the long barbels, dorsal and pectoral spines, and the absence of true scales, is distinguished by the following osteological characters, according to Professor Cope:

"Parietals and supraoccipital confluent; four anterior vertebræ ossified, an ossicula auditus, no mesopterygium. Basis cranii and pterotic bone simple; no coronoid bone.

Third superior pharyngeal bone wanting, or small and resting on the fourth, second directed backwards; one or two pairs of basal branchiyls; suboperculum wanting; premaxillary forming mouth-border above; interclavicles present." A large order, in some respects intermediate between the Sturgeons and the *Cyprinidæ*. The leading family is the *Siluridæ*.

* Opercle present; dorsal fin inserted in front of the ventrals. . . SILURIDÆ. 7.

FAMILY VII. SILURIDÆ. THE CAT-FISHES.

This family includes such of the *Nematognathi* as have the rayed dorsal fin short, and placed in advance of the ventrals, and the operculum developed. The variation in appearance among the members of this family is great, some having the skin naked, others having it covered with bony plates of various forms. The American fresh water species, some thirty in number, agree in having the body naked; the head with eight long barbels whereof the maxillary bones form the base of the longest pair; no subopercle; top of head not mailed; dorsal and pectoral fins each with a pungent spine, which is often serrate; adipose fin present, without rays; gill openings wide.

There are upwards of seven hundred species of *Siluridæ* known, referred to about one hundred genera. They are most numerous in the fresh waters of South America, and are numerous enough in North America and Africa. A few occur in Europe, and some are marine. Our species are valued for food in proportion to their size. They mostly inhabit lakes and sluggish streams, and are usually very tenacious of life.

* Adipose fin, with its posterior margin free, not adnate to the body, nor connected with the caudal fin.

a. Band of teeth on the premaxillaries, without lateral backward processes.

b. Supraoccipital bone produced backward from the skull, receiving the pointed anterior end of the second interspinal (bone at the base of the dorsal fin), thus forming a continuous bony bridge from the head to the dorsal; (slender silvery species, with small mouth and forked caudal fin). ICHTHÆLURUS. 10.

bb. Supraoccipital bone not produced, falling short of the interspinal, the bony bridge being therefore interrupted; (stout dusky-colored species, with larger mouth and less forked or truncate caudal fin). AMIURUS. 11.

aa. Band of teeth on the premaxillary, with a strong backward extension on each side; lower jaw longest; anal fin short. PELODICHTHYS. 12.

** Adipose fin low, keel-like, adnate to the body, and usually continuous with the caudal fin. NOTURUS. 13.

GENUS 10. ICHTHÆLURUS. Rafinesque.

Ictalurus, RAFINESQUE (1820), *Ichthyologia Ohnensis*, 61.

Ellkops, RAFINESQUE (1820), *Ichthyologia Ohnensis*, 62.

Synechoglanis, GILL (1859), *Annals Lyc. Nat. Hist.*, vii, 39.

Ictalurus, GILL (1862), *Proc. Boston Soc. Nat. Hist.*, 41.

Ichthælurus, COPE (1869), *Journ. Acad. Nat. Sci., Phila.*, 237. (Corrected orthography.)

Type, *Silurus punctatus*, Rafinesque.

Etymology, *Ichthus*, fish; *ailourus*, cat.

Body elongated, slender, and much compressed. The caudal peduncle is short but slender, and presents behind the anal an elongated elliptical section.

Head conical in profile, compressed, and with the sides sloping downward and outward. The supraoccipital bone is prolonged backward, and its emarginated apex receives the acuminate anterior point of the second interspinal. The skull is covered by a thin tense skin, through which the sculpture of the bones is apparent; eyes large and almost entirely lateral; mouth small, transverse, and terminal; the upper jaw protrudes beyond the lower; teeth subulate and aggregated into a short, laterally truncated band on each jaw. Branchiostegal rays 8 or 9; dorsal fin situated over the interval between the pectoral and ventral fins, higher than long, with one long spine and usually six articulated rays; adipose fin pedunculated over the posterior portion of the anal; anal fin long, and provided with from 25 to 35 rays; it commences near the anus; ventral fins each with one simple and seven branched rays; pectoral fins each with a stout spine, retrorse-serrate within, and about nine branched rays. The serræ of the pectoral spines vary with age and circumstances, and do not in this genus give good specific characters. Caudal fin elongated and deeply forked, with the lobes equal and pointed.

The genus *Ichthælurus* is at once recognized by the forked caudal fin, its silvery or olivaceous colors, and by its compressed, elongated, and slender body which gives to it a peculiarly graceful appearance, very unlike that of the stout, obese and large-headed *Amiuri*. The head is smaller in proportion than in *Amiurus*, more compressed, and not covered by so thick a skin; the mouth is proportionally much smaller. But the only invariable generic distinction resides in the mode of insertion of the supraoccipital or interparietal bone into the head of the second interspinal. A firm and immovable bridge is thus formed, which gives an uninterrupted passage from the dorsal fin to the snout. The silvery coloration is also a marked distinguishing feature.

It is not generally true that the species of *Ichthælurus* reach a larger size than those of the other genera. *Amiurus nigricans* and *Pelodichthys olivaris* far exceed in size any of the species of *Ichthælurus*.

12. *ICHTHÆLURUS FURCATUS* (Cuv. and Val.) Gill.

Fork-tailed Channel Cat.

Pimelodus furcatus, CUV. and VAL. (1840), Hist. Nat. des Poiss., xv, 136.

Ichthælurus furcatus, GILL (1861), Proc. Bost. Soc. Nat. Hist., 43.

Amiurus furcatus, GUNTHER (1864), Cat. Fish. Brit. Mus., v, 103.

Ichthælurus furcatus, JORDAN, Bull. U. S. Nat. Mus., x, 75; Man. Vert., Ed. 2d, 1878, 328.

Pimelodus affinis, BAIRD and GIRARD (1854), Proc. Ac. Nat. Sci., Phila., 26.—GIRARD (1859), U. S. Mex. Bound., Ich., 32.

Description.—Body very slender; head slender, the eye small, wholly anterior, its posterior margin being in front of the middle of the head; slope from snout to dorsal fin more or less concave; skin thin; coloration brightly silvery; anal fin extremely long, with 32 to 34 rays;* its base forming one-third of the length of the body and head; head $4\frac{1}{2}$ in length; depth, 4 in adult, $5\frac{1}{2}$ in young; pectoral spine $1\frac{1}{2}$ in head; length 1 to 2 feet.

Habitat, Ohio Valley to Texas, in the larger streams; not common.

* In this family the rudimentary rays at the beginning of the anal are always included in the enumeration.

Diagnosis.—This is the only Cat-fish in Ohio having more than thirty rays in the anal fin.

Habits.—I have seen one or two specimens taken at Cincinnati. Nothing distinctive is known of its habits, which are probably identical with those of its cogener, *I. punctatus*.

13. *ICHTHÆLURUS ROBUSTUS* Jordan.

Chuckle-headed Cat.

Ichthælurus robustus, JORDAN (1876), Bull. U. S. Nat. Mus., x, 76; Man. Vert., Ed. 2d, 1878, 328.

Description.—Body rather stout and deep, compressed behind; the back elevated; head rather large, one-third longer than broad; the eye moderate, wholly in front of the middle of the head; slope from snout to base of dorsal more or less concave, the dorsal region being elevated; skin thick; coloration pale, little silvery; anal fin moderate, its base $3\frac{1}{2}$ to 4 in length; its rays 27 to 30; head $4\frac{1}{2}$ in length; depth about 4; pectoral spine little more than half the length of head; length 1 to 2 feet.

Habitat, Ohio Valley, Mississippi Valley, not very common.

Diagnosis.—From *I. punctatus* this species may be known by the smaller and more anterior eye, which is in front of the middle of the head; from *I. furcatus* it is separated by the shorter anal fin.

Habits.—The few specimens known of this species are from the lower Ohio, Illinois, and Mississippi Rivers. Nothing distinctive is known of its habits in life.

14. *ICHTHÆLURUS PUNCTATUS* Jordan.

Blue Cat; White Cat; Silver Cat; Channel Cat.

Silurus punctatus, RAFINESQUE (1818), Amer. Monthly Mag. and Critical Review, September, 359.

Ictalurus punctatus, JORDAN (1876), Bull. Buff. Soc. Nat. Hist., 95; Manual of Vertebrates, 300.—JORDAN and COPELAND (1876), Check List, Bull. Buff. Soc. Nat. Hist., 159.—JORDAN (1877), Annals Lyc. Nat. Hist. N. Y., —. —NELSON (1876), Bull. Ills. Mus. Nat. Hist., 50.

Ichthælurus punctatus, JORDAN (1878), Bull. U. S. Nat. Mus., x, 76; Man. Vert., Ed. 2d, 328.

Pimelodus caudafurcatus, LESUEUR (1819), Memoires du Museum, v, 152.

Amiurus caudafurcatus, GUNTHER (1864), Catalogue of Fishes, v, 102.

Silurus maculatus, RAFINESQUE (1820), Quarterly Journal of Science, Literature, and Arts, London, 48 (et var. *erythroptera*, p. 49).

Pimelodus (Ictalurus) maculatus, RAFINESQUE (1820), Ichthyologia Ohiensis, 62.

Silurus pallidus, RAFINESQUE (1820), Quart. Journ. Sci. Lit. and Arts, London, 49 (et var. *marginatus*, *lateralis*, *leucoptera*).

Pimelodus pallidus, RAFINESQUE (1820), Ich. Oh., 63.—KIRTLAND (1838), Report Zool. Ohio, 169, 194.

- Silurus ceruleus*, RAFINESQUE (1820), Quart. Journ. Sci. Lit. and Arts, London, 49 (et var. *melanurus*).
- Pimelodus ceruleus*, RAFINESQUE (1820), Ich. Ohiensis, 63.—KIRTLAND (1838), Rept. Zool. Ohio, 169, 194; (1846) Bost. Journ. Nat. Hist., iv, 332.—STORER (1846), Synopsis Fishes N. A. in Mem. Nat. Acad. Sci., 405. (All these descriptions refer more or less to *Amiurus nigricans*.)
- Ictalurus cærulescens*, GILL (1862), Proc. Bost. Soc. Nat. Hist., 43.—COPE (1865), Proc. Acad. Nat. Sci. Phila., 85; (1870) Proc. Am. Philos. Soc., 489.—JORDAN (1874), Ind. Geol. Survey, 222.—GILL (1876), Ich., Capt. Simpson's Exped., 417.
- Ichthælurus cærulescens*, COPE (1869), Journ. Acad. Nat. Sci., 237.
- Silurus argentinus*, RAFINESQUE (1820), Quart. Journ. Sci. Lit. and Arts, London, 50.
- Pimelodus argyrus*, RAFINESQUE (1820), Ichthyologia Ohiensis, 64.
- Pimelodus furcifer*, CUV. and VAL. (1840), xv, 139.—“HYRTL (1859), Denkschr. Akad. Wiss. Wien, 16”.—“KNER, Sitzgsber. Akad. Wiss. Wien, xxvi, 421.”
- Ictalurus furcifer*, GILL (1862), Proc. Bost. Soc. Nat. Hist., 43.—JORDAN (1876), Manual Vert., 300.
- Pimelodus gracilis*, HOUGH (1852), Fifth Ann. Rept. Reg. Univ., Condition State Cabinet Nat. Hist., Albany, 26.
- Synechoglanis gracilis*, GILL (1859), Trans. Lyc. Nat. Hist., 3 (reprint).
- Ictalurus gracilis* GILL (1862), Proc. Bost. Soc. Nat. Hist., 43.—COPE (1865), Proc. Acad. Nat. Sci., Phila., 85.—JORDAN (1876), Man. Vert., 300.—JORDAN and COPELAND (1876), Check List, 159.
- Pimelopus vulpes*, GIRARD (1858), Proc. Acad. Nat. Sci., Phila., 170; (1859) U. S. and Mex. Bound. Surv., 33.
- Ictalurus vulpes*, GILL (1862), Proc. Bost. Soc. Nat. Hist., 43.—JORDAN and COPELAND (1876), Check List, 159.
- Pimelodus olivaceus*, GIRARD (1858), Pac. R. R. Survey, x, 211.
- Ictalurus olivaceus*, GILL (1862), l. c., 43; (1876) Rept. Ichthy. Capt. Simpson's Exp., 417.—JORDAN (1876), Man. Vert., 300.—JORDAN and COPELAND (1876), Check List, 159.
- Synechoglanis beadlei*, GILL (1859), Trans. Lyc. Nat. Hist. N. Y., 2 (reprint).
- Ictalurus beadlei*, GILL (1862), Proc. Bost. Soc. Nat. Hist., 43.—JORDAN and COPELAND (1876), Check List, 159.
- Pimelodus houghii*, GIRARD (1859), Proc. Acad. Nat. Sci. Phila., 159.
- Pimelodus megalops*, GIRARD (1859), l. c., 161 (said to have the eye very large, its diameter one-third the length of the side of the head).
- Ictalurus megalops*, JORDAN and COPELAND (1876), Bull. Buff. Soc. Nat. Hist., 159.
- Pimelodus graciosus*, GIRARD (1859), Proc. Acad. Nat. Sci. Phila., 161.
- Pimelodus hammondi*, ABBOTT (1860), Proc. Acad. Nat. Sci. Phila., 568.
- Pimelodus notatus*, ABBOTT (1869), Proc. Acad. Nat. Sci. Phila., 569.
- Ictalurus simponsi*, GILL (1862), Proc. Bost. Soc. Nat. Hist., 43; (1876) Ich. Capt. Simpson's Exp., 47.

Description.—Body slender, little elevated, the dorsal region not much elevated, and the profile from snout to dorsal little concave; head rather small, conical, with small mouth; eye larger, placed medially, the middle of the head falling in front of its posterior margin; skin thin; pectoral spines long, $1\frac{1}{2}$ in head; coloration olivaceous, silvery, the adult bluish, the young yellowish, with darker blotches, made of dark points, which disappear with age; head 4; depth 5 in length; anal base about 4 times in length, of 25 to 29 rays. Length 1 to $2\frac{1}{2}$ feet.

Habitat, Canada to Florida, Texas and Montana, abundant in all suitable waters east of the Alleghanies.

Diagnosis.—This most abundant species may be known from the other white Cat-fishes by the position of the eye, which is not wholly in advance of the middle of the head.

Habits.—This species is very abundant in the Ohio River and its larger tributaries, and is found, but less frequently, in Lake Erie. It does not usually ascend small streams. It is used for food, and is of some value, but the flesh is perhaps hardly as good as that of most of the *Amiuri*. The species prefers clear waters, being averse to mud, and is much less tenacious of life than the *Amiuri* are. Its singular form and silvery colors renders it an attractive aquarium fish.

The idea is prevalent that this is our largest Cat-fish. I find no good evidence of the truth of this supposition. The largest specimens I have ever seen would hardly weigh over five or six pounds. And all the large "Blue Cats" which have been shown me belong to *Amiurus nigricans*. I have seen the adult of *Ichthæurus punctatus* put on the hook as "live bait," to attract *Amiurus nigricans*, at Cumberland Falls, in Kentucky.

GENUS 11. AMIURUS. Rafinesque.

Silurus et Pimelodus sp., LINNÆUS, and all writers prior to 1802.

Ameiurus, RAFINESQUE (1820), Ich. Ohiensis, 65 (as section under sub-genus *Ictalurus* of *Pimelodus*.)

Amiurus, GILL (1862), Proc. Bost. Soc. Nat. Hist., 50, and of recent writers generally.

Ameurus, COPE (1864), Proc. Acad. Nat. Sci. Phila., 231.

Gronias, COPE (1864), Proc. Acad. Nat. Sci. Phila., 231.

Type, *Silurus cupreus*, Rafinesque.

Etymology, *a*, primitive; *meiourus*, curtailed, in allusion to the entire caudal fin.

Body moderately elongated, robust, anteriorly vertically ovate, and scarcely compressed; caudal peduncle also robust, but much compressed, and at its end evenly convex.

Head large, wide, laterally expanded, above ovate and in profile cuneiform; supra-occipital extended little posteriorly and terminating in a more or less acute point, which is entirely separate from the second interspinal buckler; the skin covering the bones is thick.

Eyes rather small, in one species covered by the skin; mouth large, terminal, transverse, the upper jaw in most species the longer; jaws often equal, the lower, in one or two species distinctly projecting.

Teeth subulate, aggregated in broad bands on the intermaxillaries and dentaries; the intermaxillary band is convex in front, of equal breadth, and abruptly truncated near the insertion of the intermaxillaries; the lower dental band is anteriorly semicircular, attenuated to the angles of the mouth.

Branchiostegal membrane on each side with eight or nine rays in typical species; ten or eleven in two or three aberrant species; dorsal situated over the interval between

the pectorals and ventrals, higher than long, with a pungent spinous ray dentate behind, and about six branched rays; adipose fin short, inserted over the posterior half of the anal; anal fin of moderate length, with from fifteen to twenty-six rays, the usual number being twenty or twenty-one; caudal fin short, usually truncate when spread open, slightly emarginate when not expanded,—in species related to *Ichthælurus* more or less deeply forked, in some other species rounded; when the caudal fin is forked the lobes are usually unequal; ventrals each with one simple and seven branched rays; pectoral fins each with a stout spine, which is commonly retrorse-serrate behind, these serræ vary much with age and circumstances, and do not appear in this genus to furnish good specific characters; lateral line usually incomplete.

This genus includes our common Eastern American Catfishes, and is readily recognized by the broad head covered by a thick skin, the free termination of the posterior process of the supraoccipital bone, the compressed body, and by the free adipose fin.

This genus, although undoubtedly a very natural one, is rather hard to define. Certain species (*lupus*, *niveiventris*, *nigricans*) have real affinities with the species of *Ichthælurus*, having, like them, the body elongate, the head rather narrow, the anal long, the caudal forked, and the coloration pale. The absence of the connection between the supraoccipital and the interspinal is the only technical character by which *Amiurus* may be distinguished from *Ichthælurus*.

ANALYSIS OF SPECIES OF AMIURUS.

- * Caudal fin forked. NIGRICANS. 15.
- ** Caudal fin rounded, or slightly emarginate.
- a. Anal rays 24 to 26. NATALIS. 16.
- aa. Anal rays 18 to 22.
- b. Lower jaw longer than upper. VULGARIS. 17.
- bb. Lower jaw not longer than upper.
- c. Coloration mottled or variegated; adipose fin large. . MARMORATUS. 18.
- cc. Coloration nearly plain.
- d. Head moderately broad, with a nearly even slope from the tip of the snout to the elevated base of the dorsal fin.
- e. Body elongate; anal rays 20 to 22. CATUS. 19.
- ee. Body short and deep; anal rays 18 to 20. MELAS. 20.
- dd. Head very broad; an angle at occiput; anal small, usually with 19 rays. XANTHOCEPHALUS. 21.

15. AMIURUS NIGRICANS (LeSueur) Gill.

Great Fork-tailed Cat; Mississippi Cat; Florida Cat;
Great Catfish of the Lakes.

Pimelodus nigricans, LESUEUR (1819), Memoires du Museum d'Hist. Nat., v, 153.—CUV. and VAL. (1840), xv, 133.—DEKAY (1842), Fishes N. Y., 180.—STORER (1846), Synopsis, 403.—“HYRTL (1859), Denkschrift Akad. Wiss. Wien, xvi, 16.”

Amiurus nigricans, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—JORDAN (1876), Man. Vert. 318.—JORDAN and COPELAND (1876), Check List, 159 (not of GUNTHER (1864), nor of COPE (1870), equal to *A. canosus*).—JORDAN (1877), Bull. U. S. Nat. Mus., x, 83; (1878), Man. Vert., sec. ed., 329.

Silurus (Pimelodus) nigrescens, RICHARDSON (1836), Fauna Bor.-Am., Fishes, 134.

Pimelodus sp. incog., THOMPSON, (1842), History Vermont, 139.

Pimelodus caeruleus in part, of RAFINESQUE, KIRTLAND, and others; the big "Channel Cats" all belong to this species.

Description.—Body moderately stout, head narrow, longer than broad; mouth moderate, the upper jaw the longer; barbels long; pectoral spines short and stout, dentate; caudal fin strongly furcate, but less so than in the Channel Cats; anal fin very long; color dark, sometimes mottled with paler; anal 25 or 26. Head $4\frac{1}{2}$ in length; its width 5. Length, 2 to 6 feet.

Habitat.—Great Lake region to Texas and Florida, abundant in the larger streams and lakes.

Diagnosis.—This species may be known from the other *Amiuri* by the forked tail. The form is stouter and the colors darker than in any of the species of *Ichthæurus*.

Habits.—This species is the common Cat-fish of the lake fishermen, in contra-distinction to the Bull-head, as *A. catus* is usually called. In the Ohio it is the Mississippi Cat. It is found only or chiefly in the larger bodies of water, and reaches a very great size. It is valued as food, although the flesh is rather coarse and flavorless. I have seen specimens of nearly a hundred pounds weight, and have heard of Cat-fish weighing two or three hundred pounds, but I presume them to have been weighed by guess.

16. AMIURUS NATALIS (LeSeur) Gill.

Catfish; Yellow Cat.

a. var. *natalis*.

Pimelodus natalis, LESUEUR (1819), Mem. du Museum, v, 154.—STORER (1846), Synopsis, 405.

Amiurus natalis, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—GUNTHER (1864), Cat. Fishes Brit. Mus., v, 101.—JORDAN (1877), Bull. U. S. Nat. Mus., x, 86.

Pimelodus puma, GIRARD (1859), Proc. Acad. Nat. Sci., Phila., 160.—JORDAN (1878), Man. Vert., Ed. 2, 331.

b. var. *lividus*.

Silurus lividus, RAFINESQUE (1850), Quart. Journ. Sci. Lit. and Arts, London, 48 (et var. *fuscatus*).

Pimelodus lividus, RAFINESQUE (1820), Ich. Ohiensis, 65.

Amiurus lividus, JORDAN (1876), Man. Vert., 302.—JORDAN and COPELAND (1876), Check List, 159.

Pimelodus felinus, GIRARD (1858), U. S. Pac. R. R. Expl., x, 209.

Amiurus felinus, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—COPE (1870), Proc. Am. Philos. Soc., 485.—JORDAN and COPELAND (1876), Check List, 159.

Pimelodus catus, GIRARD (1859), Proc. Phila. Acad. Nat. Sci., 160 (not of DeKay and most authors).

Amiurus catus, COPE (1870), Proc. Am. Philos. Soc., 484.—JORDAN and COPELAND, Check List, 159.

Pimelodus cupreoides, GIRARD (1859), Proc. Acad. Nat. Sci., Phila., 159.

Amiurus cupreoides, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.

c. var. *cænosus*.

Silurus (Pimelodus) cænosus, RICHARDSON (1836), Fauna Bor.-Amer., Fishes, 132.—CUV. and VAL. (1840), xv, 129.—DEKAY (1842), Fishes N. Y., 186.—STORER (1846), Synopsis, 402.

Amiurus cænosus, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—COPE (1870), l. c., 485.—JORDAN (1876), Man. Vert., 303.—JORDAN and COPELAND, Check List, 159.

d. var. *cupreus*.

Silurus cupreus, RAFINESQUE (1820), Quart. Journ. Sci. Lit. and Arts, London, 51.

Pimelodus (Ameiurus) cupreus, RAFINESQUE (1820), Ich. Oh., 65.

Pimelodus cupreus KIRTLAND (1838), Rept. Zool. Ohio, 169, 194; (1846) Bost. Journ. Nat. Hist., iv, 333.—DEKAY (1842), Fishes N. Y., 187.—STORER (1846), Synopsis, 404.—GIRARD (1859), Proc. Acad. Nat. Sci., Phila., 169.

Amiurus cupreus, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—COPE (1870), Proc. Am. Phil. Soc., 485.—JORDAN (1876), Bull. Buff. Soc. Nat. Hist., 96; Man. Vert., 303.—NELSON (1876), Bull. Ills. Mus. Nat. Hist., 50.—JORDAN and COPELAND (1876), Check List, 159.—JORDAN (1877), Annals Lyceum Nat. Hist. N. Y.; Proc. Acad. Nat. Sci. Phila., 45.

Ameurus cupreus, COPE (1865), Proc. Acad. Nat. Sci. Phila., 276.

e. var. *antoniensis*.

Pimelodus antoniensis, GIRARD (1859), Pac. R. R. Expl., x, 291.

Amiurus antoniensis, GILL (1862), l. c., 44.—COPE (1870), l. c., 485.

Description.—Body not much elongate, usually rather deep and chubby, sometimes extremely so; head wide and flattish, not much longer than broad, the mouth very wide; the lower jaw usually shortest, but sometimes the two jaws about equal when the mouth is closed; dorsal region not much elevated; anal fin very long, its base one-fourth or more the length of the body, of 24 to 27 rays; spines not very long; caudal fin truncate or slightly notched; color normally dark yellowish brown, sometimes nearly black; head $3\frac{1}{2}$ to 4 in length; depth 4 to 5; D. I, 6; A. 24 to 27. Length 1 to 2 feet.

Habitat, Great Lake Region to Virginia, Florida, and Texas, generally abundant.

Diagnosis.—This is an extremely variable species as regards color and form. It is the only Ohio Cat-fish having a truncate caudal fin and more than twenty-three anal rays. Specimens from different waters vary much from each other. A very short, fat, chubby form is occasionally seen, which looks very unlike the ordinary form. Some of the leading varieties have received special names, which it is not necessary to give here.

Habits.—This is one of the most abundant species of the lakes, ponds, and bayous of Ohio, being tolerably common throughout the State. It does not reach a very large size.

17. AMIURUS VULGARIS (Thompson) Nelson.

Long-jawed Catfish.

Pimelodus vulgaris, THOMPSON (1842), History of Vermont, 138.

Amiurus vulgaris, NELSON (1876), Bull. Ills. Mus. Nat. Hist., 50.—JORDAN and COPELAND (1876), Check List, 159.—JORDAN (1877), Bull. U. S. Nat. Mus., x, 85; (1878) Man. Vert., ed. 2d., 33.

Pimelodus ailurus, GIRARD (1858), U. S. Pac. R. R. Surv., Fishes, 210.

Amiurus ailurus, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.

Amiurus ælurus, COPE (1870), Proc. Am. Philos. Soc., 485.—JORDAN (1876), Man. Vert., 302.—JORDAN and COPELAND (1877), Check List, 159.

Pimelodus dekayi GIRARD (1859), Proc. Acad. Nat. Sci., Phila., 160.

Amiurus dekayi, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—COPE (1870), Proc. Am. Philos. Soc., 485.—JORDAN (1876), Man. Vert., 302.

Description.—Body moderately elongate; head longer than broad, rather narrowed forward; profile rather steep, pretty evenly convex; dorsal region more or less elevated; mouth wide, the lower jaw projecting beyond the upper; barbels long; anal fin moderate, of about 20 rays; caudal fin truncate; color blackish, belly pale; head $3\frac{1}{2}$ to 4 in length; depth $4\frac{1}{2}$ to 5; D. I, 6; A. 20. Length 1 to $1\frac{1}{2}$ feet.

Habitat, Great Lake Region and Mississippi Valley to Manitoba. Not uncommon.

Diagnosis.—This is the only species of *Amiurus* in which the lower jaw is the longer. From *Pelodichthys olivaris* it may be known by the longer anal fin, as well as by the very different form and coloration.

Habits.—This species is not very common in Ohio. It is taken in Lake Erie with *Amiurus catus*, and occasionally in the Ohio River. It is sold as a food fish with the ordinary "Bull-head."

18. AMIURUS MARMORATUS (Holbrook) Jordan.

Marbled Catfish.

Pimelodus marmoratus, HOLBROOK (1855), Journ. Acad. Nat. Sci. Phila., 54.

Amiurus marmoratus, JORDAN (1877), Bull. U. S. Nat. Mus., x, 89; (1878) Man. Vert., ed 2d., 332, 407.

Description.—Body rather stout and chubby; head moderately broad, with a nearly even slope from the elevated base of the dorsal to the snout; mouth rather wide; jaws about equal; barbels long, branchiostegals 10; dorsal spine high, more than half the length of head, inserted nearer the adipose fin than the snout; adipose fin very large; caudal fin truncate; coloration usually variegated, the ground color dark, sharply mottled with brown, greenish, and whitish, the coloration sometimes nearly plain; head $3\frac{1}{2}$ in length; depth 4; D. I, 6; A. 20. Length $1\frac{1}{2}$ feet.

Habitat, Southern Illinois to Florida, chiefly in lowland streams.

Diagnosis.—The color of this species is usually sufficiently distinctive; when this is obliterated it cannot be readily separated from *A. melas*.

Habits.—This species occurs in the Lower Ohio, but it has not yet been noticed in the limits of the State. Nothing distinctive is known concerning its habits, except that it is a species of the bayous, and its range is chiefly southward.

19. AMIURUS MELAS (Rafinesque) Jordan and Copeland.

Small Black Catfish.

Silurus melas, RAFINESQUE (1820), Quart. Journ. Sci. Lit. and Arts, Lond., 51.

Pimelodus melas, RAFINESQUE (1820), Ich. Oh., 66.

Amiurus melas, JORDAN and COPELAND (1876), Check List, 195.—JORDAN (1877), Bull. U. S. Nat. Mus., x, 89; (1878) Man. Vert., Ed. 2d, 332.

Pimelodus catulus, GIRARD (1859), U. S. Pac. R. R. Surv., 208.

Pimelodus confinis, GIRARD (1859), Proc. Acad. Nat. Sci. Phila., 159.

Amiurus obesus, GILL (1862), Proc. Bost. Soc. Nat. Hist., 45.—GILL (1876), Ich., Capt. Simpson's Expd., 420.

Description.—Body very stout, short and deep; head moderate, somewhat contracted forwards, the front steeply elevated, the body thick across the shoulders, rather rapidly narrowed behind; jaws nearly equal; dorsal fin inserted nearer adipose fin than snout; anal basis nearly 5 in length of body, the fin short and deep; color very dark or blackish; membrane of anal fin almost always distinctly black, contrasting with the paler rays; head $3\frac{1}{2}$; depth $3\frac{1}{2}$ to 4; anal 18 to 20. Length 1 foot.

Habitat, Mississippi Valley and Great Lake region.

Diagnosis.—The short, chubby form and short and deep anal fin usually readily distinguish this species from the closely related *A. catus*.

Habits.—This small species is rather common in the Ohio River. It is confounded by the fishermen with *A. xanthocephalus* and *A. catus*.

20. AMIURUS CATUS Gill.

Bull-head; Hornpout; Catfish.

Silurus catus, LINNÆUS (1758), Syst. Nat., x, p. 305; (1766) xii, p. 504.—BLOCH. SCHN. (1801), 387.—MITCHILL (1818), Journal Lit. and Philos. Soc. N. Y., i, 433.

Pimelodus catus, CUV. and VAL. (1840), xv, 124.—DEKAY (1842), Fishes N. Y., 182.—STORER (1846), Synopsis, 402.

Amiurus catus, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—GUNTHER (1864), Cat. Fishes, v, 99 (excl. syn. pars).—UHLER and LUGGER (1876), Fishes of Maryland, 152.—JORDAN (1877), Bull. U. S. Nat. Mus., x, 90; Man. Vert. E. U. S., 332.

Pimelodus nebulosus, LESUEUR (1819), Mem. du Museum, v, 149.—STORER (1838), Rept. Fishes Mass., 102.

Amiurus nebulosus, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—COPE (1870), Proc. Am. Philos. Soc., 485.

Pimelodus atrarius, DEKAY (1842), Fishes N. Y., 185.—STORER (1846), Synopsis, 404; (1855) Fishes of Mass., 279.

Amiurus atrarius, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—JORDAN (1876), Man. Vert., 30.—NELSON (1876), Bull. Ills. Mus. Nat. Hist., 50.—JORDAN and COPELAND (1876), Check List, 159.—JORDAN (1877), Proc. Acad. Nat. Sci. Phila., 46.

Pimelodus felis, AGASSIZ (1850), Lake Superior, 261.

Amiurus felis, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.

Pimelodus hoyi, GIRARD (1859), Proc. Acad. Nat. Sci. Phila., 159.

Amiurus hoyi, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—COPE (1870), Proc. Am. Philos.

Soc., 486.—JORDAN (1876), *Man. Vert.*, 301.—JORDAN and COPELAND (1876), *Check List*, 159.

Pimelodus vulpeculus, GIRARD (1859), *Proc. Acad. Nat. Sci. Phila.*, 160.

Amiurus vulpeculus, GILL (1862), *Proc. Bost. Soc. Nat. Hist.*, 44.

Amiurus missillensis, COPE (1870), *Proc. Am. Philos. Soc.*, 486.—JORDAN and COPELAND (1876), *Check List*, 159.

Description.—Body rather elongate; head rather broad, the front moderately steep, the slope from snout to dorsal being nearly an unbroken line; upper jaw longer than lower; anal fin with 21 or 22 rays, its base $4\frac{1}{2}$ in length of body; dorsal spine usually inserted rather nearer adipose fin than snout; head 4; depth 4 to $4\frac{1}{2}$ in length; color dark yellowish brown, varying to black, the belly white, with a tinge of yellow. Length 1 to 2 feet.

Habitat, Great Lake region to Maine and South Carolina, the commonest Cat-fish northward and east of the Alleghany Mountains.

Diagnosis.—The common Bullhead may be known by the presence of 21 or 22 anal rays, a projecting upper jaw, and a truncate or a very slightly emarginate caudal fin.

Habits.—This is the commonest of the Cat-fishes in Lake Erie and its tributaries, abounding in every brook and pond. In the Ohio River it is very much less common, its place being taken by the closely related *melas* and *xanthocephalus*. It does not reach a large size, but is a very fair food fish.

Thoreau speaks of the Horned-pout as a dull and blundering fellow, like the Eel, vespertinal in its habits, and fond of the mud. It bites deliberately, as if about its business. They are extremely tenacious of life, opening and shutting their mouths for half an hour after their heads have been cut off. A blood-thirsty and bullying race of rangers, inhabiting the river bottoms, with ever a lance in rest, and ready to do battle with their nearest neighbor. I have observed them in summer, when every other one had a scar upon his back, where the skin was gone, the mark of some fierce encounter. Sometimes the fry, not an inch long, are seen darkening the shore with their myriads.

The following vigorous description of the habits of *Amiurus catus*, and of its claims on the attention of the Fish Commission, is from the editor of the *Milwaukee Sun*. Although written as a burlesque, it gives a vivid and truthful idea of the "game" qualities of the Bull-head:

It seems that the action of the Milwaukee common council in withdrawing the use of the water works from the fish commissioners will put a stop to the hatching of white fish. This is as it should be. The white fish is an aristocratic fish that will not bite a hook, and the propagation of this species of fish is wholly in the interest of wealthy owners of fishing tubs, who have nets. By strict attention to business they can catch all of the white fish out of the lake a little faster than the State machine can put them in. Poor people can not get a smell of white fish. The same may be said of brook trout.

While they will bite a hook, it requires more machinery to catch them than ordinary people can possess without mortgaging a house. A man has got to have a morocco book of expensive flies, a fifteen dollar bamboo jointed rod, a three dollar trout basket, with a hole morticed in the top, a corduroy suit made in the latest style, top boots of the Wellington pattern, with red tassels in the straps, and a flask of Otard brandy in a side pocket. Unless a man is got up in that style a speckled trout will see him in Chicago first, and then it won't bite. The brook trout is even more aristocratic than the white fish, and should not be propagated at public expense.

But there are fish that should be propagated in the interest of the people. There is a species of fish that never looks at the clothes of the man who throws in the bait, a fish that takes whatever is thrown to it, and when once hold of the hook never tries to shake a friend, but submits to the inevitable, crosses its legs and says, "Now I lay me," and comes out on the bank and seems to enjoy being taken. It is a fish that is the friend of the poor, and one that will sacrifice itself in the interest of humanity. That is the fish that the State should adopt as its trade-mark, and cultivate friendly relations with and stand by. We allude to the Bull-head.

The Bull-head never went back on a friend. To catch the Bull-head it is not necessary to tempt his appetite with porter-house steak, or to display an expensive lot of fishing tackle. A pin hook, a piece of liver, and a cistern pole is all the capital required to catch a Bull-head. He lies upon the bottom of a stream or pond in the mud thinking. There is no fish that does more thinking, or has a better head for grasping great questions, or chunks of liver, than the Bull-head. His brain is large, his heart beats for humanity, and if he can't get liver, a piece of tin tomato can will make a meal for him. It is an interesting study to watch a boy catch a Bull-head. The boy knows where the Bull-head congregates, and when he throws in his hook it is dollars to buttons that "in the near future" he will get a bite.

The Bull-head is democratic in all its instincts. If the boy's shirt is sleeveless, his hat crownless, and his pantaloons a bottomless pit, the Bull-head will bite just as well as though the boy is dressed in purple and fine linen, with knee-breeches and plaid stockings. The Bull-head seems to be dozing on the muddy bottom, and a stranger would say that he would not bite. But wait. There is a movement of his continuation, and his cow-catcher moves gently toward the piece of liver. He does not wait to smell of it, and canvass in his mind whether the liver is fresh. It makes no difference to him. He argues that here is a family out of meat. "My country calls and I must go," says the Bull-head to himself, and he opens his mouth and the liver disappears.

It is not certain that the boy will think of his bait for half an hour, but the Bull-head is in no hurry. He is in the mud and proceeds to digest the liver. He realizes that his days will not be long in the land, or water, more properly speaking, and he argues that if he swallows the bait and digests it before the boy pulls him out, he will be just so much ahead. Finally, the boy thinks of his bait, pulls it out, and the Bull-head is landed on the bank, and the boy cuts him open to get the hook out. Some fish only take the bait gingerly, and are only caught around the selvage of the month, and they are comparatively easy to dislodge. Not so with the Bull-head. He says if liver is a good thing, you can't have too much of it, and it tastes good all the way down. The boy gets down on his knees to dissect the Bull-head, and get his hook, and it may be that the boy swears. It would not be astonishing, though he must feel, when he gets his hook out of the hidden recesses of the Bull-head like the minister who took up a collection and didn't get a cent, though he expressed thanks at getting his hat back. There is one drawback to the Bull-head, and that is his horns. We doubt if a boy ever

descended into the patent insides of a Bull-head to mine for limerick hooks, that did not, before the work was done, run a horn into his vital parts. But the boy seems to expect it, and the Bull-head enjoys it. We have seen a Bull-head lie on the bank and become dry, and to all appearances dead to all that was going on, and when a boy sat down on him, and got a horn in his elbow, and yelled murder, the Bull-head would grin from ear to ear, and wag his tail as though applauding for an *encore*.

The Bull-head never complains. We have seen a boy take a dull knife and proceed to follow a fish line down a Bull-head from head to the end of his subsequent anatomy, and all the time there would be an expression of sweet peace on the countenance of the Bull-head, as though he enjoyed it. If we were preparing a picture representing "Resignation," for a chromo to give to subscribers, and wished to represent a scene of suffering, in which the sufferer was light-hearted, seeming to recognize that all was for the best, we should take for the subject a Bull-head, with a boy searching with a knife for a long-lost fish hook.

The Bull-head is a fish that has no scales, but in lieu thereof has a fine India rubber skin, that is as far ahead of fiddle-string material for strength and durability as possible. The meat of the Bull-head is not as choice as that of the Mackerel, but it fills up a stomach just as well, and The *Sun* insists that the fish commissioners shall drop the hatching of aristocratic fish, and give the Bull-heads a chance.

21. AMIURUS XANTHOCEPHALUS (Rafinesque) Gill.

Small Yellow Catfish.

Silurus xanthocephalus, RAFINESQUE (1820), Quart. Journ. Sci. Lit. and Arts, London, 51.

Pimelodus xanthocephalus, RAFINESQUE (1820), Ich. Ohiensis, 66.—KIRTLAND (1838), Rept. Zool. Ohio, 169, 194.—STORER (1846), Synopsis, 405.

Amiurus xanthocephalus, GILL (1862), Proc. Bost. Soc. Nat. Hist., 44.—JORDAN and COPELAND (1876), Check List, 159.—JORDAN (1877), Ann. Lye. Nat. Hist., N. Y.,—

Pimelodus catus, KIRTLAND, Bost. Journ. Nat. Hist., v, 330 (excl. syn.).

Amiurus albidus, JORDAN (1876), Man. Vert., 302 (not *Pimelodus albidus* LeSueur).—NELSON (1876), Bull. Ills. Mus. Nat. Hist., 50.

Amiurus nebulosus, JORDAN (1877), Proc. Acad. Nat. Sci. Phila., 45.

Description.—Body stout and deep, much as in *A. natalis*, head very broad, about as broad as long, the slope from snout to base of dorsal quite uneven, there being a more or less decided angle at the occiput; mouth very broad; dorsal spine inserted nearer adipose fin than snout; anal fin short and low, its rays usually 19; caudal fin truncate or slightly emarginate; coloration rather pale yellowish brown; head 4 in length; depth 4 to 4½. Length 1 foot.

Habitat, Ohio Valley.

Diagnosis.—This species resembles *A. natalis*, but differs in the short anal fin. The broad head separates it from *A. catus*, and the anal fin is lower and smaller than in the latter species.

Habits.—This small species abounds in the ponds and bayous of Southern Ohio and Indiana. I have not noticed it in any of the streams tributary to Lake Erie. Its habits offer nothing distinctive.

GENUS 12. PELODICHTHYS. Rafinesque.

Pilodictis, Rafinesque (1819), *Prodrome de Soixante dix Genres, etc.*, in *Journal de Physique, de Chymie, et d'Histoire Naturelle*, Paris, 422.

Leptops, RAFINESQUE (1820) *Ichthyologia Ohiensis*, 64.

Opladelus, RAFINESQUE (1820), *Ichthyologia Ohiensis*, 64.

Ilictis, RAFINESQUE (1820), *Ichthyologia Ohiensis*, 66.

Pylodictis, RAFINESQUE (1820), *Ichthyologia Ohiensis*, 67.

Hopladelus, GILL (1862), *Proc. Bost. Soc. Nat. Hist.*, 45, and of most late authors.

Pelodichthys, GILL and JORDAN, MSS.—JORDAN (1876), *Ann. Lyc. Nat. Hist.*, N. Y., —.

Pimelodus sp., KIRTLAND, CUV. and VAL., et Auct.

Etymology, *pelos*, mud; *ichthus*, fish.

Type, *Pilodictis limosis*, Raf. = *Silurus olivaris*, Raf.

Body much elongated, very slender, much depressed, anteriorly broader than high; head large, very wide and depressed, laterally expanded, above broadly ovate, and in profile cuneiform; skin very thick, entirely concealing the skull; supraoccipital bone entirely free from the head of the second interspinal; eyes small; mouth very large, anterior and transverse; the lower jaw always projects beyond the upper; teeth in broad villiform bands on the intermaxillaries and dentaries; the intermaxillary band is convex anteriorly, and proceeds to the insertion of the maxillaries, where it is abruptly angularly deflected, and proceeds backward as an elongated triangular extension. The band at the symphysis is slightly divided and anteriorly separated by a small triangular extension of the labial membrane; the lower dental is anteriorly semicircular and attenuated to the corners of the mouth; there are about twelve branchiostegal rays on each side; the dorsal fin is situated over the posterior half of the interval between the pectorals and ventrals, and has a spine and about seven branched rays; the spine is rather small, and more or less enveloped in the thick skin; the adipose fin is large, and has an elongated base resting over the anal; it is very obese and inclines rapidly backward; it is rather less free posteriorly than in *Amiurus*; the anal fin is small; it commences far behind the anus, is a little longer than high, and is composed of about fourteen rays; the caudal fin is oblong, subtruncated, placed on a vertical basis, and with numerous accessory simple rays, recurrent above and beneath the caudal peduncle; the pectorals have a broad, compressed spine, serrated or dentated on its external and internal margins, and with the prolonged fleshy integument obliquely striated; the ventrals are rounded and have nine rays, one simple and eight branched; vent well behind ventrals, much in advance of anal; coloration brown or yellowish, more or less marbled or spotted. But one species is yet known.

22. PELODICHTHYS OLIVARIS (Rafinesque) Gill and Jordan.

Mud Catfish.

Silurus olivaris, RAFINESQUE (1818), *Am. Monthly Mag.*, iii, Sept., 355.

Hopladelus olivaris, GILL (1862), *Proc. Bost. Soc. Nat. Hist.*, 45.—COPE (1867), *Journ.*

Acad. Nat. Sci. Phila., 237.—JORDAN (1876), *Man. Vert.*, 303; (1877), *Proc. Acad.*

Nat. Sci. Phila., 46.—NELSON (1877), *Bull. Ills. Mus. Nat. Hist.*, 50.—GILL (1876),

Ich. Capt. Simpson's Expl., 426.—JORDAN and COPELAND (1876), *Check List*, 170.

Pelodichthys olivaris, JORDAN (1876), *Ann. Lyc. Nat. Hist.*, N. Y., —; *Bull. U. S. Nat.*

Mus., x, 1877, 95; *Man. Vert.*, 2d Ed., 1878, 334.

- Glanis limosus*, RAFINESQUE (1818), Am. Monthly Mag., iii, 447, and iv, 107 (name only).
Pilodictis limosus, RAFINESQUE (1819), Journ. de Physique, 422.
Pylodictis limosus, RAFINESQUE (1820), Ich. Ohiensis, 67.
Silurus nebulosus, RAFINESQUE (1820), Quart. Journ. Sci. Lit. and Arts, London, 50.
Pimelodus nebulosus, RAFINESQUE (1820), Ich. Oh., 64.
Silurus viscosus, RAFINESQUE (1820), Quart. Journ. Sci. Lit. and Arts, 50.
Pimelodus viscosus, RAFINESQUE (1820), Ich. Oh., 66.
Silurus limosus, RAFINESQUE (1820), Quart. Journ. Lit. and Arts, 51.
Pimelodus limosus, RAFINESQUE (1820), Ich. Oh., 67.—KIRTLAND (1846), Bost. Journ. Nat. Hist., iv, 335.—STORER (1846), Synopsis, 404.
Pimelodus punctulatus, CUV. and VAL. (1840), xv, 134.—DEKAY (1842), Fishes, N. Y., 187.—STORER (1846), Synopsis, 403.—GUNTHER (1864), Cat. Fishes, v, —.
Pimelodus æneus, CUV. and VAL. (1840), xv, 135.—DEKAY (1842), l. c.—STORER (1846), l. c., 403.

Description.—Body very long and slender, depressed forwards, closely compressed behind; head extremely flat, the lower jaw the longer; barbels short; dorsal spine small, half the height of the fin, enveloped in thick skin; pectoral spine very strong, flattened, serrate behind; caudal fin somewhat emarginate; anal fin short, its base about 7 in body; coloration mottled brown and yellowish, whitish below; head, $3\frac{1}{2}$ in length; depth, $5\frac{1}{2}$; D., I, 7; A., 15. Length, 2 to 3 feet.

Habitat, Ohio Valley to Iowa and southward, abundant in the larger streams.

Diagnosis.—The flat head and strongly projecting jaw distinguish this species at once from our other Catfishes.

Habits.—This species abounds in the Ohio River and its larger tributaries. It reaches a larger size than any other except *Amiurus nigricans* and is used for food, although its unattractive exterior causes it to be less valued than the other large species. As its name indicates, it is pre-eminently a mud loving species.

GENUS 13. NOTURUS. Rafinesque.

Noturus, RAFINESQUE (1818), Am. Monthly Mag., iv, 41.

Schilbeodes, BLEEKER (1858), Ichthyologiæ Archipelagi Indici Prodromus, vol. i, Siluri (Acta Societatum Indo-Nederlandicæ, vol. iv), 258, (*S. gyrimus*, Mit.).

Etymology, *notos*, back; *oura*, tail (means tail over back, Raf.).

Type, *Noturus flavus*, Raf.

Body more or less elongate, anteriorly subcylindrical, thence more or less compressed; head above ovate and depressed, with a slight longitudinal furrow, branching into a transverse depression on the nape; skin very thick, entirely concealing the bones; Supraoccipital entirely free from the head of the second interspinal; eyes small or of moderate size; mouth anterior, rather large, and transverse; upper jaw usually more or less projecting beyond the lower; teeth subulate, closely set in a broad band in each jaw, the lower one interrupted, the upper continuous; branchiostegale nine; dorsal fin situated over the posterior half of the interval between the pectoral and ventral fins, with a sharp, short, entire spine, and seven branched rays; adipose fin long and low, keel-like, its posterior lower margin being adnate to the tail, and usually connected with the caudal fin; caudal fin obliquely truncated or rounded, inserted on an

obliquely rounded base; numerous rudimentary rays in front of it both above and below; anal fin short, with 12 to 20 rays; ventrals rounded, nine rayed; pectoral fins with a sharp spine, either smooth, grooved or dentate behind; vent some distance in front of anal fin; lateral line complete.

The species are numerous and of small size. The group is less homogeneous than *Ichthælorus* and *Amiurus*.

ANALYSIS OF SPECIES OF NOTURUS.

*Premaxillary band of teeth with a strong backward process on each side (subgenus *Noturus*).

a. Pectoral spine serrate in front, nearly entire behind; adipose fin notched.

FLAVUS. 23.

**Premaxillary band of teeth without lateral backward processes (subgenus *Schilbeodes*).

b. Pectoral spine serrate behind, rough in front; adipose fin notched.

c. Pectoral spines shortish, about one-third length of head, weakly serrate; jaws equal. EXILIS. 24.

cc. Pectoral spines very strong, more than half length of the head; upper jaw longer. MIURUS. 25.

bb. Pectoral spine grooved behind; adipose fin high and continuous; stout.

STALIS. 26.

23. NOTURUS FLAVUS Rafinesque.

Yellow Stone Cat; Common Stone Cat.

Noturus flavus, RAFINESQUE (1818), Am. Monthly Mag. and Critical Review, p. 41; Ich. Oh., 1820, 68.—KIRTLAND (1838), Rept. Zool. Ohio, 167, 195; Bost. Journ. Nat. Hist., iv, 1846, 336.—STORER (1846), Synopsis, 406.—GILL (1862), Proc. Bost. Soc. Nat. Hist., 45.—COPE (1864), Proc. Acad. Nat. Sci. Phila., 277; Journ. Acad. Nat. Sci. Phila., 1869, 237.—GUNTHER (1864), Cat. Fishes, vi, 104.—UHLER and LUGGER (1876), Fishes Maryland.—JORDAN (1877), Ann. Lyc. Nat. Hist., N. Y.,—

Noturus luteus, RAFINESQUE (1819), Journ. de Physique, 421.—JORDAN (1877), Bull. U. S. Nat. Mus., x., 99; Man. Vert., 2d. ed., 1878, 335.

Noturus occidentalis, GILL (1862), Proc. Bost. Soc. Nat. Hist., 45; (1876) Capt. ? Simpson's Rept., 423.—JORDAN and COPELAND (1876), Check List, 160.

Noturus platyocephalus, GUNTHER (1864), Catalogue Fishes, v, 104.—JORDAN and COPELAND (1876), Check List, 160.

Description.—Body elongate; head depressed, broad and flat, nearly as broad as long; middle region of body subcylindrical; tail compressed; a strong keel on the back behind the dorsal, leading to the adipose fin; adipose fin deeply notched, but continuous with the caudal fin; dorsal spine very short; pectoral spine retrorsely serrated in front, slightly rough or nearly entire behind, its length contained three times in distance from snout to dorsal; color nearly uniform yellowish-brown, sometimes blackish above; fins yellowish edged; head, $4\frac{1}{2}$; width of head, $5\frac{1}{2}$; depth, $2\frac{3}{4}$; distance from snout to dorsal 3; anal rays, 16. Length, 10 to 15 inches.

Habitat, Canada to Virginia, Missouri, and Montana, abounding in the larger streams.

Diagnosis.—This species may be known from the other Stone Cats by its greater size, and by the U-shaped band of premaxillary teeth.

Habits.—Like the other Stone Cats, this is a sluggish fish, lurking under stones and logs. It is much more abundant in the Ohio and its immediate tributaries than in the streams of the interior. Although much the largest species of the genus, it is too small to be valued as food.

24. NOTURUS EXILIS Nelson.

Slender Stone Cat.

Noturus exilis, NELSON (1876), Bull. Ills. Mus. Nat. Hist., 51.—JORDAN and COPELAND (1876), Check List, 160.—JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y. —; Bull. U. S. Nat. Mus., x, 1877, 10; Man. Vert. E. U. S., 2d. Ed., 1878, 335.

Description.—Body elongated, the head small, narrow, very much depressed; the jaws nearly equal; premaxillary band of teeth without backward processes; dorsal spine low, nearer snout than anal; pectoral spines short, nearly straight, about one-third length of head, slightly retrorse, serrate without, with about six small straight teeth within, which are not one-third as long as the spine is broad; color pale yellowish-brown, nearly plain; tip of dorsal black; head $4\frac{1}{2}$ in length; depth about 6; distance from snout to dorsal 3 1-5 in length; anal rays 14 or 15. Length, 3 to 5 inches.

Habitat, Indiana to Missouri and Kansas, not yet noticed in Ohio.

Diagnosis.—This species may be known from the other Ohio species by the small, rough pectoral spines, and by the nearly equal jaws.

Habits.—This species has not yet been noticed east of the tributaries of the Illinois, but as it will probably be found in Ohio, it is inserted here. It is one of the smallest and most slender species, and its habits offer nothing distinctive.

25. NOTURUS MIURUS Jordan.

Variegated Stone Cat.

Noturus miurus, JORDAN, MSS.—JORDAN and COPELAND (1876), Check List, 160.—JORDAN (1877), Ann. Lyc. Nat. Hist., 46 (name only); Ann. Lyc. Nat. Hist. N. Y., 1877, —; Bull. U. S. Nat. Mus., x, 1878, 100; Man. Vert., 2d. Ed., 1878, 336.

Description.—Body moderately elongate, the dorsal region more or less elevated; head moderate, the upper jaw the longer; pectoral spines very strong, curved, their inner serræ very strong, spine-like, more than half as long as the spine is broad; adipose fin continuous, high, interrupted by a deep notch which does not, however, break the continuity of the fin; the rudimentary caudal rays beginning in the notch; color grayish, the back with four definite, broad, dark cross-bars; one before the dorsal, one behind it, one on the middle of the adipose fin, and one small one behind; top of head, and tips of fins black; distance from snout to dorsal $2\frac{3}{4}$ in length; pectoral spine $2\frac{1}{3}$ in this distance; head $3\frac{1}{2}$ to 4; depth $4\frac{1}{2}$ to 5; A. 12 or 13. Length 3 or 4 inches.

Habitat, Ohio Valley to Great Lake region and south to Louisiana.

Diagnosis.—From the other Ohio Cat-fishes, this species may be known by the large, saw-like pectoral spine, and by the variegated coloration.

Habits.—This pretty little fish abounds in most of the small streams of Ohio, especially southward. It is found under stones and logs. It is an attractive species for the aquarium.

26. NOTURUS SIALIS Jordan.

Chubby Stone Cat.

Noturus sialis, JORDAN (1877), Bull. U. S. Nat. Mus., x, 102; Man. Vert., 2d. Ed., 1878, 337.

Description.—Body short and thick, compressed behind; head very large and broad, less depressed than in the others; spines stout and rather long, those of the pectoral fins straight, about half the length of the head, $2\frac{1}{2}$ in the distance to the dorsal fin; smooth externally, grooved within; dorsal higher than long, its insertion nearer anal fin than snout; adipose fin high and continuous, not at all notched; barbels short, the lower darker; color nearly uniform yellowish brown, without dark bars or blotches; a conspicuous narrow black lateral streak and sometimes two dorsal streaks; head, $3\frac{1}{2}$ to 4; depth 4 to 5; distance from snout to dorsal $2\frac{1}{2}$; width of head $3\frac{1}{2}$. Length, 3 or 4 inches.

Habitat, Mississippi Valley to Red River of the North.

Diagnosis.—This species may be known by its chubby form, its plain, pale coloration, and by the absence of serrations on the pectoral spine.

Habits.—The habits of this species are similar to those of *N. miurus*. The two species reach about the same size; they are usually found together and are about equally abundant in Ohio.

ORDER 8. TELEOCEPHALI. THE TYPICAL FISHES.

This order comprises the vast majority of recent fishes, and is characterized rather negatively as wanting the peculiarities of the other orders, than as having any positive traits of its own. In general, the maxillaries are normally developed, and distinct from the premaxillaries, not forming the base of a long barbel. The gills are of the ordinary pattern, and the gill openings are in front of the pectorals and not usually very narrow; the opercle, subopercle, preopercle, and interopercle are all developed. This group includes the various soft-rayed fishes, with the ventrals abdominal, the scales generally cycloid and the air-bladder connected by a duct with the alimentary canal, the *Malacopteri* or *Physostomi* of authors, and the spinous rayed fishes, with the ventrals thoracic, the scales usually ctenoid and the air bladder without duct, the *Acanthopteri* or *Physochysti* of authors, as well as a large number of forms variously intermediate or aberrant (*teleos*, perfect; *kephale*, head; the skull having all its parts developed).

ARTIFICIAL KEY TO THE FAMILIES OF TELEOCEPHALI FOUND IN OHIO.

*Ventral fins present, abdominal.

† Rayed dorsal fin single : no spines.

a. Adipose fin present.

b. Scales ctenoid ; lateral margins of upper jaw formed by pre-maxillaries alone.

PERCOPSIDÆ. 14.

bb. Scales cycloid ; lateral margins of upper jaw formed by maxillaries.

SALMONIDÆ. 13.

aa. Adipose fin wanting.

c. Abdomen compressed to a sharp edge, which is armed with hard plates or serratures.

d. Mouth small, the upper jaw the longer ; maxillary simple.

DOROSOMATIDÆ. 10.

dd. Mouth rather large, the jaws about equal ; maxillary in three parts.

CLUPEIDÆ. 11.

cc. Abdomen not serrated.

e. Jaws toothless ; pharyngeals falciform.

f. Dorsal rays 11 or more ; pharyngeal teeth very numerous in a single row.

CATOSTOMIDÆ. 8.

ff. Dorsal rays 7 to 9 ; pharyngeal teeth few.

CYPRINIDÆ. 9.

ee. Jaws with teeth.

g. Vent normal, behind the ventrals ; eyes developed.

h. Head naked ; teeth strong ; scales large, silvery. HYODONTIDÆ. 12.

hh. Head scaly more or less ; dorsal fin inserted posteriorly, opposite anal or nearly so.

i. Upper jaw not protractile.

j. Jaws very long, armed with strong unequal, movable teeth.

ESOCIDÆ. 18.

jj. Jaws short, armed with bands of small teeth.

UMBRIDÆ. 17.

ii. Upper jaw extremely protractile ; head flattened above ; mouth small ; caudal rounded.

CYPRINODONTIDÆ. 16.

gg. Vent jugular, before the ventral fins ; eyes concealed.

AMBLYOPSIDÆ. 15.

†† Rayed dorsal fins two, the anterior of a few feeble spines ; body elongate, with a silvery lateral band.

ATHERINIDÆ. 19.

**Ventral fins present, thoracic or jugular.

a. Skin covered with scales.

b. Anterior three or more rays of dorsal fin spinous ; ventrals thoracic.

c. Dorsal with more than five spines.

d. Vomer with teeth.

e. Branchiostegal 7 ; dorsal fins two ; preopercle wanting.

PERCIDÆ. 24.

ee. Branchiostegals 6 ; preopercle nearly or quite entire.

f. Anal spines one or two ; dorsal fins two.

ETHEOSTOMATIDÆ. 23.

ff. Anal spines three to nine ; dorsal fin continuous.

CENTRARCHIDÆ. 22.

dd. Vomer toothless ; anal spines two.

g. Second anal spine not larger than first.

ETHEOSTOMATIDÆ. 23.

- gg. Second anal spine many times as large as the first. SCIENIDÆ. 25.
 cc. Doral fin continuous, with less than five spines.
 h. Vent anterior, near or in front of ventrals; bones of head serrated. APHODODERIDÆ. 20.
 hh. Vent normal; bones of head entire. . . . ELASSOMATIDÆ. 21.
 bb. Anterior dorsal of soft rays only; a barbel at tip of lower jaw. GADIDÆ. 27.
 aa. Skin naked or prickly; head broad; dorsal fins two. . . . COTTIDÆ. 26.

FAMILY VIII. CATOSTOMIDÆ. THE SUCKERS.

Body oblong or elongated, covered with cycloid scales of moderate or large size; head moderate, naked, the opercular bones normally developed; nostrils double; mouth commonly more or less inferior, usually with thickened lips; the upper jaw is formed in the middle by the small, lamelliform premaxillaries and on the side by the maxillaries; no barbels; no teeth in the jaws; pharyngeal bones falciform, with a single row of many compressed teeth which grow smaller upward; branchial openings restricted to the sides, separated by a broad isthmus; branchiostegals three; dorsal variously developed, the number of rays from nine to fifty; anal short and high; caudal emarginated or forked; pectorals placed low; ventrals abdominal; intestinal canal very long; stomach simple, without pyloric cœca; air bladder large, not protected by a bony capsule, divided by transverse constrictions into two or three regions. Fishes of the fresh water, all but two of the known species being American. The latest authority on the group (Jordan, Bull. U. S. Nat. Mus., xii, 1878) recognizes 55 species, arranged in 13 genera. These fishes feed chiefly on vegetable substances, and on worms, ova, insect larvæ, crustaceans, and small mollusks. All are used as food, but none of them are much valued as the flesh is coarse, soft, tasteless, and full of small bones. The young of some of the species abound in every brook and pond in the State of Ohio, and they form one of the most characteristic features of our fish fauna.

ANALYSIS OF GENERA OF CATOSTOMIDÆ.

- *Dorsal fin elongated, more or less elevated in front, of 25 or more rays; air bladder in two parts.
 †Fontanelle present; body oblong ovate; scales large; head large.
 a. Mouth large, terminal, protractile forwards; lips thin, nearly smooth. ICHTHYOBUS. 14.
 aa. Mouth small, subinferior, protractile downward.
 b. Pharyngeal bones strong, the teeth coarse and large, increasing in size downward. BUBALICHTHYS. 15.
 bb. Pharyngeal bones, narrow, their teeth thin and weak. CARPIODES. 16.
 ††Fontanelle obliterated by the union of the parietal bones; body elongate; scales small; head small. CYCLEPTUS. 17.
 **Dorsal fin short, subquadrate, with ten to eighteen rays; body oblong or elongate.
 c. Air bladder in two parts.
 d. Lateral line complete; lips papillose; scales moderate or small. CATOSTOMUS. 18.
 dd. Lateral line interrupted or wanting; lips plicate; scales large.

- e. Lateral line entirely wanting; mouth somewhat oblique. ERIMYZON. 19.
- ee. Lateral line incomplete, obsolete in the young, becoming more perfectly developed with age, but always interrupted; mouth inferior. MINYTREMA. 20.
- cc. Air bladder in three parts; lateral line developed.
- f. Mouth normal, the upper jaw protractile, the lower lip entire or lobed, usually plicate.
- g. Pharyngeal bones moderate, the teeth compressed, growing gradually larger downward; mouth rather small. . . . MYXOSTOMA. 21.
- gg. Pharyngeal bones very strong, with the lower teeth much enlarged, sub-cylindrical and truncate; upper teeth small and compressed; mouth large, oblique. . . . PLACOPHARYNX. 22.
- ff. Mouth singular, the upper lip not protractile, greatly enlarged, the lower lip developed as two separate lobes; operculum very short. QUASSILABIA. 23.

GENUS 14. ICHTHYOBUS. Rafinesque.

Amblodon, RAFINESQUE, *Journal de Physique de Chymie et d'Histoire Naturelle*, Paris, 421, 1819 (part).

Ichtyobus, RAFINESQUE, *Ich. Oh.*, 1820, p. 55. (As subgenus of *Catostomus*)

Ichthyobus, AGASSIZ, *Am. Journ. Sci. and Arts*, 1855, p. 195.

Type, *Amblodon bubalus*, RAFINESQUE.

Etymology, *ichthus*, fish; *bous*, bull or buffalo; i.e., buffalo-fish

Head very large and strong, wide and deep, its length $3\frac{1}{2}$ to $4\frac{1}{2}$ in that of the body, its upper surface broad and depressed; eye moderate, wholly anterior in position, the middle of the head being entirely behind it; suborbital bones proportionately narrow; fontanelle large, well open; opercular apparatus largely developed, the suboperculum broad, the operculum broad, strongly furrowed; mouth very large for a Sucker, terminal, protractile forwards, the middle of the premaxillaries rather above the line of the middle of the eye, the posterior edge of the maxillary extending about to the line of the nostrils; mandible very strong, oblique, placed at an angle of 45 degrees or more when the mouth is closed, its posterior end extending to beyond opposite the front of the eye, its length a little less than one-third that of the head; lips very little developed, the upper narrow and smooth, scarcely appreciable, the lower narrow, rather full on the sides, but reduced to a narrow rim in front, entirely destitute both of papillæ and plicæ; jaws without cartilaginous sheath; muciferous system of head well developed; isthmus narrow; pharyngeal bones in form intermediate between those of *Carpiodes* and those of *Bubalichthys*, the outer surface of the arch standing outwards, and presenting a porous outer margin; the peduncle of the symphysis is much longer proportionally, and more pointed than in *Carpiodes* and *Bubalichthys*. The teeth are very numerous, small, thin and compressed as in *Carpiodes*, but the lower ones are gradually larger than the upper ones; their inner edge slanting outward, and not uniformly arched as in *Bubalichthys*, or truncate as in *Cycleptus*, the innermost margin rising somewhat in the shape of a projecting cusp; gill-rakers of anterior arch long and slender above, becoming shorter downward; body heavy, robust, not especially arched above nor greatly compressed, the form somewhat elliptical, the depth $2\frac{1}{2}$ to $3\frac{1}{2}$ in the length of the body; scales large, thick, nearly equal over the body, their posterior edges somewhat serrate, the lateral

line well developed, but not as distinct as in *Carpiodes*, slightly decurved anteriorly, the number of scales in its course 36 to 42; 13 to 15 in a transverse series from dorsal to ventrals; dorsal fin with an elongate basis, its number of rays 25 to 30, the anterior rays somewhat elevated, their length about half that of the base of the fin; caudal not much forked; anal fin not much elevated, its rays about 9 in number; pectorals and ventrals moderate, the latter with about 10 rays; sexual peculiarities, if any, unknown; coloration dark, not silvery, above dusky olive; lower fins more or less black; air bladder with two chambers; size very large. But one species is certainly known.

27. *ICHTHYOBUS BUBALUS* (Rafinesque) Agassiz.

Red-mouth Buffalo Fish; Large-mouthed Buffalo.

Ambloodon bubalus, RAFINESQUE, Journal de Physique, 1818, 421.

Catostomus bubalus, RAFINESQUE, Am. Month. Mag. and Crit. Rev., 1818, 354; Ich. Oh., 1820, 55.

Ichthyobus bubalus, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 196.—JORDAN, Fishes of Ind., 1875, 222; Bull. Buffalo Soc. Nat. Hist., 1876, 95; Man. Vert., 1876, 298; Proc. Acad. Nat. Sci. Phila., 1877, 72; Bull. U. S. Nat. Mus., ix, 1877, 34; Man. Vert., 2d Ed., 1878, 322; Bull. U. S. Nat. Mus., xii, 1878, 214.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's Rept., 1876, 53.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 49.

Sclerognathus cyprinella, CUVIER and VALENCIENNES, Hist. Nat. des Poissons, xvii, 1844, 477, pl. 518.—STORER, Synopsis, 1846, 428.—GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 24.

Ichthyobus cyprinella AGASSIZ, Am. Journ. Sci. Arts, 1855, 196.—JORDAN, Man. Vert., 1876, 298.—JORDAN and COPELAND, Check List, 1876, 158.

Ichthyobus rauchii, AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 1855, 196.—PUTNAM, Bull. Mus. Comp. Zool., 1863, 10.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's Rept., 1876, 53.—JORDAN, Man. Vert., 2d Ed., 1878, 323.

Ichthyobus stolleyi, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 196.—JORDAN and COPELAND, Check List, 1876, 158.

Ichthyobus ischyurus, NELSON, MSS.—JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 72.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's Rept., 1876, 53.—JORDAN, Man. Vert., 2d Ed., 1878.

Description.—Body robust, moderately compressed, the outline somewhat elliptical, but the back rather more curved than the belly; depth $2\frac{1}{2}$ to $3\frac{1}{2}$ in length; head very large and thick, $3\frac{1}{2}$ in length of body; opercular apparatus very strong, the operculum itself forming nearly half the length of the head; scales very large; developed rays of the dorsal 26 to 29; anal rays 9; ventral 10; scales 7-37 to 41-6; coloration dull brownish-olive, not silvery; fins dusky; size very large, reaches a length of nearly three feet and a weight of 20 to 30 pounds.

Habitat, Mississippi Valley, generally abundant in the larger streams.

Diagnosis—This species is at once distinguished from the other Buffalo Fishes by the large terminal mouth and very thin smooth lips.

Habits.—This species abounds in the Ohio River and its larger tribu-

taries in company with the species of *Bubalichthys* and *Carpiodes*. It reaches a considerable size, a well grown specimen weighing 15 to 25 pounds. It is used everywhere as food, and sells readily, but the flesh is full of small bones, scarcely worth the picking. According to Professor Forbes it feeds chiefly on *Entomostracans*.

GENUS 15. BUBALICHTHYS. Agassiz.

Bubalichthys, AGASSIZ, Am. Journ. Sci. Arts. 1855, 92.

Sclerognathus, GUNTHER, Cat. Fishes, Brit. Mus., vii, p. 22, 1868.

Catostomus et *Carpiodes*, sp. of authors.

Type, *Carpiodes urus*, Agassiz.

Etymology, *boubalos*, buffalo; *ichthus*, fish.

Head moderate or rather large, deep and thick, its superior outline rapidly rising, its length about four in that of the body; eye moderate, median or rather anterior in position; suborbital bones comparatively narrow; fontanelle always present and widely open; mouth moderate or small, more or less inferior, the mandible short, little oblique, or typically quite horizontal, the mandible less than one-third the length of the head; the premaxillaries in the closed mouth below the level of the lower part of the orbit; lips rather thin, thicker than in *Ichthyobus*, the upper protractile, narrow, plicate, the plicæ sometimes broken up into granules; lower lip comparatively full (for a Buffalo-fish), faintly plicate, the plicæ broken up into granules, the lower lip having the general \cap -shaped form seen in *Carpiodes*; jaws without cartilaginous sheath; muciferous system well developed; opercular apparatus well developed, but less so than in *Ichthyobus*, the operculum strongly rugose; isthmus moderate; pharyngeal bones triangular, with large teeth, which increase in size from above downward; teeth compressed, their grinding edge blunt, slightly arched in the middle, and provided with a little cusp along the inner margin, which is hardly detached from the crown, and does not rise above the surface; gill-rakers of anterior arch slender and stiff above, growing shorter downward; body ovate or oblong, the dorsal outline more or less arched, the sides of the body compressed, the ventral outline curved also, but to a less degree; scales very large, about equal over the body, their posterior outlines somewhat serrate; lateral line well developed, nearly straight, with 35 to 42 scales, 12 to 14 in a cross-series from ventrals to dorsal; dorsal fin beginning near the middle of the body, somewhat in advance of the ventrals, its anterior rays elevated, their height about equal to half the base of the fin, the number of rays in the dorsal fin ranging from 25 to 32; caudal fin well forked, the lobes about equal, not falcate; anal fin comparatively long and rather low, of eight or nine developed rays; ventrals moderate, 10 rayed; pectorals rather short; sexual peculiarities, if any, unknown; coloration dull dark-brown, nearly plain, not silvery; fins olivaceous or more or less dusky; air-bladder with two chambers; size quite large.

In general appearance, the species of *Bubalichthys* bear a considerable resemblance to those of *Carpiodes*. The form is, however, coarser than that of any *Carpiodes*, the dorsal fin is lower, and the coloration is darker and duller. The species reach a larger size than do those of *Carpiodes*, but whether larger or not than the species of *Ichthyobus* I am unable to say. In external appearance, *Bubalichthys* is intermediate between *Carpiodes* and *Ichthyobus*, the one species, *bubalus*, resembling *Carpiodes* most, the other, *urus*, being most like *Ichthyobus*.

28. BUBALICHTHYS URUS Agassiz.

Big-mouthed Buffalo; Black Buffalo; Mongrel Buffalo.

?? *Ambiodon niger*, RAFINESQUE, Journal de Physique, Phila., 1818, 421. (Entirely unrecognizable.)

?? *Catostomus niger*, RAFINESQUE, Ichth. Oh., 1820, 56. (Unrecognizable; more likely *CyCleptus elongatus*.)

Bubalichthys niger, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 195.—JORDAN, Fishes of Ind., 222, 1875; Bull. Buffalo Soc. Nat. Hist., 1876, 95; Man. Vert., 1876, 298.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 50.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN, Proc. Acad. Nat. Sci., Phila., 1877, 75.—JORDAN and GILBERT, in Klippart's Rept., 1876, 53.—JORDAN, Bull. U. S. Nat. Mus., ix, 1877, 34; Man. Vert., 2d Ed., 328.

Carpiodes urus, AGASSIZ, Am. Journ. Sci. Arts, 1854, 355.

Bubalichthys urus, AGASSIZ, Am. Journ. Sci. Arts, xix, 1855, 193.—PUTNAM, Bull. Mus. Comp. Zool., 1863, 10.—JORDAN, Fishes of Ind., 1875, 222; Bull. U. S. Nat. Mus., xii, 1878, 209.—JORDAN and COPELAND, Check List, 1876, 158.

Bubalichthys bonasus, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 195.—JORDAN and COPELAND, Check List, 1876, 158.

Description.—Body much less elevated and less compressed than in the preceding, the back not at all carinated; axis of body above ventrals about at the lateral line, and but very little farther from the dorsal outline than from the ventral; depth 3 to $4\frac{1}{2}$ in length; head very stout, strongly transversely convex, thicker, larger, and less pointed than in the next, about four in length; eye about equal to snout, $5\frac{1}{2}$ in head, much smaller than *B. bubalus*; mouth large, considerably oblique, opening well forward; mandible longer than eye; dorsal fin lower and less rapidly depressed than in the next, the longest ray scarcely half the length of the base of the fin; anal fin rounded, its rays not rapidly shortened, the middle ones not much shorter than the longest; colors very dark; fins all black; scales 8-41-7; dorsal 30; anal 10.

Habitat, Mississippi Valley, in all the larger streams.

Diagnosis.—From the other species of this genus, *B. urus* may be known by the larger mouth, and the less elevated and compressed body. Its colors are darker than those of any other of the Buffalo-fishes.

Habits.—This species occurs in the Ohio River and its larger tributaries, but is rather less abundant than either the preceding or the next. It reaches a considerable size, and is of some value as a food fish.

29. BUBALICHTHYS BUBALUS Agassiz.

Buffalo-fish; Small-mouthed Buffalo; High-backed Buffalo.

Catostomus bubalus, KIRTLAND, Rept. Zool. Ohio, 1838, 163; Boston Journ. Nat. Hist., v, 1845, 266.—STORER, Synopsis, 1846, 424. (Not of Rafinesque).

Bubalichthys bubalus, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 195.—JORDAN, Fishes of Ind., 1875, 222; Proc. Acad. Nat. Sci. Phila., 1877, 75; Bull. U. S. Nat. Mus., xii, 1878, 206.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's Rept., 1877, 53.

?? *Carpiodes taurus*, AGASSIZ, Am. Journ. Sci. Arts, 1854, 355. (Not identifiable.)

?? *Bubalichthys taurus*, AGASSIZ, Am. Journ. Sci. Art, 2d series, xix, 1855, 193.—JORDAN and COPELAND, Check List, 1876, 158.

?? *Carpiodes vitulus*, AGASSIZ, Am. Journ. Sci. Arts, 1854, 356. (Not identifiable.)

?? *Bubalichthys vitulus*, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 193.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's Rept., 1876, 53.

Scleroquathus urus, GUNTHER, Cat. Fishes, Brit. Mus., vii, 1863, 22.

Ichthyobus cyanellus, NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 49.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 73; Man. Vert., 2d Ed., 1878, 323.—JORDAN and GILBERT, in Klippart's Rept., 1876, 53.

Bubalichthys altus, NELSON, MSS, 1877.—JORDAN, Proc. Nat. Sci. Phila., 1877, 73; Man. Vert., 2d Ed., 1878, 324.

Bubalichthys bubalinus, JORDAN, Bull. U. S. Nat. Mus., ix, 1867, 50; Man. Vert., 2d Ed., 1878, 325.

Description—Body considerably elevated and compressed above; the dorsal region subcarinate, belly thicker; depth $1\frac{1}{2}$ to $2\frac{1}{2}$ in length; axis of body above the ventrals below the lateral line and nearly twice as far from the back as from the belly; head moderate, triangular in outline when viewed from the side, four in length; eye equal to snout, four to five in length of head, much larger than in *B. urus*; mouth quite small, notably smaller and more inferior than in *B. urus*; mandible about equal to eye; dorsal fin elevated in front and rapidly declined, the highest ray reaching much beyond the middle of the fin, the seventh ray about half the length of the third or longest; anal rays rapidly shortened behind, the middle rays much shorter than the first long ones; scales 8-39-6; dorsal 29; anal 10; ventrals 10; coloration paler, the lower fins slightly dusky.

Habitat, Mississippi Valley, abundant in the larger streams.

Diagnosis—This species has the highest back and smallest mouth of any of the Buffalo fishes.

Habits.—Its habits are identical with those of *urus* and *Ichthyobus bubalus*. It reaches about the same size as the others, and is of similar value as food.

GENUS 16. CARPIODES. Rafinesque.

Carpiodes, RAFINESQUE, Ich. Oh., 1820, 56. (As subgenus of *Catostomus*.)

Sclerogathus, VALENCIENNES, Hist. Nat. des Poissons, xvii, 1844, 472.

Type, *Catostomus cyprinus*, LeSueur.

Etymology, Latin *carpio*, a carp; i.e., carp like.

Head comparatively short and deep, sometimes conic, sometimes blunt, its length ranging from $3\frac{1}{2}$ to 5 in that of the body, its upper surface always rounded; eye moderate, median or anterior in position; suborbital bones well developed, their depth more than half that of the fleshy portion of the cheek below; fontanelle always present, well developed; mouth always small, horizontal and inferior, the mandible less than one-third the length of the head, the lips thin, the upper protractile, narrow, the lower quite narrow, V-shaped, or rather U-shaped, behind; both lips feebly plicate or nearly smooth, the plicæ often more or less broken up; jaws without cartilaginous sheath; muciferous system moderately developed; opercular apparatus well developed, the sub-

opercle broad, the operculum in the adult more or less rugose; isthmus moderate; pharyngeal bones remarkably thin and laterally compressed, with a shallow furrow along the anterior margin on the inside, and another more central one on the outline of the enlarged surfaces; teeth very small, compressed, nearly equally thin along the whole inner edge of the bone, forming a fine comb like crest of minute serratures; their cutting edge rises above the inner margin into a prominent point. Gill rakers of anterior arch slender and stiff above, becoming reduced downward. Body ovate or oblong, the dorsal outline more or less arched, the ventral outline more nearly straight, the depth from one-half to one-third the length, the sides compressed; the back notably so, forming a sort of carina; caudal peduncle short and deep; scales large, about equal over the body, their posterior margins slightly serrate; lateral line well developed, nearly straight, 34 to 41 scales; 12 to 15 scales in a cross-row from dorsal to ventrals; dorsal fin beginning near the middle of the body, somewhat in advance of ventrals, falcate, its anterior rays very much elevated and usually filamentous, their height ranging from one-half to one and one-third the base of the fin, the number of developed rays ranging from 23 to 30; caudal fin well forked, the lobes equal; anal fin comparatively long and low, emarginate (in males?), its number of developed rays usually 8; ventrals shortish, with usually 10 rays: pectorals short; sexual peculiarities little marked; in some species, at least, the males in spring have the snout minutely tuberculated; coloration always plain; pale olivaceous above, white below, but hardly silvery, the fins all partaking of the color of the region to which they belong; air-bladder with two chambers. Size medium or rather large.

ANALYSIS OF SPECIES OF CARPIODES.

*Dorsal fin with its anterior rays shortened, one-half to three-fourths as long as the base of the fin.

a. Head short, $4\frac{1}{2}$ to 5 in length; anterior rays of dorsal short, notably thickened and osseous at base. CARPIO. 30.

aa. Head medium, $3\frac{1}{2}$ to $4\frac{1}{2}$ in length; anterior rays of dorsal not thickened.

b. Body oblong, the depth $2\frac{1}{2}$ in length; scales 6-37-5. CYPRINUS. 31.

bb. Body short, the back arched, the depth $2\frac{1}{2}$ in length, scales about 8-40 6.

THOMPSONI. 32.

aaa. Head long, $3\frac{1}{2}$ in length; eye nearly median. BISON. 33.

**Dorsal fin with its anterior rays about equal to the length of the base of the fin.

c. Muzzle conic, projecting. VELIFER. 34.

ca. Muzzle very abruptly obtuse.

d. Front margin of lower jaw notably in advance of the eye.

CUTISANSERINUS. 35.

dd. Front margin of lower jaw not in advance of the front margin of the eye, the snout being extremely blunt. DIFFORMIS. 36.

30 CARPIODES CARPIO (Rafinesque) Jordan.

Big Carp Sucker; Olive Carp Sucker.

Catostomus carpio, RAFINESQUE, Ich. Oh., 1820, 66.

Carpionides carpio, JORDAN, Bull. Buffalo Soc. Nat. Hist., 1877, 95; Man. Vert., 1876, 297; Proc Acad. Nat. Sci. Phila., 1877, 72; Bull. U. S. Nat. Mus., ix, 1877; Man. Vert., 2d Ed., 1878, 321; Bull. U. S. Nat. Mus., xii, 1878, 200.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 49.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's Rept., 1876, 63.

Carpiodes nummifer, COPE, Proc. Am. Philos. Soc. Phila., 1870, 484.

Description.—Body fusiform, more elongate than in the other species, compressed, but not much arched; head quite short; muzzle short, but projecting much beyond the mouth; eyes small, anterior $4\frac{1}{2}$ in head; first rays of dorsal short, extremely stout and osseous at base, the insertion of the first ray nearer the end of the muzzle than the base of the caudal fin; color pale, as in all the other members of the genus; head $4\frac{1}{2}$ to 5; depth $2\frac{1}{2}$ to 3; D., 30; scales 7-36-5. Length, 1 to $1\frac{1}{2}$ feet; the largest species of the genus.

Habitat, Ohio Valley, etc., abundant, often ascending smaller streams.

Diagnosis.—This species may usually be readily distinguished by the small head and the thickened anterior rays of the dorsal.

Habits.—This is the commonest species of its genus in the Ohio River, and it is often found in the streams of the interior of the State. It has not yet been recorded from Lake Erie. Like the others, it is used as food, but never highly valued.

31. CARPIODES CYPRINUS (LeSueur) Agassiz.

Eastern Carp Sucker; Nebraska Carp Sucker; Rio Grande Carp.

Catostomus cyprinus, LESUEUR, Journ. Acad. Nat. Sci., Phila., i, 1817, 91.

Labeo cyprinus, DEKAY, New York Fauna, part iv, Fishes, 1842, 194.

Sclerognathus cyprinus, CUVIER and VALENCIENNES, Hist. Nat. des Poissons, xvii, 1844, 474.—STORER, Synopsis, 1846, 427.

Carpiodes cyprinus, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 191.—GUNTHER, Cat. Fishes Brit. Mus. vii, 1868, 24.—COPE, Proc. Am. Philos. Soc. Phila., 1870, 484.—JORDAN, Fishes of Ind., 1875, 292; Man. Vert., 1876, 297; 2d Ed., 1878, 323.—UHLE and LUGGER, Fishes of Maryland, 1876, 140.—JORDAN and COPELAND, Check List, 1876, 458.

Carpiodes vacca, AGASSIZ, Am. Journ. Sci. Arts, 1854, 356.—JORDAN, Bull. U. S. Nat. Mus., 1878, 198, xii.

Carpiodes tumidus, BAIRD and GIRARD, Proc. Phila. Acad. Nat. Sci., 1854, 23.

Ictiobus tumidus, GIRARD, U. S. Mex. Bound. Surv., Ich., 34, pl. xxx, 1859, f. 1-4.

Ichthyobus tumidus, JORDAN and COPELAND, Check List, 1876, 158.

Carpiodes damalis, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 170; U. S. Pac. R.R. Expl., x, 1858, 218, pl. xlviii, f. 1-4.—COPE, Proc. Acad. Nat. Sci., Phila., 1865, 85.—JORDAN and COPELAND, Check List, 1876, 155.

Carpiodes grayi, COPE, Proc. Am. Philos. Soc. Phila., 1870, 482.—JORDAN and COPELAND, Check List, 1876, 158.—COPE and YARROW, Wheeler's Expl. W. 100th Mer., v, Zool., 1876, 681.

Description.—Body oblong, not much elevated; head moderate, the muzzle prominent but rather bluntish; front scarcely concave between the eyes, the profile forming a nearly uniform curve; eye small, nearly six in head; anterior rays of dorsal not thickened, moderately elevated, nearly three-fourths as long as the base of the fin, the first ray nearly midway from snout to base of caudal; color pale; head $3\frac{1}{2}$ to $4\frac{1}{2}$ in length; depth $2\frac{1}{2}$; D., 24 to 27; scales 6-37-5. Length, one foot.

Habitat, New England to Alabama, Nebraska and Mexico.

Diagnosis.—This species may usually be readily known from the closely related *C. velifer* by the lower dorsal, and from *C. thompsoni* by the slender body and larger scales.

Habits.—This is the common Carp Sucker of Eastern Pennsylvania and of the Southern and Southwestern States. It has not yet been noticed in Ohio, but it doubtless occurs here.

32. CARPIODES THOMPSONI Agassiz.

Lake Carp.

Catostomus cyprinus, THOMPSON, Hist. Vt., 1842, 133.

Carpiodes thompsoni, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1865, 191.—COPE, Proc. Acad. Nat. Sci. Phila., 1864, 285; Proc. Am. Philos. Soc. Phila., 1870, 483.—JORDAN, Man. Vert., 1876, 297; 2d Ed., 1878, 322; Bull. U. S. Nat. Mus., xii, 1878, 198.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's Rept., 1876, 53.

Ichthyobus thompsoni, NELSON, Bull. No. 1, Ill. Mus. Nat. Hist., 1876, 49.

Description.—Body short and stout, the back much arched, head moderate, the muzzle somewhat pointed; eye small, $6\frac{1}{2}$ in head; tip of lower jaw much in advance of the nostrils; maxillary reaching line of orbit; anterior suborbital large, deep, roundish; dorsal fin with its anterior rays not thickened, elevated, their length about two thirds that of the base of the fin; origin of dorsal about midway between snout and base of caudal; color pale; head 4 to $4\frac{1}{2}$; depth $2\frac{1}{2}$; D., 27; scales 8-39 to 41-6. Length one foot.

Habitat, Great Lakes, abundant.

Diagnosis.—This species may usually be known by the short body in connection with the comparatively low dorsal fin.

Habits.—This fish is as yet recorded only from the great lakes. It is abundant in Lake Erie, and is sold by the fishermen as Carp, or sometimes, especially after being split and salted, as Lake Shad. I have examined many specimens from Sandusky Bay.

33. CARPIODES BISON Agassiz.

Long-headed Carp Sucker.

Carpiodes bison, AGASSIZ, Am. Journ. Sci. Arts, 1854, 355; 1855, 190.—COPE, Proc. Am. Philos. Soc. Phila., 1870, 483.—JORDAN, Man. Vert., 1876, 297; 2d Ed., 1878, 322; Bull. U. S. Nat. Mus., ix, 1877, 50; xii, 1878, 197.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's Rept., 1876, 53.

Ichthyobus bison, NELSON, Bull. No. 1, Ill. Mus. Nat. Hist., 1876, 49.

Description.—Body oblong, the back not much arched; head quite long; muzzle elongate-conic, so that the eye is nearly median in position, the middle of the length of the head falling in front of its posterior margin; eye large, $4\frac{1}{2}$ in head; lips well developed; anterior rays of the dorsal fin not thickened, not much shorter than the base of the fin; color pale; head $3\frac{1}{2}$; depth 3; D., 27; scales 7-40-5. Length, one foot.

Habitat, Ohio Valley, not very common.

Diagnosis.—This species may usually be known by the large head.

Habits.—I have seen but very few specimens of this species, all from the lower Ohio. It is probably rare in this State.

34. CARPIODES VELIFER (Rafinesque) Agassiz.

**Carp Sucker; Skimback; Quillback Sailor Sailing Sucker;
Spear-fish.**

?? *Catostomus anisopterus*, RAFINESQUE, Ich. Oh., 1820, 46. (Description at second hand and unrecognizable.)

Catostomus velifer, RAFINESQUE, Ich. Oh., 1820, 56.

Carpiodes velifer, KIRTLAND, Rep. Zool. Ohio, 1838, 168—AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 191.—COPE, Proc. Am. Philos. Soc. Phila., 1870, 482.—JORDAN, Fishes of Ind., 1875, 222; Bull. Buffalo Soc. Nat. Hist., 1876, 95; Man. Vert., 1876, 297; 2d Ed., 1878, 321; Bull. U. S. Nat. Mus., ix, 34, 1877.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's First Report Ohio Fish Commission, 1877, 87.

Ichthyobus velifer, NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 49.

Sclerognathus cyprinus, KIRTLAND, Bost. Journ. Nat. Hist., v, 1846, 275. (In part; not of Cuv. and Val.)

Description.—Body rather deep, the back arched; head moderate, the muzzle conic, projecting, obtusely pointed; end of the mandible reaching to opposite the nostrils; anterior suborbital as deep as long; eye moderate, 4 to 4½ in head; first rays of dorsal very high, inserted nearer muzzle than base of caudal; color pale; head 3½; depth 2½ to 2½; D., 26; scales 7-37-5. Length, one foot.

Habitat, Great Lakes and Mississippi Valley.

Diagnosis.—This is the only species with the snout conical and the long rays of the dorsal longer than the base of the fin.

Habits.—This species is abundant in the Ohio River, where it is usually known as Quillback, Spear-fish, and Sailor, its lower finned relative, *C. carpio*, being usually known as Carp. I have seen none from Lake Erie, but as it occurs in the lakes of Western New York, it will doubtless be found there.

35. CARPIODES CUTISANSERINUS Cope.

Long-finned Carp Sucker; Quillback.

Carpiodes cutisanseerinus, COPE, Proc. Am. Philos. Soc. Phila., 1870, 481.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN, Bull. U. S. Nat. Mus., 9, 1877, 50; xii, 1878, 195; Man. Vert., 2d Ed., 321, 1878.—JORDAN and GILBERT, in Klippart's Rept., 53, 1876.

Carpiodes selene, COPE, Proc. Am. Philos. Soc. Phila., 1870, 481.—JORDAN and COPELAND, Check List, 1876, 163.—JORDAN and GILBERT, in Klippart's Rept., 1876, 73.—JORDAN, Man. Vert., 2d Ed., 1878, 321.

Ichthyobus difformis, NELSON, Bull. No. 1, U. S. Nat. Mus., 1876, 49.

Description.—Body short and deep, the back arched, head thick, the muzzle notably blunt but less so than in *C. difformis*; anterior edge of mandible in advance of the orbit; the maxillary just reaching the line of the lower rim of the orbit; eye smallish, $4\frac{1}{2}$ in head; anterior rays of dorsal longer than the base of the fin inserted about midway between snout and base of caudal; head 4; depth $2\frac{1}{2}$; D., 26; scales 7-37-5. Length, one foot.

Habitat, Mississippi Valley, generally abundant.

Diagnosis.—This is one of the species with a very blunt head and very high dorsal fin. The head is normal in appearance, not distorted as in *C. difformis*.

Habits.—This species is abundant in the Ohio, and is not usually distinguished by the fishermen from *C. velifer*.

The name, *cutisanserinus* (goose-skinned), alludes to the presence of minute tubercles on the snout of the male in the spawning season.

36. CARPIODES DIFFORMIS Cope.

Deformed Carp Sucker.

Carpiodes difformis, COPE, Proc. Am. Philos. Soc. Phila., 1870, 480.—JORDAN, Man. Vert., 1876, 297; 2d Ed., 1878, 321; Proc. Acad. Nat. Sci. Phila., 1877, 72; Bull. U. S. Nat. Mus., 9, 1877, 50; xii, 1878, 195.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's First Report Ohio Fish Commission, 86, pl. xiii, f. 21, 1877.

Description.—Body short and deep, the back considerably arched; head very thick, the muzzle exceedingly blunt, almost truncate, so that the anterior edge of the mandible is in line with the anterior rim of the orbit, and the maxillary reaches to the anterior edge of the pupil; anterior suborbital bone deeper than long; eye large, $3\frac{1}{2}$ to 4 in head; dorsal fin with its anterior rays very long, longer than the base of the fin; the first ray of the dorsal nearer the muzzle than the base of the caudal; head $4\frac{1}{2}$; depth $2\frac{1}{2}$; D., 24; scales 6-34-4. Length, one foot.

Habitat, Ohio Valley.

Diagnosis.—This species resembles a monstrosity of the preceding, which indeed it may really be.

Habits.—But two or three specimens of this species are now known, all from the Wabash and lower Ohio.

GENUS 18. CYCLEPTUS. Rafinesque.

Cycleptus, RAFINESQUE, Journal de Physique, de Chimie et d'Histoire Naturelle, Paris, 1819, 421.

Rhytidostomus, HECKEL, *Fische Syriens, Russegers Reisen*, 1842, p. 1023.

Catostomus et Sclerognathus, sp., AUCT.

Type, *Cycleptus nigrescens*, Rafinesque, = *Catostomus elongatus*, LeSueur.

Etymology, *kuklos*, round; *leptos*, small. "The name means small, round mouth." (*Rafinesque*.)

Head very small, short and slender, its length contained six to seven times in that of the body, its upper surface rounded; eye quite small, nearly median, not very high up, its length six to eight in that of the side of the head; suborbital bones rather small and quite narrow; fontanelle entirely obliterated by the union of the parietal bones; mouth small, entirely inferior, overlapped by the projecting snout, the upper lip thick, pendent, covered with three to five rows of tubercles, the outer quite large, the inner small; lower lip moderate, formed somewhat as in *Catostomus*, but less full, incised behind; jaws without cartilaginous sheath; muciferous system not greatly developed; opercular apparatus not greatly developed, the operculum smooth and narrow; isthmus moderate; gill-rakers moderately long, soft; pharyngeal bones strong, the teeth stout, increasing in size downwards, rather wide apart; body elongate, moderately compressed, not much elevated, the caudal peduncle long, the greatest depth contained four to six times in length; scales moderate, about equal over the body, not closely imbricated, with wide exposed surfaces, the number in the lateral line from 55 to 60, and about 17 in a transverse series from dorsal to ventrals; edges of scales serrate; lateral line well developed, nearly straight; fins rather large; dorsal fin beginning in front of ventrals and ending just before anal, of about 30 rays, strongly falcate in front, the first and second developed rays in length more than half the length of the base of the fin, the rays rapidly shortened to about the eighth, the length of the remaining rays being nearly uniform and all short; caudal fin large, widely forked, the lobes about equal; anal fin quite small, low, of 7 or eight developed rays, scaly at base; ventrals moderate, with ten rays; pectorals elongate, somewhat falcate; sexual peculiarities somewhat marked; the males in spring with a black pigment; the head then covered with small tubercles; air-bladder with two chambers, the anterior short, the posterior elongate. But a single species of this singular genus is as yet known. It is found in the waters of the Mississippi Valley, and, although not a rare fish, it is by no means as generally abundant as are many others of its family.

37. *CYCLEPTUS ELONGATUS* (LeSueur) Agassiz.

Black Horse; Gourd-seed Sucker; Missouri Sucker; Suckerel.

Catostomus elongatus, LESUEUR, Journ. Acad. Nat. Sci. Phila., 1817, 103.—RAFINESQUE, Ich. Oh., 1820, 60.—KIRTLAND, Rept. Zool. Ohio, 1838, 16c; Boston Journ. Nat. Hist., v, 1845, 267.—DEKAY, New York Fauna, part iv, Fishes, 1842, 203.—CUVIER et VALENCIENNES, Hist. Nat. des Poiss., xvii, 1844, 455.—STORER, Synopsis, 1846, 422. *Cycleptus elongatus*, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 197.—JORDAN, Fishes of Ind., 1875, 222; Bull. Buffalo Soc. Nat. Hist., 1876, 95 (name only); Man. Vert., 1876, 298; 2d Ed., 1878; Bull. U. S. Nat. Mus., ix, 1877, 38; xii, 1878, 189.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 50.—JORDAN and COPELAND, Check List, 1876, 158 (name only).—JORDAN and GILBERT, in Klippart's Rept., 1876, 53 (name only).

Sclerognathus elongatus, GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 23.

Cycleptus nigrescens, RAFINESQUE, Journal de Physique, 1818, 421; Ich. Oh., 1820, 61.

Description.—Body elongate, the depth four to five in length; head six to six and a half; eye small, six to seven in length of head; longest ray of dorsal a little longer than head; pectorals rather longer than head; coloration very dark, the females olivaceous and coppery, the males chiefly jet black with coppery shadings; fins dusky; dorsal 39; scales 9-56-7. Length, $1\frac{1}{2}$ to $2\frac{1}{2}$ feet; weight, 2 to 15 pounds.

Habitat, Mississippi Valley.

Diagnosis.—This species may be known by the small head and long dorsal.

Habits.—It is not rare in the Ohio River, but it seldom ascends the smaller streams. At the Falls of the Ohio it is frequently but irregularly taken, and is sold under the name of Gourd-seed Sucker. It is also called Missouri Sucker and Black Horse. According to Dr. Kirtland, "it migrates down the river at the approach of winter. It is esteemed more highly for food than any other of the family."

GENUS 19. CATOSTOMUS. LeSueur.

Catostomus, LeSUEUR, Journ. Acad. Nat. Sci. Phila., i, 1817, 89

Hypentelium, RAFINESQUE, Journ. Acad. Nat. Sci. Phila., i, 1818, 421.

Decactylus, RAFINESQUE, Ichthyologia Ohiensis, 1820,

Hylomyzon, AGASSIZ, Am. Journ. Sci. Arts, 1855, 205.

Minomus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 173.

Acomus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 173.

Type, *Cyprinus catostomus*, FORSTER = *Catostomus longirostrum*, LeSUEUR.

Etymology, *kato*, low; *stoma*, mouth.

Head more or less elongate, its length ranging from three and a half to five in body, its form varying considerably in the different subgenera; eyes rather small, high up, median or more or less posterior in position; suborbital bones narrow, longer than broad, much as in *Myxostoma*; fontanelle always present, usually widely open, in two species reduced to a narrow slit, but never wholly obliterated; mouth rather large, always inferior, and sometimes notably so; the upper lip thick, protractile, papillose; the lower lip greatly developed, with a broad free margin, deeply incised behind, so that it forms two lobes, which are often more or less separated; mandible horizontal, short, not one-third the length of the head and not reaching to opposite the eye; lower jaw usually without distinct cartilaginous sheath; opercular apparatus moderately developed, not rugose; pharyngeal bones moderately strong, the teeth shortish, vertically compressed, rapidly diminishing in size upwards, the upper surface of the teeth nearly even, or somewhat cuspidate; body oblong or elongate, more or less fusiform, subterete, more or less compressed; scales comparatively small, typically much smaller and crowded anteriorly, the number in the lateral line ranging from about 50 to 115, the number in a transverse series between dorsal and ventrals from 15 to 40; lateral line well developed, straightish, somewhat decurved anteriorly; fins variously developed; dorsal with its first ray nearly midway of the body, with from nine to fourteen developed rays; anal fin short and high, with probably always seven developed rays; ventrals inserted under the middle or posterior part of the dorsal, typically with ten rays, in one subgenus usually nine, the number often subject to variation of one; caudal fin usually deeply forked, the lobes nearly equal; sexual peculiarities not much marked, the fins higher in the male and the anal somewhat swollen and tuberculate in the spring; breeding males in some species with a rosy or orange lateral band; air-bladder with two chambers; vertebrae in *C. teres* and *C. nigricans* 45 to 47.

"The skeleton in *Catostomus* is distinguished by the comparative want of solidity, cerbones consisting merely of a network of osseous matter. There is a large and broad fontanelle on the upper surface of the head, separating the parietal bones, and leading

directly into the cerebral cavity. The occipital process is below the anterior vertebræ, enlarged into a bladder-like swelling, which is not solid, but consists of a delicate network only. The prefrontal is advanced to the anterior part of the orbit. The jaw-bones are very feeble, the intermaxillary being reduced to a thin lamella, which does not descend to the middle of the maxillary. The anterior part of the mandible is horizontal, thin and slightly dilated. The apophyses of the four anterior vertebræ are very strong and long."—(GUNTHER, *Cat. Fishes Brit Mus.*, vii, 13)

This genus as at present restricted comprises three well-marked groups, which may be accepted as subgenera, under the names *Catostomus*, *Decadactylus*, and *Hypentelium*. One of these groups, *Hypentelium*, has been considered as a distinct genus, on account of the differences in the form of the head and in the squamation. These differences are, however, individually of subordinate value, and should probably be held to designate a subgeneric section, rather than a distinct genus.

The genus *Catostomus* is, next to *Myxostoma*, the most rich in species. It is much the most widely distributed of the genera of Suckers, some of its members abounding in every river of North America, and one of them being found in Asia. Only three of them are found in Ohio.

ANALYSIS OF SPECIES OF CATOSTOMUS.

*Scales much crowded and reduced in size anteriorly.

† Scales very small, about 100 in lateral line. (Subgenus *Catostomus*.)

LONGIROSTRIS 38.

†† Scales median, 65 to 85 in the lateral line. (Subgenus *Decadactylus*.) TERES. 39.

**Scales not crowded, nearly equal over the body, 48 to 55 in the lateral line. (Subgenus *Hypentelium*.) NIGRICANS. 40.

38. CATOSTOMUS LONGIROSTRIS LeSueur.

Long-nosed Sucker; Northern Sucker; Red-sided Sucker.

Cyprinus catostomus, FORSTER, Philos. Trans., lxiii, 1773, 145, tab. 6.—SCHNEIDER, ed. Bloch., 1802, 444.

Catostomus longirostrum, LESUEUR, Journ. Acad. Nat. Sci. Phila., 1817, 102.—THOMPSON, Hist. Vt., 1842, 135.—CUVIER and VALENCIENNES, xvii, 1844, 453.—STORER, Synopsis, 1846, 421.—JORDAN and COPELAND, Check List, 1876, 156.

Catostomus longirostris, DEKAY, New York Fauna, part iv, Fishes, 1841, 203.—JORDAN and GILBERT, in Klippart's Rept., 1877, 54.—JORDAN, Bull. U. S. Nat. Mus., xii, 1878, 175.

Catostomus hudsonius, LESUEUR, Journ. Acad. Nat. Sci. Phila., 1817, 107.—CUVIER and VALENCIENNES, Hist. Nat. des Poissons, xvii, 1844, 459.—STORER, Synopsis, 1846, 419.—AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 208.—GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 13.—JORDAN, Man. Vert., 1876, 293.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 48.

Catostomus forsterianus, RICHARDSON, Franklin's Journal, 1823, 720; Fauna Bor.-Amer., iii, Fishes, 1836, 116.—DEKAY, New York Fauna, part iv, Fishes, 1842, 203.—CUVIER and VALENCIENNES, Hist. Nat. des Poissons, xvii, 1844, 463.—STORER, Synopsis, 1846, 419.—PUTNAM, Bull. Mus. Comp. Zool., 1863, 10.—JORDAN and COPELAND, Check List, 1876, 156.

Acomus forsterianus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 172.

Catostomus aurora, AGASSIZ, Lake Superior, 1850, 360, pl. 2, f. 3 4; PUTNAM, Bull. Mus. Comp. Zool., 1863, 10.

Acomus aurora, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 173.

Acomus griseus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 174; U. S. Pac. R. R. Expl., x, 1-53, 222, pl. xlix.

Catostomus griseus GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 14.—JORDAN and COPELAND, Check List, 1876, 156.

Catostomus griseum, COPE, Hayden's Geol. Surv. Wyoming, 1870, 434,

Catostomus lactarius, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 174.—JORDAN and COPELAND, Check List, 1876, 156.

Acomus lactarius, GIRARD, U. S. Pac. R. R. Expl., x, 1858, 223.

Description.—Body elongate, subterete; head quite long and slender, depressed and flattened above, broad at base but tapering into a long snout, which considerably overhangs the large mouth; lips thick, coarsely tuberculate; the upper lip narrow, with two or three rows of papillæ; jaws without cartilaginous sheath; eye rather small, behind the middle of the head; fontanelle large; scales very small, much crowded forwards; color dusky above, pale below, the males in spring with a broad rosy lateral band, and with the head and anal fin profusely tuberculate, the tubercles on the head small; head $4\frac{1}{2}$ to $4\frac{3}{4}$ in length; depth $4\frac{1}{2}$ to $4\frac{3}{4}$; D., 10 or 11; lat. l., 95 to 114; 26 to 31 scales in a cross series from dorsal to ventrals. Length, $1\frac{1}{2}$ to 2 feet.

Habitat, Great Lake region to Alaska, very abundant throughout British America.

D'agnosis.—This is the only Ohio Sucker which has more than 70 scales in the lateral line.

Habits.—This fish is quite abundant in Lake Erie, where it is taken with other species in the net. It does not often ascend the streams, and is almost never seen in waters tributary to the Ohio. It is a fish of northern distribution and likes cold, clear waters.

39. CATOSTOMUS TERES (Mitchell) LeSueur.

Common Sucker; White Sucker; Brook Sucker; Fine-scaled Sucker.

LeCyprin commersonien, LACEPEDE, Hist. Nat. des Poiss., v, 1803, 502, 508.

Catostomus commersoni, JORDAN, Man. Vert., 2d Ed., 1878, p. 329.

Cyprinus catostomus, PECK, Mem. Am. Acad., ii, 18—, pt. 2, p. 55, pl. 2, f. 4. (Not of Forster.)

Cyprinus teres, MITCHELL, Lit. and Phil. Trans. New York, i, 1814, 458.

Catostomus teres, LeSUEUR, Journ. Acad. Nat. Sci. Phila., 1817, 108.—THOMPSON, Hist. Vt., 1842, 131.—CUVIER and VALENCIENNES, xii, 1844, 468.—STORER, Synopsis, 1846, 423.—AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 208.—GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 15.—COPE, Proc. Am. Philos. Soc. Phila., 1870, 468.—JORDAN, Fishes of Ind., 1875, 221; Man. Vert., 1876, 293; Bull. U. S. Nat. Mus., ix, 1877, 37; xii, 1878, 166.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 43.—JORDAN and COPELAND, Check List, 1876, 156.—JORDAN and GILBERT, in Klippart's Rept., 1876, 53; ib., 1878, 84, pl. xii, f. 18-19.

- Catostomus communis*, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1817, 95.—DEKAY, New York Fauna, part iv, Fishes, 1842, 196.—CUVIER and VALENCIENNES, Hist. Nat. des Poissons, xvii, 1844, 426.—KIRTLAND, Boston Journ. Nat. Hist., v, 1845, 265.—STORER, Synopsis, 1846, 421.—COPE, Journ. Acad. Nat. Sci. Phila., 1868, 236.—UHLER and LUGGER, Fishes of Maryland, 1876, 138.
- Catostomus bostoniensis*, LESUEUR, Journ. Acad. Nat. Sci. Phila., 1817, 106.—STORER, Rept. Ich. Mass., 1838, 84; Synopsis, 1846, 423; Hist. Fishes Mass., 1867, 290, pl. xxii, f. 3.—CUVIER and VALENCIENNES, Hist. des Poissons, xvii, 1844, 432.—PUTNAM, Bull. Mus. Comp. Zool., 1863, 10.—GILL, Canadian Nat., Aug., 1865, p. 13.—THOREAU, Week on Concord and Merrimack, 1868, 38.
- Catostomus flexuosus*, RAFINESQUE, Ich. Oh., 1820, 59.
- Catostomus hudsonius*, RICHARDSON, Franklin's Journal, 1823, 717. (Not of LeSueur.)
- Cyprinus* (*Catostomus*) *hudsonius*, RICHARDSON, Fauna Bor.-Am., Fishes, 1836, 112.
- Cyprinus* (*Catostomus*) *reticulatus*, RICHARDSON, Fauna Bor.-Am., Fishes, 1823, 303.
- Catostomus gracilis*, KIRTLAND, Rept. Zool. Ohio, 1838, 163.
- Catostomus nigricans*, STORER, Rept. Ich. Mass., 1838, 86 (not of LeSueur).—THOMPSON, Hist. Vermont, —, 1842.
- Catostomus pallidus*, DEKAY, New York Fauna, part iv, Fishes, 1842, 200.—STORER, Synopsis, 1846, 426.
- Catostomus aureolus*, CUVIER and VALENCIENNES, Hist. Nat. des Poiss., xvii, 1844, 439. (Not of LeSueur.).—GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, p. 16.
- Catostomus forsterianus*, AGASSIZ, Lake Superior, 1850, 368; Am. Journ. Sci. Arts, 2d series, xix, 1855, 208.
- Acomus forsterianus*, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 173.
- Catostomus sucklii*, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 175; U. S. Pac. R. R. Expl., x, 1858, pl. li, 266.—COPE, Hayden's Geol. Surv. Wyoming, 1870, 1572, 434.
- Catostomus suckleyi*, JORDAN and COPELAND, Check List, 1876, 156.
- ? *Catostomus texanus*, ABBOTT, Proc. Acad. Nat. Sci. Phila., 1860, 473.—JORDAN and COPELAND, Check List, 1876, 156.
- Catostomus chloropteron*, ABBOTT, Proc. Acad. Nat. Sci. Phila., 1860, 473.—COPE, Proc. Acad. Nat. Sci. Phila., 1865, 85.
- Catostomus chloropterus*, JORDAN and COPELAND, Check List, 1876, 156.
- Catostomus alnicolus*, COPE and YARROW, Wheeler's Expl. W. 100th Mer., v, Zool., 1876, 677.—JORDAN and COPELAND, Check List, 1876, 156.
- Moxostoma trisignatum*, (COPE) COPE and YARROW, Wheeler's Expl. W. 100th Mer., v, Zool., 1876, 679.
- Erimyzon trisignatus*, JORDAN and COPELAND, Check List, 1876, 157.

Description.—Body moderately stout, subterete, heavy at the shoulders; head rather large and stout, conical, flattish above; snout moderately prominent, scarcely overpassing the mouth; mouth rather large, the lips strongly papillose, the upper moderate, with two or three rows of papillæ; jaws without cartilaginous sheath; fontanelle large; scales crowded anteriorly, much larger on the sides than below; coloration olivaceous, sometimes dusky; males in spring with a faint rosy lateral band; young brownish, more or less mottled, sometimes with two or three confluent lateral blotches which sometimes form a faint lateral band; head 4 to $4\frac{1}{2}$ in body ($3\frac{1}{2}$ to $4\frac{1}{2}$ in young); depth 4 to $4\frac{3}{8}$ in length, varying with age, the young slender; scales 10-64 to 70-9. Length, 1 to $1\frac{1}{2}$ feet.

Habitat, all waters of the United States, east of the Rocky Mountains.

Diagnosis.—This is the only Sucker in Ohio having 65 to 70 scales in lateral line.

Habits.—This species is the most common of the Suckers, swarming in every pond and stream in Ohio, and is the one to which the name Sucker primarily belongs. It varies much in size, color and form in the different streams. Its flesh is soft and poor, and of little value for food. It bites at a small hook baited with a worm, and is one of numerous tribe of boy's fish, which may be found on every urchin's string.

40. CATOSTOMUS NIGRICANS LeSueur.

Hog Sucker; Hog Mullet; Hog Molly; Crawl-a-bottom; Stone Roller; Stone Toter; Stone Lugger; Hammer-head; Mud Sucker.

a. Subspecies *nigricans*.

Cotostomus nigricans, LESUEUR, Journ. Acad. Nat. Sci. Phil., 1817, 102.—DEKAY, New York Fauna, part iv, Fishes, 1842, 202.—CUVIER and VALENCIENNES, Hist. Nat. des Poiss., xvii, 1844, 453.—KIRTLAND, Bost. Journ. Nat. Hist., v, 1845, 272.—STORER, Synopsis, 1846, 421.—COPE, Journ. Acad. Nat. Sci. Phila., 1868, 236; Proc. Am. Philos. Soc. Phila., 1870, 468.—GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 17.—UHLER and LUGGER, Fishes of Maryland, 1876, 138.—JORDON, Ann. Lyc. Nat. Hist. N. Y., xi, 1877, 345; Bull. U. S. Nat. Mus., xii, 1878, 162.

Cotostomus nigrans (sic), KIRTLAND, Rept. Zool. Ohio, 1833, 163.

Hylomyzon nigricans, AGASSIZ, Am. Journ. Sci. Arts, xix, 1855, 205.—PUTNAM, Bull. Mus. Comp. Zool., 1863, 10.—JORDAN, Fishes of Ind., 1875, 221.

Hypentelium nigricans, JORDAN, Bull. Buffalo Soc. Nat. Hist., 1876, 95; Man. Vert., 1876, 294; 2d Ed., 1878.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 48.—JORDAN and COPELAND, Check List, 1876, 156.—JORDAN and GILBERT, in Klippart's Rept., 1876, 53.

Catostomus maculosus, LESUEUR, Journ. Acad. Nat. Sci. Phila., 1817, 103.—DEKAY, New York Fauna, part iv, Fishes, 1842, 203.—CUVIER and VALENCIENNES, Hist. Nat. des Poiss., 1844, 454.—STORER, Synopsis, 1846, 422.—UHLER and LUGGER, Fishes of Maryland, 1876, 139.

Exoglossum macropterum, RAFINESQUE, Journ. Acad. Nat. Sci. Phila., 1817, 420.—CUVIER and VALENCIENNES, xvii, 1844, 486.—STORER, Synopsis, 1846, 428.

Hypentelium macropterum, RAFINESQUE, Ich. Oh., 1820, p. 68.—KIRTLAND, Rept. Zool. Ohio, 1838, 168.

Catostomus xanthopus, RAFINESQUE, Ich. Ohio., 1820, 57.

? *Catostomus* ? *megastomus*, RAFINESQUE, Ich. Oh., 1820, 59. (Most likely mythical.)

Catostomus planiceps, CUVIER and VALENCIENNES, Hist. Nat. des Poissons, xvii, 1844, 450, pl. 516.—STORER, Synopsis, 1846, 426.

aa. Subspecies *etowanus*.

Catostomus nigricans, var. *etowanus*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., xi, 1877, 345.

Description.—Body stout and heavy in front, tapering off rapidly from the shoulders to the tail, nearly cylindrical behind; head quadrangular, broad and flat above, with vertical sides; the interorbital space transversely concave; frontal bone thick, broad and short; fontanelle short and rather small; mouth large, the upper lip very thick,

strongly papillose, with a broad free margin, on which are eight to ten series of papillæ; lower lip greatly developed, strongly papillose, considerably incised behind, but less so than in the other species of this genus; pectoral fins very large; scales moderate, not crowded anteriorly, nearly equal over the body; eye rather small, four and a half to five in head; color olivaceous; sides with brassy lustre; belly white; back brown, with several dark cross-blotches, irregularly arranged, obsolete in old individuals; lower fins dull red with dusky shading; head 4 to $4\frac{1}{2}$ in length; depth $4\frac{1}{2}$ to 5; D., 11; V., 9; scales 7-50 5. Length, one to two feet.

Habitat, New York to North Carolina, west to the Great Plains and Texas.

Diagnosis.—This is the only Sucker having the eye sockets so elevated that the space between them on the top of the head is transversely concave.

Habits.—This fish is extremely abundant in every running stream in Ohio, where its singular, almost comical form is familiar to every school boy. It delights in rapids and shoals, preferring cold and clear water. Its powerful pectorals render it a swifter swimmer than any other of its family. Its habit is to rest motionless on the bottom, where its mottled colors render it difficult to distinguish from the stones among which it lies. When disturbed, it darts away very quickly, after the manner of the *Etheostomus*. They often go in small schools. I have never found this fish in really muddy water, and when placed in the aquarium it is the first fish to die as the water becomes foul. Although called the Mud Sucker in the book, it is most characteristically a fish of the running streams. This species reaches a length about two feet, and is often caught in its spawning season by means of a spear or snare. It is, like the preceding, a "boy's fish," and not worth the eating.

GENUS 20. ERIMYZON. Jordan.

Moxostoma, AGASSIZ, Journal Science and Arts, 1854, 200 (Not of Rafinesque.)

Erimyzon, JORDAN, Bull. Buff. Soc. Nat. Hist., 1-76, 95.

Tetralus, COPE, Synopsis of Fishes of N. C., 2d ed., Addenda, 1877. (Not of Rafinesque.)

Cyprinus, *Catostomus*, and *Labeo*, sp. EARLY AUTHORS.

Type, *Cyprinus oblongus*, Mitchell, *Cyprinus succetta*, Lac.

Etymology, *eri*, an intensive particle; *muzzo*, to suck.

Head moderate, rather broad above; mouth moderate, somewhat inferior, the upper lip well developed, freely protractile, the lower moderate, infolded. A shaped in outline, plicated, with 12-20 pharyngeal teeth on each side; lower jaw without cartilaginous sheath, rather stronger than usual, and oblique in position when the mouth is closed, the mouth thus similar to that of *Ichthyobus*; eye moderate, rather high up, placed about midway of the head; suborbital bones considerably developed, not very much narrower than the fleshy portion of the cheek below them, the posterior suborbital concavo convex, about twice as long as deep, sometimes divided, the anterior somewhat deeper than long, sometimes divided into two, sometimes united with the preorbital bone, which is well developed

and much longer than broad; opercular bones moderately developed, scarcely or not rugose; fontanelle evident, rather large; gill rakers rather long, about half the diameter of the eye in length; isthmus moderately developed, about the width of the eye; pharyngeal bones weak, teeth quite small, slender, and weak, rapidly diminishing in length upwards, each tooth narrowly compressed, with a cusp on the inner margin of the cutting surface, and some inequalities besides; Body oblong, rather shortened, heavy forwards and considerably compressed; scales rather large, more or less crowded forwards, sometimes showing irregularities of arrangement, the longitudinal radiating furrows much stronger than usual, the scales rather longer than deep, but so imbricated in the adult that the exposed surfaces appear deeper than long; lateral line entirely wanting; scales in the longitudinal series from head to base of caudal 35 to 45 in number; scales in transverse row from base of ventral to dorsal 12 to 18; dorsal fin rather short and high, with from 10 to 14 developed rays, the number usually 11 or 12; beginning of dorsal fin rather nearer snout than base of caudal; pectoral fins moderate, not reaching ventrals; the latter not to vent; ventrals under a point rather in advance of the middle of dorsal; their rays normally nine, but occasionally eight to ten; anal fin high and short, more or less emarginate or bilobed in adult males; caudal fin moderately forked or merely lunate, its two lobes about equal; air-bladder with two chambers.

This genus has a very wide range, one of its two known species probably occurring in all the streams of the United States east of the Rocky Mountains.

41. *ERIMYZON SUCETTA* (Lacipede) Jordon.

Chub Sucker; Creek Fish; Mullet; Sweet Sucker.

Cyprinus sucetta, LACPEDE, Hist. Nat. des Poissons, v, 1803, 606, 610.

Catostomus sucetta, LESUEUR, Journ. Acad. Phila., 1817, 109.—DEKAY, New York Fauna, part iv, Fishes, 1842, 203.

Catostomus suceti, CUVIER and VALENCIENNES, Hist. Nat. des Poissons, xvii, 1844, 466.—STORER, Synopsis, 1846, 419.

Moxostoma sucetta, AGASSIZ, Am. Jour. Sci. Arts, 2d series, xix, 1855, 202.—PUTNAM, Bull. Mus. Comp. Zool., 1869, 10.

Erimyzon sucetta, JORDAN, Man. Vert., 1876, 291; 2d Ed., 319; Bull. U. S. Nat. Mus., xii, 1878, 144 —JORDAN and COPELAND Check List, 1876, 157.

Cyprinus oblongus, MITCHILL, Lit. and Phil. Trans. New York, 1, 1814, 459.

Catostomus oblongus, LESUEUR, Journ. Acad. Nat. Sci., 1817, 108.—THOMPSON, Hist. Vt., 1842, 134 (Synonymy, but not description, which applies to *M. macrolepidotum*).—CUVIER and VALENCIENNES, Hist. Nat. des Poissons, xvii, 1844, 411.—STORER, Synopsis, 1846, 423.

Labeo oblongus DEKAY, New York Fauna, part iv, Fishes, 1842, 193.

Moxostoma oblongum, AGASSIZ, Am. Jour. Sci. Arts, 2d series, xix, 1855, 203 —PUTNAM, Bull. Mus. Comp. Zool., 1863, 10.—GILL, Canadian Nat., p. 19, Aug., 1865.—GUNTHER, Cat. Fishes Brit. Mus., vii, 1863, 21.—COPE, Proc. Am. Philos. Soc. Phila., 1870, 468.—JORDAN, Fishes of Ind., 1875, 211 (name only).—UHLER and LUGGER, Fishes of Maryland, 1876, 140.

Erimyzon oblongus, JORDAN Bull. Buffalo Soc. Nat. Hist., 1876, 25 (name only; generic diagnosis of *Erimyzon*); Man. Vert., 1876, 294; Ann. Lyc. Nat. Hist., xi, 1877, 346; xi, 1877, 365; Bull. U. S. Nat. Mus., ix, 1877, 36.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 48.—JORDAN and COPELAND, Check List, 1876, 157 (name only).

- Teretulus oblongus*, JORDAN and GILBERT, in Klippart's Rept., 1876, 53 (name only); 1877, 85, pl. xii, f. 20.
- Catostomus gibbosus*, LESUEUR, Jour. Acad. Nat. Sci. Phila., i, 1817, 92.—STORER, Rept. Ichthy. Mass., 1838, 183; Synopsis, 1846, 420; Hist. Fishes Mass., 291, 1867, pl. xxii, f. 4.—KIRTLAND, Hamilton Smith's Annals of Science.
- Labeo gibbosus*, DEKAY, New York Fauna, part iv, Fishes, 1842, 194.
- Catostomus tuberculatus*, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1817, 93.—DEKAY, New York Fauna, part iv, Fishes, 1842, 199.—CUVIER and VALENCIENNES, Hist. Nat. des Poissons, xvii, 1814, 444.—THOREAU, Week on Concord and Merrimack, 1863, 38.
- Catostomus vittatus*, LESUEUR, Journ. Acad. Nat. Sci. Phila., 1817, 104.—DEKAY, New York Fauna, part iv, Fishes, 1842, 203.—CUV. and VAL, xvii, 1844, 459.—STORER, Synopsis, 1846, 422.
- Catostomus fasciolaris*, RAFINESQUE, Ich. Ob., 1820, 58.
- Labeo elegans*, DEKAY, New York Fauna, part iv, Fishes, 1842, 192.
- Catostomus elegans*, STORER, Synopsis, 1846, 425.
- Labeo esopus*, DEKAY, New York Fauna, part iv, Fishes, 1842, 195.
- Catostomus esopus*, STORER, Synopsis, 1846, 425.
- Labeo elongatus*, DEKAY, New York Fauna, part iv, Fishes, 1842, 195.
- Moxostoma anisurus*, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 202. (Not of Rafinesque.)
- Moxostoma tenue*, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 203.—PUTNAM, Bull. Mus. Comp. Zool., 1863, 10 —GUNTHER, Cat. Fishes Brit. Mus, vii, 1868, 21.
- Erimyzon tenuis*, JORDAN and COPELAND, Check List, 1876, 157.
- Moxostoma claviformis*, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 171; U. S. Pac. R. R. Expl., x, 1858, 219, pl. xlviii, f. 5-9
- Erimyzon claviformis*, JORDAN and COPELAND, Check List, 1876, 157.
- Moxostoma kennerlyi*, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 171; U. S. Mex. Bound. Surv., Ichth., 35, 1859, pl. xx, f. 4-6.
- Moxostoma campbelli*, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 171; U. S. Mex. Bound. Surv. Ichth., 35, 1859, pl. xx, f. 4-6.
- Erimyzon campbelli*, JORDAN and COPELAND, Check List, 1876, 157.

Description.—Body oblong, compressed, becoming gibbous with age, the ante-dorsal region more or less elevated in the adults; the depth $3\frac{1}{2}$ in length, ranging from $2\frac{1}{2}$ in adults to 4 in young; head stout, short, about $4\frac{1}{2}$ in length (4 to $4\frac{1}{2}$), the interorbital space wide and depressed, the lower parts narrower, so that it is somewhat wedge-shaped downward; eye not large, $4\frac{1}{2}$ in head ($4\frac{1}{2}$ to $5\frac{1}{2}$); mouth protractile downward and forward, the mandible oblique; scales usually closely imbricated and more or less crowded forward, but often showing various irregularities in arrangement, about 43 (39-45) in a longitudinal series and 15 (14 to 16) in a transverse series between the ventrals and the dorsal; fin-rays somewhat variable, the dorsal with 11 (10 to 13) developed rays, the anal with 7, and the ventrals with 9 (rarely 8); coloration varying with age; never distinct series of black spots along the rows of scales; young with a broad black lateral band bordered above by paler; in some specimens from clear water, this band is of a jet-black color and very distinct; in others, it is duller; later this band becomes broken into a series of blotches, which often assume the form of broad transverse bars; in adult specimens, these bars disappear, and the color is nearly uniform brown, dusky

CHUB SUCKER.

above, paler below, everywhere with a coppery or brassy, never silvery, lustre; the fins are dusky or smoky brown, rarely reddish-tinged; sexual differences strong; the males in spring with usually three large tubercles on each side of the snout, and with the anal fin more or less swollen and emarginate; adult specimens with the back gibbous and the body strongly compressed, in appearance quite unlike the young; maximum length about 10 inches.

Habitat, all waters of the United States east of the Rocky Mountains.

Diagnosis—This is the only Sucker in Ohio without a lateral line which has not a series of black spots along the rows of scales on the sides of the body.

Habits—This species, like the two preceding, abounds in every brook and pond in the State of Ohio. It is one of the very smallest of the Suckers, rarely reaching the length of a foot. It is more than usually tenacious of life, and bites readily at a small hook, but is of very little value as food. The young are rather handsome fishes, the black lateral band being sometimes very distinct. In the aquarium they feed upon algæ and the offal of other fishes. In the stomachs of specimens examined by Prof. Forbes, only confervæ, diatoms, and mud were found.

GENUS 21. MINYTREMA. Jordan.

Minytrema, JORDAN, Man. Vert., 2d ed., 1878, 318.

Catostomus, *Ptychostomus*, *Moxostoma*, and *Erimyzon* sp., AUTHORS.

Type, *Catostomus melanops*, Rafinesque.

Etymology, *minus*, reduced; *trema*, aperture, in allusion to the imperfections of the lateral line.

Species with the form, squamation, and general appearance of *Myxostoma*, but with the air bladder in two parts, as in *Erimyzon*, and the lateral line imperfect, in the very young entirely obsolete, in half-grown specimens showing as a succession of deepened furrows, in the adult with perfect tubes, but interrupted, these tubes being wanting on some of the scales, especially posteriorly; head moderate, rather broad above; mouth moderate, inferior, horizontal, the upper lip well developed, freely protractile, rather small, infolded, A-shaped in outline, plicated, with 12 to 20 plicæ on each side; lower jaw without cartilaginous sheath; eye moderate, rather high up, placed about midway of the head. Suborbital bones considerably developed, not very much narrower than the fleshy portion of the cheek below them, the posterior suborbital concavo-convex, about twice as long as deep, sometimes divided, the anterior somewhat deeper than long, often divided into two, sometimes united with the preorbital, which is well developed and much longer than broad. The number and form of these bones, except as to their depth, are not constant in the same species, and do not afford specific characters; opercular bones well developed, not much rugose; fontanelle evident, rather large; gill rakers rather long, in length about half the diameter of the eye; isthmus moderate; pharyngeal bones essentially as in *Myxostoma*; body rather elongate, subterete, becoming deep and rather compressed with age; scales rather large, nearly equal over the body, the radiating furrows not specially marked; lateral line as above.

described, interrupted in the adult, but with perfect tubes, imperfect in partly grown specimens, entirely obsolete in the young; scales in a longitudinal series 44 to 47 in number, 12 to 14 in a transverse series from dorsal to ventrals; dorsal fin rather short and high, with about 12 developed rays, beginning rather nearer the snout than the base of the caudal; pectoral fins moderate, not reaching ventrals, the latter not to vent; ventrals rather in advance of the middle of the dorsal, their rays normally 9, rarely 8 or 10; anal fin high and short, often more or less emarginate in males; caudal fin moderately forked, the lobes about equal; air-bladder with two chambers; males in spring with the head covered with many small tubercles.

But one species of this genus seems to be known. It is widely distributed in the waters of the Western and Southern States.

This genus has been recently separated from *Erimyzon*, on account of the peculiarities of the lateral line. The form of the body, the form of the mouth, and the character of the equamation differ considerably in the two genera.

42. MINYTREMA MELANOPS (Rafinesque) Jordan.

Striped Sucker; Sand Sucker; Spotted Sucker; Black-nosed Sucker.

Catostomus melanops, RAFINESQUE, Ich. Oh., 1820, 57.—KIRTLAND, Boston Journ. Nat. Hist., v, 1845, 271.—STORER, Synopsis, 1846, 424.

Catostomus melanopsis, KIRTLAND, Zool. Ohio, 1838, 168.

Ptychostomus melanops, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 204.—COPE, Proc. Am. Philos. Soc. Phila., 1870, 482.

Erimyzon melanops, JORDAN, Bull. Buffalo Soc. Nat. Hist., 1876, 95; Man. Vert., 1876, 294; Ann. Lyc. Nat. Hist. N. Y., xi, 1877, 347.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 48.—JORDAN and COPELAND, Check List, 1876, 157.

Minytrema melanops, JORDAN, Man. Vert., 2d Ed., 1878, 318; Bull. U. S. Nat. Mus., xii, 1878, 158.

Catostomus fasciatus, (LESUEUR MSS.) CUV. and VAL., Hist. Nat. des Poissons, xvii, 1844, 449.—STORER, Synopsis, 1846, 426.—GUNTHER, Cat. Fishes Brit. Mus., vii, 1861, 19.

Moxostoma victoriae, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 171; U. S. Mex. Bound. Surv., Ichth., 1859, 35 pl. xx, f. 1-3.

Ptychostomus haydeni, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 172; U. S. Pac. R. R. Expl., x, 1858, 220, pl. xlix, f. 1-4.

Teretulus haydeni, JORDAN and COPELAND, Check List, 1876, 157.

Teretulus succetta, JORDAN and GILBERT, in Klippart's Rept. Fish Comm. Ohio, 1877, 53. (Supposed to be *C. succetta*, Lacepede, as it was perhaps in part the *C. succi* of Cuv. and Val., and of BOSE.)

Erimyzon succetta, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 35.

Description.—Body oblong, little compressed, the young nearly terete, the adults deeper-bodied; the dorsal region not elevated; depth about four in length, varying from three in adults to four and a half in the young; head not very large; four and a half in length of body ($4\frac{1}{2}$ to $4\frac{3}{4}$); not specially depressed; mucous pores rather strong; eye small, five to six in head; mouth quite inferior, horizontal, rather small; scales large, firm, regularly and smoothly imbricated, in 46 (44-47) longitudinal series and 13 (12 to 14) transverse series, not crowded forwards; fin-rays usually, dorsal 12, anal 7, ventrals 9; coloration dusky, with usually a black blotch behind the dorsal

fin; top of head black; lips pale; each scale along the sides with a small, more or less distinct blackish spot at its base, these spots forming interrupted longitudinal lines along the rows of scales; these lines are usually very distinct, especially in the adult, but young specimens often show them faintly; sides and belly silvery, with a coppery lustre; sexual peculiarities moderately marked; very old males with the head covered with small tubercles in spring; no great changes with age, either in form or coloration; size large; maximum length about 18 inches.

Habitat, Great Lakes to South Carolina and Texas.

Diagnosis—This species may be best known by the coloration, each scale along the sides having a conspicuous dark spot, which forms dark stripes along the series of scales.

Habits—This species is abundant in the lake regions, and grassy ponds throughout Ohio. It is fond of clear sluggish waters. It is often taken in nets in Lake Erie, but is more common in the basin of the Ohio. It is a handsome fish, and the young being very tenacious of life are attractive aquarium fishes. It may be used as food, but as a food fish is more saleable than edible.

GENUS 22 MYXOSTOMA. (Rafinesque) Jordan.

Catostomus, sp. LESUEUR, and of all writers till 1855.

Moxostoma, RAFINESQUE, Ichthyologia Ohiensis, 1820, 54. (Proposed as a subgenus for those species of *Catostomus* with eight ventral rays and the caudal lobes unequal; type *C. anisurus*, Raf.)

Teretulus, RAFINESQUE, Ichthyologia Ohiensis, 1820, 57. (As a subgenus, to include those species of *Catostomus* with nine ventral rays; no type designated—most of the species recorded belong to the present genus. *C. aureolus*, LeSueur, is the species first mentioned, and to this species and its relative the name *Teretulus* was afterwards restricted by Professor Cope.)

Ptychostomus, AGASSIZ, American Journal of Science and Arts, 1855, p. 203 (No type designated; the species mentioned are *P. aureolus*, *P. macrolepidotus*, *P. duquesnii*, and *P. melanops*. *P. aureolus* has been considered the type of the genus.)

Teretulus, COPE, Journ. Acad. Nat. Sci. Phila., 1864, 236.

Moxostoma, JORDAN, Manual of Vertebrates, 1876, 295.

Myxostoma, JORDAN, Ann. Lyc. Nat. Hist., 1877, 343. (Corrected orthography.)

Etymology, *muzo*, to suck; *stoma*, mouth.

Type, *Catostomus anisurus*, Rafinesque.

Body more or less elongate, sometimes nearly terete, usually more or less compressed; head variously long or short, its length ranging from three and a half to five and a half in that of the body; eye usually rather large, varying from three to six times in the length of the side of the head, its position high up and median or rather posterior; sub-orbital bones very narrow; fontanelle on top of head always well open, the parietal bones not coalescing; mouth varying much in size, always inferior, the mandible being horizontal or nearly so; lips usually well developed, the form of the lower lip varying, usually with a single median fissure; the lips with transverse plicæ, rarely somewhat papillose; jaws without cartilaginous sheath; muciferous system considerably developed;

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opercular bones moderately developed, nearly smooth; isthmus broad; gill-rakers feeble; pharyngeal bones rather weak, the teeth moderate, strongly compressed, the lower five or six much stronger than the others which diminish rapidly in size upward, each with a prominent internal cusp; scales large, quadrate, nearly equal over the body and not crowded anteriorly, usually about 41 in the lateral line, and about 12 series between dorsal and ventrals; lateral line well developed, straight or anteriorly curved; fins well developed, the dorsal inserted about midway of the body, its first rays usually nearer snout than caudal, the number of rays usually 13 (11 to 17); anal fin short and high, emarginate in old males, with seven rays; ventrals inserted under middle of dorsal, usually with nine rays; caudal fin deeply forked; *air-bladder with three chambers*; skeleton essentially as in *Catostomus*, the vertebræ (in *M. carpio*) 27-14; sexual peculiarities little marked, the males in the spawning season (March to June) with the lower fins reddened, and the anal rays swollen and tuberculate.

Species numerous and very closely related, abounding in all waters of the United States, east of the Rocky Mountains.

ANALYSIS OF SPECIES OF MYXOSTOMA.

- *Lower lip infolded, Δ -shaped when viewed from below, with a distinct median crease, in which the two halves of the lip meet forming an acute angle; mouth small; dorsal rays 16. VELATUM. 43.
- **Lower lip full, its posterior edge truncate, not infolded or Δ -shaped.
 - a. Dorsal rays 12 to 14.
 - b. Caudal fin with the upper lobe falcate, much longer than the lower.
 - ANISURA. 44.
 - bb. Caudal fin symmetrical.
 - c. Mouth very small; head short, 5 to 5½ in length. . . . AUREOLUM. 45.
 - cc. Mouth rather large; head larger, 4 to 5 in length.
 - MACROLEPIDOTUM. 46.
 - aa. Dorsal rays 15 to 18; mouth large. CARPIO. 47.

43. MYXOSTOMA VELATUM (Cope) Jordan.

Small-mouth Red Horse; White Nose.

- Catostomus anisurus*, KIRTLAND, Boston Journ. Nat. Hist., v, 1845, 269 (with plate). (Not of Rafinesque).—STORER. Synopsis, 1846, 424.
- Ptychostomus anisurus*, JORDAN, Bull. Buffalo Soc. Nat. Hist., 1876, 94 (name only).
- Moxostoma anisurus*, JORDAN, Man. Vert., 1876, 295.
- Teretulus anisurus*, NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 49.—JORDAN and COPELAND, Check List, 1876, 153 (name only).
- Moxostoma anisurum*, JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 72, 80.
- Moxostoma anisura*, JORDAN and GILBERT, in Klippart's Rept., 1877, 53 (name only).
- Myxostoma anisura*, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 33.
- Ptychostomus velatus*, COPE, Proc. Am. Philos. Soc., 1870, 471.
- Moxostoma velatum*, JORDAN, Man. Vert., 1876, 296.
- Teretulus velatum*, NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 49.
- Teretulus velatus*, JORDAN and COPELAND, Check List, 1876, 158.
- Moxostoma velata*, JORDAN and GILBERT, in Klippart's Rept., 1876, 53 (name only).

Myxostoma velata, JORDAN, Man. Vert., 2d Ed., 1878, 317; Bull. U. S. Nat. Mus., xii, 1879, 132.

Ptychostomus collapsus, COPE, Proc. Am. Philos. Soc. Phila., 1870, 471.

Description—Body stout, deep, compressed, the back elevated; head short, heavy, flatfish and broad above, thick through the cheeks; eye rather large, midway in head, four to five in its length; muzzle rather prominent, bluntish, overhanging the very small mouth; fins very large; the dorsal long and high, its height five-sixths the length of the head; pectorals nearly reaching ventrals; mouth quite small, the lips plicate, the lower lip infolded, A-shaped when viewed from below, with a distinct median crease, in which the two halves of the lips meet, forming an acute angle; color silvery, smoky above, lower fins red; head $3\frac{1}{4}$ to $4\frac{1}{4}$; depth 3 to 4; D. 15 to 17; scales 6-42-5. Length 1 foot.

Habitat, Upper Mississippi Valley to Georgia and North Carolina, widely distributed, but not generally abundant.

Diagnosis—This species may be known by the small and contracted mouth, in connection with the presence of 15 or more dorsal rays.

Habits.—This species is frequently taken in the Ohio River and its tributaries, but it is not abundant anywhere in the west. In some of the streams of North Carolina, it is the commonest species. It is little valued as food. This seems to be the species called White Nose by Dr. Kirtland, but more than one species is apparently included in his description.

44. MYXOSTOMA ANISURUM (Rafinesque) Jordan.

Long-tailed Red Horse.

Catostomus anisurus, RAFINESQUE, Ichthyologia Ohiensis, 1820, 54.

Myxostoma anisura, JORDAN, Man. Vert., 2d Ed., 1868, 315.

Ptychostomus breviceps, COPE, Proc. Am. Philos. Soc. Phila., 1870, 478.

Tereilus breviceps, JORDAN and COPELAND, Check List, 1876, 157. (Name only.)

Moxostoma breviceps, JORDAN and GILBERT, in Klippart's Rept., 1876, 53. (Name only.)

Myxostoma breviceps, JORDAN, Bull. U. S. Nat. Mus., 1877, 9, 50. (Name only.)

Description—Body compressed, the back somewhat elevated; head short, conic, flattish, formed as in *M. aureolum*; mouth very small, the lips plicate, the lower full and truncate behind; dorsal fin short and high, falcate, the anterior rays being elevated, and the free border deeply incised, the height of the largest rays being half greater than the base of the fin; caudal fin with the upper lobe much longer than the lower, falcate, at least in the adult; colors olivaceous, sides silvery with coppery reflections; head $5\frac{1}{2}$; depth $3\frac{1}{2}$; D. 12 or 13; scales 6-46-5. Length one foot.

Habitat, Ohio Valley.

Diagnosis.—This species is very close to *M. aureolum*, and may indeed be the male of that species. It may be known from the other Red Horse by the inequality of the lobes of the caudal.

Habits.—I have seen a few specimens of this in the United States Museum, obtained in the Cincinnati market. Prof. Cope's types came from Western Pennsylvania, further than this nothing is known of its habits or distribution.

45. MYXOSTOMA AUREOLUM (LeSueur) Jordan.

Golden Red Horse; Lake Mullet.

Catostomus aureolus, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1817, 95.—KIRTLAND, Rpt Zool Ohio, 1838, 168; Boston Journ. Nat. Hist., iii, 1840, 349.—DEKAY, New York Fauna, part iv, Fishes, 1842, 201.—STORER, Synopsis, 1846, 420.—AGASSIZ, Lake Superior, 1850, 357.—GUNTHER, Cat. Fishes Brit. Mus. vii, 1868, 16. (In part; description apparently copied and confused.)

Ptychostomus aureolus, AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 1855, 204.—PUTNAM, Bull. Mus. Comp. Zool., 1863, 10.—COPE, Proc. Acad. Nat. Sci. Phila., 1864, 285; Proc. Am. Philos. Soc. Phila., 1870, 476.

Moxostoma aureolum, JORDAN, Man. Vert., 1876, 295.

Teretulus aureolum, NELSON, Bull. No. 1, Ill. Mus. Nat. Hist., 1876, 49.

Teretulus aureolus, JORDAN and COPELAND, Check List, 1876, 157. (Name only.)

Moxostoma aureola, JORDAN and GILBERT, in Klippart's Rpt., 1876, 54. (Name only.)

Myxostoma aureola, JORDAN, Man. Vert. E. U. S., 2d Ed., 1878, 314; Bull. U. S. Mus., xii, 124, 1878.

Catostomus lesueurii, RICHARDSON, Franklin's Journal, 1823, 772.

Cyprinus (*Catostomus*) *sueurii*, RICHARDSON, Faun. Bor.-Am., Fishes, 1836, pp. 118, 303.

Catostomus sueurii, CUV. and VAL., Hist. Nat. des Poissons, xvii, 1844, 475.—STORER, Synopsis, 1847, 425.

Catostomus sueuri, DEKAY, New York Fauna, part iv, Fishes, 1842, 203.

Ptychostomus sueurii, COPE, Proc. Am. Philos. Soc. Phila., 477, 1870.

Teretulus sueurii, JORDAN and COPELAND, Check List, 1876, 157. (Name only.)

Catostomus macrolepidotus, GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 18. (Excl. syn.)

Description.—Body moderately elongate, compressed, the back somewhat arched; head comparatively short, low and small; mouth small, somewhat overpassed by the snout; lips plicate; lower lip full, truncate behind; coloration bright yellowish brown, not silvery, lower fins bright red; head 5 to $5\frac{1}{2}$; depth $3\frac{1}{2}$; D. 13; scales 6-42 to 48-5. Length, 12 to 18 inches.

Habitat, Ohio Valley and Great Lake region and northward.

Diagnosis.—This species may be known from the Common Red Horse by the shorter head and smaller mouth.

Habits.—This handsome Sucker is very common in Lake Erie, and is found, though less abundantly in the Ohio River. It is confounded by the fishermen with the Common Red Horse, and is of similarly little value as food.

46. MYXOSTOMA MACROLEPIDOTUM (LeSueur) Jordan.

Common Red Horse; Mullet; White Sucker; Large-scaled Sucker.*a. var. macrolepidotum.*

Catostomus macrolepidotum, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1817, 94.—DEKAY, New York Fauna, part iv, Fishes, 1842, 202.—CUVIER and VALENCIENNES, Hist. Nat.

des Poissons, xvii, 1844, 447.—STORER, Synopsis, 1846, 420.—UHLER and LUGGER, Fishes of Maryland, 1876, 140.

Ptychostomus macrolepidotum AGASSIZ Am. Journ. Sci. Arts, 2d series, xix, 1855, 204.—COPE, Proc. Am. Philos. Soc. Phila., 1870, 475.—JORDAN, Fishes of Ind., 1875, 221. (Name only.)

Moxostoma macrolepidotum, JORDAN, Man. Vert., 1876, 296.

Teretulus macrolepidotum, NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 49.

Teretulus macrolepidotus, JORDAN and COPELAND, Check List, x, 1876, 157. (Name only.)

Moxostoma macrolepidota, JORDAN and GILBERT, in Klippart's Rept., 1876, 53 (name only); Man. Vert. E. U. S., 2d Ed., 313, 1878; Bull. U. S. Nat. Mus., xii, 1878, 120.

Catostomus oneida, DEKAY, New York Fauna, part iv, Fishes, 1842, 198.—STORER, Synopsis, 1846, 425.

Ptychostomus oneida, COPE, Proc. Am. Philos. Soc. Phila., 1870, 476.

Ptychostomus robustus, COPE, Proc. Am. Philos. Soc. Phila., 1870, 473.

Teretulus robustus, JORDAN and COPELAND, Check List, 1876, 157 (name only).

Ptychostomus congestus, COPE and YARROW, Lieutenant Wheeler's Expl. W. 100th Mer., v, 1876, — (not of Girard.)

Habitat, North Carolina to Vermont, and northwestward—through the Great Lake Region and Upper Mississippi, the only form of the species occurring east of the Alleghany Mountains. (also in Arizona.)

b. var. lachrymale (Cope) Jordan.

Ptychostomus lachrymalis, COPE, Proc. Am. Philos. Soc. Phila., 1870, 474.

Teretulus lachrymalis, JORDAN and COPELAND, Check List, 1876, 157 (name only).

Myxostoma duquesnii, var. *lachrymalis*, JORDAN, Ann. Lyc. Nat. Hist. N. Y., xi, 1877, 349.

Myxostoma macrolepidota, var. *lachrymalis*, JORDAN, Man. Vert., 2d Ed., 1878, 313.

Habitat, North Carolina to Alabama.

c. var. duquesnii (LeSueur) Jordan.

Catostomus duquesnii, LESUEUR, Journ. Acad. Nat. Sci. Phila., 1817, 105.—RAFINESQUE, Ich. Oh., 1820, 60.—KIRTLAND, Rept. Zoo., Ohio, 1835, 168; Boston Journ. Nat. Hist., v, 1845, 263.—DEKAY, New York Fauna, part iv, Fishes, 1842, 203.—CUVIER and VALENCIENNES, xvii, 1844, 48.—STORER, Synopsis, 1846, 423.—GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 18.—UHLER and LUGGER, Fishes of Maryland, 1876, 139.

Ptychostomus duquesnii, AGASSIZ Am. Journ. Sci. Arts, 2d series, xix, 1855, 204.

Teretulus duquesnii, COPE, Journ. Acad. Nat. Sci. Phila., 1878, p. —.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 49; JORDAN and COPELAND, Check List, 1876, 157 (name only).

Ptychostomus duquesni, COPE, Proc. Am. Philos. Soc. Phila., 1870, 476.—JORDAN, Bull. Buffalo Soc. Nat. Hist., 1876, 95.

Moxostoma duquesnii, JORDAN, Man. Vert., 1876, 295.

Moxostoma duquesnei, JORDAN and GILBERT, in Klippart's Rept., 1876, 53 (name only).

Myxostoma duquesnii, JORDAN, Ann. Lyc. Nat. Hist., 1877, 349; Bull. U. S. Nat. Mus., ix, 1877, 37.

Myxostoma macrolepidota, var. *duquesni*, JORDAN, Man. Vert., 2d Ed., 1878, p. 313; Bull. U. S. Nat. Mus. xii, 120.

Catostomus erythrurus, RAFINESQUE Am. Month. Mag. and Crit. Rev., 1818, 345; Ich. Oh., 1850, 59.—KIRTLAND, Rept. Zool. Ohio, 1838, 168.

Ptychostomus erythrurus, COPE, Proc. Am. Philos. Soc. Phila., 1870, 474 —JORDAN, Fishes of Ind., 1875, 221 (name only).

Teretulus erythrurus, JORDAN and COPELAND, Check List, 1876, 157 (name only).

Rutilus melanurus, RAFINESQUE, Ich. Oh., 1820, 51.

Description.—Body stoutish, compressed, varying to moderately elongate; head stout, moderately long; mouth moderate or rather large, not very small, nor very much overpassed by the muzzle; lips thick, strongly plicate; lower lip full, truncate behind; dorsal fin moderate, not falcate, its rays 12 to 19—usually 13 in number; scales large; coloration olivaceous; sides pale or silvery, with bright reflections; lower fins red or orange in the adult; head 4 to 5; depth $3\frac{1}{2}$ to $4\frac{1}{2}$; scales 6-45-5. Length 18 to 24 inches.

Habitat, Great Lake Region to Georgia and Arizona.

Diagnosis.—This species may be known by presence of a rather large mouth, and a moderate dorsal fin.

Habits.—Two varieties of the Common Red Horse may be recognized in Ohio. One (var. *duquesnii*) is the common form in the streams of the southern two thirds of the State. This form is more silvery in color; the body and head are more elongate, and the mouth is larger; the other (var. *macrolepidotum*) is common in Lake Erie, and in all these respects forms a transition towards the short headed, small-mouthed and high-backed *Myxostoma aureolum*. Both varieties reach a large size, and are used as food, although their value is not great. The species is found in all clear waters in the west, and ascends the small streams in May, for the purpose of spawning. It is not very tenacious of life, and in the aquarium dies on the least suspicion of impure water.

47. MYXOSTOMA CARPIO (Valenciennes) Jordan.

Carp Mullet; White Lake Mullet.

Catostomus carpio, VAL., Hist. Nat. des Poiss., xvii, 1344, 457.—STORER, Synopsis, 1846, 426 —GUNTHER, Cat. Fishes Brit. Mus, vii, 1868, 20.

Ptychostomus carpio, COPE, Proc. Am. Philos. Soc. Phila., 1870, 476.

Moxostomus carpio, JORDAN, Man. Vert., 1876, 303.—JORDAN and GILBERT, in Klippart's Rept. Fish Comm. Ohio, 1877, 53 (name only).

Teretulus carpio, NELSON, Bull. No 1, Ills. Mus. Nat. Hist., 1876, 49.—JORDAN and COPELAND, Check List, 1876, 157 (name only).

Myxostoma carpio, JORDAN, Man. Vert. E. U. S., 2d Ed, 1878, 312; Bull. U. S. Nat. Mus, xii, 1878, 118.

Description.—Body deep, strongly compressed, the back somewhat elevated; head large, broad above; mouth large, with full lips, which are strongly plicate; lower lip full, truncate behind; eye large; dorsal fin high and large, more developed than in any other species of this genus, the first ray about as long as the base of the fin, the rays 15 to 18 in number; coloration very pale and silvery, the lower fins pale; head $3\frac{3}{8}$ to $4\frac{1}{2}$; depth $3\frac{1}{2}$; D. 17; scales 5-43-4. Length 18 to 24 inches.

Habitat, Ohio River and Great Lake Region.

Diagnosis—This species may be known by the presence of about 17 dorsal spines and a large mouth.

Habits.—This is a large species frequently taken with *M. macrolepidotum* in Lake Erie. I have also seen several from the Ohio River at Cincinnati and Marietta. It is a species of northern distribution.

GENUS 23. PLACOPHARYNX. Cope.

Placopharynx, COPE, Proc. Am. Philos. Soc. Phila., 1870, 477.

Type, *Placopharynx carinatus*, Cope.

Etymology, *plax*, a broad surface; *pharynx*, pharynx.

This genus is identical with *Myxostoma* in all respects, except in the development of the pharyngeal bones and teeth. The pharyngeal bones are very strong and the teeth on the lower half of the bone are much reduced in number (6 to 10). They are nearly cylindrical in form, being little compressed, and with a broad, rounded or flattened grinding surface. In size and form, these enlarged teeth are extremely irregular. The upper teeth are small, and compressed as in *Myxostoma*. The mouth in *Placopharynx* is larger than in any species of *Myxostoma* and the lips are much more developed.

But one species is known.

48. PLACOPHARYNX CARINATUS Cope.

Big-jawed Sucker.

Placopharynx carinatus, COPE, Proc. Am. Philos. Soc. Phila., 1876, 467.—JORDAN, Fishes of Ind., 1875, 221 (name only); Man. Vert., 1876, 296; 2d Ed., 1878, 311; Proc. Acad. Nat. Sci. Phila., 1877, 72; Bull. U. S. Nat. Mus., ix, 1877, 50 (name only); xii, 1878, 108; Bull. U. S. Geol. Surv., vol. iv, 1877, No. 2, p. 417.—NELSON, Bull. No. 1, Ills. Mus. Nat. Hist., 1876, 49.—JORDAN and COPELAND, Check List, 1876, 158.—JORDAN and GILBERT, in Klippart's Rpt., 1877, 53 (name only).—KLIPPART, First Report of Ohio Fish Commission, 1877, 86.

Description—Body oblong, moderately compressed, heavy at the shoulders; head very large; eye small, behind the middle of the head; mouth extremely large, the lower jaw oblique when the mouth is closed, the mouth thus opening forward as well as downward; lips very thick, coarsely plicate, the lower lip full and heavy, truncated behind; head above evenly rounded (carinate, according to Professor Cope); color brassy-green above, pale below; lower fins red; head $3\frac{3}{8}$; depth $3\frac{3}{8}$; D. 13; scales 6-45-6; V. 9. Length 18 to 24 inches.

Habitat, Mississippi Valley and Upper Great Lakes.

Diagnosis.—This large coarse species may be *certainly* known only by the examination of its pharyngeal teeth.

Habits.—This fish is probably common in the Western Rivers, but owing to its great similarity of form to the Common Red Horse, has been overlooked by most naturalists. The writer has met with the following specimens: (a) a complete skeleton of a very large specimen found by Dr. J. M. Wheaton in the Scioto River near Columbus; (b) two young speci-

mens obtained in Illinois River by Professor A. W. Brayton; (c) a pair of pharyngeal bones taken by Dr. G. M. Levette from a specimen taken in the Wabash at Terre Haute, where the fish is said to be abundant; (d) a pharyngeal bone and air-bladder from a specimen taken in Detroit River by Professor Baird; (e) a pharyngeal bone from "post pliocene" deposits at the Falls of the Ohio by Dr. John Sloan, and (f) many specimens taken in fish traps in French Broad River where it is the most abundant of the Suckers. Excepting Professor Cope's original type, the above mentioned are the only specimens on record.

GENUS 24. QUASSILABIA Jordan and Brayton.

Lagochila, JORDAN and BRAYTON, Proc. Acad. Nat. Sci. Phila., 1877, 280 (preoccupied in conchology as *Lagochilus*).

Quassilabia, (JORDAN and BRAYTON) JORDAN, Man. Vert., E. U. S., 2d Ed., 1878, 401.

Type, *Lagochila lacera*, Jordan and Brayton.

Etymology, Latin, *quassus*, broken or torn; *labia*, lip

Body elongated, not much compressed, not elevated; head shortish, conical, with lengthened snout, its length four and a half to five in body, the opercular region being reduced, so that the eye is well backwards; suborbital bones narrow; fontanelle large, widely open; mouth large, singular in structure, inferior, the upper lip not protractile, greatly prolonged, its surface closely plicate; lower lip much reduced, divided into two distinct elongate lobes, which are weakly papillose; the split between these lobes extends backwards to the edge of the dentary bones which are provided with a horny plate as in the western genus *Pantostus*; the lower lip is entirely separated by a deep fissure, from the upper at its angle; the skin of the cheeks forms a sort of cloak over this fissure, the crease separating this skin from the lips extends down on the under side of the head; muciferous tubes well developed; fins moderate, of the same type as in *Myxostoma*; scales large, the lateral line well developed and nearly straight, with about 45 scales in its course; air-bladder in three parts.

But one species is known, one of the most singular of American fishes

49. QUASSILABIA LACERA Jordan and Brayton.

Hare-lip Sucker; Split-mouth Sucker; May Sucker of the Scioto; Cut-lip.

Lagochila lacera, JORDAN and BRAYTON, Proc. Acad. Nat. Sci. Phila., 1877, 280.—JORDAN, Man. Vert., 2d Ed., 1878, 311.

Quassilabia lacera, JORDAN, Man. Vert., 2d Ed., 1878, 406; Bull. U. S. Geol. Surv. Terr., 1878, 418; Bull. U. S. Nat. Mus., xii, 1878, 106.

Description.—Head short, conical, with lengthened snout, the region between the eyes flattened and with prominent mucous ridges; cheeks and lower part of head tumid; opercle very small, its greatest length scarcely greater than the diameter of the eye; four and one-third in length of head, two in length of snout, its situation thus quite inferior; length of top of head one and two-thirds in distance from the snout to the base

the dorsal; body slender; dorsal fin low; color olivaceous or bluish-brown above; sides and belly silvery; lower fins faintly orange; head $4\frac{2}{3}$; depth $4\frac{2}{3}$; D. 12; A. 7; V. 9; scales 5-45-5. Length 1 to $1\frac{1}{2}$ feet.

Habitat, Ohio Valley.

Diagnosis.—This species will be known at sight from the fact that its under jaw is "hare-lipped," i.e. the fleshy lip is split to the bone.

Habits.—This species was first taken by Professor Brayton and the writer in Chickamauga River in Georgia, a tributary of the Tennessee. Later, we obtained a third specimen in Elk River, Tennessee. In April, 1878, much to my surprise, a fine large specimen was sent to me by Mr. J. H. Klippart of the Ohio State Fish Commission. This specimen was taken in the Scioto River, and Mr. Klippart tells us that the species is well known to the fishermen at Columbus, who call the fish "May Sucker," as it spawns in May. That so conspicuous a species should so long have eluded the ichthyologists in the Ohio Basin, is extremely remarkable. The habits of this species are doubtless similar to those of allied Red Horse.

FAMILY IX. CYPRINIDÆ. THE CARPS.

Cyprinoid fishes with the margin of the upper jaw formed by the premaxillaries alone, and the lower pharyngeal bones well developed, falciform, nearly parallel with the gill arches, each provided with one to three series of teeth in small number, from three to seven in the main row, and a less number in the others; head naked; body almost always scaly; barbels two or four (absent in most of our genera and not large in any); belly usually rounded, rarely compressed, never serrated; gill openings moderate, separated by an isthmus; no adipose fin; dorsal fin short in American species (elongate in many old world forms); ventral fins abdominal; air-bladder usually large, commonly divided into an anterior and posterior lobe, rarely wanting; stomach without appendages, appearing as a simple enlargement of the intestine. Fishes of moderate or small size, inhabiting the fresh waters of the old world and of North America. Genera about two hundred; species nearly a thousand; excessively abundant where found, both in individuals and in species, and from their great uniformity in size, form and coloration, constituting one of the most difficult groups in Natural History in which to distinguish genera and species. The genera found in Ohio, with the exceptions of *Campostoma*, *Exoglossum*, *Chrosomus*, and few others, are all very closely related, and are separated by characters which, though reasonably constant, are often difficult to determine. From time to time different authors have proposed to throw most of these small genera into the genus *Leuciscus*, a procedure, which, without further discussion, may be said to have always led to confusion. The spring or breeding dress of the male fishes is often peculiar. The top of the head and often the fins, or various portions of the body are covered with small tubercles, outgrowths from the epidermis. The fins and parts of the body in young spring males are often charged with bright pigment, the prevailing color of which is red, although in some genera it is satin-white, yellow, or black.

NOTE.—The student will find it necessary from the first to examine very carefully the teeth of these fish, as only by dental characters can most of the genera be recognized. The pharyngeal bones lie behind the gills, inside of and parallel with the shoulder girdle. They can be removed by inserting a pin or small hook under the shoulder girdle. They should be carefully cleaned, and in most cases they can be examined only by aid of a lens. Usually a principal row of four or five larger teeth will be found, in front of which is a set of one or two smaller ones. The two sides are usually *but not always* symmetrical, therefore both must be examined. Thus “teeth 2, 4-5, 1, indicates two rows of teeth on each side, on the one side four in the principal row and two in the lesser, on the other side five in the main row and one in the other. “Teeth 4-4,” indicates a single row of four on each pharyngeal bone and so on.

In most of our genera, these teeth—or the largest ones, are “*raptorial*,” that is hooked inward at the tips. A “grinding” or “masticatory” surface, is an excavated area in the concavity of the hook or at its base. Sometimes a lateral bevel on the edge of the tooth so resembles a masticatory surface as to “deceive the very elect” until the question as to its actual concavity is tested by a pin or other similar object. Sometimes the masticatory surface is very narrow and confined to one or two of the teeth. In the present state of our knowledge, the presence or absence of this surface must be taken as a generic character.

ANALYSIS OF GENERA OF CYPRINIDÆ.

*Species native, with the dorsal short and without serrated spine.

† Intestinal canal more or less elongate (more than twice as long as head and body); peritoneum (lining of abdominal cavity) dark; teeth not strongly hooked, with grinding surface.

a. Intestinal canal 6 to 9 times length of body, *coiled around the air-bladder*; teeth 4-4 or 1, 4-4, 0. CAMPOSTOMA. 25.

aa. Intestinal canal 2 to 4 times length of body, *below the air-bladder* and not coiled around it.

b. Teeth 5-5 or 4-5; anal fin short; scales minute; lateral line imperfect.

CHROSOMUS. 26.

bb. Teeth 4-4; scales rather large.

c. Dorsal fin with its rudimentary ray slender, firmly attached to the first developed ray; lateral line complete. HYBOGNATHUS. 27.

cc. Dorsal fin with its rudimentary ray rather stout, spine-like, connected by a membrane to the first developed ray (a black spot on front of dorsal fin, above the base).

d. Lateral line incomplete. PIMEPHALES. 28.

dd. Lateral line complete. HYBORHYNCHUS. 29.

†† Intestinal canal short, less than twice the length of head and body; peritoneum pale; teeth well hooked.

‡ Abdomen behind ventral fins, not compressed to an edge; anal basis moderate or short.

e. Lower jaw three-lobed; the dentary bones forming the middle lobe, *being united their whole length*; upper jaw not protractile; teeth 1, 4-4, 1, without grinding surface. EXOGLOSSUM. 30.

ee. Lower jaw not three-lobed, the dentary bones distinct, except at their symphysis.

- f.* Teeth in the main row 4-4.
- g.* Maxillary without barbel.
- h.* Teeth 4-4 or 1, 4 4, 1 or 0.
- i.* Bones of head without cavernous chambers; lips thin; teeth with grinding surface.
- k.* Lateral line complete. HUDSONIUS. 31.
- kk.* Lateral line incomplete. CHRIOPE. 32.
- kh.* Teeth 2, 4-4, 2.
- l.* Teeth without grinding surface; lateral line complete; anal basis rather long. MINNILUS. 33.
- ll.* Teeth with grinding surface; lateral line complete.
- m.* Dorsal fin inserted well behind ventrals; anal basis long (rays 10 to 13). LYTHRURUS. 34.
- mm.* Dorsal fin inserted over or a little behind ventral; anal basis short (rays 7 to 9). LUXILUS. 35.
- ii.* Suborbital, interopercle and dentary bones much dilated, cavernous, crossed by mucous channels (readily seen by looking at the head of the fish from below; teeth 1, 4-4, 0, . . . ERICYMBA. 36.
- iii.* Lips thick, fleshy, the lower enlarged behind; mouth small, inferior; teeth 4-4, without grinding surface. . . PHENACOBIVS. 37.
- gg.* Maxillary with a small barbel at or near its extremity (sometimes minute in *Rhinichthys*).
- n.* Upper jaw not protractile; scales small; dorsal behind ventrals. RHINICHTHYS. 38,
- nn.* Upper jaw protractile.
- o.* Teeth 1,4-4, 1 or 4-4.
- p.* Teeth with grinding surface, 4-4; body elongate. . ERIMYSTAX. 39.
- pp.* Teeth without grinding surface. . . . CERATICHTHYS. 40.
- oo.* Teeth 2, 4-4, 2, without grinding surface. . . . COUESIUS. 41.
- ff.* Teeth 2, 5-4, 2 or 1, or 2, 5-5, 2, without grinding surface.
- q.* Maxillary with a minute, lateral barbel (obscure or invisible in young specimens); scales moderate or large. . . . SEMOTILUS. 42.
- qq.* Maxillary without barbel; scales small.
- r.* Lateral line complete. TELESTES. 43.
- rr.* Lateral line incomplete. PHOXINUS. 44.
- †† Abdomen behind ventral fin compressed to an edge; anal basis elongated.
- s.* Teeth 5-5, with grinding surface; lateral line complete; anal rays 10 to 18. NOTEMIGONUS. 45.
- **Species introduced from Asia through Europe, with long dorsal fin preceded by a serrated spine.
- t.* Barbels none. CARASSIUS. 46.
- tt.* Barbels four. CYPRINUS. 47.

GENUS 25. CAMPOSTOMA. Agassiz.

Campostoma, AGASSIZ, Am. Journ. Sci. Arts, 1855, 219.

Type, *Eutilus anomalus*, Rafinesque.

Etymology, *kampe*, curve; *stoma*, mouth.

Body moderately elongated, little compressed; mouth normal, the jaws with a hard sheath; premaxillaries protractile; no barbel; teeth 4-4 or 1, 4-4, 0, with oblong grinding surface and but little hook; air-bladder suspended in the abdominal cavity, and entirely surrounded by many convolutions of the long alimentary canal; herbivorous; sexual difference very great; scales moderate; lateral line present; dorsal nearly over ventrals; anal basis short; no spines. The singular arrangement of the intestine in relation to the air-bladder is peculiar to *Campostoma* among all known fishes. Several species are known, all American; fishes of moderate size and bright colors, swarming in the brooks and rock-pools of the interior of the United States.

50. CAMPOSTOMA ANOMALUM (Rafinesque) Agassiz.

Stone Roller; Stone-toter; Steel-backed Minnow.

Rutilus anomalum, RAF., Ich. Oh., 1820, 52.

Campostoma anomalum, AGASSIZ, Am. Journ. Sci. Arts, 1855, 218.—JORDAN, ANN. Lyc.

Nat. Hist. N. Y., 1876, 325, and of most writers.

Exoglossum leueurianum, KIRTLAND, Rept. Zool. Ohio, 1838, 169, 193 (not of Raf.).

Exoglossum spinicephalum, CUV. et VAL., xvii, 1844, 489.

Exoglossum dubium, KIRTLAND, Bost. Journ. Nat. Hist., v, 1842, 272.

Campostoma dubium, COPE, Cyp. Penn., 1866, 395.—GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 163.

Chondrostoma pullum, AGASSIZ, Am. Journ. Sci. Arts, 1854, 357.

Campostoma formosulum, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 176; U. S. Mex.

Bound. Surv. Ich., 1859, 41.

Campostoma hippops, *callipteryx*, *mormyrus*, and *gobioninum*, COPE, Proc. Acad. Nat. Sci., Phila., 1864, 284.

Description.—Body oblong, moderately compressed, the back somewhat elevated; the head moderate, rounded above, with nearly vertical cheeks; mouth moderate, subinferior; scales deep, rather small and crowded anteriorly; fins moderate, the dorsal fin nearly over the ventrals; color brownish or nearly black, with a brassy lustre above, the scales more or less mottled with dark; a dark vertical bar behind opercle; iris usually orange; dorsal and anal each with a dusky cross-bar about half way up, the rest of the fin olivaceous, or, in spring males, fiery orange; males in spring with the head and often the whole body covered with rather large rounded tubercles; in no other American fish are the nuptial appendages so extensively developed; head $4\frac{1}{2}$; depth $4\frac{1}{2}$; D. 8; A. 7; lat. 1. 53; teeth 4-4. Length 4 to 8 inches.

Habitat, Western New York to Minnesota and southwest to the Rio Grande.

Diagnosis.—This fish may be known from all other of our minnows by the great length and peculiar arrangement of the intestines.

Habits.—This species is extremely abundant in every stream in Ohio. It spawns early in spring, and it ascends in great numbers all the running streams, even the very smallest. Later it retires to the deeper places in the creeks, where it may be readily recognized by its quick motions and dusky colors. Most of the specimens seen are comparatively small, but occasionally an old male may be noticed in the spring, with

its entire body rough and gray with tubercles, and with its vertical fins gaily variegated with black and orange. Such individuals appear to have exhausted their vitality and die quickly in confinement, and are often found dead. Young individuals are active and hardy in the aquarium, where they feed on *confervæ* and diatoms.

The Stone Roller is too small to be of any value as food, but with other of our larger Cyprinoids, is caught and valued by small boys.

GENUS 27. CHROSOMUS. Rafinesque.

Chrosomus, RAFINESQUE, Ichthyologia, 1820, 47.

Type, *Luxilus erythrogaster*, Rafinesque.

Etymology, *chros*, color; *soma*, body.

Body moderately elongate, little compressed; jaws normal; no barbels; teeth 4 5 or 5-5 moderately hooked, with oblong grinding surface; alimentary canal about twice as long as the body; peritoneum more or less black; scales very small; lateral line short or wanting; dorsal behind ventrals; anal basis short; size small; colors in spring brilliant. The brilliant little fishes which compose this genus, bear a superficial resemblance to the species of *Phoxinus* but their relation is probably nearer *Pimephales* and *Hybognathus*. All are American.

51. CHROSOMUS ERYTHROGASTER Rafinesque.

Red-bellied Minnow.

Luxilus erythrogaster, RAFINESQUE, Ich. Oh., 1820, 47.—KIRTLAND, Rept. Zool. Oh, 169; Bost. Journ. Nat. Hist., 1844, iv, 23.

Chrosomus erythrogaster, RAF, Ich. Oh., 1820, 47.—AGASSIZ, Am. Journ. Sci. Arts., 1854, 359, (!) 1855 (reprint).—PUTNAM, Bull. M. C. Z., 1863, 8.—COPE, Cyp. Penn., 1866, 391; Journ. Phila. Acad. Sci., 1869, 233.—JORDAN, Man. Vert., 2d Ed., 1871, 302, and of most authors.

Leuciscus erythrogaster, STORER, Synopsis, 1846, 410.—GUNTHER, Cat. Fishes, vii, 247.

† *Chrosomus eos*, COPE, Proc. Phila. Acad. Sci., 1868, 233.—GUNTHER, Cat. Fishes, vii, 248.—JORDAN, Man. Vert., 1876, 284.

Chrosomus pyrrhogaster, JORDAN, Bull. Buff. Nat. Hist. Soc., 1876, 94; Man. Vert. 284. (Proposed for *C. erythrogaster*, Auct., the *C. erythrogaster* of Raf. being perhaps *C. eos*. It is best however to follow the prevailing nomenclature.)

Description — Body oblong, tapering each way from the middle, little compressed; head moderate, rather pointed; mouth moderate, terminal, oblique, the jaws about equal; fins rather small, the dorsal and anal fin rather high and short; caudal long; scales quite small, firmly attached but not much imbricated; lateral line developed for less than half the length of the body; color brownish-olive, with a dusky dorsal line, and often some blackish spots; two black lateral bands as above described, between these bright silvery area; belly below the lower band abruptly silvery; females obscurely marked; males in the spring with the belly and the interspace between the lateral bands bright scarlet; base of the vertical fins also bright scarlet; in high coloration the body is everywhere minutely tuberculate, and the fins are bright yellow; head $4\frac{1}{2}$; depth $4\frac{1}{2}$; D. 7; A. 8; lat. 1.85; teeth usually 5-5, sometimes 4-5. Length, two to three inches.

Habitat, Ohio Valley to Red River of the North, in clear brooks.

Diagnosis.—This the only little Minnow in Ohio having long intestines and minute scales.

Habits.—The habits of this species are almost identical with those of *Campostoma anomalum*, with which in the north it is usually associated. It is, however, still more closely confined to the clear streams having their sources in springs. It is the most graceful of our minnows, and, in the breeding season, perhaps the most brilliantly colored. In the aquarium, it is very hardy, and is altogether more desirable than any other of our species of *Cyprinoids*. This species seldom reaches a length of more than three inches.

GENUS 27. HYBOGNATHUS. Agassiz.

Hybognathus, AGASSIZ, Am. Journ. Sci. Arts, 1855, 223.—GIRARD, Proc. Acad. Nat. Sci., Phila., 1856, 176, 180.

Type, *Hybognathus nuchalis*, Agassiz.

Etymology, *hubos*, gibbons; *gnathos*, jaw, the tip of the lower jaw having a slight protuberance.

Body more or less elongate and compressed; mouth horizontal; jaws normal, rather sharp-edged, the symphysis prominent; no barbels; upper jaw protractile; teeth 4-4, cultriform with an oblique grinding surface and scarcely any hook; alimentary canal elongated, about four times length of body; peritoneum black; scales large; lateral line continuous; dorsal over ventral; anal basis short; size moderate.

Species numerous, the typical and largest one found in most streams east of the Rocky Mountains, the others mostly southwestern.

50. HYBOGNATHUS NUCHALIS Agassiz.

Silvery Minnow.

Hybognathus nuchalis, AGASSIZ, Amer. Journ. Sci. Arts, 1855, 223.—JORDAN, Man. Vert., 2d Ed., 1876, 289, and of many authors.

Hybognathus argyritis, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, —; U. S. Pac. R. R. Surv., x, 1859, —.—COPE, Proc. Am. Philos. Soc., 1870, —.—JORDAN, Man. Vert., 2d Ed., 1878, 289, and of most writers.

Hybognathus evansi, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, —.

Hybognathus regius, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, —.—JORDAN, Man. Vert., 2d Ed., 1876, 289.

Hybognathus osmerinus, COPE, Proc. Am. Philos. Soc., 1870, —.

Description.—Body elongate, comparatively slender; head moderate, rather short, the front comparatively steep; eye large, rather longer than the muzzle, about four in head; upper jaw heavy; lower jaw thin; scales large and silvery; lateral line decurved; about twelve large scales in front of the dorsal; olivaceous green above, translucent in life; sides clear silvery, with bright reflections; fins unspotted; head $4\frac{1}{2}$; depth $4\frac{1}{3}$; D. 8; A. 1; teeth 4-4; lat. l. 38. Length, 5 to 7 inches.

Habitat, New Jersey to the Upper Missouri and southward *

Diagnosis.—This is the only silvery large-scaled minnow found in Ohio, which has long intestines and black peritoneum.

Habits.—This graceful species is found in abundance in the small streams flowing into the Ohio River. It is rare in the interior, and probably seeks the river channels. Its breeding habits are unknown to me, and the males and females are similarly colored, and do not develop horny tubercles. In the Potomac River, what I consider to be the same species, is used for food, being sold with its relative, *Hudsonius storerianus*, under the name of Smelt.

GENUS 28. PIMEPHALES. Rafinesque.

Pimephales, RAFINESQUE, Ich. Ohiensis, 1820, 52.

Type, *Pimephales promelas*, Rafinesque.

Etymology, *pimeles*, fat; *kephale*, head.

Body short and stout, little compressed; head short and rounded; mouth small, inferior; upper jaw protractile; no barbels; teeth 4-4 with grinding surface, not strongly hooked; dorsal over ventrals, its first rudimentary ray separated from the rest by a membrane; anal basis short; intestinal canal elongate; peritoneum black; scales rather small; lateral line incomplete.

Small fish of American waters. In all the known species there is a black blotch on the dorsal fin in front, about half way up. The breeding males have the head swollen and black, and the snout armed with a few disproportionately large nuptial tubercles.

53. PIMEPHALES PROMELAS Rafinesque.

Fat Head; Black Head.

Pimephales promelas, RAFINESQUE, Ich. Oh., 1820, 94.—KIRTLAND, Rept. Zool. Ohio, 1838, 194; Bost. Journ. Nat. Hist., iii, 1838, 475.—STORER, Synopsis, 1846, 418.—AGASSIZ, Amer. Journ. Sci. Arts, 1855, 230 —PUTNAM, Bull. M. C. Z., 1863, 8.—GUNTHER, Cat. Fishes, vii, 1868, 181,—JORDAN, Ind. Geol. Surv., 1874, 224; Bull. Buff. Soc. Nat. Hist., 1876, 94; Man. Vert., 1876, 275; 2d Ed., 1878, 288, and of writers generally.

Pimephales fasciatus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 180; Pac. R. R. Surv., x, 234.

Plargyrus melanocephalus, ABBOTT, Proc. Phila. Acad. Sci., 1860, 325.

Pimephales milesii, COPE, Proc. Acad. Sci. Phila., 1864, 232.—GUNTHER, Cat. Fishes, vii, 1868, 181,—JORDAN, Man. Vert., 1876, 276.

Pimephales agassizii, COPE, Cyp. Penn., 1866, 391.

Description.—Body very short and deep, head short, and everywhere convex, almost globular in adult males; mouth small, inferior, horizontal; scales deep, closely imbricated; olivaceous, the dorsal with a large black bar across it, nearly halfway up, most distinct anteriorly, appearing as a simple dusky shade in young; male fish dusky, the

*As here defined, more than one species may be included, but if so, the author is unable to distinguish them.

head jet black, with several large tubercles on the snout in spring, a dusky shade along sides of the caudal peduncle; head $4\frac{1}{2}$; depth 4; D. I, 7; A. 7; lat. 1. 47; teeth 4.5 Length $2\frac{1}{2}$ inches.

Habitat, Ohio Valley to the Upper Missouri, abundant.

Diagnosis.—Among Ohio fish, this small species may be known at sight by the short, thick head and small mouth.

Habits.—This species is most abundant in the small and often muddy brooks which flow directly into the Ohio River. It does not appear to like a sandy or gravelly bottom, and as it feeds on mud and *Algæ*, it is seldom found in company with such species *Ericymba* and *Chrosomus*.

GENUS 29. HYBORHYNCHUS. Agassiz.

Hyborhynchus, AGASSIZ, Am. Journ. Sci. Arts, 1855, 233.

Type, *Minnilus notatus*, Rafinesque.

Etymology, *hubos*, gibbous; *rhugchos*, snout.

This genus differs from *Pimephales* only in having the lateral line complete, and the maxillary often provided with a rudimentary or obsolete barbel. The species are more elongate than those of *Pimephales* and reach a larger size. The coloration and nuptial dress is similar in the two genera.

60. HYBORHYNCHUS NOTATUS (Rafinesque) Agassiz.

Blunt-nosed Minnow.

† *Minnilus notatus*, RAFINESQUE, Ich. Oh., 1820, 47.

Hyborhynchus notatus, AGASSIZ, Am. Journ. Sci. Arts, 1855, 222.—COPE, Cyp. Penn., 1866, 392; Journ. Phil. Acad. Sci., 1869, 235.—GUNTHER, Cat. Fishes, vii, 182.—JORDAN, Bull. Buff. Acad. Sci., 1876, 94; Man. Vert., 2d Ed., 1878, 288, and of writers generally.

‡ *Hyborhynchus superciliosus*, COPE, Journ. Phila. Acad. Sci. 1869, 234.—JORDAN, Man. Vert., 2d Ed., 1878, 289. (Specimens with an obsolete maxillary barbel.)

Description.—Body rather elongate, not elevated, moderately compressed; head moderate, the muzzle blunt and convex, top of the head depressed; cheeks vertical; mouth small, inferior, horizontal; fins small, the dorsal moderate, the first ray distinct and spine-like in the males, slender in the females; anal small; caudal short; scales moderate, deep, closely imbricated; scales in front of the dorsal small and crowded; eye moderate; color olivaceous, little silvery, sides bluish; a black spot on the dorsal fin in front, near the base; a dusky shade at base of caudal; males in spring with black on the dorsal more extended, and the head wholly black; snout with about fourteen disproportionately large tubercles; head $4\frac{1}{2}$; depth 5; D. 8; A. 7; lat. 1. 44; teeth 4-4. Length, 4 inches.

Habitat, Ohio Valley and Great Lake Regions, abundant.

Diagnosis.—The presence of a dark spot on the anterior rays of the dorsal distinguishes this plain species from all the others with long intestines or teeth 4-4.

Habits.—This species swarms in all the streams in the State of Ohio, ascending small and even muddy brooks. It is a species of feeble organization and without bright colors. Old males in the spring are rather curious-looking little fishes.

GENUS 30. EXOGLOSSUM. Rafinesque.

Exoglossum, RAFINESQUE, Journ. Acad. Nat. Sci., Phila., i, 1818, p. 420.

Type, *Exoglossum lesueurianum*, Raf. = *Cyprinus maxillingua*, LeS.

Body moderately elongate, little compressed; dentary bones nearly straight, *connected throughout their length*; mandible much contracted, incurved, with a fleshy lobe on each side of it at the base, the middle thus resembling a projecting tongue; teeth hooked, without grinding surface, 1, 4-4, 1; no barbels; premaxillaries not projectile; air-bladder normal; alimentary canal not elongate; scales moderate; dorsal line present; fins without spines; dorsal slightly behind ventral; anal basis short.

A single species known, singularly distinguished from all the other Cyprinoid fishes by the structure of the lower jaw.

61. EXOGLOSSUM MAXILLILINGUA (LeSueur) Haldeman.

Cut-lips; Day Chub; Nigger Chub.

Cyprinus maxillingua, LESUEUR, Jour. Acad. Nat. Sci. Phila., i, 1817, 85.

Exoglossum maxillingua, HALDEMAN, Rupp. Hist. Lancaster Co., 1844, 474.—*AGASSIZ*, Am.

Journ. Sci. Arts, xix, 1855, 215;—COPE, Trans. Am. Philos. Soc. 1866, 360.—GUNTHER, Cat. Fishes, Brit. Mus., vii, 188.—JORDAN, Man. Vert., 2d Ed., 308, and of other writers generally.

Exoglossum lesueurianum, RAFINESQUE, Journ. Acad. Nat. Sci. Phila., i, 1818, 420.

Description.—Body rather stout, little compressed; head large, broad and flatish above, with tumid cheeks; mouth moderate, slightly oblique, the end of the maxillary not reaching the line of the orbit; upper jaw longer than lower; scales rather crowded anteriorly, those in front of the dorsal small; color olivaceous, smoky or dark above; a blackish bar behind opercle, and a dusky shade at the root of the caudal in the young; fins unmarked; head $4\frac{1}{2}$; depth 5; D. 8; A. 7; lat. 1. 53; teeth 1-4-4-1. Length six inches.

Habitat, Western New York to West Virginia.

Diagnosis.—This is the only minnow in America in which the two dentary bones or forks of the lower jaw are united in one for their whole length.

Habits.—This singular fish has not yet been recorded from Ohio. As, however, it is very abundant in the Susquehanna River, and its occurrence in the Kanawha River has been noticed, it will probably be found in the eastern part of the State. Its habits resemble those of *Compostoma anomalum*, preferring clear rock-pools, but not haunting rapids. According to Professor Cope, "its stomach usually contains abundant remains of *Physæ*, *Pisidia*, and other small mollusca, which form its food. The

shovel-like mandible would appear to be adapted for removing these creatures from their hold on the rocks and bottom, while the great strength of the pharyngeal walls and muscles enables the fish to crush the shells before mastication with the pharyngeal teeth." It takes the hook readily, and is therefore a "boy's fish."

GENUS 31. HUDSONIUS. Girard.

Hudsonius, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 210.

Hybopsis, COPE, Trans. Am. Philos. Soc., 1866, 335 (not of Agassiz).

Photogenis, COPE, Trans. Am. Philos. Soc., 1866, 379 (in part).

Type, *Clupea hudsonia*, DeWitt Clinton.

Etymology, Hudson River.

Body oblong or elongate; mouth rather small, horizontal or somewhat oblique; jaws normal; no barbels; teeth 4 4 or 1, 4-4, 1 (in one species 1, 4-4, 2), hooked, with grinding surface; scales large; lateral line complete; dorsal fin inserted nearly over ventrals; anal fin short. A very large genus including our smallest and feeblest minnows, together with some of our largest species.

This genus, as now understood, comprises three well marked subgenera, which have under one name or another been sometimes taken as genera. These are:

1. *Hudsonius* proper, including silvery species of large size, with short heads; dorsal fin inserted in front of the ventrals; teeth two-rowed; scales not closely imbricated; fins plain. These species bear a close resemblance to *Hybognathus*.

2. *Miniellus* (Jordan), including small, plain species, with rather large head; dorsal fin inserted over ventrals; teeth one-rowed; scales large, not closely imbricated; fins plain. These are the smallest and most insignificant of American Cyprinidæ, and may be usually known from the young of larger species by the large scales before the dorsal.

3. *Photogenis* (Cope), including species of moderate size; compressed; dorsal fin inserted behind the base of the ventrals; teeth two-rowed; scales deeper than long, closely imbricated; dorsal fin with a dark blotch on its upper posterior portion; males in spring with the snout, etc., tuberculate, and the fins charged with satin-white pigment. The members of this group closely resemble certain forms referred to *Chiola*, and in some degree certain species of *Luxilus*. Besides the following, several other southern and western species perhaps occur within our limits.

ANALYSIS OF SPECIES OF HUDSONIUS.

* No black blotch on posterior rays of dorsal; dorsal not inserted behind ventrals; scales not closely imbricated.

† Head short, about $4\frac{1}{2}$ in length. STORERIANUS.

†† Head comparatively long; $3\frac{1}{2}$ to 4 in length.

a. Mouth inferior, horizontal.

b. Lateral line 34; pectorals reaching ventrals. VOLUCELLUS.

bb. Lateral line 36; head stoutish; pectorals short. STRAMINEUS.

aa. Mouth terminal, oblique.

c. Lateral line 35. FRETENSIS.

cc. Lateral line 44. HÆMATURUS.

** A black blotch on posterior rays of dorsal; dorsal inserted behind ventrals; scales deeper than long, closely imbricated. ANALOSTANUS.

62. HUDSONIUS STORERIANUS (Kirtland) Jordan.

Lake Minnow.

Leuciscus storerianus, KIRTLAND, Bost. Journ. Nat. Hist., v, 1845, 30.—GUNTHER, Cat. Fishes Brit. Mus., vii, 250.

Hybopsis storerianus, COPE, Trans. Am. Philos. Soc., 1866, 380, and of authors.

Hudsonius amarus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 210.

Hybopsis amarus, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1864, 279.

Hybopsis phaëna, COPE, Proc. Acad. Nat. Sci. Phila., 1864, 279.

Description.—Body elongate, considerably depressed in adults; head quite short, the muzzle blunt, decurved, shorter than the very large eye, which is three in head; top of the head flattened, somewhat concave between the orbits; greatest depth of the head nearly three-fourths its length; mouth moderate, nearly horizontal, the jaws nearly equal; the maxillary extending to the eye; lateral line nearly straight, slightly decurved anteriorly; eighteen scales before the dorsal; coloration very pale, sometimes a dusky spot at base of the caudal, especially in the young; sides with a broad silvery band; pectorals not reaching ventrals, the latter not to vent; caudal fin long; head $4\frac{3}{4}$; depth $4\frac{1}{2}$; D. 8; A. 8; scales 5-39 4; teeth 1, 4-4, 0 or 1. Length 4 to 8 inches.

Habitat, Great Lake Region to New Jersey and south to Georgia, east of the Alleghanies.

Diagnosis.—This handsome fish may usually be best known by the small size of the head and mouth, compared with other large-scaled species with short intestines.

Habits.—This fish is abundant in Lake Erie, where it reaches a considerable size. It seldom ascends the small streams, but is taken in seines in the waters of the lake. The largest I have seen were about eight inches long, and it is said to grow much larger. Dr. Kirtland also found it only in the lake.

Hudsonius fluviatilis Girard (*Clupea hudsonia*, Clinton) is also said to inhabit Lake Erie, but I have never seen specimens from the lakes. It has teeth 1, 4-4, 2, and usually a dusky caudal spot.

63. HUDSONIUS VOLUCELLUS (Cope) Jordan.

Hybognathus volucellus, COPE, Proc. Acad. Nat. Sci. Phila., 1865, 283.

Hybopsis volucellus, COPE, Trans. Am. Philos. Soc., 1866, 881, and of writers.

Leuciscus volucellus, GUNTHER, Cat. Fishes, Brit. Mus., vii, 1868, 260.

Description.—Body moderately stout; head depressed, elongate, the vertex plane, the muzzle elongate; fins more elongate than in most of the related species; the pectorals reaching the ventrals; caudal peduncle slender; eye three and one-third in head; olivaceous, a slight dusky lateral shade; no dorsal stripe; fins plain; head $3\frac{3}{4}$; depth 4; D. 8; A. 8; scales 4-34-5; teeth 4 4. Length $2\frac{1}{2}$ inches.

Habitat, Southern Michigan to Wisconsin.

Diagnosis.—This species much resembles *H. stramineus*, but differs in proportionately greater length of the pectorals. It is found in the streams of southern Michigan and Wisconsin, and doubtless in northern Ohio also, though I have not seen it. Nothing is known of its habits.

64. HUDSONIUS STRAMINEUS (Cope) Jordan.

Straw-colored Minnow.

Hybognathus stramineus, COPE, Proc. Acad. Nat. Sci. Phila., 1864, 233.

Hybopsis stramineus, COPE, Trans. Am. Philos. Soc., 1826, 331.—JORDAN, Man. Vert., 2d Ed., 1878, 291.

Description.—Body moderately stout, little compressed; head rather broad, with rounded angles; mouth small, inferior, horizontal; snout very obtuse; eye large, 3 in head; fifteen rows of scales in front of the dorsal fin; pale olivaceous; sides little silvery; usually a darker dorsal band; fins all plain; head 4; depth 5; scales 5-36-4; teeth 4-4. Length, $2\frac{1}{2}$ inches.

Habitat, Ohio Valley and Lake region, abundant in small streams.

Diagnosis.—This insignificant fish may be known by its large scales, and, in general, by the absence of all peculiarities.

Habits.—This fish, the feeblest in structure of all our minnows, and one of the smallest and dullest colored, occurs in considerable abundance throughout the State, mostly inhabiting the small streams. It is found in company with *Hyborhynchus notatus*, which it considerably resembles. The individuals of the latter are much more abundant.

A related species which is found in Kentucky and Virginia, and may occur in Ohio, is *Hudsonius microstomus* (Raf.) Jor. (*Minnilus microstomus* Raf., *Hybopsis longiceps* Cope), characterized as follows:

Body elongate, the caudal peduncle not contracted; mouth inferior, horizontal, small, the maxillary not reaching the line of the eye; fins rather short; eye large, three and a half in head; fourteen scales before the dorsal; preorbital bone much longer than deep; olivaceous, translucent, a silvery lateral band, along which is a black speck at the origin of each tube of the lateral line; D. 8; A. 7; scales 5-33-2; teeth 4-4. Length, $2\frac{1}{2}$ inches.

65. HUDSONIUS FRETENSIS (Cope) Jordan.

Hybopsis fretensis, COPE, Trans. Am. Philos. Soc. Phila., 1866, 382.—JORDAN, Man. Vert., 2d Ed., 1878, 292.

Description.—Body slender and compressed, resembling *hotropis*; head convex between orbits; mouth quite oblique, the middle of the maxillary being opposite the line of the pupil; maxillary not reaching to orbit; eye three and a half in head; seventeen rows of scales in front of the dorsal; lateral line decurved; olivaceous, a dark median dorsal band, a plumbeous silvery lateral shade; cheeks silvery; a dark spot at the base of the

caudal; fins plain; head 4; depth 5; D. 8; A. 8; scales 6-35-3; teeth 4-4. Length $2\frac{1}{2}$ inches.

Habitat, Michigan to Illinois.

Diagnosis.—From the other species of this genus, this species may be known by its resemblance in form, and structure of mouth to the genus *Minnilus*.

Habits.—I have never seen this fish in life, and known nothing of its habits.

66. HUDSONIUS HÆMATURUS (Cope) Jordan.

Red-tailed Minnow.

Hybopsis hæmaturus, COPE, Trans. Am. Philos. Soc. Phila., 1866, 392.—JORDAN, Man. Vert., 2d Ed., 1878, 292.

Leuciscus hæmaturus, GUNTHER, Cat. Fishes Brit. Mus., vii, 259.

Description.—Body stoutish; muzzle little obtuse; mouth moderate, terminal, oblique, the maxillary extending to the orbit; eye three and a half in head; lateral line nearly straight; plumbeous above; head dusky above; a dusky lateral band, not shining; a dusky spot at base of caudal; caudal fin dull red in life; twenty-one rows of scales in front of dorsal; head 4; depth 4-5; D. 8; A. 7; scales 7-44-4. Length $2\frac{1}{2}$ inches.

Habitat, Great Lake Region, not abundant.

Diagnosis.—From the other members of this genus, *H. hæmaturus* may usually be known by its smaller scales.

Habits.—This species has as yet only been recorded from tributaries of Lake Michigan, but it doubtless occurs in Northern Ohio. Nothing distinctive is known of its habits.

66. HUDSONIUS ANALOSTANUS (Girard) Jordan.

Silver Fin.

Luxilus kentuckiensis, KIRTLAND, Boston Journ. Nat. Hist., v, 1845, 27, pl. 8, f. 3 (not of Rafinesque).

Cyprinella kentuckiensis, COPE, Proc. Acad. Nat. Sci. Phila., 1864, 279.

Hypsilepis kentuckiensis, COPE, Trans. Am. Philos. Soc., 1866, 371.

Leuciscus kentuckiensis, GUNTHER, Cat. Fishes, Brit. Mus., vii, 261.

Cyprinella analostana, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 58.

Hypsilepis analostanus, COPE, Proc. Acad. Nat. Sci. Phila., 1867, 166.

Leuciscus analostanus, GUNTHER, Cat. Fish. Brit. Mus., vii, 256.

Luxilus analostanus, JORDAN, Man. Vert., 2d Ed., 1878, 294.

Photogenis spilopterus, COPE, Trans. Am. Philos. Soc., 1866, 378.

Leuciscus spilopterus, GUNTHER, Cat. Fishes, Brit. Mus., vii, 254.

Description.—Body moderately elongate, somewhat compressed, the dorsal and ventral outlines regularly and gently arched; head rather short and deep; mouth rather small, quite oblique, the lower jaw received within the upper when the mouth is closed; eye small, four and a half in head; leaden silvery, bluish in the males; edges of scales

dusky; a dark vertebral line; a large black spot on the upper posterior part of the dorsal; paired fins and lower part of the belly, as well as the tips of the anal and caudal, and the front and upper parts of the dorsal charged with clear satin-white pigment in males in spring; in full breeding dress the dorsal pigment with a greenish lustre; no creamy band at base of the caudal; males with the head and front covered with small tubercles; head $4\frac{1}{2}$; depth $3\frac{1}{2}$; D. 8; A. 8; scales 5-38-3; teeth 1, 4-4, 1 the edges more or less distinctly serrate. Length 4 inches.

Habitat, Ohio Valley, Great Lake Region, and eastward.

Diagnosis.—The dark blotch on the last rays of the dorsal sufficiently distinguishes this elegant fish from all others found in Ohio.

Habits.—This species abounds in all the clear streams in the State of Ohio. The male in the breeding season is one of the most beautiful of our minnows, on account of the satin-white lustre of its sides and fins. It is therefore desirable as an aquarium fish. The species is not used for food.

GENUS 32. CHRIOPE. Jordan.

Chriope, JORDAN, Bull. U. S. Geol. Surv. Terr., 1878.

Type, *Hybopsis bifrenatus*, Cope.

Etymology, *chreia*, want; *ope*, aperture, from the imperfections of the lateral line.

Body moderately elongate; mouth normal; no barbels; teeth 4-4, with grinding surface and hook, the edges more or less crenate; scales large, not closely imbricated; lateral line wanting posteriorly; dorsal fin over ventrals; anal fin short; species of small size differing from *Hudsonius* chiefly in the incomplete condition of the lateral line.

But two species are known, *C. bifrenate* (Cope), of the Eastern and Middle States, a handsome little fish with a jet-black burnished lateral band, and the following.

68. CHRIOPE HETERODON (Cope) Jordan.

Northern Chriope.

Alburnops heterodon, COPE, Proc. Acad. Nat. Sci. Phila., 1864, 281.

Hybopsis heterodon, COPE, Trans. Am. Philos. Soc., 1866, 382.

Leuciscus heterodon, GUNTHER, Cat. Fishes Brit. Mus., vii, 261.

Hemitemia heterodon, JORDAN, Man. Vert., 2d. Ed., 1878, 303.

Description.—Body moderately stout, the back compressed and elevated; head rather pointed, the muzzle acuminate; mouth oblique, the lower jaw projecting, the upper lip opposite the upper rim of the pupil; maxillary extending to opposite front of orbit; thirteen scales in front of dorsal; eye three in head; color olivaceous; a blackish dorsal band; sides with a leaden or dusky band; head 4; depth 4; D. 8; A. 8; scales 5-36-3; the lateral line extending about half the length of the body; teeth 4-4, often crenate. Length $2\frac{1}{2}$ inches.

Habitat, Michigan to Wisconsin.

Diagnosis.—From other small minnows with large scales, this plain species may be known by the incomplete lateral line.

Habits.—This species was first described from Detroit River, and therefore it will probably be found in tributaries of Lake Erie in Ohio. Nothing distinctive is known of its habits.

GENUS 33. MINNILUS. Rafinesque.

? *Notropis*, RAFINESQUE, Amer. Monthly Mag., ii, 1818, 209 (*nomen ineptum*).

Minnilus, RAFINESQUE, Ich. Oh., 1820, 45.

Alburnellus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 193.

Episema, COPE and JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 77.

Type, *Minnilus dinemus*, Raf.

Etymology, from the vernacular Minnow; French, *menuise*; Latin, *minus*, small.

Body elongate, somewhat compressed; mouth oblique, terminal, normal; no barbels; teeth 2, 4-4, 2, hooked, with entire edges and no grinding surface; scales thin, usually large; the lateral line continuous, somewhat decurved; exposed surface of scales broad; dorsal fin over or behind ventrals; anal basis elongate, its rays eight to twelve; species of small size, graceful form and delicate coloration.

Our species may be referred to two subgenera characterized as follows:

Episema, Cope and Jordan. Dorsal fin inserted directly over ventrals.

Minnilus, Rafinesque. Dorsal fin inserted well behind ventrals.

It does not appear best to retain the name *Notropis* for this genus, for the following reasons: 1. The typical species is not certainly identified. It is perhaps as likely to have been *Notemigonus chrysoleucus* as *Minnilus dinemus*. 2. Even if the identification were certain, the name *Notropis* is subject to rejection as an inept name, as the back is not at all keeled in any species.

ANALYSIS OF SPECIES OF MINNILUS

*Dorsal fin inserted well behind ventrals (*Minnilus*).

a. Head proportionately long, 3 4-5 in length; body compact; eye moderate, 4 in head. RUBRIFRONS. 69.

aa. Head proportionately small, 4½ in length; body elongated, compressed; eye large, 3½ in head. DINEMUS. 70.

aaa. Head moderate, 4½ in length; eye large, 3½ in head; body compressed. PHOTOGENIS. 71.

**Dorsal fin inserted directly over ventrals (*Episema*).

b. Eye extremely large, 2 3 5 in head; anal rays 9. ARIOMMUS. 72.

bb. Eye large, 3 in head; anal rays 8. SCABRICEPS. 73.

69. MINNILUS RUBRIFRONS (Cope) Jordan.

Rosy-faced Minnow.

Alburnus rubrifrons, COPE, Proc. Acad. Nat. Sci. Phila., 1865, 85; Trans. Am. Philos. Soc., 1866, 388.

Leuciscus rubrifrons, GUNTHER, Cat. Fishes, Brit. Mus., vii, 1868, 255.

Minnilus rubrifrons, JORDAN, Man. Vert., 1st Ed., 1876, —.

Notropis rubrifrons, JORDAN, Man. Vert., 2d Ed., 1878, 296.

Description.—Body moderately elongate, the back scarcely elevated, the caudal peduncle somewhat contracted; head longer than in the other species, conic and

rather pointed; mouth rather large, very oblique; upper lip above the line of the middle of the pupil, the maxillary reaching to opposite the eye; eye moderate, anterior, 4 in head; olivaceous above, the scales with darker edges; sides silvery; a dark vertebral line; males with the snout tuberculated in the spring, the forehead, opercular region, and base of the dorsals being flushed with red; head 3.4-5; depth 4½; D. 8; A. 10; scales 6-39-3; teeth 2, 4-4, 2, little hooked, one of them sometimes showing a sort of grinding face. Length 2½ inches.

Habitat, Ohio Valley.

Diagnosis.—This is a much smaller species than *M. dinemus*. It has also a notably larger head and smaller eye.

Habits.—This elegant little fish is very abundant in the southern part of Ohio. It frequents clear waters and rapids of the larger streams. In the breeding season it is very handsome.

70. MINNILUS DINEMUS Rafinesque.

Emerald Minnow; Rosy Minnow; Lake Silverside.

? *Notropis atherinoides*, RAFINESQUE, Am. Month. Mag., ii, 1818, 204 (erroneous and uncertain; may be *Notemigonus*).—JORDAN, Bull. Ills. Lab. Nat. Hist., ii, 1878, 60.

Minnilus dinemus, RAFINESQUE, Ich. Oh., 1820, 45.—JORDAN, Man. Vert., 1st Ed., 1876.

Notropis dinemus, JORDAN, Man. Vert., 2d Ed., 1878, 296, and elsewhere.

Alburnus rubellus, AGASSIZ, Lake Superior, 1850, 364.

Leuciscus rubellus, GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 254.

Minnilus rubellus, JORDAN, Man. Vert., 1st Ed., 1876, —.

Notropis rubellus, JORDAN, Man. Vert., 2d Ed., 1878, 296.

Alburnellus dilectus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 193.

Alburnellus jacutus, COPE, Trans. Am. Philos. Soc., 1866, 387.

Alburnellus arge, COPE, Trans. Am. Philos. Soc., 1866, 387.

Leuciscus copii, GUNTHER, Cat. Fishes, Brit. Mus., vii, 1868, 205.

Description.—Body long and slender, compressed, the back not elevated; head slender, conic, proportionately shorter than in the other species; mouth moderate, very oblique; upper lip on a level with the lower part of the pupil; maxillary not reaching to the front of the eye; eye large, rather longer than the snout, three and one-fourth in head; fins low, the dorsals well behind the ventrals, the tips of the ventrals extending to about the middle of the dorsal; lateral line decurved; color translucent green above, sides bright silvery; scales above finely punctate, but not enough to render them dark edged, nor to form blotches along the sides; a faint dark vertebral line; males in spring with the snout and the base of the dorsal fin rosy; head 4½; depth 5½; D. 8; A. 11; scales 5-38-3; teeth 2, 4-4, 2. Length 5 inches.

Habitat, Ohio Valley and Great Lake Region, frequenting the river channels and the lakes.

Diagnosis.—This species is perhaps the slenderest of our minnows. It may be known by its form, its silvery coloration and the size of its anal fin.

Habits.—This elegant fish is exceedingly common in Lake Erie, and throughout the State it is one of the most abundant of the Minnows. It frequents the large bodies of water, and is seldom seen in small streams. It delights in clear lakes and in the deep water at the foot of a milldam or waterfall. Off the wharves in the lake, they are often caught by boys with dip-nets, who sell them to fishermen as bait.

I find considerable variation in this species both in form and color. Lake specimens (*rubellus*) are usually brilliantly silvery. Some river specimens (*dinemus*, *jaculus*) are much slimmer than others, the depth sometimes forming less than one sixth of the length. These slender specimens have been described as a distinct species, and they may really be, but at present, I am unable to define them as such. Again, deep-bodied specimens with rather smaller eye, have been determined as *M. dilectus* (Girard). They are probably not specifically different.

Name.—The specific name, *dinemus* (two-threaded), refers to the presence of two lateral lines, i.e., the true lateral line, and a color-streak above it. It is an objectionable and perhaps misleading name, but as it has priority, I do not feel authorized to reject it. The still earlier name *atherinoides*, perhaps belongs to this species, but it may have been based on the young of *Notemigonus*.

71. MINNILUS PHOTOGENIS (Cope) Jordan.

White-cheeked Shiner.

Squalius photogenis, COPE, Proc. Acad. Nat. Sci. Phila., 1864, 280.

Leuciscus photogenis, GUNTHER, Cat. Fishes, Brit. Mus., vii, 252.

Minnilus photogenis, JORDAN, Man. Vert., 1st Ed., 1876, —.

Notropis photogenis, JORDAN, Man. Vert., 2d Ed., 1878, 297.

Photogenis leucops, COPE, Trans. Am. Philos. Soc., 1866, 379, and elsewhere.

Description.—Body slender, compressed; head moderate; mouth quite oblique, lower jaw scarcely projecting; maxillary not reaching orbit; back broad; dorsal fin inserted behind middle of body a little behind ventrals; lateral line decurved; eye large, three and a third in head; color olivaceous, with brown vertebral and dorsal lines; sides and below bright silvery; cheeks silvery; head $4\frac{1}{2}$; depth $5\frac{1}{2}$; D 8; A. 10; scales 6-40-3. Length 3 inches.

Habitat, Ohio Valley and southward.

Diagnosis.—This species much resembles the young of the preceding. Its eye is not so large, and the dorsal fin is not as far back. The anal fin is also smaller.

Habits.—This species is rarely seen in the State of Ohio. It occurs in some tributaries of the Ohio, in West Virginia, and probably will be found

in the streams running from the hills on the Ohio side of the same river. It has a wide distribution in the Alleghany region of the south. The species is subject to considerable variation.

72. *MINNILUS ARIOMMUS* (Cope) Jordan.

Big-eyed Shiner.

Photogenis ariommus, COPE, Trans. Am. Philos. Soc., 1866, 388; Proc. Acad. Nat. Sci. Phila., 1867, 164.

Cliola ariomma, JORDAN, Man. Vert., 2d Ed., 1878, 293.

Episema ariomma, JORDAN, Bull. Ills. Lab. Nat. Hist., 1878, 60.

Description.—Body stout, moderately elevated, somewhat compressed; head heavy, broad above, the snout moderate, somewhat decurved; mouth moderate, oblique, its jaws equal, the upper lip on a level with the middle of the pupil, the maxillary reaching the front of the eye; eye very large, two and three-fifths in head, much longer than snout, larger than in any other American Cyprinidæ; fins moderate, the dorsal directly opposite ventrals, the tips of the ventrals opposite the last dorsal ray; scales large; fifteen in front of the dorsal; lateral line much decurved; olivaceous, scales above dark-edged; sides and below bright silvery; no red; head $3\frac{1}{2}$; depth $4\frac{1}{4}$; D. 8; A. 9; scales 6-39-2; teeth 2, 4-4, 2. Length 5 inches.

Habitat, Ohio Valley.

Diagnosis.—The great size of the eye, larger than in any other minnow chiefly distinguishes this species.

Habits.—This species is abundant in White River, Indiana, in which stream the original type was taken. It there frequents the river channel, in company with *dinemus*, a species which it much resembles both in size and color. It doubtless occurs in Southern Ohio, but I have no specimens from that State. In fact, with the single exception of a specimen from Kentucky, preserved in the United States Museum, I have seen no specimens except from White River, and none others have been recorded. This species is very handsome, and is desirable for aquaria.

73. *MINNILUS SCABRICEPS* (Cope) Jordan.

Rough-headed Shiner.

Photogenis scabriceps, COPE, Proc. Acad. Nat. Sci. Phil., 1867, 166.

Cliola scabriceps, JORDAN, Man. Vert., 2d Ed., 1868, 298.

Episema scabriceps, JORDAN, Bull. Ills. Lab. Nat. Hist., 2, 1878, 60.

Description.—Body rather stout, little compressed, the back slightly elevated; head rather stout and broad, the muzzle bluntish, somewhat decurved; mouth rather small, terminal, oblique; the maxillary reaching the front of the orbit; lateral line decurved; fins rather small, eye large, three in head; color plain olivaceous, scales dark-edged above; sides white, with a lateral band formed of dusky specks, this band running through the

eye, around the snout; males tuberculate in the spring; head 4; depth $4\frac{1}{2}$; D. 8; A. 8; scales 6-38-3; teeth 2, 4-4, 2. Length, $3\frac{1}{4}$ inches.

Habitat, Ohio Valley.

Diagnosis.—This species resembles the preceding, but reaches a smaller size, and has a smaller eye. Its coloration is duller.

Habits.—This species is found in most of the tributaries of the Ohio, but is not very abundant. It seems to frequent mostly the small streams and brooks in company with *Hyborhynchus notatus* and *Ericymba buccata*.

GENUS 34. LYTHRURUS. Jordan.

Lythrurus, JORDAN, Man. Vert., 1st Ed., 1876, 272.

Type, *Semotilus diploemius*, Raf.

Etymology, *luthron*, blood; *oura*, tail.

Body somewhat elongate, strongly compressed; mouth normal, oblique; no barbels; teeth 2, 4-4, 2, with grinding surface; intestinal canal short; scales small, closely imbricated; lateral line continuous, decurved; fins large; dorsal well behind ventrals (with a black spot at its base in front in all known species); anal fin long; its rays ten to twelve; size small; breeding colors brilliant, the fins being deep red in the males in spring. Four species are known in the Mississippi Valley. These are closely related, and may perhaps all be varieties of *L. diploemius*. Only *L. diploemius* has as yet been noticed in Ohio, but *L. cyanocephalus*, Copeland, a small compact species resembling a *Pimephales* may be looked for in Northwestern Ohio. *L. ardeus*, Cope, a slender silvery species like a *Minnilus* may be found in Southern Ohio, and *L. atripes*, Jordan, a species with the anal black-spotted like the dorsal, may occur in the sluggish streams tributary to the Ohio River. We have, however, no evidence that any of these species have a claim to be noticed in this report.

74. LYTHRURUS DIPLOEMIUS (Rafinesque) Cope.

Red-fin.

? *Semotilus diploemius*, RAFINESQUE, Ich. Oh., 50.

Hypsolepis diploemius, PUTNAM, Bull. M. C. Z., 1863, 7.

Hypsolepis diploemia, COPE, Proc. Phila. Acad. Sci., 1864, 279; Cyp. Penn., 373; Proc. Phila., Acad., 1867, 162.—JORDAN, Ind. Geol. Surv., 1874, 223.

Leuciscus diploemius, GUNTHER, Cat. Fishes, vii, 250 (not of Kirtland).

Luxilus diploemia, JORDAN, Bull. Buff. Nat. Hist. Soc., 1876, 94.

Lythrurus diploemius, JORDAN, Man. Vert., 1st Ed., 1876, 285; 2d Ed., 1878.

?? *Rutilus* ? *ruber*, RAFINESQUE, Ich. Oh., 52 (probably *L. ardeus*).

Rutilus compressus, KIRTLAND, Rept. Zool. Ohio, 169 (probably not of Raf.).

Leuciscus compressus, KIRTLAND, Bost. Soc. Nat. Hist., iv, 306.—STORER, Synopsis, 469 (probably the female of this species).

Description.—Body elongate, compressed, little elevated; the caudal peduncle notably long; head long, conic, rather pointed; mouth large, moderately oblique, the premaxillary on the level of the pupil, the maxillary extending to opposite the eye; lower jaw somewhat projecting; eye moderate, about equal to the muzzle, $3\frac{1}{4}$ in head; scales closely imbricated, crowded anteriorly, the ante-dorsal scales about 30; dorsal fin high,

inserted about midway between ventrals and anal; pectorals not reaching ventrals, the latter to the vent; caudal fin long; coloration dark steel-blue above, pale or silvery below, the males often showing traces of 8 to 10 cross-bars; a conspicuous spot at the base of the dorsal in front, the fins otherwise all plain; males with the anterior dorsal region and the head profusely covered with small whitish tubercles, the belly and lower fins being of a bright brick red in spring; females very pale olive, sometimes colorless; head $4\frac{1}{2}$; depth $4\frac{1}{2}$; D. 7; A. 11; 9-47-3; teeth 2, 4 4, 2. Length $3\frac{1}{2}$ inches.

Diagnosis.—The Red-fin may be known from all the other minnows of similar appearance by the presence of a black spot at the base of the dorsal, in front. The only other species similarly marked, *Semotilus corporalis*, has a larger head, and a short anal fin of 7 or 8 rays.

Habits.—This species is very abundant throughout Ohio, especially in the southern part of the State. It is especially fond of small, clear streams. The male fish in the spring is one of the most brilliant of our fishes, being sometimes almost violet colored, and later of a fine brick-red. The female is usually very pale, with a delicate purplish luster.

GENUS 35. LUXILUS. Rafinesque.

Luxilus, RAFINESQUE, Ich. Oh., 1820, 47.

Hypsolepis, BAIRD, Mss., AGASSIZ Am. Journ. Sci. Arts, 1854, 359.

Alburnops, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 194.

Plargyrus (Raf.), GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 195.

Hydrophlox, JORDAN, Man. Vert., 2d Ed., 1878, 292.

Type, *Luxilus chrysocephalus*, Rafinesque; *Cyprinus cornutus*, Mitch.

Etymology, Latin, *lux*, light, in allusion to the vernacular name shiner.

Body oblong, more or less compressed; mouth normal; no barbels; teeth 2, 4, 2, hooked, with masticatory surface; intestinal canal short; scales large, more or less closely imbricated along the sides of the body, so that the exposed surfaces are higher than long; lateral line continuous, decurved; dorsal over or slightly behind ventrals; anal fin short; breeding coloration usually very brilliant; the male flushed with red, and with the snout tuberculate. As here understood, this is a large genus, including a considerable number of species, most of them Southern in their distribution. There are three well-marked subgenera: *Luxilus* proper, including large species, with the scales very closely imbricated, and much deeper than long; the dorsal over the ventrals and the jaws even; type *L. cornutus*.

Coccotis, Jor., including rather large species, with the scales less closely imbricated, but still deeper than long; dorsal behind ventrals and lower jaw projecting; type *L. coccotis*.

Alburnops, Grd. (*Hydrophlox*), small species with the scales normal; the jaws equal and the dorsal somewhat behind the ventrals. These fishes resemble certain species of *Hudsonius*, but the males are brilliantly colored. Type, *L. blennius*.

Only *L. cornutus*, the largest and best known of the species of the genus has been observed in Ohio.

75 LUXILUS CORNUTUS (Mitch.) Jordan.

Shiner; Red-fin; Rough-head.

- Cyprinus cornutus*, MITCHILL, Am. Monthly Mag. and Crit. Rev., 1817, 298 (brief mention); Am. Monthly Mag., 1818, 324 (description).
- Leuciscus cornutus*, STORER, Bost. Journ. Nat. Hist., ix, 1822, 182; Synopsis, 1840, 409.—DEKAY, Fishes N. Y., 1842, 207.—GUNTHER, Cat. Fishes, vii, 1868, 249.
- Hypsilepis cornutus*, STORER, Fishes Mass., 1855, 284.—COPE, Proc. Phila. Acad. Sci., 1864, 279.—PUTNAM, Bulletin M. C. Z., 1863, 7.
- Plargyrus cornutus*, GIRARD, Proc. Phila. Acad. Sci., 1856, 196.
- Hypsilepis cornutus*, COPE, Cyp. Penn., 1866, 372; Proc. Phila. Acad. Sci., 1867, 158; Journal Phila. Acad. Sci., 1868, 292.—JORDAN, Ind. Geol. Surv., 1874, 223.—UHLER and LUGGER, Fishes of Md., 1876, 148, and of late American writers.
- Hypsilepis cornutus*, vars *gibbus*, *frontalis*, *cerasinus*, *cornutus*, *cyaneus*, COPE, Proc. Phila. Acad. Sci., 1867, 167.
- Luxilus cornutus*, RAFINESQUE, MSS. Fishes of the Susquehanna.—JORDAN, Bull. Buff. Nat. Hist. Soc., 1876, 94; Manual Vert., 1876, 266; 2d Ed., 1878, 283, and elsewhere.—NELSON, Bull. Ills. Mus. Nat. Hist., 1877.
- Cyprinus megalops*, RAFINESQUE, Am. Monthly Mag., 1818, 121 (has probably priority of description).
- Cyprinus melanurus*, RAFINESQUE, l. c., 1818, 121.
- Luxilus chrysocephalus*, RAFINESQUE, Ich. Oh., 1820, 48.
- Semotilus deplemia*, KIRTLAND, Rept. Zool. Ohio, 1838, 168 (not of Raf.).
- Leuciscus diplemia*, KIRTLAND, Bost. Journ. Nat. Hist., v, 1846, 276.—STORER, Synopsis, 411.
- Argyreus rubripinnis*, HECKEL, Russeger's Reisen, 1843, 1040.
- Leuciscus gibbosus*, STORER, Proc. Bost. Soc. Nat. Hist., July, 1845; Synopsis, 1846, 418.
- Hypsilepis gibbosus*, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 358.
- Plargyrus gibbosus*, GIRARD, Proc. Phila. Acad. Sci., 1856, 191.
- Leuciscus plagyrus*, KIRTLAND, Bost. Journ. Nat. Hist., v, 1846, 26.
- Leuciscus plagyrus*, STORER, Synopsis, 1846, 410.
- Leuciscus frontalis*, AGASSIZ, Lake Superior, 1850, 368.
- Hypsilepis frontalis*, AGASSIZ, Am. Journ. Sci. Arts, 1854, 359.—PUTNAM, Bull. M. C. Z., 1863, 7.
- Plargyrus frontalis*, GIRARD, l. c.
- Leuciscus gracilis*, AGASSIZ, Lake Superior, 1850, 370.
- Plargyrus gracilis*, GIRARD, l. c.
- Hypsilepis gracilis*, COPE, Proc. Phila. Acad. Sci., 1867, 157.
- Plargyrus typicus*, GIRARD, l. c., 195.
- Plargyrus argentatus*, GIRARD, l. c., 196.
- Plargyrus bowmani*, GIRARD, l. c., 186, and Pac. R. R. Surv., x, 263, 1858.
- Hypsilepis cbesus*, COPE, Proc. Phila. Acad. Sci., 1867, 157 (not *L. obesus*, Storer, fide Agassiz).

Description.—Body elongate, compressed in the young, in the adult short, compressed, with the anterior dorsal much swollen and gibbous; head rather heavy, compressed, rounded between the eyes, the snout bluntish, moderate, nearly horizontal, the jaws nearly equal, the lower somewhat inclined; eye moderate, four to five in head; maxillary scarcely reaching front of eye; the premaxillaries below the level of the eye; scales always deeper than long on the flanks, becoming extremely so in the adults;

lateral line decurved; dorsal moderate, inserted directly over ventrals in the young, thrown somewhat backward in the adult by the growth of the post-occipital region; pectorals barely or not reaching ventrals, the latter about to vent; region in front of the dorsal typically with about 23 scales; coloration dark steel-blue above, the scales with dusky edges, the bases also dusky; a gilt line along the back and one along each side, these distinct only when the fish is in the water; belly and lower part of the sides silvery, or bright rosy in spring males; dorsal fin somewhat dusky, the other fins plain, the lower fins all rosy in spring males; head dark above; a dark shade behind scapula; lower jaw and region in front of dorsal to the tip of the snout covered with small tubercles in spring males; females and young fishes are plain olivaceous above and silvery below; head $4\frac{1}{2}$; depth $3\frac{1}{2}$, varying much with age; D. 8; A. 9; scales 6-41-3; teeth 2. 4-4, 2 with rather narrow grinding surface.

This species is extremely variable and several varieties have been indicated by name by Professor Cope. It is, however, unnecessary to describe them here. Length, 5 to 8 inches.

Habitat, in all waters east of the Great Plains, except in the South Atlantic States (wanting in streams between the Neuse and the Alabama), everywhere the most abundant fish.

Diagnosis.—The adult Shiner may be known at once by the disproportionately great depth of the scales on the sides, the exposed portions being very much higher than long. The young can only be distinguished from certain species of *Minnilus*, *Hudsonius*, etc., by careful discrimination.

Habits.—In every permanent stream in Ohio, this is the most abundant fish. In all small brooks, and in quiet places in every river, the young will be found in myriads, and a good part of the food of the Black Bass and other predacious species is formed by this fish. It reaches a considerable size, but is scarcely used as food except by pot fishers and boys. The flesh is soft and very soon spoils after death, hence the name Rotten gut or Rot-gut Minnow, frequently given to it in the South.

GENUS 36. ERICYMBA. Cope.

Ericymba, COPE, Proc. Acad. Nat. Sci. Phila., 1865, 88.

Type, *Ericymba buccata*, Cope.

Etymology, *eri*, an intensive particle; *kumba*, a cavity, in allusion to the mucous channel.

Body oblong, moderately compressed; muzzle broad; *interopercle and bones of the mandible with externally visible mucous chambers largely developed*; lips thin; no barbels; teeth 1, 4-4, 0, without grinding surface, hooked, the edges entire; scales rather large; lateral line continuous; dorsal fin above ventrals; anal basis short; silvery fishes of rather small size; known at once from all other minnows by the cavernous bones of the head. But a single species is now known.

76. *ERICYMBA BUCCATA* Cope.**Silver-jawed Minnow.**

Ericymba buccata, COPE, Proc. Acad. Nat. Sci. Phila., 1865, 88.—GUNTHER, Cat. Fishes Brit. Mus., vii.—JORDAN, Man. Vert., 2d Ed., 299.

Description.—Body fusiform, rather elongate, little compressed, the back not elevated; head rather long, somewhat depressed above, with broad and prominent muzzle; mouth rather small, horizontal, subinferior, the lower jaw considerably shorter than upper; upper lip below level of pupil; maxillary not reaching to eye; dentary bones dilated, the mucous channels conspicuous cross lines; opercle small; eye large, four in head; fins small, dorsal over ventrals; scales moderate, the lateral line nearly straight; middle of the belly scaleless; fifteen scales before dorsal; color olivaceous, rather pale; sides bright silver with bluish reflections; a dark dorsal streak, conspicuous posteriorly; fins plain; males without tubercles or bright colors; head 3.5-6; depth 5; D. 8; A. 8; scales 5-33-3; teeth 1, 4-4, 0. Length 5 inches.

Habitat, Ohio Valley.

Diagnosis.—This species is known at once from all other minnows by the cavernous condition of the bones of the lower jaw.

Habits.—This graceful and interesting little fish is abundant in most streams tributary to the Ohio. It prefers clear, gravelly or sandy streams, and often ascends the small brooks. Most specimens seen are small. The males do not undergo any special changes in color or form in the breeding season.

GENUS 37. *PHENACOBIUS*. Cope.

Phenacobius, COPE, Proc. Acad. Nat. Sci. Phila., 1867, 96.

Sarcidium, COPE, Hayden's Geol. Surv., 1870, 1872, 440.

Type, *Phenacobius teretulus*, Cope.

Etymology, *phenax*, deception; *bios*, life, the species having the appearance of herbivorous minnows, but with the teeth and intestines of the carnivorous.

Body elongate, subterete; mouth small, inferior, with thickened lips, the lip of the lower jaw developed as a conspicuous lobe on either side, presenting a slight resemblance to the lower jaw of *Exoglossum*; no barbels; premaxillaries protractile; dorsal fin inserted in advance of ventrals; anal basis short; intestinal canal not elongated, peritoneum pale; teeth 4 4, hooked, without grinding surface; scales rather small; lateral line continuous. Species of rather small size, bearing a considerable resemblance to young suckers. Three or four species are known, mostly of southern distribution.

77. *PHENACOBIUS TERETULUS* Cope.

Phenacobius teretulus, COPE, Proc. Acad. Nat. Sci. Phila., 1867, 96.—JORDAN, Man. Vert., 2d Ed., 299.

Sarcidium scopiferum, COPE, Hayden's Geol. Surv. Terr., 1872, 440 (probably same).

Phenacobius scopiferus, JORDAN, Man. Vert., 2d Ed., 1878, 299; Bull. Hayden's Geol. Surv. Terr., 1878; Bull. Ills. State Lab. Nat. Hist., ii, 1878, 61.

Phenacobius teretulus, var. *liosternus*, NELSON, Bull. Ills. Mus. Nat. Hist., i, 1876, 46.

FISHES—CYPRINIDÆ.

Description.—Body slender, little compressed, the back elevated, the caudal peduncle stout; head stout, the muzzle elongate, obtusely decurved, heavy; mouth small, inferior, horizontal, the maxillary not reaching to the eye; lips weakly plicate; isthmus wide; lateral line nearly straight; eye large, high up, three and a half in head; pale yellowish, the scales above dark-edged; snout blackish; a plumbeous lateral band; fins plain; head $4\frac{3}{8}$; depth $4\frac{1}{4}$; D. 8; A. 7; scales 6-43-5; teeth 4-4. Length $3\frac{1}{2}$ inches.

Habitat, West Virginia to the Rio Grande.

Diagnosis.—From other small minnows, this species may be known by the thickened lips, in connection with the short intestines and the number (4-4) of the teeth.

Habits.—This species has not yet been recorded from Ohio. *P. teretulus* occurs in the streams of West Virginia, and *P. scopiferus* which I take to be the same species or a variety of it is found in Illinois. We may therefore look for it in the streams of Southern Ohio. Little distinctive is known of the habits of this species. Professor Cope found it in the Kanawa, abundant in the river channel and in the mouths of tributaries.

GENUS 38. RHINICHTHYS. Agassiz.

Argyreus, HECKEL, Russeger's Reisen, 1843, i, 1040 (preoccupied in Entomology).

Rhinichthys, AGASSIZ, Lake Superior, 1850, 350.

Type, *Cyprinus atronasus*, Mitch.

Etymology, *rhin*, snout; *ichthus*, fish.

Body rather elongate, not much compressed; mouth small, subinferior, normal; the upper jaw not protractile; the upper lip continuous with the skin of the forehead; a barbel terminal, on the maxillary; teeth usually 2, 4-4, 2, hooked, without grinding surface; intestinal canal short; scales very small; lateral line continuous; dorsal fin inserted behind the ventrals; anal basis short; coloration dark, rosy in spring.

Species of rather small size, abounding in all clear brooks in the United States, east of the Rocky Mountains.

ANALYSIS OF SPECIES OF RHINICHTHYS.

*Body elongate, the depth about 5 in length; barbel rather long; snout much projecting. CATARACTÆ. 78.

**Body compact, the depth 4 to $4\frac{1}{2}$ in length; barbel minute; snout little projecting. ATRONASUS. 79.

78. RHINICHTHYS CATARACTÆ (Valenciennes) Jordan.

Long-nosed Dace; Niagara Gudgeon.

Gobio cataractæ, CUV. and VAL., Hist. Nat. des Poissons, xvii, 1842, 315, pl. 483.

Ceraticthys cataractæ, COPE, Trans. Am. Philos. Soc. Phila., 1866, 365.—GUNTHER, Cat.

Fishes Brit. Mus., vii, 176.

Rhinichthys cataractæ, JORDAN, Man. Vert., 2d ed., 1878, 307, and elsewhere.

Leuciscus nasutus, AYRES, Bost. Journ. Nat. Hist., iv, 1843, 2, 99, and of authors.

Rhinichthys nasutus, AGASSIZ, Lake Superior, 353.—GUNTHER, Cat. Fishes Brit. Mus., vii, 189, and of most writers.

Argyreus nasutus, COPE, Trans. Am. Philos. Soc., 1856, 369.

Rhinichthys marmoratus, AGASSIZ, Lake Superior, 1850, 354.—GUNTHER, Cat. Fishes Brit. Mus., vii, 189.

Description.—Body elongate, little compressed, not elevated; head long, the muzzle flattened, narrowed and extremely prominent, the mouth being entirely inferior and horizontal; eye nearly median, its diameter contained twice in the length of the snout, about five times in head; isthmus wide; barbels evident; lateral line commencing opposite the upper posterior angle of the opercle, decurved; pectoral fins enlarged in the males, a small fatty lobe in the axils; color olivaceous or dark green, paler below, with numerous dusky punctuations, the back often almost black, some of the scales usually irregularly darker, producing a mottled appearance; no black lateral band; young specimens with a dusky lateral shade; a blackish spot on the opercle; males in spring with the lips, cheeks and all the fins crimson; head 4, depth 5; D. 8; A. 7; scales 14-65-8; teeth 2, 4-4, 2. Length 5 inches.

Habitat, New England, Middle States, and Great Lake Region, in clear cold water.

Diagnosis.—This species may be known by the very projecting snout in connection with the barbels and the very small scales.

Habits.—This species is fond of clear swift waters, as is the trout. It haunts the rapids and rock pools, and its motions are swift and powerful. In the State of Ohio, it is not a very common species, but it is found in tributaries of Lake Erie, and sometimes in the lake itself. It also occurs in the southeastern part of the State.

Name.—This fish was first described from specimens sent from Niagara Falls to the Museum at Paris. It was therefore named *Gobio cataractæ* or "Gudgeon of the Cataract."

79. RHINICHTHYS ATRONASUS (Mitchill) Agassiz.

Black-nosed Dace; Rockfish.

var. *atronasus*.

Cyprinus atronasus, MITCHILL, Trans. Lit. and Phil. Soc. New York, i, 1814, 460.

Leuciscus atronasus, DEKAY, New York Fauna, Fishes, 1842, 205, and authors.

Argyreus atronasus, COPE, Cyp. Penn., 1866.

Rhinichthys atronasus, AGASSIZ, Lake Superior, 1850, 354.—GUNTHER, Cat. Fish. Brit. Mus., vii, 191, and of nearly all recent writers.

var. *obtusus*.

Rhinichthys obtusus, AGASSIZ, Am. Journ. Sci. Arts, 1854, 357.—JORDAN, Man. Vert., 1876, 280; Ann. N. Y. Lyc. Nat. Hist., 1876, 331.

Argyreus dulcis, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 185.

Argyreus obtusus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 185.

Rhinichthys obtusus, GUNTHER, Cat. Fishes Brit. Mus., vii, 1868, 190.

Rhinichthys lunatus, COPE, Proc. Phil. Acad. Sci., 1864, 278; Journ. Phila. Acad. Sci., 1869, 228.—JORDAN, Ind. Geol. Survey, 1874, 223; Man. Vert., 281.

Argyreus lunatus, COPE, Proc. Am. Phil. Soc., 1870.

Description—Body moderately elongate, little compressed; head moderate, rather broad and flattened above; snout moderate; mouth small, horizontal, subterminal, the lower jaw included; barbel minute, but probably always present; upper lip on the level of the lower part of the pupil; maxillary not reaching nearly to the eye; eye small, nearly median, one and one-half in snout, four and one-half in head; fins rather small; dorsal fin well back; scales quite small, somewhat imbedded; lateral line decurved; color blackish above, some of the scales irregularly darker; a black band passing from the snout through eye and along the sides of the body; a pale streak below this; belly silvery; males in spring with the lateral bands and the lower fins, and sometimes the whole body bright crimson; males in later summer with the lateral band scarlet or orange, the red color growing fainter later in the season; head 4; depth $4\frac{1}{2}$; D. 7; A. 7; lat. 1. 64; teeth 2, 4-4, 2. Length 3 inches.

Var. *obtus* (Ag.) a southwestern form may be thus characterized:

Very similar to *R. atronasus*, but usually rather stouter, the head a little shorter, and the coloration somewhat different; back olivaceous, mottled with darker; sides with a rather faint brownish band margined above and below with paler; belly silvery; a dusky blotch in the middle of the base of the dorsal fin; males with the pectoral fins enlarged, and with the lateral band rosy; head 4; depth $4\frac{1}{2}$; D. 7; A. 7; scales 14-63-8; teeth 2, 4-4, 2. Length 3 inches.

Habitat, New England to Alabama. Var. *atronasus* in the region from Cleveland eastward to Maine and Virginia. Var. *obtus* in the Upper Lake Region, Ohio Valley and southward to Georgia and Alabama.

Diagnosis.—This species may be known by its small scales and dark colors in connection with the position of the mouth. Its shorter snout distinguishes it at once from the preceding.

Habits.—This species is one peculiar to the clear small brooks and spring runs. In suitable localities it is excessively abundant. It is a very swift and active fish, and the males in spring and summer are brilliantly colored.

GENUS 33. ERIMYSTAX. Jordan.

Erimystax, JORDAN (*nova*).

Type, *Leuciscus dissimilis*, Kirtland.

Etymology, *eri*, an intensive particle; *mustax*, barbel (moustache).

Body elongate; mouth inferior, with the lips somewhat thickened; a well developed barbel at the posterior end of the maxillary; teeth 4-4, hooked, with narrow grinding surface; scales rather large; lateral line continuous; dorsal fin in advance of ventrals; anal basis short; size medium. A single species known, in coloration and habits bearing some resemblance to the Etheostomoid fishes.

80. *ERIMYSTAX DISSIMILIS* (Kirtland) Jordan.**Spotted Shiner.**

Luxilus dissimilis, KIRTLAND, Boston Journ. Nat. Hist., v, 1840, 341.

Ceratichthys dissimilis, COPE, Proc. Acad. Nat. Sci. Phila., 1864, 277; Cyp. Penn., 1866, 368.—GUNTHER, Cat. Fishes Brit. Mus., vii, 177.—JORDAN, Man. Vert., 2d Ed., 1878, 306, and of writers generally.

Description.—Body long and slender, little compressed, with long caudal peduncle; head long, rather flat above, the snout somewhat bluntly decurved, projecting a little beyond the rather small horizontal mouth; lower jaw included; both jaws with the skin hard in front, forming a sort of tip laterally; barbels considerably shorter than pupil; maxillary not reaching nearly to orbit; eye very large, high up, somewhat directed upward, rather behind the middle of the head, forming more than one-third the length of the head; opercle small; dorsal rather large, its posterior border oblique; anal small; caudal well forked; pectoral rather long; scales rather large, twenty-two in front of dorsal; lateral line nearly straight; olivaceous, sides silvery, with a bluish lateral band, which is widened into several dusky spots, formed by dark punctuations and most distinct posteriorly; a dusky band on head, through eyes and snout, fins plain; head $4\frac{1}{2}$; depth $5\frac{1}{2}$; D. 8; A. 7; scales 6-47-5; teeth 4-4. Length 5 inches.

Habitat, Ohio Valley and Lake region.

Diagnosis.—This species may be known by the long and slender body and the peculiar coloration, the bluish black lateral blotches being found in no other of our species.

Habits.—This species seeks large bodies of water, being most abundant in the lakes and in the channels of the large streams. I have never seen it in small brooks, and it is seldom taken in the rivers in small seines, except at very low water. It reaches a considerable size for a minnow and as it takes the hook, it is frequently seen on the small boy's "string of fish" along the Ohio. According to Dr. Kirtland it is often used to "bait the hook on 'sett' lines."

GENUS 40. *CERATICHTHYS*. Baird.

Ceratichthys, BAIRD, 1853.—GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 212, and of authors.

Hybopsis, AGASSIZ, Am. Journ. Sci. Arts, 1854, 358.

Nocomis, COPE, Proc. Acad. Nat. Sci. Phila., 1856, 190.

Erinemus, JORDAN, Man. Vert., 1876, 279.

Type, *Semotilus biguttatus*, Kirt.

Etymology, *keras*, horn; *ichthus*, fish.

Form various; mouth terminal or inferior, with lips thin or somewhat fleshy; a conspicuous barbel terminal on the maxillary; premaxillaries projectile; teeth 4-4 or 1, 4-4, 1 or 0, hooked, without grinding surface; scales rather large; lateral line continuous; dorsal fin inserted over, in front of, or slightly behind ventrals; anal basis short; size and coloration various.

A large genus embracing a wide range of forms. Of the numerous species, but two have as yet been found in Ohio. These two bear little resemblance to each other, and may be taken as representatives of distinct subgenera.

ANALYSIS OF SPECIES OF CERATICHTHYS.

- *Mouth subinferior; scales large, about 36 in lateral line; eye very large; silvery (subgenus *Hybopsis*). AMBLYOPS. 87.
 **Mouth terminal; scales medium, about 41 in lateral line; eye moderate; not silvery (subgenus *Ceraticthys*). BIGUITATUS. 82.

81. CERATICHTHYS AMBLYOPS (Rafinesque) Girard.

Big-eyed Chub.var. *amblops*.

Rutilus amblops, RAFINESQUE, Ich. Oh., 1820, 51.

Ceraticthys amblops, GIRARD, Proc. Acad. Nat. Sci. Phila., 1876, 213.—JORDAN, Man. Vert., 2d Ed., 306.

Nocomis amblops, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 328.

var. *gracilis*.

Hybopsis gracilis, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 358.—JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 331.

Gobio vernalis, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 168; U. S. Pac. R. R. Surv., 1858, 249.

Hybopsis winchelli, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 211.

Nocomis winchelli, JORDAN, Ann. Lyc. Nat. Hist., 1876, 330.

Ceraticthys winchelli, JORDAN, Man. Vert., 2d Ed., 306.

Ceraticthys hyalifus, COPE, Journ. Acad. Nat. Sci., Phila., 1868, 236 —GUNTHER, Cat. Fishes Brit. Mus., vii, 179, and of authors.

Description.—Body moderately elongate, little compressed, heaviest anteriorly; head large, the muzzle rather long, the profile very blunt; eye unusually large, larger than in most of our minnows, its diameter about one-third the length of the side of the head; mouth rather small, inferior, horizontal; barbels well developed; fins moderate, the dorsal inserted over the base of the ventrals; scales large; color translucent above, sides and below bright silvery; a plumbeous lateral band, sometimes faint, sometimes shining blackish; top of head and a streak through the eye dark; no vertebral band; fins unspotted; males in spring not tuberculate and without red markings; head 4; depth $4\frac{1}{2}$; scales 5-40-3; D. 8; A. 8; pharyngeal teeth 1, 4-4, 1. Length 3 inches.

Habitat, Mississippi Valley. Var. *gracilis*, Tennessee and southwards.

Diagnosis.—This species may be known by the presence of a very large eye in connection with the maxillary barbels and large silvery scales.

Habits.—This species is abundant in all tributaries of the Ohio River. It frequents clear sandy or gravelly streams, and seeks the river channels rather than the small brooks. The male in spring, so far as known, never becomes tuberculate, and the fins are never red, characters which help to distinguish this species from its ornate southern relative, *Ceraticthys rubrifrons*.

82. CERATICHTHYS BIGUTTATUS (Kirtland) Girard.

Horny-head; Horned Dace; River Chub; Jerker.

Catostomus melanotus, RAFINESQUE, Ich. Oh., 1820, 56.

Ceraticthys melanotus, JORDAN, Man. Vert., 1875, 278.

Semotilus biguttatus, KIRTLAND, Bost. Journ. Nat. Hist., iii, 1840, 344.

Leuciscus biguttatus, DEKAY, Fishes N. Y., 1842, 214.—STORER, Synopsis, 413.

Ceraticthys biguttatus, BAIRD and GIRARD, Proc. Phila. Acad. Sci., 1856, 213.—PUTNAM, Bull. M. C. Z., 1863, 8.—COPE, Cyp. Penn., 1866, 366; Journ. Phila. Acad. Sci., 1863, 226; Proc. Am. Philos. Soc., 1870, 459.—GUNTHER, Cat. Fishes Brit. Mus., vii, 178.—JORDAN, Ind. Geol. Survey, 1871, 223.—JORDAN and COPELAND, Bull. Buff. Soc. Nat. Hist., 1-76, 149.—NELSON, Bull. Ills. State Mus., 1876.—UHLER and LUGGER, Fishes of Md., 144.—COPE and YARROW, Lieut. Wheeler's Survey, 1876, and of most late writers.

Nocomis biguttatus, COPE and JORDAN, Proc. Phil. Acad. Sci., 1877.—JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 355.

Leuciscus croceus, STORER, Proc. Bost. Soc. Nat. Hist., July, 1845; Synopsis, 1846, 419.—AGASSIZ, Am. Journ. Sci. Arts, 1854, 359.

Nocomis nebrascensis, GIRARD, Proc. Phila. Acad. Nat. Sci., 1856, 213; Pac. R. R. Surv., x, 1858, 254.

Nocomis bellicus, GIRARD, Proc. Phila. Acad. Sci., 1856, 213.

Ceraticthys cyclois, COPE, Proc. Phila. Acad. Sci., 1864, 277; Cyp. Penn., 365; Proc. Am. Philos. Soc., 1874, 113.—GUNTHER, Cat. Fishes, vii, 178.

Ceraticthys stigmaticus, COPE, l. c., 366.—GUNTHER, l. c.

Description.—Body rather robust, not elevated, little compressed; head large, rather broadly rounded above, the snout conical, bluntish; mouth rather large, subterminal, little oblique, the lower jaw somewhat the shorter; the upper lip somewhat below the level of the eye, and the maxillary not reaching to the front of the eye; eye small, median, very high up; suborbitals very narrow; preorbitals large; fins moderate, the dorsal rather posterior, slightly behind the insertion of the ventrals; caudal broad, little forked; scales large and nearly equal over the body, not crowded anteriorly; eighteen rows in front of the dorsal; lateral line rising opposite upper posterior angle of opercle, somewhat decurved; color bluish olive, sides with bright green and coppery reflections; a curved dusky bar behind the opercle; scales above with dark borders; belly pale, but not silvery; rosy in spring males; fins all pale orange, without black spots; males in spring with a crimson spot on each side of the head; the adults with the top of the head swollen, forming a sort of crest, which is sometimes a third of an inch higher than the level of the neck, and is covered with large tubercles; young with a dark caudal spot; barbel well developed; head 4; depth 4½; D. 8; A. 7; scales 641.4; teeth 1, 4-4, 1 or 1, 4-4, 0. Length 6 to 9 inches.

Habitat, Pennsylvania to Utah Basin, abundant in all streams north and south.

Diagnosis.—This familiar species may in general be known by its large size and lack of silvery lustre, in connection with the presence of the barbel. It has no spot on its dorsal fin, and its scales are not crowded anteriorly.

Habits.—This fish is found in every stream in the State of Ohio. It reaches a considerable size and is nearer a "game fish" than any other of

its family in the State, as it takes the hook readily and energetically and it may be eaten when properly fried. The catching of this fish is the principal excitement of the average "summer boarder" at many places in the south and west. The male of this species, in the spring, has the head extravagantly covered with tubercles, hence the name "Horny-head." This species is less disposed to ascend small streams than the "Horned Dace" (*Semotilus corporalis*), and is hence often called the River Chub, the other being the Creek Chub. A fisherman of Rock Castle River, in Kentucky, has told me that the young of this species makes the best bait for the Black Bass, as "it will swim longer than any other with a hook in its body." These are almost the identical words used by Rafinesque, concerning his still unidentified "Indian Chubb," *Luxilus kentuckiensis*.

GENUS 42. COUESIUS. Jordan.

Couesius JORDAN, Bull. Hayden's Geol. Surv. Terr., 1878.

Type, *Leucosomus dissimilis*, Girard.

Etymology, dedicated to Elliott Coues.

Body elongate, mouth terminal, normal; a well developed barbel at the posterior end of the maxillary; teeth 2, 4-4, 2, hooked, without masticatory surface; scales rather small; lateral line continuous; dorsal fin over or slightly behind ventrals; anal basis short. This genus comprises four or five species, all of large size and northern distribution. They resemble the species of *Semotilus*, but differ in dentition and in the position of the barbel.

83. COUESIUS PROTHEMIUS (Cope) Jordan.

Lake Chub.

Ceraticthys prothemius, COPE, Trans. Am. Philos. Soc. Phila., 1866, 365 — JORDAN, Man. Vert., 2d Ed., 1868, 307.

Ceraticthys plumbeus, GUNTHER, Cat. Fishes Brit. Mus., vii, 176 (probably not *Gobio plumbeus*, Ag.).

Description.—This fish is of the average size of *Semotilus corporalis*, but of a much more slender form; the outline is fusiform, the head being small, and the muzzle broad and abruptly descending; back compressed medially; first dorsal ray midway between the end of the muzzle and the origin of the caudal, considerably longer than the first ray of the anal, its base longer than the base of the anal; ventrals opposite the first ray of the dorsal, not reaching to the vent; end of maxillary not reaching to opposite the orbit; mouth terminal, small; muzzle obtuse; isthmus narrow; barbels well developed; head and upper part of body blackish; a plumbeous band above the lateral line, white below; head 4; depth about 4; D. 8; A. 8; scales 11-63-8; teeth 2, 4-4, 2. Length six or seven inches.

Habitat, Great Lake region.

Diagnosis.—From other large chubs with a barbel, this species may be known by the presence of *two* teeth in the lesser row in the pharyngeals.

Habits.—This species has thus far only been recorded from the Upper Lakes. It is probably not abundant in Lake Erie, and does not, so far as is known, ascend the streams.

A closely related species (*Coreius dissimilis*), with the mouth larger and somewhat oblique, occurs in the Upper Lakes.

GENUS 42. SEMOTILUS. Rafinesque.

Semotilus, RAFINESQUE, Ich. Oh., 1820, 49.

Leucosomus, HECKEL, Russegger's Reise, 1843, i, 1042.

Cheilonemus, BAIRD, Storer's, Fish. Mass. 1855, 288.

Type, *Semotilus*, Raf = *Cyprinus corporalis*, Mit.

Etymology, *sema*, banner, i.e., dorsal fin; *tilus*, supposed by Rafinesque to mean spotted.

Body robust; mouth terminal, the upper jaw protractile; a small barbel on the maxillary just above its end; intestinal canal short; teeth 2, 5-4, 2, hooked, without masticatory surface; scales moderate; lateral line continuous; dorsal more or less posterior to ventrals; anal basis short; species of large size. This genus differs from *Telestes* in the presence of a maxillary barbel; and from the European genus *Gobio* in the presence of but two, instead of three, teeth in the lesser row.

But three or four species are known, divisible into two well marked subgenera.

Leucosomus.—Scales rather large, not crowded anteriorly; dorsal nearly over ventrals, without black spot at its base.

Semotilus.—Scales small, smaller and crowded anteriorly; dorsal well behind ventrals, with a black spot at its base in front.

The single representative of *Leucosomus*, *Semotilus bullaris* (Raf.) Jor., the great Chub or Fall fish of Pennsylvania and the Eastern States may perhaps occur in the eastern part of Ohio. This species is much the largest of the eastern *Cyprinidæ*, and may be known from *S. corporalis*, by the absence of the black dorsal spot, and by the other characters noticed above. In the young of both species the barbel is usually too small to be appreciated.

84. SEMOTILUS CORPORALIS (Mitchell) Putnam.

Chub; Horned Dace; Creek Chub; Smaller Fall-fish.

Cyprinus corporalis, MITCHILL, Am. Monthly Mag., ii, 1817, 289, and 1818, 324.

Leuciscus corporalis, DEKAY, Fishes N. Y., 1842, 213.

Semotilus corporalis, PUTNAM, Bull. M. C. Z., 1863, 8; in Storer's Fishes Mass., 256.—COPE, Cyp. Penn., 362, 1866; Proc. Phil. Ac. Sci., 1865, 85; Hayden's Geol. Surv. Terr., 1870, 442, and 1871, 472.—ABBOTT, Am. Nat., April, 1870, 12.—JORDAN, Ind. Geol. Surv., 1874, 223; Bull. Buff. Soc. Nat. Hist., 1876, 94; Man. Vert., 1876, 278.—GOODE, Bull. U. S. Mus., vi, 1876, 64; and of most late U. S. writers.

Leucosomus corporalis, GUNTHER, Cat. Fishes, vii, 269.

Cyprinus atromaculatus, MITCHILL, Am. Monthly Mag., ii, 1817, 324.

Leuciscus atromaculatus, DEKAY, Fishes N. Y., 1842, 210.—STORER, Synopsis, 1846, 409.

- Semotilus atromaculatus*, GIRARD, Proc. Phil. Acad. Sci., 1856, 204; Pac. R. R. Rept., 1858, 283.—ABBOTT, Am. Nat., April, 1870, 13.
- Leucosomus atromaculatus*, COPE, Proc. Phila. Acad., 1861, 223.
- Semotilus dorsalis*, RAFINESQUE, Ich. Oh., 1820, 49.—KIRTLAND, Zool. Ohio, 1838, 160; Bost. Journ. Nat. Hist., iii, 184, 345.—GIRARD, Pac. R. R. Surv., 283.
- Leuciscus dorsalis*, STORER, Synopsis, 411.
- Semotilus cephalus*, RAFINESQUE, Ichthyologia Ohiensis, 1820, 49.—KIRTLAND, Zool. Ohio, 169; Bost. Journ. Nat. Hist., iii, 1840, 345.—GIRARD, Pac. R. R. Survey, 1858, 283.
- Leuciscus cephalus*, DEKAY, Fishes of N. Y., 214, 1843.—STORER, Synopsis, 409.
- Leuciscus iris*, CUV. and VAL., xvii, 1814, 253.
- ? *Leuciscus rotengulus*, CUV. and VAL., xvii, 1844, 318.—STORER, Synopsis, 416.
- Leuciscus storeri*, CUV. and VAL., xvii, 1844, 319.
- Leuciscus pulchelloides*, AYRES, Proc. Bost. Soc. Nat. Hist., iii, 157.
- Leuciscus incrassatus*, GIRARD, Proc. Phila. Acad. Sci., 1856, 190; Pac. R. R. Surv., 1858, 252.
- Semotilus macrocephalus*, GIRARD, Proc. Phila. Acad., 1856, 201.
- Leucosomus macrocephalus*, GIRARD, Pac. R. R. Surv., 252.
- Leucosomus pallidus*, GIRARD, Proc. Phila. Acad. Sci., 1856, 190; Pac. R. R. Surv., 251.
- Semotilus pallidus*, COPE, Cyp. Penn., 363.
- Semotilus corporalis*, var. *pallidus*, JORDAN, Man. Vert., 1876, 279.
- Semotilus speciosus*, GIRARD, Proc. Phila. Acad. Sci., 1856, 204; Pac. R. R. Surv., 1858, 283.
- Semotilus hammondi*, ABBOTT, Proc. Phila. Acad. Sci., 1860, 474.

Description.—Body stout, the dorsal outline arched in front of the dorsal, the body tapering backwards from a point considerably in advance of the dorsal, so that the base of that fin is oblique; head large and heavy, broad and rounded above; snout broad, mouth broad, oblique, the lower jaw slightly included, the upper lip just below the level of the pupil, the maxillary barely reaching the front of the pupil; maxillary barbel small, not evident in specimens of less than two or three inches in length; eye rather small about five in head; scales small, considerably crowded and reduced anteriorly, about thirty series in front of the dorsal fin; lateral line beginning at upper posterior angle of the opercle, and considerably decurved; fins small, the dorsal about midway between ventrals and anal; color dusky bluish above; sides with a vague dusky band, black in the young, disappearing in the adults; belly creamy, rosy tinted in the males in spring; dorsal fin always with a conspicuous black spot at the base in front, which is bordered with red in the male; a dark vertebral line; scales everywhere edged with dark punctuations; a dusky bar behind opercle; males with the snout coarsely tuberculated in spring; head $3\frac{1}{2}$; depth 4; D. 7; A. 8; scales 9-58-6 (those in the lateral line varying from 52 to upwards of 65); teeth 2, 5-4, 2; length 10 inches.

Habitat, Western Massachusetts to Dakota and South Georgia.

Diagnosis.—But two of the Ohio Cyprinidæ, possess the characteristic color mark of a black spot at the base of the dorsal in front. These are *Semotilus corporalis* and *Lythrurus diplæmius*. These are in other respects very different. In cases of doubt, the latter may be distinguished by the greater number of rays (10 to 12) in the anal fin.

Habits.—This species, the largest of the Cyprinidæ of Ohio, abounds in every brook, bayou or clear pond in the State. It takes the hook readily, and makes fair food if fried crisp without delay.

GENUS 43. TELESTES². Bonaparte.

Telestes, BONAPARTE, Fauna Italica, Pisc.

Tigoma, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 205.

Siboma, GIRARD, Proc. Acad. Nat. Sci. Phila., 1856, 209.

Clinostomus, GIRARD, Proc. Acad. Nat. Sci. Phila., 211.

Gila, sp. COPE, etc., (not of Baird and Girard).

Type, *Leuciscus muticellus*, Bonaparte. (Italy.)

Etymology, *telestes*, perfect.

This genus as here understood includes a very wide range of forms, agreeing in having the mouth normal, large or small, without barbels; teeth 2, 4-5, 2 or 2, 5-5, 2 without grinding surface; dorsal more or less posterior, usually behind the ventrals; scales moderate or small, the lateral line complete; caudal fin without a great number of recurrent rudimentary rays. The species are numerous in Europe, Asia, and Western America. The single species thus far noticed in Ohio, belongs to the subgenus *Clinostomus*, distinguished by the enormous mouth, projecting lower jaw, backward dorsal, and small scales.

85. TELESTES ELONGATUS (Kirtland) Jordan.

Red-sided Shiner.

Luxilus elongatus, KIRTLAND, Rept. Zool., Ohio, 1838, 169, 192; Bost. Journ. Nat. Hist., ii, 389.

Leuciscus elongatus, CUV. et VAL., xvii, 404.—GUNTHER, Cat. Fishes Brit. Mus., vii, 245.

Clinostomus elongatus, GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, 212.

Gila elongata, JORDAN, Man. Vert., 2d Ed., 1878.

Leuciscus productus, STORER, Synopsis, 1846, 164.

Squalius proriger, COPE, Proc. Acad. Nat. Sci. Phila., 1864, 280.

Clinostomus proriger, COPE, Cyp. Penn., 1866, 375.

Leuciscus proriger, GUNTHER, Cat. Fish. Brit. Mus., vii, 246.

Description—Body elongate, compressed; head long, rather pointed; mouth very large, oblique, the lower jaw notably projecting, with a small knob at the symphysis; upper lip on the level of the pupil; maxillary extending to the middle of the orbit; posterior angle of the opercle acute; eye moderate, nearly four in head; scales very small; fins short and high, the dorsal somewhat behind ventrals; lateral line decurved; color dark bluish, the scales mottled with paler; sides with a broad black band; belly more or less silvery; the front half of the lateral band bright crimson in spring males, the belly and lower fins more or less reddened, a dark vertebral band; head 4; depth 5; D 8; A. 9; scales 10-70-5; teeth 2, 4-5, 2. Length 4 inches.

Habitat, Great Lake Region and Ohio Valley.

Diagnosis—The great size of the mouth and the small size of the scales distinguish this species from all other minnows found in Ohio.

Habits.—This is one of the most brilliant of our minnows. It frequents clear, cold streams, and is therefore more abundant in the tributaries of the lake than in those of the Ohio River. It is unsurpassed as an aquarium fish.

GENUS 44. PHOXINUS. Agassiz.

Phoxinus, AGASSIZ, Mem. Soc. Sc. Neuchâtel, 1, 37.

Type, *Cyprinus phoxinus* L. = *Phoxinus laevis* Ag.

Etymology, *phoxinos*, a minnow, from *phoxos*, tapering.

Body stout; mouth normal, without barbels; teeth 2, 5-5, 2, or 2, 5-4, 2, hooked, without grinding surface; scales small, but little imbricated; lateral line incomplete or wanting; dorsal fin behind ventrals, anal basis short; species of small size and brilliant coloration; found both in Europe and America. The resemblance to *Chrosomus* in form, squamation, and coloration is considerable, but the teeth and alimentary canal are quite different. Three species are known in America, and two or three in Europe.

86. PHOXINUS NEOGÆUS Cope.

New World Minnow.

Phoxinus neogæus, COPE, Trans. Am. Philos. Soc., 1866, 375.—GUNTHER, Cat. Fish. Brit. Mus., vii, 247.—JORDAN, Man. Vert., 2d Ed., 1878, 302.

Description.—A stout little fish, with the head large, short, and blunt anteriorly; mouth rather small, oblique, terminal, reaching about to the front of the eye; eye moderate, rather longer than muzzle; color blackish, a black lateral band, above which is a pale streak; a dark spot at base of caudal; belly pale, crimson in the males in spring; head 3.4-5; depth 4.1-5; D. 8; A. 8; scales 18-77-12; lateral line developed on about 24 scales; teeth 2, 5-4, 2. Length 2½ inches.

Habitat, Southern Michigan to Minnesota.

Diagnosis.—This species may be known by its very small scales and incomplete lateral line. From *Chrosomus erythrogaster* it may be best known by the presence of two rows of teeth.

Habits.—This little fish has been thus far noticed only in Southern Michigan, Southern Wisconsin, and Northern Illinois. It doubtless occurs in North-western Ohio. Its habits are probably very similar to those of *Telestes elongatus*.

GENUS 45. NOTEMIGONUS. Rafinesque.

Notemigonus, RAFINESQUE, Journal de Physique, 1819, 421.

Stilbe, DEKAY, Fishes N. Y., 1842, 204.

Leucosomus, GIRARD, 1853 (not of Heckel = *Semotilus*).

Luxilus, GIRARD, Proc. Phil. Acad. Sci., 1856, 203 (not of Raf.). (Type *C. crysoleucus*, Mitch.)

Plargyrus, PUTNAM, Bulletin M. C. Z., 1863, 7 (not of Raf.).

Stilbius, GILL, Can. Naturalist, 1865, 18.

Type, *Notemigonus auratus*, Raf. = *Cyprinus chrysoleucus*, Mit.

Etymology, *notos*, back; *hemi*, half; *gonus*, angle, the back being almost keeled.

Body deep, strongly compressed; the belly somewhat carinate behind the ventral fins, the scales not crossing it; head small; jaws normal; mouth oblique; no barbels; teeth 5-5, hooked, with grinding surface, the edges more or less crenate; the alimentary canal moderate, rather longer than body, but hardly to be considered elongate; scales

moderate; lateral line much decurved, continuous; dorsal fin much behind ventrals; anal basis moderately elongate; the rays 10 to 18; species of large size, all American, closely related to the European genus *Abramis*, from which they differ in the shorter anal, *Abramis* having from 25 to 45 rays in that fin.

87. NOTEMIGONUS-CHRYSOLEUCUS (Mitchill) Jordan.

Golden Shiner.

Cyprinus chrysoleucus, MITCHILL, Rept. Fishes N. Y., 1814, 23; Trans. Lit. and Phil. Soc., i, 1815, 459.

Rutilus chrysoleucus, RAFINESQUE, Ich. Oh., 1820, 48.

Cyprinus (*Leuciscus*) *chrysoleucus*, RICHARDSON, Fauna Bor.-Am., iii, 1837, 122.

Leuciscus chrysoleucus, STORER Rept. Fishes Mass., 1839, 88.—THOMPSON, Hist. Vermont, 1842, 136.—KIRTLAND, Bost. Journ. Nat. Hist., iv, 1843, 305.

Notemigonus chrysoleucus, JORDAN, Bull. U. S. Mus., x, 1877, 65; Man. Vert., 2d Ed., 1878, 301.

Notemigonus auratus, RAFINESQUE, Ich. Oh., 1820, 40.

Abramis versicolor, DEKAY, Fishes N. Y., 1842, 191.

Leuciscus versicolor, STORER, Syn., 1846, 415.

Stilbe versicolor, AGASSIZ, Am. Journ. Sci. Arts, 1854, 359.

Leuciscus obesus, STORER, Proc. Bost. Soc. Nat. Hist., July, 1865, p. —; Synopsis, 1846, 418.

Stilbe obesa, AGASSIZ, Am. Journ. Sci. Arts, 1854, 359.

Luxilus obesus, GIRARD, Proc. Phil. Acad. Sci., 1856, 203.

Leuciscus americanus, STORER, 1846, 408. (Not of LINNÆUS.)

Leucosomus americanus, GIRARD, Storer's Fishes Mass., 1853, 283.

Luxilus americanus, GIRARD, Proc. Phil. Acad. Sci., 1856, 203.

Plargyrus americanus, PUTNAM, Bull. M. C. Z., 1863, 7.

Stilbium americanus, GILL, Can. Nat., Aug., 1865, 18.—JORDAN, Ind. Geol. Surv., 1874, 224.

Stilbe americana, COPE, Cyp. Penn., 1866, 389.—ABBOTT, Am. Nat., 1870, 14.—GOODE, Bull. U. S. Museum, vi, 1876, 64.—UHLER and LUGGER, Fishes of Maryland, 1876, 145.

Abramis americanus, GUNTHER, Cat. Fishes, vii, 1863, 305.

Notemigonus americanus, JORDAN and COPELAND, Check List, 1876, 155.—JORDAN, Ann. N. Y. Lyc. Nat. Hist., 1877, 344, Bull. Buff. Soc. Nat. Hist., 1876, 93; Man. Vert., 1876, 291.—NELSON, Bull. Ills. Mus., 1876, 48.

Luxilus seco, GIRARD, Proc. Phil. Acad. Sci., 1856, 203; Pac. R. R. Surv., 1858, 281.

Notemigonus seco, JORDAN and COPELAND, Check List, 1876, 155.—JORDAN, Ann. N. Y. Lyc., 1877, 365.

Description.—Body moderately elongate, strongly compressed; head short, subconic, compressed, the top of the head convex, the profile of the head continuous with that of the back; mouth small, oblique, the upper lip on the level with the upper part of the pupil, the maxillary not reaching the front of the eye; eye moderate, about four in head; fins medium; color clear greenish above; sides silvery with bright golden reflections; fins yellowish, the tips of the lower fins sometimes orange in spring males; head $4\frac{1}{2}$; depth 3; D. 8; A. 12-14; scales 12-51-3; teeth 5-5. Length 12 inches.

Habitat, Maine to Alabama and Texas, north to Minnesota. Every where abundant except in the South Atlantic States, where it is superseded by the southern *N. americanus* (L.).

Diagnosis.—This species bears little resemblance to our other Ohio *Cyprinidæ*. In general, it may be known by the long anal fin, and by the carinated belly, over the middle line of which (behind the ventral fins) the scales do not pass.

Habits.—This large species is especially characteristic of sluggish waters. In every lake, pond, or bayou in Ohio it is extremely abundant; in weedy bayous most of all. The yellow pond lily is its favorite shelter. Shallow ponds, left in the spring by the overflowing of some stream, will often be found full of them, their companions in distress in such cases being often *Amiurus xanthocephalus* and *natalis*, *Umbra limi*, *Esox salmoneus*, and *Erimyzon sucetta*. This fish in form and coloration somewhat resembles a Shad, and it has been frequently taken for such by careless observers. Rafinesque himself placed it among the *Clupeidæ*, which fact accounts for the general neglect of his name, *Notemigonus*.

GENUS CARASSIUS. Nilsson.

Carassius, NILSSON, Prodrromus.

Type, *Cyprinus carassius*, L; *Carassius vulgaris*, Nilss.

Etymology, from *Karass* or *Karaus*, the vernacular name of the European Crucian Carp.

Body oblong, compressed and elevated; mouth terminal, without barbels; teeth 4-4, molar not compressed; scales large; lateral line continuous; dorsal fin very long, with a stout spine, which is serrated behind; anal short, with a similar spine; large species, of the fresh waters of Europe and Asia, often domesticated. One species, the familiar Gold-fish, is here domesticated, and has become naturalized in some streams.

CARASSIUS AURATUS (Linnæus) Bleeker.

Gold-Fish.

This fish, native of the fresh waters of China, and domesticated in all parts of the world as an aquarium fish, is too well known to need description. There are twenty species in the fresh waters of Ohio, more beautifully colored than this coarse and gaudy fish, and more desirable for aquarium purposes in every respect, except that of tenacity of life.

GENUS CYPRINUS. Linnæus.

Cyprinus, LINNÆUS, Systema Naturæ, i, 525.

Type, *Cyprinus carpio*, L.

Etymology, *kuprinos*, Carp.

Body short and deep, resembling that of a Buffalo-fish; head heavy; mouth anterior, rather narrow, with four long barbels; dorsal fin long, with a strong, serrated spine; anal short; scales large, reduced in number, or wanting in some of the domesticated varieties; teeth molar-like, 1, 1, 3-3, 1, 1. Europe and Asia, one species; introduced into America.

CYPRINUS CARPIO Linnæus.

Carp.

This well known fish was originally a native of Asia, from whence it has been introduced into Europe and America. In domestication it has split up into many varieties. I am not aware that it has as yet become naturalized in any part of Ohio. As a fish for ordinary pond culture it has no equal.

FAMILY X. DOROSOMATIDÆ. THE GIZZARD
SHADS.

Herring-like fishes, with the mouth entirely toothless, small, subinferior, oblique, overlapped by the bluntish snout, maxillary bone narrow and short, of a single piece, not reaching to opposite the middle of the eye, and forming but a small part of the lateral margin of the upper jaw; mandible short and broad, its rami enlarged at base; gill-rakers slender, comparatively short; gill membranes not united; branchiostegals 5 to 7 in number, fourth branchial arch with an accessory branchial organ; head short, body ovate, elevated, strongly compressed, covered with rather large, deciduous scales; no lateral line; belly closely compressed, its edge retrorsely serrated; dorsal fin about midway of the body, usually behind ventrals; pectorals rather long, with an accessory scale; anal very long and low; caudal forked; stomach stout, muscular, gizzard-like. Genera two, with about a dozen species inhabiting the coasts and rivers of most warm regions.

ANALYSIS OF GENERA OF DOROSOMATIDÆ.

*Last ray of dorsal fin produced into a filament. . . . DOROSOMA. 46.

GENUS 46. DOROSOMA. Rafinesque.

Dorosoma, RAFINESQUE, Ich. Oh., 1820, 39.

Chatoessus, CUVIER, Regne Animal, 2d Ed., 1828.

Type, *Dorosoma notata*, Raf., *Clupea heterurus*, Raf.

Etymology, *doros*, lance; *soma*, a body.

As here understood, this genus includes all those *Dorosomatidæ* which have the last ray of the dorsal fin prolonged into a filament. The species of this genus are properly marine, but most of them ascend fresh waters, and individuals of some species are permanently resident there.

88. *DOROSOMA CEPEDIANUM* (LeSueur) Gill.**Gizzard Shad; Hickory Shad.**var. *cepedianum* (East Coast, marine form.)*Megalops cepediana*, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1817, 361.*Chatoessus cepedianus*, CUV. et VAL., Hist. Nat. des Poiss., xxi, 99.—GUNTHER, Cat. Fish. Brit. Mus., vii, 409.*Dorosoma cepedianum*, GILL, Cat. Fish. East Coast, 1861, 55, and elsewhere, and of late writers generally.*Dorysoma cepediana*, JORDAN, Man. Vert., 2d Ed., 1878, 279.*Chatoessus insociabilis*, ABBOTT, Proc. Acad. Nat. Sci., Phila., 1860, 365.var. *heterurum*.*Clupea heterurus*, RAFINESQUE, Amer. Monthly Mag., 1818, 354.*Dorysoma cepediana heterura*, JORDAN, Bull. U. S. Nat. Mus., ix, 1877, 13; Man. Vert., 2d Ed., 1878, 280, and elsewhere.*Dorosoma notata*, RAFINESQUE, Ich. Oh., 1820, 40, and of some authors.*Chatoessus ellipticus*, KIRTLAND, Rept. Zool., Ohio, 1838, pp. 169, 195.—KIRTLAND, Bost. Journ. Nat. Hist., iv, 235, pl. 10, fig. 1.

Description.—Body ovate, much compressed, but not greatly elevated, axis of body considerably nearer dorsal than ventral outline; mouth small, inferior, the snout rounded; eye twice the length of snout, $4\frac{1}{2}$ in head; length of top of head $3\frac{1}{2}$ in distance to origin of dorsal; dorsal fin beginning midway between snout and middle of base of caudal, the last or filamentous ray being about equal to the length of the head and more than twice the base of the fin; pectorals scarcely reaching ventrals; $1\frac{1}{2}$ in head; ventrals reaching half way to anal, 2 1-6 in head; vent about midway between snout and tip of caudal; base of anal a little longer than head, three times the height of its longest ray; caudal fin widely forked, the lobes usually unequal, largely scaly at base; depth of caudal peduncle half length of head; color bluish above, sides silvery, often with golden reflections; fins plain; young with a large blackish blotch on each side behind the head, over the pectoral fins, this disappearing with age; head 4; depth $2\frac{1}{4}$; D. 11; A. 30; V. 8; lat. l. 56; 20 scales from dorsal to ventrals; 17 scutes in front of ventrals, 12 behind. Length 12 to 15 inches.

Habitat, Atlantic and Gulf coasts of United States from New York to Texas, entering streams and often becoming land-locked in ponds. Var. *heterurus*, in all large streams of the Mississippi Basin, escaped through canals into Lake Michigan and Lake Erie.

Diagnosis.—This fish may be known by its serrated belly and small, toothless mouth, and by the filament on the dorsal fin.

Habits.—This species is abundant in the Ohio River. It apparently prefers the deeper waters, and seldom ascends the smaller streams. It has, however, entered the canals, and specimens are now frequently taken in Lake Erie. Mr. Klippart states that "before the construction of the Ohio Canal it was not found anywhere north of the divide, or

water shed between the lake and the Ohio River. It abounds in the Licking Reservoir, and is a great nuisance to the fishermen, who sometimes find that two-thirds of all the fish in the net are these 'herring,' as they term them." This species feeds upon weeds, *i. e.*, vegetable debris, algæ, confervæ, desmids, and diatoms.

As a food fish, the Gizzard Shad is almost worthless. The flesh is soft, coarse, and insipid, as well as full of bones. Mr. Klippart states that it is sometimes split and salted on Lake Erie and shipped with other fish of low grade as "Lake Shad." He also states that "forty years ago it was esteemed an excellent food fish on the Cincinnati market," which, if true, shows either that the Cincinnatians do not now buy fish for their good looks (for the gizzard Shad is a handsome fish), or else in forty years they have progressed a long way toward epicureanism.

The popular name "Gizzard Shad" is given in allusion to the gizzard-like form of the stomach, which resembles that of a hen. "Hickory Shad" is said to allude to a fancied resemblance between the stomach and a hickory nut.

Synonymy.—This fish is now considered as a form or variety of the common Eastern Gizzard Shad, which is a salt water fish, although, like the Shad, it freely enters the rivers. The oldest name for the Western form is *heterurus* of Rafinesque, given in allusion to the inequality of the lobes of the tail. The difference between *heterurus* and *cephedianum* is not great, the greater arch of the back in *cephedianum* being the main difference.

FAMILY XI. CLUPEIDÆ. THE HERRINGS.

Clupeoid fishes, with the mouth moderate or rather large, terminal, the jaws nearly equal; the maxillary composed of about three pieces, not extending beyond the eye; dentition extremely various, the teeth typically feeble; gill-rakers more or less elongate, slender; gill openings wide, the membranes not united; branchiostegals rather few; body compressed, the belly serrated; scales moderate or rather large, deciduous; no lateral line; caudal fin forked; dorsal fin moderate, nearly median, nearly opposite the ventrals (which are absent in a foreign genus); anal fin moderate or long, genera about twelve, although a much greater number has been described; species about 120, inhabiting all seas, some of them ascending or remaining in fresh waters; many of them are highly valued as food fishes; others are coarse and full of small bones; most of the species are closely related to the typical genus *Clupea*, but the variations in the position of the rudimentary teeth are extremely great. These variations have given rise to a great number of generic names, most of which are probably useless.

ANALYSIS OF GENERA OF CLUPEIDÆ.

* No teeth on the vomer ; no dorsal filament ; scales cycloid.

† Cheeks deeper than long ; teeth wanting or on the jaws only. . . . ALOSA.

†† Cheeks longer than deep ; tongue and often jaws also with more or less developed teeth. POMOLOBUS. 47.

GENUS ALOSA. Cuvier.

Alosa, CUVIER, Regne Animal, 2d Ed , 1829.

Type, *Clupea alosa*, L. ; *Alosa vulgaris*, Cuv.

Etymology, Latin *alausea* or *alosa*, a name applied by early writers to the Shad, from the English *Allis* or German, *alse*, allied to the Latin, *halco*

This genus differs from *Pomolobus* chiefly in the form of the cheeks, which are higher than long, the horizontal process of the opercle being very short ; the body is deeper than in the other genera, and there are no teeth except sometimes a few cadaceous ones in the jaws. The propriety of retaining *Alasa* as a genus distinct from *Pomolobus* is not very evident ; but until the whole group can be reviewed, it is best to follow custom.

ALOSA SAPIDISSIMA (Wilson) Storer.

Common Shad.

Clupea alosa, MITCHILL, Trans. Lit. and Phil. Soc., i, 1814, 449 (not of Linnæus).

Clupea sapidissima, WILSON, Rees' Encyclopedia, Amer. Ed , 181.

Clupea sapidissima, RAFINESQUE, Am Monthly Mag., ii, 1818, 205.

Alosa sapidissima, STORER, Synopsis Fish. N. A , 458, and of nearly all late writers.

Alosa præstabilis, DEKAY, New York Fauna, Fishes, 1842, 255.—STORER, Hist. Fish. Mass., and of writers.

Description—Body stout, elliptical, compressed ; mouth moderate, usually entirely toothless ; lower jaw rather longest, its tip fitting into an emargination of the upper ; dorsal fin median, beginning rather in front of the ventrals ; ventral serrations strong ; color bluish or olivaceous, sides silvery ; usually a dusky blotch on sides behind head, sometimes followed by one or more smaller ones ; in older specimens these become obsolete ; head $4\frac{1}{2}$ in length ; depth $3\frac{1}{2}$; D 15 ; A. 19 ; lat. l. 60 ; scutes 21, 15. Length 1 to 2 feet.

Habitat, New England to Gulf of Mexico, ascending streams to spawn.

Diagnosis.—The true shad may be known by its serrated belly and rather large mouth, which is usually totally destitute of teeth.

Habits—As this familiar and excellent fish is not indigenous to the waters of Ohio, its habits may be briefly treated here. It is found along the whole Atlantic Coast of the United States, and ascends all suitable streams in the spring for the purpose of spawning. Its migrations in the sea extend from the South northward in the spring, returning in the fall. In Ohio Shad have been introduced into the Ohio River, but as they migrate southward in the summer, the chance of their returning next sea

son to the same district, or even the same State, is not very great. Several large individuals have already been taken in the Ohio. As to the value of the Shad as a food fish in Ohio, the following note by Mr. Klippart, seems to contain the gist of the matter.

"People from the East, who, in their childhood, were accustomed to Shad as a food fish, have imbibed very strong prejudices in its favor; but people accustomed to White-fish at first, never learn to esteem the Shad as highly as Eastern people do. Non-migrating fishes will find greater favor as food fish, while any sort of *game* fish will be greatly preferred by the sportsman."

GENUS 47. POMOLOBUS. Rafinesque.

Pomolobus, RAFINESQUE, Ich. Oh., 1820, 38.

Kowala, *Meletta*, etc., CUV. et VAL., Hist. Nat. des Poiss., xx.

Alausella, GILL, Proc. Acad. Nat. Sci. Phila., 1861, 36, etc.

Type, *Pomolobus chrysochloris*, Rafinesque.

Etymology, *poma*, operculum; *lobos*, lobe.

No teeth on the vomer; feeble or caducous teeth present on some one or more of the bones of the mouth (rather stout in one species); lower jaw rather the longest, its lips fitting into the emargination of the upper; gill rakers rather long; dorsal fin median, beginning rather in advance of ventrals, its last ray not filamentous; ventral serrations strong; body oblong, compressed; scales medium, posteriorly entire. Species 60 or 70, in all seas, some of them entering or remaining in fresh water.

This genus is divisible into several groups or subgenera, *Pomolobus* proper being represented by a single American fresh water species. It is distinguished by its stronger dentition, the teeth at the symphysis of the lower jaw being larger than in other *Clupeidæ*, and there are some teeth on the premaxillaries and the tongue. The American marine species (Alewife, etc.,) belong to the subgenus *Meletta*, with teeth on the tongue only. Both *Pomolobus* and *Alosa* are distinguished from *Clupea* by characters of little importance.

89. POMOLOBUS CHRYSOCHLORIS Rafinesque.

Skipjack; Ohio Shad.

Pomolobus chrysochloris, RAFINESQUE, Ich. Oh., 1820, 38—GILL, Proc. Acad. Nat. Sci., Phila., 1861, 33.—JORDAN, Man. Vert., 2d Ed., 1878, 279, and of most late writers who have noticed the species.

Alosa chrysochloris, KIRTLAND, Bost. Journ. Nat. Hist., iv, 307, pl. 15, fig. 3.

Description—Body elliptical, much compressed, not elevated; mouth rather large, terminal, oblique, the teeth in the jaws better developed than in other shad-like fishes; caudal peduncle rather deep, its depth about twice the width of the eye; color brilliant blue, with green and golden reflections, silvery below; head 4; depth $5\frac{1}{2}$; D. 18; A. 18; lat. 1. 55; 17 scutes behind ventrals. Length 8 to 12 inches.

Habitat, Mississippi Valley and Gulf of Mexico; generally abundant in the larger streams, and escaped through the canals into Lakes Erie and Michigan.

Diagnosis.—From all other Ohio fishes, this species may be known by the serrated belly, in connection with the projecting lower jaw.

Habits.—In regard to distribution, habits and value as food this species is essentially like the Gizzard Shad. It is found only in the larger rivers and ponds, never ascending the small streams. Comparatively lately, it has made its way into the Lakes. It is migratory to some extent, but whether individuals ever descend from Ohio to the Gulf of Mexico, is not yet known. It is a handsome fish, but it does not reach a very large size, and its flesh being dry and bony, it is not valued as food. The name Skipjack alludes to its habit of leaping from the water. It feeds upon small fishes, insects and probably crustaceans.

FAMILY XII. HYODONTIDÆ. THE MOON EYES.

Clupeoid fishes with the mouth moderate, oblique, terminal, the jaws about equal, the maxillary reaching to about opposite the middle of the eye; maxillary small, slender, without supplemental bones, articulated to the end of the premaxillary, and forming the lateral margin of the upper jaw; eye exceedingly large, much longer than the thick, bluntish snout; dentition greatly developed, nearly every bone in the mouth being provided with bands of teeth; premaxillary and mandible provided with rather stout villiform teeth; maxillaries with feeble teeth; tongue with two marginal rows of very long canines, between which is a band of close set, shorter, almost paved teeth; vomer with a similar long series of paved teeth, but without canines; palatines with long series of close set teeth, a similar series on the pterygoids and on the sphenoid bone; sides of lower jaw shutting within the upper, so that the dentaries fit against the palatines; gill membranes entirely separate, the branchiostegals eight to ten in number; scales large, brilliantly silvery, cycloid; lateral line distinct, straight; body oblong, compressed, rather deep, belly with ordinary scales, rounded or carinated; dorsal fin well back, beginning opposite the vent; ventrals well developed; caudal fin strongly forked. A single genus, with about three species, inhabiting the fresh waters of North America, remarkable for their brilliantly silvery coloration.

GENUS 48. HYODON. LeSueur.

Hyodon, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1818, 364.

Glossodon, RAFINESQUE, Amer. Monthly Mag., ii, 1818, 354.

Amphiodon, RAFINESQUE, Journal de Physique, 1819, 421 (*alosoides*).

Clodalus, RAFINESQUE, Ich. Oh., 1820, 43.

Glossodon, HECKEL, Russeger's Reisen, i, 1843, 1033.

Elattonistius, GILL and JORDAN, Bull. U. S. Nat. Mus., x, 1877. (Subgenus.)

Type, *Hyodon tergisus*, LeSueur.

Etymology, *huooides*, hyoid bone, i.e., bone shaped like the letter upsilon; *odon*, tooth (in allusion to the toothed tongue).

Generic characters not separable from those of the family.

90. *HYODON TERGISUS* LeSueur.**Moon-eye; Toothed Herring; "Silver Bass."**

Hyodon tergisus, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1818, 364.

Hyodon tergisus, DEKAY, New York Fauna, Fishes, 265.—KIRTLAND, Bost. Journ. Nat. Hist., v, 1846, 335—CUV. et VAL., Hist. Nat. des Poiss., xix, 309.—GIRARD, U. S. Pac. R.R. Expl., Fish., 1859, 332.—GUNTHER, Cat. Fishes Brit. Mus., vii, 375.—JORDAN, Man. Vert., 2d Ed., 1878, 277, and of all recent authors.

Hyodon clodulus, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1818, 367.

Glossodon harengoides, RAFINESQUE, Amer. Monthly Mag., 1818, 354.

Glossodon heterurus, RAFINESQUE, Amer. Monthly Mag., 1818, 354.

Hyodon vernalis, RAFINESQUE, Ich. Oh., 1820, 43.

Cyprinus (*Abramis*?) *smithii*, RICHARDSON, Fauna Bor.-Amer., iii, 1836, 110.

Leuciscus smithii of copyists.

Glossodon smithii, HECKEL, Russegger's Reisen, 1843, 1033, (as a new genus of *Cyprinidae*).

Description.—Body oblong, closely compressed; belly in front of ventrals very slightly transversely carinated, the edge obtuse; belly behind ventrals with the edge somewhat sharp; head short and blunt, the eye very large, much longer than the snout, three in head; pectoral fins shorter than head, not reaching nearly to the ventrals; dorsal fin nearly as long as high in front; color brilliantly silvery, the back slightly darker; head 4½-3; depth 3; D. 12; A. 25; scales 5-58-8. Length about a foot.

Habitat, Canada, Great Lake Region and entire Mississippi Valley; abundant in the larger streams and lakes.

Diagnosis.—The Moon-eye may be known among Ohio fishes by its compressed form and brilliant white color, in connection with the sharp teeth and very large eye. This species may be known from the next by the number of developed rays (12) in the dorsal fin.

Habits.—This fish frequents the large rivers and lakes, very seldom ascending small streams. It probably retires to deep waters in the winter. It is a vigorous and "gamey" fish, usually freely taking the minnow or fly, and it is abundant both in Lake Erie and the Ohio, so that it is often taken in large numbers in seines. From its great beauty, it is usually salable where not well known, but its flesh is poor, and, like most of its relatives, its bones are small and numerous. Dr. Estes considers it "one of the smartest of fishes. They will come up, taste a fly, let go and be gone before the angler has time to strike, Therefore to be a Moon-eye fly-fisher, one must be very sharp and not read a book while casting," (Estes-Hallock, Sportsman's Gazetteer, 327). The Moon-eye feeds on insects, crustacea and small fishes.

91. *HYODON ALOSOIDES* (Rafinesque) Jordan and Gilbert.

Amphiodon alosoides, RAFINESQUE, Journal de Physique, Paris, 1819.

Hyodon amphiodon, RAFINESQUE, Ichthyologia Ohiensis, 1820.

Hyodon chrysops, RICHARDSON, Fauna Boreali-Amer., iii, 1836, 232.—JORDAN, Bull. U. S. Nat. Mus., x, 1877, 68.—JORDAN, Man. Vert., 2d Ed., 1878, 277.

Description.—Body closely compressed, becoming deep in the adult; eye moderate, smaller than in other species, about $3\frac{1}{2}$ in head, the maxillary reaching to beyond its middle; back less arched, snout blunter and more elevated than in *H. tergisus*, mouth larger and more oblique; pectorals longer and ventrals shorter than in *H. tergisus*; belly carinated both before and behind ventrals; bluish, sides silvery, with golden luster; head 4.3-4; depth $3\frac{1}{2}$; D. 9; A. 32; scales 6-56-7.

Habitat, Ohio River to the Saskatchewan; common northward.

Diagnosis.—From *Hyodon tergisus*, this species may be known by its short dorsal, of but nine developed rays, and by the carination of the whole ventral edge.

Habits.—Nothing distinctive is known of the habits of this species. Originally described by Rafinesque from the Falls of the Ohio, its occurrence southward has been overlooked until very lately. In 1836 it was found in the Saskatchewan River by Sir John Richardson, and later by Dr. Coues in the Upper Missouri. In 1880 the writer obtained numerous specimens at the Falls of the Ohio, and was thus enabled to recognize the *Amphiodon alosoides* of Rafinesque. The species will doubtless be found in all the larger rivers of the Northwest. A third species, *Hyodon selenops*, Jordan and Bean, occurs in the rivers of the Southern States, but has not yet been seen in Ohio.

FAMILY XIII. SALMONIDÆ. THE SALMONS.

Body oblong or elongate, covered with cycloid scales; head naked; mouth terminal, varying much in size and form; maxillary forming the lateral margin of the upper jaw, provided with a supplemental bone, premaxillaries not protractile; teeth various, sometimes wanting; gills four, a slit behind the fourth; pseudobranchiæ present, but often small or rudimentary; gill-rakers moderate; gill-membranes not connected, free from the isthmus; branchiostegals 6-20; no barbels; dorsal usually median, not greatly elongate; adipose fin present; caudal fin forked; anal fin moderate or rather long; ventrals moderate, nearly median; pectorals placed low; lateral line present; abdomen rounded; air-bladder large; stomach cæcal or siphonal, the pyloric cæca few or many, sometimes obsolete; ova generally large, falling into the cavity of the abdomen before exclusion; genera about 20; species 125, a large and varied family. Its members inhabit chiefly the fresh waters of northern regions, many of them being anadromous, running up from the sea to spawn in the rivers. One genus, *Retropinna*, is found in New Zealand, and the species of *Microstoma*, *Argentina*, and *Silus* are mostly deep sea fishes. In economic importance this family ranks among the very first, and the Salmon and Trout in all northern regions are the choicest prize of the angler.

ANALYSIS OF GENERA OF SALMONIDÆ.

- a Pyloric cæca many; stomach siphonal.
 - b. Jaws toothless or nearly so; scales large. (*Coregoninæ*.)
 - c. Maxillary short and broad. COREGONUS. 49.
 - bb. Jaws with distinct teeth; scales mostly small. (*Salmoninæ*.)

- d. Anal fin elongate of 14 to 17 rays. ONCORHYNCHUS. 50.
- dd. Anal fin short, of 9-11 developed rays.
- e. Vomer flat, its toothed surface plain; teeth on the shaft of the vomer in alternating rows or one zigzag row, those on the shaft placed directly on the surface of the bone, not on a free crest (posterior vomerine teeth sometimes deciduous); species black-spotted. SALMO. 51.
- ee. Vomer boat-shaped, the shaft strongly depressed; scales very small, about 200 in the course of the lateral line; species not anadromous.
- f. Shaft of vomer with a raised crest, bearing strong teeth, the crest posteriorly free; a band of stout, recurved teeth on the hyoid bone; species gray-spotted. CRISTIVOMER. 52.
- ff. Shaft of vomer without raised crest, entirely toothless; species crimson spotted, the lower fins with marginal bands of black and plain. SALVELINUS. 53.

GENUS 49. COREGONUS. Linnæus.

Coregonus, LINNÆUS, *Sytema Naturæ*, 1758 (*artedi*).

Argyrosomus, AGASSIZ, Lake Superior, 1850 (*artedi*).

Prosopium, MILNER, Mss., Jordan, Man. Vert., 2d Ed., 1878 (*quadrilateralis*).

Allosomus, JORDAN, Man. Vert., 2d Ed., 1878 (*tullibee*).

Type, *Salmo* (*Coregonus*) *lavaretus*, L.

Etymology, *korre*, the temples; *gonos*, angle.

Body oblong or elongate, compressed; head more or less conic, compressed, the form of the snout varying considerably; mouth small, the maxillary short, not extending beyond the orbit, with a well developed supplemental bone; teeth extremely minute, if present; scales rather large, cycloid, about 80 in the course of the lateral line; dorsal fin moderate, caudal fin deeply forked, anal fin somewhat elongate, of about 14 rays; ventrals well developed; pseudobranchiæ large; gill-rakers varying from short and thick to very long and slender; air-bladder very large; stomach horse-shoe shaped, with many—about 100—*pyloric cæca*; ova small; species about 40, inhabiting the clear, fresh waters of Northern Europe, Asia, and America, in arctic regions descending to the sea. The group, as here defined, includes a number of sections characterized by minor modifications of structure, some of which have been considered as genera. It seems to us that the number of distinct species has been overestimated by previous writers, and the difficulty of distinguishing species is greater, and the geographical range of each one is much wider than has hitherto been generally supposed. The species are highly valued for food; the coloration is very uniform, bluish above, the sides and below silvery or olivaceous.

This genus may be subdivided as follows:

* Premaxillaries broad, placed vertically or turned inward, overlapping the tip of the lower jaw; the outline of the muzzle, therefore, bluntish or truncate.

† Preorbital short and very broad; gill-rakers very short, thick, few in number; supraorbital short, ovate; maxillary short and rather broad, not reaching to the line of the eye; the small supplementary bone narrow and sharply elliptical; mouth very small; the snout more or less produced. (*Prosopium*, Milner.)

QUADRILATERALIS.

†† Preorbital long and narrow; gill-rakers long and slender; supraorbital oblong maxillary comparatively long, the supplemental bone ovate, rather broad.

(*Coregonus*.)

‡ Tongue toothless, or nearly so; back elevated. CLUPEIFORMIS.

‡ Tongue with about three series of small teeth; body elongate, compressed, the back not elevated. LABRADORICUS.

** Premaxillaries narrow, placed more or less horizontally; mandible elongate, often projecting; the outline of the muzzle pointed; all the bones of the head more or less elongate.

§ Body elongate, subfusiform, the dorsal and ventral curves not equal; scales small, uniform, convex behind; gill-rakers long and slender. (*Argyrosomus*, Agassiz.)

a. Lower jaw shorter, included; premaxillaries oblique, their anterior margin in front below level of pupil; scales bright silvery, not punctate.

HOYI.

aa. Lower jaw more or less projecting; premaxillaries nearly horizontal, their anterior margins in front, not below, the pupil; scales punctulate with black. ARTEDI, NIGRIPINNIS.

§§ Body short, deep, compressed, shad-like; curve of the back similar to that of the belly; scales large, larger forwards, rather closely imbricated, the posterior margin little convex. (*Allosomus*, Jordan.) TULLIBEE.

92. COREGONUS QUADRILATERALIS Richardson.

Pilot-fish; Shad Waiter; Round Fish; Menomonee White-fish.

Salmo (Coregonus) quadrilateralis, RICHARDSON, Franklin's Journal, 1823, 714.

Coregonus quadrilateralis, GUNTHER, Cat. Fish. Brit. Mus., vi, 176.—JORDAN, Man. Vert., 2d Ed., 1878, 276, and of authors generally.

Coregonus novæanglæ, PRESCOTT, Amer. Journ. Sci. Arts, xi, 1851, 342.

Body elongate, not elevated, nor much compressed, the back rather broad, the form rather more terete than in any of the other species; mouth very small and narrow, inferior, the broad maxillary not reaching to opposite the eye, $5\frac{1}{2}$ in head; head long, the snout compressed and bluntly pointed, but not strongly decurved; mandible originating under middle of eye, $3\frac{1}{2}$ in head; adipose fin small; gill-raker short and stoutish; snout scarcely below level of lower edge of eye; preorbital wider than pupil; head 5 in length; depth $4\frac{1}{2}$; D 11; A. 10; scales 9-80 to 90-8; color dark bluish above, silvery below. Length about 1 foot.

Habitat, deep, cold lakes, New Hampshire, Upper Great Lake Region, and northward to Alaska. I have seen no specimens from Lake Erie, but it undoubtedly occurs there.

Diagnosis.—From the other species of White-fish found in the Great Lakes, this species may be known by its short, blunt gill-rakers and broad preorbital.

Habits.—Little distinctive is recorded of the habits of the Menomonee White fish. It is never taken in large numbers; it inhabits considerable depths, and the stomach is often found to be filled with small shells.

93. COREGONUS CLUPEIFORMIS (Mitchill) Milner.

Common White-fish.

Salmo clupeiformis, MITCHILL, Amer. Monthly Mag., ii, 1818, 321.

Coregonus clupeiformis, MILNER, Mas., in Jordan, Man. Vert., 2d Ed., 1878, 362. (Not of authors generally = *C. artedii*.)

Coregonus albus, LESURUR, Journ. Acad. Nat. Sci. Phila., i, 1818, 231.—GUNTHER, Cat. Fishes Brit. Mus., vi, 184, and of most authors.

Coregonus otsego, DEWITT CLINTON, Med. Phil. Regist., iii, 184, the "Otsego Lake Bass."

Coregonus richardsoni, *latior* and *sapidissimus*, GUNTHER, Cat. Fishes Brit. Mus., vi, 185, 186.

Description.—Body oblong, compressed, always more or less elevated, and becoming notably so in the adult; head comparatively small and short, the snout bluntish, obliquely truncated; maxillary reaching just past front of orbit, about four in head; eye large, 4 to 5 in head; color olivaceous above; sides white, but not silvery; width of pre-orbital less than half that of pupil; lower fins shortish; gill rakers moderate, slender, two-thirds diameter of eye, about 50 below angle of arch; tip of snout on level of pupil; tip of lower jaw on level of lower part of eye; head 5 in length; depth 3 to 4; D. 11; A. 11; scales 8-74-9. Length, 20 inches. "The average white-fish is of two or three pounds weight, a large one six or seven; rare specimens are caught, however, of much greater weight, sometimes turning the scales at 20 pounds."—*Stockwell*.

Habitat, large bodies of water; Great Lakes and northward.

Diagnosis.—This species may be known from other White-fishes by the small mouth and short lower jaw, in connection with the slender gill-rakers and narrow preorbital. The young are much slenderer than the adult, and the variations due to food and condition are very great. Old fishes usually have a considerable fleshy hump at the shoulders, and the head seems disproportionately small.

Habits.—The following account of the spawning habits is from the pen of Dr. G. A. Stockwell, of Port Huron, Michigan (in Hallock's Sportsman's Gazetteer, 4th edition, 332, 1878):

"The spawning begins in November, terminating in December, and is indicated by the fish leaving deep water and appearing in immense numbers on rocky shoals. Formerly they frequented the streams for this purpose, but at the present time, there are but few streams emptying into the Great Lakes that are free from saw-mills and their attendant dust, which is offensive to these fish. At the first day's netting on the spawning beds, the catch is wholly males, apparently well stocked with milt; on the second, a few females appear, plump with spawn. The proportion of females increased day by day until a week or ten days when there are two or three and often four times as many females as males, after which they gradually disappear, until the latter preponderate as they are the last as well as first upon the beds. The best opinion seems to be that the males precede the females only to prepare the ground; especially as they at that time assume an extraordinary roughness of scales and employ themselves constantly in scraping up gravel on which the spawn is subsequently deposited. Some, however, believe that the mere inclination to milt causes them to seek the proper position with-

out reference to the presence or absence of the females; others still are of the opinion that they precede only to wait for the females, and do not commence milting until spawning begins. The latter opinion is undoubtedly the true one, for Mr. Milner has established the fact that the act of spawning in the female and milting in the male is carried on at the same time, and with a slight though decided orgasm. The males have been accused of lingering for the purpose of feasting on the spawn, but this is contrary to nature and undoubtedly a slander. The most careful of observers assures me that the males who linger on the beds are employed in covering the spawn."

"The White-fish has been known since the time of the earliest explorers as pre-eminently a fine flavored fish. In fact, there are few table-fishes its equal. * * To be appreciated in its fullest excellence, it should be taken fresh from the lake and broiled. Father Marquette, Charlevoix, Sir John Richardson, explorers, who for months at a time had to depend on the White-fish for their staple article of food, bore testimony in their writings to the fact, that they never lost their relish for it, and deemed it a special excellence that the appetite never became cloyed with it."—*Milner*.

Food—The food of the White-fish was for a long time an unsolved problem, as nothing but slime is usually found in their stomachs. It is now known that they feed mainly on small Crustacea and Mollusks inhabiting deep waters, organisms which are digested in the stomachs of those fishes taken in the pound nets, before the fishes are taken from the water.

Mr. Milner observes (Rept. Comm. Fish and Fisheries, 1872-73, p. 44):

"To Dr. P. R. Hoy, of Racine, we think, belongs the credit of first discovering the character of their food. On opening the stomachs of numerous White-fish, he at first failed to determine the character of the stomach-contents, until after washing the half-digested mass in a basin of water, he found the sediment to be full of small crustacea, whose existence in the lake had never before been suspected.

"My examination and preservation of the stomach contents from all quarters of the lakes, confirmed Dr. Hoy's observations and discovered a few other small forms of life as the food of the White fish.

"The invertebrates found were, of Crustaceans, species of the families *Gammaridæ* and *Mysidæ*; of the Mollusks, species of the genus *Pisidium*; and certain insect-larvæ."

The White fish very rarely takes the hook, and is in no sense a game-fish. It is taken in all the great Lakes in very great numbers, formerly with seines, but now chiefly by means of gill-nets and pound-nets. Among the fishes of Ohio, it is the most important both as to quantity taken and quality as food. Attempts at artificial propagation have been very successful. The fullest and best account of the habits of the White-fish is to be found in the Report of the U. S. Comm. of Fish and Fisheries, 1872 3, pp. 43-64, written by the late Prof. Jas. W. Milner. To this report, the reader is referred for further details.

94. *COREGONUS LABRADORICUS* Richardson.**Musquan River White-fish; Labrador White-fish; "Whiting" of Lake Winnepiseogee.**

Coregonus labradoricus, RICHARDSON, Fauna Boreali-Amer., iii, 1836, 206.—GUNTHER, Cat. Fishes Brit. Mus., vi, 176, and of authors generally.

Coregonus neohantoniensis, PRESCOTT, Amer. Journ. Sci. Arts, xi, 1851, 342.

Description.—Body rather elongate, compressed, the back not elevated; head rather long and slender, compressed; mouth rather small, the jaws equal, the maxillary reaching to the front of the pupil; maxillary bone broad, rather short, its supplementary piece ovate; tongue with about three series of distinct small teeth; mandible reaching middle of eye; eye large, $4\frac{1}{2}$ in head; supraorbital bone long and rather narrow; bluish black above, silvery below; scales with dark punctulations; fins all dusky; dorsal fin high in front, the last rays short; gill rakers slender; head $4\frac{1}{2}$ in length; depth $4\frac{1}{2}$; D. 11; A. 11; scales 9-80-8. Length about 15 inches.

Habitat, Great Lake Region to the Adirondacks, White Mountains and northward, in cold, clear lakes.

Diagnosis.—This species may be known from the Common White-fish by its slenderer body, larger mouth and evidently stout small teeth, the form of the mouth readily separates it from the "Lake Herring" and its relatives.

Habits.—Little distinctive is recorded of the habits of this species. It is very abundant in Canada and northern New England, but I have seen no specimens from Lake Erie, and do not know that it occurs there. It is said to rise to the fly in the Canadian Lakes.

95. *COREGONUS HOYI* (Gill) Jordan.**Lake Moon-eye; Cisco of Lake Michigan.**

Argyrosomus hoyi, GILL, MSS., Hoy, Trans. Wis. Acad., 1872, 100 (name only).—JORDAN, Amer. Nat., March, 1875, 135.—MILNER, Rept. U. S. Fish Com'r for 1872-3, 86.

Coregonus hoyi, JORDAN, Man. Vert., 2d Ed., 1868, 275.

Body rather elongate, compressed, the back somewhat elevated; head rather long, in form intermediate between *Coregonus* and *Argyrosomus*; mouth rather large, terminal, the lower jaw evidently shorter than upper, even when the mouth is open; tip of muzzle rather bluntly truncate; maxillary reaching to opposite middle of pupil, about 6 in head; mandible extending to posterior margin of pupil; supraorbital narrow; suborbital rather broad; premaxillary on level of lower part of pupil; preorbital narrow; pseudobranchiæ very large; fins low, the free margin of the dorsal very oblique; eye very large, $3\frac{1}{2}$ in head; tongue with traces of teeth; gill-rakers slender, about 25 below angle, rather long, nearly as long as eye; color bluish above, sides and below rich silvery, brighter than in any other of our *Coregoni*, much as in *Hyodon* and *Albula*; lateral line almost straight; head $4\frac{1}{2}$; depth $4\frac{1}{2}$; D. 10; A. 10; scales 7-75-7. Length 7 or 8 inches; weight rarely more than half a pound.

Habitat. Lake Michigan, Lake Superior; one specimen in the National Museum from Lake Ontario. Said to occur in small lakes in the interior of Michigan.

Diagnosis.—This species may be known from the Lake Herring, which it resembles in form, by the shortness of its lower jaw, which fits within the upper, as in the White-fish, and by the pure silvery luster of the scales, which have none of the dusky punctulations as in the other *Coregoni*.

Habits.—Little is known of the habits of this Cisco. Dr. Hoy, its discoverer, writes, "This little beauty never approaches shoal water, where *Argyrosomus clupeiformis* (*artedi*) is only found. About 30 or 40 fathoms is as near shore as it has ever been captured here." (Racine, Wisconsin.)

Prof. Milner observes, "The Cisco of Lake Michigan, not to be confounded with the Cisco of Lake Ontario, is a fish frequenting the deep waters. It is taken in considerable quantities at depths of from 30 to 70 fathoms, and is the principal food of the Salmon or "Mackinaw Trout." Prof. Milner further remarks that the depth of 50 fathoms "may be considered in the deeper lakes the zone of the Mackinaw Trout and of the Cisco throughout the spring, summer, and fall, with the exception, in the case of the Trout, of the spawning season."

96. COREGONUS ARTEDI LeSueur.

Lake Herring; Michigan Herring; Cisco.

Coregonus artedi, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1818, 231.—JORDAN, Man. Vert. 2d Ed., 274.

Coregonus clupeiformis, DEKAY, New York Fauna, Fish., 1842, 248, pl. 60, f. 198.—GUNTHER, Cat. Fish. Brit. Mus., vi, 198, and of many recent authors (not *Salmo clupeiformis*, Mitch.).

Argyrosomus clupeiformis, MILNER, Rept. U. S. Fish Comm., 1872-3, 65, and of most recent American writers.

Salmo (Coregonus) lucidus, RICHARDSON, Fauna Bor.-Am., 1836, iii, 207.

Salmo (Coregonus) harengus, RICHARDSON, Fauna Bor.-Amer., iii, 1836, 210.

Argyrosomus sisco, JORDAN, Amer. Nat., 1875, 136. (Local variety in lakes of Indiana and Wisconsin.)

Body elongate, compressed, little elevated; head compressed, rather pointed; mouth rather large, the maxillary reaching about to the middle of the pupil, about $2\frac{1}{2}$ in head, the mandible $2\frac{1}{2}$ in head; preorbital bone long and slender; suborbital broad; supraorbital nearly as long as eye, about four times as long as broad; adipose fins very small; eye 4 to 5 in head; gill-rakers very long and slender, as long as eye, 25 to 30 below the angle; bluish black or greenish above; sides silvery; scales with dark specks; fins mostly pale; pectoral and anal dusky-tinged; head $4\frac{1}{2}$; depth $4\frac{1}{2}$; D. 10; A. 11; scales 8-76-7. Length about a foot. The usual length is rather less than a foot, and the weight 9 to 10 ounces. The largest seen are about 19 inches long and two pounds in weight.

Habitat, Great Lakes and northward to Alaska and Labrador; very abundant, usually frequenting shallow waters. In numerous small lakes in Indiana and Wisconsin (Geneva, Tippecanoe, Oconomowoc, LaBelle, etc.) is the modified var. *sisco* (*Argyrosomus sisco*, Jordan, Amer. Nat., 1875, 136), which lives in the deep waters, coming into shallow waters to spawn in December.

Diagnosis.—From our other White fish this species may be known by its slender, herring-like form and projecting lower jaw.

Habits.—The Lake Herring is found throughout the lake region in enormous numbers. It inhabits comparatively shoal waters and goes about in vast schools, "crowding into the pound-nets in masses until the cribs are filled to the surface of the water. In Lake Erie frequently a corner of the net is lowered, and a large proportion of them allowed to escape before the remainder are thrown into the boat. Although they have been taken in this way for years, there is no apparent diminution in their numbers. Perhaps the little disposition on the part of the fishermen to catch them, in some measure accounts for this fact, though there must be as well some natural advantages in their prolificity and in the tenacity of life of the egg. They are little sought after, because they are not a favorite fish in the market, being rather deficient in qualities as a fresh or salt fish, though having no objectionable flavor. They are small and thin when opened, and become shrunken when pickled.

* * * The profit on them to the fishermen is less than any other fish handled from the lakes, because of the low price they command in the market, and the expense of dressing and packing is much greater than in White-fish, Trout, or Pike, because of their smaller size. Differing from the White-fish in the construction of the mouth, it being terminal, they more readily take a bait, and may be fished for with hook and line with a suitable bait. Insects are the best for this purpose, though they are frequently taken with a minnow. The contents of the stomach have been obtained in but a few instances, the fish being taken almost exclusively in the pound nets, and in these they have generally remained long enough to digest the stomach contents. A few specimens from seines in the Detroit River were found to contain insects and a few of the *Gammaridæ*, but no remains of vertebrates, though the Herring are frequently taken with a minnow bait. They are found, by examination of their stomachs during the spawning season, to be spawn eaters of the worst character, their stomachs being crammed with White-fish ova, and considering the great numbers of the Herring and their vicinity to the spawning grounds, the destruction they effect must be very great." (Milner.)

The spawning season is about the last of November. It is thought that this species does not migrate for the purpose of spawning, but remains in the shoal waters, where it is commonly taken.

In the deep lakes of Northern Indiana (Tippecanoe, Eagle, etc.), and in similar lakes in Eastern Wisconsin (Geneva, the Oconomowoc Chain, etc.), a fish is found, known as the *Cisco*, which is generally thought to

be a different species from the Lake Herring. This opinion I formerly held, and introduced it into nomenclature, giving the fish the name of *Argyrosomus sisco*. I find, however, no structural character distinguishing the *Cisco* from the Lake Herring, and I have no doubt that they are specifically identical, the *Cisco* being a local variety, modified in its habits by its residence in the smaller lakes.

The following account of the habits of the *Cisco* of Lake Tippecanoe is furnished by Judge J. H. Carpenter, of Warsaw, Indiana (see Jordan Amer. Nat., 1875, 135.).

"Some years ago, probably five, these fish were discovered on the north side of Tippecanoe Lake, by Isaac Johnson, and at each return of their spawning season, which is the last of November, they have reappeared in large numbers. They are not seen at any other season of the year, keeping themselves in the deep water of the lakes. The general opinion is that they will not bite at a hook, but Mr. Johnson says that he has on one or two occasions caught them with a hook. * * * * *

"The spawning season lasts about two weeks, and they come in myriads into the streams which enter the lakes. There are large numbers of persons who are engaged night and day taking them with small dip-nets. They are caught in quantities that would surprise you could you witness it. Those who live in the neighborhood put up large quantities of them, they being the only fish caught in the lakes which will bear salting. Some gentlemen who have been fishing to-day (December 8, 1874) inform me that the run is abating, and that in a few days the fishes will have taken their departure for the deep water of the lakes, and will be seen no more until next November."

A correspondent ("H. S. V.") gives the following account of the *Cisco* of Geneva Lake, Wisconsin:

"This graceful, silvery fish is found in largest numbers in the water of Lake Geneva, Wisconsin. It is seen and caught there only about ten days in the year, usually in the month of June, coming to the surface of the lake from the deeper spots to feast upon the *Cisco* fly, somewhat similar to the common sand-fly, only larger, which appears at that time and again disappears after the fish have had all they want of them. The fish go in schools and are caught best when the weather is warm and the flies are thickest, usually from six to ten o'clock in the morning. A very small hook and light line is used, no sinking or bobber. The fly is used for bait, the fish jumping for it frequently before it strikes the water. At times the water is kept in a constant ferment, and many of the fish can be seen part way out of water at once. When they are biting, the sportsman who is most active gets most fish. The *Cisco* fish average from six inches to a foot in length, a slender, graceful, silvery fish. They do not make a very strong fight for life; if it were not for the rapid biting, a fisherman would miss the looked for excitement in the sport."

97. COREGONUS NIGRIPINNIS (Gill) Jordan.

Blue-fin; Black-fin.

Argyrosomus nigripinnis, GILL, MSS. in Milner's Rept., U. S. Fish Comm., 1872, 3, 87.
Coregonus nigripinnis, JORDAN, Man. Vert., 2d Ed., 1878, 275.

Description.—Body stout, fusiform, compressed; head stout; mouth large, the lower jaw projecting; eye rather large, longer than snout, about four in head; teeth very minute as in *C. artedii*, but appreciable on premaxillaries and tongue; gill-rakers very numerous, long and slender; lower fins long; color dark bluish above; sides silvery, with dark punctulations; fins all blue-black; head $4\frac{1}{2}$; depth $3\frac{1}{4}$; D. 10; A. 12; scales 7-86-6. Length, 15 to 18 inches; average weight, $1\frac{1}{2}$ pounds.

Habitat, deep waters of Lake Michigan. Not yet noticed in Lake Erie. Especially abundant in Grand Traverse Bay.

Diagnosis.—From the Lake Herring, the larger size, stouter form, and especially the deep blue-black color of the lower fins readily distinguish it.

Habits.—This species is as yet known only from the deep waters of Lake Michigan where it is found in company with *Coregonus hoyi*. It is occasionally seen in the markets of Chicago, sometimes in considerable numbers. Its qualities as a food fish are probably similar to those of the White-fish.

98. COREGONUS TULLIBEE Richardson.

Tullibee; "Mongrel White-fish."

Salmo (Coregonus) tullibee, RICHARDSON, Fauna Bor.-Amer., iii, 1836, 201.

Coregonus tullibee, GUNTHER, Cat. Fishes Brit. Mus., vi, 199.

Argyrosomus tullibee, JORDAN, Man. Vert., 2d Ed., 361.

Description.—Body short, deep, compressed, shad-like, the dorsal and ventral curves similar; caudal peduncle short and deep; head conic, compressed, much as in *C. nigripinnis*; mouth large, the maxillary as long as the eye, extending past the front of the pupil, its supplemental bone narrowly ovate, with prolonged points; jaws equal when closed; eye large, as long as snout, four and a half in head; preorbital narrow; supra-orbital elongate, rectangular; scales anteriorly considerably enlarged, their diameter half larger than the diameter of those on the caudal peduncle; color bluish above; sides white, punctate with fine dots; each scale with a silvery area, these forming a series of distinct longitudinal stripes; head 4; depth 2; D. 11; A. 11; scales 8-74-7. Length, 18 inches.

Habitat, Great Lakes and northward.

Diagnosis.—The Tullibee has the deep, compressed form of the Shad, with the projecting lower jaw of the Lake Herring. These particulars distinguish it at once from the other White-fishes.

Habits.—Scarcely anything is known of the habits of the Tullibee. It is certainly not abundant in any of the Great Lakes, although probably occurring in all of them. I once received a photograph of a *Tullibee*, from Dr. E. Sterling, of Cleveland, Ohio. The specimen had been taken in Lake Erie and Dr. Sterling informed me that it was known to the fishermen as the "Mongrel White-fish," they thinking it to be a hybrid between the White-fish and the Lake Herring.

GENUS 50. ONCORHYNCHUS. Suckley.

Oncorhynchus, SUCKLEY, Ann. Lyc. Nat. Hist. N. Y., 1871, 312.

Type, *Salmo scouleri*, Rich., Suckley, = *Salmo kisutch*, Walbaum, not *Salmo scouleri*, Richardson, which is *Salmo gorbuscha*, Walbaum.

Etymology, *ogkos*, hook; *rugkos*, snout.

Body elongate, subfusiform or compressed; mouth wide, the maxillary long, lanceolate, usually extending beyond the eye; jaws with moderate teeth, which become in the adult male enormously enlarged in front; vomer long and narrow, flat, with a series of teeth both on the head and the shaft, the latter series comparatively short and weak; palatine with teeth; tongue with a marginal series on each side; teeth on vomer and tongue often lost with age; no teeth on the hyoid bone; branchiostegals more or less increased in number; scales moderate or small; dorsal fin moderate; anal fin comparatively elongate, of 14-20 rays; pyloric appendages in increased number; gill-rakers rather numerous; ova large; sexual peculiarities (in typical species) very strongly developed; the snout in the adult males greatly distorted; the premaxillaries prolonged, hooking over the lower jaw, which in turn is greatly prolonged and somewhat hooked at tip; the teeth of these bones also greatly enlarged; a fleshy hump is developed before the dorsal fin, and the scales of the back become imbedded in the flesh. Salmon, mostly of large size, ascending the rivers tributary to the North Pacific in North America and Asia, now being introduced into Atlantic waters. The genus includes the largest of the Salmon family, and the noblest of our food fishes. One of the five known species has been introduced into various eastern streams and lakes,

99. ONCORHYNCHUS CHOUICHA (Walbaum) Jordan and Gilbert.

Quinnat Salmon; King Salmon; Chouicha; Columbia Salmon; Chinook Salmon; Saw-kwey; Spring Salmon; Sacramento Salmon.

Salmon tshawytscha (Chouicha), WALBAUM, Artedi Pisc., 1792, —.

Salmo orientalis, PALLAS, Zoogr. Rosso-Asiat., iii, 1811.

Salmo quinnat, RICHARDSON, Fauna Bor.-Amer., iii, 1836, 319, and of most late writers.

Oncorhynchus quinnat, GUNTHER, Cat. Fishes Brit. Mus. vi, 158.—JORDAN, Proc. U. S. Nat. Mus., i, 69.

Salmo quinnat, *confluentus*, and *argyreus*, SUCKLEY, Monogr. Salmo., 105, 109, 110.

Description.—Color dusky above, often tinged with olivaceous or bluish; sides and below silvery; head dark slaty, with metallic lustre, usually darker than the body and little spotted; back, dorsal fin, and tail usually profusely covered with round black spots; these are sometimes very few, but very rarely altogether wanting; tail with a peculiar metallic silvery pigment; male about the spawning season (October) blackish, more or less tinged or blotched with dull red; head conic, rather pointed in the females and spring males; jaws not emarginate either in front or on sides; maxillary rather slender, the small eye rather behind its middle; teeth small, longer on sides of lower jaw than in front; vomerine teeth very few and weak, disappearing with age; in the males in late summer and fall the jaws become elongate and distorted, and the anterior teeth much enlarged, as in the related species; the body then becomes deeper, more compressed, and arched at the shoulders; preopercle very convex; opercle strongly convex; body comparatively robust, its depth greatest near its middle; ventrals inserted behind middle of dorsal, ventral appendage half the length of the fin; caudal, as

usual in this genus, strongly forked, on a rather slender caudal peduncle; flesh red and rich in spring, becoming paler in the fall as the spawning season approaches; head 4; depth $4\frac{1}{2}$; B. 15-16 to 17-19, the number on the sides usually unlike; D. 11; A. 16; gill-rakers usually 9-14 (i. e., 9 above the angle and 14 below); pyloric cœca 140-160; scales usually 27-150-20, the number in a longitudinal series varying from 140-155, and in California specimens occasionally as low as 130-155. Length, 36 inches. Usual weight in the Columbia River 22 pounds, elsewhere 16-18 pounds, but individuals of 70 pounds have been taken.

Habitat, Ventura River to Alaska and Northern China, ascending all large streams; most abundant in the Columbia and Sacramento Rivers, where it is the principal Salmon. Upwards of 35,000,000 pounds are now taken every spring in the Columbia River, most of them canned for exportation. It ascends the large streams in spring and summer, moving up without feeding until the spawning season, by which time many of those which started first may have travelled nearly a thousand miles. After spawning, most of them in the upper waters perish from exhaustion. It is by far the most valuable of our Salmon. It has been introduced by the Fish Commission into many eastern streams.

Diagnosis.—The Quinnat Salmon at any age, may be known at once from the Salmon and Trout native in the Great Lake Region, by the long anal fin, which contains about 16 developed rays.

Habits.—The following account of the habits of the Quinnat Salmon may be interesting in view of the attempts now being made to naturalize the species in Ohio waters. This account was originally written for the Popular Science Monthly and published (May, 1881, pp. 1-6) under the title of "Story of a Salmon:"

"In the realm of the Northwest Wind, on the boundary-line between the dark fir-forests and the sunny plains, there stands a mountain, a great white cone two miles and a half in perpendicular height. On its lower mile, the dense fir-woods cover it with never-changing green; on its next half mile, a lighter green of grass and bushes gives place in winter to white; and, on its uppermost mile, the snows of the great Ice age still linger in unspotted purity. The people of Washington Territory say that this mountain is the great "King-pin of the Universe," which shows that, even in its own country, Mount Rainier is not without honor.

"Flowing down from the southwest slope of Mount Rainier is a cold, clear river fed by the melting snows of the mountain. Madly it hastens down over white cascades and beds of shining sands, through birch-woods and belts of dark firs to mingle its waters at last with those of the great Columbia.

"This river is the Cowlitz, and on its bottom, not many years ago, there lay half-buried in the sand a number of little orange-colored globules, each about as large as a pea. These were not much in themselves, but, like the philosopher's monads, each one had in it the promise and potency of an active life. In the water above them, little suckers and chubs and prickly sculpins were straining their mouths to draw those globules from the sand, and vicious-looking crawfishes picked them up with their blundering hands and examined them with their telescopic eyes. But one, at least, of the globules escaped their scientific curiosity, else this story would not be worth telling.

"The sun shone down on it through the clear water, and the ripples of the Cowlitz

said over it their incantations, and in it at last awoke a living being. It was a fish, a curious little fellow, only half an inch long, with great, staring eyes which made almost half his length, and a body so transparent that he could not cast a shadow. He was a little salmon, a very little salmon, but the water was good, and there were flies, and worms, and little living creatures in abundance for him to eat, and he soon became a larger salmon. And there were many more little salmon with him, some larger and some smaller, and they all had a merry time. Those who had been born soonest and had grown largest used to chase the others around and bite off their tails, or, still better, take them by the head and swallow them whole, for, said they, 'Even young salmon are good eating.' 'Heads I win, tails you lose' was their motto. Thus, what was once two small salmon became united into one larger one, and the process of 'addition, division, and silence,' still went on.

"By-and-by, when all the salmon were too small to swallow the others, and too large to be swallowed, they began to grow restless and to sigh for a change. They saw that the water rushing by seemed to be in a great hurry to get somewhere, and one of them suggested that its hurry was caused by something good to eat at the other end of its course. Then all started down the stream, salmon-fashion, which fashion is to get into the current, head up-stream, and so to drift backward as the river sweeps along.

"Down the Cowlitz River they went for a day and a night, finding much to interest them which we need not know. At last, they began to grow hungry, and, coming near the shore, they saw an angle-worm of rare size and beauty floating in an eddy of the stream. Quick as thought one of the boys opened his mouth, which was well filled with teeth of different sizes, and put it around that angle worm. Quicker still he felt a sharp pain in his gills, followed by a smothering sensation, and in an instant his comrades saw him rise straight into the air. This was nothing new to them, for they often leaped out of the water in their games of hide-and-seek, but only to come down again with a loud splash not far from where they went out. But this one never came back, and the others went on their course wondering.

"At last they came to where the Cowlitz and Columbia join, and they were almost lost for a time, for they could find no shores, and the bottom and the top of the water were so far apart. Here they saw other and far larger salmon in the deepest part of the current, turning neither to the right nor left, but swimming straight on up just as rapidly as they could. And these great salmon would not stop for them, and would not lie and float with the current. They had no time to talk, even in the simple sign-language by which fishes express their ideas, and no time to eat. They had an important work before them and the time was short. So they went on up the river, keeping their great purposes to themselves, and our little salmon and his friends from the Cowlitz drifted down the stream.

"By-and by the water began to change. It grew denser, and no longer flowed rapidly along, and twice a day it used to turn about and flow the other way. And the shores disappeared, and the water began to have a different and peculiar flavor—a flavor which seemed to the salmon much richer and more inspiring than the glacier-water of their native Cowlitz. And there were many curious things to see; crabs with hard shells and savage faces, but so good when crushed and swallowed! Then there were luscious squids swimming about, and, to a salmon, squids are like ripe peaches and cream for dinner. There were great companies of delicate sardines and herring, green and silvery, and it was such fun to chase them and to capture them.

"Those who eat only sardines, packed in oil by greasy fingers, and herrings dried in the smoke, can have little idea how satisfying it is to have one's stomach full of them, plump, and silvery, fresh from the sea.

"Thus they chased the herrings about and had a merry time. Then they were chased about in turn by great sea-lions, swimming monsters with huge half-human faces, long thin whiskers, and blundering ways. The sea-lions liked to bite out the throats of the salmon, with their precious stomachs full of luscious sardines, and leave the rest of the fish to shift for itself.

"And the seals and the herring scattered the salmon about, and at last the hero of our story found himself quite alone, with none of his own kind near him. But that did not trouble him much, and he went on his own way, getting his dinner when he was hungry, which was all the time, and then eating a little between-meals for his stomach's sake.

"So it went on for three long years; and at the end of this time our little fish had grown to be a great, fine salmon, of forty pounds' weight, shining and silvery as a new tin pan, and with rows of the loveliest round black spots on his head, and back, and tail. One day, as he was swimming about, idly chasing a big sculpin, with a head so thorny that he never was swallowed by anybody, all of a sudden the salmon noticed a change in the water around him.

"Spring had come again, and the south-lying snow-drifts on the Cascade Mountains once more felt the 'earth was wheeling sunward,' and the cold snow-waters ran down from the mountains and into the Columbia River, and made a freshet on the river, and the high water went far out into the sea, and out in the sea our salmon felt it on his gills; and he remembered how the cold water used to feel in the Cowlitz when he was a little fish, and in a blundering, fishy fashion he thought about it, and wondered whether the little eddy looked as it used to, and whether caddice worms and young mosquitoes were really as sweet and tender as he used to think they were; and he thought some other things, but, as a salmon's mind is located in the optic lobes of his brain, and ours in a different place, we can not be certain, after all, what his thoughts really were. What he did we know. He did what every grown salmon in the ocean does when he feels the glacier-water once more upon his gills. He became a changed being. He spurned the blandishments of soft-shelled crabs. The pleasures of the table and of the chase, heretofore his only delights, lost their charms for him. He turned his course straight toward the direction whence the cold fresh water came, and for the rest of his life he never tasted a mouthful of food. He moved on toward the river-mouth, at first playfully, as though he were not really certain whether he meant anything, after all. Afterwards, when he struck the full current of the Columbia, he plunged straight forward with an unflinching determination that had in it something of the heroic. When he had passed the rough water at the bar, he found he was not alone; his old neighbors of the Cowlitz and many more, a great army of salmon, were with him. In front were thousands; pressing on, and behind them, were thousands more, all moved by a common impulse, which urged them up the Columbia.

"They were swimming bravely along where the current was deepest, when suddenly the foremost felt something tickling like a cobweb about their noses and under their chins. They changed their course a little to brush it off, and it touched their fins as well. Then they tried to slip down with the current, and thus leave it behind. But no—the thing, whatever it was, although its touch was soft, refused to let go, and held them like a fetter; and, the more they struggled, the tighter became its grasp. And

the whole foremost rank of the salmon felt it together, for it was a great gill-net, a quarter of a mile long, and stretched squarely across the mouth of the river. By-and-by men came in boats and hauled up the gill-net and threw the helpless salmon into a pile on the bottom of the boat, and the others saw them no more. We that live outside the water know better what befalls them, and we can tell the story which the salmon could not.

"All along the banks of the Columbia River, from its mouth to nearly thirty miles away, there is a succession of large buildings, looking like great barns or warehouses, built on piles in the river, and high enough to be out of the reach of floods. There are thirty of these buildings, and they are called canneries. Each cannery has about forty boats, and with each boat are two men and a long gill net, and these nets fill the whole river as with a nest of cobwebs from April to July; and to each cannery nearly a thousand great salmon are brought in every day. These salmon are thrown in a pile on the floor; and Wing Hop, the big Chinaman, takes them one after another on the table, and with a great knife dexterously cuts off the head, the tail, and the fins; then with a sudden thrust removes the intestines and the eggs. The body goes into a tank of water, and the head goes down the river to be made into salmon-oil. Next, the body is brought on another table, and Quong Sang, with a machine like a feed-cutter, cuts it into pieces just as long as a one-pound can. Then Ah Sam, with a butcher-knife, cuts these pieces into strips just as wide as the can. Then Wan Lee, the China boy, brings down from the loft, where the tanners are making them, a hundred cans, and into each can puts a spoonful of salt. It takes just six salmon to fill a hundred cans. Then twenty Chinamen put the pieces of meat into the cans, fitting in little strips to make them exactly full. Then ten more solder up the cans, and ten more put the cans into boiling water till the meat is thoroughly cooked, and five more punch a little hole in the head of each can to let out the air. Then they solder them up again, and little girls paste on them bright-colored labels showing merry little Cupids riding the happy salmon up to the cannery-door, with Mount Rainier and Cape Disappointment in the background; and a legend underneath says that this is 'Booth's' or 'Badollet's Best,' or 'Hume's' or 'Clark's' or 'Kinnery's Superfine Salt-water Salmon.' Then the cans are placed in cases, forty-eight in a case, and five hundred thousand cases are put up every year. Great ships come to Astoria and are loaded with them, and they carry them away to London, and San Francisco, and Liverpool, and New York, and Sydney, and Valparaiso, and Skowhegan, Maine; and the man at the corner grocery sells them at twenty cents a can.

"All this time our salmon is going up the river; escaping one net as by a miracle, and soon having need of more miracles to escape the rest; passing by Astoria on a fortunate day, which was Sunday, the day on which no man may fish if he expects to sell what he catches, till finally he came to where nets were few, and, at last, to where they ceased altogether. But here he found that scarcely any of his many companions were with him, for the nets cease when there are no more salmon to be caught in them. So he went on day and night where the water was deepest, stooping not to feed or loiter on the way, till at last he came to a wild gorge, where the great river became an angry torrent rushing wildly over a hung staircase of rocks. But our hero did not falter, and, summoning all his forces, he plunged into the Cascades. The current caught him and dashed him against the rocks; A whole row of silvery scales came off and glistened in the water like sparks of fire, and a place on his side became black and red, which, for a salmon, is the same as being black and blue for other people. His comrades tried to

go up with him; and one lost his eye, one his tail, and one had his lower jaw pushed back into his head like the joints of a telescope. Again he tried to surmount the Cascades, and at last he succeeded, and an Indian on the rocks above was waiting to receive him. But the Indian with his spear was less skillful than he was wont to be, and our hero escaped, losing only a part of one his fins, and with him came one other, and henceforth these two pursued their journey together.

"Now a gradual change took place in the looks of our salmon. In the sea he was plump and round and silvery, with delicate teeth, and as handsome and symmetrical a mouth as any one need wish to kiss. Now his silvery color disappeared, his skin grew slimy, and the scales sank into it; his back grew black and his sides turned red—not a healthy red but a sort of hectic flush. He grew poor, and his back, formerly as straight as need be, now developed an unpleasant hump at the shoulders. His eyes—like those of all enthusiasts who forsake eating and sleeping for some loftier aim—became dark and sunken. His symmetrical jaws grew longer and longer, and meeting each other, as the nose of an old man meets his chin, each had to turn aside to let the other pass. And his beautiful teeth grew longer and longer, and projected from his mouth, giving him a savage and wolfish appearance, quite unlike his real disposition. For all the desires and ambitions of his nature had become centered into one. We do not know what this one was, but we know that it was a strong one, for it had led him on and on, past the nets and horrors of Astoria, past the dangerous Cascades, past the spears of the Indians, through the terrible flume of the Dalles, where the mighty river is compressed between huge rocks into a channel narrower than a village street; on past the meadows of Umatilla and the wheat-fields of Walla Walla; on to where the great Snake River and the Columbia join; or up the Snake River and its eastern branch, till at last he reached the foot of the Bitter-Root Mountains in the Territory of Idaho, nearly a thousand miles from the ocean, which he left in April. With him still was the other salmon which had come with him up the Cascades, handsomer and smaller than he, and, like him, growing poor and ragged and tired. At last, one October afternoon, they came together to a little clear brook, with a bottom of fine gravel, over which the water was a few inches deep. Our fish painfully worked his way to it, for his tail was all frayed out, his muscles were sore, and his skin covered with unsightly blotches. But his sunken eyes saw a ripple in the stream, and under it a bed of little pebbles and sand. So there in the sand he scooped out with his tail a smooth, round place, and his companion came and filled it with orange-colored eggs. Then our salmon came back again, and, softly covering the eggs, the work of their lives was done, and, in the old salmon-fashion, they drifted tail foremost down the stream.

"Next morning, a settler in the Bitter-Root region, passing by the brook near his house, noticed a 'dog-salmon' had run in there and seemed 'mighty nigh tuckered out.' So he took a hoe, and wading into the brook, rapped the fish on the head with it, and carrying it ashore threw it to the hogs. But the hogs had a surfeit of salmon-meat, and they ate only the soft parts, leaving the head untouched. And a wandering naturalist found it there, and sent it to the United States Fish Commission to be identified, and thus it came to me."

GENUS 51. SALMO. Linnæus.

Salmo (artedi), LINNÆUS, Systema Naturæ, 1758.

Fario, CUVIER and VALENCIENNES, Hist. Nat. Poiss., xxi, 294 (*argenteus*).

Salar, CUVIER and VALENCIENNES, Hist. Nat. Poiss., xxi, 319 (*fario*).

Trutta, SIEBOLD, *Susswasser fische*, 319 (*fario*).

Type, *Salmo salar*, L.

Etymology, Latin *Salmo*, a Salmon; from *Salio* to leap.

Body elongate, somewhat compressed; mouth large; jaws and tongue toothed as in other genera; vomer flat, its shaft not depressed; a few teeth on the chevron of the vomer, behind which is a somewhat irregular single or double series of teeth, which are sometimes deciduous with age; teeth on the palatine; scales large or small, 100-200 in a longitudinal series; dorsal and anal fins short, of about 11 rays each; caudal fin truncate, emarginate, or forked, its peduncle comparatively stout; sexual peculiarities variously developed; the males in typical species with the jaws prolonged and the front teeth enlarged, the lower jaw being hooked upwards at the end, and the upper jaw emarginate or perforate. In some species these peculiarities are little marked. Species of moderate or large size, black-spotted, abounding in the rivers and lakes of Northern America, Asia, and Europe, from the Atlantic Ocean; one or two species, marine and anadromous.

But one species of this genus occurs in the Atlantic waters of America, the Common Marine Salmon of Europe and America. As attempts have been made to introduce this species into the waters of Ohio, we give an account of it here.

100. SALMO SALAR Linnæus.

Sea Salmon; Common Salmon.

Salmo salar, LINNÆUS, Syst. Naturæ; GUNTHER, Cat. Fishes Brit. Mus., vi, 1758, 2, and of nearly all authors.

Salmo sebago, GIRARD, Proc. Acad. Nat. Sci. Phila., 1853, 380, a local variety, land-locked in the lakes of Maine.

Salmo gloveri, GIRARD, Proc. Acad. Nat. Sci. Phila., 1854, 85, young or parr-form.

Body moderately elongate, symmetrical, not greatly compressed; head rather low; mouth moderate, the maxillary reaching just past the eye, its length $2\frac{1}{3}$ in head; in young specimens (parrs) the maxillary is proportionately shorter; preoperculum with a distinct lower limb, the angle rounded; scales comparatively large, rather largest posteriorly, silvery and well imbricated in the young, becoming imbedded in adult males; vomerine teeth little developed, those on the shaft of the bone few and deciduous; scales large (lat. l. 120); caudal fin well forked, truncate in old individuals; no hyoid teeth; sexual differences strong; breeding males with the lower jaw hooked upwards, the upper jaw emarginate or perforate to receive its tip; coloration in the adult brownish above, the sides more or less silvery, with numerous black spots on sides of head, on body, and on fins, and numerous red patches along the sides in the males; young specimens (parrs) with about 11 dusky cross-bars, besides black spots and red patches, the color, as well as the form of the head and body, varying much with age, food, and condition; the black spots in the adult often X shaped, or XX shaped; head 4; depth 4; B. 11; D. 11; A. 9; scales 23-120-21; vertebræ 60; pyloric cæca about 65.

Habitat, North Atlantic, ascending all suitable rivers in Northern Europe, and the region north of Cape Cod; sometimes permanently land-locked in lakes, where its habits and coloration (but no tangible specific characters) change somewhat (in America) var. *sebago*.

Diagnosis.—From our Lake Trout and Brook Trout the Salmon may readily be distinguished by the much larger scales and the presence of round, black spots on the body and fins. From the Quinnot Salmon, the Atlantic Salmon may be known by the short anal fin, which has but nine or ten perfect rays.

Habits.—The habits of the Common Salmon are too well known to need discussion here. It inhabits the Northern Atlantic on both sides, and in the spring ascends all suitable streams to spawn, being especially abundant in the Canadian rivers. The land-locked Salmon (*Salmo salar*, var. *sebago*) of the lakes of Maine differs in no structural respect, but has different habits resulting from its restriction. This form has been especially recommended for introduction into the lakes of the Western States.

GENUS 52. CRISTIVOMER. Gill and Jordan.

Cristivomer, GILL and JORDAN, Man. Vert. 2d Ed., 1878, 356.

Type, *Salmo namaycush*, Walbaum.

Etymology, Latin, *crista*, crest; *vomer*, vomer.

Body elongate, moderately compressed; head long; mouth very wide, the strong maxillary reaching beyond the eye; teeth on the jaws and tongue as in the other genera, but stronger; a band of strong recurved teeth on the hyoid bone; vomer boat-shaped, the shaft much depressed, provided with a raised crest, which is posteriorly free, and which is provided with a persistent series of strong teeth; scales small, 175-220 in the lateral line; fins moderate; anal fin short; last rays of dorsal and anal not prolonged; caudal fin forked; sexual peculiarities not strongly marked; species of large size, gray-spotted, inhabiting the lakes of the northern parts of America.

This genus should probably be regarded as a section or sub-genus under *Salvelinus*. There is probably but one species, the Siscowet of Lake Superior (*Salmo siscowet*, Agassiz), being apparently a local variety of *Cristivomer namaycush*, distinguished chiefly by its extreme fatness. At least, we have failed to find any structural difference of any sort, by which the two species may be distinguished.

101. CRISTIVOMER NAMAYCUSH (Walbaum) Gill and Jordan.

Mackinaw Trout; Great Lake Trout; Large Togue.

Salmo namaycush, WALBAUM, *Artedi piscium*, 1792.—GUNTHER, Cat. Fish. Brit. Mus., vi, 123, and of most authors.

Salmo amethystinus, MITCHILL, Journ. Acad. Nat. Sci. Phila., 1818, 410 (Great Lakes).

Salmo hoodi, RICHARDSON, Fauna Bor.-Amer, iii, 1836, 83.—GUNTHER, Cat. Fish. Brit. Mus. vi, 151 (Arctic America).

Salmo confinis, DEKAY, N. Y. Fauna Fish. 1842, 238 (Lakes of New York).

Salmo symmetrica, *Salmo pallidus*, RAFINESQUE (Lake Champlain); *Salmo adirondacus*, NORRIS (Adirondacks); *Salmo toma*, HAMDEN (Maine), etc.

Var. *siscowet*.

Salmo siscowet AGASSIZ, Lake Superior, 1850, 333.

Description.—Body elongate, covered with thin skin, there being no special development of fatty tissue under the skin; head very long, its upper surface flattened; mouth very large, the maxillary extending much beyond the eye, the head and jaws proportionately lengthened and pointed; teeth very strong; caudal fin well forked; general coloration dark gray; sometimes pale, often almost black; everywhere with rounded, paler spots, which are sometimes reddish tinged; head usually vermiculate; fins often mottled; dorsal and caudal reticulate with darker; eye large, $4\frac{1}{2}$ in head; maxillary nearly half the length of the head; interorbital space nearly 4; head 4; depth 4; D. 11; A. 11; l. l. 185-205. Length 2 to 4 feet. Average weight about 4 pounds. Specimens of 50 to 80 pounds weight are sometimes taken.

Habitat, Lake Region and Lakes of Northern and Western New York, New Hampshire, and Maine to Montana and northward, very abundant in the larger bodies of water, varying somewhat in size, form, and color in the different lakes.

Description of var. siscowet (Agassiz), *Siscowet Salmon*.

Body short and deep, covered with thick skin, there being an excessive tendency to the development of fatty tissue; head very short and deep, its upper surface broad and short, covered by a skin so thick as to completely hide the bones; no distinct median carina; mouth very large, its gape narrower than in *C. namaycush*; teeth weaker than in *C. namaycush*, its supplemental bone also shorter and broader; maxillary a little more than half the length of the head; caudal fin well forked; scales small, about 175 in the lateral line; coloration as in *C. namaycush*, but usually paler; fin-rays the same.

Habitat, Lake Superior; abundant, but not yet found elsewhere. This form is very close to the preceding, but differs in the shortness and breadth of the bones of the head and in the extreme fatness of the flesh.

Diagnosis.—The Lake Trout, when adult, may be readily known by its large size and gray spots. The young much resembles the Brook Trout, and has equally small scales. It can always be distinguished (*a*) by the presence of teeth on the median line of the vomer, behind the front patch, and (*b*) by the presence of a patch of distinct, stout teeth on the hyoid bone or *root* of the tongue. The Brook Trout has teeth on the front of the vomer only, and on the margin of the tongue.

Habits.—The wide range of this species and the great variety in the waters which it inhabits, and the food on which it lives, render it more than usually subject to variations in size, color, and appearance. It is stated similar variations occur in its habits, but as I have seen the fish alive only in the Great Lakes, I have no means of verifying these statements. The following general account is condensed from Milner (Rept. U. S. Fish Commr., 1872-3, 38).

The Trout of the Great Lakes is one of three most numerous fishes (Trout, White-fish, Lake Herring), and except the Sturgeon it attains the greatest weight of any of the lake fishes. It is captured almost exclusively by the gill-nets, though the pound-nets in some portions of the lakes take them during the spawning season, and in the winter a great many are caught in the bays, through holes cut in the ice.

As compared with the White-fish, their merits as a fresh fish are relative to taste, though most people prefer the latter. Salted Trout are inferior to salted White fish, and bring a lower price in the market.

Their migrations, so far as known, are confined to the spawning season. They do not ascend the rivers, and although they occur in inland lakes connected with the main lake by rapids, there seems to be no knowledge of their ever having been seen or taken in the outlets. At other times than the spawning period, they remain chiefly in deep water, a depth of thirty fathoms being the most favorable ground for their capture. In the shallow waters of Lake Erie, in the western part of the lake, they are scarcely found at all, though numerous in the deeper portion, east of the city of Cleveland.

The Lake Trout is a ravenous feeder, The fishermen say of him that "he always bites best when he is fullest."

In Lake Michigan the food of the White-fish was ascertained to be chiefly the Cisco (*Coregonus hoyi*). The prevailing notion that they feed largely on White fish has not been confirmed by observations. During most of the year they live in deeper water than that in which the young White-fish are found.

Their exceeding voracity induces them to fill their maws with singular articles. When steamers pass, the refuse from the table is eagerly seized by the Trout. I have taken from the stomach a raw peeled potato and a piece of sliced liver, and it is not unusual to find pieces of corn cobs in the green season, and in one instance I heard of a piece of ham bone.

They are readily taken with a hook, baited with pieces of fish. They are a sluggish fish to pull in, taking hold of the bait with a tug at the line, and then allowing themselves to be pulled to the surface, with no more vibration in the line than if a heavy sinker was the weight at the end.

The spawning season is toward the last of October, about a month earlier than that of the White-fish. The localities selected for spawning are usually rock bottoms in seven to ninety feet of depth. The decrease in numbers of the Lake Trout is not as apparent as in the White-fish. The pound-nets have not made the extensive inroads upon their num-

bers, and none but mature fishes are taken. The larger ones are less numerous, and it is claimed that the average weight of the Trout is less than in former years.

Like other *Salmonoids*, the Lake Trout has proved to be well adapted to artificial culture. The one drawback with them is the difficulty of obtaining the spawn in October, when the rough weather renders a visit to the spawning grounds a matter of hardship and danger.

Herbert says, "A coarse, heavy, stiff rod, a long and powerful, oiled hempen or flaxen line, on a winch, with a heavy sinker; a cod-hook baited with any kind of flesh, fish, or fowl is the most successful, if not the most orthodox or scientific, mode of capturing him. His great size and immense strength alone give him value as a fish of game; but when hooked, he pulls strongly and fights hard, though he is a boring, deep fighter, and seldom, if ever, leaps out of the water like the true Salmon or Brook Trout."

The species or variety known as the "*Siscowet*" has thus far only been seen in Lake Superior. Its habits are thus summed by Mr. Milner:

"With the rare exceptions of young specimens found near the shore, it is taken entirely with gill-nets in deep water. It is a remarkably fat fish, and as a fresh fish, is very inferior for the table. Even boiled, it is oily and rank in flavor. As a salt fish packed in brine, it is most excellent, and is universally admitted to surpass either White-fish or Trout. Its range of depth is outside of forty fathoms. How much deeper than this it may be found, I cannot tell, as no fishing at greater depth than fifty fathoms came under my observation in Lake Superior. The stomachs were found to be filled with a Cottoid. This seemed to be its entire article of food in the vicinity of the Apostles' Islands.

"They spawn earlier in the fall than any other of the *Salmonoids* in the lakes. By the latter part of August, the spawn in some of them is ripe and running freely, while in the month of September the females are all ripe and depositing spawn. They seemed to have no migratory instinct at this season, but were taken while spawning in the same vicinity, where they had been taken for weeks previously."

GENUS 53. SALVELINUS. Richardson.

Salvelinus (Nillson), RICHARDSON, Fauna Bor.-Amer., iii, 1836.

Baione, DEKAY, New York Fauna, Fishes, 1842.

Elmbla, RAPP.

Type, *Salmo salvelinus*, L.

Etymology, an old name of the European Charr; German, *Salbling*.

Body moderately elongate; mouth large or small; teeth as in *Cristivomer*, but rather weaker, the hyoid patch rudimentary or wanting, and the vomer without the raised crest, with a few teeth on the chevron only; scales very small, 200-250 in a longitudinal row; fins moderate, as in *Cristivomer*, the caudal forked in the young, truncate in some species in the adult; sexual peculiarities not strongly marked, the males with the premaxillaries enlarged, and a fleshy projection at the tip of the lower jaw; coloration dark, with round, crimson spots, and the lower fins with marginal bands of black, reddish, and pale; species numerous in the clear streams of the northern parts of both continents, sometimes descending to the sea, where they lose their variegated colors and become nearly plain and silvery; the members of this genus are in general the smallest and handsomest of the trout. But one species is found in the Eastern United States; another very similar is found west of the Cascade Range, and several inhabit the waters of Arctic America.

102. SALVELINUS FONTINALIS (Mitchill) Gill and Jordan.

Brook Trout; Speckled Trout; Salmon Trout of Canada.

Salmo fontinalis, MITCHILL, Trans. Lit. and Phil. Soc. N. Y., i, 435.—GUNTHER, Cat. Fishes Brit. Mus., vi, 152, and of nearly all authors.

Salvelinus fontinalis, JORDAN, Man. Vert., 2d Ed., 1878, 360; Proc. U. S. Nat. Mus. i, 81.

Salmo canadensis, HAMILTON SMITH, in Griffith's Cuvier, 1834, 474.

Salmo immaculatus, H. R. STORER, Bost. Journ. Nat. Hist., vi, 1850, 364 (based on large sea-run specimens, the so-called "Canadian Salmon Trout").

Salmo hudsonicus, LUCKLEY, Ann. Lyc. Nat. Hist. N. Y., 1861, 310.

Description.—Body oblong or elongate, moderately compressed, not much elevated; head large, but not very long, the snout bluntish, the interorbital space rather broad; mouth large, the maxillary reaching more or less beyond the eye; eye large, usually somewhat above the line of the axis of the body; caudal fin slightly lunate in the adult, forked in the young; adipose fin small; pectoral and ventral fins not especially elongate; red spots on the side, rather smaller than the pupil; back mostly without spots, more or less barred or mottled; dorsal and caudal fins mottled or barred with darker; lower fins dusky, with a pale, usually orange band anteriorly, followed by a darker one; belly in the males often more or less red; sea-run individuals ("Canadian Salmon Trout") are often nearly plain, bright silvery, many local varieties distinguished by shades of color also occur; head $4\frac{1}{2}$; depth $4\frac{1}{2}$; D. 10; A. 9; scales 37-230-30; gill-rakers about 6-11. Length 18 inches or less. Weight $\frac{1}{2}$ pound to 10 pounds or more, depending on food, locality, size of stream, etc.

Habitat, clear, cold streams from Pennsylvania to Dakota and northward to the Arctic Circle, southward in the Alleghanies to the head waters of the Savannah, Chattahoochee, Catayba, and French Broad. In Ohio the species is, I am told, confined to one or two small streams in Ashtabula county.

Diagnosis.—The Brook Trout is too well known to need especial description here. It can, only by any possibility, be confounded with the young of the Lake Trout among Eastern fishes. The absence of teeth

on the hyoid bone and on the shaft of the vomer distinguish it from the latter. Its scales are much smaller than those of the Atlantic Salmon or of the Quinnat.

Habits.—It is the favorite game fish of America, pre-eminent in wariness, in beauty, and in delicacy of flesh. It inhabits all clear and cold waters within its range, the large lakes and the smallest ponds, the tiniest brooks and the largest rivers, and when it can do so, without soiling its aristocratic gills on the way, it descends to the sea and grows large and fat on the animals of the ocean.

Although a bold biter, it is a wary fish, and it often requires much skill to capture it. It can be caught with artificial or natural flies, minnows, crickets, grasshoppers, grubs, the spawn of other fishes, or even the eyes or cut pieces of other Trout. It spawns in the fall, and its period of spawning ranges from September to late in November. It begins to reproduce its kind when it is two years old, at which age, it measures some six inches in length. In May and June Trout delight in rapids and swiftly running water, and in the hot months of midsummer, they resort to deep, cool, and shaded pools. In August and September, on the approach of the spawning season, they gather around the mouths of cool, gravelly brooks, whither they resort to make their beds (*Hallock*).

It is hardly necessary to enter into a detailed discussion of the habits of the Brook Trout in this paper. Every one of my readers,

“Born beneath the fishes’ sign
Of constellations happiest,”

has his own Trout story to tell, which the next generation may believe or not.

For, in the words of Myron H. Reed, “This is the last generation of Trout fishers. The children will not be able to find any. Already there are well-trodden paths by every stream in Maine, in New York, and in Michigan. I know of but one river in North America by the side of which you will find no paper collar or other evidence of civilization. It is the Nameless River.

Not that Trout will cease to be. They will be hatched by machinery and raised in ponds, and fattened on chopped liver, and grow flabby and lose their spots. The Trout of the restaurant will not cease to be. He is no more like the Trout of the wild river than the fat and songless Reed Bird is like the Bobolink. Gross feeding and easy pond life enervate and deprave him.

“The Trout that the children will know only by legend is the gold-

sprinkled, living arrow of the White Water; able to zigzag up the cataract; able to loiter in the rapids, whose dainty meat is the glancing butterfly."

FAMILY XIV. PERCOPSIDÆ. THE TROUT PERCHES.

Body moderately elongate, somewhat compressed, the caudal peduncle long and slender; head conical, pointed, naked; mouth small, horizontal; maxillary short, narrow, without supplemental bone, not reaching to the large eye; margin of upper jaw formed by premaxillaries alone, which are short and not protractile; teeth very small, villiform on premaxillaries and lower jaw only; tongue short, adherent; gill-membranes separate, free from the isthmus; pseudobranchiæ present; branchiostegals six; gill-rakers short, tubercle-like; opercle with entire edges; lower limb of the preopercle well developed, the angle nearly a right angle, its inner edge with a raised crest; bones of the head cavernous, as in *Acerina* and *Ericymba*; cranium with a raised crest, which does not extend to the occiput; scales moderate, rather thin, adherent, their edges strongly ctenoid; lateral line continuous; dorsal short, median; ventrals anterior, just in front of the dorsal, 8-rayed; pectorals narrow, placed rather higher than usual; anal small; caudal forked; adipose fin present, small; stomach siphonal, with about 10 well developed pyloric cæca; ova rather large, not falling into the abdominal cavity before exclusion; air-bladder present; small fishes of the fresh waters of the cooler parts of America; a single genus, with probably but one species. The group is one of special interest, as it combines with ordinary salmonoid characters the structure of the head and mouth of a *percoïd*, resembling notably the European genus *Acerina*.

GENUS 54. PERCOPSIS. Agassiz.

Percopsis, AGASSIZ, Lake Superior, 1850, 284.

Salmoperca, THOMPSON, 1853.

Type, *Percopsis guttatus*, Agassiz.

Etymology, *perke*, perch; *opsis*, appearance.

The characters of the genus are included above.

103. PERCOPSIS GUTTATUS Agassiz.

Trout Perch.

Percopsis guttatus, AGASSIZ, Lake Superior, 1850, 286.—GUNTHER, Cat. Fish. Brit. Mus., vi, 207.—JORDAN, Man. Vert. 2d Ed., 1873, 270.

Salmoperca pellucida, THOMPSON.

Pale olivaceous, a silvery stripe along the lateral line, becoming obsolete forwards; upper parts with obscure, round dusky spots made of dark points. Head slender and conical; mouth small, subinferior, maxillary not nearly reaching front of orbit; caudal peduncle long and slender; peritoneum silvery; head 3 4-5 in length; depth about 4½; D. 11; A. 8; Lat. 1. 50. Length about 6 inches.

Habitat, Great Lake Region, extending southward to the Delaware, Ohio and Kansas Rivers; abundant only in tributaries of the Great Lakes.

Diagnosis.—This is the only fish which combines the adipose fin of the salmon, with the small, rough scales of the perch.

Habits.—Little is known of the habits of the Trout Perch. It is found in the open lakes and in the small streams. I have seen it taken with hook and line from the wharves at Chicago, and I have found it among schools of minnows in small streams of Northern Wisconsin. One or two specimens have been obtained by Dr. Sloan in the Ohio River. It spawns in spring, and its ova are comparatively large like those of the Trout. They are excluded through an oviduct.

FAMILY AMBLYOPSIDÆ. THE CAVE-FISHES.

Body moderately elongate, compressed behind; head long, depressed; mouth rather large, the lower jaw projecting; premaxillaries long, scarcely protractile, forming the entire margin of the upper jaw; jaws and palatines with bands of slender, villiform teeth; branchiostegals about 6; gill-rakers very short; pseudobranchiæ concealed; gill-membranes more or less completely joined to the isthmus; head naked, the surface sometimes crossed by papillary ridges; body with small, cycloid scales, irregularly placed; no lateral line; vent jugular, close behind the gill-openings; ventral fins small or wanting; pectorals moderate, inserted higher than in most soft-rayed fishes; dorsal without spine, nearly opposite the anal; caudal truncate or rounded; cranium without median crest; stomach cæcal, with one or two pyloric appendages; air-bladder present; ovary single; some, and probably all, of the species are ovoviviparous; in two of the genera the eyes are very rudimentary and hidden under the skin, and the body is translucent and colorless; fishes of small size, living in subterranean streams and ditches of the Central and Southern United States; three genera and four species are "all of the family yet known, but that others will be discovered, and the range of the present known species extended, is very probable. The ditches and small streams of the lowlands of our Southern coast will undoubtedly be found to be the home of numerous individuals, and perhaps of new species and genera, while the subterranean streams of the central portion of our country most likely contain other species" (Putnam).

None of this family have yet been recorded from Ohio, and I am not aware of the existence of any cave streams in the State in which it is likely that they will be found. I give here a brief account of the characters of the species found in the caves of Kentucky and Indiana, as they belong to the general fauna of the Ohio Valley.

ANALYSIS OF GENERA OF AMBLYOPSIDÆ.

- | | |
|--|--------------|
| a. Eyes rudimentary, concealed under the skin; body colorless. | |
| b. Ventrals present, small. | AMBLYOPSIS. |
| bb. Ventrals obsolete. | TYPHLICHTYS. |
| aa. Eyes well developed; body colored; no ventrals. | CHOLOGASTER. |

GENUS. AMBLYOPSIS. DeKay.

Amblyopsis, DEKAY, New York Fauna, Fishes, 1842, 187.

Type, *Amblyopsis spelæus*, DeKay.

Etymology, *amblyus*, blunt; *opsis*, vision.

Eyes rudimentary, concealed under the skin; surface of head crossed by vertical, tactile ridges; gill-membranes fully joined to isthmus; ventral fins present, quite small, close to anal; colorless fishes of small size, inhabiting the cave streams in the limestone regions of the Western States.

AMBLYOPSIS SPELÆUS DeKay.

Larger Blind Fish of the Mammoth Cave.

Amblyopsis spelæus, DEKAY, New York Fauna, Fishes, 1842, 147.—WYMAN, Amer. Journ. Sci. Arts, 1843, 94; Ann. Mag. Nat. Hist., xii, 1843, 298; Proc. Bost. Soc. Nat. Hist., 1850, 349, and elsewhere.—THOMPSON, Ann. Nat. Hist., 1844, 112.—TELLKAMPF, Müller's Arch., 1844, 381.—AGASSIZ, Amer. Journ. Sci. Arts, 1851, 127.—POKY, Mem. Cuba, 104.—GUNTHER, Cat. Fish. Brit. Mus., vii, 1868, 2.—PUTNAM, JORDAN, and of all writers generally.

Description.—Colorless; mouth comparatively large, the length of its cleft about equal to the base of dorsal; pectorals reaching front of dorsal; caudal long, rather pointed; one pyloric cæcum; head 3 in length; depth $4\frac{1}{4}$; D. 8; V. 4. Length 5 inches.

Habitat, subterranean streams of Kentucky and Indiana. Mammoth Cave, etc.

GENUS TYPHLICHTHYS. Girard.

Typhlichthys, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 62.

Amblyopsis, sp., GUNTHER.

Chologaster, sp., GILL.

Type, *Typhlichthys subterraneus*, Girard.

Etymology, *tuphlos*, blind; *ichthus*, fish.

This genus may be known by its blindness and by the absence of the ventral fins.

TYPHLICHTHYS SUBTERRANEUS Girard.

Small-blind Fish.

Typhlichthys subterraneus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 62, and of Putnam, Jordan, and late writers generally.

Amblyopsis spelæus, variety without ventral fins, GUNTHER, l. c.

Description.—Colorless; head rather blunter and broader forwards than in *A. spelæus*; mouth smaller, its cleft shorter than base of dorsal; pectorals scarcely reaching dorsal; one pyloric cæcum; D. 7 or 8; A. 7 or 8. Length, 2 inches.

Habitat, subterranean streams of Kentucky, Tennessee, and Alabama.

GENUS CHOLOGASTER. Agassiz.

Chologaster, AGASSIZ, Amer. Journ. Sci. Arts, xvi, 1853, 135.

Type, *Chologaster cornutus*, Agassiz (from South Carolina).

Etymology, *cholos*, deficient; *gaster*, belly, (from the lack of ventral fins).

This genus has the general characters of *Amblyopsis*, but differs in the absence of ventral fins and in the fully developed condition of the eyes, which are small and lateral; the species are not pellucid, but colored like ordinary fishes; no papillary ridges; pyloric cæca 2.

CHOLOGASTER AGASSIZI Putnam.

Chologaster agassizi, PUTNAM, Amer. Nat., 1872, 30, Mammoth Cave.—JORDAN, Man. Vert., etc.

Description.—Uniform light brown; fins somewhat speckled; head four in body, its length scarcely greater than the greatest depth; pectorals reaching little more than half way to front of dorsal; D. 9; A. 9. Length, $1\frac{1}{4}$ inches.

Habitat, subterranean streams in Tennessee, Kentucky, and Southern Illinois.

FAMILY XV. CYPRINODONTIDÆ. THE CYPRINODONTS.

Body oblong or moderately elongate, compressed behind, depressed forwards, covered with rather large cycloid scales, which are adherent and regularly arranged; no lateral line; head scaly, at least above; mouth terminal, small, the lower jaw usually projecting; margin of the upper jaw formed by the premaxillaries only; premaxillaries strong, extremely protractile; teeth incisor-like or villiform, sometimes present on the vomer, but usually in the jaws only; lower pharyngeals separate, with cardiform teeth; gill-membranes somewhat connected, free from isthmus; gill-rakers very short and thick; branchiostegals 4-6; pseudobranchiæ none; dorsal fin single, inserted posteriorly, of soft rays only, rarely with a single spine or rudimentary spinous dorsal; caudal fin not forked; ventral fins abdominal, rarely wanting; pectoral fins inserted low; no adipose fin; stomach not cæcal, without pyloric appendages; air bladder simple, often wanting. Sexes usually unlike, the fins being largest in the males. Most all are ovoviparous, the young well developed at time of birth. Fresh-water fishes of Southern Europe, Asia, Africa, and America, some of them occurring in bays and arms of the sea. They are mostly of small size, and the species are very difficult of determination. Genera 30; species about 140.

ANALYSIS OF GENERA OF CYPRINODONTIDÆ.

- a. Dorsal fin beginning in advance of anal. FUNDULUS. 55.
 aa. Dorsal fin beginning behind origin of anal. ZYGONECTES. 56.

GENUS 55. FUNDULUS. Lacepede.

Fundulus, LACEPEDE, Hist. Nat. des Poissons, v, 1803, 37.

Hydrargyra, LACEPEDE, Hist. Nat. Poiss., v, 1803, 378 (*swampinus*).

Xenisma, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876, 322 (*stellifer*).

Adinia, GIRARD, Proc. Acad. Nat. Sci., Phila., 1859, 117 (*multifasciata*).

Type, *Fundulus mudfish*, Lac. = *Cobitis heteroclitus* L.

Etymology, Latin, *fundus*, the bottom, in allusion to the supposed mud-loving habits.

Body rather elongate, little elevated, compressed behind; mouth moderate; jaws, each with two or more series of pointed teeth, usually forming a narrow band; bones of the mandible firmly united; scales moderate; branchiostegals 4 to 6; preopercle, pre-orbital, and mandible with mucous pores; dorsal and anal fins similar, moderately developed or rather large, the dorsal usually inserted in front of the anal; ventrals well developed; air bladder present; sexes differing in color, size, and development of the fins, the anal fin in the male normal; intestinal canal short; species very numerous, mostly American, inhabiting fresh waters and arms of the sea. They are the largest in size of the Cyprinodonts, and some of them are very brightly colored.

104. *FUNDULUS DIAPHANUS* (LeS.) Agassiz.

Barred Killifish; Toothed Minnow.

Hydrargyra diaphana, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1817, 130.

Fundulus diaphanus, AGASSIZ.—JORDAN, Man. Vert., 1876, —; Man. Vert. 2d Ed., 1878, 262.

Hydrargyra multifasciata, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1877, 131.

Fundulus multifasciatus, CUV. et VAL., Hist. Nat. des Poiss., xviii, 200.—COPE, Proc. Acad.

Nat. Sci. Phila., 1865, 78.—STÖRER, Hist. Fishes Mass., 1867, —.—GUNTHER, Cat.

Fishes Brit. Mus., vi, 1866, 324.—COPE and YARROW, Wheeler's Rept., Surveys, etc.,

Fishes, 1877, —, and of most recent writers.

Description.—Body elongated, somewhat compressed, the head flattened above and moderately broad; depth $4\frac{1}{2}$ to 5 in length; head $2\frac{1}{2}$; eye large, $3-3\frac{1}{2}$ in head, a little less than the width of the interorbital space; mouth moderate, of the usual form among Cyprinodonts; vent about midway between middle of caudal and front of eye; scales rather large, in 38 to 40 transverse rows; D. 12 or 13; A. 11 or 12; V. 6; branchiostegals 5; color olive-brown, more or less translucent; sides silvery with 12 to 16 dark olive-brown cross bands, somewhat undulating or irregular, rather narrower than the interspaces; dorsal region irregularly spotted with darker; fins unspotted. Length, 3 inches.

Habitat, this species occurs abundantly in the brackish waters along our eastern coast. It also ascends all streams to their sources, being especially fond of the cold spring water in which they take their rise. It has been taken in various streams of Michigan, Wisconsin, Ohio, and even in Colorado, and in all waters in the State of New York. LeSueur's original types were from Saratoga Lake.

Diagnosis.—This species may be known at once among our small fishes by the posterior dorsal, all of soft rays, in connection with the dark bars on the side.

Habits.—In Ohio, this species will be found chiefly in the small lakes and ponds in the northern part of the State. Its size is too small for it to attract special attention. Like all the members of its family, it is extremely tenacious of life.

GENUS 56. *ZYGONECTES*. Agassiz.

Zygonectes, AGASSIZ, American Journ. Sci. Arts, 1854, 135.

Micristius, GILL, Canadian Naturalist, August, 1865, p. 24. (Type, *Fundulus zonatus* CUV. and VAL.)

Fundulus, *Haplochilus*, and *Pæcilia*, sp. of authors.

Type, *Pæcilia olivacea* Storer, = *Semotilus notatus*, Raf.

Etymology, *zuges*, a yoke (in pairs); *nectes*, swimmer, from the supposed habit of swimming at the surface of the water in pairs.

This genus is closely related to *Fundulus*, differing chiefly in the small size and posterior position of the dorsal, which has usually less than ten rays and is commonly inserted behind the front of the anal fin; the species are smaller in size than those of

Fundulus, and different in appearance, so that we feel reluctant to unite the two genera, although the technical differences are very slight. Species all American. Surface swimmers, feeding upon insects.

The species are quite numerous, but have been little studied.

The following article from the pen of John A. Ryder, on the development of a species of this genus is almost the only attempt at the study of the breeding peculiarities of the Cyprinodonts :

" Since we have taken up our temporary residence at Cherrystone, Virginia, we have found this interesting genus of cyprinodonts in great abundance in fresh and brackish water streams, also in a fresh water pond in the vicinity, a few miles south of where our station is located. In the latter situation three forms have been collected, all of which are in breeding condition—we will not say spawning condition, as they do not, as do most other fishes, commit their ova to the care of the element in which they live, but carry them about in the ovary, where they are impregnated and where they develop in a very remarkable manner.

" Of the manner of impregnation we know little or nothing, except the evidence furnished by the conformation of the external genitalia of the two sexes. In the adult male, which measures one and one-eighth of an inch in length, the anal fin is strangely modified into an intromittent organ for the conveyance of the milt into the ovary of the female ; a tubular organ appears to be formed by the three foremost anal rays, but one which is greatly prolonged and united by a membrane. At the apex these rays are somewhat curved toward each other, and thus form a blunt point, but the foremost one of the three rays is armed for its whole length with ridges at its base and with sharp recurved hooks at its tip, the other two at their tips similarly with hooks, and between their tips are two small fenestra or openings which possibly communicate directly with the sperm ducts from the testes. The basal elements of the fins are aggregated into a cylindrical columnar truncated bony mass, which is prolonged upward into the cavity of the air-bladder for the distance of nearly the eighth of an inch ; from it a series of fibrous bands pass to the dorsal and posterior wall of the air-bladder to be inserted in the median line. Whether this bony column serves to steady the fin in the act of copulation, or whether it serves to give passage to the sperm duct, is an unsettled question with the writer. The modified anal fin of the male measures a third of an inch in length. Other peculiarities of the male are noticeable—for instance, the more abbreviated air-bladder or space which also occupies a more oblique position than in the female. The most remarkable difference presented by the male as compared with the female, however, is his inconsiderable weight, which is only 160 milligrammes, while that of the gravid female is 1,030 milligrammes or nearly six and one-half times the weight of the male.

" The female, as already stated, is larger than the male, and measures one inch and three-fourths in length. The liver lies for the most part on the left side. The intestine makes one turn upon itself in the fore part of the body cavity and passes back along the floor of the abdomen to the vent. The air-bladder occupies two-fifths of the abdominal cavity, and at its posterior end the wolffian duct traverses it vertically, to be enlarged near the outlet into a fusiform urinary bladder of very much the same form as in many embryo fishes, as demonstrated by Professor Kupffer and myself. The ovary is a simple, impaired organ which lies somewhat to the right and extends from the anterior portion of the body cavity to the hinder end, and serves to fill up its lower moiety when fully developed. The ova, when full grown, are each enveloped in a sac or follicle supplied

with blood from a median vascular trunk which divides and subdivides as it traverses the ovary lengthwise, in a manner similar to that of the stem to which grapes in the bunch are attached. In this way it happens that each egg or ovum has its own independent supply of blood from the general vascular system of the mother, from which the material for the growth and maturation of the egg is derived, and which afterward becomes specialized into a contrivance by which the life of the developing embryo is maintained while undergoing development in their respective follicles in the ovary or egg-bag. The ova develop along the course of the main vessel and its branches, as may be learned upon examining a hardened specimen, where the very immature ovarian eggs are seen to be involved in a meshwork of connective fibrous tissue, which serves not only to strengthen the vessels but also afterwards enters into the structure of the walls of the ovarian sacs or follicles externally.

"The very immature eggs measure from less than a hundredth of an inch up to a fiftieth, and on up to a twelfth of an inch, when they may be said to be mature. They develop along a nearly median rachis or stalk which extends backward and slightly downward and which gets its blood supply very far forward from the dorsal aorta. The ova, after developing a little way, are each inclosed in a follicle, the Græfian follicle, ovisac, ovarian capsule, *membrana granulosa* of Von Baer, or *membrana cellulosa* of Coste. As the egg is matured there is a space developed about it which is said to result from the breaking up of the granular layer of cells covering it. This space is filled with fluid, and in this liquid, which increases in quantity as development proceeds, the embryo of *Zygonectes* or top-minnow, is constantly bathed. *There is no trace whatever in the egg of this fish of an independent egg membrane*, as is the case with all known forms which spawn directly into the water, and which is usually, if not in all cases, perforated by one or more mycropoliar openings or pores for the entrance of the spermatozoon. This fact raises the question whether the egg membrane or *zona radiata* usually present in the ova of water-spawning fishes is not entirely absent in all the viviparous species. Whether Rathke has recorded anything on this point in his account of the development of *Zoarces*, the viviparous blenny, I am not able to say at present, as I do not have access to his memoir. Suffice it to say, however, that with very cautious preparation, staining and dissection of the follicles inclosing the ova of *Zygonectes*, I have completely failed to discover what I could regard as an egg membrane, although personally familiar with the appearance of the coverings of the ova of more than twenty species, embracing fifteen or more families. The *zona radiata* or covering of the egg in other bony fishes is said to be secreted from the cells lining the follicles and is composed of a gelatinoid substance, and it is often perforated all over by a vast number of extremely fine tubules called pore canals by their discoverer, Johannes Mueller. No such structure existing as a covering for the egg of *Zygonectes*, we are in a position to ask the question why such a unique condition of affairs should exist in this case? The answer, it would appear to us, is not far to seek. In the case of eggs which ordinarily hatch in water it is necessary that they should be supplied with a covering more or less firm and capable of protecting the contained embryo, which in the case of the top-minnow is not needed, because the embryo is developed so as to be quite competent to take care of itself as a very well organized little fish when it leaves the body of its parent. Nature will not waste her powers in an effort to make useless clothes for such of her children as do not need them; on the contrary, she is constantly utilizing structures economically, and often so as to serve more than one purpose. This is the apparent answer to the query with which we started.

"The follicles or sacs containing the ova are built up internally of flat, polygonal cells of pavement epithelium, and externally of a network of multipolar, fibrous, con-

nective tissue cells and minute capillary blood vessels, with cellular walls, which radiate in all directions over the follicle from the point where the main arterial vessel joins the follicle, and which, together with its accompanying veins and investment of fibrous tissue, constitutes the stalk by which the follicle and its contained naked ovum is suspended to the main arterial trunk and vein. The capillary system ends in a larger venous trunk, which also follows the course of the main median arterial trunk back to the heart by way of the Cuvierian ducts. The very intricate mesh-work of fine vessels which covers the follicle supplies the developing fish with fresh oxygen, and also serves to carry off the carbonic dioxide in much the same way as the placenta or after-birth performs a similar duty for the young mammal developing in the uterus of its parent. There is this great difference, however, between the fish and the mammal. In the former there is no uterus; the development takes place in the follicle in which the eggs have grown and matured; there is no true placenta, but respiration is effected by a follicular mesh-work of blood vessels, and the interchange of oxygen and carbonic dioxide gases takes place through the intermediation at first of the fluid by which the embryo is surrounded in its follicle, and later, when blood vessels and gills have developed in the embryo, they too become accessories to aid in the oxygenation of its blood. In the mammal there is a uterus; the egg must leave its ovarian follicle and be conveyed to the uterine cavity before a perfectly normal development can begin; there is a fully developed richly vascular placenta joined to the fœtus, the villi or vascular loops of which are insinuated between those developed on the maternal surface of the uterine cavity. In both fish and mammal, however, this general likeness remains; that there is no immediate vascular connection between mother and embryo. In both the respiration of the embryo is effected by the transpiration of gases through the intermediation of membrane and fluids, oxygen being constantly supplied and carbonic dioxide carried off by means of a specialized portion of the blood system of the maternal organism.

"There is still another difference which distinguishes the developing fish from the mammal which has not been noticed. The body of the former is built up by gradual transformation or conversion of the substance of the yolk into the various structures which make up its organization. In other words, the young fish obtains no nutrition from its parent; there is merely a reorganization of the stored protoplasm of the yolk sac. In the mammal, on the other hand, the embryo receives nourishment through the placental structures, though there is a yolk at an early stage; the largest proportion of the embryo is built up from the protoplasm supplied from the blood system of the parent. Judging from the large size of the young of some viviparous fishes, such as in *Embiotoca*, it is possible that there may be some exceptions to the rule indicated above.

"Besides the very intricate network of capillary vessels which covers the follicles of the ovary of *Zygonectes* a large opening of a circular or oval form makes its appearance in the wall of each one at or near the point of attachment of the vascular stalk by which they are supported. This opening appears to increase in size as the young fish develops; whether it is present during the earliest stages of the intrafollicular development of the embryo I do not know, as I did not have an opportunity to see those phases. A branch from the main nutritive vessel frequently lies near the margin of the opening, curving around it. Whether this opening serves the same purpose as the micropyle of ova provided with a membrane would appear very probable, as it is difficult to see in what other manner the milt, which is probably introduced into the ovarian cavity by the male, could reach the ovum through the wall of its follicle. The opening into the follicle may be named the *follicular foramen*. Through it the cavity in which the embryo

lies is brought into direct communication with the general ovarian space, which, singularly enough appears to be occluded from without by a temporary closure or plugging up of the oviduct or canal from the posterior end of the ovarian sac, a state of affairs, which, if it can be confirmed, approximates, or, to some extent, resembles, the condition found to obtain in a pregnant mammal, where the uterine os or mouth is temporarily occluded during gestation.

"We found ourselves unable to determine the species of the form, the structure of which is described above; none of those described in Jordan's Manual appear to agree with our species (*Gambusia patruelis*, B. & G.—D. S. J.). It may be, as some of us have surmised, that the isolation of the form on the eastern peninsula of Virginia for a great length of time may have served to develop specific characters, and that it is undescribed. We leave the determination of the species to the systematic ichthyologists.

"Thus far our account has dealt only with the structure of the adults and the peculiar contrivances by means of which reproduction is effected; we will now take up the discussion of the egg and embryo.

"The globular vitellus measures about a line in diameter including the embryonic or germinal portion. The germinal protoplasm probably occupies a peripheral position covering the nutritive or vitelline portion of the egg as a continuous envelope with strands of germinal matter running from it through and among the corpuscles of the vitellus. This peripheral germinal layer, when the egg is ready to be fertilized, migrates toward one pole and assumes a biscuit shape. This is essentially the history of the formation of the germinal disk of the Teleostean egg as worked out independently by Professor Kupffer and the writer. Little of a trustworthy character is known of the history of the germative vesicle and spot, which bear the same relation to the egg as the nucleus and nucleolus do to the substance of the cell of the ordinary type. When cleavage of the germinal disk has begun, it is the first positive evidence that impregnation has been successful. The disk then begins to spread over the vitellus or yolk and soon acquires the form of a watch glass with its concave side lying next the surface of the yolk. Coincident with the lateral expansion of the germinal disk, a thickening appears at one point in its margin which is the first sign of the appearance of the embryo fish. With its still further expansion, the embryo is developed more from the margin of the disk toward its centre; in this way it happens that the axis of the embryo lies in one of the radii of the disk; its head toward the centre, its tail at the margin.

"But before the embryo is fairly formed, a space appears under the disk limited by the thickened rim of the latter, and the embryo at one side. This space, the segmentation cavity, is filled with fluid and grows with the growth of the germinal disk, as the latter becomes converted into the blastoderm, and does not disappear until sometime after the embryo has left the egg as a young fish; and then it often remains as a space around the yolk sac for as long as a vestige of the latter remains, as may be seen in the young of *Cybbium*, *Parephippus*, *Gadus*, *Elecate*, and *Syngnathus*. In regard to this point, I hold views entirely different from any other observers, but inasmuch as the writer has had opportunities for the study of the development of a greater number of species representing a greater number of families than any previous investigator, and because the observations are based on material studied without the use of hardening re-agents which either deform or obliterate the segmentation cavity, and also because it was found to be present in all of the forms which were sufficiently well studied, it is believed that it will be found in the developing ova of most or all Teleostean fishes. Should this prove to be the fact, the Teleostean egg will be as distinctly defined in respect to the sum of the developmental char-

acters which it presents from the developing ova of other vertebrates, as the adult Teleost is the from remaining classes of the sub-kingdom to which it belongs. The floor of the cavity appears to be formed by the hypoblast or innermost embryonic layer, while its roof is formed by the epiblast or outermost skin layer. Gradually this blastoderm, which has been derived by cleavage from the germinal disk, grows over the yelk, no part of its epiblast layer being in direct contact with the hypoblast below on account of the presence of the intervening film of fluid, except at its rim. The embryo also appears to be in fixed contact with the yelk. The blastoderm grows at about an equal rate all around its margin; the point where the edges of the blastoderm finally close is almost directly opposite the site where the germinal disk first appeared; the closure at last occurs just behind the tail of the embryo where a little crater-like elevation marks the point at which it disappears. The embryo now lies along a meridian of the blastoderm; its head at the original germinal pole, its tail at the other. The growth of the blastoderm over the yelk is greatly facilitated by the film or fluid contained in the segmentation cavity, over which it can glide as it grows without friction. This view seems to me to be the most rational yet proposed in explanation of the method by which the blastoderm grows laterally in all directions down over the yelk. In some cases the yelk sac is frequently much absorbed before the outer epiblastic sac begins to collapse. This is the case with *Cybbium* after it leaves the egg and proves very conclusively that the outer sac is entirely free, laterally and ventrally from the inner one containing the yelk.

"There are two principal methods by which the yelk is absorbed; the one where a more or less extensive net-work of vessels is developed over the surface of the yelk, and through which all, or nearly all, of the blood passes to reach the venous end of the heart; in many cases no such net-work is ever developed, as for instance, in the shad, mackerel, cod, and bonito. To the former class the young top minnow belongs. Its yelk is orange-colored and imbedded in it superficially are a great number of refringent oil globules of small size. There appears to be a sinus beneath the head, continuous with the segmentation cavity in which the heart is developed. The body of the young fish lies in a groove or furrow on the surface of the yelk. This is the youngest state in which I have seen *Zygonectes* and explains why I have given the preceding general account of the development of a young fish. The somites or segments of muscle plates had been developed for some time. The heart, brain, intestine and organs of sense were defined.

"The next important stage observed was when the yelk sac was in great part absorbed and the fish nearly ready to hatch, or more properly to leave its follicle and the body of its parent. The extraordinary acceleration of development, noted in almost every detail of structure was such as I had never witnessed in any other species of young fish. The bones of the skull, although still cartilaginous, were advanced to a condition not seen in the shad until it has been hatched for three weeks or more. There were intermaxillary elements with teeth; pharyngeal patches of teeth; the brain was pretty well roofed over by the cartilaginous cranium; the branchiosteges were developed in cartilage; the opercles completely covered and concealed the gills, the opercular elements being differentiated; the gills already bore branchial leaflets; the neural and hæmal arches of the vertebræ were developed in cartilage; there was a lagena attached to the auditory capsule; scales covered the sides and back and were developed in pockets of the dermal epithelium; in five, all the fins were already developed except the ventrals with the same number of rays as in the adult. All this, and yet the yelk sac was still not absorbed. I have never seen in any fish embryos of the same age an in-

starce where scales were developed or where the fins had approximated their adult condition so nearly as in this case. The only instance known to me at this writing where a continuous dorsal and ventral median fin-fold is never developed, is in the case of *Syngnathus*, where the caudal rays are developed before the dorsal ones. Whether the unpaired fins of *Zygonectes* are, or are not, derived from such a fold would be an interesting observation. A marked acceleration is also noticeable in the development of the brain, a study of which by means of sections, as compared with that of the adult, has furnished me with some valuable clues in following up the developments of Teleostean genera.

"To sum up, this fish begins an independent career as far developed as when the shad, cod, mackerel, bonito, and many other fishes are from three to six weeks old. By so much he has the advantage over these types in the struggle for existence in that he is ready to feed, to pursue his prey discriminately, as soon as he is born, while the other forms alluded to are comparatively helpless until some time after they have absorbed their yolk sac, although most of them by that time have acquired mandibular, maxillary, or pharyngeal teeth or both. The Fish Commission authorities need never be uneasy about the fate of the top minnows; they will take care of themselves; their species is sure of survival. But our study, it would seem to the writer, has not been in vain, because, even though the fish is too small to be of any practical value, it has taught us that where Nature has so effectually provided for the protection of the young fish she does not require one adult to produce as many embryos. In *Zygonectes* twenty-five to thirty young is perhaps the limit of production for a single female; in *Apeltes*, or the four-spined stickleback, the male of which is provided, according to my observations, with a spinning apparatus, with which he fabricates a nest in which the young are hatched and taken care of, the number of eggs is from fifteen to twenty. Contrasting these small numbers with 100,000 to 3,000,000, the number of ova easily matured in a single season by a single female of many anadromous and marine species, which have heavy, adhesive or floating eggs, it would appear that the quantities of germs produced by different species of fishes is in some way proportioned to their chances of survival. Otherwise we are at a loss to explain the enormous fertility of many marine forms; the astounding fertility of the oyster and clams is another instance illustrating this principle, where ova are matured by the tens of millions and where barely one out of a million survives so as to attain adult age.

"Certain adaptations of structure are also plainly noticeable on a comparative study of fish ova. Thus the egg membrane of floating eggs is extremely thin, thinner than that of heavy or adhesive eggs, while the thickest membranes are those provided with external filamentous appendages. The most thinly clad hatch out soonest. May it not be that the thinness of the envelope of the egg has some relation to the rapidity with which the oxygenation of the egg is effected and consequently with the rapidity of tissue and embryonic changes? And, finally, who would undertake to say that all of these modifications of the embryonic envelope are not such as could be developed by natural selection so as to favor the survival of the greatest number of embryos?

"Before closing I wish to state that it is the *oviduct* of the female in some cyprinodonts that is prolonged into a tube at the anterior edge of the anal fin, as I have lately learned. This difference, as compared with *Zygonectes*, would be useful as a general character, as suggested by Colonel Marshall McDonald, to whose unselfish, helpful interest I am deeply indebted for assistance in manifold ways while the investigation of the material was in progress upon which the foregoing account is based.—*Forest and Stream*.

105. *ZYGONECTES NOTATUS* (Rafinesque) Jordan.**Top Minnow; Top Swimmer.**

Semotilus? *notatus*, RAFINESQUE, Ich. Oh., 1820, 86.

Zygonectes notatus, JORDAN, Man. Vert., 2d Ed., 1878, 264, and elsewhere.

Pœcilia olivacea, STORER, Proc. Bost. Soc. Nat. Hist., July, 1845; Synopsis, 430.

Zygonectes olivaceus, AGASSIZ, Amer. Journ. Sci. Arts, xvii, 1854, 353.—JORDAN, Man. Vert., 252.

Fundulus tenellus, BAIRD and GIRARD, Proc. Phila. Acad., 1853, 289.

Zygonectes tenellus, GIRARD, Proc. Phila. Acad. Sci., 1859, 60.

Zygonectes lateralis, AGASSIZ, Journ. Sci. Arts, 1854, 353.

Zygonectes zonatus, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 353.

Zygonectes pulchellus, GIRARD, Proc. Phila. Acad. Sci., 1853, 113.—JORDAN, Ind. Geol. Surv., 1874, 218.

Haplochilus pulchellus, GUNTHER, Cat. Fishes Brit. Mus., v, 1866, 314.

Fundulus aureus, COPE, Proc. Acad. Nat. Sci. Phila., 1865, 78.

Haplochilus aureus, GUNTHER, Cat. Fishes Brit. Mus., vi, 1866, 315.

Description.—Body rather slender, compressed behind; head low, depressed, and rather elongate, the snout somewhat produced, the lower jaw scarcely projecting; interorbital space broad, its width about half length of head; eye large, less than snout, about three in head; fins moderate, the dorsal and anal elevated in the males; teeth in a broad band, the outer series considerably enlarged and canine-like; coloration brownish-olive, with a broad, dark purplish-black lateral band running from tip of snout through eye to base of caudal; darker in males than in females; young specimens have the edges of the band serrated; a few series of small, black dots along the side of the back; dorsal, caudal, and anal fins dotted with black; top of head with a conspicuous translucent spot in life, which fades in spirits; concentric striæ on scales, strong; head 4; depth; $4\frac{1}{2}$; D. 9; A. 11; scales 34×11 .

Habitat, all waters of the basin of the Mississippi, and in southern tributaries of the Great Lakes.

Diagnosis.—This is the only Ohio fish with the caudal fin rounded behind, the head flattened above, and a purplish-black lateral band which passes around the nose.

Habits.—This is a very common species in the basin of the Mississippi. It frequents still waters, especially canals and ponds made by overflow of creeks in the spring. In open rivers it is found chiefly in still, weedy places. Where found, it always swims near the surface, and may be recognized as far as seen by one expert in little fishes. It is too small for food, but is sometimes used for bait. Its beauty and extreme hardness render it a desirable aquarium fish to those few who prefer our graceful native fishes to the gaudy and vulgar gold-fish.

106. *ZYGONECTES DISPAR* Agassiz.**Striped Top Minnow.**

Zygonectes dispar, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 253.—NELSON, Bull. Ills. Mus.

Nat. Hist., 1876, 42.—JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 67; Man. Vert., 2d Ed., 1878.

Description.—Body short and deep, much compressed; head short and very broad, the flat, interorbital space being two-thirds of its length, and barely twice the diameter of the eye, the distance between the eyes above greater than the distance between them below; snout broadly rounded; fins moderate; dorsal much smaller than anal; outer series of teeth somewhat enlarged; coloration pale olive, bluish in life; a very distinct brownish line along the edges of each row of scales, appearing wavy or serrated as it follows the scales; about ten of these longitudinal stripes are present; males with the lines interrupted, appearing as series of dots, and further marked by about nine dark cross-bars; adults with a dark blotch below the eye, and sometimes confluent with it; oviduct free from anal fin; head $3\frac{1}{2}$; depth $3\frac{1}{2}$; dorsal 7; A. 9; scales 35-10. Length $2\frac{1}{2}$ inches.

Habitat, Lakes and sluggish streams from Ohio to Iowa.

Diagnosis.—The dark, lengthwise stripes of this species at once distinguish it from the other Top Minnows found in Ohio.

Habits.—This species seems to prefer the waters of the large streams and lakes. As yet it has only been taken in Illinois, where it is widely distributed, and in Indiana and Ohio, the lakes tributary to the Wabash, Illinois, and Maumee. It swims near the surface, with a languid motion, as if it were very hard work.

Another species of this type, *Zygmeetes melanops* (Cope) Jordan, known by the absence of stripes and the presence of a still more conspicuous black spot below the eye, occurs in Southern Illinois, and may be looked for in the bayous of Southern Ohio.

FAMILY XVI. UMBRIDÆ. THE MUD MINNOWS.

Body oblong, broad anteriorly, compressed behind; head large, flattened above; mouth moderate, the maxillary without distinct supplemental bone; bands of villiform or cardiform teeth on premaxillaries, lower jaw, vomer, and palatines; premaxillaries not protractile; lateral margin of upper jaw formed by the broad, short maxillaries, which are toothless; lower jaw the longer; gill-openings wide, the membranes scarcely connected; gill-rakers little developed; branchiostegals 6-8; scales moderate, cycloid, covering head and body; lateral line obscure or wanting; dorsal fin moderate, posterior in advance of anal; ventrals small, close to anal; pectorals inserted low; caudal fin rounded; stomach without blind sac; no pyloric cæca; pseudobranchiæ hidden, glandular, air-bladder simple; sexes similar; carnivorous fishes, living in mud or among weeds at the bottom of clear, sluggish streams and ponds, extremely tenacious of life, like the *Cyprinodontidæ*; oviparous; genera 2; species 3; *Umbra crameri* of Austria; *Dallia pectoralis*, of Alaska; and *Umbra limi*. The family is very close to the *Esocidæ*, differing mainly in the smaller mouth and weaker teeth.

ANALYSIS OF GENERA OF UMBRIDÆ.

- a. Pectorals narrow, few (12-15) rayed; ventral rays 6; scales moderate.

UMBRA. 57.

GENUS 57. UMBRA. Muller.

Umbra (Kramer Elench. Anim. Austr. Infer., 1756), MULLER, Abhand. Akad. Wissench., Berl., 1842, 188.

Melanura, AGASSIZ, Amer. Journ. Sci. Arts, 1864, 135.

Type, *Umbra crameri*, Muller, from Southern Austria.

Etymology, Latin, *umbra*, shade.

Body oblong, covered with cycloid scales of moderate size, without radiating striæ; no lateral line; head shortish, little depressed; eye rather small; cleft of mouth moderate; ventral fins 6-rayed, below or slightly in front of dorsal; anal fin much shorter than dorsal; pectorals rather narrow, rounded, placed low, with 12-15 rays, which are much jointed; caudal rounded; preopercle and preorbital with mucous pores; branchiostegals 6; gill-rakers short, thick; size small.

107. UMBRA LIMI (Kirtland) Gunther.

Mud Minnow; Mud Dace; Dog Fish.

Hydrargyra limi, KIRTLAND, Bost. Journ. Nat. Hist., iii, 1840, 277.

Melanura limi, AGASSIZ, Amer. Journ. Sci. Arts, 1855, 217.—JORDAN, Man. Vert., 2d Ed., 1878, 265, and of many American writers.

Umbra limi, GUNTHER, Cat. Fish. Brit. Mus., vi, 1867, 232, and of many writers.

Var. ? *pygmæa*.

Hydrargyra fusca, THOMPSON, Nat. Hist. Vt., 1842, 137.

Hydrargyra atricauda, DEKAY, New York Fauna, Fishes, 1842, 220.

Melanura annulata, AGASSIZ, Amer. Journ. Sci. Arts, 1855, 217 (after Rafinesque's, which species appears, however, to be a true *Exoglossum*).

Leuciscus pygmæus, DEKAY, Fishes N. Y., 1842, 214.

Melanura pygmæa, BAIRD, Ninth Smithson. Rept., 1855.

Umbra pygmæa, BEAN, Mss., Jordan, Bull. U. S. Nat. Mus., x, 53.

Fundulus fuscus, AYRES, Bost. Journ. Nat. Hist., iv, 296.

Description.—Dark-green or olive, mottled, sides with irregular, narrow, pale bars, these often obscure or wanting; a distinct black bar at base of caudal; whitish stripes sometimes present along the row of scales; head $3\frac{1}{2}$ in length; depth $4\frac{1}{4}$; B. 6; P. 14; D. 14; A. 8; V. 6; Lat. 1. 35; L. trans. 15. Length 2 to 5 inches.

Habitat, Lake Champlain to Delaware and Minnesota, chiefly northward, occasional or rather rare in the Ohio Valley.

Diagnosis.—This species is the only small fish found in Ohio with a rounded caudal fin, and a black bar across the tail.

Habits.—This singular and interesting fish is very abundant in the grassy or weedy streams and ponds in the northern part of Ohio. In the southern part of the State it is less common, but may be occasionally taken. Its ability to survive in mud after the water has evaporated is remarkable, and instances are recorded where it has been actually plowed up in plowing through a dried up pond or swamp. Prof. Baird says, "A locality which, with the water perfectly clear, will appear des-

titute of fish, will perhaps yield a number of mud fish on stirring up the mud at the bottom and drawing a seine through it. Ditches in the prairies of Wisconsin, or mere bog-holes, apparently affording lodgment to nothing beyond tad-poles, may thus be found filled with *Melanurus*." It, however, is fond of the muddy bottoms of clear, quiet waters, and is seldom found in streams which are constantly turbid.

The name Dog fish, frequently applied to the species, comes from its resemblance to the young of *Amia calva*, and many fishermen maintain stoutly the identity of the two. The entire dissimilarity of the dorsal fins of *Amia* and *Umbra* will separate them at sight.

The Mud-minnow of the coast streams from New York southward, shows some differences from the Mud-minnow of the Great Lake Region, and is possibly a different species, *Umbra pygmaea*, (DeKay) Bean.

FAMILY XVII. ESOCIDÆ. THE PIKES.

Body elongate, not elevated, more or less compressed; head long; the snout much prolonged and depressed; mouth very large; its cleft forming about half the length of the head; lower jaw the longer; upper jaw not protractile, most of its margin formed by the maxillaries, which are quite long and provided with a supplemental bone; premaxillaries, vomer, and palatines with broad bands of strong, cardiform teeth, which are more or less movable; lower jaw with strong teeth of different sizes; tongue with a band of small teeth; head naked above; cheeks and opercles more or less scaly; gill-openings very wide; gill-membranes separate, free from the isthmus; gill-rakers tubercle-like, toothed; branchiostegals 12-20; scales small; lateral line weak, obsolete in young specimens, developed in the adult; dorsal posterior, opposite and similar to anal; caudal fin emarginate; pectoral fins small, inserted low; ventrals rather posterior; vent normal; no adipose fin; no barbels; stomach not cæcal, without pyloric appendages; pseudobranchiæ glandular, hidden; air-bladder simple. Fishes of moderate or large size inhabiting the fresh waters of the northern parts of Europe, Asia, and North America. Genus one; species about six, one of them cosmopolitan, the rest all confined to America. The species are all noted for their greediness and voracity.

GENUS 58. ESOX. Linnæus.

Esox, LINNÆUS, Systema Naturæ, 1758 (*lucius*).

Lucius, RAFINESQUE, Indice d'Ittiol. Sicil., 1810 (*lucius*).

Picorellus, RAFINESQUE, Ich. Oh., 1820, 70 (*vittatus*).

Muscalongus, JORDAN, Klippart's Second Rept. Ohio Fish Commr., 1878, 92 (*nobilior*).

Type, *Esox lucius*, L.

Etymology, Latin, *Esox*, a pike, probably from *isos*, equal, *oxus*, sharp.

The characters of the genus are included above. There are three sections of the genus which may be defined as follows:

Picorellus, RAFINESQUE.—Branchiostegals 12 to 14; cheeks as well as opercles entirely scaly; species of generally small size, greenish, barred or reticulated with darker (species, *salmonæus*).

Esox, LINNÆUS.—Branchiostegals 14 to 16; cheeks scaly; lower half of opercle bare; species of rather large size, light spotted on rather dark ground (species, *lucius*).

Muscalongus, JORDAN.—Branchiostegals 17 to 19; lower half of cheeks as well as opercles, bare; species reaching an immense size, black-spotted on a lighter ground (species, *nobilior*).

108. *ESOX SALMONEUS* Rafinesque.

Little Pickerel.

Esox salmoneus, RAFINESQUE, Ich. Oh., 70.—JORDAN, Bull. Buff. Soc. Nat. Hist., 1876, 96.—JORDAN, Man. Vert., 2d Ed., 1878, 267, and of late writers.

Picorellus salmoneus, JORDAN, Man. Vert., 1st Ed., 256.

Esox vermiculatus, LESUEUR, Cuv. and Val., Hist. Nat. des Poiss., xviii, 333.

Esox lineatus, LESUEUR, Cuv. and Val., l. c., xviii, 335.

Esox lugubrosus, LESUEUR, Cuv. and Val., xviii, 338.

Esox umbrosus, KIRTLAND, Cleveland Annals of Science, 1855, 79.—COPE, Proc. Phila. Acad. Sci., 1865, 79; Cyp. Penn. (Trans. Amer. Phil. Soc.), 1866, 408.

Esox cypho, COPE, Proc. Acad. Nat. Sci. Phila., 1865, 78.—GUNTHER, Cat. Fish. Brit. Mus., vi, 230.—JORDAN, Man. Vert., 2d Ed., 267, and of most writers.

Esox porosus, COPE, Trans. Amer. Philos. Soc., 1866, 408.

Description.—Body moderately stout, somewhat compressed; head rather short, the eye being exactly in the middle of the head; eye large, less than three times in snout, about six in head; cheeks and opercle entirely scaly; caudal well forked; color green or grayish; sides with many curved streaks; sometimes forming bars, but more usually forming marmorations or reticulations, the color extremely variable, sometimes quite plain; sides of head usually variegated; a dark bar downward from eye and one forward; base of caudal sometimes mottled; other fins usually plain; head $3\frac{1}{2}$; depth 5–6; D. 11; A. 11; Lat. 1. 105. Smallest of all the Pikes. The length about a foot.

Habitat, entire Ohio Valley and in streams tributary to the Great Lakes from the South; also in the Upper Mississippi Valley.

Diagnosis.—From the other Ohio Pikes, this species may be known by its entirely *scaly opercles*, and its small size and slender form.

The nearly related Eastern species, *Esox reticulatus*, LeSueur, the common Pickerel of the seaboard States differs in having the snout longer, and the branchiostegals more numerous, 14 or 15 in number.

Habits.—This little fish is found throughout the State, but is especially abundant in the ponds and streams tributary to the Ohio. It swarms in the spring in ponds formed by the overflow of the creeks. Thousands of them are destroyed yearly by the drying of such ponds. In the spring it ascends all small streams, and it is often found in temporary brooks in cornfields and other unexpected places, remote from its native waters. People finding pickerel thus stranded often affirm stoutly that they “rain down.”

This species is too small to be of any importance as food. I have not seen any of more than the length of a foot.

Its habits are like those of its Eastern relative, *Esox reticulatus*, which Thoreau describes as "the swiftest, wariest, and most ravenous of fishes, which Josselyn calls the River Wolf. It is a solemn, stately, ruminant fish, lurking under the shadow of a pad at noon, with still, circumspect, voracious eye; motionless as a jewel set in water, or moving slowly along to take up its position; darting from time to time at such unlucky fish or frog or insect as comes within its range, and swallowing it at a gulp. Sometimes a striped snake, bound to greener meadows across the stream, ends its undulatory progress in the same receptacle."

109. *ESOX LUCIUS* Linnæus.

Common Pike; Lake Pickerel.

* *Synonymy for European Specimens.*

Lucius, BELLON, De Aquat., 296.—RONDELET, ii, 188.—SALV., 94, 95.—SCHONEVELDE, 44.—ALDROVANDI, De Pisc., 630.—JONSTON, iii, t. 3, c. 5, t. 29, f. 1.—GESNER, De Pisc., 500.—WILLOUGHBY, 236, tab., 5, f. 2.—RAY, Syn., 112.—KLEIN, Miss. Pisc., v. 74, tab. 20, f. 1.

Esox No. 1, ARTEDI, Synon., 26; Gen. p. 10, and Spec. 53.—GRONOVIVS, Zoophyl. No. 361
Esox lucius, L., Syst. Nat., i, 516.—BLOCH, Fische Deutschl., i, 229, t. 32; Bl. Schn., 390, —LACEPEDE, v. p. 297.—REISINGER, Prod. Ichth. Hung., 47.—DONONAN, Brit. Fishes, v. pl. 109.—FLEM., Brit. Ann., 184.—JURINE, Mem. Soc. Phys. et Hist. Nat. Geneve, iii, 1825, 231, pl. 15.—ERKSTROM, Fische Morko, 78.—FRIES and ERKSTROM, Scand. Fisk., 49, t. 10.—NILSSON, Prodr. 36, and Scand. Faun. Fisk., 348.—PALLAS, Zoogr. Ross.-As., iii, 336.—PARNELL, Wern. Mem., vii, 272.—YARRELL, Brit. Fishes, 1st Ed., 1 pl., 383; 2d Ed., 1 pl., 434; 3d Ed., 1, 343.—SELYS-LONGCH., Faune Belge, 223.—CUV. and VAL., xviii, 278.—KROYER, Danm. Fisk., 236.—GRONOVIVS, Syst. Ed. Gray, 146.—GUNTHER, Fische des Neckars, 107.—RAPP, Fische des Bodensees, 11.—HECKEL and KNER, Susswasserfische, 287.—SIEBOLD, Susswasserfische, 325.—GUNTHER, Cat. Fishes Brit. Mus., vi, 226, and of all authors since Linnæus.

The Pike; Hecht; Brochet; Lucio or Luzzo, Gädda (Sweden).

Synonymy for American Specimens.

Esox estor, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1818, 413.—GUNTHER, Cat. Fishes Brit. Mus., vi, 1867, 228 (Excl. syn. pars. Not of Richardson, DeKay, and others, which is *E. nobilior*, Thompson).

Esox lucius, var. *estor*, JORDAN, Man. Vert., 1876, 255.—NELSON, Bull. Ills. Mus. Nat. Hist., 1876.—JORDAN and COPELAND, Check List Fishes, 1876, 143.

Esox lucius, RICHARDSON, Fauna Bor.-Amer. Fishes, iii, 1836, 124.—DEKAY, New York Fauna, Fishes, 1842, 226.—STORER, Synopsis Fishes N. A., 1846, 438.—COPE, Proc. Acad. Nat. Sci. Phila., 1865, 79.—COPE, Trans. Amer. Philos. Soc. Phila., 1866, 408.—GUNTHER, Cat. Fishes Brit. Mus., vi, 1867, 227.—JORDAN, Bull. U. S. Nat. Mus., x, 1877, 55.—JORDAN, Man. Vert., 2d Ed., 1878, 266.—JORDAN, Bull. U. S. Geol. Surv. Terr., 1878, 432.

Esox reticulatus, KIRTLAND, Bost. Journ. Nat. Hist., v, 1846, 233, pl. 10, f. 2 (not LeSueur, first carefully distinguished from the Muskallunge).

Esox deprandus (LESUEUR), CUV. and VAL., xviii, 1846, 336.—COPE, Proc. Acad. Nat. Sci. Phila., 1865, 79; Trans. Amer. Philos. Soc. 1866, 408.—GUNTHER, Cat. Fishes Brit. Mus., vi, 1867, 2.

Esox boreus, AGASSIZ, Lake Superior, 1850, 317.

Esox lucioideus, AUCT.

Description.—Body elongate; the head very long; eye midway in head, $6\frac{1}{2}$ in its length, in specimens 18 inches in length; mouth proportionately rather larger than in the other pikes; the palatine teeth much larger than those of the vomer, except in front, the two series about equal in length; scales a little larger than in the Muskallunge; lower two-thirds of the opercle, or from the eye downward, naked; cheeks scaled; the scales on the lower half of the cheeks smaller than those of the upper; coloration bluish or greenish-gray, with many yellowish white spots rather smaller than the eye, and arranged somewhat in rows; eye yellow; vertical fins with rounded, black spots; scales of the back with shiny, triangular specks. Young fishes are often darker and scarcely spotted, but marked with yellowish-white bars, directed downward and forward, which later break up in spots; sides of head with 3 or 4 horizontal, whitish bars, one of them bounding the scaly part of the operculum; head $3\frac{2}{3}$; depth 5; D. 17; A. 16; V. 11; Lat. l. 120–125; B. 15. European specimens have mostly but 13 or 14 branchiostegals. Length 2 to 4 feet.

Habitat, waters of Northern North America, from the Great Lake Region to Alaska, and in all waters of Northern Asia and Europe, one of the most widely diffused of fresh water fishes. It is occasionally taken in tributaries of the Ohio River, but is very abundant in Ohio in the northern part only.

Diagnosis.—This species may be known at once by its spots, which are pale or yellowish on a darker ground, and by its scaly cheeks and half-bare operculum.

Habits.—The Pike is very abundant in all the streams and ponds tributary to Lake Erie, as well as in the lake itself. In the tributaries of the Ohio it is less common, although frequently taken. It, however, prefers cool waters. It is an important fish in the markets, and is readily sold, although it is not a fish of the very first grade.

This species has long served as the emblem of rapacity among fishes. "They are mere machines for the assimilation of other organisms," feeding freely on any animate thing which they can catch, and fortunately they can sometimes catch each other.

It is stated that Dr. E. T. Sturtevant once "put two young Pickerel about five inches long in a trough with a great quantity of little *Cyprinoids* of about one inch in length. These two Pickerel ate 122 Minnows the first day, 130 the second day, and 150 the third day, and increased one inch in length in forty-eight hours." In this statement, the rate of growth is, of course, exaggerated; but they will unquestionably devour Minnows till the tail of the last one hangs out of the mouth, there being no room to swallow it.

The Pike is a gamey fish, taking the hook readily. Fishing for it through the ice, when the skating is good, is considered an exhilarating pastime.

Prof. Cope observes: "For ourselves we do not join in the condemnation visited on the Pike by some, and have a liking for its flesh. If its increase can be restrained instead of favored, in waters which produce the best species, it will cease to inflict much injury by its voracious habits, for it naturally haunts still or grassy waters, where it devours fishes inferior to itself, as Eels, and Cat-fish, and frogs. On the other hand, we do not think the Pike needs any protection, as he has many natural advantages in the struggle for life; but he should not be destroyed except for the table." (Rept. Fish Commr. Penn. for 1879-1880, 107.)

110. *ESOX NOBILIOR* Thompson.

Muskallonge; Mascalonge; Maskinonge; Great Pike.

"*Esox masquinongy* MITCHILL" (Quoted, "Mirror, 1824, 297," but it is not there; I cannot find the description anywhere).

Esox estor, RICHARDSON, Fauna Bor.-Amer., ii, 127.—KIRTLAND, Bost. Journ. Nat. Hist., v, 338, and of several writers (not of LeSueur, Journ. Acad. Nat. Sci. Phila., i, 1818, 413; nor of GUNTHER, Cat. Fish. Brit. Mus., vi, 228, *E. lucius*).

Esox nobilior, THOMPSON, Bost. Journ. Nat. Hist., 1850, 163, 173, 205.—COPE, Proc. Acad. Nat. Sci. Phila., 1865, 79.—JORDAN, Bull. U. S. Nat. Mus., x, 54; Mas. Vert., 2d Ed. 266, and of all late writers.

Description—Body elongate; the general form as in *E. lucius*, but the head rather larger; eye about midway in head; interorbital space transversely concave, with a prominent middle ridge; maxillary reaching to opposite middle of orbit; lower half of cheeks and opercles scaleless, the scaly region about as wide as the eye and bounded by an irregular line running parallel with the profile; color dark-gray, sides with round, dark spots of a grayish-black hue, nearly the color of the back on a ground color of grayish-silvery; belly white; fins black spotted; head $3\frac{2}{3}$; depth 6; D. 17; A. 15; V. 12; B. usually 18; Lat. l. 150. Length 3 to 6 feet or more, by far the largest of the Pikes, and the largest game-fish of American fresh waters.

Habitat, entire Great Lake Region and lakes of British America, seldom ascending rivers except to spawn. Said to occur sometimes in the Ohio River, but we have no certain information of its capture there.

Diagnosis.—This species may at once be known by being *dark-spotted* on a lighter ground color. Most writers who have mentioned it have confounded it with the Common Pike, although Dr. Kirtland (*l. c.*) has well pointed out the difference.

"The ground color on the sides of the Muskallunge is always light, a mixture of golden and silvery luster, maculated with dark oblong or roundish spots, while on the other the ground coloring consists of dark

reticulations, relieved with irregular, yellowish spots not placed in rows. Our fishermen say that the Muskallonge is spotted with black, and the Pike with yellow."

Habits.—The Muskallonge is much less common than the Pike, and is found almost exclusively in the deep waters of the lakes, "except for a few days in spring, when it runs into the mouths of rivers to spawn." It reaches an immense size. Dr. Kirtland mentions one more than five feet in length, and weighing over sixty pounds. The largest one of which I have a record was six feet long and weighed eighty pounds. It is highly valued for food. Dr. Kirtland informs us that "epicures consider it one of the best of fishes of the West," and Mr. J. L. Beaman affirms that "as a food fish there is nothing superior to this. He ranks with the Salmon and Speckled Trout, and surpasses the Black and Striped Bass. The meat is almost as white as snow, fine-grained, nicely laminated, and the flavor is perfect."

The Muskallonge is as voracious as the Pike, and eighty pounds of Muskallonge represents several tons of Minnows, White-fish, and the like. It is not a common fish. Its great size and voracity perhaps account for this. "It is a long, slim, strong, and swift fish, in every way formed for the life it leads, that of a fierce and dauntless marauder." (*Hallock.*)

FAMILY XIII. ATHERINIDÆ. THE SILVERSIDES.

Body elongated, more or less compressed, covered with rather small cycloid or crenate scales; sides with a bright, distinct silvery band in all known species; lateral line obsolete; teeth small, sometimes wanting; premaxillaries protractile or not; gill-membranes separate, free from the isthmus; pseudobranchiæ present; dorsal fins well separated, the anterior of a few feeble spines; ventrals subabdominal, of one spine and five soft rays; vertebræ numerous. Small, carnivorous fishes of warm regions, usually swimming in schools near the shore; a few species in permanently fresh water; genera about seven; species forty-five. Only one of the American species inhabiting fresh water.

- a. Mouth very oblique; the upper jaw plane above, concave within; the lower jaw correspondingly convex, the very protractile premaxillaries forming a peculiar roof-like beak. LABIDESTHES. 59.

GENUS 59. LABIDESTHES. Cope.

Labidesthes, COPE, Proc. Amer. Philos. Soc. Phila., 1870, 455.

Type, *Chirostoma siccum*, Cope.

Etymology, *labis*, a pair of forceps; *estheo*, to eat.

Silversides, with the premaxillary bones prolonged anteriorly into a roof-shaped beak of elongate form, reaching posteriorly to the line of the orbit, extremely protractile; teeth in several series; lower jaw as long as upper; no palatine teeth; body

very elongate, translucent; dorsal spines four; scales small. This genus contains but a single species, peculiar to the fresh waters of the Western States—a small fish, very slender and graceful, and of delicate organism.

111. LABIDESTHES SICCULUS Cope.

River Silver-side; Skipjack.

Chirostoma sicculum, COPE, Proc. Acad. Nat. Sci. Phila., 1865, 81.

Labidesthes sicculus, COPE, Proc. Amer. Phil. Soc., 1870, 455.—JORDAN, Man. Vert., 1st Ed., 1877, 2d Ed., 1878, 261.

Description.—Form very slender, the depth contained 6 to 7 times in length; the head about $4\frac{1}{2}$; eye large and round contained $3\frac{1}{2}$ times in the length of the side of the head, and $1\frac{1}{2}$ times in the length of the snout; top of head and muzzle plane, the latter convex transversely, its tip about even with that of the lower jaw; front with a median ridge; teeth slender and simple; scales small; in 14 longitudinal and 75 transverse series; anal fin very long, nearly one-third the length of the body; first dorsal short, with 4 very weak spines; D. 1; V. 10; A. I, 22; Ventrals I, 5; color very clear, translucent olive; in life quite transparent; above dusted with black points; sides with a very distinct, silvery band, which covers one row and two half rows of scales, edged above with plumbeous; cheeks silvery. Length 3 to 4 inches.

Habitat, Michigan to Tennessee, west to Iowa, Detroit River (Cope), Sandusky Bay, Clinch River (Cope), Cumberland River, Illinois River, Wisconsin River, and in most streams of Ohio and Indiana.

Diagnosis.—This is the only fish found in Ohio with a long, slender body, two dorsal fins, and a bright, silvery stripe along the sides.

Habits.—This little creature is one of the most singular and elegant of our fishes. It occurs in great abundance where found, and is especially numerous in clear pools left in summer by the fall of the waters in the stream which has filled them. It swims near the surface, and often throws itself out of the water, for which reason it is known to Indiana boys by the name of "Skipjack." It is an attractive creature in the aquarium, but from its delicacy of organization hard to keep alive.

FAMILY XIX. APHREDODERIDÆ. THE PIRATE PERCHES.

Body oblong, moderately compressed, covered with ctenoid scales; dorsal fin single, high, with but three or four spines, which are rapidly graduated, the first being quite short; ventral fins thoracic, without distinct spine, and with seven soft rays; mouth moderate, the lower jaw slightly projecting, the maxillary reaching to the anterior border of the eye; teeth in villiform bands, on jaws, vomer and palatines; pharyngeals narrow, the lower separate, with villiform teeth; preorbital, preopercle and other bones of the head strongly serrated; branchiostegals six; gill membranes free from the isthmus; air-bladder simple; pyloric cœca about twelve; scales moderate, ctenoid; no

lateral line; vent always anterior; its position varying with age, being behind the ventrals in the young and jugular in the adult, a singular fact, first noted by Prof. S. A. Forbes. A single species in this remarkable family is known. This inhabits the low-land waters, ditches and bayous of the Mississippi Valley and Atlantic coast.

GENUS 60. APHREDODERUS. Le Sueur.

Aphredoderus, LeSueur, CUV. et VAL., Hist. Nat. des Poiss, ix, 1838, 329.

Sternotremia, NELSON, Bull. Ills. Soc. Nat. Hist., i, 1876, 39.

Asternotremia, Nelson, JORDAN, Bull. U. S. Nat. Mus., x, 1877, —.

Aphrodederus, COPE. *Aphododerus*, JORDAN, corrected orthography.

Type, *Aphredoderus gibbosus*, LeSueur, = *Scolopsis sayanus*, Gilliams.

Etymology, *aphodos*, excrement; *dere*, the neck or throat, from position of the vent.

Characters of the genus included above. The body in the known species is rather short, compressed, thickened and bluntish forward; the general color is olivaceous, and a dark bar is present below the eye and at the base of the caudal fin.

The study of the position of the vent in this genus has developed some singular things. It becomes evident from the examination of a large series that the position of the vent is not a character of generic importance, as was supposed when the genus *Sternotremia* was proposed, nor is it apparently an individual or a sexual character as has since been suggested. The observations of Professor Forbes, verified by myself, appear to show that the position of the vent is dependent on the age of the fish. In the adult, the vent is jugular, close behind the little projecting knob at the throat. In the youngest specimens examined, it is more or less behind the ventral fins. In specimens intermediate in size, its position is intermediate, the degree of advancement being proportionate to the size of the fish.

Occasional irregularities occur, but the above rule holds so generally that it cannot be merely accidental. From it, I infer that in the very young, the position of the vent will be found to be as usual in Percoid fishes, as in the young Flounder the eyes are symmetrical, the aberrant characters being developed with age.

This moving forward of the vent seems to be simply due to the lengthening of the horizontal part of the intestine or "rectum" of the fish. *Aphododerus sayanus* is one of the most highly interesting of our fishes and a complete study of its embryology would be very desirable.

A closely related family *Elassomatidæ*, with a single known species *Elassoma zonatum* occurs in the streams and ponds of Southern Illinois and may be found in Ohio. It is perhaps the smallest of all spinous fishes. In *Elassoma*, the vent is normal in position and the ventral rays are in the normal number I, 5. The dorsal fin is reduced in size as in *Aphredoderus*.

112. APHREDODERUS SAYANUS (Gilliams) Dekay.

Pirate Perch.

Scolopsis sayanus, GILLIAMS, Journ. Acad. Nat. Sci. Phila., iv, 182-, 81.

Aphredoderus sayanus, DEKAY, New York Fauna, Fishes, 1842, 35.—BAIRD, Ninth Smithsonian Rept., 1855, 326.—GUNTHER, Cat. Fishes Brit. Mus., i, 271, and of authors generally.

Aphododerus sayanus, JORDAN, Man. Vert., 2d Ed., 249.

Aphredoderus gibbosus, (LeSueur) CUV. and VAL., Hist. Nat. des Poiss., ix, 1833, 448.

Sternotremia isolepis, NELSON, Bull. Ills. Mus. Nat. Hist., 1876, 39.—JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 71 (specimens with vent posterior).

Asternotremia isolepis, NELSON, Bull. U. S. Nat. Museum, x, 1877, —.

Aphododerus isolepis, JORDAN, Man. Vert., 2d Ed., 1878, 249.

Aphrododirus cookianus, JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 60 (waters of Maumee River, specimens with vent anterior).

Aphododerus cookianus, JORDAN, Bull. U. S. Mus., x, 1877, —.

Asternotremia mesotrema, JORDAN, Bull. U. S. Nat. Mus., x, 1877, — (specimens with vent intermediate.)

Description.—Body broad, stout, elevated at the dorsal, the depth $3\frac{1}{2}$ in length, without caudal; head large, broad and stout, 3 in length, its greatest thickness a little more than half its length, its depth at the pupil a little less; mouth wide, lower jaw longest; maxillary reaching anterior margin of eye; eye moderate, $4\frac{1}{2}$ in snout, its posterior margin of eye; eye moderate, $4\frac{1}{2}$ in snout, its posterior margin nearly midway of head, $1\frac{1}{2}$ in snout, and in interorbital space; lower posterior angle of cheek about a right angle; fin rays D. III., 11; A. II., 6; V. 7; B. 6; pyloric cæca 12; beginning of dorsal much nearer snout than base of caudal, base of dorsal 1.4-5 in distance from snout to first ray; pectoral as long as from snout to opercular margin; tips of pectorals not reaching as far as those of ventrals; ventrals considerably more than half length of head, reaching four-fifths the distance to anal; long anal spine $2\frac{1}{2}$ in head; caudal rounded; scales very small, strongly ctenoid, not easily seen along the middle of the body, largest on cheeks and on opercles; 48 to 55 series along sides; color dark olive, appearing bronze in spirits, profusely speckled with dark points, which give the fins a dark color; a dark bar at base of caudal and a light one behind it. Length 3 to 4 inches.

Habitat, Maumee River. Calumet River. Wabash River, tributaries of the Mississippi and lower Ohio Rivers. South to Arkansas, also in coastwise streams from New York to Louisiana. It is found only in sluggish alluvial waters among weeds, and its presence in the west seems to have been quite overlooked until lately.

Diagnosis.—This species will be always known among Ohio fishes by the presence of a continuous dorsal fin with three or four distinct spines.

Habits.—Its habits are little known. It is said to be quite voracious, and appears only at night. It is too small to be of value for food, but will doubtless take the hook if encouraged.

FAMILY XX. CENTRARCHIDÆ. THE SUN-FISHES.

Perch-like fishes with a single dorsal fin; six (rarely seven) branchiostegals; the pseudobranchiæ reduced in size and partly concealed, and the body more or less deep and compressed, the regions above and below the axis of the body nearly equally developed and corresponding to each other; dorsal fin either continuous, or more or less deeply notched; the spines six to thirteen in number, depressible in a slight groove; anal fin with three to nine spines, the soft rays in dorsal and anal being from nine to eighteen

in number; ventral fins thoracic, each with one spine and five soft rays; caudal fin either slightly forked or lunate, or else rounded; mouth terminal, usually more or less oblique; the protractile premaxillaries forming the lateral margins of the upper jaw; villiform teeth on jaws and vomer, and usually on palatines also; teeth sometimes present on tongue and pterygoid bones; pharyngeal bones provided with teeth which are conical and acute in most cases, but sometimes more or less rounded or truncate; gill-rakers of anterior branchial arch, exhibiting various degrees of development, long, setiform and numerous in *Pomoxys* and *Centrarchus*, shorter and less numerous in the others; maxillary bone in most cases broad and flat, with a small, supplemental bone lying parallel with it, on its posterior margin. In a few species of *Lepomis* this bone is minute or obsolete, and the maxillary is reduced in size; body covered with scales, which are rarely strongly ctenoid, and are sometimes cycloid; cheeks and opercles scaly; opercular bones usually nearly or quite entire; the preopercle commonly slightly dentate at its angle; operculum (*Lepomis*, *Chænobryttus*) provided sometimes at its upper posterior angle with a more or less prolonged flap, which is always black, usually with pale edging; in other cases the operculum ends behind in two flat points, with a membranous border. In all cases a more or less distinct, dusky spot is present at that point. Coloration usually brilliant; ground color olive-green, varied in some cases with yellow, orange, or blue. The species of *Lepomis* are in particular very brightly colored, and many of the others are among the most ornate of our fresh water fishes.

All the *Centrarchidæ* are North American, and with one exception (*Archoplites interruptus*, of the Sacramento River), all the species are confined to the Eastern and Southern United States and neighboring parts of Canada and Mexico. About twenty-five species probably exist, although more than a hundred have been described. All of them which reach a sufficient size are valued as food fishes. All of them in habits are carnivorous, voracious, and "gamey." Most of them construct rude nests in the spawning season, which they defend with much spirit.

Many of the species have a wide range, and are subject to considerable variations from the differences of food, water, and other causes. This is especially true in regard to the species of *Micropterus* and *Lepomis*. The latter genus is one of the most difficult among our fishes, in which to distinguish species.

The family *Centrarchidæ* was first distinguished by Dr. Gunther in 1859, as tribe *Grystina*, and more fully defined in 1860 by Dr. Holbrook, under the name *Ichthelidæ*. In 1864 Dr. Gill first circumscribed it under the name *Centrarchidæ*, the names *Ichthelidæ* and *Grystidæ* being considered untenable, as the genera called *Grystes* and *Ichthelis* had both received prior names *Micropterus* and *Lepomis*. Its relations are very close to the *Serranidæ* and other Percoid groups, from which it can scarcely be distinguished as a true family.

ANALYSIS OF GENERA OF CENTRARCHIDÆ.

* Body more or less short and deep, compressed; dorsal fin not deeply notched.

a. Dorsal and anal fins about equal, the soft portion of the latter longest and most posterior; opercle emarginate; gill-rakers setiform, very long, finely dentate, in large number; caudal fin emarginate.

b. Spinous dorsal shorter than soft part, the spines 5 to 8 in number, rapidly graduated; anal spines normally 6; body compressed and elongate; mouth large.

POMOXYS. 61.

- bb. Spinous dorsal longer than soft part, the spines about 12 in number, not rapidly graduated; anal spines normally 8; body deep; mouth moderate.

CENTRARCHUS 62.

- aa. Dorsal fin much longer than anal fin, the base of the former $1\frac{1}{2}$ to 3 times that of the latter; the soft parts of the two fins about equal, of 8 to 14 rays, and ending at the same vertical behind.

- c. Body comparatively short and deep; compressed; anal spines well-developed, dorsal spines strong, not separated by a deep notch from the soft rays.

- d. Tongue and pterygoid bones toothless; mouth moderate or small.

- e. Operculum ending behind in an entire convex process or flap, which is always more or less black; dorsal spines normally 10; anal spines 3; the soft rays in each fin about 10; caudal fin emarginate.

- f. Lower pharyngeal bones with the teeth, or most of them, coarse, rounded or truncate above, i. e., teeth paved; the bones themselves broad and concave. EUPOMOTIS. 63.

- ff. Lower pharyngeal bones narrow, with the teeth all, or nearly all, conic and sharp. LEFOMIS. 64.

- dd. Tongue and pterygoid bones with teeth; mouth large.

- g Operculum ending behind in a convex flap; anal spines 3.

CHÆNOBRYTTUS. 65.

- gg. Operculum emarginate behind; anal spines usually 6.

AMBLOPLITES. 66.

- ** Body elongate, not greatly compressed; dorsal spines 10; anal 3; dorsal fin nearly divided into two fins by a deep notch; caudal emarginate; opercle emarginate; mouth very large; supplemental maxillary bone well developed.

MICROPTERUS. 67.

GENUS 61. POMOXYS. Rafinesque.

Pomoxis, RAFINESQUE, Journ. Acad. Nat. Sci. Phila., 417 (*annularis*).

Pomoxys, GILL, Amer. Journ. Sci. Arts, 1864.

Hyperistius, GILL, Amer. Journ. Sci. Arts (*hexacanthus*).

Type, *Pomoxis annularis*, Raf.

Etymology, *poma*, opercle; *oxus*, sharp.

Dorsal and anal fins about equal in extent, the soft portion of the latter longest and most posterior, the two fins being obliquely opposed; spinous dorsal little developed, shorter than soft part, continuous with it, the spines 5 to 8 in number, rapidly graduated; anal spines normally six; body compressed and rather elongate; mouth large; lower jaw longest; supplemental maxillary bone well developed; gill-rakers setiform, very long, about 20 in number, armed with teeth; palatine teeth present; opercle emarginate behind; scales nearly smooth.

This genus contains, so far as is known, but two species; both of which are described below:

ANALYSIS OF SPECIES OF POMOXYS.

- | | |
|-----------------------------------|-----------------|
| a. Dorsal spines 6. | ANNULARIS. 113. |
| aa. Dorsal spines 7 or 8. | SPAROIDES. 114. |

113. *POMOXYS ANNULARIS* Rafinesque.

**Crappie; New Light; Campbellite; Batchelor; Bride Perch
Strawberry Perch; Chinquapin Perch; Sac-a-lai.**

Pomoxis annularis, RAFINESQUE, Amer. Monthly Mag., 1818, 14; Journ. Phila. Acad. Nat. Sci., 1818, 417; Ichth. Oh., 1820, 33.—GIRARD, U. S. P. R. R. Surv., 1858, 6.

Pomoxys annularis, JORDAN and COPELAND, Proc. Acad. Nat. Sci. Phila., 1876.—NELSON, Cat. Fishes Ill., 1876, 37.—GILBERT and KLIPPART, Rept. Ohio Fish Comm., 1877, 77.—JORDAN, Man. Vert., 1876, 231; Bull. U. S. Nat. Mus., No. 10, 1877, 37; Ann. N. Y. Acad. Sci., vol. i, 1877, 97; Man. Vert., 1878, 247; Bull. Hayden's Geol. Surv., vol. iv, 1878, 437; Bull. U. S. Nat. Mus., No. 12, 1878, 47, 76.—BEAN, U. S. Nat. Mus., 1880, 99.

Cichla storeria, KIRTLAND, Rept. Zool. Ohio, 1838, 191.

Pomoxys storerius, GILL, Proc. Acad. Nat. Sci. Phila., 1865.

Pomoxis nitidus, GIRARD, Proc. Acad. Nat. Sci. Phila., Nov., 1857, p. 200; U. S. Pac. R. R. Surv., 1858, 6.

Centrarchus nitidus, GUNTHER, Cat. Fishes Brit. Mus., i, 1859, 257.

Pomoxys protacanthus, GILL, Proc. Acad. Nat. Sci. Phila., 1865.

Pomoxys intermedius, GILL, Proc. Acad. Nat. Sci. Phila., 1865.

Pomoxys brevicauda, GILL, Proc. Acad. Nat. Sci. Phila. 1865.

Description.—Body elongate, the depth usually about $2\frac{1}{2}$ in length of body, the profile more or less strongly S-shaped, owing to the projecting snout, depressed occipital region and strongly prominent, thickened ante-dorsal area; head long, about 3 in length, the mouth very wide, the mandible being about as long as the pectorals; eye large, about 4 in head; fin rays, dorsal VI, 15, the spines varying from V to VII; anal VI, 18, the spines frequently but five in number; the number of spines is subject to considerable variation, but the normal number both in dorsal and anal is six; the proportions of the spines also vary somewhat; lateral line with about 42 scales (36 to 48); color, clear silvery olive, mottled with dark olive green, the green being chiefly on the upper part of the body and having a tendency to form narrow vertical bars; dorsal and caudal mottled with green; anal pale, scarcely marked at all; soft rays of dorsal and anal very high, but still lower than in *P. sparoides*. This species reaches the length of about a foot. The form varies much with age, large specimens having the body much deeper and more compressed than is the case with young fishes.

Diagnosis.—From all our species except the next, the presence of this fish may be known by about six spines both in the dorsal and anal. The S-curve to the profile and the larger mouth characterize this species. A good color mark is the pale color of the anal which in *P. sparoides* is strongly mottled. The normal number of dorsal spines is seven in *P. sparoides* and six in *P. annularis*.

Habitat.—This species belongs properly to the Lower Mississippi Valley, being most abundant from Missouri south. It occurs in large numbers in the Ohio River and its larger tributaries where it is valued as a pan-fish. It possesses some of the "gamey" qualities of the Black Bass but to a less extent. It prefers still waters and ponds and seldom ascends small streams. It is rarely taken in Lake Erie.

114. POMOXYS SPAROIDES (Lacepede) Girard.

Calico Bass; Grass Bass; Bar Fish; Bitter Head; Tin Mouth; Sand Perch; Sac-a-lai.

Centrarchus sparoides, CUV. and VAL., iii, 1829, 88, pl. 48.

Pomoxis sparoides, GIRARD, U. S. P. R. R. Surv., 1858, 6.

Cantharus nigromaculatus, (LeSueur, MSS.) CUV. and VAL., Hist. Nat. Poiss, 1828, 8.

Centrarchus hexacanthus, CUV. and VAL., vii, 1831, 458.—KIRTLAND, Bost. Journ. Nat. Hist., iii, iv, 1842, 480.—DEKAY, Fauna N. Y., Fishes, 1842, 31.—STORER, Syn., 1846, 299.—GUNTHER, Cat. Fishes Brit. Mus., i, 1859, 257.

Pomoxis hexacanthus, HOLBROOK, Ichthy. S. C., 1860, 39.—PUTNAM, Bull. M. C. Z., i, 1863, 6.—COPE, Proc. Amer. Philos. Soc., 1870, 451.—ABBOTT, Rept. U. S. Fish Com., 1875, 1876, 837.—JORDAN, Man. Vert., 1876, 231.—NELSON, Cat. Fishes Ill., 1876, 37.—GILBERT, Rep. Ohio Fish Com., 1877, 77.

Hyperistius hexacanthus, UHLER and LUGGER, Fishes of Maryland, 1876, 111.

Pomoxis nigromaculatus, GIRARD, U. S. P. R. R. Surv., 1858, 6.—JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 37; Ann. N. Y. Acad. Sci., i, No. 4, 1877, 97; Bull. U. S. Nat. Mus., No. 12, 1878, 47, 76; Bull. Hayden's Geolog. Surv., ii, 1878, 437; Man. Vert., 1878, 247.—GOODE, Proc. U. S. Nat. Mus., ii, 1879, 114.—BEAN, U. S. Nat. Mus., 1880, 99.

Hyperistius carolinensis, GILL, Amer. Journ. Sci. Arts, 1864, 93 (without description).

Description.—Body oblong, elevated, greatly compressed, the depth being nearly half the length, the head one-third; profile more regular than in the preceding species, the projections and depressions being less marked; head much deeper and shorter than in *P. annularis*, the mouth considerably smaller, the mandible being considerably shorter than pectorals; snout projecting, forming an angle with the descending profile; fins very high; anal rather larger than dorsal, its height being from one-fourth to one fifth of the length of the fish without caudal fin; dorsal VII, 15, varying to VIII spines, very rarely VI; anal VI, 18, varying to V, 17; lateral line with 40 to 42 scales; color a bright silvery olive, mottled with clear olive green, the dark mottlings gathered in irregular small bunches, rather than in lines or bars and covering the whole body and the soft rays of the anal as well as those of the caudal and dorsal fins; usually a dusky opercular spot. This species reaches a length of a little more than a foot.

Diagnosis.—This species may be known by the presence of 6 anal and 7 dorsal spines, and by the presence of dark markings on the anal fin and the region about it.

Habitat.—This species is widely distributed. It occurs in abundance in the Great Lake Region, and in the upper part of the Mississippi Valley, and in the Missouri. Eastward it has been found in the Delaware and Potomac, the rivers of Carolina and in the Alabama River. In the middle region it is less abundant, being replaced by the preceding species. I have seen but few specimens from the Ohio Valley. In the Great Lakes, this species is taken in large numbers. In the ponds and lakes of Northern Indiana and Ohio, it is also abundant. As a food fish it is most excellent.

Storer, and after him Kirtland and others, have confounded this fish with *P. annularis*. The synonym *carolinensis*, Gill, was given on the presumption that the Carolina fish was specifically different from that inhabiting the Great Lakes, which, however, does not seem to be the case.

Both this species and the preceding have been recommended for the stocking of ponds.

GENUS 62. CENTRARCHUS. Cuvier and Valenciennes.

Centrarchus, sp., CUVIER et VALENCIENNES, Hist. Nat. des Poissons, iii, 1829, 84.

Centrarchus, AGASSIZ, American Journal Sci. Arts, 1854.

Eucentrarchus, GILL, Amer. Journ. Sci. Arts, 1864, 92 (*irideus*, name only).

Type, *Labrus irideus*, Lacepede.

Etymology, *kentron*, spine; *archos*, anus, from the many anal spines.

Dorsal and anal fins about equal in extent, the soft portion of the latter longest and most posterior, the two fins being obliquely opposed; spinous dorsal longer than soft part forming angle with it, the spines normally about 12 in number, not rapidly graduated; anal spines normally 8; body deep, compressed; mouth moderate; lower jaw longest; supplemental maxillary bone well developed; teeth on palatines; gill rakers setiform, very long, in large number (25 to 30) on anterior gill arch, armed with small teeth; scales nearly smooth; opercle emarginate, ending in two flat points; caudal fin emarginated. But one species of this genus is now known.

Synonymy.—The name *Centrarchus* was first proposed for *Ambloplites rupestris*, *Centrarchus irideus*, and *Pomoxys sparoides* under the names of *C. æneus* (LeSueur), *C. pentacanthus* (C. & V.), *C. irideus* (Lac.), and *C. sparoides* (Lac.). No type was assigned. Afterwards (1832) species of *Pomoxys* (*hexacanthus*) and of *Chænobryttus* (*gulosus* and *viridis*) were added by Cuvier and Valenciennes. Later (1842) DeKay added two nominal species of *Micropterus* (*fasciatus* and *obcurus*). In 1854, Prof. Agassiz revived the Rafinesquian genera, *Ambloplites*, *Pomoxis*, and *Calliurus* for species then referred to *Centrarchus*, properly retaining the name *Centrarchus* for the species belonging to the original genus which had not previously been made types of other genera, i. e., *C. irideus*. In 1864, Prof. Gill suggested the name *Eucentrarchus* for *Centrarchus irideus* to be used in case of the general adoption of the rule requiring that the first species mentioned under a new genus should be considered its type, unless some other type was specified. The species first mentioned under *Centrarchus* was *C. æneus*, and under this view, *Centrarchus* would be a mere synonym of *Ambloplites*. The general common sense of naturalists has, however, rejected the "first species" rule as impracticable and undesirable.

115. CENTRARCHUS MACROPTERUS (Lacepede) Jordan.

Shining Bass; Large-finned Bass.

Labrus macropterus, LACEPEDE, Hist. Nat. Poiss., iii, 447.

Centrarchus macropterus, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 361; Bull. U. S. Nat. Mus., No. 12, 1878, 36; Bull. Hayden's Geol. Surv., iv, 1878, 437; Man. Vert., 1878, 246.

Labrus irideus, (Bosc MSS.) LACEPEDE, Hist. Nat. Poiss., iv, p. 716, pl. 5, f. 3.

Centrarchus irideus, CUV. et VAL., iii, 1829, 89.—DEKAY, Fauna N. Y., Fishes, 1842, 31.—STORER, SYN., 1846, 291.—GUNTHER, Cat. Fishes Brit. Mus., i, 1859, 257.—HOLBROOK, S. C., 1860, 18.—PUTNAM, Bull. M. C. Z., i, 1863, 6.—COPE, Proc. Amer. Philos. Soc. 1870, 451.—JORDAN, Man. Vert., 1876, 230; Ann. N. Y. Acad. Soc., i, 1877, 97; Bull. U. S. Nat. Mus., No. 10, 1877, 36; Man. Vert., 1878, 246; Bull. Hayden's Geol. Surv., iv, 1878, 437; Bull. U. S. Nat. Mus., No. 12, 1878, 47.—NELSON, Cat. Fishes Ill. 1876, 37.—BEAN, U. S. Nat. Mus., 93.

Eucentrarchus irideus, GILL, Am. Journ. Sci. and Arts, 1844, 93.

Description.—Body very short, suborbicular, the snout projecting at a considerable angle; back and belly closely compressed; the greatest thickness of the body being through the opercular region; top of head broad and flattish, the interorbital space being about equal to eye; mouth small, very oblique, almost vertical, the maxillary scarcely reaching the middle of eye; eye very large, about 3 in head; head 3 in length of body; greatest depth 2; dorsal XI to XIII, 12 or 13; anal VIII, 13 or 14; lateral line with 37 to 43 scales; color silvery green, with about 20 horizontal dark stripes along the rows of scales, the number of stripes becoming abruptly smaller on caudal peduncle where there are 8 or 9; a black spot on last rays of dorsal; a blackish bar below eye. Length of 4 to 6 inches.

Diagnosis.—This species may be known at once among our fresh water fishes by the presence of 7 to 9 spines in the anal fin, and 11 to 13 in the dorsal.

Habitat—North Carolina to Southern Illinois and southward, in deep and sluggish streams of the lowland. It has been found in abundance by Prof. S. A. Forbes in Southern Illinois near Cairo. It has not yet been noticed in Ohio, but is to be looked for in the bayous of the Ohio River. Where abundant, as in the Carolinas, it is of considerable value for food.

GENUS 63. EUPOMOTIS. Gill and Jordan.

Pomotis, sp., CUV. et VAL., Hist. Nat. des Poiss., iii, 1828, and of authors generally (not of Rafinesque, 1819 or 1820, *Lepomis*).

Eupomotis, GILL and JORDAN, Field and Forest, 1876, p. —.

Type, *Sparus aureus*, Walbaum, = *Pomotis vulgaris*, C. & V. = *Perca gibbosa*, L.

Etymology, *eu*, well; *poma*, opercle; *ous*, ear.

Dorsal fin much more developed than anal fin, the base of the former more than twice that of the latter, the soft parts of the two fins about equal and terminating at the same vertical behind; dorsal spines 10, rather high; anal spines 3; caudal fin emarginate; mouth small, with equal jaws; maxillary without supplemental bone, not reaching to orbit; no palatine teeth; gill rakers short, blunt and weak, undifferentiated, destitute of teeth; lower pharyngeal bone broad, concave, with at least the middle teeth usually conic: scales ctenoid; opercular flap moderately developed, rounded; colors brilliant or rather plain; all the known species have the opercular flap tipped with scarlet. Three or four species of *Eupomotis* are now known, most of them of southern distribution. Some of the species of *Lepomis* approach so closely to these, that the propriety of the separation of the genus *Eupomotis* from *Lepomis* must be considered very doubtful.

116. *EUPOMOTIS GIBBOSUS* (Linnaeus) Jordan.**Common Sun-fish; Pumpkinseed; Sunny.**

Perca fluviatilis gibbosa ventre luteo CATESBY, Nat. Hist. Carolina, etc., iii, tab. viii, 1730.

Perca gibbosa, LINNÆUS, Systema Naturæ, Ed. xi, 1760, 293, (based on Catesby).

Lepomis gibbosus, MCKAY, MSS.

Sparus aureus, WALBAUM, Artedi Pisc., 1792, 290, (based on Catesby.)

Pomotis aureus, GILL, Amer. Journ. Sci. and Arts, 1864, 93; Syn. Fishes Gulf of St. Lawrence and Bay of Fundy, 1865, 6.—UHLER and LUGGER, Fishes of Maryland, 1876, 113.

Eupomotis aureus, GILL and JORDAN, Field and Forest, v, 2, 1877, p. 190.—NELSON, Rept. U. S. Fish Com., 1875-76, 790, 796.—GILBERT, Ohio Fish Com., 1877, 80.—JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 35; Ann. N. Y. Acad. Sci., i, 1877, 98; Bull. Hayden's Geol. Surv., iv, 1878, 436; Bull. U. S. Nat. Mus., No. 12, 1878, 15; Man. Vert., 1878, 244.—GOODE, Proc. U. S. Nat. Mus., ii, 1879, 114.—GOODE and BEAN, Bull. Essex Inst., 1879, 18.—BEAN, U. S. Nat. Mus., 1880, 98.

Labrus auritus, WALBAUM, Artedi Pisc., 1792, 243, (not of Linnaeus).—SHAW, Zool., iv, 1805, p. 482.—MITCHILL, Mem. Fish. N. Y., 1815, 403.

Pomotis auritus, GUNTHER, Cat. Fishes Brit. Mus., i, 1859, 261.—PUTNAM, Bull. M. C. Z., i, 1863, 6.—JORDAN, Mañ. Vert., 1876, 233.—NELSON, Cat. Fish. Ill., 1876, 38.—ABBOTT, Rept. U. S. Fish Com., 1875-76, 837.

Morone maculata, MITCHILL, Rept. Fishes N. Y., 1814, 19.

Pomotis maculatus, COPE, Proc. Amer. Philos. Soc., 1870, 45.

Sparus mocasinus, RAFINESQUE, Prec. des Ieo. Som., 1814, 19.

Pomotis vulgaris, CUV. et VAL., iii, 1829, 91.—CUVIER, Regne Anim., Ill. Poiss., 1829, pl. 10, f. 3.—JARDINE, Natural Libr., i, Perches, 1835, 162.—RICHARDSON, Fauna Bor.-Amer., 1836, p. 24, pl. 76.—STORER, Bost. Journ. Nat. Hist., ii, 300.—KIRILAND, Bost. Journ. Nat. Hist., iii, iv, 1841, 470.—THOMPSON, History of Vermont, 1842, 130.—DEKAY, New York Fauna, Fishes, 1842, 31.—AYRES, Bost. Journal Nat. Hist., 1842, 10, 258.—STORER, Syn., 1847, 292.—LINSLEY, Cat. Fishes Conn.—AGASSIZ, Lake Superior, 1850, 293.—HERBERT, Frank Forester's Fish and Fishing, 1850, 200.—PERLEY, Cat. Fishes New Brunswick and Nova Scotia, 1852, 5.—STORER, History Fishes Mass., 1867, 12.—GILL, Tenth Ann. Rept. Smithsonian Inst., 1847, 258.—JACKSON, Proc. Bost. Soc. Nat. Hist. (nest and habits).—HOLBROOK, Ichthy. S. C., 1860, 8.—HOLMES, Rept. on Fishes of Maine, 1862, 71.—NELSON, Rept. U. S. Fish Com. 1875-76, 699.

Pomotis catesbei, CUV. and VAL., Hist. Nat. des Poiss., vii, 1831, 469.—STORER, Syn., 1846, 291.—DEKAY, Fauna N. Y. Fishes, 1842, 33.

Pomotis ravenellii, CUV. and VAL., Hist. Nat. des Poiss., vii, 1831, 465.—DEKAY, Fauna N. Y., Fishes, 1842, 33.—STORER, Syn., 1846, 293.—JORDAN, Proc. U. S. Nat. Mus., ii, 1878, 225.

Pomotis luna, GIRARD, Proc. Acad. Nat. Sci. Phila., Nov., 1857, p. 201; U. S. Pac. R. R. Surv., 1858, 22.

Description.—Body deep, very gibbous, both dorsal and ventral outlines strongly curved; depth in adult, a little more than half its length without caudal, the head a little more than a third; eye large, 8 to 4½ in head, about equal to flap; mouth small,

the maxillary scarcely reaching to orbit; profile usually forming an angle above eye, the antedorsal region being very convex; fins well developed, the spines of the dorsal rather high—higher than in any other of our species with blue cheek stripes; the spines as long as from snout to past pupil; pectoral fins long, reaching to anal; opercular flap moderate, broad and short, bluntly rounded, black except a broad edge on the lower posterior part, which in life is always bright scarlet; in spirits this scarlet tip becomes whitish, but it is always present and is always a striking feature; fin rays; dorsal X, 10; anal III, 10; lateral line with 36 to 45 scales; coloration very variable according to the surrounding of the fish; back greenish-olive, usually dark; sides profusely spotted with orange; belly orange-yellow; lower fins orange, the upper olivaceous, with the membranes closely spotted with orange and olive, with clear blue wavy streaks; colors varying from blackish olive to a pale yellowish olive; adult specimens usually most brilliantly colored. Length 6 to 8 or 10 inches.

Habitat, this species is most abundant and best known of all the *Centrarchidæ*, and it is the one to which the name of Sun-fish is most commonly given. It is found in great abundance, throughout New England, Canada, the entire Great Lake Region, all the tributaries of the Upper Mississippi from Illinois northward; throughout the Middle States, and southward in all the streams flowing into the Atlantic, at least as far as Georgia. It seems, however, to be entirely absent in the Lower Mississippi region and in the southwest generally. Its place being taken by the allied *Eupomotis notatus*.

Diagnosis.—This species may always be known by the peculiar form and coloration of the opercular flap, in connection with the small mouth and high spines. No other species in Ohio, has a broadly rounded opercle, black, tipped with bright scarlet. Very young specimens resemble the young of some of the species of *Lepomis*, but an attentive examination will show the differences.

Habits.—In Ohio *Eupomotis gibbosus* is the most abundant of the *Centrarchidæ* in Lake Erie and its tributary streams. It also occurs in large numbers in the head waters of the Wabash, Scioto and other streams tributary to the Ohio, which have their rise in the northern portion of the State. I have, however, never seen a specimen from the Ohio River nor from the lower course of any of its larger tributaries, and I doubt if it ever occurs in these, unless introduced through the canals. The same peculiarities of local distribution may be noticed in two other species whose range is nearly co-extensive with that of the present species *Perca americana* and *Stizostedion vitreum*.

The Common Sun-fish is taken in Lake Erie in large numbers for the market. Although small it is deservedly valued as a pan-fish.

Any kind of bait large enough for it to swallow it takes with vigor and persistence.

The following account of the nest building habits of this species—which are shared to a greater or less extent by all the *Centrarchidæ*, so far as known—is given by Dr. Holbrook (Ichthyol. S. Car., p. 10):

"This fish prefers still and clear waters. In the spring, the female prepares herself a circular nest, by removing all reeds or other dead aquatic plants from a chosen spot of a foot or more in diameter, so as to leave bare the clean gravel or sand; this she excavates to the depth of three or four inches, and then deposits her spawn, which she watches with the greatest vigilance; and it is curious to see how carefully she guards this nest against all intruders; in every fish, even those of her own species, she sees only an enemy, and is restless and uneasy till she has driven it away from her nursery. We often find groups of the nests placed near each other along the margin of the pond or river that the fish inhabits, but always in very shallow water; hence they are liable to be left dry, in seasons of great drought. These curious nests are frequently encircled by aquatic plants, forming a curtain around them, but a large space is invariably left open for the admission of light."

Thoreau (Week on Concord and Merrimack) thus spoke of this fish:

"It is the most common of all, and seen on every urchin's string; a simple and inoffensive fish, whose nests are visible all along the shore, hollowed in the sand, over which it is steadily poised through the summer hours on waving fin. Sometimes there are 20 to 30 nests in the space of a few rods, two feet wide by half a foot in depth and made with no little labor, the weeds being removed, and the sand shoved up on the sides, like a bowl. Here it may be seen early in summer assiduously brooding, and driving away minnows and larger fishes, even its own species, which would disturb its ova, pursing them a few feet, and circling around swiftly to its nest again; the minnows, like young sharks, instantly entering the empty nests, meanwhile, and swallowing the spawn, which is attached to the weeds and to the bottom on the sunny side. The spawn is exposed to so many dangers that a very small proportion can ever become fishes, for besides being the constant prey of birds and fishes, a great many nests are made so near the shore, in shallow water, that they are left dry in a few days, as the river goes down. These and the Lampreys are the only fishes' nest that I have observed, though the ova of some species may be seen floating on the surface. The breams are so careful of their charge that you may stand close by in the water and examine them at your leisure. I have thus stood over them half an hour at a time and stroked them familiarly without frightening them, suffering them to nibble at my finger harmlessly, and seen them erect their dorsal fins in anger when my hand approached their ova and have even taken them gently out of the water with my hand; though this cannot be accomplished by any sudden movement, however dexterous, for instant warning is conveyed to them through their denser element, but only by letting the fingers gradually close about them as they are poised over the palm and with the utmost gentleness raising them slowly to the surface.

"Though stationary, they keep up a constant sculling or waving motion with their fins, which is exceedingly graceful, and expressive of their humble happiness, for unlike ours, the element in which they live is a stream which must be constantly resisted. From time to time they nibble the weeds at the bottom or overhanging their nests or dart after a fly or worm. The dorsal fin besides answering the purpose of a keel, with the anal, serves to keep the fish upright, for in shallow water where this is not covered, they fall on their sides.

"As you stand thus stooping over the bream in its nest, the edges of the dorsal and caudal fins have a singular dusty golden reflection, and its eyes which stand out from the head, are transparent and colorless. Seen in its native element, it is a very beautiful and compact fish, perfect in all its parts, and looks like a brilliant coin fresh from the mint. It is a perfect jewel of the river, the green, red, coppery, and golden reflec-

tions of its mottled tides being the concentration of such rays as struggle through the floating pads and flowers to the sandy bottom, and in harmony with the sunlit brown and yellow pebbles. Behind its watery shield it dwells far from many accidents inevitable to human life."

117. EUPOMOTIS NOTATUS (Agassiz) Jordan.

Pomotis notatus, AGASSIZ, Amer. Journ. Sci. and Arts, 1834, 302.—JORDAN, Man. Vert., 1876, 240.

Lepomis notatus, COPE, Proc. Amer. Philos. Soc., 1870, 453.

Xystrophites notatus, JORDAN, Ann. N. Y. Acad. Sci., i, 1877, 99; Bull. U. S. Nat. Mus., No 10, 1877, 35; Bull. Hayden's Geol. Surv., iv, 1878, 436; Bull. U. S. Nat. Mus., No. 12, 1878, 61.

Eupomotis pallidus, JORDAN, Bull. U. S. Nat. Mus., x, 1877; Man. Vert., 2d Ed., 1878, 244 (not *Pomotis pallidus*, Agassiz.)

Description—A large stout species, of an elongate form; head 3 in length; depth about $2\frac{1}{4}$; general aspect of *Lepomis pallidus*, but the mouth larger, reaching front of eye; eye large, 4 in head; iris red; scales very large, 45 in the lateral line; four rows on the cheek; spines high and strong, the longest as long as from snout to past the middle of pupil; pectoral fins long, but not reaching anal; gill-rakers stronger than in *E. gibbosus*, much more strongly dentate; the pharyngeal bones as in that species are broad and strong, covered with large subtruncate teeth; color in spirit pale brassy green, without traces of blue or orange; opercular flap short and rounded, shorter than in *Eupomotis gibbosus*, black, with a wide pale border chiefly below and behind.

Habitat, Lower Mississippi Valley, the specimens described from the Mississippi Valley at St. Louis. Others examined from Alabama River (Bean coll.). Agassiz's types were from the Tennessee River in Alabama. Some of these sent to me by Professor Garman, belong to the present species formerly erroneously identified by me with the *Pomotis pallidus* of Agassiz. This species probably occurs in the Ohio River in Ohio, but no specimens from this State are on record.

Diagnosis.—This Sun-fish resembles among Ohio species *Lepomis pallidus*, from which it may be known by the paved teeth and by the coloration of the ear flap.

GENUS 64. LEPOMIS. Rafinesque.

Lepomis, RAFINESQUE, Journal de Physique, etc., 1819, (type *Labrus auritus*, Linnæus, and of Gill, Cope, and many recent writers, not of Rafinesque, 1820).

Pomotis, RAFINESQUE, Journal de Physique, etc., 1819 (same type); Ich. Ohiensis, 1820 (not of Holbrook and recent writers).

Apomotis, RAFINESQUE, Journal de Physique, etc. (*cyanelus*).

Ichthelis, RAFINESQUE, Ich. Ohiensis, 1820 (*auritus*).

Telipomis, RAFINESQUE, Ich. Ohiensis, 1820 (*cyanelus*).

Bryttus, CUVIER and VALENCIENNES, Hist. Nat. Poiss. (*punctatus*).

Ichthelis, HOLBROOK, Ich. S. Car., 1860 (*auritus* and *pallidus*).

Calliurus and *Bryttus*, GIRARD, U. S. Pac. R. R. Surv., 1858.

Lepiopomus, JORDAN, Ann. N. Y. Lyceum Nat. Hist., 1877 (corrected orthography).

Xenotis, JORDAN, Proc. Acad. Nat. Sci., 1877, 76 (*fallax*).

Xystroplites, JORDAN, Bull. U. S. Nat. Mus., x, 1878 (*gilli*).

Helioperca, JORDAN, Ann. N. Y. Lyc. Nat. Hist (*pallidus*).

Type, *Labrus auritus*, L.

Etymology, *lepis*, scales; *poma*, opercle.

Dorsal fin much more developed than anal, its base twice or more that of the latter the soft parts of the two about equal and terminating at the same vertical behind; dorsal spines ten; anal spines three; caudal fin emarginate; mouth moderate or rather large, with equal jaws; maxillary with a supplemental bone, which in some species is very minute or obsolete; pharyngeal bones with conic teeth which are usually, but not always sharp; palatine teeth present or obsolete; no teeth on the tongue or pterygoids; gill-rakers comparatively short, sometimes very weak; operculum with a rounded flap which is usually more or less elongate. Species of moderate or small size, usually brightly colored. The number of species is quite large and there is considerable diversity of form among them.

Synonymy.—The synonymy of this genus has been complicated in several ways. In the first place the typical species, *Labrus auritus*, was very poorly described by Linnæus, so that it can be only identified by circumstantial evidence. The name has been often but in my opinion erroneously referred to *Eupomotis gibbosus*. The genus *Lepomis* was framed in 1819, to include all the Sun-fishes, but the *Labrus auritus*, L. was expressly indicated as its type. The sub-genus *Pomotis* was proposed to include this typical species and such others as had long opercular flaps. In 1820, Rafinesque without assigning any reason changed the name of his genus of Sun-fishes from *Lepomis* to *Ichthelis*, and transferred the name *Lepomis* to the Black Bass. It will be evident from the above that the name *Pomotis* and *Ichthelis* of Rafinesque, being simple synonyms of *Lepomis* cannot be used for any of our genera of Sun-fishes so long as *Lepomis* is available. A more extended study of this group leads me to doubt the propriety of the numerous subdivisions of this genus, formerly admitted by me. The following observations of Mr. McKay on the genus *Lepomis* (Proc. U. S. Nat. Mus., 1880, 88), I quote with full endorsement:

"This genus as understood by me, includes *Apomotis*, *Xenotis*, *Bryttus*, *Helioperca*, *Xystroplites*, and *Eupomotis* of authors. *Apomotis* has been separated from *Lepomis* on account of the large size of the supplemental maxillary. On careful comparison, this is found to be scarcely larger than in one or two other species of *Lepomis*. It disappears by degrees, but seems to exist in all of the species, though so small as to be inappreciable. I have even found it present in large specimens of *L. pallidus*. Its presence in the species is only a character of degree, therefore not generic. Till the group had been more fully studied, *Xenotis* was supposed to contain a large number of species, and was separated from *Lepomis* principally for convenience sake, and on the slight character of the feeble gill-rakers. By comparison of a very large series of the alleged species from Professor Jordan's collection, I have come to the conclusion that they are all forms of single species (*L. megalotis*). The gill-rakers are usually rather more feeble than in the rest of the species of *Lepomis*, but this again is a question of degree. *Bryttus* has been distinguished from *Lepomis* by the presence of palatine teeth. This is also a question of degree and is subject to the most perfect gradation. I have found it impossible to retain *Xystroplites* and *Eupomotis* also, as there is a complete gradation in the character of the pharyngeals, between *Lepomis* proper and *Xystroplites*, and again between *Xystroplites* and *Eupomotis*, both as to the width and form of the bones themselves and the form of the teeth."

118 LEPOMIS MEGALOTIS (Rafinesque) Cope.

Long-eared Sun-fish; Red-bellied Bream.

- Ichthelis aurita*, RAFINESQUE, Ichth. Oh., 1820, 29.
- Lepomis auritus*, COPE, Journ. Acad. Nat. Sci. Phila., vi, 1869, 221.
- Ichthelis megalotis*, RAFINESQUE, Ichth. Oh., 1820, 29.—JORDAN, Man. Vert., 1876, 237.—NELSON, Cat. Fishes Ill., 1876, 38.
- Lepomis megalotis*, COPE, Journ. Acad. Nat. Sci. Phila., vi, 1869, 220.
- Xenotis megalotis*, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 36; Ann. N. Y. Acad. Sci., i, No. 4, 1877, 93; Bull. Hayden's Geol. Surv., iv, 1878, 436; Bull. U. S. Nat. Mus., No. 12, 1878, 76; Man. Vert., 1878, 242.
- Pomotis nitida*, KIRTLAND, Bost. Journ. Nat. Hist., iii, iv, 1841, 472.—STORER, Syn., 1841, 294.
- Lepomis nitidus*, COPE, Proc. Amer. Philos. Soc., 1870, 453.
- Pomotis breviceps*, BAIRD and GIRARD, Proc. Acad. Nat. Sci., Phila., vi, 1853, 309.—GIRARD, U. S. P. R. R. Surv., 1858, 23; Marcy's Expl. Red River, La., 1853, pl. xiii, 246.
- Xenotis breviceps*, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 36; Bull. Hayden's Geol. Surv., iv, 1878, 436.
- Pomotis aquilensis*, BAIRD and GIRARD, Proc. Acad. Nat. Sci. Phila., vi, 1853.—GIRARD, U. S. Pac. R. R. Surv., 1858, 25; Ichth. Mex. Bound., 1859, 7.
- Xenotis aquilensis*, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 36.
- Pomotis fallax*, BAIRD and GIRARD, Proc. Acad. Nat. Sci. Phila., vii, 1854, 24.—GIRARD, U. S. Pac. R. R. Surv., 1858, 27; Ichth. Mex. Bound., 1859, 8.
- Ichthelis fallax*, JORDAN, Man. Vert., 1876, 238.
- Xenotis fallax*, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 36; Bull. Hayden's Geol. Surv., iv, 1878, 436.
- Pomotis convexifrons*, BAIRD and GIRARD, Proc. Acad. Nat. Sci., Phila., vii, 1854, 24.
- Pomotis nefastus*, BAIRD and GIRARD, Proc. Acad. Nat. Sci. Phila., vii, 1854, 24.
- Pomotis hæmatodes*, (Agassiz Mss.), WAILES, Rept. on Agric. and Geol. Miss., 1854, 331.
- Pomotis sanguinolentus*, AGASSIZ, Am. Journ. Sci. and Arts, 1854, 304.
- Ichthelis sanguinolentus*, JORDAN, Man. Vert., 1876, 238.—NELSON, Cat. Fishes Ill., 1876, 36.
- Xenotis sanguinolentus*, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1876, 23, 36; Ann. N. Y. Acad. Sci., i, No. 4, 1877, 98; Man. Vert., 1878, 242; Bull. U. S. Nat. Mus., No. 12, 1878, 31, 46, 61; Bull. Hayden's Geol. Surv., iv, 1878, 436.—BEAN, Proc. U. S. Nat. Mus., ii, 1879, 285; U. S. Nat. Mus., 1880, 98.
- Pomotis inscriptus*, AGASSIZ, Amer. Journ. Sci. and Arts, 1854, 302.
- Lepomis inscriptus*, COPE, Acad. Nat. Sci. Phila., vi, 1869, 221, 225.
- Ichthelis inscriptus*, JORDAN, Man. Vert., 1876, 237.—NELSON, Cat. Fishes Ill., 1876, 38.
- Xenotis inscriptus*, JORDAN, Ann. N. Y. Acad. Sci., i, 1877, 93; Bull. U. S. Nat. Mus., No. 10, 1877, 33, 42; Man. Vert., 1878, 243; Bull. U. S. Mus., No. 12, 1878, 46, 61; Bull. Hayden's Geol. Surv., iv, 1878, 436.
- Pomotis popeii*, GIRARD, U. S. Pac. R. R. Surv., 1858, 26.
- Xenotis popeii*, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 36; Bull. Hayden's Geol. Surv., 1878, 436.
- Lepomis oculatus*, COPE, Journ. Acad. Nat. Sci. Phila., vi, 1869, 221.
- Lepiopomus oculatus*, JORDAN, Ann. N. Y. Acad. Sci., i, 1877, 99.
- Lepomis peltastes*, COPE, Proc. Amer. Philos. Soc. 1870, 434.

Xenotis peltastes, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 36; Ann. N. Y. Acad. Sci., i, 1877, 98; Man. Vert., 1878, 243; Bull. Hayden's Geol. Surv., iv, 1878, 436.—BEAN, U. S. Nat. Mus., 1880, 98.

Ichthelis macrochira, JORDAN, Man. Vert., 1876, 236 (not of Rafinesque).—NELSON, Cat. Fishes Ill., 1876, 38.

Ichthelis anagallinus, NELSON, Cat. Fishes Ill., 1876, 38 (*nec* Cope).

Xenotis solis, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 22, 36 (*nec* Cuv. and Val.); Bull. Hayden's Geol. Surv., iv, 1878, 436.

Xenotis lythrochloris, JORDAN, Bull. U. S. Nat. Mus., ix, 1877; Bull. U. S. Nat. Mus., 10, 1877, 40; Ann. Acad. Sci. N. Y., i, 1877, 98.

Xenotis aureolus, JORDAN, Bull. Hayden's Geol. Surv., iv, 1878; Bull. U. S. Nat. Mus., No. 10, 1877, 36, 41; Man. Vert., 1878, 243.

Description.—Body deep and rather short, the occiput depressed, and the profile high and strongly curved; dorsal outline convex; depth more than half the length; head with flap a little less; eye $1\frac{1}{2}$ in flap; dorsal spines low, lower than in the other species except *L. cyanellus*, in adults shorter than from snout to middle of eye; pectorals not reaching vent; opercular flap very long in adult, always with a broad pale edge which is pinkish behind and bluish in front; in young specimens the flap exhibits every stage of development, no two individuals being alike in this respect; colors very brilliant, more so than in any other of our Sun-fishes, but fading rapidly after death. The general color of an adult specimen is brilliant blue and orange, the black chiefly blue, the belly entirely orange, the orange forming irregular longitudinal rows of spots, the blue in wavy vertical lines along the series of scales; vertical fins with the soft rays blue and the membranes orange, sometimes fiery red; ventral and anal dusky blue, appearing blackish when folded; lips blue; cheeks with blue and orange stripes; top of head and neck black; iris bright red; fins unspotted; young specimens with the ear-flap small, and the coloration variously dull; D. X, 10; A. III, 10; lat. l. 40.

Habitat: This species occurs in great abundance throughout the Ohio Valley, and, rather more sparingly in tributaries of Lake Erie, Lake Michigan, and the Upper Mississippi.

Diagnosis.—Among Ohio species, when fully grown, it may usually be known by the large ear-flap which always has a pale margin. The young fishes may best be known by the small and feeble gill-rakers. No other of our fresh-water fishes appears in a greater variety of forms and it is not surprising that such a long array of nominal species should have been based on it.

Habits.—This species seems to prefer deep still places in rivers and clear ponds, avoiding muddy water and small brooks. It reaches a length of six to eight inches, takes the hook readily, and is of some value as a pan-fish.

119. LEPOMIS HUMILIS (Girard) Cope.

Orange-spotted Sun-fish.

Bryttus humilis, GIRARD, Proc. Acad. Nat. Sci. Phila., Nov., 1857; U. S. Pac. R. R. Surv., 1858, 21.

Lepomis humilis, COPE, Journ. Acad. Nat. Sci. Phila., 1868, 223.

Lepiopomus humilis, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 35; Bull. Hayden's Geol. Surv., iv, 1878, 435.

Lepomis anagallinus, COPE, Journ. Acad. Nat. Sci. Phil., vi, 1869, 221.

Ichthelis anagallinus, JORDAN, Man. Vert., 1876, 237.

Lepiopomus anagallinus, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 35; Ann. N. Y. Acad. Sci., i, 1877, 99; Man. Vert., 1878, 240; Bull. Hayden's Geol. Surv., iv, 1878, 435.

Description.—A small, elongate, brightly colored species, resembling somewhat the young of *Lepomis cyanellus*; depth $2\frac{1}{2}$ in length; head about 3; caudal peduncle and fin more than one-third the total length; mouth rather large; mucous cavities large; gill-rakers long, about as in *Lepomis cyanellus*; scales large; 33 to 36 in the course of the lateral line; fins well developed; dorsal spines rather high, the longest as long as from snout to past the pupil; coloration brilliant; general color greenish, the fins and sides with mottlings of a darker green (a very characteristic feature); sides in adults with many very distinct salmon red spots, very conspicuous in life, slowly fading in spirits; opercular flap rather large, with a very wide crimson border which entirely surrounds the black; no blue cheek stripes; a black dorsal spot (on Cope's type, and on specimens in the Smithsonian Institution from Indian Territory; my Kentucky specimens, however, do not show it). Length three inches.

Habitat, Kentucky to Kansas (Cope, type). Missouri (Cope), Salt River, Kentucky (Jordan, extremely abundant, many specimens sent by Mr. W. M. Linney), Indian Territory (specimens in U. S. Nat. Mus.). *Lepomis humilis* has not yet been noticed in Ohio, but it doubtless occurs in small rocky streams in the southern part of the State.

Diagnosis.—This is our smallest Sun fish, and one of the most brilliantly colored; the very wide red margin of the ear-flap, and the green mottling of the vertical fins, easily distinguish it in connection with the long gill-rakers. It is of little value as food from its small size.

120. LEPOMIS MACROCHIRUS Rafinesque.

Chain-sided Sun-fish.

Lepomis macrochirus, RAFINESQUE, Journ. de Phys., 1819, 420.

Ichthelis macrochira, RAFINESQUE, Ichth. Oh., 1820, 26.

Lepiopomus macrochirus, JORDAN, Ann. N. Y. Acad. Sci., i, 1877, 99; Bull. U. S. Nat. Mus., No. 10, 1877, 35; Bull. Hayden's Geol. Surv., iv, 1878, 435; Man. Vert., 1878, 239.

Lepomis nephelus, COPE, Journ. Acad. Nat. Sci., Phila., vi, 1869, 222.

Chænobryttus nephelus, JORDAN, Man. Vert., 1876, 235.

Telipomis nephelus, NELSON, Cat. Fishes Ill., 1876, 37.

Description.—Small, bright-colored species of a regularly oblong form; depth 2.2-5 in length; mouth large, larger than in most of the species of this genus, approaching that of *L. cyanellus*; head somewhat pointed; mucous cavities large; scales moderate, about 42 in the lateral line, 5 rows on the cheeks; fins well developed; pectorals elongate, reaching anal; dorsal spines rather high, much as in the preceeding species; coloration in life, bright with lustre; general color a brilliant steel-blue with many dark bronze-orange spots so arranged that the ground color forms a series of vertical chain-like bars very conspicuous in life; soft rays of the vertical fins mottled with brown and the anal more

or less edged with pale orange; no black dorsal spot; no blue cheek-stripes, but the sides of head with a purplish lustre; opercular flap small, bordered below with silvery. In spirits the coloration is that of a young *Chænobryttus antistius*, closely spotted or clouded with brown, so that the pale ground color appears in irregular vertical chain-like bars. The young resembles that of *Eupomotis gibbosus* very much, and older specimens look like the young of *Chænobryttus*. In both cases, the generic character will serve for identification. This species reaches a length of about four inches.

Habitat, Ohio and Mississippi Valleys from Pennsylvania to Illinois, Kiskiminitas River, Western Pennsylvania (Cope), White River (Jordan), Ohio River (Rafinesque, Jordan), Illinois River (Forbes, Nelson, Jordan).

Diagnosis.—The chain-like bars and peculiar mottled coloration best distinguish this species. The large mouth is also a point of importance. This fish is of no value as food, but its activity, hardiness, voracity and beauty commend it as an inhabitant of the aquarium.

Lepomis macrochirus, although one of the very earliest described of our Sun-fishes has been overlooked by most late writers. It is not by any means rare, but it is somewhat select in its localities, preferring clear weedy ponds and streams.

121. LEPOMIS PALLIDUS (Mitchill) Gill and Jordan.

Blue Sun-fish; Copper-nosed Bream; Dollar-dee.

Labrus pallidus, MITCHILL, Trans. Lit. and Philos. Soc. N. Y. 1814, 407.

Lepomis pallidus, GILL and JORDAN, Field and Forest, 1877.—NELSON, Rept. U. S. Fish Com., 1875-76, 790, 756.—BEAN, Proc. U. S. Nat. Mus., 1880, 97.—JORDAN, Man. Vert., 3d Ed., 241.

Leptopomus pallidus, JORDAN, Ann. N. Y. Lyc. Nat. Hist., 1876, 316; Ann. N. Y. Acad. Sci., i, 1877, 99; Bull. U. S. Nat. Mus., No. 10, 1877, 35; Man. Vert., 1878, 241; Bull. U. S. Nat. Mus., No. 12, 1878, 40, 46, 60, 76; Bull. Hayden's Geol. Surv., iv, 1878, 436.

Helioperca pallida, GILBERT, Ohio Fish Com., 1877, 80.—JORDAN, Ann. N. Y. Lyc. Nat. Hist., 1876, 355.

Lepomis appendix, MITCHILL, Suppl. to Mem. Fishes N. Y. 1818, 217.

Pomotis incisor, DEKAY, Fauna N. Y., Fish., 1842, 33.—STORER, Syn., 1846, 293.—AGASSIZ, Amer. Journ. Sci. and Arts, 1854, 302.—WAILLES, Report on Agric. and Geol. Miss., 1854, 334.

Ichthelis incisor, HOLBROOK, Ichthy. S. C., 1860, 12.—PUTNAM, Bull. M. C. Z., 1863, 6.—JORDAN, Man. Vert., 1876, 235.—NELSON, Cat. Fishes Ill., 1876, 36.—ABBOTT, Rept. U. S. Fish Com., 1875-76, 838.

Lepomis incisor, GILL, Amer. Journ. Sci. and Art., 1864, 93.

Leptopomus incisor, GOODE, Proc. U. S. Nat. Mus., ii, 1879, 114.—GOODE and BEAN, Proc. U. S. Nat. Mus., ii, 1879, 139.

Pomotis gibbosus, CUV. and VAL., Hist. Nat. Poiss., vii., 1831, 467.—DEKAY, Fauna N. Y. Fishes, 1842, 33.—STORER, Syn., 1846, 293.—JORDAN, Proc. U. S. Nat. Mus., ii, 1879, 225.

- Pomotis macrochira*, KIRTLAND, Bost. Journ. Nat. Hist., iii, iv, 1841, 469 (*nec* Raf.)
- Pomotis speciosus*, BAIRD and GIRARD, Proc. Acad. Nat. Sci. Phila., vii, 1854, 24.—GIRARD, U. S. P. R. R. Surv., 1858, 23; Ichth. Mex. Bound. 1859, 5.—GUNTHER, Cat. Fishes Brit. Mus., i, 1859, 263.
- Lepomis speciosus*, COPE, Proc. Amer. Philos. Soc., 1870, 453.
- Ichthelis incisor*, var.? *speciosus*, JORDAN, Man. Vert., 1876, 236.
- Ichthelis speciosus*, NELSON, Cat. Fishes Ill., 1876, 37,
- Pomotis obscurus*, AGASSIZ, Amer. Journ. Sci. and Arts, 1854, 302.
- Ichthelis incisor*, var.? *obscurus*, JORDAN, Man. Vert., 1876, 236.
- Lepiopomus obscurus*, JORDAN, Ann. N. Y. Lyc. Nat. Hist., 1876, 317; Ann. N. Y. Acad. Sci., i, 1877, 99; Bull. U. S. Nat. Mus., No. 10, 1877, 35; Bull. U. S. Nat. Mus., No. 12, 1878, 56, 60, 76; Man. Vert., 1878, 242; Bull. Hayden's Geol. Surv., iv, 1878, 436,
- Lepomis megalotis*, a, COPE, Journ. Acad. Nat. Sci., Phila., vi, 1869, 220 (*nec* Raf.); Proc. Amer. Philos. Soc., 1870, 452.
- Lepomis longispinis*, COPE, Journ. Acad. Nat. Sci. Phila., vi, 1869, 220.
- Lepomis ardesiacus*, COPE, Journ. Acad. Nat. Sci. Phila., vi, 1869, 222.
- Lepomis purpureus*, COPE, Proc. Amer. Philos. Soc., 1870, 454.

Description.—This species is the most widely diffused of all our Sun-fishes and it is everywhere one of the most abundant. Like *Lepomis megalotis* it is subject to very great variations in form, coloration, and general appearance, yet it is usually, of all Sun-fishes, the species most readily recognized. The body is deep and compressed, rather elongate, with slender caudal peduncle when young; short, deep and almost orbicular in very old specimens; the head is moderate, about one-third the length, with short snout, large eye, and steep, though usually concave profile; the depth of the body is about half the length, in old specimens somewhat more; the mouth is quite small, the maxillary not reaching eye; the opercular flap is large, entirely black, with a narrow margin at base, nearly as broad as long in adults; in young specimens the flap is usually quite small and broader than long; fin large; dorsal spines very high, often higher than soft rays in young, their length about equal to the distance from snout to posterior margin of eye; pectoral fins very long and falcate, reaching beyond beginning of anal; scales moderate; those on cheeks in about 6 rows; lateral-line with 45 to 48; coloration, adults dark olive or bluish-green; belly and lower parts more or less coppery; no blue stripes on the cheek; a large dusky or "inky" spot on the last rays of dorsal and anal; specimens in spirits are usually nearly uniform pale olive or even silvery; young specimens show several undulating or chain-like transverse olive bars and a bright purplish lustre in life. Length 6 to 10 inches, rarely longer.

Habitat, entire Great Lake Region. Mississippi Valley and all streams of the Gulf States. Also in all Atlantic streams from Delaware River to Florida, everywhere abundant. Throughout Ohio, it occurs in abundance in small ponds, large specimens are, however, rarely found except in the Lake and larger rivers.

Diagnosis.—This species may be known under all circumstances by the dusky blotch on the last rays of the dorsal in connection with high spines and the absence of blue stripes on the cheek.

Habits.—In the Lakes where it attains a large size it is valued as a pan fish, ranking with *Ambloplites rupestris* and *Eupomotis gibbosus*. It abounds in every stream in Ohio.

122. LEPOMIS CYANELLUS Rafinesque.

Green Sun-fish ; Red-eye.

- Lepomis cyanellus*, RAFINESQUE, Journ. de Phys., 1819, 420.
Ichthelis cyanella, RAFINESQUE, Ichth. Oh., 1820, 27.
Chænobryttus cyanellus, JORDAN, Man. Vert., 1876, 234.
Telopomis cyanellus, NELSON, Cat. Fishes Ill., 1876, 37.
Apomotis cyanellus, JORDAN, Ann. N. Y. Acad. Sci., i, 1877, 100; Bull. U. S. Nat. Mus., No. 10, 1877, 35; Bull. U. S. Nat. Mus., No. 12, 1878, 76; Bull. Hayden's Geol. Surv., iv, 1878, 435; Man. Vert., 1878, 239.—BEAN, Proc. U. S. Nat. Mus., 1880, 97.
Ichthelis melanops, RAFINESQUE, Ichth. Oh., 1820, 27.
Lepomis melanops, COPE, Journ. Acad. Nat. Sci. Phila., vi, 1869, 22.
Chænobryttus melanops, COPE, Proc. Am. Philos. Soc., 1870, 452.
Chænobryttus cyanellus, var. *melanops*, JORDAN, Man. Vert., 1st Ed., 1876, 234.
Pomotis longulus, BAIRD and GIRARD, Proc. Acad. Nat. Sci., Phila., vi, 1853, 391.—GIRARD, in Marcy's Expl. Red River, La., 1853, 245, pl. xii.
Calliurus longulus, GIRARD, Ichth. Mex. Bound., 1859, 5; U. S. P. R. R. Surv., 1858, 16.
Bryttus longulus, BAIRD and GIRARD, Proc. Acad. Nat. Sci. Phila., vii, 1854, 25.—GUNTHER, Cat. Fishes, Brit. Mus., i, 1859, 258.
Calliurus diaphanus, GIRARD, Proc. Acad. Nat. Sci. Phila., Nov., 1857; U. S. Pac. R. R. Surv., 1858, 13.
Calliurus formosus, GIRARD, Proc. Acad. Nat. Sci. Phila., Nov., 1857, 200; U. S. P. R. R. Surv., 1858, 14.
Calliurus microps, GIRARD, Proc. Acad. Nat. Sci. Phila., Nov., 1857; U. S. P. R. R. Surv., 1858, 17.
Lepomis microps, COPE, Journ. Acad. Nat. Sci. Phila., 1869, 222.
Telopomis microps, NELSON, Cat. Fishes Ill., 1876, 37.
Bryttus signifer, GIRARD, Proc. Acad. Nat. Sci. Phila., Nov., 1857; U. S. P. R. R. Surv., 1858, 20.
Apomotis signifer, JORDAN, Bull. U. S. Nat. Mus., No. 10, 1877, 35; Bull. Hayden's Geol. Surv., iv, 1878, 435.
Lepomis mineopas, COPE, Journ. Acad. Nat. Sci., Phila., vi, 1869, 223.
Chænobryttus mineopas, COPE, Proc. Am. Philos. Soc., 1870, 452.

Description—Body oblong, varying to elongate, often short and deep, especially in northern specimens, the depth usually about $2\frac{1}{2}$ in length; the head about 3; mouth pretty wide, the maxillary reaching nearly to middle of eye; lower jaw rather longest; fins rather small, the dorsal spines very low, the longest scarcely longer than snout; scales always small, about 46 in the course of the lateral line; opercular flap short and small, less than eye, broadly margined with pinkish, the black confined to the bony part of the flap; colors extremely variable, the prevailing shade usually green, with a strong brassy lustre on sides, becoming usually yellow below; often nearly all deep green, often with the blue predominating, sometimes in northern specimens nearly black; each scale usually with a sky blue spot and more or less of gilt edging, which gives an appearance of pale lines along the sides; besides the blue spots, some specimens, usually young or half-grown ones, are crossed by vertical bars of a brassy olive, or sometimes almost black color; many adults are further marked by sprinklings of black dots; vertical fins marked with green and blue, the anal almost edged in front with pale orange; in very young specimens, the vertical fins are of a dull red color; ventrals usually yel-

lowish; iris red; cheeks with narrow wavy stripes of bright blue; usually a round black spot on last rays of dorsal and anal behind, the latter, and sometimes both, obsolete. A species extremely variable both in form and coloration, yet easily recognizable at sight. As is the case in many species, specimens from tributaries of Lake Michigan in Wisconsin are deeper-bodied and darker-colored than those from the Ohio River. This species reaches a length of about eight inches, but they are usually seen of a much smaller size.

Habitat: *Lepomis cyanellus* abounds throughout the entire Mississippi Valley and in all the streams tributary to the Gulf of Mexico. It occurs more sparingly in the tributaries of the Great Lakes, and has not been noticed at all east of the Mountains. Throughout the Ohio Valley, it is one of the most abundant of fishes, occurring in every pond, and ascending small streams, where in may be found lurking in deep holes and under every projecting root. It is too small to be of much account as a food fish and is valued chiefly by the boy.

Diagnosis.—The elongated body, large mouth and low spines at once distinguish this species. It is the only species in Ohio which has but three anal spines, and a distinct supplemental maxillary bone, which has no teeth on the tongue.

GENUS 65. CHÆNOBRYTTUS. Gill.

Calliurus, AGASSIZ, Am. Journ. Sci. and Arts, 1854 (not Raf.).

Chænobryttas, GILL, Am. Journ. Sci. and Arts, 1864, 92.

Glossoplites, JORDAN, Man. Vert., 1876, 233.

Type, *Calliurus melanops*, Girard, = *Pomotis gulosus* C. & V.

Etymology, *chaino*, to yawn; *bryttus*, an allied genus = *Apomotis*.

Dorsal fin much more developed than anal fin, its base about twice that of the latter, the soft parts of the two fins nearly equal and terminating at the same vertical behind; dorsal spines strong, ten in number; anal spines three; caudal fin emarginate; dorsal fins not notched; mouth very large, the maxillary reaching to opposite the posterior margin of the eye, very broad and flat, with a very large supplemental bone; palatine teeth very strong; a conspicuous patch of teeth on the tongue and on the pterygoid bones; gill-rakers long, very strong, armed with strong teeth; opercle ending behind in a large but rather short rounded process or flap; lower jaw longest; body stout, heavy, moderately elongate; aspect and dentition of *Ambloplites*. This genus contains so far as is known but two species, both large, stout Sun-fishes, voracious in habit, resembling Bass. The second species, *Chænobryttus gulosus* (Cuv. and Val.) Cope, occurs only in the South Atlantic and Gulf States.

123. CHÆNOBRYTTUS ANTISTIUS McKay.

War-mouth; Wide-mouth Sun-fish; Black Sun-fish; Red-eyed Bream.

Chænobryttus gulosus, COPE, Proc. Acad. Nat. Sci. Phila., 1865, 84 (Michigan, not *Centrarchus gulosus*, Cuv. and Val.).—JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 43; Ann. Lyc. Nat. Hist. N. Y., 1877, —; Bull. U. S. Nat. Mus., x, 1877, —; Man. Vert., 2d Ed., 237.

Lepomis gulosus, COPE, Journ. Acad. Nat. Sci. Phila., 1869, 223.

Chænobryttus melanops, NELSON, Bull. Ills. Mus. Nat. Hist., 1876, (not *Calliurus melanops*, Grd.).

Glossoplites melanops, JORDAN, Man, Vert., 1876, 223, 317.

Chænobryttus antistius, MCKAY, Proc. U. S. Nat. Mus., 1881, 88.

Description.—Body heavy, deep and thick, stouter and thicker than in the southern *Chænobryttus gulosus*; depth $2\frac{1}{2}$ in length; head about $2\frac{3}{4}$; mouth large, its maxillary reaching nearly to posterior margin of eye—the supernumerary bone strong; scales on the cheeks in 7 to 9 rows, rather smaller than in *gulosus*; mucous pores about head very large; opercular flap rather large and broad but not long; dorsal inserted anteriorly, the first spine being over the ear-flap; spines very stout, the longest as long as from snout to middle of eye; color in spirits very dark, almost black; three oblique bands across the cheeks and a black opercular spot, pale-margined below, as large as the eye; young specimens are profusely mottled, as are the young of *Ambloplites*, and further-marked with vertical chains of spots; in life, adults dark olive-green above, sides greenish and brassy, with blotches of pale blue and bright coppery red, the red predominating; belly bright brassy yellow, profusely mottled with bright red; lower jaw chiefly yellow; iris bright red; opercular spot as large as eye, black, bordered below with copper color; 3 or 4 wide dark red bands radiating backward from across cheeks and opercles; separated by narrow pale blue interspaces; upper fins barred with black, orange, and blue, the former color predominating; lower fins dusky; a small black spot on last rays of dorsal, with a few dusky specks around it. This species is best distinguished from *Ch. gulosus*, by the position of the dorsal, the first spine being situated over the opercular lobe, while in *C. gulosus* the first spine is situated directly over the posterior portion of the base of the pectorals. Length 8 to 12 inches.

Habitat, Lake Michigan. Mississippi Valley, chiefly northwestward. Michigan (Cope), Lake Michigan (Jordan), Illinois River (Forbes, Nelson), Wabash River (Jordan).

This species has not yet been recorded from Ohio, but it doubtless occurs in the western part of the State and in the Ohio River.

It is a stout, voracious species, strongly resembling the Rock Bass. It is "gamey," and is, where abundant as in the Upper Mississippi, valued as a pan-fish. All the specimens examined from the Gulf States, belong to the allied species or variety *C. gulosus*.

Diagnosis.—This is the only one of our Ohio fishes which has teeth on the tongue, three spines in the anal fin, and ten in the single dorsal fin.

GENUS 66. AMBLOPLITES. Rafinesque.

Ambloplites, RAFINESQUE, Ich. Oh., 1820, 83.—AGASSIZ, Am. Journ. Sci. and Arts, 1854, —.

Centrarchus, CUV. and VAL., 1831, and of many authors.

Type, *Lepomis ichtheloides*, Raf. = *Bodianus rupestris*, Raf.

Etymology, *ambulus*, blunt; *oplites*, armed.

Dorsal fin much more developed than anal fin, the soft parts of the two fins about equal and terminating at the same vertical behind; dorsal fin with 11 or 12 (10 to 13) spines; anal normally with 6 (5 to 7); caudal fin emarginate; scales ctenoid; mouth large, teeth on vomer, palatine and pterygoid bones; a single large patch of teeth on

the tongue; lower jaw longest; a well-developed supplemental maxillary bone; gill-rakers long and strong, about ten of them on the anterior arch longer than the rest, and armed with teeth; operculum without flap, ending in two flat points.

The synonymy of this genus requires no special remark. The name *Ambloplites* was first suggested by Rafinesque as a sub-genus of his *Lepomis* (1820, *micropterus*) but without characterization of any importance. In 1854, the genus was first established and characterized by Prof. Agassiz who retained Rafinesque's name as by the laws of nomenclature he was obliged to do. But one species of *Ambloplites* is certainly known.

124. AMBLOPLITES RUPESTRIS (Rafinesque) Gill.

Rock Bass; Goggle-eye; Red-eye; Lake Bass.

Bodianus rupestris, RAFINESQUE, Amer. Month. Mag. and Crit. Rev., 1817, 120.

Ambloplites rupestris, GILL, Proc. Acad. Nat. Sci. Phila., 1860, 20.—COPE, Journ. Acad. Nat. Sci. Phila., vi, 1869, 217; Proc. Amer. Philos. Soc., 1870, 451.—GILBERT, Ohio Fish Com., 1878, 79.—NELSON, Rept. U. S. Fish Com., 1875-76, 790, 792, 796.—JORDAN, Man. Vert., 1876, 231; Ann. N. Y. Acad. Sci., i, 1877, 100; Bull. U. S. Nat. Mus., No. 10, 1877, 34; Man. Vert., 1878, 237; Bull. Hayden's Geol. Surv., iv, 1878, 435; Bull. U. S. Nat. Mus., No. 12, 1878, 40, 46, 60, 75.—GOODE, Proc. U. S. Nat. Mus., ii, 1879, 114.—BEAN Proc. U. S. Nat. Mus., 1880, 97, and of all recent American writers.

Ichthelis erythrope, RAFINESQUE, Ichth. Ob., 1820, 29.

Cichla aenea, LESURUR, Journ. Acad. Nat. Sci. Phila., 1823, 214.

Centrarchus aeneus, CUV. et VAL., iii, 1829.—KIRTLAND, Zool. Ohio, 1838, pp. 168, 191.—DEKAY, Fauna N. Y., Fishes, 1842, 27.—THOMPSON, Hist. of Vermont, 1842, 31.—STORER, Syn., 1846, 289.—GUNTHER, Cat. Brit. Mus., i, 1859, 256.

Ambloplites aeneus, GIRARD, U. S. P. R. R. Surv., 1858, 8.

Centrarchus pentacanthus, CUV. et VAL. iii., 1829, 88.—DEKAY, Fauna N. Y., Fish., 1842, 30.—STORER, Syn., 1846, 290.

? *Ambloplites cavifrons*, COPE, Journ. Acad. Nat. Sci. Phila., vi, 1869, 217.—JORDAN, Man. Vert., 1876, 231; Bull. U. S. Nat. Mus., No. 10, 1877, 34; Bull. Hayden's Geol. Surv., iii, 1878, 435; Man. Vert., 1878, 237.

Description.—Body oblong, the depth about $2\frac{1}{2}$ in length; head 3 in length, the profile convex, eye about equal to snout, $3\frac{1}{2}$ to $3\frac{3}{4}$ in head, about equal to length of opercle; cheeks with about eight rows of scales and a naked area; dorsal spines stout, rather low; D. XI, 11; A. VI, 10; lateral line with about 40 scales; general color, a brassy olive-green, with much dark mottling, the young irregularly blotched with black, the adult more uniformly colored, each scale with a squarish dusky blotch, these forming more or less distinct longitudinal stripes; fins dark olive the soft rays more or less barred; iris red. This species reaches the length of about a foot.

Habitat, Vermont and Lower Canada to Great Lake Region. Minnesota. Dakota, and southward to Texas; chiefly west of the Alleghanies.

Diagnosis.—This species may be known at once as the only one in Ohio having 10 to 12 spines in the dorsal and 5 to 7 in the anal.

Habits.—This familiar fish is abundant in all streams, lakes and ponds of Ohio. Like all the larger *Centrarchidæ* it is an excellent pan fish, and

is deservedly valued as food. It is a free biter, but anglers consider it destitute of game. It is recommended for propagation in ponds.

GENUS 67. MICROPTERUS. Lacepede.

Micropterus, LACEPEDE, Hist. Nat. des Poiss., iv, 1802, 325.

Calliurus, RAFINESQUE, Journ. de Physique, 1819, 420.

Lepomis, RAFINESQUE, Ich. Oh., 1820, 30. (Not of Raf., 1819.)

Aplites, RAFINESQUE, Ich. Oh., 1820, 30.

Nemocampsis, RAFINESQUE, Ich. Oh., 1820, 31.

Dioplites, RAFINESQUE, Ich. Oh., 1820, 32.

Aplesion, RAFINESQUE, Ich. Oh., 1820, 36.

Huro, CUV. and VAL, Hist. Nat. des Poiss., ii, 1828, 124.

Grystes, CUV. and VAL, Hist. Nat. des Poiss., iii, 1829, 54.

Type, *Micropterus dolomieu*, Lacepede.

Etymology, *mikros*, small; *pteron*, fin. The dorsal fin in the typical specimen having been injured, its posterior rays detached and bitten off short, were taken by Lacepede for a separate fin.

Body elongate, ovate, compressed, the back not much elevated; head oblong, conic; mouth very large, oblique, the broad maxillary reaching nearly to or beyond the posterior margin of the eye, the supplemental bone well developed; lower jaw prominent; teeth on jaws, vomer, and palatines, usually none on the tongue; preopercle entire; operculum ending in two flat points, without cartilaginous flap; branchiostegals normally 6; scales rather small, weakly ctenoid; lateral line continuous; dorsal fin divided by a deep notch, the spines low and rather feeble, 10 in number; anal spines 3, the anal fin much smaller than the dorsal, caudal fin emarginate; size large.

The two species of this genus are among the most characteristic game fishes of America. The synonymy of the genus and of both species has been very much confused; but, in our opinion, the nomenclature now adopted, after numerous changes, must hereafter be accepted.

The following article, contributed by the present writer to *Forest and Stream* (Nov. 28, 1878) gives a resume of the matter of the nomenclature as generally understood, before the more critical examination of the subject, made by Dr. Henshall in his "Book of the Black Bass."

Since the publication of the name *Micropterus pallidus* (Raf.), Gill and Jordan, as a substitute for *Micropterus nigricans* for the scientific name of the Large-mouthed Black Bass, I have received numerous congratulations, verbal and written, from brother fishermen on the appropriateness of the name selected, and I presume that my colleague in this matter, Professor Gill, has had a similar experience. Lately a correspondent of *Forest and Stream*, Mr. A. F. Clapp, suggests that the name *Micropterus salmoides* be likewise "stamped out" to make room for some more appropriate appellation. It seems timely, therefore, that we should "rise and explain."

The name *Micropterus pallidus* is not a name of our own selection, but a name which,

by the laws of scientific nomenclature, we are bound to use. By the operation of these laws every genus must bear the oldest (generic) name bestowed on any of its members, unless this name has been previously used for something else, or is glaringly false (not simply irrelevant or inappropriate), or is otherwise ineligible; every species must bear the first (specific) name imposed upon it (unless, as before, it be for one reason or another ineligible), and the proper name of any species must be made by combining the above mentioned specific and generic names.

This is the law on the subject, and, as elsewhere, the law is usually, though not always simply right. We accept many meaningless, or even objectionable names, to avoid the confusion attendant upon arbitrary changes. Were it not for these rules science would ever suffer, as it has much suffered in the past from the efforts of the improvers of nomenclature—men who invent new names for old objects, for the purpose of seeing their own personal designations, Smith, Jones, Brehm, Reichenow, or what not, after them. In the words of "a right Sagamann," John Cassin: "There is not, evidently, any other course consistent with justice and the plainest principles of right and morality, and, in fact, no alternative, unless, indeed, an operator is disposed to set himself up for the first of all history, as is said of an early Chinese emperor. The latter course, in a degree, singular as it may appear, is not entirely unknown to naturalists, especially to those who regard science as a milch cow rather than a transcendent goddess, a distinction in classification first made by the great poet Schiller."

Now, as to the names of our species of Bass, I take it for granted that the reader knows (a) what a Black Bass is, and what it is not (b); that there are two species of Black Bass, the large-mouthed and the small-mouthed, the latter being with most anglers the Black Bass *par excellence*, the other the off horse, and (c) what the difference between them is. In any event you will find it written in Professor Gill's most excellent paper, "On the Species of the Genus *Micropterus*," in the "Proceedings of the American Association for the Advancement of Science in 1873"

The earliest published notice of a Black Bass with a scientific name was one of the small-mouthed kind, sent to Lacepede from South Carolina. This specimen bore with it the name of "trout," after the abominable, contemptible, and pernicious and otherwise detestable custom of our erring Southern brethren of calling a black bass in the river, or a weak fish in the sea a "trout." Now, we may presume that the great French naturalist was puzzled by this name, and put on his spectacles to see what in the world could be "trout-like" about such a fish, with its coarse scales and spinous fins. To him it looked more like a wrasse or cunner, *Labrus*, than a trout; but no matter, it must resemble a trout somehow or the Americans would not call it so. So he put it down in his great work as *Labrus salmoides*, the trout-like *Labrus*, to the everlasting injury of the fish, the name is not only senseless, but bad Latin, the proper form of the word being *Salmonoides*.

Lacepede had another specimen of the Black Bass, without label, and from an unknown locality. This one had the last rays of the dorsal broken and torn loose from the rest, and was otherwise in a forlorn condition. This specimen he considered as a genus distinct from the other, and he gave it the name of *Micropterus dolomieu*—"Dolomieu's small fin." Dolomieu was a friend of Lacepede, who had about as much to do with the fish as George Washington or Victor Hugo. No one could tell, either from figure or description, what this *Micropterus dolomieu* was; but Cuvier, thirty years later, found the original type and pronounced it Black Bass, in poor condition, and declared that the "genus and species of *Micropterus* ought to disappear from the catalogue of fishes."

Then the versatile and eccentric Professor Rafinesque appeared upon the scene, and in rapid succession gave the small-mouthed Black Bass names enough for a whole family. First, he called it *Bodianus achigan*, being told that the Canadian voyageurs knew the fish as *l'achigan*. Then afterward specimens of different sizes appeared as *Calliurus punctulatus*, *Lepomis trifasciata*, *Lepomis flexuolaris*, *Lepomis salmonea*, *Lepomis notata*, and *Etheostoma calliura*. Soon after Le Sueur, with a lofty scorn for Rafinesque and his doings, named specimens of different sizes, *Cichla fasciata*, *Cichla ohioensis*, and *Cichla minima*. Lastly, DeKay, in 1842, called it *Centrarchus obscurus*, and we hope this may be the last.

Now, the name *salmoides* being the oldest is, of course, the one to be adopted. But suppose "we stamp it out." Is *Micropterus dolomieu* any better? Out with it! *Micropterus achigan*? Just as bad. I fear that the "stamping out" process would have to be continued too long. You may spell it *salmonoides* if you like, but you cannot get rid of it.

Now, for the large-mouthed Bass. The oldest description we find is that of a young specimen from the Ohio by Rafinesque, in 1820, as *Lepomis pallida*. The description is poor enough, and not altogether correct, but the name is a happy inspiration, as good as *salmoides* is bad. Soon after (1822) Le Sueur described the same fish from Florida as *Cichla floridana*, a name which would be well enough if it were confined to the streams of the orange groves, but it seems rather narrow in view of the fact that the fish is found in Mexico and Manitoba, and every where between.

Next, a specimen came to Cuvier and Valenciennes, under the title of "Black Bass of Lake Huron." To their eyes the fish was black enough, but not a bass, *i. e.*, *Labrax*, and they called it *Huro nigricans*, the "Black Huron," making a new genus for it, because their specimen had but six dorsal spines, the last four having been broken off, leaving two dorsal fins. The colored figure, which they published, remained a standing puzzle for some time.

In Dr. Kirtland's private copy of his own fishes of Ohio he had carefully drawn off and colored a copy of Cuvier's figure of his Black Huron, and had all his life sought for such a fish in the lakes and never found it. About a year before his death Dr. Kirtland asked me if I had ever seen that fish or could tell him what it was, and I had the pleasure of informing him what the monster really was. Next, in 1854, Professor Agassiz, thinking that this fish in the Tennessee River could not be the same as in Lake Huron, called it *Grystes nobilis*, a good name enough, but thirty-four years too late. In the same year specimens from Texas were named *Grystes nuecensis* by Baird and Girard, but the fish is found in other streams than the Rio Nueces. Then a meaty and excellent name, *Grystes megastoma*, was given by Mr. Garlick in 1857, which closes the American synonymy, but the disease has broken out in France again, and Messrs. Vaillant and Bocourt, of Paris, who ought to know better, have again described it as *Dioplites triculi* and *Dioplites variabilis*. The poorest business a French naturalist can engage in is that of describing new species of American fishes. A good share of our cumbersome and confusing synonymy is due to Gallic assistance.

Now, in 1873, Prof. Gill, in his masterly review of these species, followed the thread back only to *Huro nigricans* in 1828, and so called the big-mouthed black bass, as he was bound to do, *Micropterus nigricans*. The names *floridanus* and *pallidus* were presumed by him to refer to the other species, for the reason that he had never seen a big-mouthed Black Bass either from the Ohio River or from Florida. In 1876 Prof. Goode had collected it in Florida, and so felt bound to restore Le Sueur's name, and to call it

Micropterus floridanus. In 1877 I called Prof. Gill's attention to the fact that there were big-mouthed as well as small-mouthed Black Bass in the streams where Rafinesque fished, and he agreed with me at once that the *Lepomis pallida* of Rafinesque was the big-mouth, which is why the big-mouthed Black Bass, Oswego Bass, Grass Bass, and Bayou Bass is *Micropterus pallidus* (Rafinesque) Gill and Jordan, at present date, and such may it ever remain.

Now, as to the name of the genus itself, the difficulty is just as great. The name *Micropterus* is unquestionably the oldest. But (a) we are perhaps not absolutely certain that the original *Micropterus dolomieu* was a Black Bass at all; (b) it was described as distinct under the erroneous impression that it had a little adipose fin behind the dorsal, and (c) the name (small fin) refers to this imaginary peculiarity, and is, therefore, incorrect.

On the other hand, the Black Bass really has smaller fins than any of its relatives, and the name has, therefore, a certain appropriateness. I think, with Prof. Gill, that it should be retained, although Prof. Cope and others, as good authority as we are, are inclined to demur.

Next comes *Calliurus* (beautiful tail), not a bad name, for the young Bass have the tail ornamented with black, white, and yellow, but not a very good name. Then comes *Lepomis* (scaly opercles), previously applied to the sunfishes, and, therefore, not usable for a Bass. Then comes Rafinesque's *Aplites*, *Nemocampsis*, *Dioplites*, and *Aplesion*, unworthy of any attention, although for some reason *Dioplites* has kept up a sort of life, while the other three have wholly died.

Next comes the name *Huro* for the large-mouthed, and *Grystes* for the small-mouthed. Of course the two do not belong to separate genera. The name *Grystes* was given as a translation of the name Growler, under which name the Black Bass was sent to the museum at Paris. Thus, our two species are often called in foreign books the Black Huron (*Huro nigricans*), and the Salmon-formed Growler (*Grystes salmoides*). The name *Grystes* is a graceful one, and has been used more frequently than any other, but there are seven names ahead of it on the record, and first come first served, and synonymy take the hindmost.

The names *Labrus*, *Bodianus*, *Cichla*, and *Centrarchus* belong to wholly different fishes, and were given by different authors through mistakes as to the relationship of the Black Bass.

I trust that this hasty and rather rambling account will be of some service to the numerous class of my fishing brethren who like to be right in their use of names, and who want to know, you know, but who, like Wilhelm Tell, cannot "*lange brüfen oder wählen*."

The above account contains two fallacies, which vitiate the nomenclature there adopted, namely, the assigning of priority of date to the name *Labrus salmoides*, and the supposition that this name referred to the Small-mouthed Bass. These errors came from an examination of a reprint of Lacepede, and were exposed on the receipt of a copy of the original edition. These are: (a) the earliest published notice of a Black Bass was under the name of *Micropterus dolomieu*. This notice referred to one of the small-mouthed species, which must, therefore, of course, be known as *Micropterus dolomieu*. (b) The second notice in point

of time was the *Labrus salmoides* of Lacepede. As shown by Dr. Henshall, there is no doubt that this notice referred to the large mouthed species, which being also a *Micropterus*, must be called *Micropterus salmoides*.

A full discussion of these questions may be found in the "Book of the Black Bass," by Dr. J. A. Henshall, published as these sheets are passing through the press, to which admirable memoir the reader is referred.*

The confusion existing in regard to the proper vernacular name of the two species of Black Bass is portrayed in the following article, from the pen of Dr. Henshall :

The genus *Micropterus*, Black Bass, includes but two species: *Micropterus salmoides* (Lac.) Gill, the small-mouthed Bass, and *Micropterus pallidus* (Raf.) Gill and Jordan, the large-mouthed Black Bass, or, as it is sometimes called, the Oswego Bass. Possibly, no genus of fishes has been the occasion of so much confusion, scientifically and popularly, as the Black Bass. This is owing, no doubt, to its extensive habitat and wide-spread distribution; the original habitat of both species being the great basin of the St. Lawrence, the whole Mississippi Valley, or almost the entire range of country lying between the Alleghany and the Rocky Mountains, and the South Atlantic States from Virginia to Florida. It would naturally be expected, in view of this extraordinary and expansive habitat, to find differences of conformation, color, and habits; indeed, it is surprising that the variations are not more marked, and the number of species consequently greater when one considers the great natural differences and conditions of the numerous waters and varieties of climate to which this genus is native. We find, however, that the most striking difference is in color, which will run from almost black through all the shades of slate, green, olive, and yellow to almost white, and, indeed, these variations in color can be found in almost any one State, and to a great extent in any one stream or lake, at different seasons of the year. Slight dissimilarities of contour and some diversity of habits also exist. But all of these differences obtain, not only with regard to Black Bass, but to most other genera of fresh water fishes, and depend on well known natural causes. I lived for ten years in Wisconsin, where there were twenty lakes abounding in Black Bass within a radius of eight miles of my residence, and from close and constant observation of the characteristics of the Black Bass in them, I could almost invariably tell upon being shown a string of bass in what particular lake they had been caught.

Without going into a specific and detailed analysis of the two species of Black Bass, it will be sufficient to say, that, as a general rule, the small-mouthed Bass is more trimly built and of a darker or more sombre hue than the other variety, where they both inhabit the same water; the large-mouthed Bass being rather a coarse looking fish, with a much larger mouth, larger scales, thicker through the shoulders, with more depth of body, more pendulous belly, and growing to a larger size, with the color more inclined

* Book | of the | Black Bass, | comprising its complete, | scientific, and life history, | together with a practical treatise on | angling and fly fishing, | and a full description of | tools, tackle, and implements | by | James A. Henshall, M.D. | "I am, sir, a brother of the angler."—IZAACK WALTON | Fully illustrated | Cincinnati | Robert Clarke & Co. | 1881.

to shades of green. The color of the small-mouthed variety sometimes approaches shades of olive or yellow; and there will often be more or less red in the iris of the eye, in some instances shading down to orange or yellow. This latter distinction, however, like the double curve at the base of the caudal fin, and the more forked tail—which have been mentioned as distinguishing characteristics of the small-mouthed variety—cannot be depended on, as one or all of these distinctions are often lacking.

The former name of the large-mouthed species, *Micropterus nigricans* (C. & V.) Gill, has been very wisely discarded by Professors Gill and Jordan, who have substituted therefor the more descriptive title of *Micropterus pallidus*. This has been done in justice to Rafinesque, whose priority of description of this species certainly entitles him to this acknowledgment. Ichthyologists have, at various times, given to the genus numerous appellatives, and to the species more than thirty specific names, while laymen in different sections of the country have contributed their quota of vernacular names, among which may be mentioned: Black Bass, Bass, Black Perch, Jumping Perch, Trout, Black Trout, Chub, Green Bass, Moss Bass, Oswego Bass, etc. In almost every issue of the *Forest and Stream* correspondents write of Bass, Bass fishing, Bass tackle, etc., meaning Black Bass in each instance, and take it for granted that the legion of readers of that widely circulated journal will understand what particular kind of Bass is meant. Now, this is all wrong, and is owing to the culpable carelessness, or perhaps, in some instances, to a want of proper information, and is a habit that ought to be reformed. Let us call things by their names—a spade a spade, or a quail a quail. It is just as easy to right the distinctive name "Black Bass" as the general name "Bass." Bass is a very vague term at best, meaning one thing in one part of the country and a totally different thing in another. Along the Eastern coast it means either a Striped Bass or a Sea Bass; in the West it may be either a Black Bass, a Rock Bass, a White Bass, or a Silver Bass; while in Otsego county, New York, it means an Otsego Bass, which is not a Bass at all. Then again, your correspondents write of the real Black Bass, meaning generally *M. salmoides*, the small-mouthed species, seeming to imply that the other species is not real, or at least is not the Black Bass, but something else—a kind of *pseudo variety*. Others, in writing of the large-mouthed species, *M. pallidus*—owing to its former name, *M. nigricans*—have called it the real Black Bass, under the impression that, as it was named *nigricans*, i. e., black, the other variety must be some other color, and was not the Simon pure article. Now, one species is not more real than the other; the small-mouthed variety is regarded as the type species, because it was the first to be described. It is thought by some to be a gamier fish than the large-mouthed variety; indeed, I have sometimes thought so myself; but this notion, like the gustatory superiority of the canvas-back among ducks, the delectable excellence of the brook trout among fish, or the exquisite ambrosial flavor of Veuve Cliquot among wines, exists more in the imagination than in reality. Both varieties of the Black Bass are equally good as game fish, and equally good for the table. The term "Black Bass," then, is distinctive, and should always be used when alluding to the genus generally. In writing of the different species, they should be mentioned as the small-mouthed Black Bass, or the large-mouthed Black Bass, as the case may be, no matter whether the color be black, green, or yellow. Every reader will then know exactly what is meant, and much of the confusion and uncertainty that now prevail will be cleared away.

ANALYSIS OF SPECIES OF MICROPTERUS.

- a. Mouth smaller, the maxillary in the adult not extending beyond orbit; scales smaller, 72-75 in the lateral line; 10-12 series above the lateral line; color of young more or less barred or spotted, without dark lateral band.

DOLOMIEU. 125.

- aa. Mouth very large, the maxillary in the adult extending beyond the orbit; scales rather large, 65-70 in the lateral line; 7-8 series above lateral line; last spines of dorsal very short, so that the fin is almost divided into two; young with a blackish lateral band. SALMOIDES. 126.

125. MICROPTERUS DOLOMIEU.* Lacepede.

The Small-mouthed Black Bass.

Micropterus dolomieu, LACEPEDE, Hist. Nat. Poiss., iv, 325.—HENSHALL, Book of the Black Bass, 1881, 84.

Bodianus achigan, RAFINESQUE, Monthl. Mag. and Critic. Rev., 1817, 120.

Micropterus achigan, GILL, Rept. Commr. Ag., 1866, 407.

Calliurus punctulatus, RAFINESQUE, Ich. Oh., 1820, 26.

Lepomis trifasciata, *flexuolaris*, *salmonea*, and *notata*, RAFINESQUE, Ich. Oh., 1820, 31, 32.

Etheostoma calliura, RAFINESQUE, Ich. Oh., 1820, 36.

Cichla fasciata, *ohiensis* and *minima*, LESUEUR, Journ. Acad. Nat. Sci. Phila., ii, 216, 218, 220.—KIRTLAND, Zool. Oh., 1838, 191.

Centrarchus fasciatus, KIRTLAND, Bost. Journ. Nat. Hist., v, 1842, 28.—DEKAY, New York Fauna Fishes, 1842, 28.

Grystes salmoides, CUV. and VAL., Hist. Nat. Poiss., iii, 1854, 54, and of numerous authors.

Micropterus salmoides, GILL, Proc. Am. Ass. Adv. Sci., B. 1873, 55.—JORDAN, Man. Vert., E. U. S., 2d Ed., 1878, 236; Proc. U. S. Nat. Mus., ii, 1880, 218, and of most recent American Writers.

Centrarchus obscurus, DEKAY, New York Fauna. Fishes, 1842, 30.

Body ovate-fusiform, becoming deeper with age; head large; mouth large, but smaller than in *M. salmoides*, the maxillary ending considerably in front of the hinder margin of the orbit; scales on the cheek minute, in about 17 rows; scales on the trunk comparatively small; dorsal fin deeply notched, but less so than in *M. salmoides*; coloration quite variable, the young dull, golden green, with bronzed lustre, darker spots along the sides, which tend to form short vertical bars, but never a dark lateral band, usually three bronzed bands radiating from eye across cheeks and opercles; a dusky spot on point of operculum; belly white; caudal fin yellowish at base, then black, with white tips; dorsal with bronze spots, its edge dusky. In some waters the fin-markings are obsolete, but usually they are very conspicuous in the young. Southern specimens usually have the scales of the lower part of the sides with faint dark streaks; adult specimens have all these marks more or less wholly obliterated, and become ultimately of a uniform dead-green, without silvery luster; head $3\frac{1}{2}$; depth $3\frac{1}{2}$; D X, 13; A. III, 10 or 11; scales 11-74-17. Length 1 to 2 feet. Average weight when adult 4 or 5 pounds.

Habitat, all streams of United States from Vermont and Western New York to South Carolina, Arkansas, and Dakota, preferring clear or cold waters.

* For full synonymy, see (Henshall) "Book of the Black Bass."

Diagnosis.—The small-mouthed Black Bass may always be certainly distinguished from the other species by the smaller scales, there being 70 to 80 in the lateral line. The color of the young is always a perfectly reliable distinctive mark.

Habits.—In Ohio this species is everywhere abundant in the proper localities. As compared with *Micropterus salmoides*, it is a fish of the running waters, having little liking for warm and grassy ponds, bayous, or lakes.

The writer can add little new to our knowledge of this most excellent game fish. I, therefore, confine myself to making extracts from some of the many writers who have sounded the praises of the Black Bass.

The following article, by Dr. J. A. Henshall, first appeared in *Forest and Stream*.

Those who have tasted the lotus of salmon or trout fishing in that Utopian clime of far away, while reveling in its æsthetic atmosphere, and surrounded by a misty halo of the spray of the waterfall, or enveloped by the filmy gauze and iridescent haze of the cascade, have inscribed tomes, sang idyls, chanted pœons, and poured out libations in honor and praise of the silver spangled salmon or the ruby studded trout, while it is left to the vulgar horde of Black Bass anglers to stand upon the mountain of their own doubt and presumption, and, with uplifted hands, in admiration and awe, gaze with dazed eyes from afar upon that forbidden land—that *terra incognita*, and then, having lived in vain, die and leave no sign.

It is then with a spirit of rank heresy in my heart; with smoked-glass spectacles on my nose to dim the glare and glamour of the transcendent shore; with the scales of justice across my shoulder—*M. salmoides* in one scoop and *M. pallidus* in the other—I pass the barriers and confines of the enchanted land and toss them into a stream that has been depopulated of even fingerlings by the *dilettanti* of salmon and trout fishers; for I would not, even here, put Black Bass in a stream inhabited by salmon or brook trout. While watching the plebian interlopers sporting in an eddy, their bristling spines and emerald sides gleaming in the sunshine, I hear an awful voice from the adjacent rocks exclaiming, “Fools rush in where angels fear to tread!” Shade of Izaak Walton defend us! While appealing to Father Izaak for protection, I quote his words: “Of which, if thou be a severe, sour complexioned man, then I here disallow thee to be a competent judge.”

Seriously, most of our notions of game fish and fishing are derived from British writers; and as the salmon and trout are the only fishes in Great Britain worthy of being called game, they, of course, form the themes of British writers on game fish, Americans, following the lead of our British cousins in this, as we were wont to do in all sporting matters, have eulogized the salmon and brook trout as the game fish *par excellence* of America, ignoring other fish equally worthy. While some claim for the Striped Bass a high niche in the list of game fish, I feel free to assert that, were the Black Bass a native of Great Britain, he would rank fully as high in the estimation of British anglers as either the trout or the salmon. I am borne out in this by the opinions of British sportsmen, whose statements have always been received without question. W. H. Herbert (Frank Forester) writing of the Black Bass, says: “This is one of the

finest of the American fresh water fishes; it is surpassed by none in boldness of biting, in fierce and violent resistance when hooked, and by a very few only in excellence upon the board." Parker Gilmore ("Ubique") says: "I fear it will be almost deemed heresy to place this fish (Black Bass) on a par with the trout; at least, some such idea I had when I first heard the two compared; but I am bold, and will go further. I consider he is the superior of the two, for he is equally good as an article of food, and much stronger and more untiring in his efforts to escape when hooked." Mr. Gilmore again says: "Americans have reason to be proud of the Black Bass, for its game qualities endear it to the fisherman, and its nutty, sweet flavor to the gourmand."

Now, while salmon fishing may be the highest branch of piscatorial sport; and while trout fishing in Canada, Maine, and the Lake Superior region justifies all the extravagant praise bestowed upon it, I am inclined to doubt the judgment and good taste of those anglers who snap their fingers in contempt of Black Bass fishing, while they will wade a stream strewn with brush and logs, catch a few trout weighing six or eight to the pound, and call it the only artistic angling in the world! While they are certainly welcome to their opinion, I think their zeal is worthy of a better cause. The Black Bass is eminently an American fish, and has been said to be representative in his characteristics. He has the faculty of asserting himself and making himself completely at home wherever placed. He is plucky, game, brave, and unyielding to the last when hooked. He has the arrowy rush and vigor of a trout, the untiring strength and bold leap of a salmon, while he has a system of fighting tactics peculiarly his own. He will rise to the artificial fly as readily as the salmon or the brook trout, under the same conditions; and will take the live minnow or other live bait, under any and all circumstances favorable to the taking of any other fish. I consider him, inch for inch and pound for pound, the gamest fish that swims. The royal salmon and the lordly trout must yield the palm to a Black Bass of equal weight. That he will eventually become the leading game fish of America is my oft expressed opinion and firm belief. This result, I think, is inevitable, if for no other reasons, from a force of circumstances occasioned by climatic conditions and the operation of immutable natural laws, such as the gradual drying up and dwindling away of the small trout streams, and the consequent decrease of brook trout both in quality and quantity; and by the introduction of predatory fish in the same waters with trout. Another prominent cause of the decline and fall of the brook trout is the erection of dams, saw mills, and factories upon trout streams, which, though to be deplored, cannot be prevented; the march of empire and the progress of civilization cannot be stayed by the honest, though powerless protests of anglers. But, while the ultimate fate of the brook trout is sealed beyond peradventure, we have the satisfaction of knowing that in the Black Bass we have a fish equally worthy, both as to game and edible qualities, and which, at the same time, is able to withstand and defy many of the causes that will in the end effect the annihilation and extinction of the brook trout.

As I have stated long since in the *Forest and Stream*, the Black Bass will exhibit game qualities that will at once convince and surprise the most skeptical salmon or trout fishers, if they will angle for him with as suitable and delicate tackle as they employ for his more favored congeners of the tribe *Salmonidæ*. It is high time, then, that anglers and sporting writers should accept the situation, accord to the Black Bass his just due, and acknowledge him as the coming game fish of America."

As to the edible qualities of the Black Bass little need be said. Aside from its attractiveness to anglers as a game fish, its flesh is of the very best. "Few better pan

fish are known to epicures. He is thick, solid, and heavy; has little waste and few bones about him; is sweet, tender, and juicy, and when well cooked makes a dish fit for a king."—*Hallock*.

The following account of the breeding habits of the Black Bass is abridged from Dr. Henshall's "Book of the Black Bass." The habits of both species are usually the same:

"Black Bass are very prolific, the females yielding fully one fourth of their weight in spawn. The period of spawning extends from early spring to midsummer, according to the section of country and temperature of the water, being always earlier in warm or shallow waters.

"The Bass leave their winter quarters in deep water about a month or six weeks before the spawning season, at which times they can be seen running up streams and in the shallow portions of lakes in great numbers. Soon afterwards, the males and females pair off and prepare for breeding.

"They select suitable spots for their nests, usually upon a gravelly or sandy bottom, or in rocky ledges, in water from eighteen inches to three feet deep in rivers, and from three to six feet deep in caves and ponds; and, if possible, adjacent to deep water or patches of aquatic plants, to which the parent fish retire if disturbed.

"The nests are circular saucer-like depressions, about twice the length of the fish in diameter. They are formed by the Bass, by fanning and scouring from the pebbles all sand, silt, and vegetable debris, by means of their fins and tails, and by removing larger obstacles with their mouths. This gives to the beds a bright, clean, and white appearance, which in clear water can be seen at a distance of several score yards. I have seen hundreds of such nests in groups, almost touching each other, in the clear water lakes of Wisconsin, Michigan, and Minnesota.

"Sometimes the nests are formed upon a muddy bottom, with a pavement or foundation of small sticks and leaves, from which the mud and slime have been washed and scoured.

"The females deposit their eggs on the bottom of the nests, usually in rows, which are fecundated by the male, and become glued to the pebbles or sticks contained therein.

The eggs are hatched in from one to two weeks, depending on the temperature of the water, but usually in eight or ten days.

"After hatching, the young fry remain over the bed for three or four days, when they retire in'o deep water, or take refuge in the weeds or under stones, logs, and other hiding places.

"During the period of incubation the nests are carefully guarded by the parent fish, who remain over them, and by a constant motion of the fins create a current, which keeps the eggs free from any sediment or debris. After the eggs are hatched, and while the young remain on the nests, the vigilance of the parent fish becomes increased and unceasing, and all suspicious and predatory intruders are driven away.

"Their anxiety and solicitude for their eggs and young, and their apparent disregard of their own safety at the time is well known to poachers and pot fishers, who take advantage of this trait, and spear or gig them on their nests.

"I have also known some who call themselves anglers, who take the Bass at this time in large numbers, with the minnow or craw-fish. Of course, the Bass does not 'bite' at this season voluntarily, but when the bait is persistently held under their

noses, they at first endeavor to drive it away or remove it from their nests, and finally, I think, swallow it in sheer desperation.

"After the young Bass leave the spawning beds, their food at first consists of animalculæ, larvæ, insects, and the ova of other fish; as they grow older and larger, they devour worms, tadpoles, and small fish, and later in life, they vary their diet with crawfish, frogs, mussels, and water-snakes, until, attaining a weight of two pounds, they will bolt anything from an angle worm to a young musk-rat."

126. MICROPTERUS SALMOIDES* (Lacepede) Henshall.

The Large-Mouthed Black-Bass.

Labrus salmoides, LACEPEDE, Hist. Nat. Poiss., iv., 1802, 716.—*Grystes salmoides*, HOLBROOK, Ich. S. Car., 1860, 28.—*Micropterus salmoides*, HENSHALL, "Book of the Black Bass," 1881, 110.

Lepomis pallida, RAFINESQUE, Ich. Oh., 1820, 20.—*Micropterus pallidus*, JORDAN, Bull. U. S. Nat. Mus., x, 1877; Man. Vert., E. U. S., 2d Ed., 1878, 236, and elsewhere.

Cichla floridana, LESUEUR, Journ. Acad. Nat. Sci. Phila., ii, 1822, 219.

Huro nigricans, CUVIER and VALENCIENNES, Hist. Nat. Poiss., ii, 1828, 124, and of various copyists.—*Micropterus nigricans*, GILL, Proc. Ass. Adv. Sci., B, 1873, 70, and of various writers.

Grystes nobilior, AGASSIZ, Amer. Journ. Sci. Arts, xvii, 1854, 293.

Grystes nuecensis, BAIRD and GIRARD, Proc. Acad. Nat. Sci. Phila., vii, 1854, 25.

—*Dioplites nuecensis*, GIRARD, U. S. Pac. R. R. Surv., x, Fishes, 1858, 4.

Description.—Body ovate-fusiform, becoming deeper with age, moderately compressed; head large; mouth very wide, the maxillary in the adult reaching beyond the eye, in the young shorter; scales on the cheek in about 10 rows, scales on the trunk comparatively large; lingual teeth sometimes present; dorsal fin very deeply notched; coloration of the young dark-green above, sides and below greenish-silvery; a blackish stripe along the sides from opercle to the middle of the caudal fin; three dark oblique stripes across the cheeks and opercles; below and above the lateral band some dark spots; caudal fin pale at base, then blackish, whitish at tip; belly white. As the fish grows older the black lateral band breaks up and grows fainter, and the color becomes more and more of a uniform pale, dull green, the back being darker; a dark opercular blotch usually present; head $3\frac{1}{2}$; depth $3\frac{1}{2}$; D. X, 12; A. III, 11; scales 7-68-16. Length 1 to $2\frac{1}{2}$ feet. Average weight of the adult fish 6 to 8 pounds.

Habitat, Manitoba to Florida and Mexico and all intermediate regions, preferring sluggish waters.

There is a prevalent notion among anglers that the Big-mouthed Bass is the *Northern* species, and the Small-mouthed the *Southern*. This arises from the fact of the great abundance of the present species in many Northern ponds and lakes unsuited for the residence of *Micropterus dolomieu*. This idea is fallacious. *Micropterus salmoides* is found in Mexico and Florida, as well as throughout Texas. It is, in fact, as characteristic

* For a full synonymy of this species, see Henshall's "Book of the Black Bass," p. 110.

of the bayous of the Gulf States as of the lakelets of Michigan. A still more wide-spread notion is that *Micropterus salmoides* is the Southern species, and *M. dolomieu* the Northern. The two are certainly native in Canada and throughout the Alleghany region (except streams flowing east, north of Virginia) to Alabama and South Carolina. I have myself taken both species in every considerable river basin within those limits. The extreme Northern limit from which any Black Bass has been recorded is the Red River of the North, and the specimens there obtained belong to *Micropterus salmoides*. So that *Micropterus salmoides* has been taken farther North, farther South, and farther West than its rival species, which can only claim the Eastern extreme. The simple fact is that both inhabit the same geographical area; but *Micropterus salmoides* takes to bayous, ponds, and the sluggish rivers of the far South, while *Micropterus dolomieu* is found chiefly in running streams. Every Western river contains both species, but they are not usually taken together in the same part of the stream.

Diagnosis.—This species may be known from the preceding by the larger mouth, larger scales, of which there are *less than seventy* in the course of the lateral line. The young may be known at once by the *color*, the ground here being much paler than in the other, and there being a broad blackish band along the sides.

Habits.—This species is more sluggish in its habits than the preceding, and as above noticed, it more often frequents still waters and ponds. In the aquarium it is less active and less hardy than *Micropterus dolomieu*. It reaches a larger size than the Small-mouthed Black Bass. It is not quite so highly valued as food, but the difference is probably very slight, or even imaginary.

FAMILY XXI. SERRANIDÆ. THE SEA BASS.

Body oblong or elongate, more or less compressed, covered with adherent ctenoid scales of moderate or small size; mouth horizontal or little oblique, usually large; premaxillary protractile; maxillary broad, with or without a supplemental bone, its posterior part not slipping under the edge of the preorbital; jaws with bands of teeth, some of the teeth sometimes enlarged and canine-like; no incisors or molar teeth; vomer and palatines, with bands of villiform teeth; tongue sometimes with teeth; pterygoids toothless; gill-rakers usually stiff and rather long, armed with teeth; gills 4, a long slit behind the fourth; pseudobranchiæ large; lower pharyngeals separate, rather narrow, with pointed teeth; gill-membranes separate, free from the isthmus; branchiostegals 7 or 6; cheeks and opercles scaly; preopercle with its posterior margin more or less serrate; opercles usually ending in one or two flat points or spines; nostrils double; lateral line continuous, single, not running up on the caudal fin; skull without cranial

spines, not cavernous; no suborbital stay; dorsal fin variously developed, continuous or divided, the spines stiff; anal fin rather short, with 3 spines, which are rarely obsolete; ventrals separate, thoracic, I, 5; pectorals well developed; caudal fin truncate, rounded, or moderately forked, its peduncle stout and not keeled; vertebræ about 25; air-bladder present, usually rather small, and adherent to the walls of the abdomen; intestinal canal short, with several or many pyloric cæca; the stomach cæcal. Genera 40; species about 300, and found in all warm seas, a few in fresh waters.

ANALYSIS OF GENERA OF SERRANIDÆ.

- a. Dorsal spines ten; anal spines three; branchiostegals seven; teeth all villiform, without canines, present on jaws, vomer, palatines, and tongue; no supplemental maxillary bone. ROCCUS. 68.

GENUS 68. ROCCUS. Mitchill.

Morone, MITCHILL, Report in part on Fishes N. Y., 1814 (in part; a mongrel group composed of species of *Perca*, *Roccus*, and *Eupomotis wronge*, supposed to differ from *Perca* in having abdominal ventrals. The name may be properly considered as a synonym of *Perca*).

Roccus, MITCHILL, Report in part on the Fishes of N. Y., 1814, 25.

Lepibema labrax, RAFINESQUE, Ich. Oh., 1820, 23.

Roccus and *Morone*, GILL, Proc. Acad. Nat. Sci. Phila., iii, 1860.

Labrax, CUVIER, Règne Animal, ii, 1817 (not of Pallas, 1811.).

Type, *Roccus striatus*, Mitchill = *Sciæna lineata*, Bloch.

Etymology, Rock-fish, a barbarous latinization of the common name "Rock," applied by fishermen to *Roccus lineatus*.

Description.—Body oblong or ovate, compressed and more or less elevated; head conical, scaly above and on sides; mouth nearly horizontal; the jaws equal or the lower projecting; premaxillaries protractile; maxillaries large, without supplemental bone, only the edge of the anterior part slipping under the preorbital; teeth all villiform, in bands on jaws, vomer, palatines, and tongue; eye large, orbital ridge a little elevated; preopercle serrate behind and below, the teeth of its lower margin sometimes enlarged; opercle with two flat spines; preorbital narrow; pseudobranchiæ large; scales large; breast scaly; dorsal fins separate or connected at base, the anterior with 9 strong spines; anal spines well developed; caudal fin lunate; pectorals small; species about 6, in America and Europe, inhabiting both fresh and salt waters.

ANALYSIS OF SPECIES OF ROCCUS.

- a. Serræ on lower edge of preopercle small, not directed forwards.
 b. Teeth on base of tongue; anal spines graduated; lower jaw projecting; scales on cheeks almost cycloid; dorsal fins separate.
 c. Teeth at base of tongue in a single patch; body oblong, compressed (*Lepibema*, Rafinesque). CHRYSOPS.
 bb. No teeth on base of tongue; second anal spine enlarged; jaws equal; scales on cheeks ctenoid; dorsal fins somewhat connected (*Morone*, Gill).
 d. Sides striped with black. INTERRUPTUS.

127. *ROCCUS CHRYSOPS* (Rafinesque) Gill.**White Bass of the Lakes; Striped Bass.**

Perca chrysops, RAFINESQUE, Ich. Oh., 1820, 22.

Lepibema chrysops, RAFINESQUE, Ich. Oh., 1820, 23.

Labrax chrysops, GILL, Proc. Acad. Sci. Phila., 1860, 20 (not of Girard).

Roccus chrysops, GILL, Proc. Acad. Sci. Phila., 1860, 113 and 1861, 50.—COPE, Proc. Acad. Sci. Phila., 1865, 83.—MILNER (1874), Rept. U. S. Fish Commission, 1872-3, 6.—JORDAN (1875), Ind. Geol. Surv., 1874, 212; Bull. Buffalo Nat. Hist. Soc., 1876, 92; Man. Vert., 1876, 226.—NELSON, Bull. Ills. Mus. Nat. Hist., 1876.—JORDAN and COPELAND, Bull. Buffalo Soc. Nat. Hist., 1876, 136.—JORDAN and GILBERT, Klippart's Rept. Fish Commissioner Ohio, 1878.—JORDAN, Man. Vert., 2d Ed., 1878.

Labrax multilineatus, CUVIER and VALENCIENNES, Poissons, iii, 1830, 588.—KIRTLAND Bost. Journ. Nat. Hist., v, 1845, 21.—DEKAY Fishes N. Y., 1842, 24.—STORER, Synopsis (in Mem. Amer. Acad., New Series, ii), 1846, 274.—GUNTHER, Cat. Fishes, i, 1859, 67.

Labrax notatus, SMITH, RICHARDSON, Fauna Boreali-Americani, iii, 1836, 8.—DEKAY Fishes N. Y., 1842, 14.—STORER, Synopsis, 1846, 274.—GUNTHER, Cat. Fishes, i, 1859, 67.

Labrax albidus, DEKAY Fishes N. Y., 1842, 13.—STORER Synopsis, 1846, 275.—GUNTHER, Cat. Fishes, i, 1859, 63.

Labrax osculatii, FILIPPI, Revue et Mag. Zoologie, v, 1853, 164.—GUNTHER, Cat. Fishes, i, 1859, 65.

Silvery, tinged with golden below the lateral line and with reddish above; sides with blackish or dusky longitudinal lines, 4 or 5 above the lateral line, 1 through which the lateral line runs, and a variable number of more or less distinct ones below it, the latter sometimes more or less interrupted or transposed, so as to appear like ancient church music; dorsal outline much curved, second anal spine $\frac{1}{2}$ length of head; axis of body rather below the middle of its depth; head conical, slightly depressed at the nape; mouth small, nearly horizontal; maxillary reaching middle of pupil; head about $3\frac{1}{2}$ in length; depth about $2\frac{1}{2}$; eye large, its diameter equal to the length of the snout; D. IX-I, 14; A. III, 12; scales 7-55-13. Length 10 to 15 inches.

Habitat, Great Lake Region, Upper Mississippi and Ohio Valleys and northward.

Diagnosis.—This species may be known from *Roccus interruptus*, the only one of the Bass which it particularly resembles, by the fact that the two dorsal fins are entirely separated. The coloration is much more silvery and the dark stripes are less conspicuous in *Roccus chrysops*.

Habits.—This species is generally abundant in the lakes, where it is known as the White Bass. Its flesh is very similar to that of the Black Bass, and is similarly well-flavored. In the Ohio River it seems to be less common, but it is frequently taken. The species frequents chiefly deep or still waters, seldom ascending small streams. It is said to thrive well in ponds. It is a gamey fish, although in this respect inferior to either species of Black Bass.

128. *ROCCUS INTERRUPTUS* (Gill) J. & G.**Yellow Bass.**

Labrax chrysops, GIRARD, Pac. R. R., Expl., x, 1858, 29. (Not *Perca chrysops* of Rafinesque.)
Morone interrupta, GILL, Proc. Acad. Nat. Sci. Phila., 1860, 48.—JORDAN, Man. Vert.,

1876.—GILL, Ich. Capt. Simpson's Report, 1876; JORDAN, Man. Vert., 2d Ed., 1878, 232.

Roccus interruptus, JORDAN and GILBERT, Synopsis Fish N. A.

Description.—Brassy, tinged with olivaceous above; sides with 7 very distinct longitudinal black bands, darker than in the other species, those below the lateral line interrupted posteriorly, the posterior part alternating with the anterior; body oblong-ovate, with the dorsal outline much arched; head depressed, somewhat pointed, its profile concave; eyes large, their diameter equaling length of snout; mouth somewhat oblique, maxillary nearly reaching middle of orbit; spines very robust, second anal spine 2-5 length of head; dorsal fins little connected; head 3 in length; depth 2½; D. IX-I, 12; A. III, 9; Lat. 1. 50.

Habitat, Lower Mississippi Valley, extending up the Ohio to the mouth of the Wabash or beyond. It does not seem to be very common anywhere except in the Lower Mississippi, and nothing special is known of its habits, which probably differ little from those of the White Bass.

Diagnosis.—The Yellow Bass may be known from the White Bass by the fact that the two dorsal fins are connected by a low membrane. The color in life is yellow, not silvery, and the black lateral stripes are very conspicuous.

FAMILY XXII. PERCIDÆ. THE PERCHES.

Body more or less elongate, terete or compressed, covered more or less completely with rather small, ctenoid, adherent scales; lateral line usually present, not extending on the caudal fin; mouth terminal or inferior, small or large, the premaxillaries protractile or not; maxillaries large or small, without distinct supplemental bone; jaws, vomer, and palatines with bands of teeth, which are usually villiform, but sometimes mixed with canines, occasionally the teeth on the vomer or palatine are absent; head naked or more or less scaly; preopercle entire or serrate; opercles usually ending in a flat spine; branchiostegals 6 or 7; gills 4, a slit behind the fourth; gill-membranes free or connected, not joined to the isthmus; gill-rakers, slender, toothed; pseudobranchiæ small or granular and concealed, or altogether wanting; lower pharyngeals separate, with sharp teeth; fins generally large; two dorsals, the first of 6 to 15 spines; anal fin with one or two spines (three in *Percichthys*, a fresh water genus from Chili.) Ventrals thoracic, I, 5; pectorals often very large; caudal lunate, truncate or rounded; anal papilla often present; air-bladder small and adherent, often entirely wanting; pyloric cœca few; vertebræ 30 to 45; genera about 20; species 90 to 100; inhabitants of the fresh waters of cool regions, most of them being American, and nearly all belonging to the fauna of the United States. The great majority of the species belong to the sub-family of *Etheostomatinae*, the Darters, all the species of which group are American. They are

among the most singular and interesting of our fishes. They differ from the typical *Percinæ* in their small size, bright colors, and large fins, and more technically in the rudimentary condition of the pseudobranchiæ and the air-bladder, both of which organs are usually inappreciable. The preopercle is unarmed, and the number of branchiostegals is six. An anal papilla is likewise developed, as in the *Gobiidæ*, to which group the Darters bear a considerable superficial resemblance, a resemblance, however, which indicates no real affinity.

The colors of the *Etheostomatinae* are usually very brilliant, species of *Pæciliichthys*, *Northonotus*, and *Diplesium* being among the most brilliantly colored fishes known; the sexual differences are often great, the females being as a rule dull in color and more speckled or barred than the males. Most of them prefer clear running water, where they lie on the bottom concealed under stones, darting, when frightened or hungry, with great velocity for a short distance by a powerful movement of the fan-shaped pectorals, then stopping as suddenly. They rarely use the caudal fin in swimming, and they are seldom seen moving or floating freely in the water like most fishes. When at rest, they support themselves on their extended ventrals and anal fin. All of them can turn the head from side to side, and they frequently lie with the head in a curved position or partly on one side of the body.

Ammocrypta, and perhaps some of the others, prefer a sandy bottom, where, by a sudden plunge, the fish buries itself in the sand and remains quiescent for hours at a time, with only its eyes and snout visible. The others lurk in stony places, under rocks and weeds. Although more than usually tenacious of vitality from their bottom life, the Darters are the first to be disturbed by impurities in the water. All the Darters are carnivorous, feeding chiefly on the larvæ of gnats, and, in their way, voracious. All are of small size; the largest, *Percina*, reaches a length of eight inches, while the smallest, *Microperca*, is probably the smallest spiny-rayed fish known, barely attaining the length of an inch and a half. They are of too small size to be used for food, although, according to Rafinesque, "they are good to eat, fried."

The *Percinæ* are represented in America by two genera, and in Europe by the same two and three others—*Acérina*, *Percarina*, and *Aspro*—the latter bearing a strong external resemblance to the *Etheostomatinae*, and serving as a connecting link between them and the more typical forms.

ANALYSIS OF GENERA OF PERCIDÆ.

a. Pseudobranchiæ well developed; preopercle serrate; branchiostegals 7.

(*Percinæ*.)

b. Canine teeth none; body oblong. PERCA.

bb. Canine teeth in jaws and palatines; body elongate. STIZOSTEDIUM.

aa. Pseudobranchiæ imperfect or wanting; preopercle entire; branchiostegals 6.

(*Etheostomatinae*.)

c. Premaxillaries protractile.

d. Body extremely elongate, subcylindrical, translucent, the belly at least naked; lateral line complete; gill-membranes broadly united.

e. Anal spine single; anal fin nearly as large as second dorsal.

AMMOCRYPTA.

dd. Body less elongate, opaque, chiefly scaled.

f. Anal spine obscure, normally single; lateral line complete.

BOLEOSOMA.

ee. Anal spines two, the first commonly the longer.

- g. Gill-membranes more or less broadly united; belly with ordinary scales.
 h. Lateral line complete; maxillary adnate to the preorbital.
 DIPLESIMUM.
 gg. Gill-membranes scarcely united; anal as large as second dorsal.
 i. Belly, with enlarged caducous plates. COTTOGASTER.
 ii. Belly without enlarged plates, anteriorly naked, posteriorly scaled
 like the sides. IMOSTOMA.
 cc. Premaxillaries not protractile.
 j. Lateral line complete.
 k. Ventral line with a series of enlarged, spinous, caducous scales,
 or if these are fallen, a naked strip.
 l. Mouth small, inferior, beneath a pig-like snout. PERCINA.
 ll. Mouth large, the snout not projecting beyond it.
 ALVORDIUS.
 kk. Ventral line without caducous scales
 m. Gill-membranes scarcely connected. NOTHONOTUS.
 mm. Gill-membranes broadly connected. NANOSTOMA.
 jj. Lateral line present, incomplete.
 n. Gill-membranes broadly united. ETHEOSTOMA.
 nn. Gill-membranes separate, or nearly so. PÆCILICHTHYS.
 jij. Lateral line obsolete. MICROPERCA.

GENUS 69. PERCA. Linnæus.

Perca, LINNÆUS, *Systema naturæ*. Ed. x., 1858.

Type, *Perca fluviatilis* L.

Etymology, Latin, *Perca*, a perch; Greek, *perche*, from *perchos*, dusky.

Body elongate, fusiform, somewhat compressed; head conical; its sides mostly scaly; the operculum chiefly naked and rough-striate, armed with a single spine; preoperculum scapular and caracoid bones serrated; mouth moderate; teeth all in villiform bands; dorsal fins not connected, the first with about thirteen spines; anal with two slender spines; caudal forked; scales small, rough; lateral line complete; pyloric cæca 3; vertebrae 21-20.

129. PERCA AMERICANA Schranck.

Yellow Perch; Ringed Perch; Common Perch.

Perca americana, SCHRANCK, 17, fide Gill.—JORDAN and GILBERT, Klippart's Report Fish Commr. Ohio, 1877, 65.—JORDAN, Man. Vert., 2d Ed., 1878.

Perca fluviatilis, var. *americana*, STEINDACHNER, Butrage, 1877.

Bodianus flavescens, MITCHILL, Ph. Trans, N. Y., 1815, i, 421.

Centropomus luteus, RAFINESQUE, *Precis des Decouvertes Somnologiques*, 1814, 19.

Perca flavescens, CUVIER, *Regne Animal*, 1817.—CUV. and VAL., *Hist. Nat. des Poissons*, ii, 1828, 46.—RICHARDSON, *Fauna Bor-Amer.*, Fishes, 1836, 74.—DEKAY, *Nat. Hist. N. Y.*, Fishes, 1842, 3.—STORER, *Synopsis*, 1846, 17.—KIRTLAND, *Bost. Journ. Nat. Hist.*, v, 1847, 337.—AGASSIZ, *Lake Superior*, 1850, 291.—GUNTHER, *Cat. Fishes, Brit. Mus.*, i, 59, 1859.—HOLBROOK, *Ich. S. Car.*, 1860.—STORER, *Hist. Fishes Mass.*, 1867.—JORDAN, *Man. Vert.*, 1876, and of authors generally.

- Perca serratogranulata*, CUV. and VAL., Hist. Nat. des Poissons, ii, 1823, 47.—DEKAY, New York Fauna, Fishes, 1842, 5.
- Perca granulata*, CUV. and VAL., Hist. Nat. des Poissons, ii, 1828, 48.—DEKAY, N. Y. Fauna, Fishes, 1842, 5.
- Perca acuta*, CUV. and VAL., Hist. Nat. des Poiss., ii, 1828, 49.—RICHARDSON, Fauna Bor.-Amer., Fishes, 1836, 4.—DEKAY, N. Y. Fauna, Fishes, 1842, 6.—GUNTHER, Cat. Fish. Brit. Mus., i, 1859, 60.
- Perca gracilis*, CUV. and VAL., Hist. Nat. des Poiss., ii, 1828, 50.—RICHARDSON, Fauna Bor.-Amer., Fishes, 1836, 4.—GUNTHER, Cat. Fish. Brit. Mus., i, 1859, 60.

Description.—Body oblong, rather short, deep, and compressed; mouth moderate, the maxillary not quite reaching to orbit; lower jaw a little longest; eye moderate, $4\frac{1}{2}$ to 5 in head; top of head naked, the bones rough behind; cheeks with rather large scales, well imbricated; opercle naked, and with radiating striæ, of which the uppermost forms a strong, flat spine, below which seven or eight striæ end in sharp teeth; gill-rakers comparatively short, in length about equal to the diameter of the pupil; pseudobranchiæ very small; scales rather small, 55 to 62 in the lateral line, 6 above and 15 to 18 below; first dorsal spine inserted above base of pectorals; head $3\frac{1}{2}$; depth $3\frac{1}{2}$; fin rays: D. XIII-I, 13; A. II, 8. Color dark-olive above; sides more or less brassy-yellow; belly white; about six irregular, dark olive bars on sides; lower fins clear, pale orange, sometimes whitish, sometimes red; second dorsal and caudal yellowish-olive, somewhat dusky tinged; first dusky yellow at base, a black blotch on the posterior part of the fin; lower jaw, etc., translucent reddish. The coloration varies much with circumstances, individuals living in weedy streams, being much darker and more spotted than the average lake specimens are. Length of adult 8 to 12 inches.

Habitat, entire Great Lake Region and upper portion of the Mississippi Valley, and in all streams east of the Alleghany Mountains, south to Georgia. West of the Alleghanies it does not occur, except in the lake region and in the upper waters of such streams as the Scioto, Wabash, Illinois, Rock, etc., rising in the same water shed with streams flowing into the great lakes. In the upper courses of the Wabash, Scioto, etc., the Perch is often very abundant, but in the valley proper of the Ohio, into which these streams flow, it is not found native, a peculiarity of distribution not yet accounted for.

The Perch is voracious and gamey, readily taking the hook, and being a handsome fish, it usually finds a ready sale for food. Its flesh is, however, much inferior to that of the Bass or the Pike-Perches, being rather soft, coarse, and insipid.

"The common Perch, *Perca flavescens*, which name describes well the gleaming, golden reflections of its scales, as it is drawn out of the water, its red gills standing out in vain in the thin element, is one of the handsomest of our fishes, and at such a moment as this reminds us of the fish in the picture which wished to be restored to its native element until it had grown larger.

"The Perch is a tough and heedless fish, biting from impulse, without nibbling and from impulse refraining to bite, and sculling indifferently past. It is a true fish, such as the angler loves to put into his basket or hang on the top of his willow twig, on shady afternoons, along the banks of the streams. So many unquestionable fish he counts, and so many shiners which he counts, and then throws away."—*Thoreau*.

GENUS 70. STIZOSTEDIUM. Rafinesque.

Stizostedion, RAFINESQUE, Ich. Oh. 1820, 23.

Pomacampus, RAFINESQUE, Ich Oh., 1820 (*Perca nigropunctata*, Raf.; an erroneously described or mythical species.).

Lucioperca, CUV. and VAL., Hist. Nat. des Poissons, ii, 1838, 110 (*Perca lucioperca* L.—*Lucioperca sandra*, C. & V.).

Sandrus, STARK, Elements of Nat. Hist., i, 1828, 465.

Stizostedium, COPE, Proc. Acad. Nat. Sci. Phila., 1865, 82, 85 (amended orthography).

Stizostethium, JORDAN, Ann. N. Y. Lyc. Nat. Hist., 1877 (amended orthography).

Centropomus, BLEEKER, 1877 (*Centropomus sandat*, Lac.; *P. lucioperca* L. is the first species mentioned by Lacepede in his genus *Centropomus*—not *Centropomus* of Cuvier and Gill—*Centropomus undecimalis* Lac., a West India species, having been by them selected as the type of *Centropomus*.).

Cynoperca, GILL and JORDAN, Bull. U. S. Nat. Mus., x, 1877, 45 (subgenus, based on *Lucioperca canadensis*, Hamilton Smith.).

Mimoperca, GILL and JORDAN, Bull. U. S. Nat. Mus., x, 1877, 45 (subgenus, based on *Perca volgensis*, Pallas.).

Perca and *Centropomus*, sp. early authors.

Type, *Stizostedion salmoneum*, Rafinesque.

Perches, with the body elongate, little compressed, and the premaxillaries and palatines provided with some large teeth, arranged in rows, the rest of the teeth uniform; tongue toothless; head conical, elongate, depressed, partly covered with small ctenoid scales; preoperculum serrated; operculum armed with one to twenty spines of varying size, the terminations of rib like elevations on the surface of the bone; dorsal fins separated, the first with twelve to fifteen spines, the second with seventeen to twenty-three soft rays. This genus consists of about five species, abounding in the fresh waters of North America and Europe. They are, of course, carnivorous and voracious, but are everywhere highly valued for food.

ANALYSIS OF SPECIES OF STIZOSTEDIUM.

Dorsal fins well separated, the interspace between them more than the diameter of the eye; the distance from the base of the last spine of the first dorsal, and the first of the second equal to the space occupied by the last four to six spines of the first dorsal; anal fin II, 12, longer than high; second dorsal I, 17 to I, 21; spines of the second dorsal and anal closely attached to the soft rays; last dorsal spine scarcely erectile, more or less firmly bound down by the membrane; canine teeth strong (American species.).

* Soft dorsal comparatively short (its base one-fourth shorter than that of spinous dorsal), and with about seventeen short rays; cheeks, opercles, and top of head more or less closely scaled; body depressed, subterete; size small; pyloric cœca forming two groups, the primary one of four, unequal, moderate, much shorter than the stomach; the secondary of few (1-3) rudimentary ones, which are sometimes atrophied.

CANADENSIS.

** Soft dorsal rather long (one-sixth shorter than spinous dorsal), with about twenty soft rays; cheeks and upper surface of head nearly naked; body more compressed; size large; pyloric cœca three, subequal, all along (about as long as stomach).

130. STIZOSTETHIUM CANADENSE (C. H. Smith) Jordan.

**Sauger; Gray Pike; Sand Pike; Ground Pike; Pickering;
Pickerel.**

Lucioperca canadensis, C. H. SMITH, MSS., Griffith's Cuvier's Animal Kingdom, x, 1834, 275.—RICHARDSON, Fauna Bor.-Amer. Fishes, iii, 1836, 17.—DEKAY, N. Y. Fauna, Fishes, 1842, 19.—STORER, Synopsis, 1846, 276.—GUNTHER, Cat. Fishes. i, 1859, 75.—JORDAN, Klippart's Report, 1877, 225.

Stizostedium canadense, JORDAN, Man. Vert., 1876, 225.—JORDAN and COPELAND, Check List, 1876, 136.

Stizostethium canadense, JORDAN, Bull., x, U. S. Nat. Mus., 1877, 48; Man. Vert., 2d Ed., 1878, 230.

Lucioperca grisea, DEKAY, N. Y. Fauna, Fishes, 1842, 19.—STORER, Synopsis, 1846, 276.—GUNTHER, Cat. Fishes, i, 1859, 76.—JORDAN, Ind. Geol. Surv., 1874, 212.

Stizostedium griseum, MILNER, Rept. U. S. Fish Com., 1872-3.—JORDAN, Man. Vert., 1876, 225.—NELSON, Bull. Ills. Mus. Nat. Hist., 1876, 36.—JORDAN and COPELAND, Check List, 1876, 136.

Lucioperca borea, GIRARD, Proc. Acad. Nat. Sci., Phila., Nov., 1857 (not Okow or Horn Fish, Richardson, which is *S. vitreum*).

Stizostedion boreus, GIRARD, Pac. R. R. Surv., x, 1868, 31.

Stizostedium boreum, JORDAN and COPELAND, Check List, 1876, 136.

Lucioperca pepinus, ESTES, Hallock's Sportsman's Gazetteer.

Description.—Body most elongated, more terete than in *vitreum* proper, with the back scarcely compressed, so broad that the lateral line may be seen in a view from above; the back somewhat angulated as it descends to the sides; the depth of the body four and one-half to five in length; head quite pointed, about three and one-half in length; the slope of the profile greater than in *vitreum*; eye smaller, five to five and one-half in adult; mouth rather smaller, the lower jaw included; maxillary reaching to opposite posterior margin of eye; opercle with a sharp, flat spine, usually a smaller one below it, and an obscure one above; sometimes two or three smaller ones below, often none; the position and number of these spines extremely variable; in variety *canadense*, sometimes as many as seventeen of these spines occur; cheeks usually closely scaled, the hinder third, or less, sometimes naked; median furrow on top of head closely scaled; coloration paler and more translucent, the shades less blended than in *S. vitreum*, olive gray above, sides considerably brassy or pale orange, with much black mottling; the black gathered into several definite dark areas, the most distinct of these being opposite the second dorsal; two others fainter, at each extremity of the spinous dorsal and one at base of caudal; these blotches are irregular and diffuse, but very characteristic; young specimens are pale orange, with broad, black shades; spinous dorsal, with two or three rows of round, black spots, one of each row on the membrane between each pair of spines; no distinct blotch on posterior part of the fin; a large black blotch at base of pectorals; second dorsal with about three rows of irregular, dark spots; caudal yellowish and dusky, almost barred; fin rays: dorsal XII, 1-17, varying to XIII, 1-18; anal II, 12; lateral line with ninety two to ninety-eight scales; pyloric cæca four to seven, four of them larger than the rest, of different lengths, all small and shorter than the stomach; the usual number is six, but the two small ones are sometimes one or both absent, sometimes duplicated. Length of adult 10 to 15 inches.

Habitat, St. Lawrence River, Great Lake Region, Upper Mississippi, and Upper Missouri rivers; also in the Ohio, where it has been introduced from the lakes, through the canals, according to the fishermen.

Diagnosis.—The different form and coloration, particularly the markings of the dorsal fin, distinguish this species at once from *Stizostedium vitreum*. This species has, moreover, always fewer dorsal rays, more scaly cheeks, and permanent armature of the operculum.

Remarks.—In comparing saugers from widely separated localities certain differences appear, which are perhaps sufficiently constant to indicate distinct varieties. Of these, three are perhaps worthy to be designated by name. The above description was drawn from the common Sauger or Sand Pike of the lakes (*Lucioperca grisea*, DeKay), which should bear the name of *Stizostedium canadense*, var. *griseum*. The Sauger or Pickering of the St. Lawrence was the original *Lucioperca canadensis* of Col. C. H. Smith. It should, therefore, be the typical variety, *canadensis*. Its head is rougher and more closely scaled, and the number of spinous points on the opercle is greater. The "Sand Pike" of the Upper Missouri averages rather slender, with a long, slenderer nose, and more flattened and snake-like head. This is the *Lucioperca borea* of Dr. Girard, and may be called var. *boreum*, if the differences here noted prove at all constant.

Habits.—The Sauger never reaches a large size, the largest I have seen being from fifteen to eighteen inches in length. It is abundant everywhere in the Great Lakes, and is valued as food, although less highly rated than its relative, the Pike-Perch.

It is plentiful in the Ohio River, where it is probably indigenous, although some claim that it has been introduced there through the canals.

131. STIZOSTETHIUM VITREUM (Mitchill) Jordan and Copeland.

var. *Vitreum*.

Wall-eyed Pike; Glass Eye; Dory; Salmon; Pike-Perch; Okow; Hornfish; Green Pike; Yellow Pike; Jack; Jack Salmon.

Perca vitrea, MITCHILL, Supplement Am. Monthly Mag., ii, 1818, 247 (Cayuga Lake).

Stizostedium vitreum, JORDAN and COPELAND, Check List N. Am. Fresh Water Fishes, Bull. Buff. Soc. Nat. Hist., 1876, 136.

Stizostethium vitreum, JORDAN, Ann. N. Y. Lyc. Nat. Hist., 1877; in Klippart's Rep. Fish Commr. Ohio, 1877; Bull. U. S. Nat. Mus., 1877; Man. Vert., 2d Ed., 1878.

Lucioperca americana, CUV. and VAL., ii, 1829, 122.—RICHARDSON, Fauna, Bor.-Amer., iii, 1836, 10.—KIRTLAND, Zool. Ohio, 1838, 192; Bost. Journ. Nat. Hist., iv, 237.—THOMPSON, Hist. Vt., 1842, 130.—DEKAY, Zool. N. Y. Fishes, 1842, 17.—STORER, Syn-

opsis, 1846, 276.—**AGASSIZ**, Lake Superior, 1850, 294.—**JARDINE**, Nat. Libr., Perches, 1852, 107.—**GUNTHER**, Cat. Fishes, i, 1859, 74.—**JORDAN**, Ind. Geol. Surv., 1874, 212, and of writers generally.

Stizostedion americanum, **COPE**, Proc. Acad. Nat. Sci. Phila., 1865, 82, 85.—**COPE**, Proc. Am. Philos. Soc., 1870, 448.—**MILNER**, Rep. U. S. Fish Com., 1872-3, 425.—**JORDAN**, Man. Vert., 1876, 225.—**UHLER** and **LUGGER**, Fishes of Maryland, 1876, 110.—**NELSON**, Bull. Ills. Mus. Nat. Hist., 1876, 36.

var. *Salmoneum*.

**Blue Pike (Lake Erie); White Salmon (Ohio River);
Pickerel No 2.**

Perca salmonea, **RAFINESQUE**, Am. Monthly Mag., v, 1818, 354; Ich. Oh., 1820, 21.

Stizostedion salmoneum, **RAFINESQUE**, Ich. Oh., 1820, 23.

Stizostedium salmoneum, **COPE**, Proc. Acad. Nat. Sci. Phila., 1865, 82.—**JORDAN**, Man. Vert., 1876, 225.—**COPE**, Proc. Am. Philos. Soc., 1870, 449.—**JORDAN** and **COPELAND**, Check List, 1876, 136.—**NELSON**, Bull. Ills. Mus. Nat. Hist., 1876, 36.

Stizostethium salmoneum, **JORDAN**, Ann. N. Y. Lyc. Nat. Hist., 1877; in Klippart's Report Fish Commr. Ohio, 1877.—**JORDAN**, Bull. U. S. Nat. Mus., x, 1877.

?? *Perca nigropunctata*, **RAFINESQUE**, Ich. Oh., 1820, 23 (very erroneous).

?? *Pomacampus nigropunctatus*, **RAFINESQUE**, Ich. Oh., 1820, 23.

Description of var. vitreum—Body elongate, rather slender and subcylindric, becoming deep with age, the depth in young of 14 inches, $1\frac{1}{2}$ to 5 in length; head long, $3\frac{2}{3}$ in length; mouth large, the maxillary reaching beyond the pupil to posterior margin of orbit, its length $2\frac{1}{2}$ to 3 in head; mandible a little more than half length of head; eyes large, less than in *salmoneum*, shorter than snout and than preopercle, $4\frac{1}{2}$ to 5 in head; jaws equal, or the lower slightly projecting, its sides somewhat included; cheeks scaly, varying to nearly smooth, usually a few scales at least behind the eye; opercle with a strong, flat spine, which is sometimes bifid or trifid, no smaller ones below it; dorsal spines high, more than half the length of head, as long as from snout to past eye, and 1-3 to 1-5 past opercle; general color a heavy olive, varying considerably, finely mottled with brassy, the latter color forming indistinct lines, which run obliquely upward and backward along the rows of scales; sides of head more or less vermiculated; lower jaw flesh-colored; belly and lower fins pinkish; spinous dorsal fin without black spots except a large jet black blotch, which involves the membrane of the last two or three spines; second dorsal and caudal mottled olive and yellowish; base of pectorals without distinct black spot; dorsal XII or XIII, 2, 20, or 21; anal II, 12; lateral line with about 90 scales; pyloric cæca long and large, subequal, three in number; size very large; this species reaches a length of nearly three feet, and a weight of twenty to forty pounds.

Habitat, Mississippi Valley, Ohio and Tennessee Valleys, Great Lake Region, and streams of the Atlantic slope south of New England, north to the fur countries.

Diagnosis.—This species may be most readily known from the preceding by the presence of a single black spot on the posterior part of the spinous dorsal, instead of one or two rows of smaller spots on the middle part of the fin.

The Jack reaches, occasionally, forty pounds, and, like the trout, seeks

the highest and coolest waters that will float him. It possesses great activity and strength, and is a ravenous destroyer of perch and other species. Were it not so superior in every way to all others, this habit might condemn it; as it is, we regard it as one of the best species we possess. In the South it is eagerly bought, and forms the principal table fish for the various places of resort, where it can be obtained." (*Cope*, Rept. Comm. Fish, Penn., 1881, 128.)

In Ohio this is one of the most important food fishes. Great numbers are annually taken in Lake Erie and shipped to various parts of the East and South.

Description of var. salmoneum.—The body is shorter, thicker, and deeper, with slenderer caudal peduncle, the diameter of which is not much greater than that of the large eye; the mouth is smaller, the maxillary not reaching quite to the posterior margin of the pupil, 3 in head; the eye is larger, its diameter equal to the length of the snout or that of the preopercle; the lower jaw is slightly included; the dorsal spines are evidently considerably lower than in *S. vitreum*, the longest about equal to the distance from the snout to a point just short of hinder margin of orbit, about $2\frac{1}{2}$ in head; the coloration is similar to that of *S. vitreum*, but the adult is bluer or greener, with scarcely any of the brassiness characteristic of the latter species; the coloration of the fins is darker, and there are traces of a blackish horizontal band along the dorsal in addition to the large black blotch on the hinder rays; young specimens (from Ohio River) are more silvery, with traces of faint black bars along the back; fin-rays, dorsal XIV—1, 20; anal II, 13; lateral line with 95 scales; opercular spine single, as in *S. vitreum*; cheeks largely naked; pyloric cœca three, large, longer than stomach, as in the preceding variety; size much less than that of *S. vitreum*. The largest specimens seen by me were about fourteen inches in length.

Habitat, Lake Erie, Ohio River, and southward to Georgia.

This variety is said to frequent only bayous and inlets, not being taken in the deeper waters of the lakes, where *S. vitreum* especially abounds. It also reaches a smaller size, according to Mr. Klippart, who asks, "Why does the Blue Pike frequent the bayous and get to be no more than twelve to fifteen inches in length, and to weigh not to exceed two or three pounds, if it is identical with the wall-eyed Pike which frequents the deep waters of the lake, and attains a length of three feet and a weight of eighteen to twenty pounds?" This species, according to Mr. Klippart, is, at the Lake Erie fisheries, split and salted with the Sanger (*S. canadense*), the two together being known to the commercial world as "Pickerel No. 2," and bringing about two-thirds the price of Pickerel No. 1 (*S. vitreum*).

GENUS 71. AMMOCRYPTA. Jordan.

Pleurolepis, AGASSIZ, Bull. Mus. Comp. Zool., i, 1863, 5 (preoccupied among Fossil Ganoids).

Ammocrypta, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 5.

Type, *Ammocrypta beani*, Jordan.

Etymology, *ammos*, sand; *kruptos*, concealed.

Description.—Body slender and elongate, sub-cylindrical, pellucid in life; head slender; mouth rather wide, terminals horizontal, the lower jaw included; premaxillaries very protractile; teeth on the vomer; scales thin, ctenoid, little imbricated, present

along the region of the lateral line and on the tail, sometimes wanting on the back or belly; lateral line complete; gill membranes considerably united; head scaly or naked; no ventral plates; the belly naked; dorsal fins moderate, about equal to the anal fin and to each other; dorsal with about ten spines; anal spine single, weak; vertebrae 22 + 22 (*A. pellucida*); darters of moderate or rather large size; inhabiting the sandy bottoms of clear streams, where they bury themselves entirely excepting the eyes and snout; coloration translucent, with bright reflections.

132. AMMOCRYPTA PELLUCIDA (Baird) Jordan.

Sand Darter.

"*Etheostoma pellucidum*, BAIRD, Mss., 1853."

Pleurolepis pellucidus, AGASSIZ, Bull. Mus. Comp. Zool., 1863, 5.—JORDAN and COPELAND, Am. Naturalist, 1877 (February) 86.—JORDAN, Man. Vert., 2d ed., 1878, 219.—FORBES, Bull. Ills. Lab. Nat. Hist., ii, 1878, and of authors generally.

Description.—Body elongate, nearly cylindrical, the flesh pellucid in life, but of firm, wiry texture; head long; cheeks, opercles, and temporal region scaly; opercular spine small; region in front of dorsal mostly naked; scales little ctenoid, nearly smooth to the touch when wet, covering the sides of the body, loosely imbricated, and more or less imbedded in the skin; those along lateral line and caudal peduncle, best developed; maxillary barely reaching to opposite the large eye; eyes high up, separated by a narrow, grooved space; pectorals short, reaching tips of ventrals, half way to vent; translucent scales with fine, black dots; a series of small squarish olive or bluish blotches along the back, and another along the sides, connected by a gilt line; D. X-I, 9; A. I 8; Lat. 1 75 to 80; head $4\frac{1}{2}$; depth 7; length 3 inches.

Habitat, Ohio Valley and Upper Mississippi, Pennsylvania to Minnesota and Missouri; abundant in clear streams with sandy bottoms.

Diagnosis.—The slim, translucent, cylindrical body distinguishes this at sight from all other Ohio fishes.

Habits.—This extremely curious little fish lies buried in the sand in the bottoms of shallow streams, with only its snout and eyes uncovered. It feeds upon the larva of insects and other small organisms. For a full account of its habits see *American Naturalist* for February, 1877, p. 86. It has, of course, no economic value of any sort, but as an aquarium fish it is the most attractive which our waters yield.

Two other species of this genus are found southwestward, and may perhaps occur in Ohio. These are *A. beani* Jor., known by its naked head and nearly naked body, and *A. asprella* Jor., known by its small, rough scales, there being about one hundred in the lateral line.

GENUS 72. BOLEOSOMA. DeKay.

Boleosoma, DEKAY, New York Fauna, Fishes, 1842, 20.

Arlina, GIRARD, Proc. Ac. Nat. Sci. Phila., 1859, 64.

Estrella, GIRARD, Proc. Ac. Nat. Sci. Phila., 1869, 65.

Type, *Boleosoma tessellata*, DeKay; *Etheostoma olmstedii*, Storer.

Etymology, *bolis*, dart; *soma*, body.

Body moderately elongate, fusiform, not translucent; head small, narrowed forwards, the profile convex; mouth small, horizontal, the lower jaw included; premaxillaries protractile; maxillary not joined to preorbital, except at its insertion; vomerine teeth present; scales large; lateral line continuous (rarely wanting on two or three scales); belly with ordinary scales; gill-membranes little connected; dorsal spines 7-10, slender; soft dorsal much larger than anal; anal normally with a single, short, slender spine, the first soft ray simple but articulate; vertebræ (*B. nigrum*) 17 + 20; coloration olivaceous and speckled, the males with head black in spring; size small.

ANALYSIS OF SPECIES OF *BOLEOSOMA*.

- a. Second dorsal with 11 or 12 rays; cheeks and breast mostly naked; lateral line with more than 40 scales, its pores usually wanting on 3 or 4 posterior scales.

NIGRUM.

- aa. Second dorsal with 13 or 14 rays; cheeks scaly; breast naked; lateral line complete.

OLMSTEDI.

133. *BOLEOSOMA NIGRUM* (Rafinesque) Jordan.

Johnny Darter.

Etheostoma nigra, RAFINESQUE, Ich. Oh., 1820, 37.

Boleosoma nigrum, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 15.

Boleosoma maculatum, AGASSIZ, Lake Superior, 1850, 305.—JORDAN, Man. Vert., ed. 2, i, 1859, 77.—FORBES, Bull. Ills. Lab. Nat. Hist., i, 1878, 40, and of many authors.

Boleosoma olmstedi var. *brevipinne*, COPE, Journ. Ac. Nat. Sci. Phila., 1868, 214.

Boleosoma brevipinne, COPE, Proc. Am. Philos. Soc., 1870, 273.

Boleosoma mutatum, VAILLANT, Recherches var. les Poiss. d'Eau Douce, 1872, 88.

Description.—Body fusiform, slender; head conical, moderate, the snout somewhat decurved; mouth small, lower jaw included; cheeks and breast naked (specimens occasionally found with these regions closely scaly); opercles scaly; space before dorsal mostly scaled; fins high, but smaller and lower than in the other species; coloration pale olivaceous; back much tessellated with brown; sides with numerous small W-shaped blotches; head speckled above, mostly black in the males; a black line forward from eye, and sometimes a line downward also; fins barred; males in the spring blackish anteriorly, sometimes almost entirely black; tubes of the lateral line obsolete; on the last, 4 or 5 scales; head $4\frac{1}{2}$; depth 5; D. IX-12; A. I, 8; scales 5-51-9. Length $2\frac{1}{2}$ inches.

Habitat, Great Lake region and Mississippi Valley; abundant everywhere in the Northwest; found in nearly every stream of Ohio.

Diagnosis.—From the other Darters, the genus *Boleosoma* may be known by its speckled coloration and absence of distinct anal spines. From its congener, *B. olmstedi*, *B. nigrum* may be known by the small second dorsal of but 12 rays, and by the naked cheeks. The two forms, however, undoubtedly are subject to intergradation.

Habits.—This species lurks on the bottom in clear, small brooks, mov-

ing for a short distance with great rapidity when disturbed, then resuming its former position of quiescence.

134. *BOLEOSOMA OLMSTEDI* (Storer) Agassiz.

Tessellated Darter.

Etheostoma olmstedi, STORER, Bost. Journ. Nat. Hist., iv, 1842, 61.

Boleosoma olmstedi, AGASSIZ, Lake Superior, 1850, 299.—STORER, Fish. Mass., 1867, 30.

—COPE, Proc. Amer. Philos. Soc., 1870, 268, and of nearly all authors.

Perca (Percina) minima, HALDEMAN, Journ. Acad. Nat. Sci., viii, 1842, 330.

Boleosoma tessellatum, DEKAY, New York Fauna, Fishes, 1842, 20.—GUNTHER, Cat. Fish.

Brit. Mus., i, 1859, 77.

Boleosoma maculatiiceps, COPE, Proc. Amer. Philos. Soc., 1870, 269.

Description.—This species agrees with *B. nigrum* in all essential respects, except the following: Cheeks and opercle scaly; lateral line complete, with about fifty scales in its course; second dorsal comparatively long; D. IX, 14; A. I, 9; coloration essentially as in the preceding; size somewhat larger. Length 3 inches.

Habitat, New England to Wisconsin and south to Georgia, replacing *B. nigrum* northward and east of the Alleghanies. In Ohio probably confined chiefly to tributaries of Lake Erie.

Habits.—Similar to those of *Boleosoma nigrum*. A species of the related genus *Vaillantia* (*Vaillantia camura*, Forbes, Jordan), occurs in Illinois, and may be looked for in Southern Ohio. It may be known from the species of *Boleosoma* by its incomplete lateral line.

GENUS 73. *DIPLESIUM*. Rafinesque.

Dipleston, RAFINESQUE, Ichthyologia Ohiensis, 1820, 37.

Hystostoma, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 305.

Dipleسيوم, JORDAN, Man. Vert., 1st Ed., 1876, 218.

Type, *Etheostoma blennioides*, RAFINESQUE.

Etymology, *dis*, two; *pleston*, near = two dorsals near together.

Body elongate, subterete; head very short and blunt, with tumid cheeks, the profile very convex; mouth small, inferior, horizontal; premaxillaries protractile, little movable, joined to the forehead mesially by a slight frenum; maxillary not protractile, adnate for most of its length to the fleshy skin of the preorbital; teeth in jaws strong; no teeth on vomer or palatines; gill-membranes broadly connected; scales moderate; lateral line complete, no enlarged ventral plates; dorsal fins large, the spinous dorsal longer and lower than the second of about thirteen spines; anal smaller than second dorsal with two spines; vertebræ (*D. blennioides*) 19 plus 22; coloration largely green.

135. *DIPLESIUM BLENNOIDES* (Rafinesque) Jordan.

Green-sided Darter.

Etheostoma blennioides, RAFINESQUE, Journ. de Phys., 1819, 419; Ich. Oh., 1820, 37 (not of Agassiz).

Diplesium blennioides, JORDAN, Man. Vert., 1st Ed., 1876, 223.—JORDAN and COPELAND, Amer. Nat., 1876, 339, and in numerous recent papers.

Hyostoma newmani, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 305.

Peleoma cymatogramma, ABBOTT, Proc. Acad. Nat. Sci. Phila., 1860, 327.

Hyostoma cymatogrammum, COPE, Journ. Acad. Nat. Sci., 1868, 214.

Hyostoma blennioperca, COPE, Journ. Acad. Nat. Sci. Phila., 1868, 214.

Description.—Body stout, elongate, little compressed; profile very convex; eyes large, high up and close together, a transverse depression at the nape and a longitudinal furrow between the eyes; mouth small, horizontal, quite inferior; upper jaw concealed in a furrow under the snout; scales moderate, those on the belly large, cycloid, not caducous; cheeks with fine scales; opercles with large ones; neck scaly; chest naked; anal papilla very large; anal spines strong; caudal fin emarginate; lower rays of the pectorals, and rays of the ventrals and anal enlarged and fleshy in the males; color olive green, tessellated above; sides with about eight double transverse bars, each pair forming a Y-shaped figure. These are joined above, forming a sort of wavy, lateral band. In life these markings are of a clear, deep green; sides sprinkled with orange dots; head with olive stripes and the usual dark bars; first dorsal dark orange brown at base, blue above, becoming pale at tip; second dorsal and anal of a rich blue green, with some reddish; caudal greenish, faintly barred; young and female specimens are more or less dull, but the pattern is peculiar; head $4\frac{1}{2}$; depth $4\frac{1}{2}$; D. XIII, 13; A. II, 8; Lat. 1. 65–78. Length 3 to 5 inches.

Habitat, all streams of the central basin from Virginia to Alabama, Minnesota, and Kansas. Abundant in all gravelly streams in Ohio.

Diagnosis.—This species may be known by its very blunt head and small, inferior mouth.

Habits.—Its habits are essentially like those of the species of *Boleosoma*. It is a delicate species, perishing at once in foul water.

GENUS 74. IMOSTOMA. Jordan.

Imostoma, JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 49.

Type, *Hadropterus shumardi*, Grd.

Etymology, *eimi*, to move; *stoma*, mouth.

Body stout and heavy forwards; head broad and blunt; mouth broad, the lower jaw included; upper jaw protractile; vomerine teeth present; sides of the head scaly; body covered with rather large scales, 56 in the lateral line; no enlarged ventral plates, the posterior part of the abdomen scaled like the sides, the anterior part with a naked strip; lateral line continuous; dorsal fins large, the first larger than the second, of ten spines; anal fin large, in male specimens greatly prolonged, reaching the caudal; anal spines two, the first the larger; dorsal formula X, 15; anal II, 11; pattern of coloration not well defined, dark blotches on a lighter ground. But one species is known.

136. IMOSTOMA SHUMARDI (Girard) Jordan.

Hadropterus shumardi, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 100.

Imostoma shumardi, JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 49; Man. Vert., 2d Ed., 1878, 222, and elsewhere.

Description.—Body stout, heavy forward, compressed behind; head broad and thick, resembling that of *Diplesium*; eye large, $3\frac{1}{2}$ in head; mouth large and broad, the lower jaw wide, a little shorter than the upper; maxillary reaching to the eye; cheeks, opercles, and neck scaly; chest naked; belly naked anteriorly, scaly in front of the vent; scales rather large; dorsal fins large, the first larger than the second, which is smaller than the anal, though longer; the two dorsal fins well separated; anal fin large, very deep, in some specimens (males ?) reaching to the caudal; anal spines strong, the first the larger; color dark, densely but vaguely blotched with darker; sides with 8-10 obscure blotches, the anterior ones bar-like; a large black spot on base of spinous dorsal behind, and a small one in front; second dorsal, caudal, and pectorals barred; a very strong black suborbital bar, and a faint dark line along muzzle; head 3.2-5; depth 5; D. X, 15; A. II, 11. Length 3 inches.

Habitat, Wabash River to Illinois and Arkansas; not abundant. Not yet seen in Ohio.

Diagnosis.—From other Darters of similar appearance, this species is known by its protractile mouth.

Habits.—Nothing distinctive is known of its habits.

GENUS 75. COTTOGASTER. Putnam.

? *Cottogaster*, PUTNAM, Bull. Mus. Comp. Zool., i, 1863, 5.

Rheocrypta, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 9.

Type, *Boleosoma tessellatum*, Thompson, not of DeKay.

Etymology, *Kottos*, Cottus; *gaster*, belly.

Body rather robust, little compressed; head moderate, bluntish; mouth small, the lower jaw included; premaxillaries protractile; maxillary not adherent to the preorbital; teeth on vomer; gill-membranes nearly separate; scales ctenoid, those of the middle line of the belly enlarged and spinous, falling off at times, leaving a naked strip; lateral line continuous; dorsal fins large, the second usually smaller than the first and smaller than the anal; anal spines two, strong, the first the stronger; size moderate.

137. COTTOGASTER COPELANDI Jordan.

Rheocrypta copelandi, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 9; Man. Vert. E. U. S., 2d Ed., 1878, 222, and elsewhere.

Description.—Body rather slender and elongate; head pretty large, rather long, somewhat narrowed, resembling that of *Boleosoma*; mouth small, horizontal, subinferior; eye large, $3\frac{1}{2}$ in head; cheeks naked; opercles and neck each with a few scales; throat naked; ventral plates well developed; scales moderate, strongly ctenoid; color brownish olive, a series of rather small, horizontally oblong black blotches along the lateral line, forming an interrupted lateral band; back tessellated; blackish streaks forward and downward from eye; ventral fins dusky; vertical fins with dusky specks; a black spot on anterior rays of spinous dorsal; head $4\frac{1}{2}$; depth $5\frac{1}{2}$; D. XI, 10; A. II, 9; Lat. 1.56. Length $2\frac{1}{2}$ inches.

Habitat. This species has thus far been taken only in White River, near Indianapolis, Indiana.

Habits—It lives in rapids in clear water, and does not ascend small streams.

GENUS 76. PERCINA. Haldeman.

Percina, HALDEMAN, Journ. Acad. Nat. Sci. Phila., viii, 1842, 330.

Pileoma, DEKAY, New York Fauna, Fishes, 1842, 16.

Asproperca, HECKEL, MSS. in Canestrini Systema der Percoiden, 1860, 311.

Type, *Percina nebulosa*, Haldeman = *Sciæna caprodes*, Rafinesque.

Etymology, Latin, *Percina*, a little perch.

Body elongate, slightly compressed, covered with small ctenoid scales; lateral line continuous; ventral line with enlarged plates, which fall off, leaving a naked strip; head depressed, rather pointed, the mouth being small and inferior, overlapped by a tapering, subtruncate, pig-like snout; upper jaw not protractile; teeth on vomer and palatines; gill-membranes scarcely connected; dorsal fins well separated, the first the larger, of 13–15 spines; the second dorsal rather larger than the anal, which has two spines, the first of which is usually the shorter; a rudimentary air-bladder and pseudobranchiæ; vertebrae (*P. caprodes*) 19 plus 22; general pattern of coloration olivaceous, with dark vertical bands alternately long and short; largest of the darters.

138. PERCINA CAPRODES (Rafinesque) Girard.

Log-perch; Hog-fish; Rock-fish; Hog-molly.

Sciæna caprodes, RAFINESQUE, Amer. Monthly Mag. and Crit. Rev., 1818, 354.

Etheostoma caprodes, RAFINESQUE, Journal de Phys., 1819, 419.—RAFINESQUE, Ich. Oh., 1820, 38.—KIRTLAND, Bost. Journ. Nat. Hist., iii, 1841, 346.

Pileoma caprodes, VAILLANT, Recherches Etheost., 1873, 43.

Percina caprodes, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 66.—JORDAN and COPELAND, Amer. Nat., 1876, 337, and of all recent American writers.

Percina nebulosa, HALDEMAN, Journ. Acad. Nat. Sci. Phila., viii, 1842, 330.

Pileoma semifasciatum, DEKAY, New York Fauna, Fishes, 1842, 16.

Percina bimaculata, HALDEMAN, Journ. Acad. Nat. Sci. Phila., 1843, 157.

Etheostoma zebra, AGASSIZ, Lake Superior, 1850, 308.

Description—Body elongate, compressed; head long and pointed, depressed and sloping above; mouth small, quite inferior, the maxillary not reaching nearly to the front of the eye; cheeks and opercles scaly; chest naked, space in front of spinous dorsal scaly; fins rather low; color salmon-yellow or greenish, with about fifteen transverse dark bands from the back to the belly, these usually alternating with shorter and fainter ones, which reach about to the lateral line; a black spot at the base of the caudal; fins barred; head 4; depth $6\frac{1}{2}$; D. XV, 15; A. II, 9; Lat. l. 92. Length 6 to 8 inches, being much the largest in size of the Darters.

Habitat, Quebec to Georgia, Lake Superior, and the Rio Grande, abundant in all streams, particularly in the basin of the Ohio.

Diagnosis.—From other Darters this species may be known by the pointed and pig-like nose, and by the zebra-like black bands on the sides.

Habits.—This species thrives in clear, rapid streams with gravelly bottoms, and is generally abundant throughout Ohio. It is large enough to

be sometimes taken with a small hook, and is often brought home by boys. Its flesh is excellent, but it is too small to have any importance as a food fish.

139. *PERCINA MANITOU* Jordan.

Percina manitou, JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 53; Man. Vert. 2d Ed., 1878, 220, and elsewhere.

Description.—Body elongate, little compressed; head slender, but less so than in *P. caprodes*, the snout being shorter, blunter, and less sloping; eye larger, $3\frac{1}{2}$ to 4 in head, with mouth rather small, little inferior, the maxillary not reaching quite to the eye; cheeks and opercles with small scales; chest naked; space in front of spinous dorsal naked; fins moderate, the height of the soft dorsal less than the distance from the snout to the preopercle; colors black and olivaceous, the back strongly marbled, the lateral bars short, not extending up the sides much above the lateral line; the bars are confluent more or less, and about twenty in number, the last one blotch-like; a round, black caudal spot; dorsal and caudal fins mottled; head $4\frac{1}{2}$; depth 7; D. XV, 14; A. II, 10; Lat. l. 90. Length 5 inches.

Habitat, Lakes of Northern Indiana, Michigan, and Wisconsin; specimens variously intermediate between this and the preceding found in the Potomac River (*Bean*), and in Illinois (*Forbes*). This form is usually well marked in color and in other respects; but it is doubtful whether it can be maintained as a distinct species.

Habits.—This form has been thus far chiefly taken in lakes; the other, (*caprodes*) in rivers. Whether this is a constant difference, I am unable to say.

GENUS 77. *ALVORDIUS*. Girard.

Etheostoma, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 354 (not of Rafinesque).

Alvordius, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 67.

Ericosma, JORDAN, Bull. U. S. Nat. Mus., x, 1876, 8.

Type, *Alvordius maculatus*, GIRARD.

Etymology. Dedicated to Major B. Alvord.

Body rather elongate, little compressed; mouth rather wide, terminal, the lower jaw included, the snout above not protruding beyond the premaxillaries, which are not protractile; teeth on vomer, and usually on palatines also; gill-membranes separate; scales small, ctenoid, covering the body; belly with a median line of enlarged spinous plates, which fall off, leaving a naked strip; sides of head scaly or not; lateral line complete; fins large, the soft dorsal smaller than the spinous or the anal; anal spines 2; dorsal spines 10–15; vertebrae 22 plus 22 (*A. aspro*), 17 plus 22 (*A. evides*); coloration bright; sides with dark blotches.

Darters of moderate size, having greater powers of swimming freely in the water than any of the other genera. The species are among the most graceful in form and elegant in coloration of all American fishes. This species is very close to *Percina*, from which it differs only in the form of the mouth.

140. *ALVORDIUS MACROCEPHALUS* (Cope) Jordan.

Etheostoma macrocephalum, COPE, Trans. Amer. Philos. Soc. Phila., 1866, 401.

Alvordius macrocephalus, JORDAN, Man. Vert., 2d Ed., 1878, 220.

Description.—Body elongate; head long, eel-like; mouth rather large, maxillary reaching to opposite anterior margin of orbit; eye shorter than snout, $4\frac{1}{4}$ in head; ventral shields twice as long as other scales; cheeks, opercles, neck, and chest without scales; color light brown; with a slightly undulating whitish band from upper angle of opercle to caudal peduncle; back with dark quadrate spots; sides with nine blackish longitudinal spots, alternating with smaller ones; streaks downward and forward from the eye; vertical fins somewhat barred; spinous dorsal with a median blackish band; head spotted above; head $3\frac{1}{2}$; depth 7; D. XV, 13; A. II, 11; scales 11–77–15. Length 3 inches.

Habitat, Ohio Valley. The known specimens are all from Western Pennsylvania.

Diagnosis.—This species is distinguished from its relatives by its very large, naked head.

Habits.—Nothing distinctive known.

141. *ALVORDIUS PHOXOCEPHALUS* (Nelson) Jordan.

Etheostoma phoxocephalum, NELSON, Bull. Ills. Mus. Nat. Hist., i, 1876, 55.

Alvordius phoxocephalus, JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 50; Man. Vert., 2d Ed., 1878, 221, and elsewhere.

Description.—Body rather slender, compressed; head extremely long, narrow, and tapering, the snout very acuminate; mouth large, the maxillary reaching to the eye; the lower jaw unusually narrow and long, scarcely shorter than upper; eye about equal to snout, $4\frac{1}{4}$ in head; cheeks, opercles, and neck with small scales; chest naked; color yellowish brown, somewhat as in *A. aspro*, but the lateral spots smaller and more numerous, scarcely twice the size of the eye, quadrate in form; a small blackish spot at each end of the lateral line; head 4; depth $5\frac{1}{2}$; D. XII, 13; A. II, 9; scales 12–68–14. Length 3 inches.

Habitat, Indiana (White River) to Tennessee and Kansas; not very abundant; not yet noticed in Ohio.

Diagnosis.—Distinguished from the other species of the genus by the long, slender head.

Habits.—This species is found in clear, gravelly rivers; it has not yet been noticed in Ohio, but doubtless occurs in the Southwestern part of the State.

142. *ALVORDIUS ASPRO* Cope and Jordan.**Black-sided Darter.**

Etheostoma blennioides, KIRTLAND, Bost. Journ. Nat. Hist., iii, 1841, 348, not of Rafinesque.

—VAILLANT, Recherches sur Etheost., 1873, 54, and of many writers.

Alvordius aspro, COPE and JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 51.—JORDAN, Man. Vert., 3d Ed., 1880, 220.

Alvordius maculatus, JORDAN, Man. Vert., 2d Ed., 1878, 220 (probably not of Girard).

Description.—Body rather elongate, fusiform, compressed behind; head moderately elongate, less pointed than in some of the species; mouth moderate, the lower jaw included; maxillary reaching just past the front of the eye; eye about equal to snout, four in head; gill-membranes little connected; lateral line straight, prolonged to the eye; opercles with rather large scales; cheeks with very small ones, which are scarcely visible over its whole surface; chest naked; neck naked or more or less scaly; body otherwise entirely scaly, the scales small and rough; straw yellow or greenish, with dark tessellations and marblings above, and about seven large, dark blotches along the sides, partly confluent, thus forming a moniliform band; fins barred; head 4; depth 6; D. XIII-XV, 13; A. II, 9; scales 9-65-17.

Habitat, Virginia to Lake Michigan, Tennessee River, and Upper Missouri, an abundant and variable species.

Diagnosis.—From the other Darters generally, this species is readily known by the beautiful pattern of the black markings on its sides. From nearly related species, the stoutish head, partly scaly, will usually distinguish it.

Habits.—This species, the most graceful of all the Darters, delights in clear streams with gravelly bottoms. It is less closely confined to the bottom and to the shelter of stones than the others, swimming more freely in the water, while the others rarely rise more than two or three inches. As an aquarium fish it is "hardier than any other fish as pretty, and prettier than any other as hardy."

143. *ALVORDIUS VARIATUS* (Kirtland) Jordan.

Etheostoma variatus, KIRTLAND, Bost. Journ. Nat. Hist., iii, 1841, 274.

Alvordius variatus, JORDAN, Man. Vert., 3d Ed., 1880, 220.

? *Alvordius maculatus*, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 67.

Etheostoma peltatum, SHAUFFER, MSS.; COPE, Proc. Acad. Nat. Sci. Phila., 1864, 232.

Alvordius peltatus, JORDAN, Man. Vert., 2d Ed., 1878, 220.

Description.—Body moderately elongate, deeper than in *A. aspro*; head rather short and stout; mouth large, the maxillary reaching the eye, lower jaw scarcely shorter than upper, outer teeth somewhat enlarged; eyes moderate, about as long as snout, $3\frac{1}{2}$ in head; head naked with the exception of a few scales on the upper anterior part of the opercle; neck and breast scaleless; ventral shields larger than in any of the other species, four times as large as the other scales, 6 to 8 in number, with strong, radiating points; coloration bright olive, the back with short, brown cross bars; the sides with broad, brownish shades; black blotch on neck and on opercle; blackish bars downward and forward from eye; fins barred, the spinous dorsal with a black band. According to Dr. Kirtland, the males are further variegated with blue, green, and orange. Head $3\frac{1}{2}$; depth 5; D. XII, 12; A. II, 8; scales 7-53-9. Length 4 inches.

Habitat, Pennsylvania and Eastern Ohio. Not abundant.

Diagnosis.—The naked head and large ventral plates distinguish this species.

Habits—Nothing distinctive is known of the habits. The peculiar, enlarged caducous scales of the belly reach a larger development in this fish than in any other.

144. ALVORDIUS EVIDES Jordan and Copeland,

Gilded Darter.

Etheostoma evides, JORDAN and COPELAND, MSS. in Nelson Bull. Ills. Mus. Nat. Hist., 1876, 36.

Alvordius evides, JORDAN and COPELAND, Proc. Acad. Nat. Sci. Phila., 1877, 51.

Ericosma evides, JORDAN, Bull. U. S. Nat. Mus., x, 1877; Man. Vert., 2d Ed., 1878, 221, and elsewhere.

Description.—Body moderate, somewhat compressed; head heavy, the profile rather convex; eye rather large, high, $3\frac{1}{2}$ in head; mouth moderate, somewhat oblique, the lower jaw included; maxillary reaching front of eye; cheeks, neck above, and throat naked; opercles with rather large scales; ventral plates little enlarged; fins large; second dorsal lower than anal, but with longer base; coloration extremely brilliant; dark olivaceous above, tessellated with dark; sides with about seven broad transverse bars extending from below the lateral line on one side across the back and down the other side; these bars are wider than the eye, and are connected along the lateral line by a faint black stripe; in the female these bars are black and the intervening spaces yellowish; in the male the bars are of a dark, rich blue-green, with metallic luster; the connecting longitudinal line greenish bronze; just above this line is a luminous yellowish streak, and above in each of the interspaces between the bars is a bright blotch of bronze-red; entire lower parts of the body of a bright clear yellow, which becomes on the under side of the head, throat, and branchiostegals a bright orange-red; blackish green streaks downward and forward from eye; cheeks orange-red, the color of iron rust; dorsal fin orange-colored, with a bright, bronze edge, a blackish spot on the last rays; second dorsal and caudal pale orange; two luminous spots at base of caudal; anal bronze, with a blue-black shading; ventral fins dark blue-black; pectorals faintly orange; males with the rays of the ventral and anal fins covered with small corneous tubercles, exactly as in some *Cyprinidæ*; female and alcoholic specimens show little of the bright colors, although the same pattern is preserved; the dorsal has a dusky spot on its posterior rays, and the fins are destitute of the dark bars found in the other species of *Alvordius*; head $4\frac{1}{2}$; depth $5\frac{1}{2}$; D. XI, 10; A. II, 8; scales 9-63-9. Length $2\frac{1}{2}$ inches.

Habitat. Thus far taken only in White River, in Central Indiana.

Habits.—It frequents clear and rapid waters. It is one of the most brilliantly colored of all our fishes.

GENUS 78. NANOSTOMA. Putnam.

Nanostoma, PUTNAM, MSS.; JORDAN, Bull. U. S. Nat. Mus., x, 1877, 6.

Type, *Pæciliichthys zonalis*, COPE.

Etymology, *nanos*, small; *stoma*, mouth.

Body fusiform, not greatly compressed; mouth small, subinferior, the premaxillaries

not protractile; vomerine teeth very feeble or wanting; scales large; gill-membranes broadly connected, no enlarged ventral plates; lateral line complete; dorsals well separated, the second much larger than anal, higher and shorter than spinous dorsal; dorsal spines about ten; anal spines two.

This genus is mainly distinguished from *Nothonotus* by the broad union of the gill-membranes.

145. NANOSTOMA ZONALE (Cope) Jordan.

Poeciliichthys zonalis, COPE, Journ. Acad. Nat. Sci. Phila., 1868, 212, tab. 24, f. 1. (male).

Nanostema zonalis, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 15, and elsewhere.

Nanostoma vinetipes, JORDAN, Proc. U. S. Nat. Mus., 1879 (female).

Description.—Body slender, somewhat compressed; head small, rather short; the mouth small, subinferior; snout decurved, rather obtuse, maxillary not reaching front of eye; cheeks, opercles, neck, and throat closely scaled; eye rather large; teeth very feeble, those on the vomer not evident, probably none on the palatines; first dorsal well developed, separated from the second, which is higher and shorter than the spinous dorsal, and considerably larger than the anal; caudal emarginate; bright olivaceous above, golden below; six dark brown quadrate dorsal spots, which connect by alternating spots with a broad, brown lateral band, from which eight narrower dark-bluish bands more or less completely encircle the belly; paired, anal, and caudal fins golden, brown-spotted; middle half of the first dorsal crimson; a series of round, crimson spots near the base of the second dorsal; occiput, a band on muzzle and one below eye black; a black spot on operculum and one at base of pectorals; females duller and speckled; the ventrals barred; the lateral bars feebler; head $4\frac{1}{2}$; depth 5; D. XI, 12; A. II, 7; scales 11–50–12. Length $2\frac{1}{2}$ inches.

Habitat, Ohio and Upper Mississippi Valleys, widely diffused but not generally abundant.

Habits.—Nothing distinctive known.

146. NANOSTOMA TESSELLATUM Jordan.

Hadropterus tessellatus, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 7.

Description.—Color olivaceous, the markings obliterated in the type; body fusiform; head broad and heavy, entirely naked; neck scaly; mouth moderate, horizontal, the lower jaw included, the maxillary extending to opposite front of eye; anal higher than second dorsal, but not so long, its spines strong; gill-membranes broadly united; D. X, 12; A. II, 8; Lat. 1. 48. Length $2\frac{3}{4}$ inches.

This species is known only from one specimen, in poor condition, taken in the Alleghany River, at Foxburg, Pennsylvania.

GENUS 79. NOTHONOTUS. Agassiz.

Nothonotus, AGASSIZ, Bull. Mus. Comp. Zool., i, 1863, 3.

Type, *Etheostoma maculata*, KIRTLAND.

Etymology, *nothos*, prominent; *notos*, back, from the high dorsal fins.

Body not greatly elongate, usually compressed; head moderate, snout decurved over a moderate sized sub-terminal mouth, which is horizontal or slightly oblique; scales various, usually rather large, the lateral line continuous; gill-membranes nearly separate; fins all large, the spinous dorsal usually rather larger than the second, the base of the second dorsal longer than that of the anal; upper jaw not protractile; teeth feeble, usually not appreciable on the palatines and very feeble on the vomer; species of moderate size, among the most beautiful of all fishes. This genus differs from *Pæcilichthys* only in having the lateral line complete.

147. *NOTHONOTUS CAMURUS* (Cope) Jordan.

Blue-breasted Darter.

Pæcilichthys camurus, COPE, Proc. Amer. Philos. Soc. Phila., 1870, 262, 265.

Nothonotus camurus, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 16.—JORDAN, Man. Vert., 2d Ed., 1878, 225, and elsewhere.

Description.—Body stout; head short; muzzle abruptly decurved, the mouth somewhat inferior; lower jaw included; males very dark olive or blackish, with an obscure band of a paler shade; belly paler; breast and throat deep rich blue; sides profusely sprinkled with crimson dots, like a brook trout; these spots sometimes arranged in short longitudinal series of threes and fours; series of olivaceous lines along the rows of scales; first dorsal with a black spot at base in front and a crimson one on the margin between the first and second rays; second dorsal, caudal, and anal crimson, bordered with yellow, which again is bordered with black or dark-blue on the edge of the fin; the crimson is deepest next the yellow; pectoral and ventral fins with a broad, red margin; females less distinctly marked, olivaceous, somewhat barred; head 4; depth $4\frac{1}{2}$; D. XI, 13; A. II, 8; scales 7-53-8. Length $2\frac{1}{2}$ inches.

Habitat, Ohio Valley, Cumberland River, Tennessee; White River, Indiana; Mahoning River, Ohio; French Creek, Pennsylvania. Not abundant.

Habits.—This species is one of the most brilliant and delicate of all our fishes. It is found in clear, cold streams, and thus far nowhere in great abundance. Professor Cope remarks concerning this species and others discovered by him.

“All of the above species lie on the bottom, frequently beneath stones, with the head only projecting, on the lookout for prey. Ordinarily they lie motionless, except occasionally inclining their position and exhibiting their gorgeous colors. The effect of this is heightened by the crystal clearness of the waters of the Southern mountain streams, which reflect as well the beauty of a Southern sky and the noble trees and flowering shrubs that border them in the rich wilderness of the Cumberland Range. Few more attractive spots to the naturalist can be found, and among its natural treasures these peculiar little fishes are among the most curious. All the fishes of this group can turn the head from side to side, and they frequently lie in a curved position or partially on one side of the body.”

148. *NOTHONOTUS MACULATUS* (Kirtland) Agassiz.

Etheostoma maculatum, KIRTLAND, Bost. Journ. Nat. Hist., iii, 1840, 276, pl. ii, fig. 3.

Nothonotus maculatus, AGASSIZ, Bull. Mus. Comp. Zool., i, 1863, 3.—JORDAN, Man. Vert., 2d Ed., 1878, 225.

Description.—Body moderately elongate, deep, and compressed; head long and rather pointed; mouth pretty large; jaws equal; dorsal fin elevated, the longest rays reaching caudal; olive-green, sides with rather large spots of brilliant carmine; vertical fins more or less barred with red and white; head 4; depth $4\frac{3}{4}$; D. XII, 13; A. II, 8; Lat. I, 60. Length $2\frac{1}{2}$ inches.

Habitat. Thus far only known from Mahoning River, Ohio, whence specimens were sent long ago by Dr. Kirtland to the U. S. National Museum. "It excels in beauty the speckled trout."—KIRTLAND.

GENUS 80. ETHEOSTOMA. Rafinesque.

Etheostoma, RAFINESQUE, Journal de Phys., 1819, 419.—JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 57.

Catnotus, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 305.

Type, *Etheostoma flabellaris*, RAFINESQUE.

Etymology, "etheo, to strain; stoma, mouth.

Body elongate, compressed; mouth terminal, more or less oblique; upper jaw not protractile; vomerine teeth present, teeth in the jaws strong, the outer series canine-like; opercular spine well developed; gill-membranes broadly united; scales rather large; lateral line incomplete; an enlarged, black humeral scale; first dorsal fin low, considerably lower than the second dorsal, of seven to nine subequal spines, which, in the males, end in little fleshy knobs; anal fin smaller than the second dorsal, with two spines, the first of which is always the larger; vertebræ (*E. lineolatum*) 14 plus 21; size small; coloration dark; the species are extremely quick in their movements, and their coloration, although not gaudy as in *Percichthys*, is very elegant.

149. ETHEOSTOMA FLABELLARE Rafinesque.

Etheostoma flabellaris, RAFINESQUE, Journ. de Phys., 1819, 419.—JORDAN, Man. Vert., 2d. Ed., 1878, 227, and elsewhere.

Etheostoma flabellata, RAFINESQUE, Ich. Oh., 1820, 36.

Catnotus flabellatus, PUTNAM, Bull. Mus. Comp. Zool., i, 1863, 3.

Percichthys flabellatus, COPE, Proc. Amer. Philos. Soc., 1870, 263, 450.

Etheostoma fontinalis, RAFINESQUE, Ich. Oh., 86.

Etheostoma linsleyi, H. R. STORER, Proc. Bost. Soc. Nat. Hist.

Oligocephalus humeralis, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 66.

Catnotus fasciatus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 67.

Catnotus kennicotti, PUTNAM, Bull. Mus. Comp. Zool., i, 1863, 3.

Description.—Body elongate, compressed, the back scarcely arched; head long and rather pointed, entirely destitute of scales; mouth rather large, terminal, oblique, the lower jaw notably the longer; eye moderate, longer than the snout, about 4 in head; opercular spine strong; fins all low, the first dorsal in the males about half as high as the second, higher in the females; caudal large, rounded; anal spines longer in females

* The word *Etheostoma* is stated by Rafinesque to mean "various mouths," the species known to him, i. e., *Percina caprodes*, *Diplesium blennioides*, and *Etheostoma flabellare*—being so different in respect to the form of the mouth, that he conceived that they might belong to different subgenera.

than in the males; dorsal and anal spines pointed in the female, in the male with thickened, fleshy tips; scales moderate; lateral line extending about to end of first dorsal; neck and throat naked; scales on sides extending up to the base of the dorsal fin; color dark, each scale with a dark spot, these forming a series of conspicuous longitudinal lines along the rows of scales; second dorsal and caudal conspicuously cross-barred; head blackish, with dark stripes radiating from eye; males further marked with conspicuous dark cross-bars; a black humeral spot; head 4; depth 5; D. VIII, 12; A. II, 8; scales 7-53-7. Length $2\frac{1}{4}$ inches.

Habitat, New York, Lake Erie, and Ohio Valley. Very abundant eastward.

Diagnosis.—The short, low dorsal, and the projecting lower jaw, distinguish this species from all others in Ohio.

Habits.—This species is very abundant in Western New York and Pennsylvania, swarming on the bottom of every clear and rocky stream. It is an active and hardy little fish. It is found throughout the Ohio Valley, but seems to be less abundant westward (Wisconsin and Illinois).

In the Northwest occurs a closely related species or variety, *Etheostoma lineolatum* (Agassiz), distinguished by the presence of series of very distinct, black, lengthwise stripes made of black dots.

150. *ETHEOSTOMA SQAMICEPS* Jordan.

Etheostoma squamiceps, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 11; Man. Vert., 2d Ed., 1878, 228.

Description.—Body rather elongate, considerably compressed, the caudal peduncle deep; head large; the jaws comparatively short, and equal; lateral line wanting only on about ten of the posterior scales, and with occasional tubes behind the continuous series; spinous dorsal low and short, the spines about equal, less than half the height of the second dorsal; bases of the two dorsals about equal, slightly connected by membranes; color dark, without spots, stripes, or bands in spirits; female mottled, with about six cross blotches; vertical fins cross-barred; lower fins black in the male, pale in the female; a large black humeral spot; head 3.1-5; depth 5; D. IX, 12; A. II, 7; scales 5-50-6. Length $2\frac{1}{4}$ inches.

Habitat, Ohio Valley; the known specimens being from Russellville, Kentucky, and from New Harmony, Indiana. Nothing is known of its habits.

GENUS 81. *PŒCILICHTHYS*. Agassiz.

Pœcilosoma, AGASSIZ, Lake Superior, 1850, 299 (name preoccupied).

Pœcilichthys, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 305.

Oligocephalus, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 67.

Apleston, GIRARD, Proc. Acad. Nat. Sci. Phila., 1859, 102 (not of Rafinesque).

Astatichthys, VAILLANT, Recherches sur Poiss. Eau Douce., Amer. Septent., Etheostom., 1873, 106.

Type, *Etheostoma cærulea*, STORER.

Etymology, *poikilos*, variegated; *ichthus*, fish.

Body rather stout and compressed; head large; mouth moderate, nearly horizontal; vomer with teeth; upper jaw not protractile; scales rather large, the lateral line complete posteriorly, usually on about two-thirds of the length of the body; gill-membranes scarcely connected; dorsal spines nine to eleven, their height about two-thirds that of the soft rays; second dorsal rather larger than first and larger than anal; anal with two well developed spines, the first usually the longer; vertebrae 15-18; size rather small; general pattern of coloration vertical blue bars on an olivaceous or orange ground. The species are quite numerous.

151. *PÆCILICHTHYS VIRGATUS* Jordan.

Pæcilichthys virgatus, JORDAN, Proc. U. S. Nat. Mus., 1879.

Description.—Body slender, formed much as in *Etheostoma flabellare*; mouth rather large; head entirely naked; a naked strip on the nape; preopercle serrulate; humeral region with an enlarged, black scale-like process; lateral line short, straight, greenish; each scale with a dark spot, these forming conspicuous longitudinal stripes along the rows of scales; D IX, 10; A II, 8; Lat. l. 53. Length $2\frac{1}{2}$ inches.

Habitat: Abundant in Cumberland River, in Kentucky; probably also in Southern Ohio.

Habits.—An active inhabitant of clear mountain streams.

152. *PÆCILICHTHYS CÆRULEUS* (Storer) Agassiz.

Blue Darter; Rainbow-fish; Soldier-fish.

Etheostoma cæruleus, STORER, Proc. Bost. Soc. Nat. Hist., ii, 1845, 47.

Pæcilichthys cæruleus, AGASSIZ, Bull. Mus. Comp. Zool., i, 1863, 3, and of many writers.

Astatichthys cæruleus, VAILLANT, Recherches, 1873, 107.

Pæcilichthys variatus, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 305.—JORDAN, Man. Vert., 2d Ed., 1878, 226.

Pæcilosoma erythrogastrum, KIRTLAND, Annals of Science, Cleveland, 1854, 4.

Pæcilichthys versicolor, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 304.

Pæcilotoma transversum, ABBOTT, Proc. Acad. Nat. Sci. Phila., 1860, 326.

Astatichthys pulchellus, VAILLANT, Recherches, 1873, 113.

Description.—Body robust, rather deep and compressed, the back somewhat elevated; head large, compressed, somewhat pointed; mouth moderate, terminal, oblique, the lower jaw scarcely included, the maxillary reaching front of orbit; neck and breast usually naked; fins all large, dorsal fins usually slightly connected; scales rather large; lateral line straight; males olivaceous, tessellated above, the spots running together into blotches; *back without black lengthwise stripes*; sides with about twelve indigo-blue bars running obliquely downwards and backwards, most distinct behind, separated by bright orange interspaces; caudal fin deep orange, edged with bright blue; anal fin orange, with deep blue in front and behind; soft dorsal chiefly orange, blue at base and tip; spinous dorsal crimson at base, then orange, with blue edgings; ventral bluish, often deep indigo; cheeks blue; throat and breast orange; females much duller, with blue or red, the vertical fins barred or checked; young variously marked; head $3\frac{1}{2}$; depth $4\frac{1}{2}$; D. X, 12; A. II, 7; scales 5-45-8; the lateral line developed on about 30 to 35. Length $2\frac{1}{2}$ inches.

Habitat, Upper Mississippi Valley, Ohio Valley, and tributaries of Lake Erie and Lake Michigan. In much of the Ohio Valley the most abundant member of the family, swarming in all streams.

Habits.—It prefers the channels on gravelly bottoms, seldom ascending brooks. It is less active than many of its relatives, but is the most gaudily colored of all. Stories of its having first appeared in different streams at the time of the outbreak of the late civil war are still extant, there being something patriotic about its red and blue coloration. For similar reasons it is sometimes called "soldier-fish" by the very few persons who know of its existence.

153. PÆCILICHTHYS SPECTABILIS Agassiz

Pæcilichthys spectabilis, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 304.—JORDAN, Man. Vert., 2d Ed., 1878, 226, and elsewhere.

Description.—Very similar to the preceding, but more elongate and rather more compressed; the colors somewhat similar, but the upper portion of the sides with distinct blackish stripes along the rows of the scales, and the ground color of the back and sides having a peculiar whitish or bleached appearance; the two dorsal fins usually well separated; head 4; depth $4\frac{1}{2}$; D. X, 12; A. II, 7; scales 5–40–7; Lat. 1. on 20 to 25 scales. Length 2 to 3 inches.

Habitat, Ohio Valley and Upper Mississippi Valley, with the preceding and nearly equally abundant, but frequenting chiefly the small brooks and spring runs.

Habits.—If this be a distinct species (which I doubt), and not merely the brook form of the preceding, it differs from the latter in its place of abode. It abounds in the little brooks, where it is as plentiful as *P. cæruleus* is in its larger streams.

PÆCILICHTHYS EOS Jordan and Copeland.

Red-sided Darter.

Boleichthys eos, JORDAN and COPELAND, Proc. Acad. Nat. Sci. Phila., 1877, 46 — JORDAN, Man. Vert. 2d Ed., 1878, 238.

Description.—Body elongate, slender, somewhat compressed, especially behind, rather heavy forwards, with very long caudal peduncle; head long, rounded in front; mouth small, little oblique, the upper jaw a very little the longer; dorsal fins high, about equal; caudal truncate; cheeks, opercles, and neck closely scaled; breast with a median series of small scales, or none; lateral line developed on 22 to 26 scales, arched upward above pectorals; color dark olive, with darker markings; ten or twelve dorsal spots or bars, and as many short, dark blue bars, not continuous with them; the interspaces between these bars, as well as most of the ventral region, bright crimson in the males, nearly plain in the females; lower parts of the sides, cheeks, etc., with various sharply defined, but irregular black markings; second dorsal, caudal, and pectorals strongly marked with wavy bands; first dorsal bright blue in the males, with a broad median band of crimson, speckled in the females; top of head dark; black streaks

downward and forward from eye; head $2\frac{7}{8}$; depth $5\frac{1}{2}$; D. IX, 11; A. II, 7; Lat. 1. 58. Length $2\frac{1}{2}$ inches.

Habitat, Northwestern Ohio to Minnesota; abundant northwestward; noticed only in tributaries of the Maumee, in Ohio.

Habits.—This species seems to be found in lakes and their tributaries more abundantly than is usual in this group. It is a brightly colored and active little fish.

GENUS 82. MICROPERCA. Putnam.

Microperca, PUTNAM, Bull. Mus. Comp. Zool., i, 1863, 4.

Type, *Microperca punctulata*, Putnam.

Etymology, *mikros*, small; *perke*, perch.

Body rather short, compressed; mouth moderate; the jaws about equal, the upper not protractile; vomerine teeth present; scales large; lateral line wanting, or on one or two scales only; dorsal fin small, subequal, well separated, the first with six or seven spines; anal fin much smaller than second dorsal, with two, or rarely one, spines, which are well developed; pattern of coloration greenish, with dusky bars and zigzag markings; size very small, probably the smallest of the spiny-rayed fishes.

155. MICROPERCA PUNCTULATA Putnam.

Least Darter.

Microperca punctulata, PUTNAM, Bull. Mus. Comp. Zool., i, 1863, 4.—JORDAN, Man. Vert., 2d Ed., 1878, 228, and elsewhere.

Description.—Body rather short and deep, somewhat compressed; the back arched, the caudal peduncle rather long; head moderate, the snout somewhat decurved; the mouth moderate, terminal, oblique; cheeks naked; opercles somewhat scaly; neck and chest naked; scales quite large, strongly ctenoid; fins all small; anal spines strong, the first usually the largest; coloration olivaceous, the sides closely speckled and with vague bars and zigzag markings; second dorsal and caudal barred; dark streaks radiating from eye; a dark humeral spot; head $3\frac{1}{2}$; depth $4\frac{1}{2}$; D. VI to VII, 10; A. II, 6; Lat. 1. 34. Length $1\frac{1}{2}$ inches.

Habitat, tributaries of the Upper Great Lakes and the northern parts of the Mississippi and Ohio Valleys; abundant northwestward. In distribution and probably in habits similar to *Pacilichthys eos*.

FAMILY XXIII. SCIÆNIDÆ. THE CROAKERS.

Body compressed, more or less elongate, covered with rather thin, ctenoid scales; lateral line continuous, extending on the caudal fin; head prominent, covered with scales; bones of the skull cavernous, the muciferous system highly developed, the surface of the skull, when the flesh is removed, very uneven; chin usually with pores, sometimes with barbels; mouth small or large, teeth in one or more series, the outer of which are sometimes enlarged; canines often present; no incisor nor molar teeth; no

teeth on vomer, palatines, pterygoids, or tongue; maxillary without supplemental bone, slipping under the free edge of the preorbital; premaxillaries protractile, but not very freely movable; nostrils double; pseudobranchiæ usually large, present in all our genera; gills 4, a slit behind the fourth; gill-rakers present; branchiostegals 7; gill-membranes separate, free from the isthmus; lower pharyngeals separate or united; preopercle serrate or not; opercle usually ending in two flat points; dorsal fin deeply notched, or divided into two fins, the soft dorsal being the longer, the spines depressible into a more or less perfect groove; anal fin with one or two spines; ventral fins thoracic, 1, 5; pectoral fins normal; caudal fins usually not forked; ear bones very large; pyloric cæca usually rather few; air-bladder usually large and complicated (wanting in *Menticirrhus*); most of the species make a peculiar noise, called variously croaking, grunting, drumming, and snoring; this sound is supposed to be caused by forcing the air from the air-bladder into one of the lateral horns; carnivorous; an important family of about 25 genera and 125 species, found in all warm seas, one species being confined to fresh waters; many of them reach a large size, and nearly all are valued for food.

GENUS 83. HAPLOIDONOTUS. Rafinesque.

Aplodinotus, RAFINESQUE, Journal de Physique, de Chemie et D'histoire Naturelle, 1819, 418.

Ambiodon, RAFINESQUE, Journal de Physique, 1819, 421 (based on the pharyngeal teeth of *A. grunniens*, erroneously ascribed to *Ichthyobus bubalus*).

Haploidonotus, GILL, Proc. Acad. Nat. Sci. Phila., 1861, 103 (corrected orthography).

Eutychelithus, JORDAN, Man. Vert. E. U. S., 1st Ed., 1876, 242.

Type, *Aplodinotus grunniens*, RAFINESQUE.

Etymology, *haplois*, a simple cloak to fit the body; *notos*, the back, in allusion to the scaly coating of the base of the second dorsal, supposed by Rafinesque to distinguish this genus from *Sciæna*.

Body oblong, the snout blunt, the back elevated and compressed; mouth rather small, low, horizontal, the lower jaw included; teeth in villiform bands, the outer scarcely enlarged; no barbels; pseudobranchiæ rather small; gill-rakers short and blunt; lower pharyngeals very large, fully united, with coarse, blunt, paved teeth; preopercle slightly serrate; dorsal spines strong and high, with a close fitting sheath at base, the two dorsals somewhat connected; second anal spine very strong; caudal double truncate; chin with five pores. But one species of this genus is certainly known. It has a wide distribution in the fresh waters of the United States.

156. HAPLOIDONOTUS GRUNNIENS Rafinesque.

Sheeps-head; Thunder-pumper; Drum; Bubbler; Grunting Perch; White Perch; Croaker.

Aplodinotus grunniens, RAFINESQUE, Journal de Physique, Vol. 88, 1819, 418.

Ambiodon grunniens, RAFINESQUE, Ich. Oh., 1820, 24.—AGASSIZ, Amer. Journ. Sci. Arts, 1854.—GIRARD, Pac. R. R. Expl. and Surv., x, 1854, 96.

Haploidonotus grunniens, GILL, Proc. Acad. Nat. Sci. Phila., 1861, 104.—JORDAN, Man. Vert., 1876; Man. Vert., 2d Ed., 1878.

Sciæna oscula, LE SUEUR, Journ. Acad. Nat. Sci. Phila., 1822, 252.—KIRTLAND, Rept. Zool. Ohio, 1838, 168, 192.

Corvina oscula, CUV. et VAL., Hist. Nat. de Poiss., v, 1830, 98.—RICHARDSON, Fauna Bor.-Amer., iii, 1836, 68.—KIRTLAND, Bost. Journ. Nat. Hist., iii, 1840, 350.—DEKAY, Fishes N. Y., 1842, 73.—STORER, Synopsis, 1846, 319.—GUNTHER, Cat. Fishes Brit. Mus., ii, 1860, 297.

Sciaena grisea, LESUEUR, Journ. Acad. Nat. Sci. Phila., 1822, 254.

Corvina grisea, DEKAY, Fishes N. Y., 1842, 76.

? *Corvina richardsoni*, CUV. and VAL., Hist. Nat. Poiss., v, 100.—RICHARDSON, Fauna Bor.-Amer., 1836, 64.—GUNTHER, ii, 298 (based on a deformed individual).

? *Eutychelithus richardsoni*, JORDAN, Man. Vert., 1st Ed., 242.

Ambloodon concinnus, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 307.

Haploidonotus concinnus, GILL, Proc. Acad. Nat. Sci. Phila., 1861, 104.—JORDAN, Man. Vert., 1876.

Ambloodon lineatus, AGASSIZ, Amer. Journ. Sci. Arts, 1854, 307.

Haploidonotus lineatus, GILL, Proc. Acad. Nat. Sci. Phila., 1861, 105.—JORDAN, Man. Vert., 1876.

Ambloodon neglectus, GIRARD, U. S. Mex. Bound. Surv., Ichth., 1859, 12.

Haploidonotus neglectus, GILL, Proc. Acad. Nat. Sci. Phila., 1861, 105.

Description—Body oblong, rather elongate, the front rather steep, the outline of the back posteriorly forming a nearly straight slope with scarcely any curve; the caudal peduncle rather slender; back very much compressed, its thickness being very much less than that of the belly; the greatest depth about one-third of the length; head oblong, the snout high and blunt; length of head contained about three and one-half times in the length of body (without caudal fin); mouth rather small, rather inferior; teeth in a villiform band in each jaw, that of the upper preceded by a row of slightly larger ones; eyes rather large, placed anteriorly, their diameter about equal to the length of the snout, and about one-fourth of the length of the side of the head; scales rather irregular in position, 50 to 54 in the course of the lateral line, seven or eight rows between the lateral line and the dorsal, and ten or twelve between it and the ventrals; fin rays: D. IX-1, 30; A. II, 7; first of the anal fin short, the second very large and long, attached to a stout bone; general color grayish-silvery, the back darker, the scales considerably punctate with fine dark points. Young specimens are often marked on the back with oblique lines, caused by the presence of darker spots along the rows of scales. This species reaches a length of more than two feet and a weight of forty to fifty pounds; specimens as seen in markets have usually a weight of one to five pounds.

Habitat, entire Great Lake Region and Mississippi Valley, southward to Georgia and Texas. It is found chiefly in the channels of the larger streams and in the lakes. It seldom ascends the creeks and small rivers.

Diagnosis.—This species is the only one in Ohio which has two anal spines, whereof the second is very much longer and stronger than the first.

In the Great Lakes this species is very abundant, and reaches a large size. It is there known as Sheeps-head, and is very rarely eaten as food. It has there the reputation of being "the most worthless fish that swims." The flesh has at all times a more or less disagreeable shark-like odor, which, in lake specimens, is often positively offensive. In the lakes the

species is peculiarly liable to the attacks of parasitic entozoa, and great tumors are often found on different parts of the body.

In the lakes of Northern Indiana it is known as Crocus, which name is a corruption of Croaker, a name given to species of the marine genus *Micropogon* in the same family. In the Ohio River it is now usually known by the name of White Perch, and commands a good price, although compared with the Sun-fishes and Bass, it is very indifferent food, not better than Suckers, except that the bones are fewer. Farther south it has the name of Drum, which term is also applied to the species of the related marine genus, *Pogonias*.

The names Croaker, Drum, Grunter, Thunder-pumper, etc., refer to a croaking sound, which the fish makes when in the water, and which may be heard in the night by putting the ear close to the water in still, deep places in rivers inhabited by this species.

This phenomenon is found in all or most *Sciænidæ*, and in many of the related families, *Sparidæ*, *Cottidæ*, etc. It is always accompanied by a trembling of the sides of the fish, very perceptible when a fish recently taken is held in the hand. It is thus explained by Dr. Holbrook (Ichth. S. Car., 118), in the case of the salt water Drum (*Pogonias chromis*).

"Cuvier observes that it may depend on the air-bladder. Though he says that it has no connection with the outside atmosphere. DeKay supposes it to be occasioned by the strong compression of the expanded pharyngeal teeth on each other.

"Frequent examinations of the structure and arrangement of the air-bladder, as well as observations on the living animal just taken from the water, when the sound is at intervals still continued, have satisfied me that it is made in the air-bladder itself; that the vibrations are made by the air being forced by strong muscular contractions through a narrow opening from one large cavity, that of the air-bladder, to another, that of the cavity of the lateral horn; and if the hands be placed on the sides of the animal, vibrations will be felt in the lateral horn, corresponding with each sound."

It seems to me certain that the noises proceed from the air-bladder, but it is also certain that they are produced in some species (*Artedius*, etc. in which the air-bladder has but one cavity, and is without the complicity of structure found in *Pogonias* and most *Sciænoids*.

The ear bones in *Haploidonotus grunniens* are largely developed, quadrate in form, and marked with a rude impress of a letter L. These are commonly known as "lucky stones" to boys living where this fish is found."

FAMILY XXIV. COTTIDÆ. THE SCULPINS.

Body moderately elongate, fusiform or compressed, tapering backward from the head, which is usually broad and depressed; eyes placed high, the interocular space usually narrow; a bony stay connecting the suborbital with the preopercle, usually covered by

the skin; upper angle of preopercle usually with one or more spinous processes; teeth equal, in villiform or cardiform bands on jaws, and usually on vomer and palatines; premaxillaries protractile; maxillary without supplemental bone; gills $3\frac{1}{2}$ or 4; slit behind the last gill small, or obsolete; gill-rakers short, tubercle-like or obsolete; gill-membranes broadly connected, often joined to the isthmus; body naked, or variously armed with scales, prickles, or bony plates, but never uniformly scaled; lateral line present, simple; dorsal fins separate or somewhat connected, the spines usually slender, the soft part elongate; caudal fin separate, rounded; anal fin similar to the soft dorsal, without spines; pectoral fins large, with broad procurent base, the rays mostly simple, the upper sometimes branched; ventrals thoracic, rarely entirely wanting, the rays usually less than I, 5; pseudobranchiæ present, at least in all our species; pyloric cæca usually in small number (4—8); air-bladder commonly wanting; genera about 40; species about 150, mostly of the rock pools of Northern regions; many species found in fresh waters. The majority of the species are of small size and singular aspect. None are valued as food, the flesh being dry and rather coarse, and the waste consequent on the removal of the head and skin very great.

The fresh-water species are all small in size. They lurk under stones and in shady places after the manner of the Darters. They are found only in clear waters, and delight especially in caves and springs.

All the fresh-water species are, we think, referable to two genera.

a. Gill-membranes nearly free from the isthmus, forming a broad fold across it; a slit behind last gill; bones of head extensively cavernous; no palatine teeth.

TRIGLOPSIS.

aa. Gill-membranes fully united to the isthmus; no slit behind last gill; bones of head little cavernous; palatine teeth present or not. . . . URANIDEA.

GENUS 84. TRIGLOPSIS. Girard.

Triglopsis, GIRARD, Proc. Bost. Soc. Nat. Hist., iv, 1:51, 18.

Ptyonotus, GUNTHER, Cat. Fishes Brit. Mus., ii, 1860, 175 (substitute for *Triglopsis*, considered to be preoccupied), there being a marine genus *Triglops* Kroger, 1844, in the same family.

Type, *Triglopsis thompsonii*, GIRARD.

Etymology, *Trigla*, the Gurnard, a marine genus of another family to which the present genus bears no special resemblance; *opsis*, appearance.

Fresh-water Sculpins with the body and head slender and elongated, the former tapering quite rapidly away towards the tail; both covered with smooth naked skin; mouth large; lateral line chain-like; teeth on vomer, none on the palatines; eyes large, the interorbital area concave; bones of lower part of head extensively cavernous; a small but distinct slit behind last gill; gill membranes almost free from the isthmus, forming a broad fold across it; preopercular spines, short, straight, simple; fins large, especially the second dorsal. Small fishes inhabiting the deeper waters of the Great Lakes. A single species known, thus far found in Lake Ontario and in Lake Michigan. It undoubtedly occurs also in Lake Erie, although none has yet come to the notice of any naturalist. Most of the specimens thus far obtained of *Triglopsis thompsonii* have been taken from the stomach of the Ling (*Lota maculosa*). The relations of the genus *Triglopsis* are particularly with the marine genus *Cottus*, and it seems to be a modified survivor of an ancient salt-water species, of the fauna of the basin of the Great Lakes.

157. *TRIGLOPSIS THOMPSONII*. Girard.

Triglopsis thompsonii, GIRARD, Proc. Bost. Soc. Nat. Hist., 1851, 19; Mon. Cottoids, 1851, 65 — JORDAN, Man. Vert., 1876; Man. Vert., 2d Ed., 1878, 256.

Ptyonotus thompsonii, GUNTHER, Cat. Fishes Brit. Mus., ii, 1860, 175.

Triglopsis stimpsoni, GILL, Mss. (no description published.)

Pale olivaceous, with darker blotches; upper fins faintly banded; body elongate, very slender; head long, depressed above; snout long and pointed; eye quite large, nearly as long as snout, much wider than interorbital space, 4 in head; jaws subequal; mouth large, the maxillary extending rather beyond middle of eye; preopercle with 4 sharp spines, the upper much shorter than pupil; cavernous structure of skull highly developed; upper surface of the head smooth; gill-membranes not broadly united, nearly free from isthmus; dorsal fins well separated; spinous dorsal short and low, its height little more than length of snout; second dorsal very large, 3 times height of first, its longest rays about as long as head; anal high, half as high as second dorsal; pectoral long, reaching past front of anal; ventrals well developed; lateral line chain-like, conspicuous; skin perfectly smooth; head 3; depth 6; D. VII-18; A 15; V. I., 3; Length 3 inches.

Habitat, deep waters of the Great Lakes, Lake Michigan, Lake Ontario. This species inhabits somewhere in the depths of Lake Ontario, but has not yet been seen or caught alive either by fishermen or naturalists. The manner in which its discovery took place is as follows: In opening the stomach of the Ling (*Lota maculosa*), the fishermen of Oswego, finding it almost constantly filled with that fish, had entertained the erroneous opinion that the Ling swallowed its progeny. Professor Baird, who visited that place in 1850, and heard the story, secured specimens, which at once enabled him to recognize in them a fish new to science, although half digested, the skin and the fins in most cases destroyed. In that state, when the head and body alone have preserved their shape, the elongation of the former and the tapering head of the latter may remind superficial observers of the elongated head and the tapering body of *Lota maculosa*. Attention should be directed on all fishing grounds of the Ling to the contents of the stomachs of these fish, as at present the only way known of procuring *Triglopsis*. By this means, at least, we should become acquainted with its geographic distribution, for mere remains, when they cannot be mistaken, are always sufficient to establish its occurrence at any given place, should complete and fresh specimens escape all researches. (Girard, Mon. Cottoids, 67.)

The specimens from Lake Michigan, to which the name of *Triglopsis stimpsoni* has been given, are not distinguishable from the original types of the species.

GENUS 85. URANIDEA. DeKay.

Cottus, sp., GIRARD, 1851, and of early writers generally (not type).

Uranidea, DEKAY, New York Fauna Fishes, 1:42, 61.

Cottopsis, GIRARD, Proc. Bost. Soc. Nat. Hist., iii, 1850, 303 (*asper*).

Potamocottus, GILL, Proc. Bost. Soc. Nat. Hist., viii, 1861, 40 (*punctulatus*).

Tauridea, JORDAN and RICE, Man. Vert. E. U. S., Ed. 2d, 1878, 255 (*spilota*).

Type, *Uranidea quiescens*, DeKay = *Cottus gracilis*, Heckel.

Etymology, *ouranos*, sky; *eido*, to gaze.

Fresh-water Sculpins with body fusiform, little compressed; head feebly armed, the

preopercular spines generally short, covered by the skin; skin smooth or variously prickly, without scales; villiform teeth on jaws and vomer, and in some species on palatines also; gill-membranes fully united to the wide isthmus, over which they do not form a fold; no slit behind fourth gill; branchiostegals 6; dorsals nearly or quite separate, the first of 6-9 slender spines; ventrals I, 3, or I, 4. Fishes of small size, inhabiting clear waters in the northern parts of Europe, Asia, and America. The species are numerous, and difficult to distinguish, as they are all very similar in form and coloration. The development of the palatine teeth in some of the species is so slight that their presence cannot well be used as a generic character.

It is not unlikely that other species besides those mentioned below may be found in Lake Erie or its tributaries.

ANALYSIS OF SUBGENERA AND SPECIES OF URANIDEA.

- a. Palatine teeth obsolete; ventrals (in our species) I, 3; skin smooth or nearly so. (Uranidea.)
- b. Preopercular spine prominent, straight, directed backwards, and but little upwards. HOYI.
- bb. Preopercular spine moderate, hooked upwards.
 - c. Pectorals short, not reaching anal. FRANKLINI.
 - cc. Pectorals long, reaching anal. GRACILIS.
- aa. Palatine teeth present; ventrals (in our species) I, 4.
 - d. Skin smooth, or prickly in the axil only. (Potamocottus.)
 - e. Preopercular spine short, hooked; dorsal rays about VII-17; anal about 12. RICHARDSONI.
 - x. Pectoral rays all simple
 - y. Spinous dorsal very low, of six spines; palatine teeth little developed; body small and slender. (Subspecies.) bairdi.
 - yy. Spinous dorsal well developed of 7 or 8 spines; palatine teeth well developed; body robust. (Subspecies.) carolinae.
 - xx. Upper pectoral rays branched. (Subspecies) wilsoni.
- dd. Skin of back and sides covered with prickles.
 - f. Preopercular spine short; prickles villiform. (Cottopsis.)
 - ff. Preopercular spine long, strongly hooked; prickles stiff. (Tauridea.) SPILOTA.

158. URANIDEA HOYI Putnam.

Hoy's Cottus.

Uranidea hoyi, PUTNAM, Mss.—NELSON, Bull. Ills. Mus. Nat. Hist., 1876, 41.—JORDAN, Proc. Ac. Nat. Sc. Phila., 177, 63; Man. Vert., Ed. 2d, 1878, 253.

Description.—Grayish olive, speckled and barred; body rather slender; female with the anterior parts of body and above lateral line covered with sparse prickles; male apparently smooth; head narrowed forwards; jaws narrow, about equal; maxillary reaching front of pupil; preopercular spine prominent, longer than pupil, sharp, almost straight, directed backwards and but little upwards; below this is another sharp, prominent spine, also nearly straight, directed partly downwards; 1 or 2 minute concealed

spines still lower; pectoral fins reaching vent; D. VI-16; A. 11; V. I. 3; P. 13. Length of specimens 2 1-6 inch.

Habitat, Lake Michigan—in deep water; two specimens known.

Female specimen taken 12 miles off Racine, Wis., in 12 fathoms, June 4th, 1875, by Dr. Hoy; the male off Milwaukee, June 15th. The specimens are now in bad condition, from rough handling. The female is distended with ripe eggs, so that the width of the body is one-third the total length.

This species seems to be quite distinct from all those described by Girard. The peculiar characters are the number and form of the preopercular spines, the contracted mouth, the large eyes, the small size of the body, and the length of the ventral fins. This curious little fish is as yet known only from the waters of Lake Michigan, but its occurrence in Lake Erie, also, is not improbable.

159. URANIDEA FRANKLINI (Agassiz) Jordan.

Cottus franklini, AGASSIZ, Lake Superior, 1850, 303.—GIRARD, Monogr. Cott., 53.—GUNTHER, ii, 158.

Uranidea franklini, JORDAN, Man. Vert., Ed. 2d, 1878, 252.

? *Cottus formosus*, GIRARD, Monogr. Cott., 1851, 58.

Uranidea kumlieni, HOY, Mss.—NELSON, Bull. Ills. Mus. Nat. Hist., 1876, 41.—JORDAN, Proc. Acad. Nat. Sci. Phila., 1877, 64.

Olivaceous, mottled; both dorsals and anal with a broad dark bar on the distal half; pectorals and caudal broadly blotched with dusky; jaws equal; preopercular spine stout, short, pretty strongly hooked upwards and inwards; first dorsal rather high, not much lower than second; pectorals short, not reaching anal; axil prickly, as in *L. richardsoni*: head $3\frac{1}{2}$; depth 5; D. VIII-17; A. 11 or 12. Length 3 inches.

Habitat, deep waters of the Great Lakes: Lake Superior, Lake Michigan, ? Lake Ontario.

This small species has not yet been obtained in Lake Erie, although doubtless occurring there.

160. URANIDEA GRACILIS (Heckel) Putnam.

Slender Miller's Thumb.

Cottus gracilis, HECKEL, Ann. Wiener Mus., ii, 1837, 148.—GIRARD, Proc. Am. Assoc. Adv. Sc., 1850, 401; Proc. Bost. Soc. Nat. Hist., iii, 1850, 189; Mon. Cottoids, 85, 49.

Uranidea gracilis, PUTNAM, Bull. Mus. Comp. Zool., 1863.—JORDAN, Man. Vert., Ed. 1st, 1876, and Ed. 2d, 1878, 252.

Uranidea quiescens, DEKAY, Nat. Hist. N. Y. Fishes, 1842, 61.

Cottus gobio, AYRES, Bost. Journ. Nat. Hist., 1845, 121 (not of Linnæus).

Description.—Olivaceous, mottled, upper edge of spinous dorsal red in life; body rather slender, fusiform; preopercular spine moderate, concealed; mouth rather large, the maxillary reaching nearly to the pupil; pectorals reaching front of anal; ventrals about to vent; head $3\frac{1}{2}$; depth 5; D. VIII, 16; A. 12. Length $2\frac{1}{2}$ inches.

Habitat, New England and New York; the common Eastern species found "quies-

cent" under stones in clear gravelly brooks, after the manner of the Darters. This species has not yet been noticed in Ohio, but it may probably be found in tributaries of Lake Erie, in the north-eastern part of the State.

161. URANIDEA RICHARDSONI (Agassiz) Jordan and Gilbert.

Miller's Thumb; Blob; Muffle-jaws; Cave Bull-head.

a. var. richardsoni. (Upper Lakes.)

Cottus richardsoni, AGASSIZ, Lake Superior, 1850, 300; GIRARD, Mon. Cott., 1850, 39.—GUNTHER, ii, 1850, 158.

b. var. bairdi. (Ohio to N. Y.)

Cottus bairdi, GIRARD, Proc. Am. Ass. Adv. Sci., 1850, 410; and Mon. Cott., 44.

c. var. wilsoni. (Ohio Valley.)

Cottus wilsoni, GIRARD, Mon. Cott., 1851, 42.

d. var. alvordi. (Wisconsin and Michigan.)

Cottus alvordi, GIRARD, Mon. Cott., 1851, 46.

e. var. meridionalis. (Alleghanies.)

Cottus meridionalis, GIRARD, Proc. Ass. Adv. Sci., 1850, 410; and Mon. Cott., 1851, 47.

f. var. zopherus. (Alabama basin.)

Potamocottus zopherus, JORDAN, Ann. Lyc. Nat. Hist. N. Y., 1876.

g. var. carolinæ. (Ohio Valley and southward.)

Potamocottus carolinæ, GILL, Proc. Bost. Soc. Nat. Hist., 1861, 40.

Description.—Olivaceous, more or less barred and speckled with darker; fins mostly barred or mottled; body slender or stout, tapering regularly backward to the tail; vertex somewhat depressed; interocular space with a groove; preopercle with a short, sharp spine, little hooked, directed backwards and upwards, mostly covered by the skin; below this are 2 smaller concealed spines; subopercle with a stoutish spine, directed forwards; skin smooth, except the region immediately behind the pectorals, which is beset with very small sharp prickles; these are sometimes obsolete; lateral line conspicuous, continuous or interrupted behind; first dorsal low and feeble; pectoral fins large, their length nearly equal to that of the head, their tips usually reaching beyond the origin of the soft dorsal; ventral fins moderate; isthmus very broad, the gill-membranes not forming a fold across it; head $3\frac{1}{2}$; depth 4-6; D. VI to VIII, 16 or 17; A. about 12; V. I, 4. Length 3 to 6 inches

Habitat, Middle and Northern States, and probably northward; abounding in all clear rocky brooks and lakes southward along the Alleghanies.

NOTE.—As understood by us, *Uranidea richardsoni* is a wide-spread and abundant species, varying in different regions, as is the case with most non-migratory species. In this as

in other species of similar range, the inhabitants of each stream, or of each river-basin, may show local peculiarities. A number of these forms have received from Dr. Girard specific names, which are accompanied by detailed descriptions. Large collections of these fishes reveal the fact that numerous other "species" still exist undescribed, as it is a rare thing to find a specimen which exactly agrees in all respects with any of the species in Dr. Girard's "Monograph of the Fresh-Water Cottoids." The following forms, of all of which the writer has specimens, may possibly be recognized as "varieties," but of their complete intergradation we have no doubt.

Var. *richardsoni* (Ag.) is rather slender, with the vent rather more posterior than usual, placed midway between the snout and the tip of the caudal; in the others it is nearly midway between the snout and middle of caudal. Wisconsin to Lake Superior.

Var. *bairdi* (Girard) is small and slender, with the spinous dorsal very low, and the palatine teeth less developed than in the other forms. Cayuga Lake, N. Y., to Ohio.

Var. *wilsoni* (Grd.) is rather stouter, with stronger palatine teeth, and with some of the uppermost of the pectoral rays bifurcate, they being entire in the others. Ohio Valley, Pennsylvania, and Indiana.

Var. *alvordi* (Grd.) is short and chubby, with the first dorsal rather high and joined by membrane to the second more than in other forms. Common in Wisconsin and Michigan.

Var. *meridionalis* (Grd.) is rather robust, with the dorsal fins scarcely connected, and the mouth rather larger, the maxillary extending to opposite posterior border of eye; the preopercular spine is sharp and directed well upward. Pennsylvania to North Carolina, along the Alleghanies; abundant.

Var. *sophera* (Jor.) is slender and very dark in color, and more conspicuously variegated; the palatine teeth well developed. Alabama River.

Var. *carolinæ* (Gill) is a very large form, rather robust, reaching a length of nearly six inches, without axillary prickles, and with the palatine teeth well developed. The lateral line, as in the other forms, is sometimes continuous and sometimes interrupted. It abounds in the limestone region from Indiana to Tennessee, and is frequently found in caves and under railroad culverts.

The following interesting account of the habits of this species is from the pen of Prof. S. H. Gage, of Cornell University. He terms the fish the "Cuyuga Lake Star Gazer."

"This curious little fish *Uranidea bairdi*, which, when it is full grown, is only about as long as one's middle finger, justly merits its name, as its eyes are directly on top of its head. Its salt water cousin is the Sea Robin or the Gurnard, which it resembles in having very large pectoral fins placed close to the broad head. These fins are so large, and the head so broad that the fish looks as if it were nearly all head and pectoral fins. The Star Gazer is so peculiar in form and habits, that in nearly every locality a special name has been given it. The fishermen of Cayuga Lake call it the "stone fish," as it is found almost exclusively under stones. In the northern part of the State it is called a "flying fish," from its rapid movements, and in England it is called the "miller's thumb," from the supposed resemblance of its broad, flat head to a miller's thumb.

"The European Star Gazer (*Uranidea gobeo*) was known to that pioneer in all human knowledge, Aristotle, who called it *Kottus*, whence the modern scientific name *Cottus*.

He described its characteristics admirably, saying that it lived under stones, and that when the top of the stone was struck, the fish would come out and dart around with incredible swiftness, as if the unwonted noise made it crazy.

"The Star Gazer lives in clear, cold brooks, and in the sheltered part of lakes; and like many other fishes does not object to eating its smaller brothers and sisters. The subject of this paper lives near the west shore of the lake, down three or four miles at least, and is especially abundant at the mouth of cool, spring brooks.

"There are two interesting points with reference to its eating and respiration that have never been described of any fish in American books so far as I know. Fishes are very quick in their movements, and very slippery, so that it is not only difficult to catch them, but to hold them after they are caught. In the Star Gazer, as in many other fishes, there is a very effectual means of preventing the escape of whatever may be caught. In both jaws there are very numerous, sharp, conical, recurved teeth, having a strong hinge on the side toward the throat, and an elastic band on the opposite side. These hinged teeth are set upon a bony base, and from the arrangement of the hinge, they are very readily bent toward the throat, but are immediately straightened by the elastic band when the pressure is removed; but after being once straightened the strong hinge and bony base will not allow them to move farther in that direction. Whenever a fish is caught the teeth are readily bent toward the throat, thus freely permitting motion in that direction; but if by any means the motion tended to be in the other direction, the teeth would form a myriad of rigid hooks preventing any escape. In all the struggles of the prey to escape, every motion toward the throat would be easy, but motion in the opposite direction would be impossible, so that the very efforts to escape only render escape the more hopeless. Truly we might well write over this fearful portal the gloomy words of Dante, "All hope abandon ye who enter here."

"The mechanism of respiration is very complex, but its whole office is to force currents of water over the gills and so purify the blood. There is one very interesting point in this mechanism, which has not been described in American books as is stated above, but which is easily understood. As fishes do not have fleshy lips to securely close their mouths, it is evident that when there is an attempt to force the water filing the mouth cavity over the gills and out through the gill fissures, it will tend to flow out through the mouth as well as through the gill fissures. To prevent this regurgitation, and insure the passage of the current over the gills there is both on the floor and roof of the mouth, just behind the jaws, a crescent shaped membranous curtain. These curtains are attached at their anterior edges, but their posterior edges float freely. Whenever water is drawn into the mouth the curtains float up against the roof and down against the floor of the mouth, offering no resistance whatsoever to the current. When the mouth is closed to force the water over the gills, the water tends to flow out through the opening of the mouth, but in doing so it gets above and below the curtains, moving them so that their free edges meet, and as they are so fastened in front that they cannot move further after their edges meet, the current of water is not allowed to go further in that direction, and therefore must pass over the gills and out through the fissures. These curtains in the mouth of the fish act precisely like the valves in the heart, they freely permit a current of fluid in one direction, but not in the reverse.

"The color of the Star Gazer is reddish brown, with deeper transverse bars. In the spring some of them are entirely black. It is so quick in its movements that it sometimes takes five or ten minutes to catch one. If the fish is frightened out of its hiding place under a stone, and chased five or ten minutes before being caught, it will not be

black as when first seen, but of a light gray color. This change of color from black to gray takes place in five minutes, and sometimes even less, and changes completely the appearance of the fish. This rapid change of color was so new to me that it was demonstrated over and over again to make sure there was no mistake. The cause seemed to be the great fright and the light. Upon studying them more carefully in an aquarium, it was found that when the water became deprived of its oxygen they would pant like a suffocating animal, and become very pale just as they did when frightened. If the water is changed, these pale fish soon regain their natural color and respire slowly and regularly.

"It has been known to fishermen from time immemorial that many fishes imitate the bottom on which they live, changing their color whenever put upon a differently colored bottom. This fact has been recently studied with great care, and has been very satisfactorily explained. It was found that the skin contained very many pigment cells, which may be expanded into thin sheets or contracted into almost invisible dots. These cells are of three colors, black, red, and yellow, the black being most abundant. As they are intimately mingled together, it is evident that a great variety of shades may be produced by a suitable combination of the colors. If the black cells were contracted, and the red or yellow cells expanded, the fish would be red or yellow, or if the red cells were expanded in certain regions, the yellow in others, and the black in others, a spotted or striped appearance would be given. It was also found that if a fish were put upon differently colored bottoms frequently, it soon became able to change its color very much more quickly than at first.

"If the eyes be blinded no change in color takes place, but if the eyes are left perfect, and a spinal nerve be cut, then the skin supplied by that nerve remains of a natural tint, although the surrounding skin whose nervous supply has been unaffected, will change through its whole range of colors.

"There is one point in the character of the Star Gazer, which is, so far as I know, unique with fishes. If one be carefully watched at a considerable distance, the respirations, indicated by the alternate opening and closing of the mouth and gill fissures, will be seen to take place about forty times per minute. Now, if one suddenly moves up very near the fish, not the slightest motion of the body or of the respiratory apparatus can be detected. If, however, one remains perfectly still for about half a minute, and watches the gill covers, he will see them commence to rise and fall very gently, and in two or three minutes the respirations will be as vigorous as ever. This experiment may be tried over any number of times and always with the same result. This is equivalent to holding the breath with the higher animals, and is apparently for the same purpose; viz., to escape detection. This supposition is verified by the following observation. As was stated above, a fish in impure water respire very rapidly and with desperate effort. No matter how suddenly one moves near a fish in this condition, not the slightest notice is taken of it; that is, the distress of suffocation has rendered the fish indifferent to its surroundings.

"The parental instincts of the Star Gazer are no less interesting than its purely selfish ones. If one goes to the west shore of the lake from April to July, and lifts up flat stones in water twelve to fifty centimetres deep, there will be found clinging to the under side of many of them an irregular, conical mass of beautiful salmon colored eggs, and under the same stone a Star Gazer. If the fish be frightened away, but nothing else disturbed, it will return in a short time as if to take charge of the eggs. The eggs are those of the Star Gazer, as is proved by hatching them; and the belief that the fish

is there to watch them is irresistible; for it returns to them after being driven away, and stays on guard from the time the eggs are laid in April until they are hatched in July.

"The eggs are laid near the shore in shallow water, but the fish seems to have forethought; for they are never laid above the low water mark of July, hence in April or May one must look in deeper water for them than in July.

"When the eggs are laid they are mingled with a clear, thick substance like the white of egg; but this substance hardens almost as soon as it is brought in contact with water, and is a true hydraulic cement, serving to fasten the eggs firmly together, and to attach them to whatever they are pressed against. So firmly does this cement hold the eggs, that they will be broken before separating from each other or from the stone to which the cluster is attached.

"Now, if the eggs in the middle of the cluster should hatch first, the fishes would not only find it hard to get out, but would loosen the cluster from the stone. This does not occur, but first the outside layer of eggs hatches, and then the next, and so on till all are hatched. It may seem strange that eggs laid at one time should not all hatch together; but observation has shown that heat hastens and cold retards the hatching of the eggs of cold blooded animals as well as those having warm blood. The order in which the Star Gazer's eggs are hatched becomes intelligible from what has just been said, when it is remembered that the outside layer of eggs is constantly laved by the surrounding water, and is first warmed by it, while the deeper layers are not so soon affected."

This species is occasionally taken with the hook in our clear streams. It bites readily, and is, in its way, voracious. In the aquarium its movements are interesting, much like those of the Darters; but it is unable to endure foul water. It is too small to be used for food. The largest specimens we have seen have been taken in cave streams, in which waters the species is especially abundant. It does not, however, go far into the caves, and its eyes are fully developed.

162. URANIDEA SPILOTA Cope.

Cow-faced Sculpin.

Uranidea spilota, COPE, Proc. Acad. Nat. Sci. Phila., 1865, 82.—BEAN, Proc. U. S. Nat. Mus., 1881, 127.

Cottopsis spilotos, JORDAN, Bull. U. S. Nat. Mus., x, 1877, 1, and Proc. Acad. Nat. Sci. Phila., 1877, 61.

Tauridea spilota, JORDAN and RICE, Man. Vert., 2d Ed., 1878, 225.

Cottopsis ricei, NELSON, Bull. Ills. Mus. Nat. Hist., 1876.

Description.—Body moderately elongate, depressed, the head especially so, quite abruptly contracted opposite the base of anal, the body behind head nearly as deep as wide; body behind the vent rather slender, subterete, giving a tadpole-like form; jaws about equal, the lower narrower, but projecting in front; mouth rather contracted, the maxillary scarcely reaching to eye; palatine teeth; eye $4\frac{1}{2}$ in head, half wider than the interorbital space, about equal to snout; eyes close together, entirely superior; head very broad and flat, as broad or broader than long, including the perpendicular spines,

its depth half its length; profile rising rapidly from head to base of dorsal, which runs along a decided ridge or carina; preopercular spine extremely large, more than three times as large as in other of our fresh-water Cottoids, and as long as the eye; this spine is hooked backwards, and is slightly spiral, giving the fish a decidedly buffalo-like or cow-like physiognomy; three spines hooked downwards below the large one, the lower concealed; a strong spine directed forwards at base of opercle; isthmus as wide as from snout to middle of orbit; head 3.3-5; depth $5\frac{1}{2}$; fin rays: D. VIII, 17; A 12; ventrals 1-4; pectorals 16; branchiostegals 6; base of pectorals crescentic, their tips just short of anal, the rays all simple; ventrals under pectorals reaching two-thirds to vent, their membrane decurrent; dorsal beginning a trifle beyond ventrals, rather nearer anal than snout; vent midway between base of caudal and snout; depth at first ray of anal less than half length of head, the thickness at the same point a little more than one-third; least depth one-fourth of head; caudal peduncle slenderer than in any other Cottoid known to me in our fresh waters; head smooth; space above lateral line behind head covered with small, stiff prickles, slightly hooked backwards, readily visible as little black specks when the skin is dry; axillary region not provided with spines; color pale brown, rather finely specked and mottled with darker brown; pectorals mottled; belly white. Length of smaller specimen (Nelson's type) 2.5-6 inches; of larger $2\frac{3}{4}$.

Habitat, Great Lakes, in deep water; Lake Michigan (Nelson, Rice, Jordan); Lake Ontario (Jordan). Several specimens of this species are mixed with Girard's original types of *Triglopsis thompsoni*, in the United States National Museum; near Hudson's Bay (Bean); also in Grand River (Cope). Not yet known from Ohio, but probably occurring in Lake Erie.

Diagnosis.—From our other Sculpins this species may be known by the prickly back. Specimens poorly preserved lose these prickles, however. The species may then be distinguished by the cow-like physiognomy, due to the great development and curvature of the preopercular spines.

FAMILY XXV. GADIDÆ. THE COD-FISHES.

Body elongate, compressed behind, tapering into the isocercal tail; scales small, cycloid, covering head and body; lateral line continuous; mouth large, the teeth pointed, variously arranged; gill openings very wide, the membranes separate or nearly so, free from the isthmus; pseudobranchiæ obsolete; bones of head usually unarmed; chin usually with a barbel; fins all composed of soft rays only; dorsal fin very long, sometimes divided into two or three fins; anal long, sometimes divided; caudal free from dorsal and anal; ventrals narrow; jugular of 2 to 7 rays; pyloric cæca numerous; air-bladder usually present; genera 15; species about 70. Fishes mostly of the Northern seas, many of them reaching a large size. Several of the most important food fishes, as the Cod, Haddock, Hake, Pollock, Cusk, etc., belong to this family. A single species is found in fresh waters.

a. Dorsal fins two, the first well developed; anal fin single; ventral rays six; chin with a barbel LOTA.

GENUS 86. LOTA. Cuvier.

Lota, CUVIER, Regne Animal, ii, 1817.

Type, *Gadus lota*, L.: *Lota maculosa*, var. *vulgaris*, BEAN.

Etymology, Latin, *lota*, the ancient name of the Burbot.

Body long and low, depressed anteriorly, subterete medially, strongly compressed behind; head large, broad and flattened above, the interorbital space wide and flattened; eyes moderate, lateral, anterior; head above and behind eyes scaly; anterior nostrils each with a small barbel; middle of lower jaw with a long one; mouth large, somewhat oblique, the upper jaw the longer; premaxillaries and lower jaw each with a band of slender, recurved, equal, cardiform teeth; vomer with a broad band of similar teeth, which extends backwards laterally; no canine teeth; palatines toothless; gill-membranes somewhat connected, free from the isthmus; branchiostegals 7 or 8; gill-rakers very short, dentate; scales very small, cycloid, imbedded in the skin; lateral line present; vertical fins scaly; dorsal fins two, separate, the first short, of 10 to 13 well developed rays; second dorsal very long, similar to anal; caudal fin distinct, rounded; ventrals slender, long, of about six rays; pectorals moderate, broad. A single species known, found in the fresh waters of Europe and North America.

163. LOTA MACULOSA (LeSueur) Richardson.

**Lawyer; Ling; Burbot; Aleky Trout; Mother of Eels; Cusk;
Eel-pout.**

Var. *maculosa* (American variety).

Gadus maculosa, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1817, 83.

Molva maculosa, LESUEUR, Mem. du Mus., 1819, 159.

Lota maculosa, RICHARDSON, Fauna Bor.-Amer., 1836, 248.—KIRTLAND, Bost. Journ. Nat.

Hist., iv, 1842, 24.—DEKAY, New York Fauna, Fishes, 1842, 234.—BEAN, Science News, 1878, 42, and of most American writers.

Gadus compressus, LESUEUR, Journ. Acad. Nat. Sci. Phila., i, 1817, 84.

Lota compressus, STORER, Synopsis, 1846, 471.

Gadus lacustris, MITCHELL, Amer. Month. Mag., ii, 1817, 244 (not of Walbaum).

Molva huntia, LESUEUR, Mem. du Mus., v, 1819, 161.

Gadus lota, RICHARDSON, Franklin's Journal, 1824, 74.

Lota brosmiana, STORER, Bost. Journ. Nat. Hist. iv, 1839, 58.

Lota inornata, DEKAY, New York Fauna, Fishes, 1842, 233.

Lota lacustris, GILL, Canadian Naturalist, 1865.—JORDAN, Man. Vert., 1st Ed., and of several late writers (based on *Gadus lacustris*, WALBAUM; a worthless description of some fish, more likely an *Amiurus*).

Description.—Color dark-olive above, usually thickly marbled with blackish, sometimes nearly plain brownish; belly yellowish or dusky; upper jaw longest; head broad, depressed; D. XIII, 76; A. 68; V. 6 or 7. Length 1 to 2 feet.

Habitat, Great Lake Region, and northward to Arctic Sea, Connecticut River, Hudson River, lakes of New York, Maine, New Brunswick, New Hampshire, Upper Mississippi, Missouri, etc.; occasional in Ohio River.

Synonymy.—The earliest available specific name of this species (unless we call it *Lota lota*) is *maculosus* LeSueur, as has been shown by Dr. Bean (*l. c.*). The prior name, *lacustris* (* *Gadus lacustris*, Walbaum, 1792), which has been used by Dr. Gill and myself, appears not to have been given to this species, nor to anything in particular, and is, therefore, not available. The earliest name of the European Burbot which Dr. Bean has found, is *Lota vulgaris*, Jenyns (1835). The European form is provisionally considered a variety (var. *vulgaris*), differing only in the fewer vertebrae (61 instead of 64). Most of the common names of this species have been given in allusion to its resemblance to marine Gadoid fishes, as "ling," "cusk," etc.

Diagnosis.—The "Lawyer" or Burbot may be known from all other Ohio fishes by the presence of a single barbel on the chin.

Habits.—This species inhabits chiefly large bodies of water, particularly broad, still, or deep rivers and lakes. Its range is entirely northward, Kansas City and New Albany, Indiana, being the southernmost points from which it has been recorded. In Ohio it is found in some abundance in Lake Erie. As an article of food it is not highly valued. The unattractive appearance of the fish is probably the cause of this, rather than any bad character of the flesh. The flesh is to my taste fairly good, although rather tough and destitute of richness, ranking about with the Cat-fishes, and decidedly better than the flesh of the "Drum," or of any of the Suckers. The liver is said to be especially delicious, but my taste is not sufficiently delicate to distinguish it from other fish liver, when cooked.

In Europe the Burbot is often boiled and eaten cold with vinegar and other condiments. So prepared, it is tough and tasteless.

The Burbot "is carnivorous and voracious, having a craving and wonderfully distensible stomach, which makes it an efficient dredge in securing bottom fishes. From this source was obtained the rare sculpin-like fish, *Triglopsis thompsoni*. It is said to lie in wait under stones watching for its prey, and to feed principally at night."—BEAN.

ORDER 9. HEMIBRANCHII. THE HALF-GILLED FISHES.

No pneumatic duct communicating with the air-bladder; superior branchiophyal and pharyngeal bones reduced in number; inferior pharyngeals separated; ventral fins abdominal or subabdominal; pectoral fins elevated; mouth bounded by premaxillaries

* The following is Walbaum's description of his "*Gadus lacustris*:"

"*Gadus lacustris*, Americanus Mathemeg; Anglis Land Cod, Pennant Arct. Zool., *Introd.*, p. 191; *Corpus tripedale, superne subspadiceum, inferne griseum; cirri tres, in mandibula inferiore, quorum medius longitudine duos alios vincit.*"

This description is valueless, and applies to no fish. The "Land Cod" of British America is said to be an *Amiurus*, and there is little doubt that the species which hovered in the "distorted perspective" of Walbaum's mental vision, to borrow an expression from Dr. Coues, was the *Amiurus nigricans* LeSueur.

only; interclavicles developed. There are also several important peculiarities in the shoulder girdle and skull, which separate these fishes from the perch-like forms. The name *hemi*, half; *brachia*, gills) alludes to the reduction in number of the branchiyls.

ANALYSIS OF FAMILIES OF HEMIBRANCHII.

- a. Bones of head moderately produced; ventral fins of a stout spine and a rudimentary ray; dorsal fins preceded by free spines; body scaleless, naked, or mailed.

GASTEROSTEIDÆ

FAMILY XXVI. GASTEROSTEIDÆ. THE STICKLEBACKS.

Body elongate, somewhat compressed, tapering behind to a slender caudal peduncle; head rather long, the anterior part not produced into a tube; mouth moderate, the cleft oblique, the lower jaw prominent; teeth sharp, even, in a narrow band in each jaw; no teeth on vomer or palatines; premaxillaries protractile; preorbital rather broad; suborbital plate large, often covering the anterior part of the cheeks, connected with the preopercles; opercles unarmed; branchiostegals three; gill-membranes broadly united, free, or joined to the isthmus; gill-rakers moderate; no true scales, the skin naked or with bony plates; dorsal with its spines disconnected, two or more in number; anal similar to soft dorsal, armed with a single spine; ventral fins subabdominal, each consisting of a single sharp spine and a rudimentary soft ray; middle or sides of belly shielded by the innominate bones; pectorals short, placed at a considerable distance from the gill openings from which they are separated by a quadrate, naked area covered with shining skin; caudal fin narrow, usually lunate; air-bladder simple; a few pyloric cœca; genera 5, the two mentioned are, however, scarcely worthy of separation from *Gasterosteus*. About twenty species are known, most of them of very wide distribution in the rivers and bays of northern regions. They are all of small size, and are exceedingly active, pugnacious, and destructive.

"It is scarcely to be conceived what damage these little fishes do, and how greatly detrimental they are to the increase of all the other fishes among which they live, for it is with the utmost industry, sagacity, and greediness that they seek out and destroy all the young fry that come their way."

The Sticklebacks build elaborate nests in the spawning season. These the male fish defends with much spirit.

ANALYSIS OF GENERA OF GASTEROSTEIDÆ.

- a. Innominate bones joined together, forming a triangular or lanceolate bony piece on the middle line of the abdomen behind the ventral fins; gill-membranes posteriorly free from the isthmus.
- b. Dorsal spines 4 to 6, in the same line when erected; no caudal keel. *EUCALIA*. 87
- bb. Dorsal spines 8 to 10, not in a right line when erected, but projecting alternately to the right and left; caudal keel present. . . . *PYGOSTEUS*. 88.

GENUS 87. *EUCALIA*. Jordan.

Gasterosteus sp., KIRTLAND, STORER, and others.

Eucalia, JORDAN, Man. Vert., Ed. 1st, 1876, 248; Proc. Acad. Nat. Sc. Phila., 1877, 65.

Type, *Gasterosteus inconstans*, Kirtland.

Etymology, *eu*, well; *kalia*, nest.

Smooth-skinned Sticklebacks with the caudal keel undeveloped; the dorsal spines in small number and placed vertically in a right line; the spines all unserrated; ventral plates coalesced into a narrow plate on the median line between the ventral fins; a distinct subquadrate post-pectoral plate; caudal peduncle comparatively short and stout; gill-membranes posteriorly free from the isthmus.

Small fishes inhabiting the inland brooks and lakes of the Northern United States. But one species is certainly known, running into two or three varieties. This group is probably unworthy of generic distinction from *Gasterosteus*, from which it differs mainly in its feeble spines, and lack of armature, and in the freedom of the gill-membranes from the isthmus.

164. *EUCALIA INCONSTANS* (Kirtland) Jordan.

Brook Stickleback.

Gasterosteus inconstans, KIRTLAND, Bost. Journ. Nat. Hist., 1839; STORER, Synopsis, 1846.

—COPE, Proc. Ac. Nat. Sc. Phila., 186.

Apeltis inconstans, JORDAN, Ind. Geol. Surv., 1874, 1875, 217.

Eucalia inconstans, JORDAN, Man. Vert., 1876, 248; Proc. Ac. Nat. Sc. Phila., 1877, 65; Man. Vert., Ed. 1, 1878, 259.—NELSON, Bull. Ills. Nat. Hist. Soc., 1876 —JORDAN and COPELAND, Check List, 1876.

Gasterosteus micropus, COPE, Proc. Ac. Nat. Sci. Phila., 1864, 186.

var. *pygmæa*.

Gasterosteus pygmæus, AGASSIZ, Lake Superior, 1850.

Eucalia inconstans var. *pygmæa*, JORDAN, Man. Vert., 1876, 248; Proc. Ac. Nat. Sc. Phila., 1877, 66.—Man. Vert., Ed. 2d, 1878, 259.

var. *cayuga*.

Eucalia inconstans var. *cayuga*, JORDAN, Man. Vert., Ed. 1st, 1876, 249; Proc. Ac. Nat. Sc. Phila., 1877, 66; Man. Vert., Ed. 2d, 1878, 259.

Description —Males in spring jet black, tinged anteriorly with coppery red; females and young olivaceous, mottled and dotted with black; body moderately elongate, little compressed, the caudal peduncle comparatively stout, not keeled; skin smooth, entirely destitute of dermal plates, the skeletal plates covered by it; innominate bones small, lanceolate, covered by the skin; area in front of pectorals small; thoracic processes very slender and widely separated, covered by skin; gill-membranes somewhat free from the isthmus posteriorly; gill rakers short; dorsal spines low, subequal, in a right line, those in front lowest, a cartilaginous ridge along their base; ventral spines short and sharp, serrated; head $3\frac{1}{2}$; depth 4; D. IV-I, 10; A. I, 10. Length $2\frac{1}{2}$ inches.

Habitat, sluggish, grassy brooks, from central Ohio, northern Illinois and Kansas northward; very abundant in the tributaries of the Great Lakes.

Habits.—This interesting little fish is very abundant in many streams in the northern part of Ohio. It frequents small brooks, lurking among the weeds and grass, ready to dart on any luckless minnow or insect that attracts its notice. In the aquarium these Sticklebacks are excessively

quarrelsome, and in default of other game they destroy each other. The males are more active than the females. In the breeding season the males become jet black. In the spring this species, as well as all the other species of Stickleback, builds a nest for its eggs, and defends this nest vigorously.

GENUS 88. PYGOSTEUS. Brevoort.

Pygosteus (Brevoort, Mss.), GILL, Cat. Fishes East Coast, Proc. Ac. Nat. Sci., 1861 (not characterized); Can. Nat., August, p. 8 (reprint), 1865.

Gasterosteus, SAUVAGE, Nouv. Archives du Mus., Paris, 1872.

Type, *Gasterosteus occidentalis*, Cuv. and Val.=*G. pungitius* L.

Etymology, *puge*, rump; *osteon*, bone.

Body slender, elongate, somewhat compressed; caudal peduncle very slender, with a strong keel on each side, which renders it much broader than deep; skin destitute of bony plates (except those connected with the pelvis); the plate extending upward from the ventral fins well developed, striated; head rather long; the mouth as in the other species; naked area in front of pectorals moderate; backward processes from the shoulder-girdle below well developed, widely divergent, forming a V shaped figure, embracing a large naked space; dorsal spines moderate, subequal, or the anterior ones rather highest; spines not set in a right line, diverging alternately to the right and left, with more or less regularity; spines 7 to 9 in number; anal spine similar to the others; innominate bones rather feeble, joined more or less completely on the middle line of the belly; ventral spines moderate, finely toothed; gill-membranes free from the isthmus posteriorly. Perhaps but a single species widely distributed in northern regions, in both fresh and salt water. The group differs from *Gasterosteus* mainly in the increased number of dorsal spines, and the greater freedom of the gill-membranes. It is probably unworthy of retention as a distinct genus.

165. PYGOSTEUS PUNGITIUS (L.) Gill.

Many-spined Stickleback.

Gasterosteus pungitius, LINNÆUS, Syst. Nat. 1758.—GUNTHER, Cat. Fish., i, 6, BEAN, Bull. U. S. Nat. Mus., xv, 1879, 129, and of most writers:

Gasterosteus concinhus, RICHARDSON, Fauna Bor. Amer., 1836, 57.—GUNTHER, Cat. Fish., i, 6.

Gasterosteus occidentalis, CUV. and VAL., Hist. des Poiss., iv, 1829, 509.—DEKAY, New York Fauna Fishes, 68.—GUNTHER, i, 6.

Pygosteus pungitius, GILL, Mss.

Gasterosteus mainensis, STORER, Bost. Journ., i, 464.—GUNTHER, i, 6.

Gasterosteus nebulosus, AGASSIZ, Lake Superior, 1850.

Pygosteus nebulosus, JORDAN, Man. Vert., 1876.

Pygosteus occidentalis, var. *nebulosus*, JORDAN, Man. Vert., Ed. 1, 260.

Gasterosteus dekayi, AGASSIZ, Lake Superior, 1850, 311.—STORER, Hist. Fish. Mass.

Gasterosteus pungitia, *occidentalis* and *blanchardi*, SAUVAGE, Nouv. Archiv. Mus. Paris, 1873.

Description.—Olivaceous above, profusely punctulate; sides irregularly barred with darker; belly silvery; body very slender, somewhat compressed, tapering into the very

long and slender caudal peduncle, which is much depressed and strongly keeled, broader than deep; no dermal plates; plates of the skeleton not all covered by skin; post pectoral plate well developed, striated; head shortish, the snout rather blunt; thoracic processes well developed, widely divergent, forming a V-shaped figure; dorsal spines moderate, the anterior diverging to the right or left at different angles, the posterior more nearly erect; anal spine large, larger than the dorsal spines; innominate bone feeble, lanceolate, not carinated, its edges raised; ventral spines moderate, serrulate, length more than one-third that of head; gill rakers long and slender; gill membranes posteriorly free from the isthmus; head 4; depth $5\frac{1}{2}$; D. IX-I, 9; A. I, 8. Length $2\frac{1}{2}$ inches.

Habitat, northern parts of Europe and North America, widely distributed, inhabiting both salt and fresh waters. It is found in rather deep water in the Upper Great Lakes, and northward to the Saskatchewan, and doubtless beyond. It has not yet been observed in Lake Erie.

I have compared numerous specimens of the lake form (var. *nebulosus*), sent me by Dr. P. R. Hoy, from Racine, Wisconsin, with examples of the common marine form of *G. pungitius*, and I find no constant difference. Dr. Bean finds also no difference between the marine form found in America (*occidentalis*) and the common *G. pungitius* of Europe.

The habits of the lake form have necessarily become somewhat changed from those of its marine relatives.

Diagnosis.—This species may be known at once from all other little fishes found in our fresh waters by the presence of about ten spines in its dorsal fin, arranged in a zigzag row, and entirely disconnected from each other.

Habits.—Little distinctive is known of its habits. It has thus far been found in rather deep water in Lakes Michigan and Superior, and, although not generally common, it may sometimes be found in considerable numbers. It is a most active and graceful little fish, and with it we close our series of the Fishes of Ohio.

ADDENDA AND ERRATA.

On page 757 for "Genus 2. *Scolecossoma*, Girard;" read "Genus 2. *Ichthyomyzon*, Girard."

The proper type of *Ichthyomyzon* is *Petromyzon argenteus* Kirtl.; *Scolecossoma* was based on the young of the same species.

On page 757 for "2. *Scolecossoma argenteum* (Kirtland) Jordan;" read "*Ichthyomyzon argenteus* (Kirtland) Girard."

On page 764 for "3. *Polyodon folium* Lacepede;" read "3. *Polyodon spathula* (Walbaum) Jordan;" and add to the synonymy, "*Squalus spathula* Walbaum, Artedi Piscium, 1792, 522."

On page 781 for "11. *Anguilla vulgaris* Turton;" read "11. *Anguilla rostrata* (LeSueur) DeKay."

The American Eel seems to be a distinct species from the Common Eel of Europe. The following graphic description of its habits is from the pen of Mr. Wm. H. Ballou, of Chicago :

"They are among the most voracious of carnivorous fishes. They eat most inland fishes except the Gar-fish and the Chub. Investigation of six hundred stomachs by Oswego fishermen showed that the latter bony fish never had a place on their bill of fare. They are particularly fond of game fishes, and show the delicate taste of a connoisseur in their selections from choice Trout, Bass, Pickerel, and Shad. They fear not to attack any object when disposed, and their bite on human flesh shows even a vicious attitude towards man. On their hunting excursions they overturn huge and small stones alike, working for hours if necessary, beneath which they find species of Shrimp and Cray fish, of which they are exceedingly fond. Their noses are poked into every imaginable hole in their search for food, to the terror of innumerable small fishes.

"Eels are to the water what the fish-hawk is to the air. They are among the most powerful and rapid of swimmers. Again, they hide in the mud beneath some log or overhanging rock, and dart out with tremendous fury on their unsuspecting prey. They attack the spawn of other fishes open-mouthed, and are even said to suck the eggs from an impaled female. They fearlessly and rapidly dive head foremost in the mud-disappearing in an instant. They are owl-like in their habits, committing their depredations at night.

"No fish is known to feed upon the grown Eel. Pickerel, Gar-fish and Bass are supposed to devour the young fry."

On page 817 for "39. *Catostomus teres* (Mitchill) LeSueur;" read "39. *Catostomus commersonii* (Lacepede) Jordan."

NOTE.—The present report was prepared by the writer and submitted by him to Professor Newberry in the year 1878. The first part of the report, from page 735 to page 848, was printed during the summer of 1881, as originally written, the writer not seeing

the proof-sheets. The manuscript of that part of the work from the *Hyodontidae* to the end has been revised by the author in the fall of 1881, and thereby brought up to date. This will account for several discrepancies between the nomenclature as given in the lists of Ohio fishes (pp. 743-753), and that appearing in the text.

It has been found impossible in the printing-office to which the State of Ohio entrusts its public printing, to send proof-sheets to the authors for correction. I am, therefore, under great obligations to Dr. J. M. Wheaton for the care which he has taken in reading the proof-sheets in my stead.

Drawings of about one hundred species of Ohio fishes were prepared for this paper by Dr. E. R. Copeland, of Milwaukee, Wisconsin. The authorities in charge of the printing have, however, for some reason not seen fit to have them engraved.

D. S. J.

CORRECTION TO MAMMALIA.

Pages 118, 119—Dr. Frank W. Langdon in his paper on the "Mammalia of the Vicinity of Cincinnati," says (Journ. Cin. Soc. Nat. Hist., Jan., 1881, p. 305, foot-note).

"Since the present article has been in type, I have received, through the kindness of Dr. J. M. Wheaton, of Columbus, Ohio, proof sheets of Dr. A. W. Brayton's forthcoming Report on the Mammalia of Ohio (Ohio Geol. Survey, iv), in which I find myself given as authority for the occurrence of *Spermophilus franklini* in this State. This is an error for which I am personally and solely responsible, having misinterpreted Dr. Byrnes' description of the animal at the time of sending the note to Dr. Brayton. Subsequently a more detailed description from Dr. Byrnes revealed the fact that the animal was *S. tridecimlineatus*, but by some oversight on my part, Dr. Brayton was never notified of the correction; his remarks on *S. franklini*, therefore, so far as they relate to Ohio, should be referred to *S. tridecimlineatus*."

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Yellow-bellied	398	ZAPODIDÆ	129
Wood Rat	135	<i>Zapus hudsonius</i>	130
Wren, Bewick's	230, 588	<i>Zenædura carolinensis</i>	442
Carolina	228	<i>Zonotrichia albicollis</i>	336
House	230	<i>leucophrys</i>	337
Marsh, Long-billed	232	<i>Zygoneotes dispar</i>	910
Short-billed	233	<i>notatus</i>	910
Winter	231		

