

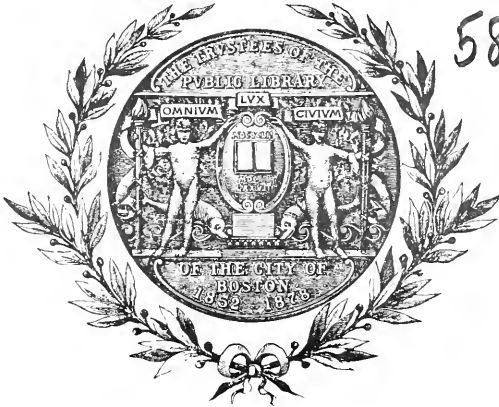
BOSTON PUBLIC LIBRARY



3 9999 06317 657 0

No 5902.64

58.62



GIVEN BY

ABSTRACT

INFORMATION is compiled for use in conserving and managing the band-tailed pigeon, largest native member of the family Columbidae in the United States. The report deals with the discovery of the bird and its appearance, distribution, migration, life history, nesting, habits, and game status, and contains a discussion of factors governing its abundance.

Original information is presented on food habits, based on the laboratory analyses of 691 stomachs and/or crops of these birds.

Mast (acorns and pine nuts) was found in 268 of the specimens and constituted 50.1 percent of the annual food. The availability of mast for food largely determines the migration routes and wintering habitat, and indirectly determines the nature and extent of damage inflicted by these birds upon crops.

The fondness of the bandtail for cultivated cherries and small green prunes forms the basis for many agricultural complaints. These fruits were found in 98 birds and made up 11 percent of the diet. Other fruits of the rose family taken by the birds included those of blackberry, salmonberry, serviceberry, toyon, and hawthorn, together making up 13.6 percent of the annual food.

Cultivated grains formed 12.8 percent of the diet, showing the adaptability of the bird to modern conditions. Cultivated peas made up nearly 5 percent of the food. Although both grain and peas are frequently waste gleaned from harvested fields, many complaints of depredations arise.

Other vegetable items found very acceptable by the bandtail include fruits of huckleberry, salal, elderberry, dogwood, cascara, and hackberry. The foods identified included 76 individual items, representing 26 plant families.

Animal food of the adult bandtail comprises less than one-fourth of one percent and appears to be taken only accidentally.

The bird is a voracious feeder and when large flocks attack a farm crop, severe damage may result. A summary of the bandtail's economic status is compiled from records of the Fish and Wildlife Service, and is followed by suggestions for crop protection.

In winter, California harbors most of the West Coast population of bandtails which constitutes the greater part of the total, as birds from the Northwest commonly concentrate there. As a species, the band-tailed pigeon is little more than holding its own, with local increases in some States, local decreases in others. As it lays only one egg, its reproductive potential is low, and careful attention must be directed toward every practice that might cause further decreases. Shooting seasons and bag limits should not be liberalized.

As to management, breeding stock must be carefully conserved over the entire range; the accepted principles and practices of forestry that will preserve or even increase the supply of oaks and pines, and the wild fruits and berries that supplement mast as food, must be kept in operation; and suitable nesting habitat must be maintained.

UNITED STATES DEPARTMENT OF THE INTERIOR
J. A. Krug, Secretary

FISH AND WILDLIFE SERVICE
Albert M. Day, Director

North American Fauna 58

HABITS, FOOD, AND ECONOMIC STATUS OF
THE BAND-TAILED PIGEON

BY
JOHNSON A. NEFF



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1947

CONTENTS

	Page		Page
Introduction	1	Value as a game bird.....	29
History of knowledge of the species....	2	Present status	33
Natural history	4	Management possibilities	36
Description	4	Agricultural relationships	37
Size	4	Depredations	37
Plumages	5	Cherries, grapes, and prunes....	39
Courtship	5	Grain crops	43
Calls	5	Walnuts	45
Behavior	6	Methods of crop protection.....	45
Nesting	6	Food habits	51
Nesting season	6	General	51
Nest location and structure	9	Use of mineral salts	54
Communal nature in nesting....	11	Results of laboratory examinations..	54
Eggs	12	Seasonal food preferences.....	63
Incubation	12	Winter	63
Growth of the young.....	13	Spring	64
Natural enemies and disease.....	17	Summer	64
Distribution	17	Autumn	65
General range	17	Discussion	65
Summer range	18	Use of gravel.....	68
Winter range	21	Influence of age or sex.....	68
Migration	26	Feeding mannerisms	68
Spring	26	Quantity of food taken.....	68
Autumn	27	Summary	69
Routes of migration	29	Bibliography	71

HABITS, FOOD, AND ECONOMIC STATUS OF THE BAND-TAILED PIGEON

By JOHNSON A. NEFF, *Biologist, Economic Investigations, Division of Wildlife Research, Fish and Wildlife Service*

INTRODUCTION

For many years the band-tailed pigeon (*Columba fasciata fasciata*) has pleurably interested sportsmen and ornithologists of the western United States, but at times it has aroused the ire of agriculturalists. Pursued as a game bird in some parts of its range for more than 70 years (except for a period of complete protection from 1913 to 1932), the band-tailed pigeon has, through its wariness and powers of flight, survived in sufficient numbers to be treated as a game species in a few far-scattered localities.

Bandtails, blue pigeons, blue rocks, or wild pigeons, as they are called in different parts of their range, are discussed in many pages of the ornithological literature of the past 75 years, yet information is still inadequate for determination of the exact status of the species and for definition of practical methods for its management.

Food and cover are the primary essentials for the welfare of any species. In few instances, however, does the availability of an ample food supply influence the habits, range, and distribution of a species as extensively as it does those of the band-tailed pigeon. This report summarizes, for practical use, the available information on the range, life history, habits, food, and game status of this bird, and records the findings from the examination of 691 stomachs and crops.

Prior to 1937 the Food Habits Laboratory, of the Bureau of Biological Survey (now part of the Fish and Wildlife Service), had accumulated 142 stomachs and gullets of the band-tailed pigeon, and 30 of these had been examined by Sterling Bunnell, E. R. Kalmbach, and Alexander Wetmore. Early in 1937 continuation of this study was assigned to the writer. The remaining 62 stomachs and crops were examined, 549 additional crops and/or stomachs were acquired and examined, and field observations were carried on in 5 States.

NOTE.—Grateful acknowledgment of services rendered and of interest shown in this study of the band-tailed pigeon is made to a group of cooperators too numerous to mention individually. Thirty former and present employees of the Fish and Wildlife Service have assisted by collecting specimens, analyzing crop and stomach contents, identifying food items, supplying information in official reports or by letter, and assisting in the writing, revising, and editing of this report. Valued assistance has been given also by various employees of the Forest Service and the Soil Conservation Service of the United States Department of Agriculture, and of the Office of Indian Affairs and the National Park Service of the United States Department of the Interior. Most of the western State Game Departments, and many of their wardens individually, have cooperated in collecting specimens and in furnishing information. Certain scientific institutions, among them the Colorado Museum of Natural History, the California Academy of Sciences, and the Museum of Northern Arizona, and biologists of many of the universities within the range of the bandtail, as well as many bird students, have also contributed freely.

HISTORY OF KNOWLEDGE OF THE SPECIES

The type specimen of the band-tailed pigeon was obtained on Plum Creek, near Castle Rock, Douglas County, Colo., by members of Long's expedition to the Rocky Mountains, and described for the first time by Say in 1823. Eggs were first collected by Lieutenant Benson (Bendire 1892)¹ near Fort Huachuca, Ariz., on September 25, 1885.

It is impracticable, if not impossible, to compare the present numbers of the pigeons with those of any year in the early history of the West. The variation in degree of concentration in response to changing food supplies and the widespread wilderness range of the species make it difficult now to draw satisfactory conclusions from the scattered reports on abundance.

Prior to 1913 small notice had been taken of the species as game in most States and little protection was afforded it. In the Northwest most of the shooting was done during the spring months when the pigeons were concentrated in grainfields. In California, however, pigeon hunting, including market shooting, was developed to a high degree. During the period before the automobile became a great factor in hunter transportation, gunning had occurred locally wherever pigeons concentrated. Although the number of hunters increased annually as the West became more densely settled, lack of transportation limited the hunters to relatively small areas. Ornithologists were few in number and widely scattered, hence there is no estimate of early-day pigeon abundance that would make possible comparison with present numbers. Early writers use such terms as "quite numerous," "common but never abundant," "very abundant," "common," "occasionally quite plentiful," and "fairly abundant."

Only one instance has been noted that specified truly great numbers. Bendire (1892) quotes Carpenter as follows: ". . . this species is most numerous near the mouth of the Columbia River, where immense flocks were to be seen from May to October 1865, which fairly rivaled those of the Passenger Pigeon."

During the winter of 1911-12 there was an enormous flight of band-tailed pigeons along the California coast from Paso Robles to Nordhoff, and sport and market hunting flourished. Chambers (1912) described conditions in that area, stating that one market hunter shipped some 2,000 pigeons to city hotels, that the morning train from San Luis Obispo to Los Olivos carried about 100 hunters each Sunday morning, and that frequently the hunters took an average of 30 birds each. The number of pigeons killed in the large area covered by that winter concentration must have been enormous, for hunters came from long distances. Apparently the birds remained in the area until shot out. This unusual congregation of birds and of hunters brought the dangers of the bandtail's situation to public notice, and in 1913 Grinnell in furthering the drive for protection published an excellent summary of the status of the species.

As practically the entire band-tailed pigeon population of the

¹ Publications referred to parenthetically by date are listed in the Bibliography, p. 71.

West Coast wintered in a relatively small area in central and southern California, it was possible for concentrated shooting to decimate the numbers of the species. The instance described by Chambers aroused ornithologists to the great need of the birds for protection.

The first action came in 1913 when in the appropriation act for the United States Department of Agriculture there was embodied what was commonly known as the Migratory Bird Law of 1913. This act asserted the authority of the United States Government over those birds, both game and nongame, that in the course of their northern and southern migrations passed through any of the States or that did not remain permanently within the borders of any State or Territory. Under this legislation the Department of Agriculture was directed to adopt suitable regulations to give effect to the act, and when the regulations were approved and proclaimed by the President on October 1, 1913, they embodied a closed season on certain species, including the band-tailed pigeon, until September 1, 1918.

This act served its purpose though there was doubt that it could stand the test of constitutionality. Therefore the treaty with Great Britain for the protection of birds migrating between the United States and Canada was negotiated and was made effective by the adoption of the Migratory Bird Treaty Act, of July 3, 1918. Under this unquestionably constitutional act the closed seasons on certain species prescribed in 1913 were continued, and the band-tailed pigeon was afforded complete protection until 1932, during which period the birds gained slowly but consistently in numbers.

Owing to the growing numbers of complaints by farmers in California that pigeons were seriously damaging their cherries, the Secretary of Agriculture, pursuant to authority granted in the Migratory Bird Treaty Act, issued an order on April 30, 1924, allowing the granting of permits for the destruction of band-tailed pigeons that were attacking cherry crops in that State. In June 1930 an amended order extended the same privilege to Arizona and Washington. Permits were issuable covering the period from May 15 to July 31, and the grounds for giving them included damage to cherries and other small fruits. It was provided also that the birds killed in protecting crops could be used as food by the landowner or lessee. Complaints of alleged depredations on agricultural products continued to increase, and the demand for permits grew until it was apparent that soon in some sections they would in effect create almost an open season and that during the breeding season of the birds.

The pigeons continued to increase slowly but steadily in numbers, and in 1932 an open shooting season was permitted in Arizona, California, New Mexico, Oregon, and Washington. In Colorado no open season was permitted until 1944, and that only in 12 southwesterly counties. In Texas and Utah the birds are so sparsely distributed that no open shooting has been permitted. The open season in each State in which band-tailed pigeons are present in shootable numbers was limited to 15 days annually until 1942,

when the period was extended to 30 days; the possession bag limit in all localities has remained at 10 birds.

NATURAL HISTORY

DESCRIPTION

The band-tailed pigeon is described by Grinnell, Bryant, and Storer (1918) as follows:

Adults, both sexes.—Head pinkish brown or vinaceous (exact tint varying greatly among different individuals), darkest and more purplish on top and back of head, more ashy on chin and cheeks; base of bill straw yellow, and black; naked eyelids, coral red; narrow collar around hind neck, white, averaging more conspicuous in males; broad area on sides and back of neck (below white collar), iridescent bronzy green; back, dark olive brown; rump and bases of tail feathers, dark bluish gray; ill-defined band across middle of tail, dull black; terminal portions of tail feathers, drab, lightest on outer ones; outer surface of closed wing, chiefly light gray, the coverts narrowly margined with white; flight feathers, brownish black; lining of wing and axillars, gray; under surface of flight feathers, dull brown; under surface of body, pinkish brown or vinaceous, deepest on breast and sides, paling to almost white on belly; under tail coverts, white; under surface of terminal portion of tail, whitish, distinctly lighter than upper surface of same; feet straw yellow. In some females the tone of coloration verges towards grayish rather than pinkish brown. **Juvenile plumage.**—Similar to that of adult, but vinaceous tinge wholly lacking; neck without white collar or iridescent bronzing; under surface dark brownish, with feather tipplings of lighter color, giving a faintly scaled effect.

Marks for field identification.—Largest of our wild pigeons (about the bulk of a domestic pigeon); general bluish coloration; distinct dark band across middle of square-ended tail; wings without white patches.

SIZE

Of 320 band-tailed pigeons examined by John C. Knox near Mountain Park, N. Mex., in June 1941, the heaviest adult weighed 15½ ounces, the smallest 8¾ ounces. D. M. Gorsuch, of the United States Forest Service, weighed 6 birds collected at Williams, Ariz., between September 26 and November 8, 1941. Two adults weighed, respectively, 345 and 359 grams (or 12.16 and 12.31 ounces), and four young, respectively, 270, 270, 290, and 290 grams (or 9.52 and 10.23 ounces). United States Game Management Agent Frank F. Poley and the writer examined 22 bandtails shot in Colorado between September 17 and 19, 1945; the average weight of 17 adults was 338 grams (or 11.2 ounces), the largest bird weighing 372 grams (or 13.1 ounces), the smallest 292 grams (or 10.3 ounces), and the average weight of 5 young was 270 grams (or 9.52 ounces). A 17-day-old nestling in Colorado weighed 140 grams (or 4.9 ounces).

Ridgway (1916) gives the following measurements for the band-tailed pigeon as taken from skins, the figures representing in millimeters respectively the smallest and the largest measurements of the birds he examined, and, in parentheses, the average (25.4 mm.=1 inch) :

Adult males, 38 specimens.—Length, 342–400 (363); wing, 195–221 (208.6); tail, 122–151 (139.4); culmen, 16–20 (18); tarsus, 24.5–29.5 (27); middle toe, 27.5–34 (30.4).

Adult females, 28 specimens.—Length, 334–395 (338); wing, 193–218 (204); tail, 121–149 (134.1); culmen, 15.5–19.5 (17.6); tarsus, 24–28.5 (26); middle toe, 26.5–33 (29.6).

PLUMAGES

In addition to features mentioned in the technical description quoted, it is stated in the literature that the nestling has a yellow skin covered with sparse, cottony, white down. The nestling studied in Colorado in 1945, however, was covered with cottony down of a peculiar shade of yellow and the skin was not noticeably yellow.

According to Bendire, juvenile birds apparently molt during their first fall. The molt of the adults is not well known. Among specimens collected for the present study some birds were identified by the field collectors as juvenile, but on laboratory examination their crops were found to contain active milk glands. Study of September-collected birds in Colorado in 1945 showed considerable molt under way. Several adult birds had lost most of their crown and face feathers and presented a quilled hedgehog appearance. It was also apparent that soon after the close of nesting activity there is a rather speedy reduction in the prominence of the white neck-ring, especially in the male birds.

COURTSHIP

Apparently little is recorded concerning the courtship of the bandtail. Bent (1932), quoting Swarth, indicates that cooing and other calls and spectacular circling glides by the male from a perch are among the details of courtship. Pearse (1935) describes another activity, apparently part of the courting behavior. Short flights in a hesitant, quivering manner, during which the bird seems almost to float, form the basis of this display. The tail is fully spread, and Pearse says that the tips of the wings appear to be held down. The display is accompanied by two separate very low calls, one of which he describes as being very like the modified chirping of a cricket.

CALLS

The deep, cooing notes of the band-tailed pigeon are distinctive. Once heard as they ring through the depths of some mountain canyon they will never be forgotten. Mrs. Florence Merriam Bailey (1902) terms the calls "owl-like." They are most often heard during the courting period, and Wales (1926) describes the tilting of the head downward to horizontal, the inflation of the neck, and other actions incident to the display of that particular period. After nesting has begun, the cooing is more subdued and less frequent.

A variety of low guttural call notes may be heard when the parents are together at or near the nest; these are similar to the notes of the domestic pigeon at such times. The squab, when hungry, utters a thin, piping note. Neither of these latter calls can be heard for more than a few yards.

BEHAVIOR

Band-tailed pigeons are very gregarious, consorting in flocks at all seasons except during nesting; even then communal tendencies are exhibited. They are fond of perching for long periods in the tops of tall dead or partially dead trees, but when approached drop quickly away to better concealment. The flight is strong and swift, and in descending mountain sides the birds may dive with wings partially or completely shut. During such swoops the noise of the wind through the rigidly held wing feathers is often audible for a long distance. When the bird takes flight, the wings may be clapped together over the back producing a sound that may be heard for some distance. This seems to be a form of signal, and not the result merely of intense exertion.

NESTING

NESTING SEASON

The nesting period of the band-tailed pigeon is lengthy. During practically all the months pigeons may be noted in flocks. Even in the nesting season bands of 5 to 50 birds have been observed. These flocks were once considered to be nonbreeders, but it is now thought that they may be nesting birds. This habit, combined with the usual remote nesting habitat, makes it difficult to obtain accurate information on the number of broods a season and other nesting phenomena. Observers have recorded successive broods from the same nest, without proof, however, that the same adults were concerned. The long nesting period alone has led some observers to believe that at least in the South some bandtails may rear two or possibly three broods. In the northern part of the bird's range it seems that normally only one brood is produced.

In California, Grinnell, Bryant, and Storer (1918) list nests containing eggs or young from March 5 to August 23, and A. C. Oberle (letter of April 15, 1935) says that nesting has been observed on the Laurette Ranch north of San Dimas, Calif., and in Brown's Flat, the first nesting starting about April 1. Eggs were observed into May. Apparently each nest contained but one egg at a time. Abbott (1927) quoted Bushnell's observation of a nest that contained one egg on March 8, 1925, and later a second egg that hatched in mid-May. Moran (1919) relates finding a nest with one well incubated egg on March 30, 1895, at the head of Lopez Canyon, San Luis Obispo County. Grinnell (1928) watched a squab being fed in a nest on September 29, 1927. Stillman (1928) describes a young bird that left its nest in San Diego County on October 2. Kloppenburg (1922) noted a nest in the Plumas National Forest that contained one egg in mid-September. Derby (1920) recorded one containing a naked squab on September 1, 1920, at 6,500 feet elevation on the headwaters of Deer Creek, Sequoia National Forest. Davis (1938) wrote of the nesting season near Eureka, and Michael (1928) of that in Yosemite National Park. These records seem to bound the outer limits for California.

Kitchin (Bent 1932) said that the nesting season in Washington lasted from April through June. Einarsen (letter of December 15, 1939) reported a nest near Triton Cove, Hood's Canal Highway, that on August 24, 1939, contained a squab about a week old. Hagenstein (1936) observed a nest containing a squab near Seattle on October 17, 1935.

Gabrielson and Jewett (1940) report that in Oregon egg-laying is at its height late in May and in June, and give May 3 and July 12 as the known extremes of the season. Later, Jewett (1941) recorded a nest with two eggs in Yamhill County on September 30, 1940.

In Arizona, according to Bendire's correspondents, nesting occurred in nearly every month of the year. Poling, writing to him from Fort Huachuca of various nests, said, "I have taken young two or three months old in February, and since that time young and eggs enough to show that they lay and nest from December to August." Benson reported nesting of the bandtails in the Huachuca Mountains from early July to late October; Willard (1913) noted an October nest; and Vorhies (1928) one in September. On Pinal Mountain south of Globe, Ariz., Carlos Stannard reported nests as follows: August 18, 1940, one egg; August 19, 1940, squab ready to fly; August 23, 1940, a squab about 4 days old which was still in the nest on August 30; and on August 14, 1941, four nests, one with eggs, three with squabs between 1 and 3 weeks old. Considerable field work by the writer, accompanied by State game wardens, leads to the conclusion that in southern Arizona nesting most commonly begins early in May, though occasionally earlier.

For New Mexico, Mrs. Florence Merriam Bailey (1928) lists a number of interesting records, chief among them being that of a nest containing one well-incubated egg on April 23, 1922, 16 miles northeast of Santa Fe, at 10,500 feet elevation, well above the snow line. There are also records for the Animas Mountains, Guadalupe Mountains, Monument Pass, Black Mountains, and the Pecos, Sacramento, Sandia, Taos, Sangre de Cristo, Jemez, and Mogollon Ranges, the dates extending from June 3 to mid-August, and the elevations from 5,800 to 8,000 feet. Of 280 adult bandtails examined by John C. Knox at Mountain Park between June 25 and July 10, 1941, 235 were males, 151 of them with testes indicating active breeding condition, and 45 were females, 22 of which contained well developed eggs.

In Utah, Lee Griner records a bandtail nesting in June, and Clarence Cottam (1941) saw a juvenile recently out of the nest on July 24. In Texas, Ray Williams, State Game Warden, observed a pair of pigeons building a nest on April 22, 1933, in the Davis Mountains, and saw a nest containing an egg in the Chisos Mountains in July of that year.

For Colorado there was until 1945 no definite breeding record substantiated by collection of eggs or young or by photographs of nests. The presence of the birds over a wide range, however, made it certain that they did nest. R. J. Niedrach (Niedrach and Rockwell 1929) of the Colorado Museum of Natural History collected a bird near Kittredge on June 20, 1928, that contained a fully

formed egg, and in Jarre Canyon near Sedalia on September 11, 1938, he took several birds that contained active milk cells in their crops. Several State game wardens and woodsmen relate having seen nests in earlier seasons, but none were reported at the time and hence are not verified. Warden Hall, of Montrose, reported that in 1943 on Tabeguache Creek in the Uncompahgre National Forest he saw a number of juvenile birds that were so immature they could not have been long out of the nest.



B-62847

FIGURE 1.—Nest and day-old young of the band-tailed pigeon in a lodgepole pine on the Rampart Range, Pike National Forest, Colo., August 22, 1945, the first recorded and authenticated nest of this species for the State.

On August 22, 1945, the writer found the first recorded and authenticated nest for the State. It was in a lodgepole pine on the summit of the Rampart Range, Pike National Forest, some 55 miles south of Denver, and contained a day-old squab (fig. 1). On August 31, R. J. Niedrach found a second nest nearby containing an older squab. On the basis of information available at the end of 1945 it seems that the major nesting season for Colorado covers the period July 1 to August 30, with a few pairs of band-tails nesting earlier or later.

NEST LOCATION AND STRUCTURE

The location of band-tailed pigeon nests varies greatly. O. B. Johnson (1880), Irene G. Wheelock (1904), and Cooper (1880) report ground nests, but no other similar nestings have been recorded. Johnson observed in the Willamette Valley, Oreg., nests ranging from the top of a stump 8 feet high to the dense branches of a fir at about 180 feet. C. E. Bendire (1892) quotes Ankeny as describing nesting in the Rogue River Valley, Oreg., on limbs of small firs, generally in dense thickets. William Lloyd wrote Bendire that in Texas and in Mexico nests were largely in oaks, and Stephens told him that in Arizona nests were usually in pines at heights of 8 to 20 feet from the ground. Benson and Poling reported nests in Arizona in pines, oaks, and mulberries, at heights of 15 to 70 feet, and from 5,000 to 8,000 feet elevation in the mountains.

E. A. Kitchin, in correspondence with Bent, said that nesting sites in Washington were mainly in dark fir trees, in the lower branches near the trunk, and averaged about 20 feet from the ground. Occasionally nests were found in alder or birch on hill-sides. Leo K. Couch informed the writer that around Willapa Harbor, Wash., the bandtails nest in Sitka spruce (*Picea sitchensis*). Ira N. Gabrielson and Stanley G. Jewett (1940) report that in Oregon the nest is usually high in a coniferous tree.

Grinnell, Bryant, and Storer wrote that most of the California nests were in oaks, at heights of 8 to 30 feet. One was reported in a Douglas fir and one in a California lilac (*Ceanothus thyrsiflorus*).

Fowler (1903) reported live oaks as favored locations for nests in the Huachuca Mountains of Arizona, the nests being built on low, horizontal limbs from 9 to 12 feet from the ground. In July 1939 the writer, with George Peterson, Deputy State Game Warden, of Nogales, Ariz., visited several of the high oak canyons in the Tumacacori and Washington Camp Mountains near Nogales in search of bandtail nests. About 10 nests, deserted but of the current season, were inspected. All were in oak trees at heights of 12 to 25 feet, in dense woods near the canyon floors. David O. Scott, of the United States Forest Service, describes a nest found near Williams, Ariz., as being 15 feet up in a yellow pine and very loosely constructed of coarse oak sticks.

The two occupied nests found in 1945 in Colorado, and several unused nests found nearby, were all in lodgepole pine forest at ele-

vations of approximately 8,400 feet. One nest was in a fork against the trunk, the others one to two feet out on flat limbs; all were 14 to 16 feet above the ground. All were in trees on rims or slopes, with lower vegetation downhill, so that the adults had room for a downward dive upon leaving the nest as they picked up momentum.

The nests (figs. 2 and 3), typical of those of the pigeon family,

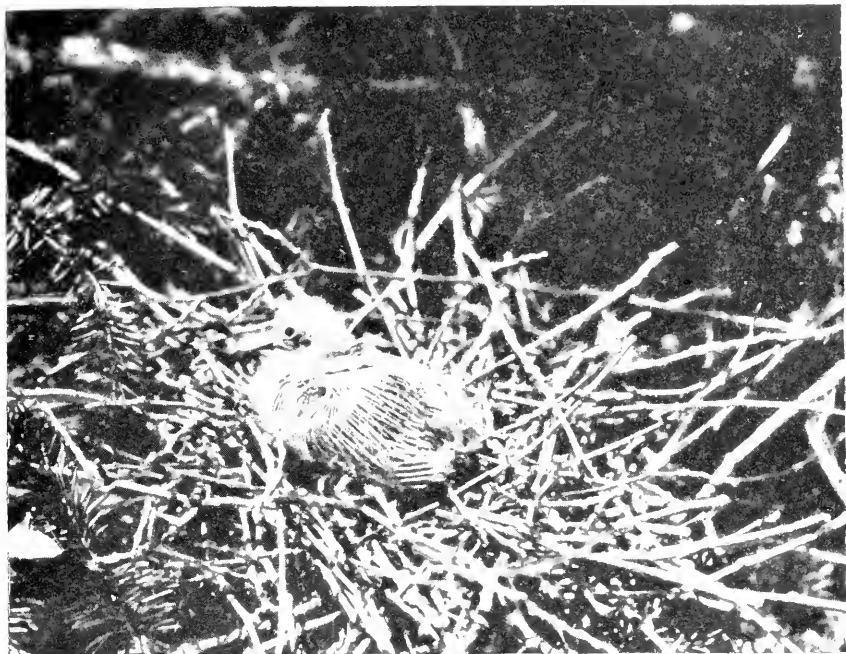


B8714M

FIGURE 2.—Band-tailed pigeon on a typical nest in a pine tree on Maverick Mountain, Prescott National Forest, Ariz. (Photographed by Floyd Schroeder, United States Forest Service.)

are usually frail platforms of dead twigs of oak, pine, or other plant stems. The ground nest reported by Johnson (1880) in the Willamette Valley was made of leaves and moss. A nest measured by Grinnell (Grinnell, Bryant, and Storer 1918) was $8\frac{3}{4}$ inches by 4 inches, exclusive of several protruding twigs. Frequently there are numerous gaps in their structure, the frailty of the nests being generally commented on in the literature. Nests observed by the writer near Nogales, Ariz., in 1939 and 1940 were thin platforms of oak twigs, so fragile as to cause one to wonder how eggs and young could remain on them.

Willard (1916), describing nest building in the Huachuca Mountains of Arizona, says that it was carried on only in the morning hours from sunrise to about 8 a. m., almost entirely by the female, and that she proceeded in a most lackadaisical manner. The period from the placing of the first stick to the laying of the first egg was 6 days.



B8713M

FIGURE 3.—Nest and young of the band-tailed pigeon in the humid coastal area of Tillamook County, Oreg., June 25, 1931. (Photographed by Alex Walker.)

Bent quotes Kitchin as stating that bandtails are very fond of their old nesting sites and that they come back year after year to the same limb even though the previous nest has been disturbed. Kitchin records second nests built on the same spot where an earlier nest of the current season had been robbed or destroyed, and cites one instance of a nest from which he collected the egg being followed by a second nest on the same site from which he again took the egg; later in the season he found in the same place a third nest that he left intact.

Noack (1916) describes the breeding of the band-tailed pigeon in captivity. The first egg laid was removed from the nest and was hatched by a domestic pigeon. Within a few days the bandtail laid another egg, which was hatched and the young bird raised. Then a third egg was laid and a second squab reared to maturity.

COMMUNAL NATURE IN NESTING

Usually the band-tailed pigeon nests in widely separated pairs. Fowler (1903), however, describes a community breeding ground near Fort Huachuca, Ariz., where some 35 pairs nested in a loose rookery; in the area most thickly populated there was one nest to each 3 or 4 acres. Observations by George Peterson, Deputy State Game Warden, of Nogales, in 1936 in the Tumacacori Mountain range northwest of Nogales, Ariz., were of the same purport. The community nesting ground was in dense vegetation along the bot-

tom of a steep canyon at an elevation of about 6,000 feet. Inspection of recently deserted nests in that canyon and others by Peterson and the writer in 1939 and 1940 showed that nests were irregularly spaced along the bottom of the canyon, sometimes within a few yards of each other, but usually fairly widely separated.

Surprising examples of community nesting are contained in two notes transmitted by H. Garvin Smith, of the United States Forest Service, Tucson, Ariz. He says that in 1933, while camping in the Magdalena Mountains of New Mexico he found 14 bandtail nests in one large Douglas fir near a spring, and that in 1934 in the same tree he found 17 nests, one of which contained two eggs, the others one each.

Fred Herman, of Sanborn Park, Montrose County, Colo., relates that a former Forest Service employee described a number of "colony trees" that he had seen among the thick, bushy conifers along the rimrock above Horsefly Creek Canyon north of Sanborn Park, and that he had also found the pigeons nesting in blowholes and on ledges in the sandstone rimrock along Big Red Creek Canyon nearby. Several other Colorado game wardens have reported bandtail activity about similar rimrock areas and they feel sure that pigeons nest there.

EGGS

The usual, or normal, deposition is one egg to a nest, but in the literature are a number of records of two eggs. In a tabulation covering 18 nests in California, Grinnell, Bryant, and Storer (1918) report one nest containing two eggs and one containing two squabs. O. B. Johnson (1880) observed two nests in the Willamette Valley, Oreg., that contained two eggs each. Bendire quotes Ankeny as saying that two eggs were laid in nests in the Rogue River Valley, and Lloyd as describing two-egg sets in Texas and in the Sierra Madre of Mexico. Cooper (1880) also said that the set was two eggs. On the other hand, Bendire quotes Benson, Stephens, and Poling as stating that only one egg to a nest was laid in the Huachuca Mountains of Arizona. Jewett (1941) reports a two-egg nest in Yamhill County, Oreg., on September 30, 1940, and H. Garvin Smith writes that he has seen several two-egg nests in New Mexico.

Ralph Morrow, Deputy State Game Warden, of Hilltop, Ariz., observed "several" nests in the Chiricahua Mountains, in each of which were a half-grown squab and one egg. G. W. Peterson, Deputy State Game Warden, of Nogales, Ariz., said that during June 1936 in canyons of the Tumacacori Range northwest of Nogales he inspected 56 bandtail nests, 11 of which contained two eggs.

The eggs of the band-tailed pigeon are elliptical-ovate, somewhat pointed, smooth, pure white, and with a slight gloss. A series reported by Bent averaged 39.7 by 27.9 millimeters in dimensions. (25.4 millimeters=1 inch.)

INCUBATION

According to Bendire (1892), incubation lasts 15 to 18 days;

even longer periods should not be exceptional in some of the early-season nests at high altitudes where the weather is still very cold.

GROWTH OF THE YOUNG

Doves and pigeons differ from all other birds in feeding their nestlings a substance, usually called "pigeon milk," that is developed in the crops of both the male and the female adult. It is creamy-colored and somewhat similar in appearance and consistency to curd. Feeding is by regurgitation, and for the first few days after the nestlings are hatched this "milk" is their only food.

Little is known of the development of this secretion in the band-tail. Even in regard to the domestic pigeon the literature lacks information on some phases that are of interest; but since the domestic pigeon incubates for 18 days and the young remain in the nest for at least 30 days, it seems probable that the development of the pigeon milk and the duration of the supply may be similar in the two species. The most detailed discussion of the phenomenon of pigeon milk that the writer has found is one that is contained in the literature on the domestic pigeon, and is here briefly summarized. About the 8th day of incubation the lobes of the pigeon's crop begin to increase in size through multiplication of the cells of the outer, or proliferating, layer; by the 12th day the walls of the lobes are obviously thickened and enlarged and on the 18th day they are at their greatest development. The inner layer of each lobe has been pushed farther away from the source of blood in the outer layer, and it begins to degenerate; globules of fat develop in the cells, and whitish masses of dead cells begin to peel off. By the time the eggs hatch on the 18th day these greasy masses are sufficient to furnish the entire food of the squabs during their first few days of life. After the first few days the regurgitated material begins to contain some quantity of seeds and other solids that have been softened in the crop of the adults. It is said that the duration of the milk supply varies considerably in the different families of the domestic pigeon, and that in some it has ceased to form by the time the young are 7 days old, whereas in others approximately half of the food is still "milk" when the young have reached 10 days of age.

Bendire (1892) states that both sexes assist in the care of the young. "The young grow rapidly and are able to leave the nest when about a month old." Mrs. Wheelock (1904) says that the squab is "fed on a thin milky fluid, by regurgitation, for 20 days."

Considerable food must be administered at a feeding, as the squabs maintain continued rapid growth with a minimum of parental visits. Abbott (1927) published notes from A. E. Stillman, of San Diego County, Calif., dated September 17, 1922, as follows: "That day the female left the oak tree in the early morning and returned at twilight; after quickly feeding the young she left again. Next day she left at daybreak and returned at sundown." This squab, according to Abbott, left the nest and tree on October 2.

Under date of November 9, 1939, Carlos Stannard, of Phoenix, Ariz., wrote:

We camped near the top of Pinal Peak, about eight miles south of Globe, Ariz., at about 7,500 feet. In a small yellow pine just over our tent was a band-tailed pigeon's nest with one young. It was about a week old on August 13. I watched the nest pretty steadily for a number of days; we were in that camp until August 31. No adult stayed on the nest during the day after we went there. And after the 16th no adult stayed on the nest during the night. The young left the nest on the 25th but did not leave the tree; it was still in the tree on the morning of the 31st. During the time we were there the young was fed once each day by the female, usually shortly after sunrise, and once by the male about 8 or 9 a.m. I banded all three. The adults seemed to pay no more attention to us than if we were cattle.

After the discovery of the two nests in Colorado in August 1945, the writer made every effort to recheck existing information on the growth of the young. As R. J. Niedrach was making a photographic record of these first Colorado nests, the adults were not disturbed as frequently as would have been desirable to obtain full data on growth, but some observations were made on the two nests. At one day of age the squab was a tiny helpless creature about 2 inches long, unable to hold up its head for more than a few seconds. The female parent was on the nest when it was found at 2 p. m. on August 22, and she remained on the nest during the daylight hours of August 24. The male was on the nest during most of the day of August 23. During the remainder of the study the adults followed this routine: The male returned to the nest between 8:45 and 9:30 a. m. each day and brooded the young bird during the day (fig. 4). The female returned to the



FIGURE 4.—Male band-tailed pigeon on nest hovering a ten-day-old squab. Rampart Range, Pike National Forest, Colo. August 31, 1945. (Photographed by R. J. Niedrach.)

nest at any time between 3:45 and 5:15 p. m. She was not observed feeding the youngster, though she undoubtedly must have fed it. Watched from dawn until dark, the tiny squab appeared to sleep until after the return of the male. During the first week about three feedings, all between noon and 3 p.m., seemed to be the schedule. As the youngster's food capacity grew, the number of feedings was reduced to two, and the period of regurgitation indicated that a large quantity of food was taken. Both feedings were about midday.

Contrary to Stannard's observation, the adults continued to hover the squab, both day and night, until it was 20 days old. On that date they stopped abruptly and did not return to the nest during either the day or the night except to feed the squab. Each parent came to the nest once daily, between 10 and 11 a. m., fed the squab, and departed. Occasionally during the day one of the parents would visit the vicinity, scan the nest and its surroundings carefully, and then depart.

During the first 10 days the young squab did not grow very rapidly. It slept most of the day and increased in size, but the feather development seemed to be slow. After about 12 days feather development began visibly to progress. At 17 days of age one of the squabs was well covered with feathers, the body feathers being about 15 mm. out of the sheath and the first primary 30 mm. out of the sheath; the tail feathers measured 28 mm. from the tip of the tail flesh to the tip of the feathers; the head was heavily pinfeathered but had no open feathers, and the sides were quite bare. The yellowish brown down adhered to the tips of the feathers, giving the squab a peculiar fuzzy appearance. At this age the youngster crawled clumsily about over the nest and snapped its beak furiously at the intruder. It weighed 140 grams, or 4.9 ounces. External examination indicated that the crop was well filled with pigeon milk.

When the squab was 20 days old the tail feathers measured 42 mm. in length and the first primary was 40 mm. out of the sheath; the pinfeathers on the head were opening but the sides were still quite bare. When it was 23 days of age its outward appearance had changed little (fig. 5), but when the writer's hand approached, the young bird snapped its beak vigorously, struck with bent wing, and danced awkwardly about over the nest. When the squab was 26 days old it weighed 243 grams and its tail measured 75 mm. For the first time it spent much time preening, apparently picking off the down that still adhered to the tips of the feathers. On that day also, one of the squabs began to exercise and spent much of the day walking about, for the first time venturing off the nest onto the nest branch, waving and flapping its wings, and craning and peering about with interest. This was repeated on the 27th day, and on the 30th day the bird was gone from the nest, tree, and immediate area. The other squab was not observed between its 20th and 26th day, but on the latter day it was sitting quietly on the nest without apparent interest in exercising. The nest was not again visited.

Nowhere in the literature examined has the writer found any



FIGURE 5.—Young band-tailed pigeon about 24 days old on nest. Note the high degree of camouflage afforded by the nest, trunk and branches of the tree, and the low-sitting, quiet habits of the young bird. Rampart Range, Pike National Forest, Colo. September 3, 1945. (Photographed by R. J. Niedrach.)

information on how long the lobes of the crops of the adult band-tails remain enlarged and thickened, with easily distinguishable milk cells, after the period of active feeding of 'milk' to the young. Knowledge of the length of time that the young bandtail is fed 'milk' is incomplete, but one squab examined in 1945 appeared to have its crop well filled with the soft curdlike 'milk' on the 17th day. Just how long this material, alone or in combination with softened seeds and grains, makes up a part of the food of the squab and how long thereafter the thickened, whitish milk-cell pads remain easily distinguishable in the lobes of the crop of the adult after the 'milk' has ceased to be an item of food for the young are not yet known.

On numerous occasions adult pigeons collected for study or shot by hunters on dates well outside the normal nesting season have carried well defined milk pads in their crops; others have contained variable remnants of the thickened crop-lobe walls. In some instances observations indicated that the birds still had young in nearby nests; in others that they apparently were migrants. Among such late-season records of bandtails containing well defined milk pads in their crops are those of birds taken in Washington, September 22 and 26 and October 2; in Oregon, September 8 and October 3; in Arizona, September 29; in New Mexico, September 23; and in Colorado, September 15 to 20. In southwestern Colorado in 1944 a majority of the birds examined by United States Game Management Agent Frank F. Poley from

September 16 to 20 contained this evidence of recent feeding of young, and in New Mexico as late as September 23, 9 out of 34 birds examined showed a similar condition. Until the correlation between disappearance of the milk-cell pads and the 'weaning' of the squab by its parents is definitely established, accurate analysis of these observations is impossible.

NATURAL ENEMIES AND DISEASE

The few instances of molestation of bandtails recorded in the available literature are those by Willard (1916), who said that in Arizona "the Prairie Falcon and Cooper Hawk take considerable toll from the flocks;" by Kitchin (Bent 1932), who remarked that in Washington a gray squirrel occasionally took possession of a pigeon nest, using it as a foundation and adding to it to suit itself; and S. D. Durrant, whose Hanna, Utah, specimen was struck from a flock by a sharp-shinned hawk (Cottam, letter of May 6, 1940). McLean (1925) reports that a western goshawk pursued bandtails in Yosemite National Park. No doubt there is some predation upon eggs and squabs, but no data are available.

One adult pigeon collected near Durango, Colo., in July 1945 was found to contain at least 12 flatworms in its abdominal cavity.

Sick pigeons were reported from Whidby Island, Wash., between September 8 and 21, 1939. All were found close about waterholes. Reports from United States Game Management Agent Bach mention six birds found dead by Washington State game protectors and three still able to fly weakly, which were shot. Six specimens were sent to Dr. Karl F. Meyer, Hooper Foundation, University of California, who found no evidence of poisoning or of bacterial disease. Dr. Meyer reported hemorrhages in the gizzard and evidence of acute irritation in the intestinal lining, but the causes were unknown.

The band-tailed pigeon seems to be relatively free from natural enemies; the birds feed on the ground with little apparent fear, and perch conspicuously in the tops of dead trees. One beneficial result of their flocking habit is that individual safety is enhanced by the combined watchfulness of all the birds of the flock. Man through shooting the birds and clearing and destroying their nesting range, appears to be the only enemy of importance.

DISTRIBUTION

GENERAL RANGE

As recorded in the American Ornithologists' Union Check-List of North American Birds, fourth edition, 1931, the range of *Columba fasciata fasciata* is as follows:

Breeds in the Transition Zone from southwestern British Columbia, Montana, and north-central Colorado south through the southwestern United States and Mexico to Guatemala, and east to western Texas. Winters from the southwestern United States southward. Accidental in North Dakota.

Library research and correspondence have been undertaken to

obtain a concept of the bird's range at the present time. The results are here presented, beginning in the northwest and moving southward and eastward.

SUMMER RANGE

The summer range of the band-tailed pigeon is shown in figure 6.

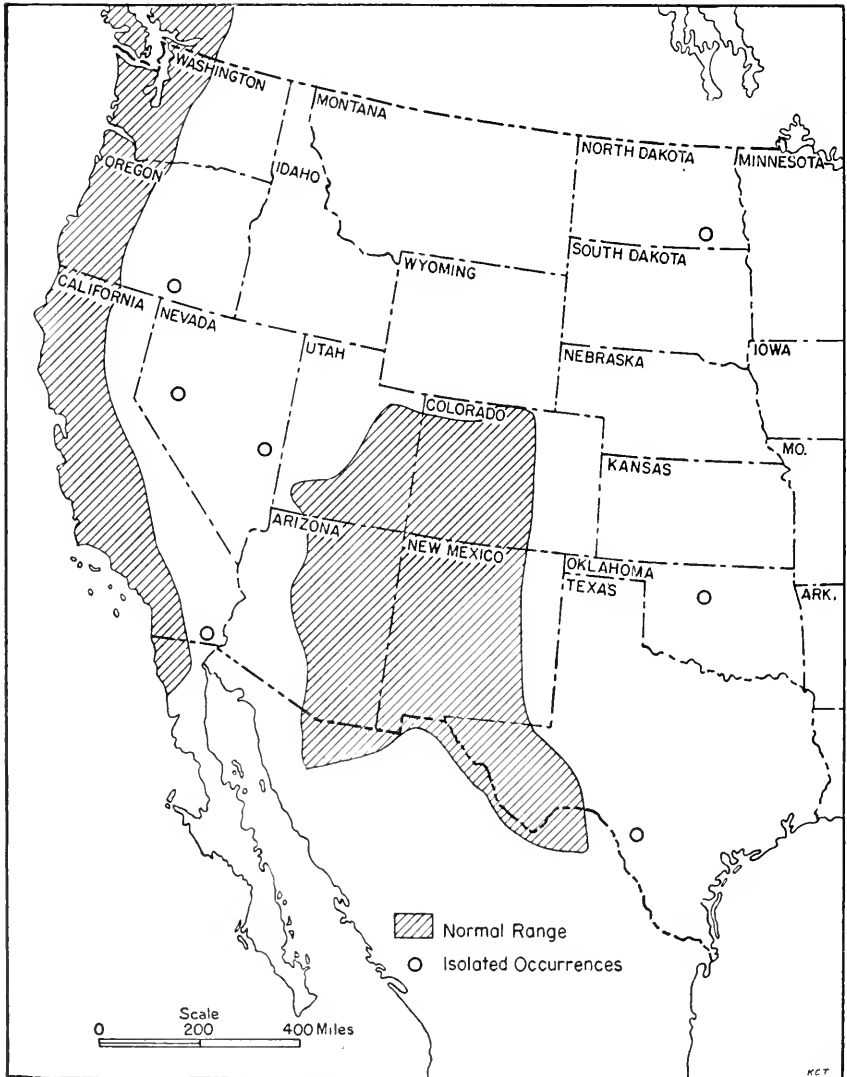


FIGURE 6.—The summer range of the band-tailed pigeon. (In Canada, north to Bella Cooola and Graham Island.) In Arizona, Colorado, New Mexico, Texas, and Utah, large expanses of range grassland and semi-arid desert may separate the mountain ranges in which pigeons are found. The range as shown in the map covers the extreme distribution as known from existing records.

In British Columbia, Taverner (1931) says that the species is found west of the Coast Range, north at least to Bella Coola on the mainland and Tow Hill, Graham Island, and Queen Charlotte group along the coast. According to Bent (1932), Courtenay and Chilliwack are the normal limits of range, hence the southern half of Vancouver Island may be considered the area normally inhabited by the birds.

In Washington, as in Oregon, bandtails breed locally in varying density west of the Cascades, and probably erratically in the Transition and Upper Sonoran Zones of the eastern slopes. The coastal belt and the area adjacent to Puget Sound seems to be the center of their abundance in the State. John Finley, of the Fish and Wildlife Service, at Olympia, says that the most easterly record he has obtained was near Bingen, Klickitat County, on the Columbia River.

In Oregon, Gabrielson and Jewett (1940) report that the species is common in the western part of the State, its greatest abundance being reached on the coast (fig. 7). Breeding in Oregon,



B8710M

FIGURE 7.—Typical band-tailed pigeon habitat in a "burn" in the Oregon coastal mountains, in Tillamook County, where the luxuriant vegetation offers both food and nesting cover. (Photographed by A. S. Einarsen, September 10, 1940.)

as elsewhere, is erratic. Pigeons may rarely be seen on the eastern slopes of the Cascades, and the only record for the State at any distance east of this range is of a lone, immature bird collected by Jewett in the Steens Mountains in Harney County on October 19, 1928.

In California band-tailed pigeons nest locally and erratically in Transition and Upper Sonoran Zone areas west of the Sierra Nevada divide, chiefly in mountainous areas from Del Norte and Siskiyou Counties in the north to the Laguna Mountains of San Diego

County. Their choice of nesting habitat apparently depends to a considerable degree on temperature. In the southern mountains, in the Sierras, and in the more northerly interior mountains nesting areas are usually at high elevations, but near the coast and in the coastal mountains they are scattered widely at much lower elevations, including the coastal redwood belt. According to Captain W. J. Harp, California Division of Fish and Game, the pigeons nest locally in fair numbers near the small ranches of Humboldt and Del Norte Counties in northwestern California.

Bandtails have been listed in so many publications on California birds that it is unnecessary to mention them all; Grinnell and Wythe (1927) describe the species as a summer resident locally in the coastal belt just north of San Francisco Bay; George Willett (1933) says that in southern California it breeds in moderate numbers in the oaks of the Transition Zone, mostly above 3,000 feet, south to southern San Diego County; Grinnell and Storer (1924) record it as being in Yosemite Valley during the nesting season; Derby (1920) describes a nest in the Sequoia National Forest; and Kloppenburg (1922) reports one in the Plumas National Forest. These records outline roughly the outer limits of the range within which band-tailed pigeons may be observed during the summer where habitat is favorable.

On October 4, 1941, Luther C. Goldman, of the Fish and Wildlife Service, collected a migrating band-tailed pigeon at a point 7 miles east of Calexico, 3 miles north of the Mexican line. This constitutes, so far as the writer knows, the first record of the species from the floor of the Imperial Valley.

In Nevada, Leo K. Couch reported observing a mature band-tail near Success Divide, Duck Creek Range, Nevada National Forest, on November 4, 1943.

In Utah, band-tailed pigeons have been observed at several points during the breeding season, and nests have been found in at least one district. Benson (1935) collected a pigeon in the Navajo Mountains on June 20, 1935, and Presnall (1935) described the bird as uncommon on the western rim of Zion National Park. According to Cottam (letter of May 6, 1940), S. D. Durrant obtained a specimen killed by a hawk near Hanna, Utah, in 1930; the specimen is now in the collection of the University of Utah. Cottam (1941) summarized the status of the species in Utah, stating that apparently the birds were annual, summer residents in the mountains of southern Utah although probably never abundant anywhere in the State. He reported 20 bandtails seen on July 24, 1940, at Oak Grove and Bitter Creek Canyon, on the south slope of Pine Valley Mountain, one of them believed to be a juvenile only recently out of the nest. He said that W. G. MacFarland saw a flock at Buckboard Flat, Blue Mountains, in June 1939 at about 8,000 feet elevation. Lee Griner is reported to have observed two flocks totaling 32 birds in the same mountain range 8 miles west of La Sal, Utah, on August 18, 1937, at 8,200 feet elevation, and a flock of 57 birds the same day a mile east of North Creek, at 7,800 feet. Griner also saw the birds and found their nests in June 1937 at Oak Grove, Pine Valley Mountain. Evidence obtained by

Griner from local observers indicated that the birds had occurred there each summer for at least the last 6 years. In June 1931 and 1932, Cottam reported that flocks of bandtails caused damage to fruit in a small cherry orchard at New Harmony on the east slope of Pine Mountain Valley, and Oscar Deming stated that in 1937 the birds frequented this same mountain from mid-May to October.

In Colorado the bandtail has been found in suitable foothill and mountain environment in the Transition and Upper Sonoran life zones on both sides of the Continental Divide. Numerous records obtained from the Colorado Museum of Natural History, the Colorado State Game and Fish Commission, and the field personnel of the Forest Service and the Fish and Wildlife Service, and reports from farmers and sportsmen show that pigeons have been seen at some time in 42 counties.

Those counties in which the pigeon population is considered as moderate to large include Archuleta, Conejos, Dolores, Douglas, Eagle, Gunnison, Huerfano, La Plata, Las Animas, Montrose, Ouray, Pitkin, Pueblo, Rio Grande, and San Miguel. Counties with small to moderate populations include Alamosa, Bent, Boulder, Chaffee, Clear Creek, Costilla, Custer, Delta, El Paso, Fremont, Garfield, Gilpin, Grand, Hinsdale, Jefferson, Mesa, Mineral, Montezuma, Park, Rio Blanco, Saguache, San Juan, Summit, and Teller. In several other counties pigeons have been seen occasionally and intermittently; these include Elbert, Jackson, Lake, Larimer, and Weld Counties.

Reports indicate extreme erraticism in much of the Colorado range; in some counties pigeons are more numerous now than for some years, while in others none has been seen for several seasons, and in others there is a noticeable fluctuation in numbers from year to year. Occasional reports from old residents indicate that fifty years ago large numbers of pigeons existed in some parts of Colorado. Food conditions undoubtedly explain many of these variations. The bulk of the birds at the present time seems to occur south of a line drawn from Montrose to Pueblo along United States Highway 50.

A Forest Service report for the year 1942 shows that pigeons were observed during that year on the Cochetopa, Holy Cross, Montezuma, Rio Grande, Roosevelt, San Isabel, San Juan, and Uncompahgre National Forests. The total reported as actually counted was 3,032. The San Juan Forest led with 1,200 pigeons.

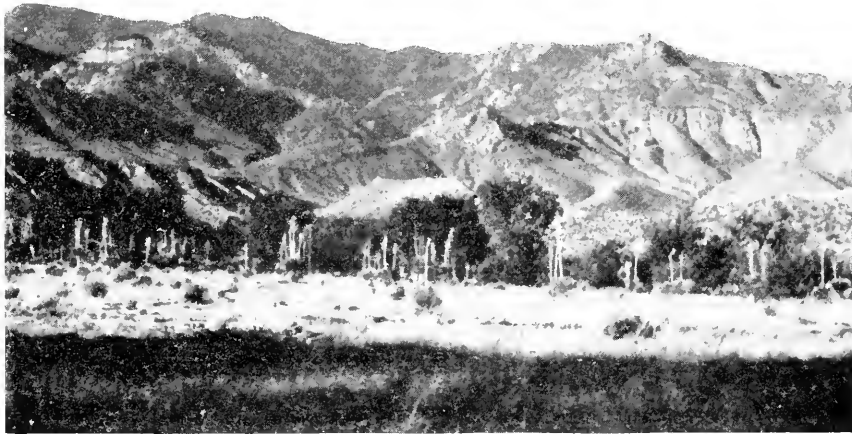
Colorado is the northeastward margin of range for the species, and for that reason variations would be expected to occur, especially in counties along the east base of the mountains and at the north. Extensive field work is necessary before the status and range of the bandtails can be definitely outlined for Colorado.

In Arizona, Swarth (1914) gave the range of the species as follows:

A common summer resident in suitable localities throughout the State; that is, in the higher mountain ranges, breeding usually above 6,000 feet. Has been found in summer on San Francisco Mountain, Mount Graham, and the White, Mogollon, Santa Catalina, Huachuca, and Carmelita Mountains.

Specimens were collected north of Williams, and a nest was found south of that town, in 1937, and specimens were also collected in 1941. South and southeast of Williams bandtails are seen in fair numbers annually at many places in the Prescott National Forest. They also occur in some numbers in Oak Creek Canyon south of Flagstaff. They have been observed on numerous occasions in the Coconino, Tonto, and Sitgreaves National Forests. In June 1941 Charles C. Sperry found them abundant near Jacob's Lake in the northern end of the Kaibab National Forest.

Clifford C. Presnall noted several pairs near Hilltop, San Carlos Indian Reservation, on May 15, 1941, and in June of the same year saw paired pigeons at several places in the Fort Apache Indian Reservation. The birds are also frequently observed near McNary and Springerville, and in many places in Greenlee County. They nest in the higher elevations of the Crook National Forest near Globe, on Pinal Peak, in the Pinaleno Mountains of Graham County (fig. 8), and in the Santa Catalina, Chiricahua, and



B8709M

FIGURE 8.—Band-tailed pigeon range in the oak-and-pine-covered Pinaleno Mountains of Arizona.

Huachuca ranges to the southward. Large numbers of them were seen on numerous occasions in the mountains between Patagonia and Nogales and in the ranges to the west of Nogales.

Mrs. Florence Merriam Bailey (1928) says that in New Mexico "the occurrence of the Band-tailed Pigeon at any given place seems to vary in different years according to the food supply. This is especially true of the oak-covered mountain slopes which may swarm with the birds when there is a heavy crop of acorns and be entirely deserted during a whole year when the acorn crop is a failure." She adds that the birds usually occurred at 6,000 to 8,000 feet, but frequently ranged much higher in the autumn, and

gives examples of observations in the Mimbres Range at 9,000 feet and on Pecos Baldy and in the Jemez Mountains at 10,000 feet.

L. W. Simmons, Deputy State Game Warden, informed L. J. Merovka, United States Game Management Agent, that he saw bandtails near Tererro on June 25 and July 7, 1940. He estimated that there were 250 of the birds, and said that they remained in the area until September 12. He also reported 115 on Cow Creek near Upper Colomas and 100 near Lower Colomas on July 15, 1940. W. M. Wilson wrote Merovka on October 2, 1940, that pigeons came into the Burro Mountains early in May 1939, nested, and left early in October. The birds concentrated well up the mountains. In 1940 pigeons were again present but widely scattered. Fred Sherman, of Deming, also reported to Merovka many past observations of bandtails in the Burro Mountains and the Black Range, and in 1940 some observations near White Signal in the Burro Mountains, and in the Black Range near Mimbres, Pinos Altos, and Kingston.

H. Garvin Smith, of the United States Forest Service, has supplied from his notes records ranging back to 1919, when he stated that bandtails in large flocks almost ruined the cherry crop at High Rolls and Orchard Park. In 1925 he said that in the Black Range pigeons were everywhere, gorging on piñon nuts; that thousands passed over his camp flying to roost; and that they were also reported from the San Mateo Mountains. By contrast, in 1926 his notes record that pigeons were very scarce in the Mogollons and on the west side of the Black Range. He also observed nesting birds in the Magdalena Mountains in 1933 and 1934.

David O. Scott, ranger in the Carson National Forest, Penasco, wrote that he saw his first pigeon for the year on May 19, 1941; he concluded that bandtails were relatively scarce in that area, though there were at times small groups of them in Santa Barbara Canyon and near Rio Pueblo. Dean M. Earl, of Carlsbad, reported that the only time he saw pigeons on the Lincoln National Forest was in the fall.

Clifford C. Presnall and other employees of the Fish and Wildlife Service saw about 400 bandtails on May 30, 1941, near White-tail School, on the Mescalero Indian Reservation, and single birds at other places on the reservation. D. Wood, Jr., one of the observers, said that during previous employment on that reservation, between 1931 and 1933, he saw many pigeons in small flocks, and that he believed they nested near Carizzo Springs. They have been reported from Sarca Canyon, Capulin Springs, and other places in the Sandia Mountains near Albuquerque.

L. J. Merovka said that band-tailed pigeons are usually fairly numerous around Bland, Senorita, and La Jara Canyons in the Jemez Mountains, and that he saw 500 in the latter place in September 1943. He also reported a flock from Stone Canyon in the Black Range, and on June 13, 1944, he noted a flock near Amalia, on the Costilla River, a few miles south of the Colorado State line.

Few early references to the range of the species in western Texas were found. One specimen from Uvalde was examined: Van Tyne and Sutton (1937) listed the birds from Presidio and Brew-

ster Counties; and Oberholser (1902) reported them from the Chisos, Guadalupe, and Davis Mountains. Ray Williams, State Warden, of Alpine, Texas, wrote Merovka that in the Trans-Pecos area bandtails ranged from 5,700 to 8,700 feet elevation in the Sierra Madre and the Glass Mountains of Pecos and Brewster Counties, in the Eagle Mountains of Hudspeth County, in the Diablo and Guadalupe Mountains, and in the Davis and Chisos ranges.

Casual records are listed by Carter and Trenton (Nice 1924), including that of one bandtail killed near Crescent, Logan County, Okla., in 1905. Schufeldt (1912) reported the taking of a single specimen near Englevale, N. Dak., on June 2, 1912. Alcorn (1941) reported the collecting of the first specimen from Nevada near Fallon on October 17, 1940.

In Mexico, according to information furnished by Frederick C. Lincoln, bandtails nest as far south as Durango (Otmapa Ranch), Puebla (Las Vegas), probably Vera Cruz (Jalapa), and the San Jose Mountains in Sonora. They are also found in Baja California. Bandtails were seen by the writer in considerable numbers in June and July 1942 along the Rio de Los Alamos south of Nogales, Sonora, and near Cananea, and along the Rio Babasac near Cocospera. American sportsmen report them widely distributed in the mountains of northern Sonora.

WINTER RANGE

In the northern part of their range band-tailed pigeons are largely migratory, only a few scattered birds remaining during the winter in sheltered locations. An Audubon Society Christmas Bird Census in the Puget Sound area in 1935 tallied 30 pigeons, and W. H. Ransom, in a letter of April 15, 1939, said that "small bunches quite regularly winter around Medina and Bellevue, Wash., along the east side of Lake Washington." On January 18, 1928, near Agnes, Oreg., a flock of about 150 pigeons feeding on madrona berries was reported to S. G. Jewett, and a few days later he found pigeon feathers along a trail in that vicinity. Jewett also observed a large flock feeding in stubble near Wolf Creek, Oreg., March 20, 1925, and A. W. Moore saw two birds on the Nehalem River in Oregon on February 22, 1940.

In California relatively few pigeons winter in the Sierras north of Yosemite National Park or in the coastal mountains north of San Francisco Bay. Hence the great majority of the bandtails breed from San Francisco Bay northward and concentrate in winter in west-central and southern California. The chief wintering area lies in the Sierras from Yosemite southward to Mexico, and in the coastal mountains from Santa Cruz and Santa Clara Counties southward to the Tehachapi range and Los Angeles, usually centering in Monterey, San Luis Obispo, and Santa Barbara Counties. In some years, the major wintering grounds may be from Los Angeles and San Bernardino Counties southward.

Moderate but irregular numbers of pigeons occasionally winter in the counties just north of San Francisco Bay, and casual winter

resident bands may at times frequent the slopes on either side of the Sacramento Valley to Redding.

The wintering range in California is closely correlated with food supply, but concentrated shooting during any one season undoubtedly causes the population of the area affected to diminish during succeeding seasons even though food is abundant. Mrs. Mary Bartol (1940) described the (to her) immense population of the Mount Pinos area in Ventura County in 1933, and remarked that only one year since then had been characterized by a crop of piñon nuts and a consequent large population of pigeons; she also said that in one of the intervening seasons the shooting area for southern California was in the oak country of the Santa Ynez Valley of Santa Barbara County.

Fred H. Post, State Game Warden, of Salinas, Calif., told the writer that in the winter of 1932-33 the birds had been very abundant in the mountains of that county. In 1933 food was scarce in the high areas and the birds scattered everywhere. In 1934 food was again plentiful and the pigeons were abundant in December. Other State game wardens in California have described to the writer large midwinter concentrations in areas of abundant food and have told of the annual fluctuation in abundance and distribution occasioned by variation in the food supply.

Grinnell and Wythe (1927) list the bandtail as a winter resident in the San Francisco Bay region, irregular but sometimes occurring in large numbers and in widespread areas. Willett (1933) records it as sporadically plentiful in southern California in foothills and mountains up to snow line, and also as having been observed on Catalina Island in 1932.

In Arizona, New Mexico, and Texas band-tailed pigeons from the northward and from the mountain ranges of those States move toward their southern boundaries or on into Mexico to winter. Variable numbers, however, remain in mountain ranges near the border as food supply and weather conditions permit. Mrs. Bailey (1928) reports them as resident some winters below the 5,000 foot elevation near Cliff, N. Mex., and quotes Stokley Ligon as having observed them on Haut Creek, Socorro County, at 7,500 feet during the winter of 1912-13. Ligon (1927) says that a heavy crop of piñon nuts has in a few instances held them throughout the winter in the Black Range.

Fred Pickens, Deputy State Game Warden, and William Wood, of the United States Forest Service, saw 35 bandtails in the Sandia Mountains near Albuquerque, N. Mex., on December 30, 1940, and on the same day Fred Johnson of the same Service saw fully 100 in a neighboring canyon.

In Texas, Ray Williams, of Alpine, reports, "I have seen them stay in the Chisos Mountains all winter when there is plenty of food," and on March 22, 1941, G. W. Peterson, Deputy State Warden, of Nogales, Ariz., wrote that "band-tailed pigeons stayed with us all winter . . . Acorn crop was very good last year."

South of the Mexican border, according to Frederick C. Lincoln, the band-tailed pigeon winters south to Guatemala and Chiapas. A subspecies, Viosca's pigeon (*Columba fasciata vioscae*), appar-

ently nonmigratory, is restricted to southern Baja California, and other subspecies occur in Central America.

MIGRATION

Periods and routes of migration of the bandtails are strongly influenced by availability of food and by weather phenomena, especially temperature and rainfall. Owing to the vast areas of wilderness through which the birds pass, it is difficult to trace their movements, and over much of their range they appear to move in small flocks which often may pass unnoticed.

SPRING

Search of the literature gives the following "earliest" dates for the appearance of the bandtail in the northerly parts of its range: Colorado, Beulah, May 7; Oregon, Mercer, March 5; Washington, Clallam Bay, April 9; British Columbia, Courtenay, May 31.

Leaving the wintering grounds in west-central and southern California late in winter, the northward-bound pigeons move slowly along the foothills of the Sierras and along the coast mountains. Frequently enormous flocks concentrate in areas of abundant food supply. The date of appearance at various California points varies with the season, but often large flights appear in the live-oak-covered foothills east of Sacramento late in February or early in March. Food supplies to a marked degree seem to control the dates and routes of movement.

Grinnell (1898) observed a large flock that remained until mid-June 1895 feeding on acorns near Pasadena, and Van Denburgh (1899) reported the birds as frequently remaining in large bands until mid-May near Palo Alto. Evidently migration is erratic and influenced by a number of factors which in few instances are well understood.

R. J. Little, State Game Warden, reported in 1935 that the pigeons usually arrived in Butte and Sutter Counties, Calif., in February. On February 15 he saw about 4,000 birds near Bangor, and on February 20 about 9,000 arrived at the small mountain uplift known as the Sutter Buttes, where they fed on acorns or on grain stubble in the adjacent valley fields. Nelson Poole, State Warden, described a large flight of pigeons, which late in February and early in March 1935 invaded the oak-covered hills between Sacramento, Folsom, and Auburn. These were feeding as they made their way northward, and soon left the Sacramento area. Near Auburn, however, although the numbers diminished, pigeons were numerous until late in April. Just as the cherry growers began to worry about their presence they suddenly moved on, and no more than normal numbers remained.

In the border States of Arizona, New Mexico, and Texas, it is more difficult to record the spring migration, as in favorable areas some of the birds frequently spend the winter. Ralph Morrow, Deputy State Game Warden, reported his first 1940 bandtail late in February in the Chiricahua Mountains. The usual spring records, however, are of birds observed late in April or early in May.

AUTUMN

The autumn migration also is strongly influenced by weather conditions and availability of food. After the major breeding season, pigeons flock together and move about locally following successions of food crops. There is also a definite vertical movement from the mountains to foothill or valley lands. This vertical migration varies greatly in season and in the Sierras of California seems to be stimulated by snow, storm, and cold weather at the higher elevations as well as by local food diminution, sometimes not occurring until December or January.

The latest fall records in the North found in the literature (Bent 1932) are for British Columbia, October 29, and for Washington, October 29. For Oregon, Bent (1932) lists the "latest" record as Newport, October 28. Jewett, in a letter of June 10, 1937, gives the following dates: Harney County, October 19; Multnomah County, October 11; Tillamook County, September 17; and Jackson County, October 6. In 1937 the writer spent the period of September 10 to September 25 in western Washington. During that time moderate concentrations of pigeons were observed feeding in the area immediately adjacent to Puget Sound from Blaine and Sumas in Whatcom County southward to Olympia, and northward to Dungeness in Clallam County. Local game wardens in those areas, however, said that there had been a considerable diminution in the population of the bandtails late in August and in the early days of September. South of Hoquiam and west of Olympia in the area between the Cascades and the ocean almost no pigeons were remaining on September 15, and local authorities stated that the mass of the population had departed by September 1 to 10.

The southward migration in Oregon normally begins during the last days of August and is well completed by September 20. Along the coastal mountains definite flyways exist, and from stations on them during the period of major migration it is possible for an observer to note band after band of pigeons passing south from daylight until dark. According to a number of observers, these birds "feed" their way along, the roosting place each evening lying farther south than that of the night before.

A. S. Einarsen, in a letter of October 3, 1944, described a Washington pigeon migration as follows:

On a trip to the State of Washington on September 25, I ran into a migration, and at one point on the Cowlitz River north of Castle Rock, counted 960 birds which came to a point, settling in a few roosting trees and, incidentally, dropping down for a drink of water in a backwater pool before continuing their migration southward almost immediately. In my experience I had never before seen such a steady drift of bandtails at any one point as large or continuous.

And in a brief special report dated March 30, 1943, Einarsen describes another migratory concentration point in Oregon thus:

They may pause for several weeks at some gravel bar or watering hole, and often other flocks join them. These facts have been confirmed by field observations at Pigeon Butte in Oregon, 12 miles south of Corvallis and 3 miles west of Bruce Station, one of many such points. Here an annual con-

centration exists from about August 25 to October 10, enlarged by migrations from areas far to the north. Pigeons come into this area to drink at a source of water supply and fly through a pass in great numbers.

From reports of local observers and from personal field observations the writer traced the 1937 migration from Benton and Tillamook Counties southward. From late August to mid-September the bulk of the bandtail population ranged from Corvallis to the vicinity of Coquille and Myrtle Point. The writer followed the flight from September 29 to October 4, and in the northern part of the area found only scattered small groups. In the Myrtle Point-Powers district a light population was found, where 20 days earlier several cooperators had reported enormous numbers. From the Roseburg-Coquille highway in Oregon south to north-central California stretches a wilderness that is so large and so sparsely traversed with modern highways that proper analysis of the bandtail migration through it is difficult. At numerous places within this great district the south-bound pigeons are reported almost annually as congregating in great numbers. In the 1937 field trip the writer continued southward along the coastal route. At Brookings, Oreg., ranchers along the Chetco River reported on October 4 that pigeons had been very abundant in their stubble-fields until the onset of a wind and rain storm on September 29 and 30. Later Einarsen wrote that from October 19 to 23, 1937, there had been a heavy concentration of pigeons feeding on madrona berries in the Applegate section of the Rogue River Valley.

In California it appears that the band-tailed pigeons on the coastal side of the northwest coast mountains congregate in flocks and commence to move south almost concurrently with the beginning of the movement in northwestern Washington and Oregon. State game wardens in Humboldt County, Calif., reported that late in August 1937 there had been a large population of pigeons in the area south of Fortuna and west of Garberville that had moved on southward down the coast prior to the arrival of the northern birds. Captain Harp, State Warden, said that in coastal Humboldt County the autumn withdrawal usually had begun by September 1 and that by mid-October of normal years none of the birds were to be found.

In 1937 the flights of bandtails from Oregon and Washington were apparently reaching northeastern Mendocino, eastern Humboldt, and Trinity Counties by early October, as during that month predatory animal hunters at various localities in the area reported pigeons in great numbers, and by late October considerable flocks were observed in southern Mendocino, Lake, and Napa Counties.

In the Sierras the autumnal flights appear to remain normally at high elevations, hence study of them is difficult. Deer hunters and State game wardens often report moderate concentrations in the area near Mount Shasta and west of Mount Lassen, and at times fairly large feeding concentrations are noted farther south along the range. In many seasons, however, the Sierra pigeon population remains at from 3,000 to 7,000 feet elevations until December.

In 1939 the autumn on the West Coast was very mild, and the

band-tailed pigeon migration was delayed considerably in comparison with average seasons. Pigeons were present in central Oregon in fairly large numbers all through September and into October, and a few yet remained in early November. Grinnell, Bryant, and Storer (1918) said that "in event of continued favorable weather, the birds will often continue in their summer haunts until October or even November . . ." if food is available in these haunts.

Mrs. Bailey (1928) compiled from the reports of several observers a number of autumn records for New Mexico, among which were the following: September 15 and 16, 1914, Upper Blue River Canyon; September 17, 1915, Diamond Creek; and November 10, 1914, 20 miles east of Silver City. W. M. Wilson, of Silver City, informed Lawrence J. Merovka that in 1940 pigeons remained in the area near Tyrone, N. Mex., until November 10, and that others were reported in the Black Range; this, he said, was fully a month later than the normal date of departure.

ROUTES OF MIGRATION

Except for evidence accumulated through observation of large flocks of band-tailed pigeons, there is little direct information concerning the routes of migration used by these birds. They appear to be very erratic, following those routes that offer satisfactory food for the migrating flocks.

Extensive banding of these birds is needed to furnish more explicit evidence relative to their migrations and to determine definitely the winter range of the pigeons produced in the major breeding areas. Reed Ferris, of Beaver, Oreg., discovered that bandtails are readily trapped when feeding on the ground, and he has banded more pigeons than any one else. Banders in pigeon country should make every effort to mark these birds.

Up to May 1, 1940, only 185 band-tailed pigeons had been banded, and only 5 return records were in the files of the Fish and Wildlife Service. Three of these were of birds that had been banded by Ferris at Beaver, Oreg., late in May 1932. One was shot at China Camp (Calaboose Canyon), Monterey County, Calif., in December 1932; another in the "Monterey Hills" on December 10, 1933; and the third, 15 miles east of Gonzales, Monterey County, on the same date. A pigeon banded at Carmel, Calif., in July 1937 was shot on December 14, 1937, near Atascadero, Calif., and one banded at the State Game Farm, at Chino, Calif., in June 1937 was found dead near Cucamonga, Calif., during the same month.

VALUE AS A GAME BIRD

Grinnell (1913) stated that "the value of the band-tailed pigeon as a true game bird is to be conceded without argument. Its pursuit is of a different type from that offered by any other game species." "Stillhunter" (1907), an anonymous writer in southern California, said that the best place for hunting pigeons was near a

dead tree where the birds alight, and that a .22 or .25-20 rifle should be used so that single birds could be procured without scaring the flock; but that for sneaking up on the flocks a "duck gun" was used. Ten pigeons were considered a good day's bag. If the flesh was strong, owing to an acorn diet, soaking it in brine flavored with vinegar or lemon would remove the disagreeable taste. Mrs. Mary Bartol (1940) describes the hunting of bandtails in southern California, noting the long-range shooting and consequent wasting of ammunition and crippling of birds. She mentions also the difference in flavor of the flesh caused by the birds eating different foods.

Since shooting seasons were resumed in 1932 after 20 years of total protection, several changes have occurred in the annual regulations, each tending toward permitting shooting at a period when more pigeons might be killed. The history of these seasons from 1932 to 1945 is abstracted.

Arizona.—1932-1934, December 1-15; 1935-1938, October 16-30; 1939, October 1-15; 1940-1941, September 16-30; 1942-1945, September 16-October 15.

California.—1932-1941, December 1-15; 1942-1945, December 1-30.

Colorado.—1944-1945, Counties of Archuleta, Dolores, Huerfano, La Plata, Las Animas, Montrose, Montezuma, Ouray, San Juan, San Miguel; and the drainage of the North Fork of the Gunnison River in Delta and Gunnison Counties. September 16-October 15.

New Mexico.—1932-1934, November 1-15; 1935-1939, October 1-15; 1940-1941, September 16-30; 1942-1945, September 16-October 15.

Oregon.—1932-1938, October 16-30; 1939-1941, September 1-15; 1942-1945, September 1-30.

Washington.—1932-1934, October 16-30; 1935-1941, September 16-30; 1942-1945, September 16-October 15.

The very slow rate of increase of this pigeon was apparently sufficient to maintain its population under early conditions, but it is amazing that the species has stood up so well and so long against the combination of modern firearms, good roads into wilderness areas, speedy automobile transportation, and the continued trend toward shooting seasons during the period when the birds are most abundant.

In winter, California is largely responsible for the fate of the bulk of the present band-tailed pigeon population of the Pacific Coast. The first open shooting season after 20 years of protection in that State occurred in 1932, continuing from December 1 for 15 days. The writer was not afield during that period but has received numerous verbal reports from hunters. In the Santa Lucia range of Monterey County, Calif., in the Monterey division of the Los Padres National Forest, there was, on December 1, 1932, a heavy wintering population of pigeons. The road leading to Tassajara Hot Springs resort, at a place close to 5,000 feet elevation, crosses a narrow saddle locally called China Camp, which separates two deep canyons, Miller and Calaboose. Oak and pine trees

are abundant on the slopes near the summit of the mountains, and a short distance north of the saddle several wide and fairly open oak flats occur. Madrona and manzanita are abundant along the canyons, and water is available in at least one of the canyons.

According to sportsmen, on the first day of the 1932 open season countless pigeons flew across China Camp saddle from Miller to Calaboose Canyons and back again. Hunters quickly congregated and band-tailed pigeon shooting became once again a leading sport. Owing to the roughness of the terrain it was extremely difficult for the game officers properly to patrol the pigeon area and no criticism of them is implied. Certain hunters told the writer of watching gunners who shot all day long, assisting others to obtain their limits, and left piles of birds on the ground.

In 1934 there was again an ample food supply in the area adjacent to China Camp saddle, and a large flight of pigeons gathered there and in the adjacent flats known as Chews Ridge and White Oak Flat. The shooting season opened on December 1, and the writer visited the area on December 7, viewing the flight and methods of hunting and conferring with wardens and hunters. Since the birds flew to and fro continuously, it was practically impossible to estimate the numbers present, but the flight on December 7, after 6 days of shooting, was not unusually large. When there was little shooting at China Camp saddle, the birds flew up and down the two canyons; when numbers of hunters occupied the saddle, the birds scattered out and flew widely over the mountain-top flats.

On December 9 (Sunday) the writer again went to the shooting area. The entire mountain abounded with hunters, automobiles, and guns. Gunners covered every opening in the forest and shots poured into the pigeon flight from all directions and elevations. At China Camp saddle the picture was not pleasant, as ten men shot where one would have been enough. Sportsmanship was virtually absent. In the continued fusillade of long-range shots, many wounded pigeons plunged to earth or fluttered down to alight in shrubbery or trees. Owing to the steepness of the slopes and their dense vegetation, the loss of birds was very high, possibly as many as five pigeons being lost or mortally wounded for every bird picked up by a hunter.

State game wardens made partial surveys of the kill during this 1934 season, usually counting only the full-limit bags taken off the area. On December 9, however, the writer assisted three State

TABLE 1.—Data on pigeon kill, Tassajara District, Monterey County, Calif., 1934

Date	Type of count	Number of hunters checked	Number of bag limits checked	Recorded kill
Dec. 1.....	Bag limits only.....	185	150	1,500
Dec. 2.....	.....do.....	412	280	2,800
Dec. 5.....	.....do.....	123	60	600
Dec. 7.....	.....do.....	60	30	300
Dec. 8.....	.....do.....	143	85	850
Dec. 9.....	...Complete.....	830	445	6,404

game wardens in a complete roadside inspection at the foot of the mountain. The record of kill on the various days is given in table 1, the figures for December 1 to 8 being generously furnished by the State game wardens covering the district.

In conversation with wardens and several scores of hunters, December 7 to 10, 1937, the writer learned the reactions of the gunners of this district. The vast majority denounced the reckless shooting and the wastage of birds. Numerous hunters expressed the opinion that the band-tailed pigeon could not maintain its existence in the face of such shooting as occurred in the China Camp area in 1932 and 1934. Fully 20 percent voluntarily declared for regulations to reduce the kill.

Since 1934 there has been no such large concentration of birds at that place. In some seasons there has been a shortage of food, but to the writer it seems that some of the scarcity of birds can be attributed to the terrific shooting of 1932 and 1934. It is for the welfare of the species, therefore, that usually the winter population in California has not concentrated in any such small areas.

The writer observed shooting practices on Whidby Island, in the Snohomish River delta area, and at other places in Washington in 1937. There was no parallel to the California situation, the shooters being widely scattered. The most frequently observed method of shooting, however, left much to be desired in the matter of "sport," as hunters lay in wait and shot at pigeons that perched in the tops of tall Douglas fir snags.

The food of the pigeons during the general period of shooting greatly affects the flavor of the flesh of the birds. In the Puget Sound area during the September open season the major food is peas from the stubblefields, and the birds are said to be of fine flavor. Mrs. Bartol (1940) pointed out the difference in flavor of California birds that fed on piñon nuts from those that ate acorns. By far the majority of pigeons killed in California have fed on acorns or on the fruits of the madrona. Their flesh is flavored by those foods, and old birds are very tough. Entirely too

TABLE 2.—*Band-tailed pigeon kill in California, 1934 and 1935: State and thirteen leading counties*¹

State and county	1934	1935 ²
CALIFORNIA (ENTIRE STATE).....	51,056	34,136
Counties:		
Monterey	21,961	10,855
Santa Cruz.....	5,819	1,439
San Luis Obispo.....	1,216	608
Santa Clara	1,075	542
Calaveras	567	.....
Tulare	528	.....
Santa Barbara	520	454
Los Angeles	515	678
Sonoma	512	.....
Fresno	506	680
San Diego .....	.....	1,048
Humboldt .....	.....	405
Riverside .....	.....	405

¹ Compiled from hunting-license application blanks by the California Division of Fish and Game.

² Published in the California Conservationist 1 (8): 3. August 1936.

³ Published in the California Conservationist 2 (8): 20. August 1937.

many of the birds killed are destined ultimately for the garbage can; no specific evidence can be given, but at numerous times the writer has heard statements that could have no other meaning. A relatively small percentage of the gunners hunt pigeons because they like to eat the birds; the majority are in the field for the sport of shooting, the thrill of killing game, and the enjoyment of the high wild country.

In table 2, based on data compiled by the California Division of Fish and Game, is given the band-tailed pigeon kill for the seasons of 1934 and 1935, as reported on applications for hunting licenses for the ensuing year. The table gives the total for the entire State and for each of the 13 leading counties. The figures are conservative, for few hunters will report more than they actually kill and some make no report at all. Table 3, based on data from the same source, shows the 1934 and the 1935 kill of each of California's game birds.

TABLE 3.—*Game bird kill in California, 1934 and 1935*¹

Game bird	1934	1935
Band-tailed pigeon	51,056	34,136
Western mourning dove.....	580,110	539,722
Quails, all species	560,181	916,589
Pheasant	25,220	40,616
Ducks, all species.....	389,247	304,882
Geese, all species	40,278	35,096

¹ Compiled from hunting-license application blanks by the California Division of Fish and Game; published in the California Conservationist 2 (8): 20. August 1937.

Writing of Pigeon Butte, near Corvallis, Oreg., Einarsen says:

For years this pass has been popular with hunters. Because of the terrain and the usual eagerness of the hunter, most of the shots are at long distances, which results in a crippling loss averaging more than 60 percent of the pigeons bagged. When the number of birds killed (at each pass) is more than 600, as in 1942 at this pass, the seriousness of the slaughter can be recognized.

The band-tailed pigeon will never have wide abundance. It is hunted on uneven ground, where a high percentage of crippled birds are lost and little effort is made to recover them. Five months after the season it was still possible to pick up birds which had died of injuries in large numbers around Pigeon Butte.

Far too few hunters know that band-tailed pigeons decoy well, and in many localities far better sport could thus be obtained with an accompanying great reduction in the number of crippled or dead birds lost. Decoying the bandtails into forest openings or fields is far preferable to shooting them at waterholes or gravel bars, pot-shooting perched birds out of dead snags, or to the average mountain-pass shooting in rough, brushy terrain.

PRESENT STATUS

Under conditions that prevailed between 1932 and 1942 it appeared that the band-tailed pigeon held its own under the 15-day

shooting season and low (10-bird) possession bag limit; there are those who state emphatically that in certain localities it was not maintaining itself, but was slowly decreasing. It is too soon to analyze the effect of the 30-day shooting season established in 1942, as wartime conditions of ammunition shortage and gasoline and tire rationing markedly affected pigeon shooting. Where numbers of the birds are to be found not far from hunting centers there may have been some reduction, but in other districts pigeon concentrations occur only in wilderness areas where during the war period few hunters could reach them.

In several States where there is an open season, it is set at a period when many of the birds have already moved southward, and there has been local clamor for a change of the season to coincide with the presence of peak populations. Such requests for changes in shooting seasons should be closely scrutinized for, if granted, they may lead to great increases in the kill in States in which the pigeon population is too low. Seasons of good shooting result in a great increase in the number of shooters afield; reports of poor shooting soon result in decreased hunting.

Earlier summaries of the status of the band-tailed pigeon are those of Chambers (1912), Grinnell (1913), and Taylor (1924). Owing to the extreme erratic nature of the species, accurate appraisal of its status over all the range is extremely difficult. The writer's own observations and reports of others are summarized for their interest in this connection.

A. S. Einarsen in a report, dated January 6, 1936, stated that "regardless of what may be said to the contrary, the population of band-tailed pigeons in the Fraser Valley, the Puget Sound country, the islands of Puget Sound, the river valleys west of the Cascade Mountains in Washington State, and in the favored nesting areas west of the Cascades in Oregon shows a tremendous decrease from that of the 1934 season . . ." Pearse (1940) said that bandtails were reduced to a precarious state on Vancouver Island and blamed overshooting in the winter habitat. Miller, Lumley, and Hall (1935), writing of San Juan in Puget Sound, state that numbers are decreasing rapidly.

Einarsen, in a letter of October 3, 1944, reported that "the migration in Oregon, generally speaking, has not been as great as in previous years, but there have been a few birds passing through throughout the entire month."

Field investigations in the Puget Sound area between September 13 and 25, 1937, indicated that the population of bandtails was from 50 percent to less than 10 percent of what it had been at the same date in 1936. This means little, however, in the absence of correlated data on weather and food conditions for the period concerned. In Whatcom County the 1936 population was reported as heavy, that of the spring of 1937 as normal, and that of the autumn of 1937 as very light. Snohomish County estimates placed the 1937 population at about 10 percent of that of 1936. In Skagit County, although scattered groups of birds were present, no pigeon concentrations were observed in September 1937.

San Juan reports indicated a normal 1937 season, except that

the autumn migration had occurred earlier than usual. Similar reports were obtained from Thurston, Grays Harbor, and Mason Counties. Pacific County reported an increased population in the spring of 1937 and an early autumn departure. Pierce County had a very large spring population, which dispersed to nest and did not reassemble. Lewis County experienced a marked increase during the 10 years previous. In Clallam County there were large spring concentrations during 1935, 1936, and 1937, and in some areas an abundant summer population also. Officials agreed that there was an increase in the area known as the Black Hills district near Elma, Shelton, and Olympia. Game protectors in all the counties named (except two) reported annually increasing shooting.

On September 27, 1937, United States Game Management Agent Gerow said that although numerous complaints of crop depredations had been received, the consensus of opinion was that pigeons were decreasing in numbers in Oregon. Alex Walker, of Beaver, Oreg., reported on September 30, 1937, that at best the pigeon population in Tillamook County was standing still and on March 30, 1940, he was of the opinion that the birds were definitely decreasing. Coincident with the late 1939 autumn migration in Oregon, a considerable increase in hunting was reported in some parts of the State.

Allen C. Oberle, of LaVerne, Calif., wrote on February 15, 1935, that in the San Dimas district of Los Angeles County there was a flock of about 350 pigeons where in 1926 there had been only three pairs. Lawrence W. Saylor (formerly with the Fish and Wildlife Service) wrote on January 15, 1940, that bandtails did not become at all common in the Ben Lomond section of the Santa Cruz Mountains of California until about 1932, when in a few seasons the flocks increased from a dozen birds to a hundred or more. Warden C. E. Holladay, of San Jose, Calif., said in 1934 that the pigeon population of Santa Clara County had doubled in 6 years.

From these and numerous recent reports it appears that the breeding population of band-tailed pigeons in California is holding its own in all sections; each year there are reports of pigeons nesting in areas where they had not been known to nest for years, and these seem to indicate that the California breeding population is slowly increasing and extending its range.

In Colorado, Bergtold (1928) called the bandtail an infrequent summer resident, and in the Denver area Niedrach (Niedrach and Rockwell 1929) reported the birds as regular summer residents in small numbers. Studies of the past two or three seasons substantiate a statement by E. R. Kalmbach to the effect that these birds seem to have decreased in numbers in northern Colorado, for few birds have been observed in the northern half of the State. On the other hand, in the southern part of the State and in a few more northerly localities, the birds seem slowly to have increased. Frank F. Poley, United States Game Management Agent, believes that there has been a constant but small annual increase for the past 10 years, especially in southern Colorado:

and Barry C. Park, of the United States Forest Service, says that the pigeon in Colorado is increasing slowly but constantly and is extending its range each year.

Inquiry among game officials and sportsmen in Arizona from 1938 to 1941 leads the writer to believe that the pigeon population of that State is slowly increasing. Recent seasons of drought caused food failure in many parts of Arizona, and this resulted in very erratic movements of the birds. Very few birds are shot in this State as the season opens after the bulk of the pigeons of the southern part of Arizona have moved into Mexico, and the birds are widely scattered.

Ligon (1927) said that the bandtails did not appear to increase in New Mexico but remained at about a constant level, and that the population was insufficient to justify an open shooting season. No recent general statement is available, but the reports from various localities in New Mexico indicate that the bandtail there, as in Arizona, may locally be slowly increasing.

From Texas, Ray Williams, of Alpine, wrote in November 1940: "For 25 years I have observed them in this territory and I do not see any increase in their numbers. They will never be too plentiful . . . They . . . just about hold their own."

Winter populations are most difficult to appraise owing to the wandering habits of the birds and to the wide range of country in which concentrations may occur. No recent information from wintering range indicates a decrease, nor is there any reliable evidence of any marked increase.

Considering actual pigeon populations alone, without reference to any other phase, it is felt that only in the Pacific Coast States are there sufficient numbers of birds to justify hunting. In Arizona, New Mexico, Colorado, Texas, and Utah, the habitats and habits of the birds may be such that few birds are killed and little damage results from open shooting; yet there is danger of again decimating the species. Shooting must be rigidly controlled. Local increases may easily be decimated by concentrated shooting in more southerly migratory or wintering areas.

It is of the utmost importance that Federal and State wildlife officials proceed with caution in liberalizing shooting privileges on this species in any part of its range. It is even more important that they carefully note the year to year status of the species over its entire range so that the need for reduction in numbers made necessary by local conditions may be anticipated and hunting control measures applied in sufficient time to prevent gross destruction that would require a total closing of the season such as was necessary in 1913.

MANAGEMENT POSSIBILITIES

It is inevitable that during a study such as this many questions that relate directly to management of the species should be raised. From a few sources have come direct inquiries concerning methods that might permit development of a sufficient population of band-tailed pigeons so that more shooting might be allowed.

Most important of all management practices must be the careful guarding of the species through continued stringent protection, with short shooting seasons and small bag limits. Crop depredations must be controlled or prevented with the minimum destruction of the pigeons. The species cannot withstand liberalized shooting in more than a few districts, and because of its restricted range, excessive liberalization at any point is undesirable.

Through cooperation of the local agencies concerned, most often the United States Forest Service and the State Game Departments, shooting should not be permitted at all in places where large concentrations of the birds are exposed to highly destructive hunting, examples of which have been mentioned (p. 31).

Normally, the bandtail is a native of the primitive forest and rough, wild country, usually at fairly high elevations. Management practices that in any manner assist in maintaining primitive areas in this country aid the bandtail; among these are fire protection, erosion control, restriction of human intrusion, and reforestation.

Few birds are controlled so completely by available food supplies as is the bandtail. Hence, management of food supplies might be expected to form part of any management program. Full study of the food habits of the bird, however, fails to elicit optimism as to the possibilities in that direction.

If any area is to attract and hold a winter population of bandtails, it must afford a bountiful supply of acorns or piñon nuts. Although the pigeons feed upon wild fruits and berries, in part, throughout the winter, mast is necessary as winter food. Hence any program looking toward increasing the winter population of pigeons must include increases in the mast supply.

During summer the food of the bandtail includes a wide range of wild and cultivated fruits and in some districts, acorns and grains. The use of cultivated fruits and grains may be largely eliminated from consideration as a practice intended to increase pigeon populations, for, except in local areas, an increase in planting of these would entail reduction in the forest or would increase the depredation problem.

In brief, it seems that only three practices are of real value in the management of the band-tailed pigeon: conservation of our present population; preservation of primitive and marginal wildernesses and woodland to offer habitat; and forestry, including fire protection and reforestation of already denuded lands, using wherever practicable species of plants that are of known value as bandtail foods. There are strong possibilities in the planting of wild fruits, such as mulberry, in high mountain park areas where these trees might thrive and where food is now scarce.

AGRICULTURAL RELATIONSHIPS

DEPREDATIONS

Depredations on agricultural crops by band-tailed pigeons although sporadic may be serious. They are generally local and vary

greatly from season to season. They sometimes involve numbers of birds so large as to be amazing, and again may concern only a few pairs. Their occurrence is so erratic as to be impossible to forecast, although in some areas slight to moderate damage may be done annually. The supply of natural wild foods is a determining factor in the occurrence of crop damage because of its effects on both pigeon concentrations and routes of migration. With natural foods plentiful in the mountains and wilderness there is less necessity for the pigeons to feed extensively on cultivated crops.

Many of the complaints against band-tailed pigeons come from ranchers whose production is relatively small, or they may concern only the loss of garden or orchard crops destined for home consumption. Noticeable attack on the products of large-scale farming operations is infrequent. Depredations on small acreages are more quickly noticed, have more vital importance, and concern a far greater number of individuals. Very frequently even a moderate loss in a cash crop like cherries may be keenly felt by the farmer concerned, and if the loss is heavy, it may mean financial disaster even though only a few trees are damaged. Even so, far too great a percentage of the complaints against the pigeons, as against other game birds, upon close analysis, are found to be unjustified. In many instances the desire to shoot pigeons for food will be found to be the underlying motive for the complaint.

In the literature are a number of records of band-tailed pigeons feeding on agricultural crops or their residues but only a few can be mentioned here. Fisher (1893) reported bandtails foraging in barley stubble in 1891, and Gilman (1903) noted large flocks of them in barley stubble in Riverside County, Calif., in March 1901. Grinnell (1913) mentions good-sized flocks on newly sown barley fields near Palo Alto in January 1901 and near Santa Monica in February and March of that year, and Barnes (1916) discusses alleged damage to grain. Anonymous news notes in 1924 and 1930 reported damage to cherries and grapes. Burtch (1930) discussed damage to grapes, and McAtee (1932) abstracted complaints against the species.

Taverner (1926) writes that "they are especially partial to peas and are said to pull up the sprouting seeds . . . As they are large birds, each one intent on filling a capacious crop, their power for damage is not small. In the autumn they alight upon the stooked grain and may take a considerable toll of it."

Grinnell and Storer (1924) describe bandtails feeding near the edge of a newly planted grainfield on the floor of Yosemite Valley in April 1916. Grinnell, Bryant, and Storer (1918) cite a single bird taken near Crescent City, Calif., on May 15, 1916, whose crop contained 509 kernels of barley, 23 of oats, 6 of corn, and fragments of acorn. Jewett reported depredations on newly planted fields of oats in Tillamook County, Oreg. Grinnell, Dixon, and Linsdale (1930) record a few bandtails coming in pairs or in small groups to cherry trees near Manton, Tehama County, Calif. (June 4, 1936). Kobbe (1900) said that they fed in wheatfields in Pacific County, Wash.

Munro (1924) reported on an investigation of band-tailed pigeon damage in British Columbia as follows:

On June 9, 1923, I had occasion to investigate a report that band-tailed pigeons were causing damage to sprouted wheat on a small bush farm in the Sooke district. The farm in question was found to include a portion of a large beaver meadow—one of the few open areas in this heavily wooded region—the balance comprising rough timbered hillside, and a wooded ravine through which flows a small stream. About eight acres of the meadow had been seeded to wheat and oats by hand and as always is the case with this method of sowing, a large percentage of the seed was on the surface. This exposed seed had germinated.

Pigeons commenced feeding on the wheat field shortly after my arrival, so, in order to study them at close quarters—for they are invariably wild when in the open—I made a careful stalk through the wooded ravine and reached, unobserved, a suitable hiding place at the edge of the field. From this position it was seen that 53 pigeons were feeding. Usually in flocks of this size small detachments from the rear keep flying over the main flock to alight in front of the foremost birds, but on this particular day the birds kept their formation — an undulating blue ribbon — and slowly moved across the field in my direction until a scant 60 yards distant, when they suddenly arose, circled several times, and then dropped on another part of the field—there to spread out immediately and commence feeding as before. From the several dead trees amongst the green timber behind me came other birds, singly as a rule, and joined the feeding band. Close observation with binoculars showed that only surface seed was being taken, the young plants from buried seed were not pulled up.

Mrs. Florence Merriam Bailey (1928) writes:

On the west side of Moreno Valley, on July 4, 1919, Mr. S. E. Piper discovered that two or three thousand Pigeons had congregated along the borders of a deep cove. He was attracted to the place by heavy shooting on the part of the ranchmen—mainly foreigners who said that the birds destroyed their young grain, especially barley. On examining several areas from which the birds rose, Mr. Piper could find no indication that they were either digging or pulling the young grain; and barley found in the gizzard of one was old stained grain evidently gathered from the surface or about old stack or shock stands. It was evident that the hunters were seeking justification for shooting them, though several averred that they found them unfit to eat.

The following accounts of band-tailed pigeon depredations were reported by ranchers, State game wardens, United States game management agents and other representatives of the Fish and Wildlife Service (formerly the Bureau of Biological Survey), and other persons. These reports include in some instances not only the original complaint but also a statement of the results of investigations by officials. A few of them have appeared in print, but most of them have never before been published.

CHERRIES, GRAPES, AND PRUNES

On August 20, 1920, E. R. Kalmbach, of the Bureau of Biological Survey (now the Fish and Wildlife Service), recorded that ranchers near Lookingglass, Oreg., reported severe damage to cherries by band-tailed pigeons.

Forest Supervisor Blair, writing from Glenwood Springs, Colo., May 29, 1920, transmitted reports of pigeon damage to cherries on several ranches in that area. One rancher who complained of very severe losses said that scarecrows were a failure and that

men without guns could not keep the birds out. Mr. Blair quoted several other small ranchers as saying that the tops of the cherry trees were completely stripped of fruit.

On June 27, 1921, W. F. Kubichek, of the then Bureau of Biological Survey, made a study of the situation as reported in 1920. He described the area concerned as a narrow belt between the Colorado River and the mountains beginning 10 miles east of the town and widening to the west. After a thorough inspection Kubichek reported (unpublished manuscript) that bandtails were seriously destructive in only a few orchards and in general were doing less damage than were other species of birds. In an orchard where severe damage had been reported he found a few pigeons feeding and was greatly surprised at their fearlessness and the extreme difficulty he had in driving them from the trees. His conclusions were that in most instances it was the size and conspicuousness of the pigeons that alarmed the owners and that actual damage by the birds was not great.

In May 1921, Charles C. Sperry, of the Biological Survey, investigated complaints of depredations on fruits by birds in Oregon. In his report (unpublished manuscript) several complaints against bandtails are included. In Lane County, Oreg., three fruit growers claimed measurable loss of cherries through damage by pigeons, and in Douglas County, Oreg., two out of four growers interviewed made the same report. From Multnomah, Benton, Linn, Marion, Polk, Yamhill, Clackamas, Columbia, Washington, Wasco, Umatilla, and Jackson Counties no reports of damages were received.

On June 25, 1923, Ray C. Steele, United States Game Warden, wrote of a visit to a cherry orchard near Riddle, Oreg. Pigeons were abundant, some trees being literally filled with them. They were very shy and flew when approached, preventing the collecting of specimens. The ground was covered with cherries, about 10 percent of them showing bill marks, the remainder having been knocked from the trees as the birds alighted or fed in the branches.

On July 20, 1923, B. R. Britton, United States Game Warden, reported damage to cherries in the Teseque Valley on the western slopes of the Sangre de Cristo Mountains of New Mexico. On July 12 on the Williams ranch, he saw trees that appeared bluish because of the many pigeons in them. On some trees the fruit was completely devoured, on others the tops were stripped. On this 84-acre ranch Britton estimated a loss of 20 to 30 percent of the cherry crop. Thirty trees near the margin were completely stripped. One bird was watched as it picked 20 cherries and dropped about one-third of them as it attempted to swallow them.

On March 7, 1924, a fruit grower of Paradise, Calif., wrote to the Biological Survey regarding pigeon depredations: "My cherry season lasts six or seven weeks . . . Last season I spent forty dollars for ammunition and had to hire a guard for four weeks; at that I lost over 1,500 pounds of cherries." Another orchardist of Paradise, also in 1924, reported: "For the last three years our cherry crop in this section has been destroyed by wild pigeons . . .

I speak for about 20 growers who estimate their losses at from one-fifth to three-fourths of the crop." In a letter of June 24, 1925, an orchardist of Fortuna, Calif., said that pigeons had taken between 1 and 1¼ tons of cherries that year.

In a letter of June 19, 1925, George Tonkin, United States Game Warden, reported several complaints against pigeons. The following comments are abstracted from his letter:

In the Paradise district, 80 miles almost due north of Sacramento, there are many pigeons. There is said to be a roost and breeding ground in the vicinity of this district and the pigeons are there nearly the entire year. I found only three farmers in this district who complained about the birds to any extent. . . . These ranchers have frightened the birds away even though they had, up to the time of my visit, been unable to get any old-fashioned black powder. One of them told me that a bullet from his 30-30 rifle fired across the orchards had a very good effect.

At another nearby ranch Tonkin found pigeons feeding in cherry trees close to the ranch house, and it was apparent no effort had been made to frighten them away. Five shots from his revolver drove fully 75 birds from the orchard. Upon investigating the complaint of a rancher near Inwood, Calif., in June 1925, Tonkin found the small cherry orchard in a wooded section completely surrounded by heavy forests. Near Mount Shasta a tenant reported pigeons attacking his strawberries. Here Tonkin saw many pigeons flying about, but as the ranch chickens had free access to the strawberry patch, he did not feel that the pigeons should be held responsible for the alleged damage.

An orchardist of Dunsmuir, Calif., on May 7, 1926, wrote of the bandtails: "They are in this section by the thousands, and you can stand and shoot and they will fly away a few feet and circle right back. We have lost our entire crop of cherries but about 60 pounds out of 1,000 this year."

On June 21, 1928, United States Game Warden Tonkin reported his investigations of several pigeon complaints. Near Garberville, Mendocino County, Calif., he inspected a small orchard of fine cherries completely surrounded by heavy redwood forests. The rancher was shooting at, and killing a few of the pigeons to protect the crop. Near Fortuna, Scotia, and Carlotta, in Humboldt County, Tonkin visited other similar orchards. In one of them the rancher or his sons maintained constant patrol with a .410 gage shotgun. Pigeons were numerous; wild berry patches in the timber attracted large numbers, which at times invaded the cherry orchards.

Recommending that an open season on band-tailed pigeons be permitted in California, Tonkin said: "It seems reasonable to believe that the wild band-tailed pigeons have been (and are now) a serious menace to the cherry and grain crops in Humboldt County. Under present conditions I do not believe that the killing of wild pigeons in the cherry orchards can be stopped so long as the farmers feel that it is impossible to drive them out by other means."

A fruit grower of Gilroy, Calif., wrote on August 27, 1930: "This spring they (the bandtails) came in here by the hundreds

and fed on green prunes, stripping some trees before we realized what they were doing. The State game warden estimated that in 6 miles along the foothills they did damage amounting to from \$2,000 to \$2,500 to the prune orchards."

The superintendent of a ranch near Arvin, Kern County, Calif., reported on March 18, 1930, that wild pigeons were damaging the extensive vineyards on the ranch. The local State game warden, county agricultural agents, and Biological Survey officials were notified. In 1929, a heavy tonnage of grapes had not been harvested. These had dried to raisins on the vines, and in March were on the ground as the result both of natural fall and of the seasonal pruning of the vines. On March 21, 1930, deciduous fruit trees on the property were in full blossom and the grapevines had already put out tender shoots that were from 2 to 4 inches long; these shoots carry both the leaf and the blossom for the current season. The pigeons frequenting the vineyards were so numerous as to arouse great interest. Capt. E. P. Brownlow and Lester Arnold, Warden, of the California Division of Fish and Game, made a detailed study of the flight and estimated that 200,000 pigeons were involved. Investigation disclosed that the birds roosted on Bear Mountain, some 6 miles to the eastward, and that the acorns and other wild foods in the foothill area had been almost entirely cleaned up. In the vineyard the enormous flocks of bandtails would alight on the trellised grapevines, then drop to the ground to feed on the waste raisins; in doing this they broke off the tender new growth carrying the current season's crop. In the nearby deciduous fruit trees they alighted at times in such numbers as to break branches and to knock off the blossoms. The defense measures undertaken are discussed under Methods of Crop Protection (p. 46). The situation was described by Burtch (1930). The depredations of the pigeons continued from March 18 to and including April 2. Officials of the ranch estimated the loss of Malaga grapes alone at 500 pounds a day, and the loss of peaches and plums at 300 pounds a day. They estimated a total loss of \$5,000 for the grapes and \$1,000 for peaches and plums. In addition, it was said the owners of the ranch and the State Division of Fish and Game together expended about \$2,000 in attempting to drive the pigeons from the vineyards.

County Game Warden Fredericksen, of Gilroy, Calif., reported that during May 1934 five prune orchards near Gilroy were damaged. In one of these the pigeons flew across nearly 2 miles of almost solid prune orchard and virtually destroyed the crop in a 10-acre block of sugar prunes.

For many years pigeons have attacked cherry crops in the vicinity of Mountain Park, Otero County, N. Mex., and during June and July 1939 J. S. Ligon, of the Fish and Wildlife Service, investigated conditions there. He reported that the pigeons were not so abundant as during some other years, but that damage was even heavier than usual owing apparently to a food scarcity in the Sacramento Mountains. Because of drought, less grain had been produced in the lower altitudes, and the pigeons concentrated on

the cherries, which, in that locality, ripen before most of the natural wild foods.

At intervals late in June and early July of 1940 and 1941, J. C. Knox, United States Game Management Agent, of Albuquerque, inspected the Mountain Park cherry orchards. He reported damage to about 20 orchards, totaling about 2,500 trees, scattered about in narrow mountain canyons. During his 1940 investigations he estimated that he did not see more than 250 pigeons, but "when 50 to 100 of them alight in one tree at a time, they either eat or bruise all the cherries in a very short time, and some of these cherries sell for 25 to 30 cents a pound." In 1941 there was a great increase in the number of pigeons attacking the cherry orchards. Knox estimated that there were 1,000 bandtails.

GRAIN CROPS

In August 1921, Webb Toms, Assistant Warden, of the California Division of Fish and Game, reported depredations by band-tailed pigeons on wheat in the San Luis Rey Valley of San Diego County. One rancher claimed that wheat enough to fill 20 sacks had been taken. Damage was inflicted only while the wheat was in the shock, and pigeons covered the shocks so densely as to break off many of the heads which dropped to the ground and were wasted. In contrast, 16 years later (1937), E. H. Glidden, State Game Warden, of San Diego, Calif., said that "depredations by wild pigeons are unknown here."

On July 22, 1923, B. R. Britton, United States Game Warden, investigated a complaint of pigeon damage near the top of the White Mountains of New Mexico. Thirty acres of winter wheat were ready to harvest. The surrounding country was in a wild state, covered with scrub oak and scattered pines; the elevation was about 8,000 feet. Britton estimated a 5-percent loss of the grain, mostly in small patches near the edges of the field close to large pine trees. In these places the stalks were beaten down, the heads broken away, and the grain stripped off. The owner later said that as soon as the grain was shocked the bandtails came in even greater numbers and stripped the shocks.

On September 26, 1924, an agriculturist of Sumas, Wash., reported that he had 7 acres of fall wheat planted, that the pigeons had been eating there since planting time, and that they were even pulling up sprouted plants.

During April 1932, the writer recorded two instances in which migrating flocks of bandtails crossing the Sacramento Valley, Calif., alighted in a newly seeded rice field and ate the broadcast seed until driven out. In January 1934, a large flight of pigeons invaded the Pacheco Pass district of California. Ranches there are more or less marginal in nature, and complaints of severe damage to grain were received. Permits for killing the pigeons committing the depredations were issued, and local wardens reported 3,300 pigeons killed, a far greater number than was justified by the damage.

Frank Poley, United States Game Management Agent, on Sep-

tember 26, 1941, investigated complaints of depredations on wheat in the Sanborn Park area near Norwood, Colo. On one ranch he estimated a loss of about one-third of the shocked wheat. Similar losses were noted on several adjacent ranches.

From April 28 to May 15, 1925, Ira N. Gabrielson investigated alleged depredations by band-tailed pigeons in two Washington Counties, San Juan Island and the mainland areas in Whatcom County. Both areas were extensive pea-growing districts, totaling from three to four thousand acres. Of the Sumas district of Whatcom County, Gabrielson wrote: "Whatever the condition may have been at other seasons, there was no damage at all in this district in the spring of 1925. There were no pigeons in the district nor had there been any up to the date of my departure (May 11). Testimony agreed that when the pigeons came in, they ate all the peas left on top of the ground. The claim was made that these peas on top of the ground would grow if left there. Most of the farmers refuted this, saying that the peas on top of the ground, while they might sprout, would never make good plants." During his study Gabrielson observed a field in which there were many peas on top of the ground; because of favorable weather, these had sprouted, but on the day of his inspection the sun shone brightly and the ends of the sprouts were blackening and shriveling.

Residents of the Sumas area told Gabrielson that pigeons had been exceedingly abundant in the spring of 1924, and that this had led to numerous complaints.

On the islands Gabrielson found a more difficult situation. Most of the peas were grown on San Juan Island, and only a few on Orcas and Lopez Islands. The industry there had developed rapidly after its start in 1922, and in 1925, 1,000 acres of peas were being grown for the cannery. The soil was largely moisture-retaining, stiff clay, hence hard to work and cloddy, and the drills left more peas exposed than on lighter soils. This condition led to the numerous complaints against pigeons.

It was the practice of most of the farmers to run a clod-masher over the fields after seeding was completed. The only loss attributable to the pigeons was the eating of peas from among the clods in the interval between seeding and clod-mashing. Farmers almost unanimously agreed that peas left on top after the masher passed were valueless.

Farmers on those islands who grew grain or peas for seed told Gabrielson that the bandtails did considerable damage at harvest time through alighting on the shocks and eating all the seed they could reach.

An orchardist of Sequim, Wash., on April 17, 1935, said that in 1933 he had suffered a total loss of five acres of peas and that he had a thin stand on the remainder of his planting; also that many bandtails were present at the time of his reporting and severe damage would probably occur. When a Biological Survey investigator inspected the property the pigeons had already departed, but there was evidence that large patches of peas had been cleaned up. The orchardist told the investigator that he grew peas for seed and that the greatest damage was inflicted on the ripening

seed crop in August when the birds alighted on shocks, bent the curing plants, and shelled them onto the ground.

S. J. Handron, State Game Protector, of Hoquiam, Wash., reported on May 24, 1937, that between two and three thousand pigeons were feeding on pea plantings near Elma, Wash., and on September 21, 1937, Fred Rice, State Game Protector, of Port Angeles, Wash., told the writer that for the past 3 years the spring concentration of bandtails had been exceptionally heavy and that severe damage to oats and peas had been sustained.

WALNUTS

In February and March 1932, a large concentration of pigeons near Exeter, Calif., caused unusual damage. The birds gathered at dusk in an English walnut grove in such numbers as to break branches from the trees. By counting pigeons in several of the trees Capt. O. P. Brownlow, in charge of the State Game Patrol in that area, estimated that at one time there were in excess of 25,000 bandtails in that grove.

METHODS OF CROP PROTECTION

Methods of effectively and economically protecting crops from damage by band-tailed pigeons have been more or less extensively studied by certain farmers and by conservation officials. In the reports of field men of the Fish and Wildlife Service are numerous notes on this phase of the pigeon problem.

Gabrielson in his 1925 report wrote of a rancher near Bellingham, Wash.:

He stated that the issuing of permits would not help any as the average farmer did not have the time to stand around and shoot these birds, and that they could not kill enough of them to make any difference. His belief was that some sort of frightening device would be of much greater value. He found that firing a gun from his front porch frightened the pigeons for an hour or two. He started in with a 12-gage shotgun . . . [he] found the 22 rifle just as effective.

In 1926, George Tonkin, United States Game Warden, reported on a method of driving pigeons from cherry orchards:

On the morning of May 16 I arrived at an orchard at Paradise [Calif.] before 5:30 a. m. I had a 10-gage shotgun and some shells loaded with 8 drams of black powder, known as the yacht cannon load, I demonstrated to several ranchers that day that a shot fired from this gun, loaded with black powder and without shot, would frighten the pigeons from their orchards and from the roosting places in the oak groves for a distance of one-third to one-half mile from the place where the gun was fired. But the birds either returned in a short time or another flock took their place, probably the latter case. At any rate, it is necessary for a rancher to keep a guard in his orchard from daylight until dark. On some days the pigeons appear to have left the country: perhaps on the following day a flock will visit the orchard every few minutes. It is a great hardship for farmers who have a large orchard some distance from their residence, as a few minutes' absence from the orchard may mean the stripping of cherries from several trees.

B. R. Britton, United States Game Warden, thus described his attempts at protecting grainfields from pigeons in the Teseque Valley, near Santa Fe, N. Mex., in 1923:

I purchased some black powder shells and returned to the Williams farm, arriving about 2:30 p. m. I took the shotgun shells and cut the shot

portion of them away, and began patrolling the orchard, firing on the pigeons whenever I was close to them, but found this had little effect. Continuous patrol by myself and hired men had the effect of keeping the birds moving. At daylight on Friday morning I found the birds roosting in the cottonwoods adjoining the orchard, and slipping under these trees I fired blank charges up through them. This was continued all day, and I found that when I could get close enough to the trees in which the birds were roosting or feeding to get the smoke and report of the gun practically among them that it had a terrifying effect. I found that the pigeons would avoid a tree in which they had been disturbed in this manner.

Constant patrol was maintained from 5 a. m. to 7 p. m., someone being in the orchard all the time. I myself gave particular attention to the resting places of the birds along the edge of the orchard. Part of the time I used a revolver and part of the time a 30-40 rifle, simply discharging them into the air. I found that the report of the rifle or revolver had a more terrifying effect on the birds owing possibly to the sharper report. I also tried fluting or cutting the revolver bullets, which resulted in a screeching sound as they passed through the air. By Monday the birds had practically deserted the cottonwood trees adjacent to the orchard as resting places (except in the very early morning) and rested in the scrub cedar and piñon trees on the hillsides. From there they were routed by firing the rifle into the dry hillside in the vicinity of the roosting trees; this caused a cloud of dust which kept the birds moving. The birds then moved into a canyon behind a hill, and I followed them there and finally succeeded in driving them out of there. By Wednesday morning there apparently remained only about 30 or 40 birds and these were very wild, flying high, and if they dropped into the orchard, would rise on the approach of any one. On Wednesday afternoon there was a violent thunder storm accompanied by a high wind, and about 5 p.m. a flock of about 200 pigeons appeared and were persistent in settling in the orchard, acting in the same manner as those found in the orchard at first, having to be driven from the trees in which they settled to feed. I might state that the orchard as viewed from the hillsides appeared like the madrone woods in California, which were favorite feeding places for the wild pigeons; and in my opinion it was this bright coloring that attracted passing birds. Thursday morning there appeared only the remnants of the flocks that were at first present, the flock of birds that had appeared on Wednesday evening apparently having passed on.

In July 1937, the writer was collecting specimens of bandtails in the mountains near Santa Cruz, Calif. One mountain ranch visited contained about 20 fine trees of sweet cherries, all loaded with a heavy crop of good fruit. Among the birds, of six species, noted feeding on the cherries were approximately 30 to 50 pigeons. In one instance about a half dozen of these birds alighted in the top of a tree on which two fruit pickers on short ladders were working. They fed until one of the pickers, after drumming on his pail and yelling, descended to the ground and threw clods at them. Shooting incident to collecting specimens continued intermittently for an hour, and the pigeons at no time retreated farther than the tops of some tall sequoias and other conifers adjacent to the cleared farm land.

James A. Blair, Forest Supervisor, at Glenwood Springs, Colo., writing on May 29, 1920, quoted a rancher in that area as having tested the effectiveness of scarecrows in preventing damage by pigeons. The rancher said that his cherry pickers tried to frighten away the pigeons, but that no method except the use of a shotgun would cause them to do more than circle to another part of the orchard.

In attempts to frighten away the enormous flocks of pigeons that were damaging the vineyard on the ranch in Kern County, Calif.,

in 1930, previously mentioned (p. 42), various methods were tested. Among these was that of trying to feed the pigeons in the mountains near their roosting grounds. There 1,000 pounds of barley and 500 pounds of raisins were scattered. The pigeons are said to have taken this food, but they were so numerous as to make the method ineffective. An airplane was then used in an attempt to drive the birds from the vineyard, but without success. The California Division of Fish and Game and the owners of the ranch cooperated in hiring 16 men to patrol the vineyards and in furnishing the necessary ammunition. After a week's trial, the flocks appeared to be little diminished in numbers and the damage was said to be increasing, owing to the increasing length of the grape shoots and the budding out of later varieties of grapes.

On March 30, fifty sportsmen were invited to assist in the drive. A number of pigeons were killed and although the rest were kept stirred up, they were not discouraged but kept alighting in the vineyard. As a result of publicity some 300 sportsmen assembled on March 31 and April 1; yet the birds continued to come in by the thousands. On April 2, about 500 men appeared at the vineyard with about 200 rounds of ammunition each, and it was said that "a bombardment such as has not been heard since the First World War took place from daylight to about noon." Not a pigeon was given a chance to alight.

On April 3, hundreds of hunters appeared but no pigeons came. A survey of the vineyard by officials revealed fewer than a dozen birds during the entire forenoon, and inspection of the roost indicated that they had deserted the area. It was estimated that between 5,000 and 7,000 pigeons were killed.

These reports indicate the problems that develop in herding off pigeons by gunfire when they range in numbers from a few birds to almost a quarter million. As intimated by Tonkin and Britton, and fully substantiated by the experience of countless farmers and game officials, timing the protective effort is most important. Control work should be started at the first evidence of crop loss, not after the pigeons have fed long enough to become accustomed to the area. It is far easier to discourage the birds at the beginning of an attack than after the flight has developed to large proportions.

Herding off pigeons with gunfire remains the standby, with advantages and disadvantages as herein pointed out. It is costly; it requires a large quantity of black-powder ammunition and constant patrol by gunners whose numbers depend on the size of the area to be patrolled. Rifle fire, although effective, is too dangerous in most localities.

As already reported, scarecrows appear to have no effect on the pigeons. Airplane herding was of no avail. Feeding the pigeons in their mountain haunts proved possible, but was so costly that it was impracticable.

John C. Knox, United States Game Management Agent, in June and July of 1940 and 1941, made extensive and fairly successful tests of frightening devices in the cherry orchards of Mountain Park, N. Mex. He described the results obtained with the use of

the automatic acetylene flash gun² known to be of value in preventing depredations by various species of birds.

One of these "guns" was operated near High Rolls in an orchard of 30 cherry trees. Before its installation 40 pigeons had fed in these trees morning and evening for more than 10 days. When the exploder was timed so that explosions occurred at 10-minute intervals, the pigeons were kept away from the trees, and when it was regulated so that explosions occurred every 3 minutes the jays, robins, orioles, and grosbeaks were controlled to an estimated 80 percent. At the end of the 1941 test, Knox concluded that the use of 10 or 12 acetylene flash guns together with a limited amount of concurrent shotgun shooting would effectively solve the problem in that area.

An adaptation of the "flagging" system commonly used against horned larks in truck crops in California³ was tested. In 1940, in an orchard of 150 trees a cord was stretched over the tops of the trees in each row. Between and near each tree streamers made of white wrapping paper were tied to the cord so that they waved in the rather constant breeze and made considerable noise. For 7 days after the installation of this device, no pigeons fed in the orchard. Then a severe rain and wind storm destroyed the papers. In 1941 streamers made from a durable kraft crepe paper with an asphalt inner binding were tested. This paper proved very successful during dry weather in frightening the pigeons. It withstood rain and wind, but when wet it made no noise. Apparently it was the crackling and popping of the streamers rather than their motion that frightened the pigeons, for when the crepe paper streamers ceased to make noise, they lost their effectiveness and the pigeons returned.

A spotlight beacon useful in frightening away night-feeding ducks⁴ was tested against the day-feeding pigeons, but proved ineffective, as did also strips of paper, cloth, and bright tin hanging in the trees.

Knox demonstrated that tree covers made of tobacco cloth were both effective and economical. Cover for trees of various sizes were made at costs ranging from 50 cents to \$3 each. Because pigeons prefer the higher branches, the covers were so constructed as to cover only the upper parts of the tree, but where other birds are plentiful extension of the covers to protect the entire tree might

² The acetylene flash gun is a commercially manufactured device consisting of a carbide, water, combustion, and flash chambers. A controlled flow of water entering the carbide chamber forms acetylene gas. When pressure forces release of the gas, it is ignited by a pilot light and explodes with a report similar to that of a shotgun, and with a blinding flash of light. By means of the valve controlling the water flow, the apparatus can be set to explode at almost any desired frequency. Information on where this and other bird-frightening devices can be obtained can be furnished by the Fish and Wildlife Service, Department of the Interior, Chicago 54, Ill.

³ Protecting crops from damage by horned larks in California. By Johnson A. Neff, Biologist, U. S. Dept. Agr., Bureau of Biological Survey Wildlife Research and Management Leaflet BS-64, 10 pp., illus., September 1936. [Processed.]

⁴ Protecting field crops from waterfowl damage by means of reflectors and revolving beacons. By F. M. Uhler, Biologist, and Stephen Creech, Game Management Agent, U. S. Dept. Int., Bureau of Biological Survey Wildlife Leaflet BS-149, 6 pp., illus., November 1939. [Processed.]

be well worth while. As the covers would be in use only about 30 days of each year, if carefully handled they should last for several seasons. The writer on many occasions has observed similar covers used to protect vines and fruit trees, the most elaborate being a gas-pipe-chicken-wire structure covering large sweet cherry trees.

Near Hermosa, Colo., in 1942, Game Management Agent Poley found the acetylene flash gun very ineffective unless it was moved about the orchard several times daily and was accompanied by liberal gunfire. Pigeons were seen feeding in the tree adjoining the flash gun after it had been operating for almost an hour. In the same area, in 1943, white Very signal flares were tested and proved most effective in frightening pigeons from the orchard. Their use was restricted by the great fire hazard in all places where the ground cover was inflammable. Pyrotechnic 3-inch flash bombs such as are widely used for frightening ducks were also tested in cherry orchards and proved to be very satisfactory, having greater value than gunfire.

Studying the depredations on cherries at Cloudcroft, N. Mex., Frank C. Knox, Game Agent, found that a small number of wild mulberry trees grew in the mountain canyons near the cherry orchards. The fruit on these trees normally ripened about 2 weeks after the earliest cherries were ripe, but before the late cherries ripened. He first noticed that the pigeons were more easily driven from the cherry orchards after the mulberries began to ripen. Then, in 1943, weather conditions caused the early cherries and the mulberries to ripen at the same time; a large part of the pigeons remained in the canyons feeding on mulberries and did not come to the cherry orchards until the mulberry crop was exhausted, at a time when most of the cherry crop had been harvested. Similar conditions existed near Paonia, Colo., in 1945.

Knox's observations led him to believe that the planting of early ripening mulberries in the canyons of the Cloudcroft area would go far toward reducing the cherry damage there. Such a method of prevention might well be practicable in districts in which the pigeon population is moderate to small, but it is the writer's opinion that it would not prove effective in areas in which the pigeon population is very large, for severe crop depredations have been noted in many instances in areas where pigeons were abundant and where the native wild food supply was far greater than was necessary for the birds. The effectiveness of the method probably depends largely on local conditions.

Studies of methods of crop protection by means of deterrent and frightening devices have not kept pace with field needs, and further extensive experimentation is desirable. Man's ingenuity in devising noise-makers and frightening devices has scarcely been tapped, and much can doubtless be accomplished along this line.

Each complaint of pigeon depredations should be carefully investigated by either State or Federal officials, and when damage is found to have occurred, the victims should be given every practicable assistance.

Because of the fondness of band-tailed pigeons for agricultural crops, good management decrees that the pigeon population should

not be permitted to increase unreasonably; therefore carefully planned open seasons should be continued so that shooting will act as a population control, particularly in areas in which pigeons are abundant and depredations severe. Open shooting seasons, however, are not the remedy for specific instances of depredation for because of the habits of these birds control of depredations by hunting could be realized only through general and widespread population reduction, which is undesirable.

The issuance of permits to kill pigeons that are damaging crops has never been completely successful. Earlier authorizations allowed the owner or lessee to use the birds so killed for food, and as a result a great demand for permits developed, the desire to hunt being the primary motive. Hence permits no longer include the privilege of utilizing the birds killed as food, and significantly there has been a great decrease in the number of complaints. During recent seasons it has been possible in some areas through agreement between Federal and State officials to require the permittee to preserve the pigeons killed for delivery to charitable institutions or hospitals. This has effected further decrease in the number of requests for permits.

Another defect of the permit system is that shooting usually is allowed only on the area on which damage is occurring; but, as has been pointed out by Britton in New Mexico, shooting the pigeons at their roosting and perching sites may aid greatly in reducing the damage. These roosts and daytime perching trees may be near the crop attacked or may be miles distant.

Where important crop losses occur, it would often facilitate protection if the owner were permitted to shoot the birds on his property while at the same time game wardens or men under their immediate and close supervision traced the flight of the pigeons and continued the frightening process at perching and roosting places until a change in flight lines or the habits of the birds brought relief. This procedure, however, would require a large personnel and a great expenditure of funds.

There can be no question that serious agricultural losses sustained by persons on account of depredations by band-tailed pigeons must be controlled. On the other hand, conservation sentiment demands that there be no excessive or unwarranted destruction of the birds. Pigeon depredations affect a large number of persons, especially in mountain, valley, or wilderness areas close to abundant bandtail populations. In many cases there is a distinct loss, but in many others the damage is magnified. Regardless of the degree of damage incurred or of the justification for control of the birds on the individual farm, studies of methods of prevention of damage have lagged, and there are few economical, practicable, and highly successful methods that can be recommended. Where the farmer will get out with his gun at daylight and keep the pigeons from feeding in his field until dark usually only one to three days are required to break up even the worst of the normal pigeon attacks.

FOOD HABITS

GENERAL

The literature on the band-tailed pigeons contains many references to their feeding habits, mostly based on field observations. Huey (1913) describes their feeding on manzanita berries in California, Willard (1916) on acorns of *Quercus emoryi* in Arizona, Gilman (1903) in grain stubble in California, and Taverner (1934) on peas and grain in British Columbia. Bendire (1892) quotes Carpenter relative to the feeding of the pigeons on the salmonberry (*Rubus nutkanus*) along the Columbia River, and Kobbe (1900) confirms the report. Belding comments on their feeding on acorns and oak buds in California, Ankeny on their eating acorns in the Rogue River Valley of Oregon, and Lloyd on their consumption of wild grapes in western Texas and of acorns there and in Mexico. From Arizona Benson reported to Bendire that acorns were taken after July 15, and Poling mentioned mulberries, although not definitely stating that the fruits were eaten.

Dawson (1923) said the bandtails fed on elderberries (*Sambucus*), cascara (*Rhamnus purshiana*), coffeeberries (*Rhamnus californicus*), huckleberries (*Vaccinium*), salal (*Gaultheria*), salmonberries (*Rubus*), madrona berries (*Arbutus*), and Christmasberries (*Photinia*), but that acorns were their favorite food.

Gabrielson and Jewett (1940) summarize the food of the birds in Oregon as consisting of acorns, mountain ash berries, berries of various species of *Rubus*, elderberries, and currants; kinnikinnick, dogwood, and other fruits; grains; and peas and other legumes. They mention that after nesting time, when the birds flock together, they feed on the fruits of salal, salmonberry, blackberry, and other wild fruits; Jewett has stated that they are particularly fond of the cascara berry (*Rhamnus purshiana*); and Gabrielson frequently observed them apparently feeding on the seeds of *Lu-pinus lyalli*.

Mrs. Bailey (1928) summarizes the food of the species as follows: "Mainly nuts, especially acorns, and berries, including wild currant, chokecherry, wild cherry, juniper, madrone, manzanita, raspberry, blackberry, elderberry, huckleberry, salmonberry, coffeeberry (*Rhamnus californica*), Christmasberry, and black gooseberry; wild grapes, flowers and leaf buds, sycamore balls, pine buds, seeds, and needles, and grain (mostly waste); together with grasshoppers and other insects."

Grimmell, Bryant, and Storer (1918), in Game Birds of California, say that "the amount of food available to the pigeon appears to be the main controlling factor in its distribution. This is more particularly true in winter, though probably to some extent in summer also." They pointed out that the food consisted mainly of nuts and berries, and that the plants that bear these are frequently alternate-year, or intermittent, crop-bearers.

Of 22 food records summarized by these authors, 10 give acorns as the chief item. Specifically, these included the acorns of *Quercus agrifolia*, *Q. wislizenii*, *Q. kelloggii*, and *Q. chrysolepis*. Berries of the madrona (*Arbutus menziesii*) were said to be an at-

tractive autumn food. Fruits of certain species of manzanita (*Arctostaphylos*) were reported as taken from the time they were first formed until very late in the season when fully ripe. During the autumn, fruits of the coffeeberry, elderberry (*Sambucus glauca*), and chokecherry (*Prunus demissa*) were mentioned as favored foods, and in the winter, berries of the toyon (*Photinia arbutifolia*) were taken.

Buds and blossoms also were taken. Dean (1904) reported the bandtails feeding on manzanita buds, and there are many records of their eating oak buds and flowers. Evermann (1886) found 35 of the ball-like flowers of the sycamore in the crop of a single pigeon. Pine seeds were recorded as bandtail food by Belding (1890) and Grinnell (1905). Cultivated grains, including wheat, barley, oats, milo maize, and field corn, have been listed in numerous instances. Many miscellaneous items are recorded, including wild peas, dogwood berries, hazelnuts, alder seeds, and juniper berries. In New Mexico, H. W. Henshaw (1886) observed the pigeons feeding on fruits of the elder (*Sambucus racemosa*) and acorns of the scrub oak (*Quercus undulata*).

J. A. Munro, Chief Federal Migratory Bird Officer, of British Columbia, reported in 1941 on the examination of the food of 13 bandtails collected in British Columbia between 1923 and 1933. The crop of a bird collected in June contained approximately 346 kernels of wheat. Of 12 birds collected in September, the crops of 6 contained field peas, and those of the others such items as acorns of *Quercus garryana*, seeds of *Cornus nuttalli*, *Sambucus glauca*, *Gaultheria shallon*, and oats.

Several writers have commented on the great volume of food that can be taken by a single pigeon. Grinnell, Bryant, and Storer mention an acorn dropped by a flying pigeon that measured nearly 1 by 1½ inches, and also record a pigeon killed in Del Norte County, Calif., whose crop contained 534 kernels of barley, oats, and corn.

Van Rossem (1914) reported finding pigeons in a dying condition, their crops pierced by acorns that they had swallowed. John G. Traub, of the Fish and Wildlife Service, who ranched for a time in San Luis Obispo County, Calif., told the writer of killing apparently healthy pigeons that upon examination were found to have points of acorns protruding through the crop wall; the feathers were matted with crop juices, an indication that this condition had existed for several days, yet the pigeons had apparently continued to feed and fly vigorously and normally.

E. H. Glidden, State Game Warden, of San Diego, Calif., wrote on December 10, 1937, "You will find the chief diet of wild pigeons at this time of the year in this district to be acorns; however, one may at times find the young shoots of pines in their crop, especially on Palomar and the Mesa Grande Mountain. During the spring they feed almost entirely on elderberries."

W. H. Ransom, United States Game Management Agent, said in 1937 that madrona and mountain ash berries were supposed to be choice winter foods for the small number of pigeons that wintered about Seattle, Wash., and that in June the bandtails fed on ripened

wild strawberries in great numbers, especially on Sand Island near Willapa Harbor.

Lawrence W. Saylor wrote: "I once kept an injured bandtail for two weeks . . . and it would eat as many as 30 madrona berries a day; it also accepted and ate huckleberries (*Vaccinium ovatum*), coffeeberries, cultivated currants, and strawberries, and on several occasions readily took grasshoppers when offered. . . . Apparently the tips of Douglas fir branches are eaten (by the wild birds), as I have stood under the trees and watched the birds pick at and swallow the tender tips of the twigs."

There is frequent mention of insects as food of these pigeons, but it would seem that most of these references trace to a field examination made by Vernon Bailey, on July 29, 1903, of a pigeon killed by him at Pecos Baldy, N. Mex., of which he said, "The gizzard was full of insects, mainly grasshoppers and the larvae of a wasplike insect." Despite this observation, and those of Saylor just mentioned, pigeons as a group eat little animal food.

Several writers have described feeding mannerisms of bandtails. Gilman (1903) says that "instead of spreading out they kept together alternately walking and flying. Those behind would fly a few feet ahead of the advance line, alight, and walk along picking up grain until other rear ones would fly ahead and it came their turn again."

Huey (1913) stated that a flock observed feeding on manzanita in San Diego County arrived a little after sunrise and left between eight and nine o'clock in the morning; in the afternoon the birds returned about four and left again at dusk. Willard (1916) described the bandtails feeding on acorns in Arizona: "They would walk out on the slender branches till they tipped down, then, hanging by their feet, would secure an acorn, and drop off to alight on a branch lower down."

In mid-June 1941, pigeons numbering possibly 12 to 20 came from the Pinaleno Mountains to a group of mulberry trees on a ranch 7 miles south of Pima, Ariz., to feed upon the ripening fruits. The distance from the mulberry trees to the oak-pine zone high up the side of Mount Graham must be at least 10 miles. Two specimens of bandtails were obtained here, giving the first representation of mulberries in stomachs in the entire study although this fruit was known to be well accepted.

In May 1932, the writer saw two migrating bands of pigeons flying across the broad Sacramento Valley of California stop to feed upon seed rice in two newly planted fields.

During the course of intermittent field work on band-tailed pigeons extending from 1936 through 1941, the writer has personally observed, or has received reports from cooperators who have observed, the birds feeding on most of the food already mentioned in the abstract of the literature on pigeon foods. In some instances no specimens of bandtails were obtained, hence the particular item does not appear in the tabulations of the result of stomach examination; in other cases the item may be represented in unnaturally small ratio owing to lack of adequate collecting in a habitat providing that particular food.

USE OF MINERAL SALTS

In 1937, many Puget Sound observers noted that the pigeons frequently flew to mud flats at the margin of the Sound to drink salt water even though fresh-water streams were available. In this connection W. H. Ransom (in a letter of April 15, 1939) writes: "Near Cathlamet, Wash., along the Columbia River there is a cliff containing saline deposits of some sort, and the game protector stationed there a few years ago told me of seeing scores of pigeons gathered there in late summer, while groups of them fluttered in the air as close to the vertical cliff as they could get, all the while picking at the salt-bearing earth."

Frank B. Wire, of the Oregon Game Commission, told the writer that many years ago he had frequently hunted pigeons at a salt spring that attracted the birds in considerable numbers. Bendire (1892) quotes Anthony relative to a large salt spring south of Beaverton, Oreg., where pigeons were always to be found in large numbers. Kloppenburg (1922) writing of the bandtails in the Plumas National Forest in California says that "they can usually be found near mineral springs, especially soda and sulphur springs."

This habit may be analogous to that of the mourning doves that are attracted to salt in the Southeastern States to such extent that the use of salt is included as a prohibited method of baiting. In Arizona the writer has observed western white-winged doves picking at salt blocks in cattle feed lots. Salt was used as bait also in connection with the shooting of the now extinct passenger pigeon.

RESULTS OF LABORATORY EXAMINATIONS

The following report covers the laboratory examination of 691 band-tailed pigeon crops and/or stomachs. This material admittedly is inadequate, some States being represented by only a few specimens. In California, the pigeons occur at some time of year in most of the more than 50 counties, but only 18 of them are represented in this study, and 194 out of 267 stomachs were salvaged from the bags of hunters during the 15-day December open season; likewise, 113 of the Washington specimens were procured from hunters during the 15-day September open season, in 1937.

For the purpose of this report the crop and stomach, or the crop or stomach, of an individual bird is considered a unit specimen. Every effort was made to obtain both crop and stomach, but since many specimens were obtained from hunters, it was found difficult to obtain both, and in many instances only the crop or the stomach was obtained. Regularly cooperating observers, however, sent in both crop and stomach.

The food percentages in this report have been computed by the standard volumetric method described by Cottam,⁵ each item be-

⁵ Economic ornithology and the correlation of laboratory and field methods. By Clarence Cottam, Biologist. U. S. Dept. Agr., Bureau of Biological Survey Wildlife Research and Management Leaflet BS-30, 13 pp., illus. January 1936. [Processed.]

TABLE 4.—*Localities and months represented by the 639 crops and stomachs of band-tailed pigeons*

State	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Arizona (6) ¹					2	4	9	8	17	17	1	1	58
California (18)	11	5	7	2		35	4	1	1	1	3	194	267
Colorado (3)						7	3		10				20
New Mexico (3)						17	31	2		1			54
Oregon (16)				3	40	10	21	9	17	1	1		102
Texas (1)												1	1
Washington (11)				4	1	1	6	8	113	1			137
Total	11	5	7	9	44	71	77	28	178	21	5	195	639

¹ The figures in parentheses following the names of the States indicate the number of counties represented by the material collected.

ing measured after drying. Although representation varies greatly, the month is used as the period for the computations. For plant names the most recent publication on taxonomic botany for each of the States has been used.

Of the specimens available, 25 had such incomplete data that they were useless, although information obtained from them may be mentioned; 27 others were so nearly empty that they were eliminated from the tabulations. Hence the percentages of food volume and frequency of occurrence are based on the remaining 639 specimens.

In the examination of these, 76 separate classes of plant food items were listed, including unidentified mosses, vegetable debris, unidentifiable vegetable fragments, and rodent scats composed entirely of vegetable debris. The identified plant-food items represent 26 plant families. In addition, 10 occurrences of insect fragments, comprising only a trace of the whole food, were recorded. Hence the species may be considered almost wholly vegetarian. Gravel in stomachs is figured in its ratio to the total content, while food item percentages are calculated after the grit has been removed.

In table 4 is summarized by States the material available for each month; the number in parentheses following the name of the State refers to the number of counties represented by the stomachs collected.

In table 5 are listed the general classes or families of food items represented, by months, with the composite percentage by volume of all species within the family, based on a total of 639 stomachs and crops. An added column gives the percentage of frequency of occurrence of the combined species of each family.

The percentages by volume and frequency of occurrence of the

TABLE 6.—Percentage by volume and frequency of occurrence of the food items that totaled one percent or more of the annual food of 639 bandtaits, based on the examination of their stomachs and crops

Food item	Percentage by volume	Percentage by frequency of occurrence
<i>Quercus agrifolia</i> , live oak acorns.....	17.5	11.1
<i>Quercus</i> sp., unidentified acorns.....	13.4	18.2
<i>Avena sativa</i> , cultivated oats.....	7.4	5.8
<i>Prunus</i> , cultivated cherries.....	7.1	12.4
<i>Pisum sativum</i> , garden peas.....	4.8	7.4
<i>Triticum aestivum</i> , wheat.....	5.0	10.3
<i>Pinus edulis</i> , piñon nuts.....	4.0	1.9
<i>Quercus kelloggii</i> , California black oak acorns...	3.9	1.6
<i>Quercus</i> sp., blossoms of oak.....	3.5	1.3
<i>Rhamnus purshiana</i> , cascara fruits.....	3.0	2.8
<i>Arbutus menziesii</i> , madrona berries.....	3.0	6.1
<i>Prunus domestica</i> , cultivated prunes.....	3.0	3.0
<i>Cornus nuttallii</i> , dogwood fruits.....	2.8	11.7
<i>Arctostaphylos</i> , sp., manzanita seeds and flowers	2.6	3.1
<i>Quercus wislizenii</i> , interior live oak acorns....	2.2	2.0
<i>Pinus ponderosa</i> , yellow pine seeds.....	2.0	.5
<i>Sambucus glauca</i> , elderberry fruits.....	1.8	6.4
<i>Quercus garryana</i> , Oregon white oak acorns....	1.7	.8
<i>Prunus</i> sp., wild cherry fruits.....	1.5	6.0
Miscellaneous vegetable debris.....	1.5	4.4
<i>Gaultheria shallon</i> , salal fruits.....	1.0	3.8
<i>Quercus emoryi</i> , Emory oak acorns.....	1.0	1.7

food items that totaled 1 percent or more of the annual food of the bandtails, as based on the examination of the 639 stomachs and crops, are shown in table 6.

Pinaceae (6.4 percent).—Buds of the Sitka spruce (*Picea sitchensis*) were found in a May-killed Oregon bird, and staminate aments of an unidentified conifer in another. Unidentified pine seeds were found in one California bird killed in December. Seeds of the yellow pine (*Pinus ponderosa*) were found in two California birds collected in June and December, respectively. One bird obtained in July in the Kaibab National Forest, Ariz., contained 625 seeds of this pine, measuring 47 cubic centimeters (4 cubic centimeters=1 teaspoonful).

Nuts of the piñon (*Pinus edulis*) were found in 12 Arizona birds collected in September, October, and November. These nuts were the only food in 11 of the birds and composed 94 percent of the food of the other. Nuts of the single-leaf piñon (*Pinus monophylla*) composed the entire food of 9 pigeons and 90 percent of the food of a tenth collected in California in December. One bird had taken 60 of the nuts which displaced 45 cubic centimeters.

Cupressaceae (trace).—One pigeon killed in Arizona in September contained 270 staminate buds of an unidentified juniper (*Juniperus*).

Gramineae (12.8 percent).—Cultivated grains make up a moderate portion of the food of the band-tailed pigeon in or near farming areas. Wheat occurred in 66 birds collected during 7 months of the year in 4 States and averaged 5.0 percent of the annual food. Oats were found in 37 birds collected in 3 States during 5 months and formed 7.4 percent of the annual food. Barley occurred in 12 birds collected in 2 States during 4 months and formed 0.4 percent of the annual food. Field corn was found in only 2 September birds from Colorado.

Unusual quantities of grain were found in a few crops; one contained 725 kernels of wheat, one 200 kernels of barley, and another 660 whole kernels of oats.

Seeds of *Poa* sp., wild oats (*Avena fatua*), darnell (*Lolium temulentum*), and needlegrass (*Stipa* sp.) were each found in single stomachs of birds taken in April, May, and June in Oregon and California. The family Gramineae contributed 12.8 percent of the annual food.

Liliaceae (0.5 of 1 percent).—Seeds of an unidentified yucca were found in one California bird collected in June, and seeds of sotol (*Dasyliirion wheeleri*) (fig. 9) in three August and two September birds from southeastern Arizona. Combined they made up one-half of 1 percent of the annual food.

Amaryllidaceae (0.8 of 1 percent).—Ten birds collected in July and August in southern New Mexico contained the anthers of an agave (*Agave parryi*) (fig. 10), aggregating 0.8 of 1 percent of the annual food, and one Arizona bird killed in August contained 125 seeds of a *Smilacina*, probably *stellaria*.

Fagaceae (43.7 percent).—The acorns and flowers of oaks constitute the major food of the band-tailed pigeon. Staminate flowers of oak were found in four January and four March birds from



B8711M

FIGURE 9.—Pigeons from the oak canyons of the Southwest often feed on the seeds of the sotol (*Dasylirion wheeleri*), which grows in the adjacent high desert, Pinal County, Ariz. (Photographed by H. L. Crockett, July 1941.)

California. Acorns or fragments of acorns were found in 233 birds collected during 10 months and from every State represented except Texas. Oak products totaled 43.7 percent of the annual food.

Acorns of the California live oaks were most frequently taken; those of the coast live oak (*Quercus agrifolia*) occurred in 71 stomachs and averaged 17.5 percent of the year's food, and those of the interior live oak (*Q. wislizenii*) were found in 13 birds col-



B8712M

FIGURE 10.—The flowers of this tree-like agave (*Agave parryi*) furnish summer food for pigeons in the Southwest. The agaves grow in the higher desert mountains, sometimes very close to pigeon-nesting habitat. Head of Mills Canyon, Pinal Mountains, Ariz. (Photographed by H. L. and Ruth Crockett, July 26, 1936.)

lected during the period November to March. Other species represented were the California black oak (*Q. kelloggii*), blue oak (*Q. douglasii*), Oregon white oak (*Q. garryana*), Emory oak (*Q. emoryi*), white-leaf oak (*Q. hypoleuca*), and the valley oak (*Q. lobata*). Fragments of acorns not further identified were found in 116 birds and averaged 13.4 percent of the annual food. The abil-

ity of these birds to consume quantities of acorns has been described. The crop of one specimen examined contained 22 acorns of the coast live oak, displacing 38 cubic centimeters.

Juglandaceae (trace).—One California bird killed in January contained flowers of the walnut (*Juglans*).

Myricaceae (trace).—Parts of the seeds of the wax myrtle (*Myrica californica*) occurred in one California specimen.

Ulmaceae (trace).—Seeds of an unidentified hackberry (*Celtis*) were taken from the stomach of a bird collected at Uvalde, Texas, in December. Pigeons collected in the Capitan Mountains of New Mexico had eaten fruits of *Celtis reticulata*.

Loranthaceae (0.2 of 1 percent).—The pine mistletoe (*Arceuthobium*) was represented in nine December stomachs from California and three July stomachs from New Mexico by fragments of both fruiting and vegetative parts.

Moraceae (0.1 of 1 percent).—Fruits of the mulberry (*Morus alba*) occurred in two June birds from Arizona, and seeds of an unidentified mulberry in one July bird from New Mexico.

Rosaceae (13.6 percent).—This family, producing many familiar wild fruits and berries, is well represented in the bandtail's diet. Seeds of wild blackberries or raspberries were found in 14 birds; eight were unidentified; and salmonberry (*Rubus spectabilis*) occurred in four, and a wild blackberry (*Rubus macropetalus*) in two birds. Rose hips were found in one stomach.

Wild cherries, including *Prunus emarginata* and *P. melanocarpa*, were found in 44 specimens collected in Washington, Oregon, Colorado, and New Mexico. Fruits of *Prunus emarginata* occurred in 38 Washington specimens taken in July, August, and September, and averaged 1.5 percent of the annual food.

Seeds of the serviceberry (*Amelanchier alnifolia*) occurred in five September birds, and those of the hawthorn (*Crataegus douglasii*) in four July birds from Oregon. Seeds of the wild strawberry (*Fragaria*) were found in two May specimens, and fruits of the toyon (*Photinia arbutifolia*) in four December birds.

Cultivated prunes were found in 19 birds collected in May in the Willamette Valley of Oregon, and averaged 3 percent of the annual food. Cultivated cherries occurred in 79 birds collected from May to August in Washington, Oregon, California, New Mexico, and Colorado, and formed 7.1 percent of the total food. Both the sweet cherry (*Prunus avium*) and sour cherry (*P. cerasus*) were represented. The Pacific coast fruits were entirely sweet cherries, but in Colorado and New Mexico both varieties were included in the food of the pigeons. The combined products of the Rosaceae family averaged 13.6 percent of the annual food.

Leguminosae (4.8 percent).—Seeds of clover (*Trifolium*), lupine (*Lupinus*), and trefoil (*Lotus*), and leaves of *Trifolium* were all found in the crop of a single California bird.

Cultivated peas had been taken by 44 bandtails collected in Washington. Those found in seven April and May stomachs had been gleaned from freshly seeded fields and averaged slightly more than 2 percent of the annual food; the significance of such feeding has already been discussed (p. 44). During July, August, and

September peas are taken mostly from the stubble of harvested fields. Occasionally the birds may attack a field that is to be harvested for seed, causing severe losses. For the entire year, cultivated peas, waste or valuable, averaged 4.8 percent of the food.

Geraniaceae (trace).—A few tiny leaves of the alfilaria (*Erodium*) had been eaten by one California bird.

Euphorbiaceae (trace).—Seeds of the turkey mullein (*Eremocarpus setigerus*) were found in one specimen.

Anacardiaceae (0.5 of 1 percent).—Seeds of two species of sumac were found. Those of *Rhus emoryi* occurred in the stomachs of five specimens from New Mexico, and those of *R. trilobata* in one bird from Arizona, making up 0.5 of one percent of the annual food.

Rhamnaceae (3.1 percent).—The berries of the cascara (*Rhamnus purshiana*) are a favorite food in Oregon; these fruits were taken from 18 Oregon specimens collected from June to September and averaged 3 percent of the annual food. Seeds of the coffeeberry (*R. californica*) occurred in one California stomach. Fruits and seeds of the lote bush (*Condalia lycioides*) were identified from a single Arizona specimen. Products of this family averaged 3.1 percent of the annual food.

Vitaceae (0.7 of 1 percent).—Fruits and seeds of the wild grape (*Vitis arizonica*) composed the major food of three August specimens collected in the Huachuca Mountains of Arizona, and formed 0.7 of one percent of the annual food.

Malvaceae (trace).—A single seed, determined as *Sidalcea* sp., was found in one Oregon specimen.

Araliaceae (trace).—A number of green berries of *Aralia humilis* were identified from the stomach of a single Arizona bird.

Umbelliferae (trace).—Seeds of the gambleweed (*Sanicula menziesii*) occurred in one California specimen taken in December.

Cornaceae (2.8 percent).—The fruits of the dogwood are a highly favored food, being found in 75 stomachs from Washington and Oregon, and averaged 2.8 percent of the annual food. Those of the mountain dogwood (*Cornus nuttallii*) are the most commonly taken.

Ericaceae (6.7 percent).—The heath family includes four groups, the fruits of which are relished by band-tailed pigeons and averaged 6.7 percent of the annual food.

In the Pacific Northwest the fruits of the salal (*Gaultheria shallon*) were taken by 24 birds from Washington and Oregon and averaged just 1 percent of the annual food. Fruits of the madrona (*Arbutus menziesii*) were eaten by 39 California birds and composed 3 percent of the annual food.

Flowers and fruits of the manzanita (*Arctostaphylos*) occurred in 20 specimens taken during every month from March to August in Oregon, California, and Arizona, and furnished 2.6 percent of the annual food. Fruits of two species of huckleberry (*Vaccinium ovatum* and *V. delicosum*) were identified, the first from a single Oregon bird, the second from two Washington birds.

Solanaceae (trace).—Seeds of *Solanum* sp., were found in one

Colorado specimen.

Caprifoliaceae (3.2 percent).—Fruits and flowers of the elderberry (*Sambucus*) were found in 70 stomachs and averaged 3.2 percent of the annual food. Of these, the fruits in 41 specimens were identified as those of the blue elderberry (*Sambucus glauca*) and averaged 1.8 percent of the food; fruits in seven other specimens were identified as red elderberries (*Sambucus callicarpa*).

Compositae (trace).—One pigeon collected in California in December contained seeds of the tarweed (*Madia*).

Miscellaneous (1.5 percent).—Bits of moss were taken from one specimen. Fragments of oak galls were often found in pigeons that had been feeding on acorns. Unidentifiable vegetable fragments and debris were recorded from 17 specimens and averaged 1.3 percent of the annual food. One Oregon bird contained 12 whole rodent scats; the scats were entirely vegetable in composition and were tentatively identified as those of the wood rat (*Neotoma*).

Animal Foods.—All the insect material in the stomachs appeared to have been accidentally or incidentally taken; it was present in only 10 stomachs or crops.

One oak twig gall very similar to an acorn in size and appearance was found to contain larvae of gall flies (*Cynipidae*). A staphylinid larva (rove-beetle) and an adult *Anthrenus* (skin beetle), each in single stomachs, might have been taken incidentally in feeding on other items.

One stomach contained 7 honey ants (*Prenolepis imparis*) and a quantity of tiny leaflets of clover, and it is reasonable to assume that the ants were upon the leaflets when they were taken. One fire ant (*Solenopsis*) occurred in a crop otherwise filled with wild berries, and one acrobat ant (*Cremastogaster*) was also identified; both are frequently found about ripe fruits.

The larvae of a *Tineid* moth were found in one crop, traces of cocoon silk in two, and fragments of the elytra of a beetle in one. With all confidence the conclusion may be drawn that the band-tailed pigeon feeds only rarely upon insects.

SEASONAL FOOD PREFERENCES

In order to set forth more clearly the relation of foods to band-tailed pigeon migration and distribution, food items identified in the present study have been segregated and tabulated in four seasonal classifications: winter, spring, summer, and autumn. The seasons, arbitrarily designated, are most nearly accurate for the California district.

WINTER

The period designated as winter includes the months of November, December, and January. Normally, by November most of the pigeons of the Pacific coast have reached California and are settled in their winter habitat, except for descent from higher to lower elevations caused by snowfall. Soon after the end of January a movement northward includes part of the wintering popu-

lation.

The stomachs and crops of 214 birds collected in four States during this period were available for examination. Acorns were taken by 172 of the 214 birds and averaged 77.2 percent of the winter food, with oak blossoms adding another 2.2 percent. Pine nuts also played an important part, contributing 8.5 percent to the winter food. Fruits of the madrona (*Arbutus menziesii*) were found in 37 of the birds and formed 4.8 percent of the season's food. Christmasberries, or toyon berries (*Photinia arbutifolia*), made up 3.4 percent, and wheat from stubblefields 2.3 percent, of the winter food. These were the only foods that averaged more than 1 percent.

Consideration of all data, both field and laboratory, leads to the conclusion that mast, acorns, and pine nuts are the basic foods necessary to maintain a population of band-tailed pigeons through the winter, and that these birds will not remain in numbers in areas that do not provide these foods.

SPRING

The period designated as the spring season covers February, March, and April. Beginning usually during February, the concentrations of bandtails that winter in central or southern California start to move slowly northward, and by the end of the period the majority of the pigeons of the west have reached their breeding range or are close to it.

Only 21 specimens were available for this period, collected in three States. Oak products, chiefly acorns, led in the spring foods; they were found in 13 specimens and averaged 62.2 percent of the season's food. Cultivated grain, including wheat, oats, and barley, and cultivated peas made up 25.4 percent of the food. This season covers at least part of the seeding period for certain of these crops, and in other areas winter wheat and barley is ripening by the end of the spring.

Other foods that averaged more than 1 percent during this period included fruits of the manzanita (*Arctostaphylos*), 4.8 percent, and of the madrona (*Arbutus menziesii*), 7.4 percent, the latter being found in only two stomachs.

SUMMER

During the summer period (May, June, and July) the majority of the pigeons are nesting, though some may not begin to nest until June, and may continue brooding until well after the end of July. Others may begin nesting before May and may be away from the nest and moving about before the end of July.

Examination of 197 specimens collected in six States furnished the data for the calculations for the summer period. Cultivated grains--wheat, oats, and barley--ranked high, averaging 25.7 percent, and were found in 80 specimens. It is certain that much of the grain was gleaned from stubblefields after harvest, and was therefore of little economic value. Cultivated cherries and prunes averaging 40.2 percent, led the summer food items, and occurred

in 95 specimens; domestic prunes were taken during May while still very small; the cultivated cherries included both sweet and sour varieties and were taken at ripening season. Complaints against pigeons arise most frequently from their pilfering in cherry and prune trees.

Wild fruits of many kinds ripen during this period, and they are taken in wide variety. These include blackberries, raspberries, wild cherries, strawberries, elderberries, and fruits of the dogwood, hawthorn, lote-bush (*Condalia*), and others. Individually they composed from 1 to as high as 3 percent, and collectively 16.9 percent, of the summer food. The blossoms and berries of the manzanita and the berries of the sumac form an additional 5.8 percent.

Acorns comprise 5.6 percent of the summer food; some of these are gleaned from the ground under the oaks, but in the southern part of the range the acorns of the Emory oak and other species are reaching maturity and are taken from the trees. Pine nuts also enter the diet again as the new crop becomes available.

AUTUMN

During August, September, and October, the arbitrarily designated autumn period, migration on the Pacific coast is under way and in many cases is completed; to considerable extent the same is true in the Rocky Mountain States and the Southwest. The crops and stomachs of 207 specimens collected in six States were available for this period.

With the ripening of the new acorn crop, these nuts rose in importance once more to 26.5 percent of the food and were found in 35 birds. Pine nuts made a further advance in the diet, averaging 9.2 percent and being found in 11 birds. Cultivated grains (wheat, oats, and barley) and cultivated peas were found in 71 specimens and averaged 13.7 percent of the food; most of this grain is taken from stubblefields. Wild fruits of many varieties continued to play an important part in the pigeon's diet. Fruits of the dogwood (*Cornus*) rose to 11.3 percent, elderberries to 7 percent, cascara (*Rhamnus*) to 8.2 percent, salal (*Gaultheria*) to 3.3 percent, wild grape (*Vitis*) to 2.8 percent, wild cherries to 6.0 percent, and a number of others ranked above 1 percent.

DISCUSSION

The seasonal food preferences of band-tailed pigeons as determined by the examination of 639 stomachs and crops are shown in table 7. The table lists the items that totaled 1 percent or more of the food for each of the four seasons and gives the percentage of their frequency of occurrence. The number in parentheses after the designation of the season refers to the number of specimens examined.

It will be noted that during three of the four seasons, oak products, largely acorns, and pine nuts, combined, led all other food items by a considerable margin. The availability of these nuts to a very large degree determines the distribution of the band-tailed pigeon; a number of the oaks bear acorns only at two-year in-

TABLE 7.—Seasonal food preferences of band-tailed pigeons as based on the examination of 639 stomachs and crops. (Includes all items that totaled 1 percent or more of the annual food.)

Food item	Winter (214)		Spring (21)		Summer (197)		Autumn (207)	
	By volume	Frequency of occurrence	By volume	Frequency of occurrence	By volume	Frequency of occurrence	By volume	Frequency of occurrence
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Pinaceae:								
<i>Pinus edulis</i> , piñon nuts	6.7	0.5					9.2	5.3
<i>monophylla</i> , single-leaf piñon nuts	1.7	4.7						
Gramineae:								
<i>Avena sativa</i> , oats			16.5	33.3	12.9	18.7	4.9	10.1
<i>Triticum arctivum</i> , wheat	2.3	.5			12.8	21.8		
Liliaceae:								
<i>Dasylirion wheeleri</i> , sotol seeds					1.8	4.6	1.9	2.4
Amaryllidaceae:					1.2	.5		
<i>Agave parryi</i> , flowers of agave								
<i>Smilacina stellaria</i> , seeds of star-flower					1.7	2.0	2.5	3.4
Fagaceae:								
<i>Quercus agrifolia</i> , coast live oak acorns	38.5	30.8	31.4	23.8				
<i>emargini</i> , Emory oak acorns	6.6	1.9					1.2	.5
<i>garryana</i> , Oregon white oak acorns								
<i>happolucua</i> , white-leaf oak acorns	7.8	3.7	7.7	9.5				
<i>kellyi</i> , California black oak acorns	2.2	5.6	7.0	4.8				
<i>walzenii</i> , interior live oak acorns	22.1	37.9	4.8	4.8	3.9	5.6	22.8	11.1
unidentified acorns	2.2	1.9	11.3	19.1				
unidentified oak blossoms								
Rosaceae:								
<i>Crataegus douglasii</i> , hawthorn fruits					1.0	2.0		
<i>Photinia arbutifolia</i> , toyon seeds	3.4	.9			11.8	9.6		
<i>Prunus domestica</i> , cultivated prunes					28.4	38.6		
cultivated cherries					1.3	5.1	6.0	17.4
wild cherries, all species					1.0	3.1		
<i>Rubus</i> sp., wild raspberry seeds					1.2	2.0		
<i>speradibis</i> , thimbleberry seeds								
Leguminosae:								
<i>Pisum sativum</i> , garden peas			8.8	19.1	2.1	4.1	8.3	16.9
Anacardiaceae:								
<i>Rhus</i> sp., seeds of sumac					1.1	2.0	1.0	1.0
Rhamnaceae:								
<i>Rhamnus purshiana</i> , fruits of cascara					3.0	4.1	8.2	4.8
Vitaceae:								
<i>Vitis arizonica</i> , wild grapes							2.8	1.4
Cornaceae:								
<i>Cornus nuttallii</i> , dogwood							11.3	36.2

tervals, and both the acorn and the pine nut crops are frequently affected by adverse weather conditions. The winter range of the pigeon and its migration routes both northward and southward are directly influenced by the presence or absence of these nuts.

Band-tailed pigeons have developed a liking for cultivated grains and peas, as well as for cultivated prunes and cherries, and are sufficiently adaptable to have learned to congregate in areas where these crops are grown; yet study of the data available does not indicate that these crops are at all necessary for the maintenance of the present population. Wild fruits during the summer season and a plentiful supply of mast suffice to maintain them.

USE OF GRAVEL

As mentioned earlier, the grit or gravel found in the stomachs examined was measured according to its ratio to the total stomach content. Reference to table 5 shows that the volume of grit ranged from 7.5 percent in July to 31.4 percent in December. In examining stomachs of band-tailed pigeons, it becomes evident that the birds do not use gravel in the digestion of foods that have a hard pit, as wild and tame cherries and seeds of dogwood; only rarely do stomachs containing these pits also contain gravel. Apparently the pits are softened by the digestive juices and broken by muscular action, the fragments then serving as grinding material.

INFLUENCE OF AGE OR SEX

No nestlings were included in the present food study. A small number of flying juveniles were examined, but a survey of the tabulations showed no difference in their feeding habits from those of adult birds, nor did the feeding habits of the adult male differ from those of the adult female.

FEEDING MANNERISMS

During this study the writer observed feeding mannerisms that have been described by others. The alternate walking and flying manner of feeding in grain stubble as described by Gilman (1903) was noted in several localities, and the birds hanging by their feet to reach food at the tips of branches, as recorded by Willard (p. 53) was observed in connection with their feeding on acorns and elderberries.

With respect to feeding hours, in some instances at least, Huey's statement (p. 53) was found to be correct. At other seasons feeding appeared to be intermittent all day long, periods of feeding to satiation alternating with hours of perching quietly in some tall dead tree.

QUANTITY OF FOOD TAKEN

The quantity of food that can be taken at one feeding is almost beyond belief, and after heavy feeding a digestive period of 2 or 3 hours is needed before the bird is able to fly about in normal fash-

ion. Owing to the usually contracted state of the stomach, it is difficult to estimate the normal capacity of the organ; however, it appears that few band-tailed pigeon stomachs contain more than 10 cubic centimeters of food and gravel, and that about 15 cubic centimeters is the maximum (4 cc.=1 teaspoonful).

The following itemizations are of actual crop contents measured by displacements when fully dried, and indicate the volume of food that a pigeon crop can hold: 227 whole garden peas, 67.6 cc.; 622 seeds of *Pinus ponderosa*, 47 cc.; 60 seeds of *Pinus monophylla*, 45 cc.; 86 seeds of *Pinus edulis*, 34 cc.; 22 whole California live oak acorns, 38 cc.; and 56 whole Emory oak acorns, 40 cc. Unmeasured, but in every instance forming the entire content of a single crop were the following items, each the largest of its group: 725 whole kernels of wheat, 660 whole kernels of unhulled oats, 104 whole berries of toyon, or Christmasberry, 270 whole berries plus 550 seeds of elderberry, 56 whole fruits of madrona, 26 whole cultivated cherries, 69 whole wild cherries, 104 fruits of cascara sagrada, and 80 whole fruits of dogwood.

SUMMARY

This report on the band-tailed pigeon (*Columba fasciata fasciata*), largest member of the pigeon family now found in the United States, is based on field studies in Arizona, California, Colorado, New Mexico, Oregon, and Washington, and on reports from observers in Nevada, Texas, and Utah. Observations from British Columbia and Mexico are also included.

Personal observations and reports received indicate that in Oregon, Washington, and California the bandtail either has shown a definite decrease or its numbers are static. In California the summer population seems to be increasing, but the winter population is no more than holding its own. In Arizona, Utah, and New Mexico the species appears to be slightly on the increase. In Colorado it seems that the population may be dropping back slightly from a moderate high reached two or three seasons back. In Texas the evidence indicates that the birds have not increased in the past 25 years and are barely holding their own.

On California largely depends the future of the band-tailed pigeon, as the bulk of the population spends the winter in that State. Owing to the response of the birds to an abundance of food, conditions may arise permitting excessive slaughter. Recognition should be made of this fact in designating bag limits, seasons, and shooting areas.

Adult bandtails weighed during this study ranged from 10.3 to 15.5 ounces. In length, the bird averages about 15 inches.

Within the United States the nesting season varies with the climate of the district inhabited, and in the 8 States where nesting is now known to occur specific records cover every month from March through October. There was no authentic nesting record for Colorado until 1945, when two nests were discovered. Nesting locations vary almost as widely as does the forest cover within the range. The nest is typical of the frail nests of all members of the

dove and pigeon group.

Normally only one egg is laid. Incubation is said to be 14 to 18 days. For 20 days after hatching, the adults carefully brooded the squabs under observation in Colorado in 1945. The male came to the nest about 9 a. m. and cared for the squab until between 4 and 5 p. m., when the female returned and cared for the youngster until the next morning. When the squab was 20 days old both parents ceased brooding, and thenceforth each came to the nest only once daily to feed the young bird.

At 17 days of age the nestling weighed 4.9 ounces, and its middle tail feathers measured only 28 mm.; at 26 days of age it weighed 8.5 ounces and the tail measured 75 mm. as compared with the average 140 mm. of the adult bird. The squab left the nest between its 28th and 30th days.

Discussion of food habits and economic status covers testimony obtained from numerous field observers as well as the results of the laboratory examination of 691 stomachs and/or crops. Of the stomachs and/or crops examined 639 contained sufficient food to serve in computations of the diet.

Mast (largely acorns and pine nuts) furnished the largest single element of the food of the bandtail; it was present in 268 of the specimens studied and averaged 50.1 percent of the total food. So important is mast to the welfare of the bandtail that it determines not only the bird's route of migration and wintering grounds, but indirectly the nature and extent of the damage these birds inflict on crops.

The birds' fondness for cultivated cherries and prunes was indicated by the presence of these fruits in 98 of the birds examined, comprising 11 percent of the diet. Other related fruits obtained from wild sources (blackberries, strawberries, serviceberries, and berries of toyon and hawthorn) increased the percentage of food referable to the family Rosaceae to 13.6.

Cultivated grains (wheat, oats, and barley) comprised 12.8 percent of the food, and their consumption reflects the bird's ability to adapt itself to the changing conditions of agriculture. A liking for cultivated peas, which composed nearly 5 percent of the food, is the basis for local concentration of the birds and at times the cause of damage.

Other items of vegetable origin acceptable to the bandtails are huckleberries, fruits of salal and other members of the heath family (Ericaceae), elderberries (Caprifoliaceae), and fruits of dogwood (Cornaceae) and cascara and other kinds of Rhamnaceae.

The animal food ingested by the adult bandtail appears to be taken accidentally; it comprises less than one-fourth of one percent of the total food. No nestlings were examined, but juveniles that had left the nest showed food preferences similar to those of the adults.

Establishment of isolated farms in otherwise primitive areas invites the possibility of damage by pigeons as well as other wild creatures and should be discouraged. Farmers now located in areas where pigeons cause damage to crops can adequately protect their crops by diligently following procedures recommended.

As the reproductive potential of the bandtail is low (in some parts of its range only one clutch is laid and this normally is composed of one egg), it cannot withstand severe drains on its numbers. For that reason demands for more liberalized shooting should be carefully scrutinized.

Management of the bandtail must be built on the premise of safeguarding the species from threatened decimation, yet there should be recognition of the fact that severe crop damage may be inflicted and effective remedial measures must be available.

Looking toward a long-time program of management, the basic population must be carefully watched and undue decimation through hunting prevented. Those accepted principles of forestry that will prevent forest destruction, and that will preserve the oaks and pines, and the wild fruits and berries that supplement mast as a food, will be advantageous to the band-tailed pigeon.

BIBLIOGRAPHY

- ABBOTT, CLINTON GILBERT.
1927. Notes on the nesting of the band-tailed pigeon. *Condor* 29: 121-123.
- ALCORN, J. RAY.
1941. New and additional Nevada bird records. *Condor* 43: 113-119.
- BAILEY, FLORENCE MERRIAM.
1902. Handbook of birds of the western United States. 511 pp., illus. Boston.
1923. Birds recorded from the Santa Rita Mountains in southern Arizona. *Pacific Coast Avifauna* 15, 60 pp., illus.
1928. Birds of New Mexico. 807 pp., illus. Santa Fe, N. Mex.
- BARNES, E. P.
1916. Band-tailed pigeons alleged destruction of grain. *Calif. Fish and Game* 2: 212.
- BARTOL, MARY.
1940. High, wild, and handsome. *Outdoor Life* 85 (4): 26-27, 107-109.
- BELDING, LYMAN.
1879. A partial list of the birds of central California. *U. S. Nat. Mus. Proc.* 1: 388-499.
1890. Land birds of the Pacific district, Calif. *Acad. Sci. Occas. Papers* 2, 274 pp. San Francisco.
- BENDIRE, CHARLES EMIL.
1892. Life histories of North American birds with special reference to their breeding habits and eggs. *U. S. Nat. Mus. Spec. Bull.* 1, 446 pp., illus.
- BENSON, SETH BERTRAM.
1935. Biological reconnaissance, Navajo Mountains, Utah. *Univ. Calif. Pub. Zool.* 40 (4): 445 pp.
- BENT, ARTHUR CLEVELAND.
1932. Life histories of North American gallinaceous birds. *U. S. Nat. Mus. Bull.* 162, 490 pp., illus.
- BERGTOLD, WILLIAM HARRY.
1912. October birds of the Gila River, New Mexico. *Auk* 29: 331.
1928. A guide to the birds of Colorado. 207 pp., illus. Denver.
- BROOKS, ALLAN CYRIL, and SWARTH, HARRY SCHELVALDT.
1925. A distributional list of the birds of British Columbia. *Pacific Coast Avifauna* 17, 158 pp., illus.
- BURTCH, LEWIS.
1930. Wild pigeons—Kern County, California. *Calif. Dept. Agr. Monthly Bull.* 19 (5): 375-376.

CHAMBERS, WILLIE LEE.

1912. Who will save the band-tailed pigeon? *Condor* 14: 108.

COOPER, JAMES GRAHAM.

1880. On the migration and nesting habits of West Coast birds.
U. S. Nat. Mus. Proc. 2: 241-251.

COTTAM, CLARENCE.

1941. Indigo bunting and band-tailed pigeon in Utah. *Condor* 43: 122.

DAVIS, JOHN M.

1938. Nesting dates in Humboldt Bay region. *Condor* 40: 182-183

DAWSON, WILLIAM LEON.

1923. The birds of California. Student's ed. 3 vols., 2121 pp.
illus. Los Angeles.

DEAN, W. F.

1904. A few notes on bird life at Three Rivers, Tulare County,
California. *Condor* 6: 110-111.

DERBY, WILLIAM F.

1920. Band-tailed pigeon nests in Sequoia National Forest.
Calif. Fish and Game 6: 182.

EVERMANN, BARTON WARREN.

1886. A list of the birds observed in Ventura County, California.
Auk 3: 86-94.

FISHER, ALBERT KENDRICK.

1893. Birds of the Death Valley expedition, North Amer. Fauna 7,
158 pp.

FOWLER, FREDERICK HALL.

1903. Stray notes from southern Arizona. *Condor* 5: 68, 71.

GABRIELSON, IRA NOEL, and JEWETT, STANLEY GORDON.

1940. Birds of Oregon. 650 pp., illus. Portland, Oreg.

GILMAN, MARSHALL FRENCH.

1903. More about the band-tailed pigeon (*Columba fasciata*).
Condor 5: 134-135.

GRINNELL, JOSEPH.

1898. Birds of the Pacific slope of Los Angeles County. Pasadena
Acad. Sci. Pub. 2, 52 pp.

1905. Summer birds of Mount Pinos, California. *Auk* 22: 378-391.

1913. The outlook on conserving the band-tailed pigeon as a game
bird of California. *Condor* 15: 25-40.

1915. A distributional list of the birds of California. Pacific
Coast Avifauna 11, 217 pp.

1928. September nesting of the band-tailed pigeon. *Condor* 30: 126.

— BRYANT, HAROLD CHILD; and STORER, TRACY IRWIN.

1918. The game birds of California. 642 pp. Berkeley.

— DIXON, JOSEPH SCATTERGOOD; and LINSDALE, JEAN MYRON.

1930. Vertebrate natural history of a section of northern California
through the Lassen Peak region. *Univ. Calif. Pub. Zool.* 35,
594 pp., illus. Berkeley.

— and STORER, TRACY IRWIN.

1924. Animal life in the Yosemite . . . 741 pp., illus. Berkeley.

— and WYTHE, MARGARET WILHELMINA.

1927. Directory to the bird life of the San Francisco Bay region.
Pacific Coast Avifauna 18, 160 pp., illus.

HAGENSTEIN, WALTER M.

1936. Late nesting of the band-tailed pigeon. *Murrelet* 17: 21-22.

HENSHAW, HENRY WETHERBEE.

1886. Birds of the Upper Pecos River, New Mexico. *Auk* 3: 80.

HUEY, LAWRENCE MARKHAM.

1913. With the band-tailed pigeon in San Diego County. *Condor* 15:
151-153.

- HUNTER, JOSEPH SLAYTON.
 1936. Kill of game in State is compiled (1934-35 fiscal year).
 Calif. Conserv. 1 (8): 3.
 1937. Kill of game in State is compiled (1935-36 fiscal year).
 Calif. Conserv. 2 (8): 20.
- JEWETT, STANLEY GOLDON.
 1941. Late nesting of the band-tailed pigeon. Condor 43: 78.
 ——— and GABRIELSON, IRA NOEL.
 1929. Birds of the Portland, Oregon, area. Pacific Coast Avifauna 19,
 55 pp., illus.
- JOHNSON, O. B.
 1880. List of the birds of the Willamette Valley, Oregon. Amer. Nat.
 July, pp. 638-639.
- KLOPPENBURG, H. A.
 1922. Band-tailed pigeons abundant in Plumas National Forest. Calif.
 Fish and Game 8: 57.
- KOBBE, WILLIAM HOFFMAN.
 1900. The birds of Cape Disappointment, Washington. Auk 17: 349-358
- LIGON, JAMES STOKELY.
 1927. Wildlife of New Mexico: its conservation and management,
 212 pp., illus. Santa Fe.
- MCATEE, WALDO LEE.
 1932. The need for studies in bird control in California. Calif.
 Dept. Agr. Monthly Bull. (4-5-6): 269-286.
- MCLEAN, DONALD DUDLEY.
 1925. A western goshawk scatters Yosemite's band-tailed pigeon colony.
 Yosemite Nature Notes 4: 103.
- MICHAEL, CHARLES WILSON.
 1928. Nesting time of band-tailed pigeons in Yosemite Valley.
 Condor 30: 127.
- MILLER, ROBERT CUNNINGHAM; LUMLEY, ELLSWORTH L.; and HALL, F. S.
 1935. Birds of the San Juan Islands, Washington. Murrelet 16 (3):
 51-65.
- MORAN, NATHAN.
 1919. Nesting of the band-tailed pigeon. Calif. Fish and Game 5: 160.
- MUNRO, JAMES ALEXANDER.
 1922. The band-tailed pigeon in British Columbia. Canadian Field-Nat.
 36: 1-4.
 1924. Miscellaneous bird notes from Vancouver Island, 1923.
 Canadian Field-Nat. 38: 149-150.
- NICE, MARGARET MORSE, and NICE, LEONARD ELAINE.
 1924. The birds of Oklahoma, Univ. Oklahoma Bull., new series 20,
 Univ. studies 286, 122 pp., illus. May 15, Norman, Okla.
- NIEDRACH, ROBERT J., and ROCKWELL, ROBERT B.
 1929. Birds of Denver and Mountain Parks. Colo. Mus. Nat. Hist.
 Pop. Ser. 5, p. 89.
- NOACK, H. R.
 1916. Band-tailed pigeons bred in captivity. Calif. Fish and Game 2:
 212.
- OBERHOLSER, HARRY CHURCH.
 1902. Some notes from west Texas. Auk 19: 300.
- PEARSE, THEOD.
 1935. Display of the band-tailed pigeon, Murrelet 16 (3): 71-72.
 1940. Precarious status of the band-tailed pigeon on Vancouver
 Island. Murrelet 21: 10-11.
- PRESNALL, CLIFFORD CHARLES.
 1935. Birds of Zion National Park. Utah Acad. Sci. 12: 201.
- RIDGWAY, ROBERT.
 1916. The birds of North and Middle America. U. S. Nat. Mus. Bull.
 50, part 7, pp. 288-291.

- SHUFELDT, ROBERT WILSON.
1912. The band-tailed pigeon in North Dakota. *Auk* 29: 539-540.
- STILLHUNTER.
1907. South coast shooting. IX: The band-tailed pigeon. *Western Field* 11: 200-202.
- STILLMAN, A. E.
1928. Nesting of the band-tailed pigeon. *Amer. Forests*, May, pp. 267-268.
- SWARTH, HARRY SCHELWALDT.
1904. Birds of the Huachuca Mountains, Arizona. *Pacific Coast Avifauna* 4, 70 pp.
1914. A distributional list of the birds of Arizona. *Pacific Coast Avifauna* 10, 133 pp.
- TAVERNER, PERCY ALGERNON.
1926. Birds of western Canada. Canada Dept. Mines, Victoria Memorial Mus. Bull. 41 (Biol. Ser. 10), 380 pp., illus. Ottawa.
1934. Birds of Canada. Canada Dept. Mines, Nat. Mus. Bull. 72 (Biol. Ser. 19), 445 pp., illus. Ottawa.
- TAYLOR, WALTER PENN.
1924. The present status of the band-tailed pigeon on the Pacific coast, Calif. *Fish and Game* 10: 1-9.
- VAN DENBURGH, JOHN.
1899. Notes on some birds of Santa Clara County, California. *Amer. Philos. Soc. Proc.* 38: 157-180.
- VAN ROSSEM, ADRIAN JOSEPH.
1914. Notes from the San Bernardino Mountains. *Condor* 16: 145-146.
- VAN TYNE, JOCELYN, and SUTTON, GEORGE MISCH.
1937. The birds of Brewster County, Texas. *Univ. Michigan Mus. Zool. Misc. Pub.* 37, illus.
- VORHIES, CHARLES TAYLOR.
1928. Band-tailed pigeons nesting in Arizona in September. *Condor* 30: 253.
- WALES, JOSEPH HOWE.
1926. The coo of the band-tailed pigeon. *Condor* 28: 42.
- WHEELLOCK, IRENE GROSVENOR.
1904. *Birds of California*. 578 pp. illus. Chicago.
- WILLARD, FRANCES COTTLE.
1913. Some late nesting notes from the Huachuca Mountains, Arizona. *Condor* 15: 41.
1916. Nesting of the band-tailed pigeon in southern Arizona. *Condor* 18: 110-112.
- WILLET, GEORGE.
1933. A revised list of the birds of southwestern California. *Pacific Coast Avifauna* 21, 204 pp.

INDEX

- Abundance, early day, 2.
 present status, 33.
- Acetylene flash gun, 48, 49.
- Agricultural relationships, 3, 37-45.
- Behavior, 6.
 calls, 5.
 courtship, 5.
 flight, 6.
 flocking, 6.
 perching, 6.
- Berries as food, 38-43, 51-53, 55-63.
- Calls, 5.
- Care of young, 13-15.
- Columba fasciata fasciata*, 1.
- Communal nesting, 11, 12.
- Control of Damage, 45-50.
 by acetylene flash gun, 48, 49.
 by flash bombs, 49.
 by paper streamers, 48.
 by shooting, 45-47.
 by signal flares, 49.
 by tree covers, 48, 49.
 permits for, 3, 49, 50.
 proper timing, 47.
- Cooper's hawk, 17.
- Courtship, 5.
- Decoys, use of, 33.
- Depredations, cherries, 3, 38-43.
 grains, 38, 43-45.
 grapes, 42.
 prunes, 42.
 walnuts, 45.
- Description, adult, 4.
 nestling, 5.
- Development, feather, 15.
- Disease, 17.
- Distribution, general, 17.
 map, 18.
 summer, 18.
 winter, 24.
- Eggs, 12.
 description, 12.
 discovery, 2.
 number, 6, 12.
 size, 12.
- Enemies, 17.
- Falcon, prairie, 17.
fasciata fasciata, *Columba*, 1.
- Feather development, 15.
- Feeding mannerisms, 68.
- Flash bombs, 49.
- Flight, 6.
- Flocking, 6.
- Food, autumn, 65.
 berries, 38-43, 51-53, 55-68.
 general, 51-71.
 grains, 43-45, 51-53, 55-58, 63-68.
 insect, 53, 63.
 mast, 37, 38-43, 51-53, 55-59, 63-68.
 quantity taken, 68, 69.
 seasonal preferences, 63.
 spring, 64.
 summer, 64.
 winter, 63.
- Grains as food, 43-45, 51-53, 55-58, 63-68.
- Gravel, use of, 68.
- Growth of young, 13-15.
- Hawk, Cooper's, 17.
 goshawk, 17.
 prairie falcon, 17.
 sharp-shinned, 17.
- Hunting, 2, 30, 31, 32, 33.
 bag limit, 3.
 effects of, 2, 31, 32, 33.
 practices, 2, 3, 30-33.
 season trends, 34, 36.
 seasons, 3, 30.
 wastage in, 31-33.
- Incubation period, 12.
- Kill, records of, 31-33.
- Location of nests, 9.
- Management, 36.
 fire prevention, 37.
 increasing food supply, 37, 49.
 reforestation, 37.
 stringent protection, 37.
 wilderness maintenance, 37.
- Mast as food, 37-43, 51-53, 55-59, 63-68.
- Measurements, 4, 5.
- Migration, autumn, 27.
 routes of, 29.
 spring, 26.
- Molts, 5.
- Nesting, 6-12.
 seasons, 6-7.
- Nest location, 9.
 structure, 9-10.
- Paper streamers, 48.
- Parasites, internal, 17.
- Perching, 6.
- Permits for control, 3, 49, 50.
- Pigeon, band-tailed, 1.
 discovery of, 2.
 blue, 1.
 blue rock, 1.
 history, 2.
 milk, 13, 16.
 wild, 1.
- Plumages, adult, 4.
 nestling, 5.
- Prairie falcon, 17.
- Predators, 17.
- Protection, 3, 30, 36.
- Quantity of food taken, 68, 69.
- Range, summer, 18.
 winter, 24.
- Records, banding, 29.

Routes of migration, 29.
 Salt, use of, 54.
 Season of nesting, 5-7.
 Sharp-shinned hawk, 17.
 Shooting, control by, 45-47.
 Signal flares, 49.
 Squirrel, gray, 17.
 Streamers, paper, 48.
 Structure of nests, 9, 10.
 Tree covers, 48, 49.
 Use of decoys, 33.
 gravel, 68.

 salt, 54.
 Value as game, 29.
 Weights, 4, 15.
 Western goshawk, 17.
 Young, 13-16.
 activity of, 15.
 brooding of, 15.
 care of, 13-16.
 feather growth, 15.
 food of, 13.
 growth of, 13-16.
 weight of, 4, 15.

* 5702127

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

**THE POCKET GOPHERS
(GENUS THOMOMYS) OF ARIZONA**

NORTH AMERICAN FAUNA 59





UNITED STATES DEPARTMENT OF THE INTERIOR
J. A. Krug, Secretary
FISH AND WILDLIFE SERVICE
Albert M. Day, Director

North American Fauna 59

THE POCKET GOPHERS
(GENUS THOMOMYS) OF ARIZONA

BY
EDWARD A. GOLDMAN



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1947

CONTENTS

	Page		Page
Introduction	1	Subspecies of <i>Thomomys baileyi</i> group..	31
Groups of Arizona pocket gophers.....	1	Subspecies of <i>Thomomys talpoides</i> group	32
Economic status.....	6	Subspecies of <i>Thomomys umbrinus</i> group	33
Species and subspecies of <i>Thomomys</i> <i>bottae</i> group.....	7		

THE POCKET GOPHERS (GENUS THOMOMYS) OF ARIZONA

BY EDWARD A. GOLDMAN, formerly *Senior Biologist, Biological Surveys, Division
of Wildlife Research, Fish and Wildlife Service*

INTRODUCTION

Pocket gophers of the genus *Thomomys* inhabit practically every part of Arizona, from the desert lowlands near the Delta of the Colorado River to near the tops of the highest mountains, including San Francisco Mountains at timber line, where the altitude is approximately 11,500 feet. Between these extremes in altitude the sedentary pocket gophers occupy every sort of habitat in which it is possible to burrow. In general, soft or sandy soil is preferred, but in some places there is so little soil that the excavated material consists almost entirely of small stones. In the desert regions some soils are so hard and compact that excavation is difficult, and with plants widely spaced the food supply is evidently precarious.

The following review of the pocket gophers of Arizona is primarily a distributional study, based mainly on the collections in the United States National Museum, including the extensive Biological Surveys collection. For the loan of specimens in their charge, however, the writer is indebted to Laurence M. Huey, Natural History Museum, San Diego, Calif.; the late Dr. Joseph Grinnell and Dr. E. Raymond Hall, then of the Museum of Vertebrate Zoology, University of California, Berkeley, Calif.; and to Dr. W. H. Burt, Museum of Zoology, University of Michigan, Ann Arbor, Mich. The maps were drawn by Mrs. Katheryne C. Tabb, of the Fish and Wildlife Service. No effort has been made to include the many published references to pocket gophers in the State, most of which would add little or nothing to present knowledge of distribution as determined by specimens examined. Colors mentioned are mainly from Robert Ridgway, "Color Standards and Color Nomenclature," 1912.

GROUPS OF ARIZONA POCKET GOPHERS

The pocket gophers of Arizona are assignable to four apparently distinct groups, as follows: (1) The *Thomomys bottae* group, (2) the *Thomomys baileyi* group, (3) the *Thomomys talpoides* group, and (4) the *Thomomys umbrinus* group.

THOMOMYS BOTTAE GROUP

The *Thomomys bottae* group (fig. 1) embraces most of the pocket gophers of Arizona. It is a remarkable assemblage of closely related forms, ranging from the coast of California through several southwestern States and east to Texas. The Colorado River and its canyons form an effective barrier limiting the distribution of pocket gophers in western Arizona, but one subspecies, *albatus*, forms a connecting link across the Delta of the Colorado River, where shifting channels transfer local populations from one side to the other. The group is also represented north of the Colorado River, in northwestern Arizona.

The *Thomomys bottae* group presents characters as follows: Size variable from rather large to small; form robust; colors of upper parts varying from nearly white to cinnamon buff and rich ochraceous tawny, more or less mixed with black; post-auricular black spots small; mammae normally 4 pairs (2 pectoral and 2 inguinal). Skull of rather heavy proportions; rostrum broad; nasals only slightly tapered and gradually narrowed posteriorly, the ends usually truncate; zygomata heavy, the maxillary arm expanded to form a prominent external angle near line of contact with jugal; interparietal not extending posteriorly beyond plane of suture between parietals and supraoccipital; ossified external auditory meatus moderately developed; upper incisors broad and heavy, usually decurved in vertical plane at anterior ends of nasals.

Members of the *bottae* group are evidently extraordinarily responsive to environmental and genetic influences combined with the isolation factor, as studies reveal that each principal mountain range or valley tends to support its more or less peculiar form, marked by variations in combination of details of a pattern of general characters which is maintained with surprising uniformity throughout the group. The intergradation of forms is clearly exhibited in some cases, and in others, in which it is not shown by the material at hand, the quantitative characters presented are those known to be of subspecific value elsewhere, and are assumed to warrant the use of a subspecific name. Despite the large number of subspecies that have been described, very few names can be relegated to synonymy. It is evident, however, that there is now an approach to the limit of the number of forms that can be recognized in Arizona.

Isolation is evidently an important factor in the evolution of the many forms. Distribution is irregular. Local colonies, which may consist of numerous individuals, develop in areas where the soil is soft, as along a wash in the bottom of a desert valley, or in

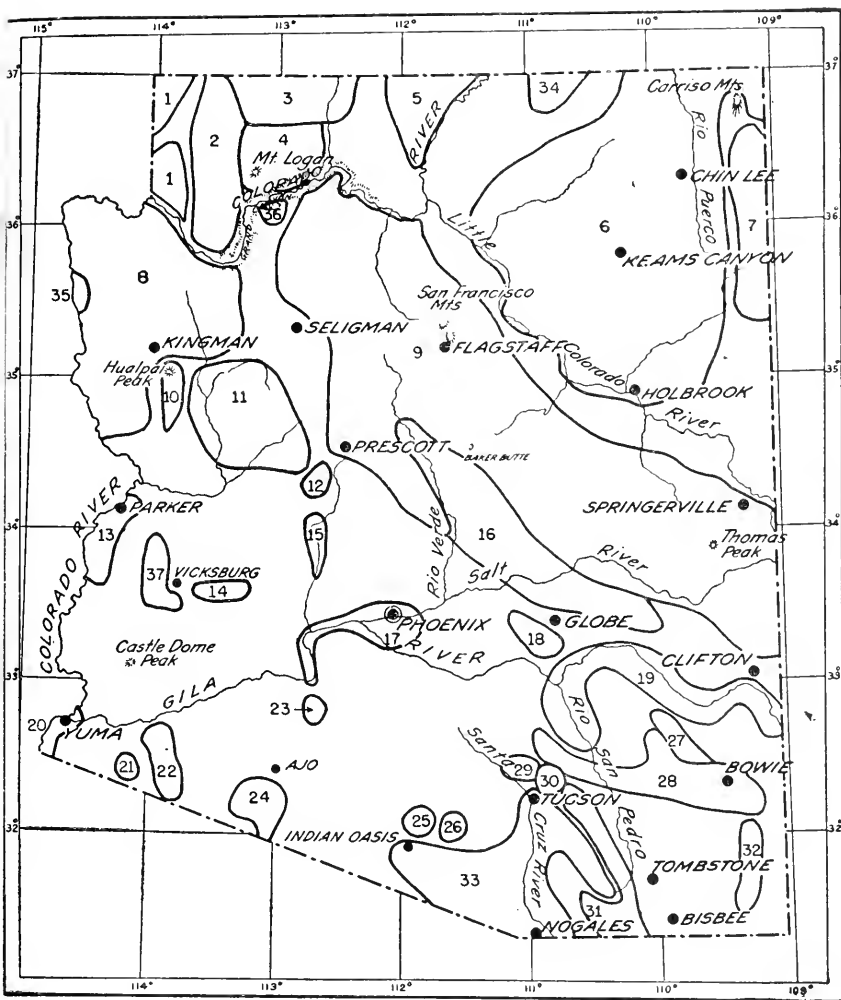


Figure 1.—Distribution of species and subspecies of *Thomomys bottae* group in Arizona:

- | | | |
|---------------------------------|----------------------------------|--------------------------------|
| 1. <i>T. b. virgineus</i> . | 13. <i>T. b. chrysonotus</i> . | 26. <i>T. b. pusillus</i> . |
| 2. <i>T. b. nicholi</i> . | 14. <i>T. b. subsimilis</i> . | 27. <i>T. b. grahamensis</i> . |
| 3. <i>T. b. planirostris</i> . | 15. <i>T. b. patulus</i> . | 28. <i>T. b. extenuatus</i> . |
| 4. <i>T. b. trumbullensis</i> . | 16. <i>T. b. mutabilis</i> . | 29. <i>T. b. catalinae</i> . |
| 5. <i>T. b. absonus</i> . | 17. <i>T. b. cervinus</i> . | 30. <i>T. b. parvulus</i> . |
| 6. <i>T. b. aureus</i> . | 18. <i>T. b. pinalensis</i> . | 31. <i>T. b. hueyi</i> . |
| 7. <i>T. b. peramplus</i> . | 19. <i>T. b. alienus</i> . | 32. <i>T. b. collinus</i> . |
| 8. <i>T. b. desertorum</i> . | 20. <i>T. b. albatrus</i> . | 33. <i>T. b. modicus</i> . |
| 9. <i>T. b. fulvus</i> . | 21. <i>T. b. depauperatus</i> . | 34. <i>T. b. alexandrae</i> . |
| 10. <i>T. b. hualpaiensis</i> . | 22. <i>T. b. phasma</i> . | 35. <i>T. suboles</i> . |
| 11. <i>T. b. desitus</i> . | 23. <i>T. b. aridicola</i> . | 36. <i>T. muralis</i> . |
| 12. <i>T. b. operosus</i> . | 24. <i>T. b. growlerensis</i> . | 37. <i>T. harquahalae</i> . |
| | 25. <i>T. b. comobabiensis</i> . | |

a mountain meadow. In such places the burrows may be close together, with many mounds of excavated earth dotting the surface and tunnels interspersed. Numerous mounds may mark the operations of one or several individuals, but studies indicate that each burrow occupant, male or female, is solitary, except during the mating season and during the time that the young must remain in the same tunnels with their mother. Colonies may be more or less isolated by areas of nearly impervious soil or by rock formations, with breeding connections between them uncertain. Below the upper walls of the Grand Canyon one form, *muralis*, was found living in isolated strips of soil only a few feet wide, bounded above and below by vertical cliffs about 300 feet high. It presents rather well marked characters, and in this and a few similar cases the use of full specific names seems warranted, although the close relationship to a neighboring form is also clearly evident.

Response to environmental conditions is shown by the marked tendency of pocket gophers to assume the colors of the soils in which they burrow. This tendency is shared with many other mammals, but is especially noteworthy in the forms of the *Thomomys bottae* group. Pocket gophers of this group inhabiting light-colored sand are usually light shades of buff, varying to almost white; those living in reddish soils assume rufescent tones; and those from blackish terrain, especially dark volcanic soils, are usually deeper reddish or dark brown, and may vary to black in some specimens. Occasional melanistic individuals may occur anywhere, but black or blackish specimens are more prevalent in lava areas. Pocket gophers inhabiting soft, sandy ground or alluvial bottomlands, where food is more abundant, or more accessible, tend to be larger than those inhabiting more rocky or sterile areas.

THOMOMYS BAILEYI GROUP

The *Thomomys baileyi* group (fig. 2), as recognized, embraces several races ranging in western Texas, parts of southern New Mexico (except the Rio Grande Valley), northern Chihuahua, and west to southeastern Arizona, where the group is represented by *T. b. mearnsi*. In some of the more important characters these races agree with those of the *bottae* group, but the zygomata are slender with slight expansion of the maxillary arm near the line of contact with the jugal, the rostrum is of shallow depth, and the upper incisors are strongly procumbent. Representatives of the two groups taken in the same vicinity appear to be distinct.

sis of the Kaibab Plateau and by *T. t. fossor* which occurs in the Tunitcha and Lukachukai Mountains in the extreme northeastern corner of the State.

The members of the *Thomomys talpoides* group are similar in size to those of the *bottae* group, but the upper parts in general are dull cinnamon buff, the back usually overlaid with rusty, the black post-auricular spots are larger and the general coloration is duller in tone. The mammae vary from four to six pairs (2 abdominal pairs normally present in typical *talpoides*). The skull is elongated and slender; rostrum long and narrow, the sides more deeply excavated than in other groups, leaving the roots of upper incisors clearly outlined; nasals rather broad anteriorly, gradually narrowing posteriorly; zygomata slender, depressed posteriorly, the jugals sloping upward to points of contact with maxillae; ossified external auditory meatus large and prominent; interparietal extends posteriorly beyond plane of posterior border of parietals; upper incisors narrow and thin, decurved about as in *bottae* group.

THOMOMYS UMBRINUS GROUP

The *Thomomys umbrinus* group (fig. 2), composed of small pocket gophers, is widely dispersed in Mexico. Like the *bottae* group, it is subdivided into numerous geographic races, several of which are restricted to the mountains of southeastern Arizona.

In color of upper parts the members of the *umbrinus* group are between cinnamon brown and russet, varying to sayal brown in *proximus*, the back usually deep black along the median line; black post-auricular spots usually large and confluent with black of back in some specimens. The skull is slender, with brain case smoothly rounded, the temporal ridges inconspicuous or absent; rostrum short, and moderately broad; nasals distinctly wedge-shaped, narrowing posteriorly, the ends usually emarginate; zygomata slender, the sides nearly parallel; ossified auditory meatus small; upper incisors relatively broad and heavy, decurved in vertical plane at anterior ends of nasals in Arizona forms, strongly procumbent in numerous Mexican races.

ECONOMIC STATUS

The pocket gophers of all groups consume plant food, but their widespread burrowing activities, which tend to stir the soil, are, under natural conditions, beneficial to plant growth and thus indirectly to other animals dependent on plants. Erosion of the land surface may, however, be started by water entering the tunnels, especially where these extend up and down steep slopes. Beneficial habits are, therefore, offset by some destructive ef-

fects, and pocket gophers seem rather negligible in the biotic complex. The desert forms are limited in numbers by the food supply and by natural enemies. Where desert land is brought under irrigation and cultivation, however, the food supply is greatly increased, predation is lessened, and the pocket gopher population may be expected to rise inordinately unless effective control measures are adopted. On cultivated lands severe damages result from crops directly consumed, or roots severed, and from the tunnels which often cause breaks in irrigation ditches.

SPECIES AND SUBSPECIES OF THOMOMYS BOTTAE GROUP

THOMOMYS BOTTAE VIRGINEUS GOLDMAN

VIRGIN VALLEY POCKET GOPHER

Thomomys bottae virgineus Goldman, Biol. Soc. Wash. Proc. 50: 133, September 10, 1937.

Type.—From Beaverdam Creek, near confluence with Virgin River, at Littlefield, northwestern Arizona (altitude 1,500 feet); collected by Luther C. Goldman, October 16, 1936.

General characters.—A cinnamon-buff form, similar to *centralis* of eastern Nevada, but skull relatively narrower, more elongated, the zygomata less widely spreading, more distinctly bowed inward near middle of jugals. Similar to *nicholi* of the Shivwits Plateau region, but somewhat darker, and skull differing in about the same characters as from *centralis*.

Measurements.—Average of three adult male topotypes: Total length, 232 (232-232); tail, 74 (72-75); hind foot, 31.5 (31-31.5) millimeters. Two adult female topotypes, respectively, 207, 210; 62, 58; 28, 29.5 millimeters.

Distribution and habitat.—The range of *virgineus* includes the Virgin River Valley below the canyon traversed by the river in breaking across the fault line marked by the Beaverdam Mountains on one side, and the Grand Wash Cliffs on the other, just above the type locality. East of the Virgin Valley this form is found in an extremely arid section near Pakoon Spring, along Grand Wash. The general area inhabited is well down in the Lower Sonoran Zone. On the bottomlands along Beaverdam Creek and the Virgin River, pocket gophers are numerous enough in some places to be destructive to alfalfa, which is grown on a limited scale.

THOMOMYS BOTTAE NICHOLI GOLDMAN

SHIVWITS PLATEAU POCKET GOPHER

Thomomys bottae nicholi Goldman, Jour. Wash. Acad. Sci. 28 (7): 337, July 15, 1938.

Type.—From 20 miles south of Wolf Hole (road to Parashonts), Shivwits Plateau, Mohave County, Ariz. (altitude 5,000 feet); collected by Luther C. Goldman, August 6, 1937.

General characters.—A light, cinnamon-buff subspecies of medium size. Closely allied to *trumbullensis* of the neighboring Mount Trumbull lava area, but paler buff, the back less mixed with black. Similar to *virgineus* of the Virgin River Valley below the break through the Beaverdam Mountains, but somewhat darker; skull differing in detail, the frontals broader, zygomata more widely spreading, and the jugals not distinctly bowed inward as in *virgineus*.

Measurements.—Two adult male topotypes, respectively: Total length, 229, 208; tail, 65, 59; hind foot, 27.5, 28 millimeters. Two adult females from Saint George, Utah, respectively: 208, 204; 71, 63; 27, 27.5 millimeters.

Distribution and habitat.—The range of this pocket gopher is the Shivwits Plateau region, on the terrace between the Hurricane Ledge on the east, and the Grand Wash Cliffs on the west, north of the Grand Canyon, northwestern Arizona. The general area, at 4,500 to 5,000 feet, is in the lower part of the Upper Sonoran Zone, but slopes down at the north end to 2,500 feet altitude in the Lower Sonoran Zone at Saint George, in the Virgin River Valley, just across the Utah boundary. The pocket gophers occur irregularly in small, widely scattered colonies, on land commonly overgrown with *Atriplex* and sagebrush (*Artemisia tridentata*).

THOMOMYS BOTTAE PLANIROSTRIS BURT

ZION PARK POCKET GOPHER

Thomomys perpallidus planirostris Burt, Biol. Soc. Wash. Proc. 44: 38, May 8, 1931.

Type.—From Zion National Park, Utah (altitude 4,400 feet); collected by A. Brazier Howell, May 4, 1920.

General characters.—Size medium but form robust; colors rich, the upper parts distinctly tawny, little modified by dark-tipped hairs. Allied to *absonus* of House Rock Valley, but colors brighter, more tawny, and proportions heavier; skull more massive, with heavier dentition.

Measurements (from Burt).—Average of eight adult male topotypes: Total length, 238.3 (222-261); tail, 75.6 (66-83); hind foot, 32.4 (31-34) millimeters. Average of eight adult female topotypes: 215 (205-228); 71 (61-78); 30.9 (30-33) millimeters.

Distribution and habitat.—The Zion Park pocket gopher is found at 4,500 feet on the broad Upper Sonoran, *Atriplex* overgrown, ter-

face near Fredonia and the vicinity of Kanab Wash to westward. This brightly colored subspecies apparently ranges into Arizona through the Short Creek Valley along the western and southern base of the Vermilion Cliffs west of Fredonia. The burrows in sandy soil were noted at intervals for miles west of Fredonia. While *planirostris* and *absonus* occur at points not far apart, and might be expected to meet along Johnson Creek east of Fredonia, these animals are very local in distribution and may not be in direct contact. Both forms occur in Zion National Park, but their ranges in the park appear to be completely separated. The floor of the narrow valley, at 4,400 feet altitude, in the park, is the type locality of *planirostris*, while *absonus* is found at 5,500 to 5,700 feet in the heads of small canyons and on the plateau near the east entrance above the barrier formed by the escarpment or eastern wall of the valley. At Fredonia pocket gophers enter alfalfa fields, but are not sufficiently numerous to be very destructive.

THOMOMYS BOTTAE TRUMBULLENSIS HALL AND DAVIS

MOUNT TRUMBULL POCKET GOPHER

Thomomys bottae trumbullensis Hall and Davis, Biol. Soc. Wash. Proc. 47: 51, February 9, 1934.

Type.—From 3 miles south of Nixon Spring, Mount Trumbull, Mohave County, Ariz. (altitude 6,500 feet); collected by Seth B. Benson, May 26, 1933.

General characters.—A dark-colored lava-area-inhabiting subspecies. Upper parts normally between cinnamon and cinnamon-buff, usually rather heavily mixed with black. Of 38 specimens examined, 7 are deep glossy black, except the feet and the tip of the tail, which are white. Similar to *nicholi* of the closely adjoining, but lower, Shivwits Plateau, and to *absonus* of House Rock Valley, but color darker than either, the upper parts more heavily mixed with black. Compared with *planirostris*, typical in Zion National Park, Utah, but which also occurs at Fredonia, Ariz., *trumbullensis* is smaller and darker, the upper parts more extensively mixed with black, less tawny; skull slenderer, with lighter dentition.

Measurements.—Average of three adult male topotypes: Total length, 234 (228-238); tail, 76 (71-83); hind foot, 30.5 (30-31) millimeters. Two adult female topotypes, respectively: 210, 204; 68, 56; 28, 26.5 millimeters.

Distribution and habitat.—The range of this subspecies is the lava and cinder area centered about Mount Trumbull on the plateau near the north rim of the Grand Canyon. The area lies mainly along the boundary between the Upper Sonoran and Tran-

sition Zones at 6,000 to 6,500 feet, but extends up to 7,000 feet on the slopes of Mount Trumbull and Mount Logan, and burrows were observed at about 4,500 feet altitude on the prominent cinder cone at the lower end of Toroweap Valley. As pointed out by Hall and Davis (op. cit.: 52), the darker color of this subspecies, compared with the neighboring geographic races, may indicate a response to environmental conditions.

THOMOMYS BOTTAE ABSONUS GOLDMAN

HOUSE ROCK VALLEY POCKET GOPHER

Thomomys perpallidus absonus Goldman, Jour. Wash. Acad. Sci. 21 (17): 425
October 19, 1931.

Type.—From Jacobs Pools, House Rock Valley, Coconino County, northern Arizona (altitude 4,000 feet); collected by E. A. Goldman, June 7, 1931.

General characters.—A dull grayish buffy subspecies of medium size with a narrow, slender skull. Closely allied to *planirostris* of Zion National Park, Utah, and the vicinity of Fredonia, Ariz., but somewhat slenderer, less tawny, and skull less massive.

Measurements.—Average of three adult male topotypes: Total length, 231 (228-234); tail, 77 (74-82); hind foot, 31 (30-32.5) millimeters. Two adult female topotypes, respectively: 210, 217; 69, 70; 30, 29 millimeters.

Distribution and habitat.—The range of *absonus* in Arizona is probably restricted to House Rock Valley, but extends north in Utah to the eastern entrance of Zion National Park, at 5,700 feet altitude.

House Rock Valley occupies a broad depression with a generally level bottom lying in the Upper Sonoran Zone along the northern side of the Marble Canyon of the Colorado River. This reach of the river bisects the interior basin of which House Rock Valley is the northern half, above the upper entrance to the Grand Canyon, and forms a barrier limiting the distribution of this subspecies and of most of the other mammals of the region. The bottom of House Rock Valley is gashed by side canyons of the Colorado, and the dispersal of this pocket gopher is much restricted even here. It has been found inhabiting soft sand extending for several miles out over the floor of the valley from Jacobs Pools, a spring at the western base of the escarpment marking the great fault line known as the Vermilion Cliffs. Burrows are common along the highway through low-growing shrubby vegetation, largely *Atriplex* bushes and *Coleogyne ramosissima*, a dominant species on poor soils. But the pocket gophers feed to

a considerable extent on the roots and tender growing tops of the large white poppy (*Argemone*).

THOMOMYS BOTTAE AUREUS ALLEN

PAINTED DESERT POCKET GOPHER

Thomomys aureus Allen, Amer. Mus. Nat. Hist. Bull. 5: 49, April 28, 1893.

Thomomys latirostris Merriam, Proc. Biol. Soc. Wash. 14: 107, July 19, 1901.

Type from Tanner Crossing, about 3 miles above Cameron, Little Colorado River, Coconino County, Ariz.

Type.—From Bluff, San Juan County, Utah; collected by Charles P. Rowley, May 12, 1892.

General characters.—A large, cinnamon-buff or golden-colored subspecies. Closely allied to and probably intergrading with *per-amplus* of the higher mountains of the northeast corner of Arizona.

Measurements.—Average of four adult male topotypes: Total length, 241 (232-252); tail, 73 (69-80); hind foot, 31 (30-32) millimeters. Average of four adult female topotypes: 222 (215-229); 66 (64-72); 30 (30-31) millimeters.

Distribution and habitat.—The range of *aureus* extends from the San Juan Valley, Utah, into northeastern Arizona, along the valley of Chin Lee Creek, and embraces as a whole the major part of the Painted Desert region to the Little Colorado River. Over this area, however, the pocket gophers are very irregularly distributed in more or less isolated colonies that favor the more fertile ground, usually in the valleys, in the Upper Sonoran Zone. Specimens have been obtained at localities varying in altitude from about 4,000 feet along the Little Colorado River to 6,500 feet in the Pueblo Colorado Valley at Ganado. The dominant vegetation of the region occupied consists largely of *Atriplex* bushes or sagebrush (*Artemisia tridentata*), with a scattered growth of nut pines and junipers along the valley borders. *Thomomys latirostris* was based on a single specimen from Tanner Crossing, near Cameron, on the Little Colorado River. Efforts to obtain topotypes, made by various collectors including the writer, have been unsuccessful. The locality is a very barren one, made more so by overgrazing by domestic stock in recent years, and if pocket gophers still occur they must be rare as we found no trace of them. The skull of the type specimen of *latirostris*, an old male, has a very broad rostral portion and is believed to be abnormal, as no such character appears in specimens from Tuba City, Winslow, and Oraibi, which are in the same general faunal area. Between the range of *aureus* along the valley of the Little Colorado River and that of the widely different subspecies *fulvus* of the

Mogollon Plateau is an arid belt in which pocket gophers have not been detected.

THOMOMYS BOTTAE PERAMPLUS GOLDMAN

TUNITCHA MOUNTAIN POCKET GOPHER

Thomomys fulvus peramplus Goldman, Jour. Wash. Acad. Sci. 21 (17): 423
October 19, 1931.

Type.—From Wheatfields Creek, west slope of Tunitcha Mountains, Apache County, northeastern Arizona (altitude 7,000 feet) collected by Paul Trapier, June 23, 1927.

General characters.—A large, dark-colored subspecies, closely resembling *apache* of northern New Mexico, but upper parts duller, the sides vinaceous-buff instead of ochraceous-buff; skull more elongated; nasals longer and broader, less wedge-shaped posteriorly. Contrasting strongly with the lighter cinnamon or cinnamon-buff tones of *aureus*, which inhabits parts of the neighboring desert region, in dark, dull coloration, but cranial characters indicate close relationship and the two probably intergrade in places along the basal slopes of the mountains.

Measurements.—Average of four adult male topotypes: Total length, 246 (240-255); tail, 80 (60-90); hind foot, 35 (34-37) millimeters. Average of six adult female topotypes: 230 (225-240) 75 (65-88); 32 (31-33) millimeters.

Distribution and habitat.—The Tunitcha Mountain pocket gopher is known from 7,000 feet altitude on Wheatfields Creek up to 8,000 feet on the upper slope of the range. It also occurs at 7,000 feet altitude in the valley at St. Michaels on the eastern side of the Defiance Plateau. This pocket gopher probably occurs irregularly in suitable places throughout this high mountainous section of the State. It gives way, however, at the higher elevations in the Tunitcha Mountains to *Thomomys talpoides fossor*, which tends toward chestnut color, with large, conspicuous, black ear patches. The general habitat of *peramplus* is in the yellow pine belt of the Transition Zone.

THOMOMYS BOTTAE DESERTORUM MERRIAM

DETRITAL VALLEY POCKET GOPHER

Thomomys desertorum Merriam, Biol. Soc. Wash. Proc. 14: 114, July 19, 1901.

Type.—From Mud Spring, Detrital Valley, Mohave County, Ariz.; collected by Vernon Bailey, February 21, 1889.

General characters.—A small, tawny subspecies, similar in color and closely allied to *desitus* of the Big Sandy River Valley, but smaller.

Measurements.—An adult male: Total length, 200; tail verte-

prae, 68; hind foot, 26 millimeters. Average of four females: 190; 30; 25.5 millimeters.

Distribution and habitat.—This little pocket gopher occupies the Lower Sonoran desert region of the broad Detrital Valley and neighboring areas lying mainly at about 3,500 feet altitude in the angle formed by the bend of the Colorado River north and west of the Hualpai Mountains in the northwestern part of the State. It ranges to a somewhat higher elevation in the Upper Sonoran Zone, however, near its southern limit in the Chemehuevis or Mo-have Mountains. East of the northern end of the Hualpai Mountains it doubtless intergrades with *desitus*. The burrows are located in hard upland soil among tree yuccas and a varied assortment of other desert vegetation, including cactuses.

THOMOMYS BOTTAE FULVUS (WOODHOUSE)

FULVOUS POCKET GOPHER

Geomys fulvus Woodhouse, Acad. Nat. Sci. Phila. Proc. 6: 201, 1852.

Thomomys bottae nasutus Hall, Biol. Soc. Wash. Proc. 45: 96, June 21, 1932.

Type from West Fork of Black River, Apache County, Ariz. (altitude 7,550 feet); collected by Annie M. Alexander, June 14, 1931.

Type.—From San Francisco Mountains, Coconino County, Ariz.; collected by S. W. Woodhouse, October 1851.

General characters.—Pocket gophers of medium size, distinguished in the region south of the Grand Canyon by dark, rusty brown coloration associated with that of the dark lava soil they inhabit. Skull with wide-spreading zygomata and small auditory bullae. Closely allied to *mutabilis* of the Verde Valley, but darker, the upper parts more extensively mixed with black; skull less massive; basicranial region narrower; auditory bullae smaller.

Measurements.—Average of five males: Total length, 219; tail vertebrae, 70; hind foot, 30 millimeters. Average of five females: 209; 66; 29.2 millimeters.

Distribution and habitat.—The fulvous pocket gopher is the most widely dispersed of the numerous representatives of the *Thomomys bottae* group found within the State. Its distribution area occupies the whole of the elevated Coconino and Mogollon Plateau regions, extending from the southern rim of the Grand Canyon southeastward to the White Mountains and on far into New Mexico. A spur from the main range reaches south through the high country to the Bradshaw Mountains west of the Verde River Valley. This pocket gopher ranges mainly in the yellow pine forests of the Transition Zone above 5,000 feet altitude, but ascends into the Canadian Zone on San Francisco Mountains and the White Mountains. The general region is marked by cinder

cones and old lava beds, indicating volcanic activity in the past. The decomposing cinders and lava produce dark-colored soils that are reflected in the color tones not only of the pocket gophers but of many of the other small mammals. Along the southern side of the Mogollon Plateau *fulvus* intergrades with *mutabilis*, which ranges at lower levels. On the long gradual desert slope from the top of the plateau toward the Little Colorado River pocket gophers are generally absent, and no direct connection with *aureus*, which inhabits parts of the Little Colorado Valley and Painted Desert is apparent.

In the yellow pine forests the pocket gophers occur irregularly in colonies wherever there is sufficient soil for their excavations but they favor the soft soil of open grassy meadows.

THOMOMYS BOTTAE HUALPAIENSIS GOLDMAN

HUALPAI MOUNTAINS POCKET GOPHER

Thomomys bottae hualpaiensis Goldman, Jour. Wash. Acad. Sci. 26 (3) : 114, March 15, 1936.

Type.—From Hualpai Peak, Hualpai Mountains, Mohave County, Ariz. (altitude 7,000 feet); collected by E. A. Goldman, October 6, 1917.

General characters.—A light ochraceous buffy subspecies of medium size. Allied to *desitus* of the adjoining valley of the Big Sandy River; similar in size but paler; brain case lower, nasals more wedge-shaped. Compared with *desertorum* of the Detrital Valley: considerably larger and paler.

Measurements.—The type, an adult male: Total length, 245; tail, 78; hind foot, 31.5 millimeters.

Distribution and habitat.—Known only from 6,500 to about 7,500 feet altitude in the Transition Zone on the slopes of the Hualpai Mountains. The burrows occur in soft spots in yellow pine and oak timber.

THOMOMYS BOTTAE DESITUS GOLDMAN

BIG SANDY RIVER POCKET GOPHER

Thomomys bottae desitus Goldman, Jour. Wash. Acad. Sci. 26 (3) : 113, March 15, 1936.

Type.—From Big Sandy River, near Owen, Mohave County, Ariz. (altitude 2,000 feet); collected by E. A. Goldman, September 21, 1917.

General characters.—A medium-sized, tawny subspecies; color about as in *desertorum* of the neighboring Detrital Valley region, but size much larger. Size about as in *fulvus* of the Mogollon Pla-

beau, but color lighter, clearer tawny, the back less mixed with black.

Measurements.—An adult male: Total length, 230; tail vertebrae, 70; hind foot, 30.5 millimeters. An adult female: 210; 62; 29.5 millimeters.

Distribution and habitat.—This pocket gopher occupies the Big Sandy River Valley. Thence it ranges east to Kirkland, Yavapai County. Its distribution area is in the Lower Sonoran Zone at 2,000 to 4,000 feet altitude. In the Big Sandy River Valley *desitus* is confined mainly to the loose sand along the broad alluvial river bottom, the excavated mounds of earth often appearing close to the edge of the water where the stream is bordered by willows and *Baccharis* bushes.

THOMOMYS BOTTAE OPEROSUS HATFIELD

PEEPLER VALLEY POCKET GOPHER

Thomomys bottae operosus Hatfield, Chicago Acad. Sci. Bull. 6 (8): 151, January 12, 1942.

Type.—From Peeples Valley, 6 miles north of Yarnell, Yavapai County, Ariz. (altitude 4,400 feet); collected by Roy Komarek, May 30, 1937.

General characters.—From original description: Size large; tips of hairs on back cinnamon to middorsal area which is blackish; sides pinkish buff; top of head blackish; ears surrounded by black; skull broad, with widely spreading zygomata. Differs from *fulvus* in larger size, more widely spreading zygomata, greater mastoid breadth, and heavier dentition. Differs from *mutabilis* in darker color, with more black on nose, occiput, and back. Differs from *patulus* and *desitus* in darker color, longer tail, and more widely spreading zygomata.

Measurements.—From original description: Average of three adult males: Total length, 232.3 (228-237); tail, 81.3 (80-82); hind foot, 29 millimeters. Average of eight adult females: 216.5 (202-234); 71.4 (65-79); 27.4 (26-29) millimeters.

Distribution and habitat.—No specimens of this subspecies have been examined by the writer. It is known only from the type locality and appears to be a local race, perhaps restricted to Peeples Valley, which is somewhat isolated, midway between the desert country of southern Arizona and the high plateau to the northward.

THOMOMYS BOTTAE CHRYSONOTUS GRINNELL

GOLDEN POCKET GOPHER

Thomomys chrysonotus Grinnell, Univ. Calif. Pub. Zool. 10: 174, June 7, 1912.
Thomomys fulvus flavidus Goldman, Jour. Wash. Acad. Sci. 21 (17): 417, October 19, 1931. Type from Parker, Yuma County, Ariz. (altitude 350 feet).

Type.—From Ehrenberg, Yuma County, Ariz.; collected by Frank Stephens, March 27, 1910.

General characters.—A large ochraceous-buff or golden yellowish subspecies with an angular massive skull. Similar to *albatus*, but upper parts ochraceous-buff instead of pinkish buff; skulls much alike; auditory bullae larger, more inflated in *chrysonotus*.

Measurements.—An adult male: Total length, 249; tail vertebrae, 83; hind foot, 33 millimeters. An adult female: 224; 67; 31.5 millimeters.

Distribution and habitat.—The golden pocket gopher occupies the alluvial bottomlands along the east side of the Colorado River from near Ehrenberg north to Parker, and invades the adjoining gravelly mesa overgrown with creosotebush (*Covillea glutinosa*) to some extent. The opposite, or western, side of the Colorado River Valley is inhabited by *Thomomys bottae riparius*, the river serving as a barrier between the two forms. Within the main range of the golden pocket gopher on the bottomlands the burrows are numerous in the soft alluvial soil and extend down in places into the arrowweed (*Pluchea sericea*) belt near the edge of the water.

THOMOMYS BOTTAE SUBSIMILIS GOLDMAN

HARQUAHALA MOUNTAIN POCKET GOPHER

Thomomys fulvus subsimilis Goldman, Biol. Soc. Wash. Proc. 46: 71, April 27, 1933.

Type.—From Harquahala Mountains, Yuma County, Ariz. (altitude 3,000 feet); collected by E. A. Goldman, October 14, 1917.

General characters.—A very small cinnamon-buff animal with a weakly developed skull. Similar to *desertorum* of the Detrital Valley region, but still smaller and paler; skull more delicate in structure.

Measurements.—The type, an adult female: Total length, 186; tail vertebrae, 60; hind foot, 25 millimeters.

Distribution and habitat.—This tiny pocket gopher is known only from a single specimen from 3,000 feet altitude in the Harquahala Mountains. The mountain slopes are rocky, with little soil, but the animal is likely to be found in the softer spots up to near the summit at about 5,000 feet altitude. The mountains are Lower Sonoran in faunal character up to near the top, where a few Upper Sonoran Zone elements appear.

THOMOMYS BOTTAE PATULUS GOLDMAN

HASSAYAMPA VALLEY POCKET GOPHER

Thomomys bottae patulus Goldman, Jour. Wash. Acad. Sci. 28 (7): 341, July 15, 1938.

Type.—From bottomland along Hassayampa River, 2 miles below Wickenburg, Maricopa County, Ariz. (altitude 2,000 feet); collected by Luther C. Goldman, September 16, 1937.

General characters.—A large subspecies, similar to *cervinus* of the Salt River Valley, but upper parts more vivid in color, near cinnamon or cinnamon-buff instead of vinaceous-buff or fawn; skull shorter, less angular. Somewhat resembling *mutabilis* of the Verde River Valley and *desitus* of the Big Sandy River Valley, but larger and paler than either.

Measurements.—An adult male and an adult female topotype, respectively: Total length, 240, 215; tail, 80, 60; hind foot, 31, 29 millimeters.

Distribution and habitat.—Known only from the type locality, but probably has an extensive range in alluvial soil along the valley of the Hassayampa River. The subspecies *patulus* is abundant in alfalfa fields, where it becomes somewhat troublesome to farmers. The distribution of pocket gophers appears to be discontinuous in the arid areas bordering the Hassayampa River Valley.

THOMOMYS BOTTAE MUTABILIS GOLDMAN

VERDE VALLEY POCKET GOPHER

Thomomys fulvus mutabilis Goldman, Biol. Soc. Wash. Proc. 46: 75, April 27, 1933.

Type.—From Camp Verde, Yavapai County, Ariz. (altitude 3,200 feet); collected by Walter P. Taylor, July 25, 1916.

General characters.—A medium-sized, cinnamon-buff subspecies. Closely allied to *fulvus*, but paler, the upper parts less mixed with black; skull more massive; basicranial region broader; auditory bullae larger.

Measurements.—An adult male: Total length, 236; tail vertebrae, 71; hind foot, 31 millimeters. Average of 7 adult females: 216; 68; 29 millimeters.

Distribution and habitat.—The Verde Valley pocket gopher inhabits the valleys and lower slopes of the mountains in the Verde and Salt River drainages along the southern side of the Mogollon Plateau from Camp Verde east to the Gila Mountains, Graham County. Vertical range from about 2,500 to 4,500 feet. This subspecies inhabiting a region arid in general character favors the softer soils along streams.

THOMOMYS BOTTAE CERVINUS ALLEN

FAWN-COLORED POCKET GOPHER; PHOENIX POCKET GOPHER

Thomomys cervinus Allen, Amer. Mus. Nat. Hist. Bull. 7: 203, June 29, 1895.

Type.—From Phoenix, Maricopa County, Ariz. (altitude 1,000 feet); collected by J. Diefenbach, October 20, 1894.

General characters.—A large vinaceous-buff or light fawn-colored subspecies. Similar to *albatus* of the lower Colorado River Valley, but larger; color darker (upper parts near pale pinkish buff or pinkish buff in *albatus*); skull more elongated, with relatively narrower brain case; auditory bullae relatively larger. Allied to *modicus* of the Altar and Santa Cruz Valleys, but larger; color paler (near wood brown, varying to tawny in *modicus*); skull of similar proportions, but much larger, more massive.

Measurements.—Average of three adult male topotypes: Total length, 253 (251-255); tail, 84 (77-90); hind foot, 34.5 (34-36) millimeters. Average of three adult female topotypes: 246 (239-255); 78 (73-81); 34 (33-34.5) millimeters.

Distribution and habitat.—The range of this large pocket gopher is in the Salt River and Gila River Valleys, near Phoenix, and southwest along the latter watercourse to Gila Bend, where it intergrades with the desert subspecies, *aridicola*. The general area is in the Lower Sonoran Zone at from 700 to 1,000 feet altitude. The fawn-colored pocket gopher is associated with such native vegetation as the mesquite (*Prosopis juliflora*), catsclaw (*Aca-cia greggii*), and paloverde (*Cercidium torreyanum*), but with the rapid development of agriculture it has invaded the fields and multiplied greatly in numbers. Owing to the extent of its depredations in an important agricultural area, this pocket gopher should probably be rated as the most destructive of the numerous geographic races that occur within the State.

THOMOMYS BOTTAE PINALENSIS GOLDMAN

PINAL MOUNTAINS POCKET GOPHER

Thomomys bottae pinalensis Goldman, Jour. Wash. Acad. Sci. 28 (7): 342, July 15, 1938.

Type.—From Oak Flat, 5 miles east of Superior, Pinal Mountains, Ariz.; collected by Walter P. Taylor, May 22, 1924.

General characters.—A very small cinnamon subspecies, with a narrow, slenderly formed skull. Most closely allied to *mutabilis* of the adjoining region to the north, but much smaller and darker; skull smaller, narrower, less massive.

Measurements.—The type, an adult female: Total length, 195; tail, 56; hind foot, 24 millimeters.

Distribution and habitat.—The burrows of this small subspecies were noted in numbers in various places along the highway between Superior and Globe across the upper slopes of the Pinal

Mountains. The animal favors the softer soil in small openings in the oak woods of the Upper Sonoran Zone.

THOMOMYS BOTTAE ALIENUS GOLDMAN

UPPER GILA VALLEY POCKET GOPHER

Thomomys bottae alienus Goldman, Jour. Wash. Acad. Sci. 28 (7): 338, July 15, 1938.

Type.—From Mammoth, San Pedro River, Pinal County, Ariz. (altitude 2,400 feet); collected by E. A. Goldman, November 4, 1936.

General characters.—A large, rich rufescent subspecies, allied to *cervinus* of the Salt River Valley, but smaller; upper parts near cinnamon instead of vinaceous-buff. Similar to *toltecus* of the Casas Grandes Valley, northwestern Chihuahua, but color more vivid; skull with lower brain case; upper incisors less projecting forward. Larger, less distinctly tawny than *mutabilis* of the Rio Verde and Salt River drainages.

Measurements.—Average of four adult male topotypes: Total length, 240 (230-254); tail, 68 (58-80); hind foot, 32 (30-33.5) millimeters. Average of four adult female topotypes: 212 (207-218); 58 (57-59); 28 (27.5-28.5) millimeters.

Distribution and habitat.—The general range of this large subspecies is along the bottoms of the lower San Pedro River Valley near Mammoth, and the bottoms of the Gila River Valley above the confluence of the Gila and San Pedro as far as Redrock, New Mex. The area is in the Lower Sonoran Zone from about 2,000 to 3,500 feet or a little more in altitude. These pocket gophers are restricted rather closely to the fertile, alluvial lands along the rivers, overgrown in the natural state with a heavy stand of mesquite (*Prosopis juliflora*) timber.

Economic status.—Much of the alluvial land along the San Pedro and Gila Rivers is cultivated under irrigation, alfalfa being one of the principal crops. The pocket gophers feed upon both the roots and tops of alfalfa and tend to increase in number where a bountiful supply of food is thus provided. Where they become very numerous the alfalfa crop is materially reduced. At Safford the farmers complained of damages to alfalfa, and also of breaks in irrigation ditchbanks caused by gopher tunneling.

THOMOMYS BOTTAE ALBATUS GRINNELL

WHITISH POCKET GOPHER

*Thomomys albatu*s Grinnell, Univ. Calif. Pub. Zool. 10: 172, June 7, 1912.

Type.—From west side of the Colorado River at old Hanlon Ranch near Pilot Knob, Imperial County, Calif.; collected by Joseph Dixon, May 7, 1910.

General characters.—Distinguished by extremely pallid coloration and rather large size. Upper parts nearly uniform pale pinkish buff, in some specimens appearing almost white. Closely allied to *phasma* of the Tule Desert region, but larger; skull more massive.

Measurements.—An adult male: Total length, 272; tail vertebrae, 100; hind foot, 35 millimeters. An adult female: 264; 91; 34 millimeters.

Distribution and habitat.—This nearly white subspecies inhabits both sides of the lower Colorado River Valley from the vicinity of Yuma, at least, to points in the Delta. It burrows in soft alluvial soil, and local occurrence points to the transfer of colonies from one side to the other with the frequently changing channels of the river. Across the lowlands of the Delta, therefore, the general range of *albatus* appears to be the connecting link in a chain of subspecies of the *Thomomys bottae* group extending from the Pacific coast to the Rio Grande Valley in Texas.

THOMOMYS BOTTAE DEPAUPERATUS GRINNELL AND HILL

TINAJAS ALTAS POCKET GOPHER

Thomomys perpallidus depauperatus Grinnell and Hill, Jour. Mammal. 17 (1): 4, February 17, 1936.

Type.—From the east base of the Tinajas Altas Mountains, 7 miles south of Raven Butte, Yuma County, Ariz. (altitude 1,150 feet); collected by Annie M. Alexander, January 17, 1934.

General characters.—Distinguished by pale pinkish buff coloration combined with small size. Color about as in the geographic neighbors *albatus* and *phasma*, but smaller than either (much smaller than *albatus*); skull weaker in structure, less angular than in *phasma*; zygomata more slender; nasals relatively shorter.

Measurements.—A representative female (from original description): Total length, 188; tail, 60; hind foot, 28 millimeters.

Distribution and habitat.—Known only from a small colony in the desert along the eastern base of the Tinajas Altas Mountains, a southern extension of the Gila Mountains, and about 4 to 5 miles north of the Mexican Boundary. It is reported to inhabit gravelly soil along the margins of washes, where the mesquite (*Prosopis juliflora*) and catsclaw (*Acacia greggii*) are among the dominant woody plants.

THOMOMYS BOTTAE PHASMA GOLDMAN

TULE DESERT POCKET GOPHER

Thomomys fulvus phasma Goldman, Biol. Soc. Wash. Proc. 46: 72, April 27, 1933.

Type.—From 2 miles south of Tule Tank, Tule Desert, Yuma

County, Ariz. (altitude 1,200 feet); collected by E. A. Goldman, December 8, 1913.

General characters.—One of the palest of the known forms of the genus. Upper parts near pale pinkish buff, scarcely modified by dark-tipped hairs. Closely allied to *albatus* of the Colorado Delta region, but smaller; skull less massive.

Measurements.—An adult female: Total length, 199; tail vertebrae, 66; hind foot, 29 millimeters.

Distribution and habitat.—The Tule Desert pocket gopher occurs irregularly so far as known in small, local colonies on the low Lower Sonoran plains from the vicinity of the type locality near the Mexican Boundary northwest to Wellton, Yuma County. Its habitat on the desert is in one of the most arid regions in North America. The burrows are found along washes and in open stands of desert vegetation, including the creosotebush (*Covillea tridentata*), ironwood (*Olneya tesota*), paloverde (*Cercidium torreyanum*), and giant cactus (*Carnegiea gigantea*). Numerous mounds of earth pushed out near together at about the same time are evidences of periodical activity, apparently following rains, which are infrequent in the region. Periodical excavation of earth on an extensive scale is a characteristic of pocket gophers in general that seems emphasized in this and some of the other desert forms. During the long intervals between rains the animals remain in the deeper underground workings, and there is little evidence of activity on or near the surface. At such times tunnels near the surface are generally plugged for several feet, or show signs of disuse. To obtain specimens of the gophers may involve considerable labor, as under such conditions it may be necessary to dig a trench 2 to 3 feet deep with a shovel in order to reach the used tunnels where traps can be set with excellent results.

THOMOMYS BOTTAE ARIDICOLA HUEY

GILA BEND POCKET GOPHER

Thomomys bottae aridicola Huey, San Diego Soc. Nat. Hist. Trans. 8 (25): 354, June 15, 1937.

Type.—From 10 miles south of Gila Bend (or, exactly, on Ajo Railroad right-of-way, about 2 miles north of Black Gap), Maricopa County, Ariz. (altitude 900 feet); collected by Laurence M. Huey, February 1, 1936.

General characters.—A medium-sized, light buffy, desert subspecies. Similar to *cervinus* of the Salt River Valley, but smaller and color of upper parts shading toward cinnamon-buff instead of vinaceous-buff.

Measurements.—Type, an adult female: Total length, 212; tail, 63; hind foot, 29 millimeters.

Distribution and habitat.—The type and a topotype of this pocket gopher came from close along the Ajo Railroad, 2 miles north of Black Gap, and 10 miles south of Gila Bend, Maricopa County, Ariz. The animal appears to be one of the isolated forms that exist as local colonies in the wide expanse of Lower Sonoran desert.

THOMOMYS BOTTAE GROWLERENSIS HUEY

GROWLER VALLEY POCKET GOPHER

Thomomys bottae growlerensis Huey, San Diego Soc. Nat. Hist. Trans. 8 (25): 353, June 15, 1937.

Type.—From 7 miles east of Papago Well, Pima County, Ariz. (or, exactly, along a well wooded desert wash on the southwestern side of a range of hills in the southern end of Growler Valley; the Agua Dulce Mountains form the southern boundary of this locality and are not far distant); collected by Laurence M. Huey, March 16, 1937.

General characters.—A desert form, closely allied to *phasma* of the Tule Desert to the west, but darker, deeper pinkish buff or yellowish in color. Much lighter colored in comparison with *modicus* of the Altar Valley to the east.

Measurements.—Type, an adult male: Total length, 208; tail, 62; hind foot, 30 millimeters.

Distribution and habitat.—The known range of this denizen of the desert includes several localities from the southern end of Growler Valley and Quitobaquito north to Bates Well in Growler Pass, between the Growler Mountains and Bates Mountains, all in the Lower Sonoran Zone. The burrows are usually found in soft soil along gravelly wooded washes where the ironwood (*Olneya tesota*), mesquite (*Prosopis*), catsclaw (*Acacia greggii*), and paloverde (*Cercidium torreyanum*) are among the dominant woody plants.

THOMOMYS BOTTAE COMOBABIENSIS HUEY

COMOBABI POCKET GOPHER

Thomomys bottae comobabiensis Huey, San Diego Soc. Nat. Hist. Trans. 8 (25): 354, June 15, 1937.

Type.—From 5 miles northwest of Sells, Pima County, Ariz. (altitude 2,400 feet); collected by Laurence M. Huey, March 22, 1937.

General characters.—A medium-sized, distinctly brownish subspecies. Similar in color to *modicus* of the Altar Valley, but somewhat smaller; skull with larger, more fully inflated, auditory bullae.

Measurements.—The type, an adult female: Total length, 215;

tail, 70; hind foot, 28 millimeters.

Distribution and habitat.—Known only from the type locality on the basal slope of the Comobabi Mountains. Like some of the other desert representatives of the genus, this form appears to be very local in distribution. More abundant material for study may show close alliance to *modicus* to which specimens from Sells are referred.

THOMOMYS BOTTAE PUSILLUS GOLDMAN

COYOTE MOUNTAIN POCKET GOPHER

Thomomys fulvus pusillus Goldman, Jour. Wash. Acad. Sci. 21 (17): 422, October 19, 1931.

Type.—From Coyote Mountains, Pima County, Ariz. (altitude 3,000 feet); collected by E. A. Goldman, September 4, 1915.

General characters.—A small, rich ochraceous-tawny form with a slender, delicate skull and large, fully distended, auditory bullae. Mammae, pectoral two pairs, inguinal two pairs. Allied to *modicus* of the neighboring valleys, but much smaller; color more tawny.

Measurements.—The type, an adult female: Total length, 201; tail vertebrae, 65; hind foot, 27.5 millimeters.

Distribution and habitat.—As the name implies, this is a very small pocket gopher. It is known only from a spot where a little soil had accumulated at 3,000 feet altitude in the exceedingly rocky Coyote Mountains. It is associated with the catsclaw (*Aca-cia greggii*), mesquite (*Prosopis juliflora*), and other vegetation of the Lower Sonoran Zone.

THOMOMYS BOTTAE GRAHAMENSIS GOLDMAN

GRAHAM MOUNTAINS POCKET GOPHER

Thomomys fulvus grahamensis Goldman, Jour. Wash. Acad. Sci. 21 (17): 420, October 19, 1931.

Type.—From Graham Mountains (=Pinaleno Mountains), Graham County, Ariz. (altitude 9,200 feet); collected by Ernest G. Holt, June 7, 1914.

General characters.—A dark, high-mountain subspecies, resembling *fulvus* of the Mogollon Plateau region, but upper parts near ochraceous-buff instead of ochraceous-tawny, but as in *fulvus* rather heavily mixed with black; skull narrower, with zygomata less widely spreading. About like *collinus* of the Chiricahua Mountains in color; skull narrower, but interorbital region broader.

Measurements.—An adult male: Total length, 231; tail vertebrae, 71; hind foot, 29 millimeters. An adult female: 228; 76; 28 millimeters.

Distribution and habitat.—This subspecies is known only from the forested upper slopes (6,100 to 9,200 feet altitude) of the Graham Mountains, which like other ranges of the general region, rise steeply, island-like, from arid surrounding plains and valleys. This pocket gopher burrows in soft soil in the Transition Zone, and is numerous in the grassy high mountain meadows bordered by firs (*Pseudotsuga*) and spruces (*Picea*) in the Canadian Zone along the crest of the range. Pocket gophers from Fort Grant at the west base are closely allied to *grahamensis*, but are much paler and are referred to *extenuatus*. Along the arid, eastern basal slopes of the Graham Mountains pocket gophers are scarce or absent, and *grahamensis* contrasts strongly with *alienus*, which is abundant along the Gila Valley.

THOMOMYS BOTTAE EXTENUATUS GOLDMAN

SULPHUR SPRINGS VALLEY POCKET GOPHER

Thomomys bottae extenuatus Goldman, Biol. Soc. Wash. Proc. 48: 149. October 31, 1935.

Type.—From Willcox, Cochise County, Ariz. (altitude 4,000 feet); collected by Vernon Bailey, November 27, 1889.

General characters.—This small cinnamon-buff or light tawny pocket gopher, with strongly decurved upper incisors and large auditory bullae, is allied to several neighboring forms from all of which it differs in combination of size, color, and skull structure. Similarity in color of *extenuatus* to *alienus* of the lower elevations along the San Pedro and Gila River Valleys is evident, but the smaller general size and more swollen auditory bullae of *extenuatus* are distinctive. *Extenuatus* is about the same in size as, and evidently related to, the neighboring high-mountain forms *grahamensis*, *collinus*, *catalinae*, and *hueyi* but differs from all in lighter color and cranial details. In size and color *extenuatus* closely approaches *Thomomys baileyi mearnsi*, and the two occur together in places; *extenuatus* may be recognized by the higher brain case and heavier dentition, and the upper incisors are more strongly recurved instead of projecting forward beyond the nasals as in *mearnsi*.

Measurements.—An adult male and an adult female topotype, respectively: Total length, 203, 198; tail, 67, 67; hind foot, 27.5, 29 millimeters.

Distribution and habitat.—The range of *extenuatus* embraces the desert plains and the basal mountain slopes bordering the Sulphur Springs Valley, and adjoining valleys near the top of the Continental Divide, extending east into the San Simon Valley, north to Fort Grant, and west across the upper part of the San

Pedro Valley to Oracle. The general area lies near the boundary between the Upper and Lower Sonoran Zones. In this region, as near Willcox, the ranges of *extenuatus* and *mearnsi*, which are regarded as representatives of distinct species, interdigitate, and careful examination of skulls may be necessary to distinguish them.

THOMOMYS BOTTAE CATALINAE GOLDMAN

SANTA CATALINA POCKET GOPHER

Thomomys fulvus catalinae Goldman, Jour. Wash. Acad. Sci. 21 (17): 419, October 19, 1931.

Type.—From Summerhaven, Santa Catalina Mountains, Pima County, Ariz. (altitude 7,500 feet); collected by E. A. Goldman, August 6, 1923.

General characters.—A small, notably dark-colored subspecies, the upper parts tawny, heavily mixed with black. Closely allied to *hueyi* of the Rincon Mountains, but darker in color, the upper parts more profusely mixed with black, and the under parts having a darker buff tone. Closely resembles *collinus* of the Chiricahua Mountains in dark color, but skull flatter and narrower; zygomata less widely spreading.

Measurements.—Average of four adult male topotypes: Total length, 211 (204-220); tail vertebrae, 64 (58-72); hind foot, 28.5 (27.5-30) millimeters. Average of four adult female topotypes: 202 (196-212); 59 (55-62); 25 (24-26) millimeters.

Distribution and habitat.—This richly colored pocket gopher is restricted to the upper slopes of the Santa Catalina Mountains, where it burrows in the soft, gravelly soil in rather open stands of timber, largely yellow pines and oaks, in the Transition Zone at 7,000 to 8,000 feet altitude. It also occurs, however, among Canadian Zone elements nearer the summit of Mount Lemmon. The oak belt along the northern basal slope of these mountains, at Oracle, is inhabited by pocket gophers obviously closely related to the present form, but that in color are more like *extenuatus*, to which they are referred. The Santa Catalina Mountains are connected across a saddle or pass with the Rincon Mountains, the upper slopes of which are occupied by the closely related, but paler, form *hueyi*. Mountainous masses of nearly solid rock tend to separate the two, and the well marked, small, local form *parvulus* is interposed in a series of shallow, rock-bound depressions filled with stony soil in the pass. Pocket gophers appear to be absent in a broad, arid belt along the southern side of the Santa Catalina Mountains, and no evidence of intergradation with *modicus*, which is common along the Santa Cruz River near Tucson, is found.

THOMOMYS BOTTAE PARVULUS GOLDMAN

INTERMOUNTAIN POCKET GOPHER

Thomomys bottae parvulus Goldman, Jour. Wash. Acad. Sci. 28 (7): 339, July 15, 1938.

Type.—From the pass between the Santa Catalina and Rincon Mountains, Pima County, Ariz. (altitude 4,500 feet); collected by Luther C. Goldman, June 5, 1937.

General characters.—A very small cinnamon or tawny subspecies; mammae, pectoral two pairs, inguinal two pairs. Allied to *catalinae* of the upper slopes of the closely adjoining Santa Catalina Mountains, and to *hueyi* of similar proximity in the Rincon Mountains, but much smaller than either, color lighter, more inclining toward tawny.

Measurements.—Two adult male topotypes, respectively: Total length, 203, 211; tail, 60, 57; hind foot, 27, 25 millimeters. Two adult female topotypes, respectively: 190, 188; 56, 55; 25, 25 millimeters.

Distribution and habitat.—These diminutive pocket gophers are apparently restricted in range to gravelly pockets in the granitic formation in the pass between the Santa Catalina and Rincon Mountains. Here they are numerous, although the soil is so thin and scanty that gopher excavations consist largely of pebbles. Massive rock exposures in the vicinity may be effective barriers limiting distribution. The area, at 4,000 to 4,500 feet altitude, is near the boundary between the Upper Sonoran and Lower Sonoran Zones, as shown by overlapping floral elements. The Upper Sonoran Zone is represented by the lower edge of the oaks (*Quercus arizonica* and *Q. emoryi*), but along these is a thin stand of mesquite (*Prosopis juliflora*), catsclaw (*Acacia greggii*), and desertwillow (*Chilopsis linearis*).

THOMOMYS BOTTAE HUEYI GOLDMAN

RINCON MOUNTAINS POCKET GOPHER

Thomomys bottae hueyi Goldman, Jour. Wash. Acad. Sci. 28 (7): 340, July 15, 1938.

Type.—From Spud Rock Ranger Station, Rincon Mountains, Pima County, Ariz. (altitude 7,400 feet); collected by Laurence M. Huey, June 17, 1932.

General characters.—A small, cinnamon subspecies, closely allied to *catalinae* of the adjoining Santa Catalina Mountains, but upper parts less profusely mixed with black, and under parts a lighter buff tone. Larger than its near neighbor *parvulus*, which occupies the pass between the Rincon Mountains and Santa Catalina Mountains; color darker, less tawny.

Measurements.—Two adult male topotypes, respectively: Total length, 220, 220; tail, 62, 66; hind foot, 30, 29 millimeters. Two adult female topotypes, respectively: 198, 196; 60, 60; 26, 27 millimeters.

Distribution and habitat.—In the Rincon Mountains *hueyi* is known from the Transition Zone near the top at 7,400 to 7,900 feet altitude. Pocket gophers that appear to be referable to this subspecies are also found at about 7,000 feet altitude in Ramsay Canyon and in the head of Miller Canyon in the Huachuca Mountains. The same subspecies may inhabit the Whetstone Mountains and elevated plains between the two localities mentioned. In the Rincon Mountains massive rock exposures apparently separate the habitat of *hueyi* from that of *parvulus* in the pass connecting this range with the Santa Catalina Mountains.

THOMOMYS BOTTAE COLLINUS GOLDMAN

CHIRICAHUA MOUNTAIN POCKET GOPHER

Thomomys fulvus collinus Goldman, Jour. Wash. Acad. Sci. 21 (17): 421, October 19, 1931.

Thomomys umbrinus chiricahuae Nelson and Goldman, Jour. Mammal. 15 (2): 117, May 15, 1934. Type from Pinery Canyon, Chiricahua Mountains, Ariz. (altitude 7,500 feet).

Type.—From Fly Park, Chiricahua Mountains, Cochise County, Ariz. (altitude 9,000 feet); collected by A. K. Fisher, June 10, 1894.

General characters.—A dark, high-mountain subspecies, resembling *catalinae* of the Santa Catalina Mountains and *grahamensis* of the Graham Mountains, but skull differing in more widely spreading zygomata and other details. Pectoral mammae, normally two pairs, but they may vary to one pair.

Measurements.—Average of five adult males: Total length, 213 (207-222); tail vertebrae, 58 (50-60); hind foot, 28.3 (27-30) millimeters.

Distribution and habitat.—Like some other high-mountain forms of the general region, this pocket gopher is restricted to a single mountain range, and in this case the Chiricahua Mountains. It ranges from the mouths of Cave and Turkey Creeks at about 5,000 feet altitude on the eastern and western sides, respectively, to the extreme summit of Fly Peak, at 9,700 feet, but is most abundant in the soft, dark soil of mountain meadows, such as Rustler Park, at 8,500 feet altitude in the Canadian Zone. Specimens from the lower elevations are somewhat paler and approach *extenuatus* of the Sulphur Springs Valley region. A few specimens from 7,500 feet in Pinery Canyon are small, and as only one pair of pectoral mammae was found, they were described as *Thomomys umbrinus*

chiricahuae, but the number of these mammae proves to vary from normal in some individuals. Additional specimens of *collinus* indicate that the characters ascribed to *chiricahuae* are within the range of individual variation in that form.

THOMOMYS BOTTAE MODICUS GOLDMAN

ALTAR VALLEY POCKET GOPHER

Thomomys fulvus modicus Goldman, Jour. Wash. Acad. Sci. 21 (17): 418, October 19, 1931.

Type.—From La Osa (near Mexican Boundary), southern end of Altar Valley, Pima County, Ariz.; collected by E. A. Mearns and F. X. Holzner, December 14, 1893.

General characters.—A dark-colored subspecies of medium size. Closely allied to *cervinus* of the Salt River Valley, but smaller; upper parts near wood brown or cinnamon, varying to rich tawny instead of vinaceous-buff or fawn color; skull more slender.

Measurements.—Average of four adult male topotypes: Total length, 214 (204-222); tail vertebrae, 67 (55-75); hind foot, 28 (25.5-30) millimeters. Average of six female topotypes: 208 (198-224); 69 (60-74); 27.5 (26.5-28) millimeters.

Distribution and habitat.—The general range of this subspecies includes the Altar Valley, the upper part of the Santa Cruz River Valley, and neighboring valleys and desert plains as far west as Sells, and east to Fort Huachuca. The altitudinal limits are from about 2,500 to about 4,500 feet, mainly in the upper part of the Lower Sonoran Zone. The vegetation consists prominently of mesquite (*Prosopis juliflora*), catsclaw (*Acacia greggii*), palo-verde (*Cercidium torreyanum*), creosotebush (*Covillea tridentata*), and many cactuses. The gophers range up in places, however, along the basal slopes of the mountains into the lower edge of the oaks (*Quercus emoryi* and *Quercus arizonica*), marking the Upper Sonoran Zone. Distribution, as in many other forms of the group, is not continuous. These pocket gophers exhibit a preference for the softer soils along streams and dry washes, which may be separated by many miles of unoccupied desert. Along the lower slopes of the Santa Rita and Huachuca Mountains, *modicus* meets the range of *Thomomys umbrinus proximus*, regarded as a representative of a distinct species.

THOMOMYS ALEXANDRAE GOLDMAN

NAVAJO POCKET GOPHER

Thomomys alexandrae Goldman, Jour. Wash. Acad. Sci. 23 (10): 464, October 15, 1933.

Type.—From 5 miles southeast of Rainbow Lodge, near Navajo

Mountain, Coconino County, Ariz. (altitude 6,200 feet); collected by E. A. Goldman, June 16, 1933.

General characters.—An apparently distinct species of the *Thomomys bottae* group, allied to *aureus* of the adjoining desert region, but decidedly smaller; color much duller, near cinnamon-buff instead of rich ochraceous-tawny; skull flatter and slenderer, with more widely separated temporal ridges.

Measurements.—An adult male: Total length, 210; tail, 60; hind foot, 28 millimeters. An adult female: 215; 70; 27 millimeters.

Distribution and habitat.—The Navajo pocket gopher is common in places on the nearly flat sagebrush-covered mesa at 6,200 feet altitude south of Navajo Mountain. It has also been recorded by Benson (Univ. Calif. Pub. Zool. 40: 449, Dec. 31, 1935) from near Soldier Spring at 8,600 feet on Navajo Mountain, just across the Utah line. The species appears to be isolated in a somewhat triangular area between the precipitous walls of Navajo and Pinto Creek canyons which diverge to the Colorado River. Along the narrow divide between the upper courses of these creeks the solid bedrock formation is nearly bare of soil for miles. None of the characteristic gopher mounds was seen, and this barren ridge, as well as the canyons, may have served as an effective barrier isolating the habitat of *alexandrae* for thousands of years.

THOMOMYS SUBOLES GOLDMAN

SEARCHLIGHT FERRY POCKET GOPHER

Thomomys fulvus suboles Goldman, Biol. Soc. Wash. Proc. 41: 203, December 18, 1928.

Type.—From Old Searchlight Ferry, Colorado River, northwest of Kingman, Mohave County, Ariz. (altitude 600 feet); collected by Luther C. Goldman, September 26, 1923.

General characters.—A small, light-colored species, allied to *desertorum* of the Detrital Valley, but more ochraceous-tawny; skull more angular, narrower, but heavier in detail; maxillary arms of zygomata much broader, with acutely projecting lateral angles; auditory bullae more compressed laterally, less rounded.

Measurements.—An adult male: Total length, 227; tail vertebrae, 75; hind foot, 30 millimeters. An adult female: 194; 62; 26.5 millimeters.

Distribution and habitat.—In an embayment of the escarpment flanking the Colorado River, near Old Searchlight Ferry, above Pyramid Canyon, and northwest of Kingman, Ariz., are alluvial bottoms extending for several miles until interrupted by cliffs

rising abruptly from the water. The bottoms, consisting of soft, sandy soil, are overgrown with mesquite (*Prosopis*), catsclaw (*Acacia greggii*), and other Lower Sonoran Zone vegetation. The pocket gophers have become isolated here in a narrow belt between the river and the escarpment, which arises steeply to the crest of a rocky ridge at about 3,500 feet altitude. These pocket gophers have evidently found their restricted habitat congenial as attested by their numbers. The distribution and habitat of *suboles* in relation to other species have been discussed in detail by Grinnell and Hill (Jour. Mammal. 17 (1): 7-10, Feb. 17, 1936), who refer to the occurrence of a quite different subspecies, *Thomomys bottae centralis*, on the opposite side of the Colorado River, although the two forms live under similar conditions of soil, climate, and food.

THOMOMYS MURALIS GOLDMAN

GRAND CANYON POCKET GOPHER

Thomomys muralis Goldman, Jour. Wash. Acad. Sci. 26 (3): 112, March 15, 1936.

Type.—From lower end of Prospect Valley, Grand Canyon, Hualpai Indian Reservation, Ariz. (altitude 4,500 feet); collected by E. A. Goldman, October 3, 1913.

General characters.—A diminutive ochraceous buffy or somewhat tawny species, similar in size and in color to, and closely resembling, *desertorum*, but cranial characters distinctive; brain case more rounded and inflated, the basicranial region tending to bulge more prominently posteriorly; frontal region broader; upper incisors more strongly recurved. Differs from *fulvus* in lighter color, and smaller size, the skull more delicate in structure and exhibiting a departure in about the same details as from *desertorum*.

Measurements.—*Type*, an adult male: Total length, 194; tail, 64; hind foot, 26 millimeters. Two adult female topotypes, respectively: 182, 190; 57, 56; 24.5, 25.5 millimeters.

Distribution and habitat.—Isolated on terraces along the inner gorge below the outer rim in Prospect Valley, a lateral pocket within the Grand Canyon, near the eastern end of the Hualpai Indian Reservation. The geographic isolation of *muralis* in the Grand Canyon appears to be complete, and characters presented suggest full specific rank. In places it was found inhabiting strips of soil on ledges only a few feet wide, bounded above and below by vertical cliffs hundreds of feet high. *Zonal range*: Upper Sonoran.

THOMOMYS HARQUAHALAE GRINNELL AND HILL

RANEGRAS PLAIN POCKET GOPHER

Thomomys harquahalae Grinnell and Hill, Jour. Mammal. 17 (1): 7, February 17, 1936.

Type.—From Ranegras Plain, 10 miles west of Hope, Yuma County, Ariz. (altitude about 1,250 feet); collected by Louise Kellogg, February 27, 1934.

General characters.—A large pinkish buff species; skull with widely spreading zygomata and anteriorly projecting upper incisors. Not very closely allied to any other known form, and therefore accorded full specific status. Similar to *chrysonotus* of the Colorado River Valley, but paler (cinnamon-buff in *chrysonotus*); zygomata wider; upper incisors strongly procumbent instead of strongly decurved; auditory bullae shorter, more rounded, less projecting below plane of basioccipital.

Measurements.—An adult male: Total length, 236; tail vertebrae, 69; hind foot, 31 millimeters. An adult female: 210; 62; 29.5 millimeters.

Distribution and habitat.—Known only from a colony along the highway where it crosses the lowest part of the broad open grassy Ranegras Plain west of Hope. The soil in which these pocket gophers burrow is compact in texture and difficult to perforate, suggesting a possible special use for the forward-curving incisors. Many mounds, marking excavations in the highway embankment, where food appears to be scanty, indicate that the animals welcome a change from the hard soil of their natural habitat.

SUBSPECIES OF THOMOMYS BAILEYI GROUP

THOMOMYS BAILEYI MEARNISI BAILEY

MEARNS POCKET GOPHER

Thomomys mearnsi Bailey, Biol. Soc. Wash. Proc. 27: 117, July 10, 1914.

Type.—From Gray's Ranch, Animas Valley, southwest corner of Grant County, N. Mex.; collected by E. A. Goldman, August 10, 1908.

General characters.—This subspecies, a near relative of typical *baileyi* of western Texas, requires close comparison with *extenuatus*, a form of the *bottae* group in Arizona, as the ranges of the two meet or interdigitate. In cinnamon-buff or light tawny coloration *mearnsi* resembles *extenuatus*, and for differential characters recourse must be had to the skull, which is very similar in general, but relatively broader with a somewhat lower, flatter brain case, a combination of characters apparently indicating group relationship. In *mearnsi* the dentition is lighter, the upper

incisors narrower, more projecting forward beyond the nasals.

Measurements.—Type, adult male, and an adult female topotype, respectively: Total length, 220, 201; tail, 67, 65; hind foot, 31, 29 millimeters.

Distribution and habitat.—The range of *mearnsi* extends from the Animas Valley, southwestern New Mexico, into the elevated plains region mainly in the lower part of the Upper Sonoran Zone of southeastern Arizona. Specimens were obtained in soft moist ground along a small stream at San Bernardino, near the Mexican Boundary and on the open plain near Willcox in the Sulphur Springs Valley. While *mearnsi* and *extenuatus* appear to be typically quite distinct, their general ranges meet or interdigitate and specimens from San Simon Valley suggest the possibility of hybridism. The exact habitat relations of the two forms remain, therefore, to be determined.

SUBSPECIES OF THOMOMYS TALPOIDES GROUP

THOMOMYS TALPOIDES KAIBABENSIS GOLDMAN

KAIBAB PLATEAU POCKET GOPHER

Thomomys fossor kaibabensis Goldman, Jour. Wash. Acad. Sci. 28 (7): 333, July 15, 1938.

Type.—From DeMotte Park, Kaibab Plateau, Ariz. (altitude 9,000 feet); collected by Luther C. Goldman, September 10, 1937.

General characters.—Resembles *fossor* of southwestern Colorado, but larger, less rufescent; skull with more widely spreading zygomata; interparietal smaller; auditory bullae larger; upper incisors broader, less recurved.

Measurements.—An adult male and an adult female topotype, respectively: Total length, 238, 230; tail, 58, 77; hind foot, 31, 30 millimeters.

Distribution and habitat.—The Kaibab Plateau pocket gopher appears to be restricted to the higher parts of the well forested Kaibab Plateau, which rises island-like from arid plains or broad valleys toward the north and presents a sheer face along the north side of the deepest part of the Grand Canyon. This pocket gopher occurs irregularly in local colonies mainly in the Canadian Zone at 8,500 to 9,000 feet altitude. These animals are numerous in the soft soil in DeMotte Park near the top of the plateau, an open grassy meadow several miles in length, bordered by fir, spruce, and aspen forest. Specimens have also been taken near the northern rim of the Grand Canyon.

General habits.—In DeMotte Park, on the Kaibab Plateau, when the deep snow of winter melts away, many lines of earth 5 to 10

feet in length, with branches, are revealed radiating from the entrances to the burrows of the gophers. These cylindrical dumps, in addition to the usual mounds, are evidence of burrowing operations late in winter that seem to be followed in spring by a period of comparative inactivity.

THOMOMYS TALPOIDES FOSSOR ALLEN

ROCKY MOUNTAIN POCKET GOPHER

Thomomys fossor Allen, Amer. Mus. Nat. Hist. Bull. 5: 51, April 28, 1893.

Type.—From Florida, La Plata County, Colo. (altitude 7,200 feet); collected by Charles P. Rowley, June 25, 1892.

General characters.—Small pocket gophers, characterized by the chestnut brown overtone of the top of head and back and conspicuous black ear patches; skull (compared with *bottae* group) narrow, with widely separated temporal ridges; interparietal triangular; zygomata depressed posteriorly, the jugal sloping upward to join maxilla anteriorly; auditory meatus large and prominent.

Measurements.—An adult male and an adult female, respectively, from the Lukachukai Mountains: Total length, 212, 210; tail, 70, 60; hind foot, 30, 28 millimeters.

Distribution and habitat.—The Rocky Mountain pocket gopher is a denizen of the upper slopes of high mountains. In Arizona *fossor* is known only from about 8,000 to 9,000 feet altitude, mainly in the Canadian Zone, near the tops of the Tunitcha and Lukachukai Mountains in the northeastern corner of the State. Here its range seems to meet that of *Thomomys bottae peramplus*, which extends from the lower slopes upward to about 8,000 feet, but the two forms are not known to occupy the same local terrain.

SUBSPECIES OF THOMOMYS UMBRINUS GROUP

THOMOMYS UMBRINUS PROXIMUS BURT AND CAMPBELL

ARIVACA POCKET GOPHER

Thomomys burti proximus Burt and Campbell, Jour. Mammal. 15 (2): 151, May 15, 1934.

Type.—From Old Parker Ranch (Pickett's Ranch on U. S. Geological Survey topographic map, Patagonia Quadrangle, edition of August 1905), altitude 4,800 feet, west slope of Santa Rita Mountains, Pima County, Ariz.; collected by W. H. Burt, June 9, 1931.

General characters.—A small, pale russet-colored form, similar to *Thomomys umbrinus burti* of the upper slopes of the Santa Rita Mountains. Some specimens are not very unlike *Thomomys bottae modicus* of the neighboring plains, representing a distinct species;

pectoral mammae, sometimes two pairs, as in *modicus*; skull more slender, with narrower nasals and smaller auditory bullae. Similar in size to *burti*, but upper parts paler, less deep russet, with a less well defined, less uniformly darkened median dorsal area, skull very similar.

Measurements.—Type, an adult female: Total length, 193; tail, 61; hind foot, 25 millimeters. Two adult males, respectively, from Fort Huachuca: 200, 195; 59, 54; 27, 26 millimeters.

Distribution and habitat.—A few specimens have been taken at the type locality on the west slope of the Santa Rita Mountains, at the Empire Ranch, east of these mountains, at Fort Huachuca and at Arivaca. At Arivaca, W. P. Taylor collected two specimens on the same day, one of which is referred to *proximus* and the other to typical *modicus*, a representative of a species regarded as distinct. Of 20 specimens from the Empire Ranch, 19 are nearly typical *modicus*, but one is referred to *proximus*. This single individual was also obtained by Taylor on the same day and at the same recorded altitude (4,632 feet) as an example of *modicus*. The occurrence of two species of pocket gophers regarded as distinct in such close proximity is unusual. *Zonal range*: Upper Sonoran, as indicated by open stands of oaks (*Quercus emoryi* and *Quercus arizonica*); altitude, 4,500 to 4,800 feet.

THOMOMYS UMBRINUS BURTI HUEY

SANTA RITA MOUNTAIN POCKET GOPHER

Thomomys burti Huey, San Diego Soc. Nat. Hist. Trans. 7 (15): 158, July 28, 1932.

Type.—From Madera Canyon, Santa Rita Mountains, Santa Cruz County, Ariz. (altitude 6,000 feet); collected by W. H. Burt, May 29, 1931.

General characters.—A small, dark subspecies, with a coloration unusual except in closely allied forms; upper parts between cinnamon and cinnamon-brown or russet, becoming uniformly blackish along the moderately broad, well defined median area from top of head to rump; skull small, brain case smoothly rounded; nasals wedge-shaped, emarginate posteriorly; auditory bullae small; mammae, pectoral one pair, inguinal two pairs. Closely allied to *intermedius* of the upper slopes of the Huachuca Mountains; color slightly paler, dentition heavier.

Measurements.—An adult male and an adult female topotype, respectively: Total length, 217, 200; tail, 60, 61; hind foot, 27.5, 26 millimeters.

Distribution and habitat.—Restricted to the Santa Rita Mountains, southern Arizona. *Zonal range*: from 4,500 feet altitude in

the Upper Sonoran Zone near the mouth of Madera Canyon up to 8,000 feet in the Transition Zone near the summit. The burrows are located in the softer soil, usually in small open meadows.

THOMOMYS UMBRINUS QUERCINUS BURT AND CAMPBELL

PAJARITO MOUNTAIN POCKET GOPHER

Thomomys burti quercinus Burt and Campbell, Jour. Mammal. 15 (2): 150, May 15, 1934.

Type.—From Peña Blanca Spring, Pajarito Mountains, Ariz. (altitude 4,500 feet, near Mexican Boundary, north of Monument 128); collected by Berry Campbell, July 15, 1933.

General characters.—A small, cinnamon subspecies; mammae, pectoral one pair, inguinal two pairs. Closely allied to *proximus*, but still smaller; coloration of the same pattern and general tones; skull smaller, more delicate in structure; nasals slightly shorter, reaching anterior plane of zygomata.

Measurements.—An adult male topotype: Total length, 198; tail, 60; hind foot, 27 millimeters. Type, female, and an adult female topotype, respectively: 193, 182; 61, 56; 25, 25 millimeters.

Distribution and habitat.—The known range of this close relative of *proximus* is from 4,500 feet altitude at the type locality in the Pajarito Mountains to about 6,000 feet in the pass over the summit of the Patagonia Mountains. Both localities are in the oak belt in the Upper Sonoran Zone. At Peña Blanca Spring burrows indicating a small colony were found in gravelly soil along a broad wash. At the time of the writer's visit in June the ground was very dry, no fresh gopher excavations were in evidence, and specimens were difficult to obtain. In the pass over the Patagonia Mountains, where the slopes are steep and brush-covered, considerable search failed to reveal the excavations of any gophers except those of the single individual taken.

THOMOMYS UMBRINUS INTERMEDIUS MEARNS

HUACHUCA MOUNTAIN POCKET GOPHER

Thomomys fulvus intermedius Mearns, U. S. Nat. Mus. Proc. 19: 719, July 30, 1897.

Type.—From summit of the Huachuca Mountains, southern Arizona (altitude 9,000 feet); collected by F. X. Holzner, September 6, 1893.

General characters.—A small, dark subspecies, closely allied to *burti* of the Santa Rita Mountains; color slightly darker; skull very similar, but nasals longer; dentition lighter.

Measurements.—Type: Total length, 200; tail, 66; hind foot, 26 millimeters.

Distribution and habitat.—The type, from 9,000 feet altitude near the summit of the Huachuca Mountains, is the only specimen examined and definitely assigned to this form. Specimens from Fort Huachuca, near the north base of the mountains, are referred to *proximus*.

INDEX

[Principal page references to a species in **boldface**; synonyms in *italic*]

- absonus, *Thomomys bottae*, 3, 8, **10**.
Thomomys perpallidus, 10.
- albatu*s, *Thomomys*, 19.
Thomomys bottae, 2, 3, 16, 18, **19**,
 20, 21.
- alexandrae*, *Thomomys*, 3, 28.
- alienus*, *Thomomys bottae*, 3, 19, 24.
- apache*, *Thomomys bottae*, 12.
- aridicola*, *Thomomys bottae*, 3, 21.
- Arivaca pocket gopher, **33**.
- aurcus*, *Thomomys*, 11.
Thomomys bottae, 3, 11, 12, 14, 29.
- baileyi*, *Thomomys*, 1, 4, 5.
- Big Sandy River pocket gopher, 14.
- bottae*, *Thomomys*, 1, 2, 6.
- burti*, *Thomomys*, 34.
Thomomys umbrinus, 5, 33, 34.
- catalinae*, *Thomomys bottae*, 3, 24, 25,
 26, 27.
Thomomys fulvus, 25.
- centralis*, *Thomomys bottae*, 7, 30.
- cervinus*, *Thomomys*, 17.
Thomomys bottae, 3, 17, 21, 28.
- Characters, 2.
- Chiricahua Mountain pocket gopher,
 27.
- chiricahuac*, *Thomomys umbrinus*, 27.
- chrysonolus*, *Thomomys*, 15.
Thomomys bottae, 3, 15, 31.
- collinus*, *Thomomys bottae*, 3, 23, 24, 27.
Thomomys fulvus, 27.
- Comobabi pocket gopher, 22.
- comobabiensis*, *Thomomys bottae*, 3, 22.
- Coyote Mountain pocket gopher, 23.
- depauperatus*, *Thomomys bottae*, 3, 20.
Thomomys perpallidus, 20.
- desertorum*, *Thomomys*, 12.
Thomomys bottae, 3, 12, 14, 16, 29,
 30.
- desitus*, *Thomomys bottae*, 3, 12, 14, 15,
 17.
- Detrital Valley pocket gopher, 12.
- Economic status, 6.
- extenuatus*, *Thomomys bottae*, 3, 24,
 25, 27, 31, 32.
- Fawn-colored pocket gopher, 17.
flavidus, *Thomomys fulvus*, 15.
fossor, *Thomomys*, 33.
Thomomys talpoides, 5, 12, 33.
- Fulvous pocket gopher, 13.
- fulvus*, *Geomys*, 13.
Thomomys bottae, 3, 11, 13, 14, 15,
 17, 23, 30.
- Geomys fulvus*, 13.
- Gila Bend pocket gopher, 21.
- Golden pocket gopher, 15.
- Graham Mountains pocket gopher, 23.
- grahamensis*, *Thomomys bottae*, 3, 23,
 24, 27.
Thomomys fulvus, 23.
- Grand Canyon pocket gopher, **30**.
- Group, *Thomomys baileyi*, 1, 4, 5 (dis-
 trib. map), 31.
Thomomys bottae, 1, 2, 3 (distrib.
 map), 7.
Thomomys talpoides, 1, 5 (distrib.
 map), 32.
Thomomys umbrinus, 1, 5 (distrib.
 map), 6, 33.
- Growler Valley pocket gopher, 22.
- growlerensis*, *Thomomys bottae*, 3, 22.
- Harquahala Mountain pocket gopher,
 16.
- harquahalae*, *Thomomys*, 3, 31.
- Hassayampa Valley pocket gopher, 16.
- House Rock Valley pocket gopher, 10.
- Huachuca Mountain pocket gopher, 35.
- Hualpai Mountains pocket gopher, 11.
- hualpaiensis*, *Thomomys bottae*, 3, 11.
- lneyi*, *Thomomys bottae*, 3, 24, 26.
- intermedius*, *Thomomys fulvus*, 35.
Thomomys umbrinus, 5, 34, 35.
- Intermountain pocket gopher, 26.
- Kaibab Plateau pocket gopher, 32.
- kaibabensis*, *Thomomys fossor*, 32.
Thomomys talpoides, 5, 32.
- latirostris*, *Thomomys*, 11.
- Mearns pocket gopher, 31.
mearusi, *Thomomys*, 31.
Thomomys baileyi, 5, 24, 25, 31.
- medius*, *Thomomys bottae*, 3, 18, 22,
 23, 25, 28, 33, 34.
Thomomys fulvus, 28.
- Mount Trumbull pocket gopher, 9.
- muralis*, *Thomomys*, 3, 4, 30.
- mutabilis*, *Thomomys bottae*, 3, 14, 15,
 17, 18, 19.
- uasutus*, *Thomomys bottae*, 13.
- Navajo pocket gopher, 28.
- nicholi*, *Thomomys bottae*, 3, 7, 9.
- operosus*, *Thomomys bottae*, 3, 15.
- Painted Desert pocket gopher, 11.
- Pajarito Mountain pocket gopher, 34.
- parvulus*, *Thomomys bottae*, 3, 26, 27.
- patulus*, *Thomomys bottae*, 3, 15, 16.
- Peoples Valley pocket gopher, 15.
- peramplus*, *Thomomys bottae*, 3, 11, 12,
 33.
Thomomys fulvus, 12.
- phasma*, *Thomomys bottae*, 3, 20, 22.
Thomomys fulvus, 20.
- Phoenix pocket gopher, 17.
- Pinal Mountains pocket gopher, 18.

- pinalensis, *Thomomys bottae*, 3, 18.
 planirostris, *Thomomys bottae*, 3, 8, 9, 10.
 Thomomys perpallidus, 8.
 Pocket gopher, Arivaca, 33.
 Big Sandy River, 14.
 Chiricahua Mountain, 27.
 Comobabi, 22.
 Coyote Mountain, 23.
 Detrital Valley, 12.
 fawn-colored, 17.
 fulvous, 13.
 Gila Bend, 21.
 golden, 15.
 Graham Mountains, 23.
 Grand Canyon, 30.
 Growler Valley, 22.
 Harquahala Mountain, 16.
 Hassayampa Valley, 16.
 House Rock Valley, 10.
 Huachuca Mountain, 35.
 Hualpai Mountains, 14.
 intermountain, 26.
 Kaibab Plateau, 32.
 Mearns, 31.
 Mount Trumbull, 9.
 Navajo, 28.
 Painted Desert, 11.
 Pajarito Mountain, 35.
 Peoples Valley, 15.
 Phoenix, 17.
 Pinal Mountains, 18.
 Ranegras Plain, 31.
 Rincon Mountains, 26.
 Rocky Mountain, 33.
 Santa Catalina, 25.
 Santa Rita Mountain, 34.
 Searchlight Ferry, 29.
 Shivwits Plateau, 7.
 Sulphur Springs Valley, 24.
 Tinajas Altas, 20.
 Tule Desert, 20.
 Tunitcha Mountain, 12.
 Upper Gila Valley, 19.
 Verde Valley, 17.
 Virgin Valley, 7.
 whitish, 19.
 Zion Park, 8.
proximus, *Thomomys burti*, 33.
 Thomomys umbrinus, 5, 33, 34, 35.
pusillus, *Thomomys bottae*, 3, 23.
 Thomomys fulvus, 23.
quercinus, *Thomomys burti*, 35.
 Thomomys umbrinus, 5, 35.
 Ranegras Plain pocket gopher, 31.
 Rincon Mountains pocket gopher, 26.
riparius, *Thomomys bottae*, 16.
 Rocky Mountain pocket gopher, 32.
 Santa Catalina pocket gopher, 25.
 Santa Rita Mountain pocket gopher, 34.
 Searchlight Ferry pocket gopher, 29.
 Shivwits Plateau pocket gopher, 7.
suboles, *Thomomys*, 3, 29.
- suboles*, *Thomomys*—Continued.
 Thomomys fulvus, 29.
subsimilis, *Thomomys bottae*, 3, 16.
 Thomomys fulvus, 16.
 Sulphur Springs Valley pocket gopher, 24.
talpoides, *Thomomys*, 1, 5, 6.
Thomomys albatrus, 19.
 alexandrae, 3, 28.
 aureus, 11.
 baileyi, 1, 4, 5.
 baileyi mearnsi, 5, 24, 25, 31.
 bottae, 1, 3 (distrib. map), 6.
 bottae absonus, 3, 8, 10.
 bottae albatrus, 2, 16, 18, 19, 20, 21.
 bottae alienus, 3, 19, 24.
 bottae apache, 12.
 bottae aridicola, 3, 21.
 bottae aureus, 3, 11, 12, 14, 29.
 bottae catalinae, 3, 24, 25, 26, 27.
 bottae centralis, 7, 30.
 bottae cervinus, 3, 17, 21, 28.
 bottae chrysonotus, 3, 15, 31.
 bottae collinus, 3, 23, 24, 27.
 bottae comobabiensis, 3, 22.
 bottae depauperatus, 3, 20.
 bottae desertorum, 3, 12, 14, 16, 29, 30.
 bottae desitus, 3, 12, 14, 15, 17.
 bottae extenuatus, 3, 24, 25, 27, 31, 32.
 bottae fulvus, 3, 11, 13, 14, 15, 17, 23, 30.
 bottae grahamensis, 3, 23, 24, 27.
 bottae growlerensis, 3, 22.
 bottae hualpaiensis, 3, 14.
 bottae hueyi, 3, 24, 26.
 bottae modicus, 3, 18, 22, 23, 25, 28, 33, 34.
 bottae mutabilis, 3, 14, 15, 17, 18, 19.
 bottae nasutus, 13.
 bottae nicholi, 3, 7, 9.
 bottae operosus, 3, 15.
 bottae parvulus, 3, 26, 27.
 bottae patulus, 3, 15, 16.
 bottae peramplius, 3, 11, 12, 33.
 bottae phasma, 3, 20, 22.
 bottae pinalensis, 3, 18.
 bottae planirostris, 3, 8, 9, 10.
 bottae pusillus, 3, 23.
 bottae riparius, 16.
 bottae subsimilis, 3, 16.
 bottae toltecus, 19.
 bottae trumbullensis, 3, 8, 9.
 bottae virgineus, 3, 7, 8.
burti, 34.
 burti proximus, 33.
 burti quescinus, 35.
 cervinus, 17.
 chrysonotus, 15.
 desertorum, 12.
 fossor, 32.
 fossor kaibabensis, 32.
 fulvus catalinae, 25.
 fulvus collinus, 27.
 fulvus flavidus, 15.

Thomomys—Continued.

fulvus grahamensis, 23.
fulvus intermedius, 35.
fulvus modicus, 28.
fulvus mutabilis, 17.
fulvus peramplius, 12.
fulvus phasma, 20.
fulvus pusillus, 23.
fulvus suboles, 29.
fulvus subsimilis, 16.
harquahalae, 3, 31.
latirostris, 11.
mearusi, 31.
muralis, 3, 4, 30.
perpallidus absonus, 10.
perpallidus depauperatus, 20.
perpallidus planirostris, 8.
suboles, 3, 29.
talpoides, 1, 5, 6.
talpoides fossor, 5, 6, 12, 33.
talpoides kaibabensis, 5, 32.
umbrinus, 1, 5, 6.

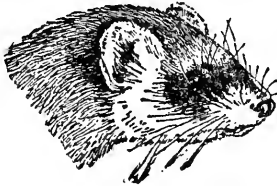
umbrinus burti, 5, 33, 34.
umbrinus chiricahuac, 27.
umbrinus intermedius, 5, 34, 35.
umbrinus proximus, 5, 33, 31, 35.
umbrinus quercinus, 5, 35.
 Tinajas Altas pocket gopher, 20.
 toltecus, *Thomomys bottae*, 19.
 Tule Desert pocket gopher, 20.
 Tumitcha Mountain pocket gopher, 12.
trumbullensis, *Thomomys bottae*, 3, 8,
 9.
umbrinus, *Thomomys*, 1, 5, 6.
 Upper Gila Valley pocket gopher, 19.
 Verde Valley pocket gopher, 17.
 Virgin Valley pocket gopher, 7.
virginus, *Thomomys bottae*, 3, 7, 8.
 Whitish pocket gopher, 19.
 Zion Park pocket gopher, 8.

* 5902.64

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

RACCOONS OF NORTH AND MIDDLE AMERICA

NORTH AMERICAN FAUNA 60





UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, *Secretary*
FISH AND WILDLIFE SERVICE
Albert M. Day, *Director*

North American Fauna 60

RACCOONS OF NORTH AND MIDDLE AMERICA

BY
EDWARD A. GOLDMAN

With
Foreword, Appendix, and Revision
of Bibliography
By
Hartley H. T. Jackson



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1950

FOREWORD

The present monograph, *The Raccoons of North and Middle America*, was completed by its author, Edward Alphonso Goldman, in December 1940, and early in 1941 was submitted for publication in the North American Fauna series. Advent of World War II delayed its printing, and at the time of the death of Major Goldman, September 2, 1946, he had been so engrossed in the preparation of his manuscript on *Biological Investigations in Mexico* that he had not revised the raccoon manuscript. In the meantime one new subspecies *Procyon lotor megalodons* Lowery had been described and several papers relating to raccoons had been published. Since Major Goldman's death another subspecific name *Procyon lotor maritimus* Dozier has appeared and a few other papers have been published.

In this final review and analysis of the manuscript it is believed desirable to leave Goldman's views and expressions as little changed as possible. Accordingly all editing has been done with this in view and only such changes made as would clarify and collate the text, or make consistent abbreviations and citations. Some important items to be noted have been indicated and explained in footnotes. No deletions of pertinent matter have been made. The bibliography (p. 87) has been extended to include literature published to date. The two subspecies, *Procyon lotor megalodons* Lowery (1943, p. 225) and *Procyon lotor maritimus* Dozier (1948, p. 286), descriptions of which may be found in the appendix (p. 84), have been included in the distributional map of species and subspecies of the subgenus *Procyon* (fig. 1) but have not been included in the list of North American species and subspecies, with type localities (p. 27), in the key to species and subspecies (p. 29), or in the general discussion throughout the text.

ILLUSTRATIONS

PLATE	Page
1. Pacific Northwest Raccoon (<i>Procyon lotor pacificus</i>)..... Frontispiece	
2. Skins (dorsal view) <i>Procyon lotor lotor</i> , <i>Procyon cancrivorus panamensis</i>	109
3. Skulls (lateral view) <i>Procyon lotor lotor</i> , <i>P. l. hirtus</i>	111
4. Skulls (lateral view) <i>Procyon lotor litoreus</i> , <i>P. l. elucus</i>	113
5. Skulls (lateral view) <i>Procyon lotor incautus</i> , <i>P. maynardi</i>	115
6. Skulls (lateral view) <i>Procyon lotor excelsus</i> , <i>P. l. psora</i>	117
7. Skulls (lateral view) <i>Procyon lotor hernandezii</i> , <i>P. l. pumilus</i>	119
8. Skulls (lateral view) <i>Procyon pygmaeus</i> , <i>P. insularis insularis</i>	121
9. Skulls (dorsal view) <i>Procyon lotor lotor</i> , <i>P. l. hirtus</i>	123
10. Skulls (dorsal view) <i>Procyon lotor litoreus</i> , <i>P. l. elucus</i>	125
11. Skulls (dorsal view) <i>Procyon lotor incautus</i> , <i>P. maynardi</i>	127
12. Skulls (dorsal view) <i>Procyon lotor excelsus</i> , <i>P. l. psora</i>	129
13. Skulls (dorsal view) <i>Procyon lotor hernandezii</i> , <i>P. l. pumilus</i>	131
14. Skulls (dorsal view) <i>Procyon pygmaeus</i> , <i>P. insularis insularis</i>	133
15. Skulls (ventral view) <i>Procyon lotor lotor</i> , <i>P. l. hirtus</i>	135
16. Skulls (ventral view) <i>Procyon lotor litoreus</i> , <i>P. l. elucus</i>	137
17. Skulls (ventral view) <i>Procyon lotor incautus</i> , <i>P. maynardi</i>	139
18. Skulls (ventral view) <i>Procyon lotor excelsus</i> , <i>P. l. psora</i>	141
19. Skulls (ventral view) <i>Procyon lotor hernandezii</i> , <i>P. l. pumilus</i>	143
20. Skulls (ventral view) <i>Procyon pygmaeus</i> , <i>P. insularis insularis</i>	145
21. Skulls (dorsal view) <i>Procyon lotor elucus</i> (male), <i>P. l. elucus</i> (female) <i>P. l. lotor</i> (lateral view of mandibular ramus).....	147
22. Skulls (dorsal and ventral views) <i>Procyon cancrivorus panamensis</i>	149
 FIGURE	
1. Map, showing distribution of species and subspecies of subgenus <i>Procyon</i>	24
2. Map, showing distribution of subgenus <i>Euprocyon</i> (<i>Procyon cancrivorus panamensis</i>) in Panama.....	81



THE RACCOONS OF NORTH AND MIDDLE AMERICA

By EDWARD A. GOLDMAN, *Senior Biologist, Biological Surveys, Branch of Wildlife Research*

INTRODUCTION

The raccoons, genus *Procyon*, colloquially known as "coons," belong to the carnivorous family Procyonidae, which also includes the American genera *Nasua*, *Nasuella*, *Bassaricyon*, and *Potos*, and the Old World genera *Ailurus* and *Ailuropoda* of the subfamily Ailurinae.

The members of the *Procyon lotor* group (subgenus *Procyon*), with a trancontinental range from southern Canada to Panama, except in parts of the Rocky Mountain region, and including those inhabiting several distant islands, are among the most familiar and characteristic of North American mammals. This group is not known to occur south of Panama. It is overlapped in the Isthmian region by the so-called crab-eating raccoons of the subgenus *Euprocyon*, which range from that northern limit as far south as Paraguay in South America. The raccoons have been greatly reduced in numbers or have disappeared in many formerly wooded sections, owing to clearing and intensive human occupation. Despite adverse conditions, however, they have maintained themselves in many places with remarkable tenacity. Trapping for other fur bearers may have reduced the northern fringe to some extent, but the general range of the group has been little diminished. At the present time raccoons reach their northern limit in regular occurrence on Vancouver Island, B. C.

The continental forms of the subgenus *Procyon* constitute a compact assemblage of closely allied geographic races all assignable to *Procyon lotor*. Complete intergradation is evident in numerous cases and the relative value and combination of characters presented indicate such close relationships that it can safely be assumed where lack of material leaves gaps in the known ranges.

In the present revision of the raccoons are treated the North American continental species as far as the eastern border of Panama and the

PLATE I

Pacific Northwest Raccoon (*Procyon lotor pacificus*).

species on outlying islands along both the Atlantic and the Pacific coasts. Thirty species and subspecies are recognized. Twenty-nine of these are assigned to the subgenus *Procyon* and one to the subgenus *Euprocyon*.

The revision is based mainly on a study of raccoon material in the collection of Biological Surveys, Fish and Wildlife Service, and in other collections in the United States National Museum. These and 358 specimens borrowed from other museums make a total of 1,337 examined. The assemblage included the types or topotypes of most of the known species and subspecies.

For the loan of specimens the writer is especially indebted to Dr. Thomas Barbour, Museum of Comparative Zoology, Cambridge, Mass.; the late Dr. Joseph Grinnell, Museum of Vertebrate Zoology, Berkeley, Calif.; Dr. W. H. Osgood, Chicago Natural History Museum, Chicago, Ill.; Dr. H. E. Anthony, American Museum of Natural History, New York City; Dr. R. M. Anderson, National Museum of Canada, Ottawa, Canada; the late Oldfield Thomas of the British Museum (Natural History); Francis Kermode, Provincial Museum, Vancouver, British Columbia; Dr. L. R. Dice, Museum of Zoology, University of Michigan, Ann Arbor, Mich.; and the late D. R. Dickey, Pasadena, Calif. Grateful acknowledgment is also due to Percy Shufeldt, La Cueva, N. Mex., for the generous donation of specimens collected by him in Campeche, Mexico. Notes on his examination of specimens in the British Museum have been kindly furnished by Dr. Remington Kellogg, United States National Museum, Washington, D. C. Stanley P. Young, Fish and Wildlife Service, Washington, D. C., generously supplied the photograph for the frontispiece.

Dr. E. W. Nelson became keenly interested in the raccoons, as shown by his work on those inhabiting the Florida Keys (1930a).¹ During the same time and in the following year new subspecies were described jointly by Nelson and the writer in preparation for a revision of the group; but other projects claimed attention and our collaboration could not be carried beyond this preliminary stage.

HISTORY

The raccoons represent a highly successful branch of a well-developed phylogenetic tree. Their ancestry has been traced far back to the genera *Phlaocyon* and *Cynodictis* of the Lower Miocene or Oligocene periods. Early progenitors of these animals probably also gave rise to such divergent modern families as the Canidae, the Ursidae, and the Mustelidae. For detailed discussion of the phylogenetic relationships of the raccoons see the authors listed in the Bibliography (p. 87), especially Wortman and Matthew (1899, p. 109), Matthew (1930, p.

¹ Publications referred to parenthetically by date are listed in the Bibliography, pp. 87-106.

129), and Gregory (1933, p. 83). The genus *Procyon* was well represented in the early Pleistocene of North America, when it already ranged across the present United States from the Atlantic to the Pacific. Among Pleistocene species described were *Procyon prisens* Le Conte (1848, p. 106) from Illinois, *Procyon simus* Gidley (1906, p. 553) from California, and *Procyon nanus* Simpson (1929, p. 575) from Florida.

The name "raccoon" is derived from Indian appellations of the animal, which have been variously rendered as "aroungheun," "arathkone," and "arakun." The familiar abbreviation "coon" is in general colloquial use in the United States. An animal as common and conspicuous and possessing such peculiar and interesting traits as the raccoon could not remain long unobserved by explorers and settlers in its country, and as it became better known it was accorded a prominent place in the folklore of the United States.

The earliest reference to a raccoon found in the literature is by Captain John Smith (1612, p. 13), who in describing the animals of Virginia says: "There is a beast they call Aroungheun, much like a badger, but vseth to live on trees as Squirrels doe." This reference was closely followed by that of Purchas (1614, p. 761) in describing the same region.

Under the name "Mapach," and apparently as "Tepe Maxtlaton," and perhaps under others, the raccoon was recorded by Hernandez (1651, tract 1, pp. 1, 9) in southern Mexico. The voyager around the world, Dampier (1729, p. 276), mentions the abundance of these animals on the Tres Mariás Islands, off western Mexico, which he visited in 1686. The early systematic term *Vulpi affinis Americana* was applied by Ray (1693, p. 179), in connection with a generalized description of animals probably representing both the subgenera *Procyon* and *Euprocyon* then undifferentiated and very imperfectly known from both North and South America. Quaint descriptions of the raccoon in the Carolinas were published by Lawson (1718, p. 121), and by Catesby (1743, p. XXIX). Hans Sloane (1725, p. 329) credits the animal to Jamaica as follows: "The Raccoons are commonly here in the mountains, and live in hollow fiddlewood Trees, from whence they make Paths to go to seek Sugar Canes, which is their chief, if not only Sustenance." No specimens are available from Jamaica, and if this record was well founded it seems strange that it has not been supplemented by others.

Evidently noting the general resemblances, Linnaeus closely associated the raccoon with the bear in the 1740 edition of his *Systema Naturae* (p. 35) as *Ursus cauda elongata* in contradistinction to the true bear, *Ursus cauda abrupta*. Under the same name in 1747 (pp. 277-289, table 9, figs. 1 and 2) he published a lengthy description of

the raccoon accompanied by the earliest illustrations seen by the author. Of these, figure 1 is a sketch of the entire animal. In figure 2 attention is directed to the strongly developed and peculiarly formed os penis, or baculum.

The accounts of the raccoon in Pennsylvania and New Jersey by Peter Kalm in 1753 (Benson 1937, pp. 52-53, 111, 242-243) formed a part of the basis for Linnaeus' short description of *Ursus lotor* in the tenth edition of his *Systema Naturae* (1758, p. 48). Recognizing distinctive characters, Storr (1780, p. 35) used *Procyon* as the generic name for the group typified by *Ursus lotor* Linnaeus. G. Cuvier (1798, p. 113) described *Ursus canerivorus*, the crab-eating raccoon from Cayenne which later became the type of the subgenus *Euprocyon* Gray (1864, p. 705). Only a few new North American species or subspecies were added during the nineteenth century by Wagler (1831, p. 514), Gray (1842, p. 261), Baird (1857, p. 215), Bangs (1898a, p. 219; 1898b, p. 92), and Merriam (1898, p. 17; 1899, p. 107). Short papers descriptive of new forms by Merriam (1900, p. 151; 1901, p. 101), Miller (1911, p. 3), Mearns (1914, pp. 63-66), Hollister (1914, p. 142), Goldman (1913, p. 15), Nelson (1930a, pp. 7-10), and Nelson and Goldman (1930a, p. 82; 1930b, pp. 453-459; 1931a, pp. 17-20; 1931b, p. 308) have since appeared.

RACCOON NAMES NOT CLEARLY ASSIGNABLE

The following names that have been proposed for species of the raccoon are unrecognized or unassigned owing to the author's inability to associate them with any particular region, or because of some obvious defect in status. If the type specimens of any of these are extant, it is possible that any such accompanied by skulls, may afford clues to their identity; because of the range of individual variation in subspecies, however, there is likely to be considerable uncertainty. Skins subject to fading over a period of many years are of very limited value for comparative purposes, beyond the determination of the subgenus.

Procyon nivea Gray, Charlesworth's Mag. Nat. Hist., vol. 1, p. 580, 1837. "Inhabits North America, Texas." "Fur soft, silky, white. Tail one-colored." No type specimen designated. Doubtless based upon an albino, as suggested in the original description. At least two subspecies occur in Texas. Name unidentifiable.

Procyon brachyurus Wiegmann, Archiv für Naturgesch., dritter Jahrgang, erster band, p. 369, 1837. "Patria: Antillae?" Based on two specimens said to have come from the West Indies (see pp. 354-355), but their place of origin was regarded as uncertain by the describer, as shown by the notation. Figured by Wagner in Schreber's Säugethiere (p. 143 C). The plate illustration is of two brownish animals, the tail shown in one as quite short.

- Procyon obscurus* Wiegmann, Archiv für Naturgesch., dritter Jahrgang, erster Band, p. 370, 1837. "Patria ignota." Figured by Wagner in Schreber's Säugethiere (p. 143 D). The plate illustration is of a very dark-colored animal. This seems to be unidentifiable.
- [*Procyon brachyurus*] var. *fusca* Burmeister, Verzeichniss Zool. Mus. Univ. Halle-Wittenberg Säugeth., Vögel Amphib., 1850, p. 13. Based on *Procyon obscurus* Wiegmann and *Procyon obscurus* Wagner, in Schreber's Säugethiere, Suppl., vol. 2, p. 159, 1841, without description.
- [*Procyon lotor*] var. *melanus* Gray, Proc. Zool. Soc. London, 1864, p. 704. No type locality indicated. No type specimen designated. "Nearly black." Unidentifiable.
- [*Procyon lotor*] var. *albina* Gray, Proc. Zool. Soc. London, 1864, p. 704. (Nomen nudum.)
- Procyon hernandezii castaneus* de Beaux, Zool. Anzeiger, vol. 35, p. 624, April 26, 1910. From Mexico. Based on a specimen (No. 357) which had been in the Royal Zoological Museum, Florence, Italy, since 1857. According to the description in part (p. 621), "Die Körperfarbe ist ein echtes und rechtes Kastanienbraun mit prachtvoll silbrigem Glanze." The color of raccoons is so variable that a single specimen does not afford reliable differential characters. The color described is unusual for a raccoon and might be due to fading or to erythrisms. If the skin is accompanied by a skull, comparison of the latter with those of the several geographic races known to occur in Mexico might afford a clue to identity.
- Procyon lotor rufescens* de Beaux, Zool. Anzeiger, vol. 35, p. 625, April 26, 1910. Type locality unknown ("?Heimat"). Type specimen not designated. About 10 specimens said to have been examined. Body color more or less suffused with rich red brown. Apparently not identifiable.
- Procyon [lotor] flavidus* de Beaux, Zool. Anzeiger, vol. 35, p. 626, April 26, 1910. Type locality "Southern United States?" Type specimen not designated. Only one skin examined. Color dirty yellow. Hairs of back neither ringed nor tipped with black. Apparently not identifiable.
- Procyon hudsonicus* Brass, Aus dem Reiche der Pelze, p. 564, April 1911. No type designated. Described as "sehr gross und graubraun." Apparently based upon commercial skins assumed by the describer to be from Hudson Bay where no raccoons occur. The name is therefore unidentifiable.

HABITS

Few North American animals are endowed with more interesting or attractive ways than the raccoons. The general habits, as recorded by many observers, seem everywhere to be very similar for the members of each of the two subgenera. In Panama, *Procyon* and *Euprocyon* share to some extent the same local habitat, both favoring the vicinity of swamps and streams and both being addicted to the crab-eating habit as shown by stomachs examined. But *Procyon* seems to be more arboreal than *Euprocyon*, and the two probably depart materially in general behavior. Dr. Thomas Barbour informed the author that the local representatives of both subgenera have been kept in captivity at the biological station on Barro Colorado Island

in Gatun Lake, Canal Zone, and that he has noted that *Procyon* "washes" its food in the characteristic manner while *Euprocyon* does not. The writer's own general observations indicate that under natural conditions *Procyon* does not regularly wash its food and suggest that washing may be limited mainly to food supplied to animals in captivity. As *Euprocyon* has a very restricted range in North America, the present discussion is limited chiefly to the members of the typical subgenus *Procyon*.

Much has been written on the life history of the raccoon of the eastern United States which may be assumed to apply, with some reservations, to all members of the *Procyon lotor* group. The peculiar habits of the raccoon began to attract the attention of the settlers during the early colonial period, as is shown by the following quaint and somewhat fantastic account of this animal in the Carolinas by Lawson (1718, p. 121):

The Raccoon is of a dark-gray Colour; if taken young, is easily made tame, but is the drunkenest Creature living, if he can get any Liquor that is sweet and strong. They are rather more unlucky than a Monkey. When wild, they are very subtle in catching their Prey. Those that live in the Salt-Water, feed much on Oysters which they love. They watch the Oyster when it opens, and nimbly put in their Paw, and pluck out the Fish. Sometimes the Oyster shuts, and holds fast their Paw till the Tide comes in, that they are drown'd, tho' they swim very well. The way that this Animal catches Crabs, which he greatly admires, and which are plenty in Carolina, is worthy of Remark. When he intends to make a Prey of these Fish, he goes to a Marsh, where standing on the Land, he lets his Tail hang in the Water. This the Crab takes for a Bait, and fastens his Claws therein, which as soon as the Raccoon perceives, he, of a sudden, springs forward, a considerable way, on the Land, and brings the Crab along with him. As soon as the Fish finds himself out of his Element, he presently lets go his hold; and then the Raccoon encounters him, by getting him cross-wise in his Mouth, and devours him. There is a sort of small Land-Crab, which we call a Fiddler, that runs into a Hole when any thing pursues him. This Crab the Raccoon takes by putting his Fore-Foot in the Hole, and pulling him out. With a tame Raccoon, this Sport is very diverting. The Chief of his other Food is all sorts of wild Fruits, green Corn, and such as the Bear delights in. This and the Possum are much of a Bigness. The Fur makes good Hats and Linings. The Skin dress'd makes fine Womens Shooes.

More accurate early descriptions of the animal in Pennsylvania and New Jersey are those of Kalm (Benson 1937, pp. 52-53):

The quadruped, which Dr. Linné in the memoirs of the Royal Academy of Sciences has described by the name of *Ursus cauda elongata*, and which he calls *Ursus Lotor*, in his *Systema Naturae*, is here called a raccoon. It is found very frequently and destroys many chickens. It is hunted by dogs, and when it runs up a tree to save itself a man climbs up after it and shakes it down to the ground, where the dogs kill it. The flesh is eaten and is reputed to taste well. The bone of its male parts is used for a pipe cleaner. The hatters purchase their skins and make hats of them, which are next in quality to those of beavers. The tail is worn round the neck in winter and therefore is likewise valuable.

And quoting Kalm further (Benson 1937, pp. 242-243):

I have already mentioned something of the raccoon; I shall here add more of the nature of this animal and its mode of living in its habitat, in a place which is properly its native country [vicinity of the then village of Raccoon at or near the present town of Swedesboro, N. J.]. The English call it everywhere by the name of raccoon, which name they have undoubtedly taken from one of the Indian nations; the Dutch call it *hespan*, the Swedes, *espan*, and the Iroquois, *attigbro*. It commonly lodges in hollow trees, lies close in the daytime, never going out except on a dark, cloudy day; but at night it rambles and seeks its food. I have been told by several people that in bad weather, especially when it snows and blows a storm, the raccoon lies in its hole for a week without coming out once; during that time it lives by sucking and licking its paws. Its food consists of the several sorts of fruit, and corn, while the ears are soft. In gardens it often does a great deal of damage to the apples, chestnuts, plums, and wild grapes, which are its favorite food; to the poultry it is very cruel. When it finds the hens on their eggs, it first kills them, and then eats the eggs. It is caught by dogs, which trace it back to its nest in hollow trees, or by snares and traps, in which a chicken, some other bird, or a fish is put for bait. It generally brings forth its two or three young in May when it prepares its nest. Some people eat its flesh. It leaps with all its feet at once; on account of this and of several other qualities many people here reckoned that it belonged to the genus of bears. The skin is sold for eighteen pence at Philadelphia. I was told that the raccoons were not nearly so numerous as they were formerly; yet in the more inland parts they were abundant. I have mentioned before the use which the hatters make of their furs, that they are easily tamed, and that they like sweetmeats, etc. Of all the North American wild quadrupeds none can be tamed so easily as this one.

In regard to the duration of life in the raccoons under natural conditions, no information is now at hand. Such data should become available in the future through the tagging or otherwise marking of animals captured and liberated. According to Flower (1931, p. 177), a male raccoon lived in the Rotterdam Zoological Garden from September 30, 1890 to May 6, 1900, 9 years, 7 months, and 6 days, and an albino was in the London Zoological Garden from May 6, 1884, to February 27, 1898, 13 years, 9 months, and 21 days. He also mentions a crab-eating raccoon that lived in the London Zoo 15 years, 10 months, and 5 days. Lowery (1936, p. 19) quotes Claude Odum of Bernice, La., who said that he kept a raccoon in captivity 14 years.

FOOD AND GENERAL ACTIVITIES

Throughout the vast range of the group, raccoons favor the vicinity of water in forested regions; but they also occur along streams traversing open desert areas. Although raccoons are truly omnivorous, feeding to a considerable extent on a great variety of plant substances such as acorns, beechnuts, berries, persimmons and other fresh fruits of many kinds, and corn in the "milk" stage, most of their food is obtained in or near shallow water in swamps and marshes, and along

the shores of streams, lakes, and brackish lagoons, and even along the sea coasts, as in the Florida Keys and other islands. In such places, frogs, small fishes, crayfish, crabs, clams, oysters, insects, small mammals, reptiles, and other animal foods are sought, as shown by the characteristic telltale footprints revealing the course of nocturnal wanderings and by stomach examinations.

As water recedes to lower levels and pools become detached, fish, of which raccoons are very fond, are more readily captured by them. Referring to some water holes near Lake Drummond, Dismal Swamp, Va., in October 1895, A. K. Fisher reported: "Judging from the tracks about these pools, as many as a dozen must have come every night to feed on the fish imprisoned therein. The heads of catfish, pike, eels, and perch were found in abundance under the bushes and along the edges where the raccoons had dropped them." According to Mary J. Rathbun (1918, p. 401), the fiddler crab (*Uca pugilator*) is the main food of the raccoon on the bay shores next to the Gulf in Texas. Young birds and eggs in the nest are often taken, and departing from the usual aquatic habitat, the raccoons occasionally make raids on the farmer's poultry.

A complete list of the miscellaneous items composing the diet of raccoons would be exceedingly long and would vary in accordance with the season and with local conditions. On Key Largo, Fla., E. W. Nelson found the raccoons feeding extensively on the ripening fruit of the marlberry (*Icacorea paniculata*) in March. The taking of dry berries may be resorted to when more acceptable food supplies are insufficient. Examination of stomach contents has revealed the hard seeds of the hackberry and juniper berries in Texas raccoons and Vernon Bailey found these animals feeding upon manzanita (*Arctostaphylos*) berries in California. The eating of grasshoppers has been reported in Texas.

Although raccoons enter the water freely, much time is spent in patrolling the muddy shores. Closely crowded tracks, suggesting the imprints of human baby hands and feet, often mark the lines of least resistance up and down the banks of streams or through swamps, and well worn trails are gradually formed, disappearing in places at the edge of the water where it was necessary for the animals to wade or swim, and reappearing again on the farther side. In addition to water, trees, especially hollow ones affording shelter, are almost indispensable for the well-being of most raccoons. There seems to be evidence that the clearing of timber, especially the cutting of the large shelter trees needed for refuge and hibernation, has been an important factor in reducing the numbers of these animals in the northern part of their range. In the warmer southern territory, where hibernation does not occur, shelter trees are evidently not so essential. Mangrove

swamps, with no large trees within many miles, are regularly inhabited by large numbers of raccoons that seem able to forego supplies of fresh water. Although hollow trees are favored for the shelter afforded, holes in banks and rocky ledges are also occupied, especially in localities where such trees are few or absent. Raccoons are mainly nocturnal in their search for food, but they sometimes come out during the day, and are especially fond of sunning themselves, usually sprawled in a variety of postures on the larger upper limbs of trees.

SENSES AND INSTINCTS

The sensory organs in raccoons are evidently highly developed. Many observers accord these animals a reputation for great curiosity and cunning, and a cleverness or adroitness, involving a high order of general intelligence. As a result of experiments Cole (1907, p. 261) concluded that "in the rapidity with which it forms associations the raccoon seems to stand midway between the monkey and the cat. In the complexity of the associations it is able to form it stands nearer the monkey." It is remarkable, as pointed out by Stock (1929, p. 288), that although *Procyon* occurred in California during the Pleistocene, no member of the family has been found in the Rancho La Brea deposits. This is probably due to the caution of raccoons in approaching and investigating water holes or such natural traps as the miry, sticky tar pits presented.

The senses and instincts of raccoons, as exhibited by animals in captivity, have been carefully studied and well described by Cole (1912), who concluded that although most of the senses are strongly developed, that of smell is less utilized than the others. His results seem worth quoting at length:

The most conspicuous behavior of the raccoon seems to be associated with the sense of touch, which is highly developed in the palm of the forepaw and the tip of the nose. During their hours of activity the animals were most often busy in exploring with their paws the floor and objects on the floor of the room in which they were kept. . . . Dark places, as your pocket or a knothole, are explored by touch hundreds of times. . . . Notwithstanding the strength of the raccoon in clinging and climbing, no touch is softer or more gentle than that of his forepaws when engaged in this investigating activity.

An evidence that the nose is sometimes used for pure touch is the fact that these animals frequently investigated the experimenter's hands, and even his face, with the nose. This also seemed to be an affair of pure curiosity and quite breathless. . . . Occasionally they would both touch a strange object with the nose and sniff at it also. . . .

The raccoon's taste for sweets is especially marked. All other foods were promptly deserted for cane sugar by my animals. . . . My raccoons avoided all food which had a purely sour taste, yet ripe apples and peaches were eaten which have for human taste a slightly acid tang along with the sweet flavor. Unlike herbivorous animals the raccoon refuses to taste salt. . . .

Next to sugar the raccoons preferred boiled beef and they were almost equally fond of uncooked apples, peaches, plums, and cherries. My animals never ate the raw beef which we offered them a few times. Some raccoons have been forced to eat it but they do not appear to thrive on such food. My raccoons were often seen to catch and eat flies. They would eat grains of corn, even when dry and hard, if they were hungry. Bread made of either corn-meal or flour was readily accepted. It seems evident, therefore, that the raccoon in his native haunts lives upon forest fruits and buds, and upon flies, beetles, minnows, etc. . . .

So far as I could observe the raccoons did not often employ the sense of smell, though this may have been due to their captive condition. In no case did they seem to find pieces of meat on the floor by means of smell. If one of them saw a small piece of meat dropped in the hay on the floor he would search for it carefully but beyond a distance of a few inches he did not seem to smell it. They found small pieces of loaf sugar on the floor quite as promptly as they did meat, yet from the standpoint of the human sense of smell sugar has no odor.

In one case smell was evident. When the animals were to be fed the basin of food was usually placed on the step while the door was being unlocked. During this time all of the raccoons sniffed noisily at the crack beneath the door. When it was opened, however, they *looked* for the food basin. So in this case smell was evident only when sight could not be used.

The studies of Cole indicated that the raccoon has a keen sense of sight. In regard to hearing he says:

This appears to be the special protective sense of the raccoon. The slightest sound produced (1st) perfect immobility, and (2d) fear and scurrying to the highest part of their place of confinement. . . .

Every sound at a distance was listened to intently for several seconds after the experimenter had ceased to hear it. On one occasion all the raccoons became still and yet the observers could hear no sound. Investigation showed that a man was trundling a wheelbarrow over the grass plot at least 100 yards distant from the house in which the raccoons were kept.

The sound caused by dropping on the floor a piece of meat, one-half the size of a grain of corn, was often heard by each of the animals. They turned directly toward the source of the sound. Hence they not only hear faint sounds but localize them well. Localization was further tested by putting raccoon No. 3 in a large box with a solid back. The experimenter then scratched on the outside of the back of the box with a small stick. The raccoon turned directly to the spot. The place was changed some two feet. He turned instantly to the new place and grasped with both forepaws at the exact spot. He did this repeatedly. His behavior suggests that localization of sound is much more definite than that of the human ear. His grasping at the spot might indicate that the raccoon catches some small prey partly by the aid of hearing. . . .

On the principle that animals which make sounds hear sounds we may, in connection with hearing, mention the sounds which the raccoon is capable of making. A warning growl always accompanied eating when they were fed. When hungry they sometimes emit a sound about midway between a whine and a purr, "a whimpering cry." This sound is well-known to woodsmen and is far more characteristic of the young than of the adult animal. . . . When forcibly held their whining and growling is somewhat similar to that of a dog. In fighting the animal gives short, sharp barks as he snaps.

Turning once more to the whining-purr, there is less and less of it (in captivity) as the animals grow older and only long waiting for food produces it. In the

forest it may be used as a call to others. A very young raccoon, making this cry from loneliness or in search of its mother, will cease to make it if gently stroked or scratched.

Of the climbing habit Cole says:

This instinct involves the sense of support, which is present before the raccoon possesses either the strength or the muscular co-ordination necessary for climbing, and the impulse to cling to any support. The sense of support is best described by an example. When raccoon No. 5 was probably not more than two weeks old I placed him one day upon the top of a small closed box six inches high. He groped over the top of this box . . . with his forepaws extended, feeling the way. But the moment his paws felt the edge of the box the animal shrank back and began to grope in another direction. Again he would find the edge and again shrink back and start anew. Apparently at this age vision did not serve to show him that he might safely drop to the floor. It seems likely that this impulse enables the young raccoon to remain safely in a high nest, even though it were not enclosed. . . .

When the raccoon is a month old it is able to sustain its weight by clinging to a support by any one of its paws and this it does instinctively. . . . As soon as the young raccoon can walk well any bush or tree arouses his impulse to climb. At first there is some awkwardness and two of our animals were seen to fall from a small tree, when about eight weeks old. A little later they could hardly be dislodged at all. . . . As Brehm states, the raccoon often climbs along a branch with his back down "like a sloth or an ape". . . . My raccoons always laid hold of one bough before releasing the other. They go from one bough to another very quickly yet they rely much more on their strength than on their agility.

Cole agrees with other observers in the conclusion that raccoons are very playful:

One would sit for a long time and play with his hind feet or the tip of his tail. Three were observed to play in this fashion for one and a quarter hours, with almost no pause. While my animals had to work twice a day for their food I observed only momentary play, or perhaps curiosity, as the tendency to pick up a straw or bit of cornhusk and roll it for a moment between their forepaws. In some degree, therefore, their play seems to depend on the possession of surplus energy. When well rested they played roughly with each other in mock fights, running and seizing each other gently with the teeth, rolling over and over in their tussles. In this play they would often climb to the shoulder of the observer, whereby he may learn both the strength of their grip and the sharpness of their claws. They also make a pretense of biting your hand in play, a characteristic reaction of the pet raccoon.

In this connection Cole quotes Beekmann, as follows:

"In the numberless leisure hours which every captive raccoon has he does thousands of things in order to dispel the tedium. Now, he sits upright in a secluded corner, and with a most earnest expression he is busied in trying to tie a straw around his nose. Now, he plays thoughtfully with the toes of his hind foot, or snatches after the wagging end of his long tail. At another time he lies on his back and has a whole heap of hay or dry leaves hugged against his belly and he tries to tie down this loose mass by drawing his tail tightly over it with his forepaws."

The impulse to follow which seems to be inherent in young animals of many kinds was noted by Cole, who says:

After learning to walk, the raccoons would all follow me, or anyone else, with the utmost eagerness. If I ran they struggled through the grass at their best rate, giving the instinctive cry more and more shrilly as I got further away from them, and ceasing to give it when they overtook me. In the middle of the seventh month this instinct to follow began to wane. When released from their place of confinement each one tended to go on an exploring tour of his own and to make for a nearby tree. At this time they would still follow if called. A month later no one of the four would follow at all, and their period of infancy was past.

Although Cole regards the raccoon as especially good-natured, ". . . yet anger or ferocity was observed in these animals at about the twelfth week of their age. Though scrupulous care was taken to keep the animals tame they became fierce if they were left without being handled for a few days. In the fighting attitude the ears are laid back, the head lowered and the posterior portion of the body sharply humped up. Growling and unflinching the teeth accompany this fighting attitude and, when provoked the raccoon is an ugly fighter." He found that his raccoons showed fear by starting at sounds, and the sudden darkening of the room caused by the door blowing shut produced in young animals a panic for a moment. Indifference to each other's behavior was marked. No certain evidence of the sexual instinct was noted by Cole until the twelfth month.

In regard to the practice of washing food that caused Linnaeus to apply the name *lotor*, and the Germans *Waschbär*, Cole says: "My raccoons did not always dip their food in water. No doubt this was partly due to their being fed together so that they formed the habit of eating rapidly. . . . Nevertheless, I do not believe that the raccoon in his native state will carry food very far for the purpose of 'washing it'." Whitney (1931, p. 35) comments on this point as follows: "Unquestionably the most common error into which writers have fallen in regard to the habits of raccoons is that the raccoon washes most of the food that he eats . . . in the wild state the raccoon washes almost nothing that he eats." He regards the error as due to observations made on animals in confinement. It is obvious that the washing of many kinds of food taken by raccoons, especially at a distance from water, would be impracticable. It is probable that under natural conditions raccoons wash only shellfish and other food gathered in or about water, the washing being often necessary to remove sand or other gritty matter.

Concerning the sleep of raccoons, Cole writes:

There are two rather characteristic positions in sleeping. In one the animal lies on his back with his forepaws placed over his eyes. A young raccoon, when

held and somewhat frightened, also puts both forepaws over his eyes, thus giving a somewhat comical appearance, suggestive of "hiding its face in its hands." Another position in sleep consists in rolling the body almost into a ball with the top of the head placed flat on the floor between the forelegs. In this position even the ears are hardly visible. Though the animal does sleep in other positions these two are most common. It would seem that the raccoon sleeps best, therefore, with his eyes not only closed but covered, and for protection he depends most upon his lofty nest and its concealment from enemies.

Among mental attributes of the raccoon, both Davis (1907, p. 486) and Whitney (1933, p. 112) regard curiosity as an outstanding characteristic.

BREEDING

The period of gestation in *Procyon lotor*, at least in the northern part of its range, has been determined by various authorities to be about 9 or 10 weeks. One of the more definite records is that of Gander (1928), relating in a single instance to *Procyon lotor psora* in southern California. An animal kept in captivity was mated January 27 to 29 and the young were born April 3. Another record is that of Brown (1936) of 69 days from first coition.

A litter of small young was collected by E. A. Preble at Tuckerton, N. J., June 23; one taken by B. V. Lilly at Abbeville, La., suggests that in southern localities the season may be more irregular. Raccoons breed but once a year and four young are usually produced at a birth, but the number may vary from two to six. In regard to breeding in the Adirondacks of northern New York, Merriam (1884, p. 94) says:

The Raccoon makes its home high up in a hollow of some large tree, preferring a dead limb to the trunk itself. It does little in the way of constructing a nest, and from four to six young are commonly born at a time, generally early in April in this region. The young remain with the mother about a year.

The act of copulation, rarely recorded in raccoons under natural conditions, was witnessed by the author on Blackbeard Island, Ga., April 19, 1939. From a point of vantage on high ground in the woods a mated pair, unconscious of his presence, was observed in short grass in the open marsh about 75 yards away. With a pair of field glasses a very clear view of the animals in bright sunshine was obtained at short range. When first seen at 2:05 p. m., the female, surmounted by the male, was in a standing position and sexual conjunction appeared to be already complete. Rhythmical movements of the hind quarters of the male were interrupted by periods of quiet. Several times he shifted position slightly from one side to the other, but remained most of the time with his head resting near the median line of the back of the female. The latter remained passive until at the end of about half an hour by the watch she laid her ears back and turned

her head, showing her teeth and apparently snarling at the male, although even at the short distance no sound was heard. The male quietly slipped from her, and both animals moving only a few feet immediately resumed their search for small crabs that were numerous in the marshy ground. The fur on the lower part of the back of the female had become considerably rumped, but this was ignored by her in the search for food.

HIBERNATION

The winter activities of raccoon vary in southern and northern latitudes. In the southern United States and southward the raccoons are active throughout the year. In the North these animals become torpid, and there is a kind of hibernation or partially suspended animation, similar to that of the bears and only approximating the deep lethargic winter sleep of some other northern animals. In describing behavior in winter in Canada, Wesley Mills (1892, sec. 4, p. 50) refers to W. Yates, of Hatchly, Ontario, and says: "This observer has made some very interesting observations on a tame raccoon (*Procyon lotor*). This creature lived in a hollow log lined with straw and drowsed away the greater part of December and January, leaving any food placed before him unnoticed. The raccoon is known to spend the greater part of the winter in hollow elm trees in this part of the country, and Mr. Yates points out that the cutting down of most of these trees resulted in the raccoons betaking themselves to underground burrows including those once occupied by foxes." According to Seton (1929, p. 252): "In the Red River Valley [Canada], the sleep lasts from mid-November to early March." Concerning hibernation in the Adirondacks of northern New York, Merriam (1884, p. 93) writes: "The Raccoon hibernates during the severest part of the winter, retiring to his nest rather early, and appearing again in February or March, according to the earliness or lateness of the season. Disliking to wade through deep snow he does not come out much till the alternate thawing and freezing of the surface, suggestive of coming spring, makes a crust upon which he can run with ease."

ECONOMIC STATUS

Raccoons are naturally prolific, and owing to very extensive geographic range and adaptability the forms of *Procyon lotor* constitute a wildlife asset of major recreational and economic importance. In the extreme scarcity of money in pioneer days raccoon skins supplied an important element in helping the people to maintain their existence. In 1788 (Chase 1911) the residents of a mountain section in Tennessee organized the local "State of Franklin." Money was scarce, and the

salaries of public officials were paid in animal skins, including the following: ". . . secretary to his excellency, the governor, 500 raccoon [skins]; . . . clerk of the house of commons, 200 raccoon [skins]; members of assembly, per diem, 3 raccoon [skins]; . . ." Throughout the pioneer days raccoon skins were regular articles of barter. The skins were especially popular for making caps and coats, the latter use extending to the present time as garments for both men and women. Although their original numbers have greatly decreased, owing to the reduction or elimination of suitable habitat incident to human encroachment, raccoons have persisted where many other native animals have become extinct. Aside from the fur produced, their value in providing excellent nocturnal sport for an army of hunters and exercise for the "coon" dogs nearly throughout the forested sections of the country is well known. This hunting asset is becoming better appreciated by State game commissions and sportsmen's associations, and the liberation of raccoons in suitable places is a regular part of the annual program of wildlife management.

The meat, especially of young raccoons, is an accepted article of food in some parts of the country and is very palatable. During the early days in California, according to Newberry (1855, p. 47), raccoons in considerable numbers were sold in the San Francisco market, commanding a price of one to three dollars each.

Raccoons are destructive to human interests in some places to a limited extent. Of the economic status of the animal in its typical region, Pennsylvania and New Jersey, Rhoads (1903, p. 182) says:

Dr. Warren reports answers from correspondents which condemn this animal as a stealer of fish, especially trout. Others say it does not catch many of these but is after crayfish chiefly. His raids on nesting turkeys I can vouch for, the eggs being sucked. His destruction of poultry is occasionally severe and he likes green maize ears dearly. No doubt he is a destroyer of birds' nests, eggs and young, both terrestrial and arboreal. He catches some mice, but being a slow sort of fellow, prefers more leisurely employment. On this account, he is quite a vegetarian, grapes, nuts, fruits and certain vegetables falling to his share. His furs for warmth and his carcass for food about compensate for the direct losses sustained by humanity in his depredations.

In the Gulf Coast Region, where raccoons still abound, conditions are described by Kopman (1921, p. 28) thus:

One of the principal foods of the raccoon in Louisiana is crayfish. Among vegetable foods, corn in the milk, persimmons, wild grapes, and palmetto berries are very acceptable to the "coon." As a destroyer of poultry the raccoon is often a great nuisance, and it takes many wild birds. These animals are established on many of the bushy islands of the coast, and they eat the eggs and young of the seabirds and other aquatic species breeding there. On Marsh Island and other bird and game preserves on the coast owned by the State, the Department of Conservation has had to provide for systematic trapping of the raccoon. . . .

In considering the natural enemies of birds, Forbush (1916, pp. 24-25) discusses the raccoon as follows:

There is some evidence to the effect that the raccoon robs birds' nests, but it is not numerous enough now in settled regions to be very destructive. Its fondness for green corn has not endeared it to the farmer, and the sportsman and angler believe that it destroys game and fish. Add to these alleged reasons for its destruction the increasing price for its skin in the market and we can see why the "coon" is not destined long to be a great factor as an enemy of birds, except possibly on lands where all animals are protected.

An early mention of the raccoon in New England is by Josselyn (1672), who says: "The Raccoon liveth in hollow trees, and is about the size of a Gib Cat; they feed upon Mass, and do infest our *Indian* Corn very much; they will be exceeding fat in Autumn; their flesh is somewhat dark, but good food roasted."

Corn is grown extensively throughout much of the range of the raccoon, and perhaps more complaints are lodged against the animal for damages to this staple crop than to any other human interest. Cornfields adjoining woodland inhabited by raccoons may be invaded, usually for only a short distance, about the time that the ears reach the "milk" stage. The stalks are pulled down, or the ears stripped off and partly eaten and left scattered over the ground. In some of the most serious instances noted by the writer more than one-half of the corn was destroyed on areas several acres in extent. Other grain crops (as, for example, kafir corn) and fruits and vegetables of many kinds are also subject to some injury. Personal observations have shown that raccoons sometimes become nocturnal despoilers of the nests of waterfowl.

General observations over a wide range indicate that the depredations of raccoons are sporadic in relation to human interests, involve few individuals, and are usually so limited and local in extent that they are quite negligible. The removal of one or two offenders by trapping or shooting will put a stop to the raids in most cases. In a very few instances systematic trapping may be necessary to reduce a local raccoon population that has become too numerous and destructive. The isolated cases of damages sustained are, in general, far outweighed by the asset value of the species.

The northern subspecies of *Procyon lotor* are among the most important fur bearers, but pelts of the forms of the crab-eating raccoon, *Procyon (Euprocyon) cancrivorus*, are of little value, owing to the short, thin, bristly character of the pelage.

Some idea of the numbers of raccoon (*Procyon lotor*) pelts that have been handled as furs may be gained from estimates based upon statistical studies made in 1925 by Frank G. Ashbrook of the then Bureau of Biological Survey, United States Department of Agriculture (now part of the Fish and Wildlife Service, Department of the In-

terior), and Horace J. McMullen, of the then National Association of the Fur Industry (Ashbrook and McMullen 1925). The data gathered from the principal fur auctions in the United States and in London, and from raw fur receiving houses indicated that the average yearly production of raccoon pelts for the 10 years preceding 1925 was 600,000 to 1,000,000. These figures were also taken to represent the average yearly consumption for the period stated. [The most recent (1948) information compiled by the Fish and Wildlife Service indicates an annual take of from 1 to 1½ million pelts in the United States.]

The raccoon has an assured place as one of the more important American fur-bearing animals and will continue to hold this position so long as it can be maintained in suitable numbers. [It is outnumbered only by the muskrat, opossum, and skunk in pelts taken.]

The natural supply of raccoon furs is being gradually reduced through the general encroachment of civilization upon the range of the animal. Aside from trapping for the fur, hunting for sport without adequate regulations, and harassment by dogs, the drainage of water areas and the cutting of timber, especially the older trees affording convenient sheltering hollows, have resulted in conditions unfavorable for raccoons. Displaying wonderful adaptability, raccoons still maintain themselves even in many well-settled areas, often in the vicinity of human habitations or even large cities, with a persistence truly remarkable. Experiments have been conducted on raising raccoons in captivity. Much should be done, however, to further better management of the raccoon in the wild, not only as an important fur bearer and for the sport afforded in its chase, but as a characteristic American animal of outstanding general interest owing to its peculiar and attractive habits.

GENERAL CHARACTERS

The raccoons as a whole present a narrow range of variation in external appearance. The general color pattern, including the black facial mask and the barred tail, is everywhere very similar, even for the two subgenera. The subgenus *Procyon*, embracing the numerous forms of the typical North American group, is, however, easily distinguished by the normal, or backward direction of the hair on the nape, by the presence of underfur, and by the grayish forearms and thighs. In *Euprocyon*, on the other hand, the pelage of the nape is reversed, underfur is absent, and the forearms and thighs are usually blackish instead of grayish.

The normal number of mammae seems to be six in both *Procyon* and *Euprocyon*, but has been found to vary to eight in the latter subgenus. Cranial and dental subgeneric distinctions are pointed out in the treatment of subgeneric characters.

In both subgenera the plantigrade structure of the feet is an outstanding feature. The fore feet somewhat resemble tiny hands, with long fingers opposable to a high degree, possessed of great strength, and yet capable, in *Procyon* at least, of being used with a remarkable deftness and delicacy of touch. The digits of the hind feet are much less opposable, and the imprints of the broad flattened soles along muddy shores may be likened to those of a small child's feet. Although the favorite haunts of the members of both subgenera are in the vicinity of water and much time is spent upon the ground, *Procyon*, as compared with *Euprocyon*, is provided with claws that are narrower, sharper, more compressed laterally, and strengthened by greater vertical depth at the base, better adapting this subgenus for climbing and a more arboreal life. In Panama, where the two subgenera occur together, the crab-eating habit is shared in common, but may be indulged in to a greater extent by *Euprocyon* than by *Procyon*. The broader, less trenchant cusps in the molariform teeth of *Euprocyon*, as compared with those of *Procyon*, are better fitted for crushing hard substances. Along the coast of Salvador, mangrove swamps are inhabited by a local form, *Procyon lotor dickeyi*, which feeds extensively, perhaps principally, upon crabs. The abrasive effect of such a diet on the teeth of a member of the typical subgenus is there strikingly shown by the early wear and rapid shearing off of the crowns of the molars, leaving the premolars comparatively little affected. In some of the older specimens of *dickeyi* the molar crowns are reduced until a mere shell remains near the roots. This may, however, be due to some unusual local condition as such rapid or extensive wear has not been observed anywhere else.

The black mask varies somewhat in extent, and some forms are paler than others, but owing to general uniformity in pattern of coloration in each subgenus, recourse must usually be had to size and to cranial and dental modifications in tracing the relationships of species and subspecies.

In the subgenus *Procyon* most of the sutures of the skull are easily traced at birth. Among the earliest sutures to close are those of the basiscranial segment surrounding the foramen magnum. The supraoccipital, exoccipitals, and basioccipital are all firmly united, and the sutures have disappeared before the permanent dentition is fully in place. The union between these bones and the remainder of the skull, however, remains distinctly visible until finally closed later with advancing age. The jugals unite with the maxillae earlier than with the squamosals. Progressive obliteration extends to the maxillo-premaxillary sutures and to the median line between the frontals, while the parietal sutures remain distinct. The closure of the parietal sutures may be taken as an indication of maturity. In old age all the

bones of the skull become coalesced, among the last to unite firmly being the nasals and the mandibles. A well-developed, sometimes high and trenchant, sagittal crest commonly present in the older males is less frequent and less prominent in the females; but in many old adults of both sexes the temporal impressions do not unite to form a crest. The deciduous dentition is retained only a short time. The permanent middle incisors appear before the molars.

In the continental forms of the subgenus *Procyon* subspecific distinctions rest upon combinations of relatively slight characters, indicating close relationships. Although the characters do not stand out very conspicuously as a rule, and due allowance must be made for individual variation, they are maintained with a fair degree of constancy over areas often of considerable extent. Some of the more extreme forms of the intergrading series are very similar in external appearance, but are differentiated by well-marked details of cranial structure. Skull characters, rather than color, must therefore be relied upon in determining systematic relationships. In dental sculpture all the forms are very similar, but they vary greatly in the size of the teeth and, to some extent, in the form of the molar crowns.

In tracing the relationships of the numerous forms of the subgenus *Procyon* the principal characters of taxonomic value are the following: General color, whether light or dark, plain grayish, or suffused with ochraceous buff, or varying shades of rusty rufous; relative development of the black mask, whether continuous across middle of face, extent of black postauricular spots, and of white facial markings; general form of the skull (especially of the brain case and the frontal profile), massiveness, development of postorbital processes and of zygomata, width of palate, size of auditory bullae; size and relative length and breadth of large molariform teeth. The males are usually decidedly larger than the females in all dimensions, but the sexes agree closely in details of cranial structure.

PELAGE AND MOLT

The pelage differs widely in the subgenera *Procyon* and *Euprocyon*, as pointed out in the treatment of subgeneric characters. In the subgenus *Procyon* it is longer, softer, and much denser than in *Euprocyon*, the denseness being largely due to the fine underfur, which differs in texture from the longer overfur or guard hairs, and which is absent in *Euprocyon*. Owing to the differences in density and texture of the hairs, *Euprocyon* is of little value for the fur.

The annual molt in the subgenus *Procyon* extends over a lengthy period during the summer, at least in the more northern and more heavily furred subspecies. The new pelage, rather short in the fall,

becomes longer in the winter. In the subgenus *Euprocyon*—inhabiting tropical countries—no definite seasonal molt seems apparent.

VARIATION

Variation in the raccoons is assignable to several categories, of which perhaps the most obvious are geographic and individual.

GEOGRAPHIC VARIATION

The raccoons are believed to intergrade throughout the vast range of the species *Procyon lotor* on the North American mainland, and the component subspecies are the expression of geographic variation in size, weight, color, and minor details of structure in response to environmental and genetic influences. Some of the insular forms present a greater degree of differentiation, evidently due to isolation, and are regarded as distinct species. The largest form of the genus, *Procyon lotor excelsus*, inhabits interior valleys, principally the Snake River Valley in southeastern Washington, eastern Oregon, and southern Idaho. Large, but less extreme, geographic races occupy the other Western States and the mainland of Middle America. These give way to smaller subspecies in the eastern United States, the minimum size being reached by those living on the Florida Keys. María Madre and María Magdalena of the Tres Mariás Islands Group off western Mexico are occupied by *Procyon insularis*, a large form regarded as specifically distinct from the mainland animal. Small species of raccoons inhabit New Providence Island in the Bahamas, and Guadeloupe and Barbados Islands of the Lesser Antilles. The smallest species of raccoon known was well named *Procyon pygmaeus* from Cozumel Island, Yucatan.

Geographic variation in color in the raccoons is limited mainly to the general tone and to the relative development of the black mask and other facial markings. The paler subspecies, such as *Procyon lotor pallidus*, inhabit the thinly timbered desert areas in the Colorado River Valley and adjoining territory, while darker races have developed in the eastern United States and in densely forested regions of heavy precipitation in Central America. In considering the pallid coloration of raccoons from desert areas, as along the Colorado River, it should be understood that these animals are restricted to the vicinity of water, yet they share the general pallor that is a marked characteristic of the mammals of the region as a whole.

INDIVIDUAL VARIATION

By individual variation reference is made to all the degrees of divergence from a typical mean exhibited by large series of conspecific skins and skulls from any given locality. In the raccoons the range of this variation in size, color, and cranial details is about the same as

that for which due allowance must be made in other groups of carnivores. Since the subspecies of *Procyon lotor* are geographic races with confluent geographic ranges, an unusually large individual of a small form may be similar in size to an unusually small individual of a large form, and color and cranial details may vary in comparable ratio. Owing to individual variation, some specimens, especially from unknown localities, may be difficult to identify subspecifically. They may usually be distinguished, however, by the combination of characters presented.

Apparently, abnormal individual variations in general color are common in the raccoons. A half-grown example (No. 253823, U. S. Natl. Mus.) from Nelson County, Va., exhibits an apparent case of erythrim. The usual black facial mask, postauricular spots, dark bands on the tail, and the normally dark tips of hairs are light yellowish brown; the usual white areas tend toward creamy white. In a specimen from Santee, S. C. (No. 178391, U. S. Natl. Mus.), the usual black tips of the hairs over the back and the dark tail rings are light brownish. The dark facial markings are also inclined toward brown instead of black, and the basal color of the fur in general is lighter than normal.

No definitely melanistic raccoons have been examined, but in a specimen from Red Bluff, Calif. (No. 14466, U. S. Natl. Mus.), there is an intensification of the overlying black on the upper parts, due to the unusual extent of the black on the tips of the hairs and the corresponding reduction of the light subapical zone on these hairs. As a result the back appears to be almost solid black. The usual light bars are present on the tail, and the white facial markings are normal. The occurrence of albino raccoons is reported from time to time. An adult male from Paducah, Ky. (No. 151657, U. S. Natl. Mus.), is pure white except on the nape where the white is suffused with yellowish.

The weight of the northern raccoons undoubtedly varies considerably according to the season; the animals become very fat in the fall, especially in regions where they must hibernate. The more southern raccoons that are active throughout the year do not accumulate so great a store of fat, and even their shorter pelage would weigh less. The weight differs, of course, in accordance with size in animals of comparable age, sex, and condition in the various species and subspecies. Comparatively few weights, however, appear to have been reliably recorded and are available for comparison. Whitney (1931, p. 31) reports the taking of more than 300 raccoons (*Procyon lotor lotor*) in Massachusetts and Connecticut during a 7-year period. Of the 300, every one that appeared to be uncommonly large was weighed on accurate scales. The largest weighed 22 pounds and 10

ounces. Whitney believed, however, that the average would be about 13 pounds as the weights included those of a good many animals taken in the fall that had been born in the spring of the same year and had not been able to attain a weight of much more than 10 pounds. Eighteen raccoons regarded by Whitney as of uniformly greater weight were taken by him in the fall near Brunswick, Maine. Eight of these weighed more than 23 pounds each, the largest, 27 pounds, including, a sack estimated to weight three-fourths of a pound.

A large, fat, adult male raccoon (*Procyon lotor hirtus*) collected by Vernon Bailey (1923, p. 124) at Elk River, Minn., November 5, 1886, was recorded by him as weighing 30½ pounds. Another male of the same subspecies taken at Fargo, N. Dak., by O. J. Murie, November 9, 1919, weighed 24 pounds. Average animals from the same localities would undoubtedly weigh much less.

Weights of specimens of *Procyon lotor elucus*, which is active throughout the year and does not become so fat as the more northern subspecies, were obtained in winter by E. A. Mearns on Saw Grass Island, Catfish Creek, Polk County, Fla. Five adult males from the island ranged from 10 to 12 pounds in weight, the average being 11 pounds. The weight of three adult females from the same locality ranged from 7.7 to 10 pounds, the average being 9 pounds. Weights of the diminutive raccoon *Procyon lotor auspicatus*, of Key Vaca, one of the Florida keys, were obtained late in winter by E. W. Nelson. Five adult males were found by him to range in weight from 4 to 6 pounds, with an average of 5.3 pounds. Two adult females from the same locality weighed 4 and 5 pounds, respectively.

Individual variation in cranial and dental development is extensive in scope and may render difficult the determination of some specimens, especially if from unknown localities. The variations are noticeable especially in the form of the brain case and frontal profile, relative prominence of postorbital processes, size of auditory bullae, and size of large molariform teeth. Dental abnormalities are presented in a few cases. In two individuals, one of *Procyon lotor litoreus* from Saint Simon Island, Ga., and the other of *Procyon gloreralleni* of Barbados, Lesser Antilles, the first premolars in both jaws are absent. Supernumerary teeth sometimes suggest early division of the dental matrix. In a skull of *Procyon lotor hernandezii* from Colima two canines are present on one side in the upper jaw, one somewhat smaller being posterior to the normal canine in the space usually occupied by the first premolar which is absent. On the side opposite the double canines the first premolar is also absent, there being a hiatus between the canine and second premolar. The mandible is normal.

EXPLANATIONS

MEASUREMENTS

All measurements of specimens are in millimeters. The weights given are in pounds. Adult males usually exceed adult females in dimensions, and the measurements are, therefore, presented according to sex. In some cases so few nearly typical examples are available that the measurements given may not represent the normal range of individual variation, and too broad generalizations, therefore, should not be based on them.

The external measurements, unless otherwise stated, were taken in the flesh by the collector, as follows:

Total length.—Nose to end of terminal tail vertebra.

Tail vertebrae.—Upper base of tail to end of terminal vertebra.

Hind foot.—Heel to end of longest claw.

The following cranial measurements were taken with a vernier caliper by the author:

Greatest length.—Length from anterior tip of premaxillae to supra-occipital in median line over foramen magnum.

Condylobasal length.—Length from anterior tip of premaxillae to posterior plane of occipital condyles.

Zygomatic breadth.—Greatest distance across zygomata.

Interorbital breadth.—Least distance between orbits.

Least width of palatal shelf.—Width between outer sides of palate at constriction behind posterior molars.

Maxillary tooth row.—Distance from front of canine to back of posterior molar at alveolar border.

Crown length of upper canassial.—Greatest length of crown of upper canassial along outer side.

Crown width of upper canassial.—Greatest transverse diameter of crown of upper canassial.

COLORS

Owing to the banding of the individual hairs, raccoons present coarsely blended colors difficult to segregate. For this reason very limited use has been made, in quotation marks, of names of colors from Ridgway's "Color Standards and Color Nomenclature, 1912." In the description of colors generally understood, modifying or comparative terms have been employed in naming tones, many of which are not well defined.

SPECIMENS EXAMINED

Specimens examined, unless otherwise indicated, are in the collections of the United States National Museum, including the Biological Surveys collection.

USE OF KEY TO SPECIES AND SUBSPECIES

The key to the species and subspecies of the subgenus *Procyon* is based largely on the geographic ranges, as trenchant characters cannot be assigned to intergrading geographic races, and most of the insular forms treated as species are imperfectly known. The key supplements the map (fig. 1) in affording a clue to the identification of particular specimens from known localities.

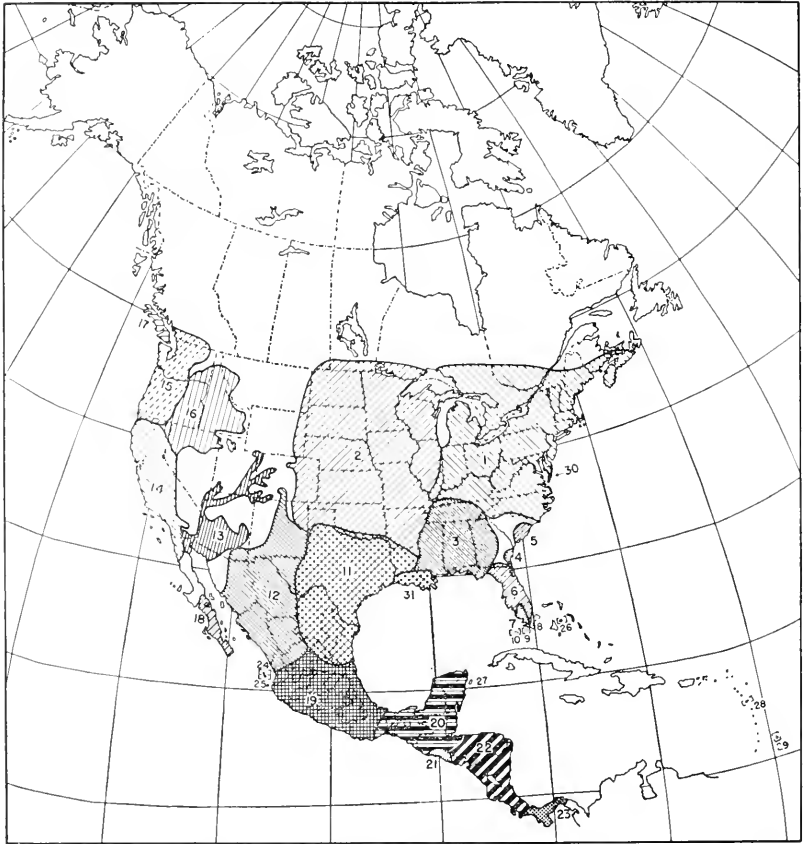


FIGURE 1.—Distribution of species and subspecies of the subgenus *Procyon*:

- | | | |
|--------------------------------|-----------------------------------|-------------------------------------|
| 1. <i>P. lotor lotor</i> . | 12. <i>P. l. mexicanus</i> . | 23. <i>P. l. pumilus</i> . |
| 2. <i>P. l. hirtus</i> . | 13. <i>P. l. pallidus</i> . | 24. <i>P. insularis insularis</i> . |
| 3. <i>P. l. varius</i> . | 14. <i>P. l. psora</i> . | 25. <i>P. i. vicinus</i> . |
| 4. <i>P. l. littoreus</i> . | 15. <i>P. l. pacificus</i> . | 26. <i>P. maynardi</i> . |
| 5. <i>P. l. solutus</i> . | 16. <i>P. l. excelsus</i> . | 27. <i>P. pygmaeus</i> . |
| 6. <i>P. l. elucus</i> . | 17. <i>P. l. vancouverensis</i> . | 28. <i>P. minor</i> . |
| 7. <i>P. l. marinus</i> . | 18. <i>P. l. grinnelli</i> . | 29. <i>P. gloveralleni</i> . |
| 8. <i>P. l. incesperatus</i> . | 19. <i>P. l. hernandezii</i> . | 30. <i>P. l. maritimus</i> . |
| 9. <i>P. l. auspicatus</i> . | 20. <i>P. l. shufeldti</i> . | 31. <i>P. l. megalodous</i> . |
| 10. <i>P. l. incautus</i> . | 21. <i>P. l. dickcyi</i> . | |
| 11. <i>P. l. fuscipes</i> . | 22. <i>P. l. crassidens</i> . | |

Genus **PROCYON** Storr

Procyon Storr, Prodr. Meth. Mammal., p. 35. 1780. Type *Ursus lotor* Linnaeus.
Campsiurus Link, Beytr. Naturg. 1 (2): 87, 1795. Type *Ursus lotor* Linnaeus
 (see Hollister, p. 146, 1915).

Lotor Geoffroy and Cuvier, Mag. Enc. 2: 187, 1795.

Lotor Oken, Lehrb. Naturg., 3^{ter} Theil., 2^{te} Abth., p. 1080, 1816.

Euprocyon Gray, Zool. Soc. London Proc. 1861: 705 (subgenus). Type *Ursus cancrivorus* Cuvier.

*Mamprocyon*us Herrera, Sin. Vulg. Cient. Vert. Mexicanos 1899: 18.

Euprocyon Goldman, Smithsn. Misc. Coll. 60 (22): 16, Feb. 28, 1913 (genus).

Euprocyon Hollister, U. S. Natl. Mus. Proc. 49 (2100): 146, Aug. 13, 1915 (subgenus).

Distribution.—Southern Canada to southern Brazil and northern Argentina, and some of the outlying islands.

Generic characters.—Form robust; head broad, with short, pointed muzzle; ears medium-sized, pointed; upper lip hairy across median line; soles of feet naked, smooth, without well-developed digital pads; digits free, very long, the first more than half the length of the second; claws nonretractile; tail shorter than body, cylindrical, distinctly annulated; baculum long, curved and bilobed distally; mammae 6, arranged in three pairs, as follows: pectoral, 2; abdominal, 2; inguinal, 2.

Skull broad and massive; rostrum broad; brain case broad posteriorly, tapering gradually anteriorly; interorbital and postorbital constrictions moderate; postorbital processes of maxillae usually more developed than postorbital processes of frontals; sagittal crest high and trenchant in some old adults, absent in others, the temporal ridges not uniting along median line. Mastoid processes long, stout, strongly everted, rounded distally; hamular processes rounded, with knob-like ends; auditory bullae large, inflated on inner side, the outer side sloping gradually to external auditory meatus. Mandible heavy, inferior border evenly rounded; symphysis short; coronoid process rising high and curving backward over condyle.

Dental formula: $i\ 3,3\ c\ 1\ 1\ pm\ 4,4\ m\ 2,2=40$.

Dentition heavy; molar crowns moderately high, with prominent cusps; first and second upper premolars simple unicuspid; third upper premolar with a high conical principal cusp and a postero-internal shelf-like cingulum sometimes bearing a small cusplet; crown of fourth upper premolar subquadrate, about as long as broad, with five principal cusps; crown of first upper molar usually slightly broader than long, with four principal cusps; second upper molar subtriangular, with three principal cusps; crown of first lower molar elongated, subrectangular, with five distinct cusps. First upper premolar with a single root; second and third upper premolars 2-rooted; fourth upper premolar 3-rooted. Incisors heavy, the crowns more or less distinctly grooved when unworn. Canines oval in cross section at alveoli,

conical, without distinct grooves, the upper canines not strongly everted.

Remarks.—The genus *Procyon* is readily distinguished from the other living genera of Procyonidae. It is most closely allied to *Nasua*, but differs strikingly in external appearance as well as internal structure. It shares with *Nasua* the general pattern of white and black facial markings, hairy mid-section of upper lip, and annulated tail, but departs in more robust form, shorter snout, pointed ears, free digits, short front claws, and short, cylindrical instead of tapering tail. Important similarities in cranial structure and dental details, especially the molar cusps, are apparent, but the skull diverges notably in its short and broad, instead of narrow and elongated outlines. Among other cranial characters that distinguish *Procyon* from *Nasua* are the greater breadth of the palate between the molars in relation to breadth of bony palate behind molars (palate nearly parallel-sided throughout its length in *Nasua*); upper molariform tooth rows curved posteriorly, instead of being nearly straight; mastoid processes much more prominent; and canines more rounded and conical, instead of flattened and saber-like, with trenchant anterior and posterior edges. The genus *Procyon* differs from the genus *Nasuella* in about the same characters as from *Nasua*.

The genus *Procyon* is more distantly related to the genus *Bassaricyon* which it approaches in general type of dentition, but with which it contrasts strongly in color and in many important structural details. *Procyon* is a much larger, more heavily built animal than *Bassaricyon*, which also exhibits a departure in color, pelage, and other external features. In *Bassaricyon* the color is more uniform, the face somewhat grayish but lacking the black mask and white markings of *Procyon* and the general body color ochraceous tawny. The general pelage is much denser, softer, and has a silky quality very unlike that of *Procyon*. The tail is longer in *Bassaricyon*, flattened instead of cylindrical, and is indistinctly annulated. The ears are more rounded in *Bassaricyon* than in *Procyon*, and a median projection of the rhinarium extends across the lip to the mouth. The skulls of *Procyon* and *Bassaricyon* are somewhat similar in general form, but differ in many important features. Contrasted with that of *Bassaricyon*, the skull of *Procyon* presents points of difference including the following: Much larger, more massive (thin-walled and delicate in *Bassaricyon*); brain case less inflated; orbits relatively smaller; postorbital processes much less, and mastoid processes much more, developed; canines without distinct grooves (canines with two distinct longitudinal grooves on inner, and two on outer, surfaces in *Bassaricyon*).

Compared with the genus *Potos*, the most aberrant American member of the family as currently recognized, the genus *Procyon* differs so

widely that the commonly accepted family alignment seems open to some question. *Potos* contrasts strongly in nearly uniform coloration, rounded ears, and long, tapering, short-haired, prehensile tail. The rhinarium in *Potos* traverses the upper lip more as in *Bassaricyon*. In the skull of *Potos* similarly striking contrasts with *Procyon* are evident. The teeth may be regarded as somewhat similar in general form but there the resemblance ends. The molar crowns in *Potos* are lower and much simpler than in *Procyon*, being nearly flat and without well-developed cusps at any age, the posterior molars almost completely opposed, above and below. Anterior premolars, present in *Procyon*, are absent in *Potos*, a condition correlated with the shortening of the rostrum in the latter genus. The canines, normally rounded and without distinct grooves in the adult stage in *Procyon*, are flattened and saber-like, with deeply grooved sides in *Potos*. The mandible in *Potos* is remarkable for its depth and long, early-fused symphysis, the space between the rami anteriorly U-shaped instead of V-shaped, as is usual in the group. The lower border of the ramus, convex in *Procyon*, is concave in *Potos*, owing to lateral compression and downward expansion of the angle. Among other differential cranial features of *Potos* are the parallel-sided palate, peculiar flat bullae, and complete absence of the mastoid processes so well developed in *Procyon*.

The genus *Procyon* requires no close comparison with the Old World procyonid genera *Ailurus* and *Ailuropoda* of the subfamily Ailurinae. The characters of the Old World genera and their relationship to the other procyonids have recently been discussed by Gregory (1936) and by McGrew (1938). Among other important references bearing on the classification of the Procyonidae are Hollister (1915), and Pocock (1921).

KEY TO SUBGENERA

- a*¹. Pelage of two kinds, long guard hairs and short, soft underfur; hair on nape normal, not directed forward; palate extending behind posterior molars a distance of more than one-fourth length of palate *Procyon* (p. 28)
- a*². Pelage coarse and wiry, without underfur; hair on nape directed forward; palate extending behind posterior molars a distance of less than one-fourth length of palate *Euprocyon* (p. 80)

LIST OF NORTH AMERICAN SPECIES AND SUBSPECIES, WITH TYPE LOCALITIES

Subgenus **PROCYON** Storr

<i>Procyon lotor lotor</i> (Linnaeus)	Pennsylvania (p. 33).
<i>lotor hirtus</i> Nelson and Goldman	Elk River, Minn. (p. 37).
<i>lotor varius</i> Nelson and Goldman	Castleberry, Ala. (p. 38).
<i>lotor litoreus</i> Nelson and Goldman	Saint Simon Island, Ga. (p. 40).
<i>lotor solutus</i> Nelson and Goldman	Hilton Head Island, S. C. (p. 41).
<i>lotor elucus</i> Bangs	Oak Lodge, Brevard County, Fla. (p. 42).
<i>lotor marinus</i> Nelson	Chokoloskee, Fla. (p. 44).

LIST OF NORTH AMERICAN SPECIES AND SUBSPECIES, WITH TYPE LOCALITIES—Continued

Subgenus **PROCYON** Storr—Continued

<i>Procyon lotor inesperatus</i> Nelson	Upper Matecumbe Key, Fla. (p. 46).
<i>lotor auspicatus</i> Nelson	Marathon, Key Vaca, Fla. (p. 47).
<i>lotor incantus</i> Nelson	Torch Key, Fla. (p. 48).
<i>lotor fuscipes</i> Mearns	Fort Clark, Tex. (p. 49).
<i>lotor mexicanus</i> Baird	Espia, Chihuahua, Mexico (p. 52).
<i>lotor pallidus</i> Merriam	New River, Colorado Desert, Calif. (p. 54).
<i>lotor psora</i> Gray	Sacramento, Calif. (p. 56).
<i>lotor pacificus</i> Merriam	Lake Keechelus, Wash. (p. 58).
<i>lotor excelsus</i> Nelson and Goldman	Owyhee River, Oreg. (p. 60).
<i>lotor vancouverensis</i> Nelson and Goldman.	Vancouver Island, British Columbia (p. 61).
<i>lotor grinnelli</i> Nelson and Goldman	La Paz, Baja Calif. (p. 62).
<i>lotor bernandezii</i> Wagler	Valley of Mexico, Mexico (p. 64).
<i>lotor shufeldti</i> Nelson and Goldman	La Tuxpeña, Campeche, Mexico (p. 65).
<i>lotor diekeyi</i> Nelson and Goldman	Barra de Santiago, Salvador (p. 67).
<i>lotor crassidens</i> Hollister	Talamanea, Costa Rica (p. 69).
<i>lotor pumilus</i> Miller	Ancon, Panama (p. 70).
<i>insularis insularis</i> Merriam	María Madre Island, Tres Marias Islands, Mexico (p. 72).
<i>insularis vicinus</i> Nelson and Goldman	María Magdalena Island, Tres Marias Islands, Mexico (p. 73).
<i>maynardi</i> Bangs	New Providence Island, Bahamas (p. 75).
<i>pygmaeus</i> Merriam	Cozumel Island, Yucatan (p. 76).
<i>minor</i> Miller	Pointe-à-Pitre, Guadeloupe Island, Lesser Antilles (p. 77).
<i>gloveralleni</i> Nelson and Goldman	Island of Barbados, Lesser Antilles (p. 79).

Subgenus **EUPROCYON** Gray

Procyon cancrivorus panamensis (Goldman) Gatun, C. Z. (p. 82).

Subgenus **PROCYON** Storr

[References under Genus *Procyon* Storr, p. 25]

Distribution.—Nearly transcontinental from southern Canada to Panama; occurring also on some of the outlying islands.

Subgeneric characters.—Contrasted with the subgenus *Euprocyon*: Pelage longer and of two kinds—long coarse guard hairs and short, soft underfur; hair on nape normal, not directed forward; claws narrower, more compressed laterally, of greater vertical depth at base, and more sharply pointed. Bony palate extending behind posterior molars a distance of more than one-fourth the total length of palate. Molariform teeth, except first premolars, smaller, with narrower, more sharply pointed cusps; connecting ridges between principal cusps higher, more trenchant.

Remarks.—The subgenus *Procyon* overlaps the range of the subgenus *Euprocyon* in Panama, but the characters pointed out are quite distinctive.

KEY TO SPECIES AND SUBSPECIES OF THE SUBGENUS PROCYON

[Typical adults]

- a*¹. Geographic range continental.
- b*¹. Geographic range eastern United States and southern Canada, west to near longitude 90°.
- c*¹. Size smaller; hind foot usually less than 120 mm.; geographic range excluding greater part of Florida.
- d*¹. Color darker; geographic range southeastern Canada and the North-eastern States, mainly north of latitude 35° *P. l. lotor* (p. 33).
- d*². Color paler; geographic range Southeastern States, mainly south of latitude 35° *P. l. varius* (p. 38).
- e*². Size larger; hind foot usually more than 120 mm.; geographic range greater part of Florida *P. l. lucus* (p. 42).
- b*². Geographic range not including eastern United States far beyond longitude 90°.
- c*¹. Geographic range mainly east of longitude 105°, and north of latitude 22°.
- d*¹. Color darker, more suffused with buff; pelage longer; geographic range mainly upper Mississippi and Missouri River drainage *P. l. hirtus* (p. 37).
- d*². Color paler, more suffused with gray; pelage shorter; geographic range mainly Texas and northeastern Mexico *P. l. fuscipes* (p. 49).
- e*². Geographic range not mainly east of longitude 105° and north of latitude 22°.
- d*¹. Geographic range mainly west of the Sierra Nevada and Cascade Range.
- e*¹. Color darker; geographic range mainly southwestern British Columbia, western Washington, and western Oregon *P. l. pacificus* (p. 58).
- e*². Color paler; geographic range mainly California *P. l. psora* (p. 56).
- d*². Geographic range not mainly west of the Sierra Nevada and Cascade Range.
- e*¹. Size larger; geographic range mainly Snake and Humboldt River drainage in Idaho, Oregon, and Nevada *P. l. exelsus* (p. 60).
- e*². Size smaller; geographic range not including Snake and Humboldt River drainage in Idaho, Oregon, and Nevada.
- f*¹. Color paler; geographic range Colorado River drainage *P. l. pallidus* (p. 54).
- f*². Color darker; geographic range not including Colorado River drainage.
- g*¹. Geographic range southern Baja California *P. l. grinnelli* (p. 62).
- g*². Geographic range not including southern Baja California.
- h*¹. Geographic range mainly north or west of Isthmus of Tehuantepec.
- i*¹. Color paler; geographic range northwestern Mexico south to about latitude 22° *P. l. mexicanus* (p. 52).
- i*². Color darker; geographic range high tableland and coastal regions of Mexico from about latitude 22° to Isthmus of Tehuantepec *P. l. hernandezii* (p. 64).
- h*². Geographic range mainly south or east of Isthmus of Tehuantepec.
- i*¹. Color paler; geographic range mainly north of latitude 14°, including Yucatan Peninsula *P. l. shufeldti* (p. 65).
- i*². Color darker; geographic range mainly south of latitude 14°.
- j*¹. Skull less massive; known geographic range southwestern coast of Salvador *P. l. dickeyi* (p. 67).

- j*². Skull more massive; known geographic range excluding southwestern coast of Salvador.
- k*¹. Skull longer and narrower; dentition heavier; known geographic range Costa Rica, Nicaragua, and Honduras
P. l. crassidens (p. 69).
- k*². Skull shorter and broader; dentition lighter; known geographic range Panama.....*P. l. pumilus* (p. 70).
- a*². Geographic range insular (at least in part).
- b*¹. Geographic range off Pacific coast.
- c*¹. Geographic range Vancouver Island.....*P. l. vancouverensis* (p. 61).
- c*². Geographic range off west coast of Mexico [*P. insularis* and subspecies].
- d*¹. Color paler; geographic range María Madre Island, Nayarit
P. i. insularis (p. 72).
- d*². Color darker; geographic range María Magdalena Island, Nayarit
P. i. vicinus (p. 73).
- b*². Geographic range off Atlantic coast (at least in part).
- e*¹. Geographic range far offshore islands (Bahamas and Lesser Antilles).
- d*¹. Geographic range Bahama Islands (New Providence Island)
P. maynardi (p. 75).
- d*². Geographic range Lesser Antilles.
- e*¹. Color darker; upper carnassial longer than broad; geographic range Barbados Island.....*P. gloveralleni* (p. 79).
- e*². Color paler; upper carnassial shorter than broad; geographic range Guadeloupe Island.....*P. minor* (p. 77).
- e*². Geographic range coastal islands (at least in part).
- d*¹. Size larger; hind foot more than 90 mm.; geographic range southern Florida Keys and islands and coasts of Georgia and South Carolina.
- e*¹. Geographic range southern Florida Keys (at least in part).
- f*¹. Color darker; geographic range very close to or extending to Florida coast.
- g*¹. Size larger; total length (adult male) more than 700 mm.; geographic range Upper Matecumbe and other keys near base of main Florida chain.....*P. l. inespertus* (p. 46).
- g*². Size smaller; total length (adult male) less than 700 mm.; geographic range keys of Ten Thousand Islands group and adjacent coast
P. l. marinus (p. 44).
- f*². Color paler; geographic range outer half of Florida Keys.
- g*¹. Size larger; hind foot (adult male) more than 110 mm.; palatal bridge extending on median line beyond plane of last molars more than 12 mm.; geographic range Big Pine Key group, near extreme end of Florida chain.....*P. l. incautus* (p. 48).
- g*². Size smaller; hind foot (adult male) less than 110 mm.; palatal bridge extending on median line beyond plane of last molars less than 12 mm.; geographic range Key Vaca.....*P. l. auspicatus* (p. 47).
- e*². Geographic range islands and coasts of Georgia and South Carolina.
- f*¹. Dentition heavier; crown length of upper carnassial usually more than 9 mm.; geographic range Saint Simon Island, neighboring islands, and coast of Georgia.....*P. l. litoreus* (p. 40).
- f*². Dentition lighter; crown length of upper carnassial usually less than 9 mm.; geographic range Hilton Head Island, neighboring islands, and coast of South Carolina.....*P. l. solutus* (p. 41).
- d*². Size smaller; hind foot about 90 mm. or less; geographic range Cozumel Island, east coast of Yucatan.....*P. pygmaeus* (p. 76).

PROCYON LOTOR GROUP

Distribution.—Transcontinental (except in parts of the Rocky Mountain region) from southern Canada to Panama, and islands as far distant as the Tres Mariás off the west coast of Mexico and the Bahamas and Lesser Antilles, West Indies. Altitudinal range is from sea level up along streams to about 5,000 feet in parts of the Rocky Mountain region (a few animals reaching as high as 8,500 feet elevation), and to more than 9,000 feet in the mountains near Ajusco south of the Valley of Mexico. It occupies the Tropical, Austral, Transition, and lower part of Canadian Zones.

Characters.—Contrasted with *Procyon cancrivorus* and related forms: Pelage of nape inclined backward; pelage consisting of two distinct kinds of hairs—soft, dense, velvety underfur, and longer, stiffer, projecting overlying hairs; throat and postauricular areas blackish; cusps of larger molariform teeth relatively high and trenchant, with distinct connecting ridges.

Remarks.—The *Procyon lotor* group includes *P. lotor* and subspecies of the mainland from Canada to Panama and closely adjacent islands. To the group may also conveniently be referred several more distant insular forms regarded as specifically distinct, but closely allied, as shown by similarity in important characters. These inhabit the Tres Mariás Islands off the west coast of Mexico, Cozumel Island off Yucatan, and several rather widely separated islands of the West Indies. How the particular West Indian islands now inhabited were reached by raccoons and why these animals do not occur on many other islands of the archipelago where conditions seem similarly suitable are interesting subjects for speculation. Sloane (1725, p. 329) referred to the occurrence of the animal in Jamaica, as follows: "The Raccoons are commonly here in the Mountains, and live in hollow fiddlewood Trees, from whence they make paths to go to seek Sugar Canes, which is their chief, if only Sustenance." As there appear to be no later records and as Sloane referred vaguely to various authors who described raccoons elsewhere, he probably confused Jamaica with some other island.

The members of the group as a whole differ among themselves in tone of coloration, but the pattern of color markings is essentially the same, and all forms are much alike in general external appearance. They require close comparison as a group only with the crab-eating raccoon, *Procyon (Euprocyon) cancrivorus*, the range of a northern representative of the latter being overlapped in Panama. The characters that have been mentioned, however, readily separate the two groups.

PROCYON LOTOR (LINNAEUS)

[Synonymy under subspecies]

Distribution.—Transcontinental (except in the Rocky Mountain region) from southern Canada to Panama, and islands near mainland coast. The altitudinal and zonal ranges have been given under the distribution of the various subspecies.

General characters.—Size variable, general color of upper parts ranging from iron grayish to blackish, more or less suffused with ochraceous buff, especially on nape and lighter caudal rings; pelage long, full, and soft in the northern subspecies, much shorter, thinner, and stiffer in the more southern forms. Similar in external appearance to, but differing in cranial characters from, distant insular animals recognized as belonging to distinct species.

Color.—Upper parts in general varying from iron grayish to blackish, more or less suffused with buff, rusty, or "orange rufous," especially on nape, the general tone depending much upon the relative width and distribution of light subapical bands and black tips of long hairs; dorsum more or less heavily overlaid with black, tending to thin out and become grayer along sides; top of head varying mixtures of black and white or gray, producing a grizzled effect; face with a sharply delimited black mask usually reaching from cheeks across eyes and muzzle, with median extensions downward to rhinarium and upward on forehead, more or less interrupted between the eyes, however, in some forms; facial mask bordered above by conspicuous white lines extending from near middle of forehead backward under ears or to sides of neck; sides of muzzle, lips, and chin white; tufts of stiff, whitish vibrissae 50 to 100 millimeters in length, arising from sides of muzzle, and smaller, less conspicuous tufts arising, one on each side over eyes and sides of cheeks; under parts, in general, thinly overlaid with long grayish or buffy over hairs, only partially concealing the dense brownish underfur; throat crossed by a distinct blackish or brownish area, separated from facial mask by narrow white lines extending posteriorly from muzzle; ears clothed with short grayish or buffy hairs, with black areas varying in size and distinctness at posterior base; forearms and thighs similar to under parts, but hind legs more or less distinctly blackish near heels; fore feet whitish; hind feet usually whitish, but dusky of ankles sometimes extending down on metatarsus; toes of hind feet with a few grayish or dusky bristles usually extending beyond ends of longest claws; tail above with five to seven conspicuous black rings and a black tip, alternating with broader grayish or buffy rings, the black rings less sharply defined and sometimes interrupted below.

Remarks.—*Procyon lotor* is divisible into 25 geographic races which on the mainland form a closely intergrading series. The species attains its largest size in *P. l. exelsus* of the Snake River Valley in southeastern Washington, eastern Oregon, and southern Idaho, and the smallest forms are from the Florida Keys. The palest subspecies inhabit the hot arid delta of the Colorado River and adjoining regions, and the darkest have developed in the regions of heavy precipitation in Central America.

PROCYON LOTOR LOTOR (LINNAEUS)

EASTERN RACCOON

[*Ursus*] *lotor* Linnaeus, Syst. Nat. (ed. 10) 1: 48, 1758.

[*Martes*] *lotor* Boddaert, Elenchus Animal 1: 80, 1784. "Habitat in America."

L[otor] vulgaris Tiedemann, Zoologie. Zu seinen Vorlesungen entworfen, erster band, Mensch und Säugthiere, p. 380, 1808, (part). From North America, Mexico, and the Antilles.

Procyon annulatus G. Fischer, Zoognosia 3: 177, 1814 (part). "Habitat in Americae maritimis."

Procyon lotor Illiger, Abhand. König Akad. Wissensch. Berlin, 1804-1811, pp. 70, 74, 1815.

Procyon gularis Hamilton Smith, Jardine's Nat. Lib. 15: 222, 1848. From State of New York.

Type locality.—Pennsylvania.²

Type.—Not known to exist.

Distribution.—Nova Scotia, southern New Brunswick, southern Quebec, and southern Ontario south through the eastern United States to North Carolina, and from the Atlantic coast west to Lake Michigan, Indiana, southern Illinois, western Kentucky, and probably eastern Tennessee. Lower Austral to Canadian Zones.

General characters.—A rather small, dark form with long, full, soft pelage; skull with moderately high, narrow frontal region, and weak or obsolescent postorbital processes. Similar to *P. l. hirtus* of Minnesota, but much smaller; pelage less extremely long, and less suffused with ochraceous buff; skull smaller. Differs from *P. l. solutus* of Hilton Head Island and the coastal region of South Carolina in darker, less grayish coloration, more elongated skull, and other cranial details. Resembles *P. l. litoricus* of Saint Simon Island and the coastal region of Georgia, but pelage longer and softer, and cranial characters, especially the much smaller molariform teeth, distinctive. Much like *P. l. varius* of Alabama, but larger, usually darker, and pelage much longer; skull larger and of heavier proportions.

Color.—Upper parts, in general, varying shades of buffy grayish (becoming ochraceous buff or rusty rufous on nape and across shoul-

²Type locality fixed by Thomas, Proc. Zool. Soc. London. 1911, p. 140.

ders in some individuals) overlaid with black, the general tone due mainly to black-tipped hairs with a lighter subterminal zone, the dark brownish underfur showing through to some extent; sides of body somewhat lighter, the black tips of hairs shorter or black-tipped hairs less numerous than on median dorsal area; top of head mixed black and white or grayish, giving a coarsely grizzled effect; black mask enclosing eyes, but more or less discontinuous on middle of face where a blackish median line is more or less distinctly isolated by lighter lateral lines; upper surface of muzzle usually brownish; facial mask bordered above by rather broad and conspicuous whitish lines extending posteriorly across cheeks to sides of neck; sides of muzzle, lips, and chin white; under parts, in general, thinly overlaid with long grayish or buffy overhairs only partially concealing the dense underfur, which varies from near wood brown to chestnut brown; throat crossed by a brownish or blackish area, separated from facial mask laterally by narrow whitish or buffy lines extending posteriorly from muzzle; ears densely clothed inside and out with short, whitish or buffy hairs, merging with the general pelage on external basal portion; black postauricular patches usually large and conspicuous; forearms and thighs similar to under parts, but hind legs more or less distinctly blackish near heels; fore and hind feet, including toes, whitish, the soles black and naked; tail above with five to seven narrow black rings and a black tip, alternating with broader grayish or ochraceous buffy rings, the black rings less sharply defined and sometimes interrupted below. *Young* (in first pelage): Color markings as in adults, but top of head, nape, and postauricular spots nearly pure brownish black, in contrast to the lighter, generally buffy, tone of dorsum, over which the black-tipped hairs beginning to appear are still inconspicuous.

Cranial characters.—Skull rather small, with moderately high, narrow frontal region; brain case depressed near fronto-parietal suture; postorbital processes of frontals small or obsolescent; postorbital processes of jugal well developed. Very similar to that of *P. l. hirtus*, but much smaller, less massive; sides of frontals behind orbits usually more deeply indented or constricted, the result being that sides of brain case are more rounded or bulging, less tapering anteriorly; dentition relatively the same. Not very unlike that of *P. l. solutus*, but longer and relatively narrower; frontal region usually narrower; palatal shelf longer, extending farther posteriorly beyond posterior molars; dentition usually somewhat lighter, the large molariform teeth rather narrow, but maxillary tooth row longer as a rule, owing to wider spacing of premolars. Similar in general form to that of *P. l. litoreus*, but smaller, and dentition relatively much lighter, the difference most marked in the molariform teeth. Compared with that of *P. l. varius*,

the skull of *P. l. lotor* is larger and heavier; jugal broader; sides of frontals behind orbits usually more deeply indented or constricted; maxillary tooth row longer; posterior upper premolar and upper carnassial usually distinctly larger.

Measurements.—Adult female from Liberty Hill, Conn.: Total length, 832 millimeters; tail vertebrae, 247; hind foot, 118. Adult female from Minerva, N. Y.: 805; 225; 105. Adult male from Granville, Nova Scotia: 837; 240; 116. Two adult males from Dismal Swamp, Va., respectively: 800, 860; 245, 285; 115, 110. Adult female from Dismal Swamp, Va.: 800; 250; 115. *Skull:* Adult female from Liberty Hill, Conn.: Greatest length, 114.4; condylobasal length, 109.8; zygomatic breadth, 74.1; interorbital breadth, 23; least width of palatal shelf, 14.8; maxillary tooth row (alveoli), 41.7; upper carnassial, crown length, 8.8, crown width, 9.2. Male and female from Adirondack Mountains, N. Y., respectively: Greatest length, 117, 110.9; condylobasal length, 112.9, 107.4; zygomatic breadth, 71.8, 67.9; interorbital breadth, 22.7, 23.3; least width of palatal shelf, 16.2, 16.2; maxillary tooth row, 42.4, 41.9; upper carnassial, crown length, 8.3, 8.3, crown width, 8.9, 9.3. Male and female from Dismal Swamp, Va., respectively: Greatest length, 116, 111.6; condylobasal length, 109.2, 105.7; zygomatic breadth, 76.4, 68.5; interorbital breadth, 25, 23.3; least width of palatal shelf, 16.2, 16.5; maxillary tooth row, 41.9, 39.7; upper carnassial, crown length, 8.8, 8.5, crown width, 9.2, 9.1.

Remarks.—Although individual variation is considerable, and due allowance should be made for it, the general characters of *P. l. lotor* are maintained with a fair degree of constancy throughout its range. Specimens from the northern part of the area have somewhat longer pelage and average somewhat darker than those from the southern part, but individuals contrasting strongly in color, some very dark and others light in tone, may be found at the same locality. Intergradation with *P. l. hirtus*, *P. l. solutus*, *P. l. litoreus*, and *P. l. varius* is evident, but the transition from one geographic race to another seems to be rather abrupt. [See also appendix, p. 84.] Specimens of *P. l. lotor* from Belleville, Ill., and New Richmond, Mich., approach *hirtus* and might be referred to that form. Those from Dismal Swamp, Va., and eastern North Carolina are variable; some being near-typical *lotor*, while others grade toward *solutus*.

[*Melos*] *lotor* Boddaert, [*Lotor*] *vulgaris* Tiedemann, and *Procyon annulatus* G. Fischer are substitute names for [*Ursus*] *lotor* Linnaeus. *Procyon gularis* Hamilton Smith was based on a live individual "in the State of New York," in which the "whole throat was black." There is no reason to assume that the animal differed from the typical form of the region, in which the amount of black on the throat is quite variable.

Specimens examined.—Total number, 181, as follows:

Connecticut: Liberty Hill, 3;³ West Greenwich, 2 (skulls only); exact locality unknown, 1 (skull only).

District of Columbia: Washington, 1 (skull only).

³ Mus. Comp. Zool.

- Illinois:** Belleville, 2 (skulls only); Olive Branch, 2 (skulls only);⁴ Rosiclare, 1.⁴
- Indiana:** Bicknell, 2 (skulls only); Culver, 1 (skull only); Pitcher Lake, Posey County, 1 (skull only);⁵ Porter County, 1 (skull only); Russiaville, 1 (skull only); Salamonia, 1 (skull only).⁴
- Kentucky:** Mammoth Cave, 1; Paducah, 1.
- Maine:** Bethel, 4 (3 skulls without skins);⁶ Bucksport, 2 (skulls only);³ Ellsworth, 1 (skin only);³ Greenville, 1;³ Penobscot River, 2; Umbagog Lake, 1 (skull only);³ Upton, 1.³
- Maryland:** Blackwater National Wildlife Refuge, Dorchester County, 5 (1 skull without skin) [preferable to *P. l. maritimus*, see appendix, p. 85]; Bowie, 1 (skull only); Branchville, 1; Cabin John, 1; Jefferson, 2 (1 skull without skin); Laurel, 7 (skulls only); Marshall Hall, 1 (skull only); Patuxent River, 1 (skull only).
- Massachusetts:** Ayer, 1 (skull only);³ Brookhaven, 1 (skull only); Pepperell, 1 (skull only);³ Stockbridge, 1 (skull only).³
- Michigan:** Constantine, 1 (skin only);⁴ Detroit, 1 (skull only); New Richmond, 1 (skull only).
- New Hampshire:** Ossipee, 1 (skull only).
- New Jersey:** Tuckerton, 3.
- New York:** Adirondack Mountains, 9 (skulls only); Essex County, 4 (skulls only); Fort Montgomery, 2 (1 skin without skull);⁷ Hastings, 1;⁴ Hastings on Hudson, 4 (2 skins without skulls);⁷ Lake George, 1 (skull only); Lewis County, 1 (skull only); Leyden, 1 (skull only); Locust Grove, 1; Long Island, 1;⁷ Monroe County, 1 (skull only);⁴ Minerva, 3;⁷ Netherwood, 1;⁷ Piseco, 1; Saint Lawrence County, 2 (1 without skin and 1 without skull); Schoharie, 1 (skin only);⁷ Schroon Lake, 1 (skull only); Severance, 8 (skulls only); Sing Sing, 16 (skulls only); West Point, 2 (skins only).
- North Carolina:** Asheville, 6 (5 skulls without skins); Coinjock, 1 (skin only); Highlands, 1 (skin only); Moore County, 1 (skull only); Pisgah National Forest (Bent Creek), 3 (skulls only); Raleigh, 1 (skull only).
- Nova Scotia:** Bridgetown, 1;³ Digby, 1; Granville, 3.⁴
- Ontario:** Credit River, 1 (skull only);⁸ Preston, Waterloo County, 1 (skull only).⁸
- Pennsylvania:** Allegheny County, 2 (1 without skin and 1 without skull); Carlisle, 7 (skulls only); Chester County, 1 (skull only).
- Vermont:** Newfane, 1 (skull only).
- Virginia:** Amelia County, 1 (skull only); Buckingham County, 2 (skins only); Chesterfield, 1 (skull only); Chesterfield County, 1 (skull only); Clarke County, 1 (skull only); Dismal Swamp, 5 (1 skull without skin); Fredericksburg, 4 (skulls only); Gunston, 2 (skulls only); Morrison, 1 (skull only); Nelson County, 1 (skin only); Smith Island, 2; Warwiek County, 1 (skull only); Washington, 4 (1 skull without skin).

³ Mus. Comp. Zool.
Chicago Mus. Nat. Hist.
Univ. Michigan Mus. Zool.

⁶ Mus. Vert. Zool.

⁷ Amer. Mus. Nat. Hist.

⁸ Natl. Mus. Canada.

PROCYON LOTOR HIRTUS NELSON AND GOLDMAN

UPPER MISSISSIPPI VALLEY RACCOON

Procyon lotor hirtus Nelson and Goldman, Jour. Mammal. 11 (4): 455, Nov. 11, 1930.

Type locality.—Elk River, Sherburne County, Minn.

Type.—No. 187926, male adult, skin and skull, United States National Museum (Merriam collection); collected by Vernon Bailey, March 4, 1886.

Distribution.—Upper Mississippi and Missouri River drainage areas from the eastern slopes of the Rocky Mountains east to Lake Michigan, and from southern Manitoba and probably southwestern Ontario and southeastern Alberta south to southern Oklahoma and Arkansas. Overlapping divisions of Upper Austral and Transition Zones; entering Canadian Zone to a limited extent near Lake Superior.

General characters.—A large, dark subspecies with long, full, soft pelage, usually suffused with ochraceous buff; skull with high, narrow frontal region, and weak or obsolescent postorbital processes. Similar to *P. l. lotor* of the eastern United States, but much larger; pelage longer and usually more suffused with ochraceous buff. Size about as in *P. l. fuscipes* of Texas, but color darker, the pelage much longer and denser, more suffused with buff instead of grayish, the light subapical zone of hairs over upper parts less extensive and permitting the under color to show through; skull differing in slight details.

Color.—Similar to *P. l. lotor* but usually more suffused with ochraceous buff.

Cranial characters.—Skull very similar to that of *P. l. lotor* in general form, but much larger, more massive; brain case usually more tapering anteriorly, the sides of frontals diagonally below and behind postorbital processes less deeply indented or constricted; postorbital processes of frontals weakly developed, or obsolescent, as in *lotor*. About the same in size and in most important details as *P. l. fuscipes*, but interorbital and postorbital regions usually narrower; frontal area similarly high, but usually less flattened, with a narrower, more distinct, V-shaped median depression.

Measurements.—An adult male from Fargo, N. Dak.: Total length, 880 mm.; tail vertebrae, 265; hind foot, 125. *Skull*: Type: Greatest length, 127.1; condylobasal length, 122.2; zygomatic breadth, 80.5; interorbital breadth, 25.8; least width of palatal shelf, 15.8; maxillary tooth row (alveoli), 45.8; upper carnassial, crown length, 8.8, crown width, 9.

Remarks.—The raccoon of the upper part of the Mississippi Valley is readily distinguished from its eastern relative, *P. l. lotor*, by much larger size, especially of the skulls. It is less easily separated from *P. l. fuscipes* of Texas, which is of about the same size, but typical specimens differ in color and in cranial details as pointed out. Inter-

gradation is evident, but in the sum of characters presented these widely ranging forms are quite distinct.

Specimens examined.—Total number, 61, as follows:

- Colorado:** Arkins, 1 (skull only); Cherry Creek, Arapahoe County, 2 (1 skull without skin); Estelene, 1; Las Animas, 1; Loveland, 1; Tuttle, 1; Wray, 4 (1 skin without skull; 3 skulls without skins).
- Illinois:** Chicago (Jackson Park), 1; Henderson County, 1; Joliet, 1 (skin only).
- Iowa:** Keosauqua State Park, Van Buren County, 1.⁹
- Kansas:** Manhattan, 1 (skull only).
- Minnesota:** Beltrami County, 1; Elk River (type locality), 13 (6 skulls without skins).
- Missouri:** Independence, 1 (skull only); Marble Cave, 1 (skull only).
- Nebraska:** Beemer, 2 (skulls only); Haigler, 1 (skull only); Johnstown, 1 (skull only); Republican Fork, Platte River, 1 (skull only); Valentine, 1 (skull only); without exact locality, 1 (skull only).
- New Mexico:** Bear Canyon, Raton Range, 1 (skull only); Raton Range (mouth of Trinchera Pass), 1.
- North Dakota:** Fargo, 1; Grafton, 1 (skull only); Towner, 1.
- Oklahoma:** Fort Cobb, 1 (skull only); Frederick ("20 miles from"), 1 (skin only); Mount Scott, 4 (1 skull without skin); Redfork, 1 (skin only).
- Texas:** Canadian, 1 (skull only).
- Wisconsin:** Delavan, 6 (5 skulls without skins); Okee, 1 (skull only); without exact locality, 1 (skull only).
- Wyoming:** New Haven, 1.

PROCYON LOTOR VARIUS NELSON AND GOLDMAN

ALABAMA RACCOON

Procyon lotor varius Nelson and Goldman, Jour. Mammal. 11 (4): 456, Nov. 11, 1930.

Type locality.—Castleberry, Conecuh County, Ala.

Type.—No. 158246, female adult, skin and skull, United States National Museum (Biological Surveys collection); collected by A. H. Howell, October 10, 1908.

Distribution.—Extreme southwestern Kentucky, Tennessee, Mississippi, northern Louisiana, Alabama, northwestern Florida, and western Georgia. Mainly Lower Austral Zone.

General characters.—A small subspecies most closely resembling *Procyon lotor lotor*, but smaller, usually paler, pelage much shorter, and skull differing in detail. Differing from *P. l. lucus* of Florida in paler color, rather decidedly smaller size, and in cranial features. Similar to *P. l. fuscipes* of Texas in color, but much smaller, with a different skull.

Color.—Upper parts in general light buffy grayish, with a light ochraceous buffy suffusion along median dorsal area, becoming more intense on nape and shoulders, thinly overlaid with black; sides clearer gray, the black-tipped hairs of dorsum thinning out; top of head mixed brownish black and gray; facial mask brownish black,

⁹Iowa State College.

becoming rusty brownish on median line between eyes, and ochraceous buffy on upper surface of muzzle; sides of muzzle, lips, and chin white; under parts in general thinly overlaid with buffy grayish; throat patch brownish black; ears grayish with small black patches at posterior base; legs grayish, becoming whitish on feet; tail above with about five or six black rings and a black tip, alternating with light ochraceous buffy rings, the dark rings becoming buffy and less distinct below.

Cranial characters.—Skull small and slender, with weak or obsolescent postorbital processes of frontals; very similar to that of *P. l. litor.* but smaller and more delicate in structure; jugal narrower; sides of frontals diagonally behind and below postorbital processes usually less deeply indented or laterally constricted; maxillary tooth row shorter; posterior upper premolar and upper carnassial usually distinctly smaller; very similar to that of *P. l. chueus* in general form, but rather decidedly smaller; brain case narrower, frontal region flatter, less "humped." Compared with that of *P. l. fuscipes* the skull is much smaller, more slender, with narrower frontal region, and postorbital processes of frontals (not very prominent in *fuscipes*) less developed.

Measurements.—Type: Total length, 720 mm.; tail vertebrae, 218; hind foot, 103. An adult male from Hurricane, Ala.: 772; 258; 109. *Skull:* Type: Greatest length, 101.8; condylobasal length, 98.6; zygomatic breadth, 64.4; interorbital breadth, 22.5; least width of palatal shelf, 14.6; maxillary tooth row (alveoli), 39.8; upper carnassial, crown length, 7.8, crown width, 7.9.

Remarks.—The Alabama raccoon agrees more closely in combination of characters with typical *litor* than with any of the other known subspecies, although its distribution area constitutes a wedge, separating the ranges of *chueus*, *fuscipes*, and *litorcus*. [See appendix, p. 84.] Intergradation with these forms is evident, but the lines of demarcation between them appear to be fairly sharply drawn.

Specimens examined.—Total number 57, as follows:

Alabama: Ashford, 2 (1 skull without skin); Barachias, 5 (skulls only); Castleberry, 2; Huntsville, 1; Hurricane (4 miles north), 2; Orange Beach, 11 (9 skulls without skins); Perdido Bay, 1 (skull only); Sylacauga, 2 (skulls only).

Florida: Apalachicola, 5 (skulls only).

Georgia: Geneva, Talbot County, 1 (skull only); Juniper, Talbot County, 6;¹⁰ Nashville, 2 (1 skin without skull); Talbot County, 5 (skulls only).

Kentucky: Hickman, 2.

Louisiana: Baton Rouge, 1;¹¹ Morrow, Saint Landry Parish, 1 (skull only); Mississippi River (mouth), 1 (skull only)¹¹ [referable to *P. l. megalodous*, see appendix, p. 84].

Mississippi: Bay Saint Louis, 1 (skin only); Saucier, 1;¹² Washington, 2.

Tennessee: Arlington, 1; Big Sandy, 1; Clarksville, 1.

¹⁰ Mus. Comp. Zool.

¹¹ Louisiana State Univ. Mus.

¹² Southern Forest Expt. Sta. Collection.

PROCYON LOTOR LITOREUS NELSON AND GOLDMAN

SAINT SIMON ISLAND RACCOON

Procyon lotor litoreus Nelson and Goldman, Jour. Mammal. 11 (4): 457, Nov. 11, 1930.

Type locality.—Saint Simon Island, Glynn County, Ga.

Type.—No. 2450, adult (probably male), skull only, United States National Museum; collected by Samuel W. Wilson; entered in museum catalog, August 7, 1856.

Distribution.—Coastal strip and islands of Georgia. Austroriparian division of Lower Austral Zone.

General characters.—Size medium and color dark, much as in *Procyon lotor clucus* of Florida; length and texture of pelage about the same; skull differing in detail, especially in the much heavier dentition. Similar to *P. l. lotor* of Pennsylvania in color, but pelage shorter, more bristly, and cranial characters distinctive. Differing from *P. l. solutus* of South Carolina in more buffy or brownish coloration and heavy dentition.

Color.—About as in *P. l. clucus*.

Cranial characters.—Skull similar in general form to that of *P. l. clucus*, but frontal region narrower and flatter, the sides usually more compressed or abruptly indented behind postorbital processes, leaving the brain case bulging laterally instead of tapering gradually into orbit as in *clucus*; dentition much heavier throughout, the difference being most noticeable in the large molariform teeth. Differing from that of *P. l. solutus* in larger size and much heavier dentition. Compared with that of *P. l. lotor* the skull is usually larger, with much heavier dentition; postorbital processes of frontal weak or obsolescent as in *lotor* and *clucus*.

Measurements.—Adult topotype: Hind foot (dry skin) 107 mm. *Skull*: Type: Greatest length, 116.6; condylobasal length, 109.4; zygomatic breadth, 72.9; interorbital breadth, 22.2; least width of palatal shelf, 15.8; maxillary tooth row (alveoli), 43.6; upper carnassial, crown length, 9.6, crown width, 9.9.

Remarks.—The remarkably heavy dentition readily distinguishes *P. l. litoreus* from all others of the group inhabiting the eastern United States. Its large teeth are equalled elsewhere in the group only in some of the larger subspecies of the Western States and southern Mexico and Central America. Specimens from Saint Simon Island appear to reach the maximum in dental development, but are closely approached by those from the adjacent mainland.

Specimens examined.—Total number, 25, as follows:

Georgia: Altamaha River (mouth), 5 (skulls only); McIntosh County, 2 (skulls only); Ossabaw Island, 1 (skin only); Saint Simon Island, 15 (2 skins, 13 skulls); Thunderbolt Creek, Chatham County, 2.

PROCYON LOTOR SOLUTUS NELSON AND GOLDMAN

HILTON HEAD ISLAND RACCOON

Procyon lotor solutus Nelson and Goldman, Jour. Mammal. 12 (3): 308, Aug. 24, 1931.

Type locality.—Hilton Head Island, Beaufort County, S. C.

Type.—No. 256027, male adult, skin and skull, United States National Museum; collected by W. L. Brown, December 10, 1930.

Distribution.—Coast region and islands of South Carolina. Lower Austral Zone.

General characters.—Size rather small; color grayish; black mask uninterrupted across face in two of every three individuals; winter pelage rather long and dense. Similar, in general to *P. l. litoricus* of Saint Simon Island and the coast region of Georgia, but color clearer gray, less inclining toward buffy or brownish; skull characters, especially the much lighter dentition, distinctive. Differing from *P. l. lotor* in more grayish general coloration, less elongated skull, and other cranial details.

Color.—Upper parts in general grayish, rather heavily overlaid with black, especially on median dorsal area; rather small nape patch suffused with ochraceous buff; top of head mixed black and gray, the gray predominant; black mask usually continuous across middle of face, prolonged upward along median line to middle of forehead and downward over middle of muzzle to nose; sides of muzzle, lips, and chin white; under parts in general thinly overlaid with silvery gray, the dark brownish under color showing through; throat patch blackish; ears gray, with black patches at posterior base; limbs similar to under parts, becoming brownish gray on feet, the hind legs with pure black areas on outer side above heels; tail with about six black rings, narrowest near base, and a black tip, alternating with light ochraceous buffy rings.

Cranial characters.—Skull of medium size, rather broad, short, and light in structure. Similar in general to that of *P. l. litoricus* but smaller; dentition very much lighter. Compared with that of *P. l. lotor* the skull is shorter and relatively broader; frontal region usually broader and flatter; palatal shelf shorter; dentition usually somewhat heavier, but maxillary tooth row shorter as a rule, the premolars more closely crowded.

Measurements.—An adult male from Bulls Island, S. C.: Total length, 803 mm.; tail vertebrae, 244; hind foot, 117. Two adult females from Bulls Island, S. C., respectively: 635, 749; 493, 260; 105, 107. *Skull*: Type: Greatest length, 111.7; condylobasal length, 108.2; zygomatic breadth, 75.1; interorbital breadth, 24.1; least width of palatal shelf, 16.4; maxillary tooth row (alveoli), 42.1; upper carnassial, crown length, 8.8, crown width, 9.2.

Remarks.—The raccoon of Hilton Head Island and neighboring islands, and the adjacent mainland is readily distinguished from *P. l. litorcus* by much lighter dentition. Differentiation of this insular form is apparently due to isolation, its typical habitat being separated from the mainland by a broad and rather deep channel. Some skulls of this form closely resemble some of those of *P. l. varius*, the general size and dentition being very similar. Closely compared with those of *varius*, however, the skulls are usually shorter and broader, the frontal region broader and flatter, the brain case more rounded and inflated, and the cheek teeth somewhat larger. In addition, the longer pelage, grayer coloration, and more complete black facial mask appear to be distinctive.

Specimens examined.—Total number, 31, as follows:

South Carolina: Bulls Island, Charleston County, 11 (8 skins without skulls); Eddings Island, 1; Edisto Island, Charleston County, 5; ¹³ Hilton Head Island (type locality), 9 (6 skulls without skins); Hunting Island, 1; Saint Helena Island, 1; Santee, 2; Yemassee, Hampton County, 1 (skull only).¹³

PROCYON LOTOR ELUCUS BANGS

FLORIDA RACCOON

Procyon lotor elucus Bangs, Boston Soc. Nat. Hist. Proc. 28 (7): 219, March, 1898.

Type locality.—Oak Lodge, on a peninsula opposite Mico, Brevard County, Fla.

Type.—No. 3502, old male adult, skin and skull, Museum of Comparative Zoology (Bangs collection); collected by Outram Bangs, February 15, 1895.

Distribution.—Peninsular Florida, except southwestern part inhabited by *P. l. marinus*, north to extreme southern Georgia; grading into *P. l. varius* in northwest Florida. Tropical and Austroriparian division of Lower Austral Zone.

General characters.—A medium-sized, generally dark-colored subspecies, with a deep, rusty rufous nuchal patch prominent in many typical examples; skull characterized especially by greatly inflated frontal vacuities usually giving the upper outline a decidedly "humped" appearance. Much like *P. l. litorcus* of Saint Simon Island, Ga.; general size, color, length and texture of pelage about the same; skull differing^s in detail, especially the much lighter dentition. Similar to *P. l. varius* of Alabama, but color usually darker, size decidedly larger, and cranial characters distinctive. Differing from *P. l. marinus* of the

¹³ Mus. Comp. Zool.

Ten Thousand Islands and *P. l. incspratus* of Upper Matecumbe Key in larger size, and the more elevated frontal region of skull.

Color.—About as in *P. l. litorcus*. Very similar to *P. l. lotor* but averaging somewhat paler, the hairs over median dorsal area with shorter black tips and the nape more regularly and deeply suffused with rusty or orange rufous.

Cranial characters.—Skull similar to that of *P. l. litorcus*, but frontal region broader, higher arched, or more "humped"; sides of frontals usually less compressed or abruptly indented behind orbits, leaving the brain case tapering more gradually anteriorly, instead of bulging laterally as in *litorcus*; dentition much lighter, the difference most noticeable in the molariform teeth. Decidedly larger than those of *P. l. lotor*, *P. l. varius*, *P. l. marinus*, or *P. l. incspratus*, with brain case broader, and frontal region more "humped"; postorbital processes of frontals obsolescent or small as in other eastern forms.

Measurements.—Type (from original description): Total length, 892 mm.; tail vertebrae, 286; hind foot, 125. An adult male topotype: 800; 244; 120. Average of five adult males from Saw Grass Island, Catfish Creek, Polk County, Fla.: 812 (790–850); 259 (240–280); 126 (125–129); weight (pounds), 11 (10–12). Average of three adult females from same locality: 758 (745–770); 245 (235–255); 121 (117–123); weight (pounds), 9 (7.7–10). *Skull*: Average of five adult males from Saw Grass Island, Catfish Creek, Polk County, Fla.: Greatest length, 119.4 (113.7–123); condylobasal length, 114.5 (110.3–117.1); zygomatic breadth, 71.1 (72–76.6); interorbital breadth, 23.7 (22.3–24.8); least width of palatal shelf, 16 (14.9–17.3); maxillary tooth row (alveoli), 13.2 (41.7–44.6); upper carnassial, crown length, 8.7 (8.4–9.1), crown width, 8.9 (8.8–9.2). Average of three adult females from same locality: Greatest length, 113.6 (112.1–115.2); condylobasal length, 108.8 (106.8–110.4); zygomatic breadth, 68.1 (66.6–70); interorbital breadth, 24 (23.3–24.5); least width of palatal shelf, 16.4 (15.4–17.6); maxillary tooth row, 41.9 (41.3–42.7); upper carnassial, crown length, 8.8 (8.7–9), crown width, 8.8 (8.6–9).

Remarks.—In *P. l. lucus* the inflation of the frontal sinuses reaches its extreme development giving the skull a "humped" appearance in outline, a character shared to some extent with other forms including *P. l. lotor*. Typical examples of *lucus* are quite dark in color, and the rusty rufous suffusion of the nape, appearing irregularly in many subspecies, is more prevalent and of a deeper and richer tone than is usual in the group. Intergradation with *litorcus*, *varius*, and *marinus* is evident, and while not clearly indicated probably occurs with *incspratus* which is known only from the mangrove-fringed islands along the southeast coast of the peninsula of Florida. Specimens from as far south as Naples on the west coast and Cutler, Dade County, are clearly referable to *lucus*.

Specimens examined.—Total number, 127, as follows:

- Florida:** Allenhurst, 1 (skull only); Aucilla River, 6 (skulls only); Black Point, Dade County, 1; Blue Cypress Lake, Osceola County, 1 (skull only); Blue Springs, 1 (skin only);¹⁴ Buena Vista, 1 (skull only); Citronelle, 4;¹⁴ Cutler, Dade County, 9 (1 skull without skin);¹⁴ Englewood, Sarasota County, 1; Enterprise, 1 (skin only);¹⁴ Fort Kissimmee, 18 (14 skulls without skins); Gainesville, 3;¹⁵ Homosassa, 1 (skull only); Kissimmee, 1; Kissimmee River, 1; Lake Cypress, 1; Lake Harney, 5 (1 skin without skull); Lake Hatch-nahaw, 15 (skulls only); Lake Kissimmee, 8 (7 skulls without skins); Lake Monroe, 1; Matanzas Inlet, 1 (skull only); Miami, 1; Micco, 1 (skull only); Naples, 3 (skulls only); New Berlin, 5;¹⁶ Oak Lodge (type locality on peninsula opposite Micco), 2 (1 skull without skin);¹⁴ Orlando, 1 (skin only);¹⁵ Royal Palm Hammock, 1 (skull only); San Mateo (5 miles northeast), 1 (skin only); Saw Grass Island, Catfish Creek, Polk County, 12; Snapper Creek, Dade County, 2; Tarpon Springs, 3 (2 skins without skulls; 1 skull without skin);¹⁵ Taylor Creek, 2 (skins only);¹⁵ Wilson, 1; Welaka, 1 (skin only).¹⁴
- Georgia:** Fargo, 8 (5 skulls without skins); Okefenokee Swamp, 2 (1 skull without skin).

PROCYON LOTOR MARINUS NELSON

TEX THOUSAND ISLANDS RACCOON

Procyon lotor marinus Nelson, Smiths. Misc. Collect. 82 (8): 7, July 10, 1930.

Type locality.—Near Chokoloskee, Collier County, Fla.

Type.—No. 254989, male adult, skin and skull, United States National Museum; collected by E. W. Nelson, February 28, 1930.

Distribution.—Keys of the Ten Thousand Islands Group, and adjoining mainland of southwestern Florida from Cape Sable north through the Everglades to Lake Okeechobee (Ritta). Tropical Zone.

General characters.—A very small subspecies with heavy dentition. Not very unlike *P. l. ducus* and *P. l. inexpectatus* in color, but smaller than either, and cranial characters, especially the relatively larger posterior upper premolar and carnassial, distinctive. Decidedly darker than *P. l. auspicatus* or *P. l. incautus* and cranial characters quite different.

Color.—Similar to that of *P. l. ducus*, but somewhat grayer, especially on the head, the back usually less heavily overlaid with black; rusty nape patch averaging less strongly marked, often obsolescent; under parts and light rings on tail paler, less ochraceous buffy; black mask more restricted.

Cranial characters.—Skull much smaller and more delicately proportioned than in *P. l. ducus*, frontal area much more depressed; brain case more rounded; posterior upper premolar and carnassial relatively, and sometimes actually, larger; palatal shelf about the same. Very similar in general form to that of *P. l. inexpectatus*, but smaller, with

¹⁴ Mus. Comp. Zool.

¹⁵ Amer. Mus. Nat. Hist.

¹⁶ Four in Chicago Mus. Nat. Hist.; one in Mus. Comp. Zool.

relatively and often actually larger (especially broader) posterior upper premolar and carnassial. Differing from those of *P. l. auspicatus* and *P. l. incautus* mainly in usually broader frontal region and much larger posterior upper premolar and carnassial.

Measurements.—Type: Total length, 665 mm.; tail vertebrae, 222; hind foot, 105; weight (pounds), 7. Two adult male topotypes, respectively: 642, 655; 214, 200; 100, 98; weight (pounds), 7, 8. Two adult female topotypes: 610, 613; 200, 192; 93, 93; weight (pounds), 5, 5.5. *Skull*: Type: Greatest length, 105.9; condylobasal length, 101.8; zygomatic breadth, 64.8; interorbital breadth, 22.3; least width of palatal shelf, 13.9; maxillary tooth row (alveoli), 40; upper carnassial, crown length, 9, crown width, 9.1. Two adult male topotypes: Greatest length, 101.3, 106.7; condylobasal length, 98, 101.8; zygomatic breadth, 65.5, 69.5; interorbital breadth, 20.4 23.3; least width of palatal shelf, 14.9, 15; maxillary tooth row, 39.8, 40.5; upper carnassial, crown length, 8.9, 8.7, crown width, 9.7, 9.5. Two adult female topotypes: Greatest length, 93.7, 94.7; condylobasal length, 90.1, 91.8; zygomatic breadth, 58.3, 60.6; interorbital breadth, 20.5, 20.3; least width of palatal shelf, 14.2, 14.1; maxillary tooth row, 36.4, 38; upper carnassial, crown length, 8, 8.8, crown width, 9.2, 9.1.

Remarks.—*P. l. marinus* is one of the smaller subspecies of raccoons that have developed near the southern end of the peninsula of Florida, not differing much in size from *P. l. auspicatus* and *P. l. incautus*. It appears to be limited to the great maze of mangrove-covered or -bordered islands, or keys, known as the "Ten Thousand Islands" where raccoons are present in great numbers, and to parts of the adjoining Everglades region. Specimens from Ritta at the southern end of Lake Okeechobee appear to be referable to *marinus*. Most of the islets mentioned are covered by the sea to a depth of from 3 to 4 feet at each high tide, and are totally devoid of fresh water. As most of these keys have no large trees to afford hollows and no dry land the raccoons must make their homes on top of the mangrove roots where they are forced to retreat by the incoming tide. Specimens from Cape Sable show gradation toward *P. l. lucus*, which ranges south to the eastern part of Dade County along the eastern side of the peninsula. Although evidently closely related to *lucus*, which occupies a different, but adjoining habitat, *marinus* maintains its distinctive characters with remarkable constancy.

Specimens examined.—Total number, 49, as follows:

Florida: Cape Sable, 3; Chokoloskee (type locality), 38; Coon Key, Ten Thousand Islands, 1;¹⁷ Flamingo, Monroe County (skulls only), 3;¹⁸ Ritta, 4 (skulls only).

¹⁷ Amer. Mus. Nat. Hist.

¹⁸ Mus. Comp. Zool.

PROCYON LOTOR INESPERATUS NELSON

MATECUMBE KEY RACCOON

Procyon lotor inesperatus Nelson, *Smithson. Misc. Collect.* 82 (8): 8, July 10, 1930.

Type locality.—Upper Matecumbe Key, Monroe County, Fla.

Type.—No. 255037, male adult, skin and skull, United States National Museum; collected by E. W. Nelson, March 19, 1930.

Distribution.—Key Largo Group, embracing fringing keys along the southeast coast of Florida, from Virginia Key south to Lower Matecumbe Key. Tropical Zone.

General characters.—Closely allied to *P. l. clucus* of adjacent mainland, but averaging smaller and grayer; skull flatter. Differs from *P. l. marinus*, *P. l. auspicatus*, and *P. l. incautus*, representatives of neighboring groups of Florida keys, in its larger, more robust form, and in the combination of color and cranial characters.

Color.—Much as in *P. l. clucus* but usually somewhat grayer, especially on head and face; black mask more restricted, the upper surface of muzzle paler; dorsum rather heavily washed with black, and rusty rufous nuchal patch well marked as in *clucus*; dark rings on tail distinct, and light rings often strongly buffy.

Cranial characters.—Skull similar to that of *P. l. clucus*, but frontal area markedly depressed, instead of highly arched, or "humped." Differing from those of *P. l. marinus*, *P. l. auspicatus*, and *P. l. incautus* in larger size and more massive proportions; posterior upper premolar and carnassial actually, and therefore relatively, decidedly smaller than in *P. l. marinus*. Compared further with those of *auspicatus* and *incautus*, the palatal shelf extends farther behind the posterior molars than in the former and the frontal region is usually broader than in either.

Measurements.—Type: Total length, 730 mm.; tail vertebrae, 250; hind foot, 115; weight (pounds), 8.5. Adult male from Key Largo: 795; 222; 124; weight (pounds), 12. Adult female from Lower Matecumbe Key: 648; 228; 102; weight (pounds), 5. *Skull*: Type: Greatest length, 114; condylobasal length, 108.1; zygomatic breadth, 68.2; interorbital breadth, 23.1; least width of palatal shelf, 15.2; maxillary tooth row (alveoli), 41; upper carnassial, crown length, 9.1, crown width, 9.6.

Remarks.—Only a short distance separates the insular habitat of the present subspecies from the adjacent Florida mainland which is occupied by *P. l. clucus*. Nevertheless specimens from the various keys of the Key Largo Group differ somewhat in color as pointed out, and the skulls may at once be recognized by appreciably smaller size and more flattened frontals. The skulls of those from Key Largo and Virginia Key are larger than those from the more distant Upper and Lower Matecumbe Keys, and in this respect grade toward the

mainland animal. The motor highway from Miami to Key West, connecting keys by fills or viaducts enabling raccoons to pass from one key to another will doubtless result, through interbreeding, in the blending and obliteration of the interesting characters that now distinguish the various races of the island chain.

Specimens examined.—Total number, 25, as follows:

Florida (Key Largo Group): Elliotts Key, 7;¹⁹ Key Largo, 5;²⁰ Lignum Vitae Key, 1; Lower Matecumbe Key, 7; Plantation Key, 2; Upper Matecumbe Key, 1 (type); Virginia Key, 2.

PROCYON LOTOR AUSPICATUS NELSON

KEY VACA RACCOON

Procyon lotor auspicatus Nelson, Smithsn. Misc. Collect. 82 (8): 9, July 10, 1930.

Type locality.—Marathon, Key Vaca, Monroe County, Fla.

Type.—No. 255080, male adult, skin and skull, United States National Museum; collected by E. W. Nelson, March 28, 1930.

Distribution.—Key Vaca and doubtless closely adjoining keys of the Key Vaca Group, a central section of the main chain off the southern coast of Florida. Tropical Zone.

General characters.—A very small, pale subspecies; skull with a narrow, but rounded brain case. Similar in size to *P. l. marinus* of the Ten Thousand Islands and *P. l. incantus* of the Big Pine Key Group, but decidedly paler than the former and differing in cranial details from both. Distinguished from *P. l. inasperatus* of Upper Matecumbe Key, by smaller size, much paler color, and by cranial characters.

Color.—Very pale, similar to that of *P. l. incantus*, but not quite so extreme, much paler throughout than *P. l. inasperatus* or *P. l. marinus*, the upper parts usually thinly overlaid with rusty brownish, and the underfur of a lighter brownish tone than in *inasperatus* or *marinus*; black facial mask more restricted; dark rings on tail narrower, more brownish, but usually distinct all around.

Cranial characters.—Skull very small, with a short palatal shelf and moderately heavy dentition. Similar to that of *P. l. marinus*, but somewhat smaller, with shorter palatal shelf, and lighter dentition. Smaller than that of *P. l. inasperatus*, with brain case relatively narrower, palatal shelf shorter, pterygoids less divergent posteriorly. Compared with that of *P. l. incantus* the skull is smaller, with shorter palatal shelf and narrower zygomata.

Measurements.—Type: Total length, 644 mm.; tail vertebrae, 214; hind foot, 99; weight (pounds), 5.5. Average of five adult male topotypes: 657 (634–700); 236 (214–275); 100 (96–107); weight (pounds), 5.3 (4–6). Two adult

¹⁹ Mus. Comp. Zool.

²⁰ Two in Mus. Comp. Zool.

female topotypes, respectively: 603, 620; 212, 232; 83, 97; weight (pounds), 4, 5. *Skull*: Type: Greatest length, 100; condylobasal length, 94.7; zygomatic breadth, 64.5; interorbital breadth, 19.4; least width of palatal shelf, 13.9; maxillary tooth row (alveoli), 37.4; upper carnassial, crown length, 7.8, crown width, 8.6. Average of five adult male topotypes: Greatest length, 102.1 (99.9–105.9); condylobasal length, 97 (94.3–101); zygomatic breadth, 63.5 (60.2–66.2); interorbital breadth, 20 (18.8–22.7); least width of palatal shelf, 14 (13.4–15); maxillary tooth row, 38 (36.1–38.9); upper carnassial, crown length, 7.8 (7.6–8.1), crown width, 9 (8.7–9.3). Two adult female topotypes: Greatest length, 93.6, 97.5; condylobasal length, 89.4, 94; zygomatic breadth, 59.8, 58.7; interorbital breadth, 18.8, 19; least width of palatal shelf, 14, 13.8; maxillary tooth row, 35, 36.6; upper carnassial, crown length, 7.4, 7.7, crown width, 8.3, 8.6.

Remarks.—The Key Vaca raccoon is one of the most salient in characters of the subspecies inhabiting the Florida Keys. It resembles *P. l. incautus* in pale coloration, but departs from all in combination of cranial features. Its range is the most restricted of any of the Florida races.

Specimens examined.—Thirteen, from type locality.

PROCYON LOTOR INCAUTUS NELSON

TORCH KEY RACCOON

Procyon lotor incautus Nelson, *Smithson. Misc. Collect.* 82 (8): 10, July 10, 1930.

Type locality.—Torch Key, Big Pine Key Group, Monroe County, Fla.

Type.—No. 255060, male adult, skin and skull, United States National Museum; collected by E. W. Nelson, March 24, 1930.

Distribution.—Big Pine Key Group, near southwestern end of chain of Florida keys. Tropical Zone.

General characters.—A small, very pale subspecies, palest of the Florida forms, with skull highly arched, and narrow between orbits. Closely resembling *P. l. auspicatus* of Key Vaca in color, but cranial characters, especially the narrower, high frontal region, distinctive. Decidedly paler than *P. l. marinus* or *P. l. insperatus* of Upper Matecumbe Key, and skull differing in important details.

Color.—Very pale, similar to that of *P. l. auspicatus*, but averaging even paler, especially on head and face, the black mask more restricted, more distinctly interrupted between eyes, the whitish areas correspondingly extended and more completely isolating the dusky median streak; upper surface of muzzle light buffy; rusty nuchal patch conspicuous, inclining toward yellowish in worn pelages; dark rings on tail rusty brown, as in *auspicatus*, but usually broader.

Cranial characters.—Cranium small, with narrow, highly arched frontal region and light dentition. Averaging larger than that of *P. l. auspicatus*, with frontal region narrower, usually more highly arched; palatal shelf extending farther behind plane of last molars;

pterygoids more divergent posteriorly; molariform teeth smaller. Similar in general to those of *P. l. marinus* and *P. l. inespertus*, but distinguished by narrower frontal region and smaller molariform teeth.

Measurements.—Type: Total length, 694 mm.; tail vertebrae, 263; hind foot, 118; weight (pounds), 8.5. Average of five adult males from Big Pine Key and No Name Key: 710 (656–738); 247 (216–273); 111 (108–113); weight (pounds), 8 (7.5–9.5). Average of four adult females from Torch Key (type locality), Boca Chica Key, and No Name Key: 688 (660–720); 240 (226–253); 105 (103–110); weight (pounds), 6.1 (5.5–6.5). *Skull*: Type: Greatest length, 111; condylobasal length, 104.7; zygomatic breadth, 66.7; interorbital breadth, 49.8; least width of palatal shelf, 14.9; maxillary tooth row (alveoli), 38.8; upper carnassial, crown length, 7.8, crown width, 8.5. Average of seven adult males from Big Pine Key and No Name Key: Greatest length, 109.8 (105–113.8); condylobasal length, 102.9 (97.8–106.2); zygomatic breadth, 69.4 (62.5–78.1); interorbital breadth, 21.8 (19.6–23.9); least width of palatal shelf, 14.8 (13.9–16); maxillary tooth row, 39.2 (38.1–40.4); upper carnassial, crown length, 7.8 (7.6–8), crown width, 8.6 (8–9). Average of four adult females from Torch Key, Boca Chica Key, and No Name Key: Greatest length, 104.9 (101–107.7); condylobasal length, 94 (96.5–100.5); zygomatic breadth, 61.9 (60.7–64.2); interorbital breadth, 21.1 (20–22.2); least width of palatal shelf, 14.4 (14–15); maxillary tooth row, 38 (37.4–38.5); upper carnassial, crown length, 7.5 (7.3–7.8), crown width, 8.3 (7.8–8.8).

Remarks.—The home of this race of raccoons is on the group of Florida Keys farthest from the mainland. As is the case with the other Florida Key raccoons they live mainly, and sometimes entirely, in mangrove swamps without access to fresh water except during rains. The brilliant light of their environment may have affected their general color more than the others, as suggested by their pale, faded tints. In general form and proportions the skull resembles that of *P. l. chicus* rather more closely than those of its geographically nearer insular relatives. It is much smaller, however, and suggests a miniature of that of the mainland animal.

Specimens examined.—Total number, 33, as follows:

Florida: Big Pine Key, 16; ²¹ Boca Chica Key, 2; Geiger's Key, 2; ²² Key West, 3 (1 skull without skin); ²³ No Name Key, 5; Stock Island, 3; ²³ Torch Key (type locality), 2.

PROCYON LOTOR FUSCIPES MEARNS

TEXAS RACCOON

Procyon lotor fuscipes Mearns, Biol. Soc. Washington Proc. 27: 63, March 20, 1914.

Type locality.—Las Moras Creek, Fort Clark, Kinney County, Tex. (altitude 1,011 feet).

²¹ Ten in Mus. Comp. Zool.

²² Mus. Comp. Zool.

²³ One in Mus. Comp. Zool.

Type.—No. 63055, male adult, skin and skull, United States National Museum; collected by Edgar A. Mearns, February 6, 1893. Original number 2273.

Distribution.—Texas, except extreme northern and western parts, southern Arkansas, Louisiana, except delta region of Mississippi, and south into northeastern Mexico, including Coahuila and Nuevo Leon, to southern Tamaulipas, Austroriparian and Lower Sonoran divisions of Lower Austral Zone.

General characters.—A large, dark grayish subspecies, with pelage of medium length and texture; skull with high, moderately broad frontal region and weakly developed postorbital processes. Size about as in *P. l. hirtus* of Minnesota, but color grayer, less suffused with buff; mask more uniformly black and continuous across face and on upper surface of muzzle; pelage much shorter and less dense. Similar to *P. l. mexicanus* of Chihuahua, but decidedly darker, and cranial characters distinctive. Resembling *P. l. varius* of Alabama in general color, but somewhat grayer and much larger, with a different skull. Similar in size to *P. l. hernandezii* of the Valley of Mexico, but less grayish, the postauricular spots larger, more conspicuous; skull less flattened and differing in detail.

Color.—Similar to that of *P. l. varius*, but averaging somewhat grayer, less suffused with buff; mask usually more uniformly black and continuous across middle of face and on upper surface of muzzle to nasal pad.

Cranial characters.—Size and general proportions of skull nearly as in *P. l. hirtus*, but interorbital and postorbital regions usually broader; frontal region similarly high, but usually flatter, with a less distinct, V-shaped, median depression. Similar in size to that of *P. l. mexicanus*; frontal region similarly high behind plane of postorbital processes, but more elevated anteriorly, the upper outline more convex; brain case more depressed near fronto-parietal suture; interorbital and postorbital regions usually narrower; postorbital processes of frontals shorter, the upper margin of orbit less deeply concave. Compared with that of *P. l. varius* the skull is much larger and heavier, with broader frontal region. Not very unlike that of *P. l. hernandezii*, but less flattened, the frontal region more elevated; brain case usually more depressed near fronto-parietal suture; postorbital processes of frontals less prominent, the upper margin of orbit less deeply concave; posterior upper premolar and upper carnassial usually smaller.

Measurements.—Type: Total length, 900 mm.; tail vertebrae, 290; hind foot, 132. Two adult males from Laredo, Tex., respectively: 860, 850; 298, 275; 136, 131. An adult male and female from Sabinas, Coahuila: 922, 760; 330, 260; 136, 116. *Skull*: Type: Total length, 130.2; condylobasal length, 125; zygomatic

breadth, 84.4; interorbital breadth, 26.9; least width of palatal shelf, 16.2; maxillary tooth row (alveoli), 47.4; upper carnassial, crown length, 8.5, crown width, 9.6. An adult male and female from Sabinas, Coahuila: Greatest length, 130.6, 117.7; condylobasal length, 123.9, 112.1; zygomatic breadth, 82.8, 75.5; interorbital breadth, 24.4, 24; least width of palatal shelf, 18.1, 15.9; maxillary tooth row, 46.9, 43.3; upper carnassial, crown length, 8.9, 8.7, crown width, 10, 9.4.

Remarks.—*P. l. fuscipes* requires rather close comparison with *P. l. hirtus* to the north and *P. l. hernandezii* to the south, but typical specimens differ in combination of characters as pointed out. It is readily distinguished from *P. l. varius* by much larger size and from *P. l. mexicanus* by darker color. Intergradation with all of these may safely be assumed. In typical *fuscipes*, however, the facial mask usually extends as a broad, uniformly black area across the face as in *P. l. mexicanus* and western subspecies in general, instead of being more or less distinctly interrupted by whitish longitudinal lines, one on each side near inner angle of eye, tending to isolate a narrow, elongated black median patch as in *hirtus*, *varius* and other eastern continental forms. In *fuscipes* the brain case, on the other hand, is somewhat depressed near the fronto-parietal suture and the postorbital processes of the frontals are very short or obsolescent, characters shared with *hirtus*, *varius* and the eastern subspecies in contrast with *mexicanus* and the more western and southern continental forms in which the depression of the brain case is less evident, and the postorbital processes of the frontals are well developed.

Specimens examined.—Total number, 100, as follows:

Coahuila: Muzquiz, 1; opposite Langtry, Texas, 3; Sabinas, 3.

Louisiana: Abbeville, 8 (3 skins without skulls); Abbeville (24 miles southwest), 3; Iowa, 1 (skull only); Lake Ridge, 1; Morgan City, 1; Tallulah, 12 (10 skulls without skins). [All specimens except those from Lake Ridge and Tallulah probably are referable to *P. l. megalodontus*.]

Nuevo Leon: Monterrey, 1.

Tamaulipas: Alta Mira, 1 (skull only); Bagdad, 1; Camargo, 3; Marmolejo, 1;²⁴ Matamoros, 3 (2 skulls only).

Texas: Angleton, 1; Aransas National Wildlife Refuge, Refugio County, 2; Aransas County, 2 (skulls only); Broome, 1 (skin only); Brownsville, 1; Canyon, 2; Carlsbad (10 miles east), 3; Columbia, 1 (skull only); Corpus Christi, 2; Dickinson Bayou (opposite Galveston), 1; Eagle Pass, 1; Fort Clark, 2 (including type); Grady, 1 (skull only); Kerrville, 2 (skulls only); Kountze, 1; Langtry, 1; Laredo, 5 (3 skins without skulls); Liberty, 1 (skull only); Lomita Ranch, 2 (skulls only); Long Point, 1 (skull only); Los Ratonos, Zapata County, 1; Mason, 4; Matagorda, 6 (5 skulls without skulls); Padre Island, 1 (skull only); Port Lavaca, 1 (skull only); Rankin, 2; Sour Lake, 4 (3 skulls without skins); Texarkana (10 miles northwest), 2; Washington County, 1 (skull only); Water Valley, 2 (skulls only).

²⁴ Univ. Michigan Mus. Zool.

PROCYON LOTOR MEXICANUS BAIRD

MEXICAN RACCOON

Procyon lotor, variété mexicaine I. Geoffroy-Saint Hilaire, Voy. sur la Venus, Zoologie, p. 125, pl. VI, 1855. From Mazatlan, Sinaloa, Mexico.

Procyon hernandezii var. *mexicana* Baird, Mammal. North Amer., p. 215, 1857.

Procyon lotor mexicanus Mearns, Biol. Soc. Washington Proc. 27: 65, Mar. 20, 1914.

Type locality.—Espia, northwestern Chihuahua, Mexico.

Type.—No. 2018, probably female, adult, skull only (originally accompanied by skin which cannot now be found), United States National Museum; collected by C. B. R. Kennerly, April 1855.

Distribution.—New Mexico, except northeastern and northwestern parts, southeastern Arizona, western Texas, and south through Chihuahua, eastern Sonora, Sinaloa and Durango to northern Nayarit, Mexico. Lower Sonoran to Transition Zone.

General characters.—One of the palest subspecies of the group; skull with broad frontal area highly arched behind plane of well-developed postorbital processes. Color and general size about as in *P. l. pallidus* of the Colorado River Valley, but skull usually broader, especially between orbits, and differing in other slight details. Decidedly paler than *P. l. fuscipes* of Texas, or *P. l. hirtus* of Minnesota, and combination of cranial characters quite different. Similar in general to *P. l. hernandezii* of the Valley of Mexico but paler, the upper parts less extensively overlaid with black; skull more highly arched and presenting other distinctive features.

Color.—Upper parts in general coarsely grizzled iron grayish and under parts light buffy about as in *P. l. pallidus*; black mask broad and uninterrupted across face; rusty nuchal patch usually absent, but faintly indicated in occasional specimens.

Cranial characters.—Skull most closely resembling that of *P. l. pallidus*, but brain case, frontal area and palatal shelf usually broader; frontals rather high behind plane of postorbital processes as in *pallidus*; tooth rows usually shorter. Compared with those of *P. l. fuscipes* and *P. l. hirtus* the frontal region is similarly high behind plane of postorbital processes, but less elevated anteriorly, the frontal outline descending in a more nearly straight line with nasals; brain case less depressed near frontoparietal suture; interorbital and postorbital areas usually broader; postorbital processes of frontals longer, the upper margin of orbit more deeply concave. Contrasted with that of *P. l. hernandezii* the skull is of similar size, but less flattened, the frontal region more elevated behind plane of postorbital processes;

interorbital and postorbital areas usually broader; maxillary tooth row shorter; posterior upper premolar and carnassial smaller.

Measurements.—Adult male from Lochiel, Santa Cruz River, Ariz.: Total length, 895 mm.; tail vertebrae, 365; hind foot, 121. Adult female from Deming, N. Mex.: 840; 395; 125. Adult male and female from Fort Lowell (near Tucson), Ariz., respectively: 890, 820; 325, 305; 131, 125. *Skull*: Adult male from Lochiel, Ariz., and adult female from Deming, N. Mex.: Greatest length, 121.1, 120.6; condylobasal length, 114.6, 115.4; zygomatic breadth, 77, 78; interorbital breadth, 21.2, 24.2; least width of palatal shelf, 55.7, 55.9; maxillary tooth row (alveoli), 42.5, 42.7; upper carnassial, crown length, 8.7, 8.6, crown width, 9.7, 9.7. Adult male and female from Fort Lowell, Ariz.: Greatest length, 123.3, 116.2; condylobasal length, 115.6, 110.9; zygomatic breadth, 83.5, 78.8; interorbital breadth, 28.8, 25.3; least width of palatal shelf, 17.6, 16.4; maxillary tooth row, 42.7, 43.6; upper carnassial, crown length, 8.5, 8.8, crown width, 9.5, 9.6.

Remarks.—*P. l. mexicanus* shares extremely pale coloration with *P. l. pallidus* of the Colorado River Valley, typical examples of the two being externally indistinguishable. They are evidently very closely allied, some specimens being practically identical, but the combination of cranial characters pointed out usually serves to separate them as geographic races. The specimen described by Baird and regarded as the type of *mexicanus* is a fully adult, but undersized individual, probably a female (greatest length of skull, 113) which does not properly reflect the true characters of the subspecies as shown by other specimens from the type region. The type locality was originally given as Espia, Sonora. Examination of Boundary Survey reports and statements by C. B. R. Kemmerly, the collector, show that it was taken at Espia, shown on modern maps in extreme northwestern Chihuahua. The error was doubtless due to lack of information in regard to the exact location of the Sonora-Chihuahua boundary. To this subspecies are referred specimens from Mazatlan, Sinaloa. A specimen from Mazatlan formed the basis of the detailed description by Geoffroy-Saint Hilaire (1855, p. 125) of a Mexican raccoon, "variete mexicaine," which, however, he did not name. A specimen from northern Nayarit is referred to *mexicanus*, but those from localities farther south seem more properly assignable to *P. l. hernandezii*. Specimens from the upper part of the Gila River Valley grade toward and might be referred to *pallidus*. The series of 47 specimens from Escuinapa, Sinaloa, affords an unusual opportunity for the study of individual variation.

Specimens examined.—Total number, 87, as follows:

Arizona: Fort Huachuca, 1; Fort Lowell, 2; Lochiel, 1; San Bernardino Ranch, Cochise County, 1; Santa Catalina Mountains, 1 (skull only); Santa Rita Mountains (McCleary's Ranch), 1.

Chihuahua: Casas Grandes, 1; Colonia Diaz, 1; Espia, 1 (type, skull only); San Luis Mountains, 1.

Durango: Rancho Santuario (northwestern Durango), 1 (skull only).²⁵

Nayarit: Acajoneta, 1.

New Mexico: Alcalde, 7 (skulls only); Central, Grant County, 1 (skull only); Chloride, 1; Deming, 1; Gila National Forest, 2 (skulls only); Magdalena Mountains, 1; Redrock, 1; Rinconada, 1; Santa Rosa, 2; Velarde, 3 (skulls only).

Sinaloa: Escuinapa, 47 (12 skins without skulls; 10 skulls without skins);²⁵ Mazatlan, 2; Rosario, 1.

Sonora: "N. Sonora, Lumpholtz Expedition", 1 (skin only);²⁵ Oputo, 2.

Texas: El Paso, 1 (skull only).

PROCYON LOTOR PALLIDUS MERRIAM

COLORADO DESERT RACCOON

Procyon pallidus Merriam, Biol. Soc. Washington Proc. 13: 151, June 13, 1900.

Procyon lotor ochraceus Mearns, Biol. Soc. Washington Proc. 27: 64, Mar. 20, 1914. Type from Sonoita River, Sonora, Mexico, near Quitobaquito, Pima Co., Ariz., No. 59900, male subadult, U. S. Natl. Mus.; collected by Edgar A. Mearns, February 7, 1894.

Type locality.—New River, Colorado Desert, Imperial County, Calif.

Type.—No. 99272, female adult, skin and skull, United States National Museum (Biological Surveys collection); collected by Frank Stephens, October 16, 1899.

Distribution.—Colorado and Gila River Valleys and adjoining territory from the delta north to northeastern Utah, and east to western Colorado and northwestern New Mexico. Mainly Lower Sonoran division of Lower Austral Zone, but ranging up along streams into Transition Zone.

General characters.—One of the palest subspecies of the group; skull with narrow frontal area highly arched behind plane of postorbital processes. Color and general size about as in *P. l. mexicanus* of Chihuahua, but skull usually narrower, especially between orbits, and differing in other slight details. Decidedly paler, more ashy gray than *P. l. psora* of the Sacramento Valley; skull with upper outline rising more prominently behind plane of postorbital processes. Similar to *P. l. grinnelli*, but slightly paler, and cranial characters, especially the more abruptly sloping frontal profile from apex behind plane of postorbital processes, distinctive.

Color.—About as in *P. l. mexicanus*.

Cranial characters.—Skull closely resembles those of *P. l. mexicanus* and *P. l. psora* but brain case, frontal area and palatal shelf usually narrower; frontals high behind posterior plane of postorbital processes as in *mexicanus* (flatter and rising less prominently in *psora*); tooth

²⁵ Amer. Mus. Nat. Hist.

rows usually longer than in *mexicanus*. Compared with *P. l. grinnelli* the brain case and interorbital region are narrower, and the anterior frontal outline descends in a more nearly straight line from apex immediately behind the postorbital processes—upper outline of frontals a more evenly convex curve in *grinnelli*.

Measurements.—Type: Total length, 855 mm.; tail vertebrae, 295; hind foot, 128. Two adult males from Colorado River, Mexican Boundary, Ariz., respectively: 950, 875; 405, 340; 135, 126. An adult female from same locality: 845; 305; 128. *Skull*: Type: Greatest length, 117.6; condylobasal length, 111.1; zygomatic breadth, 77.8; interorbital breadth, 25.5; least width of palatal shelf, 13.5; maxillary tooth row (alveoli), 43.1; upper carnassial, crown length, 8.8, crown width, 9.6. Two adult males from Colorado River, Mexican Boundary, Ariz.: Greatest length, 133, 126.6; condylobasal length, 122.4, 120.6; zygomatic breadth, 79.1, 78.6; interorbital breadth, 25.3, 24.8; least width of palatal shelf, 15.4, 16.8; maxillary tooth row, 46.6, 43.7; upper carnassial, crown length, 9.7, 8.6, crown width, 10.1, 9.5. An adult female from same locality: Greatest length, 119.6; condylobasal length, 114.1; zygomatic breadth, 77.1; interorbital breadth, 23.4; least width of palatal shelf, 14.6; maxillary tooth row, 41.7; upper carnassial, crown length, 8.7, crown width, 9.3

Remarks.—As the name indicates the present subspecies is characterized by light coloration, a feature shared with *P. l. mexicanus*. The close alliance of *P. l. pallidus* and *P. l. mexicanus* is obvious but differing combinations of cranial characters seem to warrant their recognition as distinct, but not strongly marked forms. The type of *pallidus* is an unusually pale specimen as shown by comparison with others from localities so near that they must be regarded as typical. The type of *P. l. ochraceus* is a subadult male in rather faded pelage to which the name is doubtless due. It is not satisfactorily separable from *P. l. pallidus*.

Specimens examined.—Total number, 29, as follows:

Arizona: Colorado River, Mexican Boundary, 3; Fort Apache (25 miles southeast), 1; Lakeside, 1 (skull only); Mellen, 1;²⁶ Phoenix, 1; Springerville (3 miles northwest), 2; Tempe, 1; Topock, 1; Wupatki National Monument, Coconino County, 1.

Baja California: Calexico (11 miles southeast), 1; Cocopah Mountains, 3 (skulls only); New River (5 miles south of Mexicali), 1 (skin only); Pascualitos Laguna, 1; exact locality unknown, 1 (skull only).

California: Colorado River (5 miles below Needles), 1;²⁶ Colorado River (near Pilot Knob), 1;²⁶ Colorado River (20 miles north of Picacho), 1;²⁶ New River, Colorado Desert, 1 (type); Pilot Knob, 1; Potholes, 1.²⁶

Colorado: Navajo River, Archuleta County, 1 (skin only).

Sonora: Sonoyta River, near Quitobaquito (type of *ochraceus*), 1.

Utah: Pine Valley, 1 (skull only); Saint George, 1.

²⁶ Mus. Vert. Zool.

PROCYON LOTOR PSORA GRAY

CALIFORNIA RACCOON

Procyon psora Gray, Ann. Mag. Nat. Hist. 10 : 261, Dec. 1842.

Procyon lotor californicus Mearns, Biol. Soc. Washington Proc. 27: 66, Mar. 20, 1914. Type from ocean beach near last Mexican Boundary Monument (No. 258), San Diego County, Calif., No. 60675, female subadult, U. S. Natl. Mus.; collected by Frank Xavier Holzner, July 16, 1894.

Type locality.—Sacramento, Sacramento County, Calif.

Type.—Perhaps in British Museum; collected by Captain Belcher.

Distribution.—California, except extreme northwest coastal strip, the northeastern corner and southeastern desert region, ranging south through northwestern Baja California to San Quintin; extreme west-central Nevada (Wilson Canyon, east slope of Sierra Nevada). Lower Austral, Upper Austral, and Transition Zones.

General characters.—A large, moderately dark form with a broad, rather flat skull. Very similar to *P. l. pacificus* of Washington, but averaging paler; skull usually more elongated and differing in detail. Decidedly darker, less ashy gray than *P. l. pallidus* of the Colorado River Valley, and cranial characters distinctive. Similar in general to *P. l. creclusus* of the Snake River Valley, but much smaller and usually darker; skull relatively narrower.

Color.—Similar in general to that of *P. l. lotor*, but upper parts grayer, less suffused with buff under the overlying black-tipped hairs; light rings on tail less buffy; rusty nuchal patch usually absent or less prominent; black mask continuous across face, as in western forms in general, instead of more or less distinctly interrupted on either side of median line as in *lotor*.

Cranial characters.—Skull closely resembles that of *P. l. pacificus* but usually more elongated, the brain case less fully expanded, especially anteroexternally; interorbital region narrower; upper profile rather flat and postorbital processes of frontals well developed as in *pacificus*. Similar to that of *P. l. creclusus*, but smaller, relatively narrower. Compared with that of *P. l. pallidus*, the skull is of similar size, but relatively broader, with flatter frontal region.

Measurement.—Adult male from Tehama, Calif.: Total length, 880 mm.; tail vertebrae, 277; hind foot, 138. Adult female from Wheatland, Calif.: 870; 300; 120. Adult male and female from Nicasio, Calif., respectively: 901, 820; 348, 312; 132, 121. *Skull*: Adult male from Tehama and adult female from Wheatland, Calif.: Greatest length, 124.8, 120.4; condylobasal length, 120, 113; zygomatic breadth, 82.6, 79.2; interorbital breadth, 26.3, 26.8; least width of palatal shelf, 17.6, 16.2; maxillary tooth row (alveoli), 44.2, 43.9; upper carnassial, crown length, 8, 8.6, crown width, 9.3, 9.6. Adult male and female from Nicasio, Calif.: Greatest length, 124.5, 118.7; condylobasal length, 116.6, 114.2; zygomatic breadth, 82, 78.4; interorbital breadth, 24.2, 25.8; least width of palatal shelf, 16.4, 16.1; maxillary tooth row, 43.2, 41.8; upper carnassial, crown length, 8.8, 8.6, crown width, 9.7, 9.3.

Remarks.—*P. l. psora* has commonly been treated by authors as specifically distinct from *P. l. lotor* of the eastern United States. This is not so surprising as direct comparison of the skulls of these widely separated subspecies reveals rather striking differences, especially the much larger general size, and broader, flatter frontal region with much more prominent postorbital processes of *psora*. These differences, however, are completely bridged by the intervening forms. *P. l. psora* passes gradually into *P. l. pacificus* in northern California and southwestern Oregon, and some specimens from those regions might with similar propriety be referred to either form. Some specimens from near the type locality of *P. l. californicus* suggest gradation toward *P. l. pallidus*, but general comparisons indicate that *californicus* cannot satisfactorily be separated from *psora*.

Specimens examined.—Total number, 198, as follows:

Baja California: Laguna Hansen, 1; ²⁷ San Quintin, 1; San Ramon (mouth of Santo Domingo River), 2; ²⁷ San Telmo, 1 (skin only); ²⁷ Valle de las Palmas, 1 (skin only).²⁷

California: Arcata, 2; ²⁷ Baird, 1; Bakersfield, 1; ²⁷ Banta, 1 (skull only); Berkeley, 4; ²⁷ Bodfish, 1; Bradley, 3 (1 skull without skin, 2 skins without skulls); Camp Meeker, 1; Carbondale, 1; ²⁷ Carlotta, 1; ²⁷ Cassel, 4 (skulls only); Cazadero, 1 (skull only); ²⁷ Chico, 4; Colusa, 2 (1 skull without skin); Covelo, 1 (skull only); Cuddeback, Humboldt County, 2 (skulls only); ²⁷ Cuyamaca Mountains, 1; ²⁷ Cypress Point, Monterey County, 1; ²⁷ Dyerville (5 miles south), 1; Eel River (southwest of South Yollo Bolly Mountain), 2; El Portal, 2; ²⁷ Eureka, 1; ²⁷ Fort Tejon, 2 (1 skull only); Gazelle (5 miles east), 2 (skulls only); Glen Ellen, 1; Grass Valley, 3; ²⁷ Grizzly Island, 1; ²⁷ Gualala, 1; ²⁷ Hay Fork, Trinity County, 1; ²⁷ Helena, 3; ²⁷ Hoopa Valley, 1; Humboldt Bay (Carson's Camp, Mad River), 1; Inverness, 1 (skull only); Isabella, 1; ²⁷ Jolon, 3; Julian, 2; ²⁷ Kern River (25 miles above Kernville), 1; Klamath River, Siskiyou County, 1 (skull only); Knight's Landing (near type locality), 1; La Jolla, 1; ²⁷ Lake Merced, 1; ²⁷ Lassen Creek, 1; Laytonville, 2; Lierly's Ranch, Mendocino County, 1; Little Browns Creek, Trinity County, 2 (skulls only); Little Shasta, 3; Lockwood, 2; Marysville Buttes, 2; ²⁷ McCloud River (near Baird), 3 (2 skulls without skins); ²⁷ Mendota, 1; Menlo Park, 1; ²⁷ Mission, Santa Inez, 1; Mohave River, 1 (skull only); Monterey, 2; Mount Diablo, 1; ²⁷ Mount Saint Helena, 2; Mount Sanhedrin, 2 (1 skull without skin); ²⁷ National City, 2; Nelson, 1 (skull only); Nicasio, 10 (5 skulls without skins); Orland, 1 (skin only); Orubaun Spring, Humboldt County, 1 (skull only); ²⁷ Pacific Ocean beach, near Monument 258, Mexican Boundary, 1 (type of *californicus*); Paine Creek (Dale's Ranch), Tehama County, 4 (2 skins without skulls); ²⁷ Pescadero, 5; ²⁷ Pine City, 2 (skulls only); Pitt River, Shasta County, 1 (skull only); Placerville, 2 (skulls only); ²⁷ Pleyto, 2 (skulls only); Point Pinolis, 1; Point Reyes, 4 (2 skulls without skins); Portola, 2; ²⁷ Portola Lake, San Mateo County, 1; ²⁷ Posts, 1; Red Bluff, 1 (skin only); Rio Dell, 1 (skull only); Rockport, 1 (skull only); Round Mountain, 3 (skull only); Rumsey, 1; ²⁷ Saint John, Glenn County, 2; San Emigdio, 3; San Francisco, 1 (skin only); San Luis Obispo, 3; Sausalito, 1 (skull only); ²⁷ Shasta County, 1; Shasta Valley (6 miles east of Edgewood),

²⁷ Mus. Vert. Zool.

1; Snelling, 3; ²⁷ Soquel Mill (40 miles east of Raymond), 1; South Yollo Bolly Mountain, 1; Spalding, Eagle Lake, 3; ²⁷ Spenceville, 1; ²⁷ Stockton, 14; ²⁷ Suisun Marsh, 1; ²⁷ Tehama, 1; Three Rivers, 1; Tower House, Shasta County, 1; ²⁷ Trinidad, 1; ²⁷ Union Island, 1; Vacaville, 1; ²⁷ Victorville, 1; ²⁷ Wawona, 1 (skull only); Weaverville, 2 (skulls only); ²⁷ Wheatland, 1; Willow Lake, Plumas County, 1; ²⁷ Winthrop, 1 (skull only); Wolf, 1.²⁷

Nevada: Wilson Canyon, east slope of Sierra Nevada, 1.

PROCYON LOTOR PACIFICUS MERRIAM

PACIFIC NORTHWEST RACCOON

Procyon psora pacifica Merriam, North Amer. Fauna 16: 107, Oct. 28, 1899.

Procyon proleus Brass, Aus dem Reiche der Pelze, p. 564, 1911. West coast from Puget Sound to the Cascade Mountains. (Not *Procyon proteus* Allen, 1904.)

Type locality.—Lake Keechelus, Kittitas County, Wash. (altitude 8,000 feet).

Type.—No. 93137, adult [female], skin and skull, United States National Museum (Biological Surveys collection); collected by C. Hansen, January 15, 1898.

Distribution.—Southwestern British Columbia, except Vancouver Island, northern, central, and western Washington, western Oregon, and extreme northwestern California. Upper Austral and Transition Zones.

General characters.—A dark subspecies with a relatively broad, flat skull. Most closely resembling *P. l. psora* of the Sacramento Valley, Calif., but darker; skull relatively shorter and broader. Similar to *P. l. exelsus* of the Snake River Valley, southeastern Oregon, but much smaller, darker, and cranial characters distinctive. Decidedly larger than *P. l. rancourcensis* of Vancouver Island, and skull differing in detail.

Color.—As in *P. l. rancourcensis*. Much as in *P. l. psora*, but darker, the top of head and long guard hairs over upper parts in general more extensively black; subapical light bands of hairs somewhat narrower, tending to permit the basal color, which is of a darker tone (near dark cinnamon brown), to show through; mask unmixed black continuous across face and over upper surface of muzzle; rusty nuchal patch usually absent or inconspicuous.

Cranial characters.—Skull comparatively short, broad and flat; interorbital space very broad; postorbital processes of frontals well developed. Resembling that of *P. l. psora*, but usually less elongated, the brain case more fully expanded, especially anteroexternally; interorbital region broader. Similar to that of *P. l. exelsus*, but smaller, with brain case more rounded. Very similar in general form to that of *P. l. rancourcensis*, but much smaller throughout; brain case

²⁷ Mus. Vert. Zool.

relatively larger, more inflated; nasals broader, narrowing more abruptly to a point posteriorly; pterygoids longer, more diverging posteriorly; maxillary tooth rows longer, the individual teeth much larger.

Measurements.—Adult female from Steilacoom, Wash.: Total length, 830 mm.; tail vertebrae, 270; hind foot, 129. *Skull:* Type (♀) and an adult female from Steilacoom, Wash., respectively: Greatest length, 113.8, 114.2; condylobasal length, 106.8, 109.2; zygomatic breadth, 79.9, 81.2; interorbital breadth, 26.8, 27.3; least width of palatal shelf, 14.9, 16.9; maxillary tooth row (alveoli), 41.4, 41.3; upper carnassial, crown length, 8.6, 7.9, crown width, 9.4, 10. Average of five adult males from Lake Cushman, Wash.: Greatest length, 119.5 (116.1–123.1); condylobasal length, 112.6 (109.5–116.5); zygomatic breadth, 81.7 (78.8–84.7); interorbital breadth, 26 (25.1–27.1); least width of palatal shelf, 16.8 (16.2–17.6); maxillary tooth row, 43.6 (42.8–44); upper carnassial, crown length, 9.1 (8.8–9.4), crown width, 9.8 (9.5–10).

Remarks.—The present subspecies is the raccoon of the Pacific Northwest coastal and Cascade Range regions, extending in small numbers into the interior along the Columbia River Valley to north-eastern Washington. Like the regional representatives of other groups of mammals it is characterized by dark coloration. Compared with *P. l. lotor* of the eastern United States, which is also dark in color, the upper parts in *pacificus* are more heavily overlaid with black, the light subterminal bands of the longer hairs and the light rings of the tail are grayer, less buffy or yellowish, the top of the head is blacker, and the mask is more uniformly black and continuous across the face. *P. l. pacificus* intergrades with *P. l. psora* in southwestern Oregon and northwestern California, and with *P. l. exreclusus* east of the Cascade Mountains in Washington and Oregon. *Procyon proticus* Brass was assigned to the raccoon of the west coast from Puget Sound to the Cascade Mountains, which is within the range of typical *P. l. pacificus*. The name is also preoccupied by *Procyon proticus* Allen, applied to a crab-eating raccoon in South America.

Specimens examined.—Total number, 82, as follows:

British Columbia: Hastings, 1; Port Moody, 3 (skulls only).

California: Crescent City, 5 (4 skulls without skins).

Oregon: Big Summit Prairie, Ochooco National Forest, 1 (skull only); Blue River, 1 (skull only); Bridge, 1; Collywash Burn, 1; Estacada, 3 (2 skulls without skins); Glendale, 3 (skulls only); Glide (24 miles east), 1; Glide (14 miles northeast), 1; Grant's Pass, 7 (32 miles south, 5 [1 skull without skin]; 43 miles northeast, 2 [1 skin without skull]); Hardman, 2; Pistol River (North Fork), Curry County, 1; Port Orford, 5 (skulls only); Remote, 1 (skull only); Riverside, 2.

Washington: Easton, 1; Hoodspout, 4 (skulls only); Lake Cushman, 10 (skulls only); Lake Keechelus, 1 (type); Mount Vernon, 2 (skulls only); Oreas Island, 1 (skull only); Skokomish River, Olympic Mountains, 2 (skulls only); Steilacoom, 5 (1 skin without skull); Tieton, 1; Toppenish, 3; Trout Lake, south base of Mount Adams, 5 (skulls only); Whidby Island, 1 (skull only).

PROCYON LOTOR EXCELSUS NELSON AND GOLDMAN

SNAKE RIVER VALLEY RACCOON

Procyon lotor excelsus Nelson and Goldman, Jour. Mammal. 11 (4): 458, Nov. 11, 1930.

Type locality.—Owyhee River, Oreg., 10 miles west of Fairylawn, Owyhee County, Idaho.

Type.—No. 236214, old male adult, skin and skull, United States National Museum (Biological Surveys collection); collected by J. W. Fisk, April 15, 1920.

Distribution.—Snake River drainage in southeastern Washington, eastern Oregon, and southern Idaho, the Humboldt River Valley, Nev., and river valleys of northeastern California. Mainly Upper Sonoran Zone.

General characters.—Size largest of the group; color rather pale, similar in color to *P. l. psora* of California, but usually paler, and much larger, with skull differing in detail. Closely allied to *P. l. pacificus* of Washington, but much larger, decidedly paler, top of head much grayer, and cranial characters distinctive.

Color.—Upper parts of body in general very light buffy grayish, with a light ochraceous buffy suffusion along median dorsal area, becoming pronounced on nape, moderately overlaid with black; sides clearer gray, the overlying black-tipped hairs less numerous than on dorsum; top of head a grizzled mixture of black and gray; face with the usual black mask and white markings; under parts in general thinly overlaid with buffy grayish, the light brownish undertone showing through; throat patch dark brownish; ears grayish with black patches at posterior base; limbs grayish, the hind legs with small, unmixed brownish areas on outer sides near heels; tail above with about six black annulations and a black tip, alternating with somewhat broader, light buffy rings, the dark rings usually becoming indistinct below.

Cranial characters.—Skull similar to that of *P. l. psora*, but larger and more angular; frontal region broader, generally flattened, and postorbital processes well developed, as in *psora*. Compared with that of *P. l. pacificus* the skull is larger, with brain case relatively more elongated; frontal region broad as in *pacificus*.

Measurements.—No skin measurements available. *Skull*: Type: Greatest length, 136.5 mm.; condylobasal length, 125.8; zygomatic breadth, 89.1; interorbital breadth, 30.1; least width of palatal shelf, 17.2; maxillary tooth row (alveoli), 47; upper carnassial, crown length, 9, crown width, 10.6.

Remarks.—The present form is easily distinguished from all others of the group by the large size and massive development of the skull. No close cranial comparisons with forms east of the Rocky Mountains are necessary as this race differs notably in the much larger size, and

broad, flat frontal region, with prominent postorbital processes—frontal region generally high and narrow, and postorbital processes weak, or obsolescent, in forms east of Rocky Mountains.

Specimens examined.—Total number, 32, as follows:

California: Parker Creek, Modoc County, 1,²⁸

Idaho: Bruneau, 1 (skull only); Emmett, Gem County, 1; Forest (Deer Creek), 1 (skin only); Hagerman, 1 (1 skull without skin); Lost Valley Reservoir, head of Wieser River (altitude 5,000 feet), Adams County, 1 (skin only); Preuss Mountains, 1 (skull only); Stanley Lake, Custer County (altitude 8,500 feet), 1 (skin only); Three Creek, 2 (1 skin without skull; 1 skull without skin).

Nevada: Golconda, 1 (skull only); Montello, 1.

Oregon: Adel, 2; Dry Creek, Malheur County, 1 (skull only); Enterprise, 1 (skin only); Harper (8 miles east), 1 (skull only); Huntington, 1 (skull only); Innaha, 1 (skull only); Owyhee River (type locality, 10 miles west of Fairy-lawn, Idaho), 2; Rome, 1; Tupper, 1 (skull only); Vansycle, 1 (skull only).

Washington: Alpowa, 1 (skull only); Garfield County, 1; Touchet, 1; Wallula, 1; Washtucna, 1.

PROCYON LOTOR VANCOUVERENSIS NELSON AND GOLDMAN
VANCOUVER ISLAND RACCOON

Procyon lotor vancouverensis Nelson and Goldman, Jour. Mammal. 11 (4): 458, Nov. 11, 1930.

Type locality.—Quatsino Sound, Vancouver Island, British Columbia, Canada. Transition and Canadian Zones.

Type.—No. 135457, male adult, skull only, United States National Museum (Biological Surveys collection); collected by Charles Sheldon, November 1904.

Distribution.—Known only from Vancouver Island.

General characters.—A dark subspecies most closely allied to *P. l. pacificus* of Washington, but decidedly smaller, and cranial details distinctive.

Color.—An adult (winter pelage) from Beecher Bay, Vancouver Island: Upper parts in general grayish, heavily overlaid with black; small nape patch suffused with ochraceous buff; top of head mixed black and gray, the black predominating; face with brownish black mask, the dark color extending down along middle of muzzle to nose; sides of muzzle, lips, and chin white; under parts, in general, thinly overlaid with buff gray, the dense brown underfur showing through; throat patch brownish, mixed with gray along median line; ears grayish, with black patches at posterior base; limbs similar to under parts, becoming soiled whitish on feet, but hind legs with unmixed, dark brownish areas on outer sides above heels; tail with six narrow black rings and a black tip, alternating with broader grayish rings, the black rings interrupted on under side near base.

²⁸ Mus. Vert., Zool.

Cranial characters.—Skull rather small, short, low, broad, and flat, with well-developed postorbital processes. Very similar in general form to that of *P. l. pacificus*, but much smaller throughout; brain case relatively smaller and less inflated; nasals narrower and more attenuate posteriorly; pterygoids shorter, less diverging posteriorly; maxillary tooth rows shorter, the individual teeth much smaller.

Measurements.—An adult from Beecher Bay, Vancouver Island: Hind foot (dry skin), 112 mm. *Skull:* Type: Greatest length, 116; condylobasal length, 108.9; zygomatic breadth, 77.5; interorbital breadth, 25.4; least width of palatal shelf, 16.5; maxillary tooth row (alveoli), 40.2; upper carnassial, crown length, 8.3, crown width, 8.9.

Remarks.—The Vancouver Island raccoon is a well-marked subspecies. It requires close comparison only with *P. l. pacificus* of the adjacent mainland.

Specimens examined.—Total number, 40, as follows:

Vancouver Island, B. C.: Alberni Valley (Hall's Ranch), 1; ²⁹ Beecher Bay, 3 (2 skulls without skins); ³⁰ Cadboro Bay, 1 (skull only); ³⁰ Errington, 1; ²⁹ Fort Rupert, 1 (skull only); ³¹ French Creek, 1; ²⁹ Little Qualicum River, 1; ²⁹ Mount Tolmie, 1 (skull only); ³⁰ Parksville, 2; ²⁹ Quatsino Sound (type locality), 21 (skulls only); San Josef River Valley, 1 (skull only); Sooke, 2 (skulls only); ³⁰ Victoria, 1 (skull only); ³⁰ exact locality unknown, 3 (skulls only).³⁰

PROCYON LOTOR GRINNELLI NELSON AND GOLDMAN

BAJA CALIFORNIA RACCOON

Procyon lotor grinnelli Nelson and Goldman, Jour. Washington Acad. Sci. 20 (5): 82, Mar. 4, 1930.

Type locality.—La Paz, Baja California, Mexico.

Type.—No. 147181, male adult, skin and skull, United States National Museum (Biological Surveys collection); collected by E. W. Nelson and E. A. Goldman, February 15, 1906.

Distribution.—Southern Baja California from the Cape region north at least to San Ignacio. Tropical and Lower Sonoran Zones.

General characters.—A large, pale subspecies with a rather broad, high, evenly arched skull. Similar to *P. l. pallidus* of the Colorado Desert, but slightly darker and cranial characters, especially the more evenly arched profile of skull, distinctive. Compared with *P. l. psora* of the Sacramento Valley, general color paler, more grayish, less deeply suffused with buff, the long black guard hairs over dorsum less in evidence; top of head grayer, less heavily mixed with black; black areas at posterior base of ears smaller; skull with frontal region more highly arched.

²⁹ Mus. Vert. Zool.

³⁰ Provincial Mus., British Columbia.

³¹ Amer. Mus. Nat. Hist.

Color.—Upper parts in general coarsely grizzled iron grayish, the median dorsal area faintly suffused with pale buff, becoming pronounced on back of neck, rather thinly overlaid with black; top of head gray, mixed with black, producing a grizzled effect; face with solid black mask; white facial markings as usual in the group; under parts in general overlaid with very pale buffy grayish, the brown undertone showing through; throat patch blackish; ears grayish, with rather small black patches at posterior base; limbs similar to under parts, but becoming whitish on feet; hind legs with small, pure brownish areas on outer side near heels; tail with the usual annulations and black tip, the light rings pale cream buff and the narrower dark rings (6 to 7) consisting of black-tipped hairs with an underlying buffy suffusion; dark rings less evident on under side of tail and scarcely complete, tending to fade out on median line, except near tip.

Cranial characters.—Skull similar to that of *P. l. pallidus*, but brain case and interorbital region broader; frontals rising higher anteriorly, the upper outline a more evenly convex curve— anterior frontal outline descending in a more nearly straight line from apex immediately behind postorbital processes in *pallidus*; dentition about the same. Compared with that of *P. l. psora* the skull is less flattened, the frontal region more highly arched; brain case rather broad and other cranial details much as in *psora*.

Measurements.—Type: Total length, 913 mm.; tail vertebrae, 335; hind foot, 132. *Skull*: Type: Greatest length, 122.1; condylobasal length, 115.5; zygomatic breadth, 77.9; interorbital breadth, 24.3; least width of palatal shelf, 16.7; maxillary tooth row (alveoli), 44.1; upper carnassial, crown length, 8.8, crown width, 9.3.

Remarks.—Raccoons are dependent upon water for existence, and owing to exceedingly arid conditions in the central section of Baja California their general range is interrupted for considerable distances. The form here described, which occupies the southern half of the peninsula, differs rather markedly in combination of characters from both of the more northern subspecies, *P. l. psora* and *P. l. pallidus*. It requires no very close comparison with *P. l. mexicanus* of the adjacent mainland of Mexico, which in general, is paler, with the black postauricular spots obsolescent, and skull notably depressed in frontal region.

Specimens examined.—Total number, 11, as follows:

Baja California, Mexico: La Paz (type locality), 3;³² Mount Miraflores, 3;³³ San Ignacio, 5.

³² One (skull only) in Mus. Vert. Zool.

³³ Two in Amer. Mus. Nat. Hist.

PROCYON LOTOR HERNANDEZII WAGLER

MEXICAN PLATEAU RACCOON

Procyon [hernandezii] Wagler, Isis 24: 514, 1831.

Procyon lotor hernandezii Allen, Amer. Mus. Nat. Hist. Bull. 3: 176, Dec. 10, 1890.

Type locality.—Valley of Mexico, Mexico (specimens from Tlalpam regarded as typical).³⁴

Type.—Not designated.

Distribution.—Southern part of tableland or plateau region of Mexico and adjoining coasts, from Nayarit, Jalisco, and San Luis Potosi, south to near the Isthmus of Tehuantepec. Altitudinal range from sea level to about 8,000 feet. Tropical to Transition Zone.

General characters.—A large, dark grayish subspecies; skull somewhat flattened, with narrow frontal region and slender, wide spreading zygomata; dentition heavy. Similar in general to *P. l. fuscipes* of Texas, but upper parts grayer; skull flatter and differing in detail. Decidedly darker than *P. l. mexicanus* of Chihuahua, the upper parts more extensively overlaid with black, and cranial characters distinctive. Differing from *P. l. shufeldti* of Campeche in longer pelage; top of head darker and back more heavily overlaid with black; skull more slender.

Color.—Very similar to that of *P. l. fuscipes* but still grayer, less buffy beneath overlying black; black postauricular spots smaller. *Young* (in first pelage): Similar to *lotor* of corresponding age, but top of head and postauricular areas less extensively brownish black, and black mask continuous across face (mask more or less interrupted between eyes in *lotor*); feet dark brownish instead of buffy.

Cranial characters.—Skull size about as in *P. l. fuscipes* but more flattened above, the frontal region less elevated, and brain case less depressed near fronto-parietal suture; postorbital processes of frontals usually longer, narrower, more acutely pointed; upper margin of orbit usually more deeply concave; posterior upper premolar and upper carnassial usually larger. Similar to that of *P. l. mexicanus*, but flatter, the frontal region less elevated; interorbital and postorbital regions usually narrower; maxillary tooth rows longer; posterior upper premolar and upper carnassial larger. Compared with that of *P. l. shufeldti* the skull is more slender, less massive; interorbital and postorbital regions narrower; dentition about the same.

Measurements.—Adult male from Tlalpam, Valley of Mexico, Mexico: Total length, 905 mm.; tail vertebrae, 283; hind foot, 122. Two adult males from Jalpan, Queretaro, and Patzcuaro, Michoacan, respectively: 894, 872; 340, 308; 129, 127. Two adult females, Tetela del Volcan, Morelos, and El Chico, Hidalgo: 860, 825; 300, 264; 120, 122. *Skull*: Adult male from Tlalpam, Mexico: Greatest

³⁴ Type locality fixed by Nelson and Goldman, Biol. Soc. Washington Proc. 44: 17, Feb. 21, 1931.

length, 122.9; condylobasal length, 116.9; zygomatic breadth, 86; interorbital breadth, 25.2; least width of palatal shelf, 16.8; maxillary tooth row (alveoli), 45.7; upper carnassial, crown length, 9.2, crown width, 10.3. Two adult males from Acambaro, Michoacan, and Jalpan, Queretaro: Greatest length, 128.3, 123.7; condylobasal length, 124.8, 116; zygomatic breadth, 86.2, 83.1; interorbital breadth, 24.2, 23.9; least width of palatal shelf, 16.4, 16.4; maxillary tooth row, 45.2, 44.2; upper carnassial, crown length, 9.3, 9.1, crown width, 10, 9.3. Two adult females from Tetela del Volcan, Morelos, and El Chico, Hidalgo: Greatest length, 118.1, 114; condylobasal length, 114.8, 109.3; zygomatic breadth, 79.3, 76.8; interorbital breadth, 24.7, 22.1; least width of palatal shelf, 16.4, 15.8; maxillary tooth row, 44.2, 42.3; upper carnassial, crown length, 9.4, 8.2, crown width, 10, 9.4.

Remarks.—The range of *P. l. hernandezii* in southern Mexico is transcontinental, and while mainly at 4,000 to 6,000 feet on the tableland of the interior it extends from sea level along the tropical coasts to 8,000 feet altitude on the slopes of the mountains bordering the Valley of Mexico. It intergrades on the north in eastern Mexico with *P. l. fuscipes* and in western Mexico with *P. l. mexicanus*. Toward the southeast its range meets that of *P. l. shufeldti*.

Specimens examined.—Total number, 50, as follows:

Colima: Armeria, 1; Colima, 5 (3 skulls without skins); Manzanillo, 8 (3 skulls without skins).

Guerrero: Papayo, 2; Tlapa, 1.

Hidalgo: El Chico, 1.

Jalisco: Arroyo de Plantinar, 1;³⁵ Atemajac, 3 (1 skull without skin); Barranca Ibarra (Canyon de Oblatos), Rio Grande de Santiago, 1; Garabatos, 1;³⁵ Las Canoas, 2;³⁵ Zacoalco, 1; Zapotlan, 2 (1 skull without skin).

Mexico: Ajusco, Distrito Federal, 1 (skull only); Tlalpam, Distrito Federal, 1.

Michoacan: Acambaro, 2 (skulls only); Patzeuaro, 2 (1 skull without skin); Querendaro, 3 (2 skulls without skins).

Morelos: Tetela del Volcan, 1.

Nayarit: San Blas, 1.

Oaxaca: Cuicatlan, 1.

Queretaro: Jalpan, 2 (1 skull without skin).

San Luis Potosi: Hacienda la Parada, 1; San Luis Potosi, 1.

Veracruz: Jico, 3; Mirador, 2 (1 skin without skull).

PROCYON LOTOR SHUFELDTI NELSON AND GOLDMAN
CAMPECHE RACCOON

Procyon lotor shufeldti Nelson and Goldman, Biol. Soc. Washington Proc. 44: 17, Feb. 21, 1931.

Type locality.—La Tuxpeña, Champoton, Campeche, Mexico.

Type.—No. 177546, male adult, skin and skull, United States National Museum (Biological Surveys collection); collected by Percy W. Shufeldt, April 20, 1911.

Distribution.—From the Isthmus of Tehuantepec east through Chiapas, Tabasco, Campeche, Yucatan, Quintano Roo, British

³⁵ Amer. Mus. Nat. Hist.

Honduras, and Guatemala to western Honduras; limits of range unknown. Tropical Zone.

General characters.—A large, rather pale, short-haired subspecies, with massive skull. Similar in general to *P. l. hernandezii* of the Valley of Mexico, but pelage shorter, color duller, top of head grayer and back less modified by black-tipped hairs; black postauricular spots (small in *hernandezii*) still less distinct; skull more massive and differing in detail. Size about as in *P. l. crassidens* of Costa Rica, but color decidedly paler and grayer, the upper parts less heavily overlaid with black, and the subterminal light zone of longer hairs more extended and thus affecting the general tone; skull less flattened. Differing from *P. l. dickeyi* in larger size, much grayer color, and in cranial characters.

Color.—Upper parts in general usually light buffy gray, with rather thinly distributed overlying black-tipped hairs resulting in a coarsely grizzled blend; nape patch rusty rufous; sides lighter, the black tips of hairs inconspicuous; top of head clearer gray, mixed with black, lacking the light buffy tone suffusing the back; black mask across face extending downward along median line of muzzle to nose and upward to middle of forehead; lines bordering mask above, sides of muzzle, lips, and chin white as usual in the group; under parts in general thinly overlaid with very light buffy hairs, the light brownish underfur showing through, but short and scarcely concealing the skin; throat patch brownish; ears grayish; black postauricular spots small and inconspicuous; limbs similar in color to under parts, but over hairs denser, becoming dull whitish on feet; hind legs with outer sides of ankles brownish; tail above with seven to eight narrow blackish rings and a black tip, alternating with light ochraceous buffy rings, less distinct and tending to become confluent below, especially near base. Varying in some specimens from paler and grayer to darker, with dorsum more profusely overspread with black, and rusty rufous nape patch indistinct or absent. *Young* (in first pelage): Similar to *P. l. hernandezii*, but paler above, especially the top of head, which is scarcely differentiated from back.

Cranial characters.—Skull similar in size to that of *P. l. hernandezii*, but more massive; interorbital and postorbital regions broader; dentition about the same. Similar in size and angularity to that of *P. l. crassidens*, but less flattened, the frontal region higher arched behind postorbital processes; dentition and other cranial details about as in *crassidens*. Compared with that of *P. l. dickeyi* the skull is decidedly larger, more massive; sagittal and lambdoid crests heavier, thicker and less trenchant; palate broader; auditory bullae usually larger.

Measurements.—Type: Total length, 874 mm.; tail vertebrae, 292; hind foot, 116. An adult female topotype: 909; 296; 128. *Skull*: Type: Greatest length,

126.1; condylobasal length, 118.7; interorbital breadth, 26.8; least width of palatal shelf, 16.8; maxillary tooth row (alveoli), 45.1; upper carnassial, crown length, 9.6, crown width, 9.8.

Remarks.—The general range of the present subspecies embraces the peninsula of Yucatan and adjoining territory as far south and west as the Isthmus of Tehuantepec. Like the representatives of other widely ranging subspecies inhabiting the general region it is characterized by pale colors. Occasional specimens, however, as one from Huilotepec (near Tehuantepec), Oaxaca, have the upper parts more heavily overlaid with black, indicating gradation toward the darker Central American forms. It is closely allied to *P. l. hernandezii*, but the characters pointed out are distinctive.

Specimens examined.—Total number, 23, as follows:

British Honduras: El Cayo (near San Lorenzo), 1.³⁶

Campeche: La Tuxpeña (type locality), 3.

Chiapas: San Vicente, 1 (skull only).

Guatemala: El Espino, 1; northern Guatemala (exact locality unknown), 1.

Honduras: Santa Barbara, 1.³⁷

Oaxaca: Huilotepec, 7; San Mateo del Mar, 1 (skull only); Tehuantepec, 4.³⁸

Tabasco: Montecristo, 1.

Veraacruz: Minatitlan, 1.

Yucatan: Chichen Itza, 1.

PROCYON LOTOR DICKEYI NELSON AND GOLDMAN
SALVADOR RACCOON

Procyon lotor dickeyi Nelson and Goldman, Biol. Soc. Washington Proc. 44: 18, Feb. 21, 1931.

Type locality.—Barra de Santiago, Department of Ahuachapam, Salvador.

Type.—No. 12796, male adult, skin and skull, collection of Donald R. Dickey; collected by G. D. Stirton, April 14, 1927.

Distribution.—Coast region of southwestern Salvador and probably of southeastern Guatemala; limits of range unknown. Tropical Zone.

General characters.—A dark-colored subspecies (one of the darkest of the group) of medium size; skull short and light in structure. Color about as in *P. l. crassidens* of Costa Rica; size similar, but skull of lighter proportions, and differing in important details. Similar in general to *P. l. shufeldti* of Campeche, but smaller, and much darker, the upper parts more heavily overlaid with black; cranial characters distinctive.

Color.—Upper parts in general grayish, heavily and rather uniformly overlaid with black extending well down along sides; light subterminal zone of longer hairs narrow and dark undercolor showing through in-

³⁶ Univ. Michigan Mus. Zool.

³⁷ Amer. Mus. Nat. Hist.

³⁸ One skin without skull, one skull without skin, Amer. Mus. Nat. Hist.

tensifying general dark tone; top of head clearer gray, heavily mixed with black, producing a somewhat grizzled effect, the black predominating; black facial mask extending downward on median line to nose and upward to middle of forehead; white supraorbital lines short and narrow, ending under ears instead of continuing posteriorly to sides of neck as in *shufeldti* and more northern forms; sides of muzzle, lips, and chin white; under parts in general thinly overlaid with buffy white, the underfur light brownish, sparse and only partially concealing the skin beneath; throat patch brownish black; ears grayish; black post-auricular spots small, tending to blend with dark tone of back; forearms dull grayish, becoming soiled whitish on feet; outer surfaces of hind legs similar to sides of body, becoming brownish black near heels and soiled whitish on feet; tail above with about seven blackish rings, rather indistinct near base, and a black tip, alternating with rich ochraceous buffy rings, tending to blend along median line below.

Cranial characters.—Skull characterized by thin-walled, delicate structure, with weakly developed sagittal and lambdoid crests. Most closely resembling that of *P. l. crassidens*, but of lighter proportions; frontal region less flattened; palate much narrower, a character very noticeable in the lesser distance between cheek tooth series; jugal more slender; dentition heavy, much as in *crassidens*. Compared with that of *P. l. shufeldti* the skull is decidedly smaller and less massive; frontal region of similar elevation; sagittal and lambdoid crests weaker, thinner and more trenchant; palate narrower; auditory bullae usually smaller; dentition about the same.

Measurements.—Type: Total length, 840 mm.; tail vertebrae, 310; hind foot, 115. Average of four adult male topotypes: 840 (800–870) mm.; 297 (300–340); 114 (110–120). Average of eight adult female topotypes: 782 (730–790); 300 (280–340); 110 (105–120). *Skull:* Type and an adult male topotype, respectively: Greatest length, 114.7, 108.3; condylobasal length, 108.4, 102.7; zygomatic breadth, 79.3, 76.2; interorbital breadth, 23.9, 22.5; width of palate between last molars, 19.5, 20.9; least width of palatal shelf, 16, 15.3; maxillary tooth row (alveoli), 41.7, 40.7; upper carnassial, crown length, 7.7, 8.5, crown width, 9, 8.9. Average of seven adult female topotypes: Greatest length, 116.1 (113–122.5); condylobasal length, 109.7 (107.5–115.9); zygomatic breadth, 74 (70.2–80); interorbital breadth, 23.9 (22.9–25.3); width of palate between last molars, 19.7 (18.4–21); least width of palatal shelf, 15.2 (14.7–15.7); maxillary tooth row, 43.7 (42.7–45.7); upper carnassial, crown length, 9.2 (8.7–10), crown width, 10 (9.5–11).

Remarks.—*P. l. dickeyi* is the most northern of the known Central American subspecies, all of which are characterized by darker color than their more northern relatives. It appears to be a highly specialized mangrove-inhabiting race as specimens from the interior only a short distance away are markedly different and nearer to *crassidens*. In external appearance this subspecies is similar to *P. l. crassidens*, but the cranial features are quite distinctive. The rusty rufous nape

patch often present in more northern forms is absent or only faintly indicated in some individuals. In the type locality it was found by the collector living among mangroves where specimens were obtained by shooting. Examination of stomach contents revealed crabs, which appear to be the principal food. In all of the skulls, including that of a young individual about two-thirds grown, the large cheek teeth are much more worn than is usual in raccoons of corresponding ages. This excessive wear, greatest on the molars, is due evidently to the abrasive character of the food. The delicate cranial structure and rapid reduction of the molars also suggest that malnutrition resulting from an imperfect diet, or incomplete mastication of food, may have been responsible for the development of the peculiar characters of this localized race.

Specimens examined.—Total number, 22, as follows:

Guatemala: Exact locality unknown, 5.

Salvador: Barra de Santiago, Department of Ahuachapam (type locality), 17 (4 skins without skulls).³⁹

PROCYON LOTOR CRASSIDENS HOLLISTER
COSTA RICAN RACCOON

Procyon lotor crassidens Hollister, Biol. Soc. Washington Proc. 27: 142, July 10, 1914.

Type locality.—Talamanca, northeastern Costa Rica.

Type.—No. $\frac{12191}{14191}$, adult [male?], skin and skull, United States

National Museum; collected by William M. Gabb. Original number 14.

Distribution.—Costa Rica, Nicaragua, Salvador, except southwestern coast region and probably Honduras, except western part; probably extending into western Panama. Tropical Zone.

General characters.—One of the darkest known forms of the group; closely resembling *P. l. pumilus* of Panama and *P. l. diceyi* of Salvador externally, but cranial characters distinctive.

Color.—About as in *P. l. diceyi*, the dorsum heavily overlaid with black extending well down the sides; white supraorbital lines distinct, but short and disappearing under the ears as in *diceyi*.

Cranial characters.—Skull similar to that of *P. l. diceyi*, but more massive; frontal region more flattened; palate much broader, the tooth rows more widely separated; dentition heavy much as in *diceyi*. Compared with that of *P. l. pumilus* the skull is larger, relatively longer, narrower, and less extremely flattened; interorbital and postorbital regions narrower; postorbital processes of

³⁹ Donald R. Dickey collection.

frontals shorter, broader and more obtusely pointed; dentition similar but usually heavier.

Measurements.—An adult male from Jalapa, Nicaragua: Total length, 950 mm.; tail vertebrae, 310; hind foot, 120. An adult male from San Rafael del Norte, Nicaragua: 880; 250; 110. *Skull:* Type: Greatest length, 125.5; condylobasal length, 122.9; zygomatic breadth, 75.8; interorbital breadth, 25.8; width of palate between last molars, 24.1; least width of palatal shelf, 17.3; maxillary tooth row (alveoli), 47.3; upper carnassial, crown length, 10, crown width, 10.7.

Remarks.—*P. l. crassidens* is similar to *P. l. pumilus* and *P. l. dickeyi* in external appearance, all sharing an extremely dark coloration. While closely allied to the forms mentioned, the cranial characters presented are quite distinctive. Some specimens from the interior and southeastern coast region of Salvador, quite near the restricted range of *dickeyi*, are distinctly grayer than typical *crassidens*, and in this character, as in cranial details, grade toward *shufeldti*.

Specimens examined.—Total number, 18, as follows:

Costa Rica: El Sauce Peralta, 1; Talamanca, 1 (type); exact locality unknown, 1.

Nicaragua: Jalapa, 2;⁴⁰ San Rafael del Norte, 2;⁴⁰ Vijagua, 1.⁴⁰

Salvador: Barrios Mine, Morazan, 1;⁴¹ Colima, Cuscatlan, 1;⁴¹ Lake Guija, 1;⁴¹ Puerto del Triunfo, Usulután, 1;⁴¹ Rio Goascoran, La Union, 1;⁴¹ Rio San Miguel, 3;⁴¹ San Pedro Mine, Morazan, 1;⁴¹ Volcan San Miguel, 1.⁴¹

PROCYON LOTOR PUMILUS MILLER

ISTHMIAN RACCOON

Procyon pumilus Miller, Biol. Soc. Washington Proc. 24: 3, Jan. 28, 1911.

Type locality.—Ancon, Panama.

Type.—No. 171983, young adult [female?], skin and skull, United States National Museum; collected by Allan H. Jennings, 1910.

Distribution.—Panama and the Canal Zone from Porto Bello west to Boqueron, Chiriqui, limits of range unknown. Tropical Zone.

General characters.—Closely allied to *P. l. crassidens* of Costa Rica; color very similar; skull shorter, relatively broader and flatter.

Color.—Very dark, the upper parts heavily overlaid with black about as in *P. l. crassidens*, but white supraorbital lines usually less distinct, somewhat obscured by dusky hairs.

Cranial characters.—Skull smaller, shorter, relatively broader, and still flatter than that of *P. l. crassidens*; interorbital and postorbital regions broader; postorbital processes longer, narrower, more acutely pointed; dentition lighter, especially the cheek teeth distinctly smaller.

Measurements.—Adult male from Porto Bello, Panama: Total length, 920 mm.; tail vertebrae, 350; hind foot, 125. Adult female from Gatun, Canal Zone: 831; 292; 123. *Skull:* Adult male from Porto Bello, Panama and adult female from Gatun, Canal Zone, respectively: Greatest length, 113.5, 113.2; condylo-

⁴⁰ Amer. Mus. Nat. Hist.

⁴¹ Donald R. Dickey collection.

basal length, 110.8, 110.5; zygomatic breadth, 81.1, 80.6; interorbital breadth, 26.8, 24.8; least width of palatal shelf, 15.1, 14.8; maxillary tooth row, 44, 41.9; upper carnassial, crown length, 8.9, 7.6, crown width, 9.6, 9.

Remarks.—The range of *P. l. pumilus* marks the known extreme southern limit of the *Procyon lotor* group. Its distribution area overlaps that of *Procyon cancrivorus panamensis*, the so-called crab-eating raccoon, the two occurring in the same localities in the Canal Zone and vicinity. From the latter it is easily distinguished externally by its smaller size, more slender proportions, grayish instead of blackish forearms and thighs, presence of underfur, and the normal inclination backward of the pelage of the nape which in the crab-eating raccoon is reversed. The skull is recognizable especially by the smaller molars, with more pointed instead of rounded cusps. Although the dentition of *pumilus* is not so well fitted as that of the crab-eating raccoon for crushing hard substances such as crabs, it shares with it the crab-eating habit, at least to some extent, as shown by the examination of stomach contents.

P. l. pumilus is most closely allied to *P. l. crassidens*. In external appearance some specimens of the two are practically indistinguishable, although the white supraorbital lines are usually less distinct in *pumilus*; but the skull is notable for its shortness; and in the general flatness, and length of the postorbital processes it reaches the extreme development presented in the group. Material now available, including a series of six topotypes (Balboa and Ancon, the type locality, are contiguous), shows that this raccoon is not so very small as the type, an unusually under-sized and not fully adult individual, seemed to indicate.

Specimens examined.—Total number, 15, as follows:

Canal Zone: Ancon, 1 (type); Balboa, 6;⁴² Gatun, 4.

Panama: Boqueron, 1;⁴³ Pedregal, 1;⁴⁴ Porto Bello, 2.

PROCYON INSULARIS MERRIAM

[References under subspecies]

Distribution.—Tres Mariás Islands, off west coast of Nayarit, Mexico.

General characters.—A large, pale species, with short, coarse pelage and massive skull. Similar to adjacent mainland forms of *P. lotor* (*P. l. mexicanus* and *P. l. hernandezii*), but pelage shorter, more bristly, color inclining toward buffy instead of iron grayish, the back less overlaid with black; black postauricular spots much smaller, less conspicuous; skull more angular and differing in important details.

⁴² Chicago Mus. Nat. Hist.

⁴³ Amer. Mus. Nat. Hist.

⁴⁴ Mus. Comp. Zool.

Color.—Upper parts in general light cream buff, the dorsal area thinly overlaid with black; nuchal patch undifferentiated or faintly indicated by a very pale buffy line; sides lighter, the black-tipped hairs inconspicuous; top of head grizzled gray and black; black mask extending across face and along median line from nasal pad to middle of forehead; white supraorbital lines continuous to sides of neck; sides of muzzle, lips, and chin white; under parts, in general, thinly overlaid with very pale creamy buff, the light brown underfur showing through; throat patch brownish flecked with gray; ears grayish, the black patches at posterior base, usual in the group, obsolescent; limbs about like sides, becoming dull whitish on feet; hind legs brownish on outer sides near ankles; tail above with about seven black rings and a black tip, alternating with broader cream buffy or light ochraceous buffy rings, the dark rings interrupted below.

Cranial characters.—Skull large, angular, and massive, with remarkably heavy zygomata, the squamosal arm, especially, very broad anteriorly and extended vertically (as apparent when viewed from the side). Similar in general to that of *P. lotor*, especially, *P. l. mexicanus* and *P. l. hernandezii*, but more angular; zygomata broader and heavier, the squamosal arm broader anteriorly, more extended vertically; transverse squamosal portion of zygoma bearing a more conspicuous process on anterior border near posterior end of jugal; palatal shelf relatively narrower, the lateral borders more deeply concave; postorbital processes of frontals well developed as in *mexicanus* and *hernandezii*; large molariform teeth narrower; crown of second upper molar subquadrate, instead of subtriangular, the inner border more evenly rounded.

Remarks.—*P. insularis* is clearly allied to *P. l. mexicanus* and *P. l. hernandezii* of the adjacent mainland and was regarded by its describer as a subspecies of the widely ranging continental animal. The characters pointed out are so trenchant, however, that its position in the group is better expressed by according it specific rank. It is subdivisible into two closely related insular forms.

PROCYON INSULARIS INSULARIS MERRIAM

MARÍA MADRE ISLAND RACCOON

Procyon lotor insularis Merriam, Biol. Soc. Washington Proc. 12: 17, Jan. 27, 1898.

Type locality.—María Madre Island, Tres Mariás Islands, off west coast of Nayarit, Mexico.

Type.—No. 88978, old male, skin and skull, United States National Museum (Biological Surveys collection); collected by E. W. Nelson and E. A. Goldman, May 10, 1897.

Distribution.—Known only from María Madre Island. Tropical Zone.

General characters.—Closely resembling *P. i. vicinus* of María Magdalena Island, but dorsum less conspicuously overlaid with black, and top of head grayer; cranial characters distinctive.

Color.—About as set forth for the species as a whole, differing only slightly from *P. i. vicinus* in the somewhat lesser amount of overlying black.

Cranial characters.—Skull very similar to that of *P. i. vicinus*, but brain case less highly arched; lambdoid crest more broadly spreading, not rising so high over foramen magnum; basioccipital, basisphenoid, and palatal shelf broader; palatal ridges (extending posteriorly to pterygoids) more widely separated; pterygoids thicker, the posterior ends more strongly everted and knob-like; maxillary arm of zygoma with lower external border projecting as a distinct process separated from outer alveolar border of molars by a deep notch (process absent in *vicinus*); zygomata very broad and heavy as in *vicinus*; foramen magnum more decidedly wider than high (more nearly circular in *vicinus*); dentition about the same.

Measurements.—Type: Total length, 854 mm.; tail vertebrae, 286; hind foot, 132. An adult male topotype: 840; 264; 128. *Skull*: Type and an adult male topotype, respectively: Greatest length, 121.8, 119; condylobasal length, 114.6, 114; zygomatic breadth, 86.4, 82.5; interorbital breadth, 27.8, 27.2; least width of palatal shelf, 15.4, 14.3; maxillary tooth row, 43.6, 42.2 (alveoli); upper carnassial, crown length, 8.6, 8.6, crown width, 9.3, 9.1.

Remarks.—*P. i. insularis* requires close comparison only with *P. i. vicinus* of María Magdalena Island. While cranial details appear to be quite distinctive these insular forms are much alike in external appearance. In the few specimens available, however, the black overlying the dorsum—rather thin in *vicinus*—is further reduced in *insularis*, leaving a coarsely grizzled effect.

Specimens examined.—Six, all from the type locality.

PROCYON INSULARIS VICINUS NELSON AND GOLDMAN

MARÍA MAGDALENA ISLAND RACCOON

Procyon insularis vicinus Nelson and Goldman, Biol. Soc. Washington Proc. 44: 20, Feb. 21, 1931.

Type locality.—María Magdalena Island, Tres Mariás Islands, Nayarit, Mexico (altitude 250 feet).

Type.—No. 88982, male adult, skin and skull, United States National Museum (Biological Surveys collection); collected by E. W. Nelson and E. A. Goldman, May 27, 1897.

Distribution.—Known only from María Magdalena Island. Tropical Zone.

General characters.—A pale subspecies with short, coarse pelage. Closely resembling *Procyon i. insularis* of María Madre Island, but dorsum more conspicuously overlaid with black, and top of head somewhat darker; cranial characters distinctive.

Color.—Upper parts in general light cream buff, the dorsal area rather thinly overlaid with black; sides lighter, the black-tipped hairs inconspicuous; top of head gray mixed with black, giving a grizzled effect; black mask across face extending downward to nose and upward on median line to middle of forehead; white supraorbital markings normal; sides of muzzle, lips, and chin white; under parts in general thinly overlaid with very pale creamy buff, the light brown underfur showing through; throat patch brownish flecked with gray; ears grayish, the black patches at posterior base, usual in the group, obsolescent; legs about like sides, becoming dull whitish on feet; hind legs brownish on outer sides near ankles; tail above with seven black rings and a black tip, alternating with broader cream buff rings, the dark rings interrupted below.

Cranial characters.—Skull very similar to that of *P. i. insularis*, but brain case more highly arched; lambdoid crest rising higher over foramen magnum; basioccipital, basisphenoid, and palatal shelf narrower; palatal ridges (extending posteriorly to pterygoids) less widely separated; pterygoids thinner, the posterior ends less everted; maxillary arm of zygoma normal, the lower external border not projecting and forming a distinct process separated from outer alveolar border of molars by a deep notch; zygomata very broad and heavy, as in *insularis*; foramen magnum more nearly circular (more decidedly wider than high in *insularis*); dentition about the same.

Measurements.—Type: Total length, 904 mm.; tail vertebrae, 313; hind foot, 135. *Skull:* Type: Greatest length, 120; condylobasal length, 115.2; zygomatic breadth, 84.6; interorbital breadth, 27.7; least width of palatal shelf, 14.1; maxillary tooth row (alveoli), 42.6; upper carnassial, crown length, 8.7, crown width, 9.2.

Remarks.—As might be expected *P. i. vicinus* is closely allied to its near geographic neighbor, *P. i. insularis* of María Madre Island, and requires no very close comparison with any other form. It is distinguished externally from adjacent mainland forms, *P. l. mexicanus* and *P. l. hernandezii*, by shorter, coarser pelage, the general color inclining toward buffy instead of grayish, and the black postauricular spots obsolescent; the skull differs in numerous important details, especially the higher arched brain case, much broader, heavier, zygomata, narrower palatal shelf, and narrower carnassials.

Specimens examined.—Two, from the type locality.

PROCYON MAYNARDI BANGS

BAHAMA RACCOON

Procyon maynardi Bangs, Biol. Soc. Washington Proc. 12: 92, Apr. 30, 1898.

Type locality.—New Providence Island, Bahamas.

Type.—No. 7750, male young, skin and skull, Museum of Comparative Zoology (collection of E. A. and O. Bangs); collected by Herbert L. Claridge, August 1897.

Distribution.—Known only from New Providence Island, Bahamas, Tropical Zone.

General characters.—A small, medium dark-colored species with a slender, delicate skull, narrow palatal shelf, and light dentition. Similar in general to *P. l. incantus* of the extreme southern Florida keys, but color darker, and cranial characters, especially the small teeth, distinctive. Somewhat similar in size to *P. minor* of Guadeloupe Island, Lesser Antilles, but apparently somewhat paler in color and skull differing notably in the narrowness of the palatal shelf.

Color.—Upper parts in general grayish, becoming ochraceous buffy on nape and over shoulders, moderately overlaid with black, thinning out along sides; top of head a grizzled mixture of gray and black; black mask interrupted between eyes, a dusky median patch extending to forehead somewhat isolated by lighter lateral lines, as in *P. l. lotor*; upper surface of muzzle ochraceous buffy; supraorbital lines, sides of muzzle, lips, and chin white; ears grayish, with black patches at posterior base; under parts thinly overlaid with grayish; limbs similar to under parts, the hind legs blackish near ankles; tail with five or six black rings and a black tip, alternating with ochraceous buffy rings.

Cranial characters.—Skull very similar in outline and general proportions to that of *P. l. incantus*, but palatal shelf narrower, the sides distinctly concave (sides more nearly parallel in *incantus*); nasals narrower posteriorly; auditory bullae slightly larger, more inflated; posterior upper premolar and carnassial slightly smaller. Similar in size to that of *P. minor*, but brain case narrower, less flattened above; palatal shelf decidedly narrower, the sides more concave; nasals narrower between anterior processes of frontals; auditory bullae slightly larger; dentition similar, but molariform teeth broader.

Measurements.—Adult Male topotype: Total length, 713 mm.; tail vertebrae, 240; hind foot (dry skin), 100. *Skull*: An adult male and an adult female (topotypes), respectively: Greatest length, 105.9, 103.5; condylobasal length, 101.7, 101; zygomatic breadth, 79.3, 64.6; interorbital breadth, 21.9, 22.1; least width of palatal shelf, 12.2, 13.3; maxillary tooth row (alveoli), 38.7, 38.9; upper carnassial, crown length, 7.6, 7.6, crown width, 8.4, 8.5.

Remarks.—The Bahama form is closely related to the raccoons of the Florida Keys as shown in the skull by agreement in form and general proportions, especially the height of the frontal region, with slight

development of postorbital processes, and the depression of the brain case near the fronto-parietal suture. The differential characters, however, warrant its recognition as a distinct species. In describing *P. maynardi* Bangs (1898b, p. 92) says: "There is no tradition among the inhabitants of Nassau that the raccoon was ever introduced upon the island. . . . The raccoon is abundant upon Nassau [New Providence] but Mr. Maynard believes that it does not exist upon any of the other islands of the Bahama group." According to the Acting Colonial Secretary Charles P. Bethel, the raccoons on New Providence Island have decreased during recent years owing to the destruction by hurricanes of fruit trees that afforded a food supply.

Specimens examined.—Three,⁴⁵ all from New Providence Island.

PROCYON PYGMAEUS MERRIAM

COZUMEL ISLAND RACCOON

Procyon pygmaeus Merriam, Biol. Soc. Washington Proc. 14: 101, July 19, 1901.

Type locality.—Cozumel Island, Yucatan, Mexico. Tropical Zone.

Type.—No. 108511, male subadult, skin and skull, United States National Museum (Biological Surveys collection); collected by E. W. Nelson and E. A. Goldman, April 14, 1901.

Distribution.—Known only from Cozumel Island.

General characters.—Smallest known species of the genus, with short, bristly, grayish pelage; skull with short, posteriorly rounded nasals and very small teeth. Somewhat similar in color and texture of pelage to *P. l. shufeldti*, of the adjacent mainland, but so much smaller and cranial characters so distinctive that close comparison is not required.

Color.—Upper parts in general light buffy gray, the median dorsal area suffused with pale buff, becoming more pronounced and approaching ochraceous buff on a narrow nuchal patch in some specimens, rather thinly overlaid with black; top of head clearer, grizzled gray and black, lacking light buffy tone suffusing back; black mask becoming brownish and usually more or less mixed with gray on middle of face, the gray admixture invading also the dark median streak extending to the forehead; upper surface of muzzle brownish; lines bordering mask above, sides of muzzle, lips, and chin white; under parts, in general, thinly overlaid with light buffy hairs, the light brownish underfur showing through; throat patch dark brownish, clearly defined; ears grayish or light buffy; postauricular spots brownish, small and inconspicuous; legs similar to under parts, becoming dull whitish on feet, the hind legs with outer sides of ankles clearer brownish; tail with six or seven narrow, brownish or blackish rings and a black tip, alternating with broader ochraceous buffy rings, the dark rings ill-defined on under side.

⁴⁵ One in Amer. Mus. Nat. Hist.; one in Mus. Comp. Zool.

Cranial characters.—Skull small, short, and flattened, with relatively short, narrow rostrum, short nasals, broad frontal region and brain case, and light dentition. Somewhat similar in general form to that of *P. l. shufeldti*, but departing widely in the smaller size; rostrum relatively shorter and narrower; frontal region relatively broader; nasals relatively shorter, more rounded, less acutely pointed posteriorly; postorbital processes of frontals well-developed and upper border of orbit distinctly concave as in *shufeldti*; teeth similar in sculpture, but relatively much smaller, the first and second upper premolars more widely spaced, and the last molar with a narrower internal lobe. Compared with those of *P. maynardi* and *P. minor*, the skull is smaller, with rostrum shorter, frontal region flatter and relatively broader than in either; nasals shorter, broader and more rounded posteriorly; palatal shelf narrow much as in *maynardi* (much narrower than in *minor*); auditory bullae smaller than in either; postorbital processes of frontals more developed; dentition similar but lighter.

Measurements.—Type: Total length, 667 mm.; tail vertebrae, 230; hind foot, 90. Adult female topotype: 665; 250; 97. *Skull*: Type and adult female topotype, respectively: Greatest length, 100, 96.7; condylobasal length, 93.7, 91.9; zygomatic breadth, 58.8, 60.8; interorbital breadth, 19.5, 19.8; least width of palatal shelf, 12.5, 12.3; maxillary tooth row (alveoli), 35.3, 35.5; upper ear-nassial, crown length, 6.8, 7, crown width, 7.8, 8.

Remarks.—*P. pygmaeus*, as the name suggests, is distinguished by its small size. The general flattening of the cranium, especially the flatness and breadth of the frontal region, the development of the postorbital processes of the frontals, and the slight depression of the brain case near the fronto-parietal suture, indicate relationship to the raccoon of the adjacent mainland as might be expected, rather than to any of the West Indian species. Striking differences from the mainland animal in size and in other more important characters, however, point to long isolation in its insular habitat. The teeth are remarkably small, the second upper premolar especially, being reduced in size and separated from the third upper premolar by a distinct gap.

Specimens examined.—Five, all from the type locality.

PROCYON MINOR MILLER

GUADELOUPE ISLAND RACCOON

Procyon minor Miller, Biol. Soc. Washington Proc. 24: 4, Jan. 28, 1911.

Type locality.—Pointe-à-Pitre, Guadeloupe Island, Lesser Antilles.

Type.—No. $\frac{38417}{15481}$, male young (permanent canines not quite fully

in place), skin and skull, United States National Museum; collected by L. Guesde. Received from the l'Herminier Museum.

Distribution.—Known only from Guadeloupe Island. Tropical Zone.

General characters.—A small, rather dark species with a slender, delicate skull, remarkably broad palatal shelf, and very light dentition. Similar to *P. maynardi*, of the Bahamas, but apparently somewhat darker in color, and cranial characters, especially the much broader palatal shelf, distinctive.

Color.—Upper parts in general grayish, becoming “ochraceous buff” on nape and shoulders, the dorsum heavily overlaid with black; sides paler and almost silvery gray, the dark-tipped hairs thinning out; top of head whitish mixed with black, with the usual grizzled effect; black mask continuous across face in one specimen, somewhat interrupted between eyes in another; sides of muzzle, lips, chin, and supraorbital lines white; ears grayish, with large, conspicuous black patches at posterior base; under parts thinly overlaid with grayish, the light brown underfur showing through; throat patch blackish; forearms, hind legs and feet grayish, similar to sides, the ankles blackish; tail with about seven black rings and a black tip, alternating with ochraceous buffy rings.

Cranial characters.—Skull similar in size and general form to that of *P. maynardi*, but brain case broader and flatter; palatal shelf much broader, the sides forming nearly straight parallel lines (sides more concave in *maynardi*); nasals broader between anterior processes of frontals; auditory bullae slightly smaller; dentition similar, but molariform teeth narrower.

Measurements.—No reliable skin measurements available. *Skull:* Type and a subadult topotype, respectively: Greatest length, 101.6 mm., 104.5; condylobasal length, 94.5, 98.5; zygomatic breadth, 55.3, 62; interorbital breadth, 18.1, 19.8; least width of palatal shelf, 16.5, 15.5; maxillary tooth row (alveoli), 38.5, 37.3; upper carnassial, crown length, 7.6, 7.6, crown width, 8.1, 8.1.

Remarks.—Although widely separated geographically, *P. minor* appears to be more nearly related to *P. maynardi* than to any other known form. The elevation of the frontal region, absence or slight prominence of the postorbital processes of the frontals, and the depression of the brain case near the fronto-parietal suture are characters denoting alliance with *maynardi* and the raccoons of the Florida region. It requires no close cranial comparison with *P. gloveralleni* of Barbados, the skull of which is distinguished at a glance by the larger molariform teeth.

Specimens examined.—Two, the type, and a topotype.⁴⁶

⁴⁶ Mus. Comp. Zool.

PROCYON GLOVERALLENI NELSON AND GOLDMAN

BARBADOS RACCOON

Procyon gloveralleni Nelson and Goldman, Jour. Mammal. 11 (4): 453, Nov. 11, 1930.

Type locality.—Island of Barbados, Lesser Antilles, West Indies.

Type.—No. 18591, young male, skin and skull, Museum of Comparative Zoology; collected by Sir Francis Watts, 1920.

Distribution.—Known only from the Island of Barbados. Tropical Zone.

General characters.—A small, dark species, with a short, delicately formed skull. Similar in color to *Procyon minor*, of Guadeloupe Island, Lesser Antilles, but sides of body and limbs in type specimen darker, owing to more numerous black-tipped hairs (black-tipped hairs thinning out and sides of body and limbs more grayish in *minor*); cranial characters, especially the much heavier dentition, distinctive. Contrasting with *P. maynardi*, of New Providence Island, Bahamas, in darker general color and widely different skull.

Color.—Type: Upper parts in general near "light ochraceous buff" (most intense on nape and shoulders) rather heavily overlaid with black, becoming lighter buff, less obscured by black on sides of body and limbs; top of head buffy gray, mixed with black; face with solid black mask and usual white markings; the upper surface of muzzle black to nose; sides of muzzle, lips, and chin white; under parts thinly overlaid with buffy grayish; throat patch brownish black, thinly overlapped by ochraceous buffy hairs, here reversed as usual in the group; ears buffy grayish with black patches at posterior base; ankles dusky all around; feet soiled buffy whitish; tail with four narrow black rings and a black tip alternating with light ochraceous buffy rings, the subterminal black ring and tip nearly coalescent.

Cranial characters.—Skull similar in general to that of *P. minor*, but frontal region broader and flatter; postorbital processes more prominent; palatal shelf narrower; teeth very similar in sculpture, but crown of upper carnassial tending to be longer than broad, a condition unusual in the group. Compared with that of *P. maynardi* the skull differs in about the same characters as from *minor*, except that the palatal shelf is decidedly broader.

Measurements.—Type: Hind foot (dry skin), 89 mm. *Skull*: Type: Greatest length, 94; condylobasal length, 89.2; zygomatic breadth, 53.4; interorbital breadth, 18.7; least width of palatal shelf, 13.6; maxillary tooth row (alveoli), 37; upper carnassial, crown length, 9.8, crown width, 9. Two adult topotypes, No. 267380, female, and No. 267381, sex undetermined, United States National Museum, respectively: Greatest length, 113.2, 109.8; condylobasal length, —, 105.3; zygomatic breadth, —, 69; interorbital breadth, 24.3, 24.3; least width of palatal shelf, 15, 14.4; maxillary tooth row, 40, 39.8; upper carnassial, crown length, 8.6, 8.7, crown width, 8.9, 8.6.

Remarks.—Dr. Glover M. Allen (1911, p. 221) recorded the occurrence of raccoons in Barbados and referred to Griffith Hughes (1750, p. 66) who, writing in the middle of the 18th century, mentioned a law of the Island providing a bounty for their destruction. In the absence of specimens for study the animal was tentatively referred by Allen to "*Procyon (?) cancrivorus* G. Cuvier." Subsequent efforts by him to obtain representatives resulted in the collection, in 1920, of the young individual later made the type of a new species bearing his name.

The type specimen was so young when collected that the permanent premolars and canines, although well advanced, are not in full functional position. In the type the first premolars, both deciduous and permanent, are absent in both jaws, an abnormality observed elsewhere only in the large-toothed form *P. l. litoricus*, inhabiting Saint Simon Island, Ga. Since the original description was published two specimens, in the exhibit collection of the United States National Museum, taken by the Reverend Barnett about 1867 have attracted attention and have been dismounted. The skulls show full maturity. One specimen, No. 267380, had been marked female, and the other, No. 267381, slightly smaller, is probably of the same sex. The molariform teeth are rather large, but not so large as in the type. In the upper carnassial a tendency toward equal to or greater length than width of the crown is exhibited, a condition sometimes presented in *P. l. pumilus* of Panama. In the broad frontal region and well-developed postorbital processes the relationship of *gloveralleni* to the raccoons of Central America is also suggested, but it differs widely in other respects.

Raccoons, formerly abundant, and said to favor a rugged region on the south side of the island, have apparently been reduced to or near extermination. In response to a formal inquiry the American Consul, Frederick W. Baldwin, wrote July 13, 1932: "Very few raccoons now exist in Barbados and specimens would be extremely difficult to obtain."

Specimens examined.—Three, all from the type locality.

Subgenus **EUPROCYON** Gray

[References under Genus *Procyon* Storr, p. 25]

Distribution.—Southern Costa Rica, western Panama, and northern Colombia to southern Brazil.

Subgeneric characters.—Contrasted with subgenus *Procyon*: Pelage shorter, underfur absent; hair on nape directed forward; claws broader, less compressed laterally, of lesser vertical diameter at base, and more bluntly pointed. Bony palate extending behind posterior molars a distance less than one-fourth total length of palate. Molariform

teeth, except first premolars, larger and more massive, with broader, more rounded and bluntly pointed cusps; connecting ridges between principal cusps lower, less trenchant.

Remarks.—The subgenus *Euprocyon* overlaps the range of the subgenus *Procyon* in Panama, but the two differ so conspicuously in appearance that no very close comparison is necessary.

PROCYON CANCRIVORUS (G. CUVIER)

Ursus cancrivorus G. Cuvier, Tabl. Élém. de l'Hist. Nat. des Animaux, 1798, p. 113. Type from Cayenne, French Guiana.

Procyon cancrivorus Desmarest, Dict. Hist. Nat. 29: 93, 1819.

Distribution.—(See under subgenus *Euprocyon*.)

General characters.—(See subgeneric characters under subgenus *Euprocyon*.)

Color.—General dorsal area varying from ashy gray to ochraceous, more or less heavily overlaid with black; ears, supraorbital streaks, and sides of muzzle whitish; black mask, usual in the group, extending across face to cheeks, including orbits, and the median line from forehead to nose; under parts varying from pale gray to yellowish or ochraceous; outer surfaces of forearms and thighs usually blackish; feet varying from gray to brown; tail with about seven or eight alternating black and gray or yellowish rings and a black tip.

Cranial characters.—(See subgeneric characters under subgenus *Euprocyon*.)

Remarks.—Few specimens of *Procyon cancrivorus* have been available for study, but general comparisons indicate that the species has

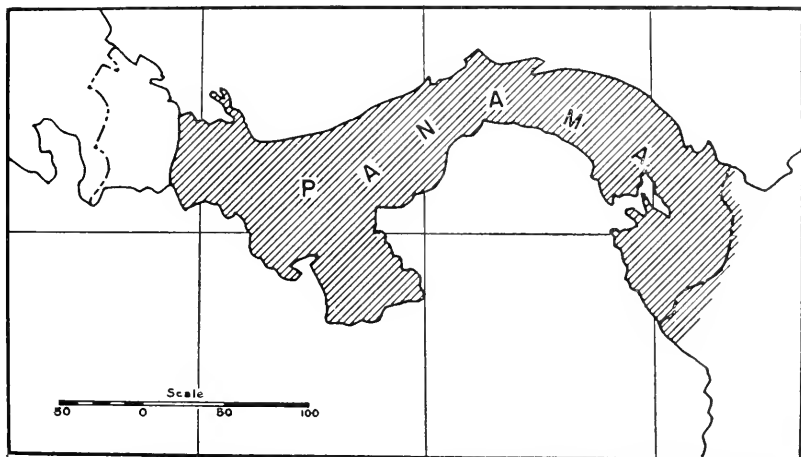


FIGURE 2.— Distribution of *Procyon cancrivorus panamensis* (subgenus *Euprocyon*).

a wide range in South America, somewhat paralleling the great range of *P. lotor* in North America. A single subspecies extends into the region under review.

PROCYON CANCRIVORUS PANAMENSIS (GOLDMAN)

PANAMA CRAB-EATING RACCOON; MAPACHIN

Euprocyon cancrivorus panamensis Goldman, Smithsn. Misc. Collection 60 (22): 15, Feb. 28, 1913.

Type locality.—Gatun, Canal Zone, Panama.

Type.—No. 171669, female adult, skin and skull, United States National Museum (Biological Surveys collection); collected by E. A. Goldman, June 21, 1911.

Distribution.—Southern Costa Rica, western Panama to near the Colombian boundary; doubtless reaching Colombia, but range in that country undetermined. Tropical Zone.

General characters.—A dark Panama representative of the species ranging widely in South America. Similar in size to *P. c. proteus* of northern Colombia, but general color less tawny; cranial details distinctive. Differing from *P. c. cancrivorus*, of Cayenne, in darker color and in cranial characters.

Color.—Ground color over dorsum varying from ashy gray to ochraceous buffy or yellowish ochraceous, heavily overlaid with black; top of head grizzled black and gray, the black predominating; sides of muzzle, and rather restricted supraorbital streaks, white or grayish white; facial area, including orbits, interorbital space, lower part of cheeks, and median line from forehead to nose, nearly clear black; under parts, including base of tail, varying from pale ochraceous buff to yellowish ochraceous, becoming more or less grayish white on throat, chin, and lips; ears well-clothed with whitish or yellowish hairs, darkening gradually on upper base by encroachment of body color; outer sides of hind legs and ankles all around deep glossy black; fore legs black or dark brownish all around; feet thinly clothed with short hairs varying from brownish to grayish; tail with seven or eight alternating black and grayish or yellowish rings and a black tip, the proximal rings more or less interrupted along median line below.

Cranial characters.—In general form the skull closely resembles that of *P. c. cancrivorus*, but palate more elongated, lower surface of basioccipital more convex, the lateral margins turning downward and partly covering auditory bullae; nasals broader; auditory bullae broader, more inflated posteriorly; dentition about the same. Contrasted with that of *P. c. proteus* the skull differs in longer palate, and anteriorly broader, posteriorly narrower nasals.

Measurements.—Type: Total length, 950 mm.; tail vertebrae, 350; hind foot, 142. *Skull*: Type: Greatest length, 130; condylobasal length, 125.8; zygomatic

breadth, 83.3; interorbital breadth, 25.7; least width of palatal shelf, 17.7; maxillary tooth row (alveoli), 48.3; upper carnassial, crown length, 10.2, crown width, 11.

Remarks.—Comparison of the Panama series and South American material from various localities, including a specimen from northern Brazil assumed to be near typical *P. c. cancrivorus* of Cayenne, and the type and two topotypes of *P. c. proteus*, of northern Colombia, indicates that the Panama animal is a well-marked geographic race. The close agreement in dentition and the other essential characters, however, point to probable intergradation of all forms of *cancrivorus*. *P. c. panamensis* overlaps the range of *Procyon lotor pumilus* in Panama where both occur at the same localities, but may readily be distinguished by the reversed pelage of the nape, absence of underfur, and the blackish instead of grayish forearms and thighs.

Specimens examined.—Total number, 7, as follows:

Canal Zone: Gatun (type locality), 3.

Costa Rica: Canas Gordo, 1,⁴⁷

Panama: Boquete, 1 (skull only);⁴⁸ Cana, 1; Porto Bello, 1.

⁴⁷ Amer. Mus. Nat. Hist.

⁴⁸ British Mus. (Nat. Hist.).

APPENDIX

Descriptions of two subspecies that were not included in the Goldman manuscript are here abstracted or copied almost verbatim from the original accounts of the respective authors, but as nearly as possible in conformity of treatment with the Goldman manuscript.

PROCYON LOTOR MEGALODOUS LOWERY

MISSISSIPPI DELTA RACCOON

Procyon lotor megalodous Lowery, Occas. Papers Mus. Zool. Louisiana State Univ. 13: 225, November 22, 1943.

Type locality.—Marsh Island, Iberia Parish, Louisiana.

Type.—No. 2321, male adult, skin and skull, Louisiana State Univ. Mus. Zool.; collected by Ted O'Neil and prepared by George H. Lowery, Jr., October 24, 1943.

Distribution.—Coast region of southern Louisiana from St. Bernard Parish west to Cameron Parish.

General characters.—A medium-sized raccoon in which the pelage is strongly suffused above with black and pale yellow. Skull massive and with extremely large molariform teeth, by which characters it is separable from the two geographically adjacent subspecies *P. l. varius* and *P. l. fuscipes*.

Color.—Nearest to *P. l. varius*, but distinguished in its much more yellowish (less grayish) suffusion on upper parts and greater concentration of black along mid-dorsal line; ears, pale areas of face, legs, flanks and under parts decidedly yellowish, not grayish as in *P. l. varius*. Also much more yellowish (less grayish) than *P. l. fuscipes*, with black of dorsal midline more pronounced.

Cranial characters.—Skull differing from both *P. l. varius* and *P. l. fuscipes* in the larger size of the molariform teeth; also differing from that of *P. l. varius* in its more inflated frontal region, and lesser interorbital breadth.

Measurements.—*Type*: Total length, 804 mm.; tail vertebrae, 262; hind foot, 128. *Skull*: None available except a long table of measurements of molariform teeth (Lowery 1943, pp. 228–229).

In his discussion of *P. l. megalodous* Lowery (1943) has made the following comments:

Remarks.—This new race of raccoon, which is an abundant inhabitant of the Louisiana coastal marshes, is so clearly separable from all other races of *Procyon*

lotor that it is surprising it has not been described until now. Superficially, it resembles *varius* of northern and eastern Louisiana, Mississippi, and Alabama, but its much more yellowish pelage which is strongly suffused with black, and its massive skull and large molariform teeth clearly set it apart from that form. In coat color this new race bears no close similarity to *P. l. fuscipes* of Texas, being distinctive as outlined above. However, the two agree with respect to certain cranial characters. In both the skull is massive, the frontal "hump" distinct, and the postocular constriction evident, but the dentition of *megalolous* is so decidedly heavier that skulls of the latter are separable from *fuscipes* without much difficulty.

Three skins from Grand Terre Island are decidedly yellower than anything else examined in the present connection. The dark middorsal area is restricted to a narrow but heavily concentrated band of dark brown (no black); hence the yellowish pelage of the sides and flanks is less suffused with dark hairs than in other raccoon specimens. The pelage of these specimens lacks any vestige of gray or black, the hairs being either yellowish or brown. Although there is a definite tendency among marsh dwelling raccoons to assume a decided xanthochronistic appearance in late spring and summer, this condition is clearly associated with wear, stain, and fading. These latter factors are not at all evident in the Grand Terre Island specimens, which are in fresh fall pelage. Whether this island population merits taxonomic recognition is dependent upon how constant the above noted characters appear in additional material, which is not obtainable at present.

Specimens examined.—Total number, 20 skins and 41 skulls, as follows:

Louisiana: *Cameron Parish:* Rockefeller Refuge, 1 skin without skull; near Sabine Wildlife Refuge, 19 skulls. *Calcasieu Parish:* Lake Charles, 1 skin with skull. *Terrebonne Parish:* Timbalier Island, 1 skin with skull. *St. Bernard Parish:* Toea Village, 1 skin with skull; Belair, 9 skins and 10 skulls. *Plaquemines Parish:* Delta [National Wildlife] Refuge below Pilottown, 3 skins and 4 skulls. *Jefferson Parish:* Grand Terre Island, 3 skins with skulls and one miscellaneous skull. *Iberia Parish:* Marsh Island, skin with skull (type).

PROCYON LOTOR MARITIMUS DOZIER

COASTAL MARSH RACCOON

Procyon lotor maritimus Dozier, Jour. Mammal. 29 (3): 286, August 31, 1948.

Type locality.—Blackwater National Wildlife Refuge, Dorchester County, Maryland.

Type.—No. 275,290, female adult, skin and skull, U. S. Natl. Mus. (Biological Surveys collection); collected by Herbert L. Dozier, December 3, 1946.

In describing *P. l. maritimus* Dozier (1948) wrote:

Distribution.—Known only from marsh areas on the Delmarva Peninsula (Delaware, Maryland, and Virginia).

General characters.—A small to medium, pale subspecies. Readily distinguished from typical *Procyon l. lotor* by its paler coloration; longer but more sparse guard hairs; much smaller size; more slender legs and general build; narrower and more pointed head; decidedly shorter, more pointed, and less prominently banded tail; and relatively much shorter caudal vertebrae. In general color and length of the subapical band of the guard hair it is perhaps nearest to *Procyon l. mexicanus* of Arizona, New Mexico, and Mexico, but is only about half the size of the latter and its tail is decidedly shorter and less distinctly marked.

Color.—Upper portion in general pale buffy grayish, becoming light ochraceous buffy on shoulders, with rufous tinge on nape; the longer, black-tipped guard hairs over the median dorsal area are grouped on the back as unevenly colored streaks, somewhat undulating or serpentine in arrangement (in marked contrast to the darker general salt and pepper effect of typical *Procyon l. lotor*); light-colored subapical band of each guard hair extends a greater distance beyond the underfur tips than in *lotor* and results in a much paler or more yellowish east to the outer pelage; guard hairs almost entirely white along the sides and lower parts, adding to the pale, shaggy general appearance of the animal; top of head a light grizzled mixture of gray and brownish-black; facial mask brownish-black and decidedly less prominent than in *lotor*; feet black, with gray hair dorsally, the claws dull black (description from live and freshly killed animals); tail with five rather narrow, brownish-black rings and a black tip, alternating with wider light ochraceous buffy rings, less clearly defined below.

Pelage.—An uneven spread of hair with respect to average guard hair length is apparent, that of the middorsal area being in general slightly shorter than in the rest of the pelt, due probably both to sparser distribution of hair and to variation in fiber length. The very long, coarse guard hair is typical of this race and unique among eastern races of raccoons. Due to the length and sparseness of the guard hairs, coupled with possible decreased density of the underfur, there is a slight backward slant to the direction of the hair flow. In *lotor* the hair is more dense, shorter, erect, and more fluffy in appearance than in *maritimus*.

Skull.—Of medium size, rather narrow and elongate. Compared with that of *lotor*, the skull is slightly smaller, less heavily built, distinctly narrower, and more elongate; interorbital portion more elongate, postorbital processes of frontals rather weakly developed or obsolescent, frontal area relatively narrow, flatter, markedly more sloped or depressed, and somewhat concave; palatal shelf decidedly narrower; posterior part of zygomata less arched dorsally.

Measurements.—Type: Total length, 718 mm; tail vertebrae, 210; hind foot, 111. Adult male topotype (No. 275,296, U. S. Natl. Mus.): Total length, 762; tail vertebrae, 254; hind foot, 102. *Skull*: Type: Greatest length, 112.2; condylobasal length, 107.9; zygomatic breadth, 68.8; interorbital breadth, 23.6; least width of palatal shelf, 15.1; maxillary tooth row, 41.7.

To quote Dozier further:

Remarks.—This form appears well adapted for survival under the rather exacting requirements of our eastern tidewater, coastal marsh conditions. The medium size and slender build fit it for fast traveling in the marsh; the pale coloration blends well with the vegetation of its habitat during most of the season; and the long, coarse-haired pelage can withstand a lot of abrasive action from sharp-edged sedges and coarse grasses. In *Procyon l. maritimus* the length of the pale subapical band is the greatest yet recorded, nearest that in some western races of *Procyon lotor*, namely, *excelsus*, *pacificus*, *psora*, and *mexicanus*. The guard hairs are the longest of any known race except *hirtus* of the Upper Mississippi Valley, in which the hairs average slightly longer.

Specimens examined.—Total number, 34, as follows:

Delaware: Rehoboth Bay, 1.

Maryland: Blackwater National Wildlife Refuge, 29 (6 skins only); Crocheron, 1 (skin only); Vienna, 1 (skin only).

Virginia: Saxis Island, 2 (skins only).

BIBLIOGRAPHY

ANONYMOUS.

1939. Wisconsin raccoon. Wisconsin Conserv. Bull. 4 (10): 56. October.
 1945. Raccoons are "Up" in Michigan. Michigan Conserv. 14 (3): 5.
 March.

ABBOTT, ROY L.

1944. The way of a coon. Nat. Hist. 53 (7): 310-311. September.

ALDOUS, C. M., and H. L. MENDALL.

1941. The status of big game and fur animals in Maine. Maine Coop. Wildlife Research Unit, Univ. Maine, Orono. September 1.

ALFARO, ANASTASIO.

1897. Mamíferos de Costa Rica. Impreso para la primera Exposición Centroamericana, San José, Costa Rica, pp. 1-51.

ALLAN, PHILIP F.

1947. Farms and fur bearers. Virginia Wildlife 8 (3): 14-16. March.

ALLEN, GLOVER MORRILL.

1911. Mammals of the West Indies. Mus. Comp. Zool. Bull. 54 (6): 175-263. July.
 Records *P. maynardi*, *P. minor*, and "*Procyon* (?) *cancricorvus*" (= *P. glomeralleni*), pp. 220-221.

ALLEN, J. A.

1869. Catalogue of the mammals of Massachusetts, with a critical revision of the species. Mus. Comp. Zool. Bull. 1 (8): 143-252.
 Discussion of color variations.
 1876. Geographical variation among North American mammals, especially in respect to size. U. S. Geol. and Geog. Survey Territories Bull. 2 (4): 309-344. July 1.
 1890. Notes on collections of mammals made in central and southern Mexico, by Dr. Audley C. Buller, with descriptions of new species of the Genera *Vespertilio*, *Sciurus*, and *Lepus*. Amer. Mus. Nat. Hist. Bull. 3: 175-194.
 1895. On a collection of mammals from Arizona and Mexico, made by W. W. Price, with field notes by the collector. Amer. Mus. Nat. Hist. Bull. 7: 193-258. June 29.
 1906. Mammals from the States of Sinaloa and Jalisco, Mexico, collected by J. H. Batty during 1904 and 1905. Amer. Mus. Nat. Hist. Bull. 22: 191-262.
 1910. Additional mammals from Nicaragua. Amer. Mus. Nat. Hist. Bull. 28: 87-115. April 30.

AMUNDSON, ROD.

1949. The raccoon. Wildlife in North Carolina 13 (5): 4-6, 20, illus. May.

ANDERSON, JAMES R.

1893. Second report of the Department of Agriculture of British Columbia for the year 1892. British Columbia Sess. Papers, Victoria, 56, pp. 747-978.

ANDERSON, RUDOLPH MARTIN.

1894. Third report of the Department of Agriculture of the Province of British Columbia (1893), p. 1885.
 1938. Mammals of the Province of Quebec. Provancher Soc. Nat. Hist. Canada. Rapport Annual, pp. 50-114.
 Distribution records of raccoon in Quebec, p. 62.
 1947. Catalogue of Canadian recent mammals. Natl. Mus. Canada Bull. No. 102, Biol. Ser. No. 31, pp. 1-238. January 24.

ARANT, FRANK SELMAN.

1939. Status of game birds and mammals in Alabama. Alabama Dept. Conserv., Montgomery, 38 pp.

ARTHUR, STANLEY CLISBY.

1926. Louisiana fur-bearing mammals. Seventh Bien. Rept. Louisiana Dept. Conserv. 1924-1926, pp. 63-113.
 1928. The fur animals of Louisiana. Louisiana Dept. Conserv. Bull. No. 18, pp. 1-433. November.
 Account of the natural history of the raccoon.

ASHBROOK, FRANK G., and HORACE J. McMULLEN.

1925. A preliminary study of statistical data on the fur resources and the fur trade. Yearbook Natl. Assoc. Fur Industry, pp. 5-34.

AUDUBON, JOHN JAMES, and JOHN BACHMAN.

- 1849-54. The quadrupeds of North America. 3 vols. New York.
 Account of the raccoon, vol. 2, pp. 74-82.

BAILEY, BERNARD.

1929. Mammals of Sherburne County, Minnesota. Jour. Mammal. 10 (2): 153-164.

BAILEY, VERNON.

1905. Biological survey of Texas. North Amer. Fauna 25, 222 pp., illus.
 General account of raccoons in the State, pp. 192-195.
 1923. Mammals of the District of Columbia. Biol. Soc. Washington Proc. 36: 103-138. May 1.
 Includes an account of the raccoon, pp. 123-124.
 1926. A biological survey of North Dakota. North Amer. Fauna 49, 226 pp., illus. December.
 General account of *P. l. hirtus* in North Dakota, pp. 187-190.
 1931. Mammals of New Mexico. North Amer. Fauna 53, 412 pp., illus. December.
 General account of *P. l. mexicanus* in New Mexico, pp. 348-349.
 1933. Cave life of Kentucky. Amer. Midland Nat. 14 (5): 433-434.
 1936. The mammals and life zones of Oregon. North Amer. Fauna 55, 416 pp., illus. June.
 Accounts of *P. l. pacificus* and *P. l. excelsus*, pp. 315-317.

BAIRD, SPENCER FULLERTON.

1857. Mammals of North America. Pacific R. R. Rept. 8, 757 pp., illus.
 General account of the raccoons, pp. 209-215; original description of *Procyon bernandezii* var. *mexicana* (= *P. l. mexicanus*), p. 215.

BANGS, OUTRAM.

- 1898a. The land mammals of peninsular Florida and the coast region of Georgia. Boston Soc. Nat. Hist. Proc. 28 (7): 157-235. March.
 Original description of *P. l. oluceus*, p. 219.
 1898b. A new raccoon from Nassau Island, Bahamas. Biol. Soc. Washington Proc. 12: 91-92. April 30.
 Original description of *P. maynardi*, p. 92.

1901. Chiriqui Mammalia. Mus. Comp. Zool. Bull. 39 (2): 17-51.

BARNES, CLAUDE TEANCUM.

1922. Mammals of Utah. Univ. Utah Bull. 12 (15): 1-66. April.
 Distribution of the raccoon in Utah, pp. 133-134.

BENNET, JAMES MILTON.

1925. Dog, gun, and raccoon. *Forest and Stream* 95: 554.

BENNETT, RUDOLF, and WERNER O. NAGEL.

1937. A survey of the resident game and fur bearers of Missouri. *Univ. Missouri Studies* 12 (2): 1-215. April 1.

BENSON, ADOLPH B.

1937. The America of 1750, Peter Kalm's travels in North America. The English version of 1770. Revised from the original Swedish and edited by Adolph B. Benson, with a translation of new material from Kalm's diary notes. Vol. 1, 380 pp., illus.; vol. 2, pp. 381-797, illus., folding map 1. New York.

Accounts of the raccoon in Pennsylvania and New Jersey. Vol. 1, pp. 52-53, 111, faced with illustration, 242-243.

BERGTOLD, W. H.

1925. Unusual nesting of a raccoon. *Jour. Mammal.* 6 (4): 280-281.

BILLINGS, E.

1856. Natural history of the raccoon (*Procyon lotor*). *Canadian Nat. and Geol.* 1 (4): 253-260. September.

An early general account.

BLACK, JOHN DAVID.

1938. Mammals of Kansas. *Kansas State Board Agr., Thirteenth Bien. Rept.*, pp. 116-217.

Distribution and habits, pp. 154-155.

BLAIR, W. FRANK.

1938. Ecological relationships of the mammals of the Bird Creek Region, northeastern Oklahoma. *Amer. Midland Nat.* 20 (3): 496 November.

1939. Faunal relationships and geographic distribution of mammals in Oklahoma. *Amer. Midland Nat.* 22 (1): 104. July.

1940. A contribution to the ecology and faunal relationship of the mammals of the Davis Mountain region, southwest Texas. *Univ. Michigan Mus. Zool. Misc. Pub. No. 16*, p. 23. June 28.

BODDAERT, PETER.

1784. *Elenchus Animalium*. Vol. 1, 174 pp. Roterdami.

Description of *Procyon lotor* under the substitute name [*Melis*] *lotor*, p. 80.

BOLE, B. P., JR., and PHILIP N. MOULTHROP.

1942. The Ohio recent mammal collection in the Cleveland Museum of Natural History. *Cleveland Mus. Nat. Hist. Sci. Pub.* 5 (6): 83-181. September 11.

BRADT, GLENN W.

1946. The raccoon, masked clown of the woodlots. *Michigan Conserv.* 15 (8): 6-7. September.

BRASS, EMIL.

1911. *Aus dem Reiche der Pelze*. 709 pp. April.

Descriptions of *Procyon lotor* [unidentifiable] and *Procyon proteus* (= *P. l. pacificus*), p. 564.

BROWN, C. EMERSON.

1936. Rearing wild animals in captivity, and gestation periods. *Jour. Mammal.* 17 (1): 10-13. February 14.

Gestation period in a raccoon in Philadelphia Zoo 69 days from first coition, p. 13.

BROWN, L. G., and LEE E. YEAGER.

1943. Survey of the Illinois fur resource. Illinois Nat. Hist. Survey Bull. 22 (6): 462. September.

BROWNE, F. C.

1892. The coon in eastern Massachusetts. Forest and Stream 39: 405. November 10.

BURMEISTER, HERMANN.

1850. Verzeichniß der im Zoologischen Museum der Universität Halle-Wittenberg aufgestellten Säugethiere, Vögel und Amphibian. 84 pp.

Lists three species of raccoon. Proposes new combination [*Procyon brachyurus*] var. *fusca*, p. 13, based upon *Procyon obscurus*, without description or comment.

BURT, WILLIAM H.

1946. The mammals of Michigan. 288 pp., 13 color pls., 107 text figs., 67 text maps.

BUTTERFIELD, ROBERT T.

1944. Tagged raccoons—1943-44. Ohio Conserv. Bull. 8 (7): 11. July.

CAGLE, FRED R.

1949. Notes on the raccoon, *Procyon lotor megalodous* Lowery. Jour. Mammal. 30 (1): 45-50. February 14.

CAHALANE, VICTOR H.

1928. A preliminary wild life and forest survey of southwestern Cattaraugus County, New York. Roosevelt Wild Life Bull. 5 (1): 81-98. March.

1947. Mammals of North America. 682 pp., illus. Macmillan Co.

Raccoon, pp. 156-161.

CAHN, ALVIN R.

1921. The mammals of Itasca County, Minnesota. Jour. Mammal. 2 (2): 68-74.

CAMPBELL, J. E.

1945. The raccoon in North Dakota. North Dakota Outdoors 7 (8): 4. February.

CARTWRIGHT, GEORGE.

1792. A journal of transactions and events, during a residence of nearly sixteen years on the coast of Labrador. 3 vols.

A northern record; On the Alexander River, a branch of the St. Lewis River, shot a raccoon, August 22, 1774, vol. 2, p. 23.

CARY, MERRITT.

1911. A biological survey of Colorado. North Amer. Fauna 33, 256 pp., illus. August 17.

Distribution and habits in Colorado, pp. 193-194.

CATESBY, MARK.

1743. The natural history of Carolina, Florida and the Bahamas. 2 vols.

Describes the raccoon, p. XXIX, "An Account of Carolina and the Bahama Islands"; in appendix to vol. 2.

CHAMBERLAIN, MONTAGUE.

1884. List of the mammals of New Brunswick. New Brunswick Nat. Hist. Soc. Bull. 3: 39.

CHASE, HARRY.

1911. The Sullivan Law. Forest and Stream 77: 551-552. October 7.

Refers, p. 552, to the use of raccoon skins in payment for services of the Secretary to the Governor of the "State of Franklin" in eastern Tennessee.

CLARKE, FRANK I.

1910. Game of British Columbia. Bur. Provincial Information British Columbia Off. Bull. No. 17: 29.

COLE, H. E.

1922. Wildlife in Baraboo Hills. Wisconsin Conserv. 3 (4): 9. January.

COLE, LAWRENCE WOOSTER.

1907. Concerning the intelligence of raccoons. Jour. Comp. Neurol. and Psychol. 17 (3): 211-261. May.

Records the results of rather elaborate experiments.

1912. Observations of the senses and instincts of the raccoon. Jour. Animal Behavior 2 (5): 299-309. September-October.

CORY, CHARLES B.

1912. The mammals of Illinois and Wisconsin. Field Mus. Nat. Hist., Zool. Ser. 11, Pub. 153, p. 396.

CRIDDLE, STUART.

1929. An annotated list of the mammals of Aweme, Manitoba. Canadian Field-Nat. 43: 156. October.

CROSS, E. C., and J. R. DYMOND.

1929. The mammals of Ontario. Royal Ontario Mus. Zool. Handbook No. 1, pp. 12-13.

CURRIE, JOHN W.

1949. This raccoon racket. Kentucky Happy Hunting Ground 5 (2): 5, 19. March.

Brief account of raising raccoons at Game Farm of the Kentucky Game and Fish Commission.

CUVIER, GEORGES.

1798. Tableau elementaire de l'histoire naturelle des animaux. 710 pp., illus. Paris.

Original description of *Ursus cancrivorus* (= *Procyon cancrivorus*), p. 113, from Cayenne.

DALQUEST, WALTER W.

1948. Mammals of Washington. Univ. Kansas Pubs. Mus. Nat. Hist., vol. 2, 444 pp.

Discussion of the raccoon, pp. 179-182.

DAMPIER, WILLIAM.

1729. A new voyage round the World. Vol. 1, 550 pp.

Refers to the occurrence of raccoons on the Tres Marias Islands, off the west coast of Mexico, p. 276.

DANNER, E. Y.

1931. Raccoons like candy. Mt. Rainier Nature Notes 9 (8): 8.

DAVIS, HERBERT BURNHAM.

1907. The raccoon: A study in animal intelligence. Amer. Jour. Psychol. 18 (4): 447-487. October.

An important detailed account of the results of experiments.

DAVIS, WILLIAM B.

1939. The recent mammals of Idaho. 400 pp., illus. Caxton Printers, Caldwell, Idaho.

An account of *P. l. exelsus* within the State, pp. 128-129.

DE BEAUX, OSCAR.

1910. Über eine neue Farbenspielart des Waschbären. (Ein Beitrag zur Systematik des *Procyon lotor*.) Zool. Anzeiger 35: 621-626. April 26.

A confusing general discussion of raccoons. Three new names, "*Pr. l. flavidus*" (p. 626), "*Pr. lotor rufescens*" (p. 625), and "*Pr. hernandezii castaneus*" (p. 624) are proposed, but appear to be unidentifiable.

DELLINGER, S. C., and J. D. BLACK.

1940. Notes on Arkansas mammals. Jour. Mammal. 21 (2): 188.

DESMAREST, A. G.

1819. Dictionnaire histoire naturelle. Vol. 29, p. 93.

DICE, L. R.

1925. A survey of the mammals of Charlevoix County, Michigan, and vicinity. Univ. Michigan Mus. Zool. Occas. Papers No. 159, p. 20. April 11.

DIONNE, CHARLES EUSÈBE.

1902. Les mammifères de la Province de Quebec. 285 pp.

Distribution and habits of raccoon, pp. 164-168.

DOZIER, HERBERT L.

1948. A new eastern marsh-inhabiting race of raccoon. Jour. Mammal. 29 (3): 286-290. August 31.

Description of *Procyon lotor maritimus*, from Blackwater National Wildlife Refuge, Dorchester County, Maryland.

DOZIER, HERBERT L., THORA M. PLITT HARDY, and MERLE H. MARKLEY.

1948. Fur characteristics of two eastern raccoons. Jour. Mammal. 29 (4): 383-393. December 31.

DYMOND, JOHN RICHARDSON.

1928. The mammals of Lake Nipigon region. Trans. Royal Canadian Inst. 16 (pt. 2): 239-250.

Northern records of the raccoon, p. 240.

ELLIOT, D. G.

1901. A list of mammals obtained by Thaddeus Surber in North and South Carolina, Georgia, and Florida. Field Columbian Mus. Pub. No. 58, Zool. Ser. 3 (4): 51-53. June.

1903. A list of mammals collected by Edmund Heller, in the San Pedro Martir and Hanson Laguna Mountains and the accompanying coast regions of Lower California. Field Columbian Mus. Pub. No. 79, Zool. Ser. 3 (12): 231. June.

1904. Catalogue of mammals collected by E. Heller in southern California. Field Columbian Mus. Pub. No. 91, Zool. Ser. 3 (16): 316. March.

1907. A catalogue of the collection of mammals in the Field Columbian Museum. Field Columbian Mus. Pub., No. 115, Zool. Ser. 8: 426-427.

ENDERS, ROBERT K.

1930. Some factors influencing the distribution of mammals in Ohio. Univ. Michigan Mus. Zool. Occas. Papers No. 212, p. 9. April 23.

EVERMANN, BARTON WARREN, and HOWARD WALTON CLARK.

1911. Notes on the mammals of the Lake Maxinkuckee region. Washington Acad. Sci. Proc. 13 (1): 32.

FISCHER, GOTTHELF.

1814. *Zoognosia Tabulis Synopticis*. Vol. 3, 732 pp.

Description of *Procyon annulatus* (= *Procyon lotor*), p. 177.

FLOWER, STANLEY SMYTH.

1931. Contributions to our knowledge of the duration of life in vertebrate animals. V. Mammals. Zool. Soc. London, Proc. 1931 (pt. 1): 145-234.

The longevity of the raccoon in captivity, p. 177.

FORBUSH, EDWARD HOWE.

1916. The natural enemies of birds. Massachusetts Board Agr. Bull. No. 3, pp. 24-25.

Consideration of the raccoon in relation to birds.

FRANTZIUS, A. VON.

1881. Los mamíferos de Costa Rica. Colecion de documentos para la historia de Costa Rica publicados por el Don Leon Fernandez. 412 pp.

Raccoon, p. 412.

FRYE, O. EARL, and DANIEL W. LAY.

1943. Fur resources and fur animals of Texas. Texas Game, Fish, and Oyster Comm. Bull. No. 25: 18-19.

GANDER, FRANK FORREST.

1928. Period of gestation in some American mammals. Jour. Mammal. 9 (1): 75. February 9.

Records the period of gestation in a raccoon under observation.

GARMAN, H.

1894. A preliminary list of the vertebrate animals of Kentucky. Essex Inst. Bull. 26 (1-3): 4.

The raccoon as an enemy of bird life.

GAUMER, GEORGE FRANKLIN.

1917. Monografía de los mamíferos de Yucatan. Pub. by Secretaria de Fomento, D. F. Mexico. 331 pp.

Notes on the raccoon of Yucatan, pp. 210-215.

GEOFFROY-SAINT HILAIRE, ISIDORE.

1855. Voyage sur la Venus. Zoologie. 355 pp., illus.

Description of "*Procyon lotor* variete mexicaine," from Mazatlan, Sinaloa, pp. 125-132, pl. VI.

GEOFFROY-SAINT HILAIRE, ISIDORE, and G. CUVIER.

1795. Memoire sur une nouvelle division des mammiferes, et sur les principes qui doivent servir de base dans cette sorte de travail. Mag. Encyc. 2: 464-490.

GIDLEY, JAMES WILLIAMS.

1906. A fossil raccoon from a California Pleistocene cave deposit. U. S. Natl. Mus. Proc. 19: 553-554, illus.

Original description of *Procyon sinus*, p. 553. Similar in size to *P. l. exelsus*, but molari-form tooth rows more strongly curved outward near middle; crown of first upper premolar with outer side sloping inward posteriorly, instead of nearly parallel to antero-posterior axis of skull; posterior lower molar with a distinctly broader cusp, or "heel."

GILL, THEODORE N.

1872. Letter on the alleged hybrid between a raccoon and cat. Amer. Nat. 6: 53-55. January.

GILPIN, J. BERNARD.

1870. On the Mammalia of Nova Scotia. *Trans. Nova Scotia Inst. Nat. Sci.* 2 (pt. 1): 15.

GOLDMAN, EDWARD ALPHONSO.

1913. Descriptions of new mammals from Panama and Mexico. *Smithsn. Misc. Collect.* 60 (22): 1-20. February 28.

Original description of *E. c. panamensis* (= *Procyon (Euprocyon) cancrivorus panamensis*), p. 15.

1920. Mammals of Panama. *Smithsn. Misc. Collect.* 69 (5): 1-309, illus. Accounts of *P. l. pumilus* and *P. c. panamensis*, pp. 151-153.

GOODPASTER, W.

1941. A list of the birds and mammals of southwestern Ohio. *Jour. Cincinnati Soc. Nat. Hist.* 22 (3): 43. June.

GOODWIN, GEORGE GILBERT.

1924. Mammals of the Gaspé Peninsula, Quebec. *Jour. Mammal.* 5 (4): 253.

1934. Mammals collected by A. W. Anthony in Guatemala, 1924-1928. *Amer. Mus. Nat. Hist. Bull.* 68, art. 1, 60 pp., illus. December 12. Records *P. l. shufeldti* from El Espino and Finca Cipres, Guatemala.

1935. The mammals of Connecticut. *Connecticut State Geol. and Nat. Hist. Survey Bull.* 53, 221 pp., illus. Distribution records in Connecticut, p. 59.

1942. Mammals of Honduras. *Amer. Mus. Nat. Hist. Bull.* 79: 176. May 29.

1947. The carnivores. Part II. Raccoons and their allies. *Audubon Nat. Bull., Ser. No. 18, Bull. No. 3*, 4 pp. November.

GRAY, JOHN EDWARD.

1837. Charlesworth's Mag. *Nat. Hist.* 1: 580.

Description of *Procyon nivea* which is unidentifiable.

1842. Descriptions of some new genera and fifty unrecorded species of Mammalia. *Ann. Mag. Nat. Hist.* 10: 255-267. December.

Description of *Procyon psora*, p. 261.

1864. A revision of the genera and species of ursine animals (Ursidae), founded on the collection in the British Museum. *Zool. Soc. London Proc.* 1864: 677-709.

Includes accounts of the raccoons, pp. 703-706. *Euprocyon* proposed as a subgenus, p. 705.

GREEN, H. U.

1932. Mammals of the Riding Mountain National Park, Manitoba. *Canadian Field-Nat.* 46 (7): 149-152. October.

Records extinction of raccoon in Riding Mountain section during past two decades, p. 152.

GREGORY, TAPPAN.

1936. Mammals of the Chicago region. (Program of Activities.) *Chicago Acad. Sci.* 7 (2-3): 34. July.

GREGORY, WILLIAM KING.

1933. Nature's wild dog show. *New York Zool. Soc. Bull.* 36 (4): 83-96, illus. July-August.

Brief reference to origin of raccoon family during lower Oligocene period, p. 83.

GREGORY, WILLIAM KING—Continued

1936. On the phylogenetic relationships of the giant panda (*Ailuropoda*) to other aretoid Carnivora. Amer. Mus. Novitates No. 878, pp. 1-20. August 8.

GRINNELL, JOSEPH.

1914. An account of the mammals and birds of the lower Colorado Valley. Univ. California Pub. Zool. 12 (4): 51-294, illus. March 20.
Distribution and habits of *P. l. pallidus*, pp. 260-262.

1933. Review of the recent mammal fauna of California. Univ. California Pub. Zool. 40 (2): 99. September 26.

GRINNELL, JOSEPH, JOSEPH SCATTERGOOD DIXON, and JEAN MYRON LINSDALE.

1930. Vertebrate natural history of a section of northern California through the Lassen Peak Region. Univ. California Pub. Zool., vol. 35, 591 pp., 181 text figs. October.

Account of *P. l. psora*, pp. 460-462.

1937. Fur-bearing mammals of California. 2 vols. Vol. 1, pp. 137-165. Univ. California Press, Berkeley.

GRINNELL, JOSEPH, and JEAN MYRON LINSDALE.

1936. Vertebrate animals of Point Lobos Reserve, 1934-35. Carnegie Inst. Washington, Pub. No. 481, p. 134. December 10.

HALL, ARCHIBALD.

1861. On the mammals and birds of the district of Montreal. Canadian Nat. & Geol. 6 (4): 294.

Description of specimen of raccoon.

HALL, E. R.

1946. Mammals of Nevada. 710 pp. Univ. California Press, Berkeley.

Notes on raccoons, pp. 175-179.

HAMILTON, WILLIAM JOHN, JR.

1941. Notes on some mammals of Lee County, Florida. Amer. Midland Nat. 25 (3): 688. May.

1943. The mammals of eastern United States. 432 pp., illus. Ithaca, N. Y. Raccoons, pp. 118-125.

HARDY, MANLY.

1907. The raccoon. Forest and Stream 69: 852. November 30.

On raccoon characteristics.

HARLAN, RICHARD.

1825. Fauna Americana: being a description of the mammiferous animals inhabiting North America. 318 pp.

General account of the raccoon, pp. 53-56.

HARPER, FRANCIS.

1920. Okefinokee Swamp as a reservation. Jour. Amer. Mus. Nat. Hist. 20: 30. January-February.

1927. The mammals of the Okefinokee Swamp region of Georgia. Boston Soc. Nat. Hist. Proc. 38: 297.

1929. Notes on mammals of the Adirondaacks. New York Mus. Handbook, No. 8, p. 69. May.

HARRINGTON, LYN.

1944. The masked bandit of the woods. Canadian Nature 6 (5): 154, illus. November-December.

HATT, ROBERT T.

1924. The land vertebrate communities of western Leelanau County, Michigan, with an annotated list of the mammals of the county. *Papers Michigan Acad. Sci., Arts and Letters* 3: 392.

HERNANDEZ, FRANCISCO.

1651. *Rerum medicarum Novae Hispaniae thesaurus sen plantarum animalium, mineralium Mexicanorum Histaria* [Francisci Hernandez, et al.].

Accounts of the "Mapach," tract 1, cap. 1, p. 1 and of the "Tepe Maxtlaton," tract 1, cap. 28, p. 9 of an appendix of the general work; both apparently referable to the raccoon.

HERRERA, ALFRED L.

1899. *Sinominia vulgar y cientifica de los principales vertebrados Mexicanos*. 31 pp. Mexico.

HERRICK, CLARENCE LUTHER.

1892. *Mammals of Minnesota*. *Minnesota Geol. Nat. Hist. Survey Bull.* 7, 299 pp., illus.

Account of *Procyon lotor* (= *P. l. hirtus*), pp. 139-145.

HIBBARD, CLAUDE W.

1933. A revised check list of Kansas mammals. *Trans. Kansas Acad. Sci.* 36: 235.

1944. A checklist of Kansas mammals, 1943. *Trans. Kansas Acad. Sci.* 47: 61-88.

Notes on raccoons, p. 67.

HOLLISTER, NED.

1914. Descriptions of four new mammals from tropical America. *Biol. Soc. Washington Proc.* 27: 141-144. July 10.

Original description of *P. l. crassidens*, p. 142.

1915. The genera and subgenera of raccoons and their allies. *U. S. Natl. Mus. Proc.* 49 (2100): 143-150. August 13.

An important contribution to knowledge of the classification of the group.

HOWELL, ARTHUR H.

1921. A biological survey of Alabama. *North Amer. Fauna* 45, pp. 34-35.

HUGHES, GRIFFITH.

1750. *The natural history of Barbados*. 314 pp., illus. London.

Refers to a bounty on raccoons, p. 66.

HUNTINGTON, GEORGE S.

1892. On the ileo-colic junction in *Procyon lotor* and allied forms. *Trans. New York Acad. Sci.* 11: 50-53.

ILLIGER, JOHANN KARL WILHELM.

1815. Ueberblick der säugthiere nach ihrer vertheilung uber die welttheile. *Abhand. Konig Akad. Wissensch.* 1801-1811: 39-159. Berlin.

IVEY, DEWITT R.

1948. The raccoon in the salt marshes of northeastern Florida. *Jour. Mammal.* 29 (3): 290-291. August 31.

JACKSON, H. H. T.

1908. A preliminary list of Wisconsin mammals. *Wisconsin Nat. Hist. Soc. Bull.* 6: 13-34.

JAEGER, E. C.

1947. Use of the os phallus of the raccoon as ripping tool. *Jour. Mammal.* 28 (3): 297. August.

JAMESON, E. W., JR.

1943. Notes on the habits and siphonapterous parasites of the mammals of Welland County, Ontario. *Jour. Mammal.* 24 (2): 194-197. May 20.

JOHNSON, CHARLES E.

1916. A brief descriptive list of Minnesota mammals. *Fins, Feathers and Fur*, No. 8, p. 7. December.

JOHNSON, M. S.

1930. Common injurious mammals of Minnesota. *Univ. Minnesota Agr. Expt. Sta. Bull.* 259, p. 57. January.

JONES, GLENN.

1946. The raccoon in Oklahoma. *Oklahoma Game and Fish News* 2 (12): 4-5, 7. December.

JOSSELYN, JOHN.

1672. *New England's rarities discovered in birds, beasts, fishes, serpents, and plants of that country.* (Reprint, 1865, 169 pp.)
Refers to the habits of the raccoon, p. 52, 1865 edition.

KEELER, CHARLES A.

1891. Notes on the colors of west coast mammals. *Zoe* 2: 212.

KELLOGG, REMINGTON.

1937. Annotated list of West Virginia mammals. *U. S. Natl. Mus. Proc.* 84 (3022): 443-479. October 7.
Distribution and habits of raccoon, p. 451.

1939. Annotated list of Tennessee mammals. *U. S. Natl. Mus. Proc.* 86 (3051): 245-303.

Distribution of raccoon within the State.

KERR, ROBERT.

1792. *The animal kingdom or zoological system of the celebrated Sir Charles Linnaeus, Class 1, Mammalia.* 400 pp.

An account of the raccoons under the names *Ursus lotor* and "*U. lotor melinus*," the latter a color phase, pp. 188-189.

KOPMAN, H. H.

1921. *Wild life resources of Louisiana.* Louisiana State Dept. Conserv. Bull. No. 10, pp. 23-39. December.

Contains an account of the raccoon in Louisiana, p. 28.

LANMAN, CHARLES.

1856. *Adventures in the wilds of the United States and British American Provinces.* 2 vols. Vol. 1, p. 83. Philadelphia.

LAWSON, JOHN.

1718. *The history of Carolina.* 258 pp.

An account of the raccoon, p. 121.

LE CONTE, JOHN L.

1848. Notice of five new species of fossil Mammalia from Illinois. *Amer. Journ. Sci. and Arts (Silliman's Journal)*, ser. 2, vol. 5, art. 16, pp. 102-107. May.

New name, *Procyon prisens*, proposed, p. 106.

LEREAS, H. J.

1942. Notes on mammals from west-central Minnesota. *Jour. Mammal.* 23 (3): 344. August 14.

LINNAEUS (LINNÉ), CARL.

1740. *Systema Naturae*, in quo naturae regna tria, secundum classes, ordines, genera, species, systematice proponuntur. Ed. 2, 80 pp., Stockholmiae.

Listed the raccoon with the bear as *Ursus cauda elongata*, p. 35.

1747. *Beskrifning Pa et Americanskt Diur, som Hans Konglige Hoeghet gifvit til underjoekning*. Kongliga Svenska Vetenskaps Academiens Handlingar, vol. 8, pp. 277-289, tab. 9, figs. 1-2.

A general description of the raccoon under the name *Ursus cauda elongata*, including habits, and perhaps the first illustration of the animal and its os penis.

1758. *Systema Naturae*, secundum classes, ordines, genera species, cum caracteristibus, differentiis, synonymis, locis. Ed. 10, tomus I, regnum animale, 824 pp.

Original description of [*Ursus*] *lotor* (= *Procyon lotor lotor*), p. 48.

LOWERY, GEORGE H., JR.

1936. A preliminary report on the distribution of the mammals of Louisiana. Louisiana Acad. Sci. Proc. 3 (1): 1-39. March.

Distribution and habits of raccoons, p. 19.

1943. Check-list of the mammals of Louisiana and adjacent waters. Louisiana State Univ. Mus. Zool. Occas. Papers No. 13, pp. 213-257, illus. November 22.

Raccoons, pp. 225-231. Description of *Procyon lotor megalodous*, p. 225.

LUTTRINGER, L. L., JR.

1931. An introduction to the mammals of Pennsylvania. Pennsylvania Bd. Game Comm'rs. Bull. 15: 29.

LYON, MARCUS WARD, JR.

1936. Mammals of Indiana. Amer. Midland Nat. 17 (1): 1-384. January.

MAAR, R. D.

1947. Raccoons snap their own pictures. Field and Stream 52 (6): 112-113, illus. October.

MACFARLANE, RODERICK ROSS.

1905. Notes on mammals collected and observed in the northern Mackenzie River District Northwest Territories of Canada, with remarks on explorers and explorations of the far North. U. S. Natl. Mus. Proc. 28: 673-764, illus. June.

Raccoon numbers and distribution, pp. 715-716.

MACLULICH, D. A.

1936. Mammals of the Wanapitei Provincial Forest, Sudbury District, Ontario. Canadian Field-Nat. 50 (4): 57. April.

MANVILLE, R. H.

1942. Notes on the mammals of Mount Desert Island, Maine. Jour. Mammal. 23 (4): 393. November 14.

MATTHEW, WILLIAM DILLER.

1930. The phylogeny of dogs. Jour. Mammal. 11 (2): 117-138.

Phylogenetic relationships of raccoons, p. 129. May 9.

MCGREW, P. O.

1938. Dental morphology of the Procyonidae with a description of *Cynarcoides*, gen. nov. Field Mus. Nat. Hist. Geol. Ser. 6 (22): 323-338, illus. October 31.

- McKEAN, WILLIAM T.
1948. Winter foods of North Dakota predatory animals. *North Dakota Outdoors* 10 (8): 6. February.
- McLEAN, DONALD D.
1934. Predatory animal studies. *California Fish and Game* 20 (1): 32 January.
- McMAHAN, C. A.
1946. Trapping the raccoon. *Texas Game and Fish* 4 (12): 30. November.
- McQUEEN, A. S., and HAMP MIZELL.
1926. *History of Okefenokee Swamp*. 191 pp. Jacobs & Co., Clinton, S. C.
- MEARNS, EDGAR ALEXANDER.
1914. Descriptions of three new raccoons from the Mexican boundary region. *Biol. Soc. Washington Proc.* 27: 63-67. March 20.
Original descriptions of *P. l. fuscipes*, p. 63, *P. l. ochraceus* (= *P. l. pallidus*), p. 64, and *P. l. californicus* (= *P. l. psora*), p. 66.
- MERRIAM, CLINTON HART.
1884. *The mammals of the Adirondaek Region*. 316 pp.
Includes an account of the raccoon, pp. 91-95.
1898. *Mammals of Tres Marias Islands off western Mexico*. *Biol. Soc. Washington Proc.* 12: 13-19. January 27.
Original description of *Procyon lotor insularis* (= *P. insularis insularis*), p. 17.
1899. *Results of a biological survey of Mount Shasta, California*. *North Amer. Fauna* 16, 179 pp., illus. October 28.
Original description of *Procyon psora pacifica* (= *P. lotor pacificus*), p. 107.
1900. *Descriptions of two new mammals from California*. *Biol. Soc. Washington Proc.* 13: 151-152. June 13.
Original description of *Procyon pallidus* (= *P. lotor pallidus*), p. 151.
1901. *Six new mammals from Cozumel Island*. *Biol. Soc. Washington Proc.* 14: 99-104. July 19.
Original description of *Procyon pygmaeus*, p. 101.
- MILLER, GERRIT S., JR.
1900. *Key to the land mammals of northeastern North America*. *New York State Mus. Bull.* 8 (38): 137.
1905. *Mammals of the Bahama Islands*. (The Bahama Islands.) *Geog. Soc. Baltimore*, pp. 371-384, illus.
Extended account of *P. maynardi*, pp. 376-379.
1911. *Descriptions of two new raccoons*. *Biol. Soc. Washington Proc.* 24: 3-6. January 28.
Original descriptions of *Procyon pumilus* (= *Procyon lotor pumilus*), p. 3, and *Procyon minor*, p. 4.
1924. *List of North American recent mammals, 1923*. *U. S. Natl. Mus. Bull.* 128, 673 pp.
Species of *Procyon*, pp. 107-110.
- MILLS, WESLEY.
1892. *Hibernation and allied states in animals*. *Trans. Royal Soc. Canada* 10 (sec. 4): 49-66 (1893).
Describes the hibernation of a tame raccoon, p. 50.

MOHR, CARL O.

1947. Table of equivalent populations of North American small mammals. Amer. Midland Nat. 37 (1): 224. January.

MORRIS, R. F.

1948. The land mammals of New Brunswick. Jour. Mammal. 29 (2): 168. May.

MOSBY, HENRY S.

1947. Virginia animals everyone should know: The raccoon. Virginia Wildlife 8 (2): 8-9, 20. February.

MURIE, ADOLPH.

1935. Mammals from Guatemala and Honduras. Univ. Michigan Mus. Zool. Misc. Pub. 26, 30 pp., illus. July 15.
Records *P. l. shufeldti* from El Cayo, British Honduras.

NAGEL, W. O.

1943. How big is a 'coon'? Missouri Conserv. 4 (7): 6-7. October.

NECKER, WALTER L. and DONALD F. HATFIELD.

1941. Mammals of Illinois. An annotated check list with keys and bibliography. Chicago Acad. Sci. Bull. 6 (3): 46. May 15.

NELSON, ARNOLD B., and HARVEY I. SCUDDER.

1947. The raccoon as a predator on turtles. Jour. Mammal. 28 (4): 406.

NELSON, EDWARD WILLIAM.

1899. Natural history of the Tres Marias Islands, Mexico. North Amer. Fauna 14, 97 pp., illus. April 29.
Distribution and habits of the raccoons, p. 17.

- 1930a. Four new raccoons from the keys of southern Florida. Smithson. Misc. Collect. 82 (8): 1-12, illus. July 10.

Original descriptions of *P. l. murinus*, p. 7; *P. l. inesperatus*, p. 8; *P. l. auspicatus*, p. 9; and *P. l. incautus*, p. 10.

- 1930b. Wild animals of North America: intimate studies of big and little creatures of the mammal kingdom. 1930 ed., 254 pp., illus.

General account of the raccoon, pp. 59-60.

NELSON, EDWARD WILLIAM, and EDWARD ALPHONSO GOLDMAN.

- 1930a. A new raccoon from Lower California. Jour. Washington Acad. Sci. 20 (5): 82-83. March 4.

Original description of *P. l. grinnelli*, p. 82.

- 1930b. Six new raccoons of the *Procyon lotor* group. Jour. Mammal. 11 (4): 453-459. November 11.

Original descriptions of *Procyon glomeralleni*, p. 453; *P. l. hirtus*, p. 455; *P. l. varius*, p. 456; *P. l. litoreus*, p. 457; *P. l. exelsus*, p. 458; and *P. l. vancovertensis*, p. 458.

- 1931a. Three new raccoons from Mexico and Salvador. Biol. Soc. Washington Proc. 44: 17-22. February 21.

Original descriptions of *P. l. shufeldti*, p. 17, *P. l. dickeyi*, p. 18, and *P. l. vicinus*, p. 20.

- 1931b. A new raccoon from South Carolina. Jour. Mammal. 12 (3): 308-309. August 24.

Original description of *P. l. solutus*, p. 308.

1932. The type locality of *Ursus lotor* Linné. Jour. Mammal. 13 (4): 367. November.

NEWBERRY, J. S.

1855. Report upon the mammals, in routes in California and Oregon explored by Lieutenants R. S. Williamson and Henry L. Abbott, Corps Topographic Engineers in 1855, Rept. Expl. and Surv. R. R. route Mississippi River to Pacific Ocean, 1854-1855. Vol. 6, pt. 4, No. 2, chap. 1, pp. 35-72.

Raccoons sold for food in San Francisco market, p. 47.

NORTON, ARTHUR H.

1930. The mammals of Portland, Maine, and vicinity. Portland Soc. Nat. Hist. Proc. 4 (1): 21-25.

OKEN, LORENZ.

1816. Lehrbuch der Naturgeschichte. Dritter Theil, Zoologie, Zweite Abth. Fleischthiere, pp. 386-387.

ORR, ROBERT T.

1943. Mammals of the Clearwater Mountains, Idaho. California Acad. Sci. Proc., 4th ser. 23 (35): 521. August 18.

OSGOOD, F. L., JR.

1938. The mammals of Vermont. Jour. Mammal. 19 (4): 437. November 14.

PACKARD, A. S., JR.

1866. List of vertebrates observed at Okak, Labrador, by the Reverend Samuel Weiz. Boston Soc. Nat. Hist. Proc. 10: 269.

1891. The Labrador coast. 513 pp. New York.

PEARSON, LEONARD, and B. H. WARREN.

1897. Diseases and enemies of poultry. Special Report. 749 pp. (Pub. by authority Pennsylvania State Legislature.)

Chickens killed by raccoons and other habits injurious to human interests in Pennsylvania described, pp. 481-484.

PIKE, ZEBULON M.

1895. Expeditions of Z. M. Pike 1805-1807. 2 vols. Edited by Elliott Coues.

POCOCK, REGINALD INNES.

1921. The external characters and classification of the Procyonidae. Zool. Soc. London Proc. 1921: 389-422.

A discussion of the genera and subfamilies.

POOLE, ARTHUR J., and VIOLA S. SCHANTZ.

1942. Catalog of the type specimens of mammals in the United States National Museum, including the Biological Surveys collection. U. S. Natl. Mus. Bull. 178, pp. 1-705.

POPE, CLIFFORD H.

1944. Attainment of sexual maturity in raccoons. Jour. Mammal. 25 (4): 91. November.

PRINCE, E. E.

1906. Zoological report. Trans. Ottawa Field Nat. Club. 22: 58. June.

PURCHAS, SAMUEL.

1614. Purchas his pilgrimage. Or relations of the world and the religions observed in all ages and places discovered from the creation unto the present. 918 pp., 8th "booke", chap. 5.

An early reference to the raccoon in Virginia, p. 761.

RAND, A. L.

1933. Notes on the mammals of the interior of western Nova Scotia. Canadian Field-Nat. 47 (3): 45. March.
 1943. History of the raccoon (*Procyon lotor* L.) in Nova Scotia. Canadian Field-Nat. 57 (4-5): 95. April-May.
 1944. The recent status of Nova Scotia fur bearers. Canadian Field-Nat. 58 (3): 90. May-June.
 1948. Mammals of the eastern Rockies and western plains of Canada. Nat. Mus. Canada Bull. No. 108, 237 pp., illus.

RATHBUN, MARY JANE.

1918. The grapsoid crabs of America. U. S. Natl. Mus. Bull. 97. 445 pp., illus. (1917).
 Reference to fiddler crab as food of raccoon, p. 401.

RAUSCH, ROBERT.

1947. Suggestions for the handling of certain mammals. Jour. Wildlife Mangt. 11 (2): 189. April.

RAY, JOHN.

1693. Synopsis methodica animalium. Quadrupedum. 336 pp. London.
 Includes an early reference to the raccoon, p. 179

RHOADS, S. N.

1885. Tenacity and ferocity in the raccoon. Amer. Nat. 19 (8): 823-824.
 1894. Contributions to the mammalogy of Florida. Acad. Nat. Sci. Philadelphia Proc., p. 155.
 1903. The mammals of Pennsylvania and New Jersey. 266 pp., illus.
 Account of *Procyon lotor*, pp. 182-183.

RICHARDSON, JOHN.

1829. Fauna Boreali-Americana. Part 1, p. 36. London.

RIDGWAY, ROBERT.

1912. Color standards and color nomenclature. 44 pp., 53 color pls. Washington, D. C.

RINKER, GEORGE C.

1944. Os clitoridis from the raccoon. Jour. Mammal. 25 (4): 91-92.

ROWLEY, JOHN.

1902. The mammals of Westchester County, New York. Abst. Proc. Linn. Soc. New York, Nos. 13-14, p. 53.

RUST, H. J.

1946. Mammals of northern Idaho. Jour. Mammal. 27 (4): 313. November.

SANSOM, JOSEPH.

1820. Travels in lower Canada. Voyages and Travels 3 (1): 49.

SAUNDERS, WILLIAM EDWIN.

1932. Notes on the mammals of Ontario. Trans. Royal Canadian Inst. 18 (pt. 2, No. 40): 271-309. July.
 Notes on distribution and habits of raccoon. A few reported on north shore of Lake Superior; rare north of latitude 47°, p. 281.

SCHOONMAKER, W. J.

1929. Notes on some mammals of Allegany State Park. Jour. Mammal. 10 (3): 247. August.

SCOTT, WILLIAM BERRYMAN.

1913. A history of land mammals of the Western Hemisphere. 693 pp., illus.
 Origin and relationships of Procyonidae, pp. 546-548.

SETON, ERNEST THOMPSON.

1929. Lives of game animals. Bears, coons, badgers, skunks, and weasels. Vol. 2 (pt. 1), 367 pp., illus.

Includes an illustrated account of the raccoon, pp. 230-256.

SHERMAN, H. B.

1936. A list of the recent land mammals of Florida. Florida Acad. Sci. Proc. 1: 110.

SHIRAS, GEORGE, 3D.

1920. A raccoon explores new country. Forest and Stream 90 (1): 10, 11, 44, January.

SHUFFELDT, ROBERT WILSON.

1915. On the taxonomy of the Procyonidae. Science (n. s.) 41 (1062): 691-692. May 7.

A superfamily Procyonidea is divided into two families - the Procyonidae and the Potosidae, with the former divided into three subfamilies.

SIMPSON, GEORGE GAYLORD.

1929. Pleistocene mammalian fauna of the Seminole Field, Pinellas County, Florida. Amer. Mus. Nat. Hist. Bull. 56 (art. 8): 561-599. February 12.

Original description of *Procyon nanus*, p. 575, which differed conspicuously from living species of the region in greater length in proportion to width of first upper molar.

SLOANE, HANS.

1725. A voyage to the Islands Madera, Barbados, Nieves, St. Christophers, and Jamaica with the natural history of the herbs and trees, four-footed beasts, insects, reptiles, etc., of the last of these Islands. Vol. 2, 499 pp., illus.

Records the raccoons (apparently erroneously) in Jamaica, p. 329.

SMITH, CHARLES HAMILTON.

1848. Introduction to Mammalia. Jardine's Naturalist's Library 15: 17-313, illus.

Description of *Procyon gularis* (= *P. l. lotor*), p. 222, based on a live specimen "in the State of New York," and of *P. caucrivorus*, p. 223.

SMITH, CAPTAIN [JOHN].

1612. A map of Virginia. With a description of the country, the commodities, people, government, and religion. 109 pp.

Contains the earliest reference to the raccoon found in literature. The animal is recorded under the name *arouagheun*, p. 13.

SMITH, RONALD WARD.

1940. The land mammals of Nova Scotia. Amer. Midland Nat. 24 (1): 225. July.

SNYDER, L. L.

1930. A faunal investigation of King Township, York County, Ontario. Trans. Royal Canadian Inst. 17 (pt. 2): 175.

1941. The mammals of Prince Edward County, Ontario. Univ. Toronto Studies, Biol. Ser. No. 48, p. 21.

SNYDER, L. L., and E. B. S. LOGIER.

1931. A faunal investigation of Long Point and vicinity, Norfolk County, Ontario. Trans. Royal Canadian Inst. 18 (pt. 1) 39: 131.

SOPER, J. DEWEY.

1923. The mammals of Wellington and Waterloo counties, Ontario. *Jour. Mammal.* 4 (4): 251. November.

1942. Mammals of Wood Buffalo Park, northern Alberta and District of Mackenzie. *Jour. Mammal.* 23 (2): 126 May 14.

SQUIRES, W. AUSTIN.

1946. Changes in mammal population in New Brunswick. *Acadian Nat.* 2 (7): 31. May.

STEPHENS, FRANK.

1906. California mammals. 351 pp., illus.

Accounts of *P. l. psora*, *P. l. pacifica*, and *P. l. pallidus*, pp. 225-228.

STOCK, CHESTER.

1929. A census of the Pleistocene mammals of Rancho La Brea, based on the collections of the Los Angeles Museum. *Jour. Mammal.* 10 (4): 281-289, illus. November.

Points out, p. 288, the remarkable absence of Procyonidae.

STONE, WITMER, and WILLIAM EVERETT CRAM.

1902. American animals, a popular guide to the mammals of North America north of Mexico, with intimate biographies of the more familiar species. 318 pp., illus.

A good account of the common raccoon, pp. 247-254.

STORR, GOTTLIEB CONRAD CHRISTIAN.

1780. *Prodromus methodi mammalium*. 43 pp., Tubingen.

Procyon employed as a generic name for the first time, p. 35.

STRUWING, NELS J.

1948. North Dakota fur harvest report, 1947-48. *North Dakota Outdoors* 11 (2): 11. August.

STUEWER, FREDERICK W.

1943a. Reproduction of raccoons in Michigan. *Jour. Wildlife Mangt.* 7 (1): 60-73. January.

1943b. Raccoons: Their habits and management in Michigan. *Ecol. Monog.* 13: 203. April.

1948. Artificial dens for raccoons. *Jour. Wildlife Mangt.* 12 (3): 296-301. July.

STURGIS, ROBERT S.

1939. The Wichita Mountains Wildlife Refuge. *Chicago Nat.* 2 (1): 12. March.

SURBER, THADDEUS.

1932. The mammals of Minnesota. *Minnesota Dept. Conserv. Bull., Div. of Game and Fish*, p. 48.

SVIHILA, ARTHUR, and RUTH DOWELL SVIHILA.

1940. Annotated list of the mammals of Whitman County, Washington. *Murrelet* 21 (3): 54. September-December.

SWANSON, G. A., T. SURBER, and THOMAS S. ROBERTS.

1945. The mammals of Minnesota. *Minnesota Dept. Conserv. Tech. Bull.* No. 2, p. 63.

SWARTH, HARRY SCHELWALD.

1912. Report on a collection of birds and mammals from Vancouver Island. *Univ. California Pubs. Zool.* 10 (1): 1-124, illus.

Distribution and habits of raccoon, pp. 108-109.

SWENSON, SIDEL B.

1931. The mammals of Minnesota. *Fins, Feathers and Fur*, No. 94, p. 7. February.

TAYLOR, WALTER PENN, and W. T. SHAW.

1927. Mammals and birds of Mount Rainier National Park. 249 pp., illus.
Occurrence and habits of *P. l. pacificus*, pp. 41-45.

TEVIS, LLOYD, JR.

1947. Summer activities of California raccoons. *Jour. Mammal.* 28 (4): 323-332. December 1.

TIEDEMANN, D. FRIEDRICH.

1808. *Zoologie*. Zu seinen Vorlesungen entworfen, erster Band, Mensch und Säugthiere. 610 pp.

Description of *Procyon lotor* under the substitute name *L[otor] vulgaris*, p. 380.

TUCKER, WILLIAM J.

1930. Yearbook on Texas conservation of wildlife 1929-30. Texas Game, Fish, and Oyster Comm., p. 37.

TYRRELL, J. B.

1889. Catalogue of the Mammalia of Canada exclusive of the Cetacea. Canadian Inst. Proc., 3rd ser. 6: 76.

WAGLER, JOHANN GEORG.

1831. Einige Mittheilungen über Thiere Mexicos. *Isis* 21: 510-533.

Description of *P. hernandezii*, p. 511.

WAGNER, JOHANN ANDREAS.

1841. In Schreber's *Die Säugthiere*. Supplement, Abth. 2, 558 pp.

Treatment of the genus *Procyon*, pp. 153-162, and refers to illustrations: *Procyon lotor*, pl. 143, *P. hernandezii*, pl. 143 A, *P. brachyurus*, pl. 143 C, and *P. obscurus*, pl. 143 D, published in 1778. The latter two species are unidentifiable.

WARREN, EDWARD ROYAL.

1910. The mammals of Colorado. 300 pp. G. P. Putnam's Sons, New York.

Account of *Procyon lotor* (= *P. l. hirtus*) in the State, pp. 219-220.

1942. Mammals of Colorado. Their habits and distribution. 330 pp. Univ. of Oklahoma Press.

WHITLOW, WAYNE B., and E. R. HALL.

1933. Mammals of the Pocatello region of southeastern Idaho. Univ. California Pub. Zool. 10 (3): 216.

WHITNEY, LEON F.

1931. The raccoon and its hunting. *Jour. Mammal.* 12 (1): 29-38. February 12.

A good general account of the raccoon in New England.

1933. The Raccoon—some mental attributes. *Jour. Mammal.* 14 (2): 108-111. May 15.

WIEGMANN, AR. FR. AUG.

1837. Ueber die Gattung *Procyon*. *Archiv für Naturgesch.*, dritter Jahrgang, erster Band, pp. 353-372.

An early review of the genus in which five species are recognized, two of these, *Procyon brachyurus* (p. 369) and *Procyon obscurus* (p. 370) described as new. Neither of these seems to be clearly identifiable.

WILLIAMS, M. Y.

1942. Notes on the fauna of Bruce Peninsula, Manitoulin and adjacent islands. *Canadian Field-Nat.* 56 (6): 92. September.

WILLIAMS, S. R.

1909. On hibernation in the raccoon. *Ohio Nat.* 9 (6): 495-496. April.

WOOD, FRANK ELMER.

1910. A study of the mammals of Champaign County, Illinois. *Illinois State Lab. Nat. Hist. Bull.* 8: 573.

WOOD, N. A.

1911. Results of the Mershon Expedition to the Charity Islands, Lake Huron. *Michigan Acad. Sci. 13th Ann. Rept.*, p. 133.

1912. Notes on Michigan mammals. *Michigan Acad. Sci. 14th [Annual] Rept.*, p. 164.

1914. An annotated check-list of Michigan mammals. *Univ. Michigan Mus. Zool. Occas. Papers No. 4*, p. 9. April 1.

1922. The mammals of Washtenaw County, Michigan. *Univ. Michigan Mus. Zool., Occas. Papers, No. 123*, p. 10.

WOOD, NORMAN A., and L. R. DICE.

1924. Records and distribution of Michigan mammals. *Papers Michigan Acad. Sci., Arts and Letters* 3: 437-438.

WORTMAN, J. L., and WILLIAM DILLER MATTHEW.

1899. Ancestry of certain members of the Canidae, the Viverridae, and Procyonidae. *Amer. Mus. Nat. Hist. Bull.* 12: 109, 131-138.

WRIGHT, A. H., and S. E. R. SIMPSON.

1920. The vertebrates of the Otter Lake Region, Dorset, Ontario. *Canadian Field-Nat.* 34: 167. December.

YEAGER, LEE E.

1942. Coal-stripped land as a mammal habitat, with reference to fur animals. *Amer. Midland Nat.* 27 (3): 621-622. May.

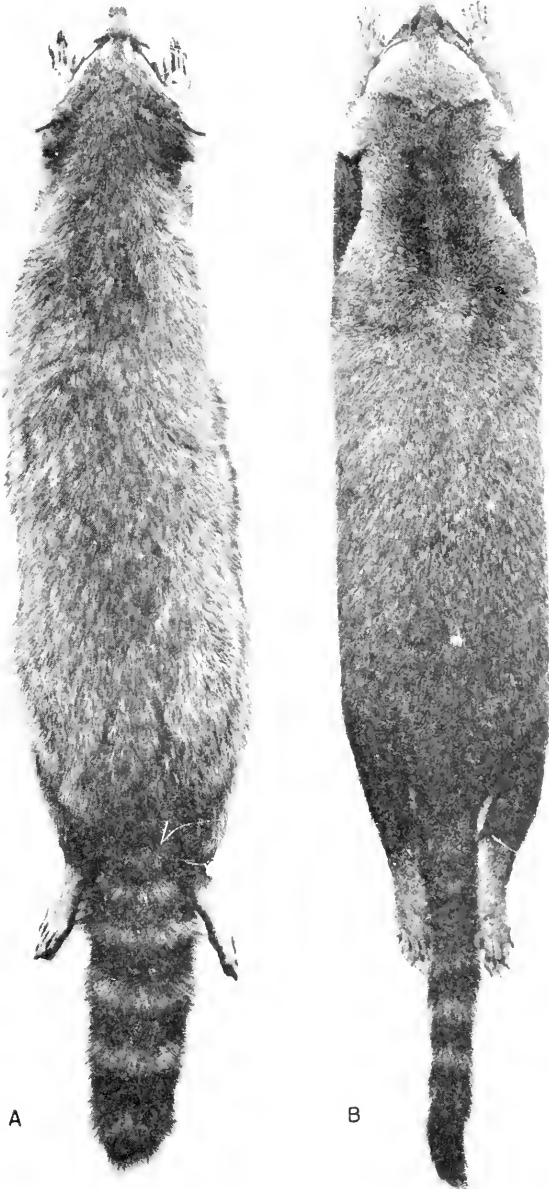
YEAGER, LEE E., and R. G. RENNELS.

1943. Fur yield and autumn foods of the raccoon in Illinois River bottom lands. *Jour. Wildlife Mgmt.* 7 (1): 45-60. January.

P L A T E S

PLATE 2

- A. *Procyon* [*Procyon*] *lotor lotor* (Linnaeus); male adult; Lake Drummond, Disual Swamp, Va. (No. 75255, U. S. Natl. Mus., Biological Surveys collection.) Note long pelage, uniformly directed backward.
- B. *Procyon* [*Euprocyon*] *cancrivorus panamensis* Goldman; female adult; Gatun, Canal Zone, Panama. (No. 171229, U. S. Natl. Mus., Biological Surveys collection.) Note short pelage, reversed on nape.

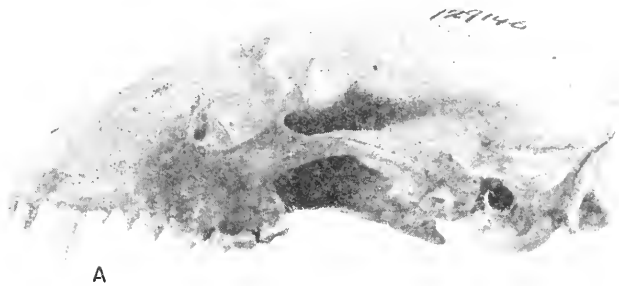


Skins of the subgenera *Procyon* and *Euprocyon*.

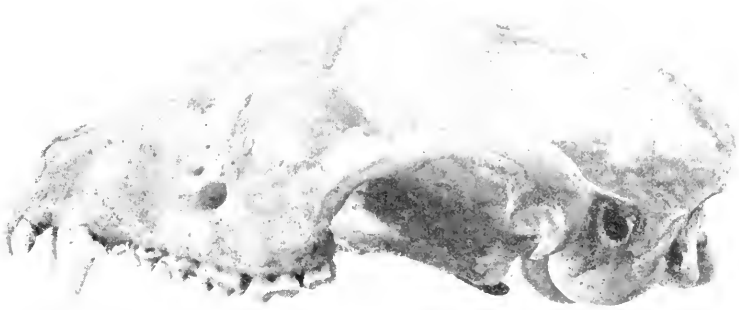
PLATE 3

[Two-thirds natural size]

- A. *Procyon* [*Procyon*] *lotor lotor* (Linnaeus): [male] adult; Sing Sing, N. Y. (No. 129146, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon* [*Procyon*] *lotor hirtus* Nelson and Goldman; male adult; Elk River, Minn. (No. 187926, U. S. Natl. Mus., Merriam collection.)



A



B

Skulls of *Procyon*, subgenus *Procyon*.

PLATE 4

[About three-fourths natural size]

- A. *Procyon* [*Procyon*] *lotor litoreus* Nelson and Goldman; type; [male] adult; Saint Simon Island, Ga. (No. 2450, U. S. Natl. Mus.)
- B. *Procyon* [*Procyon*] *lotor clucus* Bangs; male adult; Fort Kissimmee, Fla. (No. 64002, U. S. Natl. Mus., Biological Surveys collection.)



A



B

Skulls of *Procyon*, subgenus *Procyon*.

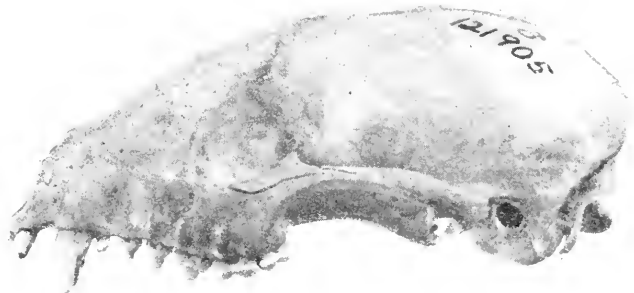
PLATE 5

[About three-fourths natural size]

- A. *Procyon [Procyon] lotor incautus* Nelson; type; male adult; Torch Key, Fla.
(No. 255060, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon [Procyon] maynardi* Bangs; male adult; New Providence Island,
Bahamas. (No. 121905, U. S. Natl. Mus.)



A



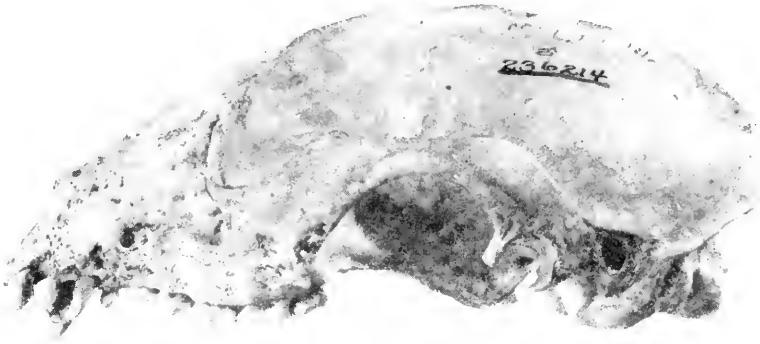
B

Skulls of *Procyon*, subgenus *Procyon*.

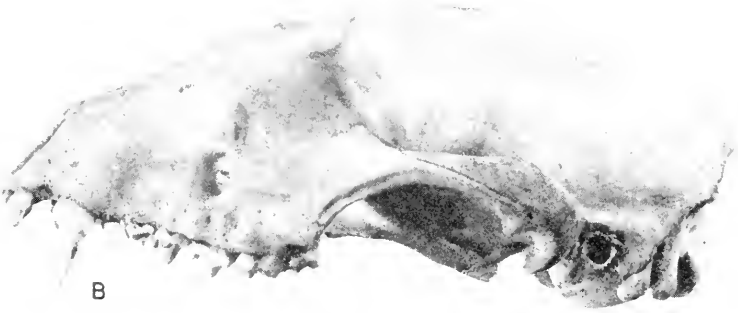
PLATE 6

[About four-fifths natural size]

- A. *Procyon* [*Procyon*] *lotor excelsus* Nelson and Goldman; type; male adult; Owyhee River, Oreg., 10 miles west of Fairylawn, Idaho. (No. 236214, U. S. Natl. Mus., Biological Surveys collection.) Distinguished by very large size.
- B. *Procyon* [*Procyon*] *lotor psora* Gray; male adult; Nicasio, Calif. (No. 187936, U. S. Natl. Mus., Merriam collection.)



A



B

Skulls of *Procyon*, subgenus *Procyon*.

PLATE 7

[Three-fourths natural size]

- A. *Procyon* [*Procyon*] *lotor hernandezii* Wagler; male adult; Talpam, Valley of Mexico, Mexico. (No. 51151, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon* [*Procyon*] *lotor pumilus* Miller; male adult; Porto Bello, Panama. (No. 171484, U. S. Natl. Mus., Biological Surveys collection.)



A



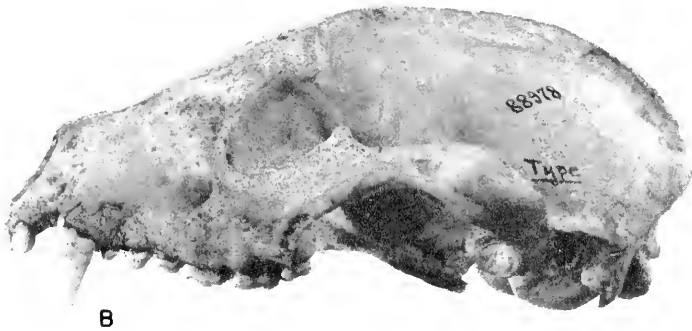
B

Skulls of *Procyon*, subgenus *Procyon*.

PLATE 8

[Five-sixths natural size]

- A. *Procyon* [*Procyon*] *pygmaeus* Merriam; type; male young adult; Cozumel Island, Yucatan, Mexico. (No. 108511, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon* [*Procyon*] *insularis insularis* Merriam; male adult; María Madre Island, Nayarit, Mexico. (No. 88978, U. S. Natl. Mus., Biological Surveys collection.) Note heavy zygomatic arch.



Skulls of *Procyon*, subgenus *Procyon*.

PLATE 9

[Fives-sevenths natural size]

- A. *Procyon [Procyon] lotor lotor* (Linnaeus); [male] adult; Sing Sing, N. Y. (No. 129146, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon [Procyon] lotor hirtus* Nelson and Goldman; male adult; Elk River, Minn. (No. 187926, U. S. Natl. Mus., Merriam collection.)



A



B

Skulls of *Procyon*, subgenus *Procyon*.

PLATE 10

[Three-fourths natural size]

- A. *Procyon [Procyon] lotor litorcus* Nelson and Goldman; type; [male] adult; Saint Simon Island, Ga. (No. 2450, U. S. Natl. Mus.)
- B. *Procyon [Procyon] lotor clucus* Bangs; male adult; Fort Kissimmee, Fla. (No. 64002, U. S. Natl. Mus., Biological Surveys collection.)



A



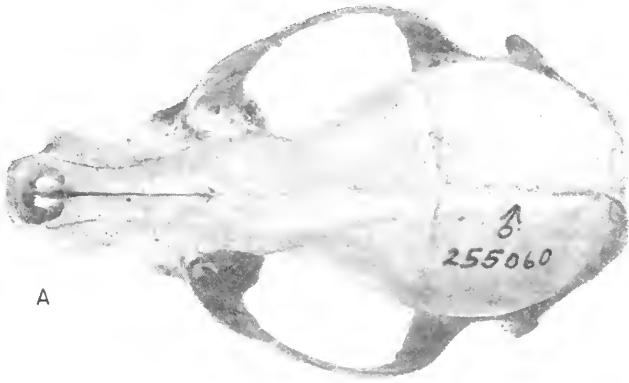
B

Skulls of *Procyon*, subgenus *Procyon*.

PLATE 11

[Three-fourths+ natural size]

- A. *Procyon* [*Procyon*] *lotor incautus* Nelson; type; male adult; Torch Key, Fla. (No. 255060, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon* [*Procyon*] *maynardi* Bangs; male adult; New Providence Island, Bahamas. (No. 121905, U. S. Natl. Mus.)



A



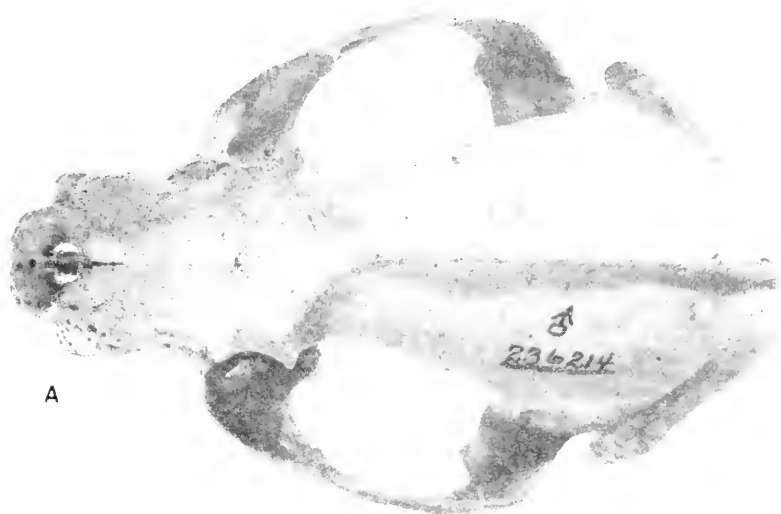
B

Skulls of *Procyon*, subgenus *Procyon*.

PLATE 12

[About three-fourths natural size]

- A. *Procyon* [*Procyon*] *lotor excelsus* Nelson and Goldman; type; male adult; Owyhee River, Oreg., 10 miles west of Fairylawn, Idaho. (No. 236214, U. S. Natl. Mus., Biological Surveys collection.) Distinguished by very large size.
- B. *Procyon* [*Procyon*] *lotor psora* Gray; male adult; Nicasio, Calif. (No. 187936, U. S. Natl. Mus., Merriam collection.)



A



B

Skulls of *Procyon*, subgenus *Procyon*.

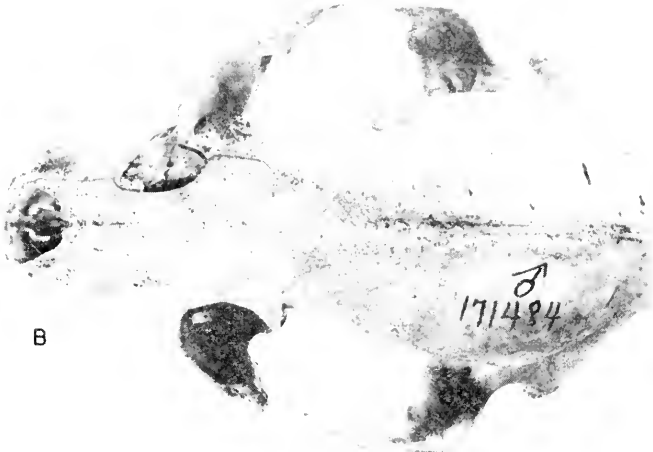
PLATE 13

[About three-fourths natural size]

- A. *Procyon* [*Procyon*] *lotor hernandezii* Wagler; male adult; Tlalpam, Valley of Mexico, Mexico. (No. 51151, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon* [*Procyon*] *lotor pumilus* Miller; male adult; Porto Bello, Panama. (No. 171484, U. S. Natl. Mus., Biological Surveys collection.)



A



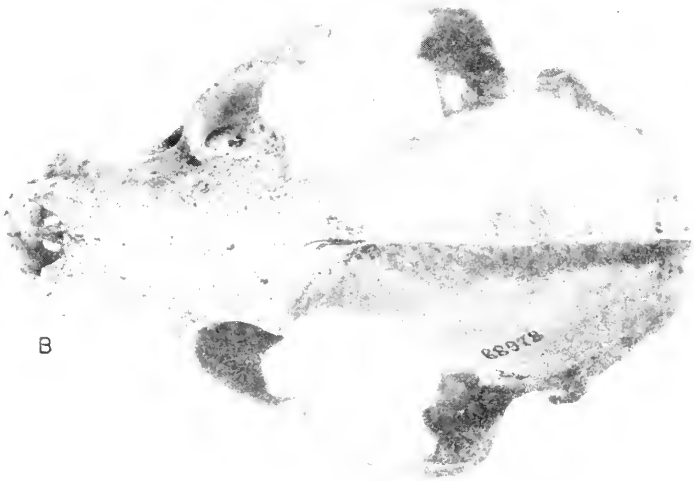
B

Skulls of *Procyon*, subgenus *Procyon*.

PLATE 14

[Three-fourths natural size]

- A. *Procyon [Procyon] pygmaeus* Merriam; type; male young adult; Cozumel Island, Yucatan, Mexico. (No. 108511, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon [Procyon] insularis insularis* Merriam; male adult; Maria Madre Island, Nayarit, Mexico. (No. 88978, U. S. Natl. Mus., Biological Surveys collection.)



Skulls of *Procyon*, subgenus *Procyon*.

PLATE 15

[seven-tenths natural size]

- A. *Procyon* [*Procyon*] *lotor lotor* (Linnaeus); [male] adult; Sing Sing, N. Y. (No. 129146, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon* [*Procyon*] *lotor hirtus* Nelson and Goldman; male adult; Elk River, Minn. (No. 187926, U. S. Natl. Mus., Merriam collection.)



A



3176

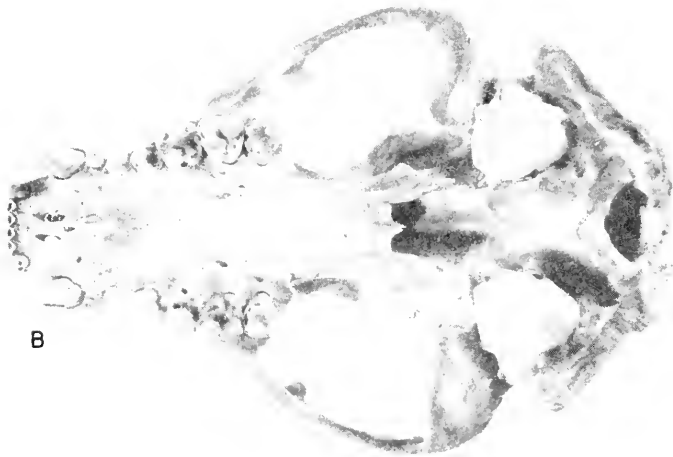
B

Skulls of *Procyon*, subgenus *Procyon*.

PLATE 16

(About three-fourths natural size)

- A. *Procyon [Procyon] lotor liloreus* Nelson and Goldman; type; [male] adult; Saint Simon Island, Ga. (No. 2450, U. S. Natl. Mus.) Note heavy dentition.
- B. *Procyon [Procyon] lotor elucus* Bangs; male adult; Fort Kissimmee, Fla. (No. 64002, U. S. Natl. Mus., Biological Surveys collection.)



Skulls of *Procyon*, subgenus *Procyon*.

PLATE 17

[About three-fourths natural size]

- A. *Procyon [Procyon]olor incantus* Nelson; type; male adult; Torch Key, Fla.
(No. 255060, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon [Procyon]maynardi* Bangs; male adult; New Providence Island,
Bahamas. (No. 121905, U. S. Natl. Mus.)



A



B

Skulls of *Procyon*, subgenus *Procyon*.

PLATE 18

[About three-fourths natural size]

- A. *Procyon [Procyon] lotor excelsus* Nelson and Goldman; type; male adult; Owyhee River, Oreg., 10 miles west of Fairylawn, Idaho. (No. 236214, U. S. Natl. Mus., Biological Surveys collection.) Distinguished by very large size.
- B. *Procyon [Procyon] lotor psara* Gray; male adult; Nicasio, Calif. (No. 187936, U. S. Natl. Mus., Merriam collection.)

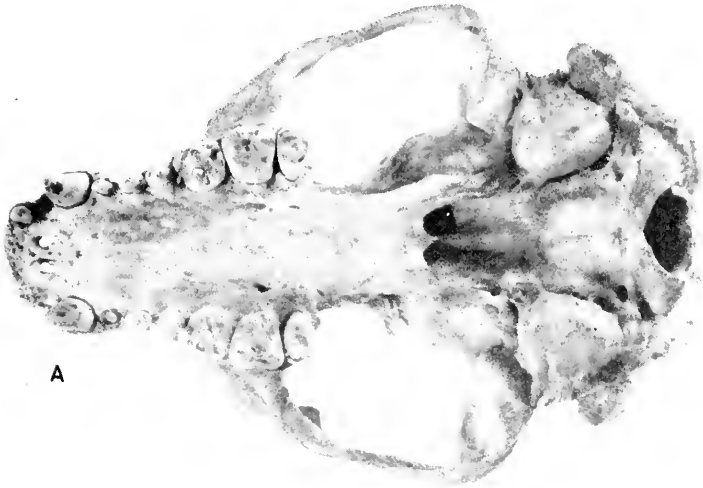


Skulls of *Procyon*, subgenus *Procyon*.

PLATE 19 ·

[Five-sixths natural size]

- A. *Procyon* [*Procyon*] *lotor hernandezii* Wagler; male adult; Talpam, Valley of Mexico, Mexico. (No. 51151, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon* [*Procyon*] *lotor pumilus* Miller; male adult; Porto Bello, Panama. (No. 171181, U. S. Natl. Mus., Biological Surveys collection.)



A



B

Skulls of *Procyon*, subgenus *Procyon*.

PLATE 20

[About two-thirds natural size]

- A. *Procyon [Procyon] pygmaeus* Merriam; type; male young adult; Cozumel Island, Yucatan, Mexico. (No. 108511, U. S. Natl. Mus., Biological Surveys collection.)
- B. *Procyon [Procyon] insularis insularis* Merriam; male adult; María Madre Island, Nayarit, Mexico. (No. 88978, U. S. Natl. Mus., Biological Surveys collection.)



Skulls of *Procyon*, subgenus *Procyon*.

PLATE 21

[Six-sevenths natural size]

- A. *Procyon [Procyon] lotor elucus* Bangs; male adult; Fort Kissimmee, Fla. (No. 64002, U. S. Natl. Mus., Biological Surveys collection.) Note larger size and greater angularity of male.
- B. *Procyon [Procyon] lotor elucus* Bangs; female adult; Fort Kissimmee, Fla. (No. 64012, U. S. Natl. Mus., Biological Surveys collection.) Note smaller size and lesser angularity of female.
- C. *Procyon [Procyon] lotor lotor* (Linnaeus); female adult; Schroon Lake, N. Y. (No. 98595, U. S. Natl. Mus., Biological Surveys collection.) Lateral view of typical mandibular ramus.



A



B



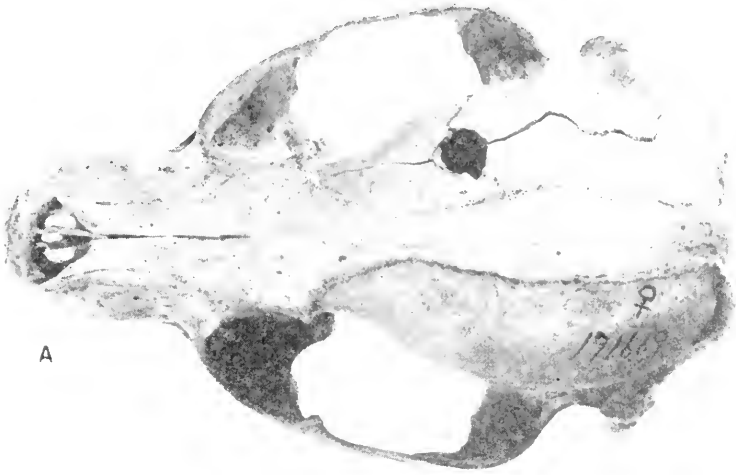
C

Skulls, including a mandibular ramus, of *Procyon*, subgenus *Procyon*.

PLATE 22

[About five-sixths natural size]

- A. *Procyon* [*Euprocyon*] *cancerivorus panamensis* Goldman; type; female adult; Gatun, Canal Zone, Panama. (No. 171669, U. S. Natl. Mus., Biological Surveys collection.) Upper surface of cranium.
- B. *Procyon* [*Euprocyon*] *cancerivorus panamensis* Goldman; type; female adult; Gatun, Canal Zone, Panama. (No. 171669, U. S. Natl. Mus., Biological Surveys collection.) Under surface of cranium. Note molar crowns with rounded cusps adapted for crushing food; and compare with more trenchant cusps in subgenus *Procyon*.



A



B

Skulls of *Procyon*, subgenus *Euprocyon*.

INDEX

[Page numbers in **boldface** refer to principal entries; those in *italic* to synonyms]

- abrupta, *Ursus cauda*, 3.
 Ailuropoda, 1.
 Ailurus, 1.
 Alabama raccoon, 38.
 albina, *Procyon lotor*, 5.
 annulatus, *Procyon*, 33, 35.
 auspiciatus, *Procyon lotor*, 22, 24, 28, 44, 46, **47**, 48.

 Bahama raccoon, **75**.
 Baja California raccoon, **62**.
 Barbados raccoon, **79**.
 Bassariexon, 1, 26.
 brachyurus, *Procyon*, 4.
 breeding, 13.

 California raccoon, **56**.
 californicus, *Procyon lotor*, 56, 57.
 Campeche raccoon, **65**.
 Campsiurus, 25.
 canerivorus, *Euprocyon*, 16.
 Procyon, 16, 31, 80, **81**.
 Procyon canerivorus, 82, 83.
 Ursus, 4, 25, 81.
 castaneus, *Procyon hernandezi*, 5.
 coastal marsh raccoon, 85.
 Colorado Desert raccoon, **54**.
 Costa Rican raccoon, **69**.
 Cozumel Island raccoon, **76**.
 crab-eating raccoon, 4.
 crassidens, *Procyon lotor*, 24, 28, 66, 67, 68, **69**, 71.
 Cynodietis, 2.

 diekeyi, *Procyon lotor*, 18, 24, 28, 66, **67**, 69, 70.

 eastern raccoon, **33**.
 economic status, 14.
 elongata, *Ursus cauda*, 3, 6.
 elucius, *Procyon lotor*, 22, 24, 27, 38, 39, 40, **42**, 44, 46, 49, 113, 125, 137, 147.
Euprocyon, 1, 2, 3, 4, 25, 27, 28, 29, **80**.
 canerivorus, 16.
 canerivorus panamensis, 28, 82.

 excelsus, *Procyon lotor*, 20, 24, 28, 33, 56, 58, 59, **60**, 86, 117, 129, 141.
 flavidus, *Procyon lotor*, 5.
 Florida raccoon, **42**.
 food, 7.
 fusca, *Procyon brachyurus*, 5.
 fuscipes, *Procyon lotor*, 24, 28, 37, 38, 39, **49**, 52, 64, 65, 84.

 general activities, 7.
 gloveralleni, *Procyon*, 22, 24, 28, **79**.
 grinnelli, *Procyon lotor*, 24, 28, 54, 55, **62**.
 Guadeloupe Island raccoon, **77**.
 gularis, *Procyon*, 33, 35.

 hernandezii, *Procyon*, 64.
 hernandezii, *Procyon lotor*, 22, 24, 28, 50, 52, 53, **64**, 66, 67, 72, 74, 119, 131, 143.
 hibernation, 14.
 Hilton Head Island raccoon, **41**.
 hirtus, *Procyon lotor*, 22, 24, 27, 33, 34, 35, **37**, 50, 52, 111, 123, 135.
 hudsonicus, *Procyon*, 5.

 ineautus, *Procyon lotor*, 24, 28, 44, 46, 47, **48**, 75, 115, 127, 139.
 inesperatus, *Procyon lotor*, 24, 28, 43, 41, **46**, 47, 48.
 instincts, 9.
 insularis, *Procyon*, 20, **71**.
 Procyon insularis, 24, 28, **72**, 74, 121, 133, 145.
 Isthmian raccoon, **70**.

 key to subgenera, 27.
 to species and subspecies of subgenus *Procyon*, 29.
 Key Vaca raccoon, **47**.

 litoreus, *Procyon lotor*, 22, 24, 27, 33, 34, 35, **40**, 41, 42, 43, 80, 85, 86, 109, 111, 113, 123, 125, 135, 137, 147.
 longevity, 7.
Lotor, 25.

- lotor, Meles, 33, 35.
 Procyon, 1, 31, 33, 52.
 Procyon lotor, 21, 24, 27, 33, 35, 38, 39, 40, 41, 43, 56, 57, 75.
 Ursus, 4, 6, 25, 33.
 Lotor vulgaris, 33, 35.
- Mamiprocyonius, 35.
 Mapachin, 82.
 María Madre Island raccoon, 72.
 María Magdalena Island raccoon, 73.
 marinus, Procyon lotor, 24, 27, 42, 43, 44, 46, 47, 48.
 maritimus, Procyon lotor, 24, 36, 85.
 Matecumbe Key raccoon, 46.
 maynardi, Procyon, 24, 28, 75, 78, 79, 115, 127, 139.
 megalodous, Procyon lotor, 24, 39, 51, 84.
 melampus, Procyon lotor, 5.
 Meles lotor, 33, 35.
 Mexican Plateau raccoon, 64.
 Mexican raccoon, 52.
 mexicana, Procyon hernandezii, 52.
 mexicanus, Procyon lotor, 24, 28, 50, 52, 54, 55, 63, 64, 65, 72, 74, 85, 86.
 minor, Procyon, 24, 28, 75, 77, 79.
 Mississippi Delta raccoon, 84.
 molt, 19.
- nanus, Procyon, 3.
 Nasua, 1.
 Nasuella, 1.
 nivea, Procyon, 4.
 nomenclature, 3.
- obscurus, Procyon, 5.
 ochraceus, Procyon lotor, 54, 55.
- Pacific Northwest raccoon, 58.
 pacifica, Procyon lotor, 28.
 Procyon psora, 58.
 pacificus, Procyon lotor, 24, 56, 57, 58, 59, 60, 61, 86.
 pallidus, Procyon, 54.
 Procyon lotor, 20, 24, 28, 52, 54, 56, 57, 62, 63.
 Panama crab-eating raccoon, 82.
 panamensis, Euprocyon cancrivorus, 28, 82.
 Procyon cancrivorus, 28, 81, 82, 109, 149.
 pelage, 19.
 Phlaocyon, 2.
 Potos, 1, 27.
- priseus, Procyon, 3.
 Procyon, 25, 27, 28, 29.
 annulatus, 33, 35.
 brachyurus, 4.
 brachyurus fusca, 5.
 cancrivorus, 16, 31, 80, 81.
 cancrivorus cancrivorus, 82, 83.
 cancrivorus panamensis, 28, 81, 82, 109, 149.
 cancrivorus proteus, 82, 83.
 gloveralleni, 22, 24, 28, 79.
 gularis, 33, 35.
 hernandezii castaneus, 5.
 hernandezii, 64.
 hernandezii mexicana, 52.
 hudsonicus, 5.
 insularis, 20, 71.
 insularis insularis, 24, 28, 72, 74, 121, 133, 145.
 insularis vicinus, 24, 28, 73.
 lotor, 1, 31, 32, 33, 52.
 lotor albina, 5.
 lotor auspiciatus, 22, 24, 28, 44, 46, 47, 48.
 lotor californicus, 56, 57.
 lotor erassidens, 24, 28, 66, 67, 68, 69, 71.
 lotor dickeyi, 18, 24, 28, 66, 67, 69, 70.
 lotor elueus, 22, 24, 27, 38, 39, 40, 42, 44, 46, 49, 113, 125, 137, 147.
 lotor excelsus, 20, 24, 28, 33, 56, 58, 59, 60, 86, 117, 129, 141.
 lotor flavidus, 5.
 lotor fuscipes, 24, 28, 37, 38, 39, 49, 52, 61, 65, 84.
 lotor grinnelli, 24, 28, 54, 55, 62.
 lotor hernandezii, 22, 24, 28, 50, 52, 53, 64, 66, 67, 72, 74, 119, 131, 143.
 lotor hirtus, 22, 24, 27, 33, 34, 35, 37, 50, 52, 111, 123, 135.
 lotor incautus, 24, 28, 44, 46, 47, 48, 75, 115, 127, 139.
 lotor inesperatus, 24, 28, 43, 44, 46, 47, 48.
 lotor insularis, 72.
 lotor litoreus, 22, 24, 27, 33, 34, 35, 40, 41, 42, 43, 80, 113, 125, 137.
 lotor lotor, 21, 24, 27, 33, 35, 37, 38, 39, 40, 41, 43, 56, 57, 75, 85, 86, 109, 111, 123, 135, 147.
 lotor marinus, 24, 27, 42, 43, 44, 46, 47, 48.
 lotor maritimus, 24, 36, 85.
 lotor megalodous, 24, 39, 51, 84.

Procyon—Continued

- lotor melanus*, 5.
lotor mexicanus, 24, 28, 50, **52**, 54, 55, 63, 64, 65, 72, 74, 85, 86.
lotor ochraceus, 54, 55.
lotor pacificus, 24, 28, 56, 57, 58, 59, 60, 61, 86.
lotor pallidus, 20, 24, 28, 52, **54**, 56, 57, 62, 63.
lotor psora, 13, 24, 28, 54, **56**, 58, 60, 62, 63, 86, 117, 129, 141.
lotor pumilus, 24, 28, 69, **70**, 80, 83, 118, 131, 143.
lotor rufescens, 5.
lotor shufeldti, 24, 28, 64, **65**, 67, 68, 70, 76.
lotor solutus, 24, 27, 33, 34, 35, 40, **41**.
lotor vancouverensis, 24, 28, 58, 61.
lotor varius, 24, 27, 33, 34, 35, 38, 42, 43, 50, 84.
maynardi, 24, 28, **75**, 78, 79, 115, 127, 139.
minor, 24, 28, 75, **77**, 79.
nanus, 3.
nivea, 4.
obscurus, 5.
pallidus, 54.
priseus, 3.
proteus, 58, 59.
psora, 56.
psora pacifica, 58.
pumilus, 70.
pygmaeus, 20, 24, 28, **76**, 121, 133, 145.
simus, 3.
proteus, *Procyon*, 58, 59.
Procyon cancrivorus, 82, 83.
psora, *Procyon*, 56.
Procyon lotor, 13, 24, 28, 54, **56**, 58, 60, 62, 63, 86, 117, 129, 141.
pumilus, *Procyon*, 70.
Procyon lotor, 24, 28, 69, **70**, 80, 83, 118, 131, 143.
pygmaeus, *Procyon*, 20, 24, 28, **76**, 121, 133, 145.
raccoon, Alabama, 38.
 Bahama, **75**.
 Baja California, **62**.
 Barbados, **79**.
 California, **56**.
 Campeche, **65**.
 coastal marsh, **85**.
 Colorado Desert, **54**.
 Costa Rican, **69**.

raccoon—continued

- Cozumel Island, **76**.
 crab-eating, 4.
 eastern, **33**.
 Florida, **42**.
 Guadeloupe Island, **77**.
 Hilton Head Island, 41.
 Isthmian, **70**.
 Key Vaca, **47**.
 María Madre Island, **72**.
 María Magdalena Island, **73**.
 Matecumbe Key, 46.
 Mexican, **52**.
 Mexican Plateau, **64**.
 Mississippi Delta, **84**.
 Pacific Northwest, **58**.
 Panama crab-eating, **82**.
 Saint Simon Island, **40**.
 Salvador, **67**.
 Snake River Valley, **60**.
 Ten Thousand Islands, 44.
 Texas, **49**.
 Torch Key, 48.
 Upper Mississippi Valley, 37.
 Vancouver Island, 61.
rufescens, *Procyon lotor*, 5.
 Saint Simon Island *raccoon*, **40**.
 Salvador *raccoon*, **67**.
senses, 9.
shufeldti, *Procyon lotor*, 24, 28, 64, **65**, 67, 68, 70, 76.
simus, *Procyon*, 3.
 Snake River Valley *raccoon*, **60**.
solutus, *Procyon lotor*, 24, 27, 33, 34, 35, 40, **41**.
 Ten Thousand Islands *raccoon*, 44.
 Texas *raccoon*, **49**.
 Torch Key *raccoon*, 48.
 Upper Mississippi Valley *raccoon*, 37.
Ursus cancrivorus, 4, 25, 81.
cauda abrupta, 3.
cauda elongata, 3, 6.
lotor, 4, 6, 25, 33.
 Vancouver Island *raccoon*, 61.
vancouverensis, *Procyon lotor*, 24, 28, 58, **61**.
varius, *Procyon lotor*, 24, 27, 33, 34, 35, **38**, 42, 43, 50, 84.
vicinus, *Procyon insularis*, 24, 28, **73**.
vulgaris, *lotor*, 33, 35.
weights, 22.

64 * 5922

FAUNA OF THE ALEUTIAN ISLANDS AND ALASKA PENINSULA

WITH NOTES ON
INVERTEBRATES AND FISHES
COLLECTED IN THE ALEUTIANS,
1936-38



NUMBER 61

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE



FAUNA OF

6
* 5 70-100

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

NORTH AMERICAN FAUNA NO. 61

Fauna of the Aleutian Islands and Alaska Peninsula

CORRECTION

A report on so great an area as the Aleutian Islands and the Alaska Peninsula, to be comprehensive, must include data collected by many persons. While I was preparing this report, at a time when Ira N. Gabrielson and Frederick C. Lincoln were preparing their comprehensive work, *Birds of Alaska*, Dr. Gabrielson kindly lent me his field notes of Alaska trips. With his own notes Dr. Gabrielson also supplied field notes of Frank Beals, who was in the Aleutians in the 1940's for the Fish and Wildlife Service, and a few notes of Douglas Gray, who made some fine observations in the Aleutians.

Immediately after issue of this Fauna, Dr. Gabrielson noted that several observations were attributed to his notes whereas they should have been credited to Frank Beals; somehow, in the compilation of many observations the original sources of the field notes were confused. Dr. Gabrielson points out that his field work in the areas concerned covered the following periods: June and July of 1940; late September and early October of 1941; August of 1943; late July to mid-August of 1945; and June, July, and August of 1946. Where records outside these periods are attributed to Gabrielson's field notes, they should be credited to Frank Beals.

In correcting this misplaced credit, I join Dr. Gabrielson in thus giving recognition to the splendid biological notes made by Beals (as well as the excellent photographs of his, which I have seen).

OLAUS J. MURIE

February 1969

FAUNA OF THE ALEUTIAN ISLANDS AND ALASKA PENINSULA

By Olaus J. Murie, *Biologist*

INVERTEBRATES AND FISHES
COLLECTED IN THE ALEUTIANS,
1936-38

By Victor B. Scheffer, *Biologist*



NUMBER 61

UNITED STATES DEPARTMENT OF THE INTERIOR

Fred A. Seaton, *Secretary*

FISH AND WILDLIFE SERVICE

Arnie J. Suomela, *Commissioner*



PUBLISHED BY U. S. FISH AND WILDLIFE SERVICE • WASHINGTON • 1959

PRINTED AT U. S. GOVERNMENT PRINTING OFFICE, WASHINGTON

For sale by the Superintendent of Documents, U. S. Government Printing Office,
Washington 25, D. C. Price \$1:25 cents.

CONTENTS

FAUNA OF THE ALEUTIAN ISLANDS AND ALASKA PENINSULA, by Olaus J. Murie

	Page
Foreword	xiii
Introduction	1
Geography and geology	3
Climate	10
Environment and biotic distribution	11
Geographic and geologic influences	12
Asiatic immigrants	12
Bering Sea avifauna	14
Fauna of wider northern distribution	15
Southern and southeastern birds	16
Environmental influence	17
Ecological classification	18
Vegetation	22
Birds	27
Family Gaviidae	28
<i>Gavia immer</i> , Common loon	28
<i>Gavia adamsii</i> , Yellow-billed loon	29
<i>Gavia arctica</i> , Arctic loon	29
<i>Gavia stellata</i> , Red-throated loon	31
Family Podicipedidae	32
<i>Podiceps grisegena</i> , Red-necked grebe	32
<i>Podiceps auritus</i> , Horned grebe	33
Family Diomedeidae	34
<i>Diomedea nigripes</i> , Black-footed albatross	34
<i>Diomedea albatrus</i> , Short-tailed albatross	36
<i>Diomedea immutabilis</i> , Laysan albatross	39
Family Procellariidae	41
<i>Puffinus tenuirostris</i> , Slender-billed shearwater	41
<i>Puffinus griseus</i> , Sooty shearwater	44
<i>Pterodroma incpectata</i> , Scaled petrel	44
<i>Pterodroma cookii</i> , Cook's petrel	45
<i>Fulmarus glacialis</i> , Fulmar	45
Family Hydrobatidae	48
<i>Oceanodroma fureata</i> , Fork-tailed petrel	48
<i>Oceanodroma leucorhoa</i> , Leach's petrel	51
Family Phalacrocoracidae	52
<i>Phalacrocorax auritus</i> , Double-crested cormorant	52
<i>Phalacrocorax pelagicus</i> , Pelagic cormorant	55
<i>Phalacrocorax urile</i> , Red-faced cormorant	57
Family Ardeidae	59
<i>Ardea herodias</i> , Great blue heron	59

	Page
Family Anatidae	59
<i>Olor columbianus</i> , Whistling swan	59
<i>Olor buccinator</i> , Trumpeter swan	61
<i>Branta canadensis</i> , Canada goose	61
<i>Branta nigricans</i> , Black brant	67
<i>Philacte canagica</i> , Emperor goose	69
<i>Anser albifrons</i> , White-fronted goose	73
<i>Chen hyperborea</i> , Snow goose	74
<i>Anas platyrhynchos</i> , Mallard	74
<i>Anas strepera</i> , Gadwall	76
<i>Anas acuta</i> , Pintail	77
<i>Anas falcata</i> , Falcated teal	78
<i>Anas crecca</i> , Common teal	79
<i>Anas carolinensis</i> , Green-winged teal	80
<i>Mareca penelope</i> , European widgeon	82
<i>Mareca americana</i> , American widgeon	82
<i>Spatula clypeata</i> , Shoveler	83
<i>Aythya americana</i> , Redhead	83
<i>Aythya valisineria</i> , Canvasback	84
<i>Aythya marila</i> , Greater scaup	84
<i>Aythya affinis</i> , Lesser scaup	86
<i>Aythya fuligula</i> , Tufted duck	86
<i>Bucephala clangula</i> , Common goldeneye	86
<i>Bucephala islandica</i> , Barrow's goldeneye	87
<i>Bucephala albeola</i> , Bufflehead	88
<i>Clangula hyemalis</i> , Oldsquaw	89
<i>Histrionicus histrionicus</i> , Harlequin duck	90
<i>Polysticta stelleri</i> , Steller's eider	92
<i>Somateria mollissima</i> , Common eider	94
<i>Somateria spectabilis</i> , King eider	97
<i>Lampronetta fischeri</i> , Spectacled eider	98
<i>Melanitta deglandi</i> , White-winged scoter	99
<i>Melanitta perspicillata</i> , Surf scoter	101
<i>Oidemia nigra</i> , Common scoter	102
<i>Mergus merganser</i> , Common merganser	104
<i>Mergus serrator</i> , Red-breasted merganser	105
Family Accipitridae	106
<i>Accipiter gentilis</i> , Goshawk	106
<i>Accipiter striatus</i> , Sharp-shinned hawk	107
<i>Buteo lagopus</i> , Rough-legged hawk	107
<i>Aquila chrysaetos</i> , Golden eagle	109
<i>Haliaeetus albicilla</i> , Gray sea eagle	110
<i>Haliaeetus leucocephalus</i> , Bald eagle	111
<i>Haliaeetus pelagicus</i> , Steller's sea eagle	117
<i>Circus cyaneus</i> , Marsh hawk	117
<i>Pandion haliaetus</i> , Osprey	118
Family Falconidae	118
<i>Falco rusticolus</i> , Gyrfalcon	118
<i>Falco peregrinus</i> , Peregrine falcon	119
<i>Falco columbarius</i> , Pigeon hawk	120
<i>Falco sparverius</i> , Sparrow hawk	121
Family Tetraonidae	121
<i>Canachites canadensis</i> , Spruce grouse	121

	Page
<i>Lagopus lagopus</i> , Willow ptarmigan	122
<i>Lagopus mutus</i> , Rock ptarmigan	123
Family Gruidae	129
<i>Grus canadensis</i> , Sandhill crane	129
Family Rallidae	130
<i>Fulica americana</i> , American coot	130
Family Haematopodidae	130
<i>Haematopus bachmani</i> , Black oystercatcher	130
Family Charadriidae	132
<i>Charadrius dubius</i> , Little ringed plover	132
<i>Charadrius semipalmatus</i> , Semipalmated plover	132
<i>Pluvialis dominica</i> , American golden plover	133
<i>Squatarola squatarola</i> , Black-bellied plover	134
<i>Aphriza virgata</i> , Surfbird	135
<i>Arenaria interpres</i> , Ruddy turnstone	135
<i>Arenaria melanocephala</i> , Black turnstone	136
Family Scolopacidae	137
<i>Capella gallinago</i> , Common snipe	137
<i>Numenius phaeopus</i> , Whimbrel	138
<i>Numenius tahitiensis</i> , Bristle-thighed curlew	138
<i>Acititis macularia</i> , Spotted sandpiper	138
<i>Tringa glareola</i> , Wood sandpiper	139
<i>Heteroscelus incanum</i> , Wandering tattler	139
<i>Totanus melanoleucus</i> , Greater yellowlegs	140
<i>Totanus flavipes</i> , Lesser yellowlegs	141
<i>Calidris canutus</i> , Knot	141
<i>Erolia ptilocnemis</i> , Rock sandpiper	141
<i>Erolia acuminata</i> , Sharp-tailed sandpiper	146
<i>Erolia melanotos</i> , Pectoral sandpiper	146
<i>Erolia bairdii</i> , Baird's sandpiper	147
<i>Erolia minutilla</i> , Least sandpiper	147
<i>Erolia alpina</i> , Dunlin	150
<i>Limnodromus griseus</i> , Short-billed dowitcher	150
<i>Ereunetes pusillus</i> , Semipalmated sandpiper	152
<i>Ereunetes mauri</i> , Western sandpiper	152
<i>Limosa fedoa</i> , Marbled godwit	153
<i>Limosa lapponica</i> , Bar-tailed godwit	153
<i>Limosa haemastica</i> , Hudsonian godwit	154
<i>Crocethia alba</i> , Sanderling	154
Family Phalaropodidae	155
<i>Phalaropus fulicarius</i> , Red phalarope	155
<i>Lobipes lobatus</i> , Northern phalarope	156
Family Stercorariidae	157
<i>Stercorarius pomarinus</i> , Pomarine jaeger	157
<i>Stercorarius parasiticus</i> , Parasitic jaeger	159
<i>Stercorarius longicaudus</i> , Long-tailed jaeger	161
Family Laridae	162
<i>Larus hyperboreus</i> , Glaucous gull	162
<i>Larus glaucescens</i> , Glaucous-winged gull	165
<i>Larus schistisagus</i> , Slaty-backed gull	171
<i>Larus argentatus</i> , Herring gull	171
<i>Larus delawarensis</i> , Ring-billed gull	172
<i>Larus cauus</i> , Mew gull	172

	Page
<i>Larus philadelphia</i> , Bonaparte's gull	174
<i>Larus ridibundus</i> , Black-headed gull	175
<i>Rissa tridactyla</i> , Black-legged kittiwake	175
<i>Rissa brevirostris</i> , Red-legged kittiwake	176
<i>Xema sabini</i> , Sabine's gull	178
<i>Sterna hirundo</i> , Common tern	178
<i>Sterna paradisaea</i> , Arctic tern	179
<i>Sterna aleutica</i> , Aleutian tern	180
Family Alcidae	182
<i>Uria aalge</i> , Common murre	182
<i>Uria lomvia</i> , Thick-billed murre	182
<i>Cephus columba</i> , Pigeon guillemot	186
<i>Brachyramphus marmoratum</i> , Marbled murrelet	187
<i>Brachyramphus brevirostre</i> , Kittlitz's murrelet	188
<i>Synthliboramphus antiquum</i> , Ancient murrelet	189
<i>Ptychoramphus aleutica</i> , Cassin's auklet	191
<i>Cyclorhynchus psittacula</i> , Parakeet auklet	193
<i>Aethia cristatella</i> , Crested auklet	194
<i>Aethia pusilla</i> , Least auklet	197
<i>Aethia pygmaea</i> , Whiskered auklet	200
<i>Cerorhinca monocerata</i> , Rhinoceros auklet	202
<i>Fratercula corniculata</i> , Horned puffin	202
<i>Lunda cirrhata</i> , Tufted puffin	204
Family Cuculidae	205
<i>Cuculus saturatus</i> , Oriental cuckoo	205
Family Strigidae	205
<i>Bubo virginianus</i> , Horned owl	205
<i>Nyceta scandiaca</i> , Snowy owl	206
<i>Surnia ulula</i> , Hawk owl	207
<i>Asio flammeus</i> , Short-eared owl	207
<i>Aegolius funereus</i> , Boreal owl	209
Family Trochilidae	210
<i>Selasphorus rufus</i> , Rufous hummingbird	210
Family Alcedinidae	210
<i>Megasceryle alcyon</i> , Belted kingfisher	210
Family Picidae	211
<i>Dendrocopos pubescens</i> , Downy woodpecker	211
<i>Picoïdes arcticus</i> , Black-backed three-toed woodpecker	211
<i>Picoïdes tridactylus</i> , Northern three-toed woodpecker	212
Family Tyrannidae	212
<i>Sayornis saya</i> , Say's phoebe	212
Family Alaudidae	212
<i>Eremophila alpestris</i> , Horned lark	212
Family Hirundinidae	212
<i>Tachycineta thalassina</i> , Violet-green swallow	212
<i>Iridoprocne bicolor</i> , Tree swallow	213
<i>Riparia riparia</i> , Bank swallow	213
<i>Hirundo rustica</i> , Barn swallow	214
Family Corvidae	214
<i>Perisoreus canadensis</i> , Gray jay	214
<i>Pica pica</i> , Black-billed magpie	215

	Page
<i>Corvus corax</i> , Common raven	216
<i>Corvus caurinus</i> , Northwestern crow	217
<i>Nucifraga columbiana</i> , Clark's nutcracker	217
Family Paridae	217
<i>Parus atricapillus</i> , Black-capped chickadee	217
<i>Parus hudsonicus</i> , Boreal chickadee	218
Family Certhiidae	219
<i>Certhia familiaris</i> , Brown creeper	219
Family Cinclidae	220
<i>Cinclus mexicanus</i> , Dipper	220
Family Troglodytidae	221
<i>Troglodytes troglodytes</i> , Winter wren	221
Family Turdidae	225
<i>Turdus migratorius</i> , Robin	225
<i>Ixoreus naevius</i> , Varied thrush	225
<i>Hylocichla guttata</i> , Hermit thrush	226
<i>Hylocichla ustulata</i> , Swainson's thrush	228
<i>Hylocichla minima</i> , Gray-cheeked thrush	228
<i>Luscinia calliope</i> , Siberian ruby throat	228
Family Sylviidae	229
<i>Phylloscopus borealis</i> , Arctic warbler	229
<i>Regulus satrapa</i> , Golden-crowned kinglet	229
<i>Regulus calendula</i> , Ruby-crowned kinglet	229
Family Motacillidae	230
<i>Motacilla alba</i> , White wagtail	230
<i>Motacilla flava</i> , Yellow wagtail	230
<i>Anthus spinoletta</i> , Water pipit	231
<i>Anthus cervinus</i> , Red-throated pipit	233
Family Laniidae	233
<i>Lanius excubitor</i> , Northern shrike	233
Family Parulidae	234
<i>Vermivora celata</i> , Orange-crowned warbler	234
<i>Dendroica petechia</i> , Yellow warbler	234
<i>Dendroica coronata</i> , Myrtle warbler	235
<i>Dendroica striata</i> , Blackpoll warbler	235
<i>Seiurus noveboracensis</i> , Northern water thrush	236
<i>Wilsonia pusilla</i> , Wilson's warbler	236
Family Icteridae	236
<i>Euphagus carolinus</i> , Rusty blackbird	236
Family Fringillidae	237
<i>Pinicola enucleator</i> , Pine grosbeak	237
<i>Leucosticte tephrocotis</i> , Gray-crowned rosy finch	237
<i>Acanthis hornemanni</i> , Hoary redpoll	240
<i>Acanthis flammea</i> , Common redpoll	240
<i>Spinus pinus</i> , Pine siskin	242
<i>Loxia curvirostra</i> , Red crossbill	242
<i>Loxia leucoptera</i> , White-winged crossbill	242
<i>Passerculus sandwichensis</i> , Savannah sparrow	243
<i>Junco hyemalis</i> , Slate-colored junco	246
<i>Junco oreganus</i> , Oregon junco	246
<i>Spizella arborea</i> , Tree sparrow	247
<i>Zonotrichia leucophrys</i> , White-crowned sparrow	247
<i>Zonotrichia atricapilla</i> , Golden-crowned sparrow	248

	Page
<i>Passerella iliaca</i> , Fox sparrow	249
<i>Melospiza lincolni</i> , Lincoln's sparrow	254
<i>Melospiza melodia</i> , Song sparrow	254
<i>Calcarius lapponicus</i> , Lapland longspur	257
<i>Plectrophenax nivalis</i> , Snow bunting	258
<i>Plectrophenax hyperboreus</i> , McKay's bunting	260
<i>Emberiza rustica</i> , Rustic bunting	260
 Mammals	 262
Family Soricidae	262
<i>Sorex cinereus</i> , Cinereous shrew	262
<i>Sorex tundrensis</i> , Tundra saddle-backed shrew	263
<i>Sorex hydrodromus</i> , Unalaska saddle-backed shrew	263
<i>Sorex obscurus</i> , Dusky shrew	265
<i>Microsorex hoyi</i> , Pigmy shrew	266
Family Vespertilionidae	266
<i>Myotis lucifugus</i> , Little brown bat	266
Family Ursidae	266
<i>Euarctos americanus</i> , Black bear	266
<i>Ursus arctos</i> , Brown bear	267
<i>Thalarcos maritimus</i> , Polar bear	274
Family Procyonidae	274
<i>Procyon lotor</i> , Raccoon	274
Family Mustelidae	275
<i>Martes americana</i> , Marten	275
<i>Mustela erminea</i> , Weasel	275
<i>Mustela rixosa</i> , Least weasel	276
<i>Mustela vison</i> , Mink	276
<i>Gulo luscus</i> , Wolverine	277
<i>Lutra canadensis</i> , Otter	278
<i>Enhydra lutris</i> , Sea otter	278
Family Canidae	287
<i>Vulpes fulva</i> , Red fox	287
<i>Alopex lagopus</i> , Blue fox	292
<i>Canis lupus</i> , Wolf	304
Family Felidae	305
<i>Lynx canadensis</i> , Canada lynx	305
Family Otariidae	305
<i>Eumetopias jubata</i> , Steller sea lion	305
<i>Callorhinus ursinus</i> , Northern fur seal	306
Family Phocidae	307
<i>Phoca vitulina</i> , Harbor seal	307
<i>Pusa hispida</i> , Ringed seal	309
<i>Pagophilus groenlandicus</i> , Harp seal	309
<i>Histiophoca fasciata</i> , Ribbon seal	310
<i>Erigonathus barbatus</i> , Bearded seal	310
Family Odobenidae	311
<i>Odobenus rosmarus</i> , Walrus	311
Family Sciuridae	314
<i>Marmota caligata</i> , Hoary marmot	314
<i>Citellus parryii</i> , Ground squirrel	314
<i>Citellus kodiakensis</i> , Ground squirrel	316
<i>Tamiasciurus hudsonicus</i> , Red squirrel	316

	Page
Family Castoridae	317
<i>Castor canadensis</i> , Beaver	317
Family Cricetidae	317
<i>Synaptomys borealis</i> , Lemming mouse	317
<i>Lemmus trimucronatus</i> , Lemming	318
<i>Dicrostonyx groenlandicus</i> , Collared lemming	318
<i>Clethrionomys rutilus</i> , Red-backed mouse	320
<i>Microtus oeconomus</i> , Meadow mouse	320
<i>Microtus pennsylvanicus</i> , Meadow mouse	324
<i>Ondatra zibethicus</i> , Muskrat	324
Family Muridae	324
<i>Mus musculus</i> , House mouse	324
<i>Rattus norvegicus</i> , House rat	325
Family Zapodidae	326
<i>Zapus hudsonius</i> , Jumping mouse	326
Family Erethizontidae	327
<i>Erethizon dorsatum</i> , American porcupine	327
Family Ochotonidae	327
<i>Ochotona collaris</i> , Collared pika	327
Family Leporidae	327
<i>Lepus americanus</i> , Varying hare	327
<i>Lepus othus</i> , Arctic hare	328
Family Cervidae	328
<i>Cervus canadensis</i> , Elk (Wapiti)	328
<i>Odocoileus hemionus</i> , Black-tailed deer	328
<i>Alces alces</i> , Moose	329
<i>Rangifer arcticus</i> , Barren ground caribou	329
<i>Rangifer</i> sp., Reindeer	331
Family Bovidae	332
<i>Ovis dalli</i> , Dall sheep (White sheep)	332
Family Hydrodamalidae	332
<i>Hydrodamalis gigas</i> , Steller sea cow	332
Family Balaenidae	333
<i>Eubalaena sieboldi</i> , Pacific right whale	333
<i>Balaena mysticetus</i> , Bowhead whale	333
Family Eschrichtidae	334
<i>Eschrichtius glaucus</i> , Gray whale	334
Family Balaenopteridae	334
<i>Balaenoptera physalus</i> , Finback whale	334
<i>Balaenoptera borealis</i> , Sei whale	334
<i>Sibbaldus musculus</i> , Blue whale	335
<i>Megaptera novaeangliae</i> , Humpback whale	335
Family Physeteridae	335
<i>Physeter catodon</i> , Sperm whale	335
Family Delphinidae	335
<i>Grampus rostrata</i> , Pacific killer whale	335
<i>Globicephala scammonii</i> , Pacific blackfish	337
<i>Lissodelphis borealis</i> , Right-whale porpoise	337
<i>Lagenorhynchus obliquidens</i> , Pacific striped porpoise	337
<i>Phocoena vomerina</i> , Pacific harbor porpoise	337
<i>Phocoenoides dalli</i> , Dall porpoise	338
Family Monodontidae	338
<i>Delphinapterus leucas</i> , White whale (Beluga)	338

	Page
Family Ziphiidae	339
<i>L. cradius bairdii</i> , Baird beaked whale	339
<i>Mesoplodon stejnegeri</i> , Stejneger beaked whale	339
<i>Ziphius cavirostris</i> , Cuvier beaked whale	339
References	340

ILLUSTRATIONS

Figure	Page
Frontispiece: The <i>Brown Bear</i> in the Aleutians	xiv
1. Aleutian Islands	4
2. Semichi Islands	6
3. Sketch elevation of Agattu Island	6
4. Sketch elevation of Buldir Island	6
5. Sketch elevation of several Aleutian Islands	6
6. Sketch elevation of three Aleutian Islands	7
7. Little Sitkin Island	7
8. Sketch elevation of Rat Island	7
9. West end of Rat Island	7
10. West end of Rat Island	8
11. Southeast end of Rat Island	8
12. Sketch elevation of Semisopochnoi Island	8
13. Sketch elevation of West Unalaga Island	8
14. Sketch elevation of Ilak Island	9
15. Sketch elevation of Kavalga Island	9
16. Sadatanak Island	9
17. Sagchudak Island	9
18. Sketch elevation of Bobrof Island	9
19. Anagaksik Island	9
20. Sketch elevations of Kasatochi Island and Koniuji Island	9
21. Seguam Island	10
22. Sketch elevation of Ananiuliak Island	10
23. Mounds on Kavalga Island	26
24. Red-faced cormorant	57
25. Rough-legged hawk	108
26. Black oystercatcher	131
27. Aleutian rock sandpiper	143
28. Least sandpiper	148
29. Least sandpipers	149
30. Glaucous-winged gulls	166
31. Black-legged kittiwakes	176
32. Colony of Pallas's thick-billed murre on Bogoslof Island	184
33. Pallas's thick-billed murre	185
34. Kittlitz's murrelet	189
35. Ancient murrelet	190
36. Crested auklets	196
37. Least auklets	197
38. Least auklet	199
39. Horned puffins	203
40. Tufted puffins	204
41. Aleutian song sparrow	255
42. Sea otter	279
43. Blue fox	294

INVERTEBRATES AND FISHES COLLECTED IN THE
ALEUTIANS, 1936-38, by Victor B. Scheffer

	Page
Introduction.....	365
Marine algae	367
Marine invertebrates.....	370
Sponges	370
Coelenterates	370
Hydroids	370
Jellyfishes	370
Flatworms	371
Roundworms	371
Nemertean worms	371
Brachiopods	371
Annelid worms	371
Echinoderms	372
Brittle stars	372
Starfishes	372
Sea urchins	373
Sea cucumbers	375
Crustaceans	375
Copepods	375
Barnacles	376
Amphipods	377
Isopods	379
Shrimps	379
Hermit crabs	379
Anomuran crabs	381
Other crabs	381
Mollusks	381
Bivalves	381
Snails and sea slugs	383
Chitons	385
Devilfishes	386
Fresh-water invertebrates	387
Crustaceans	391
Cladocerans	391
Copepods	391
Ostracods	391
Mollusks	391
Land invertebrates	392
Mollusks	392
Beetles	392
Bird lice	393
Diptera	393
Spiders	393
Fishes	395
Literature cited	406

ILLUSTRATIONS

Figure	Page
1. <i>Fucus</i> , a brown seaweed	368
2. Calcareous algae of the <i>Lithothamnion</i> group	368
3. The 5-rayed starfish <i>Asterias amurensis</i>	373
4. Twenty-rayed starfish, <i>Pycnopodia helianthoides</i>	374
5. Green sea urchin <i>Strongylocentrotus drobachiensis</i>	375
6. Rock barnacles, <i>Balanus</i> sp.	376
7. Two species of barnacles	377
8. Parasitic amphipod <i>Paracyamus boopis</i>	378
9. Common crab, <i>Cancer magister</i>	380
10. King crab, <i>Paralithodes</i> sp.	380
11. Mussels, <i>Mytilus edulis</i>	382
12. Limpets, <i>Acmaea</i> sp.	384
13. Periwinkles, <i>Littorina</i> sp.	385
14. Fresh-water pool, type 1 (small and clear)	387
15. Fresh-water pool, type 2 (small and weedy)	388
16. Fresh-water pool, type 3 (large and barren)	389
17. Alaska cod, <i>Gadus macrocephalus</i>	396
18. Red sculpin, <i>Hemilepidotus hemilepidotus</i>	397
19. Irish lord, <i>Hemilepidotus jordani</i>	398
20. Halibut, <i>Hippoglossus stenolepis</i>	399
21. Pogie, <i>Lebius superciliosus</i>	400
22. Pink salmon, <i>Oncorhynchus gorbuscha</i>	401
23. Native boy netting sockeye salmon	402
24. Red or sockeye salmon, <i>Oncorhynchus nerka</i>	402
25. Atka mackerel, <i>Pleurogrammus monoptygius</i>	403
26. Silver hake, <i>Tneragra chalcogramma</i>	404

Foreword

This report is based on a biological survey of most of the Aleutian Islands and the Alaska Peninsula in 1936 and 1937. The report was largely prepared soon after the survey, but for various reasons it has not been practical to publish it until now. Even in manuscript form, this material has been consulted frequently, and it is issued now in the North American Fauna series so as to make more accessible information on one of North America's most significant biogeographic regions.

While the report was being readied for publication, the fifth edition of the Check-List of North American Birds appeared (American Ornithologists' Union 1957). Throughout the report, scientific and common names of birds have been made to conform to the new Check-List, but generally references to "the A. O. U. Check-List," without specification, are to the fourth (1931) edition. Scientific names of mammals have been made to conform in general to the List of North American Recent Mammals (Miller and Kellogg 1955); common names of mammals for the most part follow Hall (1957). The Pinnipeds conform to the nomenclature of Scheffer (1958).

No attempt has been made to include references to all recent publications on the Aleutian and Alaskan fauna; references included are those from which data were obtained for this report.

O. J. MURIE

May 1959



The *Brown Bear* in the Aleutians. Carlisle Island rising above the fog.

FAUNA OF THE ALEUTIAN ISLANDS AND ALASKA PENINSULA

By Olaus J. Murie, *Biologist*

Introduction

The Aleutian Islands, treeless, fog-bound, and volcanic, extend westward from the tip of the Alaska Peninsula for about 1,100 miles to Attu, which is less than 600 miles from the Kamchatka Peninsula of Asia. The Aleutian Islands Wildlife Reservation, now a National Wildlife Refuge, was established on this chain in 1913. This reservation embraces the islands of the Aleutian chain between the North Pacific Ocean and the Bering Sea. These islands were set apart as a preserve and breeding ground for native birds, for the propagation of reindeer and fur-bearing animals, and for the encouragement and development of fisheries.

In 1920, the United States Bureau of Biological Survey¹ was given the responsibility of enforcement of the Alaska fur laws and administration of the blue-fox industry in the Aleutians. As time went on, it became apparent that proper supervision of this important wildlife refuge would necessitate an extensive inventory of the resources of these islands.

In 1936, assisted by Cecil S. Williams of the Bureau of Biological Survey, I was assigned to make the necessary investigations. The motorship *Brown Bear* was placed at our disposal, and H. Douglas Gray and Homer Jewell, both of the Alaska Game Commission, joined us at Juneau. A second season was required for the work, and, in 1937, Victor B. Scheffer, John H. Steenis, H. Douglas Gray, and I made up the scientific party. During these two seasons we visited every Aleutian island of any size, as well as many islands south of the Alaska Peninsula and several points on the Peninsula, including Bristol Bay and the Nelson Island region of the Bering Sea coast. In 1938, Scheffer returned

¹ Now a part of the U. S. Fish and Wildlife Service.

with the *Brown Bear* for another season's work. He made limited studies of the lesser forms of animal life that inhabit the subarctic waters of the North Pacific Ocean and the Bering Sea and those that occupy the shores and slopes of the islands.

Our work, and the work of Scheffer, expanded upon information obtained by biologists who visited the area late in the 19th century and early in the 20th century. In 1902, W. H. Osgood for the Bureau of Biological Survey, conducted an expedition to the base of the Alaska Peninsula. Results of his field work were published as "A Biological Reconnaissance of the Base of the Alaska Peninsula" (North American Fauna Series No. 24, 1904). In 1911, Alexander Wetmore and A. C. Bent investigated the western end of the Alaska Peninsula and some of the Aleutian Islands (Wetmore's field report was never published). In the summer of 1925, assisted by Fur Warden Donald H. Stevenson, I was assigned to field work at the western end of the Alaska Peninsula. Additional investigators who visited the Aleutians include Lucien M. Turner and William H. Dall (in the 19th century), and Ira N. Gabrielson (in the 20th century).

In the present report, references are made to all individuals who are known to have contributed to the knowledge of the fauna of the Aleutian Islands. These individual contributions total into a considerable volume of data that have been of inestimable help in evaluating the Aleutian fauna. In view of this assemblage of data, and for a better understanding of the fauna of this part of Alaska, the present report embraces all of the Alaska Peninsula and the Aleutian Islands.

In compiling the material presented here, and in gathering the field data, I am indebted to my colleagues in the field on all three expeditions—1925, 1936, and 1937. These colleagues, already mentioned—Stevenson, Williams, Scheffer, Steenis, Gray, and Jewell—are men whose zeal for research and loyalty to the joint undertaking must ensure success of an expedition. John Sellevold, veteran seaman and captain of the *Brown Bear*, went beyond the requirements of his duty to help us in many ways.

John W. Aldrich and Allen J. Duvall, both of the U. S. Fish and Wildlife Service, have been especially helpful with advice and assistance in working with specimens. Herbert Friedmann, of the National Museum, has also helped considerably, and Ira N. Gabrielson, who has made many trips to the Aleutian district, has been especially generous with his field notes. Many others, both in Washington and in the field, assisted in many ways.

Also, I must pay tribute to those original inhabitants of the

Aleutians, the Aleuts, who as a race have suffered many vicissitudes through earlier contacts with white men. Those with whom we associated were eager to help with information. It is with special affection that I recall the friendly cooperation of Mike Hodikoff, Chief of Attu village, who was ready to do anything to further the work of our expeditions and to add to our knowledge. He, with his village, was captured by Japanese invasion forces during World War II; there is no knowledge of his fate.

GEOGRAPHY AND GEOLOGY

The Alaska Peninsula and Aleutian Islands (see fig. 1) form a great arc that swings across the northern seas for about 1,500 miles, almost to Siberia. The Aleutian chain alone is about 1,100 miles long. This arc, together with the Commander Islands, forms a barrier that separates the Bering Sea from the North Pacific Ocean. The Alaska Peninsula extends southwestward from about latitude 59° N., and Amatignak Island, the southernmost of the Aleutians, lies nearly as far south as latitude 51° N.—the same latitude as the north end of Vancouver Island.

The north shore of the Alaska Peninsula shelves off gradually into the shallow waters of Bering Sea, forming a low coastal plain with a comparatively even coastline. However, farther inland the land rises to the rugged volcanic Aleutian Range, which runs the length of the Peninsula, and, on the south side, breaks off into the deeper water of the North Pacific. Accordingly, the south shore is irregular and rugged with bays and headlands and offshore rocks and is fringed by offshore islands—notably the Kodiak-Afognak, Semidi, Shumagin, and Sanak Island groups, as well as a number of smaller ones.

The eastern Aleutians retain some of the characteristics of the Alaska Peninsula. This is most pronounced on Unimak Island, which has a low coastal plain, lagoons, and rugged interior mountains that extend southward to the Pacific Ocean. In fact, Unimak Island is separated from the Peninsula by only a narrow strait.

Numerous eruptions have been recorded since the discovery of these islands, and the Aleutian chain proper consists of over 70 named islands, some small, others large; Unimak is about 70 miles long. The chain is irregular and is bordered on the north and south sides by deep oceanic troughs. In other words, the south border of the shallow Bering Sea bottom, which is virtually a continental shelf, veers off northwestward so as to leave deep waters north of the Aleutian chain. As Stephen R. Capps (1934, p. 143) has stated,

A line of soundings taken by the fathometer on the *Gannet* in 1932, extending along an irregular course from a point north of Amukta Pass to Attu Island, at varying distances from the intervening islands, shows that north of the islands the 1,000 fathom line lies close to the island 'estoon and that at a distance of 50 miles or more from them there is a remarkably smooth-floored depression at a depth of 2,000 to 2,200 fathoms. The shape of this depression between the islands and the continental mass, which includes much of Bering Sea, is not known, but it is significant that the island arc rises as a sharp ridge separating deeps of 2,000 fathoms or more both to the north and south.

The volcanic nature of this region is well known. Capps (1934, p. 142) says,

Throughout the Alaska Peninsula the volcanoes have broken out through older sedimentary or igneous rocks, by which they are now flanked. In the Aleutian Islands there are few if any exposures of the basement rocks, and the islands are largely constructional, having been built up to and above sea level by the accumulation of lavas and volcanic fragmental material ejected from below.

Many volcanoes along this remarkable arc are still in an active state. The eruption of Katmai Volcano, on the Alaska Peninsula, in 1912 was one of the great volcanic spectacles of modern times (see Griggs 1922). The activities of Bogoslof Island and Mount Shishaldin on Unimak Island are well known, and in 1930 there was an eruption on Gareloi Island. On our visit there in 1937 we examined some of the small craters, from which were issuing steam and other gases, and we noted many lava bombs on the lower slopes. We found several typical hot thermal springs that were rimmed with algae. On Kagamil Island, noisy steam jets issued from a rocky bluff, and rumblings could be heard under the boulder beach. After our return from the expedition of 1937, we learned that there had been an eruption on Yunaska Island while we had been exploring other areas. Many of the mountains have plumes of steam issuing from the top. Mount Cleveland, on Chuginadak Island, erupted in 1944, and Okmok and Umnak Islands erupted in 1945.

As would be expected, most of the islands are mountainous. There are a few relatively flat islands, such as Amchitka, Agattu, and Semichi. However, there is a low mountain range along one side of Agattu, and there is a small mountain at one end of Alaid Island, in the Semichis. Most of the larger islands have lakes and streams, and several, such as Amchitka, Agattu, and the Semichis, are dotted with lakes. In keeping with their volcanic origin, some of these islands have notable lava beds that furnish nesting crevices for petrels and auklets, as on Amukta and Gareloi. Other islands, notably Ogliuga and part of Kavalga,

have been covered with volcanic ash in recent times. The shore-lines are irregular, with offshore islets, rocks, and undersurface reefs, and there are boulder beaches, sandy beaches, and abrupt cliffs in great variety.

The accompanying field sketches, (see figs. 2-22) showing a few of the islands in profile, suggest the variety of configuration.

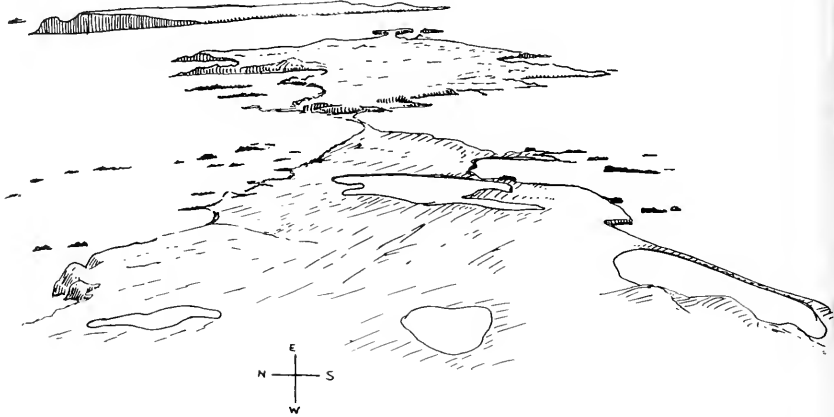


FIGURE 2.—Semichi Islands from mountain on Alaid Island (June 1937). Note that a narrow spit connects Alaid, in foreground, with the middle island; Shemya, the easternmost, is in the distance.



FIGURE 3.—Sketch elevation of Agattu Island, seen from west end of Alaid Island, looking southwesterly.



FIGURE 4.—Sketch elevation of Buldir Island, looking southeast.

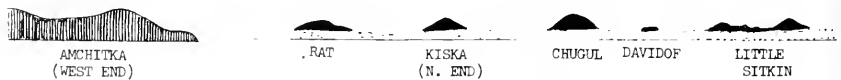


FIGURE 5.—Sketch elevation of several Aleutian Islands, looking west.

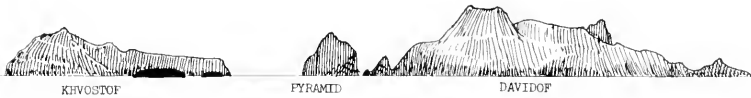


FIGURE 6.—Sketch elevation of three Aleutian Islands from Gunner Cove on Rat Island, looking northerly.

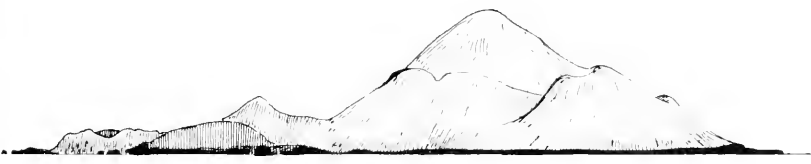


FIGURE 7.—Little Sitkin Island from Gunner Cove on Rat Island, looking northeasterly.



FIGURE 8.—Sketch elevation of Rat Island from southeast end of Khvostof Island, looking southerly.

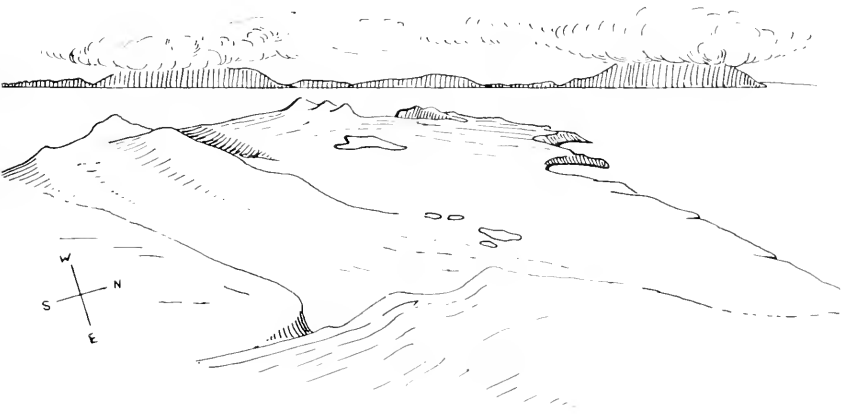


FIGURE 9.—West end of Rat Island (July 1937). Kiska Island in distance.

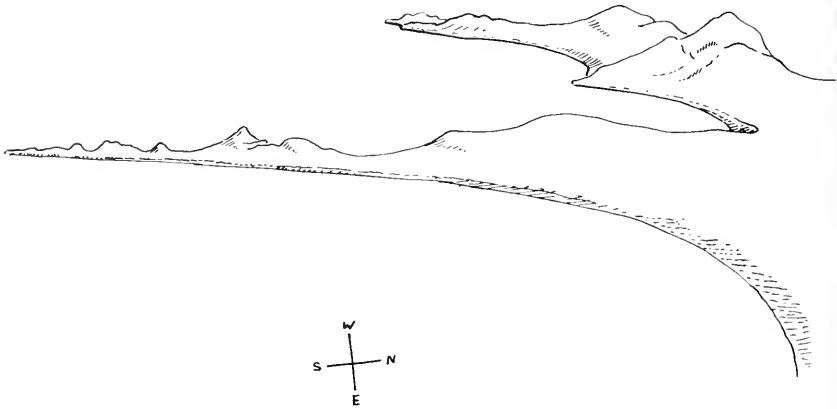


FIGURE 10.—West end of Rat Island (July 1937) from beach on south shore

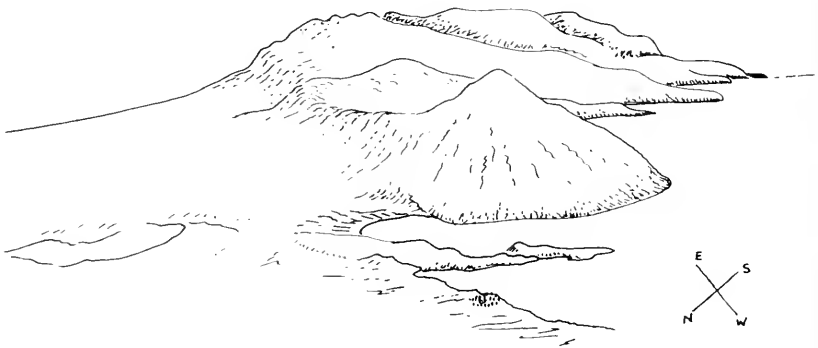


FIGURE 11.—Southeast end of Rat Island (June 1937).



FIGURE 12.—Sketch elevation of Semisopochnoi Island seen from west end of Amchitka, looking northeasterly. Low fog bank on horizon.



FIGURE 13.—Sketch elevation of West Unalaga Island, looking westward.

FIGURE 14.—Sketch elevation of Ilak Island, looking southerly.



FIGURE 15.—Sketch elevation of Kavalga Island from West Unalga Island, looking easterly.



FIGURE 16.—Sadatanak Island looking easterly.



FIGURE 17.—Sagchudak Island looking easterly.



FIGURE 18.—Sketch elevation of Bobrof Island, looking southwestery.

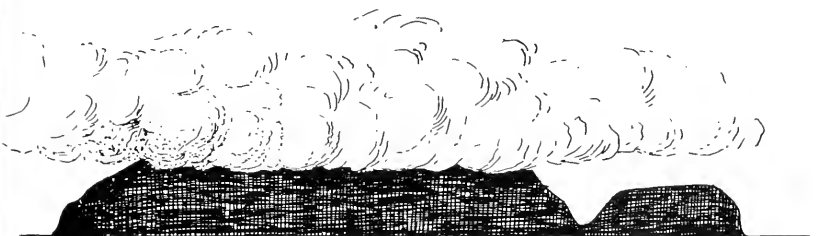


FIGURE 19.—Anagaksik Island, looking southeasterly.

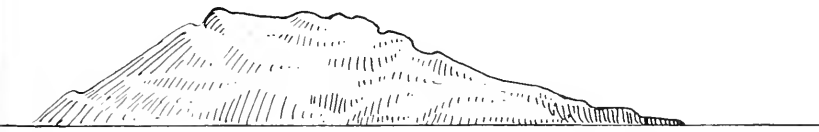


FIGURE 20.—Sketch elevations of Kasatochi Island and Koniuji Island, looking west.





FIGURE 21.—Seguam Island, looking south-southwest.



FIGURE 22.—Sketch elevation of Ananiuliak Island, looking southerly. Umnak Island in background.

CLIMATE

The Aleutian Islands and Alaska Peninsula are south of the severe low winter temperatures of interior and northern Alaska and the surrounding waters are generally free of sea ice. To characterize winter conditions briefly: temperatures go well below freezing, fresh-water ponds freeze over at times, and snow sometimes piles knee deep. But the snow is likely to be wet and slushy, and there will be some bare ground. At high elevations, however, snow is heavier, and the higher mountains are snowcapped in winter.

A few temperature records from Turner (1886), with notes on clear days, are of interest:

Month	Temperature (°F.)			Number of—	
	Mean	Maximum	Minimum	Clear days	Fair days
UNALASKA, 1878-79					
September.....	48.02	55	36	0	0
October.....	40.77	49	26	0	0
November.....	33.50	48	21	1	0
December.....	35.12	45	19	2	0
January.....	33.97	48	20	1	2
February.....	29.25	44	7	1	1
March.....	32.16	49	15	8	0
April.....	33.07	52	21	0	7
ATKA, 1879					
May.....	39.90	65	30	0	0
June.....	42.08	64	30	0	2
July.....	48.96	65	38	2	4
August.....	50.31	69	45	0	0

ATTU, 1880-81

July.....	52 35	66	42	5	3
August.....	51 56	66	38	3	5
September.....	47 75	58	36	6	6
October.....	41 12	49	30	0	4
November.....	35 45	46	25	0	4
December.....	33 91	44	22	0	1
January.....	31 17	42	17	1	6
February.....	31 95	41	17	0	8
March.....	29 02	41	11	1	7
April.....	36 70	52	26	0	3
May.....	39 55	49	31	0	1

Sutton and Wilson (1946) observed birds on Attu Island from February 20 to March 18, 1945. They report,

The air temperatures at sea level did not vary much from freezing as a rule. During the daylight hours it sank somewhat below 32° F. on 20 of the 27 days, climbed as high as 38° during the day on March 4, sank as low as 15° during the night on March 15, and averaged 31°. On March 3 the greatest temperature variation (15° to 31°), as well as the lowest temperature, was recorded. The general aspect was wintry: the sky overcast, the wind raw, the sea turbulent. Highlands and lowlands alike were covered with snow. Along the shore, tufts of rank grass and coarse stalks of wild parsnip protruded from the drifts, and boulders, turfy mounds and narrow gray beaches were always bare. Elsewhere, save for an occasional cliff or exposed slope, everything was white.

A striking feature of the Aleutian climate is the prevalence of foggy or cloudy weather, the abundance of rain in summer, and the frequent violent winds that arise suddenly and unexpectedly. On western Alaska Peninsula, in 1925, we built a windbreak of alder brush to protect our tent, and, on the beach, light gravel occasionally would be blown into our faces. Briefly, then, one might say that although the temperature is mild—neither very low in winter nor very high in summer—there is a minimum of sunshine and a maximum of fog, rain, and storm.

ENVIRONMENT AND BIOTIC DISTRIBUTION

The Alaska Peninsula and Aleutian Islands, stretching as a land bridge between two continents, present a most interesting distribution of plant and animal life. There are, of course, a number of physical facts that bear on the distribution of animals and plants—including the location of the area with relation to that of other significant areas, the geologic history, the physiographic conformation of the land, the ocean currents, and the temperature, humidity, and other climatic influences.

GEOGRAPHIC AND GEOLOGIC INFLUENCES

The Aleutian district lies within the Boreal region, and it may be identified as the southern fringe of this great circumpolar area throughout which life has so much in common. It is significant that the Alaska Peninsula and Aleutian Islands lie in a sense, almost isolated from the mainland of Alaska and extend westward a tremendous distance toward Kamchatka, thus, in some respects, serving as a "bridge" between Asia and North America. It is also significant that they are near the other intercontinental bridge at Bering Strait, which is recognized as having an important influence on our biota.

The Aleutian Islands and Alaska Peninsula are of comparative recent geologic origin. Volcanic activity is still prevalent, and changes in the surface of the land are still taking place. For this reason, and for reasons mentioned later, the area has a new and changing environment that has not yet been fully occupied by flora or fauna to the extent of its potential capacity. Thus, the area presents an opportunity to see immigration still taking place and to note the changes imposed on the newcomers by an unusual environment.

As the following sections show, the Aleutian biota is drawn from its members from several directions. As would be expected, some have come directly from Asia; some have come from the north on the Alaskan side; others have come from the southeast along the Pacific coast; and still others are part of the fauna that appears to have developed in the Bering Sea region—an area roughly bounded by Siberia, mainland Alaska, and the Aleutian Islands. Many others are drawn from biotic populations that at present are so widely distributed in the Palaearctic region that it is impossible to judge the direction from which they entered the Aleutian area. Following, are some of these groups that have contributed to the Aleutian biota:

ASIATIC IMMIGRANTS

BIRDS

SCIENTIFIC NAME	COMMON NAME
<i>Branta nigricans</i>	Black brant
<i>Mareca penelope</i>	European widgeon
<i>Anas crecca</i> ssp.	Common teal
<i>Haliaeetus albicilla</i>	White-tailed sea eagle
<i>Haliaeetus plegiacus</i>	Steller's sea eagle
<i>Falco rusticolus uralensis</i>	Asiatic gyrfalcon
<i>Charadrius dubius curonicus</i>	Little ringed plover

<i>haradrius semipalmatus</i>	Semipalmated plover
<i>luvialis dominica fulva</i>	American golden plover
<i>renaria interpres interpres</i>	Ruddy turnstone
<i>ringa glareola</i>	Wood sandpiper
<i>rolia acuminata</i>	Sharp-tailed sandpiper
<i>arus hyperboreus hyperboreus</i>	Glaucous gull
<i>arus schistisagus</i>	Slaty-backed gull
<i>arus argentatus vegae</i>	Herring gull
<i>arus ridibundus sibiricus</i>	Black-headed gull
<i>terna aleutica</i>	Aleutian tern
<i>ethia pygmaea</i>	Whiskered auklet
<i>uculus saturatus horsfieldi</i>	Oriental cuckoo
<i>uscinia calliope camtschatkensis</i>	Siberian rubythroat
<i>roglodytes troglodytes</i> ssp. (in part)	Winter wrens
<i>otacilla alba lugens</i>	White wagtail
<i>mberiza rustica latifascia</i>	Rustic bunting

MAMMALS

SCIENTIFIC NAME	COMMON NAME
<i>alopex lagopus</i>	Blue fox
<i>arctos gyas</i>	Brown bear
<i>arctos arctos middendorffi</i>	Brown bear

Some of these are only occasional visitors, such as the two eagles mentioned, and *Larus schistisagus* (slaty-backed gull), *arus ridibundus sibiricus* (black-headed gull), *Cuculus saturatus horsfieldi* (oriental cuckoo), and some others. Some have become established in the Aleutians, such as *Anas crecca* (common teal), *ethia pygmaea* (whiskered auklet), and *Sterna aleutica* (Aleutian tern), and *Alopex lagopus* (blue fox). Others have reached the Alaskan coast in general, including the Aleutian district, but not necessarily by the Aleutian route, such as *Falco rusticolus calensis* (Asiatic gyrfalcon), *Pluvialis dominica fulva* (American golden plover), and the big brown bears. Some, such as *haradrius semipalmatus* (semipalmated plover) and *Branta nigricans* (black brant), have extended eastward considerably beyond the Alaskan Peninsula but show greater affinity with Asiatic populations than with those farther east in North America. In the case of the winter wrens, *Troglodytes troglodytes*, the origin appears to have been from Asia and from the southeast. Of course, the bears came by the more remote northern route. Plants, too, have begun the long traverse over from Asia. In the case of plants which occur widely on both sides of Bering Strait, and which have become established all the way through the Aleutian chain, it is difficult to know the direction from which their immigration took place. There are some plants that, according to Hultén's distribution maps (1937a), have obtained

a foothold in the western Aleutians but have not been observed to the east, even though some of them also occur on the Alaska mainland. Concerning the plant distribution, Hultén (1937a, 44) stated,

If Commander Islands and westernmost Alaska Penin. are included, as this flora, 92 America species reach that area, but 47 of them do not further westward than to Umnak. 49 species reach the Aleutians from the west but not other parts of southern Alaska. 40 of them do not reach further eastwards than to the westernmost group of the Aleutians.

Some of the prominent Asiatic forms that we observed in the westernmost Aleutians are *Cirsium kamtschaticum*, *Veratrum album oxyselalum*, *Cacalia ariculata*, and *Sorbus sambucifolia*. These are confined to the Near Islands, though some are thought to have reached as far east as Buldir.

Hultén says further, "The flora of the middle Aleutians is very depauperated, probably due to the relatively short time elapsed since the glacial period, when most of their plants were exterminated."

Only the more obvious Asiatic elements are mentioned here. Other animal and plant forms probably originated in Siberia at a more remote time.

BERING SEA AVIFAUNA

The following birds represent a group largely confined to the coastal parts of Bering Sea, although some of them range farther north or south. They appear to be characteristic of all shores of the Bering Sea, instead of the Siberian side exclusively.

SCIENTIFIC NAME	COMMON NAME
<i>Phalacrocorax pelagicus pelagicus</i>	Pelagic cormorant
<i>Phalacrocorax urile</i>	Red-faced cormorant
<i>Branta canadensis minima</i>	Canada goose
<i>Philacte canagica</i>	Emperor goose
<i>Anas crecca nimia</i>	Common teal
<i>Polysticta stelleri</i>	Steller's eider
<i>Arenaria melanocephala</i>	Black turnstone
<i>Numenius tahitiensis</i>	Bristle-thighed curlew
<i>Erolia ptiloenemis</i> ssp.	Rock sandpiper
<i>Limosa lapponica baueri</i>	Bar-tailed godwit
<i>Rissa tridactyla pollicaris</i>	Black-legged kittiwake
<i>Rissa brevirostris</i>	Red-legged kittiwake
<i>Xema sabini woznesenskii</i>	Sabine's gull
<i>Uria lomvia arra</i>	Thick-billed murre
<i>Brachyramphus brevirostre</i>	Kittlitz's murre
<i>Cyclorhynchus pittaacula</i>	Parakeet auk
<i>Aethia cristatella</i>	Crested auk

<i>ethia pusilla</i>	Least auklet
<i>ratercula corniculata</i>	Horned puffin
<i>hyloscopus borealis kennicotti</i>	Arctic warbler
<i>motacilla flava tschutschensis</i>	Yellow wagtail
<i>lectrophenax hyperboreus</i>	McKay's bunting

AUNA OF WIDER NORTHERN DISTRIBUTION

BIRDS

SCIENTIFIC NAME	COMMON NAME
<i>avia arctica pacifica</i>	Arctic loon
<i>avia stellata</i>	Red-throated loon
<i>lor columbianus</i>	Whistling swan
<i>ranta canadensis leucopareia</i>	Canada goose
<i>anser albifrons frontalis</i>	White-fronted goose
<i>langula hyemalis</i>	Oldsquaw
<i>omateria mollissima v. nigra</i>	Common eider
<i>uteo lagopus s.johannis</i>	Rough-legged hawk
<i>alco rusticolus obsoleteus</i>	Gyr Falcon
<i>agopus lagopus</i> ssp.	Willow ptarmigan
<i>agopus mutus</i> ssp.	Rock ptarmigan
<i>rolia alpina pacifica</i>	Dunlin
<i>reunetus</i> sp.	Sandpipers
<i>phalaropus fulicarius</i>	Red phalarope
<i>obipes lobatus</i>	Northern phalarope
<i>tercorarius</i> sp.	Jaegers
<i>arus hyperboreus barrovianus</i>	Glaucous gull
<i>terna paradisiae</i>	Arctic tern
<i>irus atricapillus turneri</i>	Black-capped chickadee
<i>arus hudsonicus hudsonicus</i>	Boreal chickadee
<i>urdus migratorius migratorius</i>	American robin
<i>glocichla minima minima</i>	Gray-cheeked thrush
<i>canthis</i> sp.	Redpolls
<i>inco hyemalis hyemalis</i>	Slate-colored junco
<i>asserella iliaca zaboria</i>	Fox sparrow
<i>alcarius lapponicus alascensis</i>	Lapland longspur
<i>ectrophenax nivalis</i> ssp.	Snow bunting

MAMMALS

SCIENTIFIC NAME	COMMON NAME
<i>orex tuundrensis</i>	Tundra saddle-backed shrew
<i>tellus</i> sp.	Ground squirrels
<i>icrostonyx</i> sp.	Collared lemmings
<i>icrotus oeconomus</i> ssp.	Meadow mice
<i>pus othus poadromus</i>	Arctic hare
<i>ngifer arcticus granti</i>	Barren ground caribou
<i>lphinapterus leucas</i>	Beluga

These are some of the more northern birds and mammals whose distribution with relation to the Alaska Peninsula is such that

they probably immigrated southward or southwestward to the Aleutian district. There are, of course, a great many others of northerly distribution whose general range is such that the route of the population movement is uncertain. In the groups here listed it will be seen that the Aleutian district has drawn heavily from the fauna that characterizes the northern portion of the continent from northern Alaska across to Hudson Bay. Lemmings, Arctic hares, the jaegers, Sabine's gull, and others came straight down the Bering Sea coastal strip.

It will be noted that not all of the birds just listed actually nest in the Aleutian district.

SOUTHERN AND SOUTHEASTERN AVIFAUNA

SCIENTIFIC NAME	COMMON NAME
<i>Phalacrocorax auritus cincinatus</i>	Double-crested cormorant
<i>Olor buccinator</i>	Trumpeter swan
<i>Anas strepera</i>	Gadwall
<i>Larus glaucescens</i>	Glaucous-winged gull
<i>Brachyramphus marmoratum marmoratum</i>	Marbled murrelet
<i>Synthliboramphus antiquum</i>	Ancient murrelet
<i>Ptychoramphus aleutica</i>	Cassin's auklet
<i>Cerorhinca monocerata</i>	Rhinoceros auklet
<i>Megasceryle alcyon caurina</i>	Belted kingfisher
<i>Troglodytes troglodytes</i> ssp. (in part)	Winter wren
<i>Ixoreus naevius</i>	Varied thrush
<i>Vermivora celata lutescens</i>	Orange-crowned warbler
<i>Pinicola enucleator flammula</i>	Pine grosbeak
<i>Leucosticte tephrocotis</i> ssp.	Gray-crowned rosy finch
<i>Loxia curvirostris sitkensis</i>	Red crossbill
<i>Passerculus sandwichensis</i> ssp.	Savannah sparrow
<i>Passerella iliaca</i> ssp.	Fox sparrow
<i>Melospiza melodia</i> ssp.	Song sparrow

Some of these listings give us a clear demonstration of the route of influx into the Aleutian district, by way of closely related subspecies in a series extending along the coastal strip of southern and southeastern Alaska. Such examples are the song sparrow, fox sparrows, and winter wrens in particular. The fox sparrow presents an interesting distributional picture. It is the dark coastal *unalaschcensis* group that has worked along the coast and formerly occupied the suitable habitats as far as the eastern Aleutians. But the bright-colored eastern type has come down from the northeast and, at the base of Alaska Peninsula, this type has made contact with the coastal forms.

Naturally, there could be error in the interpretation of faunal immigration just cited, because complexities may have intervened

nce the territory in question was "opened for settlement"; however, the conclusions submitted are based on strong probability at least.

It will be seen that the coastal mountain masses of southern Alaska and the Alaska Range form a barrier. Although this is not an absolute barrier, presumably it is enough of an obstacle that the way of least resistance would be north and west along the coast for some species. Similarly, there is an easy avenue southward along the open Bering Sea coast for tundra-loving forms. And the Aleutian chain, reaching out close to Siberia, is an inviting route.

ENVIRONMENTAL INFLUENCE

There are some striking environmental influences operative in the Aleutian district. We know, of course, that humid regions tend to produce dark pigmentation, and this fact holds true for this area. The rosy finches reach their darker hues in the Aleutian area, with the darkest in the Pribilofs. The fox sparrows show the same tendency, exceeded in dark tones only by the populations of the excessively humid Pacific rain-forest zone that extends from the coast and islands of southeastern Alaska, southward to the northwest coast of the United States. Except for the aberrant yellow types in the middle Aleutians, the darkest black ptarmigans are found in the Aleutian area, especially on Attu and the Commanders. Here, parasitic jaegers are, and the Arctic foxes are, almost entirely in the dark-color phase. In primitive times, silver foxes were unusually plentiful somewhere in this district, judging by the cargoes of the first Russian traders. The lemmings, *Dicrostonyx*, of Unalaska and Umnak do not acquire a white pelage in winter.

This is also a region of giantism. Note the huge size of the big sparrows, Savannah sparrows, and rosy finches, which, as genera, reach their greatest size in the Aleutians and Commander Islands. Here, the Aleutian winter wrens, as a group, have developed unusually long bills. Here, too, we may include the Alaska brown bear, which achieves its greatest size on the Alaska Peninsula, Unimak Island, and Kodiak Island.

Marine biologists have found that in many instances the invertebrate subspecies in the northern Pacific waters, and even farther north, are strikingly larger than forms of the same species farther to the south. This invites interesting speculation. As pointed out later, the Aleutian waters are unusually rich in plankton, and there is an abundant and varied marine inverte-

brate fauna. An exceptionally nutritious marine food source should influence the vigor and size of the terrestrial vertebrates of that region.

The song sparrow's habitat in the Aleutians is the beach, and it is probable that its food is largely of marine origin—the small beach crustaceans, for example. Some other land birds, such as winter wrens and pipits, feed to some extent on the beach. The blue foxes feed chiefly on marine life.

The case of the Alaska brown bears is not so clear, though for a part of the summer they comb the beaches and live extensively on salmon, which are nourished in the sea. One wonders, also, if a certain type of food may, with other factors, help to encourage melanism (as in the jaeger), or darker shades of color, as in some of the other birds. It is generally accepted that a humid habitat produces dark coloration. It is not certain that this tendency, as well as melanism, is encouraged by rich food.

This is, of course, pure speculation, yet the significance of a food chain from the sea to the higher vertebrates on the adjacent land may be worthy of earnest study. There are many birds that have not responded to environmental influence. The Aleutian song sparrow has not developed dark pigmentation to an unusual degree. The northern form of the fork-tailed petrel, though averaging larger in the Aleutians, apparently is paler than those in southeastern Alaska. Also, it must be considered that the interior Alaska and Yukon caribou, as well as the Alaskan moose, which have no direct connection with the sea, are the largest of this continent. But these examples suggest that there is something in the environment—favorable food, humidity, or other stimuli—that tends to produce dark pigmentation and large size. This is an important challenge to future investigation and understanding.

ECOLOGICAL CLASSIFICATION

By the usual standards of life-zone allocation, the Alaska Peninsula and Aleutian Islands would fall chiefly in the Arctic Zone. A part of the Kodiak-Afognak Island group supports tree growth and forests encroach on the base of Alaska Peninsula to the vicinity of Mount Katmai. Therefore, these locations would mark the limit of the Hudsonian Zone. However, we find the life-zone classification here to be far from simple. There are probably a number of physiographic and oceanic reasons for this situation.

There are serious difficulties in the interpretation of life zones in the Aleutians that should be considered. The lack of tree

presumably would indicate some form of Arctic or Alpine Life one. So far as latitude is concerned, the southernmost island of the Aleutian chain, Amatignak, lies not far north of 51° N., which is the latitude of heavily timbered, coastal British Columbia in the vicinity of Vancouver Island; however, the treeless Aleutians lie hundreds of miles south of the tree limit in the Brooks Range of interior Alaska. Some of the lowest temperatures in Alaska are recorded from the timbered interior, while the temperatures in the Aleutians are uniformly higher in winter, and the adjacent seas are not frozen over. From the standpoint of vegetation growth, summer temperatures are probably of greater significance than winter temperatures, and probably do not show so great a variation. Certainly the temperatures average much lower and have a lower maximum in summer than temperatures found in the forested continental areas.

Wind is another factor that generally accompanies treelessness at high altitudes and latitudes. There is a treeless coastal strip bordering the Bering Sea, with few interruptions, from Alaska Peninsula to Bering Strait, continuing around to the treeless Arctic coast. This coastal area is characterized by strong winds, as contrasted with the comparative stillness of the interior. We know the effect of wind on tree growth at timberline in mountains. In the Aleutians, I found many instances where the wind had scoured out the soil, exposing the roots of such ground-sucking plants as crowberry and dwarf willow. If wind is one of the factors that establish the edge of forests, it is operative to an unusual degree in the Aleutians.

Forest growth is another important factor to be considered in the Aleutian district. Attention is invited to the series of publications on Alaskan flora by Robert F. Griggs (see bibliography)—particularly his 1934 report on the edge of the forest, in which he has assembled numerous data to show that the edge of the forest has been advancing in Alaska. This was particularly evident on Kodiak Island and in the Katmai region, where Dr. Griggs worked intensively. According to Griggs' studies, we may reason that, since the last glaciation, climate or a combination of other factors has been gradually improving the area toward suitability for forest growth. The forest, however, has not been able to migrate fast enough to keep pace with favorable climatic conditions and has not reached its potential limit.

Where, then, is the limit of the potential climax forest growth? At the end of the Alaska Peninsula? Farther west? On Merriam's life zone map, the Hudsonian Zone is shown extending the

length of Alaska Peninsula. Spruce trees that were planted on Unalaska Island grew, but did not spread. It may be significant that tall willows, alders, and tall salmonberry have extended westward as far as Unimak Island in heavy thicket form. Here salmonberry thickets are similar to those seen in southeastern Alaska. These facts may be indicative of a territory ripe for forest. And such an advance line, based on climatic limitation rather than on the present position of the forest edge, may be considered to be the boundary of the Hudsonian Life Zone. The biome concept, to rely strictly on the climax end product, would have the same difficulty here, and published maps of the Tundra Biome and the Tundra-Coniferous Forest Ecotone for this area would simply substitute these terms for Arctic and Hudsonian Zones. There is the same potential boundary difficulty.

Granted that in the Boreal Zone, at least, tree growth is directly affected by the climatic factors usually associated with the life-zone concept, to what extent is the rest of the biota affected by the same influences? To what extent is it influenced by the mere presence of trees? It is reasonable to believe that the woodland plants that comprise the understory of the Alaskan forest are to a large extent, dependent on association with trees. Some forms, such as blueberries, often extend from open country into scattered forest. But there is a plant association that coincides with forest growth.

Similarly, there is a fauna that has become specialized for forest habitat—woodpeckers, certain grouse, certain warblers, jays, squirrels, black bear, and many others. These appear to be limited by the mere presence of trees. There is good reason to believe that wapiti and other deer would have a much more northern distribution if it were not for the physical barrier of deep snow in winter. On the other hand, the red-backed mouse, the hermit thrush, and the chickadee have inhabited the length of Alaska Peninsula. It is possible to assume that these mobile woodland forms simply would not wait for the slow-moving forest and thus have adapted themselves to more-open habitat than is normal for the species. Also, this would imply a less specialized response to habitat than some of the other forest species, as well as a greater sensitivity to direct climatic stimuli. Birds and mammals are more or less adaptive and vary between wide extremes in tolerance of adverse elements in their environment. However, there is a strong tendency for the majority of any population to be associated with the distribution of certain major vegetation types.

One cannot escape the conviction that if we grant a certain degree of climatic influence on distribution of vegetation to cause it to fall into broad life zones, many of the birds and mammals that have become adapted to vegetation types will also tend to fall into these same life zones. These birds and mammals may be affected to a lesser extent by the life-zone climatic influences than by the indirect effects of these influences—the vegetation type of the habitat.

It should be kept in mind that, in boreal regions, biotic units are not so clearly defined as in desert or semidesert areas. Griggs (1934c), writing on Arctic vegetation, says,

In short every feature of Arctic vegetation, the anomalies in the geographical distribution of arctic species, the occurrence of many species in all sorts of habitats, and their apparent indifference to the diverse conditions thereof, the lack of definiteness to the composition of the plant cover in any particular habitat, the physical instability of the ground itself, the general ruderal character of arctic vegetation, the large number of our weeds which are native to the arctic—all these testify to an instability in arctic vegetation very different from the relatively stable plant formations of the temperate zone.

He states further that—

First, combined with the demonstrated active migration of the Alaskan forest into the arctic, it gives definite support to the supposition that vegetation there has not yet recovered from the glacial period but is still in process of active readjustment.

This statement is applicable to the fauna as well, especially in the Aleutian district. Native rodents have only begun to encroach on the Aleutian Islands. Savannah sparrows have gone only part way. Song sparrows have reached Attu, but fox sparrows have gone only as far as Unimak. Foxes had started to enter the Aleutian chain from Alaska, as well as from Siberia, before man intentionally affected their distribution.

Minute organisms that thrive unusually well in the cold waters of the northern seas have set up a food chain that developed a rich marine biota. This accounts for the presence of the fish, pinnipeds, whales, and sea otters that once inhabited these waters so abundantly. Given such a good supply of food, with an abundance of ideal cliffs and lava beds and boulder beaches for nesting sites, it is logical that the present swarming seabird colonies have assembled in the Aleutians.

There is much of the Arctic element in the Aleutians. Indeed, the Arctic and Alpine merge on these islands. The mountain-loving rosy finches and the Arctic snow bunting nest practically side by side, close to sea level. Alpine vegetation types

are not far above the level of the sea. But if we apply the term "Arctic" here, it must denote the "Low Arctic."

The Aleutian district is unique. For animal life, it combines favorable climatic factors and unusual food resources. It is a focal point to which animal life has been coming from north and south, and east and west, and it is a melting pot for faunal elements from two continents that have not yet reached equilibrium. It is necessary to keep in mind the fluid nature of the Aleutian biota in arriving at any system of zonal delineation.

From a purely descriptive standpoint, the fauna of the Aleutian district stands apart, and it may well merit distinction as the "Aleutian Fauna." There may be good reason to consider it as a unit of a more comprehensive Bering Sea fauna.

VEGETATION

In 1937, Eric Hultén published (in Stockholm, Sweden) "Flora of the Aleutian Islands and Westernmost Alaska Peninsula with notes on the flora of Commander Islands." The same author has also published "Flora of Alaska and Yukon," in 10 parts, issued from 1941 to 1950. This work covers the botany of the Aleutian district so thoroughly that no detailed account of the vegetation need be attempted here, except for mention of some prominent plant associations and their distribution.

The first consideration is the distribution of forests. The spruce-forest edge is found midway on Kodiak Island and in the general vicinity of Becharof Lake on Alaska Peninsula. We find elements of the flora, as well as some of the birds, converging on the base of Alaska Peninsula from two directions. From the east, the Sitka spruce (*Picea sitchensis*) of southern Alaska has made its way to Kodiak Island at the base of Alaska Peninsula, out to the region about Becharof Lake, and now it constitutes the principal forest growth in this area. The status of the white spruce (*Picea glauca*) is less certain, but this interior Alaska tree has come down from the north to at least as far as Bristol Bay, near Nushagak, and it may be considered to have barely reached the border of Alaska Peninsula, inland from the coast. The birch (*Betula kenaica*) is associated with the coniferous growth in all this forested area.

With the exception of this meager forest, in all lowland portions of Alaska Peninsula and Unimak Island, and to some extent as far west as Unalaska, tall vegetation is in the form of shrub thickets—dwarf birch (*Betula nana exilis*), willow, and alder. Alder (*Alnus crispa sinuata*) is particularly prevalent and forms

heavy thickets. Hultén described a new form (*Alnus crispa laciniata*) from Kodiak Island, and mentions *Alnus incana* as occurring in the Katmai district. Shrubby salmonberry (*Rubus spectabilis*) is found in suitable places along the Alaska Peninsula, and in the eastern Aleutians it is found as far as Unalaska Island.

Beyond Unalaska, the vegetation is of the low type; the willows are of the dwarf species, close to the ground, and we find no appreciable high-shrub growth until at the very end, on Attu Island. Attu Island possesses moderate shrubby and tall plants—largely those with Siberian affinities. Hultén (1937a) states:

In the westernmost Aleutians, on Attu I., are found fragments of a high-grown vegetation similar to that growing in the upper subalpine belt on the open spots between the *Alnus* shrubs in Kamtchatka and along the Kamtchatka west coast. It is largely built up of Asiatic elements, which occur only on the westernmost islands, such as *Cirsium kamtschaticum*, *Veratrum oxysepalum*, *Cacalia auriculata*, *Senecio palustris*, and *Sorbus sambucifolia*, but it also includes elements occurring all over our area, such as *Geranium erianthum*, *Streptopus amplexifolius*, *Calamagrostis Langsdorffii* and others.

Some plant communities may be distinguished readily. Throughout all the coastal areas of southwestern Alaska the sandy beaches are bordered with a rank growth of wild rye. In the Aleutian district, other members of the *Elymus arenarius*, or wild rye, association are *Senecio pseudoarnican*, (a groundsel), *Lathyrus maritimus* (beach pea), *Honckenya peploides*, and *Mertensia maritima* (sea bluebell). Within this association we found the low-to-ground *Honckenya peploides* generally pushing out nearest the water. In many places the leafy, bulky *Senecio pseudoarnica* formed vigorous patches that virtually left no room for other plants. The Aleuts used the tall, coarse beach rye, *Elymus arenarius*, for weaving the exquisite "Attu" baskets.

Near the beach, but clinging to rocky sites, is *Potentilla villosa*, a herbaceous cinquefoil, which is associated with other plants. It is separate from the wild rye, or *Elymus*, association, though it is close to the tide, because its habitat is rock, not sand.

Behind this beach-line association, on a somewhat drier area farther from the tide, was another zone of miscellaneous grasses, with some other plants. Here, we noted a dense stand of *Poa*, (blue grass), *Calamagrostis* (brown top), *Bromus* (brome), and other grasses that we did not observe closely; however, we noted the demarcation between outer beach *Elymus* association and the adjacent inner zone of other grasses.

The dividing line was not always located by a given distance

from the beach. I recall a striking instance where a sloping bank arose from the beach to a height of about 30 feet. *Elymus*, exposed to the sands of the sea, clung to the open face of this slope to the crest. At the exact point where the ground levelled off toward the interior, the other, more inland, grass formation began with a dense growth. The plants of this inner group bordering the *Elymus* association are by no means confined to the vicinity of the beach; instead, they become diffused among other plants farther inland.

Farther in the interior, and at higher elevations, we find what Hultén refers to as a "mosaic" of Alpine heath and meadow. Meadow formations have an abundance of *Carex* (sedge), together with many other species, though sedges occur elsewhere as well. In these meadows are found *Artemisia unalaschensis* (a herbaceous sage), *Epilobium angustifolium* (fireweed), *Calamagrostis landsdorffi* (a brown top), *Geranium erianthum* (geranium), *Anaphalis margaritacea* (pearly everlasting), *Aconitum kamtschaticum* (aconite), *Polygonum viviparum* (viviparous knotweed), *Trientalis* (star flower), *Bromus aleuticus* (brome), *Castilleja unalaschensis* (paint brush), *Arnica chamissonis* (arnica), and *Aster peregrinus* (aster). Such a meadow association, as defined by Hultén, is more characteristic of the eastern Aleutians. Prominent patches of the characteristic cotton grass, *Eriophorum*, and *Ranunculus* (bitterroot), were found in many wet areas. Here and there, were found *Geum* (avens), *Caltha* (marsh marigold), *Habenaria* (rein orchis), *Lupinus* (lupine), *Geranium* (geranium), and a botanical list too long to enumerate.

In the more exposed situations above the meadows, scattered in accordance with the character of the terrain, are the heaths. Here, are lichens, mosses, crowberry (*Empetrum nigrum*), and cranberry, (*Vaccinium uliginosum*). Numerous other plants are distributed rather indiscriminately. The showy anemone (*Anemone narcissiflora*), so prominent when in bloom, is very common.

Mention should be made of *Heracleum lanatum* (cow parsnip) and *Coelopleurum gmelini* (seacoast angelica). These robust plants grow throughout the Aleutian district, apparently where soil is rich. They are particularly conspicuous, together with other plants, on old Aleut village sites where the soil has been enriched by refuse from human habitation. Such village sites, seen at a distance, were recognizable by the deep-green, heavy vegetation.

On some occasions we would note a particularly green high

mountain slope where we would find a colony of auklets nesting among rock crevices. We came to the tentative conclusion that vegetation grew more luxuriantly on the site of such bird colonies as a result of fertilization by bird guano and waste food. This vegetation was not necessarily of the same species as those growing on the Aleut village sites; however, the reasons for its presence in the two instances may have been related.

We did not have opportunity to study in detail the recovery of vegetation on islands recently covered by volcanic ash, as Griggs (1936) has done at Katmai and at Kodiak. However, little flat Ogliuga Island would furnish such an opportunity. In 1930, there was an eruption on Gareloi, and the ash from the eruption covered Ogliuga. At the time of our visits in 1936 and 1937, vegetation was just beginning to recover. Tall vigorous clumps of coarse sedges, *Carex*, and some *Juncus*, had pushed up through the ash here and there. These clumps had caught some of the drifting ash driven by the wind, had pushed up higher to clear the ash, and in turn had caught more wind-driven ash, until mounds had been created which were similar to sand dunes.

In the north are found the so-called bird mounds, whose origin has caused much speculation. One theory is that birds such as gulls and jaegers, repeatedly alighting on a small prominence, fertilize the spot, thus causing exuberant vegetative growth—a process that continues until a tall mound is formed.

On nearby Kavalga Island, I found that a part of the area nearest to Ogliuga evidently also had been in the path of an ash fall from a volcanic eruption, probably not so heavy a fall as that which covered Ogliuga.

Some typical "bird mounds" on Kavalga were carefully dissected, with the result shown in the accompanying diagram. In figure 23, parts a and b, two such mounds show (by dark spots) the wearing away, or undercutting, by wind erosion. Also, note the wind erosion on the side in the diagrammatic section of another mound, as shown in part c.

Part c shows, in cross section, the layers of materials in one of these bird mounds. Note that the first layer under the vegetation consists of lava sand, or ash. Beneath the first layer are the alternating layers, in increasing width toward the center, of black soil and rotted moss. This was, of course, a fairly crude field examination, with no opportunity for more precise analysis of materials. But the drifting volcanic ash on nearby Ogliuga, piling up in mounds around the pioneering clumps of vegetation, suggested a process that may also have operated on Kavalga

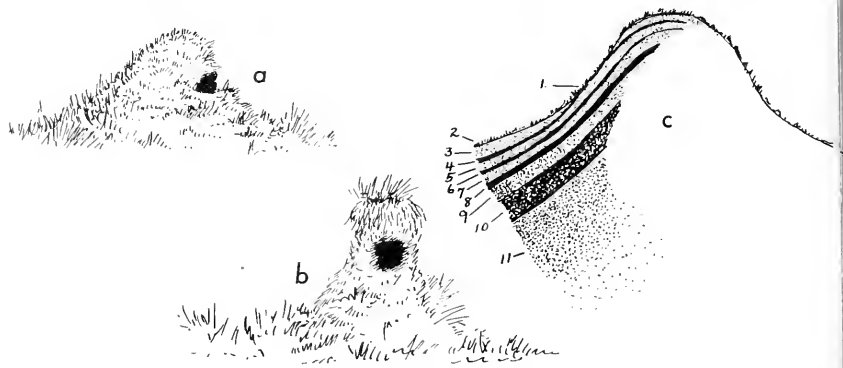


FIGURE 23.—Mounds on Kavalga Island (July 1937). *a* and *b*, undisturbed mounds. *c*, cross-section of a mound: 1, wind erosion to black soil; 2, vegetation on surface; 3, lava sand $2\frac{1}{4}$ inches; 4, black earth $\frac{3}{4}$ inch; 5, rotted moss $1\frac{1}{4}$ inches; 6, black earth $\frac{1}{4}$ inch; 7, rotted moss 2 inches; 8, black earth 1 inch; 9, rotted moss $2\frac{1}{2}$ inches; 10, black earth $4\frac{1}{2}$ inches; 11, rotted moss 12 inches plus.

to initiate the formation of the so-called bird mounds. Possibly, the creation by the wind of these miniature dunes, together with the perching of birds thereon, are both involved in the formation of these mounds.

Wind erosion is very severe on some exposures. In places, the wind had eroded the soil in troughs, undermining the vegetative turf to form a crude type of terracing. The woody roots of crowberry had been exposed and were already supporting a thin coating of lichens. With such constant wind action, one wonders how the vegetation became established in the first place. As shown in part *c*, wind erosion apparently had affected only the outer layer.

Marine vegetation is well represented by the kelp beds, which consist of a considerable variety of seaweeds that are prevalent throughout the Aleutian district. The kelp is, of course, the habitat of numerous marine organisms, and during the summer it furnishes a favorite habitat for the sea otter. These kelp beds disappear in the winter.

The oceanic climate of this region, the high humidity and precipitation, and the prevalence of strong winds have combined to shape the vegetative complex that we find in the Aleutian district. In turn, this complex, together with climatic conditions, topography, and the rich marine fauna, has influenced the composition of the indigenous fauna.

Birds

An effort was made to ascertain the Aleut names for birds and mammals. There are difficulties in such an undertaking, because one must be certain that both investigator and native informant are talking about the same bird. To make sure of this, a description of the bird and its calls and habits was supplemented with a colored illustration by Allan Brooks, which was obtained from the National Geographic Magazine, and in numerous instances actual specimens were used for identification. In spite of all these precautions, it was necessary to guard against confusion in the minds of the natives because not all of them know their birds perfectly. This is particularly true of the more eastern communities, which are farthest removed from a primitive way of life. The most accurate information was obtained from the Attu people living at the extreme western end of the island chain.

There also is difficulty both in accurately *hearing* names spoken by natives, and in *writing* them adequately. Not being familiar with the technique of the ethnologist, I have used the English alphabet to represent the sounds of Aleut words as closely as possible. The endings of Aleut words, or syllables, are also a problem, because they are very soft, often somewhere between *h* and *ch*, and sometimes have a soft *r* sound included. Final *ch*, as used here, is the same as in the German *Buch*. *R* is guttural, glided over, and sometimes is accompanied by an *h* to emphasize this quality. *I*, as in "it." *E*, as in "let," unless marked long. *A*, as in "Ah."

There are at least three Aleut dialects, which are indicated here as Attu, Atka, and Unalaska. When available, names from Alaska Peninsula, recorded by Wetmore or others, are included. Stejneger's names from the Commander Islands are also given (most of these names are Russian, but some are Aleut). Jochelson has listed a few names, but usually he did not designate the dialect or the exact species. Some of his names cannot be identified; however, only names that are generally accepted are used here. A few names in Russian and Chukchi, from the mainland of Siberia, are also given.

Without doubt, the Aleut language will disappear, and it is worthwhile to record the names that these people applied to the species in their native fauna. Too often, the professional ethnologist obtains only the obvious and generalized terms applied to a fauna; however, primitive societies clearly distinguish various species, almost as precisely as the scientist.

Family GAVIIDAE

Gavia immer: Common Loon

Attu: *Kah-goó-gieh*

Atka: *Kri-guch*

Qíguux (Jochelson)

The common loon, often observed on salt water in winter and in migration, usually is found nesting in interior lakes and ponds rather than in coastal marshes, but it also breeds throughout the Aleutian district. In this connection it is interesting to note that it does not occur in the Pribilofs.

Bones of this loon have been identified from Kodiak Island and from Little Kiska (Friedmann, 1935, 1937). A specimen was taken by Bretherton on Kodiak (1896), and the bird was reported by Chapman at Seldovia (June 30, 1903). Dall (1873) reports a "*Colymbus torquatus*" at Simeonof Island, in the Shumagins, on September 2, 1873, and further reports (1874) that it breeds on Kiska and is abundant on Amchitka. On July 23, 1925, I noted a pair of common loons, probably nesting, on a pond near Izembek Bay, near the west end of Alaska Peninsula.

In 1936, our party saw one of these birds (probably a migrant) on May 11, near Ushagat Island of the Barren Islands group, and on May 23, in Nushagak Bay, we saw six or more. The greatest number of these loons was found on Adak Island, though we also saw them on Amchitka, Kanaga, and Kiska. In 1937, at least 3 pairs were found on Agattu, and on June 17 of that year we found at least 2 pairs on Semichi Islands, each with 2 small downy young. In this instance, when we disturbed the adults, a glaucous-winged gull swooped down and carried off one of the young.

Dall reported that the common loon does not winter in the Aleutians, and Mike Hodikoff, chief of Attu Village, stated that it arrives at Attu Island in April and departs in October. However, during the years 1940 and 1946, Gabrielson found these loons on various islands as far west as Atka in midwinter, and in early spring and summer they were "common" or "plentiful" in numerous localities throughout the entire Aleutian district.

Also, Cahn (1947) found this loon "not uncommon in winter in Captains and Makushin Bays" of Unalaska Island, and he noted it also in Iliuliuk Bay; the latest date was March 3.

***Gavia adamsii*: Yellow-billed Loon**

Russian, Commander Islands: *Bolschoj gagara* (Stejneger)

Russian, latitudes of Yana: *Gagara*

Bolschaja gagara (Pleske)

Chukchi: *Uvanketsjouku* (Palmén)

It is extremely rare in this district. Herbert Friedmann (1934, 1935, 1937) has recorded bones of the yellow-billed loon from middens on Kodiak Island, on Amaknak (near Unalaska), and on Little Kiska Island in the western Aleutians. A specimen was collected at Kodiak by Bischoff in 1868, and Fisher obtained an adult male in 1881.

We did not observe this species on our expeditions, but the chief of Attu seemed to recognize pictures of the bird and said it occurs in his home area occasionally. Stejneger (1885, 1887) considered it to be a rare winter visitor in the Commander Islands, where he obtained one specimen and saw another. The bird he obtained was found on glare ice, unable to rise; evidently, it had mistaken the ice for water.

According to published accounts, this loon migrates along the Alaskan coast, from southeastern Alaska, west and north through Bering Strait. Presumably, the fall migration is the reverse of this. Several specimens are recorded from the Pribilofs (in May and August) as transients. In the spring of 1924, I obtained a specimen from an Eskimo at Hooper Bay and was informed that these loons pass that point in migration. It is likely, however, that the yellow-billed loon migration is not confined to the Alaskan coastline. In the autumn of 1924, several natives along the Koyukuk River in interior Alaska assured me that the yellow-billed loon passes through there in migration, though it does not nest there. They seemed well acquainted with the species as it was described to them, having particularly noted the light-colored bill. Therefore, the yellow-billed loon, nesting in the far north, is widely scattered in migration and occurs as a transient in the Aleutian, Commander, and Pribilof Islands.

***Gavia arctica*: Arctic Loon**

Gavia arctica pacifica

Russian: *Gagara*

We could obtain no Aleut name for this species. The Russian name for loon in the general sense seems to have been adopted

by the Aleuts, so that we find Bretherton (1896) and Turner reporting different forms of this word as the Aleut name for loon in general, and Nelson applying it to the red-throated loon.

The Arctic loon is widely distributed, nesting commonly on parts of the coastal plains of Bering Sea and the Arctic Ocean, as well as in many inland localities. It is quite common on the eastern portion of Alaska Peninsula, but it becomes exceedingly rare to the westward, as the following records show.

Bretherton and Bent report them nesting on Kodiak Island, and Cahalane (1943) found them to be common in the Kodiak-Afognak group in 1941. Friedmann (1935) records bones at various levels in archeological diggings on Kodiak, this indicating a regular occurrence over a long period.

Writing of his observations on the Alaska Peninsula in 1940, Cahalane (1944) says,

We found this species common on the Naknek River September 3, and at Brooks Lake September 9. . . . On the western shore of Shelikof Strait, I recorded loons as "common" between Amalik and Katmai Bays, October 4, and "abundant" on the following day in Amalik and Kinak Bays and Geographic Harbor.

He also observed them off Cape Nushagak, October 7, but he adds, "They were absent from the interior of the Alaska Peninsula, even where suitable habitats existed."

These observations were made chiefly in the migration period, when Arctic loons are strikingly abundant along the Alaskan coast. On May 18, 1937, as we were approaching Valdez, Pacific loons were scattered widely over the water of the fjord. We counted at least 75 at one time. One loose flock contained 50 loons.

In 1940, Gabrielson observed 30 or more pairs, as well as scattered individuals, on Kvichak River, July 23, and he noted 2 of these birds at the upper end of Iliamna Lake on July 24. On July 7, 1946, he noted a loon at Port Moller.

Jaques (1930) found them to be common near Port Moller, June 1-23, 1928. On May 29, 1936, I noted at least eight pairs, apparently preparing to nest, among the ponds bordering the lower reaches of Ugashik River, but they are scarce at the west end of the peninsula.

Farther west, these loons are less numerous. Among the Aleutians proper, we did not identify a single Arctic loon during two seasons of extensive field work and a third season of hasty reconnaissance. The chief of Attu Village did not recognize pictures of the bird and declared that no such bird occurs there. Donald H. Stevenson, former warden in the Aleutian Islands National Wildlife Refuge, reported them as "not common." His only spe-

cific record is the mention of two birds that he saw at Unalaska Harbor, October 15, 1920, which he thought were of this species.

Austin H. Clark (1910) mentions only one bird, which was seen on a lake on Agattu Island in 1906.

Turner, however, reported this loon, under the name of *Urinator pacificus*, as a common breeding bird in the Near Islands (1885), and, later (1886), he specifically reported one at Attu in the winter of 1880-81 and said that they nested commonly on Semichi Islands. Using the name *Urinator arcticus*, he said that this species was to be found among the Aleutians at any time of year, and he mentions seeing one at Amchitka Island in June.

These reports of Turner are rather surprising, and certainly they are not in accord with more recent findings. We had abundant opportunity to examine Agattu, Semichi, and Amchitka Islands, which were specifically mentioned by Turner, and though we found the common loon and red-throated loon, we did not see an Arctic loon. Stejneger did not record it for the Commander Islands, and it has not been recorded for the Pribilofs.

Gavia arctica viridigularis is known to be an occasional Old World straggler from Siberia to Alaska, and it has been recorded on the Pribilofs. Turner recorded two forms for the Aleutians, therefore it might be expected that *viridigularis* has occurred among those islands. However, in view of the confusion that has existed over the identity of the American forms of this loon, and because of its complete absence from the Aleutians, in recent years at least, a reported occurrence should be well authenticated before being accepted.

Gavia stellata: Red-throated Loon

Attu: *Ka-ka-dra-cha* or *Ka-da-dra-ka*

Atka: *Ka-kach*

Russian, Commander Islands: *Gagara* (Stejneger)

Russian, latitude of Yana: *Gagara* (Birula); *Malaja gagara* (Birula)

Chukchi: *Jouku* (Palmen)

As previously mentioned, the Russian word "gagara" is used by natives in various parts of coastal western Alaska. This, and the Aleut names, are imitations of the call of this loon.

The red-throated loon is the most abundant and widespread loon in the North, especially on coastal areas, and it occurs on both shores of Bering Sea. On the basal portion of Alaska Peninsula it appears to be less abundant. Neither Gabrielson nor Cahalane reported seeing it there, although they observed the

Pacific loon. We did not observe them there on our expeditions. Osgood (1904) records a pair on Chulitna River, August 12, 1902, and he observed a few others "at comparatively long intervals" on the Chulitna and Kakhtul Rivers; however, he adds that "they were far exceeded in numbers by the Pacific loon." McKay had collected specimens at Nushagak, and Friedmann has recorded the bird from Kodiak Island.

At the western end of Alaska Peninsula, however, red-throated loons were abundant. They were noted in some numbers on Izembek Bay in 1925. Turner (1886) found them to be abundant in the Aleutians and records them nesting on Atka, Semichi, and Agattu. We found these loons to be plentiful on Semichi, Agattu, and Amchitka, and we noted them on Sanak, Adak, Tanaga, Kiska, and Attu. Gabrielson records them on Attu, Amchitka, and Izembek Bay. Friedmann and Cahn also recorded the bird from Unalaska. They are present on all islands that bear suitable nesting ponds, and many of these red-throated loons spend the winter in the Aleutians.

Stejneger and Hartert report this loon as "abundant" and breeding "frequently" in the Commander Islands. Clark also noted a pair on Bering Island in 1906.

Family PODICIPEDIDAE

Podiceps grisegena: Red-necked Grebe

Podiceps grisegena holbölli

Friedmann (1935) records a bone, as well as several skins, from Kodiak Island. Cahalane (1943) recorded these birds as numerous in Uyak Bay and recorded a few in Kupreanof Strait. He also observed 2 birds on Brooks Lake, in the Katmai region, on September 9, and he observed 4 or 5 on the lower Naknek River on September 28. He stated, "On Shelikof Strait, the species was abundant between Katmai and Kinak Bays on October 4 and 5, and off Cape Nukshak on the 7th."

On May 29, 1936, we found one of these birds in a pond, apparently nesting, near lower Ugashik River, and another was swimming in the river.

A little farther west, in ponds near Port Moller, Jaques (1930), reports several, June 4 and 20, 1928, and Gianini (1917) observed several at Stepovak Bay in June 1916.

On April 28, 1925, I obtained a specimen at False Pass, at the extreme tip of Alaska Peninsula, and on July 21, 1925, I found an adult with two young in a pond near Moffet Cove, at

the east end of Izembek Bay, thus positively establishing the species as a nesting bird that far west. The bird was heard calling in the evenings.

In 1942, Gabrielson observed this grebe at Cold Bay, and on October 20, 1943, he obtained a specimen at Kodiak and obtained two more in September and October 1946.

There are a number of records for Unalaska. Turner mentions two specimens from there. There is a specimen in the National Museum that was taken by Dall at Unalaska, December 14, 1871, and Donald H. Stevenson informed me that this grebe occurred on the salt water at Unalaska, chiefly in the fall. Laing (1925) also reports it at Unalaska and at Atka.

More recently, Cahn (1947) reported this grebe as not uncommon at Atka in November, December, and January.

There are a few records of the red-necked grebe west of Unalaska, though we have no positive data on nesting. Taber (1946) observed a flock of about 50 at Adak Island on November 25 and observed another large group December 16—this group disappeared by December 25. These sightings were on the salt water of Bering Sea. On June 18, 1936, we observed a pair as they arose from the salt water near the northeast shore of Seguam Island. We have no record of its occurrence west of Adak, but Stejneger (1885) described it as a rare straggler in the Commander Islands, where he obtained a specimen. Hartert also (1920) considered it a straggler in the Commander Islands, where he obtained three specimens.

Podiceps auritus: Horned Grebe

This little grebe is found sparingly in the Aleutian district, and there is no evidence that it nests there. Friedmann (1935) found osseous remains in a collection of bones from Kodiak Island and lists nine specimens taken there, most of which were taken in the winter months. On October 1, 1940, Cahalane (1943) recorded several grebes in Viokoda and Terror Bays, Kodiak Island. Referring to the Katmai region of the Alaska Peninsula, he reports one horned grebe on Brooks Lake, September 9, 1940; he found them scarce west of the Aleutian Range. On the east side, however, he found them abundant and observed "great numbers" in early October along the Shelikof Strait coast of Katmai National Monument, as well as in most of the inlets from Katmai to Kinak Bay. Osgood (1904) recorded several small grebes, assumed to be this species, at Becharof Lake, October

6-7, 1902, and McKay obtained a specimen at Nushagak, June 21, 1881.

Gabrielson noted two specimens at King Cove, March 25, 1942. He obtained a specimen at Kodiak in October 1944 and obtained three more in 1946.

On our expeditions we saw no horned grebes in the Aleutian Islands, but we observed several at Port Chatham, Kenai Peninsula, on May 6, 1936, and observed two at Ushagat Island, of the Barren Islands group, 5 days later.

However, there are a few records for the Aleutian chain. Laing (1925) saw about a dozen horned grebes at Unalaska, presumably in early spring judging from his itinerary. Bailey (1925) records two specimens taken by Hendee at Unalaska, September 21, 1922. Cahn (1947) reports on this bird at Unalaska: "Seen sparingly in any of the bays during December and January, always solitary and rather shy. December 2, 1943, and February 21, 1946 are the extreme dates of record." Turner (1886) reports seeing a grebe at Attu that he suspected was *auritus*, but states that he did not observe it in the Aleutians in the summer, "and at no time to the westward of Unalaska Island." However, on July 1, 1946, Gabrielson noted one horned grebe on Amukta. Taber (1946) noted them in small numbers on the salt-water lagoons at Adak Island throughout the period of his observations and mentions specifically the dates November 22 and January 9.

The bird noted by Turner at Attu might well have been *auritus*, because Stejneger (1885) obtained a skeleton of one in the Commander Islands, though he considered it rare. Hartert (1920) also records two horned grebes wintering on the Commander Islands.

There is no evidence that the horned grebe nests in the Aleutian district, but, according to these records of its occurrence, it evidently winters in those waters.

Family DIOMEDEIDAE

Diomedea nigripes: Black-footed Albatross

Attu: *A-la-gri-gich* or *Ah-lu-gri-gich*

Atka: *A-ga-lig-ahh* or *Ah-ga-lig-ach*

Agligax (Jochelson)

This is the albatross common in the North Pacific during our summer season, at least from May to October. The earliest dates that I have noted this bird were April 20-23, 1925, in the open

sea from Ketchikan to the western part of Alaska Peninsula. The black-footed albatross occurs commonly in the Gulf of Alaska; it was observed in the vicinity of Kodiak, and frequently along the Alaska Peninsula and the Aleutian chain, though it rarely was observed near land. This albatross also was seen in the waters of Bering Sea, just north of Alaska Peninsula and the Aleutians. We found these birds particularly plentiful at the Petrel Banks, north of Semisopochnoi Island. Laing (1925) reports them "about 100 miles north of Kyska Island." Though these birds were usually far offshore, there are two places where they came near land—Seguam and Kiska Islands.

Nelson (1887) was of the opinion that the northern limit of distribution was considerably south of the Aleutians and quotes T. H. Bean to the effect that latitude 51° marked the northern limit. Turner (1886), on the other hand, stated that the species is quite a common bird in some localities north of the Aleutian Islands. In Bristol Bay in June, 1878, I saw numbers of them in the vicinity of Cape Newenham . . . Toward the western Aleutian Islands they are not common but are frequently met.

It is not certain that this albatross ranged beyond latitude 51° N. in the past, nevertheless it does so today, and, at least in the Bristol Bay region, it reaches nearly to latitude 58° N. Further consideration of albatross distribution will be found in the discussion of the short-tailed albatross.

An interesting story was told to me by several old natives at Atka Island. They insisted that albatrosses used to nest in small numbers on Bobrof Island, on top of the mountain, *in winter*. Judging by the descriptive gestures of one informant, icicles formed on their beaks while the birds were incubating. This is indeed a strange legend. It seems unbelievable that any of these albatrosses could have tried to nest in the Aleutians, but at least these Aleuts were talking about the proper nesting season.

If I correctly understood the information given me by the Aleuts, they do not distinguish two species of albatrosses in the islands, possibly assuming that *nigripes* is the young of *albatrus*, in which case this story might more properly apply to *albatrus*.

A female *D. nigripes* collected June 17, 1936, near Seguam Island weighed $6\frac{1}{4}$ pounds and had a wingspread of 85 inches.

The black-footed albatross is said to feed on whatever becomes available at the surface of the water, including refuse from ships—this is true for our experience in the Aleutians. On one occasion, a dozen were following our ship; they were attracted by fish offal thrown overboard by the sailors, who

were cleaning codfish. At times, we saw the albatrosses, accompanied by shearwaters and auklets, feeding in tide rips.

Cottam and Knappen (1939) reported on two stomachs of the black-footed albatross from the Aleutians. One stomach contained fish (mostly Scorpaenidae), 35 percent; remains of 6 or more squids, 55 percent; sea urchin, 2 percent; brown algae, 8 percent. The other stomach contained fish (mostly Scorpaenidae) 92 percent; Gammaridae, 1 percent; brown algae, 7 percent.

In 1941, Loye Miller (1942) found, in the course of experimental food studies off the coast of southern California, that "the greatest gooney appeal was provided by bacon drippings which had congealed to semisolid state." For better handling of this bait material, it was mixed with puffed rice before cooling. He remarked further that "Bacon grease seems to throw the birds almost into a frenzy. Some of them rushed right up under the overhang of the poop."

Miller summed up his findings as follows:

The most attractive bait discovered is animal fat. Bacon fat was superior to beef suet. The semisolid gelatin settling out from roast beef drippings was of no interest at all and was neglected after the first taste. Taste buds in the tip of the bill appear to be highly sensitive and discriminative. The turpentine-linseed flux of paints used in marking is very repugnant and seemed to be recognizable by odor before actual contact was made. I was repeatedly impressed by their seeming acuity of olfactory perception.

He noted, further, that in subsurface feeding the albatross would tip up, or actually submerge to a depth of at least 2 feet with wings partially spread. This suggests a trait similar to that of the slender-billed shearwater, though the latter is capable of descending to a depth of many fathoms.

Diomedea albatrus: Short-tailed Albatross

Kodiak: *Kay-mah-rye-erk* (Nelson)

As mentioned above, the Aleuts apparently do not have separate names for the two species of albatross. At least one Aleut identified *albatrus* as the adult bird, *nigripes* the young. Thus, the Aleut nomenclature is confusing, and the names already given for the black-footed albatross might apply equally well to the short-tailed albatross.

We are concerned here with what appears to be an extinct bird. We had thought that a few remained in the Aleutian district, but when the one specimen we collected in 1937 proved to be *immutabilis*, serious doubt was thrown on the possibility that any of the light-colored birds were *albatrus*.

Bering Sea appeared to be the particular domain of the short-tailed albatross in summer. Nelson (1887) defined its summer range from 50° N. latitude northward through Bering Sea as far as Bering Strait. He reported them in the Aleutians and quotes T. H. Bean as having found them around the Gulf of Alaska, but he considered the mouth of Cook Inlet and the vicinity of the Barren Islands as their favorite resort. Nelson "found them very common between the islands east of Unalaska" during May 1877. Turner also found them plentiful among the Aleutians, as well as at Cape Newenham in the Bristol Bay region. Friedmann, who has examined bones unearthed from ancient village sites on Kodiak, Amaknak, Unalaska, Little Kiska, Atka, and Attu Islands, found numerous remains of this albatross, but he found no remains of *nigripes*. They are reported to have been abundant in the vicinity of the Pribilofs when whalers were active there, and they became scarce when whaling was abandoned.

Austin H. Clark (1910), writing of his expedition in 1906, reported that—

We first saw this species about 100 miles east of Unalaska on the day before our arrival at Dutch Harbor. On the next day, two were seen near the Aleutian chain, one of them within five miles of the islands. Two more were seen between Attu and Copper Island, on June 12; on the 20th one was observed about 20 miles off the Kamchatka coast, and the next day another in the Okhotsk Sea, near the mouth of the Aangan River. On October 1 this species was very common about the southern end of the Kurils, on both the inside and outside of the chain.

Clark believed that the birds were more abundant than these notes indicate, because they are very shy and not readily observed.

Stejneger (1885) reported that the species is not a rare visitor to the Commander Islands, and he, too, considered them "remarkably shyer than *D. nigripes*."

Nelson (1887) also considered them shy, though "natives of Alexandrovak sometimes spear them from their kayaks."

According to Otto Geist (in Murie 1936), in earlier days, near St. Lawrence Island, these birds ". . . were often caught on the pack ice near the island. This was often easy because the birds were very fat and could hardly make their way in the air."

Today, the short-tailed albatross is rare, or extinct. Although Nelson had reported it as common in Bering Strait and noted it at St. Lawrence Island, in 1887, Otto Geist, in the course of archeological work on St. Lawrence Island from 1926 to 1925, did not see this bird. However, bones were found in excavations,

and natives stated that it had been present in considerable numbers at one time (Murie 1936). Bent (1922) reports that he did not observe this bird during a cruise along the Aleutian chain in June 1911. Laing (1925) observed two whitish albatrosses at a distance in the Kuriles in 1924, but he saw no others during two crossings of the North Pacific. In the course of many voyages across the Gulf of Alaska after 1920, I never saw a short-tailed albatross. In 1936 and 1937, we cruised about the Barren Islands several times and saw none, although this had been considered to be a favorite area for them by T. H. Bean.

It appears, then, that at one time the short-tailed albatross was plentiful in the Aleutian district and Bering Sea region in general, but that the population had suffered a drastic reduction in numbers, probably about 1900 or a little later.

Austin (1949) has indicated that Japanese fishermen and plume hunters were responsible for the destruction of this species on its nesting grounds. But it seems that the decline began long ago. Did the plume trade affect this species, as it affected the Laysan albatross? Whatever the facts might be, the concentrated nesting of a species on one or on a few small islands constitutes a serious hazard to its perpetuation.

There is a puzzling problem in distribution revealed by Friedmann's work on bones found in ancient village sites. All bones found on the Aleutian Islands proved to be those of *D. albatrus*, and not those of *D. nigripes*. This indicates that in earlier times *D. albatrus* was the common bird of the region and that *D. nigripes* was scarce or absent, at least close to the coast. Even at Kodiak Island, though there were some bones of *D. nigripes*, Friedmann found numerous bones of *D. albatrus*, thus confirming early reports of this bird's abundance in those more easterly waters.

Friedmann's findings from midden material, therefore, lend some support to Bean's designation of 51° N. latitude as the northern limit of range of *D. nigripes*, even though Turner states that he saw this bird as far north as Bristol Bay. Otherwise, at least a few bones of this bird would have appeared in middens.

In his study of the distribution of these two forms off the California coast, Loye Miller (1940) did not find *nigripes* in channel waters near the coast, but found them farther out; however, there is evidence that *albatrus* did occupy the channel waters chiefly. He quotes Willett to that effect, and remarks: "The two birds seem to have divided the territory between them, as it were." He states, "I have taken from the channel Indian

mounds great number of their [*D. albatrus*] bones, but never any of *D. nigripes*."

Here, we have a parallel with the situation in the Aleutians. In both areas (California and the Aleutian district), only the short-tailed albatross occurs in middens, except for some overlapping of the two species at Kodiak. Is it possible that in early times *D. albatrus* was the species that came closer to land and was therefore more available? Apparently, in the north, too, these two species had "divided the territory between them."

We need to know more about the whitish birds being seen today in the Aleutian district. Are some of these birds the remnants of the vanishing short-tailed albatross, or are they all Laysan albatrosses? If they are the latter, will that species eventually take over the range of *albatrus*?

Turner, in writing of the short-tailed albatross, mentions two birds that were killed at Attu in the latter part of March, 1881. He claimed that "this species passes the winter in this locality and may be found, during very severe weather, about the western end of Attu." And he believed that it nested somewhere in that region, which also was the belief of the Attu chief at the time of our visit there.

Nelson mentions a specimen, obtained by Dr. Bean, that had a wing spread of 88 inches.

Diomedea immutabilis: Laysan Albatross

We had not suspected that this bird occupied the Aleutian district until a specimen, collected near Ulak island, July 31, 1937, eventually proved to be of this species. On the field trip, we had assumed this specimen to be *D. albatrus*, and on the basis of that assumption we had recorded our observations on white albatrosses as *albatrus*. However, because Oliver Austin has pointed out the extreme scarcity of specimens or certain records of the short-tailed albatross in recent years, and suggests its probable extinction, there must remain doubt about the records on our expedition. This, of course, throws much doubt on the possible existence of *albatrus* in the Aleutians today, but I shall record our observations for what they are worth, keeping in mind that the species observed was in doubt in each instance.

In these seasons of field work, we occasionally saw white-colored albatrosses throughout the Aleutian islands. In 1936, we saw one between Seguam and Chagulak Islands on June 21. On July 31, we saw another sitting on the water between Buldir and

Kiska Islands, and, later in the evening, we saw one nearer to Kiska Island.

In 1937, we saw them oftener: On May 31, 1 north of Seguam; on June 2, at least 3 west of Atka; on June 3, several near the Petrel Banks and 2 between Kiska and Segula; on June 17, 1 east of Semichi Islands; on June 18, 1 east of Buldir; and, on July 31, 1 specimen was taken at Ulak Island, 178° W. longitude.

In 1938, Scheffer reported the following: On August 11, 4 were seen south of Atka, 3 of these in 1 group; August 14, 1 was seen south of Khwestof; August 17, 1 was seen northwest of Semichi; August 25, 1 was seen south of Tanaga; and, on September 23, 1 was seen in the Gulf of Alaska off Cape Hinchinbrook.

On June 9, 1940, Gabrielson observed a white albatross following the ship in the Gulf of Alaska. In 1941, he saw the following: February 3, 1 was sighted near Amchitka, and on February 7, 2 were seen near Amchitka Pass; June 24, 1 was seen at Tanaga Bay; June 27, 1 was seen near Amchitka; and on July 22, 2 were seen near Attu.

Were all these birds the Laysan albatross, the same as the one specimen collected, or were some, or most, of them *albatrus*?

The specimen collected weighed 4 pounds 6 ounces. Its length was 30½ inches, and wingspread was 77¾ inches.

During 1947, 1948, and 1949, on cruises for the Fish and Wildlife Service in North Pacific waters, Karl W. Kenyon (1950) made noteworthy observations on albatross distribution. Alert to the confusion in sight identifications of light-colored birds, he gave close attention to field characteristics.

On October 13, 1948, Kenyon saw a Laysan albatross about 230 miles east of Kodiak, and Captain Carlson said that during 5 round trips to the Pribilofs he often saw 1 or 2 of the white albatrosses with the black wings and back at about this same place while crossing the Gulf between Kodiak and Cape Spencer but not in the Bering Sea.

Kenyon records a number of other sightings in the North Pacific, but south of the Aleutian chain. He received parts salvaged by Elmer C. Hanson from two dead birds at the Army air base at Amchitka, June 5, 1948, which were sufficient for identification as Laysan albatrosses.

Family PROCELLARIIDAE

Puffinus tenuirostris: Slender-billed ShearwaterAttu: *A-la-mach*Russian, Commander Islands: "*Tschornij Glupisch*" (Stejneger)

In summer, the slender-billed shearwater is distributed widely over the North Pacific and throughout the Bering Sea. On the Gulf of Alaska, we observed them often, singly or in small groups. Some of the birds that we thought to be slender-billed shearwaters may have been the sooty shearwater, *P. griseus*.

At Kodiak Island, however, *P. tenuirostris* has been identified, and we obtained a specimen there in 1936. Shearwaters, believed to be this form, were noted May 10, 1936, near the entrance to Cook Inlet; one was noted near Barren Islands on May 11; they were numerous between Sutwik Island and Cape Kumlik on May 14, and there was a flock at the entrance to Chignik Bay. On May 15, a few were seen near Nagai Island, in the Shumagins; on August 29, some were noted near Simeonof Island in this group, and some were noted between that point and the mainland; next day, between Kupreanof Harbor and Chignik, more were sighted. Again, on September 1, we passed through dense masses of shearwaters north of Karluk, in Shelikof Strait. These birds occur also on the north side of Alaska Peninsula and were seen as far east as the entrance to Bristol Bay.

Slender-billed shearwaters occur all through the Aleutian Islands, with their center of abundance apparently at the eastern end of the chain, among the Fox Islands. Unimak Pass is a favorite feeding place, with large concentrations also observed in other places as far as the western end of Umnak Island.

Many published accounts describe the hordes of shearwaters observed at various times. Arnold (1948), during an hour and a half, June 9, 1944, recorded 160,000 shearwaters in Unimak Pass. Probably the most outstanding was the flock noted by Scheffer in Umnak Pass on September 3, 1938. He says, in his field report:

In the Pass we saw the greatest concentration of shearwaters that we have ever seen in the Aleutians. Captain Sellevold remarked that it was the greatest in his experience. The Pass is 3 miles wide. We estimated that the raft of birds extended for 25 miles by 2 miles wide, or an area of 50 square miles. From 5:30 a. m. to 8:00 a. m. the ship passed through dense masses of the birds, about half of them on the water and half flying back and forth . . . At 5 p. m. the birds had thinned out by more than half.

Apparently this bird is much less abundant to the westward, though in 1941 Gabrielson saw "thousands" at Attu and "several

thousands" at Atka. Stejneger (1885) considered it rather scarce in the Commander Islands. It appears to be relatively scarce in Bering Sea north of the Aleutian chain, though it does range far northward. In 1944, Gabrielson saw "thousands" between St. Matthew and Nunivak Islands and a "scattering of birds" between St. Matthew and Adak. Nelson (1887) mentions a specimen obtained by Dall in Kotzebue Sound in 1899 and adds, "just northwest of the straits, the last of August, 1881, quite a number of dark-plumaged birds were seen, with many Rodgers's fulmars, which appeared to differ in size and appearance from the latter, and which I am inclined to think belonged to this species." Nelson records the Eskimo name for the slender-billed shearwater in Kotzebue Sound, thus showing that it must habitually occur there. A number of specimens have been taken at St. Lawrence Island in recent years (Murie 1936). The Eskimos of this island have certain taboos in connection with eating the bird. A specimen is recorded from the Pribilofs.

According to Bent (1922), the northward migration is mainly in the western Pacific, and the southward migration is in the eastern Pacific. He says they occur in the Okhotsk Sea, as well as in Bering Sea.

Slender-billed shearwaters will feed on refuse from a ship's galley. On August 10, 1937, three of these birds came up to the stern of our ship as we drifted in the fog. They readily ate bits of beef and fish thrown overboard. They would dive for pieces that sank, keeping wings half opened, but propelling themselves entirely by their feet under water. Apparently they can go to a considerable depth; they would sometimes pursue a baited fishhook thrown in for cod and remain underneath for a considerable length of time.

On two occasions we watched a shearwater pursue an injured codfish that had been discarded by the sailors as being wormy; as the fish wiggled feebly through the water, the bird pursued it and snipped out pieces of the gills from the still-living fish.

But probably the most important food of the shearwater consists of crustaceans and other small invertebrates. On numerous occasions they joined with fulmars and auklets in the turbulent tide rips, where all were busy feeding. Sample tows taken in such places revealed a greater quantity of plankton than in adjacent areas unoccupied by birds. In this connection, it may be significant that the center of abundance of shearwaters in the Aleutians today coincides fairly well with localities where whales were once particularly abundant—in the Fox Island group. Per-

haps both birds and whales were attracted by the swarming invertebrate life.

Cottam and Knappen (1939) reported on 10 stomachs of this species that were collected in Alaska. They tabulated the total contents as follows:

Amphipods, 13%; schizopods, 15%; undetermined crustaceans, 20.8%; squid (*Loligo* sp.) 16.1%; undetermined marine invertebrate flesh, possibly squid, 29.4%; and fish, 5.7%. Gravel was found in each stomach and averaged only slightly less than 40% of the contents.

In their summer range, the only foe of the shearwater that we could discover is the northern bald eagle. The shearwater furnishes one of the principal items of the eagle's diet, probably because of its great numbers. These birds also perish in storms, perhaps the storm mortality rate is higher than that caused by natural enemies. Early in September 1937 a heavy rain-storm was raging for several days about Unimak Island. While the storm was still at its height, we began to find dead shearwaters on a strip of beach. They finally totaled over 30; one bird was still alive. The birds from this one sample beach may have been representative of the destruction of birds over a large area. In 1925, I frequently found dead shearwaters on the beaches of Alaska Peninsula.

On May 31, 1936, as we approached Cave Point on Unimak Island, a lone shearwater was sitting on the water. C. S. Williams shot it for a specimen, and it was found to be poor in flesh. On June 30, 1937, Scheffer shot one that was in a similar condition near Rat Island. As it sat on the water, we noticed that it appeared to be "dumpy." Grinnell (1900) says, "On July 4th, 1899, I secured a single specimen about 4 miles off Cape Blossom. It was resting on the water not far from a small icefloe and was in an emaciated condition."

Certainly, there is a mortality element of some sort operating on the shearwater, as on other sea birds.

Occasionally, shearwaters come close to land. At least 1 was seen in Nelson Lagoon, and in 1925 they were noticed at the entrances to Izembek Bay, on the Alaska Peninsula, and at least 1 flew over the shallow bay. Some of the large flocks noted in the turbulent waters of various island passes are not far from the rocky points.

Chief Hodikoff, of Attu Island, declared that shearwaters formerly nested abundantly on Agattu Island and that a few were seen on Semichi Island in 1932. He said there were "not many" now since the introduction of blue foxes. He stated that

they nested "on level ground, some in clumps of grass" and that as soon as the young were able to fly they left their nesting grounds.

It is interesting to note that, about 1879, Turner was on Amchitka Island with some Attu natives, when they picked up a dead shearwater. The natives told him that the birds "breed plentifully in the Semichi Islands." Though the breeding range of shearwaters is now well established, perhaps we should not entirely ignore native information of this kind.

Puffinus griseus: Sooty Shearwater

According to the fourth edition of the Check List of North American Birds, of the American Ornithologists' Union, the sooty shearwater occurs in the Aleutian and Kurile Islands. On all of our expeditions, we scrutinized flocks of shearwaters in an attempt to identify this species among the predominant slender-billed shearwaters. Although we thought that we could see differences in some instances, positive identification was doubtful. But, in the series of specimens of shearwaters collected in the Aleutian district, a single specimen proved to be *P. griseus*.

Nichols (1927), speaking of his voyage between Seattle and the Aleutian Islands, says:

Of the sooty shearwater I have no satisfactory identification, but am of the impression that it replaced the generally common slender bill farthest off shore at a point midway between the islands and the coast, and to some extent at least on the east side of the Gulf of Alaska.

Pterodroma inexpectata: Scaled Petrel

Attu: *Le-vi-dré-che*

This petrel has a wide range, but we have little information on it in the southern Alaskan waters. There is a record for Kodiak Island, a specimen collected by Fisher, June 11, 1882, that served as the type of Ridgway's *Aestrelata fisheri*. Wetmore collected a specimen at the Alaska Peninsula, August 6, 1911, and while crossing from Cape Muzon to Unimak Pass he observed a number of birds that appeared to be of this form. On the same expedition, A. C. Bent also observed the bird in the North Pacific, while sailing to the Aleutian Islands, and Rollo H. Beck, who was a member of the expedition, took a specimen at Kiska Island on June 17.

Nichols (1927), speaking of seeing this petrel on his trip from Seattle to Nome, Alaska, says:

Seen in the Pacific on 1 day only, August 5, when midway between the islands and the west coast, noon position 53° 36' N., 145° 37' W. They were

frequent all day, singly and in small groups, a conservative estimate for the total number, 30.

We did not see this bird on our expeditions, but at Attu Island the native chief insisted that there was a *third* petrel, calling it *le-vi-dré-che*. He said that it is gray in color—if we understood him correctly—but that it is distinct from the forked-tailed and the Leach's petrels, with which he was also familiar and for which he had names.

The chief provided some native guides, and we visited two small islets, Cooper and Gibson Islands, which are adjacent to Attu. We searched diligently and hopefully, but we found only the other two species. Inasmuch as it is known to breed in New Zealand, and because the egg dates are "December 24 to January 7" according to Bent, one would not expect to find it nesting in the Aleutians. But in view of the Attu chief's confidence in the matter, there was a possibility that the bird may enter burrows to roost.

Pterodroma cookii: Cook's Petrel

Pterodroma cookii orientalis

A. W. Anthony (1934, p. 77) recorded a specimen of this petrel, positively identified, which was taken at Adak Island by members of the crew of the *U. S. S. Kingfisher*. It was 1 of 2 such birds that came aboard the ship, and the specimen saved had been sent to the San Diego Zoo in California, where it was placed in the collection of Louis B. Bishop.

Fulmarus glacialis: Fulmar

Fulmarus glacialis rodgersii

Attu: *Kil-u-ghoó-kin*

Atka: *Ah'-ga-luch*

Probably Russian Commander Islands: *Glupisch* (Stejneger)

The Atka name for fulmar should not be confused with their name for killer whale, which was recorded as *A'-ga-loh*, with shorter syllables.

Fulmars are common in the North Pacific and Bering Sea region, though in varying numbers. They are seen on the Gulf of Alaska, in small groups, in company with the black-footed albatross and shearwaters. We found them in Shelikof Strait, between Kodiak-Afognak Islands and the mainland, and farther west near the Shumagins. A few were seen north of the Alaska Peninsula, east to Bristol Bay, and north to Nunivak and Nelson Islands. They were more abundant among the eastern Aleutians,

and they are fairly prevalent throughout the chain, some having been noted at Wrangell Cape on the west side of Attu Island.

Arnold (1948) recorded a concentration of about 38,000 fulmars in Unimak Pass on June 9, 1944. Throughout the Aleutian district, the dark color phase predominates, though some concentrations of the light phase were encountered. On May 21, 1936, Cecil Williams estimated that 50 percent of the fulmars seen in Unimak Pass were light colored, and that most of those sighted on the north side of Unimak Island were whitish, though there were entire bands of dark ones.

It is interesting to recall that Nichols (1927) found "the dark phase to light phase about as 99 to 1" in Shelikof Strait; elsewhere in the Pacific, it was about 9 to 1; near Unimak Pass, the pale and dark birds "were in about equal numbers;" and in Bering Sea, they were almost all pale.

Nesting

Nesting fulmar colonies have been known in the Bering Sea region, on the Pribilofs, where light-colored birds are in the majority; on the Siberian coast opposite St. Lawrence Island; and at Copper Island, where light-colored birds are rare. Nesting places in the Aleutians had been suspected, but they had not been found. It was gratifying, therefore, to find several such colonies in 1936 and 1937, and in 1940 Gabrielson found other colonies east of the Aleutian chain.

In 1940 Dr. Gabrielson learned that Sea Otter Island, near Afognak, supports a colony of fulmars. This nesting colony would account for the fulmar flocks so often observed in Shelikof Strait. In the same year, on June 18, he found nesting colonies in the Semidi Islands, and says, "The enormous concentrations of Fulmars, for example, was a great surprise to us, as the colony apparently has developed since the previous exploration." In the Semidi group, he found the fulmars in "huge colonies" on Aghik and Choweit Islands, and there were fulmars also on Kateekuk, Anowik, Kiliktagik, and Suklik Islands. They were mostly of the dark color phase, with an occasional light-colored one.

In the Aleutians proper, we had found at least four nesting places. Among these, Chagulak Island is outstanding. As we approached this island on June 15, 1936, it loomed as a peaked mountain top rising sheer from the water. It affords nesting sites for a variety of sea birds, and a swarm of fulmars swirled above its top and milled about its slopes. On the cliffs of the south side there were small recesses in the red crumbly rock

strata. Each of these recesses was occupied by a fulmar, nesting with a single egg. They nested also on other types of ledges and on the grassy slopes all the way to the snow line.

On the same day, we found another large fulmar colony on the neighboring island of Amukta. These two islands have the largest and the principal nesting colonies of fulmars in the Aleutian chain.

In 1937, we found fulmars nesting in considerable numbers on the reddish cliffs of Segula Island (also known as Chugul), though this group was not nearly so large as those on Amukta and Chagulak.

Another nesting place is Gareloi Island. Natives had assured us that fulmars nest there, though we did not find the birds on the first trip. In 1937, however, we found them in limited numbers on the south side of the island. According to the natives, their numbers had been decimated, at least on all accessible ledges, since the introduction of the blue foxes. The volcanic eruption of 1930 also disturbed them; however, if the foxes were removed, this colony should increase.

Natives told us that the fulmars nest on outlying rocks at Unalga Island, southwest of Gareloi, but we found none there in August. They are also reported to nest on Agattu, but we failed to find them.

It is highly probable that a nesting colony will eventually be discovered in the general vicinity of Unimak Pass, perhaps on some isolated cliff or islet at Unimak Island, because fulmars are common in that area. A full schedule and bad weather prevented us from exploring that part of the Aleutian chain as thoroughly as we wished.

Food Habits

We had assumed that fulmars feed to a large extent on plankton, for we often found them congregated in tide rips, busily feeding. And Arnold (1948), observing a huge concentration of fulmars and shearwaters in Unimak Pass, found that they—

evidently were feeding on a type of reddish-orange water life. On occasion, when one of the birds was hard-pressed to leave the area in the immediate vicinity of the ship, it would turn its head down and to one side and regurgitate a reddish-orange liquid substance.

However, records show a great variety in fulmar diet, including refuse from ships.

A. W. Anthony (1895) has pointed out an interesting feeding habit of the fulmar off the California coast. Speaking of a large jellyfish that is abundant along that coast, he says,

I have often seen a fulmar sitting on the water by the side of a jelly fish, part of which it had eaten, so filled that it could scarcely move out of the way of the boat. Specimens shot while these *Medusae* are common. I have always found with the stomach filled with these alone, and a half pint of the slimy mass will often run from their mouths when lifted from the water by their feet.

I think the fulmars enjoy a monopoly of this diet, for I have never seen other species eating it, nor will gulls, nor any sea birds that I have observed, pay any attention to a fulmar that is eating a jelly fish though they all claim their share if the food is of a kind that they care for.

The abundance of the fulmars off this coast would seem to have some relation to the abundance of *Medusae*, since the winter of 1893-94 was noted for the almost if not entire absence of fulmars as well as jelly fish until some time in late February or March, when both jelly fish and fulmars appeared in small numbers.

This is quoted at some length because it reveals an important habit of the fulmar, which also was noted among the Aleutians, where a large brown jellyfish, *Cyanea capillata*, often proved an attraction to fulmars.

Mortality Factors

Aside from the danger from foxes on accessible nesting sites, the only other natural enemy on which we have information is the northern bald eagle. The fulmar appears to furnish an important item in the eagle's diet throughout the Aleutian Islands as a whole, though murrens and other species may dominate the diet of individual eagle pairs. The drain on the fulmar population by eagles could not be significant, in view of the great variety of birds on which the eagle preys. More important are man's activities, such as the raising of blue foxes. Dead fulmars are found on beaches, but, at present, it is hard to estimate the results of storms or disease. At any rate, we have several large flourishing colonies of fulmars, and those that have been depleted should increase again owing to the protection now being given.

Family HYDROBATIDAE

Oceanodroma furcata: Fork-tailed Petrel

Oceanodroma furcata furcata

Attu: *A-la-ma-gó Ké-kech*

Atka: *Kí-ki-tich-noch*

Russian, Commander Islands: *Sturmofka* (Stejneger) The Atka name is applied to both this petrel and to Leach's petrel.

In 1939, Grinnell and Test separated the forked-tailed petrel into two races, designating the southern form *O.f. plumbea*, whose range is said to extend northward to "the Alexander

Archipelago, just short of Cross Sound." Sitka birds proved to be intermediate, but closer to *plumbea*.

In looking over material from the Aleutian district, it is obvious that there is variation in the characters used by Grinnell and Test—size and color (light or dark)—and many Aleutian specimens are puzzling in this respect. A specimen from Kodiak is similar to the Aleutian group. One from Ugashik, on the north side of Alaska Peninsula, obviously is *furcata*. This also is true for two from Nushagak. But a series from Belkofski, on the Alaska Peninsula, are darker than other Aleutian specimens—fully as dark as a series from Forrester Island, Stephen's Passage, Sitka, and Icy Strait—though the Belkofski petrels are larger. Since we are dealing with average characters, it is clear that the birds from the Aleutian district, from Kodiak and Nushagak west to Attu Island, should be called *O.f. furcata*.

It is of interest to note that birds from the Commander Islands and Kamchatka are paler and (on the average) larger than those from the Aleutian Islands. A few from the Aleutians are equally large and pale, and one from as far east as Nushagak is identical with many of the Kamchatka birds. These birds bear out Grinnell and Test's statement of an increase in size and a color transition from dark to pale, in the populations from south to north and west. Probably, we should consider the Siberian birds as the culmination of this trend toward larger size and paler coloration, and, for the present at least, we should class them with *furcata* of the Aleutian district.

The forked-tailed petrel ranges widely over the North Pacific and Bering Sea and is the dominant species among petrels there. From May 29 to June 4, 1911, Wetmore found these birds common on the Gulf of Alaska. Friedmann (1935) records several specimens and eggs from Kodiak. Specimens have been taken at Nushagak by Hanna and Johnson and have been taken at Ugashik by McKay. We observed them in the Shumagin Islands and found them to be abundant throughout the Aleutian chain. Stejneger (1887) found them nesting in the Commander Islands.

Nesting of this species in Bering Sea proper has not been reported, though the bird occurs far northward. Nelson (1887) found the birds off Nunivak Island in June 1877, but he speaks of them chiefly as autumnal visitors, as far north as St. Lawrence Island, Bering Strait, and Plover Bay, Siberia. Two specimens were secured from Kotzebue Sound. According to Nelson, they lingered in Bering Sea even after the formation of ice, and the Eskimos told him that they were captured on the ice, near air

holes, in a weakened condition. He says that they were found on the lower Yukon, and that one was found about 75 miles up the Tanana River, near an air hole in the ice, late in November. These petrels are also recorded from the Pribilofs (Preble and McAtee 1923). Cahn (1947) reports from Unalaska: "Seen abundantly in the fall and winter far out in Bering Sea."

The Aleutians must be considered to be the stronghold of this petrel. We found them on most of the islands. Experience taught us that wherever we found petrel wings left by blue foxes, or petrel remains in fox droppings, it was safe to assume that the birds nested on the island.

The following islands were specifically noted as being nesting places for these petrels: Sanak group, Egg Island (in Akutan Pass), Uliaga, Kagamil, Chuginadak, Herbert, Yunaska, Chagulak, Amukta, Amlia (reported by natives), Atka (on Korovin Volcano, reported by L. M. Turner), Salt (until destroyed by fox raising), Kasatochi, Igitkin, Ulak, Bobrof, Tanaga, Ilak (reported by natives, but now destroyed by blue foxes), Gareloi, Semisopochnoi, Little Sitkin, Chugul (reported by natives), Kiska, Buldir, Agattu, and Attu. It is almost certain that the birds nest also on most of the other islands—on the Shumagins, and probably on other islands off the Alaska Peninsula. This list serves to show the uniform distribution of these birds.

It is well known that the forked-tailed petrel nests underground. It may make its own burrow, often as a side tunnel from the wall of the tufted puffin's burrow, or it may nest in natural cavities, such as those found in lava beds. Amukta Island furnishes a typical example, where the moss-covered lava formation had neat round holes through the vegetative crust leading in to irregular cavities beneath.

Food Habits

The forked-tailed petrel is said to skim the oil from the surface of the water near a wounded seal or whale, but we do not have extensive data on its food habits. Preble and McAtee (1923) record one stomach from the Pribilofs that contained a few fish bones. Scheffer made interesting observations at Kagamil Island on August 30, 1938, when about 25 forked-tailed petrels and 3 Leach's petrels were picked up on the deck of the ship. Six piles of regurgitated material on the deck contained broken remains of small fish—the largest was about the size of a man's little finger.

Mortality Factors

The principal enemy of the petrel, so far as our observations

go, is the introduced blue fox. Petrels appeared to be especially palatable to these carnivores, or perhaps they are easy prey at their burrows. On Salt Island the species had been entirely eliminated by foxes, and this appeared to be true of Ilak, also.

Petrels are attracted by ship's lights at night. They flock around the ship, chirping and chattering incessantly, striking the rigging and fluttering about the deck. Often, they get into staterooms, the galley, or other portions of the ship, and sometimes in the excitement an egg or two may be dropped on the deck. Joseph Mailliard (1898), writing of the petrels on St. Lazaria Island, Sitka Bay, quotes Grinnell as saying that it was impossible to keep a fire alight in the middle of the night because the petrels flew into it in such numbers that they extinguished it.

Oceanodroma leucorhoa: Leach's Petrel

Oceanodroma leucorhoa leucorhoa

Attu: *Kě'-Kěch*

Atka: *Ki-ki-tich-noch*

Russian, Commander Islands: *Malinka tschornaja sturmfotka* (Stejneger)

The Russian name given by Stejneger means a small black petrel. Leach's petrel has a more southern distribution than *O. furcata* and does not range far into Bering Sea. Though it nests throughout the Aleutian chain and on Copper Island, according to Stejneger, it is much less abundant than the other species. Farther south, it becomes much more abundant. Bent (1922) states that on St. Lazaria Island, at Sitka Bay of Baranof Island, Grinnell and Mailliard estimated that *O. leucorhoa* outnumbered *O. furcata* four to one. They also are extremely numerous on Forrester Island.

On the Aleutians we found this ratio reversed. Among the remains of petrels left by foxes, those of *O. leucorhoa* were scarce. The petrel colonies of any size were *O. furcata*. When flocks of petrels fluttered about the ship's lights at night they were usually *furcata*, though sometimes there were a few *leucorhoa*. It is interesting to note that in 1941 Gabrielson found Leach's petrel outnumbering *furcata* at Kasatochi Island. There may have been a nesting colony nearby.

Thus, we find that these two species more or less intermingle in their ranges. But *O. furcata* has a more northerly center of abundance, and ranges farther north, while *O. leucorhoa* is more concentrated somewhat farther south, and does not reach far into Bering Sea.

The natives declared that these petrels (probably referring to both species) nest "everywhere," but the following islands are the only ones for which we have precise evidence of nesting of Leach's petrel: Sanak Island group, Egg Island (McGregor, 1906), Amchitka (reported by Dall), Davidof, Kiska, Buldir, Agattu, and Attu. Dr. Gabrielson noted evidence of their presence on Amatuli Island, of the Barren Islands group, June 13, 1940. They were especially numerous on Buldir Island, where we found the greatest number of nesting burrows. No doubt they occur on a great many other islands, as the natives intimated, but probably in such small numbers that they are not easily detected.

On Buldir Island, where we had the best opportunity for examination, their burrows were found in the sandy banks above the beach and along a stream, as well as on high grassy slopes, well up on the higher part of the mountain. The burrows extended about arm's length, often with a very small entrance so that it was difficult to insert the hand, but generally there was an enlarged chamber at the end. In sandy soil, the burrows were larger in diameter; in sod, they were much smaller and the entrance was more obscure. There was a flat nest of dried grass in the end chamber. Usually, there was a single bird in the nest, but in at least 1 burrow there were 2 birds.

Food Habits

Leach's petrels have been observed following whales for food fragments, and they have been seen picking fish refuse in the vicinity of fishing boats. We obtained no additional data on their food habits.

Mortality Factors

Foxes prey on these birds where nesting colonies are available.

Family PHALACROCORACIDAE

Phalacrocorax auritus: Double-crested Cormorant

Phalacrocorax auritus cinctatus

Attu: *Kúch-tírch*

Unalaska: *T'chunq-ahh*

Of the three species of cormorants nesting throughout the Alaska Peninsula and Aleutian Islands, the double-crested is much less common than the pelagic or the red-faced. It nests on Kodiak Island. Cahalane (1943) reported it to be abundant in the Kodiak-Afognak group, and Gabrielson noted a few at Whale Island and four in Uyak Bay. Probably it nests in the Barren Islands also. Several were seen at Ushagat Island of this group,

on May 11, 1936. On May 7, 1936, we had seen several of these birds on Chisik Island, in Tuxedni Bay, Cook Inlet, obviously preparing to nest. C. J. Rhode noted a colony of about 50 cormorants on islands of Skilak Lake, Kenai Peninsula. Identification was uncertain, but it is probable that these were double-crested cormorants.

Osgood (1904) recorded this cormorant nesting on islands of Iliamna Lake. He saw them flying up and down Nogheling River, and several were seen on Lake Clark (one specimen taken); however, he believed few, if any, nested on that lake. He states that from the Mulchatna River near the mouth of the Tikchick to Nushagak these cormorants were seen daily, but not in great numbers. Again, he saw several on Becharof Lake, October 4 to 7, 1902.

Cahalane (1944) observed cormorants, "presumably all of this species" (double-crested), rather commonly in the Katmai region of the Alaska Peninsula in 1940, and he reported them in September on Naknek River, on Naknek Lake, at the south shore of Iliuk Arm, at the mouth of Savanoski River, on Brooks River, and on Brooks Lake. By September 27 and 28, they were relatively scarce on Naknek Lake and River. On the Pacific side, he reported them to be much more numerous and recorded them as "common to abundant" in the bays of the Katmai coast, October 4 to 7.

On July 23, 1940, Gabrielson noted 1 or 2 double-crested cormorants on the Kvichak River, and on July 25, he reported 2 more on Iliamna Lake. In the same season, he also noted them at the Semidi Islands.

On August 29, 1936, we saw at least two double-crested cormorants near Simeonof Island, in the Shumagin group. They probably nest among those islands. On May 16 and 17, 1928, F. L. Jaques (1930) saw cormorants, which he thought to be this species, near the Shumagins and near Belkofski.

The largest colony of this cormorant was found by the writer in 1925, in Isanotski Strait, at the extreme tip of Alaska Peninsula. On the larger of the two Isanotski Islands, which was not over 150 yards long, there were at least 25 nests in a close group on a grassy slope. On July 27 the nests contained from 2 to 5 eggs, but usually there were 4 or 5. A specimen was collected. It is interesting to note that Beals and Longworth, on June 10, 1941, 16 years later, stated in their field report that "Small colony of 50 or more birds nesting on the most northerly of the two Isanotski Islands."

Donald H. Stevenson, who accompanied me in 1925, described cormorants nesting on a small island in Swanson Lagoon, on the north part of Unimak Island. His description, and the location of the nesting site, leaves little doubt that a colony of double-crested cormorants were nesting in Swanson Lagoon at that time.

Among the eastern Aleutians we found several nesting groups, though they were small in number. On July 16, 1936, we observed five of these cormorants perched on low rocks at one of the little islands (which we designated "Puffin Island") in Trident Bay, Akun Island. On June 7, we had seen about a dozen at the west end of Umnak Island; a specimen was taken here. Nesting was not actually observed in these instances. But on June 8, we found several of these cormorants nesting on Kagamil Island. Some also were found on Uliaga Island near by, and two small colonies were found on Carlisle Island. Seven nests, and a number of birds, were located on Herbert Island. The nests among the Islands of the Four Mountains were on ledges of sheer cliffs and in the walls of high caverns (sometimes very high), which was in great contrast to the nesting on the low Isanotski Islands, observed in 1925. In some cases, these cormorants were nesting in close proximity to red-faced and pelagic cormorants.

We observed no double-crested cormorants west of these islands. The natives of Atka assured us that this cormorant does not occur in that part of the Aleutians. We are fairly confident that today this species does not nest west of the Islands of the Four Mountains. Yet, the Chief of Attu appeared to be familiar with this bird; he gave us the native name and declared that formerly it was abundant, though it has become scarce in recent years. Austin H. Clark (1910), writing of his expedition of 1906, said "I have a note of a few [double-crested cormorants] being seen in Unalga Pass near Unalaska, and I found them at Atka, Attu, and Agattu." Turner (1885) also, writing of the Near Islands, reported double-crested cormorants to be abundant, resident, and breeding.

Clearly there has been a drastic change in distribution of this species since about 1906, (the time of Clark's notes). The cause of this restriction of range has not been determined.

The species *P. auritus* as a whole is quite versatile in nesting habits. Many of the prominent nesting sites in the northern part of the continental range are on low islands. Elsewhere, cormorants nest in trees and on cliffs as well as on low islands.

Therefore, there must be adaptability in the species. The introduction of blue foxes on a large scale in the Aleutians discouraged the low-ground type of nesting; therefore, the birds nested in the cliffs in greater numbers. This change in nesting locale of the double-crested cormorant may have resulted in competition with the more agile red-faced and pelagic cormorants. It may be pointed out that in the absence of blue foxes, the double-crested cormorant would nest on low flat ground, away from cliffs—a habitat not usually desired by the other two species. What the human factor might have been in the ecological picture is hard to say, but, under conditions prevailing in recent years, cormorants could hardly succeed in nesting except on well-protected cliffs.

Whatever the factors, it is a fact that the double-crested cormorant has virtually disappeared from the Aleutians west of the group known as the Islands of the Four Mountains.

Phalacrocorax pelagicus: Pelagic Cormorant

Phalacrocorax pelagicus pelagicus

Attu: *Krí-li-ti-keh* or *Krí-li-ti-kich*; *Til'-i-toch* (1-year-old young)

Atka: *Agh'-i-uh* (possibly referring to any cormorant species)

Agayúx (Jochelson)

Russian, Commander Islands: *Malinky Uril* (Stejneger)

This is the most abundant cormorant in the North Pacific and Bering Sea region. We found them in the Barren Islands, the Kodiak-Afognak group, Chisik Island in Cook Inlet, Sutwik Island, Chignik Bay, Shumagin Islands, and along the north side of Alaska Peninsula to Bristol Bay.

Hine (1919) said, "Colonies of this cormorant nested on the shelves of the sea wall along Katmai and Kashvik bays during the 1919 season."

Osgood (1904) found these birds on Becharof Lake. Gabrielson found them to be common in the Semidi Islands.

We found the pelagic cormorant to be numerous throughout the Aleutian Islands, and they are common in the Commander Islands (Stejneger 1885). This bird has a more northerly distribution than other species, for it occurs on both sides of Bering Sea and as far as the Arctic coast.

Ordinarily, this species was the more common in the waters about the Aleutian Islands, though among the birds actually nesting *P. urile* outnumbered *P. pelagicus*. There appeared to be a considerable number of nonbreeding *P. pelagicus*, in subadult plumages. In some cases we found no nests, though the birds were present in considerable numbers.

Usually, the nests were placed on ledges of steep cliffs, though sometimes they were on overhanging walls of caverns well out of reach of the surging water. Only once was a different nesting site noted. In 1925, I found an unusual nesting situation near Izembek Bay at the west end of Alaska Peninsula. On Glen Island, at this bay, on May 20, there was a considerable colony of *P. p. pelagicus* in a compact group on a low point. Some of the birds had white flank patches at this time. On June 1, Stevenson reported that the birds were sitting on nests. On June 26, about 30 nests were counted, but there were no eggs. On July 27, the cormorants were still plentiful at Glen Island, but there had been no success in nesting.

The interesting fact in this instance is the unusual nesting site, which was a low sandy point above tidewater. While there had been a few birds in breeding plumage, the majority seemed to be immature birds. Amak Island, with immense cliffs occupied by large numbers of *P. urile* and only a few *P. p. pelagicus*, is about 12 to 14 miles out to sea. It was not determined whether this was an abortive attempt at nesting on Glen Island by cormorants crowded off Amak Island, or whether the birds were immature. Throughout the Aleutian chain, both *P. urile* and *P. p. pelagicus* are found nesting on the same cliffs.

While the pelagic cormorant is a salt-water bird almost exclusively, Osgood found it on Becharof Lake, as noted previously, and natives of Atka Island said these birds will go to the lakes of Amchitka Island in winter.

Cahn (1947) reports them at Unalaska as "abundant everywhere along the rocky shores from September to May," and Taber (1946) says the species was present at Adak in winter, where they continuously lived in salt water, never in fresh-water lakes. Sutton and Wilson (1946) found them at Attu in the summer and in the winter.

Food Habits

The food of this cormorant is assumed to be fish, but, according to Preble and McAtee (1923), a considerable percentage consists of various crustacea, at least in the Pribilofs. Sutton and Wilson, at Attu, obtained a specimen on February 28, and report: "Its stomach and crop were packed with small sculpins which it had caught in water about 15 feet deep along the west side of Casco Cove."

***Phalacrocorax urile*: Red-faced Cormorant**Attu: *Inǵ-a-tohh* or *Inǵ-a-torh*Atka: *Inǵ-a-tohh*Russian, Commander Islands: *Bolschoj Uril* (Stejneger)

Walrus Island, in Bering Sea, has been considered the chief nesting place of the red-faced cormorant in Alaskan waters. It was a surprise, therefore, to find that the red-faced cormorant is the dominant nesting cormorant throughout the Aleutian chain.



FIGURE 24.—Red-faced cormorant.

On May 16, 1936, while anchored at Unga, in the Shumagin Islands, we discovered a good-sized colony of red-faced cormorants on the precipitous cliffs of a rocky point. There were about 300 birds beginning to nest. Some of them were carrying nesting material; many had no nest at all. In our experience, this is the easternmost colony of this species.

In 1925, I found a colony on Amak Island, a small conelike island off the west end of Alaska Peninsula in Bering Sea. It was estimated that there were between 4,000 and 5,000 birds nesting on the high cliffs—by far the largest colony known south of the Pribilofs. When visited again in 1936, these birds were still nesting on the same cliffs, many of them carrying nesting material (on May 31). On May 22, 1928, Jaques (1930) observed this species near Port Moller.

Bogoslof Island is also occupied by red-faced cormorants, mostly in the form of individuals scattered among a large number of murrens.

While most of the Aleutian colonies of the red-faced cormorants are very small, there are a few sizable concentrations. On Adokt Island, one of the Baby Islands group in Unimak Pass, we estimated 500 nests. There were also large concentrations on certain islets in the Bay of Islands of Adak Island. But in many instances there were small groups, sometimes six or less.

Following are the islands, east to west, on which the red-faced cormorant was found nesting: Unga (Shumagins), Amak, Adokt and Excelsior of the Baby Islands group, Egg (probably), Poa, Tangik, Bogoslof, Ananiuliak near Umnak (not certain), Uliaga, Kagamil, Carlisle, Herbert, Yunaska, Chagulak, Amukta, Seguam, Ulak, Kasatochi, Igitkin (probably), Adak, Gareloi, West Unalga, Semisopohnoi, Amchitka, Little Sitkin, Davidof, Kwhostof, Kiska, Agattu, Semichi, and Attu.

These birds were identified at other islands, though nests were not actually observed. This gives the red-faced cormorant a fairly uniform distribution as a nesting bird from Unga and Amak Islands, and Port Moller, all the way to Attu, and they are known to nest still farther west, in the Commander Islands. The red-faced cormorant also winters in the Aleutian waters.

Mortality Factors

Birds which prey on the cormorants are the bald eagle, peregrine falcon, and glaucous-winged gull. In a study of the food habits of the bald eagle in the Aleutians it was found that cormorants had been taken for food frequently; however, the species of cormorants was not determined. It seemed likely

that most of the remains that were examined were those of the pelagic cormorant, but no doubt the red-faced cormorant would be taken also where it is available. We found no remains of the double-crested species, but that form is relatively scarce.

On Amak Island, several carcasses of red-faced cormorants, probably killed by peregrine falcons that nested nearby, were found beneath the nesting ledges. Falcons are indicated as the predator because eagles would have carried their prey away to their feeding places.

Glaucous-winged gulls persistently seek the cormorant's eggs, and they are most successful when the parents are frightened off the nests, thus exposing the eggs to predation.

Family ARDEIDAE

Ardea herodias: Great Blue Heron

Ardea herodias fannini

The heron seldom enters the territory with which we are concerned. Osgood (1901) reports, "A great blue heron was seen at Hope by E. Heller." In the same general vicinity, May 8, 1936, the first mate of our ship reported seeing a heron early in the morning, as we were approaching Anchorage. It was recorded at Portage Bay (Nelson, 1887). So far as we know, then, this heron reaches the western part of its range at about the head of Cook Inlet.

Family ANATIDAE

Olor columbianus: Whistling Swan

Attu: *Koñ-kirch*

Qúmqux (Jochelson—dialect not given)

Atka: *Ko-kiñ-yeh* (or *ko-kiñ-e-rech* ?)

Whistling swans nest on Kodiak Island and in suitable areas along the Alaska Peninsula. Osgood (1904) specifically mentions Swan Lake, Chulitna River, and "upper waters of the Nushagak system, and near the Ugaguk River and Becharof Lake."

Einarsen (1922) observed a swan with four young near Ugashik on June 26, 1922, and Jaques (1930) observed eight swans near Port Moller from May 24 to June 14, 1928.

While in the Katmai region in September 1940, Cahalane (1944) observed swans "from Kwichak River to Naknek," on tundra pools, on Lake Grosvenor, mouth of Savanoski River, between Iliuk Arm and Mount Katolinat and above New Savanoski Village.

On July 19, 1940, Gabrielson noted three pairs of swans between Naknek and Brooks Lake, and on July 21, while flying over the country from Becharof Lake to Egagik, by way of Ruth, Ugashik, and Mother Goose Lakes, he saw numerous pairs of swans with 1 to 5 young among the many tundra pools and lakes of this area.

According to local residents (1936), swans nest on small islands in ponds near Ugashik River, and up the river from Nelson Lagoon. At Chignik I was informed that swans nest in Black Lake, the "second lake up Chignik River." Gabrielson was told that they nest in the King Cove-Cold Bay area.

In 1925, though none were found nesting, a swan was seen flying over Hazen Point in Izembek Bay on June 13, and on July 23 there was a group of three in a lake near the sand dunes there. In the same year, on April 29 and on several subsequent dates, two were seen at Urelia Bay, on Unimak Island, and a trapper said that he saw a few swans in that locality each year.

More recently, we have precise information that swans nest on Unimak Island, for in 1936 we obtained an egg, which, we were told, had rolled out of a nest on Ikatan Flats. The following year we learned that a pair had returned to the same flats.

In 1941, Beals and Longworth noted several swans at Unimak Island, and they reported that on August 31 a trapper observed 3 pairs near Swanson Lagoon—each pair with 2 young. It is also reported that a pair nested on Ikatan Flats in 1940.

Chase Littlejohn (manuscript notes) says, "Only a few seen at Morzhovoi Bay, where I know at least one pair reared their young in 1879. I found them with their parents in a lake still unable to fly on August 29."

Swans are not known to nest west of Unimak Island.

Dall (1874) reports the killing of three swans at Sanak Island in September 1872 by a sea-otter hunter, who said they were not uncommon there in the fall.

Apparently, swans have not been considered a part of the fauna of the Aleutian chain proper. Dall stated that they did not occur there, though Turner said a few wintered on Attu Island. It is possible that conditions have changed, for there is ample evidence that swans occur on many of the islands—at least in winter. At Atka Island, the natives assured us that swans winter in the Aleutians, and they specifically mentioned Kanaga and Amchitka, where swans had been observed on the lakes. On Amchitka, we found swan remains among the native buildings,

and we learned that about 20 had been killed there the previous winter.

We also found swan wings on Semisopchnoi Island, thus showing that some had been killed there in winter by native fox trappers. Friedmann (1937) found four swan bones in midden material from Little Kiska.

The native chief on Attu Island assured us that swans winter abundantly among the lakes on the south side of that island, occurring in flocks of "eight, ten, to twenty-six." In 1924, the swans were said to have walked among the houses of the village, and, in 1932, "hundreds and hundreds" were seen among the lakes on the south side. Now, they occur only in small numbers. According to the natives, the swans arrive at Attu Island late in October, and they leave late in April.

Mortality Factors

It is probable that man has been the greatest enemy of the swan, for, under ordinary circumstances, the swan probably is able to protect itself against natural enemies. A trapper at Port Moller, on the Alaska Peninsula, told me that he had seen a swan defend itself against a red fox, and he doubted whether foxes were much of a hazard.

Olor buccinator: Trumpeter Swan

Quoting Friedmann (1937) on Kodiak Island: "A synsacrum and 2 tarsometatarsi were found in the superficial levels and another tarsometatarsus in the intermediate depths in 1935; in 1936 a metacarpal and the head of a humerus were collected."

There are no other records.

Branta canadensis: Canada Goose

Branta canadensis leucopareia

Branta canadensis minima

Attu: *Legch*

Atka: *Luch* or *lug-ach*, or *lagix* (Jochelson)

Resident whites: *land geese*

The white-cheeked geese were formerly common migrants throughout the Aleutian Islands area and nested on many of the islands. These populations now (1936, 1937, and 1938) have been universally reduced.

The forms of the white-cheeked groups of geese that nest in the Aleutian district is a question that has led to endless confusion. Our latest findings show that *leucopareia* and *minima* are so inextricably associated throughout the Aleutians that it is desir-

able to discuss them together. As far as we were able to learn, the Aleuts have only one name for this general type of goose. However, the Eskimos at Hooper Bay distinguish between these two forms, and they have a distinctive name for each form.

It should be noted here that in much of the previous work with these birds, the name *hutchinsi* was used to identify the form that we now call *leucopareia* (A.O.U. Check List); and this change has resulted in considerable confusion and misunderstanding of the literature.

It is certain that 2 forms of the white-cheeked geese nest in the Aleutians, but there is a question about the taxonomic rank to accord these 2 forms. As to considering them races of the same species, I agree with Bent (1925) that "Both the cackling goose [*minima*] and the Hutchins goose [*leucopareia*] are said to breed on the Aleutian Islands, but it seems hardly likely that these two subspecies should occupy the same breeding range."

The situation we find here supports Taverner's conclusion (1931) and the findings of Aldrich (1946) that we have two species. Aldrich has proposed that the smaller species includes three subspecies: true *hutchinsii* (not *leucopareia*), *minima*, and *asiatica*, and that *B. canadensis* includes the other subspecies of this group. On June 23, 1911, a female was collected on Attu Island by R. H. Beck, which Bent (1925) recorded as *minima*. On June 13, 1937, John H. Steenis collected a male goose of this group on Agattu Island. These specimens were studied by Aldrich, and he agreed that the Attu specimen was true *minima*, and that the one from Agattu was equally typical of *leucopareia*.

At Hooper Bay (south of Yukon Delta), we found the Alaskan cackling goose (*minima*) nesting nearest the sea, while the lesser Canada goose (*leucopareia*) nested farther inland, though the two nesting ranges were adjacent. Two groups of Eskimos, an inland group and a coastal group, with slightly differing dialects, both recognized these two species of geese as different and had a name for each. With two geese populations nesting in such close proximity, without space for "intergrades," it would be illogical to consider them subspecies, aside from the facts shown by examination of characters. In the Aleutian district, these two species occupy ranges similar to the kinds in the Hooper Bay district.

Former numbers—Turner found "thousands" of geese on the Near Islands, of which Agattu and Semichi were the chief breeding grounds. They nested on Unaska, Amlia, Atka, Adak, Kanaga, Tanaga, Kiska, Buldir, Semichi, and Agattu. On some

of these islands, the foxes had forced the birds to nest on offshore islets, and on Attu the natives hunted them extensively and domesticated them, clipping the wings of young birds. Jochelson (1933) says: "Some of them breed on the Four Mountain Islands."

Bill Dirks, Atka chief, mentioned as former nesting grounds: Tanadak, Unak, and Tanaklak (all near Great Sitkin), as well as Amchitka, Ulak, Tanadak (the one near Kavalga), and Kiska. He also stated that at one time there had been a native village on Buldir, and that the villagers used to pinion young geese to prevent them from migrating in the fall so that they would be available later in winter. Dirks recalled that his father once obtained 50 goslings on Buldir, and brought them to Atka, where he fattened them for food. Nelson (1887) saw a flock of domesticated geese at Unalaska, which had been obtained in the western Aleutians.

We must include Attu in the breeding range, for it was on that island that Beck collected the nesting goose examined by Aldrich and identified as *minima*. Evidently a few geese have been able to nest in spite of foxes, and in primitive times undoubtedly a great many nested there.

As late as 1911, Wetmore reported at Kiska "Two flocks of rather good-sized geese were seen flying over high up June 18. One of the officers reported seeing two on an inland lake. None were taken." And, again at Atka, he reported, "a flock of geese seen flying high up June 13."

Austin H. Clark (1910) has presented a striking picture of geese in abundance:

This goose is the most abundant bird on Agattu, where it breeds by thousands. When we approached the shore we saw a number of geese flying about the cliffs and bluffs, and soaring in circles high in air. On landing I walked up the beach to the left and soon came to a small stream which enters the sea through a gap in the high bluffs, when I saw fifty or more of these birds along the bank preening their feathers. From this point I walked inland over the rough pasture-like country toward a lake where this stream rises. Geese were seen on all sides in great abundance, walking about the grassy hillsides in companies of six or eight to a dozen, or flying about from one place to another.

Migration

As would be expected, in the days when the lesser Canada goose and the Alaskan cackling goose flourished there was an east and a west migration along the Aleutian chain. In 1925, Donald Stevenson, former reservation warden, said that geese from the western Aleutians came eastward in the fall to join the throngs

concentrated about Isanotski Strait. Atka natives said that geese passed eastward at Isanotski in August.

Chief Ermeloff, of Umnak, said that geese passed there "in the fall." Nick Kristensen, who has lived many years on Unimak Island, said geese arrived at Uria Bay before they reached St. Catherine Cove, and he wondered, because Uria Bay lies west of St. Catherine Cove, if this meant they "came from Siberia somewhere."

Jochelson (1933) says: "In April it flies to the west, in October to the east, resting on the islands."

It is evident that there was an annual fall migration eastward along the Aleutians. When the Aleutian birds arrived at the west end of the Alaska Peninsula, they undoubtedly joined the throngs of cackling geese that came down from the north.

On August 14, 1936, we noted six cackling geese flying southward over Nunivak Island. We were told that they linger a bit on the south side of Nunivak Island before continuing farther south. According to local information, they generally arrive at Unimak and the Alaska Peninsula about September 1, but they do not become numerous until 1 or 2 weeks later. Then, they assemble in surprising numbers and congregate at Uria Bay, Swanson Lagoon, and St. Catherine Cove, all on Unimak Island, and at Izembek Bay, head of Morzhovoi Bay, Nelson Lagoon, and Port Moller on the Peninsula. In 1942, Gabrielson reported the first fall migrant at Izembek Bay as early as "late in July."

In 1925, accounts of the coming of the geese in "countless thousands" and "millions" testified to unusual concentrations, and it is safe to say that this area is the principal gathering place for geese nesting along the shore of Bering Sea northward, as well as those from the Aleutians proper. The emperor goose and the 2 forms of the Canada goose all assemble here—of the two, the Canada geese are in the majority.

This area seems to be a place where the geese can fatten in the fall before continuing to their wintering grounds. They are said to feed to some extent on eelgrass; *minima* and *leucopareia* feed mostly on crowberry (*Empetrum nigrum*) and other berries and spend so much time on the slopes seeking these foods that they are known locally as "land geese"—distinguishing them from the "beach goose," which is the local name for the emperor goose.

The geese become very fat and leave for the south about November 1, though according to some reports it is as late as November 15 or 20. Probably, the earlier date is the more

usual one. In 1942, according to Gabrielson, the geese departed rather suddenly, eastward, on November 20.

This situation is quite comparable to that on the other side of the continent at the head of James Bay, a southern extension of Hudson Bay, where the blue geese spend more than 2 months fattening, and then continue south about November 1.

As the lesser Canada geese and the Alaskan cackling geese move south, they are noted in many other places, such as Metrofane and Mallard Bays in the Chignik area, at Simeonof Island in the Shumagins, and the Sanak Island group. Chase Littlejohn (manuscript notes) said: "A large number are seen annually at Sanakh in the fall where they remain for a short time at this season; they are very fat and toothsome . . . They are also numerous on the peninsula where they feed entirely on berries."

Our information on the white-cheeked group of geese for the more eastern parts of the Alaska Peninsula is, at this time, not as complete as the information that we have for other parts of this group's range. Osgood (1904) reported a flock of the birds at the mouth of the Chulitna River on August 5, 1902. Others were seen later on the Mulchatna and were seen between the Mulchatna and Nushagak. On July 6, 1925, I saw a pair of geese, not specifically identified, on the tide flats of Izembek Bay; it is possible that they were nesting birds. In August 1911, Wetmore repeatedly saw "a small goose" on the marshes back of Thin Point. On July 28, 1911, he saw another at Morzhovoi Bay and saw three more on July 30. All of these, he provisionally identified as cackling geese.

The spring migration is much less noticeable, no doubt because the birds are intent on reaching the nesting grounds and therefore do not gather in large concentrations, and also because their numbers have been greatly reduced since the previous autumn. Residents at False Pass were undecided whether the geese pass through there in the spring. We were told that they also pass through the Chignik area, and at Simeonof Island in the Shumagins, and at Sanak Island farther west. At Sanak, we learned that the geese gather on the water enclosed by Sanak, Elma, and Caton Islands, though they do not linger there in the fall. This suggests that in the spring they have completed a lengthy flight over the ocean, thus needing both food and rest. Chase Littlejohn, writing of the migration at Sanak in 1887-88, said, "They used to stop here on their way north a few years ago, but they rarely if ever do now, for what reason I do not know."

Evidently, the geese have resumed the practice in view of our information for more recent years.

Jaques (1930) reported that "Three flocks of what were probably cackling geese were migrating to the southwest May 16, inside the Shumagin Islands." They may have been headed for the Aleutians, judging by the direction they were taking.

It is evident, from information at hand, that the spring migration took place in April and part of May, but it was not so spectacular as the fall migration.

Nesting Habits

Agattu, in the Near Islands group, is the most favorable for geese. Most of the island is a lowland, liberally dotted with lakes. This makes it easy to understand why such islands as Semichi, Amchitka, Tanaga, and Kanaga were at one time a goose paradise—all of them have extensive lowlands with lakes.

There is another type of nesting habitat which is typified by Buldir Island—a domelike island rising sheer from the sea. Buldir possesses beaches and a small grassy valley cut by a stream. In this valley, where the grasses and sedges are heavy and rank, there were no geese. High on the mountain there are little depressions, benches, and valleys, which are cut by water courses. In this terrain, where the grasses and sedges are short and tender, there were geese—even though there is fog much of the time. So, on Buldir, the geese apparently have found an environment that is suited to them.

It is interesting to note that these geese do not hesitate to take to salt water. One, with two downy young, was seen in a bay at Agattu, and another was seen in the water near Chagulak, an island at Amukta Pass. The presence of a goose at Chagulak suggests another high-mountain habitat, because that island is extremely precipitous.

Present numbers—We have just enumerated the early accounts of "thousands" of geese, including Turner's "thousands" in the Near Islands, and Clarke's tale of abundance on Agattu. Today, the Aleutian district presents a striking example of the rapid decline of a species; the general opinion is that the fall concentrations in the False Pass area have greatly declined, apparently involving to some extent the geese from the more northerly nesting grounds.

We were surprised to find no sign of these geese on the lake-dotted flats around the lower part of the Ugashik River, and in 1937 we observed only a few pairs of geese on Agattu Island—probably less than 6 pairs in 4 days of traveling over the island.

One pair had 2 young, and another had 5 young. In the Semichis, we found feathers and a few droppings on Alaid Island. On June 15, 1936, the captain and the mate of our ship saw a "small goose" of the *canadensis* type near the shore of Chagulak Island, and we found signs of geese on Buldir. However, they had disappeared on most of the islands, and our total observations indicated that only a few pairs remained in the Aleutians. In fact, these geese are so scarce that the migration is no longer noticeable, and some of the younger Aleuts didn't seem to know about it. When the remaining geese that go to the Aleutians are killed, it will be a long time for a migration to become reestablished, and consequently an extensive habitat for *minima* and *leucopareia* will lie vacant.

Causes for decline—The natives, as well as several writers, have assumed that the disappearance of these geese from many islands was due to the introduction of blue foxes. Undoubtedly, this is true, yet on Buidir where there are no foxes, the geese are not plentiful. Undoubtedly, another important cause for their decline is increased hunting along the migration route and on the wintering grounds in the south.

Administrative action has already been taken to free certain favorable islands, including Agattu, from foxes. Further, to preserve these geese, it remains for sportsmen to protect the birds on the wintering grounds. With such a combination of protection, it is still possible to prevent these geese from losing their present tenuous hold in the Aleutians, and perhaps it would be possible for them to build up to a point where they will be safe from extinction.

***Branta nigricans*: Black Brant**

Attu: *Agru-gé la-ghé*

Nelson Island Eskimo: *Nuk-hla-ra-nak*

Hooper Bay Eskimo: *Nuk-lu-nuk*

Hooper Bay, a more inland dialect: *Nuk-lu-gu-nuk*

Nelson (Eskimo dialect): *Luk-hlug-u-huk*

Russian, Yana district: *Njemok* (Pleske)

Chukchi: *Nedljuitti* (Palmén)

The black brant is only a migrant in the Aleutian district, but it occurs in considerable numbers. In 1936, we were told at Port Moller that the brant appear there in April, and we received the same information for the Chignik area. We had seen them on northward migration near Seymour Narrows, British Columbia, on April 24, and on Queen Charlotte Sound on April

25. Donald Stevenson, in 1925, said that he had seen them at King Cove "late in April."

Apparently, the many bays at the western end of Alaska Peninsula are favorite gathering places for black brant in migration. In 1925, Stevenson and I observed them on Izembek Bay, where they were present on May 20 in small flocks, on the water and flying from point to point. However, some flocks contained as many as 200 birds, and about 5,000 black brant were estimated for the entire bay. The following day, at the east end of the bay, there were only a few groups.

Stevenson arrived at this bay on June 2 and found the brant to be plentiful. As he passed Applegate Cove, he saw a "swarm" of brant up the bay, rising and settling in a funnel-shaped mass. There were other groups of 50 to 75 brant flying up the bay, some of these joining the large flock. The following day he saw more of them, and, in each instance, they seemed inclined to move in a northeasterly direction.

On June 16, we saw a small flock and a single bird; next day we saw several small flocks near the outer sand islands. This was their last appearance.

In 1943, Gabrielson found black brant on the Sanak Islands on April 30, and the next day, at King Cove, he saw 100, or more, heading toward Cold Bay. In 1944, residents at Port Moller reported the first spring flight on April 26.

A. C. Bent (1925) quotes Chase Littlejohn as saying that the brant move westward along the Alaska Peninsula, 1 or 2 miles offshore, turn into Morzhovoi Bay, and thence go into the Bering Sea. This probably outlines the spring migration fairly accurately.

While we were at Nunivak Island on August 14, 1936, black brant had arrived from the north. Eskimo said that these brant remain on the inland lakes of that island for about 2 months, or until sometime in October, before continuing south. In the meantime, many others have gone farther south, because at Port Moller, on August 29, the residents said that the brant were due at that time and that they would remain there until about November 1, before continuing south. They also return to Izembek Bay during their migration.

Dall reported that black brant were nesting on some of the western Aleutians, but Nelson was undoubtedly correct when he assumed that these birds must have been small geese of the *canadensis* group. Friedmann (1937) records the following remains from native middens: One skull and 2 sterna from Little

Kiska; 1 humerus from Atka; and 4 humeri from Attu. In 1936, the Attu natives told us that black brant appear there occasionally in the fall, sometimes in company with the emperor goose.

Stejneger (1885) reported the species occurring sparingly in the Commander Islands in migration.

Philacte canagica: Emperor Goose

Attu: *Il-á-ghir-lich*

Atka: *Ká-ghu-mung*

Qámgān (Jochelson)

The emperor goose apparently does not commonly nest in the Aleutian Islands, nor on the Alaska Peninsula, but at least one record of nesting was established. During June 1925, a Bureau of Fisheries boat had stopped for a short time at Amak Island, on the way to Port Moller. The pilot informed me that during that stop at least three pairs of emperor geese were seen. On July 10, 1925, during a visit to Amak, I found the remains of a young emperor goose in a bald eagle nest. The feet, stomach, and numerous pinfeathers were present in the nest, and were collected. This appears to be the southernmost nesting locality.

The Aleutian district is certainly the principal wintering place for emperor geese. We noted evidence of such occurrence and obtained statements of natives and others who were familiar with specific localities, and in 1941 and 1942 Gabrielson noted them as plentiful at a number of the islands he visited in the winter months. They are reported as spending at least a part of the winter as far east as Port Moller, on the north side of the peninsula, leaving when the ice formed but returning when the water opened again. Some of these geese winter at Urelia Bay on Unimak Island and on Izembek Bay; a few geese winter near Chignik on the south side of Alaska Peninsula, and some of them winter at Simeonof Island in the Shumagins. A banded bird was recorded at King Cove in the fall of 1926.

Turner (1886) makes the sweeping statement that these birds winter on the south side of Alaska Peninsula and on offshore islands as far east as Cook Inlet. Friedmann recorded bones of this goose in all layers of Kodiak middens. Today, they are less numerous along those shores, possibly because of the advent of white men and an increased kill resulting from modern weapons.

Emperor geese are known to winter in some numbers in the Sanak group. We found recent remains at Unalaska, June 3, 1936, and on Bogoslof Island, June 5, 1936. Eyerdam (1936)

obtained two specimens at Unalaska on June 20 and on August 7, 1932. These geese are known to winter on the following islands: Unimak, Unalaska, Sanak, Umnak, Amukta, Seguam, Atka, Adak, Tanaga, Kanaga (abundant), Amchitka, Ulak (longitude 178° W.), Ogliuga, Kavalga, Semisopchnoi, Kiska, and Attu. The chief of Attu declared that they were in that locality in "millions." These are the islands on which we have specific information. Undoubtedly, emperor geese occur on many, if not all, of the other islands; almost certainly they occur on Agattu and Semichi, for example.

As may be expected, there are many records of winter occurrences farther south, in Washington, Oregon, and California. These records are numerous enough to suggest that some stragglers find their way into those southern localities quite regularly; however, the regular wintering area is confined to portions of Alaska Peninsula, the Shumagin and Sanak Islands, and the Aleutian chain. Apparently, they are rare on the west side of Bering Sea during the winter. Stejneger (1887) records two specimens taken at Bering Island, April 6, 1886.

The spring migration varies according to the locality and the age class. Natives declare that emperor geese leave Attu Island in April; Turner (1886) gave the date as the "latter part of March." He also stated that after the middle of April considerable numbers of geese begin to arrive on the north side of Alaska Peninsula, particularly in the neighborhood of Ugashik.

In 1924, I observed the spring migration at the nesting grounds at Hooper Bay. The first migratory wave began about the middle of May and continued to the end of the month. There was another notable flight about June 5 and 6, which appeared to end the migration of breeding birds. Nesting had begun at that time.

A second distinct migration at Hooper Bay took place from June 21 to July 1. These were immature birds, probably all nonbreeders.

It was my good fortune to observe the other end of such migration in 1925, at Izembek Bay and Unimak Island. On April 29, 1925, and for several days following, flocks of emperor geese were noted at Uria Bay, on the north side of Unimak Island, many of them flying northeastward. On May 17, a flock of 250 was seen standing on an exposed sand bar in St. Catherine Cove. On May 20, they were common in Izembek Bay, and Donald Stevenson noted a flock of 300 there on June 2. We saw a similar-sized flock on June 8, at Moffet Cove, where they

were noted throughout June in diminishing numbers. The last flock was seen on July 7. The time of gradual disappearance on Alaska Peninsula corresponds very well with the time of the late migration noted at Hooper Bay the previous year. The lingering flocks in Izembek Bay were mostly immature birds. One bird, which was collected in adult plumage, proved to be a nonbreeder.

A few late occurrences were noted farther west. C. S. Williams noted a group of about six emperor geese on Uliaga Island on June 8, 1936; and a bald eagle's nest on Kavalga Island contained remains that were fresh enough to indicate a kill in July.

Apparently, there is an eastward movement of emperor geese along the Aleutian chain, and a consequent "piling up" at favorite locations on the Alaska Peninsula, until the northern flights are well under way.

The exact reversal of this process occurs in the fall. Some time early in September, the emperor geese begin to arrive from the north in the vicinity of Izembek Bay. And, according to the enthusiastic accounts of local residents, these emperor geese are almost as numerous as the cackling geese before the latter declined in numbers. At Port Moller, emperors are said to arrive as early as the latter part of August. They congregate on Nelson Lagoon, Izembek Bay, head of Morzhovoi Bay, locally in Isanotski Strait, St. Catherine Cove, Swanson Lagoon, and Urilia Bay. Most of these geese move westward some time in November. Incidentally, Swarth (1934) states that emperor geese were present on Nunivak Island, to the north, as late as October 29, 1927. The Attu chief said that they arrive at that westernmost point in the Aleutians late in October.

Apparently, in fall migration the immature birds again lag behind their elders. According to Swarth, the first arrivals on Nunivak Island, observed by Cyril G. Harrold, August 20 to the middle of September, were white-headed adults. "On September 15 the first young birds (dusky headed) were seen and they were common thereafter."

Food Habits

It is well known that the emperor goose is largely a beach feeder; in fact, it has earned the local name "beach goose." Yet, it is reported as occasionally feeding on the berries of the tundra, notably *Empetrum nigrum*. Swarth (1934) sums it up thus,

The emperor geese fed mostly upon the sea shore, but occasional flocks were encountered on the tundra, feeding upon berries. The one adult male

of the series had its face stained and the throat and entire intestinal tract dyed blue from a diet of berries.

In the spring of 1925, these birds were feeding at low tide on tide flats in Izembek Bay. The tide is about an hour later at the head of Izembek Bay than at the entrance; the same situation exists between the two sides of the long Hazen Point. The emperor geese were well aware of this, and when their feeding grounds were flooded by the incoming tide they simply flew up to Hazen Point, crossed over a few hundred yards to the east side, where the flats were still exposed, and continued feeding. The narrower parts of this point were favorite flyways. In this area, the principal food was thought to be eel grass. On June 14, at the margin of a pond, it was noted that the grass was grazed off short; the area was trampled and was littered with droppings. However, the stomach of an immature bird found in a bald eagle's nest on Amak Island on July 10 contained remains of small crabs.

Emperor geese are often reported as feeding on some kind of kelp in winter. At Kanaga Island, we were told that they feed on kelp and the green shoots of *Elymus*, which, even in winter, may be found under the dead vegetation. One informant stated that the geese probed into the ground and pulled out the horizontal rhizomes of *Equisetum*. We had noted droppings on Ogliuga Island consisting of the herbaceous parts of *Equisetum arvense*, but these droppings could not be positively identified.

Several observers in the Aleutians reported that emperor geese feed extensively on green "sea lettuce," as well as *Fucus*, and the "exposed roots" of *Elymus*.

Chase Littlejohn, apparently referring to Sanak Island and Morzhovoi Bay, says: "Here they live almost entirely on a bright green seaweed, locally known as sea lettuce, but at times eating small mussels."

Cottam and Knappen (1939) have presented a comprehensive statement on the food habits of the emperor goose, based on analyses of 35 stomachs. Few, if any, of these stomachs were obtained in the Aleutian Islands, yet the data agree fairly well with observations made in this area. Their findings (based on the contents of 33 stomachs) show 91.58 percent vegetable matter, and 8.42 percent animal matter. Their findings are further summarized as follows: Algae, 30.73 percent; eel grass and other pond weeds, 13.91 percent; grasses and sedges, 24.94 percent; undetermined and miscellaneous plant fiber, 22 percent; bivalve mollusks (*Pelecypoda*), 3.66 percent; crabs and other crustaceans, 2.18 percent; rodents and fishes, 1.76 percent; and miscellaneous animal life, 0.82 percent.

Mortality Factors

At Sanak Island, a resident declared that one winter he found 15 dead emperor geese on the beach. Although he thought that the deaths were caused by the frozen condition of the fresh-water creeks, the precise mortality factor here must remain unknown.

Among the natural enemies of the emperor goose is the bald eagle. However, there is no evidence that the eagle materially affects the goose population.

Anser albifrons*: White-fronted goose**Anser albifrons frontalis***

Attu: *Kog-a-la-gich'*

Russian, latitudes of the Yana: *Kasorka* (Pleske)

Bones of white-fronted geese are recorded by Friedmann in middens on Kodiak, Amaknak, Little Kiska, and Attu Islands. The Attu natives informed us that they have seen these geese in September; but they stated that the sightings are rare and that these geese do not winter there. Stejneger (1887) stated that occasionally these geese visit Bering Island in spring migration. Turner did not observe this species in the Aleutian Islands. In 1925, I learned of a trapper at False Pass who had a white-fronted goose in captivity; he had caught the goose at St. Catherine Cove during the previous autumn. Residents of the area stated that this goose is very scarce around the west end of Alaska Peninsula.

The white-fronted goose is a rare migrant in the Aleutian chain; therefore, Turner (1886) no doubt was partly right when he said, "They probably never visit the islands lying west of the mainland, as that region does not contain their particular food in sufficient quantity to induce them to visit it." His further statement that the Russians at St. Michaels referred to it as the *"uú-dri-na* goose, or lowland goose, is further explanation of its scarcity in the Aleutians, where most of the land is rugged. Farther east along the Alaska Peninsula, however, suitable ground is available, and we found nesting birds on the tide flats at Ugashik River. On May 27-29, 1936, at least six pairs were noted in that area.

Osgood (1904) records that he saw these birds at the base of Alaska Peninsula in 1902; he frequently saw them on the Chulitna River in early August, saw one on the Mulchatna River on September 3, and on the trip from the Mulchatna River to Nushagak he saw a considerable number of these birds each day.

On July 23, 1940, Gabrielson observed three pairs of white-fronted geese along Kvichak River, above Naknek, and he was informed by natives that this is the common nesting goose at the base of Alaska Peninsula. He estimated that he saw 500 birds along the Chulitna River on July 26.

To sum up, the white-fronted goose nests on the eastern portions of Alaska Peninsula, at least as far west as Ugashik River; farther westward throughout the Aleutian district it is only a rare visitor.

Chen hyperborea: Snow Goose

On October 1, 1942, Gabrielson noted two snow geese with a flock of Canada-type geese at Cold Bay. Again, on October 20, 1944, he saw 4 large flocks flying over Olga Bay at Kodiak Island, and, on the same day, he stated that 1,000 to 1,500 birds settled near Kodiak village, where several were shot by the townspeople. He comments: "They are seldom seen here, though more frequently at the south end of the island."

This is the only information available for this goose. There are no records concerning the area to the west.

Anas platyrhynchos: Mallard

Anas platyrhynchos platyrhynchos

Attu: *Argh'-ich*

Atka: *Ag'-ich* (apparently the same word in both dialects)

Russian, Commander Islands: *Selesenn* (Stejneger)

The mallard is widespread throughout the length of the Alaska Peninsula and Aleutian Islands, both as a breeding species and as a winter resident. Stejneger (1887) reported also that it was "resident, breeding numerously in Bering Island; comparatively rare on Copper Island." In 1886, Turner reported that the mallard was plentiful in the Aleutians in winter, and stated that it breeds sparingly on Agattu and Semichi Islands and that a few pairs were seen on Amchitka Island in the latter part of May 1881—which indicates nesting. Our expeditions verify this information. In 1936, Attu natives stated that they had observed these birds nesting near streams, and stated that they winter there. The following season, on June 9, which was during the nesting season, we saw several mallards along the shore of Attu Island. Wilson (1948) observed them at Attu in the breeding season when some of them were paired. The last ones observed were on August 28. We found a number of mallards among the lakes of Agattu Island, and on June 13 we found

a female with eight downy young. On June 21, 1937, a pair was seen among the lakes on the southeast part of Kiska Island, and another pair was seen in a lake at the South Harbor. On July 5, we flushed two males and a female from a pond on Amchitka Island. The natives of Atka also assured us that mallards are found there both summer and winter, which suggests nesting. June 20, 1941, Gabrielson saw a female with four young at Unalaska Island. The islands mentioned here are the principal ones that contain ponds and lakes. However, Cahn found this bird nesting at Unalaska Island.

Farther east, we obtained additional nesting data. On May 7, 1925, I found a nest of 11 eggs at Urelia Bay, Unimak Island. On June 6, a nest of 5 fresh eggs was found in a stream valley below Aghileen Pinnacles, western Alaska Peninsula, and on June 23 a nest of 10 eggs was observed on the tide flat at Hazen Point, Izembek Bay. In 1936, residents at Port Moller assured us that mallards nest around Nelson Lagoon, and in 1928 Jaques (1930) found it a "common breeder in the Port Moller region." On May 29, 1936, we saw a single male at Ugashik River. We had seen a pair at Chisik Island, Tuxedni Bay, in Cook Inlet on May 6, and, on May 9, another pair was observed at Anchorage. According to Osgood (1904), "McKay found the species breeding at Nushagak and took a number of specimens there in May and June, 1881." Gabrielson noted a few along Kvichak River July 23, 1940, including one brood of young. He also noted a male in the Barren Islands on June 13.

Mallards undoubtedly nest on various islands south of the Alaska Peninsula. On August 29, 1936, I saw two mallards on a pond on Simeonof Island, in the Shumagins, and the local rancher said they nest there. On Afognak Island, September 2, 1936, 14 mallards were seen in a lily pond. These could have been migrants, yet mallards undoubtedly nest there because they are known to nest on Kodiak, nearby.

As stated above, mallards winter throughout the territory under discussion. Localities where considerable numbers have been reported are Unalaska, Kanaga, and Unimak. We were told by natives of Unimak that when the bays and lakes freeze over, the mallards move to the unfrozen streams in the interior of the island and return to the lowlands only when the ice has disappeared.

In the summer and fall of 1936 there was an unusually large run of salmon up the streams of Unimak Island; at that time, mallards and other ducks, we were told, assembled there to feed on free-floating salmon eggs.

Anas strepera: Gadwall

The gadwall has been considered to be "accidental" in Alaska, on the strength of two records for the Pribilof Islands. It was, therefore, of particular interest to find that this bird nests regularly in parts of Alaska.

On May 16 and 17, 1937, several pairs of gadwalls were found on the Copper River Flats, near Cordova, not far from the mouth of Eyak River. Evidently, these were paired birds that were preparing to nest.

Alfred M. Bailey (1927) reports a pair at Bartlett Cove, Glacier Bay, on August 9, and "felt sure" he had identified a band at Holkham Bay on September 25, though the light was poor.

Cahalane (1943) reports that two gadwalls were shot on October 2, 1940, at the head of Terror Bay, Kodiak Island.

Chase Littlejohn says "A few of these ducks were shot by me while on their way north in the spring at Dolgoi Island, near Belkofski. They were the only ones seen."

On the north side of Alaska Peninsula, where suitable marshlands are present, the gadwall is fairly common. On May 27 to 29, 1936, they were common on the tidal marsh and on numerous ponds adjacent to Ugashik River where they were courting and preparing to nest. Generally, a female would be seen flying about, pursued by two or more males. On May 28, this species was recorded as "the principal duck seen," and on May 29 "they and the scaups made up most of the duck population." A pair was collected for specimens.

At Port Moller, residents assured us that gadwalls nest plentifully in the lakes upriver from Nelson Lagoon.

On May 8, 1925, I observed 4 gadwalls near the shore of a lagoon at Urilia Bay, Unimak Island; 2 of these were taken for specimens. On May 21, five gadwalls were seen among the ponds on Hazen Point in Izembek Bay; gadwalls were seen repeatedly as late as July 25.

Beals and Longworth, in a field report, mention that they saw 4 gadwalls on Unimak Island, March 19, 1941, 1 of which was collected. Local residents considered it to be uncommon.

Gabrielson reports a male and female on a lake at Izembek Bay, June 4, 1942. During the fall and winter periods of 1943 and 1944, he found them to be common among the Kodiak-Afognak Islands.

Turner (1886) records a specimen taken at Unalaska Island in December, 1878, and states that they are "abundant" along the Yukon Delta district in summer. Nelson does not mention it,

however, and we did not see this duck in the Hooper Bay district in 1924.

Taber found 5 males and 4 females at Adak Island during the winter of 1945-46.

Stejneger says (1887), "Reported by Dybowski as taken on Bering Island." Hartert (1920) mentions a specimen shot on Copper Island on May 13, 1911.

Thus, we find (as is the case with a number of species that require lowland marsh) that this duck nests along the lowlands on the north side of Alaska Peninsula, possibly also on Unimak Island, but it occurs only as a straggler in the Aleutians to the west.

Anas acuta: Pintail

Russian, Commander Islands: *Vostrochvost* (Stejneger)

This widely distributed bird is not common in the Aleutian district, but it does occur here and there throughout the entire area. It is known to occur on Kodiak Island (Friedmann 1935; Howell 1948), where Gabrielson found it plentiful in fall and winter. Cahalane (1944) observed pintails in several localities in the Katmai region in the autumn of 1940, but his report implies that this species is not plentiful. Gabrielson noted a female on Naknek River on July 19, 1940, and on July 23 several females, evidently with broods, were noted on Kvichak River. He also found it at Unimak, Cold Bay, Izembek Bay, Shumagin Islands, and Kodiak-Afognak Islands; they were rather plentiful in the last-mentioned localities in fall and winter. Einarsen (1922) found pintails nesting near Ugashik in 1922, and Jaques (1930) found it to be a common breeding bird around Port Moller in June 1928.

On May 23, 1936, we saw 2 pintails near Dillingham, Bristol Bay, and, on May 26, 2 more pintails were seen near Snag Point. On May 27 to 29, an occasional pair was seen on the flats near Ugashik River, where they evidently were nesting.

Residents on Unimak Island stated that pintails nest there, and this was verified by my observations in 1925. In that year, they were first seen at Urelia Bay on April 30. On May 4, Donald Stevenson saw 10 males flying about, and on May 17 a pair was seen at St. Catherine Cove. Pintails were also present on Izembek Bay, and on June 30, near Point Grant, in the midst of nesting Arctic terns and Pacific eiders, a nest of eight eggs was found. Near Frosty Peak, a female that obviously had eggs, or young, nearby was observed.

Turner did not observe the pintail in the Aleutians during the

nesting season, and we found that the natives did not recognize pictures of the bird, yet the bird assuredly occurs in these islands. We noted pintails on a lake on Umnak Island May 30, 1937, and on August 23, 1937, Steenis obtained a specimen there. On June 16, 1936, C. S. Williams reported a pair on Amukta Island. Laing (1925) saw a small flock at Kuluk Bay, Adak Island, April 13, 1924. We noted a pair among the lakes at the southeast point of Kiska Island on June 5, 1937, and, in the same vicinity, on June 21 we saw two males and a female. Remains of a pintail were found in a bald eagle's nest on the north side of Little Sitkin Island, and, on June 17, 1937, a pair was observed on Alaid Island, of the Semichi group, which is near the western end of the chain. On Attu Island, Wilson (1948) found three pairs that he thought to be nesting.

Undoubtedly, all these records denote nesting throughout the Aleutian chain, though successful nesting in recent years may be adversely affected by the blue-fox industry.

Stejneger (1887) says pintails are very numerous on Bering Island, but less common on Copper Island.

Turner did not think pintails wintered in the Aleutians; however, he recorded them at Unalaska as late as November. Moreover, Beals and Longworth (field report) state that pintails are plentiful in winter in the vicinity of Unimak Island. On March 1, a flock of 25 was recorded; on March 16, 2 were noted; on March 26, a flock of 23 was noted. Moreover, Taber observed a flock of 48 that were wintering at Adak, in 1945-46.

Anas falcata: Falcated Teal

Rowland Wilson (1948) reports an unusual observation, in part, as follows:

On May 23 and 24, 1945, Lt. C. L. Stone and I observed a male and female of this handsome species, together with two Tufted Ducks and three male and four female Greater Scaups, on a little "pothole" pond inland from Murder Point [Attu Island]. We had abundant opportunity to watch the teals, for they were not shy. On the 24th we saw the male diving several times. He went under rather awkwardly, giving us the impression that he was not used to such activity. The female did not dive while we watched her. . . . Possibly they had been blown in from the west by a recent storm.

Anas crecca: Common Teal**Anas crecca nimia**

Attu: *Cheerrh-ook* (obviously the Russian name)

Atka: *Krech-cheer-tha* (derivation from Russian is at least suggested by the middle syllable)

Ataxciyax (Jochelson—probably the true Aleut name)

Russian, Commander Islands: *Tschirok* (Stejneger)

It is now well established that the breeding species of teal throughout the Aleutian chain is *Anas crecca*. During our expeditions, with only one exception, when a close view of males was possible, or when specimens were collected, the bird proved to be the common teal. Beals and Longworth collected a male at Unimak Island, June 11, 1941. This is the easternmost point for which we have a record of this bird. Swarth (1934) records 3 specimens, 2 males and 1 female, taken on Akutan Island, May 24, 1927. We found these teals common throughout the Aleutian chain, and they are to be found on most of the islands where suitable habitat is available. Bent lists a specimen collected by Lucien M. Turner on Atka Island, June 28, 1879, and one taken by J. Hobart Egbert on Kiska Island, July 14, 1904. He also states that in 1911 his party collected "quite a series" of specimens in the western and central islands, and every male proved to be this form. Laing (1925) records two males taken at Adak Island, April 13, 1924. On our own expeditions, several specimens were taken, including males on Kagalaska, July 4, 1936, and on Amchitka, July 24, 1936.

Gabrielson noted a pair of common teals on Amukta Island, June 25, 1940; he saw about a dozen on Amchitka, June 28, and saw others at Tanaga, Ogliuga, Atka, Ulak, Kavalga, Segula, and Adak.

These teals are the most abundant fresh-water ducks in the Aleutians. Broods of young were seen on the small islands, Ogliuga and Skagul, and two broods were seen on Kanaga. On July 7, 1937, we found a nest of seven fresh eggs on Amchitka. On July 3, 1936, a female with two downy young were seen in a shallow grassy pond on Adak Island. The natives said that teals nest on Attu, and a male was seen on Agattu, June 15, 1937. On August 23, 1937, I counted at least 42 teals on a lake near Nikol'ski Village, Umnak Island, and Steenis, on the same day, saw a greater number. Pairs were seen on various other islands, and it is certain that they nest throughout the length of the Aleutian chain.

Stejneger (1887) reported the European (common) teal as an

abundant visitor on Bering Island, but less common on Copper Island. The species also occurs in the Pribilof Islands.

Apparently, while nesting, the teals are less susceptible to the predations of the blue fox than are most other waterfowl, though the chief of Atka Village declared that they were much more numerous in early days. They generally occupy shallow, weedy ponds, though they also spend much time on the beaches—sometimes on boulder beaches. They feed extensively along the beach margin and are often found on salt water. This was noted particularly on Ogliuga Island. The nest found on Amchitka Island, July 7, 1937, was situated in the dense stand of *Elymus* bordering the ocean beach, and the female repeatedly was observed feeding on this open beach.

Cottam and Knappen (1939) have reported on the contents of five stomachs of this species, and say that "three out of four birds taken in coastal Alaska had fed almost exclusively on soft-bodied crustaceans." The authors felt that the high percentage of animal matter (80.2 percent) was probably not typical and would not be maintained in a larger series of stomachs. However, our observations on the feeding habits of these teals in the Aleutians are in accord with these findings from the stomach analyses.

Evidently, the common teal winters in the Aleutians. We were assured of this by the natives of Attu and Kanaga, and residents of Unimak also stated that teals winter there. Furthermore, Donald Stevenson, who spent several winters in the Aleutians, furnished positive evidence of it, for in his field reports he said, in part (referring to Unalaska Island),

They were again noted here Nov. 2, 1920, and at intervals in the month of November until November 21. Then again here January 7, 1921, to January 31, 1921. Being often observed feeding in small pools of salt water along the beach after the cold weather had set in and had frozen the fresh water streams. . . . Existed in great numbers at Umnak Island, near Otter Point November 22, 1920, in small fresh water pond, and in large fresh water stream. . . . Observed about five hundred here Dec. 13, also noted here Dec. 18, 1920. Specimens taken were in a fine fat condition.

In 1943, Cahn noted 1 common teal at Unalaska Island on October 14, and 2 on December 2. Taber noted a flock of 47 at Clam Lagoon, Adak Island, from November 1945 to late January 1946. Sutton and Wilson saw a male at Attu, March 5, 1945.

Anas carolinensis: Green-winged Teal

The common teal occupies the Aleutian Islands, and the green-winged teal occupies the Alaska Peninsula. There is some over-

lapping in range. On June 5, 1937, Steenis and I observed 3 teals at a small pond on Kiska Island—at least 2 were males in bright plumage. One was clearly *A. crecca*, with a plain breast and a light-colored scapular streak. The other bird lacked the scapular streak, and plainly showed the crescent on the side of the breast. We both saw these markings, but we failed to note the markings of the third bird. It may have been a female. It is interesting to note that both species of teals occur on the Pribilofs.

Cahn, writing of his observations at Unalaska Island during the war years, says of the green-winged teal: "Observed in every month of the year except August in four years of observations; inhabits the same area as *A. crecca*, but more common." Taber did not record it as being present in winter at Adak.

Because of the difficulty of identification in the field, and because females of the two forms are indistinguishable, even with specimens, there is confusion about their ranges and the extent of territorial overlapping. Until more collecting is done, and because specimens of *nimia* east of Unimak are lacking, we may assume for the present that the birds of Alaska Peninsula are chiefly *carolinensis*. They occur in suitable locations along the peninsula. In 1925, they were noted on Unimak Island and Izembek Bay. In 1936, we were informed by residents that teals nest up the river from Nelson Lagoon, and we saw at least two teals at Ugashik River on May 29, 1936. Osgood (1904), however, found teals scarce in the interior of the base of Alaska Peninsula, and says,

One old female was seen on the Nogheling River July 21, and no more appeared until we neared the coast on the lower Nushagak River. Immense flocks were seen in late September in the vicinity of Nushagak. McKay obtained several specimens at Nushagak and at Ugashik.

The National Museum has a male green-winged teal that was taken at Nushagak, May 6, 1883, by Paul J. Kojevnikoff.

Cahalane (1944) has observed the green-winged teal on the mainland only once positively: a flock of 12 was seen September 24, 1940, near the mouth of Savanoski River.

Gabrielson saw several green-winged teals, obviously with broods, up the Kvichak River, July 23, 1940. On April 27, 1942, he positively identified 21 of these birds at King Cove, and later he saw many more at Cold Bay.

Green-winged teals occur on Kodiak Island, according to Friedmann (1935) and Howell (1948). Cahalane and Gabrielson found them to be numerous in the Kodiak-Afognak area, but there are no records for the rest of the territory under discussion.

Teals winter at Unimák Island, according to residents, and, according to Cahn, they winter as far west as Unalaska Island.

***Mareca penelope*: European Widgeon**

Russian, Commander Islands: *Svistsch* or *Svistun* (Stejneger)

Four specimens have been collected on the Pribilof Islands, and Dall (1873) records a specimen taken at Unalaska, October 12, 1871. He says it is "not uncommon among the ducks brought in by the native hunters of that locality." He considered it to be a winter visitor, "migrating about May 1st."

On June 21, 1937, we found a pair at a lake back from the beach at the more southerly harbor on Kiska Island. As the two birds flew by, I clearly saw the buffy coloration on the head of the male. At that season of the year, a pair suggests nesting.

Stejneger (1887) records this bird as being a visitor to the Commander Islands in migration.

***Mareca americana*: American Widgeon**

The American widgeon, or baldpate, is rare in the Aleutian district. On May 27, 1936, 2 or 3 were observed on the flat marshes near Ugashik River, and 2 males were seen May 29. We saw none to the westward, though Gabrielson records seeing a male and a female on a pond near Izembek Bay on June 6, 1942, and saw others at Port Moller, July 7, 1946.

Osgood (1904) mentions specimens taken by McKay at Cape Constantine and Ugashik in September 1881.

Hine (1919) observed this duck occasionally in the Katmai Region in 1919, and he obtained specimens near the mouth of Katmai River.

Friedmann (1935) records seeing the baldpate at Kodiak, and a specimen was taken. He also (1937) reports that bones of this duck were found in middens on Little Kiska Island. Gabrielson records that the species was "common" in the Kodiak-Afognak Islands in the fall and winter months of 1943 and 1944.

Howell (1948) reports as follows for Kodiak: "Two were seen May 31, at Middle Bay, and one on June 16, at Bell's Flats," in 1944.

Turner states that it is rarely seen on Attu Island.

Finally, Stejneger (1887) found a dead bird of this species among the sand dunes of Bering Island.

***Spatula clypeata*: Shoveler**Attu: *Koo-chú-tuh* or *Koo-chú-thoh*Russian, Commander Islands: *Soksun* (Stejneger)

The natives of Attu Island seemed to know this duck and had a name for it—if their identification is correct. They recognized a picture, agreed on the spoon-shaped beak, and claimed that the shoveler nests on Attu Island.

Stejneger (1887) considered it to be one of the rarer ducks on Bering Island, but he thought that it breeds there—hence, it would not be surprising to find it among the Near Islands.

We did not find the shoveler in the Aleutians, but on May 29, 1936, a male was seen among some other ducks in a pond near Ugashik River on the peninsula. Two specimens were taken by McKay near Nushagak, on August 14, 1881, and on September 24, 1882. Cahalane (1944) records 1 bird seen by him, September 7, 1940, on Brooks River, and Gabrielson observed 2 at Morzhovoi Bay, June 21, 1940—the westernmost point for which we have precise record.

The shoveler is scarce in the Aleutians and Alaska Peninsula, and it is comparatively scarce on other parts of the Bering Sea coast. The only place where we found them in considerable numbers was in the vicinity of Cordova, on the Copper River flats near the mouth of Eyak River. There, on May 16 and 17, 1937, we saw many of them engaged in courtship, evidently preparing to nest.

***Aythya americana*: Redhead**Attu: *Ka-vé im'-much*

The A. O. U. Check-List states that the redhead is a casual visitor on Kodiak Island, Alaska, and Friedmann (1935) mentions a specimen taken there by Rutter.

On June 16, 1936, I had a glimpse of a pair of ducks, identified as redheads, rising from a pond near the beach on Amukta Island. Upon arrival at Attu, Chief Hodikoff declared that a few ducks (like those in the picture of redheads that we showed him) nest on Attu and remain in winter. He gave us the native name, *Ka-vé* (head) *im'-much* (round). He was certain of his identification.

At the time, we were concerned only with the redhead, but because of its similarity to the pochard, which occurs on the Pribilofs, it is possible that the Aleut chief was really referring to the Old World species, *Nyroca ferina*, and conceivably the birds that we noted on Amukta were also of that species.

Aythya valisineria: Canvasback

In 1925, I was told by a trapper that canvasbacks had been seen on Uria Bay, on Unimak Island. It was thought at the time that he had confused the birds with some other canvas-backed type of duck. But the report is more plausible since Friedmann (1937) referred to this species—five humeri found in old middens at Dutch Harbor. The bird has also been recorded for the Pribilofs. No other records for canvasbacks were obtained.

Aythya marila: Greater Scaup*Aythya marila nearctica*

Attu: *Han-o ka-vé-too*

Russian, Commander Islands: *Tschernik* (Stejneger)

Four specimens of this species, which were breeding birds, were collected by Donald Stevenson at Izembek Bay in June 1925. On geographic grounds, also, the scaup of this region should be *A. marila nearctica*, rather than *A. affinis*. The American greater scaup was recorded from Kodiak Island by Friedmann (1935). Concerning this bird, Osgood (1904) says, "Scaup ducks, doubtless this species, were seen in small flocks along the Nushagak River September 4 to 9. McKay took them in May and July at Nushagak and Ugashik." And again, he says (1901), "a flock of six scaup ducks were seen on a pond near Tyonek September 17."

Cahalane records this duck on the Naknek River, where it was abundant, on September 28, 1940, and he found it to be common on Brooks Lake, September 9, though he did not see it in the more interior portions of the Katmai National Monument. He also said that they were fairly common in the Kodiak-Afognak area.

On July 23, 1940, Gabrielson observed four broods of greater scaups on the Kvichak River. In later years, he saw them in numbers at Unimak, Atka, Kanaga, Umnak, Unalaska, Amchitka Shumagin, Sanak, and Kodiak-Afognak Islands.

We saw two greater scaups near Chisik Island, Cook Inlet, May 7, 1936. On May 27–29, 1936, scaups were common, flying about in pairs, near Ugashik River. In June 1928, Jaques found them to be common near Port Moller. They were reported to be common near Chignik, maintaining their numbers better than other ducks in that vicinity.

In 1925, I found scaups nesting in Izembek Bay. About the middle of May of that year, there were small bands in St. Catherine Cove, at Unimak Island, swimming on the salt water or on the small ponds on the shore, sometimes segregating in pairs. In the middle of June, they were particularly common

about Hazen Point, and they were seen elsewhere in Izembek Bay. On June 20, they were still flying about in pairs. On that date, a female was seen standing near a recently constructed nest cavity. On June 30, 3 nests were found on small islands near Point Grant; 2 of these nests contained 9 and 10 eggs respectively. The number of eggs in the third nest was not recorded. On July 26, a nest of seven eggs was found on a gull island.

Residents stated that scaups nest on Unimak Island.

Scaups were noted at intervals throughout the Aleutian chain. Four or five were seen near Nikolski, Umnak Island, on May 30, 1937; 7, mostly males, were seen on Corwin Lake on Atka, June 22, 1936; several were noted on Amchitka, July 1937; a flock of 30 was seen on a lake on Kiska, July 26, 1936 (where half a dozen were seen on June 4, 1937); and several pairs were seen on Agattu Island in the middle of June 1937. Steenis observed four pairs and a female there, and other members of the party observed paired scaups. On June 15, 1937, on Agattu, I found a scooped-out nest cavity with a little down and some white breast feathers, which I thought to be a scaup nest. Austin H. Clark (1910) found this species to be rather common at Attu and Agattu.

Chase Littlejohn (manuscript notes) says, "Found breeding at Sanak, Ukamuk [Chirikof Island], and Morzhovoi Bay, each nest contained nine eggs. They congregate in large flocks in winter at Sanakh and remain so until spring, when they pair off and begin nesting."

The Attu chief assured us that scaups nest on Attu and winter there. On Kanaga Island, also, we were assured that scaups are plentiful in winter, and that they become very tame around the dock.

Taber found them wintering at Adak, and for Unalaska Island Cahn reports—

An abundant winter inhabitant of all the larger bays, in common with the Harlequin ducks and white-winged scoters. The greatest numbers occur in December and January, and the species disappears entirely in April as a rule; May 3, 1946 is the latest recorded date. It returns again a few at a time, in September and October, gradually increasing in abundance.

Sutton and Wilson found scaups wintering at Attu Island.

At Unimak Island, March 1, 1941, Beals and Longworth observed two rafts, of at least 1,500 scaups each, on Swanson Lagoon, and a trapper assured them that these ducks spend the winter there.

In several localities, mention was made of the scaup's habit of assembling near docks. In some cases, at least, fish offal appears

to be the attraction. This was definitely reported to be the case at False Pass, where the ducks gather at the cannery docks during the fishing season.

Aythya affinis: Lesser Scaup

Friedmann (1935) lists the lesser scaup in the avifauna of Kodiak Island on the basis of osseous remains found in middens. We did not identify this duck on our expeditions, and we assumed that the scaups observed were of the larger form.

Aythya fuligula: Tufted Duck

Howland Wilson (1948) added this species to the list of Aleutian birds, bearing out our assumption that it could easily occur among the western islands. He reports seeing 2 males and 2 females in a little pothole, inland from Murder Point on Attu Island on May 23 and 24, 1945; he watched them for some time, and the "tufts of long, loose feathers which streamed down from the nape of each male" were noted in detail.

Bucephala clangula: Common Goldeneye

Bucephala clangula americana

Attu: *Ha-no sakh-oi-a*

Russian, Commander Islands: *Gogol* (Stejneger, referring to the closely related European form).

This may be the "whistler" *amtátux*, given by Jochelson, for which no dialect was mentioned.

Friedmann (1935) lists bones found in Kodiak middens, which he assigned to this subspecies on geographic grounds, and he mentions two specimens collected there by Fisher. On March 21, 1924, Laing (1925) observed three of these ducks at Uyak Bay of Kodiak Island.

Gabrielson noted that this duck is plentiful in the Kodiak-Afognak area in fall and winter; he found it in the winter at Unalaska, Umnak, Kanaga, and Atka, and at King Cove and Cold Bay in spring and fall.

I observed the goldeneyes in 1925 at Unimak Island. On April 29, 1925, I saw a pair flying over a lagoon at Urelia Bay, and on May 1, 1925, I saw a flock of about 10. On May 4, 1925, Donald Stevenson reported at least 200 on Peterson Lagoon. Identification could not be positive on all of these instances, but they were assumed to be *americana* on the basis of known distribution.

Friedmann identified a goldeneye humerus in middens of Dutch Harbor, and Laing (1925) observed nine goldeneyes at Unalaska,

March 21 and 22, 1924; however, those were immature birds, or females, and identification of the species was doubtful. Turner, also, records this duck for Unalaska in December, and he says that it winters there.

Cahn reports the goldeneye for Unalaska Island, saying,

Strictly a winter visitor, present in considerable numbers but never in large flocks. Goldeneyes drift in by one's and two's in late October (October 24, 1943), and are common in the larger bays during the period of December through February, at which time they disappear far more abruptly than they arrive. April 11, 1946, is the latest recorded date; this is unusually late.

Laing observed an unidentified goldeneye at Adak Island, and at Attu Island he positively identified two adult males that "were found ardently courting in a flock of six."

Taber found goldeneyes wintering at Adak Island in 1945-46.

When shown colored illustrations, the Attu chief picked out the common goldeneye and said it was plentiful there in winter, arriving in November and (he thought) leaving early in March.

Sutton and Wilson found them wintering at Attu. Stejneger (1885) reported that the European common goldeneye occurred at the Commander Islands in winter in small numbers.

Because there are so few specimens, and because racial identification cannot be ascertained in the field, it would be possible that the Old World form (keeping in mind that it is recorded from the Pribilofs) occurs in the western Aleutians and has not been detected. In the case of this form, we are leaning heavily on assumed geographical distribution.

Bucephala islandica: Barrow's Goldeneye

We saw several Barrow's goldeneyes at Seward, May 5, 1936; at least 12 at Port Chatham, Kenai Peninsula, on May 6; 2 at Chisik Island, Cook Inlet, May 7; and 1 male at Kodiak Island, May 13. Friedmann (1935) has given a number of records for Kodiak Island, and Gabrielson noted them in winter and fall at Unalaska and Kodiak-Afognak Islands.

With regard to the base of Alaska Peninsula, Osgood (1904) reported—

One was seen on the Nogheling River July 20, and one was killed there some days later; another was shot by W. L. Fleming on a small pond near the head of Lake Clark July 28. Several immature birds were killed at the mouth of the Chulitna River August 4. Rather common at intervals along the Chulitna River August 12 to 17; generally seen in family parties of 6 to 10. Near Swan Lake a flock of about 15 was seen feeding on a shallow lake in company with a flock of 10 swans. Seen almost daily in pairs or small flocks along the Malchatna and upper Nushagak September 3 to 6.

Cahalane (1944) found this duck "numerous in the upper portion of the Naknek River, September 4." They were also abundant in Amalik, Kafia, and Kukak Bays on October 5 and 7. Hine (1919) considered it to be a common species in the Katmai Bay area, and he obtained a specimen there.

Thus, it would appear that the Barrow's goldeneye is confined pretty much to the basal part of Alaska Peninsula, adjacent island groups, and mainland areas as a breeding bird. The American common goldeneye, on the other hand, is the form generally encountered to the westward, as a migrant. There are no data to show that any goldeneye nests west of the more or less tree-covered base of Alaska Peninsula.

Bucephala albeola: Bufflehead

Attu: *Chirr-u-num Sakh-oi-a*

Atka: *Mith-i-mé-thruh*

The bufflehead occurs sparsely throughout the Aleutian district. Friedmann's data (1935) show that this duck is rather common on Kodiak Island, and that it nests there. Osgood (1904) reports that "two specimens were seen at Cold Bay October 17 among some ducks killed on the bay by natives. One was taken at Nushagak by McKay, May 2, 1882."

We noted at least six buffleheads at Port Chatham, Kenai Peninsula, May 6, 1936. At Chignik, we were told that buffleheads are seen there in autumn. Gabrielson has seen them at Cold Bay, at the Shumagin Islands, and at Sanak Island.

We found two females in a pond at Ikatán Peninsula, Unimak Island, May 19, 1936. Beals and Longworth noted one at False Pass, March 7, 1941, and four on Ikatán Peninsula on April 15, 1941.

Turner (1888) says that this duck occurs in winter at Unalaska, where he obtained specimens, and he adds that they are rare to the westward, where they are present only in winter. Gabrielson found them in winter at Unalaska, Atka, Amchitka, and Umnak. Over a period of 4 years, Cahn saw only one bufflehead at Unalaska Island (on February 22, 1944).

Ray Clark, storekeeper on Umnak Island, said that butterballs (buffleheads) remain there in winter.

Wetmore (manuscript notes) says that R. H. Beck saw a pair of buffleheads in a pond back of Atka village on June 13, 1911; Laing (1925) saw "fully thirty-five" in a small lagoon on Adak Island on April 11, 1924. And Taber found the species wintering at Adak, where there were 32 birds noted in a census on January 13, 1946.

The Attu chief stated that his island is within the wintering range of the bufflehead, but he insisted that they also nest on Attu, "up high."

Stejneger (1887) reports the bufflehead as "an accidental visitor during the winter of 1882-83" in the Commander Islands.

Incidentally, this bird is mentioned in a number of records for the Pribilof Islands.

Clangula hyemalis: Oldsquaw

Attu: *Anǵ-lach*

Atka: *A-lang-ach*

Unimak: *Alg-nach'*

Russian, Commander Islands: *Sofka* (Stejneger)

Russian, Yana region: *Savka* (Birula)

Chukchi: *Pojgochek*, male

Achak, female (Palmén)

The oldsquaw is fairly common, especially in migration, and has been reported by most writers on southwestern Alaska. It occurs on Kodiak, and Osgood (1904) reports it from various places at the base of Alaska Peninsula and the Bristol Bay region. Einarsen (1922) reports several of these birds nesting near Ugashik in 1922. Laing (1924) counted as many as 200 at Dolgoi Island, March 23, 1924, and apparently he saw it in many other unidentified localities. He collected a specimen at Kodiak, March 21, 1924. Dall (1873) considered it to be abundant east of Unalaska.

We noted the bird at various points: 2 migrating flocks on the Gulf of Alaska, May 2, 1936; 150 birds at Chisik Island, Cook Inlet, May 7; a flock of 30 in Shelikof Strait, May 13; 1 bird in Nushagak Bay, May 23; and 2 birds on the flats at Ugashik River, May 27. They are said to arrive at Chignik "late in the fall."

The oldsquaw is common in migration along the Alaska Peninsula and adjacent islands, but we were unable to establish nesting records.

They are rather common in the Aleutians at certain seasons, especially in winter. In 1925, I found them to be numerous about False Pass in the latter part of April and in May. One was seen in St. Catherine Cove as late as May 20, but none was seen after that date. Beals and Longworth (field report) recorded them at False Pass and neighboring points on January 12, 13, and 19, 1941, and they observed them daily through March and as late as April 10.

Wetmore (manuscript notes) saw 2 birds at Unalaska Island

on June 7 and 11, 1911, and McGregor (1906) collected 1 female in worn plumage on July 20, 1901, at Tigalda Island.

Cahn often found them wintering at Unalaska Island; the earliest date was November 3, 1943, and the latest date was April 19, 1946. Taber found them wintering at Adak.

We did not see many oldsquaws in the Aleutians; however, at Atka Island we were told by the natives that they formerly had nested on that island, but not "since the foxes came." The natives said that these birds winter on Atka and Kanaga in large numbers. The Atka chief assured us that these ducks nest on Amchitka—he stated that although he had seen the young, he had not seen any nests.

Kiska Island appears to be one of the favorite localities for the oldsquaw. This island was mentioned by Dall as the western limit of its range. We saw several birds there as late as June 4 and 5, 1937, and Wetmore reported them to be fairly common near the entrance to Kiska Harbor, June 17 to 21, 1911. We also found oldsquaw remains in two bald-eagle nests on that island; oldsquaw remains were also found on West Unalga, and in eagle nests on Rat and Little Sitkin Islands.

Dall (1874) said that the oldsquaw was resident as far west as Kiska, but that it was not abundant. We learned from the Attu natives that it nests on Agattu and is abundant in the Near Islands in winter. This is substantiated by the report by Sutton and Wilson on Attu. The oldsquaws wintered there, and after March 4 they were observed courting. Turner (1886) said that few of these birds nested in the Aleutians, but that many of them wintered there. In 1887, Stejneger reported oldsquaws "breeding numerously on Bering Island." Gabrielson also observed them wintering as far west as Atka.

To sum up, Turner's statement (see above) applies very well to the Aleutian district as a whole.

Histrionicus histrionicus: Harlequin Duck

Attu: *Kagh'-i-ach*

Atka: *Kagh'-a-thi-ga*

Unalaska: *Kang'-a-rich*

Unimak: *Kang'-ath'-a-gich*

Russian, Commander Islands: *Kamenuschka* (Stejneger)

This is the most abundant duck in the Aleutian Islands. We found harlequin ducks at practically every island that we visited, singly sometimes, generally in small groups, and occasionally in larger flocks. It is safe to say that, at one time or another, harlequin ducks occur at every island, large or small, from Uni-

nak to Attu. Stejneger has reported them to be common in the Commander Islands.

They were also found east of the Aleutians—at Amak Island, at Izembek Bay, and at False Pass. In the Shumagin group, we observed them at Unga, Nagai, and Simeonof Islands. They were at King Cove, the Barren Islands, Afognak, Port Chatham on Kenai Peninsula, and at Seward. Osgood (1904) observed them along the Egegik River and “about the mouths of the larger streams that empty into Becharof Lake.” He found them to be common at Kanatak and Cold Bay, and he mentions specimens taken by McKay and Johnson at Igushik and Nushagak.

Cahalane (1944) reported harlequins in large numbers in the general region of Katmai National Monument in the fall of 1940, and Hine (1919) considered them to be one of the most common ducks in the Katmai Bay area in the summer of 1919. Cahalane also recorded them as being abundant in the Kodiak-Afognak group in the fall of 1940, where Gabrielson noted 200 on June 16, 1940. W. Sprague Brooks (1915) observed them on April 19, 1913, at the Semidi Islands, and on April 22, 1913, he saw them at King Cove.

Although these birds occur on the north side of Alaska Peninsula, they are more common on the south side, which is more rugged. Evidently, these birds nest on Alaska Peninsula. On July 19, 1940, Gabrielson noted a pair flying along Kittiwake Creek, between Brooks and Naknek Lakes, and Friedmann (1935) states that Bretherton found them breeding in June on Kodiak Island. In the spring of 1925, I often observed two pairs along a stream just north of Aghileen Pinnacles, near the western end of Alaska Peninsula. Eventually, on June 3, only the males were seen; presumably, the females were nesting.

On July 16, 1911, Wetmore (manuscript notes) observed a female and a group of young in King Cove.

It is difficult to determine the status of the harlequin ducks in the Aleutians. The natives insisted that they nest along streams and that their nests are very hard to find. In way of substantiation, we found no nests and no broods of young. However, we found these birds on islands that had no suitable nesting streams. On the other hand, Austin H. Clark (1910) reported: “It was common about Atka, where 1 or 2 were seen inland on a small stream; on Attu and Agattu it was also numerous on the streams as well as along the coast.”

Turner (1886) described a deserted nest on Unalaska Island, in a hollow formed by two blocks of rock. A native assured him

that it was the nest of a harlequin duck. Here, again, our own experience was baffling. Though there were numerous cliffs and many available sites for nesting along the rocky shores, we saw no young brood throughout the two summers of observations.

Wetmore, however, had pertinent observations at Kiska Island in 1911, when he says (manuscript notes) that

some of them were already nesting along the base of a high rocky cliff, as they seemed very anxious while I was along there, those on the water whistling and swimming in small circles. I saw one or two females slipping quietly away from shore ahead of me, but flushed none from the beach itself.

Beals and Longworth found harlequin ducks wintering at Unimak Island, and stated that they nest there. Elsewhere in the Aleutians, natives said that they are more numerous in winter than in summer.

Stejneger (1885) found no evidence of nesting in the Commander Islands, and stated that the natives knew of no nesting.

From these various observations, it can be concluded that the harlequin ducks nest on the Alaska Peninsula, possibly rather commonly; that they also nest in numbers unknown in the Aleutian Islands; that immature birds, various nonbreeders, and males gather for the summer in these waters; and that they winter there in great numbers.

We had little opportunity to study food habits, and it must be assumed that, in the salt water, it consists of marine invertebrates. The teacher of the native school at Atka informed us that in the autumn of 1936, when there was a large run of salmon up the streams of Atka Island, harlequin ducks were seen on the streams, presumably feeding on salmon eggs. However, we have no certain data on this subject.

Polysticta stelleri: Steller's Eider

Chukchi: *Kataadlin* (Palmén)

This little eider of the Bering Sea region occurs abundantly along the Alaska Peninsula and the Aleutian chain at certain seasons—particularly in winter. It is recorded as far east as Kodiak, where Friedmann (1935) lists many specimens and observational records, including some bones from middens. Dall (1873) says it was observed in the Shumagins “in March, and in the summer months.” The same writer (Dall 1874) reports them as wintering at Sanak Island, but he considered Unalaska to be the center of abundance for this species. He remarked upon the irregularity of their occurrence, because he had found Steller's eider, together with the Pacific eider, to be numerous at Unalaska

in May 1872, however in May 1873 he did not see a single one of either species in that locality.

Osgood (1904) considered the Steller's eider to be common about Bristol Bay, and he mentions specimens collected by McKay and Johnson at Nushagak and Ugashik. On October 4, 1940, Cahalane (1944) observed a group of 6 in Amalik Bay, and he saw 6 again (perhaps the same group) the next day. Gabrielson noted 2 males at Morzhovoi Bay June 21, 1940, and collected 1, which was not in breeding condition. In 1936, we observed several sizable flocks in Nelson Lagoon.

In 1925, I found this duck to be rather common in Izembek Bay. On May 17, 1925, there were small groups at St. Catherine Cove, Unimak Island, and on May 20 about 200 were seen there, as well as several bands offshore in Bering Sea. Several flocks, totaling at least 300 birds, were spending the summer in Izembek Bay; they used Glen Island, near its entrance, as their home-ground. These were immature birds of both sexes, though there was an occasional one in adult male plumage. One male in adult plumage was collected on June 17. The testes were very small. None of the birds were seen on the adjacent marshlands, and there was no evidence of nesting.

Turner (1886) testifies to the presence of the Steller's eider among the Aleutians in winter, even to the western end of the chain. Stejneger (1887) said that they wintered in the Commander Islands in "countless numbers," arriving early in November and remaining until after the middle of May. Friedmann (1937) has recorded five humeri of this duck from middens on Little Kiska Island. Beals and Longworth observed them often in January, March, and April, 1941, and saw them as late as April 25, at False Pass.

Although we did not find the Steller's eider nesting, older records furnish rather good evidence of nesting on the Alaska Peninsula and Aleutian chain. A. C. Bent (1925) records some notes sent to Major Bendire in 1892 by Chase Littlejohn, which included a statement that "a few were nesting at Morzhovoi Bay in June." Dall (1873) writes of the pairing of these ducks at Unalaska and describes a nest found on Amaknak Island, May 18, 1872. It contained a single egg. Turner (1886) saw a few of these ducks at the western end of Attu Island in July 1880, and the natives told him that the species nested sparingly on Agattu Island.

Judging by the information available to us, we must recognize the strong probability that at one time the Steller's eider nested

on Alaska Peninsula and Aleutian chain (though undoubtedly in small numbers), and that it wintered there in great numbers. It is also clear that there has been a great diminution in numbers. On our two expeditions in 1936 and 1937, we were in the general region early enough to have observed these ducks before all of them had left their wintering grounds. We saw very few, and those that we saw were on the north side of Alaska Peninsula. We saw none in the Aleutian chain. We found the natives of Attu Island—who have had only limited contact with the white man—to be well versed in their local fauna, much more so than natives farther east. These Attu natives did not recognize pictures of the Steller's eider and declared that it does not occur there, even in winter. They could be mistaken; however, if we accept their testimony there must have been a great decline in numbers since 1880, when natives told Turner that these birds nest "sparingly" on Agattu Island.

A. C. Bent (1925) considers the principal migration route in the fall "southward along the Siberian coast of Bering Sea to their winter homes in the Kurile, Commander and Aleutian islands." It is probable that the migration along the Siberian coast is the greater one, but if the information furnished by the Attu Islanders proves correct (and since we know these birds do winter in the eastern Aleutians), it is unlikely that the Siberian birds go to the Aleutians. On the other hand, we now know that there are large nesting populations on the American shores—at Hooper Bay and Nelson Island—and we have observations pointing out that the eastern Aleutians and parts of Alaska Peninsula, even Kodiak Island, are the principal concentration points in winter. In view of these facts, we must conclude that there is also a southward migration down the Alaskan coast of Bering Sea to the eastern Aleutians and Alaska Peninsula, and that the majority of the birds wintering in the Aleutians nest on the Alaskan coast.

Somateria mollissima: Common Eider

Somateria mollissima v. *nigra*

Attu: *Kaf-segh'-ich*, male

Chá-is, female

Kú-ku-toch, young

Atka: *Ka-sam'-ich*, adult (sex?)

Ku-kú-toch, young

Kasimax (Jochelson—dialect not given)

Russian (?), Copper Island: *Pistrak* (Stejneger)

Chukchi: *Kupuken*, male

Emngi, female (Palmén)

Common eiders were observed at practically every island of the

Aleutian chain and are as universally distributed as the western harlequin duck, though not so abundant. Apparently, they are not plentiful on the Commander Islands, for Stejneger (1887) says that they breed in "very limited numbers in a few places on Copper Island, only occasionally flying over to Bering Island, round the shore of which a few may be seen in winter."

In the Aleutians, we saw these birds in small groups, generally paired, and they nest, or try to nest, throughout the Aleutian chain. Blue-fox raising has seriously interfered with nesting on certain islands.

Nesting of common eiders was determined for the following islands:

Attu—quite a number nesting on rocky islets in Massacre Bay.

Agattu—preparing to nest.

Semichi—nesting on islets in a lake.

Buldir—nesting on the beach (no foxes present).

Chugul, Little Kiska, Kiska—nesting reported by Wetmore in 1911.

Amchitka—nesting on offshore rocks and preparing to nest on beach.

Ogliuga—plentiful, many young birds seen.

Aiktak, Kavalga, Ulak, and Tanaga—nesting reported by Gabrielson.

Little Tanaga, Kanaga, Adak, Aso, Igitkin, Salt, Atka, Chuginadak.

Baby Islands—nesting on Adokt and Excelsior (no foxes present).

These are the nestings actually observed. The birds were observed at many other islands, where they were probably nesting. Were it not for the predations of introduced blue foxes, they undoubtedly would nest on practically all islands.

In 1925, I found nesting groups in Izembek Bay, Alaska Peninsula (particularly on Glen Island and islets near Point Grant), as well as on a gull island far out in the bay. On May 22, 1936, we found flocks of common eiders in Nelson Lagoon, and in one place I counted 111 males on the beach. Residents said that they nest abundantly on some grass-covered sand islands there. Osgood (1901) mentions a young bird and a set of eggs secured by T. H. Bean in July 1880 at Chugachik Bay (Kachemak Bay). In 1936, we saw them in Ugashik River, but we did not remain long enough to determine their nesting status.

Thus, we have a fairly accurate and continuous record of nesting from Bristol Bay westward to Attu Island.

On the south side of Alaska Peninsula, our observations are more scattered. Common eiders are known to nest as far east as Kodiak, and at Chisik Island, in Cook Inlet, we observed at least 12 pairs in the spring of 1936. The local game warden assured us that they nest on Duck Island nearby, and on May 13, 1937, several common eiders were seen in Icy Straits—the farthest east that we had observed this species. Mrs. Frank C. Hibben (1942, p. 182) found them nesting in Glacier Bay, the most easterly nesting record for southern Alaska.

Gabrielson observed about 12 common eiders at Kodiak on June 14, 1940; at least 40 birds and 1 nest were seen in the Semidi Islands on June 18; and a few were seen at Morzhovoi Bay on June 21.

As might be expected, companies of immature birds (nonbreeders) spend the summer in the waters along Alaska Peninsula and the Aleutians. Furthermore, this is the principal wintering ground for the species; they do not venture farther south in any great numbers.

Nesting Habitat

These eiders utilize a variety of nesting sites. Probably they would prefer low islands of gentle slopes (such as the sand islands of Izembek Bay), where they can nest in the grass. In such places, they nest both on the slopes and on the beach. Similar situations may be found in the Aleutians—the beach of Buldir Island is an example. There are few places in the Aleutians where they can nest with safety on the principal shorelines because of the introduced blue fox. We found a few birds nesting on the shores at Amchitka and Agattu, but, being adaptable, they now seek the grassy tops of offshore rocks and pinnacles, or islands in lakes, where they are protected by water. The natives assured us that they also nest on ledges of sheer cliffs, where foxes are unable to climb.

Mortality Factors

The blue fox is probably the most potent predator that the eiders face in the Aleutians. In addition to this introduced enemy, the northern bald eagle also obtains an occasional eider, but apparently it does not prey extensively on the species. In a total (taken during three seasons) of 466 food items that were identified in 32 eagle nests and at a few perching places, only 8 common eiders are represented. In one of these instances, the eider had a nest within 10 feet of an eagle's perch, and it was to be expected that the eagle would eventually seize the bird. It is surprising that so few eiders are taken by the eagle, because this duck does not

appear to be agile on the wing and is present everywhere. Probably the great variety of "sea birds" attract the eagle's attention more readily.

Gulls and ravens are another potent factor in stabilizing the eider population, because they prey on the eggs and young. The raven is included here solely on the basis of fragmentary observations elsewhere. But the glaucous-winged gull was observed at times to be active in raiding eider nests. There is an interesting relationship here that has been noted frequently. Gulls and eiders often nest on the same area. Presumably, this should give the gulls a better chance to rob the nests of their duck neighbors; however, it does not appear to be that simple, and the situation deserves careful study. Assuredly, upon entering such a mixed nesting colony, one finds a number of eider nests already rifled; yet, many others have not been disturbed. It is noticeable that human intrusion, which forces the eiders to leave hurriedly without covering the eggs, gives a splendid opportunity to the first passing gull, and the gulls readily take advantage of it.

In 1925, in Izembek Bay, I found eiders nesting in the midst of a gull colony and found others nesting in a colony of terns. All these birds seek the same type of nesting terrain, regardless of neighborly problems. During that season, an effort was made to reduce the hazard for nesting eiders by carefully covering the disturbed nest with down, just as the bird would have done. So far as the results could be observed, this method was effective. One will sometimes find gull and eider nests in amazingly close proximity, apparently with no detriment to the eider.

After being hatched, the small duckling still faces danger from the gulls. A number of decimated broods were seen, and sometimes, as observed at Ogliuga Island, several families then join together in a band.

But in spite of all these nesting hazards, the eiders hold their own—they occupy the entire Aleutian district in fair numbers and are plentiful enough to utilize whatever nesting sites are available to them.

Somateria spectabilis: King Eider

Attu: *Sakh'-uch*

Sákux (Jochelson)

Russian and Yukat, latitudes of the Yana: *Turkan* (Pleske)

Chukchi: *Jekadlin* (Palmén)

Information on the king eider is incomplete. We know that it spends the winter among the Aleutian Islands, the Shumagins, along the Alaska Peninsula, and as far east as Kodiak, where

Friedmann (1935) has recorded specimens taken and many bones found in middens. He also found many bones in middens of Dutch Harbor and Little Kiska. In the wintering season, Gabrielson found this eider at various points from Kodiak to Unalaska, and Hine (1919) obtained specimens near the mouth of Katmai River on June 25, 1919. Though we have relatively few published reports of king eiders from the winter range, these ducks must occur along the Aleutians and Alaska Peninsula and the adjacent seas in large numbers, judging by the striking northward migration we observed at Hooper Bay in the spring of 1924.

The Attu chief appeared to recognize this duck; he gave us a name for it and stated that a few of them nest at Attu Island and that a few winter there.

Judging by the relatively large number of bones found by Herbert Friedmann in the middens at Dutch Harbor and Kodiak, and considering the statement of the Attu chief that only "a few" winter there, the king eider evidently assembles in the greatest numbers among the eastern Aleutians and along the Alaska Peninsula. In 1925, I was told by local residents that many of these ducks winter at Isanotski Strait and at Wide Bay. Beals and Longworth (field report) observed king eiders at Isanotski Strait, Ikatana Peninsula, and at neighboring areas at intervals from early January to the latter part of May 1941; their numbers began to diminish in May, and at the end of May practically none were left. Four specimens were collected on January 13 and 24 and March 6.

In winter, Cahn found the king eider to be more common than the common eider at Unalaska Island, and he says,

present from early December to early March, usually in small flocks of three to six, or solitarily. Dec. 2, 1945, is the earliest record; April 3, 1944, the latest. The gizzard of a female found dead contained two specimens of the snail *Callistoma*.

Though we do not have nesting records for the Aleutians—the Attu chief's statement about their nesting on that island may properly be questioned—a number of king eiders spend the summer near Alaska Peninsula. In 1925, I observed a flock of about 200 birds (females and immature males) that spent the summer at Glen Island in Izembek Bay.

Lampronetta fischeri: Spectacled Eider

Information on this eider is disappointingly meager for the area under discussion. We saw none during the course of our expeditions to the Alaska Peninsula and the Aleutians. They are

considered to be winter residents there, and A. C. Bent (1925) says they occur sparingly east to Sanak Island. Friedmann (1934) records a humerus from native-village middens on Kodiak Island. Dall (1873) records it as rare at Unalaska as a winter visitor, leaving there in May for northern nesting grounds.

Surprisingly enough, Turner (1886) says "This species occurs among all the Aleutian Islands, where it breeds and is a constant resident, but extremely shy." This certainly is not the case today. Dall's statement, above, would seem to be more credible.

Melanitta deglandi: White-winged Scoter

Melanitta deglandi dixonii

Attu: *Tru-pań-ach* (obviously of Russian origin)

Atka: *Ta-mu-ghá-luh*

Russian, Commander Islands: *Turpan* (Stejneger)

The *Kanádgix* of Jochelson (dialect not indicated) may possibly refer to this duck.

White-winged scoters have always been common along the southern Alaskan coasts in spring migration, and in the course of several voyages they have been noted regularly in late April and early May along the southeastern Alaskan waters, as well as farther west. In 1936, we noted a few at Seward on May 5; at least 20 were noted at Port Chatham, Kenai Peninsula, on May 6; a few individuals were seen among the Barren Islands, May 10 and 11; and several were noted at Kodiak. They were common in Kupreanof Strait on May 13.

In the fall of 1940, Cahalane found that scoters were numerous in the Kodiak-Afognak area. Early in September, he found them to be abundant in Naknek River, but none were seen by the end of September. He says (1944), "On the Pacific side of the area scoters were very numerous during the first half of October. They were 'abundant to very abundant' along the entire mainland coast from Katmai Bay to Point Nukshak."

On June 16, 1940, Gabrielson noted 100 scoters near Whale Island.

Osgood (1904) observed a flock of six scoters on Neekahweena Lake, about halfway up the Chulitna River on August 14.

Chase Littlejohn, referring to the area between Kodiak Island and the west end of Alaska Peninsula in 1887-88, wrote, "Seen often during winter. I saw a number of birds at Ukanuk in summer where I am sure they breed but for want of time I did not succeed in finding their nests."

In 1936, we found these ducks to be abundant in Nushagak

Bay on May 26, and we observed several on lower Ugashik River on May 27 to 29.

Jaques (1930) noted them as abundant in southeastern Alaska, May 1 to 9, 1928, and saw a few about Port Moller, May 22 to June 2, 1928.

In 1925, I found them about the western end of Alaska Peninsula: At King Cove, April 25; plentiful at False Pass, April 28; a flock in Bering Sea near St. Catherine Cove (Unimak Island), May 17; and a few near Izembek Bay, May 20. As late as July 27 a few (possibly nonbreeders) were found along the coast in the vicinity of Izembek Bay.

We did not observe white-winged scoters in the Aleutians west of Unimak Island, but Wetmore (manuscript notes) reported "a great raft" of these birds at Tanaga Island, June 25, 1911, and he noted small flocks in Kiska Harbor, June 17-21, 1911; Gabrielson noted a few at Akun, July 9, 1941.

A. C. Bent (1925) suggests that the species may possibly breed in the Aleutians, basing his conjecture on these summer observations. This is possible, not only in the Aleutians but also on the peninsula, especially before the introduction of blue foxes on the islands. However, we have no nesting records for this entire district.

According to general information and statements of natives, white-winged scoters winter in large numbers in the Aleutians and along the Alaska Peninsula. In 1941, Beals and Longworth (field report) recorded these ducks at intervals from January 12 to June 12 in the region about eastern Unimak and the adjacent Alaska Peninsula, and Gabrielson recorded wintering birds from Kodiak to Unimak.

Cahn (1947) writing of Unalaska Island, says: "An abundant fall and winter visitor, especially from December to February." And Taber (1946) found a few of these birds wintering at Adak. Sutton and Wilson (1946) observed one scoter at Attu, March 17, 1945.

G. H. Mackay in 1891 (quoted in Bent 1925) gave an interesting account of a mass migration of white-winged scoters to their nesting grounds, as observed in Rhode Island. He stated that it generally took place about the middle of May and that the daily flight was begun in the afternoon.

We observed a similar occurrence on the other side of the continent when we visited Nushagak Bay in 1936. As we went up this bay on May 23, we saw large numbers of white-winged scoters assembled there, some of them flying about in pairs. The following is quoted from our field report;

On the evening of May 26, as we were going back out through Nushagak Bay, we observed flock after flock of white-winged scoters flying high in the air in goose-like formation, all heading up the bay in a general 'inland' direction. Some flocks contained 75 or 100 birds. It appeared that we were witnessing a movement, en masse, from a temporary salt-water meeting place to the inland nesting grounds.

Melanitta perspicillata: Surf Scoter

We observed this bird in considerable numbers in the spring, on the way to the Aleutians, along the coast of southeastern Alaska. They (apparently all males) were particularly numerous on the south side of Millbank Sound on April 25, 1936. One large flock arose from the water and strung out for a mile. It must have contained at least 1,000 birds. There were other smaller flocks. We saw 4 or 5 of these birds at Port Chatham, Kenai Peninsula, on May 6, which was the last sighting.

Surf scoters are known to occur at Kodiak Island. Cahalane (1944) says: "All of the surf scoters seen were on the Shelikof Strait coast of Katmai National Monument, Oct. 4 to 7. They were 'common' in Kinak Bay, but were abundant from Katmai to Amalik Bay and in Kafliia and Kukak Bays." Gabrielson also observed them at Kodiak in early spring and fall.

Laing (1925) observed these birds in spring as far west as Dolgoi Island, south side of Alaska Peninsula, but he saw none west of there.

On July 23, 1940, Gabrielson noted four old males up the Kvichak River, and in winter he saw a few at Unimak.

Wetmore (manuscript notes) reported, "A small flock of scoters, that I took to be this species, was seen June 4 in Lost Harbor, on Akun Island, and others were seen June 10 and 11, in Chernofski Harbor (Unalaska Island)." He reported none west of that point.

Dall (1873), referring to the surf scoter under the name *Melanitta velvetina*, says: "Killed Oct 27th, 1871, at Unalaska, and noticed at intervals there during the winter. It was not seen at the Shumagins, though it may occur there. A winter visitor."

Beals and Longworth reported a single male as False Pass on March 1, 1941, remarking that they saw this bird on several occasions.

Cahn observed 3 scoters at Captain's Bay, Unalaska Island, April 3, 1943, and saw 1 on March 16, 1945; Taber saw 1 at Adak, December 14, 16, and 23, 1945.

Austin Clark (1910) reports that "A few were seen at Attu and Agattu."

Turner is the only observer who states that the surf scoter is "common among the Aleutian Islands," and is "abundant" in winter. He also says that "The surf duck is the *svestu'n* or whistler, of the Russians." There is much confusion in Turner's account. While the surf scoter does make a whistling sound with its wings, the vocal whistling is so characteristic of the common scoter that if any 1 of the 3 scoters should be so designated, it should be *Oidemia n. americana*. If sound of wings is the criterion, then *deglandi* is outstanding. Furthermore, Turner (1886) says of *O. n. americana*, "The male is noted for the gibbosity of pinkish-white near base of bill; the lower edge of the swelling is deep red, gradually blending with the black of the rest of the bill." Assuredly, this fits *perspicillata* and not *americana*, and testifies to Turner's confusion on these species.

In any case, the surf scoter is comparatively scarce today in the Aleutians.

Oidemia nigra: Common Scoter

Oidemia nigra americana

Attu: *Hco-vai-ach*

Atka: *Koo-ghańg-ach*

Russian (reported at Unimak): *Swiss-tooń* (No doubt the *svestun* applied by Turner to *perspicillata*.)

Laing (1925) observed the common scoter at Kodiak, March 21, 1924, and Friedmann (1935) has recorded a number of specimens from Kodiak Island, though we do not have nesting records from there. Cahalane (1943) noted a small number of these birds in Viekoda Bay in the fall of 1940, and he saw a larger number in Uyak Bay. He also reported that this scoter was numerous in the fall of 1940, along the coast from Katmai to Amalik Bay, but he reported that noticeably fewer birds were seen north of this area. A few were noted in Kafia and Kukak Bays.

Osgood (1904) reported a few broods of young on ponds near Lake Clark, and he adds "Females with young were also seen occasionally along the more sluggish courses of the Chulitna River."

On July 19, 1940, Gabrielson noted adults on Naknek River, and he saw a female with three young on a small lake at Egegik. On July 23, he noted three broods up Kvichak River and noted the species again near Iliamna Lake on July 24 to 26.

On May 23, 1936, we noted 15 or 20 males among large numbers

of white-winged scoters in Nushagak Bay. These probably were migrants. On May 29, several flocks were flying about at the mouth of Ugashik River, and on the adjacent marshes two pairs were discovered among the ponds, the males whistling. Apparently, these birds were preparing to nest.

Jaques (1930) observed them "about Moller Bay and on fresh-water pools on the tundra, May 23 to June 20—not common." This, too, suggests nesting.

In 1925, I saw this species at the western end of Alaska Peninsula—a flock of both sexes at King Cove, April 25, and a few at False Pass on April 28. On June 13, small bands were flying about on Izembek Bay, whistling. By June 20, the birds were generally paired; on June 13, a female, taken for a specimen, contained a perfectly formed, hard-shelled egg. There can be no question about these birds nesting at Izembek Bay, chiefly at Hazen Point.

At Unimak Island we were told that this duck nests at Swanson Lagoon, which would be expected.

Laing (1925) observed this duck at Dolgoi Bay, March 23, and says: "From Unalaska, where twenty-five were seen on March 26, the species was present in most of the harbors as far as Hitokappu in the southern Kurils, May 7. It was noted at Copper Island, Oest, Kamchatka, or Petropavlovsk." This statement indicates that it was noted along the Aleutian chain.

Bishop (1900) recorded a number of these ducks off Unalaska, October 5, 1899.

The Atka natives stated that this scoter winters sparingly in the Aleutians, while the Attu natives said that it was abundant there in winter. This is also borne out by Gabrielson's observations on wintering birds from Kodiak to Atka.

Beals and Longworth noted common scoters quite often in various places about the east end of Unimak Island from January 19 to June 12, 1941.

Cahn (1947) reported for Unalaska Island: "Common in very large flocks in all the major bays from December to February, inclusive." Taber (1946), writing of Adak for the winter of 1945-46, states, "This was the most common bird of the area; it was seen in groups of 2 to 70 on the salt lagoon and the open sea." Sutton and Wilson (1946) found it wintering commonly at Attu.

Bent (1925) records this bird as nesting in the Aleutian Islands; this is verified by the A.O.U. Check-List (fourth edition). It is possible that both statements are based on Turner's account.

But, considering (1) the apparent confusion of the three scoters by Turner (shown by his description and misplacement of the Russian names); (2) that Bent and his party did not observe it nesting there in 1911; (3) that we did not find any evidence of it nesting there on expeditions throughout the chain, when all islands were examined; and (4) that none of the Aleuts reported it nesting; then we must conclude that nesting of the common scoter in the Aleutian Islands as a whole must remain in doubt.

Mergus merganser: Common Merganser

Mergus merganser americanus

Attu: *Chu-vai-ach, Siss-uch*
Tan-num-ak-tum sak-oi-a
Chunǵ-ung-é-koo-loo-ghearch
Ha-Ka chai-ú-too

Russian, Commander Islands: *Bolschoj Krachal* (Stejneger)

Friedmann (1935) records a number of specimens from Kodiak, as well as a number of eggs, which he said to be those of the common merganser, and he quotes Bretherton as saying that this duck nests on Kodiak.

Osgood (1904) had very little information on this merganser for the base of the Alaska Peninsula, but he mentions an adult male killed at Becharof Lake.

Cahalane (1944) observed several on the Naknek River on September 4, 1940.

Jaques (1930) found flocks of these ducks (most were males) near Port Moller in late May and June, but he saw no sign of nesting.

In 1936, we were informed by residents at Chignik that two kinds of mergansers occur there.

A number of records of occurrence are available for Unalaska, probably because it has always been a prominent port where vessels put in during voyages through that region. Dall (1873) said several specimens were taken there on December 20, 1873, and he adds that none were seen in the Shumagins. Turner says they winter at Unalaska, but do not breed there. Eyerdam (1936a) reports that two birds were collected at Unalaska on June 10 and August 6, 1932.

We saw no common mergansers in the Aleutians. The chief of Attu Island, who furnished the series of names for this bird, said that a few common mergansers nest there but that they are more numerous in winter.

To sum up, the common merganser occurs sparingly from

Kodiak to Attu; the best evidence of nesting comes from Kodiak Island; and (possibly) it nests on Attu Island. We know that it is an inland form—more so than *M. serrator*.

Mergus serrator: Red-breasted Merganser

Mergus serrator serrator

Attu: *Cruch-ah'-lich*

Atka: *A-ga-lai-ahh*

Agláyax (given by Jochelson as applying to two species)

Russian, Commander Islands: *Krakhal* (Stejneger) (The Attu name is undoubtedly a corruption of the Russian.)

This is the commoner merganser of the Aleutian district. It breeds on Kodiak Island (Friedmann, 1935), and Cahalane (1943) found it generally very abundant in the Kodiak-Afognak group in 1940. He also observed it in various places in the Katmai region, where Hine (1919) also reported it to be common.

Osgood (1904) found it "exceedingly abundant on all the lakes and rivers" visited at the base of Alaska Peninsula, and he mentions seeing broods of young on Iliamna, Chulitna, Kakhtul, and Nushagak Rivers. He remarks, "From start to finish probably more mergansers were seen than any other species of water bird, with the exception of the large gulls."

Gabrielson also noted this duck in 1940 on the rivers tributary to Bristol Bay. There were at least 50 broods of young, in all ages, on the Kvichak River, July 23.

This merganser was reported as common at Chignik, and Jaques (1930) found it paired on King Salmon Creek, near Port Moller after June 11, "possibly breeding."

On May 26, 1936, we saw two females in Nushagak River at Snag Point, and a pair was seen back on the marshes among the lakes near Ugashik River, where they probably nest.

In 1925, I found this merganser nesting about Izembek Bay, and, on May 25, 1925, 4 were seen on a mountain stream below Aghileen Pinnacles. (On May 4, and on several subsequent days, red-breasted mergansers were noted at Urelia Bay, on Unimak Island.) On July 5, a nest with six eggs was found on a small island near Point Grant, and another nest was found on a little island far out in Izembek Bay, in the midst of a colony of glaucous-winged gulls. Red-breasted mergansers with molting wing feathers were seen late in July.

Chase Littlejohn, in 1887–88, said that this duck breeds at Sanak and at Morzhovoi Bay, where they remained all winter.

McGregor (1906) found three nests on Round Island, Beaver Inlet, Unalaska Island, July 4, 1901. On June 3, 1936, we saw

six of these mergansers at Unalaska—Wetmore also had observed them here on June 6 and 7, 1911, and had collected a specimen.

At Unalaska Island, Cahn (1947) found a brood of 9 young in the Makushin Valley swamp, June 23, 1944, and he observed a brood of 11 downy young on Coxcomb Lake, July 4, 1945.

On August 15, 1937, we flushed a female from a grass-topped islet off the shore of Amlia Island. We had found 3 pairs on Kiska Island, June 4 and 5, where Wetmore had seen 1 pair in June 1911. We found a foot of red-breasted merganser in an eagle's nest on Buldir. On June 17, we saw a flock of 7 at Semichi Islands; 6 were noted on Amchitka Island. Incidentally, Dall (1874) had reported that Amchitka was the only place in the western Aleutians where this species had been observed.

In 1936, we noted a flock of seven red-breasted mergansers on Corwin Lake, Atka Island, June 22. Several were seen on Kanaga, June 29, and eight were seen in a lake on Kiska, July 26. At Adak Island, July 3, two were seen in Bay of Islands, and three or four in Kuluk Bay. June 26–27, 1911, Wetmore found them to be fairly common in the small lakes back of Bay Waterfalls, Adak Island, where he found a brood of nine downy young about a week old—he suspected that there was a brood in another lake. And on September 3, 1944, Gabrielson found a brood on Amchitka, thus definitely establishing a nesting record for that part of the Aleutian chain.

The Attu chief said that these ducks nest on Attu, and Atka natives reported them nesting on their island. Turner also reported them nesting on Atka.

We can definitely state that the red-breasted merganser nests from Kodiak to Attu, and, according to Stejneger (1885), it is a very common breeding bird in the Commander Islands.

Apparently, it winters in the Aleutians also (though perhaps in small numbers), because Taber (1946) observed them at Adak from December 9, 1945, to January 13, 1946.

Family ACCIPITRIDAE

Accipiter gentilis: Goshawk

Accipiter gentilis atricapillus

The goshawk occurs on Kodiak Island, as shown by specimens recorded by Friedmann (1935). Harrold saw one on Sitkalidak Island, near Kodiak, in May 1927 (Swarth 1934). Howell (1948) found a goshawk nest July 9, 1944, located in a 35-foot spruce at Middle Bay, Kodiak Island—there was a single young, which flew

from the nest. Osgood (1901) saw goshawks frequently near Tyonek, and two immature birds were collected. Osgood (1904) again reported a goshawk at Iliamna Pass, July 13, 1902, and several immature birds were observed repeatedly at the mouth of Chulitna River. Later, he observed the species at Nushagak.

This sums up normal distribution of the goshawk in the region under discussion, though on August 15, 1946, Gabrielson recorded one at Dutch Harbor, and, on August 20, he noted another at Simeonof Island in the Shumagins. Ordinarily, the goshawk is confined to the Kodiak-Afognak area and the base of the Alaska Peninsula—the regions that contain the forested areas.

***Accipiter striatus*: Sharp-shinned Hawk**
Accipiter striatus velox

Friedmann (1935) records a specimen collected by Bischoff on Kodiak Island, March 10, 1869. Osgood (1904) reports seeing a sharp-shinned hawk on the Mulchatna River, September 3, 1902; apparently, these are the only records for the area here considered—this bird sharing the forested areas with the goshawk. But Swarth (1934) reports a specimen taken on Nunivak Island, north of the area here considered, on September 14, 1927. This bird was found among the boulders on the shore, far from any forest, which is a most unusual occurrence.

***Buteo lagopus*: Rough-legged Hawk**
Buteo lagopus s. johannis

We observed the rough-legged hawk at Kodiak and Afognak Islands. Friedmann (1935) has recorded a number of specimens in both light and dark color phases from Kodiak, and he mentions Bretherton's statement that this species nests there. Osgood (1904) reports a nesting pair on an islet in Lake Clark, and he observed one bird near the mouth of Chulitna River and another on the lower Nushagak. McKay took a specimen in 1881 on the Aleknagik River.

Cahalane observed these hawks on the west side of Alaska Peninsula, on Naknek River and Three Forks, in September 1940, and, in the same year, Gabrielson noted one at Kodiak, June 14, and one at Dillingham, July 17.

Gianini (1917) observed these hawks nesting in "fair numbers," in Stepovak Bay, in 1917. In 1911, Wetmore found them to be fairly common near Frosty Peak, and he noted one at Unalaska.

In 1925, I found a number of nests on cliffs about Izembek

Bay and at least 4 nests on Amak Island, and I noted five or six hawks on Unimak Island. In 1936, when our party visited Amak Island very briefly, two rough-legged hawks were noted there again. They occur also in the Shumagins, because we saw one at Unga Island.

Rough-legged hawks have been noted by various ornithologists in the Fox Islands group. We saw them on East Unalga, Unalaska



FIGURE 25.—Rough-legged hawk.

Alaska, Umnak, and Ananiuliak (the last is a smaller island off the west end of Umnak). Swarth (1934) reports that these hawks were seen almost daily on Akutan from May 17 to June 13, 1927, by Harrold, nesting and in both color phases. He also found this species nesting at Unalaska.

Our own observations, and the published record, show that rough-legged hawks nest along the Alaska Peninsula and on suitable offshore islands, and westward in the Aleutians as far as Ananiuliak Island—but no farther. It is significant that this breeding range coincides exactly with the distribution of rodents, for no rodents originally occupied the Aleutian Islands west of Ananiuliak. Rats and ground squirrels have been introduced on a few islands to the westward, but evidently these introductions have not yet affected the original distribution of the rough-legged hawk.

Rodents constitute the chief item in the diet of these hawks, as was verified by a number of observations. Speaking of the area about Frosty Peak, Alaska Peninsula, Wetmore reported in 1911: "The thousands of ground squirrels (*Citellus*) here furnished them an abundant food supply as the crops of those taken testified."

On Amak Island, in 1925, I found a quantity of mouse fur, three *Microtus*, and the wing of a Savannah sparrow in a rough-legged hawk's nest. *Microtus amakensis* is the only rodent there. The stomach of a female hawk collected by Harrold on Akutan Island contained two field mice *Microtus*.

Stejneger (1885), speaking of *Archibuteo lagopus*, said that it was occasionally seen in the Commander Islands, and he thought that it might become established there, because mice had been introduced.

Aquila chrysaëtos: Golden Eagle

Aquila chrysaëtos canadensis

Both Turner and Dall reported the golden eagle to be abundant in the Aleutians. Austin H. Clark (1910) reported: "I observed this species once on Unalaska and several times on Atka, where it appears to be rather common."

Chase Littlejohn (manuscript notes), speaking of the area from the southwest end of Kodiak Island to the end of Alaska Peninsula, including adjacent islands, says,

Saw quite a number of these fine birds but only obtained one, which was unavoidably lost to my collection. He was caught in a steel trap. A couple

of days before, he had killed and eaten a silver fox which was in a trap. It seems he returned to pick up the fragments and was himself caught. He measured nine feet from tip to tip.

The exact locality was not given.

In 1936, Douglas Gray and C. S. Williams saw an eagle at Unalaska, which they described as having considerable white on the tail, but with a terminal dark band. This assuredly suggests that the bird was a golden eagle. At Chignik we were told that one had been killed there, but we did not see the specimen.

Cahn (1947) writes, "While probably not rare in the higher and wilder parts of Unalaska Island, this species is uncommon around Dutch Harbor. Two records in four years: June 17, 1944, over Mt. Ballyhoo, and August 7, 1944, sitting atop a mast on a ship anchored at a dock."

Osgood (1904) refers to a specimen that was supposed to have been collected by McKay at Nushagak, but he was unable to find it in the National Museum collection.

Friedmann (1937) found a sternum of this species in midden material from Kodiak Island—the only record for that locality.

Thus, we have quite a number of records (mostly based on observations); however, authentic specimens are rare. It is a little difficult to conceive of the golden eagle as abundant in the Aleutians, in view of observations dating back to the time of Turner and Dall, but there seems to be ample evidence to conclude that at one time the bird was more common than it is today. It is now only an occasional straggler in the Aleutian Peninsula region.

Haliaeetus albicilla: Gray Sea Eagle

Friedmann (1935) records osseous remains of the gray sea eagle from village middens on Kodiak Island. Bishop (1900) reported the first record of this bird for North America—a young female that was found dead at Unalaska, October 5, 1899. Again, in 1905, he records a specimen that was taken at Vancouver Island, March 18, 1898.

Eyerdam (1936) says, "Several of these birds were seen on Unalaska Island on May 25th and May 30th. One was killed near Dutch Harbor by a seaman from one of the coast guard cutters, who kept the claws, tail and wing feathers for souvenirs." It is unfortunate that a specimen was not saved, since it is rather remarkable to casually see "several" of a species so rare in North America.

Cahn (1947) reports seeing one of these birds at Dutch Harbor on May 16, 1945, and he reports that he watched it under favorable circumstances for 10 minutes. Sutton and Wilson, at Attu, watched two dark-headed, white-tailed eagles, identified as this species, on March 15, 1945.

We did not see this bird on any of our expeditions. A number of times we thought that we had sighted one, but each time it proved to be a bald eagle in one of its immature plumages. These plumages can be confusing, and we felt that records of the gray sea eagle should be based on specimens.

Haliaeetus leucocephalus: Bald Eagle

Haliaeetus leucocephalus alascanus

Attu: *Tirrh-g-luch*

Atka: *Tig-a-lach*

A-waich'-rich (immature)

Alaska Peninsula: *Tikh-lukh* (Wetmore)

The bald eagle is commonly distributed throughout the length of Alaska Peninsula and adjacent island groups, and the Aleutian chain. It is numerous in some places. In the Aleutians, nearly every island that we visited had at least 1, often 2 or more, pairs, nesting. They are numerous about the larger islands. Williams noted 15 eagles in Bay of Islands, Adak Island, July 2, 1936, and more were found on other parts of the island. On June 29, we saw several at Kanaga Island. The caretaker of a fox-ranching establishment there had killed 14 of these eagles for the bounty, and he planned on raiding 20 more nests later.

For some reason, the bald eagle is scarce in the Near Islands—including Attu, Agattu, and Semichi. We observed a single pair on Agattu in 1937, but we saw none at Attu or Semichi and the natives assured us they were very scarce. However, we found a nest on Buldir Island, and from that point eastward bald eagles were common.

Not only do eagles occur along the Alaska Peninsula, they also occur on the offshore island groups. In 1940, Gabrielson observed them in several places at the base of Alaska Peninsula. At Kodiak, in 1936, one merchant erected a sign advertising the fact that eagle feet were acceptable as cash (bounty could be collected for them).

Plumage and Other Color Changes

Too few specimens were handled to obtain precise information on plumage changes. A. C. Bent (1937) states that he believes the bald eagle assumes the adult plumage in the fourth year.

Field observations on numerous immature birds in Alaska were confusing, and we were unable to correlate some plumage patterns with age.

The downy-young plumages are well known and are well described by Bent. However, the color of beak, eyes, and other soft parts is not so well known. A young bird in the dark-down stage on Ananiuliak Island had a slate-colored upper mandible, the cere was of a similar color, but it was of a little lighter shade. The tip of the lower mandible was similar to the upper in color, but posteriorly the margin of the gape was flesh color, becoming paler posteriorly and shading into a near-yellow at the corner of the mouth. The lores were dull bluish. The iris was dusky brown, and the pupil was blue. The eyelids were pale plumbeous. The feet were a yellowish-clay color, and the claws were slaty.

The first-year plumage is dark; as Bent says, "uniformly dark 'bone-brown' to 'clove brown' above and below; the flight feathers are nearly black, but there is usually a slight sprinkling of grayish white in the tail." In the first year, both the bill and cere are of a blackish-slate color. The iris is brown, and the pupil is black. At this stage, the eyelids are still plumbeous.

The plumages preceding the final adult stage are hard to define. There appears to be much variation, probably over a 2-year period. Assuming a 2-year period for the postjuvinal phases, the plumage varies in the degree of white mottling. The essential feature is a pattern that includes patches of dull-white mottling on scapulars and back (which, in flight, show as three distinct areas), and light-colored upper tail coverts and considerable white in under parts. In one phase of this plumage, which must be in the second year, the bill and cere are still blackish and the eye is still a rich brown. The preocular area is essentially white, the eyelid is plumbeous, and the gape is dull yellowish. The feet are yellow.

A later phase, which possibly may represent the third year, still includes the dark bill, with a dull-yellowish hue appearing on the lower mandible and the margin of the cere. The eye is dull yellow also, and a yellowish tinge is encroaching upon the preocular area. The eyelid is gray, and the gape is yellow. There is much light speckling on the head, though the head is chiefly brownish. The specimen on which this description is based did not have the light mottling on upper parts falling into a pattern of three light patches, as was seen on many birds; instead, it was more scattered.

In still another phase, which is quite advanced, the head is white, speckled with a blackish hue. The beak is a dull-yellowish tone—perhaps best designated as tan, somewhat streaked with a slaty tone. The lower mandible is bright yellow at the base. The cere is a mixture of gray black and yellow. The eye is yellow (as in the adult), the eyelid is a brighter yellow, the preocular area is pale yellow, and the gape is a rich, bright yellow.

These are the advancing stages in development, the transition from dark "soft parts" to the characteristic yellow of the adult, but it was not possible to allocate all of these plumages to age groups.

Nesting

Trees are absent in the area except in a limited portion of the base of Alaska Peninsula, therefore nests are placed on cliffs or pinnacles, or on low ground. Many nests are inaccessible to man by ordinary means of climbing. Frequently, a nest is placed on the top of a pinnacle, which sometimes is separated from an adjacent cliff by a narrow chasm, and which is surrounded by water, at least at high tide. At times, the nest is placed on a cliff, where it may be fairly accessible to man. In one case, on Buldir Island in 1936, a nest was found on a small rock outcrop on a slope, where one could walk to it without climbing. The same place was visited the following year; the former nesting site was abandoned, and the eagles (probably the same pair) had made their nest on the flat grassy valley bottom below. There was not even a hummock at the nest location.

In 1925, on Unimak Island, a nest containing eggs was placed on the top of a smooth sand dune. It is interesting to note that on June 9, 1941 (16 years later), Beals and Longworth reported finding an eagle's nest on a sand dune in the same locality. As a rule, eagles seek inaccessible locations on cliffs and obviously prefer pinnacles.

Nests are generally built by assembling a layer of dried grasses, mosses, and other vegetable debris. Sometimes kelp is used. Kelp nests are rimmed with the dried stems of *Heracleum* and *Ligusticum*, which are the largest material available in lieu of twigs from trees. In some cases, however, the eagles use sticks from the driftwood on the beach.

Eagles build various types of nests. The nest on the sand dune, already mentioned, consisted of a cavity that was 360 mm. wide and 130 mm. deep, heavily lined with dry grass, bits of moss, and a small amount of dead eelgrass from the beach.

A number of large dry stalks of *Heracleum lanatum* lay around the rim, though these were not used in the construction of the nest proper.

Another nest was on a rock mass rising from a slope on Amak Island. A few dried plant stems were the only evidence of nest construction, and the single young sat on a bare spot, well trampled, on top of the rock, surrounded by a fringe of green grass.

Another nest on the same island was somewhat similar. It was on the grassy top of a high cliff. Two well-feathered young perched in a bare trampled spot about 8 feet long, which was crescent-shaped because of a hump in the middle of the space. There were the usual dry cow parsnip stems around the edge, but there was practically no nesting material in the center.

A third nest on this island was more substantial, consisting of dry grass with dry cow parsnip stems around the rim.

These scanty nests contrast sharply with a nest found at Amukta Island, June 16, 1936. This nest, on top of a pinnacle, was built of kelp, grasses, and driftwood to a height of 4 feet. A nest observed at Kanaga Island, June 29, 1936, was on the grassy top of a pinnacle; it was made mostly of moss and had a wide platform rimmed with dry stems of *Heracleum* and *Ligusticum* and a few driftwood sticks.

A nest on the grassy top of a columnar rock on the shore of Kiska Island was in the form of a bulky mass, consisting mostly of kelp.

Still another nest, on a rocky point of Little Sitkin, was built largely of dry stems of *Heracleum* and *Ligusticum* and willow roots, with a lining of finer vegetation. The willow there is a prostrate form, whose roots often are partly exposed by wind erosion.

These examples illustrate the general type and the variations of bald eagle nests. Some of the bulky nests resulted from an accumulation of material over a long period—a typical example was found at Amchitka Island, July 11, 1937. This nest—a shallow affair—was made mostly of moss on the grass-topped point of a pinnacle rising from the beach. It rested on a mass of old sod and soil to a depth of about 6 feet. This accumulation was filled with bird bones. Evidently, this accumulation had been built up by annual increment of debris left by nesting eagles for many seasons.

Our various expeditions were usually too late in the season to observe eggs—there were young in nearly every case. The

number of young, in a series of 34 nests, varied from 1 to 3 per nest, though in 1941 Beals and Longworth reported a nest with 4 young. In 1 nest, there was 1 live youngster and 1 partly eaten dead youngster; in 2 other nests, there was 1 young and 1 rotten egg containing an embryo. All of these must be considered as having had two fertile eggs originally. On that basis, there were 12 nests with 1 young, 17 nests with 2 young or eggs, and 5 nests with 3 young.

In every nest that we observed, the nesting birds were white-headed adults. One report, from Cecil Williams in 1936, indicated a nesting pair, in immature plumage, on Uliaga Island.

Food Habits

I have discussed the food of this eagle in detail in "Food habits of the northern bald eagle in the Aleutian Islands, Alaska" (Condor, 1940, vol. 42, No. 4, pp. 198-202). The data presented were based on examination of 28 nests. In addition to this published material, data from 4 other nests are available, comprising 21 more food items. This additional material agrees with the published percentages.

In the Aleutian district, birds constitute the major part of the bald eagle's diet—58.9 percent on the basis of material obtained in 1936; 86 percent for 1937. As would be expected, most of the birds taken are the so-called sea birds, chiefly shearwaters, fulmars, cormorants, glaucous-winged gulls, murre, ancient murrelets, paroquet auklets, crested auklets, and horned and tufted puffins. Fulmars and shearwaters head the list. Two ravens had been eaten. Others taken included: Petrels, kittiwakes, pigeon guillemots, ptarmigan, least auklets, and ducks, though none of these are taken in great numbers. Ducks were not preyed on extensively, probably because of the abundance of other birds, although harlequin ducks, oldsquaws, European teals, pintails, common eiders, red-breasted mergansers, and three emperor geese were identified in food remains.

Mammals are not universally available to eagles in this district and are seldom found in the diet. The ground squirrel is by far the most common mammal captured. Others, which occasionally are taken, are the house rat, the field mouse, the blue fox, and, possibly, the domestic sheep at Umnak Island. In 1938, Scheffer reported that one of the men in charge of the sheep on Umnak Island declared that he had never seen eagles bothering live sheep, though they will eat carrion. Another informant, a sheep herder at Unalaska, said that eagles will not bother healthy sheep, but they will attack dying ones and will feed on dead ones.

He had seen both ravens and eagles feeding on carcasses of winter-killed sheep. Beals and Longworth, in 1941, reported that local residents on Unimak Island believed that the bald eagle kills caribou fawns. However, this would need verification. It is known, of course, that eagles feed on dead whales and seals.

It has been thought that bald eagles kill many blue foxes. But, according to the evidence we obtained, this is not the case in the Aleutian district. The remains of only one fox were found in an eagle nest, and these remains could have been carrion because we found a few dead foxes on the beaches. To further refute this theory, many blue fox families were being raised successfully in the vicinity of eagle nests.

A moderate percentage of fish and invertebrates is eaten by the bald eagle. To what extent this eagle feeds on dead or spawning salmon on the Alaska Peninsula was not determined. In July 1911, at Morzhovoi Bay, Wetmore observed them feeding on dog salmon taken from shallow rapids. Edward D. Crabb (1923) apparently found fish remains to be prominent in nests examined along Alaska Peninsula; there were parts of seven Dolly Varden trout in one nest. Edward J. Reimann (1938) observed a bald eagle taking a mullet out of the water, reaching for it with one foot. Beals and Longworth found two sockeye salmon and the head of a sea gull in a nest on Unimak Island, June 9, 1941. We did not see bald eagles capture live fish, but Atka mackerel were often observed near the surface of the water, where an eagle could very easily seize one.

In the Aleutian chain proper, the main food of the bald eagle consists of sea birds. There are some indications that fish of various kinds are more prominent in the diet along the Alaska Peninsula, where we did less work on this bird. At any rate, there is abundant evidence that the eagle is not a serious detriment to man's interests throughout the Aleutian district.

Banding

A number of nestling bald eagles were banded in the Aleutian Islands in 1937. Of these, six returns were obtained. All six had been banded in June; 1 on Little Kiska Island, 2 at Little Sitkin, and 3 (all in one nest) on Rat Island. The following winter, all of these were killed by natives on Attu Island. This shows a westward drift of immature eagles, at least in the western part of the Aleutian chain.

These eagles are permanent residents in the Aleutian district, summer and winter.

***Haliaeetus pelagicus*: Steller's Sea Eagle**

In the course of all our expeditions to the Aleutians, a Steller's sea eagle was never observed, though we scrutinized all eagles closely for such a possibility. Charles H. Gilbert's specimen from Kodiak Island (1922) is the only record of a specimen obtained from the Aleutian district; however, more recently, Friedmann (1935) has recorded several bones of this species from middens on Kodiak Island. G. Dallas Hanna (1919, 1920) has recorded a specimen taken in the Pribilofs in December 1917. These are the only records for North America based on actual specimens. Austin H. Clark (1910) reported seeing one of these eagles near Unalaska on May 26, 1906.

Leonard Stejneger (1885) says of this eagle: "The habitat is especially the mainland of Kamschatka, where it is abundant, but also all the countries bordering the Okotsk Sea. On Bering Island it is only an occasional visitor, being chiefly an inland bird preferring the quiet rivers and lakes surrounded by dense forests."

Circus cyaneus*: Marsh Hawk**Circus cyaneus hudsonius***

Friedmann (1935) records a specimen taken on Kodiak Island by Bretherton on April 2, 1894. Osgood (1901) reports the marsh hawk near Homer and Hope, in the Cook Inlet region, and again, in August 1902, he found them at intervals along the Kakhtul River and occasionally, all the way to Nushagak. Cahalane (1914) observed 4 marsh hawks in Katmai National Monument in September and October 1940; 2 of these were males.

We did not see any of these hawks west of Kodiak Island during three expeditions, nor does Wetmore record any west of Kodiak Island in his field report for 1911. But Turner (1886) records a flock of 10 of these hawks at Unalaska, and he remarks that it is a rare summer visitor to Attu Island; however, this statement is surprising in view of present-day information. Those observed at Unalaska must have been a migrant group. But Cahn (1947) contributes the valuable information that he observed a male in Makushin Swamp, Unalaska Island, June 7, 1943, and saw a female over the swamp at the end of Captain's Bay on July 7, 1944.

Although the marsh hawk may occasionally appear to the westward, it certainly prefers the meadows and marshes of the more wooded parts of Alaska, including the base of Alaska Peninsula and the Kodiak-Afognak group. Along the north side

of Alaska Peninsula all the way to the west end, and on Unimak Island, numerous marshy areas with an abundance of mice and birds may be found; yet, this treeless region generally is avoided by the marsh hawk.

Family PANDIONIDAE

Pandion haliaetus: Osprey

Pandion haliaetus carolinensis

This bird has not been recorded from the Kodiak-Afognak Islands, but Osgood (1904) reports it to be quite common on nearly all watercourses that he has traveled, and he specifically mentions the Nogheling, Chulitna, and Kakhtul Rivers—all these are north of Lake Iliamna.

Cahalane (1944) saw 2 American ospreys—1 at Naknek River, September 4, 1940, and the other at the outlet of Brooks Lake, September 7.

In 1940, Gabrielson saw 1 osprey at Wood River Lakes, July 18; he observed 1 at Brooks Lake, July 19, and he saw another near the upper end of Iliamna Lake on July 25.

There are no records of sighting the American osprey farther west, but Stejneger (1885) said that it is an occasional visitor in the Commander Islands and that it is very abundant in Kamchatka. This is another bird that does not venture out into the treeless areas to nest.

Family FALCONIDAE

Falco rusticolus: Gyrfalcon

Falco rusticolus uralensis

Attu: *Kus-sum Ah'-ghu-lich*

The Attu chief described a bird larger than the peregrine falcon, and gave us the above name. (If it were different from the peregrine falcon, and larger, it could hardly be anything but a gyrfalcon.) The chief declared that it nests and winters on Attu Island. Austin Clark (Collins et al. 1945, p. 37) says "Lieutenant Nelson, an experienced falconer, believes he saw gyrfalcons on Kiska, though only one, in the white phase, was identified with certainty."

We did not identify this bird on any of our expeditions, nor did Wetmore record it. Nelson (1887), using the name *Falco rusticolus gyrfalco*, said that it was very common along the Bering Sea coast, but less common in the Aleutian Islands. Swarth

(1934), using the name *Falco rusticolus candicans*, records a pair seen on Akutan and several on Unalaska by Cyril G. Harrold. Beals and Longworth report—

March 2, False Pass: 1 falcon, very light, almost grey, on a cliff approximately 1500 feet elevation. March 14, False Pass: 2 at elevation of 1800 feet, color white. March 24, False Pass: 1 with color predominantly white, flying over alders back of cannery. May 13, False Pass: 2 almost pure white falcons at 1500 feet.

These are all sight records, and one cannot be sure which form of gyrfalcon was represented. But there are several specimens in the National Museum that are referable to *uralensis*: Three were taken at Nushagak, September 1, 1881, October 20, 1881, and December 5, 1882; and a juvenile specimen was obtained from Herendeen Bay, taken July 15, 1890, by C. H. Townsend, and marked by Friedmann as "Prob. *uralensis*." Friedmann has also recorded 2 from Kodiak Island, 1 taken by Fisher, September 18, 1882, and the other (no longer extant) by Panshin in 1871.

On September 21, 1942, Beal obtained a specimen at Cold Bay, on Alaska Peninsula.

Stejneger (1885) listed *Falco rusticolus* and *Falco islandus* for the Commander Islands. The former, he says, is not uncommon in winter—feeding chiefly on "the numerous field mice which now infest that island,"—and possibly nests there. He states that *F. islandus* breeds there in limited numbers.

Hartert (1920) records 4 white and 4 dark immature birds and 1 white and 3 dark adults from the Commander Islands, all taken in winter; he lists them all under *Falco rusticolus candicans*.

Falco rusticolus obsoletus

In the National Museum there is a specimen taken by McKay at Ugashik in 1881; it was identified by Friedmann as *obsoletus*. To what extent this bird occurs in the Aleutian district is unknown, nor do we know how many of this form were represented in the sight records listed under *uralensis*.

Bond (1949) has thrown some doubt on the classification of western American gyrfalcons, but I have not had an opportunity to evaluate the situation.

Falco peregrinus: Peregrine Falcon

Falco peregrinus anatum

We did not obtain specimens of *anatum* in the Aleutian district, though Friedmann (1935) records a specimen from Kodiak Is-

land, which he suggests may possibly have been a migrant or vagrant. Likewise, the duck hawks reported by Captain Ammann and Lieutenant Nelson on Kiska (Clark 1945, p. 36) would have to be migrants or vagrants if we are to retain the subspecific status of these forms. There is, of course, the possibility that these birds were wanderers from Siberia (*F. p. calidus*).

Falco peregrinus pealei

Attu: *Ah'-ghu-lich*

Atka: *Ah'-ghu-lich*

Commander Islands: *Agulekh* (Stejneger)

Russian, Commander Islands: *Tschornij Jastrip*, black hawk (Stejneger)

The Aleuts of the Commander Islands speak the language of the Aleutian Islands, and, evidently, the name for this falcon is the same in all dialects.

It is pretty well established that the nesting birds of the Aleutian chain are *pealei*, and that this form also nests in the Commander Islands. Probably the same form occupies the Alaska Peninsula and adjacent island groups. However, there is a specimen of *F. p. anatum* recorded by Friedmann from Kodiak Island, and we did not collect specimens of *F. p. pealei* east of the Aleutian chain.

We found this falcon to be common throughout the Aleutians. It nests on nearly all the islands, usually on high inaccessible ledges. It is a resident breeding bird and also winters in the Aleutians.

As would be expected, the peregrine falcon feeds chiefly on birds. Casual observations revealed that the least auklet and the crested auklet are taken—one falcon was seen carrying a crested auklet. It has been reported as capturing ptarmigan and shorebirds, but it is believed that sea birds furnish a large portion of its food.

***Falco columbarius*: Pigeon Hawk**

Falco columbarius bendirei

Friedmann (1935) records a number of specimens of *bendirei* from Kodiak Island, though, as he points out, Peters states in his check-list of the birds of the world that *suckleyi* is the breeding bird of Kodiak Island. The 1931 A.O.U. Check-List considers the Kodiak birds to be *bendirei*. Two specimens were obtained from Kodiak by Gabrielson, August 8, 1945.

Osgood (1904) records specimens from the Nogheling and Chulitna Rivers, Nushagak Village, and Aleknagik Lake, and he observed others on the Kakhtul and Nushagak Rivers. He also

reported them common in the Cook Inlet region—specifically mentioning Hope and Tyonek (1901).

Cahalane (1944) observed a pigeon hawk on lower Ukak River, September 9, 1940, and saw another on Windy Creek, September 16.

Hine (1919) also found these little hawks to be common in the region of Katmai Bay in the summer of 1919.

The pigeon hawk is exceedingly rare farther west, but there are a few records available. Turner (1886) mentions a specimen taken at Unalaska in 1879. Bailey (1926) says "Hendee collected one at Unalaska Sept. 25, 1922, and saw another the next day."

Captain G. A. Amman reported a pigeon hawk, not positively identified, on Kiska Island.

Taber had an opportunity to observe a pigeon hawk rather closely at the military establishment on Adak Island on December 9, 1945.

It must be considered rare in the Aleutians, however.

Hartert (1920) records a female *Falco columbarius insignis* collected on Bering Island, June 10, 1915.

Falco sparverius: Sparrow Hawk

Falco sparverius sparverius

The only record of the sparrow hawk is the statement by Dall (1873) that one was killed at Unalaska in the fall of 1871, but it was not preserved. There are no other records of this species in the entire area under discussion; therefore, Dall's inability to preserve the specimen is unfortunate.

Family TETRAONIDAE

Canachites canadensis: Spruce Grouse

Osgood (1901, 1904) found spruce grouse to be plentiful in the wooded portions of the base of the Alaska Peninsula and the Cook Inlet region. Friedmann (1935) refers to a specimen from Kodiak Island, which was mentioned by Baird, Brewer, and Ridgway. Cahalane (1944) found this bird to be abundant in the spruce forests north of Mount Katolinat, in the fall of 1940, and saw evidence of its presence north of Savanoski River. The Kodiak Island record had been referred to the Valdez spruce grouse, *C. c. atratus*, by Friedmann, but it is not known what the Alaskan Peninsula birds would be referable to.

This bird could not be expected to occur west of the forested portions of Alaska Peninsula.

Lagopus lagopus: Willow Ptarmigan*Lagopus lagopus alascensis*Aleut: *Alladek* (Wetmore)

The willow ptarmigan, distributed throughout the Alaska Peninsula, is represented by two races, *L. l. alascensis* and *L. l. muriei*. Gabrielson and Lincoln (1949) referred the subspecies on the Alaska Peninsula proper to *alascensis*, as distinct from the race on nearby islands.

Alaska willow ptarmigan were observed at the west end of the Alaska Peninsula in 1925. About the middle of May, the males were strutting and crowing in a lively fashion at Izembel Bay. On June 14, very few females were seen. Evidently, they were incubating, because on June 22 I found a nest of nine eggs pipped, ready to hatch, and late in July there were broods of young on the marsh at Moffet Bay.

Concerning the boldness of males at this time, I find the following in my field notes for June 3:

The female was sulking among the alder stems on the shore of a pond and I stood on a rise nearby. The male rushed between me and his mate growling, puffing out his chest, and elevating his combs. He was a splendid bird as he strutted, following his mate as she sneaked along in the brush but keeping out in the open himself, evidently to attract attention away from the female. I was within 15 feet of him at times.

On July 3, Donald Stevenson watched a pair of ptarmigan protesting the approach of a brown bear. The bear had been walking across a gentle slope toward the mountains and evidently had disturbed a brood of young birds. Both parents were pretending to be crippled before the huge intruder. The bear made several lunges at the birds, but finally continued on its way.

*Lagopus lagopus muriei*Aleut: *Alladak* (Wetmore)

This ptarmigan occurs on Kodiak Island, Unga, Nagai, Little Koniuji, Simeonof, and Popof Islands of the Shumagins, and Atka, Unalaska, and Unimak of the Aleutians.

This willow ptarmigan was described by Gabrielson and Lincoln in 1949, as follows: "As compared with *L. l. alascensis*, this race is much redder and darker when skins in comparable plumages are compared. *L. l. alascensis* is buffy; the new race, *muriei*, more reddish and darker, near walnut brown, while *alexandrae* [of Baranof and adjacent islands] is dark brown to bister."

As to distribution, they commented: "Somewhat to our sur-

rise, all birds from Morzhovoi Bay, only a few miles across from False Pass, certainly belonged to *alascensis*, while those from Unimak Island just as definitely belonged to the island group (*muriei*)."

Beals and Longworth (field report, 1941) reported numerous ptarmigans on Unimak from February 26 to April 10, in flocks of 5 to 300 birds. They noted, on March 6, at False Pass as follows: "Large flocks of 300 or more birds each flew about the ledgers back of the cannery. We saw several flocks of 75 to 100 birds in Sourdough Flats and vicinity the same day." On March 4, they reported "ptarmigan by the hundreds" in the valley back of False Pass. On March 31, at Ikatán Valley, they saw 3 flocks of 100 birds each, and saw numerous groups of 10 to 15 birds. On April 2, at Sourdough Flats, they reported, "Flock after flock of 100 to 150 or more each all through this area. The flocks kept moving ahead of us until several thousand ptarmigans were gathered in one large brood across the valley floor. It looked and sounded like a gigantic chicken ranch." On April 10, at False Pass, a flock of "several hundred" were noted; the males were "reddish brown about the head and shoulders."

During field work on Unimak Island in May, 1925, I found these ptarmigan common in the lowlands and on the middle slopes of the mountains. On April 30, I saw three males that had acquired much of the brown plumage, but on May 4 the females that I observed were still mostly white, though speckled with brown. On May 5, I saw one male in almost complete summer plumage.

An interesting incident occurred on May 19, 1925, at St. Catherine Cove. I was about ready to leave my cabin, when the rattling call of a male willow ptarmigan sounded close by. The call was followed by a light patter on the floor of an adjoining shed. Before going into the shed to investigate, I glanced out the window and saw a peregrine falcon. In the shed, I found a rock ptarmigan that ran out through the open door, only to return almost at once. But my presence proved too much for him, and he finally bolted out through the open door and, with lusty crowing, took flight and disappeared over a rise. By this time, the falcon was some distance away.

Lagopus mutus: Rock Ptarmigan

The rock ptarmigan occurs on the Alaska Peninsula, on the eastern Aleutian Islands as far west as Yunaska, on the middle and western Aleutians from Atka Island as far west as Kiska

and, on the extreme western end of the chain, Attu Island. It is represented by eight subspecies: *nelsoni*, *yunaskensis*, *atkhensis*, *chamberlaini*, *sanfordi*, *gabrielsoni*, *townsendi*, and *evermanni*.

As reported elsewhere (Murie 1944, p. 122), the rock ptarmigan of the Aleutian Islands—Alaska Peninsula district fall into two groups: A dark, more or less blackish group (in summer plumage), and a yellowish group (also in summer plumage). The dark group, comprising *nelsoni*, *yunaskensis*, and *evermanni*, occupies the Alaska Peninsula and the eastern Aleutians as far west as Yunaska, with the representative subspecies *evermanni* on the extreme western end of the chain, Attu Island. The yellowish group, comprising the other five forms, occupies the middle and western Aleutians from Atka Island as far west as Kiska.

The five so-called yellowish ptarmigan races in the middle Aleutians are actually very similar in appearance and are hard to distinguish without a series for comparison purposes. The fact that so many forms can be separated within such a comparatively limited area can be explained only by the partial isolation afforded by island habitat, though a given race is not necessarily confined to a single island, but may occupy a group of islands.

Close knit as these five "yellowish" races are, it is still possible to separate them. The three eastern forms, *atkhensis*, *chamberlaini*, and *sanfordi* (the most difficult to distinguish one from another), form a group characterized by pale coloration, and, more particularly, by finer barring in the plumage. The two western forms, *gabrielsoni* and *townsendi*, have much heavier barring.

As Bent has pointed out, middle-Aleutian ptarmigan occupy lowland areas, comparatively speaking, in contrast with the high mountain habitat of rock ptarmigan farther east. This does not mean that the middle-Aleutian races avoid highlands; they occur on relatively high ground on Atka and Kiska, and elsewhere. But the terrain of these islands is not particularly rugged, not of the high-mountain type. Amchitka, for instance, is a low island. It is true, as Bent has said, that these rock ptarmigan live to a large extent in grassy areas, but it does not necessarily follow that they have responded directly to environment by taking on colors that blend with the color of dead grass. This is a possibility, but at present we do not have sufficient facts for a conclusive decision.

Lagopus mutus nelsoni

Nelson's rock ptarmigan is a dark race that occurs throughout the Alaska Peninsula area, including Kodiak and Afognak is-

lands, the Shumagins, and other neighboring island groups, and west in the Aleutians as far as the Islands of the Four Mountains.

We had suspected that birds from the Islands of the Four Mountains might have developed new characteristics due to isolation. Ground color of the plumage of birds taken on these islands in early summer differs in tone from that of *evermanni* or *ridgwayi* (of the Commander Islands)—although there is a slight livaceous cast, the predominating shade is yellow-brown. The ground color also differs from that of specimens of *nelsoni* from Unalaska and farther east, tending to gray rather than to red in overall effect. Such differences, if real, are too insignificant to warrant naming a new form. They can best be referred to a slight deviation from the usual in *nelsoni*. There is a similar situation at Kodiak and neighboring localities, where *nelsoni* shows an approach to *dixonii* (of southeastern Alaska), because the ground color of *nelsoni* has a slightly grayish cast.

The females of each Aleutian form cannot readily be distinguished, but there is a discernible difference between females of *nelsoni* (which represent the darker forms) and the females of the middle Aleutians (which represent the pale forms). On female *nelsoni*, barring is black, broad, and in contrast; whereas, on the pale forms, the barring is less sharp, and the bars tend to be discontinuous with a softer effect.

Spring-plumage changes in Nelson's rock ptarmigan come much later than the changes in willow ptarmigan. A 1-pound specimen, collected on Ushagat of the Barren Islands group on May 1, 1936, was still mostly white. On May 7, 1925, I found, on Unimak Island, that the plumage was still nearly all white. On May 14, 1925, males were seen with well-speckled plumage, but it was a long time before these birds attained full summer dress. On June 6, in the Izembek Bay region on Alaska Peninsula, males still had considerable white in the plumage, but the females had changed completely into summer plumage. A female taken on Dolgoi Island, May 24, 1937, contained well-developed eggs.

Nelson's rock ptarmigans are largely inhabitants of the high mountains, though they are not confined to the steeper parts. They are often found on gentler middle slopes—in this respect, they resemble the rock ptarmigan of interior Alaska.

Lagopus mutus yunaskensis

The Yunaska rock ptarmigan was described by Gabrielson and Lincoln (1951) on the basis of a specimen collected by Gabrielson on Yunaska. As might be suspected, although it is grayer

than *nelsoni*, it seems to be more nearly allied to this darker group to the east. Although its range is thought to be confined to Yunaska, this is not certain.

Lagopus mutus atkhensis

Atka: *A-gha-dé-gach*, or *A-gha-dé-gah*
Agdikax (Jochelson)

Although native names seem to apply to rock ptarmigan in general, it seems appropriate to apply the Atka dialect name to this form found on Atka Island. Turner's rock ptarmigan may possibly occur on Amlia Island (separated from Atka by only a narrow pass), though no specimens were collected on Amlia. Whether this form occurs eastward as far as Seguam is unknown but it is logical to assume that it does. It may be expected that *atkhensis* also occurs westward to the next group of islands, and that it intergrades with the neighboring form, *chamberlaini*, of Adak.

One is struck by the grayish color of *atkhensis*, even in flight as compared with *nelsoni*. This color is generally more rufescent than *chamberlaini*, though both birds have the characteristic variegation of gray and rufescent patches. In fact, *atkhensis* and *chamberlaini* are hard to distinguish, though, when a good series of each is laid out for comparison, the difference can be seen.

On April 4, 1924, Laing obtained a series of 15 birds on Atka—a few of these birds were still in full white plumage. The birds were just beginning to molt into summer dress, a change that appears to be slightly earlier in *atkhensis* than in *nelsoni* on Unimak Island.

Rock ptarmigan have always been abundant on Atka, as many visiting collectors have testified. They are able to maintain their numbers in spite of the blue foxes. It was on Great Sitkin—a neighboring island—that I obtained the only direct evidence of cyclic behaviour among the Aleutian ptarmigan. John Taylor, who had a lease on Great Sitkin to raise blue foxes, said that he had placed 14 foxes on the island in 1934. At that time ptarmigan were numerous—"Thousands of them" was the way he expressed it. When Taylor returned to Great Sitkin the following year ptarmigan were scarce. He did not think that the blue foxes on this large island could have been responsible for such a swift and marked decrease. There had been red foxes on the island before the planting of the blues. This sudden decrease in the ptarmigan population appears to have been a case of the characteristic "die-off" of ptarmigan. Similar fluctuations were not reported for Atka Island.

Lagopus mutus chamberlaini

Chamberlain's rock ptarmigan is known only from Adak Island, but it undoubtedly occurs on neighboring islands. It is somewhat grayer than *atkhensis*, and is darker on the top of the head and upper neck—an effect, not particularly striking, that results from a greater number of black markings. No doubt *chamberlaini* and *atkhensis* intergrade on some of the intermediate islands.

Laing (1925) found rock ptarmigan on Adak “even more numerous” than on Atka. He collected five males on Adak, April 13, 1924, that had started to molt into summer plumage. The date, like that for the molt into summer plumage by *atkhensis*, is unusually early for ptarmigan.

Lagopus mutus sanfordi

Sanford's rock ptarmigan is abundant on Kanaga, Tanaga, and neighboring islands. Bent (1932), speaking of Tanaga, says: “The ptarmigan were tamer and more abundant here than on any of the other islands that we visited; we shot more than 40 in one afternoon.” The two specimens we obtained on Kanaga Island are referable to *sanfordi*, showing that this race occupies Tanaga and Kanaga, at least.

As Bent said, Sanford's rock ptarmigan is paler than *chamberlaini*, and is somewhat more ochraceous than either *chamberlaini* or *atkhensis*. Bent (1932) says:

Although I described and named this race myself (1912), in honor of my friend Dr. Leonard C. Sanford, who cooperated with me in organizing our expedition to the Aleutian Islands, I must confess that it is only slightly differentiated from the Adak ptarmigan. We all noticed a difference when our birds were collected, and when we laid our series of about 40 specimens of *sanfordi* beside nearly as many of *chamberlaini*, it was easy to see that the Tanaga birds were appreciably paler than the Adak birds. The Tanaga birds are therefore the lightest in color of any of the Aleutian ptarmigan, and have the finest vermiculations.

Lagopus mutus gabrielsoni

Gabrielson's rock ptarmigan occurs on Amchitka Island, the type locality, as well as on Little Sitkin Island and Rat Island. We have no specimens from Semisopochnoi Island, where this form may occur also. In 1938, Scheffer obtained, on Amchitka, a specimen whose crop was filled with berries of *Empetrum nigrum*, no doubt a favorite food of all these rock ptarmigan.

In summer plumage, the male *gabrielsoni* differs from *sanfordi*

in that the ground color is more uniformly dark, and the bars are broader and extend farther down the flanks and back; it differs from *townsendi* in that the coarse barring is not restricted to the anterior part of the body, and the ground color is paler and less ochraceous.

Lagopus mutus townsendi

Differences between *townsendi* and *gabrielsoni* have just been given. Townsend's rock ptarmigan is found on Kiska and on Little Kiska Islands. We have no specimens to prove that it occupies Chugul Island. It is possible, but unlikely, that *townsendi* is found on Buldir Island, far to the west; in any event, we found no ptarmigan there on several visits.

Lagopus mutus evermanni

Attu: *A-ti-ka-took-ach*

Russian, Commander Islands: *Kuroptka* or *Kuropaschka* (Stejneger)

Russian, Yana River region: *Mala Kuropatka* (Pleske)

(The Attu and Russian names undoubtedly refer to all rock ptarmigan.)

Evermann's rock ptarmigan occupies Attu Island. Apparently, ptarmigan have always been scarce on Attu, even before the introduction of blue foxes. According to Turner (1886), the natives reported ptarmigan on Agattu Island, but we did not obtain specimens there on our visit in 1936.

Comparison of *evermanni* with *ridgwayi* (of the Commander Islands) shows that *evermanni*, darkest of the rock ptarmigan series, is closely related to the Commander Islands form. In *ridgwayi*, the ground color shades from dark buckthorn to hazel. This ground color varies with different specimens and on different parts of the body; it is heavily overlaid with a close pattern of fine black vermiculation and is spotted with blackish feathers. In the Attu *evermanni*, the ground color suggests buckthorn brown, as in *ridgwayi*; but it is duskier and less rufescent, and the black vermiculations are more closely woven and the black feathers are more prevalent. The plumage characteristics in *evermanni* give the effect of a darker bird than *ridgwayi*. Comparing *evermanni* and *ridgwayi* with *nelsoni* from the Islands of the Four Mountains in the eastern part of the Aleutian chain, we find that there is a general resemblance among the three, but that *ridgwayi* and *evermanni* show the closest affinity, while, in ground color, *nelsoni* tends to be more olivaceous with an abundance of Dresden brown.

Family GRUIDAE

Grus canadensis: Sandhill Crane*Grus canadensis canadensis*

This sandhill crane nests on practically the entire length of Alaska Peninsula, so it is not surprising that Friedmann (1935) includes this species in the avifauna of Kodiak Island also, on the basis of a reported specimen as well as on bones found in middens.

On May 26, 1936, a crane was heard calling on the tundra at Snag Point, Nushagak River; cranes were heard several times on the flats about Ugashik River, and, on May 27, one was observed flying high in the air. On May 29, there was a pair and a group of three, on the tide flats. Curiously enough, 1 bird in this group of 3 appeared to be much larger than the others, giving the appearance of an adult with 2 immature birds. It is believed that cranes nest on the flats along Ugashik River.

A local trapper said that cranes commonly nest upriver from Nelson Lagoon, and Gabrielson received reports of cranes in the Cold Bay district.

In 1925, I found cranes on Unimak Island and adjacent parts of Alaska Peninsula, and, on May 1, 1925, two cranes were seen at Uria Bay. On May 21 and 22, 1925, at Moffet Cove, on Izembek Bay, a pair, or a group of 3, were noted on several occasions, and on June 14, 1925, Donald Stevenson saw 1 bird. This bird (seen by Stevenson) was very fearless, and we thought that its mate probably was on a nest not far away. On July 18, on a marsh in another part of Moffet Cove, a pair of cranes tried to decoy us away—evidently they had their young nearby.

Thus, it is clear that the crane nests in suitable areas along the Alaska Peninsula, probably also at Uria Bay, Unimak Island. If it nests at Unimak Island, this point probably is the western limit of its breeding range.

On August 24, 1937, I found the decomposed remains of a crane (evidently a migrant straggler) on the beach of Bogoslof Island. Turner (1886) states that the natives reported killing a crane on Attu in October. In Turner's opinion, this bird was a storm-driven straggler.

But Austin H. Clark (1910) gives us a more significant observation when he says—

On the morning of June 8 while ashore on Agattu Island I encountered a pair of these birds, but could not succeed in getting anywhere near them. On being flushed, they never flew for any great distance, but always alighted far out in the open pasture-like areas, out of reach from any rocks or other suitable cover.

It is not impossible that cranes nested occasionally on flat, lake-strewn Agattu Island.

Hartert (1920) records two adult specimens, a male and a female, from the Commander Islands, and states that they probably visit that area from time to time.

Family RALLIDAE

Fulica americana: American Coot

Fulica americana americana

The only record of this bird was obtained by Gabrielson. On December 10, 1943, John Gardner, of False Pass, observed this bird in a small stream near his home. It remained for several days and appeared to be sick; on December 15, it was killed by a dog. The head, wings, and feet were saved for identification. Residents of the community had never seen a coot there before.

Family HAEMATOPODIDAE

Haematopus bachmani: Black Oystercatcher

Attu: *Hé-gich*

Hekh (Turner)

Atka: *Héch*

Hegis (Turner)

Unalaska: *Hekh* (Turner)

Hekli (Clark)

Russian: *Morskoi Ptookh*, "Sea Cock" (Turner)

(The variations in native names are unquestionably due to individual speech mannerisms, and represent the same name in all dialects.)

Speaking of *Haematopus osculans*, Stejneger (1885) says,

The Russians of Kamtschatka apply to this bird especially the name Ptuschok (pl. "Petuschki"), a chicken, a term used for *Simorhynchus pygmaeus* by the natives of Bering Island, for *Leucosticte griseonucha* by those living on the Prybilof Islands (according to H. W. Elliott), and to other birds in different parts of the vast empire where the Russian tongue is spoken.

It would not be surprising, then, to have this name appear, variously applied, in western Alaska.

The black oystercatcher breeds commonly from Kodiak Island westward for the length of Alaska Peninsula, especially on islands. We recorded one at Chignik, but we did not record the species on the shore of Alaska Peninsula. On May 11, 1936, one was found on Ushagat (Barren Islands), and we observed them also on Kodiak Island.



FIGURE 26.—Black oystercatcher.

In 1940, Gabrielson noted 6 of these birds at Whale Island, and he saw 15 or 20 in the Semidi Islands.

On May 16, 1936, we obtained a specimen of the black oystercatcher on Nagai Island, in the Shumagins.

Chase Littlejohn (manuscript notes, 1887-88) wrote: "Found from Sanakh to Kodiak in limited numbers. Their warning cry at the approach of man if heard by the sea otter causes the latter to make off at once, for this reason they are much hated by otter hunters." Turner also mentions the reactions of sea-otter hunters.

The north side of Alaska Peninsula is not suitable for this bird because it lacks a rocky-shore habitat. But the bird nests on Amak Island, near the west end of the Peninsula, which is probably the eastern limit of its nesting range in Bering Sea.

In the Aleutian Islands proper, the black oystercatcher occurs on nearly every island and is a fairly constant feature of the rocky-shore fauna. On Attu Island, however, we saw none, and we were assured by the native chief that they do not occur there. This probably is true of all the Near Islands. We have no record of this bird west of Kiska. Turner points out (1886) that the distance between Kiska and the next island, Buldir, may be too much of an over-water flight for this bird. Strangely enough, in 1885, Turner had reported it as a rare visitor to Attu, occurring oftener on Semichi and Agattu.

In this connection, it is interesting to note Stejneger's remarks on *Haematopus osculans*, of Siberia (1885): "This bird comes only as a rare visitor to the [Commander] islands during the migration seasons. This is rather strange, as it inhabits the nearest coast of the mainland."

Perhaps the oystercatchers are merely conservative—lacking the exploratory tendency of some other species—and have not yet had time to extend their range to the end of the Aleutian chain. However, if we believe Turner's report of 1885, rather than his report of 1886, the oystercatchers had reached Attu in 1885.

Apparently, oystercatchers do not exceed a certain population density and are scattered rather thinly along rocky shores.

Usually, there were only a few pairs on an island (about six), although more birds can be found on the larger islands. But sometimes, in summer, they gather in loose flocks. On Ogliuga Island, August 6, 1936, at least 25 or 30 were seen. On tiny Salt Island, off the shore of Atka, on July 8, 1936, a flock of 13 was noted.

A nest was found June 28, 1936, on a small islet off Little Tanaga Island. The nest was in the grass—merely a shallow depression lined with a few bits of barnacle shells—and contained two eggs. Gabrielson (1941) found a nest on Tanaga Island that contained 2 young and 1 pipped egg.

Family CHARADRIIDAE

Charadrius dubius: Little Ringed Plover *Charadrius dubius curonicus*

The only record of the little ringed plover is the one by Schalow (1891, p. 259), for Kodiak Island, which originally was recorded as *Charadrius alexandrinus* Pallas. Oberholser (1919) concluded that this record should be identified under *Charadrius dubius curonicus*, and it was so listed in the 1931 A. O. U. Check List. This record is considered doubtful, and has been dropped from the 5th edition of the A. O. U. Check List.

Charadrius semipalmatus: Semipalmated Plover

The semipalmated plover is recorded from Kodiak Island (Friedmann 1935), and we observed two on the beach of Ushagat, Barren Islands, May 11, 1936. Howell (1948) found a nest with eggs at Kodiak Island, May 31, 1944. It occurs throughout the length of Alaska Peninsula. G. D. Hanna collected a

specimen, May 23, 1911, at Nushagak. Gianini (1917) found them to be common about Stepovak Bay on the south side of Alaska Peninsula, where they appeared to be nesting, in May and June 1916. Jaques (1930) recorded them on the north side near Port Moller. We saw three at False Pass, Unimak Island, August 23, 1936. In 1925, I observed the species at False Pass and at St. Catherine Cove, May 16 and 17. In the latter part of May 1925 they were found again in a valley below Aghileen Pinnacles, near Izembek Bay, and at Applegate Cove. At the time, it was believed that they were nesting. Wetmore found a few of these birds at Thin Point, near Cold Bay, in August 1911, and he obtained two immature specimens at the east base of Frosty Peak on August 6. Beals and Longworth, reporting on False Pass, in 1941, noted one on a gravel bar of an old stream bed May 9, and remarked that "2 are seen on this gravel bar every time we pass. They were not observed after the 25th of May." In 1940, Gabrielson also noted three of these birds at Morzhovoi Bay. Donald Stevenson obtained a specimen on Unimak Island, May 25, 1922, and made this notation: "Arrived about May 1st. Rather common along glacial stream beds. Breeds."

McGregor (1906) obtained a male and a female in English Bay, Unalaska Island, May 27, 1901, and he obtained two immature birds on Unimak Island, August 14.

In view of all these observations, the evidence is rather conclusive that the semipalmated plover nests as far west as Unalaska Island.

Pluvialis dominica: American Golden Plover

Pluvialis dominica fulva

Attu: *Svegch*

Smix (Jochelson) (Probably refers to this bird; no dialect given)

Osgood (1904) says of this species at the base of Alaska Peninsula:

A few small flocks were seen on the tide marshes and along the mud flats about Nushagak September 12 to 26. Several were seen at Igagik and others occasionally along the Ugaguk River, as far up as the mouth of Becharof Lake. Specimens were taken at Nushagak by McKay in June, 1881.

Hine (1919) observed these birds at Kashvik Bay in 1919, and he collected a specimen on August 24.

Friedmann (1935) records a number of specimens and observations of this bird at Kodiak, where it is no doubt a regular migrant.

Farther westward, records are available all the way to Attu. On May 16, 1925, Donald Stevenson saw a bird at False Pass, which he thought was the golden plover. Eyerdam (1936) says "Frequently seen and collected at Unalaska and Unimak Island." Dall (1873) reports a specimen of "*Charadrius virginicus*, Borck" taken June 22, 1872, at Popof Island, in the Shumagins. Turner (1886) observed a golden plover at Sanak in July 1878, and on May 17, 1879, at Atka Island, he identified the plucked body of a golden plover. Again, in the early part of October 1880, he saw two golden plovers on the beach at Massacre Bay, on the south side of Attu Island.

Gabrielson obtained specimens at Cold Bay and in the Shumagins, in 1943 and 1944 respectively.

On June 3, 1937, we observed a golden plover circling over the stormy sea between Segula and Semisopochnoi Islands.

The chief of Attu village declared that he knew of the golden plover; he recognized a colored picture of it, gave us the Aleut name, and referred to it as the "gold snipe." He insisted that this plover nests commonly on Attu Island, and that it remains until October.

The reported nesting on Attu requires verification, but it is safe to say that the golden plover may appear anywhere—as a migrant or nonbreeder, at least, from Kodiak Island to Attu Island, though it does not appear to have been observed in great numbers.

Stejneger (1885) remarked that "The individuals of *fulvus* breeding in America migrate in winter along the Asiatic coasts, thus giving evidence of the way in which the species once immigrated into Alaska." The records here given, however, are proof of a migration along the Alaskan coast. Conover (1945) has shown that both the American and Asiatic forms occur in Alaska, and that *fulva* predominates on the Bering Sea coast of Alaska. Thus, both forms could occur in the Aleutian district.

Squatarola squatarola: Black-bellied Plover

Friedmann (1935) says of the black-bellied plover, "The only Kodiak record I have found is a specimen referred to by Salvin and Godman in their description of this species in their great work on Central American birds."

Osgood (1904) says "Two black-bellied plover were collected by McKay at Nushagak Aug. 8 to 14, 1881."

Turner (1886) says "They occasionally occur in the spring migrations on the Aleutian Islands, the more abundantly on the

western islands than those in the vicinity of Unalaska. I saw several on Sañakh Island in the spring of 1878, and also in late August of 1879."

Stejneger (1885) says that they occur on the Commander Islands in fall migration only.

We saw none of these birds on any of our expeditions.

Aphriza virgata: Surfbird

Turner (1886) says of the surfbird "At Sannakh Island in 1878, and at Kodiak in 1881, I saw several individuals of this species, but under circumstances which rendered it an impossibility to collect them."

Friedmann (1934) records a specimen to the northward at Goodnews Bay on the Bering Sea coast, taken August 12, 1933.

The Attu chief, who is well versed in his native avifauna, did not recognize a picture of this bird.

Arenaria interpres: Ruddy Turnstone

Arenaria interpres interpres

Commander Islands (native): *Kidmalgikh* (Stejneger)

Russian, Commander Islands: *Kasnonogoj Kulik*, i.e., red-legged sand snipe (Stejneger)

A series of specimens was available for study: 2 from Nushagak, 1 from King's Cove, 2 from Unimak Island, 1 from Unalaska, 2 from Umnak Island, 1 from Ogliuga Island, and 1 from "Aleutians." In addition to these (which we examined), McKay obtained a turnstone at Nushagak, August 12, 1881.

We carefully compared the above-mentioned specimens with series of *A. i. morinella* from eastern localities and with specimens of *A. i. interpres*. The relationship between these two forms did not seem to justify the insertion of an intermediate subspecies, such as *A. i. oahuensis*, as has been proposed. Moreover, the present series from the Aleutian district agrees with the characters of *A. i. interpres*. One specimen, No. 118845 of the U. S. National Museum, taken by William Palmer, at Unalaska, May 19, 1890, is much like *morinella* and perhaps could pass for that race, especially because of the coloration of the head. But, when the extensive black on upper parts and the restricted brown areas and paleness on the wings is considered, it seems best to refer it to *interpres*.

On May 22, 1936, we observed a small flock of turnstones, believed to be of this species, at Nelson Lagoon. On August 20, 2 or 3 ruddy turnstones were seen at Port Moller, where they were feeding on the beach with Aleutian sandpipers.

In 1925, I took three specimens of ruddy turnstones at St. Catherine Cove, Unimak Island—others were seen, including one at False Pass.

Wetmore observed them at King's Cove in August 1911; McGregor (1906) noted them on Unimak Island, August 14, 1901, and he obtained two specimens on Amaknak Island, August 17.

Laing (1925) found 10 of these birds at Unalaska on August 8, 1924, and collected 3. Cahn (1947) saw one ruddy turnstone, in company with other sandpipers, at Summer Bay, Unalaska Island, July 18, 1944.

Gabrielson found small groups of ruddy turnstones at Amchitka in September 1944.

Littlejohn (1887-88) wrote "Plentiful in the fall at Sanakh where some remain during winter. They are very fat and toothsome. Also numerous at Morzhovoi Bay."

We found small flocks at Ogluga and Skagul Islands, on July 23 and August 5, 1936, and the following year they were seen again at the same place on July 27 and on August 4. One specimen was taken. On June 5, 1937, we saw 1 on Kiska Island; on July 31, we saw 1 on West Unalga; and on August 2, we saw 12 on Ilak Island.

Turner (1886) says "The turnstone is of more frequent occurrence in the region about the shores of Bristol Bay, the Alaska Peninsula, and the Aleutian Islands; perhaps more common on the western islands of that chain than to the eastward. I saw individuals at Attu, Amchitka, Atkha, and in the vicinity of Belkovsky village." And he adds: "They do not arrive on the Aleutian Islands until the middle of May, and none were observed anywhere after the 1st. of October."

Nesting throughout this region was not established. Stejneger (1885) states, concerning the Commander Islands, that they are at least migrants, and that possibly some of them breed.

Arenaria melanocephala: Black Turnstone

Bretherton (1896) found the black turnstone breeding on Kodiak Island, and Friedmann (1935) lists a number of other records for that island. Osgood (1904) collected one black turnstone at Lake Clark, base of Alaska Peninsula, July 23, 1902, and observed others at Nushagak. He also mentions specimens taken in June, July, and August, at and near Nushagak and Ugashik, by McKay and Johnson.

During August, Hine (1919) found these birds at Kashvik Bay in increasing numbers; by August 25, they were one of the most

abundant shorebirds, being observed in flocks of at least 100. Specimens were taken. Evidently, this is in the migration route.

July 23, 1940, Gabrielson found this turnstone to be common along Kvichak River, above Naknek.

We frequently saw the black turnstone on the tide flats at Ugashik River, May 27 to 29, 1936. One day, I noted 8 pairs, and found a deserted nest containing 3 eggs. Evidently, the birds were on their nesting grounds, which were confined to the tide flats rather than to the somewhat higher mossy areas farther back.

Littlejohn (notes) wrote "Saw one flock in the spring at Sanakh. Tried hard to obtain a specimen but failed. They were very wild."

Turner (1886) saw one of these turnstones at Belkovsky, south side of Alaska Peninsula, in the early part of August 1881. He says that they were reported to be plentiful on Unga and Sanak Islands, where natives claimed this bird interfered with hunting of marine mammals by making its characteristic outcries. The natives had stated that the black turnstone is not found on "Unalashka and other islands west of the mainland."

Family SCOLOPACIDAE

Capella gallinago: Common Snipe

Capella gallinago delicata

Attu: *Goo-lech'-arch* (?)

The Attu chief insisted that he recognized a picture of a Wilson's snipe and gave us the native name, adding that the bird nests on Attu as well as on other islands. Since this is at variance with all other information, one must seriously question it. There is the possibility that the chief was referring to an allied form from Siberia, which resembles the Wilson's snipe, and which may occur sometimes in the Near Islands.

On May 12, 1936, a Wilson's snipe was performing high in the air over Kodiak Island, evidently on its nesting ground. Again, on May 25 and 26, several of these snipe were performing at Snag Point, Nushagak River. Osgood observed this species at various parts of the base of Alaska Peninsula, and, he records a specimen taken by McKay, April 25, 1882 (1904). Hanna also obtained a specimen at Nushagak, May 16, 1911.

Cahalane (1944) observed the common snipe in several places within the Katmai National Monument in 1940, and on July 17, 1940, Gabrielson saw two snipe at Dillingham.

Jaques (1930) found these birds in the Port Moller region in June, and Bent (1927) includes the Shumagin Islands in the breeding range.

In 1925, I noted one common snipe at Urilia Bay, Unimak Island, on May 3, and another was heard several times at Moffet Cove, Izembek Bay, on July 22. Undoubtedly these were nesting birds, so there is good evidence that the nesting range reaches westward at least as far as the Shumagins and Unimak Island.

***Numenius phaeopus*: Whimbrel**
Numenius phaeopus hudsonicus

The occurrence of curlews or whimbrels was rather sketchy and none was found breeding. Osgood (1904) reported three specimens collected by McKay at Nushagak in August 1881. Cahalane observed a flock of seven flying in an easterly direction about 5 miles above Naknek village, on Naknek River, September 2, 1940.

On July 23, 1925, I observed a flock of six curlews flying over the marsh at Moffet Cove, Izembek Bay. On June 5, 1937, 2 curlews were seen at Kiska Island in company with 16 Pacific godwits and a ruddy turnstone. Again, on July 30, a curlew was seen on Kavalga Island. These were thought to be *phaeopus*, but specimens were not taken, and it is possible that some, or all, were *tahitiensis*. Stejneger (1885) reports the eastern whimbrel as a migrant on Bering Island.

***Numenius tahitiensis*: Bristle-thighed Curlew**

On July 23, 1940, Gabrielson recorded in his field notes, for the Kvichak River, above Naknek, "Flock of 20 flew over. Dufresne has seen as many as 200 in the past 3 days around Naknek."

This is the only record we have, but, in 1924, we had observed migrating flocks of immature birds at Hooper Bay, and it is logical that bristle-thighed curlews should pass over the basal part of Alaska Peninsula in migration.

***Actitis macularia*: Spotted Sandpiper**

Friedmann (1935) lists the spotted sandpiper in the Kodiak avifauna on the basis of four specimens collected by Wosnesensky during 1842-43. Speaking of the base of Alaska Peninsula, Osgood (1904) says—

When we arrived at Lakes Iliamna and Clark, in the latter part of July, the majority of the spotted sandpipers, which doubtless breed in the region,

had migrated, and only scattering stragglers remained. One small flock of 8 or 10 hornotines was seen nervously flitting from point to point along the gravelly beaches of Lake Clark July 25. Some days later a few belated individuals were found along the lower part of the Chulitna River. Practically all were gone before August 10.

We found none of these birds farther west.

Tringa glareola: Wood Sandpiper

There is a single record of this bird for Sanak Island—a specimen taken by Chase Littlejohn on May 27, 1894 (Littlejohn, 1904). The bird was found among some Aleutian sandpipers, and another, thought to be of this same species, was seen.

Stejneger (1885) reported it rather common and breeding in the Commander Islands.

Heteroscelus incanum: Wandering Tattler

Russian, Commander Islands: *Tschornij Kulik* (Stejneger)

A wandering tattler was seen on Kodiak Island, May 12, 1936, and 6 or 7 were seen on the beach at Karluk, Kodiak Island, September 1. Hine (1919) collected two specimens at Katmai Bay in 1919. Gabrielson noted a wandering tattler near Iliamna Lake on July 24 and 26, 1940, and he noted the species at Cold Bay, King Cove (with specimens), and Kodiak, as well as at Dutch Harbor and Amchitka. We obtained a specimen on Nagai Island, Shumagin group, May 16, 1936, and we saw one at False Pass, August 23. Scheffer saw one on Sanak Island, August 28, 1937. Nelson (1887) had seen one on Sanak Island, May 15, 1877.

The wandering tattler has frequently been reported in the eastern Aleutians. Bishop (1900) obtained 2 at Unalaska, October 5, 1899; McGregor (1906) recorded 2 specimens from English Bay, Unalaska Island, June 2, 1901; Laing (1925) saw 4 at Unalaska, where Turner also recorded 1; and Swarth (1934) reports 6 at Akutan, which includes 3 specimens taken.

On July 16, 1911, Wetmore obtained a breeding female at King Cove, Alaska Peninsula, and said he judged that she had young in the vicinity. He found the birds to be common there in August.

In 1925, I observed wandering tattlers at False Pass and Izembek Bay. On May 21, there was a pair on the beach, calling and perching on various boulders. On July 19 and 23, there was a pair and a single bird on a small gravelly stream flowing out of the marsh at Moffet Cove. August 8 and 9, there were several on the gravelly stream at False Pass, and, the next day, five

were collected on the rocky beach at Ikatán Peninsula. These last-mentioned were extremely fat. Local residents said that these birds occur on streams in the vicinity of Becharof Lake.

Undoubtedly, the wandering tattler nests along the gravel bordered streams in this region. It was on such a habitat that Adolph Murie and I found a nest in Mount McKinley National Park in 1923, and, considering the available evidence, it is more than likely that the wandering tattler nests along the Alaska Peninsula, on Kodiak Island, and probably on other suitable adjacent islands. It is possible that it nests on many of the Aleutian Islands farther west also. Turner (1886) said: "Among the Aleutian Islands it was observed once on Unalaska, several on Atkha, and twice on Attu." Clark (1910) reported it at Unalaska, Agattu, and Attu Islands, but it was not common. Scheffer saw one at Atka, June 1, 1937. We also noted one on Kiska Island, June 5, 1937, and obtained a specimen on Herbert Island, August 22.

Stejneger (1885) reported this bird to be common in the Commander Islands, and he suspected that it nested there. While visiting those islands, he also obtained a specimen of *Heteroscelus brevipes*. It is possible that some of our sight records in the Aleutians represent the latter form. It can be expected in the Aleutians, for it has been found on the Pribilofs.

Totanus melanoleucus: Greater Yellowlegs

Osgood (1904) described a pair that evidently was nesting at a small pond on the portage trail between Lake Clark and Lake Iliamna. He found the species again at Swan Lake and Mulchatna River, and he mentions two specimens taken by McKay at Nushagak, August 14 to 28, 1881. Hine reported that it commonly nested along the shore of Katmai Bay (1919). We observed two of these birds at Anchorage in 1936, and we were informed by local people that the species nests there. Bretherton said that it occurs on Kodiak Island and that it probably breeds there. Howell reports seeing two birds at Kodiak on May 9, 1944. In 1940, Gabrielson found this bird to be common on Alaska Peninsula; he obtained a specimen, and saw others, at Cold Bay in September 1942.

We observed three greater yellowlegs on the beach at Port Moller, August 20, 1936. On July 7, 1925, I observed one of these birds circling about on Amak Island, and from July 18 to 24 they were common on the marsh at Moffet Cove, Izembek Bay.

Evidently, this bird nests at the base of Alaska Peninsula,

and it is possible that it nests as far west as the end; however, this is not certain.

Totanus flavipes: Lesser Yellowlegs

We did not encounter this species on our expeditions to the Aleutian Islands, and records are few. Friedmann (1935) mentions a specimen (not available) collected by Bischoff on Kodiak Island; its occurrence at Karluk River was reported by Bean in 1889. Cahalane reported (1943) that he saw "considerable numbers of these birds September [1940] on mud flats exposed by falling tide on the Naknek River below the rapids."

Calidris canutus: Knot

This species is mentioned here on the strength of Turner's remark (1886): "I have not observed this bird west of Ugasik, on the eastern end of Aliaska, where it was quite plentiful in the latter part of June 1878." Presumably, it migrates through the Aleutian district, but we do not know the subspecies that are involved.

Erolia ptilocnemis: Rock Sandpiper

Erolia ptilocnemis ptilocnemis

Using material that is available in the U. S. National Museum, *ptilocnemis*, *couesi*, *quarta*, and *maritima* were carefully compared. The last-named species appeared to be more stable in characters than the forms from Bering Sea. In some instances there was a close similarity, shown, for instance, between certain specimens of *couesi* from the Aleutians and specimens of *maritima*; winter plumages are quite similar. There seemed good reason to include them all as forms of one species—*maritima*. However, Conover (1944) studied a much greater series—more than 500 specimens—and concluded that two basic species exist. His conclusion is followed here.

E. p. ptilocnemis is larger than the other Bering Sea forms, and it is paler, both in summer and winter plumages. Compared with *couesi*, there is more tan color in the plumage of the back (less of the rusty brown and less of the black admixture). Even the primaries and tail are of a lighter color.

In immature plumage, the feathers of the back are dark and narrowly edged with rusty brown in a smooth regular pattern, thus being distinguished from the broadly edged feathers of the adult at that time of year. In this immature plumage, the differ-

ence in color of upper parts between *ptilocnemis* and *couesi* is not striking. The under parts of *ptilocnemis* are much paler with a pale buffy and gray area across the breast, the throat is nearly white and finely spotted, and the streaks on the breast and upper flanks are narrow and pale. In contrast, the under parts of *couesi* in the same plumage are heavily and boldly streaked and spotted, thus giving the bird a darker appearance. In the winter plumage also, *ptilocnemis* is markedly paler than *couesi*.

In all races, the measurements of wing and exposed culmen average greater in the female than in the male. Measurements, in millimeters, of 13 males and 19 females of *ptilocnemis* are as follows:

Males: wing, 118 to 132 (125.6); exposed culmen, 27 to 32 (29.3)

Females: wing, 125 to 136 (129.5); exposed culmen, 29.5 to 37.5 (33.4)

The Pribilof sandpiper nests on St. Matthew and the Pribilof Islands, but, as would be expected, it occurs on Alaska Peninsula and the Aleutian Islands in migration. Probably, it winters in this area to some extent. At any rate, among the specimens examined there are at least four from the Bristol Bay region that are referable to *ptilocnemis*. One of these, a female, was taken by C. L. McKay, at Point Etolin, April 8, 1883. Three others were collected by J. W. Johnson, at Nushagak, April 1 and April 18, 1885. McGregor (1906) records that this species was collected on Unimak Island, August 14, 1901, and on Tigalda Island, August 5, 1901.

Erolia ptilocnemis couesi

Attu: *Too-loo-goo-yuch*

Atka: *Chu-lich'-tah*

Alaska Peninsula: *Tsoo-gooch* (Wetmore)

Russian, Commander Islands: *Lajdinij kulik* (Stejneger)

In measurements, *couesi* is quite comparable to *maritima* and *quarta*, but all three are definitely smaller than *ptilocnemis*. The Aleutian sandpiper is decidedly darker than the Pribilof sandpiper—the markings on the under parts are bolder and heavier; the upper parts contain more black and a greater proportion of rusty brown. In this respect, *couesi* approaches *quarta*.

Measurements, in millimeters, of 29 males and 24 females of *couesi* are as follows:

Males: wing, 110 to 123 (117.1); exposed culmen, 25 to 34 (27)

Females: wing, 113.5 to 127 (120.5); exposed culmen, 27 to 33 (30.7)

The Aleutian sandpiper nests throughout the Aleutian Islands, where it is the common shorebird; it also nests along the Alaska Peninsula and adjacent islands—at least as far east as Port Moller (Jaques 1930), and undoubtedly all the way to the base of the Peninsula. Hine (1919) observed it at Katmai Bay in 1919. At least two specimens in immature plumage were taken by Johnson, at Nushagak, July 11 and 18, 1884, and another was taken April 18, 1885—all these specimens appear to be *couesi*. There may be some question in regard to the breeding status of this bird on Kodiak Island; however, it winters there.

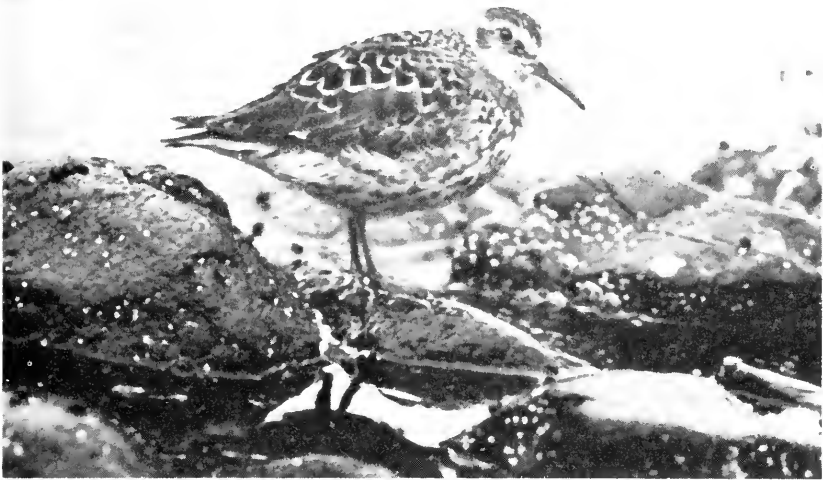


FIGURE 27.—Aleutian rock sandpiper.

The winter range includes all of the Alaska Peninsula–Aleutian district.

The Nesting Period

Extensive observations on the nesting of the Aleutian sandpiper were possible in 1925, when I spent a season on Unimak Island and the adjacent part of Alaska Peninsula. On April 29, flocks of Aleutian sandpipers (as many as 20 birds) were feeding along the lagoon at Uria Bay. The first mated pairs were noted on May 3; these mated birds had left the shorelines and were nesting on the mossy tundra. By May 7, they had become

more plentiful, and mating was in full swing. At this time, flocks were still common on the beaches—several flocks were noted at St. Catherine Cove on May 17. A flock of 150 to 200 birds, feeding on the tide flat, occasionally would rise, maneuver, wheel, and turn in the air (in characteristic sandpiper fashion), then settle back on the beach. Thereupon, a great babel of chattering would arise, as they all dabbled busily in the wet sand and mud.

On May 18, a single bird was collected on the beach. It proved to be a female with an egg almost ready for the shell. The next day, a flock of 400 was seen. The significance of seeing these large flocks at the same time that others were nesting is hard to determine. They must have been nonbreeders or late nesters.

On May 23, these sandpipers were common on the higher tundra back of Moffet Cove, Izembek Bay trilling and calling, evidently nesting or still making preparations. Some had obviously selected the nesting place or had eggs. By May 28, egg laying was definitely under way.

A nest containing four eggs, found June 5, was a cavity in the ground lined with a few tiny leaves—diameter was 100 mm.; depth was 53 mm.

These nesting habits were verified on later expeditions (in 1936 and 1937) throughout the Aleutian chain. Some sandpipers nested close to tidewater, others nested back in the hills—sometimes a considerable distance from a body of water. On June 1, 1937, on Atka Island, I found 2 nests, each containing 4 eggs. They were shallow depressions in a mass of low vegetation, lined with bits of lichens, straws, and dwarf-willow leaves.

Another nest, with four eggs, was found June 4, high up on Kiska Island. It was a depression in the moss beside a rock; the cavity was 3 by 4 inches wide, and 1½ inches deep.

On June 22, 1936, on Atka Island, I found a dead, newly hatched young. On June 22, 1937, Scheffer found a brood of 4 recently hatched young on Little Kiska Island. Another brood of 4, several days old, was found on Little Sitkin Island on June 27; and, on June 29, a brood of 3 was found on Rat Island.

I heard the mating song of the Aleutian sandpiper at Izembek Bay in 1925. Quoting from my field report, the song suggested—

the droning trill of toads, varied by a repetition of "per-deerrrr, per-deerrrr" ... very much like the red-backed sandpiper's call, but shorter. Later on, when frightened from their nests, they had a variety of alarm calls. As they flew away, they would call "Ka-deer, ka-deer, ka-deer," similar to the notes of mating time, but shorter and sharper, and they also uttered a very rapid "uh-uh-uh-uh-uh-uh."

Wetmore, in his field report for 1911, says: "The males have a trilling note, almost a whinny that is hard to describe. Also a quick musical whistled *turdle turdle*, on the Carolina wren order."

The first signs of flocking were noted early in July. On July 5, 1937, a group of 3 adults was observed flying along the beach on Amchitka Island, and, from July 10 to July 20, 5 or 6 were seen in groups several times. On July 24, 1925, two immature birds were collected at Izembek Bay, and several flocks were seen. On July 29, 1937, flocks of 40 or more were seen on Ogliuga Island; after July 29, they generally were seen in flocks.

Erolia ptilocnemis quarta

Russian, Commander Islands: *Lajdiniĭ kulik* (Stejneger)

Ernst Hartert (1920) described *quarta* from the Commander Islands and said—

The purple sandpiper of the Commander Islands differs from *E.m.couesi* from Alaska and the Aleutian Islands as follows: 'In the winter plumage the foreneck and jugulum are darker slate-colour and less mixed with white. In the full summer plumage the edges to the feathers of the upperside are much wider and of a brighter ferruginous, so that the upperside looks quite rust-red, with mostly concealed black centers to the feathers. The wings measure 121-127, in one female even 130 mm.'

In the series from the Commander Islands (in the U. S. Nation Museum), 6 males and 5 females measure, in millimeters, as follows:

Males: wing, 117-129 (121); exposed culmen, 25.5-28.5 (27).

Females: wing, 120-126.5 (122.8); exposed culmen, 27.5-33 (29.5)

These measurements easily fall within the size range of *couesi*.

While it is true that *quarta* is essentially a Siberian form, there are a number of records for Alaska. A. C. Bent (1927) reported these birds, at least one of which was a breeding bird, from Attu Island. Two specimens in the U. S. National Museum, Nos. 131763 and 131764 (probably the ones mentioned by Bent), assuredly are *quarta*. Another Attu specimen, No. 201468, is very similar to the less brightly colored specimens from the Commander Islands. There is another specimen, No. 298506, from Izembek Bay, Alaska Peninsula, that is very similar to *quarta* and is practically identical with a specimen from St. Lawrence Island, No. 165056. Another specimen, No. 230608, from Morzhovoi Bay, has the coloration of *quarta*. Moreover, Bailey (1943) records two specimens from Cape Prince of Wales, taken June 6, 1922, that were identified as *quarta*.

Four specimens were collected by F. L. Beals on Unimak Island in January 1941. One of these is very dark, thus agreeing with the description of *quarta* in winter plumage, and another is nearly as dark as *quarta*. These specimens have not been identified definitely.

It should be pointed out that in the series from Bering Island (the type locality), there are several specimens that lack the extreme of bright rufescence which characterizes *quarta*; in fact, these specimens are very similar to average *couesi*. One specimen from Bering Island, No. 89037, is as pale as some *ptilocnemis*.

In the light of this circumstance, it is difficult to evaluate the Alaskan records. Are these stragglers of *quarta*, or are they extremes in variation within the population of *couesi*? Until more Siberian material is obtained, and until a more extensive knowledge of *quarta* is at hand, it may be best to accept our records as stragglers of the Old World form.

Since the above studies were made, Conover (1944) reviewed the group and referred the mainland birds north of Alaska Peninsula to *tshuktschorum*.

Erolia acuminata: Sharp-tailed Sandpiper

Specimens of this sandpiper have been obtained in various parts of Alaska, including St. Lawrence, St. Michael, and Nunivak Islands, the Pribilofs and the Russian-held Commander Islands. We saw none of these birds on our expeditions to the Aleutian Islands, but Bailey (1925) reported the capture of a specimen (a young of that year) by Hendee, on Unalaska Island, on September 27; and Bishop (1900) obtained a specimen at Unalaska, on October 5, 1899. Undoubtedly, this species occurs in the Aleutian district during migration more often than is shown by published records.

Erolia melanotos: Pectoral Sandpiper

The pectoral sandpiper proved to be exceedingly rare. Osgood (1904) says "One was taken by Johnson at Nushagak October 15, 1884. The species was not seen by our party." Gabrielson saw three of these birds up the Kvichak River, July 23, 1940.

On July 23, 1925, I observed two birds in the grassy marsh at Moffet Cove, Izembek Bay, which were believed to be immature pectoral sandpipers, but, unfortunately, specimens were not obtained. The Alaska Peninsula should be in the migration route.

Bishop (1900) obtained a specimen at Unalaska October 5,

1899; Turner (1886) reports taking 3 specimens on Attu Island; and Hartert (1920) reports taking 2 specimens from Bering Island.

Eventually, this bird may be found nesting on some of the favorable habitats on the north side of Alaska Peninsula, such as those near Ugashik River, but at present the nearest known nesting locality, reported by Friedmann, is at Goodnews Bay (1933).

Erolia bairdii: Baird's Sandpiper

Friedmann (1935) records a number of specimens from Kodiak Island; only one of these specimens is now available for verification. This specimen was taken by Townsend, August 15, 1888.

According to Nelson (1887), Dall recorded Baird's sandpiper from Kodiak and from Amak Island, north of Alaska Peninsula, but there are no specimens to support these records.

More recently, August 7, 1945, Gabrielson obtained a specimen at Wide Bay, Alaska Peninsula. Furthermore, he recorded them at Togalak Island, August 5, 1941; at Unalaska, Adak, Amchitka, Shemya, Agattu, and Kodiak in 1943; and at Amchitka, Adak, and Kodiak in 1944. These records reveal that this bird is more numerous in the Aleutian district than was formerly supposed.

Erolia minutilla: Least Sandpiper

Attu: *Kre-a-ma-ghré—choo*(?)

The chief of Attu village said that he recognized a colored picture of the least sandpiper, and he gave us the native name for it. But because the lack of striking markings makes identification difficult, and because we have no records for the western Aleutians, the chief's statement needs verification.

During our brief stops at Kodiak Island we did not see this bird, but Friedmann (1935) records 6 adults and 9 downy young from Kodiak in the Thayer collection. We observed least sandpipers at Port Chatham, Kenai Peninsula, May 6, 1936, and we observed it again on Ushagat Island, Barren Islands, May 10, where two specimens were taken. Several of these birds were noted at Chignik on May 14, and, on May 24, 1937, a pair was seen on Dolgoi Island.

Hine (1919) observed a few least sandpipers, and took a specimen, near the mouth of Katmai River, July 23, 1919.

Dall (1873) reported it to be rather abundant along the beaches of Popof Island, in the Shumagins, June 20, 1872, and he obtained specimens at that time.



FIGURE 28.—Least sandpiper.

On May 25, 1936, six, or more, least sandpipers were found in the marshy vegetation at Snag Point, Nushagak River, where they were evidently nesting; the following day, a male, with incubation patches, was collected. The flight song was heard here also.

Jaques (1930) reported that after May 25 this bird was abundant about Port Moller in the vicinity of tundra pools. In 1911, Wetmore observed the species in August at King Cove near Thin Point. Late in July, he saw them at Morzhovoi Bay under circumstances that suggested they had just finished nesting. He also mentions seeing them on August 25 between King Cove and Little Koniuji Island, and on August 26 he saw them off Chignik Bay. Gabrielson, on June 21, 1940, found 6 or 8 in a high meadow at Frosty Peak, and he took specimens there and at Unalaska, Alaska Peninsula, and the Shumagins. Gianini (1917) reported them to be common and breeding at Stepovak Bay, where he found a nest with four eggs.

In May 1925, I observed these sandpipers about Uruilia Bay and St. Catherine Cove, Unimak Island, where they were common by May 19. At Hazen Point, Izembek Bay, a pair was seen on May 21, and, on May 29, birds were observed going through their mating performance in the valley below Aghileen Pinnacles. Evidently these birds were nesting in the marshy valley bottom. Least sandpipers were found nesting commonly at Hazen Point, where a nest was found on June 22. The nest consisted of a slight cavity in the matted vegetation, with a few small round leaves in the bottom, and it contained four well-incubated eggs. On June

20, a small flock, probably nonbreeders, was noted at Hazen Point. During July, this sandpiper was common near Frosty Peak and the islands near Point Grant, and, on July 24, a number of flocks, probably immature birds, were feeding on the tide flats.

Chase Littlejohn (notes) wrote that he "Found [it] breeding from Kodiak to Sanakh, but not in great numbers, a few remain during winter."

McGregor (1906) obtained a specimen on Amaknak Island, May 17, 1901, and obtained another on Tigalda, August 5. Eyerdam (1936) obtained a specimen at Unalaska on May 17, 1932, and Gabrielson collected one there on July 4, 1946. Swarth (1934) records two specimens taken on Akutan Island on May 19 and 31, by Cyril G. Harrold, who had remarked that "Several pairs were observed on the flats on Akutan Island. The male has a strange flight song consisting of a repetition of several low notes uttered while the bird is alternately gliding and hovering."

On May 30, 1937, a pair of least sandpipers was seen by our party at Nikolski Village, Umnak Island.

We have no records beyond Umnak, but the data indicate that the least sandpiper nests as far west as Akutan—very probably as far as Umnak.



FIGURE 29.—Least sandpipers.

Erolia alpina*: Dunlin**Erolia alpina pacifica***

The red-backed dunlin, or sandpiper, occurs in some localities on the Alaska Peninsula. Osgood (1904) observed several flocks flying up and down the Egegik River on September 29. He mentions several specimens taken by McKay at Ugashik in May and July 1881. G. D. Hanna obtained three specimens at Nushagak on May 31, 1911, and Hine obtained a specimen near the mouth of Katmai River, August 23, 1919.

The specimens taken by McKay suggest nesting. Certainly in 1936 we found good evidence of nesting at Ugashik River; these sandpipers were common on the tide flats on May 27 and 29. They were paired and evidently breeding. One was obviously flushed from a nest, though the nest was not found.

On April 29, 1925, I saw a red-backed dunlin feeding on the shore of a lagoon at Uria Bay, Unimak Island, in company with some Aleutian sandpipers. This may have been a migrant because none were found nesting on the marshes about Izembek Bay. The dunlin's westernmost nesting locality on Alaska Peninsula is, so far as we know, the tidal marshes about Ugashik River.

Taber (1946) noted a few red-backed dunlins wintering on Adak Island.

Stejneger (1885) reported this bird as a migrant in the Commander Islands.

Limnodromus griseus*: Short-billed Dowitcher**Limnodromus griseus caurinus***

A series of specimens from various parts of the Alaska Peninsula is available, and comparison of these birds with those in other series from differing localities brings up the question of the subspecific status among the dowitchers. Specimens from Point Barrow, St. Michael, Hooper Bay, Fort Yukon, Nushagak, Ugashik, and the west end of Alaska Peninsula were examined and compared with numerous specimens from eastern localities.

At the time that these comparisons were made, it appeared that the Alaska Peninsula birds should properly be included with *scolopaceus*. Since then, Pitelka (1950) has studied this genus intensively with nearly 3,000 specimens. On the basis of this study, he concluded that *scolopaceus* and *griseus* are distinct species, and that *griseus* includes three forms—*griseus*, *hendersoni*, and a new subspecies, *caurinus*. Previously, Aldrich (1948) had concluded that intergradation between populations could be

demonstrated among North American dowitchers and, therefore, only one species was involved.

The designation of *L. g. caurinus* as the breeding form for southern Alaska would tend to solve some of the classification problems of Alaska Peninsula specimens. However, it still seems difficult to visualize specific status for *scolopaceus*, as proposed by Pitelka. As one example, a female from Nushagak, with the spotting of the underparts characteristic of the *griseus* group, was mated with a male, that was heavily barred on the underparts, typical of *scolopaceus*. Should we consider this to be a case of hybridization between two ordinarily isolated species, or should it be considered a case of intergradation between two races of the same species? A parallel situation exists in the case of the fox sparrows at the base of Alaska Peninsula.

A specimen from Ugashik River, Alaska Peninsula, was compared with one from La Saline, Athabaska River, which, presumably, is the range of the proposed race *hendersoni*. Both are males—the Canadian specimen was taken May 12, 1920, and the Alaskan specimen was taken May 27, 1936, from a mated pair. These two specimens are almost identical. The longer bill is on the Canadian bird, 60.5 mm., while the bill of the Alaskan bird is 54.5 mm. The wing of the Canadian bird is smaller than that of the Alaskan bird (144 mm. and 147 mm.). Both birds are deep buff, with very little spotting, the round spots occurring on the sides of the breast and on the flanks. The Alaskan bird has a little more white on the belly than the Canadian bird, though the latter has a pale, noticeably whitish edging on the feathers of the under parts. On the upper parts, the Canadian bird is somewhat darker buff than the Alaskan one. If a mixed series of these birds were laid, it would be most difficult to separate them.

Another specimen from Nushagak River is mostly white underneath and rather heavily spotted. This is a female; the wing measures 145.5 mm., and the bill measures 62 mm. Neither of these two Alaskan specimens has barring on the side of the breast. Without knowledge of the locality, one would place these two, both breeding birds, with the Canadian group; however, other birds from Nushagak show plumage associated with typical *scolopaceus*. Indeed, most significant of all, the female from Nushagak, lacking the bars, was mated with a male that was heavily barred. Other birds from the Bering Sea coast vary greatly in degree of spotting, in amount of barring, in amount of white underneath, and in shade of solid buff color. Length of bill also varies greatly—even within each sex group.

In view of so much variation, obvious in any series from given locality, and because of the extreme overlapping shown here, it would seem that subspecific variation best expresses the nature of the forms.

Friedmann (1935) reports one record for Kodiak Island, "two specimens collected by Wosnessensky in 1842-1843, now in the Zoological Museum of the Academy of Sciences at Leningrad."

As mentioned above, we found several breeding birds on a low marshy area near Snag Point, Nushagak River, in 1936, and a female, collected there on May 25, contained two eggs almost ready for deposition of the shell. Several pairs were seen on the tide marshes at Ugashik River, May 27 and 29.

Jaques (1930) observed several of these birds, and collected one at Port Moller, June 12, 1928.

At Izembek Bay, near the west end of Alaska Peninsula, Donald Stevenson collected an immature female, July 2, 1925, and obtained another immature female there, July 24, 1925. These birds possibly could have been migrants, but we believe they were on their nesting grounds. The locality is excellent habitat for this bird.

Cecil Williams, a member of our party in 1936, reported seeing a long-billed dowitcher on Bogoslof Island, June 5, at the little "sulphur lake." On such a barren island, this sighting is a most surprising occurrence.

Ereunetes pusillus: Semipalmated Sandpiper

Eyerdam (1936) reports that this bird was collected at Unalakleet and Unimak—the only report of this species for the Aleutian district. I have not had an opportunity to see these specimens.

Ereunetes mauri: Western Sandpiper

Friedmann (1935) mentions that specimens were collected on Kodiak by Bischoff, August 10 to 15, 1868. These are the only positive records based on specimens. This bird should occur there in migration more commonly than these meager records show. On May 10, 1936, C. S. Williams obtained a specimen on Ushagat, one of the Barren Islands, which are not far from Kodiak. Osgood (1904) mentions two specimens collected by McKay at Nushagak, and Hine (1919) observed them commonly in the Katmai-Kashvik Bay area, where he collected specimens. Wetmore found these birds to be common near Thin Point, on the Alaska Peninsula, August 3 to 13, 1911, and back of King

Cove, July 12 to 20, 1911. Eyerdam (1936) reported that he collected specimens at Unalaska and Unimak, and Gabrielson obtained a specimen at Cold Bay, July 20, 1942.

Turner (1886) stated that "This sandpiper is abundant in all the Aleutians. At Atkah and Amchitka it is extremely abundant." Turner's observations must have been made during certain migration periods. Certainly, his statement does not fit present-day conditions, because, except for Eyerdam's records, no one else appears to have seen these birds in the Aleutians.

Limosa fedoa: Marbled Godwit

Osgood (1904) says of this species that "Two immature specimens of the marbled godwit were taken by McKay at Ugashik July 16-18, 1881."

This is 1 of the 3 unusual records of this species for Alaska.

Limosa lapponica: Bar-tailed Godwit

Limosa lapponica baueri

Attu: *Mi-u-keegh*

Atka: *Chu-éé-gceh*

Dall obtained a specimen on an islet in Akutan Pass, June 2, 1872, and he noted it at Unalaska, June 9. He stated that it breeds there. Nelson (1887) said "On May 26, 1877, while I was at Unalaska, a native brought in half a dozen of these birds, and on June 3 I obtained three others from the sandy beach of a small inner bay." He said that they appeared to be migrating.

Cahn observed one of these birds near Unalaska Island, on the beach of Hog Island, May 21, 1946.

Turner (1886) said that—

This godwit is found on the Aleutian Islands in the latter part of May as it is on its way to the northward. On Atkah Island I obtained three specimens. They were on the sandy beach of the west side of Nazan Bay. They remain but a few days, and are probably stragglers from the main body of their kind.

At Amchitka I saw four of this species on May 24, 1881. They were in Constantine Harbor of this Island.

I do not think they breed on any of the Aleutian Islands.

Joseph Grinnell (1910) has also recorded two specimens taken at Unalaska by C. L. Hall on May 29 and June 4, 1894.

Donald Stevenson obtained a male bird on Unimak Island, June 3, 1922, and noted that "A few observed, this one only taken. Was very thin and weak. Sex organs swollen."

Chase Littlejohn (manuscript notes for 1887-88) noted that—
Many of these seen in the spring going north at Morzhovoi Bay but they do not stop, they take almost the same route as the black brant but do not bother about flying around the sand bar. As they are not seen in the fall they must take some other route.

A. C. Bent (1927) said—

On its spring migration the Pacific godwit passes through the Aleutian Islands and the Pribilof Islands on its way to its breeding grounds in northwestern Alaska. I saw two birds on Atka Island on June 13, 1911, probably belated migrants; it has been said to breed near Unalaska, but this seems hardly likely.

On our own expeditions, we met with this bird only once. On June 5, 1937, we found a flock of 16 Pacific godwits, 2 Hudsonian curlews, and a European turnstone at the south end of Kiska Island. Two specimens of the godwit were taken.

We have no records for the Alaska Peninsula, and we have no proof of nesting in the Aleutians. According to Stejneger (1885), this bird is a regular migrant in the Commander Islands.

Limosa haemastica: Hudsonian Godwit

Osgood (1901) wrote "Nine specimens were taken by Bischoff at Fort Kenai. At least two of these are still in the National Museum—one an adult in breeding plumage, the other in fall plumage."

A. C. Bent (1927) wrote that "It has been reported from Alaska (Kenai, Nulato, Ugashik, mouth of the Yukon River, and Point Barrow)."

These observations show that this godwit rarely appeared near the base of Alaska Peninsula.

Crocethia alba: Sanderling

Chase Littlejohn (manuscript notes for 1887-88) says "Only three seen during my stay, and these were seen during very cold weather. Twice alone and once with Aleutian sandpipers." He does not mention localities here, but his observations covered the general region from Kodiak to Sanak Island.

On February 7, 1941, F. L. Beals obtained a male specimen on Amchitka Island.

Stejneger (1885) reports the sanderling to be a rare migrant in the Commander Islands.

Family PHALAROPODIDAE

Phalaropus fulicarius: Red PhalaropeAttu: *A-chi-li-rhá-uch*Russian, Yana River region: *Plavounetz*, more often *Petouschok* (Pleske)

We observed flocks of red phalarope in spring migration as well as later in the summer, when some of them may have been returning from the north. On May 22, 1937, several flocks were seen in Shelikof Strait, many in the red plumage, and the next day, they were common all the way between Sutwik Island and the Shumagins. These were chiefly in the red plumage. On August 26, as we approached East Unalga Island from Unalaska, flocks were seen, this time in whitish winter plumage. On the evening of May 21, 1936, while passing offshore from Unimak Island in Bering Sea, we saw bands of red phalaropes, totaling nearly 100, flying over the water. On July 15, over 100 were flying near the Baby Islands in Akutan Pass, and near Rootok Island. Next day, more of these birds were seen near Rootok Island. On two occasions, they were seen feeding along a line of dead kelp.

Cahalane (1943) says "N. J. Benson told me that in August 1940 he had seen a flock of 'at least five thousand' of the 'whale birds' in Shelikof Strait."

Turner (1886) wrote that he "saw but few of these birds at Nushagak. At the mouth of Ugasik River, and the low grounds surrounding it, I saw hundreds of these birds."

Jaques (1930) says that the red phalarope was "First seen near the Shumagin Islands May 15 and 16, at Moller Bay, and throughout Bering Sea on the northward voyage." And again, "Only one bird (at Port Moller) was seen on or near the shore."

There is a strong probability that a few red phalaropes nest on parts of Alaska Peninsula. Turner's observations at Nushagak and Ugashik, and the bird noted by Jaques at Port Moller, suggest nesting, because these are birds of the open sea when on migration. Furthermore, on May 25, 1925, I found a female along the stream flowing northwesterward from Aghileen Pinnacles, on the north side of Alaska Peninsula, and on May 29 another female was flushed from a pond in the upper end of the same valley. On June 22 Donald Stevenson shot a female at Hazen Point; he thought that this bird had incubation patches.

Nelson (1887) says "It is an abundant summer visitant on the Near Islands, and breeds abundantly on some of the Commander group."

Turner, on the other hand, (1886) says "I have no record

of their occurrence in the Aleutian Islands. They may occasionally occur there with other species."

Stejneger (1885) merely reports a flock seen at sea, near the Commander Islands. Hartert (1920) records five specimens taken on the Commander Islands, and he remarks that the late dates, May 25 to June 16, suggest breeding.

Clark (1910) reports that when he approached Unalaska "thousands of these birds were seen, mostly in flocks of from fifty to a hundred or more, but many singly or in small companies."

The chief of Attu Village said that the red phalarope does not nest in the Aleutians, but he stated that it is plentiful there in winter. This probably is true, though the above data gives good evidence of nesting along the Alaska Peninsula.

Lobipes lobatus: Northern Phalarope

Attu: *Chirr-teg-ech*

Chimt-khukh (according to Turner)

Atka: *Chir-riž-ing-ah*

Large numbers of the northern phalarope migrate along the southern Alaskan coast. On May 8, 1937, while passing through Snow Pass in southeastern Alaska, we enjoyed the impressive spectacle of several thousands of northern phalaropes resting on the water. There was much dead kelp, which apparently afforded good feeding. On May 16 and 17, northern phalaropes were abundant on the tide flats at Eyak River, near Cordova, and local residents declared that they nest there. On May 11, 1936, we observed a small group between the Barren Islands and Afognak Island, and on May 13 we saw a flock of about 25 in Kupreanof Strait as well as smaller groups near Kodiak Island. All of these flocks were seen over open water, where they sometimes alighted and swam about.

Cahalane (1944) observed two northern phalaropes in the Katmai region in September 1940, and Hine (1919) noted them on a number of occasions near the mouth of Katmai River where he obtained specimens.

Littlejohn wrote: "Seen often at sea in large flocks and found nesting at Kodiak and Sanakh in April 1888."

On May 25, 1936, two were seen near a pond on the tide flat at Snag Point, Nushagak River, evidently preparing to nest, and, on May 27 and 29, on the tide flats at Ugashik River, many more seemed to be preparing to nest. Some were seen in small flocks, others in twos and threes.

Jaques (1930) found this bird "abundant about the Port

Moller region in all sorts of pools on the tundra after June 1 until our departure on June 22."

Gianini (1917) noted the species at Stepovak Bay as "one of the most common and interesting of the smaller birds. Every pond had a pair or more . . . I found no nests nor saw any young, yet these birds breed there."

In 1911, Wetmore found these phalaropes evidently breeding in the Morzhovoi Bay region.

In 1925, I observed many northern phalaropes, obviously breeding, in the wet valley bottom below Aghileen Pinnacles, on Hazen Point, and on the marshes at Moffet Cove. Two males that were collected June 15 had incubation patches, and, on July 9, Donald Stevenson saw a young bird.

Turner (1886) says: "Hundreds of them were seen on the low grounds on the northern side of Alaska."

The northern phalarope also nests on many of the Aleutian islands. We found them on Unimak, Unalaska, Atka, Little Tanaga, Adak, Amchitka, Ogliuga, Little Sitkin, Kiska, Little Kiska, Buldir, Semichi, and Agattu. Swarth (1934) reports a pair taken on Akutan.

Wetmore found them nesting on Adak, Tanaga, and Kiska, and he believed that they nested on Atka.

Turner (1886) says that they are abundant on the western islands in the Aleutian chain, and he adds that many of them breed on Atka, Amchitka, Semichi, and Agattu.

On Buldir Island, we were much interested to find two of these birds high on the mountain, in the area occupied by nesting geese.

Stejneger reported the northern phalarope to be a common breeding bird in the Commander Islands.

Family STERCORARIIDAE

Stercorarius pomarinus: Pomarine Jaeger

Russian, Yana and Indigirka regions: *Terbei* (Pleske)

Chukchi: *Aunuklinuadl'-ukanodlin* (Palmén)

According to Pleske, the Russian name "*Terbei*" applies to jaegers in general. He states that in northern Siberia, people of various languages use one name for all jaegers, adding "large" or "small" for the different kinds. Similarly, among some Eskimos I found that the same name was applied to *parasiticus* and *longicaudus*.

The pomarine jaeger proved to be a rare bird in the Aleutian district, and there was no evidence of nesting.

On the evening of May 21, 1936, several miles off Uruia Bay Unimak Island, 3 pomarine jaegers passed the ship—2 were together, followed by a single bird that Cecil Williams identified at close range. On May 22, another pomarine jaeger was seen offshore from Nelson Lagoon, Alaska Peninsula, and several others were seen farther east later in the day. On two occasions we noticed a jaeger trying to rob an Arctic tern. On May 23 three or four jaegers were seen in outer Nushagak Bay. Farther west, on July 4, three jaegers were observed between Little Tanaga and Kagalaska Islands. They probably were *pomarinus* because they were large and were light underneath; however positive identification was impossible. Another was seen at West Unalga Island on August 3.

Pomarine jaegers were seen again in 1937. One was seen near Resurrection Bay on May 20; 1 was observed near the Shumagins, May 23, and several were seen near Deer Island May 24; 1 was seen near Unimak Island, May 25; and 1 was sighted west of Kiska Island, June 6. One June 17, the captain of our ship counted 7 of these birds off Semichi Islands—I verified 4 of them. Later in the day, another was seen at sea, farther eastward. On August 19, at Cape Cheerful, near Unalaska, there were quite a number of these jaegers among the shearwaters and on August 24 one was seen near Bogoslof, among gulls and shearwaters.

Austin H. Clark (1910) saw a pomarine jaeger at Bower's Bank in Bering Sea on June 3—this is the only one that he noted.

Pomarine jaegers were always found either at sea or well offshore, they never were seen on land. Apparently, the water about the Alaska Peninsula and the Aleutians afford excellent foraging for nonnesting individuals. Jaegers probably parasitize gulls and shearwaters in this area, though no doubt they are also capable of feeding directly from the water, where marine organisms are so abundant.

In 1924, we found the pomarine jaeger nesting commonly at Hooper Bay, and no doubt the nonbreeding individuals would be attracted to the Aleutian area, which must lie in their migration path.

Hartert (1920) records two specimens taken on the Commander Islands.

***Stercorarius parasiticus*: Parasitic Jaeger**Attu: *Klí-pa-soch*Atka: *K'é-uch*Russian, Commander Islands: *Rasbojnik* (Stejneger)Chukchi: *Uadl' Ukangodlin* (Palmén)

The parasitic jaeger nests on Kodiak Island (Friedmann 1935; Bent 1921), throughout the Alaska Peninsula, and along the Aleutian chain. On May 23, 1936, 2 of these birds were seen in outer Nushagak Bay; on May 25, 3 were seen, and, the next day, 2 were observed over the marshy tide flats at Snag Point, Nushagak River. On May 27 and 29, a number of these birds were seen flying about over the tide flats at Ugashik River—both the light- and dark-color phases were noted. C. S. Williams collected one in the light-color phase. On August 26, there were five (all of which were in the light-colored phase) over the marsh at Sand Point, Popof Island.

On June 18, 1940, Gabrielson saw a pair at the Semidi Islands, and on July 17, he saw three birds at Dillingham. On July 19, he saw 12 parasitic jaegers on Naknek River.

Jaques (1930) says the parasitic jaeger was "Common along shore and over the tundra north of Port Moller, where it was breeding in June."

In 1925, I found these jaegers to be numerous about Izembek Bay during the nesting season, and I suspected that they were nesting, though proof was lacking. Wetmore reported these birds "tolerably common" about Morzhovoi Bay, and Gianini (1917) found them quite common about Stepovak Bay.

We saw this bird frequently throughout the Aleutian chain. They were in pairs, on characteristic tundra habitat, and they acted in a manner typical of nesting. Unfortunately, we had no time to hunt for nests.

On June 12, 1936, 4 pairs of jaegers were found on Chuginadak Island; June 14, 1 was seen on Herbert; June 18, a pair was seen on Seguam; June 29, 3 were seen on Kanaga; July 23, 2 were seen on Ogliuga; July 26, several were observed on Kiska; July 30, 3 were sighted on Attu; July 31, at least 21 were seen high up on Buldir; August 4, 5 were seen on Kavalga and 3 were seen on Skagul Island.

In 1937, they were noted again: June 4 and 5, 6 were seen on Kiska; June 7 and 10, 4 were seen on Attu; June 11 to 15, common on Agattu; June 17, 6 were seen on Semichi; June 18, abundant on Buldir; June 21, common on Kiska; June 22, a pair was seen on Little Kiska; June 23, 3 were seen on Chugul; June 27, a pair was seen on Little Sitkin; June 30, at least 2 pairs were

seen on Rat Island; July 4, 3 were seen on Semisopchnoi; July 5 and 11, about 7 were sighted on Amchitka; July 29, at least 4 were seen on Ogliuga; July 30, three or four were observed on Kavalga; July 31, 2 were seen on West Unalga; and on August 2, 2 were seen on Ilak.

On the Alaska Peninsula, the black-color phase of the parasitic jaeger is particularly common, though the light phase probably predominates. In the Shumagins, all five birds seen were light colored.

Among the Aleutian Islands, however, the light-color phase is a rarity. More than 100 parasitic jaegers were recorded, and, of this number, only 4 were specifically mentioned in our field notes as being light colored; nearly all the rest were mentioned as being definitely dark. Possibly in no other area is the parasitic jaeger population so uniformly dark.

Stejneger (1885) says of the color phase that "On the Commander Islands the dark form is the most common. A few only with white lower surface were seen and one secured."

Hartert (1920) obtained 4 adults in the Commander Islands with white underparts, and he obtained 3 of the dark phase.

Dall (1874) noted the same tendency, believing, however, that the dark color was in the immature plumage; this becomes obvious when he says "nor have we ever obtained any in completely adult plumage. All our specimens are of a nearly uniform dark slate color."

Bent (1921) has suggested that the dark color phase may be a distinct species. That appears doubtful, however. Bent quotes Grinnell as saying that he found a light and a dark bird mated. On two occasions in the Aleutians we observed trios, one of which was white. Unless we can show that normally the two color types keep segregated in breeding, with only an occasional crossbreeding that may be construed as hybridization, it will be better to consider that they are color phases.

A dark-color phase, becoming dominant or very prominent locally, is known among other animal species—for example, in the case of the marmot in parts of the Rocky Mountains, the ground squirrel in eastern Alaska, and the Arctic fox in the Aleutians.

Food Habits

The name of this bird suggests its food habits. It is known to rob gulls and terns of their food. The Arctic tern and European turnstone were seen pursuing parasitic jaegers, evidently recognizing them as foes. On Alaska Peninsula, there was evidence

hat these jaegers were seeking fragments of salmon left on the banks by brown bears. On Buldir Island, where parasitic jaegers were so numerous, a colony of nesting glaucous-winged gulls probably furnished a food supply for the jaegers.

On Agattu Island, 24 pellets were obtained; these pellets contained the remains of 17 forked-tailed petrels, 3 murrees, and 5 unidentified birds. Of the last mentioned, 2 were possibly parakeet auklets and 1 was a small, sparrow-sized bird.

Some of these items, especially the murrees, were undoubtedly carrion. A nesting colony of forked-tailed petrels, near the perch where the pellets were obtained obviously was the source of the items found in the pellets—however, the method of capture was not ascertained. It is, of course, possible that the jaegers found parts of petrel carcasses left by blue foxes.

Certain observations suggest that the parasitic jaeger is not solely a carrion eater and robber, but that it hunts part of the time in the manner of a hawk. On Semisopochnoi Island, Douglas Gray and I sat on a slope in the midst of a least auklet colony and watched the performance of a parasitic jaeger. For over an hour, we watched the bird repeatedly pursue these little auklets as the flocks came in from the sea. It did not stoop from a height, but it would single out a bird and follow it as swiftly as possible on the level or at various angles, in irregular flight. There are two possible interpretations. It may have been trying to capture an auklet, or it may have been trying to make it disgorge. So far as we could see, in spite of its persistence, it did not succeed in either purpose.

Stejneger (1885) says, of the Commander Islands: "In the autumn they seem to feed to a great extent on the berries of *Empetrum nigrum*, and their excreta at that time are colored dark blue."

Stercorarius longicaudus: Long-tailed Jaeger

Chukchi: *Ankakenuadl'-ukangodlin* (Palmén)

The long-tailed jaeger is rare in the Aleutian district. Friedmann (1935) records a few bones found in middens on Kodiak Island. Osgood (1904) reports one on Iliamna Lake, July 16, 1902, and he records specimens taken by McKay at Nushagak and Ugashik in July and August 1881.

On July 17, Gabrielson recorded a long-tailed jaeger at Dillingham; and, on July 19, he noted three on Naknek River.

Gianini (1917) is the only observer who has reported these jaegers to be common; his observations were made at Stepovak

Bay, where he collected a specimen. Apparently, Wetmore did not observe them on Alaska Peninsula in 1911, and I did not positively identify this jaeger at Izembek Bay in 1925.

Turner (1886) says "The Long-tailed Jaeger is rarely seen on the Eastern Aleutian Islands. I saw one on Sannakh Island in July, 1878. I saw a few at Atkah Island in 1879, and two at Attu Island in 1880 . . . This species is reported to breed at the Semichi Islands."

Friedmann (1934) reports a number of bones of this jaeger found in middens on Amaknak Island.

Stevenson obtained a specimen on Ilak Island, September 8, 1921.

We observed it only once in the Aleutians. On June 13, 1937, I watched a bird in the normal light-colored plumage, flying about with three parasitic jaegers.

Clark (1910) reports seeing one on Bower's Bank, Bering Sea.

Hartert (1920) records two specimens from Commander Islands. Stejneger (1885) stated that they do not nest there.

Family LARIDAE

Larus hyperboreus: Glaucous Gull

Larus hyperboreus hyperboreus

Russian, Murman coast: *Kluscha* (Pleske)

Chukchi: *Yttak*, *tchikerga* (Palmén)

Though the glaucous gull normally nests north of the Aleutian district, it reaches this area in considerable numbers in winter and in migration to more southern localities. As Friedmann suggested (1935), it is practically certain that Turner was in error when he reported "countless thousands" of these gulls on cliffs at Kodiak. Friedmann records several bones found in middens on Kodiak, adding, "Macoun mentions a bird in the Henshaw collection, and 3 eggs taken in June, 1880, now in the Mailliard collection, [which] are the only other records I have found."

While these are recorded under the name *Larus h. hyperboreus*, they could possibly refer to *L. h. barrovianus*. We do, however, have at least one undoubted specimen of *L. h. hyperboreus*—a male taken at Unalaska Island by Wetmore on June 9, 1911. Though this specimen was listed by Oberholser (1918) under *L. h. barrovianus*, examination of the specimen shows that it has the massive beak that characterizes *L. h. hyperboreus*, the measurements being greater than in *barrovianus*. Since it is

known that the eastern glaucous gull nests on St. Matthew and Valrus Islands, we would expect it to visit the Aleutian district at times, though the western glaucous gull would be most prevalent. Oberholser (1918) also mentions Diomede Islands for this form.

Larus hyperboreus barrovianus

Though the status of *barrovianus* has been belabored repeatedly by able ornithologists, certain specimens obtained in the Aleutians induced me to examine the whole question again. More than 200 specimens were examined in the U. S. National Museum and in the American Museum of Natural History in New York.

It is useless to deny the difficulties in recognizing *barrovianus* as a distinct form. In studying series from a given locality, one is confronted with specimens that do not fit a given description. Gulls are variable, and one must be cautious in arriving at conclusions. On the other hand, if one is careful to give due weight to breeding territory, and to allow for migration to explain certain irregularities, many of these difficulties disappear.

All gulls of the species *hyperboreus* are pale mantled, but true *hyperboreus* is noticeably paler than *barrovianus*. Furthermore, *hyperboreus* is definitely larger and has a decidedly larger and more massive beak. Listed measurements do not adequately express the difference. Depth of bill of the two forms overlaps, or meets, at about 23 mm., though most of them are above, or below, this figure, and a difference of even 2 mm. makes a considerable difference in appearance.

A good series of specimens from Point Barrow and the east shore of Bering Sea are remarkably uniform in the characters assigned to *barrovianus*—the darker mantle, the smaller size, and especially the smaller bill. Available specimens from eastern North America are confusing, but it is notable that when winter specimens are eliminated, and apparent breeding birds are used, they fall more generally into the group of *hyperboreus*. This was especially true of Greenland, where a good series of breeding birds presented a clear picture of *Larus h. hyperboreus*, as here described.

The confusing aspect of the distribution of these two forms is the considerable number of small-sized birds found along the Atlantic coast in winter, which apparently agree with *barrovianus*, but which are far from the type locality. Possibly we should expect this. Oberholser gave the breeding range as extending along the Arctic coast as far east as "the territories of

Yukon and western Mackenzie." It is entirely possible that the breeding range extends much farther east. Among specimens examined, *L. h. hyperboreus* was found to the westward across northern Eurasia, Greenland, and northeastern North America as far west as Baffin and Ellesmere Islands. In any case, it may be expected that many of the birds can find their way from Arctic Canada to the Atlantic coast in winter. The gulls are far ranging birds. Steller's eider has been recorded from the Gulf of St. Lawrence (Fisher 1900).

It seems logical to consider *Larus h. hyperboreus* as breeding throughout the Arctic regions of Siberia and Europe, traveling as far west as Baffin and Ellesmere Islands (and probably neighboring areas) and, from the west, traveling eastward to the Bering Sea coast of Siberia. In Bering Sea, the birds obviously have come eastward as far as St. Matthew and Walrus Islands. There is a specimen from St. Matthew taken by G. D. Hanna on July 9, 1916. Gabrielson obtained a breeding specimen on St. Matthew Island in the summer of 1940. He noted particularly that the breeding colony consisted of birds obviously larger than the glaucous-winged gulls. It may be remarked that the size of the average *barrovianus* is not far different from *glaucescens*, including the size of bill. Therefore, the birds noted on St. Matthew Island by Gabrielson would be the larger *hyperboreus*.

Thus, *L. h. barrovianus* has a breeding range that includes the Bering Sea coast of Alaska and the Arctic coast of Alaska and Canada eastward, possibly across most of the Northwest Territory. Collections of breeding specimens would aid in this determination. There are indications that the two forms meet in the Pribilofs, for there is an immature bird from St. Paul Island that agrees with *barrovianus*, and another that seems to be intermediate. (No. 118716, U. S. National Museum)

There are a number of records of the smaller *barrovianus* in the Aleutian district. The records that are not supported by specimens, or specimens that were not examined, are included here on geographic grounds.

Oberholser (1918) listed specimens from the following places: Unalaska, November 1, 1903; November 12, 1904; July 4, 1901 (nestling); Amak Island, July 18, 1911 (nestling.)

Wetmore reported seeing a "finely marked" glaucous gull in Unimak Pass on June 4, 1911. (The specimen that he collected on June 9, at Unalaska, proved to be *hyperboreus*.)

Swarth (1934) records two immature specimens taken on Akutan, May 18 and 21, 1927. Laing (1925) obtained two immature specimens at Unalaska, March 26 and 28, 1924.

Friedmann (1934) reports two bones from middens on Amaknak Island, and (1937) a bone from Dutch Harbor middens, a skull and a femur from Little Kiska, and two skulls from Attu. Undoubtedly these were not subspecifically determined. In 1937, in the dirt foundation of a bald eagle's nest on Amchitka Island, I obtained two humeri that appeared large enough to be a glaucous gull. This identification was later supported by Friedmann, who thought the bones were slightly undersized (which would indicate *barrovianus*.)

Bishop (1900) reported seeing several of this species at Unalaska October 4, 1899.

Another specimen collected at False Pass by Donald Stevenson, April 28, 1925, is an immature bird typical of *barrovianus*. Still another, similar to the above, was taken on Unimak Island by F. L. Beals, April 5, 1941, and another one at Unalaska, March 5, 1942.

Cahn (1947), under heading of *Larus hyperboreus*, reports seeing a few at Unalaska, and Taber (1946) reports a few wintering at Adak. It would be difficult to determine the subspecies without specimens, but Sutton and Wilson (1946) observed immature glaucous gulls wintering at Attu. On March 17, when they made a count, there was a glaucous gull for every 25 glaucous-winged gulls. It is significant that they noted that the size was similar to that of glaucous-winged gulls, suggesting *barrovianus*.

We did not find nesting birds of this species on either Unalaska or Amak Islands, therefore it is surprising to recall that Oberholser had listed his two specimens as "nestlings."

Larus glaucescens: Glaucous-winged Gull

Attu: *Hlú-ka*

Chá-larch, immature

Atka: *Shlú-ka*

Slúkax (Jochelson)

Chiá-li-arch, immature

Culúgidax, immature (Jochelson)

Russian, Commander Islands: *Tschaika*, gull in general (Stejneger)

The Aleut names given the glaucous-winged gull are obviously the same in both dialects and resemble the Russian.

This is the common breeding gull throughout the length of Alaska Peninsula, the Aleutians, and other islands, including the Kodiak-Afognak group. Osgood (1904) reported them nesting on islands in Iliamna Lake and at Becharof Lake, and he observed them at Nushagak. On July 24 and 27, 1940, Gabrielson found

glaucous-winged gulls common about the upper end of Iliamna Lake, and he found a nesting colony on some small rocky islets. In flying over the tundra between Egegik cannery and Becharof Lake, he found these gulls to be common everywhere.

The species is the nesting gull on the Commander Islands; also it nests in Kamchatka, the Pribilofs, and as far north as St. Lawrence Island (Murie 1936).

Nesting

Glaucous-winged gulls nest in a great variety of sites—on high ledges on cliffs (as near False Pass), on high grassy slopes of islands (a favorite site), on low rock islets, or on the sandy shores

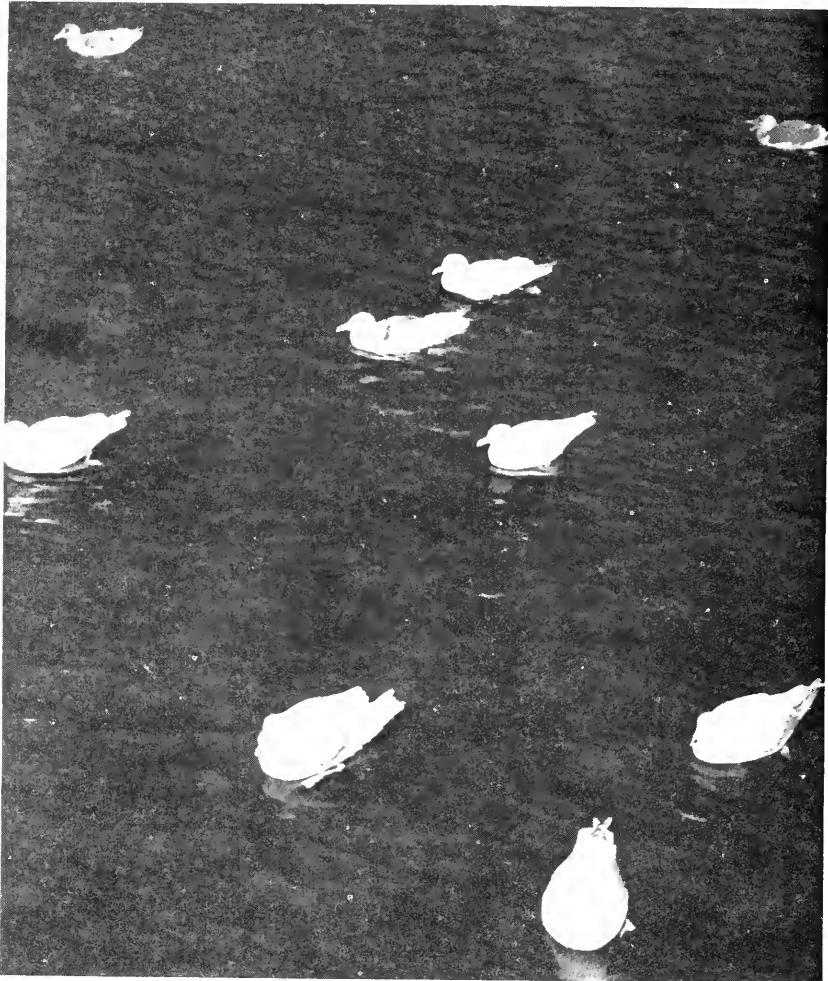


FIGURE 30.—Glaucous-winged gulls.

midst the rank growth of *Elymus*. The most important requirements seem to be a handy source of food, and protection from mammalian intrusion. As in the case of many other birds, if blue oxes inhabit an island, the gulls nest on offshore rocks.

Size of colonies varies from a few individuals to as many as 5,000 birds—this is an estimated count of birds that I observed nesting on Glen Island, at the entrance to Izembek Bay in 1925. A colony on a high green slope above the cliffs on Amak Island numbered about 2,000, and, on Amagat Island, there were at least 2,000. Throughout the Aleutian chain to the westward, however, the colonies numbered from 50 to 150, rarely more than 400. The large numbers in the colonies (mentioned above) may be due to the large food supply provided by the refuse at the cannery at False Pass, the salmon fragments left by brown bears on the Alaska Peninsula, and the fish that the gulls are able to obtain in the salmon-filled streams.

Nests are usually the typical gull structure—a mass of vegetation consisting of grasses, dry kelp or eel grass rolled up by the tide, with dry sponges and other debris mixed in. Frequently, however, the nest is a depression with a scanty lining of grass or other material, and in some instances the gulls had merely formed a depression in a windrow of kelp and eel grass above the usual high-tide mark.

The eggs are of the well-known large gull type, but considerable variation was found. The color tone (speaking in general terms) varied from brownish to greenish. One unusual set of two eggs were a plain light-blue color without brown markings.

Curiously enough, a corresponding variation in color was noted also among the downy young. The majority had a buffy color tone, but a few were blue gray with no buffy color.

The downy young gull is precocious and is wonderfully adept at hiding at an early age, and therefore it is hard to find where vegetation is rank. On open sandy nesting grounds, the young are likely to run, and they take to the water fearlessly, swimming out a considerable distance. When once started in flight over open ground, these youngsters go headlong and do not stop until they think a safe distance has been attained, even though pursuit has stopped.

One young bird, with its gullet bulging with food, presented an ungainly and ludicrous sight running across the beach. It stopped to spew up food several times until its throat had regained its normal proportions, then it took flight. This action was observed repeatedly. Was the bird consciously lightening its

cargo to quicken its speed, or was it a peace offering, an early manifestation of the adult reaction to jaegers' attack? Possibly it is only a nervous reaction and may be common to the young of several species, such as cormorants and pelicans, which promptly spew up their food when disturbed.

Food Habits

The omnivorous habit of the glaucous-winged gull is well known; it is a glutton in the presence of an abundant food supply. Wetmore (manuscript notes, 1911) wrote of the gulls near the cannery at False Pass that—

Everything is gobbled up greedily, and some of the birds can hardly rise in the air when gorged. I have seen one of them choke down two full-sized dog salmon heads entire, and stand gasping and choking for several minutes with an enormous lump in the throat.

Gulls congregate in large numbers at the cannery docks to feed on the refuse, and are accepted as welcome scavengers. For the same purpose they follow the ships, and they gather to feed on the carcasses of stranded whales or seals or on dead fish thrown up by the tide. They found abundant food at the whaling station at Akutan. On Alaska Peninsula and Unimak Island, where Alaska brown bears feed on salmon, the gulls gather to pick up the leavings.

The natural food taken by the glaucous-winged gulls depends on the environment. In 1925, at Izembek Bay and at St. Catherine Cove on Unimak Island, I found these gulls feeding chiefly on crabs. A small yellow-brown, hairy variety is very common in these waters, and the gulls consistently hunt for it. On the ocean beach, they stalk about at low tide and eat crabs. As the tide ebbs, many crabs are left on the beach, covered with a layer of sand so that they present only a slight lump on the smooth beach surface, however the gulls are expert in finding them. In Izembek Bay, parts of which run nearly dry at low tide, the gulls find a good crab-hunting ground. Food remains on nesting grounds of Glen Island and other points in the bay consisted almost entirely of crab remains, and many empty carapaces were strewn along the beaches, picked clean by the gulls. The smaller crabs are swallowed whole.

The gulls manage to find an occasional clam, and there also is an occasional dead murre or codfish on the beach—additional items in the gull's diet.

On Amak and Bogoslof Islands, the glaucous-winged gull specializes in murre's eggs and young. Nesting gull colonies were situated at a convenient distance from murre cliffs, and the

gulls flew along the ledges boldly, hunting eggs in a business-like manner. The murre cackled and presented a pointed beak, but the gull usually managed to snatch the egg of an absent neighbor.

Common-eider and gull colonies are often closely associated, because of similar habitat preferences—an islet safe from blue foxes. An eider nest and a gull nest are sometimes situated only a few feet apart, apparently in good neighborly relations. Yet the gulls seize the eggs or the downy young of the Pacific eider when they have an opportunity. In fact, it appears that the gulls manage to devour an appreciable percentage of eider increase, both in eggs and young.

Other nesting birds may be thus preyed upon under favorable circumstances. On Semichi Island, Scheffer and I were passing a lake, when a common loon swam off at our approach, leaving two downy young. A glaucous-winged gull swooped down, picked up a young loon and flew off with it, pursued by another gull.

Certain adult birds are also taken by gulls. On Semisopchnoi Island, in a least auklet rookery, 137 glaucous-winged gull pellets were collected and analyzed, with the following results:

Least auklet	116 pellets
Forked-tailed petrels	3 pellets
Small fish	7 pellets
Sea urchin	8 pellets
Limpet	3 pellets

On Gareloi Island we found gull pellets that contained both least and crested auklets, and two fulmar eggs.

Some of the bird material, especially that of the crested auklets, probably was carrion left by blue foxes; however, our observations were not conclusive.

The sea urchin is another important item in this gull's diet throughout the entire Aleutian district.

At Unalaska, on May 27, 1937, we saw a large flock of these gulls, chiefly immature birds, feeding back in the hills; apparently they were pulling up small clumps of grass. Regurgitated material consisted mainly of seeds, but we did not have time to make a thorough study of this incident.

Where the gulls depend on the tides for their food, they naturally adapt their foraging periods to the time of ebb tide. This was noted particularly in Izembek Bay. At Glen Island, it was noted that fewer birds were present at the colony during low tide; when the tide came in, the colony was in full force. Incidentally, it seemed that by means of a division of labor, the nests remained guarded while a part of the colony fed.

On Hazen Point, June 13, 1925, I watched large flocks of gray, immature gulls resting 400 yards inland from shore during ebb tide. This area was covered with numerous oval pellets composed of crab fragments. I also found clam shells, which were partly overgrown with vegetation. Obviously, this was a favorite, perhaps an ancestral, resting area, where nonbreeding glaucous-winged gulls had rested and digested food gleaned from the last ebb tide.

Ecological Relations

It is clear that the clever, adaptable glaucous-winged gull finds its living in a great variety of ways, effectively filling the ecological niche in which it happens to find itself. What is the effect on its environment?

The gull is a scavenger, and the effect of its food habits may be somewhat beneficial to man. Gleanings from the beach, which include crabs, clams, sea urchins and other "shellfish" probably do not upset any balance and, so far as we know, have no bearing on human interests in the area considered here.

As for depredations in murre and eider colonies, we did not work out the ecological problem in any systematic way, yet certain observations may be significant. Perhaps nowhere are depredations more severe than in a murre colony. However, on Bogoslof Island, where such gull depredations on eggs and young have continued for a long time, the murrees were present in great numbers and were utilizing all the available nesting sites. The same situation seemed to prevail on other islands. For more detailed consideration of this matter, the reader is referred to the discussion of the murre.

Likewise, the Pacific eider, which also is preyed upon by these gulls, appears able to produce a satisfactory increase in population by the end of the summer. It should be remembered that this eider is not preyed upon by man to any appreciable extent, except for the robbing of nests for fresh eggs in a few localities. Viewing the situation as a whole, it appears that, at least in the Alaska Peninsula-Aleutian Islands district, the Pacific eider and the murre, as well as other species, survive in satisfactory numbers in spite of the gulls.

The glaucous-winged gull is believed to feed on salmon eggs and to prey upon the spawning salmon in shallow streams. This question would require special study, with attention given to the breeding habits and ecological requirements of salmon and the percentage of loss occasioned by the gulls. Naturally, such de-

tailed work could not be attempted in the course of our general investigation.

Larus schistisagus: Slaty-backed Gull

This bird is seldom seen on the Alaskan coastline, though it is common on the Siberian side of Bering Sea. Nelson (1887) records a specimen taken by Bean, October 1, 1880, at the head of Chernofski Bay, Unalaska, saying, "the birds were abundant there at the time." He adds: "Further work in this region may show that this specimen is of regular and common occurrence at many points on the Alaskan coast, although it was not noted by myself nor by any previous explorer there."

The slaty-backed gull has continued to be rare, however, and has seldom been seen. Swarth (1934) wrote "None collected but several identified in life [by C. G. Harrold] from time to time. An adult was shot from the ship but lost, between Kodiak and Akutan, May 16, and others were seen at Cape Etolin [Nunivak Island] on August 27 and 29."

Gianini (1917), speaking of Stepovak Bay, Alaska Peninsula, says "I noted but one or two here."

Clark (1910) observed a few in Unalga Pass, near Unalaska, but saw no more until he reached the Commander Islands.

In the course of three expeditions to the Aleutians I saw a dark-mantled gull only once—at Bogoslof Island, August 24, 1937, when a single gull of this kind was noted among some glaucous-winged gulls. The specimen was collected and proved to be *schistisagus*.

On February 14, 1941, F. L. Beals obtained a good specimen of a female at Atka Island, and on March 15, 1942, he obtained parts of another at Sanak. Gabrielson saw 1 at False Pass on March 16, 1942, and was told of 1 at Unalaska, March 20.

Larus argentatus: Herring Gull

Larus argentatus smithsonianus

Friedmann (1935) says "The only definite Kodiak specimens known to me are two birds collected by Wosnessensky in 1842 or 1843, another taken on August 30, 1906 and a number of bones unearthed from old Eskimo middens by Hrdlicka in 1934." He also recorded (1937) bones of this gull from middens at Dutch Harbor, Little Kiska, and Attu.

Jaques (1930) reports "One immature near the Shumagin Islands."

Cahalane (1944) observed a number of gulls on Naknek River,

Naknek Lake, and Brooks Lake in 1940, which he believed were of this species, and Gabrielson, in 1940, observed the species at various points along the base of Alaska Peninsula.

Taber reports *Larus argentatus* wintering at Adak Island, but specimens were not obtained. Sutton and Wilson observed a few among the gulls wintering on Attu Island.

We saw no herring gulls on any of our expeditions.

Larus argentatus vegae

According to the 1931 Check-List, this gull "occurs casually in Bering Sea and on the coast of Alaska to the Aleutian Islands." Swarth (1934) obtained three gulls of the *argentatus* type from Nunivak Island, which could not be satisfactorily identified. Many of the sight records of herring gulls centered around the base of Alaska Peninsula, where they appeared to be too common to be the Siberian-ranging *vegae*; all such records are here included under *smithsonianus*.

Clark (1910), referring to *Larus vegae*, says: "This gull was rather common in Unalga Pass, near Unalaska, and was seen again, though not in any numbers in Avacha Bay, Kamchatka."

There is at least one specimen of this gull—a female collected by F. L. Beals at Unalaska on February 14, 1942.

Larus delawarensis: Ring-billed Gull

In 1911, Wetmore recorded in his field notes: "In August I noted a few ring-billed gulls about the head of the lagoon back of King Cove, where they were feeding on dead dog salmon, that lay in a creek bed. I shot one for identification but did not preserve it."

This is the only record of this species west of Prince William Sound.

Larus canus: Mew Gull

Larus canus brachyrhynchus

Turner (1886) makes the surprising statement that "Among the Aleutian Islands these birds congregate in many thousands on the cliffs to breed." Obviously, this is an error, since he describes very well the nesting habitat of kittiwakes, and not the marsh or lake habitat chosen by the short-billed gull. In view of this, it is hard to credit his further remarks on the food habits of this gull at Atka and Amchitka.

Nelson (1887) states the situation more in keeping with the

usual findings when he says "Although perhaps occurring as a straggler on the Eastern Aleutian Islands during the migrations, it is nearly or quite unknown on the other islands of Bering Sea, except those closely bordering the shoreline."

On September 7, 1938, Scheffer noted a few of these gulls feeding on scraps at the Akutan whaling station, and, on September 8, he noted them with glaucous-winged gulls feeding on refuse behind the ship.

Friedmann (1937) has recorded two humeri of this gull from middens on Attu Island.

Aside from Friedmann's find, there are no records west of Akutan. In 1925, I noted this species at the cannery at False Pass, and, on May 25, 1937, a few were seen at Ikatan Peninsula. There are suitable lowland nesting places on Unimak Island.

Nests and eggs were found among some small ponds on Dolgoi Island on May 25, 1937. Evidently, nesting was just beginning, for only one of the nests contained eggs. These gulls were observed also at Sand Point and Unga, in the Shumagins, August 29, 1936.

In 1911, Wetmore observed short-billed gulls at Thin Point Bay and King Cove, and Gianini (1917) reports them at Stepovak Bay. On May 17, 1936, we found a widely scattered colony of short-billed gulls on a wide marshy flat at Belkofski; this colony consisted of fifty to several hundred pairs. This was the largest "colony" discovered.

In 1925, I found these gulls nesting about Izembek Bay in moderate numbers. Jaques (1930) found them to be common in June in the Port Moller region, where they nest, and, at Snag Point, Nushagak River, we found them to be common on May 23 to 26, 1936. They also were numerous on the tide flats near Ugashik River, where they were preparing to nest.

Hine (1919) noted the species at Kashvik Bay and obtained a specimen.

We saw one on May 12, 1936, at Kodiak, and we saw three or four at Nagai, one of the Barren Islands, on May 16. We had found them to be common at Seward on May 5; we saw a few at Chisik Island, Cook Inlet, May 7; and we saw some that appeared to be preparing to nest at Anchorage on May 9.

This fairly well outlines the nesting range—from Unimak Island to Kodiak, Seward, and Bristol Bay—which contains the marshland that this gull desires.

Taber (1946) reports four of these gulls at Adak Island, January 12, 1946.

Food Habits

Little was learned about the food habits of the short-billed gull. In 1925, I found these gulls on the tundra back of Izembel Bay, among the salmon streams. No doubt they feed on fish scraps left by the Alaska brown bears, but they also eat salmon eggs. Where the water was a little deep, the gulls would drop headfirst and partly submerge in order to reach the salmon eggs on the bottom. The stomach of a bird taken for a specimen was crammed full of salmon eggs.

***Larus philadelphia*: Bonaparte's Gull**

This little gull is found only sparingly in most of the area here considered, though it is abundant in southeastern Alaska. At Petersburg, a favorite gathering place, flocks assemble at the docks of the shrimp cannery and feed on the refuse. At Juneau they were eating herring roe attached to fish nets, and we found them again at Cordova. They are reported to be a plentiful summer bird, and they nest at Yakutat (Shortt 1939).

Though they might be expected on Kodiak, such records have not been found. On May 5, 1936, several were noted at Seward and one was seen there on May 21, 1937. On May 9, 1936, several were seen at Anchorage, and a pair seemed to be preparing to nest at a small marsh, near town.

Osgood (1904) reports a pair of these gulls, evidently nesting on Lake Iliamna, July 16, 1902, and he mentions specimens taken by McKay and Johnson at Nushagak, at Lake Aleknagik, and at Ugashik. Jaques (1930) found about 40 near Port Moller on June 10, and Hine observed large flocks and took specimens in Kashvik Bay about August 1, 1919. Cahalane found them common on Naknek River, September 3 and 4, 1940, and saw one on Savanoski River, September 20. In 1940, Gabrielson observed these gulls in the Bristol Bay region, and, in 1945, he obtained two specimens at Chignik.

McGregor (1906) found this species among the Krenitzin group of the Aleutians as follows: a bird and a wing found at Tigalda Bay on August 6; about 30 seen off Ugamak on August 12; 1 seen off Tigalda, and 4 seen off Poa, on August 15. He states that they were abundant at Dutch Harbor, August 17.

Bishop (1900) reported these gulls common at Unalaska October 4-5, 1899.

The base of Alaska Peninsula and the Cook Inlet region lie within the normal breeding range of this gull. Occurrences westward on Alaska Peninsula can hardly be considered nesting

records without further proof, and certainly this would be true also of those seen in the Aleutians.

***Larus ridibundus*: Black-headed Gull**

Larus ridibundus sibiricus

On June 4, 1937, Douglas Gray noted 3 strange gulls among the glaucous-winged gulls in Kiska Harbor, at Kiska Island, and took 1 for a specimen. This was at first hastily identified as a Bonaparte's Gull, but, on later examination, it proved to be *L. r. sibiricus*, which is the only positive record for North America (Murie 1945).

***Rissa tridactyla*: Black-legged Kittiwake**

Rissa tridactyla pollicaris

Attu: *Teegle-ah'-gírch*

Atka: *Teegle-gá-gha*

Russian: Commander Islands: *Gavaruschka*, "on account of its loquacity"
(Stejneger)

Chukchi: *Kakyttack* (Palmén)

The Pacific kittiwake can truly be said to occur throughout the entire length of the Alaska Peninsula and the Aleutian chain; however, it nests only in suitable places. Gabrielson (1940) has described the large colony at Resurrection Point, near Seward, and he recorded two large colonies on Whale Island, near Kodiak. The largest colony we observed was on Chisik Island, Cook Inlet. Some estimates of the number of birds on Chisik Island ran as high as 25,000 birds. At any rate, we judged this to be the largest kittiwake colony that we observed on our trip, though it may be rivaled by the Resurrection Bay and Whale Island rookeries.

We observed groups of these birds along both sides of Alaska Peninsula, as far east as Bristol Bay on the north side. Cahalane found them in some numbers in the Katmai region, and Hine observed them at Katmai Bay in 1919—though they did not appear there until about August 10. Gianini (1917) reports a small colony on a rocky islet in Stepovak Bay. Gabrielson found them to be common in the Semidi Islands, and we found them in the Shumagins. There is a colony on a rocky headland on Unga Island. They nest in large numbers on Amak Island, and there is a small colony on some cliffs at Cave Point, on the north side of Unimak Island.

We found the Pacific kittiwake in moderate numbers, with occasional concentrations, throughout the Aleutian chain. There



FIGURE 31.—Black-legged kittiwakes.

are nesting colonies on Chagulak, Amukta, Koniuji, Buldir, Unalga, Alaid (of the Semichi group), Agattu, and Attu. There were at least 2 colonies on Attu Island; 1 of them was on Wrangell Cape, which is the westernmost point in the Aleutians. There were at least 3 colonies on Agattu, 1 of which contained 300 to 400 birds.

An interesting observation was made in regard to the colonies on Attu and Agattu, where we noticed a number of birds in immature plumage perching on points near the nesting pairs. Because of the time of year (too early for full-grown young), these birds must have been 1-year-olds that were lingering about their birthplace.

***Rissa brevirostris*: Red-legged Kittiwake**

Aleut: *Gagáyax* (*Larus brevirostris* Joehelson)

Russian, Commander Islands: *Krasno-nogaja gavaruschka* (Stejneger)

Clark (1910) reported that "The red-legged kittiwake was seen in small numbers at sea near Unalaska, but became more

common in the western part of the Aleutian chain and about the Commander Islands. It was not found in Kamchatka nor in the Kurils."

Bishop (1900) says "One was seen by Osgood at Unalaska (Dutch Harbor) Oct. 5, 1899."

Nelson (1887) found them "in considerable numbers" at Unalaska on May 26 and Friedmann (1937) has recorded two humeri from middens on Kodiak Island.

We have no nesting records based on specimens. Nelson (1887) says it is an "abundant summer resident in both the Near and Commander islands." He had never been there and obviously was quoting Turner. In 1885, Turner stated, writing of the Near Islands, that the Pacific kittiwake was not abundant and was not known to breed there, while *brevirostris* was an abundant breeding bird. No specimens were taken. In 1886, speaking of the Aleutians as a whole, he said,

The Aleutian Islands and the Pribylof group are its home. On Akutan quite a number were observed on a high cliff near the village on that island. In the same year (1878) I saw a few at Sannakh, and in later years I frequently saw them passing the vessel which I was on. To the westward this kittiwake occurs more plentifully than *tridactyla*, with which it associates.

It is true that Clark reported the red-legged kittiwake becoming "more common in the western part of the Aleutian chain," but, on the whole, the situation today appears to be the reverse of what Turner reported. Certainly we cannot say that the Aleutians "are its home." We found that *pollicaris* was the abundant bird in the Near Islands—based on careful examination of specimens and of birds on nesting cliffs—while Turner stated that it did not breed there.

Wetmore, in 1911, and Gabrielson, in 1940, failed to note the red-legged kittiwake in the Aleutians; Bent does not report any nesting records, but he assumes that it nests there on the strength of the records mentioned above.

On our expeditions we observed kittiwakes closely at all times, but we never identified *brevirostris*. All of the birds that we collected proved to be the Pacific kittiwake.

Turner (1886) obviously confused the short-billed gull with the kittiwake, and it is possible that he was in error in his account of the nesting of *brevirostris*.

At any rate, we can be assured that the red-legged kittiwake appears in the Aleutians as a migrant, because the observations listed above probably involve migrants. The bird may also nest in the Aleutians, but, in view of the uncertainties, any such claim

should be based on a precise observation, or on specimens of breeding birds.

Hartert (1920) and Stejneger (1885) reported both species nesting on the Commander Islands, usually in separate colonies according to Stejneger, though he once found both species nesting on the same cliff.

Xema sabini: Sabine's Gull

Xema sabini woznesenskii

Friedmann (1935) reports a specimen from Kodiak, taken by Bischoff, July 25, 1868, and Gabrielson observed one there on August 10, 1945. Osgood (1904) apparently did not observe it at the base of Alaska Peninsula, but he records a specimen taken by McKay at Lake Aleknagik. Hanna obtained a specimen at Nushagak, May 31, 1911.

These birds undoubtedly nest on Alaska Peninsula, however. At Ugashik River, May 27 to 29, 1936, they were common on the tide flats, in pairs, obviously preparing to nest. This area is identical in character with the nesting habitat of this species noted at Hooper Bay in 1924. It is probable that Sabine's gull nests farther west—at Port Heiden and Port Moller for example. We could not examine those areas thoroughly, but, on May 22, at least one bird, in immature plumage, was seen offshore opposite Nelson Lagoon, and Jaques (1930) reports an adult at Port Moller on May 23, 1928.

There is no evidence that these birds nest to the west of Nelson Lagoon, although they have been observed much farther west. On May 18, 1936, one was seen at False Pass, Unimak Island. On May 11, 1925, I saw one at Uria Bay, and McGregor (1906) obtained a specimen on Unimak Island, August 14, 1901. In June 1937, the natives of Atka Island obtained a specimen, which they presented to us—this specimen is the westernmost record in the Aleutians.

Hartert (1920) records a specimen of an adult male from the Commander Islands, which apparently is the only record for those islands.

Sterna hirundo: Common Tern

Sterna hirundo hirundo

The only record of this bird is a brief statement by Wetmore in his field report of 1911: "I saw several common terns 50 miles off Tigalda Island, June 4."

Sterna paradisaea: Arctic TernAttu: *Ki-ti-ki-té-ach*Atka: *Kri-thich'-tha*Russian, Yana region: *Tschernogradka* (Birula)Chukchi: *Tekechyak* (Palmén)

Arctic terns nest in suitable places all the way from Kodiak Island to Attu. Walker (1923) observed a small colony in Alitak Bay, Kodiak Island, and reports them nesting at least as far south as Taku Glacier, near Juneau. We were informed that a colony of terns, presumably of this species, nested at Bear Bay, near Belkofski, and on an island in Pavlof Bay. Walker has also recorded terns as being common on Simeonof Island, in the Shumagins.

On the north side of Alaska Peninsula a few Arctic terns were seen at Ugashik River, probably nesting, and there was a nesting colony at Nelson Lagoon. In late July 1940, Gabrielson found them to be common on the basal portions of Alaska Peninsula, particularly between Becharof Lake and Egegik cannery, on the Wood River Lakes, along Kvichak River, and on the upper end of Iliamna Lake.

In 1925, I found them nesting at Izembek Bay, a few in the marshy bottom of the valley running north from Aghileen Pinnacles; a group of 40 and a group of 200 on two small islands near Point Grant; and at least 2 pairs at a small pond near the base of Frosty Peak.

In 1940, Gabrielson found 10 pairs and 3 nests at Morzhovoi Bay on June 21.

In the Aleutians proper, we were told that there was a colony on Kanaga, a few were seen on Tanaga, and we found several colonies on Ogliuga and Skagul. A flock of eight or ten was seen at the south end of Kiska Island, and we noted 15 or 20 at a low reef in Massacre Bay, Attu Island, June 9, 1937. Evidently, there were nesting or preparing to nest. Three pairs were nesting on a small island of a lake on Alaid, and another pair was nesting on the middle island of the Semichi group. Turner reported them plentiful here, and breeding. A few birds were noted at Semisopchnoi and Amchitka, and in 1938 Scheffer saw one at Sanak Island.

The Arctic tern is not abundant among the Aleutian Islands, and the islands mentioned here are probably the majority of those occupied by these terns. Colonies are usually small, and even one or two pairs may be all that nest in a given locality.

Arctic terns nest in the Commander Islands.

Food Habits

We did not obtain extensive data on food habits. However, we noticed that Arctic terns followed in the wake of our ship when traveling through Bristol Bay. It is possible that the terns desired to feed on the ship's refuse, as gulls commonly do, but it seemed more likely that these terns intended to feed on the small invertebrates, which were brought to the surface by the churning action of the ship's propellers.

***Sterna aleutica*: Aleutian Tern**

This tern was first discovered on Kodiak Island and was described by Baird from a specimen taken there. As Friedmann has pointed out, there is one specimen and an egg taken by Bischoff on June 12, 1868, when these terns were breeding on Kodiak Island, and, in addition, the National Museum has 14 other eggs taken by Bischoff in that same year, as well as 4 eggs taken by W. J. Fisher in July 1882. But because original data slips are not present, there can be some doubt as to identification of these eggs. Bretherton noted the birds associating with Arctic terns as late as 1895, but there were no later records until Howell (1948) reported a colony of 50 pairs nesting on Double Island at Kodiak, June 11, 1944. These, too, were associating closely with a colony of 100 pairs of Arctic terns.

Nelson (1887) described 2 nesting places, 1 on an island about a mile from St. Michael in the mouth of the "canal," the other on an island "some 18 miles to the eastward, along the coast, and less than a mile from the Eskimo village of Kegikhtowik."

In 1920, I visited the first-mentioned of these two islands. The Aleutian terns were still there, but the island was being used as a slaughtering ground for reindeer, and all the nests were trampled by the animals. Fragments of downy young birds were noted. More recent information indicates that these terns no longer nest on this island.

Ernest P. Walker found Aleutian terns nesting on Strawberry Island, Situk River flats, near Yakutat (1923).

Friedmann (1933) reports a colony of Aleutian terns nesting at the mouth of Goodnews Bay. These were discovered by D. Bernard Bull, who estimated between 60 and 75 pairs, together with some Arctic terns. Mr. Bull obtained 1 of the birds with the eggs. As Friedmann says, this is no doubt the largest colony now known on our shores.

Jaques (1930) says "Several hundred were seen at Port Moller May 22 to 30," but he says nothing about nesting. We saw none

on our visit to Port Moller in 1936, but found Arctic terns nesting at Nelson Lagoon. As many as "several hundred" Aleutian terns would indicate a nesting colony, the largest yet known, but unfortunately there are no further details. It is to be hoped that a good nesting colony will be found on that part of Alaska Peninsula.

In 1925, I thoroughly investigated reports of the nesting of this tern on Unimak Island. Donald H. Stevenson, who had spent 5 years in the Aleutians, reported a colony of Aleutian terns on a little sand island in St. Catherine Cove, on the east end of Unimak Island, and a local guide, John Gardner, appeared to know the species and corroborated Stevenson's statement. However, upon investigation it was found that the powerful tidal currents prevailing there, which no doubt had deposited the little island originally, had washed it away again since Stevenson's last visit. He had collected specimens, some of them at that breeding place. Moreover, on May 20, 1925, I observed 3 terns at St. Catherine Cove, 1 of which was identified as *aleutica*. The other two, though not observed so closely, were probably the same. On the whole, there is good reason to accept this record of nesting, the first for the Aleutians proper.

Not far from this locality, at Izembek Bay, on Alaska Peninsula, we obtained good evidence of nesting. On June 16, 1925, we saw a number of Aleutian terns flying toward Point Grant, and one was shot for a specimen. This specimen was a male with incubation patches. On June 30, three or four terns flew by at an island near Point Grant. Two specimens that were taken proved to be a breeding male and a female.

We covered this area pretty thoroughly, but we found no nesting colonies; however, it is safe to say that Aleutian terns were nesting somewhere in that vicinity. Possibly a few were nesting in the Arctic tern colony, undetected by us, or they may have been in a group by themselves.

On August 14, 1936, C. S. Williams picked up a wing on Nunivak Island, which proved to be that of an immature Aleutian tern.

There are a number of specimens taken on Sakhalin Island in 1914. Stejneger did not find them in the Commander Islands, but Hartert records a specimen, a male, taken in 1911 on Copper Island, the first record for the Commanders.

The Aleutian tern apparently shifts its nesting place in the face of adverse circumstances. This can be construed as an adaptability of survival value. It is possible that this rare species will become more safely established in the Alaskan avifauna.

Family ALCIDAE

Uria aalge: Common Murre*Uria lomvia*: Thick-billed Murre*Uria aalge inornata**Uria lomvia arra*Attu: *Oo-la-rhook-ta*Atka: *O-loonǵ-thrah**Sakitax* (Jochelson)Russian (?), Commander Islands: *Are* (Stejneger)

Undoubtedly, natives do not distinguish the two species. The Commander Island name given by Stejneger (referring to the sound made by the birds), which is assigned to *Uria l. arra*, may be Russian.

Necessarily, these two species will have to be discussed together, because, in many cases, it was not known which species of murre predominated in a rookery. Only a few birds could be identified because the two species were intimately associated on the nesting cliffs.

In early spring, murrens can be seen at frequent intervals from the Kodiak-Afognak region to the end of Alaska Peninsula, and in most places throughout the Aleutian chain. Many of these probably are migrants.

Beals and Longworth (field report for 1941), writing of Unimak Island, said—

Murrens were far from plentiful through the month of March. . . One or two birds a day at the most were all we saw until well into April. On March 16 we saw two birds in full summer plumage. . . Through May only scattered pairs and small groups of 3-5 birds were encountered. From the last of May until leaving the island June 17, larger bunches were being seen, groups of 15 and 20 in full summer plumage. They nest on Bird Island near Ikatán Peninsula we are told.

Cahn speaks of the murre at Unalaska Island as "a rare and solitary fall, winter and spring visitor."

There are numerous nesting colonies, often associated with kittiwakes. Gabrielson (1940) has described the large colony associated with kittiwakes at Resurrection Point. He also found some birds nesting at Kodiak and saw large numbers in the Semidi Islands. At the Semidis only *inornata* was identified.

Among the outstanding murre colonies that we visited was the one on Amak Island. In 1925, I spent 9 days on this island and came to the conclusion that most of the thousands of birds on the cliffs were Pallas thick-billed murrens.

Bogoslof Island is noted for its sea lions and its murre. Here again, although both species are present, we concluded that Pallas murre were in the majority. In 1938, Scheffer estimated that there were about 50,000 of these birds on Bogoslof.

There is a notable colony, consisting of both species, on the steep cliffs of Kagamil Island; however, we could make no estimate of the relative abundance of each.

Chagulak and Amukta Islands also have their murre colonies, and we found a small group on Seguam—all of these colonies contained both species. On Chagulak, the Pallas thick-billed murre again seemed to predominate. Both species nest on Kasatochi, and unidentified murre colonies were seen at a distance on Koniuji. We found 2 colonies on Attu and 3 colonies on Agattu.

Other small groups nest on various cliffs, and the murre is found almost everywhere throughout the Aleutian chain and along the south side of Alaska Peninsula. On the north side of the Peninsula, however, they do not occur as a nesting bird east of Amak Island, because the low relatively flat coastal plain does not afford proper nesting sites.

At Agattu Island, on June 11, 1937, we obtained a specimen of Pallas's murre that was weak, very thin, and still in winter plumage.

Ecology of the Murre

The ecological reactions between gulls and murre have already been discussed, but further attention should be given this question with special reference to the murre. It is a well-known fact that large gulls, in this instance *L. glaucescens*, visit bird-nesting colonies (such as those of murre) to feed on eggs and young. When one observes this relationship in action for the first time, one becomes apprehensive that the prey species will be drastically reduced in numbers, or exterminated, through interference with the reproducing function. However, the more one studies this problem, the more one is impressed with the principle of mutual racial adjustment, or balance.

Amak Island may be cited as an example. There are the usual colonies of glaucous-winged gulls adjacent to the murre cliffs, together with several nesting pairs of northern bald eagles and Peale's falcons. I visited this island in the summer of 1925, in the month of July. There was plenty of time to take stock of the avifauna of this little island, for we had to remain 9 days before the weather permitted departure in the small boat. In 1936, we visited the island again, which gave us the opportunity for comparison after an interval of 11 years. Conditions had obviously

remained static. There were the numerous murrelets and gulls, and about the same number of nesting eagles and falcons.

On Bogoslof Island, in 1937, we watched the glaucous-winged gulls seizing eggs and young murrelets, apparently on a large scale. In 1938, Scheffer remarked in his field report, "On the island [Bogoslof], more murrelets were noted this year resting on the cliff or vertical bluffs where the party landed in 1937 and 1938. Apparently, the colony was not only holding its own, but it may have been increasing. The bluffs mentioned by Scheffer were not in the main nesting grounds, and were not typical, nor perhaps as favorable, in some respects. Possibly these bluffs were in reality an overflow area in a crowded bird population.

R. A. Johnson (1938) has presented a detailed study of predation of gulls in murre colonies, based on his own specific studies of Atlantic murrelets and great black-backed gulls, as well as reports of other ornithologists. One factor is disturbance by human intruder, which makes the murrelets more vulnerable to attack by gulls. Johnson believes that the fear response by the murrelets is very important, and that it is a colony response. Once a decline in a murre colony is begun and the colony becomes con-



FIGURE 32.—Colony of Pallas's thick-billed murrelets on nesting cliffs of Bogoslof Island.



FIGURE 33.—Pallas's thick-billed murrelets.

ditioned to the fear stimulus, either by human disturbance or by excessive predation, progressive reduction of the colony may result.

In the Aleutian district, no such drastic reduction of a population came to our notice. Probably there is a minimum of human intrusion. Furthermore, in many cases the historical background was unknown.

The murre is one of the animal species preyed upon rather extensively by raptorial forms. Yet, it does not find it necessary to produce more than a single young in a season. On the other hand, it nests in close-packed colonies and exists in large numbers, and it seems that local predation has little effect.

In common with some other sea birds, murrelets often succumb to the elements and are found washed upon the beach.

Beals and Longworth, reporting for Unimak Island in 1941, wrote:

Between April 2 and 4 numerous dead and sick murrelets were along all the beaches. We counted 37 dead birds along 3 miles of beach. The condition was general along the strait [probably Isanotski strait], we were told. Old-timers on Unimak told us that this happens every spring and that some years the beach is black with dead birds. Swimming in close to the waterline many of them appeared to be sick or very weak and hardly able to dive in shallow water. Altogether we saw 38 dead birds and 40 or more very weak ones along 3 miles of beach. For three days before this heavy winds and snow blew from the southeast.

One would expect such heavy mortality over a considerable area to be disastrous, but the reproductive rate seems ample to cope with all such natural opposing forces, as well as with predation.

Cepphus columba: Pigeon Guillemot

Cepphus columba kaiurka

Attu: *Seev-luch*

Siblux (Jochelson)

Atka: *Seem-luch*

Simlux (Jochelson)

Commander Islands: *Kajurka* (Stejneger)

Russian, Commander Islands: *Svistun* (Stejneger)

There may be an error in the Commander Islands names. Stejneger told me that both Aleut and Russian was spoken on those islands. The supposed native name, *Kajurka*, appears to have the structure of Russian, and *Svistun* is essentially the same name that Turner found applied to a scoter in the Aleutians, and that I found applied to the American scoter by residents on Unimak Island. The race found in the Commander Islands is *C. c. kaiurka*.

The pigeon guillemot is so universally distributed, from Kodiak Island to Attu, that an enumeration of localities is superfluous. Along the north side of Alaska Peninsula it was observed at Moller Bay by Jaques (1930), and specimens have been taken at Nushagak.

Usually they are found in small groups. Possibly the largest aggregation was a loose band of 40 seen at Chugul Island, west of Atka. They nest among boulders on the shore or in crevices of cliffs.

Birds were occasionally seen with an unseasonable whitish suffusion on the plumage, suggesting the winter dress. The first one was noted June 24, 1937, at Davidof Island, and another was noted on June 26, at Little Sitkin. Several were noted at Rat Island, June 30; several were seen at Tanaga on August 3; one was seen at East Unalga, August 26; and several were seen at Sanak on August 29. During this period the vast majority were, of course, in the plain black summer dress.

Apparently, two races of this guillemot breed in the Aleutians. Robert W. Storer (1950) has described *Cepphus columba adianta*, giving its range from the mouth of the Columbia River "north to and including the Alaska Peninsula and the Aleutians at least as far west as Umnak Island." This would leave the Aleutians west of Umnak and the Commander Islands to the race *Cepphus columba kaiurka*. I have not had an opportunity to investigate this, but the A.O.U. Check List has not recognized the validity

of *adianta*, therefore at present we may call this species, which breeds on the Alaska Peninsula and on the Aleutian chain as far as Umnak, *C. c. columba*. The race that is breeding on the more western Aleutian Islands and the Commander Islands is probably *kaiurka*, as indicated by Storer.

In 1941, at Unimak Island, Beals and Longworth noted 4 birds in winter plumage, and 5 in summer plumage on March 26; a group of 15 birds in summer plumage was seen on April 8; and 3 in mottled plumage were noted on April 21.

Brachyramphus marmoratum: Marbled Murrelet

Brachyramphus marmoratum marmoratum

On our expeditions we observed this bird frequently in southeastern Alaska, where it is common. On May 6, 1936, a bird in the black and white plumage was seen at Port Chatham, Kenai Peninsula; on May 11, at least 6 were seen between the Barren Islands and Afognak (1 of these birds was in the black and white plumage); and on May 14, one or two birds (believed to be of this species) were seen south of Alaska Peninsula and southwest of Sutwik Island. Other murrelets were seen, but under circumstances unfavorable for identification.

Marbled murrelets occur at Kodiak, as shown by Friedmann's well-documented account, and may nest there. Osgood (1904) says "Several murrelets (apparently this species) were seen on Kanatak Bay October 13. A single immature specimen (No. 106605 U.S.N.M.) was taken near Nushagak by J. W. Johnson, Sept. 5, 1885."

Cahalane reports (1944) "I saw these birds commonly along the Shelikof Strait coast, from Katmai Bay northward. They seemed to be most abundant in Kukak and Hallo Bays."

On July 27, 1940, Gabrielson observed a number of marbled murrelets at the upper end of Iliamna Lake.

Gianini (1917) reports seeing this species at Stepovak Bay.

In 1925, I observed murrelets on both sides of Alaska Peninsula, near the western end, but positive identification was difficult. The marbled murrelet was most abundant on the south side, between Ikatan Peninsula and Amagat Island, where several pairs were taken.

The species has been recorded frequently from Unalaska. Nelson (1887) found it there in May 1877 and says that it breeds there. Bailey (1925) reports a specimen taken there by Hendee on September 24, 1922, and Clark (1910) secured a female at Dutch Harbor. Laing (1925) obtained a "breeding female with

bare brood patches" at Unalaska on August 8, 1924, and he saw a murrelet at Adak Island, but he was doubtful of identification.

There is no information on the nesting of the marbled murrelet beyond Unalaska Island.

Brachyramphus brevirostre: Kittlitz's Murrelet

Glacier Bay has been shown to be the center of abundance of the Kittlitz's murrelet (Grinnell 1909), but of course it occurs much farther west and north.

Actual records for the Kodiak-Afognak Islands are not at hand, though the birds undoubtedly have occurred there. Osgood (1904) mentions three specimens taken by McKay near Nushagak April 3, 1883, and Jaques (1930) obtained a specimen at Port Moller, June 6, 1928. Laing (1925) obtained a male in full winter plumage at Chignik Bay on March 22, 1924, and on July 27, 1925, I took a specimen in Isanotski Strait. Stevenson obtained a specimen there on August 3, and obtained one in Izembek Bay on June 17.

It is of interest here to note that a specimen was taken on June 21, 1933, at Goodnews Bay, north of Alaska Peninsula which was recorded by Friedmann (1934).

Nelson (1887) obtained a specimen at Unalaska the last of May 1877; Turner (1886) obtained one there on April 24, 1879 and says that they are not rare at Amchitka and Atka, though he obtained no specimens at the latter places. He quotes natives as saying that this species occurs throughout the year at Sanak Island.

On June 9, 1937, I collected a pair of Kittlitz's murrelets in Massacre Bay, Attu Island. The female had brood patches, and dissection showed that egg laying had taken place. The Attu chief knew this species and said that it nests on Attu and Agattu but does not winter there. According to him, the birds build a nest similar to that of kittiwakes, on ledges of cliffs, and lay two eggs.

According to Turner's information from natives (1886), "The nest is placed among the roots of the large tussocks of grass on the edges of bluffs and cliff ledges." He stated that the birds lay a single pure white egg.

F. E. Kleinschmidt (Thayer 1914) also refers to a white egg when he quotes Chester A. Reed, the data of Capt. Tilson: "Kittlitz Murrelet—a pure white egg found in a hollow under a bunch of rank matted grass on Sanak Island, June 25, 1899."

In May and June 1913, Kleinschmidt collected eggs of this bird,

the nesting place being high in the mountains in the vicinity of Avlof Bay. Some eggs were obtained from birds collected, but one egg was found on the bare lava rock, from which the bird was flushed. The egg, as described by John E. Thayer (1914), is not white, as had been reported, but "has a ground color of olive lake, dotted all over with different-sized markings of dark and light brown. Two others, taken from the oviduct of birds May 29, 1913, had a ground color of yellow glaucous, with dark brown spots over the whole egg."

More recently, the species was found breeding at Wales, Alaska, on July 10, 1934, by an Eskimo, who sent the skin (of an incubating female) to the Chicago Academy of Sciences. The next year, on June 29, the Eskimo obtained an egg. Edward R. Ford (1936) described the egg as having "the ground color of the Xantus murrelet egg figured as No. 6 on Pl. 49 of Bent's 'Diving Birds of North America'. The markings are similar too, in character, but in color are black or very dark brown. In shape it is exactly like the Marbled Murrelet's egg shown as No. 5 on Pl. 48 of the same work."

There is one other record, not in an ornithological journal, but in a paper-covered pamphlet published by Rev. Bernard R.



FIGURE 34.—Kittlitz's murrelet beside its egg. (Photo by Bernard Hubbard.)

Hubbard (apparently for the tourist trade), entitled "One Hundred Pictures of Little Known Alaska." Among other pictures, there is a photograph of a "Rare merelet and egg," which undoubtedly is that of the Kittlitz's murrelet. The caption explains that

This very rare web-footed bird usually nests far from water on the rock crests of mountain ridges. This specimen, unafraid of the camera, was gently lifted off its egg and photographed. The picture was taken in mid-July in the unmapped northern section of the Katmai National Monument on the Alaska Peninsula and is regarded as the only one in existence of this unusual bird and its egg.

Synthliboramphus antiquum: Ancient Murrelet

Attu: *Satrch*

Sátáx and *qidánax* (Jochelson)

Atka: *Kriz-yung-a*

Russian (?), Commander Islands: *Starik*, "old man" (Stejneger)

This murrelet is definitely established as a breeding bird on Kodiak Island (Friedmann 1935), and we saw it at intervals all the way to the western end of the Aleutian chain. Jaque (1930) saw several near Belkofski, May 17 and 18, 1928; and McGregor (1906) obtained a specimen at the west side of Unalaska Island, August 14, 1901.

Probably this bird appears only rarely, if at all, along the northern side of Alaska Peninsula, but in the Shumagins, on May 23, 1937 we found flocks of them to be quite common. Chase Littlejohn (Bendire 1895) has given us a vivid account of numbers of these birds nesting on Sanak Island, but on our brief visit to that island in 1937 we learned that large colonies of sea birds no longer nest there. Evidently, they have disappeared because of man's exploitation of fisheries, with the attendant disturbance, and be-



FIGURE 35.—Ancient murrelet.

cause of the blue-fox industry. Nelson (1887) states that Dall found the ancient murrelet breeding abundantly at the Chica Islets, in Akutan Pass, near Unalaska, and he adds that Dall found them to be abundant throughout the Aleutian chain.

Turner (1886) obtained a specimen at Atka, June 12, 1879, and says "Among the Nearer Islands this Murrelet is abundant in summer, breeding, and is sparingly resident; rarely coming to Attu, but more plentiful on the western end of Semichi and the south side of Agattu."

We recorded them specifically at Umnak, Kagamil, Carlisle, Herbert, Amukta, Adak, Amlia, Salt, Igitkin, Kasatochi, Gareloi, Ogluga, Kiska, Little Sitkin, Buldir, and Semichi Islands.

Beals and Longworth found them at Unimak Island in small groups from March 24 to April 27, 1941, and saw them again on August 28, 1941.

We found the ancient murrelets nesting in burrows; a cold egg was found on one occasion in the burrow of a tufted puffin. Early accounts and the statements of natives agree, however, that these murrelets also nest in clumps of tangled grass.

Clark (1910) says "Ancient murrelets were very common all about the shores of the Aleutian Islands and in the bays and harbors, being rather more numerous about Atka, Attu, and especially Agattu, than elsewhere."

Cahn found them "not uncommon during the winter months" around Unalaska Island.

This is one of the species that undoubtedly has greatly declined in recent years, as a result of increase of the blue-fox industry.

Ptychoramphus aleutica: Cassin's Auklet

Ptychoramphus aleutica aleutica

Atka: *Mak-cheeth-ah*

It proved to be a little difficult to identify this bird when speaking with the natives, but it is believed the native name given above is correct. We could obtain no name in the Attu dialect, as the people did not seem to know the bird.

While the Cassin's auklet is supposed to range "from the Aleutians and Queen Charlotte Islands to Lower California," it is by no means equally abundant throughout this range, nor uniformly present therein. It is known to nest at Kodiak (Friedmann 1935). To the westward of that place it is no longer common. It formerly nested in large numbers on Sanak Island, according to local residents and early accounts (Bendire 1895), but today it has nearly, if not entirely, disappeared from that

nesting ground. However, on May 23, 1937, we saw several Cassin's auklets not far east of the Shumagins. On August 26, 1937, several flocks were noted off Lava Point, Akutan Island, and, on the next day, near Kaligagan Island in Unimak Pass, a few groups were noted. George Ermeloff, former chief of Umnak Village, stated that this auklet nested on Keegaloo and Adugak Island, but added: "I guess foxes finish now."

On June 14, 1936, at least 12 of these birds were feeding in the tide rips off the shore of Yunaska Island in company with the more numerous whiskered auklets.

Paul Dirks, former resident of Atka, said that years ago Cassin's auklets were numerous, "millions of them," on 2 small islands, 1 on the north side of Amlia, the other on the south side. He assumed that they were still there, but some native bystanders from Atka remarked that there are not so many there any more, for the blue foxes now swim over to these small islands. Paul's brother, Bill Dirks, chief of Atka Village, said these auklets also nest on one of the small islets at the east end of Tagalak, on Ikiginak, Oglodak, Amtagis, on a small islet in Iskum Bay (Atka Island); on a small islet in the bay west of Amlia Pass; on two pinnacles just west of Cape Idalug (Amlia Island); and on Tanadak, south of the east tip of Amlia. All of these islands mentioned by the Dirks brothers are in the general vicinity of Atka and Amlia Islands. It may be mentioned that Turner (1886) obtained his one specimen from Atka Island.

On July 7, 1936, at Kasatochi Island, a number of these auklets were identified among the vastly more abundant least and crested auklets.

Ilak Island was mentioned as another nesting place, but natives pointed out that blue foxes recently had been placed on that island. On our visit to Ilak Island, we found no live Cassin's auklets, but a few must have been present, for we found their remains in at least three blue-fox droppings.

Clark (1910) noticed these birds about Unalaska, Atka, and Agattu, and he saw a few at Attu. We found none of these birds west of Ilak.

In earlier times, the Cassin's auklet was considered a delicacy by the Aleuts, and Paul Dirks described one method of capture. A fire was built at night near their nesting place. As the birds came to the fire, dazzled by the light, they were seized and thrown into a bag. This attraction to light suggests the similar behaviour of the petrels.

Cyclorhynchus psittacula: Parakeet AukletAttu: *A-bo-chee-arch*Atka: *Krech-mó-ga-tha*Russian, Commander Islands: *Bjele-bruschka*, "white breast"
Bjele-bruski, plural (Stejneger)

The parakeet auklet has been found nesting on Kodiak Island—where a few specimens have been taken, and where Fisher collected seven eggs in 1884 (Friedmann 1935). Apparently, that is the easternmost point in its nesting range, and probably it is not abundant there. We saw none in Kodiak–Afognak waters on our voyages, and they do not seem to be abundant along the Alaska Peninsula. On May 14, 1936, we found a few near Sutwik Island. On May 18 and 19, some of this species were identified among the numerous crested auklets feeding near Ikatan Peninsula of Unimak Island, and, on May 21, a flock of 100 or more was seen near Cape Lazarof of that island. In the following year, we again noted these birds near Ikatan Peninsula, and they were fairly common near the Shumagins on May 23, 1937.

These auklets apparently do not nest on the north side of Alaska Peninsula. On April 30, 1925, I found a dead parakeet auklet at Uria Bay, Unimak Island; this was the only one seen in a summer's work in that area. They do not nest on Amak Island.

Throughout the Aleutian Islands, however, this auklet is well distributed. On June 4, 1911, Wetmore observed "large flocks of paroquet [parakeet] auklets" in Unimak Pass. We found these birds in small numbers at Umnak, Kagamil, and Uliaga; they were quite plentiful at Carlisle, where they nest, and several were nesting on Chagulak. (In 1940, Gabrielson found them to be numerous there.) Nearly 150 were seen at Herbert Island, and several thousand of these birds nest on Seguam. A few were noted at Kagalaska, Aso, Tanaklak, Unak, Igitkin, Ulak (50 to 100), Kasatochi, Koniuji, Ogliuga, and Unalga. They were abundant on Gareloi, Kiska, and Buldir, and were seen in fair numbers on Semisopchnoi. A few were also noted at Segula (Chugul), Khwostof, Little Sitkin, Amchitka, near Kavalga, Ulak (178° W. long.), Iiak, and East Unalga. Probably the principal nesting colonies are those at Gareloi, Kiska, Buldir, and Seguam, while more-detailed study may show that Semisopchnoi also harbors a great many more than we noticed.

We did not record the parakeet auklets in the Near Islands, but Turner (1895) reported it to be plentiful on Agattu, and Clark (1910) said that it was "rather numerous in Unalga Pass

as we approached the harbor of Unalaska, and was met with at Atka, Agattu, and Attu, though in small numbers."

It also nests in the Pribilofs.

Stejneger (1885) reported it to be a common nester in the Commander Islands, though not numerous, and said that they arrive there about the end of April. Turner intimated that they do not winter in the Near Islands.

The parakeet auklets nest among large boulders on the beach and in crevices in rocky cliffs, also on slopes where the rocks are partly covered with vegetation. This bird has been considered quite solitary in habits, and although this is true for the most part, they occasionally occur in flocks of moderate size. They often gather in flocks on the water just out from the beach, where they sit and chatter in chorus; then they may suddenly disappear from the shoreline and if one were to inspect the beach at such time it would seem that there were no auklets in the vicinity.

We concluded that the parakeet auklet does not consistently fly far out to sea to feed, as is common with other species of auklets. Its principal food seems to consist of small crustaceans.

In his notes for 1938, Scheffer reports that, on August 12, at Ogliuga Island, the stomach of a 2-foot cod contained the entire body of a parakeet auklet.

Aethia cristatella: Crested Auklet

Attu: *Ku-noó-yuch*

Atka: *Ku-noó-yuh*

Commander Islands: *Konjuga* (Stejneger)

Pribilofs: *Canooskie*, "Little Captain" (Preble)

Eastern Aleutians: "Sea quail"

Apparently, Kodiak Island is the eastern limit of the nesting range of the crested auklet. We saw none east of there. Friedmann (1935) lists a number of specimens from Kodiak, and Laing observed them there in March (1925). Though the birds occur along the Alaska Peninsula, we did not discover nesting colonies there and did not see them in numbers until we reached Unimak Island. There, especially about Ikatán Peninsula, we saw them in characteristic flocks. Dense masses of them would fly over the water, and drop into it, in unison, with a splash, apparently disappearing from sight momentarily, but then appearing suddenly like a dark carpet undulating with the swells. We saw some of these birds opposite Urilia Bay, on the north side of Unimak Island, but we did not learn where these Unimak birds nest. We were told that they do not nest on the Sanak Island group.

In the Shumagins, however, the crested auklets evidently have nested in huge numbers. Townsend (1913) has given us a vivid account of his experience with these birds at Big Koniuji, in the Shumagins. In Yukon Harbor there were "myriads" of these birds, and Townsend declares that here the crested auklets were more numerous than the least auklets were on St. George, in the Aleutians.

The crested auklet occurs along the north side of Alaska Peninsula, but not as a nesting bird. Turner (1886) observed them in Bristol Bay and along the north side of the Peninsula. Osgood (1904) records 2 specimens taken by J. W. Johnson at Nushagak on April 22, 1885, and he records 2 specimens taken by McKay at Nushagak and Ugashik.

This auklet nests throughout the Aleutian chain, though usually not in great numbers. There are sizeable colonies, however, on Chagulak, Seguam, Koniuji, Kasatochi, Gareloi, Semisopchnoi, Kiska, and Buldir, and, of course, there are lesser colonies on other islands. Turner (1885) reported them to be plentiful and nesting in the Near Islands. Hartert (1910) noted a few near Unalaska, "but at Atka, Attu, and especially Agattu, they were much more plentiful." Stejneger (1885) reported this bird nesting on both of the Commander Islands, though not abundantly.

Nesting and Feeding Habits

The crested auklet nests deep in crevices among boulders on the beach, in cavities in cliffs, or among jumbled lava rock on high slopes. When feeding, they fly in compact flocks and often go far out to sea.

On August 9, 1937, we had an opportunity to observe large numbers of foraging crested auklets. They came in flocks through the pass between Tagalak and Ikigmak Islands (which lie west of Atka), and the water in, and south of, the pass was dotted with the birds. Here, they were literally "loading up" with food to take back to their young, and some were so full they could hardly fly. From our knowledge of the existing nesting places in this section of the Aleutians, we knew that these swarms of auklets must have come from Koniuji or Kasatochi, or both, and that they would have a distance of at least 10 miles to fly with their loads of food. It is certain, then, that crested auklets will go at least 10 miles out to sea to forage, perhaps farther.

Observations on the nesting grounds show that small crustacea form an important part of the diet. The rocks about the nest crevices were streaked pink with excrement or with material occasionally spewed out by the birds.



FIGURE 36.—Crested auklets.

C. H. Townsend has characterized the food situation for the auklets very well when he said (1913) :

We found that a considerable part [of the food] of this [crested] and other kinds of auklets consisted of amphipod crustaceans or "beach fleas," as they are called, when found under bits of seaweed along shore. These small crustaceans, less than a quarter of an inch in length, are amazingly abundant in Alaskan waters and, as a never-failing food supply, account for the surprising abundance of auklets of all kinds.

G. Dallas Hanna reported that in the vicinity of the Pribilof Islands he found crested auklets in two cod stomachs. One of the stomachs contained 1 bird and the other stomach contained 2 of these birds. Cod are bottom feeders, therefore he points out that the birds must have descended 30 fathoms—the depth at which these two cod were caught (Preble and McAtee 1923).

The crested auklet winters around the Aleutian Islands, northward in Bering Sea waters, and southward in the North Pacific. Judging by Gabrielson's observations, they winter in great numbers in the Kodiak region. Some of the sea birds succumb in violent winter storms. A crested auklet was blown far inland about September 21 or 22, 1937, and was found at Nulato, at least 85 miles from the nearest point in Norton Sound (Geist 1939).

Residents on Unimak Island reported that sometimes they find hundreds of dead crested auklets on the beaches.

Aethia pusilla: Least Auklet

Attu: *A-la-ma-gam hú-li-gi* (see next species)

Atka: *Choo-cheah*

Bent (1919) remarks, probably on the authority of Turner (1886), that this bird is said to breed on Kodiak Island. We saw none that far east in the breeding season, and Friedmann (1935), who has recorded only a few winter specimens from that island, rightly concludes that "it must be either very scarce, or local, or of only sporadic occurrence." We saw none of these birds until we reached the Aleutian Islands, and they do not nest on Amak Island, where so many other species nest, though Turner (1886) reported seeing it in that vicinity.



FIGURE 37.—Least auklets.

In Unimak Pass, however, these birds occur in numbers and have been recorded there by Bent (1919), Wetmore (field notes), and Nelson (1887). Laing (1925) observed them in Akutan Pass.

During our various expeditions, no least auklets were identified east of Amlia, where we saw a few. On Koniuji and Kasatochi, a little farther west, they are very numerous and there are large colonies on Gareloi, Semisopochnoi, Segula, Kiska, and Buldir. This group of islands contains the principal least auklet populations in the Aleutians, and, on some of these islands, they were concentrated in greater numbers than the other auklets.

We found trace of this species on a few other islands—a few were seen at Amatignak, a wing was found on Tanadak, and the remains of a few birds were found on Bobrof, where blue foxes had feasted.

We did not find them in the Near Islands, though Turner reported them near Semichi (1886) and breeding on Agattu. Nelson undoubtedly was quoting Turner when he wrote (1887) "This species is abundant on the Near Islands where it breeds on Agattu, but does not winter there."

Possibly, the breeding range has been curtailed since Turner's observations by the introduction of foxes. We know from native reports that least auklets were once abundant on Bobrof Island but that now they are rare because of the introduction of blue foxes.

Nesting and Feeding Habits

In the manner of other auklets, this species nests among boulders on the beach, in openings in cliffs, and in jumbled lava beds. We found the greatest concentrations on extended beds of lava that were partly covered with vegetation, and on the mountainous slopes of islands such as Gareloi, Segula, and Semisopochnoi.

In common with other auklets, this bird feeds on small crustaceans, and it has the habit of loading itself with food on a foraging trip at sea to the extent that, when it comes back to the nesting place, it often literally "spills over" on landing. Hence, the pink material that is so prevalent on the nesting grounds.

Stejneger has reported on the contents of the crops of several specimens from the Commander Islands. Briefly stated, the contents were as follows: One crop contained several small Gammaridae; the stomach and crop of another contained Gammaridae and Palaemonidae; one crop was crammed with small Palaemonidae; and another crop contained amphipods.

The least auklets gather in large swarms—from a distance, they sometimes give the impression of swarms of insects, or of smoke. In flight, the flocks change shape, twisting like drifting smoke, and sometimes the “bottom” seems to drop out of the flock in some sudden maneuver.

No attempt was made to estimate the total numbers in any given colony, but, while anchored offshore at Gareloi on the evening of July 29, 1937, I watched a constant procession of least auklet flocks moving out to sea, low over the water. After some time, I decided to count the flocks for a given period of time. During 5 minutes, I counted 106 flocks with an average of 50 birds per flock. This indicated that 5,300 least auklets passed out to sea in my line of vision during those 5 minutes. By that time, a parallel line of flocks had begun to return to the island.

We observed least auklets foraging at sea about 6 or 7 miles from their nesting place on Kiska Island. Apparently, this was the limit of their feeding range, though it could vary with the distribution of organisms on which they feed. We also have seen them flying at night. Aleuts informed us that least auklets winter in the Aleutians and that, in winter, they continue to enter their rock crevices for shelter—thus giving the blue foxes a further opportunity to prey upon them. Stejneger (1885) says

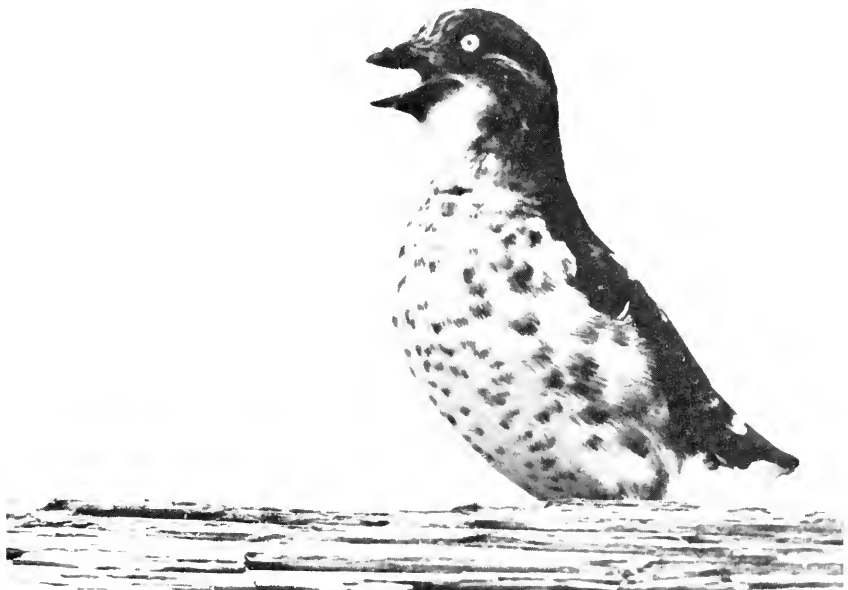


FIGURE 38.—Least auklet.

"They evidently winter on the open ocean somewhere about the islands [Commander Islands]."

F. L. Beals collected a specimen at Atka on January 31, 1941, and collected another at Unimak Island, April 5, 1941. Gabrielson observed them in moderate numbers in winter among the easternmost Aleutian Islands.

Aethia pygmaea: Whiskered Auklet

Attu: *Choo-chir'-ech*

Atka: *Tooch'-much*

Aleut, Copper Island: *Too-roo-toork* (Stejneger)

Russian, Commander Islands: *Malinka Konjuga*, "small crested auklet", a local usage on Bering Island, or the general term *Petuschka* (Stejneger)

There probably is some confusion in these native names. The Attu name for the whiskered auklet, as given above, apparently corresponds to the Atka name for the least auklet, *choo-cheah*. This, in turn, seems to correspond to *choochkie*, or its variants, as so often recorded as the least auklet in the Pribilofs. Yet, we had actual specimens for identification and the Attu natives insisted that the whiskered auklet is identified by the name given above.

This bird, which is the rarest of our auklets, is restricted in range and numbers, though it probably was more abundant in the past. Dall (1874) discussed a bird obtained by him in Unimak Pass in 1865, which was described by Coues as *Simorhyncus cassini*, and says: "Brandt refers *cassini* to the immature form of *Kamchaticus*, but *Kamchaticus* has never been authentically identified from the Aleutian chain, and I doubt its occurrence there." Dall believed that this bird was the young of the ancient murrelet, "*Brachyrhamphus antiquus*." Nelson (1887) referred to this specimen and considered it to be the young of the whiskered auklet.

McGregor (1906) mentions specimens taken at Dutch Harbor on June 8; one taken from Easy Cove, Akun Island, in winter dress; and a pair taken in fall plumage in Akutan Harbor on August 19.

We found no evidence of the whiskered auklet east of the Islands of the Four Mountains. Today, these auklets nest on a number of islands from the Four Mountains group westward as far as Chugul, near Kiska, though in small numbers. They may still occur as far east as Akutan, though we saw none there.

We obtained 1 specimen at Kagamil, saw at least 300 at Herbert Island, and saw several flocks at Chuginadak. There were at least 250 near Yunaska; they were found nesting on Chagu-

lak; and at Seguam we counted 138 and noted others. The Aleuts said that they nest at Amlia Island. Turner (1886) reports seeing them at Nazan Bay, Atka Island, and he obtained three specimens there, which were brought in by natives from the base of Korovinsky Volcano. Laing (1925) obtained specimens at Atka and reports "about a hundred" in Kuluk Bay, Adak Island, on April 11. In 1940, Gabrielson also recorded the species on Atka, where he obtained a specimen, and he saw several hundred between Carlisle and Kagamil islands.

Still farther west, we found a few of these birds at Little Tanaga; we observed 11 at Umak, about 100 at Aso, about 6 near Igitkin, two or three at Ulak, and saw 5 at Chugul. They nest on Kasatochi, and the natives assured us that they also nest on nearby Koniuji. We found a few at Gareloi, and saw three at Ulak (179° W.); the Aleuts reported them to be nesting on Segula (or Chugul), near Kiska.

Turner reported the whiskered auklet "quite abundant" in the Near Islands (1886), and Nelson agrees, evidently on the basis of Turner's report. However, we saw none in the Near Islands, and it is probable that this bird, as well as other species, has decreased in numbers since the time of Turner's observations. Stejneger (1885) found these birds nesting commonly on Copper Island and saw a few on Bering Island.

In 1936, we observed about 1,000 whiskered auklets during the season, and we estimated that there would be at least 2,000 in the Aleutians, though this figure could prove to be ridiculously low.

Nesting

The nesting habits of the whiskered auklet are the same as those of the least auklet. According to the natives, this species also winters in the Aleutians and, as is the habit of the least auklet, it enters the rocky crevices to roost, thus being subjected to blue-fox depredations. Fortunately, the principal nesting islands for this species have now been withdrawn from fox farming.

Food Habits

Stejneger (1885) reported that these birds feed mainly on gammarids.

Of 5 stomachs collected in June 1936, and reported upon by Cottam and Knappen (1939), 3 stomachs contained copepods (*Xanthocalanus* sp.) exclusively. Another stomach contained 60 percent soft-bodied crustaceans (amphipods, isopods, and copepods); 40 percent of one fish (Scorpaenidae); and a trace of spider. The fifth stomach contained 10 percent of unidentified

soft-bodied crustaceans and 90 percent of fragments of what appeared to be mollusk eggs.

Cerorhinca monocerata: Rhinoceros Auklet

Bent (1919) gives the breeding range of this species as "west to the Aleutian Islands (Atka, Agattu, and Umnak Islands)." We found no trace of this bird on any of our expeditions. Friedmann (1935) records two specimens taken at Kodiak Island in 1842 or 1843 by Wosnessensky, and he mentions that they were observed there by Brandt. He has also recorded three humeri from middens on Little Kiska Island (1937).

Austin H. Clark (1910) said: "This species was observed in limited numbers at Atka and at Agattu, and in the northern Kurils I occasionally noticed small companies on the water as far south as Simushir."

Cahalane (1943) reported: "I observed a number of these auklets on October 4 between Amalik and Katmai Bays." This observation was made in 1940.

Hartert (1920) wrote of the Commander Islands: "*Cerorhinca monocerata* was obtained by Grebinitzki, but neither Stejneger nor Sokolnikoff came across it."

Fratercula corniculata: Horned Puffin

Attu: *Ka-geé-ach*

Atka: *Ka-geeth'-ah*

Russian, Commander Islands: *Ipatka*, (pronounced *Ipatok* on Copper Island) Stejneger

The horned puffin is so universally distributed and so common that it is hardly of interest to single out a particular locality. As Bent (1919) has aptly stated it:

The horned puffin is essentially an Alaskan and a Bering Sea bird, being found breeding throughout the whole length of the Alaskan coast, from Cape Lisburne, north of the Arctic Circle, south nearly to British Columbia; it also breeds westward throughout the Aleutian Islands and on all the coasts and islands of Bering Sea.

It also breeds on the Commander Islands and the Siberian coast.

We found the horned puffin on all suitable islands, from Kodiak to Attu, including the Shumagins and Sanak; Gabrielson found them in the Semidis. The only factor that limits their distribution is unsuitable terrain. Naturally, they do not nest on the low shores of the north side of Alaska Peninsula, but they do nest on nearby rocky Amak Island. There were at least a few at nearly every island of the Aleutian chain.

Perhaps one of the largest horned puffin colonies that I observed in 1925 was on Amagat Island, near the mouth of Morzhovoi Bay. I estimated that the colony contained 15,000 birds.

The horned puffin is less abundant than the tufted puffin, in whose company it generally nests. The fact that it has a different nesting habit may account for its smaller numbers, for its particular nesting habitat may be less available than that of the tufted puffin. While the latter burrows in the sod, the horned puffin seeks a crevice among large boulders or in a cliff. Its habit of nesting in burrows already has been described, and Bretherton (1896), writing of Kodiak Island, states that it digs its own burrow. This, however, cannot be considered to be a normal procedure, for, as stated above, its distinctive nesting habitat is in rock crevices.

There were a few places where this species equaled, or exceeded, in numbers the tufted puffin, as at Gareloi and Agattu, and possibly at Davidof and Khwostof. Gabrielson considered them to be more abundant on Chagulak. They were nearly as abundant as the tufted puffin on Little Sitkin Island.

According to the natives, the horned puffin winters in the Aleutians.



FIGURE 39.—Horned puffins.

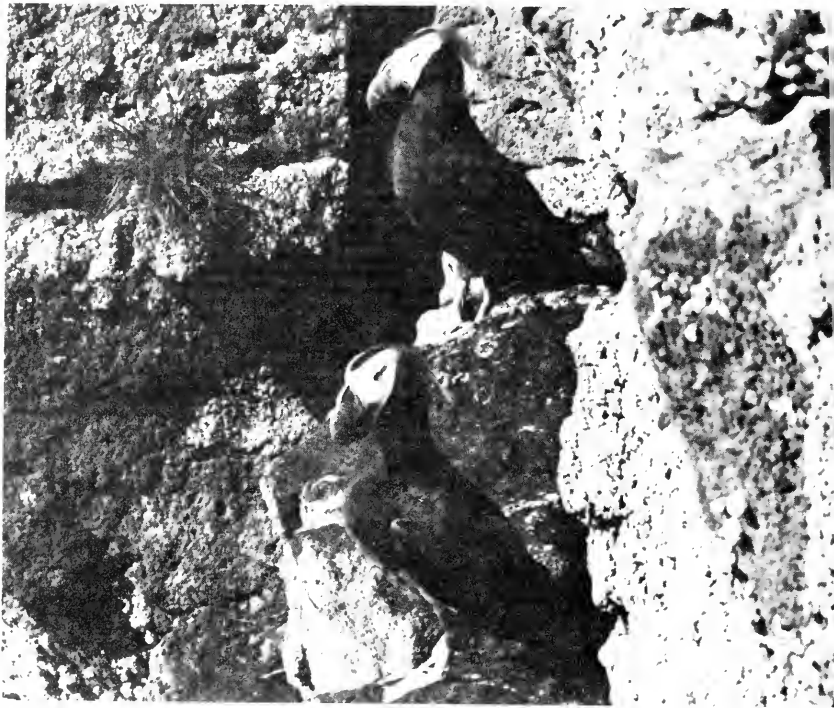


FIGURE 40.—Tufted puffins.

***Lunda cirrhata*: Tufted Puffin**Attu: *Och'-choch**Kong'-o-luch*, the young.Atka: *OK-chuh* or *Ok'-chuch**Uxoux* (Jochelson)Russian, Commander Islands: *Toporok*, *Toporki*, plural (Stejneger)

The tufted puffin is even more plentiful than the horned puffin; it probably is the most abundant single species in the Aleutian district. We noted them in the Barren Islands, Kupreanof and Shelikof Straits, and the Shumagins and Sanak groups. Gabrielson recorded them in the Semidis. Some islands, such as Uliaga, in the Four Mountains group, contain large numbers of these birds. When a shot is fired, there is a shower of puffins sailing out and down from the high grassy slopes. A small island in Trident Bay of Akun Island was thoroughly honeycombed by puffin burrows. Gabrielson described Bereskin Island, near Akutan, as being honeycombed in the same manner. Many other islands harbor thousands of these birds. They occur on Bogoslof, and Stejneger considered this bird to be the most numerous of the Alcidae in the Commander Islands.

The tufted puffin, unlike *corniculata*, normally digs a burrow in the turf for its nest, though it will nest in a natural opening, such as a crevice among jumbled blocks of stone.

The natives say that the tufted puffin winters among the Aleutian Islands. Apparently, they begin to arrive at their nesting sites in May.

Arnold (1948) who recorded data on populations of North Pacific pelagic birds, makes the comment that—

These data indicate that the Fulmar, Tufted Puffin (*Lunda cirrhata*), Shearwater (Slender-billed?) (*Puffinus* sp.), and Black-footed Albatross are the only birds that could be classed as truly universal pelagic birds in the area concerned . . . During periods of high winds and rough water, the Tufted Puffin was the only bird of the four with a decided tendency to "ride out the storm" on the water rather than remain aloft.

The above statement is understandable when one considers the inability of the puffin to remain aloft in soaring flight. Remaining in the water is a necessity, but it also is proof of its hardihood.

Family CUCULIDAE

Cuculus saturatus: Oriental Cuckoo

Cuculus saturatus horsfieldi

On June 29, 1937, at Rat Island, Steenis saw a strange bird on the beach as he was returning from the day's field trip. He shot it for a specimen and thus obtained the first cuckoo that has been recorded for the Aleutian district.

Deignan (1951) recently reexamined 3 specimens of *Cuculus* from St. Lawrence Island, Wales, and St. Paul Island for the benefit of the A.O.U. Committee on Nomenclature, and he concluded that all 3 are referable to *Cuculus saturatus horsfieldi*. I then called attention to this specimen from the Aleutian Islands and forwarded a second specimen from St. Lawrence Island to Duvall for determination. He and Deignan examined these 2 specimens and reported them to be the same as the other 3 (Murie 1952). The five North American specimens, then, are finally resolved as *Cuculus saturatus horsfieldi*.

Family STRIGIDAE

Bubo virginianus: Great Horned Owl

Bubo virginianus algistus

This owl, of course, is confined to the wooded regions. Osgood (1904) observed several at the base of Alaska Peninsula and

considered it to be fairly common. He heard one at Iliamna Village, July 14; heard another at the mouth of Chulitna River August 6; heard one on lower Kakhtul River, September 1; and collected an immature bird at the forks of Upper Chulitna River August 16. He also recorded a specimen taken by McKay near Aleknagik River, August 24, 1881.

Friedmann (1934) reported six ulnae of a horned owl in middens on Kodiak Island, which could be *algistus*; but there would be some doubt about this because *lagophonus* occurs in neighboring areas. Grinnell (1910) recorded *lagophonus*, an adult male, taken on Kenai by A. Seale, August 5, 1906. Specimens are needed from Kodiak.

Nyctea scandiaca: Snowy Owl

Attu: *Ah'-vai-ach*

Russian: *Sovà* (Birula)

Russian, Commander Islands: *Sitsch* (Stejneger)

Chukchi: *Jakkadlej* (Palmén)

Stejneger remarked that, according to Pallas, the name "*sitsch*" is applied to *Nyctala tengmalmi* in Russia proper.

The snowy owl occurs mostly as a straggler over the Aleutian district. Friedmann (1935) records a specimen taken by Fisher, at Kodiak, in March 1882. Osgood (1904) found a mounted specimen in the trader's store at Nushagak and learned that it was a regular winter visitant there, as well as at Egegik and Becharof Lake. He also mentions specimens taken by McKay on the Mulchatna River and at Lake Aleknagik. These occurrences are not surprising, for the snowy owl nests regularly at Hooper Bay to the north, and we know from the Eskimo that it nests in the interior of Nunivak and Nelson Islands also.

In 1925, and again in 1936, local residents assured me that the snowy owl occurs in winter about the western end of Alaska Peninsula and Unimak Island. Dall (1873) observed a number of skins in the possession of people at Unalaska, where it was said to be "resident." Friedmann (1937) found a femur among bones collected in a village site on Little Kiska, and Turner (1886) also obtained a specimen at Unalaska and said that according to the natives it is "only occasionally seen there." He adds that it is quite common on Agattu, where it is a constant resident, but that it rarely visits Attu. On May 8, 1944, Gabrielson saw what appeared to be three immature snowy owls near Sand Point, and he was assured that they occur throughout the year in that area.

Cahn reported it—

Rare on Unalaska Island but present in the uninhabited and rugged interior. On January 22, 1943, I saw a male that had been shot near Pyramid Mountain; on February 5, 1945, I saw another male shot near Unalaska village. During the war, men stationed on Bogoslof Island, 40 miles northward of Dutch Harbor in the Bering Sea, shot three during the winter of 1943.

The Attu chief told us that it nests on Attu.

Stejneger, writing in 1885 of the Commander Islands, said that the snowy owl, which formerly was considered to be rare (though nesting), was now becoming common. He stated that it has increased in numbers after the introduction of mice. Nine stomachs contained only *arvicolae*, and one stomach contained bird remains.

Although we did not see the snowy owl in the Alaska Peninsula and Aleutian Islands, it is evident from the records that it visits the region, especially in winter, and that it may nest in the Near Islands, and possibly in the Shumagins.

Surnia ulula: Hawk-Owl

Surnia ulula caparoch

The hawk-owl is fairly common in the wooded portions of the base of Alaska Peninsula, where Osgood collected several specimens (1904) in the following localities: at the head of Lake Clark (an immature bird); at the mouth of Chulitna River; and at a locality a few miles above the mouth of Chulitna River. He also mentions a specimen taken by McKay, on the Aleknagik, and four specimens taken by Johnson, at Nushagak. Cahalane observed several of these owls at Mount Kalolinat and other localities in the Katmai region in September 1940. Friedmann (1935) records a number of specimens and eggs taken on Kodiak Island, and Gabrielson also obtained specimens there. Howell (1948) obtained a specimen at Kodiak Island, June 6, 1944, which contained developing eggs. All of these localities are typical nesting habitat for the hawk-owl.

Farther west, sightings of the hawk-owl would be accidental, and no records of such sightings have been found.

Asio flammeus: Short-eared Owl

Asio flammeus flammeus

Attu: *Too-toó-tooch*

Atka: *Too-toó-tuch*

The short-eared owl is a common breeding bird at least as far west as Unalaska. Skins and eggs have been collected on Kodiak Island (Friedmann 1935). We saw 1 on Ushagak, Barren Islands,

on May 10, 1936, and saw 1 near Sand Point, Popof Island, on May 16. Osgood (1904) found it plentiful at the base of Alaska Peninsula. The first mate of our ship reported seeing one flying offshore at Bristol Bay, May 23, 1936.

In 1925, I noted several of these owls at Moffet Cove, at the west end of Alaska Peninsula, and others were seen on Umnak Island at Urilia Bay, St. Catherine Cove, False Pass, and Ikatan Peninsula. All of these localities contain excellent marshy nesting places. In the evening of May 13, 1925, we watched a short-eared owl soaring and hooting high in the air at False Pass, in its mating performance.

In 1936, a short-eared owl was found on Amak Island; this owl was found, not on marshland, but on a high grassy slope, where mice were plentiful.

On August 26, 1937, we collected a short-eared owl on Akutan Island. In 1902, McGregor reported that "The short-eared owl was observed on Amaknak Island June 23, where one was flushed from its nest containing two eggs. The nest consisted of a deep hollow on a hillside, and was neatly lined with grass." In 1906, he reported taking a specimen on Amaknak Island. It is known to occur on Unalaska, where the natives say it nests commonly. Dall (1873) reported finding these owls nesting in burrows on Unalaska. Swarth, also (1934), reports 1 seen on Unalaska and 1 on Akutan, and Eyerdam (1936) observed 1 on Unalaska. Turner (1886), Nelson (1887), Clark (1910), and Cahn (1947) all observed this bird at Unalaska, and Gabrielson saw one there on June 18, 1943.

Certainly, the occurrence and nesting of this owl is well established for Unalaska. West of that island, however, it appears to be rare. Turner (1886) intimates that it is common in the Aleutian Islands, yet he mentions only two places west of Unalaska where he observed it—Atka and Attu. Natives told us that although the short-eared owl does not nest in the western Aleutians, it occurs there in winter. In 1936, while at Atka Island, we were told that in the previous winter a short-eared owl had been shot on an adjacent islet, and our informant volunteered to guide us to the place. Upon searching the vicinity we found the wings and part of the body, which was sufficient for identification. The stomach, which we found also, contained the remains of a common house rat.

The short-eared owl has a nesting distribution quite similar to that of the rough-legged hawk in this district. It is practically certain that more detailed work on Umnak, lying just west of

Unalaska Island, will reveal the presence of this owl. In that event, the westward nesting distribution of these two birds coincides with the westward distribution of small native rodents. Ground squirrels have been introduced on Kavalga, and rats have been introduced on Rat and Atka islands, but these artificial innovations have not yet influenced the nesting distribution of these two raptors. It is of ecological significance, perhaps, that the only owl that we obtained west of Umnak (at Atka Island) had eaten a rat, which is the only rodent available there.

Aegolius funereus: Boreal Owl

Aegolius funereus richardsoni

There are only a few records of this owl in the area here considered, and some of these records are doubtful. Friedmann (1935) reports a specimen and a set of eggs collected at Kodiak by Fisher in June 1882. The identity of the eggs is open to question as they are no longer available. Osgood (1904) says—

The catalogue of the National Museum records one specimen of Richardson owl, taken at Nushagak by J. W. Johnson February 20, 1884. I have been unable to find this specimen in the Museum, but since the occurrence of the species in the region is altogether probable, and since most of the names entered in the catalogue are correct, the record may be accepted.

On the basis of this information, the wooded portions of the base of Alaska Peninsula and Kodiak Island may be considered as part of the range of this little owl. How much farther west it may occur is problematical. Gianini (1917) reports for Stepovak Bay: "The guide told me of a small owl he had often seen in the alders and willows but I was never fortunate enough to see one. On several occasions, late in the afternoon, I heard the notes of some species of owl and I thought it might be Richardson's."

Likewise, Wetmore reported, in his field notes for 1911, under the heading "*Nyctala t. richardson?*", "a small owl was reported to me as seen occasionally in a little thicket of stunted spruces on Expedition Island, in Unalaska Harbor. I looked for them, but could not find them."

With further reference to this locality, Laing (1925) says: "At Unalaska, Mr. Donald A. Stevenson pointed out the only growing spruce clump on the island as the usual roosting place of a short-eared owl, but time did not allow of verification."

Did these two reports refer to the same species? Certainly, verification is needed, but eventually we may learn that the Richardson owl occurs in the alder thickets that far west.

Family TROCHILIDAE

Selasphorus rufus Rufous Hummingbird

On May 21, 1937, four or five rufous hummingbirds were seen at Seward. Osgood (1901) says "Mr. T. W. Hanmore, who has been stationed at Tyonek for 11 years, says that he has seen hummingbirds there several times. This is doubtless near the limit of the range of the species, as the bird has not been recorded farther north."

There is one other curious occurrence. On June 20, 1936, Howard Jensen, a member of the ship's crew, declared that he saw a hummingbird on the beach at Uliaga Island. When questioned, he described it as a "brown bird," smaller than a winter wren, with a long bill. He did not see a red gorget, but he noted a whirring of the wings and heard their sound and described the bird as darting here and there in the air. He assured us that he "knew a hummingbird when he saw one." This man was a good observer and had assisted us considerably in our work. His description fits the hummingbird pretty well. Yet, this occurrence would be offered here with some hesitation except for the fact that Swarth (1934) reported that a hummingbird (species unknown) was seen by Cyril G. Harrold on August 9, 1927, at Cape Etolin, Nunivak Island. Possibly we may accept the Uliaga Island record, with Swarth's, as unusual occurrences. Because of Jensen's description of a "brown bird," and because of the geographic possibilities, the logical species would be *Selasphorus rufus*.

Family ALCEDINIDAE

Megaceryle alcyon: Belted Kingfisher*Megaceryle alcyon caurina*

Friedmann (1935) recorded the kingfisher on Kodiak Island, and, on September 19, 1940, Cahalane observed several on the small lakes and streams north of Kodiak Village. Cahalane (1943) also found kingfishers "fairly common in the lake country of the Katmai region, as well as in the bays of Shelikof Strait." Osgood (1904) observed a kingfisher on Kakhtul River, August 28, 1902, another on August 31, and another on the Mulchatna River on September 3. We saw a kingfisher at Port Chatham, Kenai Peninsula, May 6, 1936.

There are some records farther west on Alaska Peninsula. Gabrielson noted it at King Cove and Cold Bay, and he recorded

ne nesting at Sand Point, in the Shumagins. In 1925, I learned that a local guide, John Gardner, has seen a kingfisher at False Pass in the autumn of 1924, probably in October. He stated that he had seen one there in the previous autumn, but that they did not summer there.

On August 23, 1936, these 10-year-old reports were verified when we saw a kingfisher at False Pass. Again, in 1938, Scheffer saw one at False Pass, back of the cannery buildings. In 1941, Seals and Longworth reported that, as of January 13, "one bird seen daily for several weeks," and later reported "one bird seen about the cannery buildings all through March and April." Gabrielson also noted them at False Pass in winter.

Cahn reports from Unalaska Island that—

I have three records for this species, all in the area of Captain's Bay: On August 17, 1943, a male and female were seen flying over the tip of that bay; on August 21 a single individual was seen near the village of Unalaska; and on July 27, 1944 a male was seen and heard near the mouth of the Shaishnikof River.

This suggests possible nesting as far west as Unalaska, though it has not been verified.

Gabrielson observed the kingfisher in winter as far west as Unalaska, and he reported that one was killed at Nikolski Village, on Umnak Island, and was identified by the village school teacher.

Family PICIDAE

Dendrocopos pubescens: Downy Woodpecker

Dendrocopos pubescens nelsoni

Friedmann (1935) has summarized what we know of this bird's occurrence on Kodiak Island, listing a number of specimens taken there. Swarth (1934) had referred to the Kodiak bird as *leucurus*, but, after comparing a number of specimens from this island with mainland forms, Friedmann concluded that it should be referred to the interior-Alaska *nelsoni*.

We saw none elsewhere, and Osgood did not mention the species in his report on the base of the Alaska Peninsula. Cahalane, however (1944), records that a male was observed between Iliuk Bay and Mount Katolinat on September 19, 1940.

Picoïdes arcticus: Black-backed Three-toed Woodpecker

Osgood (1904) records a single specimen taken by McKay on the Mulchatna River in March 1883. No other data have been secured on this species for the territory here considered.

Picoïdes tridactylus*: Northern Three-toed WoodpeckerPicoïdes tridactylus fasciatus*

I saw one, and heard another, of these birds at Kodiak, May 12, 1936. Friedmann (1935) lists at least four specimens taken there.

Osgood (1904) noted this species at Iliamna Village, at Keek Village on Lake Clark, on the Chulitna River, and near the head of Lake Clark, where he took two specimens. He also mentions a specimen taken by McKay on Nushagak River, January 10, 1882.

Cahalane (1944) observed one at the outlet of Ukak River, September 12, 1940.

Family TYRANNIDAE***Sayornis saya*: Say's Phoebe***Sayornis saya yukonensis*

Osgood (1904) took a specimen of this bird at the mouth of the Chulitna River, August 6, 1902, which was the only one seen. We have no other records for this area.

Family ALAUDIDAE***Eremophila alpestris*: Horned Lark***Eremophila alpestris arctica*

Osgood (1904) says "A small flock of 10 or 15 was seen flying about the summit of 'Portage Mountain,' between the head of the Chulitna River and Swan Lake, August 19."

The Alaska Peninsula should offer satisfactory nesting habitat for horned larks, but we have no records of their presence. Harold Etolin saw one among the sandhills 2 miles south of Cape Etolin, Nunivak Island, on August 28, 1927 (Swarth 1934).

Family HIRUNDINIDAE***Tachycineta thalassina*: Violet-green Swallow***Tachycineta thalassina lepida*

A violet-green swallow was seen flying over the tide flats at Point Gustavus, Icy Strait, on May 12, 1937, and several were noted at Seward on May 21. We saw none west of Seward, but Osgood (1904) found them in considerable numbers at Iliamna Village, and he saw a few on Iliamna and Clark lakes.

Iridoprocne bicolor: Tree Swallow

On May 13, 1937, we saw two of these birds at Point Gustavus, Icy Strait. Friedmann (1935) mentions a reported sight record of a family group on the northern part of Kodiak Island on July 27, 1929. Osgood (1904) identified a few at Iliamna Village. On May 25 and 26, 1936, we observed at least six at Snag Point, Nushagak River. Turner, also, observed these birds on Nushagak River (1886). On July 17, 1940, Gabrielson found these swallows common at Dillingham; he saw some at Brooks Lake, July 20, and noted one at Iliamna Lake, July 24.

There is a specimen in the National Museum taken by G. D. Hanna at Lake Aleknagik, June 17, 1911.

As would be expected, the tree swallows are confined to the wooded basal part of Alaska Peninsula.

Riparia riparia: Bank Swallow*Riparia riparia riparia*

Aleut (dialect uncertain): *Agámdax'* (Jochelson, for "the swallow")

In his work at the base of Alaska Peninsula, Osgood found that, on the Nushagak River between the mouth of the Tikchik and Kakwok, most of the high banks "were drilled along the upper edges with their characteristic holes," and he mentions that specimens of the bank swallow were taken at Nushagak by McKay. Osgood obtained a specimen at Lake Iliamna, July 17, 1902. Turner (1886) found them "quite plentiful on Nushagak River."

On June 17, 1940, Gabrielson observed two bank swallows at Karluk weir on Kodiak Island. On June 19, he noted 5 of these birds at Chignik Bay; on June 21, he saw at least 12 at Morzhovoi Bay; on July 17, he saw several at Dillingham; on the next day they were common at Wood River Lakes; on July 21, they were noted at Brooks Lake; and on July 21, they were common in the tundra region between Becharof Lake and Egegik cannery.

On May 30 and June 4, 1925, I found several bank swallows along the upper part of the stream flowing into Izembek Bay from Aghileen Pinnacles. Near Point Grant, in Izembek Bay, there was a nesting colony on a steep bank of one of the islands. A bank swallow was seen on Amak Island, July 7, and, on August 9, several were seen at False Pass.

In 1911, Wetmore collected specimens of bank swallows nesting in small numbers at some sandy cutbanks at the head of Morzhovoi Bay. Gianini (1917) saw one at Stepovak Bay. Beals and Longworth reported, May 22, 1941, at False Pass that "First

swallows seen today. They were flying about a small pond up Lee's valley." Twenty-five or thirty were seen there until the observers left in June. It was reported that the swallows nested in banks. Gabrielson found them at False Pass, Chignik, Cold Bay, and in the Shumagins, and he obtained specimens at Wid Bay and Cold Bay.

We have no records of bank swallows west of Unimak.

Hirundo rustica: Barn Swallow

Hirundo rustica erythrogaster

A specimen from Kodiak was collected by Bischoff in 1888 and Friedmann (1935) mentions other observations there. Osgood (1904) found them breeding commonly in the vicinity of Lake Iliamna and Lake Clark, and he observed them at the mouth of Chulitna River. Turner (1886) found the barn swallow in considerable numbers at Nushagak, where it nested. On July 21, 1940, Gabrielson recorded two or three of these birds at Ugashik Lake, and, on July 24, he saw at least 12 about some buildings at the upper end of Iliamna Lake.

Gianini (1917) found a pair nesting on a house at Stepoval Bay, and, in 1925, I observed several barn swallows among the cannery buildings at Ikatan Peninsula, Unimak Island, where they evidently were nesting. At Unalaska, the barn swallow has been observed by many naturalists, including Turner, Dall, Nelson, Wetmore, Clark, and McGregor. The last-named observer (McGregor 1906) found a pair nesting "on a rocky shelf in the face of a sea cliff."

There is no satisfactory evidence as yet that the barn swallow occurs west of Unalaska Island—Turner stated that, in his opinion, it does not.

There is a series of specimens in the National Museum. Among these, at least three are from Unalaska, and others are from Lake Iliamna and Nushagak. These were carefully examined and show that the bird of the Aleutian district is typical *erythrogaster*.

Family CORVIDAE

Perisoreus canadensis: Gray Jay

Perisoreus canadensis pacificus

Osgood (1904) found this jay to be common from Iliamna Pass to Nushagak. Speaking of the Cook Inlet region (1901) he says "Occasionally seen. One morning, after a light fall of snow, a

small party of jays visited our camp in the mountains near Hope. A few were also seen at Tyonek. A large series was taken by Bischoff at Fort Kenai."

Nelson (1887) speaks of this bird occurring throughout "the Sitkan and Kodiak region." It is not clear whether he had specific reference to Kodiak Island.

Cahalane (1944) found them "common in the spruce-aspens forest', and wherever scattered trees occurred," in the Katmai region.

Normally, this bird would, of course, be confined to the wooded region, though Gianini (1917) reports that he saw 4 of these birds one day at Stepovak Bay, a surprising record. No specimens were taken.

Pica pica: Black-billed Magpie

Pica pica hudsonia

Turner and Nelson both reported the magpie as common on Kodiak Island, and Friedmann (1935) has listed many specimens taken there. In 1940, Cahalane observed several on Kodiak Island and found them in many places in the Katmai region. We noted magpie feathers at Port Chatham, Kenai Peninsula, in 1936. On May 10, 1936, we saw a magpie on Ushagat, Barren Islands; on May 13, we saw one on Afognak; on May 16, we saw several birds and a nest with eight eggs on Nagai Island, Shumagins; and, on August 26, we saw several at Sand Point, Popof Island, in the Shumagins. We also noted one on Dolgoi Island, May 24, 1937. In 1940, Gabrielson observed the magpie at Kodiak, Sand Point (in the Shumagins), and Brooks Lake. Turner (1886) heard of its presence at Belkofski, and he saw one on Unga, in the Shumagins. Gianini (1917) found magpies and nests at Stepovak Bay, and Wetmore found them nesting at King Cove and saw them at Belkofski.

Dall had stated (1873) that magpies do not occur on the north side of Alaska Peninsula, but, in 1925, I found them nesting at Moffet Cove, Izembek Bay. Undoubtedly, magpies are more plentiful on the Pacific side.

Curiously enough, we did not find any on Unimak Island, and local residents said that they do not occur there, nor on other Aleutian Islands.

Corvus corax*: Common Raven**Corvus corax principalis***Attu: *Ká-ga-lach*Atka: *Kang-lach'*Russian: *Woron* (Pleske)*Voroń* (Stejneger)Chukchi: *Uedlje* (Palmén)

Pleske applies the Russian name to *Corvus corax corax*. Stejneger applies it to *Corvus beringianus*, but, of course, the Russian common name has a general application.

The raven is universally distributed throughout this entire district, from Bristol Bay, Seward, and the Kodiak-Afognak group westward to Attu Island. We noted them at the Barren Islands, Shumagins, Amak Island, and throughout the Aleutians, where at least one or two were found at nearly every island. Gabrielson observed them in the Semidis.

In his field notes for 1911, Wetmore described the actions of numerous ravens at the village on Unalaska Island, where they were very tame and acted as scavengers. Turner also (1886) found this bird to be a scavenger about villages in the Aleutian Islands. In 1925, when I collected several specimens of the Alaska brown bear in the mountains west of Pavlof Volcano, ravens gathered in large numbers to feed on the carcasses. They also were seen along salmon streams, where they probably find fragments of salmon left by bears, just as the gulls do. And they join the gulls in gleaning food, dead or alive, on reefs or beaches at low tide.

During the war, the military establishments from Dutch Harbor to Attu furnished abundant garbage for ravens and sea gulls.

Ravens are by no means exclusively carrion eaters. Pellets found on Amak Island contained remains of field mice, *Microtus*, and sea urchins. At St. Catherine Cove, Unimak Island, a raven was flushed from the partly eaten body of a female willow ptarmigan. They have been reported as killing incubating birds on their nests, and this may have been an example of that occurrence, though the evidence was not conclusive.

Cahn, at Dutch Harbor, says "Twice I have watched a raven kill a rat, the second time a young Bald Eagle was also watching, and when the rat was dead, the eagle took it away from the raven without argument."

At Kanaga Island, the caretaker of fox-raising operations said he had trapped about 150 ravens in the previous winter. He stated that ravens will kill blue foxes in traps and that he has found remains of blue-fox pups in raven nests. Whether adult

blue foxes are killed in traps by ravens, and whether the raven will seize and carry off blue-fox pups, and, if so, the frequency of such an occurrence, are facts that should be established by accurate observation. The ecological status of the raven should be determined by a comprehensive study.

In 1938, Scheffer was informed by someone at Umnak Island that ravens will "gang up" and kill full-grown sheep. "Four or five birds peck at the head until the sheep stands still with head bowed and allows the birds to pick off flesh." Another sheep herder said that ravens will pick the eyes out of weak sheep. This last habit has been observed elsewhere, when ravens have begun to pick at the eyes of a dying animal. In all such cases, it is important to know the condition of the animal preyed upon, as well as other attendant circumstances.

In turn, the raven itself is preyed upon occasionally, as shown by remains sometimes found in northern bald eagle nests.

Corvus caurinus: Northwestern Crow

The crow is common at Seward, where it patrols the beaches, and it is abundant in the Kodiak-Afognak Islands group. At Afognak Village, on September 2, 1936, we found a flock of 50 to 75 birds.

We did not see this bird anywhere to the westward, and I was unable to find any record of its occurrence on the base of Alaska Peninsula.

Nucifraga columbiana: Clark's Nutcracker

There is a specimen in the National Museum of a Clark's nutcracker, which was taken by J. W. Johnson at Nushagak, November 5, 1885. This is the only information on this bird for the Alaska Peninsula, and of course it is not found west of there.

Family PARIDAE

Parus atricapillus: Black-capped Chickadee

Parus atricapillus turneri

The black-capped chickadee is widespread; it occurs from the base of Alaska Peninsula and Kodiak to the Shumagins, though too little work has been done in intermediate localities to determine relative abundance. Both Osgood (1904a), who found this bird sparingly throughout portions of the base of Alaska Peninsula and Friedmann (1935), who examined the speci-

mens from Kodiak, concluded that the bird of this region is *turneri*.

Subsequently, Duvall (1945) reviewed the black-capped chickadees of North America and assigned *turneri* to "The coast of Alaska north to St. Michael; west to the Aleutian Islands (Shumagins etc.), Kodiak Island; south to southeastern Alaska (Haines), northern British Columbia (Atlin), southern Yukon, and central-southern Mackenzie; and east to Great Bear Lake in west-central Mackenzie."

Cahalane (1944) "found them quite frequently and in some abundance west of the Aleutian Range" in September 1940.

On our expeditions, we heard a chickadee in the woods near Afognak Village, September 2, 1936; we heard one in the alders at Sand Point, Popof Island, August 26; and heard at least 3 pairs on Nagai Island, Shumagins, May 16, where we collected 2 specimens.

Gianini (1917) saw several chickadees at Stepovak Bay on one occasion. He listed them as *Penthestes cinctus alascensis* and said they looked much like the eastern black cap. Undoubtedly, these birds were *P. a. turneri*, judging by his own description and by the fact that the Alaska gray-headed chickadee resembles the Hudsonian chickadee.

Gabrielson observed these chickadees at Kodiak, King Cove, and the Shumagins.

Parus hudsonicus: Boreal Chickadee

Parus hudsonicus hudsonicus

Osgood (1904) found this chickadee at long intervals in the timbered portions of the base of Alaska Peninsula and collected several specimens. In 1940, Gabrielson saw them on Naknek River and Brooks Lake, and he obtained two specimens in the latter locality.

In 1940, Gabrielson noted two chickadees on Kodiak which he called Hudsonian chickadee. Friedmann (1935), under the heading of *Penthestes rufescens rufescens*, says "all that I have been able to learn of this chickadee on Kodiak Island is that Finsch states that Bischoff observed it there. Apparently he collected no specimens." On geographic grounds, considering Gabrielson's sight identification and the absence of specimens of *rufescens* that far west, it is more likely that it is a form of the boreal chickadee that occurs there.

At least 15 specimens from the Bristol Bay region, and 2 from Brooks Lake, were available and were compared with large s-

ies from interior and southeastern Alaska. In this study, I was again impressed with the importance of restricting comparisons to comparable seasonal plumages. Neglect of this procedure can lead to erroneous conclusions.

Of the series available, Osgood obtained 2 from Nushagak on May 28, 1911, and G. D. Hanna obtained the others in 1912, 2 from Doonochehogaweeet Mountains, 1 from Kakwok River, 45 miles from its mouth, and 8 from 80 miles up the Kakwok River. Gabrielson obtained 2 from Brooks Lake. These all appear to be *P. h. hudsonicus*, the form occurring in interior Alaska, though some of these are not typical of true *hudsonicus* from interior Alaska and Canada. At least seven of them, from Nushagak and Kakwok River, appear to be a little paler than normal, especially on the crown. On the back, too, the general tone is more plumbeous, rather than the usual olive brown. These are in spring plumage, therefore the differences noted may be seasonal ones. At any rate, the series is referable to typical *hudsonicus* rather than to *columbianus*, and it furnishes evidence that the range of *hudsonicus* extends southward to the base of Alaska Peninsula.

Parus hudsonicus columbianus

Although this form has not been identified on the Alaska Peninsula proper, there is a specimen taken by Osgood at Tyonek, in Cook Inlet. Another specimen, taken by Osgood on July 31, 1902, at Lake Clark (though in badly worn plumage and hard to place), was referred to *columbianus* on the basis of some new plumage that was coming in. Gabrielson (1944) reported specimens of *columbianus* from Kodiak Island and Brooks Lake.

Family CERTHIIDAE

Certhia familiaris: Brown Creeper

At present, the brown creeper has not been recorded from the Alaska Peninsula proper; however, it occurs on some parts of the adjacent mainland. On February 4, 1922, I obtained a specimen at Susitna. Bischoff obtained a specimen at Fort Kenai, May 6, 1939; C. H. Townsend took a specimen in Cook Inlet, April 8, 1932; and Osgood obtained another specimen from Hope, Cook Inlet, August 31, 1900. Then, on June 13, 1944, Howell (1948) saw two brown creepers at Bell's Flats, Kodiak Island. Lack of specimens from the geographical area covered in this report makes it impossible to identify the subspecies of brown creeper that breeds in the eastern portions.

Family CINCLIDAE

Cinclus mexicanus: Dipper*Cinclus mexicanus unicolor*

Judging by published records, the dipper occurs from Kodiak and Bristol Bay to Attu Island. Osgood (1904) obtained a specimen near Lake Clark and one at Cold Bay, and he records five specimens taken by McKay at Mulchatna River. On September 5, 1940, Cahalane (1944) saw a northern dipper at Brooks Falls in the Katmai region. The dipper is known to occur on Kodiak Island (Friedmann 1935), and Cahalane saw several on Afognak Island in 1940.

Gianini (1917) saw one at Stepovak Bay, and his guide considered these birds to be very common in the swift streams in that district. On June 21, 1940, Gabrielson observed the species at Morzhovoi Bay. In 1925, I found several in small streams in the valley below Aghileen Pinnacles. In that same season, 1 was seen at Urelia Bay, Unimak Island, and at False Pass, where Scheffer also saw 1 on September 8, 1938. Eyerdam (1936) has reported the dipper as occurring on Unimak Island and at King Cove.

Beals and Longworth, in their field report for 1941, sum up the status of the dipper on Unimak Island, saying—

Common on Unimak Island. Every stream seems to have its quota of these birds and we often found them four and five to the mile of stream. On Sour dough Flats we enjoyed a concert given by four dippers on the same little bend of the stream. They are well known to everyone on the island.

According to residents, the dippers winter on Unimak.

Swarth (1934) reported several specimens from Akutan, where it was considered to be common.

Dippers have been reported from Unalaska by several observers (Dall, Turner, Bishop, Cahn), and we obtained a specimen there.

We did not find the dipper on any island west of Unalaska, though there are many streams that should furnish suitable habitat. Turner (1886) stated that he saw a dipper in a little stream that emptied into Chichagof Harbor, Attu Island; he did not obtain a specimen. He remarked that it was extremely rare and that few natives had any knowledge of the birds.

Family TROGLODYTIDAE

trogodytes troglodytes: Winter WrenAttu: *Kach-tai-ach Kit-rich*Atka: *Kat-chrai-uh*Russian, Commander Islands: *Limaschinka* (Stejneger)

The name given by Stejneger is undoubtedly Russian, meaning "Little chew of tobacco," which has been adopted by many leuts. This bird is the "limmershin," as reported from the ribilofs.

Oberholser (1919) proposed that all of the winter wrens be combined under the European species *trogodytes*. After examining the forms from the Bering Sea region, I found no difficulty in bridging the gap between the Old World and the New World at the Aleutians. *Pallescens*, of the Commander Islands, and *eligerus*, of Attu, are not much different; in fact, they have more characters in common than have *meligerus* and wrens of the more eastern Aleutians.

On the other hand, the most difficult gap to bridge to make them all conspecific, is the gap between *helleri* of Kodiak Island and either *semidiensis* of the Semidis, or *petrophilus* of the Fox Islands group. The Aleutian wrens, and the one on the Semidis, are comparatively long billed. *Helleri* and its nearest relatives, *pacificus* and *hiemalis*, are short billed. In this character, the two groups do not intergrade. Coloration may approach more closely in the two groups, but color comparisons in the winter wrens (in the plumages usually available) are rather complex, and it is difficult to know what factor constitutes real intergradation. It should be pointed out, however, that there is a long distance between Kodiak and the end of Alaska Peninsula; in fact, there are many hundreds of miles of territory from which specimens are not available, and one could assume intergradation here. Furthermore, *petrophilus* from Unalaska, and *alascensis* from the Pribilofs, are the closest in color and measurements to *helleri*, though they do not intergrade. It could be reasonably argued that these two at least show a trend toward *helleri* and that intermediate areas will eventually produce the intergrades. Furthermore, *helleri* has the longest bill of the *hiemalis* group. Yet, the Semidi wren, whose habitat is not far from Kodiak (relatively speaking), is decidedly of the long-billed group.

The three short-billed wrens, *helleri*, *pacificus*, and *hiemalis*, naturally fall into one group, possibly into one species, and the other forms throughout the Aleutians and the west side of Ber-

ing Sea fall into another group or species. Some such course was suggested by Swarth (1931), who wished to regard the "North American, the Bering Sea, and the Old World group, each as separate species."

There has not been opportunity to review the Old World wrens and because they have generally been placed in the species *troglodytes*, that name is the most convenient to use for the Aleutian group until the relationships with the Old World group can be determined.

The Aleutian winter wrens are a difficult group to identify because their plumages vary so greatly with wear and we do not always have comparable plumages for study. Giving these facts their due weight, we cannot speak with too much assurance in some cases, nor can we rely too much on island isolation to produce new characters.

The winter wren is one of the few small land birds found commonly throughout the Alaska Peninsula-Aleutian district. This is a bird of the rocky shoreline, nesting in rock crevices. It was not found far inland; in fact, it apparently prefers the vicinity of the sea, and it finds its favorite habitat on islands.

On Amchitka Island, July 11, 1937, I found a family of young winter wrens on the beach, and, a few days later, I found a nest with eggs. This nest had been placed in the timber structure of an old barabara. On July 17, these eggs hatched. They were probably a second laying.

Troglodytes troglodytes helleri

This is the wren of the Kodiak-Afognak Islands. It has not been determined if it also occurs on the adjacent parts of Alaska Peninsula.

This winter wren is quite similar to *pacificus* in coloration when comparable plumages are used. The bill, however, is slightly longer. Measurements are as follows:

helleri (9 males) 10 to 11.5 mm.; average, 11.1 mm.
pacificus (5 males, chiefly from Alaska) 10 to 11 mm.; average, 10.4 mm.

Troglodytes troglodytes semidiensis

This form is confined to the Semidi Islands. According to Brooks (1915), it is "similar to *N. alascensis*, but less rufescent especially above; bill longer." He gave the length of culmen for two males, including the type, as 16 mm. This is in contrast with the average of 11.1 mm. for *helleri*.

Troglodytes troglodytes petrophilus

This wren is much like *alascensis* from the Pribilofs, but, with comparable specimens, the upper parts appear to be somewhat more rufescent and the under parts are definitely paler, or grayer. The bill of *petrophilus* averages slightly longer than that of *alascensis*, though the difference is small, and these two differ from other Aleutian wrens in having somewhat shorter bills. Measurements of the exposed culmen are as follows:

<i>petrophilus</i> (11 males)	13 to 14.5 mm.; average, 13.9 mm.
<i>petrophilus</i> (4 females)	13 to 14 mm.; average, 13.2 mm.
<i>alascensis</i> (3 males)	13 to 13.5 mm.; average, 13.3 mm.
<i>alascensis</i> (7 females)	12 to 13.5 mm.; average, 13 mm.

This wren occurs on Unalaska, Amaknak, Unalga, and Akutan Islands. One would expect to find it also on Umnak and Akun Islands, but we do not have specimens from these two islands.

Troglodytes troglodytes stevensoni

This wren was described by Oberholser on the basis of specimens from Amak and Amagat islands, near the west end of Alaska Peninsula. It was described as being slightly less rufescent than *petrophilus* and with a slightly longer bill and middle toe. I found it very difficult to distinguish this form from *petrophilus* by color, though the slightly longer bill was apparent in the four adult specimens available. Most of the birds in the series are young, and the material seems inadequate to determine the status of this small group. The adult Aleutian wrens taken during the nesting season are so irregular in condition of plumage that a very extensive series should be at hand to adequately evaluate its taxonomic position. For this reason, I can not attempt to ascertain whether these easternmost specimens of the Aleutian chain show the slightest trend toward *helleri*, whose habitat is far to the east, on Kodiak.

Stevensoni is known from Amak and Amagat Islands, and it can be expected to occur on adjacent parts of Alaska Peninsula and on Unimak Island.

Troglodytes troglodytes seguamensis

Gabrielson and Lincoln (1951) described this form on the basis of specimens from the islands of Seguam, Amukta, and Yunaska. They commented that "This is the palest and grayest of all the Aleutian races," and it appears, logically, to be an intermediate race between *petrophilus* to the east and *tanagensis* to the

west. The wrens from the Islands of the Four Mountains are described as not typical of *petrophilus*, but somewhat intermediate between it and *seguamensis*. However, in the present state of our knowledge, we probably should include the Islands of the Four Mountains in the range of *seguamensis*.

Troglodytes troglodytes tanagensis

After careful study of a series of specimens, *tanagensis* appears to be slightly less rufescent than *petrophilus*. In length of bill, it differs significantly, *tanagensis* having a decidedly longer bill. Measurements of culmen of 12 males and 7 females are as follows:

Males 14 to 16 mm.; average, 14.9 mm.
Females 13.3 to 15.5 mm.; average, 14.8 mm.

Since Gabrielson and Lincoln's determination of *T. t. seguamensis*, we must confine the range of *tanagensis* to Tanaga and the immediately adjacent islands.

Troglodytes troglodytes kiskensis

This wren is paler, but more tawny, than *meligerus*. It is also more tawny than *tanagensis*. In length of culmen, it appears to average greater than either of the other two. Measurements of culmen, in millimeters, of 8 males and 8 females are as follows:

Males 14.5 to 16 mm.; average, 15.6 mm.
Females 14 to 17 mm.; average, 15.2 mm.

This wren occupies the Rat Islands group, from Kiska to Amchitka. There are specimens from Kiska, Little Kiska, Davidof, Little Sitkin, Semisopochnoi, and Amchitka; and there are three specimens from Ogliuga Island, in the Andreanof group—supposedly in the range of *tanagensis*, which appeared referable to *kiskensis*.

Troglodytes troglodytes meligerus

The wrens of the Aleutian chain fall into two groups that may be distinguished pretty well at the extremes of the total range. The wrens of the westernmost islands, and we may include the Commander Islands, show a marked tendency toward a dusky, grayish cast, while those of the eastern Aleutians, including *alascensis*, of the Pribilofs, are more rufescent.

T. t. meligerus is quite similar to *T. t. pallescens* of the Commander Islands, sharing with that form the general duski-ness

and the more-extensive barring and spotting of the under parts, which separates these forms from *kiskensis*. The under parts are noticeably grayer than those of *kiskensis*, the latter being more tawny. But *meligerus* is the darkest one of the group.

There is a single specimen from Agattu Island—a mummified, extremely dark, immature bird. The fact that this single specimen is immature makes it impracticable to identify it with certainty, though one would expect it to be *meligerus*. Four specimens from Buldir Island, 2 immature and 2 in worn breeding plumage, are referable to *meligerus*—this is most interesting, because Buldir (the most isolated island in the Aleutian chain) is a lone island, far from either Kiska or Attu.

Family TURDIDAE

Turdus migratorius: Robin

Turdus migratorius migratorius

We found robins common at Snag Point, Nushagak River, on May 25 and 26, 1936. We saw them at Seward on May 21, 1937. Osgood (1904) says—

A few robins were seen near Iliamna Village, and one specimen was taken here July 15. From this point on to the upper Chulitna River robins were seldom seen, though once in a great while we heard their familiar note. They were quite abundant in small flocks about Swan Lake August 25, and considerable numbers were also seen near there in the brush and young timber around the base of the "Portage Mountain."

Cahalane (1943) reports—

I found that robins were numerous in the willow-cottonwood-spruce thickets on Naknek River at Big Creek on the early morning of September 4. They were probably migrating. I did not see any after leaving the river on that date and passing into the lake region in the National Monument.

Gabrielson noted a few robins on Afognak Island on June 15, 1940, and he found them to be common at Dillingham on July 17.

There are specimens in the National Museum from Nushagak, Kakwok, and Lake Iliamna.

Toreus naevius: Varied Thrush

Toreus naevius naevius

At least six specimens from Kodiak Island were examined. These were collected by F. Bischoff, in 1868; by C. H. Townsend, in 1888; by A. K. Fisher, in 1899; and by R. H. Beck, in 1919. All these specimens are typical *naevius*, thus suggesting that this

form also would be found on the adjacent Kenai Peninsula. We found varied thrushes to be common at Port Chatham, Kena Peninsula, May 6, 1936. One was seen in the driftwood on the beach of Ushagat, Barren Islands, May 11, where there is only a trace of forest growth. We saw them at Seward on May 21, 1937, and on Kodiak Island, May 12, 1936, varied thrushes appeared to be the most common bird. Several were noted on Afognak, May 13 and September 2, and Cahalane and Gabrielson found them to be abundant on Afognak in 1940.

Ixoreus naevius meruloides

A number of specimens are available in the National Museum from the Bristol Bay region. C. L. McKay obtained 2 specimens 10 miles below Lake Alleknagik and 1 on the Nushagak River in 1881. J. W. Johnson obtained 1 at Nushagak in 1885, and G. D. Hanna obtained 2 at Nushagak and 1 on the Kakwok River in 1911. All these specimens are referable to *meruloides* and furnish another example of how the eastern and northern avifauna extends to the base of Alaska Peninsula.

Osgood (1904) noted two of these birds on the Kakhtul River and Gabrielson found varied thrushes to be common at Dillingham on July 17, 1940.

Hylocichla guttata: Hermit Thrush

Hylocichla guttata guttata

A number of specimens of the Alaska hermit thrush are in the National Museum, including a good series from Kodiak, one each from Hope and Tyonek, Cook Inlet, and others from Lake Clark, Nushagak, Kukak Bay, Chugachik Bay, King Cove, and Frosty Peak. Hine (1919) obtained a specimen at Katmai Bay on July 25, 1919. Thus, the range of this thrush is established for the length of Alaska Peninsula.

The species has also been observed by various naturalists. In 1940, Gabrielson found these birds to be very common on Afognak Island, and he noted two or three at Chignik Bay. Howell (1948) records 6 nests with eggs at Kodiak Island from June 9 to July 4, 1944—one nest with 3 eggs, one nest with 5 eggs, and four nests with 4 each. We observed several of these birds at Kodiak and Afognak Islands on May 12 and 13, 1936, and, on May 11, we found two or three birds on Ushagat, Barren Islands, on a high slope where the principal vegetation is crowberry. On May 15, 1936, many of these thrushes were singing among the alders

on Nagai, Shumagin Islands, and, on the next evening, several thrushes were noted in the alders at Sand Point, Popof Island. On May 24, 1937, we heard several thrushes singing on Dolgoi Island, west of the Shumagins.

In 1911, Wetmore found hermit thrushes to be "tolerably common" in the alders at King Cove and in the alders at the east base of Frosty Peak, and he obtained specimens. Gianini (1917) reports that he observed the bird at Stepovak Bay.

I found the hermit thrush in the alders back of Izembek Bay, early in June 1925. One of these birds was in the last alder patch at the head of the valley below Aghileen Pinnacles. Two or three thrushes were heard singing at the base of Frosty Peak on July 3.

On July 15, Donald Stevenson heard thrushes singing on the rocky slopes of Amak Island; although he had a distant view of them, they were too wary for him to obtain a specimen. There is no shrubbery on Amak, the tallest vegetation being *Heracleum anatum*.

Beals and Longworth, in their field report of 1941, on Unimak Island, stated that they heard the first thrush of the spring at False Pass on May 12. Next day, they saw five of these birds in the alder thickets. Between May 12 and June 17, "they could be heard whenever we patrolled the valley floors and even up to 5-6000 ft. elevation." No specimens were taken, but "their song, habits and appearance are the same as our Russet-backed thrushes of Southeastern Alaska." Later, in May 1944, Gabrielson obtained a specimen at King Cove, and, in 1946, he took specimens from Popof and Aghiyuk Islands.

The hermit thrush is most common in this region, and the lack of conflicting information leads us to suppose that it is the hermit thrush that is most common on Unimak Island. However, specimens are needed for positive identification.

Nelson (1887) has discussed the impropriety of assigning Melin's name "*Turdus aoonalascensis*" to this bird, the type of which was supposed to have come from Unalaska. He pointed out that no other naturalist has observed it there. However, we found the hermit thrush on such barren islands as Amak and Dolgoi, and (apparently) as far west as Unimak; therefore, it is not at all improbable that a specimen could have been obtained in Unalaska. But Nelson's thesis remains correct, especially since he demonstrates that the original description was inadequate.

Hylocichla ustulata*: Swainson's Thrush**Hylocichla ustulata incana***

Osgood (1904) reported finding this thrush in the Lake Clark and Lake Iliamna region and he obtained a specimen at Lake Clark on July 24. This specimen is in the Fish and Wildlife Service collection at the U. S. National Museum. It is a male in juvenal plumage and probably was taken not far from its nesting area. A. Wetmore (manuscript notes) heard this species singing July 12 and 16 at King Cove. We did not identify this form on any of our trips to the Alaska Peninsula.

Hylocichla minima*: Gray-cheeked Thrush**Hylocichla minima minima***

Osgood (1904) writes—

A gray-cheeked thrush was seen at Swan Lake August 25, and another few days later on the Kakhtul River; a third was collected near the mouth of the Kakhtul River September 1. This specimen is more olivaceous than any other I have seen, which is perhaps due to its being in newly acquired fall plumage.

Friedmann (1935) records a number of specimens from Kodiak Island, and the National Museum has a number of specimens from Nushagak, Lake Aleknegik, and Kakwok River. Gabrielson obtained specimens at Dillingham on July 18, 1940, and at Naknek River and Brooks Lake on July 10, 1946.

This bird has a wide distribution, occurring on the Pribilof Islands, St. Lawrence Island, and parts of Siberia. Wallace (1939) remarks—

One striking feature of the distribution of this form is its apparent preference for coastlines, islands, rivers, and lakes. The presence of sheltering thickets of alder and willow bordering the streams and water courses in these otherwise treeless regions presumably accounts for such a pattern of distribution.

At present, this species has not been recorded west of the base of Alaska Peninsula, though it could occur somewhat farther west.

Luscinia calliope*: Siberian Rubythroat**Luscinia calliope camtschatkensis***

This species was collected on Kiska Island by F. B. McKechnie on June 17, 1911, and he saw two others. Still another was seen there on June 19 by Wetmore (Bent 1912). These are the only records for North America.

Family SYLVIIDAE

Phylloscopus borealis: Arctic Warbler*Phylloscopus borealis kennicotti*

Osgood (1904) obtained two specimens of this bird near Uiamna Village, and he records a specimen taken by McKay near Aleknegik River on August 24, 1881. Two specimens were taken by J. W. Johnson at Nushagak on June 19, 1884, and Hanna obtained a specimen at Lake Aleknegik on July 2, 1911.

On July 19, 1940, Gabrielson saw 3 of these birds at Brooks Lake and collected 1 of them, and he obtained another at Dillingham.

According to Parkes and Amadon (1948), the Kennicott arctic warbler "winters commonly in the Philippine Islands and sparingly in the Indo-Chinese countries, Malaysia and the East Indies east to the Moluccas; known to migrate through eastern China (Shantung, Yunnan)."

Regulus satrapa: Golden-crowned Kinglet*Regulus satrapa amoenus*

A number of specimens are in the National Museum that were collected by Bischoff and Townsend on Kodiak Island. Gabrielson noted the species on Afognak in 1940, and he found it to be common on Kodiak Island in the winters of 1941 to 1944, where he collected two specimens.

This bird could be expected in the wooded parts of Alaska Peninsula, but Osgood did not record it, except for the Cook Inlet region, where he found it "moderately common." A study of this species by Aldrich (manuscript notes) indicates that birds of this region are referable to *amoenus*, and that *olivaceus* is restricted to the narrow coastal strip from Sitka, Alaska to Oregon.

Regulus calendula: Ruby-crowned Kinglet*Regulus calendula calendula*

Osgood (1901) mentions a male taken by Bischoff at Fort Kenai, and remarks that "Examination of this specimen does not show any characters that approach those of *Regulus calendula irinnelli*, which is found on the coast only a short distance farther south."

We heard one singing at Port Chatham, Kenai Peninsula, on May 6, 1936, but we saw none west of there, nor did Osgood

record any for the base of Alaska Peninsula. However, Turner (1886) reports seeing one at Nushagak on June 28, 1878.

On June 14, 1940, Gabrielson noted one on Kodiak Island. The bird from Kenai Peninsula is *R. c. calendula*, therefore the Kodiak birds would undoubtedly be the same.

Family MOTACILLIDAE

Motacilla alba: White Wagtail

Motacilla alba lugens

During the expedition in 1913 and 1914 on which Joseph Dixon and W. Sprague Brooks were the zoological collectors, several of these wagtails were seen on the beach of Attu Island early in May 1913, and, on May 4, an adult male was collected. This is the only occurrence known for the Aleutian district; it was reported by John E. Thayer and Outram Bangs in 1921.

This bird is a regular migrant in the Commander Islands, according to Stejneger (1885).

Turner (1886) observed a wagtail at Attu Island on May 18, 1881, which he thought would be *M. a. ocularis*, though he mentions the possibility of its being *M. a. lugens*. The specimen was not secured, and there must remain some doubt about the identity. Turner quotes Seebohm to the effect that a specimen of *Motacilla amurensis* had been collected by Wosnessensky on April 23, 1845, on Oorogan Island "possibly either one of the Kurile or one of the Aleutian Islands." Oorogan Island cannot be identified, therefore this record too must remain doubtful.

Stejneger (1885) records a specimen from Bering Island.

Motacilla flava: Yellow Wagtail

Motacilla flava tshutschensis

This wagtail is not common in the area here considered, though it has been observed numerous times in the Bristol Bay region, where it is considered to be a breeding species. Osgood (1904) states that McKay and Johnson obtained four breeding birds at Nushagak, and he concludes that "This is doubtless near the southern limit of its breeding range on this continent." Turner also (1886) found this bird at Nushagak in the breeding season.

We did not find this bird on the Alaska Peninsula or in the Aleutian chain, but Turner (1886) reports seeing one on Attu Island on October 8, 1880. He adds that the bird does not breed in the Aleutians. The 1931 Check List states that this wagtail migrates through the western Aleutian Islands to eastern Asia.

Anthus spinoletta: Water Pipit*Anthus spinoletta pacificus*Attu: *Assu Ka-vij'*

A series of 13 breeding birds and 2 in winter plumage from Unalaska was available for study, as well as one breeding bird each from Fort Kenai, King Cove, Morzhovoi Bay, Chogiung, Nushagak, Sanak, and Unimak Island. There was also a series from Sitka, Hoonah Sound, and Ketchikan, Alaska, and White Pass, Yukon Territory, as well as others from interior Alaska and eastern North America.

The series from Unalaska and other parts of western Alaska is grayer on the back than those from Alberta and Mackenzie, and the under parts of the Alaska birds average paler, though the coloration varies from a definite pinkish buff to rather pale individuals. This is not due to wear, because some of the most-worn specimens are the most buffy. Also, the spotting on the breast varies from very sparse to very heavy.

In winter plumage, the western Alaskan birds are a little browner, and the Canadian birds are slightly, but noticeably, more olivaceous.

When compared with a small series from White Pass, Ketchikan, and other southeastern localities, which are presumed to be *pacificus* as described by Todd (1935), the Aleutian birds correspond very well and therefore are referred to *pacificus*.

It was difficult to separate the birds from Alberta, Canada, at least those used in this study, from the birds described as *alticola* from Colorado, Idaho, and Wyoming.

The pipit occurs from the base of Alaska Peninsula to Attu Island, though it is not equally abundant everywhere. Osgood found them near Kakhtul River, McKay obtained specimens at Nushagak, and Hine observed them, and obtained specimens, at Katmai and Kashvik Bays.

We noted the birds at Ugashik River on May 29, 1936. On May 14, we found them at Chignik, and, on May 16, 2 were heard singing at Unga and 2 were heard at Sand Point, Popof Island. Several were heard singing at Unimak Island on May 19 and 20, and, on May 24, 1937, pipits were commonly seen on Dolgoi Island. John Steenis obtained a specimen at Sanak Island on August 28, 1937, and two were seen on Bogoslof on August 24.

In 1925, I found pipits to be common on the north side of Alaska Peninsula, mainly in the mountains above the alder growth. There were pipits at False Pass on the mountains near

Aghileen Pinnacles, Frosty Peak, and Amak Island, where young birds were flying about on July 10.

In 1911, Wetmore found pipits to be common at the east base of Frosty Peak, Morzhovoi Bay, and King Cove, where they nested above the alder growth on mountain sides. He also found them to be common at Unga. Gianini (1917) observed them at Stepovak Bay.

In 1940, Gabrielson noted a pipit above timberline on Kodiak Island, noted four or five at Morzhovoi Bay, and noted one on Metrofania Island. In subsequent years, he found them to be rather common in many localities, including Akutan and Unalaska.

Howell (1948) found the pipits on Kodiak on the open grassy slopes above 1,500 feet. A nest sunk in the ground with its rim flush with the surface, containing four well-incubated eggs, was found on June 17.

Nelson (1887) observed pipits on Unalaska Island and says that specimens have been obtained on Kodiak. Laing (1925) collected pipits on Unalaska. McGregor (1906) found them at Dutch Harbor, Unimak Island, and Aektok Island. Swarth (1934) reports specimens taken by Harrold on Akutan, where it was common.

We found pipits to be fairly numerous on Unimak and Unalaska, but they were scarce farther west. One was seen on Amchitka Island on July 24, 1936. The chief of Attu was familiar with the bird and gave us the native name.

Turner (1886) reports it throughout the Aleutian Islands and specifically mentions Unalaska, Atka, and Attu. We did not see the species in the Near Islands.

Cahn reports for Unalaska that "Pipits arrive in early May (earliest date, May 3, 1944), and remain until mid-September."

Nesting

In general, pipits nest chiefly on high ground, above the alder zone where such growth occurs, and on the more or less barren mountain tops or ridges of the western islands. They occasionally occur on lower ground, however, even in the nesting season. After the nesting season, when they begin to form small flocks, they often feed on the beaches, among the tide-rolled masses of dead kelp.

Swarth (1934) mentions a nest with six eggs found by Harrold on Akutan on a "bare wind-swept ridge about 1,000 feet above the sea." Swarth also mentions another nest with six

fresh eggs, found on June 19, on Unalaska, at an elevation of about 500 feet.

On June 10, 1925, in the valley bottom below Aghileen Pinnacles, I found a nest on mossy ground, almost completely overhung by vegetation, mostly grass. The nest was made of fine roots in the outer structure, then a layer of old fine grass, dark in color, and an inner lining of fine clean grass. Outer diameter was 110 mm.; inner diameter was 67 mm.; and depth was 40 mm. There were six eggs in the nest.

Anthus cervinus: Red-throated Pipit

This species is credited to the Aleutian Islands on the authority of Zander (1853). Stating its general distribution, Zander says that it is widespread, reaching from Dalmatia and Lapland, through the adjacent part of Asia to the islands near America, and also in Egypt and Nubia ("durch den angrenzenden Theil von Asien bis zu den Inseln bei Amerika verbreitet").

This is a vague reference in a general statement of distribution. It does not specify specimens taken nor type of observations made, nor does it identify the "islands near America" that he mentions. Apparently, subsequent authors have assumed that he meant the Aleutian Islands. Certainly, Zander did not state the case adequately, and, although it is possible that the species occurs on the Aleutians, we should have better evidence.

Family LANIIDAE

Lanius excubitor: Northern Shrike

Lanius excubitor invictus

Osgood (1904) records specimens from the mouth of Chulitna River and Swan Lake, and he observed the bird on Kakhtul River and near Nushagak. McKay obtained specimens at Ugashik, and Cahalane (1943) "found shrikes to be fairly common on the west side of the Aleutian Range" in the Katmai region. Friedmann (1935) mentions 2 specimens from Kodiak, and Gabrielson observed 3 of these birds at Kodiak also.

These records refer to the base of Alaska Peninsula and neighboring localities, where some timber is present, but the bird also occurs far to the west on treeless terrain. In 1936, Petri, who was warden in the U. S. Bureau of Fisheries at Chignik, told us that shrikes occur commonly in that locality.

On May 5, 1925, I saw a shrike on a trapper's hut at Urilia Bay, Unimak Island. Arthur Neuman, of Ikatán Peninsula,

said shrikes occur on Unimak and that on several occasions he had seen them carrying mice, or hanging them in the willows. He had once seen a shrike harrying a ptarmigan.

Beals and Longworth reported seeing 10 shrikes near False Pass, between January 11 and May 15, 1941. Presumably, some of these sightings may have been duplications. They saw a pair on one occasion. They remarked that "Residents of Unimak Island recognize them and their murderous work among the smaller song birds."

A more western record for this bird in the Aleutians is Gabrielson's observation at Unalaska Island, July 3, 1941.

Taber, writing of Adak Island, reports—

On January 9, 1946, a female mallard was seen flying along a small stream near Shagak Bay; a shrike struck at her back twice as she flew. The mallard lit in the water and the shrike hovered characteristically over her for a moment and then lit on a barbed wire fence. The ground was snow covered at this time, leading to the supposition that this shrike was extremely hard pressed for food.

Family PARULIDAE

Vermivora celata: Orange-crowned Warbler

Vermivora celata celata

The orange-crowned warbler was collected by McKay at Nushagak, where it breeds, and Osgood (1904) observed a few about Lakes Iliamna and Clark, and took specimens. We obtained a specimen at Snag Point, Nushagak River, May 25, but we saw none farther west.

Vermivora celata lutescens

This is the form known to inhabit the Cook Inlet region. Nelson (1887) mentions a specimen taken by Bischoff at Fort Kenai, the type locality, and says that it occurs on Kodiak. Howell reported them to be common on Kodiak, where he found four nests. He considered them "sparsely but regularly distributed in the wooded valleys" of this island. Friedmann (1935) lists three Kodiak specimens. It is interesting to note that it is *lutescens*, from Kenai Peninsula, and not *celata*, from Alaska Peninsula, that has reached Kodiak Island.

Dendroica petechia: Yellow Warbler

Dendroica petechia rubiginosa

Aldrich (1942) has presented convincing evidence that the golden and yellow warblers are conspecific, and, because the

name *petechia* has priority, all of them are placed under that species.

The Alaska yellow warbler has an extensive distribution. Osgood (1904) observed the bird, and obtained specimens, at Lake Clark and Lake Iliamna and on the Chulitna River, and he mentions specimens taken by McKay and Johnson at Nushagak. Hine (1919) obtained a specimen, and observed the species, on various occasions about Katmai Bay. Friedmann (1935) records a number of specimens from Kodiak, and it is evident that it breeds there. In June 1940, Gabrielson found the yellow warbler to be common on Kodiak and Afognak Islands; he noted several on the Semidi Islands, and he recorded the bird as common at Chignik Bay. Later, he observed it on Unimak Island, Nelson Lagoon, Wide Bay, and Cold Bay.

Gianini (1917) obtained a specimen at Stepovak Bay, and he saw others, but he remarks that they were not common there. On July 3, 1925, I saw one of these warblers below Frosty Peak, and I observed another at False Pass on August 9.

Beals and Longworth, in their 1941 field report, reported the yellow warbler to be common on the eastern part of Unimak Island. These birds were referred to by residents as "little yellow canaries." One had been seen there May 5, and two were seen on May 20.

The alder brush is the home of the yellow warbler.

Dendroica coronata: Myrtle Warbler

Dendroica coronata hooveri

Osgood (1904) found this warbler to be abundant about Lake Clark and took several specimens. He also observed it at the mouth of Chulitna River. McKay took specimens at Nushagak, and Turner (1886) found it to be abundant there in June 1878. Gabrielson observed it at Brooks Lake, July 10, 1946.

Dendroica striata: Blackpoll Warbler

Osgood (1904) considered this to be the most common warbler that he saw at the base of Alaska Peninsula from July 14 to August 12. He observed it at Iliamna Village, Lake Clark, and Nogheling River. McKay obtained a specimen 80 miles up Nushagak River and obtained another on Aleknagik Lake.

Gabrielson saw this warbler at Dillingham, July 17, 1940.

Seiurus noveboracensis*: Northern Waterthrush**Seiurus noveboracensis notabilis***

Osgood (1904) observed a pair of these birds at Iliamna Village on July 14, and he found them to be quite common at the mouth of Chulitna River on August 3. A specimen was taken by McKay 85 miles up the Nushagak River on June 6, 1881.

On May 26, 1936, I repeatedly heard a song in the alders and willows at Snag Point, Nushagak River, that I identified as that of the waterthrush, but I could not get a glimpse of the birds.

Wilsonia pusilla*: Wilson's Warbler**Wilsonia pusilla pileolata***

This warbler inhabits the entire length of Alaska Peninsula. Osgood (1904) frequently found it at the base of the Peninsula, Hine (1919) reported it to be common in lower Katmai River valley and secured specimens, and Friedmann (1935) recorded many specimens from Kodiak.

On May 23 and 26, 1936, these warblers were heard singing in the willows and alders at Snag Point, Nushagak River. On August 20, as we approached Port Moller (but still several miles offshore), three Wilson's warblers hovered about the ship for some time and occasionally settled on the deck.

In June 1940, Gabrielson noted this warbler commonly on Kodiak Island; he saw a few on Semidi Islands, and he noted them as common at Chignik Bay. Howell reported this "the most numerous warbler" on Kodiak. Later, he saw them on Unimak Island, at Cold Bay, at King Cove, at Pavlof Bay, and at Nelson Lagoon.

In 1925, I found these birds below Aghileen Pinnacles, near the western end of Alaska Peninsula—the first sighting was on May 29. They were common in the alders at Moffet Cove, Izembek Bay, and two were seen on Hazen Point on June 22.

Gianini (1917) found them to be common, and nesting, at Stepovak Bay.

In 1911, Wetmore reported this warbler as common at King Cove; he saw one west of Morzhovoi Bay, and he said that they were common at the east base of Frosty Peak.

Family ICTERIDAE***Euphagus carolinus*: Rusty Blackbird**

Osgood (1904) recorded several occurrences of the rusty blackbird at the base of Alaska Peninsula: A specimen taken near

Keejik Village, Lake Clark, July 24; observations made near the headwaters of Chulitna River; and several seen at Ikwok Village, on Nushagak River, September 5. McKay obtained a specimen on Nushagak River and two at Lake Aleknagik. Osgood obtained 2 specimens at Tyonek, Cook Inlet, and he mentions 2 others taken here by Bischoff.

Friedmann (1935) records a specimen taken on Kodiak Island by Reichenow, October 22, 1906. Cahalane (1943) found the rusty blackbird to be abundant at Kodiak in the fall of 1940.

Family FRINGILLIDAE

Pinicola enucleator: Pine Grosbeak

Pinicola enucleator alascensis

The type specimen of the Alaska pine grosbeak (No. 86510, U. S. National Museum) was taken by McKay near Nushagak on June 9, 1881, and he obtained others on Nushagak River and Lake Aleknagik. Hanna obtained two specimens at Ahyoowaytha Creek and two on Kakwok River in 1912. We found the skeleton of a female at Snag Point, Nushagak River, on May 25, 1936.

Pinicola enucleator flammula

Specimens from Kodiak and other localities along the coast to Sitka were compared with a series from Bristol Bay and interior Alaska. The colors are confusing, but the coastal birds, including those from Kodiak, have larger bills. Thus we find still another subspecies on Kodiak that apparently has been derived from the southern Alaskan coast, rather than from the north.

At least eight specimens from Kodiak were available for study, collected by Panshin, Ridgway, Osgood, and R. H. Beck. In 1940, Gabrielson noted the bird on Kodiak and Afognak Islands. Howell also observed this grosbeak on Kodiak, and, on June 9, 1944, he found a nest with three fresh eggs; he obtained a specimen on Kodiak, November 12, 1944.

Leucosticte tephrocotis: Gray-crowned Rosy Finch

For a proper understanding of the relationships of the rosy finches of the Alaska Peninsula, Kodiak, and Aleutian Islands, it became necessary to examine, as a whole, the group occupying Alaska and the Bering Sea region. As a result of this study, the group appears more closely knit than previous taxonomic usage

has indicated. There appears to be gradation from the smaller birds of the eastern and southeastern part of this territory to the large birds of the Aleutians and Commander Islands. The various forms should be included under the species *tephrocotis*. This parallels the series of song sparrows, which have shown a similar development.

Leucosticte tephrocotis littoralis

The rosy finches of Kodiak Island have been difficult to identify. Nelson had reported that both *griseonucha* and *littoralis* occur there together, and Friedmann (1935) listed both forms for Kodiak. Allen J. Duvall (to whom I am indebted for further comparisons with additional material after the initial study had been made) finds that Robert Ridgway had at first designated the Kodiak birds as a new form in his manuscript notes, but that later he changed his mind. In 1901, McGregor named the bird *Leucosticte kadiaka* and defined it as similar to *L. griseonucha*, but with a smaller bill and smaller, weaker feet and claws. Grinnell (1901) pointed out that five specimens from Kodiak in the collection of Leland Stanford University indicated that—

an almost complete gradation between *Leucosticte tephrocotis* of the Sierra Nevada and *griseonucha* of the Aleutian and Pribilof Islands. Such being the case, then the latter form is a subspecies of *tephrocotis*, as long ago contended (*L. tephrocotis* var. *griseonucha* Coues Key, 1872, p. 130).

It has been difficult to obtain breeding birds from Kodiak, and specimens from there may be migrants. Thus, it would seem that the *kadiaka* form must be assumed to be merely intergradation between the birds of the Aleutians farther west and *littoralis* farther east and south, and it is not included in the Fifth Edition of the A. O. U. Check-List.

Leucosticte tephrocotis littoralis is known to occur from White Pass, Yukon Territory, south to central Oregon. But a specimen taken by Adolph Murie at Savage River, Mount McKinley National Park, September 2, 1923 (298055, U. S. National Museum), proved to be *littoralis*, thus extending its range considerably northward. In 1926, Joseph Dixon (1938, p. 121) obtained additional specimens there, which also proved to be *littoralis*. On May 28, 1955, Adolph Murie obtained another specimen of *littoralis* in Mount McKinley National Park. On the other hand, two specimens that I obtained at Bettles, Alaska, October 17, 1924 (298085 and 298086, U. S. National Museum) are *L. t. tephrocotis*.

The specimens just referred to here suggest the following distribution: *L. t. tephrocotis* is the more-inland form, occurring in eastern Alaska and extending its range chiefly along the Brooks Range; *littoralis* is a coastal form, ranging through southeastern Alaska and occupying the more southern mountain ranges, including the Alaska Range, at least as far west as the Mount McKinley region; and *kadiaka* is a form intermediate between *littoralis* and *griseonucha*, occupying the Kodiak-Afognak island group. The specimen from Nushagak suggests an influence from the Kodiak form, therefore we may assume that *kadiaka* also occurs on nearby parts of Alaska Peninsula.

Leucosticte tephrocotis griseonucha

Attu: *Kohl-grhá-ghuch*

Qúlgax and *Ulugásix* (Jochelson)

Atka: *Chá-nuh*

This well-known, large-sized rosy finch ranges throughout the Aleutian Islands and probably over a large part of Alaska Peninsula. We found them to be common, and nesting, on Amak Island on May 31, 1936 (where I had also observed them in 1925), and we saw them among the alders at Chignik on May 15, and at Belkofski on May 17. Laing (1925) also observed them near Chignik, and, in 1911, Wetmore saw them with young at the east base of Frosty Peak and at Unga, in the Shumagins. Scheffer noted them at Sanak Island in 1938.

The distance that this form extends northeastward along the Alaska Peninsula is not known, but Gabrielson obtained four specimens on the Semidi Islands that are referable to *griseonucha*.

For the most part, the Aleutian rosy finch is a beach bird, spending much of its time among the boulders and the coastal bluffs. But it also is found in the high interior of islands, especially where lava beds are present. It is fond of feeding about buildings and trappers' huts. At Ikatan, Unimak Island, they were common about the cannery buildings, and, on Amchitka Island, these birds used some abandoned houses as roosting places, entering through broken windows. Sometimes a bird is trapped in this way, being unable to find the small hole through which it entered, and, of course, eventually starves.

In July, on Amchitka Island, the rosy finches were found to be feeding on plant seeds, including those of *Poa* sp. and *Alsine sitchana*.

Reporting on Adak Island, Taber says, "These birds were present throughout the winter, feeding on the heads of composites which projected above the snow. Even after the heaviest snow-

storms, some dry vegetation always seemed to be exposed. The Rosy Finch flocks varied from 6 to about 30 individuals."

In 1937, the first family of young on the wing was seen on Buldir Island on June 18, and another such family was seen on Little Kiska Island on June 22.

Two other forms are of interest here. *Leucosticte tephrocotis umbrina*, from the Pribilof Islands (Murie 1944, p. 122), has become differentiated as a darker bird, about the same size as *griseonucha*, and *L. t. maxima*, the Commander Islands rosy finch, is the largest of the group. The bird of the Commander Islands is of the American type; the nearest Siberian form, *brunneinucha*, from Kamchatka, is of an entirely different group. Thus, the rosy finches show a gradual increase in size north and west through the Aleutian district—culminating in the largest one being found on the Commander Islands (which is the farthest point reached to the west), and the darkest one being found on the Pribilof Islands.

***Acanthis hornemanni*: Hoary Redpoll**

Acanthis hornemanni exilipes

Chukchi: *Kedliptschekadlin* (Palmén)

Osgood (1904) observed flocks of these birds at Nushagak and lower Nushagak River in September, and they were common at Becharof Lake, Kanatak, and Cold Bay during October. McKay and Johnson have collected specimens in breeding plumage in June and July at Nushagak, and Cahalane (1943) reports a group near the outlet of Katmai River on October 4, 1940.

We did not see this bird. Wetmore, however, according to his field notes for 1911, heard a redpoll in the mountains west of Morzhovoi Bay on July 26, and he suspected that it may have been this species. He felt certain that it was not *A. f. flammea*.

Stejneger (1885) lists this redpoll as a winter visitor in the Commander Islands.

***Acanthis flammea*: Common Redpoll**

Acanthis flammea flammea

Osgood (1904) found this redpoll to be common about Lake Iliamna and Lake Clark and the Chulitna River. McKay and Johnson have taken specimens at Nushagak, and Hine (1919) obtained specimens at Katmai Bay, where they began to appear about the middle of July. Gabrielson found several on the Kvichak River on July 23, and they were common at Iliamna Lake on July 24. We observed these birds at Snag Point, Nushagak River,

May 25 and 26, 1936. Redpolls also occur on Kodiak Island, apparently the year round according to the specimens recorded by Friedmann (1935). Howell (1948) observed them frequently on Kodiak, and, on June 19, he found a nest with four eggs in an alder bush.

The common redpoll also is found far to the west. In June, 1940, Gabrielson noted this bird at Chignik Bay, at Sand Point on Popof Island, and at Morzhovoi Bay. We noted them at Sand Point on August 26, 1936, and, on May 24, 1937, two or three were heard singing on Dolgoi Island.

Arthur Neumann, a resident at Ikatan, Unimak Island, described a "small brown bird with pink head" that came to feed on crumbs he put out for birds.

In May 1925, I found redpolls to be common on Unimak Island, in the alders back of False Pass, where the first flock were seen April 27. Late in May, redpolls were trilling and singing among the alder patches below Aghileen Pinnacles.

Beals and Longworth found redpolls in flocks at False Pass in the winter and spring of 1941. Specific dates mentioned are: January 19, February 24, March 13 and 18, and May 2, 3, and 23. Flocks, which often were seen in alder thickets, numbered from 10 to 60 birds.

McGregor (1906) found redpolls nesting on Unalaska Island. We saw them on Unalaska on July 12, 1936, and Gabrielson saw them nesting on several occasions. Wetmore refers to one of these birds that Bent saw on Amaknak Island on June 7, 1911, and Turner (1886) records the species from Unalaska, adding that it does not occur west of that point. Probably they do not nest farther west, but, on July 28, 1937, we saw 2 redpolls on the beach of Ogliuga Island, and, on July 31, we saw 2 more on West Unalga Island. However, these may have been migrants. Gabrielson saw a flock of nine birds on Atka Island on January 31, 1941. Taber saw a single redpoll on Adak Island on December 16 and 30, 1945, and Sutton and Wilson (1946) record one on Attu on February 18, 1945.

Stejneger (1885) mentions this species in the Commander Islands, but he thought that it probably does not nest there.

Acanthis flammea holboellii

This subspecies was taken by McKay and Johnson at Nushagak. We have no other records of it, but redpolls are not always readily identified, and it might be overlooked in mixed flocks unless a good view is obtained.

Stejneger (1885) considers this to be a resident of the Commander Islands.

***Spinus pinus*: Pine Siskin**

Spinus pinus pinus

Apparently, the pine siskin occurs only sparingly at the base of Alaska Peninsula. Osgood (1904) obtained one at Iliamna Village, and he saw a few others there and on the Nogheling River. He saw a large flock at Tyonek and obtained three specimens from it, but he saw the bird nowhere else about Cook Inlet (1901).

Friedmann (1935) indicates that the pine siskin occurs regularly on Kodiak Island, and Beal obtained a specimen at Kodiak on March 16, 1947. Apparently, however, it is not abundant in this part of Alaska.

It is interesting to note that on March 9, 1942, Gabrielson saw a group of about 15 birds, which he thought to be siskins, in a grove of spruce trees at Sand Point in the Shumagin Islands, and on April 20, 1943, Lieutenant Eddy, of the U. S. Navy, positively identified eight or ten siskins in the same spruce grove at Sand Point.

***Loxia curvirostra*: Red Crossbill**

Loxia curvirostra sitkensis

This crossbill occurs on Kodiak Island, which probably is the western limit of its range. Friedmann (1935) records three specimens taken there by Bischoff on May 18 and June 13, 1868, which were the only records he could find. We observed a group of 12 crossbills feeding on spruce cones on Afognak Island, but positive identification of the species was not possible.

Osgood (1901) mentions a specimen taken at Graham Harbor, in Cook Inlet, in 1892, by C. H. Townsend and B. W. Evermann.

***Loxia leucoptera*: White-winged Crossbill**

Loxia leucoptera leucoptera

This crossbill seems to be more common than *sitkensis* in this area. Osgood saw a few at Lake Clark and Iliamna (1904), and many specimens have come from Kodiak (Friedmann 1935). On June 15, 1940, Gabrielson obtained a specimen on Afognak Island. McKay got a specimen in January, 1883, on Mulchatna River and Osgood (1901) found them to be common in Cook Inlet and obtained specimens at Hope. We did not observe these birds on our expeditions.

Passerculus sandwichensis: Savannah Sparrow*Passerculus sandwichensis anthinus*

Examination of a fairly large series of specimens revealed that the birds of the Kodiak-Afognak group, Barren Islands, base of Alaska Peninsula, and Cook Inlet average smaller than *P. s. sandwichensis*, and therefore they are referred to *anthinus*. The length of bill usually is 10 mm. instead of 11 mm. The bill of *sandwichensis*, on the other hand, rarely is less than 11 mm., and it often reaches 12 mm. in length, sometimes more. The length of wing averages less in *anthinus*. There is some overlapping of characters.

Localities represented by specimens are Kodiak, Middleton Island, Barren Islands, Nushagak, Ugashik River, Chogiung, Kakwok, Lake Iliamna, Hooper Bay, and Hope and Tyonek in Cook Inlet.

In June 1940, Gabrielson found Savannah sparrows to be common at Amatuli, Barren Islands, Kodiak, Afognak, and Semidi Islands. Allen Duvall, who examined two immature specimens taken in the Semidis by Gabrielson on August 5, 1945, states that these are referable to *anthinus* on the basis of measurements, but that it is not certain that they had reached full development. There also is a specimen from Wide Bay, on the peninsula, that appears to be *anthinus*.

There are some puzzling specimens. I took a specimen on May 29, 1936, at Ugashik River (original No. 3536) that is larger than usual, however the beak is not so heavy as most *sandwichensis*, and it seems referable to *anthinus*.

On May 12 and 13, 1936, we heard Savannah sparrows singing on Kodiak and Afognak Islands. On May 10 and 11, a number of these birds were feeding on the gravel beach at Ushagat, Barren Islands, and specimens were obtained. On May 14, a Savannah sparrow passed our ship between Sutwik Island and Cape Kumlin; it is possible that these were migrating. On May 2, near Yakutat, 1 of these sparrows had settled on our forward deck, and the first mate reported 2 other "sparrows" on the deck.

Howell found them to be common on Kodiak. On June 9, 1944, he found a nest, containing 5 fresh eggs, in a swampy area at Middle Bay, and, on June 17, he found a nest with 4 half-incubated eggs in an open growth of grass and moss at an elevation of 1,500 feet.

Under the heading of *alaudinus* [*anthinus*], Osgood (1904) says—

breeding abundantly on the treeless slopes and in the small grassy moun-

tain valleys on the west side of Iliamna Pass, where one specimen was taken July 12. Seen in small numbers in open places in the vicinity of Iliamna Village and along the Nogheling River. None were seen about Lake Clar until August 7, when they suddenly appeared in considerable numbers near the mouth of the Chulitna River, not in the open swamps, but in scattering twos and threes in the thick willow brush, evidently preparing for migration. After this date none were seen. McKay and Johnson found the species breeding at Nushagak.

Hine (1919) obtained specimens at Katmai Bay, June 22 and July 8, 1919, and found the species to be common there.

We found these sparrows at Snag Point, Nushagak River, on May 25, 1936, and on May 27 and 29 they were common at Ugashik River, being the principal passerine bird in that locality.

Presumably, the birds here recorded would all be *anthinus*. It is difficult to know where to place the line of demarcation on the Alaska Peninsula between *anthinus* and *sandwichensis*, but the Wide Bay specimen suggests that *anthinus* extends at least that far southwest.

Passerculus sandwichensis sandwichensis

Unalaska: *Saksagada* (Wetmore)

This is the largest of the Savannah sparrows, and it has the longest bill. In a large series from Unalaska, and many more from other localities, the bill measures from 11 to 12 mm. long—only five specimens in a series of more than 80 had a bill shorter than 11 mm. A few bills were as long as 13 to 13.5 mm. Length of wing, in this series, is also greater than that of *anthinus*. There are some, of course, that approach the intermediate status. One specimen (No. 298534, U. S. National Museum) from Izembek Bay has a fairly small bill, but it does not fit into the series of *anthinus* very well and has a long wing. Another specimen (No. 164927), from Stepovak Bay, has a bill that is 11.5 mm. long with a slightly smaller body; this bird is larger than *anthinus* and should be placed with *sandwichensis*. Thus, the range of this subspecies extends eastward at least as far as Stepovak Bay, and as there is a specimen of *anthinus* from Ugashik River, the meeting place for these two subspecies would comprise the area between Stepovak Bay and Ugashik River.

On May 2, 1936, we found Savannah sparrows to be common at Yakutat. They seemed to be large and robust and could have been *sandwichensis* on westward migration. The bird occurs on Kodiak Island, where it is undoubtedly a migrant. Bischoff collected an immature bird on Kodiak Island in July 1868, and Bretherton obtained an adult in July 1893.

In 1941, Beals and Longworth noted the first Savannah sparrow at False Pass on May 1; they became abundant after this date. In 1925, I noted the first sparrow at Uria Bay, Unimak Island, on May 7. They had become common at False Pass by May 13, 1925.

Thus, the migration period can be limited to the first part of May.

After May 13, 1925, Savannah sparrows became common in all the lowlands, including the grassy islands of Izembek Bay and the mountain valley to Aghileen Pinnacles. They were common on Amak Island, where young birds were on the wing by July 11, and, in late summer, they were noted on Amagat Island and at Akutan.

In 1936, we found them to be common on Unimak Island, Amak, Unalaska, Baby Islands, and Tangik Island, near Akun. In 1937, we saw a considerable number of them on Unalaska, and, on August 29, they were common on Sanak. On May 16, 1936, they were present on Nagai and Popof, in the Shumagins, where they were again observed on August 26. We took a specimen on Popof, May 24, 1937.

Gianini (1917) noted these birds at Stepovak Bay. In 1911, Wetmore found them to be common at Morzhovoi Bay, at King Cove, at Belkofski, and at the east base of Frosty Peak.

In 1940, Gabrielson reported these birds to be common at Morzhovoi Bay, Akutan, Carlisle, and Amukta, and in following seasons he found them to be plentiful in numerous places throughout this area, including Uliaga, Kagamil, Yanaska, and Adak, but he saw none on Amchitka.

McGregor (1906) found this species on Unalaska, Amaknak, Samalga, Tigalda, Unimak, Akutan, Akun, Egg, and Aektok Islands. He says, "The sandwich sparrow was abundant on every one of the Krenitzin Islands, and on most of them they fairly varied, outnumbering all other land birds combined."

In 1936, we saw them on Ananiuliak (near Umnak Island), Kagamil, Uliaga, Chuginadak, and Carlisle. In 1937, we noted them on Ananiuliak and at Nikolski Village on Umnak. On August 22, they were common on Samalga Island, which is low and grassy, and we noted one on Herbert Island.

Cahn writes of this sparrow on Unalaska, "Apparently arrives in numbers overnight; by late May (earliest date, May 20, 1943) or early June they are suddenly everywhere among the tundra grasses, and in full song at once. During June, July and August they are extremely abundant and nest in the open tundra."

In summary, the Aleutian Savannah sparrow is abundant and occupies the western part of Alaska Peninsula, the Fox Islands, Islands of the Four Mountains, and has been seen as far west as Amukta, where Gabrielson collected a specimen on June 25, 1940 and on Adak, where he found many adults and young.

Farther west, they are rare, and they were not seen on any of our expeditions; however, Turner (1886) reported that he saw a few at Atka Island in 1879 and a few on Attu in 1880. The Attu chief did not seem to know of the bird.

Nesting

McGregor (1906) obtained several sets of eggs that indicate the nesting period: A nest with 4 slightly incubated eggs was found on June 27 in Beaver Inlet; 5 slightly incubated eggs were found June 28 at English Bay; 5 moderately incubated eggs were collected on July 20 on Tigalda; a set of 4 eggs was found on July 28 on Akun; and 2 females were collected on July 15 and 16 at Dutch Harbor, each of which contained eggs. Some of these data suggest a second laying.

Wetmore found a nest of five fresh eggs at Unalaska, June 9, 1911. By July 7, apparently all the young had been hatched.

When Savannah sparrows are flocking, they are prone to feed along the beaches.

Junco hyemalis: Slate-colored Junco

Junco hyemalis hyemalis

Osgood (1904), writing of his expedition at the base of Alaska Peninsula, says, "Up to the second week in August juncos were seen almost daily from Iliamna Village to the lower Chulitna River."

They are not recorded from Nushagak. Osgood found the junco to be common at Hope and collected specimens there. We saw several of these birds at Seward on May 21, 1937, and Gabrielson found them on Kodiak in November and December.

Junco oreganus: Oregon Junco

Junco oreganus oreganus

Turner (1886) reported that he obtained a specimen of the Oregon junco at Unalaska Island on April 8, 1879, but I could not find the specimen in the National Museum. Turner says further that he saw "numerous individuals" at Karluk, Kodiak Island, where they were hopping about the village.

These identifications must be held in doubt. Miller (1941,

275) lists the western boundary for the Oregon junco as southeastern Alaska; it is nonmigratory, and clings to the forest habitat. The nearest junco population is *hyemalis*, from the base of Alaska Peninsula and Kenai Peninsula—we have no junco records west of this area.

Pipizella arborea: Tree Sparrow

Pipizella arborea ochracea

Osgood (1904) found the tree sparrow to be common along his route through the base of Alaska Peninsula, and McKay collected specimens at Nushagak. Turner also (1886) observed the bird at Nushagak, and, on May 25, 1936, we obtained a specimen at Snag Point, Nushagak River.

Cahalane (1944) reported that he saw the species at Big Creek on Naknek River, September 4, 1940, and near the outlet of Savanoski River on September 6. In the same year, Gabrielson found them to be common near Iliamna Lake on July 24. He obtained specimens at Iliamna Lake, at Dillingham, and at Naknek. On August 7, 1945, he noted the species at Wide Bay, and on August 17, 1946, he saw these birds at Pavlof.

Zonotrichia leucophrys: White-crowned Sparrow

Zonotrichia leucophrys gambelii

Osgood (1904) says—

First seen on the portage between lakes Iliamna and Clark, where it was found in company with *Z. coronata* [*atricapilla*] July 18. Scattered individuals were observed later about Lake Clark and along the Chulitna River. One specimen was taken and a few others were seen near Swan River August 7. They were quite rare at this time, and the majority that breed in the region had doubtless migrated. One specimen was taken at Nushagak as late as September 18. Specimens were also taken at this locality by McKay June 6 to August 9, 1881.

Howell (1948) found these birds on Kodiak "Common in the valleys and on the slopes of the mountains up to 1500 feet." On June 10, he found a nest, containing five well-incubated eggs, just below the snow line. On June 13, he found a nest with 4 eggs, and, on June 19, he found a nest with 5 eggs at Bell's Flats. We obtained a specimen at Snag Point, Nushagak River, May 5, and Williams saw a Gambel's sparrow at Sand Point, Popof Island, May 16.

On July 19, 1925, near Moffet Cove, Izembek Bay, I saw a bright-plumaged male and heard another. These are the westernmost records of this bird—though specimens were not taken,

identification was almost certain. This was verified in July 1941 when Beals and Gabrielson obtained a specimen, and noted other at Izembek Bay.

Zonotrichia atricapilla: Golden-crowned Sparrow

This fine-looking sparrow is perfectly at home throughout the length of Alaska Peninsula, on Unimak Island, and the Shumagin Islands. There are many records of its occurrence. Osgood (1901) found it to be common around the village of Hope, and he saw it occasionally in the mountains nearby. On a later expedition, I found it to be very common about Iliamna Bay and Iliamna Village, and he saw a few at Lake Clark, which he considered to be as far as these birds go into the interior (1904). He mentions the fact that these birds are erratic in migration, straggling along irregularly. He refers to one of these stragglers which was taken by McKay and Johnson at Nushagak on November 5.

Cahalane (1944) observed a flock of these sparrows in the lower Ukak River Valley, September 11, 1940, and Hine (1919) evidently found them to be common in the general region of Katmai National Monument.

The golden-crowned sparrow is a common nesting bird on Kodiak Island, where Friedmann (1935) has obtained many specimens. In the summer of 1940, Gabrielson noted the species on the Barren Islands, Kodiak Island, Afognak Island, Semikof Islands, at Chignik Bay, and Dillingham, and he took several specimens. Later, he saw this bird at Umnak, the Shumagins, and other peninsula localities.

Gianini (1917) found them to be fairly common at Stepovaya Bay, remarking that he heard them first on May 28. In 1911 Wetmore observed them at the east base of Frosty Peak, Kikory Cove, and in the mountains west of Morzhovoi Bay.

On the 1936 expedition, we noted this sparrow at Yakutat on May 2; at Ushagat (Barren Islands), May 10; at Kodiak, May 11; at Chignik, May 14; at Nagai and Popof Islands, Shumagins, May 16 (again on Popof Island, August 26); and we saw several at Snag Point, Nushagak River, May 25 and 26. A sparrow was heard singing on Amak Island, May 31, and Williams secured a specimen there. In 1937, we saw this bird at Seward, May 21, and on May 24 they were common, singing and evidently nesting, on Dolgoi Island, west of the Shumagins.

In 1925, I observed this sparrow about the west end of Alaska

Peninsula and Unimak Island. My field studies were summarized in a report, as follows:

May 22, near Moffet Cove on Izembek Bay, I heard the first golden-crowned sparrow. Next day there were many. [In 1941, Beals and Longworth reported the first ones at False Pass on May 5.] They were common among the alders, as far as these bushes grow up the valley toward Aghileen Pinnacles. They were noted in the alder patches at the base of Frosty Peak, at False Pass, and Ikatan. While not as numerous as some other sparrows, the golden-crown nests commonly throughout the region covered, though local range is naturally governed by the boundaries of the alder patches, which are by no means universally distributed. This statement, however, must be subject to some exceptions, for on July 10 and 11 three males were singing and on July 15 a specimen was taken on Amak Island, where there are no alders and the largest form of vegetation is the cow parsnip.

On one occasion I heard a distinct variation of the song. Instead of three notes in descending scale, the usual second and third notes were reversed. It was the normal song for this bird, as I heard it day after day in the same lump of alders near camp.

Passerella iliaca: Fox Sparrow

Passerella iliaca zaboria

The fox sparrows of this region present an interesting distributional pattern. At the base of Alaska Peninsula there are a number of specimens of typical *zaboria*. G. D. Hanna collected three specimens in May and June 1911, at Nushagak (Nos. 231281, 231282, and 231283, U. S. National Museum). He also obtained an immature male at Kakwok, August 19, 1911 (No. 239707). There is another taken at Nushagak on June 20, 1881 (No. 86535). And on May 26, 1936, I obtained a specimen on the Nushagak River, at Snag Point (original No. 3528). Osgood also mentions a specimen taken at Nushagak, by McKay, June 6, 1881, which I have not examined. Furthermore, on July 17, 1940, Gabrielson recorded several eastern-type fox sparrows at Dillingham (with one specimen) and, the next day, he saw several at Wood River Lakes.

At any rate, the birds occupying the base of Alaska Peninsula, in the Nushagak district, apparently are typical *zaboria* from the interior Alaska fox-sparrow population, which has found here an outlet to the southwest coast of Alaska.

Here, too, it has come in contact with another fox sparrow population—the *unalaschensis* group. There are several interesting specimens that have intermediate characters—two immature birds, (Nos. 239705 and 239706, U. S. National Museum), taken by Hanna at Kakwok, and another (No. 110105) taken by J. W. Johnson in this general area, July 14, 1885. The streaking on the

back, so characteristic of *iliaca* and almost absent in *unalascensis* or *insularis*, is much subdued and clouded over by duskieness of the coloration. The spotting on the breast is slightly bicolored, as in *iliaca*, but it is more like that in *unalaschce*. Osgood (1904) evidently referred to one of these specimens adult taken by Johnson, and described it as "intermediate character between *iliaca* and *unalaschcensis*, but nearer to *iliaca*".

Swarth (1920), in his revision of this genus, properly recognized three fox sparrow groups, the *iliaca* group, the *unalascensis* group, and the *schistacea* group. He considered all to be subspecifically related, but this relationship is complex, not entirely clear. In the same general area occupied by *iliaca* group, as mentioned above, there are typical specimens of the *unalaschcensis* group. Osgood (1904) reported—

One specimen was taken and several were seen in the mountains near Iliamna Bay July 12; two others, one adult and one immature bird, were taken at Iliamna Village July 14; and another young bird was taken on Lake Iliamna at the Nogheling portage July 18. These agree well with birds from Shumagin Islands and localities to the westward on the Alaska Peninsula.

A specimen of typical *unalaschcensis* in fresh fall plumage was taken at Nushagak September 19; another, which is not quite typical, but comparable to *unalaschcensis*, was taken at the same locality by J. W. Johnson October 22, 1884.

The last two specimens just mentioned may have been migrants, though they were north of the known breeding range rather than south of it. But omitting these as possible breeding birds, there is hardly room for an area of intergradation between the known breeding ranges of these two well-marked forms. Osgood suggested many years ago, there does not appear to be gradual intergradation here. The intermediate specimens described above show the abrupt mixtures found in hybrids.

Apparently, *altivagans* is the form in which we may look for complete intergradation with typical *iliaca*. Specimens of *altivagans* available for this study did not show complete intergradation. Presumably this may take place somewhere in Alaska. On the whole, on the basis of material that is available at present, *iliaca* seems to be a species apart, although it may be possible to assume intergradation with *altivagans* somewhere in Canadian territory. Therefore, granting subspecific status, *iliaca* is an example of a subspecies that intergrades with another subspecies at one part of its range and becomes a species, with hybrids where it meets another subspecies of the same group, as at the base of Alaska Peninsula.

Serella iliaca unalaschcensis

The three subspecies of the *unalaschcensis* group that are involved in the present study are *unalaschcensis*, *insularis*, and *nuosa*. Minute examination of material available, which was strictly segregated into seasonal lots, brought out general differences as follows: All are brown in general coloration, but *unalaschcensis* is the palest and grayest of the three. *Insularis* averages darker, sometimes with a slight olivaceous trend, and often a markedly richer brown. *Sinuosa* is the darkest; in some seasons it is a deeper, "ruddier," brown, sometimes merely more sky. Probably the chief distinction of *sinuosa* is the darker, duskier, quality. These forms are very close and are very difficult to distinguish, especially the difference between *insularis* and *sinuosa*. Incidentally, in some instances it was found that even July specimens could not be assigned with certainty. August specimens, with their fresh plumage, were very satisfactory, but they were not comparable with spring specimens. Furthermore, it was found that considerable change takes place in the plumage during the spring from April through June, and apparently this change is much greater than the change that takes place throughout the entire winter period. It was only by a careful adherence to seasonal segregation of specimens that reasonable identification could be made.

The Shumagin fox sparrow, as stated above, is characterized by a grayer coloration, and some specimens from Unimak Island show this to a remarkable degree. In fact, fox sparrows from Unimak seem to be slightly different from fox sparrows in the Shumagins and the Peninsula. However, this extreme grayish character is not entirely consistent even among Unimak Island specimens, and it is possible that there is a slight dichromatism in this group. At least, there is variation.

We heard fox sparrows singing at Chignik, May 14, 1936, and on May 16, we saw them in the Shumagins on Unga, Nagai (abundant), and Popof (common). Specimens were taken. In August, they were very common in the alders at False Pass. On May 24, 1937, we saw several and collected two on Dolgoi Island. Gianini (1917) saw a few at Stepovak Bay. In 1911, Wetmore saw them in the mountains west of Morzhovoi Bay, and he found them nesting commonly at King Cove and at the east base of Frosty Peak. In 1940, Gabrielson saw the birds on the islands, Chignik Bay, and at Sand Point in the Shumagins.

There is an important specimen in the collection of the Museum of Vertebrate Zoology, at Berkeley, Calif., which is an adult male

taken by C. L. Hall at Unalaska, June 4, 1894. It is almost as gray as the specimens from Unimak Island, though the tail is slightly more rufescent. Speaking of this specimen, Grinnel (1910) says—

No Fox Sparrow has been previously secured from Unalaska 'unless the Aoonalashka Bunting of Latham really came from there' (Ridgway, Bird of North and Middle America, Vol. I, 1901, p. 389). So that the present specimen assumes a decided importance. This bird bears out all the characters of the race called *unalaschcensis*, as defined by Ridgway, and doubtless indicates the western limit of the range of that form.

In view of these uncertainties, Cahn (1947) makes an important contribution when he reports, for Unalaska Island "One was seen on June 5, 1944, at the foot of Mt. Ballyhoo."

The 1931 Check List gives Unalaska as part of the nesting range of the Shumagin fox sparrow, and the two records mentioned above may have been nesting birds. Yet, Harrold (Swarth 1934) says—

No fox sparrows were found on Akutan Island. The only cover consists of salmon-berry canes and a few stunted willows here and there, of an average height of about 18 inches. Unalaska, although having slightly larger bushes, was just as unfavorable, and none of this species was seen there either.

Apparently, the fox sparrow has occurred only sporadically on Unalaska, and actual nesting has not been established. It is interesting to note that a specimen was obtained by Hanna on St. Paul, Pribilofs, May 20, 1919 (which is in the breeding season) and an immature male was taken by Harrold on Nunivak Island on September 9.

So far as is known, Unimak Island marks the western limit of the breeding range of the Shumagin fox sparrow, as well as the western limit of a habitat that is typical and fully occupied. If the unique record from Unalaska was a breeding bird, it probably was an accidental occurrence. The regular breeding range extends eastward at least as far as the Shumagins and the Alaska Peninsula opposite these islands. Still farther eastward, on portions of the peninsula from which we do not now have specimens, this subspecies must merge so thoroughly with *insularis* that it would be impractical to separate them.

There are two specimens in the National Museum (Nos. 105767 and 184003) that are hard to identify. They are from Nushagak, taken on October 22, 1884, and on September 19, 1902, and may have been migrants. These specimens appear to be *unalaschcensis*. (Since these studies were made, Gabrielson has obtained many specimens from Alaska Peninsula, which have not been compared with the series here discussed.)

esting

The following is quoted from my field report for 1925:

On returning to False Pass from Urilia Bay I found the fox sparrow plentiful among the alders. May 13 they were singing everywhere. They are common both on Unimak and the Peninsula, among the alders. Two nests were found in the valley below Aghileen Pinnacles, June 2, constructed as follows:

No. 1. Outer structure of old brown coarse vegetation, mostly grass; inner structure of fine dry grass, a little porcupine hair, and a few feathers. Sunk in the ground on the side of a little bank, in moss, completely screened by almonberry stems and grass, 6 feet from edge of alder patch. Outside diameter 140 mm.; inside diameter 70 mm.; depth 68 mm.; five eggs.

No. 2. Outer structure of dead grass, inner structure finer grass, with a few feathers, the whole sunk evenly in the ground under some large overhanging alder stems. Ferns were just emerging near rim. Outside diameter 100 mm., inside diameter 70 mm., depth 47 mm.; five eggs.

Passerella iliaca insularis

This is the bird of the Kodiak-Afognak Island group, though specimens have been taken elsewhere. It undoubtedly occurs on adjacent parts of Alaska Peninsula and nearby islands, though the limits of its breeding range are unknown. There are two specimens taken by Osgood at Lake Iliamna on July 12 and July 14, 1902. These are intermediate in character, but probably should be called *insularis*. Furthermore, two others taken by Osrood at Hope, in Cook Inlet, also appear referable to *insularis*. We obtained two specimens on the Barren Islands on May 10 and May 11, 1936, that are referable to *insularis* in comparable plumage. I have not examined a specimen taken by Hine in Katmai River Valley, July 9, 1919, and I have not examined specimens from the Semidi Islands, which also are available.

In summary, *insularis* is the fox sparrow of the Kodiak-Afognak Islands, Barren Islands, and (according to a few available specimens) the adjacent parts of Alaska Peninsula. Probably it extends eastward for an unknown distance to merge with *inuosa*, and westward to the range of *unalaschensis*.

We observed many of these birds, singing, on May 12, 1936, on Kodiak Island, and on the next day on Deranof Island near Afognak; we saw them on Afognak on September 2. Gabrielson noted the birds on Kodiak and Afognak in June 1940, and on that occasion he thought that it was the most abundant bird on Afognak.

Melospiza lincolni*: Lincoln's Sparrow**Melospiza lincolni lincolni***

Birds observed in the Cook Inlet region by Osgood evidently were considered to be the typical form, for he says (1901)

An adult male was taken at Hope August 28, and a few others were seen while we were there. The specimen taken shows none of the characters attributed to *Melospiza lincolni striata* [*gracilis*].

On July 27, 1940, Gabrielson collected a Lincoln's sparrow at the upper end of Iliamna Lake, the only record we have for the base of Alaska Peninsula.

***Melospiza melodia*: Song Sparrow**

Attu: *Chü-gu-chigh*

Atka: *Chig-wiach*

The song sparrows occupy the Aleutian district (as here defined) from Attu Island to Kodiak. Gabrielson and Lincoln (1951), who reviewed the Alaskan song sparrows, have characterized them as follows, to state the matter very briefly.

Melospiza melodia maxima

Described as a new form, differing from *sanaka* in being browner, with a larger beak. Range extends from Atka to Attu

Melospiza melodia sanaka

Grayer in color. Range extends from Seguam Island, in the Aleutians, eastward to Stepovak Bay on Alaska Peninsula and to the Semidi Islands, including other islands south of the western part of the peninsula (Sanak, Shumagins, and many others).

Melospiza melodia amaka

This is a new race, described by Gabrielson and Lincoln—

Resembles *maxima* from the western Aleutians in color and extensive brown markings, but somewhat more heavily marked with brown than that race both on back and breast; in most available specimens the brown markings also somewhat brighter. Closer in color to *maxima* than to the geographically closer race *sanaka*. Bill short and stubby as in *sanaka*. Range, confined to Amak Island, a rocky island north of the west end of Alaska Peninsula some 15 miles.

A distinct subspecies that is confined to a single island, such as Amak, may seem incongruous when one considers the extensive ranges of the other forms. However, Amak is somewhat



FIGURE 41.—Aleutian song sparrow.

more isolated from other song sparrow range than is suggested by the short distance from the mainland. The adjacent mainland is not song sparrow habitat. Quoting from my field report for 1925—

In general, the song sparrows occur on the Pacific side of the Peninsula and Unimak and do not occur on the Bering Sea side, which is due to the topography of the country. The Bering Sea shores are low and sandy, while the Pacific side, with deeper water, is rocky, with boulder-strewn beaches—the chosen habitat of this bird. An exception is Amak Island, a rugged island on the Bering Sea.

Melospiza melodia insignis

This bird is somewhat smaller and darker than *sanaka* “with a sooty wash that noticeably obscures the markings and tends to make the color more uniform.” But it is paler and grayer than the next race to the east. Its range is the Kodiak–Afognak island group, Barren Islands, and generally the adjacent base of Alaska Peninsula. There is a long gap to Stepovak Bay from which specimens have not been taken.

Upon arrival in the Aleutian district, one is impressed with the large size and the habitat of these sparrows. They are largely

littoral, living in boulders or on cliffs, although they ascend in grassy areas to nest. Here, as elsewhere, the song sparrow seems to delight in finding a mass of driftwood, which it substitutes for the brush heaps of interior country in the south.

Song sparrows often frequent buildings, especially unbarabaras or huts. In a cabin on Herbert Island, August 22, 1936, Scheffer found 30 dead adult and immature song sparrows, together with several individuals of other species. Evidently, they had entered by a small opening and failed to find a way out. On Segula Island, I found a dead immature song sparrow floating in a keg of water at a trapper's cabin.

On Kasatochi Island, a song sparrow was seen within the crater rim, which rises about 1,000 feet above the beach. However, the inner walls of the crater descend abruptly to a crater lake, far below, creating an aspect of a sloping cliff above water as on the seashore.

These sparrows nest in the grass on slopes adjacent to the beach. We found a nest at East Anchor Cove, Unimak Island, May 19, 1936. It was in ryegrass on a slope a considerable distance from the beach. The nest was tucked away under a mass of dead grass and was made of fine, smooth, nicely bleached grass stems. There were three downy young.

A similar nest, in a similar situation, but abandoned, was found on Unimak Island, June 7, 1936. On Kiska, June 5, 1936, Steenis found a nest containing three eggs. It was placed deep in the vegetation and was built of fine grass stems. Incidentally on that same day, Douglas Gray reported a curious performance—a song sparrow followed him along the beach for about a mile.

Cahn (1947) reports that the song sparrow was abundant on Unalaska Island from April 7 to September 22, 1945. He found that the young left the nest by early July; a second nesting was suggested by observing a nest with newly hatched young on August 8, 1945.

Although there may be local movements due to the approach of winter, the song sparrows of the Aleutian district are permanent residents. Cahn reports them to be absent in winter in the Dutch Harbor area, but Taber found them all winter on Adak and Sutton and Wilson (1946) found them in winter on Atka. As this sparrow evidently finds its food on the beach at the tidal edge, subsistence is possible year round where the sea never freezes and where the ebb and flow of tide is dependable.

Alcarius lapponicus: Lapland Longspur*Alcarius lapponicus alascensis*Attu: *Chir-loch*Atka: *Chir-loch*Unalaska: *Chelookh* (Wetmore)Commander Islands: *Tschelutschjek* (Stejneger)Chukchi: *Tumkup* (Palmén)

This is one of the most common passerine birds throughout the Aleutian chain, the Alaska Peninsula, and adjacent islands, and it also occurs on Nunivak Island and the Pribilofs. The Alaska longspurs probably inhabit every island in this district some time of the year. Furthermore, this bird has a well-distributed habitat, ranging from the beach line to the upper mountain sides and lava beds, although it evidently prefers grassy flats and slopes. We saw them on the flat lowlands at Kashik River, on the sand dunes at Uria Bay, as well as on the slopes of such islands as Amak, Ananiuliak, and Uliaga.

The Attu chief stated that longspurs leave Attu in August and return early in April. This is fairly well verified by Beals and Longworth, who reported in 1941 that the first longspur was seen on Unimak Island on April 16. They further stated that none were seen when they returned to the island, August 31. We noted longspurs on Sanak Island as late as August 28.

In 1925, I had an opportunity to note the progress of the nesting season at Unimak Island and Alaska Peninsula. The first longspurs, two small groups, appeared among the sand dunes at Uria Bay on April 30. A few were seen each day afterward; they were heard singing on May 3; they were common and were heard singing on May 5; and they were numerous on May 8. On May 16, they were noted as common at False Pass; they were common at St. Catherine Cove on May 17; and were common on May 28 at Izembek Bay. On June 14, a nest of four eggs was found on Hazen Point, Izembek Bay, and, the following day, a number of specimens were taken. The females of this group of specimens had brood patches, which were absent on the males. On June 18, 1936, we found a nest on Segoum Island. It was hidden in the vegetation and was built of fine dried grass stems with a few longspur feathers. There were four young, with yellow down.

On May 24, 1937, longspurs were common on Dolgoi Island; they were singing, and some of them evidently were nesting. On June 1, they were very active, singing, on Atka Island—this probably was at the height of the nesting period. On June 22, I found a nest with 5 eggs in a clump of anemones on Little Kiska

Island, and Steenis found another nest with 4 eggs. Apparently the male sings throughout the entire nesting period.

In 1936, young birds on the wing were seen as early as July. On July 11, 1937, four or five young birds were seen flying above Amchitka Island. On August 22, Scheffer found 2 dead longspurs in a cabin on Herbert Island, together with 30 dead song sparrows.

The Alaska longspur is lighter in color than typical *lapponicus*. Concerning the birds of the western Aleutians, Ridgway says (1901), "The great contrast in coloration is just as marked between specimens from the extreme western Aleutian Islands (Atka, Adak, and Attu) and the extremely dark form (*C. coloratus*) of the Commander Islands as between the latter and specimens from the Pribilofs and Unalaska."

Plectrophenax nivalis: Snow Bunting

Plectrophenax nivalis nivalis

It is probable that some eastern snow buntings winter in the Aleutian district. According to Ridgway (1901), this form winters at Unalaska, the Shumagins, and at other points in southeastern Alaska. Osgood (1904) reports—

One specimen was taken on the beach at Nushagak, September 20, and another was seen in company with it. A small flock was seen on Becharof Lake, October 6, and a few more were seen in the mountains between Becharof Lake and Kanatak. Numerous specimens were taken at Nushagak, McKay and Johnson. Most of these are winter birds, but at least one (1110128) is in full nuptial plumage. It was taken July 3, 1886, which would indicate its breeding in the vicinity. It also breeds at Cold Bay, where Mendenhall found it nesting in high rocky cliffs in the summer of 1903.

Hine (1919), and other members of the 1919 expedition of the National Geographic Society noted snow buntings on mountain tops of the Katmai region and in Katmai Canyon. A pair were noted, singing, in upper Mageik Creek. These observations indicate nesting.

Specimens from Kodiak have been taken in the migration period, but Turner (1886) states that he saw these birds "at Kodiak in the early part of August, 1881. At the latter place young birds of the season were abundant." On June 18, 1940, Gabriels noted snow buntings on the Semidi Islands.

Howell (1948), reporting for 1944, says of the snow bunting on Kodiak Island—

Seen only on the top of a mountain near Bell's Flats. Here ten were seen on June 25. They were above the snow line near the crest of the mountain at an elevation of about 2500 feet. Numerous bare areas in the extensive

low fields were overgrown by low grass. In one of these a nest was found high contained five young three days old. The nest was in a crevice in some rocks that was too small to admit my hand until some overhanging moss was removed.

Thus, we know that the eastern snow bunting nests in suitable places on Kodiak Island and at the base of Alaska Peninsula, westward as far as Becharof Lake, and probably in the Semidis. It may be assumed that *nivalis* intergrades with *townsendi* somewhere on Alaska Peninsula.

Lectrophenax nivalis townsendi

Attu: *Kó-ka-noch*

Atka: *Math'-a-wach*

Unalaska: *Masnikh* (Wetmore)

Russian, Commander Islands: *Sniegírok*, plu. *Snegírki* (Stejneger)

Russian: *Snegír* (Zitkow, Birula) or *Seryi Snegír* (Tolstow)

Chukchi: *Ptochekadlin* (Palmén)

This snow bunting nests throughout the Aleutian Islands, preferring the high, rocky terrain. We considered it likely that snow buntings inhabited most of these islands.

Turner (1886) observed snow buntings at Belkofski in July 1881, and Gianini (1917) found snow buntings in the mountains at Stepovak Bay. In 1911, Wetmore found the birds to be common in the mountains near Morzhovoi Bay. Without question, snow buntings nest in the high country throughout Alaska Peninsula. Somewhere along this Aleutian Range, probably well to the east, *townsendi* must intergrade with *nivalis*. Of course, *townsendi* is known to nest also on Nunivak, the Pribilofs, the Komagins, the Commanders, and the Bering Sea coast of Siberia.

In 1925, I observed snow buntings at King Cove on April 25, and on April 26 and 27 I saw more of these birds at False Pass. Subspecific identification was not made in these instances, but, later, the birds were found on the nesting grounds and were identified as *townsendi*. On May 4, a male was heard singing among the lava beds near Uruilia Bay, Unimak Island, where they were common. Soon, their songs were ringing everywhere in the rugged lava. Later, they were found among the high rocks at False Pass; at the head of the valley near Aghileen Pinnacles; on the rocky slopes of Frosty Peak; on Amak Island; and on Katan Peninsula. Immature birds were flying about on Amak Island on July 11. On August 10, at Ikatan, a family of young birds on the beach was observed learning to fly.

In 1941, Beals and Longworth found snow buntings on Unimak Island all winter.

In the Aleutians, the snow bunting is found from the shoreline to the high mountains, but it seems to prefer the mountains.

The nest of the snow bunting may be placed among lava rocks in crevices or cliffs, or under a ledge of a rock on fairly level terrain. On June 4, 1937, Douglas Gray found a nest with three eggs under an overhanging rock on Kiska Island.

On June 12, 1937, on Agattu Island, I found two nests. One was in the form of a deep grassy cup, with a few feathers worked in, placed under a ledge of a flat rock on fairly level ground. It contained four eggs.

The other nest was located under an overhanging boulder, and it had feathers of a forked-tailed petrel woven into the structure. This nest also contained four eggs.

On June 14, also on Agattu Island, a similar nest made of grass was found in a hollow under a flat rock. There were four eggs.

According to the Attu chief, the snow bunting is a permanent resident in the Near Islands.

Plectrophenax hyperboreus: McKay's Bunting

This species nests only on Hall and St. Matthew Islands, but occurs in migration in the Aleutian district. Nelson (1887) describes a bird of this species taken at Unalaska in January, and several specimens were taken at Nushagak Bay by McKay and Johnson. Without doubt, this bird is quite common on Alaska Peninsula and the Aleutian Islands in winter.

Emberiza rustica: Rustic Bunting

Emberiza rustica latifascia

The only record of this species for North America is a small series of skins obtained on Kiska Island in June 1911 by Wetmore and F. B. McKechnie. On June 17, Wetmore found a dead bird which was estimated to have been dead about a month, and another dead bird was found by McKechnie. In his field notes Wetmore says further—

On June 19, while making the rounds of my traps, I flushed a small bird that flew up with a faint *tsip*, and dove immediately into the grass along creek. The flight was quick and with an up and down motion, and the bird showed two white outer tail feathers. I flushed it again after some tramping and shot it on the wing, and found it a fine specimen of the bird found the seventeenth. A hundred yards further I flushed another on a grass slope, and missed it the first time. When it got up again I shot it, but the wind carried it so that I was not able to find it, though I searched carefully. No others could be found. The one taken was a female, in fine plumage, but exceedingly fat.

Apparently, these birds represented a straggling group that had landed on Kiska Island. On our visits to Kiska Island in 1937 we spent considerable time on lowlands and uplands, but we did not encounter this species.

Mammals

Family SORICIDAE

Sorex cinereus: Cinereous Shrew *Sorex cinereus hollisteri*

This western Alaska form of *cinereus* is distributed throughout the length of Alaska Peninsula and on Unimak Island. A mummified specimen from Tigalda Island, obtained by Stevenson in April 1925, marks the westernmost record of this shrew.

More than 200 specimens have been collected, chiefly in the district here under discussion. We have specimens from the basal parts of Alaska Peninsula and adjacent territory, including such localities as Nushagak, Kakwok, Lake Aleknagik, Lake Clark, Iliamna Lake, Katmai, and Becharof Lake. There are specimens from Port Moller, Cold Bay, Chignik, King Cove, Frosty Peak, Izembek Bay, and Unimak Island, but we have no specimens from Kodiak-Afognak Islands, the Shumagins, or other outlying islands.

In 1925, I found these shrews to be abundant at Izembek Bay and I obtained specimens at Uruia Bay, St. Catherine Cove, and False Pass on Unimak Island. They were found in the grassy margin of ponds as well as on the higher tundra. On May 5, 1925, as Donald Stevenson and I came upon a high grassy flat above a lagoon at Uruia Bay, we heard a faint squeaking in the grass and caught glimpses of shrews darting here and there. This is a quote from my notes:

I imitated the squeaks, and presently a shrew came bobbing over the grass right up to me and I pounced on him. Soon another came along in response to my squeaking, but disappeared in a tuft of grass. Then a third came up and I caught him. Stevenson caught another and we missed several. These shrews came from a distance of 20 to 25 feet. Those caught (original Nos. 1979, 1980 and 1981) were all males, with enlarged testes. They probably responded to the squeaking in the spirit of battle with another male, or perhaps with the expectation of finding a female.

Stevenson trapped two females at Izembek Bay; one had 1 embryo, and the other had 8.

***Sorex tundrensis*: Tundra Saddle-backed Shrew**

This well-marked shrew is represented by specimens from Ushagak, Kakwok, Lake Weelooluk, and Lake Aleknagik. Robert C. Orr (1939, p. 251) records a more-recent specimen taken by Dallas Hanna in 1937 at Wide Bay, which is the farthest west that this animal has been recorded. Lack of other specimens suggests a limited distribution farther west on the peninsula.

***Sorex hydrodromus*: Unalaska Saddle-backed Shrew**

In view of the uncertainties concerning the Unalaska saddle-backed shrew (the only known specimen is in Russia), every effort was made to obtain specimens, but without success. Our stops at Unalaska were necessarily brief, and no shrews of any kind were found.

In 1911, Wetmore was told by the natives that shrews were present on Unalaska Island, but no specimens were taken.

Donald Stevenson, who spent 5 years in the Aleutians from 1920 to 1925, had reports of shrews on Unalaska, but he got no specimens.

Therefore, the original specimen and description are all we have on this species. In 1937, E. Raymond Hall had an opportunity to examine the original specimen in the Zoological Institute of the Academy of Sciences in Leningrad. He has kindly furnished a copy of his notes, which are here quoted in full.

ADDITIONAL EVIDENCE INDICATING THAT
SOREX HYDRODROMUS DOBSON IS A MEMBER OF THE *SOREX*
ARCTICUS GROUP OF SHREWS

Sorex hydrodromus Dobson from Unalaska Island, Aleutian Islands, Alaska, was diagnosed in the original description (*Annals and Mag. Nat. Hist.*, ser. 6; vol. 4 p. 373, November 1889) as resembling *Sorex vulgaris* of the Old World in dental characters but resembling *Neosorex* in possessing swimming fringes on the digits. Jackson, who was unable to examine the type specimen or topotypes, in his "A Taxonomic review of the American long-tailed shrews" (*N. Amer. Fauna* No. 51, July, 1928) tentatively assigned the species to the *Sorex arcticus* group, with the suggestion that *S. hydrodromus* might be the same as *Sorex tundrensis* or at most subspecifically distinct.

Bearing in mind the uncertainty as to the relationships of this shrew, I was glad to take advantage of the opportunity which Prof. B. Vinogradov and his assistant, Mr. A. J. Argyropulo, afforded me to study the type specimen when I visited the Zoological Institute of the Academy of Sciences in Leningrad in August 1937.

The assumed type is an immature female, no. 2389, Zoological Museum of the Academy of Sciences of Leningrad, Union of Soviet Socialist Republics, collected by I. G. Vosnesensky at Unalaska, Aleutian Islands, Alaska, some

time between 1840 and 1848 (see Essig, E. O., p. 777, "A History of Entomology," The Macmillan Co., New York, 1931).

The specimen was preserved in alcohol, in a small jar containing another specimen. An unattached label in the jar bears the catalogue number 2389, "Unalaska" and "Wosnesensky". A label on the outside of the jar bears the data given on the label inside the jar and also the words "*Sorex hydrodromus* type". The specimen is poorly preserved and has lost much of the hair. From the parts preserved, it is ascertainable that the animal was darker-colored above than below. The hairs remaining on the tail are of the same reddish color on the top, bottom and sides of the tail. Dissection of the specimen revealed the uterine horns as small structures which certainly had not recently contained young. Upon removal, the skull was found to have the left side of the brain case broken in and to be broken in two along the plane of the cribiform plate. Fortunately, another specimen, an adult female, containing 6 embryos, 5.8 mm. in crown-rump length, taken at Unalaska by Vosnesensky in 1848, is available at the Zoological Institute at Leningrad. This specimen, no. 2370, also an alcoholic, proved to have a perfect skull. Nos. 2389 and 2370, measured respectively as follows: Total length, 97, 93; length of tail, 42.8, 32.6; length of hind foot, with claws, 13.4, 12.3.

Species and locality	Catalog Number	Sex	Condylobasal length	Palatal length	Cranial breadth	Interorbital breadth	Maxillary breadth	Maxillary tooth row	Wear of teeth	Remarks
<i>Sorex hydrodromus</i> : Unalaska.....	2389	♀ yg	16.1	6.0	8.2	2.8*	4.45	5.3	None	Type, body in alcohol
<i>Sorex</i> : Unalaska.....	2370	♀ ad	16.0	6.3	8.0	3.2	4.7	5.6	Moderate	Body in alcohol
<i>Sorex pribilofensis</i>	2437	? ad	?	6.1	7.8	3.2	4.8	5.55	Moderate, but less than above	Coll. by Vosnesenski

* Probably least interorbital breadth.

The hairiness of the tail is about the same in no. 2370 and *Sorex arcticus* No. 39709, of the Mus. Vert. Zool., from Barrow, Alaska, and the fringe of hair on the sides of both the fore- and hind-feet are not appreciably different. The skull of no. 2370, compared with M.V.Z. 39710 (one of the specimens of *S. tundrensis* taken with me from the United States to use in comparison), has less protruding upper incisors and a slightly "flatter" brain case, due in each instance, I think, to the greater age of no. 2370, which, however, is smaller in every measurement taken. Otherwise, when viewed from the side the two skulls have identical contour in the dorsal longitudinal axis. Also, when the same two skulls are viewed from directly above they are, to my eye, of identical outline excepting in the rostrum, which appears to be broader, relative to its length, in no. 2370, even allowing for the lesser protusion of the incisors in that specimen—a circumstance which magnifies the impression of greater relative breadth.

When comparison is made between *Sorex pribilofensis* (cat. nos. 2485 and

2437 of Leningrad Acad. Sci.) from St. Paul Island, and no. 2370, the latter is seen to differ in wider (labial to lingual side) molars, seemingly broader rostrum and certainly less continuous ridge on unicuspid. In *S. pribilofensis* there is a ridge continuous from the tip of the unicuspid on down into the cingulum without a break, whereas in no. 2370 from Unalaska there is a notch, or break, in this ridge where it meets the cingulum, although the notch is shallower than in a specimen of *Sorex tundrensis* (no. 39710, Mus. Vert. Zool., from Barrow, Alaska) which may be said to have a distinct notch separating the internal ridge from the cingulum. In no. 2370 the pigmentation stops short of the cingulum. The holotype of *Sorex hydrodromus* agrees with no. 2370 in the presence of the notch and in the extent of the pigmentation. Nevertheless, in the holotype of *hydrodromus* the molar teeth are narrower than in no. 2370 and about the same width as in *Sorex pribilofensis*.

My conclusion is that *Sorex hydrodromus* is a recognizable kind (species or subspecies) of *Sorex* best placed in the *arcticus* group. In structure of unicuspids it bridges the gap between *S. tundrensis* and *S. pribilofensis*. If specimens from the base of the Alaska Peninsula are morphologically intermediate between *S. hydrodromus* and populations of *S. tundrensis* east of the base of the Alaska Peninsula, perhaps *S. hydrodromus* should be treated as only subspecifically distinct from *S. tundrensis*—otherwise as a full species. To judge from measurements (published by Ognev in Vol. I of his "Mammals of the U. S. S. R.", 1928) of the various subspecies of *Sorex ultimus*, *S. hydrodromus* is a smaller animal.

In a further communication, Hall expressed the opinion that *hydrodromus* probably should rank as a full species rather than as a subspecies. In that connection, it is interesting to note that from Unalaska to the Bristol Bay region there are hundreds of miles of territory from which no specimens of saddle-backed shrews have been taken. This would indicate ample isolation on Unalaska for the formation of a species.

Sorex obscurus: Dusky Shrew

Sorex obscurus shumaginis

Unalaska: *Chichimukthah* (Wetmore)

In southwestern Alaska, this shrew has a range that is roughly coextensive with that of *S. c. hollisteri*. About 200 specimens are available in the Fish and Wildlife Service collection, some of which are from the following localities: Nushagak River, Kakwok, Lake Aleknagik, Ugaguk River, Dillingham, Cold Bay, Becharof Lake, Katmai, Chignik, King Cove, Morzhovoi Bay, Port Moller, Frosty Peak, Izembek Bay, Unimak Island, and the Shumagins. In 1937, on Sanak Island, I obtained a shrew that proved to be *shumaginis*.

In the field, we noted that this shrew was about as abundant as *hollisteri*, and that it inhabited grassy areas and wet places. Wetmore reported it to be especially abundant along little streams.

At Sanak Island, where this shrew is common and is known as the "pig-nosed mouse," it readily enters buildings.

It is of considerable interest that *S. o. shumaginensis* occurs on island groups, such as the Shumagins and Sanak, while specimens of *S. c. hollisteri* have not been obtained from such localities apparently being confined to the Alaska Peninsula and Unimak. The picture may change, however, with more extensive field work. At present, we have no specimens of shrews from the Kodiak-Afognak group.

***Microsorex hoyi*: Pigmy Shrew**

Microsorex hoyi eximius

Only 2 specimens of this rare shrew have been obtained in this district—one was taken by Maddren on the south branch of Chulitna River (west of Lake Clark), and another was taken 80 miles up the Kakwok River.

Family VESPERTILIONIDAE

***Myotis lucifugus*: Little Brown Bat**

Myotis lucifugus alascensis

We saw no bats on any of our expeditions, but Osgood (1904) mentions seeing several of them, presumed to be this form, at Iliamna Village and near the head of Lake Clark, in July. True (1886) records a specimen taken by McKay at Iliamna Lake in the spring of 1882, and he mentions many specimens taken by W. J. Fisher on Kodiak Island.

Captain G. A. Amman has compiled a list of birds, mammals and plants, which were observed or collected chiefly by him or by Private Edward D. McDonald, while stationed on Kiska Island with the 87th Mountain Infantry Regiment from August 15 to December 5, 1943. Included in the list is a bat observed at Kiska. Naturally, this would not represent a resident species, because a bat could not survive in the environment of the Aleutians. It would have to be a storm-driven waif that had been blown a great distance from its normal territory.

Family URSIDAE

***Euarctos americanus*: Black Bear**

Kenai, Indian: *Terdeeshlah* (Osgood)

Osgood (1904), concerning the distribution of the black bear, stated that—

The Indians of Iliamna village say that according to tradition a few black bears were formerly found in the mountains northeast from there, but that in recent years none have been seen. As far as we could learn they do not occur elsewhere in the region. Their westward limit on the Pacific side of the peninsula is about coincident with that of the coniferous trees, which cease a short distance east of Iliamna Bay. The westernmost records of the black bear known to the writer are those of two killed at Chinitna Bay in 1901 by the party of J. H. Kidder, of Boston, Mass.

True (1886) mentions the skins of two young bears brought in to Kakwok on April 30, 1882. Osgood suggested that these may have been the young of the large brown bear.

Nelson (1886) probably was confusing this species with the brown bear when he stated that it occurred throughout the Alaska Peninsula and Unimak Island, as well as on Kodiak. He also refers to Veniaminof's statement that the black bear was found on the "easternmost" of the Aleutians. There is no evidence that the habitat of the black bear extends beyond the last timber at the eastern end of Alaska Peninsula.

Ursus arctos: Brown Bear

Ursus arctos gyas

Aleut, Alaska Peninsula: *Tunarokh* and *Chuchiuk* (Wetmore)
Tanghakh or *Tanghaghikh* (Geoghegan)

For many years there has been much speculation about the status of the large number of so-called Alaska brown bears, as described years ago by C. Hart Merriam. In the first place, early writers were inclined to consider all of the "brown bear" forms on both continents, to be of one species. In 1954, Marcel A. J. Couturier published a monograph, "L'Ours Brun," on the brown bears and grizzlies of the world, putting them all into one species, *Ursus arctos* L. In 1953, Robert Rausch adopted the one species, *Ursus arctos*, for the grizzly and the brown bear.

We find great individual variation in size and color in the same locality. In his color movies of bears in the Mount McKinley region, Adolph Murie shows a small, very light-colored male and a large dark male, both near a rather large female. At the approach of the large male the small, light-colored male arose on his hind legs, looked over the large newcomer, then fled. Some grizzlies in this region are nearly white, many are shades of brown, and, in 1953, my brother and I skinned a large grizzly that had been shot at a road camp. This animal was black, with a little brown tipping to the hairs, which was not noticeable at a little distance.

In his studies, Rausch also found much variation in the skulls from a given locality. Without attempting to revise the whole

group of Alaska grizzlies, on the basis of my field observations and the studies I have cited above, it seems wise to assume North American and Palearctic bears of the brown group conspecific. Furthermore, in view of my field observations and as a result of the more recent work of Rausch, it seems improbable that there is more than one form occupying Alaska Peninsula. Therefore, I list for the Alaska Peninsula only one subspecies, *U. a. gyas*.

The great size of the Alaska brown bear has caught the imagination of the public, and it is a favorite trophy for the sportsman, as well as for the camera enthusiast. The estimates of weight of this animal probably are not greatly exaggerated.

Necessarily, most of the information on weight is based on estimates, but some authentic figures have been reported.

Loring (1907) gives the weight of one bear as 1,010 pounds.

There are some interesting data on a male bear, *Ursus gyas*, that lived for many years in the National Zoological Park in Washington, D. C. The bear died September 30, 1914, and was measured by Vernon Bailey. A record of weights, kept since its capture at Cape Douglas, Alaska Peninsula, on May 24, 1901, were published by Townsend Whelen (1946) as follows:

	Pounds
May 24, 1901	18
January 9, 1902	180
June 15, 1903	450
January 18, 1904	625
January 28, 1905	770
February 26, 1906	890
March 11, 1907	970
March 21, 1908	1,050
January 20, 1911	1,160
September 30, 1914	1,020

Measurements of this bear, taken by Vernon Bailey at time of death, were as follows: Total length, 2,590 mm.; tail vertebrae, 120 mm.; length of hind foot, 350 mm. (claws were worn short); height at shoulder, 1,380 mm.; girth back of shoulders, 1,760 mm.; girth at belly, 2,305 mm.

The bear had attained an age of about 13½ years; cause of death was attributed to rupture of the abdominal aorta. At time of death, it was described by Bailey as being "in fine muscular condition, but not fat."

Allen (1904) reports the measurements of a specimen taken at Port Moller as follows: Total length, 2,057 mm.; tail vertebrae, 127 mm.; hind foot, 349 mm.; shoulder height, 1,068 mm.; weight, approximately 1,600 pounds. The weight was estimated.

Anderson (1909) obtained a bear, June 1, 1909, on Unimak Is-

land, that weighed 1,325 pounds—the skin weighed 135 pounds. Anderson gives the height at shoulder as 48 inches; height at hip, 3 feet 10 inches; girth back of shoulders, 10 feet; and width between ears, 14 inches.

McCracken (1920) obtained a bear at Frosty Peak, whose weight was estimated to be between 1,600 and 1,800 pounds. The tanned skin was 11 feet 4 inches long, and “the skull was 18¼ in. long one-half inch under the world’s record according to Washington, D. C. authorities.”

Beasley (1910) shot a bear at Port Moller that weighed 1,200 pounds.

I obtained a large male bear north of Pavlof Volcano, May 30, 1925. Total length was 2,100 mm. The skin, when laid out loosely, measured 11 feet. It made a heavy pack load, weighing well over 100 pounds. The bear was estimated to weigh roughly about 1,000 pounds. This probably was a conservative estimate because he was extremely fat. The fat on the rump was so thick that the tail bone was completely buried in the layer, and the tail itself was not visible. There were large bare places on both elbows, which were calloused as a result of the bear lying about on the rocks.

Brown bears have been abundant on Alaska Peninsula. McCracken (1924) says—

On my sojourn in the section around the western end of the Alaska Peninsula, which was in 1922 between the breakup of spring until August, I saw 190 brown bears. The fact that we saw 28 bears in a single day, and as high as 12 in sight at the same time, is in itself good evidence of the numbers to be found.

In primitive times, brown bears are said to have been gregarious and very plentiful. Even today, on Unimak Island, where the primitive state has been preserved, groups of at least seven or eight bears have been noted.

In areas that are extensively hunted, the large, old, male bears tend to become scarce, though there may be many females, younger animals and cubs.

The dates of hibernation are not definitely known, and no doubt there is much variation among individuals. Many bears probably come out of hibernation some time in April. Beals and Longworth (field report) saw their first bear on April 15, 1941; after this date, sightings became common. In 1925, I saw the first bear on May 5, ambling about the lower edge of the lava beds at Urilia Bay. The bear country on the mainland was not investigated until May 24. At that time, it was evident that the bears had

been out of hibernation for quite a while. The bears that we observed at this time were very sluggish, still fat, and apparently did not require large quantities of food. A local guide said that he once found a bear sleeping on a snow patch, and the trail leading to the bear had thawed away. The guide believed that bears sometimes remain several days in one spot.

In early spring, the bears remain high in the mountains, in the upper valleys, among the rocky ledges and high snowfields, as well as in the lava beds. During May and early June, there is still much snow in the mountains, especially in scattered deep drifts, and the weather is often cold and stormy. But the bears are immune to such weather and generally are seen resting on exposed rocky ledges or snow banks. This is their habitat until at least the middle of June, though a few may appear in the lowlands much earlier. Bear trails were found on the slopes of Pavlof Volcano and on many of the high ridges, as well as on the glacier in the shadow of Aghileen Pinnacles.

For the most part, the spring diet consists of grass and roots varied occasionally by a ground squirrel. The stomach of a male killed on May 24 contained a ground squirrel, various roots, and a mass of *Equisetum* (horsetail). A large male killed on May 30 had only a handful of roots in the stomach. The stomach of a female killed on June 3 was empty, but the intestines contained a considerable amount of grass. At this time of year, there is little else for the bears to eat, unless they occasionally find some carrion.

When the salmon ascend the streams in June, the bears seem to subsist largely on salmon. However, they do not entirely forsake the highlands. Long trails leading back to the highlands show the routes of travel down to the salmon streams, though the bears often sleep near the streams, in the alder thickets. The bears scoop out beds along the banks, and sometimes pile up moss and other vegetation to form a mattress. We found one such structure at Izembek Bay, and, in 1911, Wetmore described a similar heap found at Morzhovoi Bay, at a salmon pool: "On the bank above this was a curious bed of moss and grass dug up from the ground around piled up a foot deep and twelve feet square. Below it were smaller ones freshly made about two feet square and all padded down as though bruin had been sitting on them."

I have observed a bear capturing salmon only once. It took place in July 1925, when I was photographing a bear that was attempting to dig out a ground squirrel. The bear seemed to be

azy, and after a short time he stopped digging and ambled over to a shallow stream near my place of concealment. He splashed noisily through the stream and ran through some shallow riffles where he seized two or three of the swarming salmon with his teeth.

In some streams there were deep pools that showed claw marks on the bottoms and sides far underwater. Evidently, these marks were made by bears that were fishing, but the method of capturing salmon in such places was not observed.

In autumn, when berries ripen, a new food supply becomes available. On Unimak Island, the bears then seek the salmon-berry thickets and feed on the ripe fruit. Many other berries are eaten also. Osgood (1904) mentions crowberry (*Empetrum nigrum*), which are eaten in "great quantities," and various species of *Vaccinium*. There were indications that roots and grass are eaten in the fall, and it was reported that bears occasionally are seen on the beach, where they probably would eat anything edible that had washed ashore.

Bears are always on the lookout for carrion. Some caribou carcasses appeared to have been eaten by bears, but there was no indication that the brown bear will kill caribou under normal circumstances.

A striking feature of the brown-bear country is the characteristic bear trail. In marshy ground, the bear trail forms a well-marked path, in which a man can sink to the ankles. But on firm ground, on the higher mossy tundra, the trail consists of two well-defined ruts with a high center. In one instance, where the trail led over a slight embankment, the ruts had been worn so deeply that the bear's chest had rubbed on the high hump between the ruts. The bear had literally "high-centered."

One often finds a trail in which individual footprints are preserved. Each bear has carefully stepped in the tracks of his predecessors until the well-worn trail becomes a zig-zag series of holes. It was only with great effort that I could step far enough to walk in these tracks. This type of trail was usually found in the vicinity of a large boulder, where a bear was accustomed to lurk, or where the trail led to a den or some other local point of interest. The trails with uniform ruts generally extended for long distances.

Occasionally, an abandoned trail is evidenced by clumps of grass that have found a foothold in the disturbed ground in each footstep. Griggs (1922) mentions an interesting bear trail in the volcanic ash of Katmai, in which drifting grass seeds had lodged and taken root in the individual footprints.

Much has been written about the ferocity of the Alaska brown bear. The great strength of the bear cannot be doubted, but danger from this bear is dependent upon its disposition at given moment. There have been some disastrous encounters with this huge beast, but a detailed analysis of such cases will not be attempted here. However, during my experience on Alaska Peninsula there was not a single instance when the bear did not try to get away, even when wounded. One bear that was photographed at close range, a matter of some 30 or 40 feet, started for the photographer at the sound of the shutter, and I must admit considerable nervousness at the time, but it was obvious that he was advancing out of curiosity. The bear fled when we shouted and brandished a rifle vigorously. On the same day, another bear, coming slowly along a trail straight for the camera, heard the camera at close range and stopped. This bear was more suspicious and walked off reluctantly, obviously puzzled. In neither case did I wish to shoot, unless it was unavoidable. Indeed, except for a head shot, it might have been dangerous to shoot at such close range.

Apparently, some residents of Unimak Island had little fear of the brown bear. Arthur Neumann related that on one occasion he had forced a group of bears into the rough water of Swanson Lagoon on a stormy day to watch them struggle with the choppy waves.

The Alaska brown bear deserves respect and should be approached carefully, because it can cause considerable damage for a few moments even after being shot through the heart. It is best to realize that although this bear is not particularly vicious it is very curious and is likely to investigate anything unusual. The bear's eyesight is not good, which may account for its close approach at times.

An interesting incident occurred on the slope of Pavlof Mountain. A companion and I sighted several bears high on a slope. At the first shot, the largest bear rolled downhill, obviously shot in the head (incidentally, this was a regrettable shot because the bear was wanted for a specimen). Three other bears followed the rolling carcass, pell-mell, and it was apparent that they were yearling cubs that were instinctively following the mother. The mother rolled by very near us, and dropped off a small cliff at that point. The three young bears followed headlong, and we could hear them grunting, but at the very brink of the little cliff they suddenly braced themselves and stopped. After a detour, they approached the dead bear farther down the slope.

it suddenly they became frightened and fled. Either the death of the mother, or our scent, had frightened them. Upon examination, it was discovered that there was a small amount of milk in the udders of the mother. Next day, the cubs were seen again on the same mountain slopes; they were wary and seemed able to shift for themselves.

It has been said that the female brown bear has cubs only every other year, or only over an interval of three years. This may be true, for the female mentioned above had no young cubs that year, and there may be some irregularity and individual variation in the breeding cycle. The young number from two to four; two are the usual number.

According to some reports from the western end of Alaska peninsula, brown bears may go into hibernation in December, as late as Christmas. Osgood (1904), speaking of the base of the peninsula, on the authority of natives there, said that they go into hibernation early in November, and even in October, but he holds that the time of hibernation may vary with the severity of the weather. They occasionally may emerge during the winter.

Brown bears find dens in the lava rocks. I was told of several such caves at the north base of Shishaldin Volcano on Unimak Island. They are said to extend for a distance of as much as 100 feet. In 1925, I explored such a cave in a lava bed near Shishaldin. It formed an underground tunnel some 30 or 40 feet long and proved to be unoccupied at the time, though there were large footprints on the floor.

Ursus arctos middendorffi

This has been assumed to be the largest of all the Alaska brown bears, though Merriam, in his monograph on these animals, suggests that the peninsula bear may be fully as large. With information at hand, we are not in a position to decide.

This bear occupies the Kodiak-Afognak Island group, apparently including some of the smaller islands. E. M. Ball, of Afognak, writing to Barton W. Evermann, of the Bureau of Fisheries, January 10, 1914, says—

It is true that the brown bear is found on Shuyak and Raspberry Islands, as well as Afognak. The east end of Raspberry Straits is very narrow and shallow and is often dry during heavy ebb-tides so that bears can cross from one island to the other without entering the water. It is highly probable that they swim across these straits. Presumably there are only a few bears on Raspberry at this time. On Shuyak, however, bears are comparatively plentiful, and the number is believed to be fairly constant. Local hunters seldom go that far for them. Shuyak Straits are narrow and deep, and there may be some travel to and from Afognak Island.

Bears should have no difficulty reaching any of these islands because residents of Unimak Island stated that bears have been known to swim across Isanotski Strait, from the Alaska Peninsula.

I have not had firsthand experience with this Kodiak bear, but undoubtedly its habits are quite similar to those of the Alaska Peninsula bears. At times, the bears have interfered with domestic stock raising on Kodiak Island, but I have no recent information, and there is no report based on consistent study of the question.

Thalarctos maritimus: Polar Bear

Thalarctos maritimus maritimus

Information on the occurrence of the polar bear in the Aleutian district is vague and unsatisfactory. In volume 2 of "Voyages of Captain James Cook", mention is made of white bear skins seen in Prince William Sound, in May 1778. Evermann (1922) lists the polar bear among the marine mammals of the Pacific. They have been known to occur on the Pribilofs, and Preble and McAtamney (1923) quote W. L. Hahn to the effect that the latter had found the St. Paul Island log, "under date of September 20, 1874, an entry stating that a party visited the cave on Bogoslof and brought back a bear skull known to have been there since the time of the first occupation of the island."

This is the most definite record we have for the Aleutian district, though St. Paul is several hundred miles north of the chain. Polar bears could visit the Aleutians or Alaska Peninsula only by means of ice floes drifting south—no doubt this is possible, but it would be a rare occurrence.

Family PROCYONIDAE

Procyon lotor: Raccoon

Turner (1886) reported, "I have heard, on what I consider a reliable authority, that the Raccoon is not uncommon in the southern portions of the Alaskan mainland."

Such occurrence has not been substantiated. However, in 1932 it was learned that A. W. Bennett and A. C. Bryant were operating a blue-fox farm on Long Island, near Kodiak. A number of years previously they had stocked the little island with raccoons from Wisconsin, Minnesota, Michigan, and North Dakota. In the years 1932, 1933, and 1934, dead raccoons had been

found at intervals on the island. In a single year, 12 to 15 dead raccoons were found, as well as some sick ones—the sick ones apparently were paralyzed, dragging the hind quarters.

There were still a few raccoons at large on Long Island in 1936.

Family MUSTELIDAE

Martes americana: Marten

Martes americana actuosa

Indian or Aleut (?), Iliamna Village: *Keheegocho* (Osgood)

Russian: *So-bel* (Buxton)

Osgood (1904) reported the marten as being scarce at the base of Alaska Peninsula. We have, indeed, very few records of it. There are five skulls from Kakhtul River in the Fish and Wildlife Service collection that were taken by Hanna in 1912. Naturally, these animals are confined to forested areas and would not be found far out on Alaska Peninsula.

Nelson (1887) says marten occur on Kodiak Island, but I have not seen specimens from there.

Mustela erminea: Weasel

Mustela erminea arctica

Aleut (dialect?): *Samikakh* (Geoghegan)

Aleut Iliamna Village: *Amectahduk* (Osgood)

Indian, Iliamna Village: *Tahkiak* and *Kahoolcheenah* (Osgood)

Russian: *Gor-no-stai-e* (Buxton)

Hall (1951) has placed the weasels in three groups: The least weasels, *rixosa*; the long-tailed weasels, *frenata*; and the short-tailed weasels, *erminea*. Accordingly, the weasel of Alaska Peninsula becomes *Mustela erminea arctica*.

These weasels occur throughout the entire length of the Alaska Peninsula and Unimak Island, as well as the Kodiak-Afognak group. They are common on Unimak Island but have not been found on any islands farther west. Specimens have been obtained at the following localities: Nushagak, 1 by Osgood; Ugashik River, 6 by McKay, and 1 by Hanna; Kakwok River, 1 by Hanna; Lake Aleknagik, 1 by Hanna; Lake Weelooluk, 1 by Hanna; Becharof Lake, 3 by Osgood and Maddren; Chignik, 7 by J. Oliver; Frosty Peak, 1 by Wetmore; Unimak Island, 1 each by Gardner, Murie, and Beals.

Crabb (1922) reports a specimen from Pavlof Bay. No doubt, there are other specimens, obtained by various collectors, that I have not examined.

Weasels are reported to occur on Kodiak Island, but specimens were not available. Jack Benson, agent of the Alaska Game Commission, in a report dated June 30, 1940, commented that weasels on Kodiak and Afognak were not as plentiful that year. In 1936 on a visit to Kodiak and Afognak Islands, we were assured that weasels occur there, and we were shown a photograph of a live weasel as proof.

Mustela rixosa: Least Weasel

Mustela rixosa rixosa

Though this little weasel has been seldom observed in this area, it is known to occur as far west as Unimak Island. In 1924 a trapper informed me that he had caught a least weasel near Izembek Bay and had intended sending it to the Biological Survey, but he said that the specimen had been neglected and lost.

In 1941, Beals reported that this weasel, though not plentiful on Unimak Island, is known to most of the residents there. He saw one at St. Catherine Cove and another at False Pass; the latter was taken for a specimen. This animal was seen trying to capture snow buntings, but it was not successful.

Mustela vison: Mink

Mustela vison ingens

Aleut, Morzhovoi Bay: *Illigitookh* (Wetmore); *ilgitukh* (Geoghegan)

Aleut (?), Iliamna Village: *Emachamooduk* (Osgood)

Egegik: *Kochcheechuk* (Osgood)

Kenai: *Yarkeechah* (Osgood)

This is assumed to be the form occupying the Alaska Peninsula. Hollister (1913) says: "Though specimens from the Alaska Peninsula are placed with *ingens*, these show an approach toward *melampeplus*." Evidently, the mink occurs throughout the length of the peninsula and on Unimak Island. Specimens, mostly skulls but also a few skins, are available from various localities: Kaklut, 2; Kakwok, 1; Kakwok River, 7; Lake Weelooluk, 5; Lake Aleknagik, 1; Becharof Lake and between Portage Bay and Becharof Lake, 73; Cold Bay, 3; Stepovak Bay, 1; Chignik and Chignik Bay, 2; Frosty Peak, 1. No specimens are available from Unimak Island, but mink are known to occur there, for trappers mention their occurrence as a matter of course. In 1925, a trapper told me that he had trapped six minks at Uril Bay in the winter of 1924-25. In 1936, another trapper on Unimak Island remarked that minks were increasing in number and, in 1941, Beals saw mink tracks at False Pass and neighboring localities.

On July 21, 1925, I saw a mink at Moffet Cove, Izembek Bay. In 1911, Wetmore had seen proof of the presence of mink at Morzhovoi Bay, Frosty Peak, and King Cove.

In 1936, we were informed at Afognak that there are mink on that island, but Jack Benson, of the Alaska Game Commission, reported in 1940 that there are no mink on the Kodiak-Afognak group. It is of interest to note that a blue-fox farm on Long Island (near Kodiak) has released mink.

I have not seen specimens from the Kodiak-Afognak group, and there are no records of mink west of Unimak.

Urocyon luscus: Wolverine

Aleut (dialect?): *Khachimoyughnakh* (Geoghegan)

Russian, Siberia: *Rus-so-makah* (Buxton)

The wolverine never becomes abundant, being largely a solitary animal, but it occurs throughout the length of Alaska Peninsula and on Unimak Island. There are wolverine skulls in the Fish and Wildlife Service collection from upper Nushagak River, from the area between Portage Bay and Becharof Lake, from Chignik, and from Frosty Peak. Allen (1903) describes a specimen taken at Oksenof Bay, Unimak Island.

In 1925, I found evidence of wolverines at the west end of Alaska Peninsula. A wolverine was seen on May 25 on a ridge west of Aghileen Pinnacles, and, on June 3, another was seen north of Aghileen Pinnacles high on a rocky slope. Wolverine tracks were seen on several occasions, and a wolverine, identified by tracks, was noted as having fed on a brown bear carcass—it had carried off a foreleg.

In 1925, it was reported that wolverines were extremely scarce on Unimak Island. By means of extensive inquiries, Donald Stevenson had estimated that over a 20-year period before 1925, four male wolverines had been killed on Unimak Island. However, in 1936, we saw tracks on the beach at Ikatán, and, in 1941, Beals and Longworth stated that wolverines were plentiful on Unimak. They saw their tracks "on practically all the beaches from Swanson Lagoon to Banjo Bay." On January 13, they watched a wolverine foraging along the beach at Ikatán, and, on April 22, they saw a very dark animal, almost black, high on a mountain on Ikatán Peninsula.

It was reported that a wolverine, killed near Pavlof Mountain, had small rock fragments embedded in the skin of the head and neck. The hair was gone from these spots, but the skin had healed perfectly. It was surmised that these pieces of rock could

have been small fragments of lava material from an eruption of Mount Pavlof.

Lutra canadensis: Otter

Lutra canadensis yukonensis

Aleut: *Ahkweeah* (Osgood) Morzhovoi Bay: *akhuyakh* (Geoghegan)

Aleut, *Ahkwenkh* (Wetmore)

Russian: *Nee-drah* (Buxton)

This mustelid species ranges throughout the length of Alaska Peninsula and Unimak Island, but we have no records farther west. Wetmore reported that they were partial to salt water as well as fresh, "frequently swimming boldly out to the islands lying off the coast."

In 1925, I learned that a local trapper had caught 10 otters at Uria Bay in the winter of 1924-25.

Lutra canadensis kodiacensis

Goldman (1935) distinguished the Kodiak otter from the mainland form. The type is a skull from Uyak Bay, Kodiak Island collected by C. Hart Merriam in 1899. There are a number of other skulls from the same island. Otters occur on both Kodiak and Afognak Islands, and in 1936, we saw a number of otter skins at Afognak Village.

Enhydra lutris: Sea Otter

Enhydra lutris lutris

Attu: *Chach²-toch*

Caxtux (Jochelson)

Atka: *Ching-á-tho*

Cna-tux (Jochelson)

Morzhovoi Bay (dialect?): *Chngatukh* (geoghegan); *Chgatluk* (Wetmore)

Base of Alaska Peninsula: *Ahchgh-nahchgh* (Osgood)

Kodiak: *Ach-an-ah* (King)

Kwakiutl Indian: *Kas-uh* (Dawson)

Russian: *Bobr Morskoi* (Steller), "sea beaver"

Bobry, adult males

Matka, females

Koschloki, 1-year-olds

Medviedki, "little bears"—cubs

The northern sea otter is described as being larger than the southern sea otter of the California coast, *E. l. nereis*. I collected a single specimen at Ogliuga Island on August 4, 1937. It was an old male, weighing 80 pounds, and its measurements, in millimeters, were as follows: Total length, 1,390; length of tail vertebrae, 315; and length of hind foot, 242.

The sea otter is stockier than the land otter, *Lutra canadensis*, and has acquired other special modifications. Its specialized food habits (discussed later) do not call for great agility, and this may be one reason for the development of a heavier, somewhat less streamlined body than the ancestral form—if we may assume the ancestral form to be similar to that of the present-day *Lutra*. But the sea otter has become more aquatic than its ancestors, with much less dependence on land, and it has developed seal-like flippers on its hind feet. Its front feet, on the other hand, appear to have responded to a specialized use in handling sea urchins and hard shells of mollusks that make up its principal food. The soles of the front feet have become very thick hard pads, and the toes have more or less coalesced—judging by the specimen examined in detail (mentioned above) the toes are hardly functional as separate digits. The claws have become very weak and pale colored and are placed well up on the dorsal surface of the toes. They probably have little use. The whole structure of the front paw indicates that it is used largely for resisting abrasion from hard sea urchins and shells; it seems incapable of manual dexterity. In fact, the animal seems incapable of holding anything in one “hand.” Yet, I have watched sea otters feeding and have seen them use one paw to toss away, with a forward motion, an unwanted fragment of shell or other substance. Possibly it was only “pushed” away. (Karl W. Kenyon,



FIGURE 42.—Sea otter.

in correspondence in 1957, writes that a subadult female in the Seattle Zoo is very dexterous. It uses its front digits almost like fingers in grooming and feeding operations.)

It is well known that the molariform teeth have been greatly modified for a special diet, and have departed strikingly from the mustelid type. Instead of the teeth having a shearing function, they are used for crushing, and have taken a bunodont form.

A most interesting feature of the sea otter dentition is the prevalence of cavities in the molariform teeth. Among the more or less fragmentary skulls and jaws found in Aleut village sites a considerable percentage of the teeth had cavities, large and small. E. M. Fisher (1941) has given a detailed discussion of this and other features of the sea otter's dentition, and intimates that rather active evolutionary changes may be taking place. She suggests that the difference in diet between the southern and northern sea otter may account for the great prevalence of cavities in the teeth of the northern form. As interpreted by Fisher, the dental formula of the adult would be

$$\frac{I \ 1,2,3 - C1 - Pm \ 2,3,4 - M1}{I \ 1,2 - C1 - Pm \ 2,3,4 - M1,2} \times 2 = 32.$$

The sea otter is generally dark brown, with considerable variation, although this variation may be due to age. Some old animals, as typified by the old male obtained by the writer at Ogliu Island, are a dull, dark brown, becoming black on legs, but with a pale-brown head and neck—this pale coloration extends down on the chest, where it becomes almost straw-colored. The underside of the tail is paler than the body. White hairs are sprinkled throughout the pelage. In most of the darker animals the silvery hairs become more conspicuous. The younger adults are much darker, often blackish, with fine, lustrous fur.

The young pups are a very light brown. In every case, from the pup to the grizzled old male, the head and neck is paler than the body, and this difference is accentuated in the very old ones.

General Habits

There is a voluminous literature on the habits of the sea otter, much of it largely repetition of what was reported by the earlier observers, including Steller. Only in the last few years have we begun to study the sea otter in any great detail, and there is much to learn. Therefore, I will not attempt to give a comprehensive life history of this interesting mammal.

Of chief interest to the biologist is the fact that this member of the weasel family has resorted to a marine environment and has

one a long way in adapting itself to a strictly aquatic life. It is interesting to note that, according to reports, the "land otter" of the Aleutian district readily takes to salt water at times; apparently, this also is true of the otter of Great Britain.

The sea otter spends most of its time in the water. When wishing to sleep, it simply lies on its back and dozes, sometimes with a strand or two of kelp across the body serving as an anchor, whether intentional or not. When feeding, the animal dives for its food, then lies on its back to eat, using its chest for a table. On specimens from Alaska that were examined, the hair on the chest was somewhat worn, no doubt through this use in feeding. When the little pup wishes to sleep, it curls up on the mother's abdomen, and both mother and offspring lie quiescent in the water. The offspring also climbs aboard the mother to nurse.

When startled, the mother puts an arm around the little one and dives with it. On some occasions, the mother seemed to pat the little one on the head first, as if by this patting or pushing motion she were warning it of the impending immersion. This was never clearly seen, however, and it needs to be verified. If merely worried or suspicious, the mother seizes the pup with her arm and swims away with it.

Generally, when startled, the sea otter rises erect in the water for a better view of the intruder before diving. It swims readily on its back, as well as on its belly. In fact, the observer soon gains the impression that the sea otter spends most of its life floating on its back.

The sea otter does come ashore, however, and there are favorite hauling-out places for certain individuals. One or more mothers may climb out on a kelp-covered rock, with their youngsters, where they squirm about and fondle their little ones and endlessly dress their fur. Sometimes a pup will wander off to the water, or will be reluctant to climb out on the rock. Then the mother persistently forces him, nudging and pushing, until he complies with her desire to haul out on the rocks. Occasionally, a male will join the group. We also saw lone individuals, apparently adult males, curled up on a rock, where they may lie long enough for the fur to dry. Even here, they appear restless, and may raise their heads to look about, yawn, rub their faces with their paws, or otherwise dress their fur.

It is reported that sea otters go ashore in times of severe storms, but that sometimes they succumb in heavy surf on the reefs.

Reproduction

Sea otter breeding was observed once in Aleutian waters. It took place in the water, as the pair rolled over and over, sometimes being at the surface, sometimes underneath, the male grasping the female at the head with his teeth. This was on July 23, 1936, at a time when the female had a small dependent pup. The pup had been left at the outer edge of the kelp patch, where it swam about calling for its mother. This circumstance indicates that the female may breed in successive years. Scammon (1874) remarks that the gestation period is supposed to be 8 or 9 months. Probably it is fully that long.

Many observers agree that breeding may take place at almost any time of the year, because young of different ages can be seen at any season. Fisher (1940) appears to have definitely noted this during her research on the California sea otter. It is known that the young are born on the kelp beds, but in Alaska waters, where kelp beds disappear during the winter, the procedure is uncertain. Herendeen (1892) claims that the young are born at sea—he did not mention kelp beds.

Food Habits

It is well established that the northern sea otter feeds largely on sea urchins, and that this diet is supplemented by considerable quantities of mollusks, including mussels, chitons, limpets, snails, and others; and with lesser quantities of crabs, octopuses, and other items—fish play a minor role in the diet. More detailed analyses of the diet of the northern sea otter are given by Williams (1938), Barabash-Nikiforov (1935), and Murie (1940).

Although the sea otter has, to a large extent, forsaken fish as an important item in the diet, apparently it still enjoys such food on occasion. Chase Littlejohn (1916) reports an interesting incident: A sea otter was seen approaching his ship, but it dived. Presently, a fisherman pulled in a codfish and, as the fish came to the surface, the sea otter was seen clasping it in its paws.

One feature of the feeding habits deserves special mention because it involves the use of tools. It was first seen in detail in California (Fisher 1939, and Murie 1940). Briefly stated, the sea otter dove for food and when it came to the surface the observer saw a rock lying on its chest or abdomen. The animal held a small mussel (or whatever the food morsel might be in such instances) in both paws and pounded it on the rock to break it. When feeding, the sea otter has a habit of rolling over occasionally in a complete turn, then continuing with its repast. Sometimes, it performs this roll with a rock and mollusk bot-

in the chest. Naturally, it must clasp both of these objects to its body during the roll, but it does this very adroitly and usually, and it continues unconcerned with its meal.

Mortality Factors

The natural mortality factors affecting the sea otter are almost unknown. The northern bald eagle has been suspected of preying on young sea otters, and it is possible that this may occur on rare occasions. But it is notable that in our study of the food habits of this eagle (see under that species), not a single instance of such predation was found upon examination of eagle nests in the center of abundance of sea otters. It was concluded that eagle predation on the sea otter must be negligible.

Two mammals, the sea lion and the killer whale, have frequently been mentioned as sea otter enemies, but we had little opportunity to verify this. We rarely saw these animals near any sea otters, and although occasionally we saw killer whales cruising by the outer edge of a kelp bed, we could not identify its prey. However, the killer whale is known to eat fur seals, therefore it is reasonable to suppose that it will pick up a sea otter when the opportunity is presented. At any rate, the sea otter has demonstrated in recent years that it can increase in numbers and extend its range when it is protected from human hunters. Identification, and degree of predation, of its natural enemies must be determined by thorough scientific study.

It is a well-known fact that dead sea otters occasionally are washed up on the beach. On our expeditions, we found a number of skeletons on the beaches, from which blue foxes or eagles, or both, had eaten the flesh. It is said that a sea otter sometimes succumbs in the heavy surf in winter. Pups, as well as large adults, are included in casualties thus recorded on the beach. In the postwar years a higher mortality rate has become evident and many dead sea otters have been found. The cause is not yet known.

From the evolutionary standpoint, the sea otter seems to be in an intermediate or transitional stage. The peculiar dental specialization has been mentioned, as well as the prevalence of cavities in the molariform series. These cavities are present in fresh specimens as well as in remains from old Aleut village middens. Fisher (1940) has reported an instance of gastric perforations in a sea otter found dead on a California beach.

One cannot refrain from speculating whether the specialization in food, which involves hard and sharp mollusk shells, tests and spines of sea urchins, barnacles, and similar materials that

are ingested together with the soft digestible parts, are causing the sea otter some difficulty. Do some individuals succumb through injuries caused by such materials? How are the tissues responding to the demands for taking care of such rough fare?

It is obvious that the sea otter does not meticulously select only the soft parts. Apparently, it relies on crushing the shells with its teeth (and the teeth have developed enormously to meet this need) and then proceeds to swallow a considerable portion of shells, tests, and spines. Even the byssus of the mussel, often with pieces of stone or coral attached, is swallowed. In one instance, pebbles made up 21.8 percent of the contents of one scat. All such material passes through the alimentary tract, therefore it would not be surprising if serious injury occasionally resulted. It would be interesting to know how many of the sea otters washed up on the beach in Alaska have internal injuries similar to the gastric perforations reported by Miss Fisher.

On the other hand, from the standpoint of the sea otter population as a whole, the organism appears to be coping with the demands successfully. Rate of reproduction is slow—one young per year—yet, when released from the pressure of the fur trade, the sea otter has multiplied rapidly.

Distribution and Numbers

It is well known that in primitive times the northern sea otter ranged along all of the southern Alaskan coast, including the Aleutian chain and Alaska Peninsula. It ranged southward, evidently intergrading with the southern form at some unknown point, and the southern form ranged from this point southward as far as the coast of Baja California. The northern sea otter also occurred in the Commander Islands and southward into the Kurile Island chain, and they were numerous about the Pribilof Islands. Littlejohn (1916) reported schools of 400 sea otters in the early days of hunting along the Kuriles.

The decline of the sea otter population is a striking instance of the near extinction of a species through unregulated commercial exploitation. Before the coming of the white man, sea otters were extremely numerous and the skin was used by the Aleuts for clothing and (according to the chief of Atka Village) for a lining of the interior of their underground huts. We found Aleut mummies in a cave on Kagamil Island that were wrapped, in part, in sea otter skins.

When the Pribilofs were first visited, the sea otters were abundant. Preble and McAtee (1923), quoting Elliott and Littlejohn (1916), state that 5,000 sea otters were killed in the first year of

cupation of the Pribilofs. Veniaminof, speaking of the Pribilofs, stated that the animals became scarce in 1811, and that they were extinct 30 years later (Preble and McAtee 1923).

In the Aleutian district, the Russians found a rich harvest of sea otter furs and exploited it vigorously. Without citing the voluminous statistics on the shiploads of furs sent back to Russia, let it suffice to say that the sea otter population could not stand up under the continued excessive harvest. History tells that the Russians, sensing the end of a lucrative industry, attempted to regulate the killing of sea otters. But a new complication had entered the picture. Trading ships from the south had discovered this great fur resource—Americans, French, and others. Although the Russians could impose regulations on their own people, they found it hard to deal with this new foreign influx. The sea otters continued to decline in numbers and probably reached their low point shortly after 1900. When almost all were destroyed, protection was finally granted.

For years, the few remaining sea otters found a refuge in the Aleutians. Their status was hidden in the fog and mystery of this seldom-visited island chain, and for years naturalists feared that this animal species had disappeared from American fauna. But, as mentioned above, complete protection had finally become a reality, and it soon became evident that the animal had revived in sufficient numbers to perpetuate itself. In spite of occasional poaching, in 1936 we found substantial sea otter populations in several places throughout the Aleutian chain, and we made a conservative estimate of at least 2,000. Most heartening of all, they were extending their range, not only in the Aleutians, but also along Alaska Peninsula. However, on our last visit to Unalaska Islands the sea otters had not reappeared, although at one time this area was one of the best sea otter hunting territories (since our visit, five sea otters have been seen).

The range of the sea otter raises a puzzling point. There seems to be a difference of opinion as to the distance that the sea otter will venture from land. It is generally believed, and observations bear this out, that sea otters normally will live close to shore where they find their food in comparatively shallow water. Yet, there are reports of sea otters being seen far out at sea. On our expeditions, we never saw any of these animals far from land. However, at one time sea otters were numerous in the Pribilof Islands, and they must have made a long sea journey to reach these islands. After World War II, it was found that sea otters had increased still more and had extended their range.

Littlejohn (1916) believed that sea otters live on squids when far from land. He did not think that the otter could dive deeper than 60 fathoms, and because its normal sea-bottom diet was not available, it ate squid.

Sea Otter Hunting

At the height of the commercial exploitation of the sea otter a number of hunting methods were used. The Russians utilized the skilled Aleuts for this purpose. The various methods have often been described, and the subject will be only briefly mentioned here.

One method was to spear the animal from the native boat. Several boats would surround the animal and keep it diving repeatedly until it was exhausted. In the meantime, spears were thrown until the animal was dead or helpless. Later, when the rifle was used, three boats would surround the otter, according to Littlejohn (1916). Here, too, the object was to keep the otter diving quickly, to prevent a long dive, until someone could manage an effective shot.

A dead sea otter will float, which insures recovery of an animal killed by any type of weapon. It is reported, also, that sea otters were sometimes clubbed to death on reefs or rocky shores, where they had taken refuge from severe storms. At such times, the noise of the wind and surf would drown out any sound of approach by the hunter. Littlejohn (Hall 1945, p. 90) has described how natives would creep around on the rocks during dark night to feel for the otters, then club them on the head.

Nets also were used. These nets were set in favorable locations frequented by sea otters, and, according to Littlejohn, they were very effective.

The encouragement of natives to secure sea otter skins on a large scale, promiscuous hunting by whites (who outfitted ships for that purpose), combined with pelagic sealing, produced a large and profitable fur harvest for many years.

Sea Otter Management

The return of the sea otter in satisfactory numbers, at a time when we are being made conscious of wildlife management, makes the subject especially pertinent. In the case of the sea otter, the first step in management was to provide protection, and to encourage spread to all of its ancestral range. This process is now under way. From what we know of the food habits of the sea otter, the food supply should be ample to support a large population without artificial manipulation.

Apparently, the Russians are experimenting with, and studying

ing, the sea otter of the Commander Islands (May 1943), and it is said that the Japanese have been managing the sea otters of the Kurile Islands on a commercial basis. The southern sea otter is increasing along the California coast. All in all, this interesting animal has already regained much of its lost range, and it can be assumed that it has attained a lasting place in the American fauna.

Family CANIDAE

Vulpes fulva: Red Fox

Vulpes fulva alascensis

Aleut, Morzhovoi Bay: *Ikowukh* (Wetmore)

From vocabulary compiled by R. H. Geoghegan at Valdez in 1903:

Ukhaehing

Russian: *Lee-see-sha* (Buxton)

Russian, Siberia; *See-way-doos-ka* (cross fox)

The red fox is plentiful throughout the Alaska Peninsula and is found on the eastern Aleutian Islands. Unimak Island, in particular, has a large fox population, and the species occurs also on Adak, Unalaska, Umnak, Chuginadak, Amlia, Adak, Kanaga, and Sanak Islands. Foxes occur on Dolgoi, which was utilized for commercial fox propagation—it is possible that the fox originated here in that fashion. Great Sitkin, also, was said to have had some red foxes. Those on Amlia and Adak Islands are the silver-gray color phase.

Kellogg (1936) found bones of the red fox to be one of the most abundant mammal remains in Aleut middens on Kodiak Island.

The westward expansion of the red fox, in its various color phases, on the Aleutian chain is uncertain, but it certainly must have occupied the easternmost group of islands. General historical accounts give us a few clues. In his "History of Alaska, 1730-1885," Bancroft (p. 120) states that in 1758 Glottof started for the Aleutians, and wintered at Bering Island. The following summer, he arrived at an unknown island, probably Umnak, where he remained for 3 years. He returned with a cargo of furs, including the black foxes from the Aleutian Islands. The shipment included 11 sea otters, 280 sea otter tails, 1,002 black foxes, 1,100 cross foxes, 400 red foxes, 22 walrus tusks, and 58 blue foxes.

Again (p. 154), Bancroft remarks, "In 1764, when the first black fox skins had been forwarded to the empress, gold medals

were awarded to the merchants Orekhof, Kulkof, Shapkin, Panoz and Nikoforof." He says, "Ocheredin's share of the proceeds was 600 sea otters, 756 black foxes, 1230 red foxes; and with this rich cargo he arrived at Okhotsk on the 24th of July 1770. These skins were obtained from Akutan, Unalaska, or adjacent islands.

There are other passages worthy of record. On page 123, Bancroft states that the ships *Gavril* and *Vladimir* combined force in 1760 and hunted Umnak, Sitkin, Atka, and Seguam, where they obtained about 900 sea otters, 400 foxes of various kinds, and 432 pounds of walrus tusks.

On page 153 of Bancroft's account, we find reference to a 176 expedition by Solovief, during which he obtained 500 black foxes.

Bancroft (p. 169) further states that—

Shiloff, Orekhof, and Lapin, in July of the same year (1770), fitted out once more the old ship *Sv Pavel* at Okhotsk, and dispatched her to the islands under command of the notorious Solovief. By this time the Aleuts were evidently thoroughly subjugated, as the man who had slaughtered their brethren by hundreds during his former visit passed four additional years in safety among them, and then returned with an exceedingly valuable cargo of 1,900 sea otters, 1,493 black, 2,115 cross, and 1,275 red foxes. He claims to have reached the Alaskan Peninsula, and describes Unimak and adjoining islands.

The wording of this passage would lead us to believe that Solovief did not go far east of Unimak. If that is true, he undoubtedly obtained his foxes among the eastern islands, the group designated as the Fox Islands, from Unimak to Umna inclusive. In all of these early cargoes of fox furs, there is an amazingly high percentage of black and cross color phases—these two phases greatly outnumbering the normal red color phase. There had not been time for artificial development of such strains on so great a scale, and there is no record of such breeding activities at that time. Therefore, it is evident that in the eastern Aleutian district a natural concentration of the melanistic type of the red fox had taken place, comparable to a similar development of the Arctic fox in the western Aleutians, Commander, and Pribilofs. This may prove to be a significant biological phenomenon, when the active factors become understood.

It is probable that the dark color phases occurred also on the Alaska Peninsula, and it is almost certain that excessive killing of these darker kinds, on a selective basis because of their greater value, has served to bring the population back to a practically uniform type, the red phase. The silver fox persists on Amli Island, but this island has been leased and the foxes are cor-

colled artificially. We can no longer find the dark kinds in any numbers on Unalaska, where they were first found.

The following table shows the proportions of these color phases in the cargoes of three ships. The records of other cargoes are not used here because they appear to have been of a selective nature, not comparable for this purpose. For example, some cargoes showed only black fox, and some cargoes showed no cross fox.

Commander of expedition	Name of ship	Year of return	Species of foxes obtained					
			Black fox		Cross fox		Red fox	
			Number	Percent	Number	Percent	Number	Percent
Stoff...	(No record)	1761	1,002	40	1,100	44	400	16
Novik...	(No record)	1774	1,493	30.6	2,115	43.3	1,275	26.1
(No record)	Sv Andrei	1773	996	33.1	1,419	47.2	593	19.7
(No record)	Sv Prokop	(No record)	20		40			
Average percent of cargoes				34.6		44.8		20.6

At the time of these expeditions, the red fox probably had not reached as far west as Kanaga (where a few have been present in recent years). It is difficult to evaluate the present distribution because of the extensive commercial manipulation of the Aleutian fauna. We can be confident, however, that the red fox originally occupied the so-called Fox Islands, as far west as Umnak at least; it may have occurred as far as the Andreanofs, much farther west. Though Bancroft, writing a general history of Alaska, was not specific in mentioning the Aleutian fauna, he did make some helpful observations. His generalization on fur bearers at least gives us helpful indications:

The distribution of fur-bearing animals during the last century was of course very much the same as now, with the exception that foxes of all kinds came almost exclusively from the islands. The stone-foxes—blue, white, and gray—were most numerous on the western islands of the Aleutian chain and on the Pribilof group. Black and silver-gray foxes, then very valuable, were first obtained from Unalaska by the Shilof and Lapin company and at once brought into fashion at St. Petersburg by means of a judicious presentation to the empress.

This passage confirms the general conclusion that blue foxes were confined to the western islands and red foxes (with their color phases) were limited to the eastern islands.

Turner (1886) reported the red fox "as far west as Umnak." Speaking of the cross and silver fox, he said that they occur in all of Alaska, except the extreme western Aleutian Islands."

Food Habits

In the summer of 1925, I had an opportunity to frequently observe foxes on Unimak Island and Alaska Peninsula. They were found on some of the sand islands at Izembek Bay—it is probable that they reached these islands by traveling over the ice during the winter. They spent much time on the beaches of these islands, where they dug for clams which they located by scent. They also picked up crabs at low tide and ate codfish or other carrion thrown up on the beach.

On Unimak Island, Unalaska, and some other localities, rodents become important in the diet and the foxes spend more time inland.

In 1911, Wetmore examined a den in the Morzhovoi Bay region where he noted fragments of ptarmigan and ground squirrel. He also noted that foxes came down to the beach at Thin Point to feed on the many stranded flounders.

Beals and Longworth (field report, 1941) found red foxes to be well distributed over Unimak Island, but noted that they were concentrated in the coastal areas, where they could feed on the beaches. "Sandfleas were present in unbelievable numbers under boulders and in rotting kelp. Scores of droppings were composed almost entirely of these little fellows. The valley floors were littered with mounds and tunnels made by small rodents and here again we found fox droppings showing only hair and bones of rodents. We found hundreds of instances where nesting burrows had been torn out and the inhabitants eaten."

They also found ptarmigan to be unusually abundant, observing flocks of 300 to 400 birds, and they remarked: "Fox-eaten ptarmigan were found often enough to indicate them as having an important place in his diet."

The contents of 57 red fox droppings from Dolgoi Island were found to contain the following items, listed in number of occurrences:

<i>Item</i>	<i>Number</i>	<i>Percent</i>
<i>Microtus</i>	38	52
Bird	16	21.9
Beach fleas (Crustacea)	6*	8.2
Sea urchin (<i>Strongylocentrotus drobachiensis</i>)	4*	5.4
Mussel (<i>Mytilus</i> sp.)	2*	2.7
Heavy cloth	2	2.7
Brown paper	2	2.7
Hair seal (<i>Phoca</i> sp.)	1	1.3
Small fish	1	1.3
Large bone	1	1.3

* Such forms are listed as times occurring, rather than as actual number of individuals.

At least two of the birds represented here were of sparrow size and may have been captured, but the others were larger birds and (since we found no bird colonies on this island) probably were carrion washed up on the beach. One dropping contained 10 percent sea urchin, three others contained 100 percent beach grass.

The contents of 25 red fox droppings from Unalaska Island, listed on number of items, were as follows:

<i>Item</i>	<i>Number</i>	<i>Percent</i>
<i>Citellus</i>	16	48.5
<i>Microtus</i>	9	27.3
<i>Dicrostonyx</i>	2	6
Bird	6	18.2

In this case, rodents furnish the bulk of the food. The droppings were collected in summer. It is interesting to note that on Uginadak, on Amlia, and probably on the sand islands in Izemek Bay, there are no rodents and the red fox evidently adapts itself to beach combing.

General Habits

There is no doubt that the life history of the Alaskan red fox follows a normal pattern, but there are certain unusual traits. One of these unusual traits is the remarkable tameness of certain "wild" foxes. Frequently, I approached quite close to a fox as it went about its usual business without giving me much attention. A most unusual incident occurred on Operl Island, at Izemek Bay, in the summer of 1925. A red fox that was hunting on the beach allowed me to approach with the camera to within 5 feet. The animal had fed well on the beach, judging by the contour of its body. When the tide came in, the animal left the beach and wandered into the sand dunes, where it eventually lay down to rest. It closed its eyes and went to sleep while I photographed within a distance of 6 or 8 feet. The animal was still sleeping when I departed.

Local trappers assured me that foxes lose this extreme tameness on the approach of winter.

On another occasion, Stevenson and I came upon a group of five beach-feeding red foxes that exhibited more normal traits, particularly an aversion to swimming. They were at the tip of a narrow sand spit that was separated from the main beach by a narrow channel of water. This was an ideal situation for a picture, assuming that they would hesitate to swim the channel.

We quickly reached the base of the sand spit and, dividing the

width equally between us, we walked slowly toward the fox camera ready. The foxes immediately sensed that they were trapped and acted at once. One after the other, three of them chose to race past us, rather than to swim a distance of 7 or 8 yards to the main beach. At high speed, a fox charged straight at us and passed within 5 or 6 feet. There was hardly time to change film before another fox, frantic because it was cornered, came rushing past us in the same manner, and the third fox followed the other two. Meanwhile, the remaining foxes swam across the lane of water and reached the main beach.

Management

On Unimak Island, there is an annual limit to the trapper's take—each legal trapper is allowed a maximum of 50 red foxes for the trapping season. This appears to be a satisfactory arrangement, and the fox population has not been unduly depleted. Even on the Alaska Peninsula, where no bag limit is in effect, the fox population has remained fairly stable. The same is true of Umnak. There were reports that the status of the red fox on Unalaska was not so favorable; however, fox signs were quite common when we visited there in 1936 and 1937.

On other Aleutian Islands to the westward, red foxes are handled as private property and are either harvested at intervals as on Amlia, or are being eliminated in favor of blue foxes.

Alopex lagopus: Blue Fox

Attu: *Mis-si-sirch' Chir'-ri-ech*

Mis-si-si Kón-uch (white fox)

From vocabulary compiled at Valdez by R. H. Geoghegan: *Aikagukh*

Morzhovoi Bay: *Ikowkookmah* (Wetmore)

Russian, Siberia: *Gol-o-ba pee-scez-(a)* (Buxton)

Pee-seetz-(a), "white fox" (Buxton)

The original distribution of the Arctic fox in the Aleutians is difficult to determine because of the fact that foxes have been placed on many of the islands for commercial breeding. The Chief of Attu Village insisted that the blue fox had been introduced in the Aleutians by man. Remington Kellogg, who examined many bones from old village sites excavated by the late Aleš Hrdlička, reported that no fox bones appeared in material from the Aleutians, though he found them in midden material from Kodiak.

Certain historical records counteract this evidence. Ivan Petrov (1884), speaking of Atka Island, stated "even the blue fox (*Vulpes lagopus*), now confined to but few localities throughout Alaska is still found here." Concerning Attu, he said, "On account

he scanty supply of sea otters the natives have turned their attention to the protection and preservation of the blue fox, and of these they now kill about 200 annually, with every prospect of increasing their stock in hand." Again, he says: "The blue fox exists now on several of the Aleutian Islands, where it was found by the first discoverers in 1741." He mentions that traders reported the presence of blue foxes to a limited extent at Ugashik, on Alaska Peninsula.

However, Petroff's records may be doubted, because he says that the red fox is "everywhere" on all the Aleutians, as far as Attu, on the Pribilofs, and on the Shumagins, and he also states that the brown bear is present on the Shumagins.

There is historical evidence that originally there were blue foxes on at least a part of the Aleutian chain, as well as on the Commander Islands. It is a well-known fact, first reported by Steller, that, when Bering and his crew were wrecked on Bering Island on their return from Alaska in 1741, Bering Island was well populated with foxes. Speaking of this island, Bancroft (1886, p. 88) says, "The only animals visible on land were the *pepsi* or Arctic foxes, exceedingly bold and rapacious. They fell upon the carcases and devoured them almost before the survivors could make preparations for their burial. It seemed to be impossible to frighten them away." Again (p. 112), he says, "This vessel was named the *Jeremy* and carried the castaways to Kamchatka in the autumn of 1752, with a cargo of 820 sea otters, 1,900 blue foxes, and 7,000 fur seals, all collected on the island upon which they were wrecked." A footnote explains that this island probably was one of the Commander Group.

Bancroft continues (p. 100), "Besides Bering Island, Bassoff also visited Copper Island, and collected 1,600 sea otters, 2,000 fur seals, and 2,000 blue Arctic foxes. From this trip Bassoff returned on the 31st of July 1746."

Such commercial records show that the Commander Islands were heavily populated with blue foxes in early times. Barabash-Nikiforov (1938, p. 424) points out that *Alopex lagopus beringensis* Merriam is the form on Bering Island and *Alopex l. semenovi* Ognev on Copper Island; and that the latter is the larger and darker of the two forms.

Historical records also point to the presence of blue foxes on the Near Islands of the Aleutian Chain. Early Russian expeditions obtained profitable cargoes of furs from these western islands. Bancroft (1886) furnishes several pertinent passages. On page 112 he says, "During the same year, 1749, the mer-

chants Rybinskoi and Tyrin sent out the *Shitrika Sv Ioam* to the Near Islands, the vessel returning in August 1752 with 700 sea otters and 700 blue foxes."

On page 118, he refers to Attu Island when he says, "After living on this island in peace with the natives for over a year Tolstykh departed with 5,360 sea otters and 1,190 blue foxes and reached Kamchatka in the autumn of 1758."

Again, this historian reports (p. 155), "The *Vladimir*, owned by Krassilnikof and commanded by Soposhnikof, sailed in 1766 and returned from the Near Islands with 1,400 sea otters, 2,000 fur seals, and 1,050 blue foxes."

Dall (1870, p. 499) stated that blue foxes had been intro-

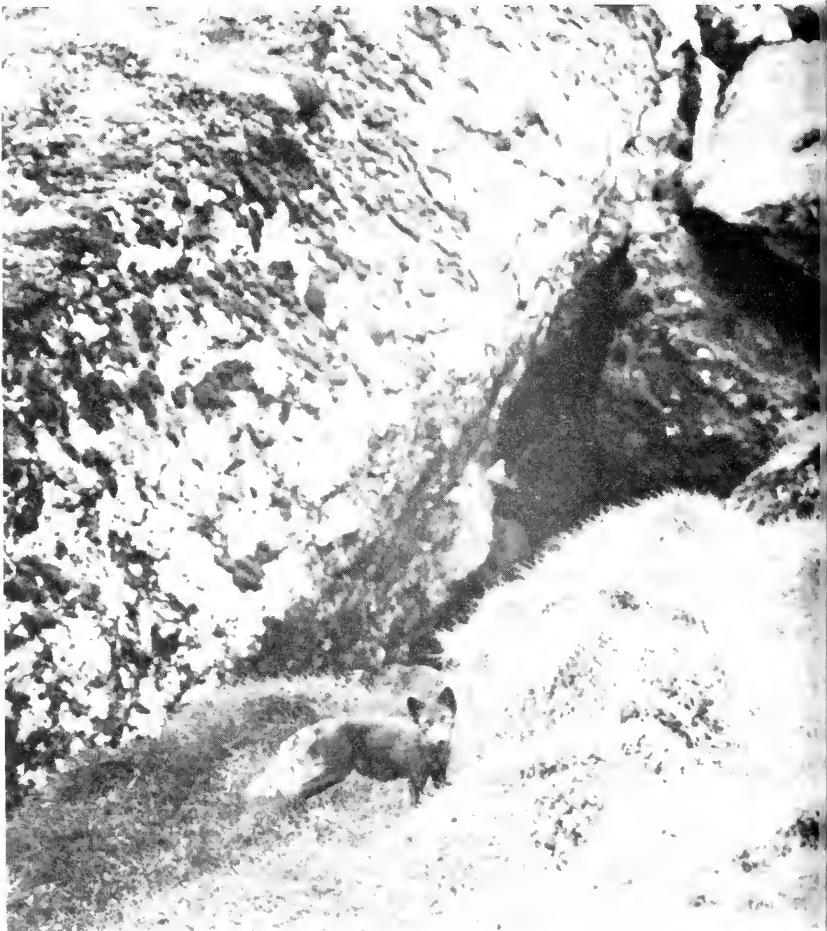


FIGURE 43.—Blue fox.

used for commercial purposes on most of the islands by the Russian-American Company. He adds that the earliest visitors to the Aleutians found "tame" foxes on the larger islands and assumed they had originally been placed there by man. However, with due consideration of the well-known "tameness" of the Arctic fox in all its range, including Greenland, the lack of wildness is no indication of any degree of domestication.

Elliott (1897, p. 180) wrote that blue foxes were introduced on Attu "many years ago." The above records, however, furnish good evidence to the contrary.

At present, there is no evidence that blue foxes occupied the eastern Aleutians. From available records it is reasonable to conclude that blue foxes originally occupied only the Near Islands of the Aleutian chain. Even today, the next island eastward, Buldir, has no foxes and apparently has never had them. It is one of the few islands on which geese are able to nest unmolested by foxes. Evidence is lacking that blue foxes occupied any islands east of Buldir.

It is possible that the blue foxes of the Near Islands originally were derived from the Commander Group. Ice floes from more northern latitudes could have drifted down, at rare intervals, to provide the necessary bridge or ferry—red foxes have been known to reach the Pribilofs over the ice, and a crossing to the Aleutians could easily be made.

The Arctic fox, apparently chiefly of the white color phase, occurs rather sparingly on the Alaska Peninsula. Osgood (1904) reported—

Straggling individuals of the Arctic fox are not infrequently found as far south as the north shore of the Alaska Peninsula, doubtless having followed the pack ice in winter. One was killed by fishermen near Igagik in the spring of 1902. They are also said to be found in the Togiak district and very rarely at Nushagak.

In 1911, Wetmore wrote (of the Morzhovoi Bay region), "One white fox is reported to have been killed on the Bering Sea side here in the winter of 1908. It is supposed to have come down on the ice in winter. No others were known."

I found no evidence of Arctic fox at the western end of Alaska Peninsula in 1925, but in 1936 I was informed by a resident at Port Molier that there were some white foxes about 60 miles northeast of that place in 1914. In 1936, the late Alexis Yatchneneff, who had been chief of one of the Aleut villages, said that before the Russians came there were red, cross, and silver foxes on Unalaska but there were no white or blue foxes.

Kellogg (1936) found no bones of the Arctic fox in the middle material from Kodiak Island, though the red fox was abundantly represented. Probably this fox never ranged on the more rugged Pacific side of Alaska Peninsula.

It appears, then, that the Arctic fox, mostly in its blue color phase, reached the westernmost Aleutians from the Commander Islands, while the Alaskan continental form straggled out, at least part way, on Alaska Peninsula.

Food Habits

The leasing of islands for the purpose of raising blue foxes has a direct influence on the native fauna, therefore particular attention has been given to the food habits of the blue fox in the Aleutians. Accordingly, we made every effort to learn what constituted the fox food on each island. This was accomplished by the only two methods possible—observation and the analysis of droppings. Such studies were made on about 40 islands, though data from a few of these were meager. Table 1 presents the food habits data obtained on 22 islands, from the contents of more than 1,800 blue fox droppings. While a much greater number would be desirable from any given island for a complete picture of the food habits pattern in percentages, the data here presented agree closely with our field observations and furnish an accurate statement of the food that is available and utilized by the blue fox in the Aleutians.

It had been assumed by lessees operating in the Aleutians that sea urchins were the most important food item, supplemented by birds and beach drift. We found that sea urchins, though acceptable, do not rank in importance with amphipods (tiny crustaceans commonly referred to as beach fleas). Crustaceans were found in 26.1 percent of the droppings studied, and sea urchins were found in 2.1 percent (see table 2).

Beach fleas appear to be the most commonly available food item. They swarm on the beaches, where windrows of dead kelp furnish a favorite habitat. They lurk under bits of wood, or under anything else that may lie on the sand and preserve the required moist shelter underneath. It is easy for a fox to pick up a full meal of sand fleas; on the other hand, sea urchins must be picked up at low tide and in limited areas on exposed reefs or other favorable spots. An island with extensive beaches, either sand or gravel, is favorable for foxes. An island with a rocky shore, and with few or no beaches, is not satisfactory; here, the foxes must rely on sea birds, as long as the bird colonies last. Throughout the Aleutians, life is concentrated pretty much along

the shoreline, and there are few land birds. The sea birds depend on the ocean for food and generally are found at, or near, the shores. The life-giving tides are the principal source of food. There are no native rodents west of Unnak, but ground squirrels have been placed on Kavalga for fox food, and rats accidentally were introduced on Rat Island in early days. Foxes feed on both of these animals.

On Rat Island, 28.8 percent of fox droppings contained rats, and about 40 percent contained beach fleas. Rat Island has extensive beaches, and most of the rats are confined to the beaches because of the nature and distribution of the vegetation.

Rats have also been introduced on Atka and are eaten by foxes, but our data for that island are too meager for tabulation. On Unalga Island, in the Fox Islands group, blue foxes were feeding on field mice, but these rodents are not available on most of the Aleutians.

A stranded whale, or a dead seal or sea lion, often becomes an important item of fox food. We witnessed a whale being eaten on Yunaska Island, but a whale on the beach of Kanaga was hardly touched—this was explained by the caretaker who stated that most of the foxes were on the other side of the island.

The importance of birds in the blue fox diet is evident in the tabulation. In the Aleutians as a whole, they furnish 57.8 percent of the food, though the percentage varies on different islands, depending on availability. Land birds are relatively unimportant. They are hard to capture and do not gather in large groups. But the concentrated colonies of petrels, auklets, and related species furnish rich hunting grounds. In addition to the droppings tabulated in table 1, for Kasatochi Island, we found a single fox cache under a rock that contained 65 crested auklets, 37 least auklets, 1 whiskered auklet, 1 parakeet auklet, and 1 pigeon guillemot, and there were more birds farther back under the rock. On Bobrof Island, we found remains of 103 petrels, 6 tufted puffins, 4 least auklets, and 1 pigeon guillemot. On Semisopochnoi, we listed remains found at dens as follows: 107 least auklets, 18 crested auklets, 3 tufted puffins, 1 horned puffin, 1 murre, and 7 fork-tailed petrels.

Necessarily, insects are a minor item in the diet, yet it is interesting to note that of the 10 droppings from Kiska Island that contained larvae of *Noctuidae*, one dropping consisted of 50 percent, another 75 percent, of these caterpillars.

There is an interesting item from Kagamil Island. Two droppings contained skin from Aleut mummies. When we examined

TABLE 2.—*Summary: Food items in blue-fox droppings, Aleutian Islands, 1936 and 1937*

Food item	Occurrences	
	Number	Percent of total
Invertebrates:		
Crustaceans.....	653	26.1
Sea urchins.....	53	2.1
Mollusks.....	30	1.1
Annelid worms (<i>Nereis</i> sp.).....	3	.1
Insects.....	45	1.75
Total.....	784	31.3
Birds:		
Petrels.....	396	15.8
Fulmars and shearwaters.....	9	.35
Puffins.....	158	6.3
Murres.....	15	.6
Ancient murrelet.....	13	.5
Pigeon guillemot.....	17	.7
Auklets.....	604	24.1
Cormorants.....	4	.1
Gulls and kittiwakes.....	12	.4
Emperor goose.....	4	.1
Ducks.....	7	.2
Shorebirds.....	7	.2
Ptarmigan.....	4	.1
Small land birds.....	56	2.2
Bird eggs.....	59	2.3
Unidentified birds.....	83	3.3
Total.....	1,448	57.8
Fish.....	70	2.7
Mammals:		
Blue fox.....	37	1.4
Sea otter.....	3	.1
Rat.....	38	1.5
Hair seal.....	5	.2
Human skin (mummy).....	2	.08
Total.....	85	3.3
Vegetation.....	86	3.4
Miscellaneous (mud, pebbles, paper).....	28	1.1
Grand total.....	2,501	100

a cave filled with mummies (which are now in the U. S. National Museum), we discovered that blue foxes had torn some of these apart, literally limb from limb, and had made themselves thoroughly at home in the mummy cave. Obviously, blue foxes find human flesh tasty, either fresh or dried. The tabulations also indicate cannibalism. Presumably, most of the foxes that were eaten were carrion.

Disposition and Habits

The Arctic fox is known to be tame and unafraid in the presence of man, not at all like the red fox. Steller has given a vivid account of the reactions of blue foxes to Bering's shipwrecked crew. They were exceedingly bold, and on some occasions they would begin nibbling on exposed parts of a person if he were lying where a fox could get at him.

An interesting experience on Rat Island illustrates the surprising behaviour of these animals at times. To quote from my field notes—

I sat down to rest on a ridge. Through the tall grass I could see two adult foxes and a well-grown young in the draw below me. I was sharpening my pencil and one of the foxes evidently caught the motion of my hand, and saw my head and shoulders. The young fox disappeared and one of the adult foxes came charging straight up the slope. To my amazement it came all the way, ran up to me, poked me in the arm, apparently with bared teeth or it was a sharp sensation, then ran off a little distance. Immediately, the other fox started up the hill in the same manner. But at this point, the first fox quickly stood up and waved it back. Both foxes then stood at a little distance and barked at me.

The blue fox is a clever hunter. According to the Aleuts, sometimes a fox will catch an emperor goose when it is asleep and has its head tucked under its wing. On occasion, too, a fox will stand on a point of rock where ducks are diving and, when a duck is rising in the water nearby, the fox will jump in and seize it while it is still below the surface. The Aleuts added that the blue fox will jump in the water and seize salmon. Incidentally, Homer Jewell, a member of our party, said that he had known of several dogs in southeastern Alaska that would seize salmon in the water.

Blue foxes readily swim from one island to another when the distance is not great; sometimes they will attempt this where there are strong tidal currents and are carried off to sea and lost. Foxes also can climb moderate cliffs with ease. Occasionally, one will even leap across a chasm and down to the top of a pinnacle where ducks are nesting, then clamber down the pinnacle, and swim back to shore.

Foxes have learned to take every possible advantage over birds, and the birds must nest on sheer cliffs or inaccessible offshore rocks to be entirely safe.

Birds vs. Blue-Fox Industry

Possibly, there are areas where bird colonies are so huge that the Arctic fox has made only an insignificant reduction in the number of birds. In the Aleutian Islands, there are some large bird colonies, and the foxes take their toll. In some instances, this has not as yet made a great difference, but, in many other instances, great changes have taken place. On some of the smaller islands the birds have been almost eliminated, and on many islands such birds as eider ducks have ceased to nest, except on a few offshore pinnacles where they can find protection. The cackling goose and lesser Canada goose have become so scarce

that it is somewhat doubtful whether they can survive in the Aleutians. If the migration to these islands should cease, these species would disappear from the Aleutian fauna. Certain rare species, too, are threatened. The whiskered auklet is not abundant, and the Cassin's auklet has become very scarce.

No native rodents occur on most of the islands, hence there is no food for foxes except for the birds and invertebrates, and the drift on the beaches. Many of the islands are small, and the fox populations are under commercial management, which necessarily strives for the greatest possible fox numbers. Many of the islands have rocky shores with a minimum stretch of beach where foxes can feed. These are some of the factors that cause a special hazard to the Aleutian bird colonies.

Canis lupus: Wolf

Canis lupus pambasileus

Aleut: *Alixgikh* (Geoghegan)

Russian: *Volk* (Buxton)

The wolf has ranged the entire length of the Alaska Peninsula and is referred to by Osgood (1904, p. 40). He found tracks near Lake Clark and around the portage between Chulitna River and Swan Lake, and he was told of wolves occurring on Alaska Peninsula. Turner (1886, p. 208) reports it as being present on Unimak Island, stating that it reached this island over ice that sometimes jams into False Pass. Nelson (1887, p. 238) quotes Veniaminoff to the effect that wolves were resident on Unimak Island and that two were killed on Akun Island in 1830—this is the farthest west that they have been reported.

In 1911, Wetmore saw tracks of wolves in the King Cove region. In 1925, I obtained further information on wolf distribution in that western district. Donald H. Stevenson, at that time resident fur warden there, reported that six wolves were killed on Unimak Island in 1912. He had unverified reports that the last ones were killed in 1914. It was learned that two wolves were killed in the winter of 1918 at the west end of Alaska Peninsula. This had been a hard winter, the two wolves were poor, and their fur was greasy, showing that they had been living off a whale carcass. Griggs (1922, p. 315) found wolf tracks at Mount Katmai in 1916, and he mentions reports of wolf packs in former years.

In 1936, wolves were reported to be plentiful on Mulchatna River, in the Lake Clark region, and in the Nanwhyenuk Lake and Naknek Lake country, but there were no recent reports of wolves westward along the Peninsula.

Family FELIDAE

Lynx canadensis: Canada Lynx
Lynx canadensis mollipilosus

Osgood (1904, p. 39) reported that lynx were scarce at the base of the Alaska Peninsula, according to the natives, though in 1901 (p. 67) he recorded that lynxes were fairly common in the Cook Inlet region. Griggs (1922, p. 315) stated that trappers had reported the capture of lynxes within the Katmai National Monument.

In 1911, Wetmore wrote—

The lynx is not common in the region around King's Cove, but a few are reported every year. It has been known from the region around Cold Bay or as far back as the trappers could remember, but has come into the region west of Nelson's Lagoon, on the Bering Sea side, within the last year or 5 years. Its food is reported to be the Arctic Hare.

Thus, it is evident that the lynx has occurred far out on the Alaska Peninsula, beyond all timbered areas. It is not reported from the Kodiak-Afognak group, where varying hares were introduced only recently.

Family OTARIIDAE

Eumetopias jubata: Steller Sea Lion

Attu: *Káv-reh*

Atka: *Kow'-uhh*

Aleut (dialect?): *Qa'hwax* (Jochelson)

Khawakh (Geoghegan)

Russian: *Sivutcha* (Steller)

Sea lions are found throughout all of southwestern Alaska, extending to Attu Island, where we saw some at its westernmost point, Cape Wrangell. There were colonies, numbering from 40 or 50 to several hundred individuals, at such places as Amak Island, Bogoslof (the outstanding herd), Carlisle, Yunaska, Chagulak, Amukta, Segula, Semisopchnoi, Ilak, and Buldir. Bogoslof has by far the largest and most spectacular herd—so outstanding that it deserves special consideration as an object of particular scientific, as well as popular, interest. In 1938, Scheffer estimated 800 sea lions were on Bogoslof.

The Aleuts use the skin of the sea lion for leather, and find the flesh very palatable. On one occasion, I ate the flesh of a young sea lion and found that it was decidedly acceptable.

***Callorhinus ursinus*: Northern Fur Seal**Attu: *Hla-koó-yach**Laku'dax* (Jochelson)Aleut (dialect?): *Lakukh* (Geoghegan)Russian: *Kot* (Steller)

The fur seal migrates to and from the Pribilof Islands by way of various passes throughout the Aleutian chain, and, at such times, they may be found, well offshore, south of Alaska Peninsula.

In 1925, I was told of some unusual overland movements of these seals near the western end of Alaska Peninsula. At that time, Nick Kristensen, a local trapper at False Pass, stated that fur seals in fall migration had been observed going up Nelson Lagoon, then crossing overland to the Pacific. Stevenson, a reliable observer, related that several people had reported fur seals going overland from the Bering Sea side, across the narrow strip into Morzhovoi Bay, and that they had crossed the sandspit at St. Catherine Cove as well as the sandspit at Village Cove on the opposite mainland.

In regard to overland movements of seals, it is interesting to recall Bailey's notation of a report of an Eskimo at Cape Prince of Wales to the effect that spotted seals and ribbon seals had migrated overland out of lagoons to reach open water to the south because of ice conditions in the lagoons. In this instance, they crossed high country, and traveled several miles a day.

There appeared to be a general understanding among the Aleuts that fur seals hauled out on Buldir Island in the past, and some of the natives insisted that they bred there. These stories came from natives of Attu as well as Atka. In 1937, Bill Dirks, brother of the chief of Atka Village, insisted that fur seals were on Buldir. He told me that he had landed there years ago and had killed some for their furs. He was confident that these seals would still be hauling out on Buldir.

At this point, it is of interest to quote a short note from Scheffer, who wrote under date of January 28, 1942, that—

In a collection of notes bequeathed to us by G. Dallas Hanna there appeared a card with the following statement: "August 1 [1902]—Judge and Lembke shown a pup fur seal taken by the officers of the *Manning* this summer on Bowldir Island." The statement was attributed to the official log of St. Paul Island, Alaska.

In American Field (1902, vol. 53, p. 198), there is a report of "recent news" from Washington, D. C., to the effect that Captain Charles H. McLellan, commanding the U. S. Revenue Cutter

lanhattan had reported to Captain Shoemaker of the Revenue Cutter Service the discovery of a new fur seal rookery in the Aleutian Islands, on "Bouldyer Island." It was stated that Lieutenant Berthodd had approached the herd closely enough to observe that none of the seals had been branded.

In 1938, Scheffer was told by Bill Dirks, of Atka, that his father lived on Buldir Island for a month in 1900 and had killed several fur seals there. He also said that A. C. Goss visited the northwest end of Buldir in 1920 and had reported the presence of fur seals and sea lions.

We tried to find fur seals on Buldir, but we found only a sea lion rookery on a beach of an offshore islet. However, we were unable to make a landing. When I mentioned this sea lion rookery to the chief at Atka, he was not surprised. He stated that he knew of the presence of sea lions there, and he added that the fur seals would be there too.

In spite of our negative findings, all the evidence seems to show that, at one time, the fur seal was to some extent a resident as well as a migrant in the Aleutians.

Family PHOCIDAE

Phoca vitulina: Harbor Seal

Phoca vitulina richardii

Attu: *Ish'-u-gich*

Atka: *Ish'-u*

Aleut (dialect?): *Isukh* (Geoghegan)

Hisook (Wetmore, at Morzhovoi Bay)

Ishooik (Osgood).

Russian, Siberia (Gichiga): *Ola* (Buxton)

Russian, Ikhotsk, Ayan, Pengina, and Marcova: *Largha* (Buxton)

It is interesting to note that Nelson (1887, p. 262) gives *Ish-ó-ik* as the Eskimo name for the ringed seal (*Pusa hispida*), which is extremely rare, or absent, in the Aleutians, and is not distinguished from *Phoca vitulina* by the Aleuts.

The harbor seal occurs all along the southern Alaskan coast, and throughout the length of the Aleutians. We did not find it to be particularly abundant, but we sighted single animals or small groups here and there. In 1925, it was rather common along the Bering Sea side of Alaska Peninsula.

In his revision of the Genus *Phoca*, Doult (1942, p. 120) identified specimens of this race from Alaska Peninsula between Katmai and Kanatak and between Portage Bay and Becharof Lake, from Zembek Bay, Nagai Island in the Shumagins, from Kagamil

Island, and from Adak Island. He gave the range of this form as the "American side of the North Pacific Ocean." Obviously this is the seal of the Aleutian district, but there is a possibility that the more western form, *P. v. largha*, may occur near the western islands.

These seals will enter fresh water. Osgood (1904, p. 49) mentions reports of a spotted seal living in the fresh waters of Lake Iliamna, and he says that most of those killed were taken either near the outlet of the lake or in Kvichak River, "which seems to indicate that the animals whether distinct or not, go back a long way forth from Bristol Bay to Lake Iliamna."

Among the Aleutian Islands, seals were usually found in the kelp beds, but they do not always seek such a habitat. I had a fine opportunity to study these animals in the spring and summer of 1925, at Unimak Island and at the west end of Alas Peninsula. They were very common at that time. They hauled out on the boulders of the reef at Amagat Island and basked on the kelp-covered boulders near the beaches of Amak Island. In Uria Bay, they hauled out on the sand along the entrance to Rosenberg Lagoon, and in Izembek Bay they hauled out on the shoals and sandbars at low tide. A small sand island in the channel between Operl and Neumann Islands was a favorite hauling-out place.

Seals pick a resting place that provides ready escape, always near deep water. If the ebbing tide recedes from a boulder on which a seal is resting, the animal will move to another rock nearer to deeper water. When navigating the shallow Izembek Bay with our whaleboat, we could steer a deep-water course by noting the location of resting seals.

Mothers and pups appear to be very affectionate, swimming near each other and occasionally touching noses. A little pup would try to climb to its mother's perch on a rock. After a while the mother might lazily roll into the water to join it; later, the pup might be able to clamber out on the same perch.

On June 17, a young seal was taken for a specimen—the stomach was filled with milk. On July 10, Stevenson and I each observed a pup nursing.

We found a number of deserted pups, probably those whose mothers had been killed. A deserted pup had been picked up at False Pass in May. On June 16, I found a pup on Neumann Island, at the edge of the grass far from water, since the tide had ebbed. A dead pup lay on a hauling place on a small sand island. A very lean pup was found on Glen Island on June 30; when v

approached, it hurriedly scrambled into the sea. We noted a dead pup on this island on July 27. On June 17, a pup was swimming near the beach calling for its mother. We answered its call, and it responded several times by coming out on the sand at our feet, but it retreated hastily when it learned its mistake, and finally it swam out to sea. The pups have a plaintive, moaning call, which is quickly identified by the mother. The adults have a lower and more raucous voice.

On July 27, a partially blind seal swam near the beach at Glen Island. One eye was white, and the other was partly white. It could see me only when it faced me squarely.

On June 17, it was noticed that the seals were shedding their hair. Old hair was found in their beds, where they had been basking on the beach. At this time, some were a dirty yellowish color; some were mixed, partly light and partly dark; and others were all dark. Evidently, these color variations were stages of pelage change.

On June 24, 1937, a female seal was taken for a specimen at Khvostof Island, and her pup was kept alive for a time. Part of the navel cord was still attached, and it was evident that the pup was recently born. It had the typical dark, spotted coat of this species of seal. The mother weighed 220 pounds.

As one would expect, the seal was much prized by the Aleuts, and was used for food and for other purposes. Wetmore, writing of Unalaska and neighboring islands in 1911, stated that "The hide is used for various purposes and oil is tried out of the blubber. The gut is split and dried and used for many purposes. It is sold in the store like cloth at about 15 cents a yard."

Pusa hispida: Ringed Seal

Russian (Siberia): *Ak'-ec-pah* (Buxton).

Turner (1886, p. 206) implies that this seal occurs in the Aleutians, but from his casual statement it is obvious that he had no specimens to support his opinion. Nelson (1887, p. 262) does not mention any locality farther south than St. Michael, but there is a specimen in the National Museum (No. 227077) that was obtained near Chogiung, Bristol Bay, by Hanna in 1913. This is a seal of the ice floes and would not be expected to occur regularly in the Aleutian district. Stragglers may have come that far at times in winter with southward-drifting ice.

Pagophilus groenlandicus: Harp Seal

This is another seal whose reported presence in the Aleutians must be seriously doubted. Turner (1886, p. 206) gives as its

range: "All the Arctic shore, Bering Sea, and the Aleutian Islands." There is no evidence of its presence in the Aleutians. Allen (1880, p. 641) refers to Pallas and Steller as recording it from Kamchatka, and he says that Temminck mentions having examined three skins obtained at Sitka. On Temminck's record Nelson (1887, p. 263) expresses serious doubt: "considering that we have no subsequent record of its capture in that now well-known region, and that it is unknown from the Aleutian Islands and is of such extreme rarity in Bering Sea, that record can be safely considered as more than doubtful."

I agree with Nelson's opinion without any hesitation. In fact Doutt (1942, p. 90), considering the complete lack of specimens from the western Arctic and Bering Sea, has some doubt about it being circumpolar in distribution, although Nelson described the skin of a young individual from Cape Prince of Wales, and described several individuals that were seen at close range in the pack ice near Wrangel and Herald Islands.

Histiophoca fasciata: Ribbon Seal

Russian: *Kre-lat-ah* and *Mandar-ka* (Buxton)

This is a rare and little-known seal, but apparently it is quite migratory, and there is a possibility that it has been found among the Aleutian Islands. Allen (1880, p. 681) refers to Pallas as recording the range as far south as the Kurile Islands, and refers to Von Schrenck as stating that Wosnessenski obtained specimens that had been killed on the east coast of Kamchatka. Allen also states that Von Schrenck had seen skins of these seals that had been killed on the southern coast of the Sea of Okhotsk. Allen further states that Dall had obtained specimens from Cape Romanzoff, and he quotes Scammon as follows: "It is found upon the coast of Alaska, bordering the Behring Sea, and the natives of Ounalaska recognize it as an occasional visitor to the Aleutian Islands."

Erignathus barbatus: Bearded Seal

Erignathus barbatus nauticus

Russian, (Siberia): *Nerpah*

Russian, Kamchatka and Marcona: *Lock-tock* (Buxton)

Nelson (1887, p. 260) says—

The Bearded Seal is rather common along the Alaskan coast of Bering Sea south to Bristol Bay, but it is not found on the Aleutian Islands nor about the Fur-Seal group, except possibly as a winter visitor with the ice pack about the latter islands. On the coast south of Cape Vancouver they are far less common than north of that point.

Osgood (1904, p. 47) obtained a skull of this seal from the natives near his camp on Ugagik River. The animal had been killed there on October 3, 1902.

On May 23, 1936, in Bristol Bay, Captain Sellevold, who was in command of our ship the *Brown Bear*, reported that he saw a seal that "dived like a fur seal," that is, sliding over head first, with humped back, but that it had a "white streak" on its face. It is true that this is the diving habit of the bearded seal, and the so-called "white streak" may have been the appearance of the long whiskers of this seal.

A skull is in the National Museum (No. 260363) that was obtained from Kodiak Island by Aleš Hrdlička.

Bill Dirks, Atka Chief, said that in the winter of 1935-36 two strange large seals arrived at Atka Island on ice floes after a period of northerly winds. It is probable that these were bearded seals, for the natives were familiar with their own common harbor seals.

Family ODOBENIDAE

Odobenus rosmarus: Walrus

Odobenus rosmarus divergens

Aleut (dialect?): *Amgadakh* (Geoghegan)

Amagadookh (Wetmore)

Russian: *Morsjec* (Elliot)

The walrus was never known south of Alaska Peninsula or the Aleutian Islands in any numbers. Elliott (1882, p. 98) wrote—

no walrus are found south of the Aleutian Islands; still, not more than 5 or 50 years ago, small gatherings of these animals were killed here and there on the islands between Kodiak and Oonimak Pass; the greatest aggregate of them, south of Bering straits, will always be found in the estuaries of Bristol bay and on the north side of the peninsula.

On October 9, 1923, Walker wrote, "One individual was killed in the fall of 1921 or spring of 1922 at the head of Cold Bay (north of Deer Island) on the south side of the Alaska Peninsula."

Apparently, there was even a more southerly distribution in primitive times. Golder (1922, p. 292) quotes from the journal of Chirikov's vessel, the *St. Paul*, under date of July 16, 1741, the locality being near Cape Addington in southeastern Alaska: "Observed many ducks and gulls of different species, also sea animals—whales, sea lions and walrus."

The same author (p. 295) quotes again for July 23, 1741, somewhere in or near Lisianski Strait: "At the eleventh hour a

walrus swam past our ship." And again (p. 298), for August 1741, near Cape Elizabeth, the southwestern point of Kenai Peninsula: "A walrus dived near the ship."

If we may accept these early records, and they appear to be authentic, in primitive times the walrus must have ranged at least as far south and east as Prince of Wales Island in southeastern Alaska, possibly farther. It should be noted that this was actually not farther south than the north shore of Unimak Island. However, if there had been large herds in southeastern Alaska, surely some of them would have survived long enough to have been more generally recorded. It is reasonable to conclude that walruses occurring south and east of Alaska Peninsula were only in small groups and that they represented the southern fringe of their distribution.

The Aleutian Islands west of Unimak are not properly in the walrus range, but Turner (1886, p. 207) records a 2-year-old male killed at Attu Island in September 1880.

In 1938, Scheffer recorded the following statement by Peter Olson, of Unalaska Island:

I went to Anderson Bay near Makushin with my power dory and towed a walrus up on the beach. It had been killed by natives, was two or three years old, and had a body about two thirds as long as my twenty foot dory. The walrus was beached and the natives took some meat. A doctor on the Coast Guard boat "*Haida*" took the head, cleaned off the meat, and saved the skull. This happened in the late fall of 1926 or 1927.

Such records represent strays.

Walruses feed on clams on the ocean floor, therefore we would not expect to find optimum habitat in the deep waters that are so prevalent in the western Aleutians. On the other hand, we know that walruses existed in great numbers in Bering Sea whose shallow waters afford favorable feeding grounds. It is significant that Bristol Bay, whose shallow waters and mud and sand bottom were the home of great numbers of walruses in earlier days, now has very few.

Several places on the north side of Alaska Peninsula were visited by great numbers of walruses, though early accounts do not always specify precise localities. It is obvious that the "south side of Bristol Bay" harbored large walrus herds. Local residents indicated that the vicinity of Ugashik had one or more hauling-out places.

Osgood (1904, p. 49) reported in 1902 that—

A very limited number of walruses still occur about some of the smaller islands in Togiak Bay west of Nushagak, and on the north coast of the Alaska Peninsula in the vicinity of the native village of Unangashik. Large

quantities of walrus bones, witnesses of bygone slaughters, are to be found at various points along the peninsula. One such place was reported by the fishermen of Igigik, who had recently found it while on a hunting trip near there. From their accounts, the remains must be in great quantities.

Great numbers of walruses are known to have been killed at Port Moller. In 1911, Wetmore reported that a few walruses were still to be found on "Walrus Island", in Izembek Bay, near the west end of Alaska Peninsula. In 1925, when I visited Izembek Bay, parts of walrus skulls were found on Hazen Point and on the ocean beaches of the Kudiakof Islands. These are a string of sand islands that extend across the mouth of Izembek Bay. About 14 miles offshore at this place is isolated Amak Island, which has a long boulder beach thickly strewn with old walrus bones. Assuredly, at one time this was a much-used resting place for these animals.

In 1936, the late Alexis Yetchmenef, Aleut chief then residing at Unalaska, said that in 1880 to 1883, during his visit at his old home in Morzhovoi Village, walruses were numerous on the north side of Unimak Island and were found in St. Catherine Cove. On one occasion, while hunting on Unimak Island, he saw 40 or 50 walruses leaving the island. For 2 years they were plentiful there. Then, in 1898 or 1899, some white men "did a lot of shooting there," and the chief believed that the walrus left for that reason. Unimak Island undoubtedly marks the westernmost point in this area that is reached by the walrus in any numbers, because it also marks the western end of suitable habitat.

In 1887, E. W. Nelson (1887, p. 270) said, "Today it is safe to say that the number of these animals in existence is not over 50 percent of the number living ten years ago, and a heavy annual decrease is still going on."

In a letter dated March 4, 1921, C. L. Andrews wrote to E. W. Nelson, at that time Chief of the U. S. Biological Survey—

The walrus should be looked after. They are increasing, and are again coming to the Alaska Peninsula in small numbers where they, in Russian days, were by thousands. But the skin and ivory hunters will again wipe them off the waters if nothing is done to stop it. If handled properly an industry of at least a million dollars a year could be perpetuated in their skins, oil, and ivory. I can't get the record of the amount brought down for the last 8 or 10 years, the customs do not give it, but I know of 2800 skins being in Seattle about 4 years ago, and the "*Belvedere*" was lost in the Arctic "walrusing" last year.

An occasional walrus is still seen in the vicinity of Nunivak Island, but the herds that Elliott thought would be "preserved indefinitely" are gone from Bristol Bay and Alaska Peninsula. Moreover, there is no assurance, with modern transportation

and with modern firearms in the hands of the natives, that the northern herds will survive. Eskimos still kill walrus for food and clothing. But with the use of firearms about 50 percent of the animals sink and are lost. Today the walrus poses an important conservation problem.

Family SCIURIDAE

Marmota caligata: Hoary Marmot

Marmota caligata caligata

Russian, Siberia: *Tar-bah-gan* (Buxton)

Howell (1915, p. 58) gives the distribution of the marmot including much of southern and interior Alaska, Kenai Peninsula and Alaska Peninsula as far west as the Port Moller region. Allen (1904, p. 278) records a marmot taken at "Muller Bay. The type locality is Bristol Bay. They do not occur in the Kodiak Afognak Islands.

Captain Cook (1842, p. 358), writing at Unalaska, states that foxes and weasels were the only quadrupeds seen, but he adds that he was told that there were hares, and the "marmottas" mentioned by Krasheninikoff in October, 1778. This statement probably refers to the general region of Unalaska, and if the "marmottas" are referable to "marmot," as used later, it is important to note that this name was often applied to the ground squirrel, *Citellus*. Marmot Island obviously was named for the ground squirrel. There are no records of marmots west of Port Moller.

Citellus parryii: Ground Squirrel

Citellus parryii ablusus

Aleut (dialect?): *Anánuchgh* (Osgood)

Russian, (Morzhovoi Bay): *Everaskha* (Wetmore)

Russian, Siberia: *Ov-ráhs-ka* (Buxton)

The type locality of this ground squirrel is Nushagak, and it inhabits the entire length of Alaska Peninsula and Unimak Island. The ground squirrels from the Barren Islands, between Kenai Peninsula and Afognak Island, also are this form, instead of *kodiakensis*. These ground squirrels were introduced on Unalaska Island by Samuel Applegate, of the U. S. Signal Service and they became plentiful in their new home. Osgood (1904, p. 31) states that Applegate obtained the ground squirrels at Nushagak. In 1936, Chief Alexis Yetchmeneff told us much the same story, giving the date of the introduction as 1896 or 1897.

ut he thought that they had come from Unimak Island or Iorzhovoi Bay. The chief was a little uncertain about the precise locality, and Osgood's statement was very definite, so it is likely that they came from Nushagak. In any case, it is the same subspecies.

According to Bill Dirks, chief of Atka Village, 10 or 12 ground squirrels were brought from Unalaska by Nick Bolshanin and were liberated on Kavalga Island, in 1920, where they increased in number. These two introductions, on Unalaska and Kavalga Islands, were the only ones that we learned about.

It is obvious that ground squirrels are able to cross narrow channels of water to reach adjacent islands. In 1925, I was informed that a ground squirrel had been seen swimming across a bay in Isanotski Strait. It came to a net, ran along on the floats for a distance, then swam on again.

When I arrived at King Cove on April 25, 1925, the ground squirrels were active, though it was not known how much earlier they had been out. On May 2, on Unimak Island, it was noted that they were sluggish and not much in evidence, which probably was due to the cold, disagreeable weather that prevailed at that time. Beals and Longworth, in 1941, saw the first ground squirrels on April 15. A trapper, Nick Kristensen, declared that occasionally he had seen ground squirrel tracks in January, presumably in warm spells of weather, but that he had dug them out in winter and found them fully dormant. Osgood (1904, p. 32) said "The animals were more or less active at Cold Bay as late as October 18, although comparatively cold weather was prevailing."

On May 25, 1925, on a plateau near Aghileen Pinnacles, I discovered that ground squirrels had burrowed up through the snow from their place of hibernation, and were living on this snowfield, sometimes wandering far from the burrow.

On June 3, a ground squirrel was observed pulling a big mouthful of grass into a den, no doubt for a nest for the young. Others were similarly engaged on subsequent days—the last observation being on June 8.

Though the food of the ground squirrel is chiefly vegetation, they will eat animal matter. Several came to my camp on Alaska Peninsula to nibble at the fat on a bear hide stretched out to dry. The stomach of a specimen taken on Unimak Island May 8, 1925, examined by the Food Habits Research Section of the U. S. Biological Survey, contained the following items:

21 caterpillars and lepidopterous pupae, 60 percent; 1 tipulid larva and *Bibio* larvae, 4 percent; 2 beetles (*Cryobius* sp.); 1 ichneumonid and spider, trace; 2 berries (*Vaccinium* sp.) 2 percent; a few leaves of *Empetrum nigrum* and other vegetable matter, 34 percent.

In 1937, Scheffer noted that on Kavalga Island the ground squirrels were cutting out the basal parts of *Anemone narcissiflora* and *Ligusticum* above the roots. In 1938, on Unalaska Island, he noted again that ground squirrels were eating out the center of basal parts of stems of the anemone, and he found wilted tops and outer layers of stems near the burrows.

On Kavalga Island, the blue foxes feed to some extent on ground squirrels, and on Alaska Peninsula the Alaska brown bears dig them out of their burrows.

Citellus parryii nebulicola

This form occupies the Shumagin Islands, and was observed on Nagai, Simeonof, and Koniuji Islands in this group.

Citellus kodiacensis: Ground Squirrel

Howell (1938, p. 103) considered this form distinct enough to be a full species. Its range is confined to Kodiak Island.

There is a peculiar circumstance connected with this species. Howell refers to Osgood's statement that the ground squirrels of Kodiak Island were introduced from North Semidi Island (Osgood obtained this information from a native). Petroff (1884, p. 139) states that "The animal [ground squirrel] does not exist on the island of Kodiak, but abounds on some of the smaller islands." And again, 1936, Petellin, of Afognak, informed us that ground squirrels occur on Chirikof and Semidi Islands and on Marmot Island, but none are on Kodiak or Afognak Islands. Yet Howell records 45 specimens from Kodiak Island. There is confusion here that should be cleared up when an opportunity is offered. During our short visits on Kodiak and Afognak Islands, in 1936 and 1937, we did not see the ground squirrel, but in 1938, Scheffer obtained two specimens at Kodiak.

Tamiasciurus hudsonicus: Red Squirrel

Tamiasciurus hudsonicus kenaiensis

Osgood (1904, p. 30) expressed the distribution of red squirrels very well when he said—

Red squirrels were found sparingly in the timbered regions. . . . This scarcity of red squirrels is doubtless because they reach the extreme western limit of their range in this region. Specimens were taken at the following localities

gheling Portage, Lake Clark (near head), mouth of Chulitna River, Neekveena Lake, south fork Chulitna River, Kakhtul River (near Malchatna section). Howell gives the range of this form as reaching as far east as Kutat.

It is to be expected that red squirrels range as far as the evergreen forest at the base of Alaska Peninsula. Presumably, this animal does not occur on Kodiak or Afognak Islands.

Family CASTORIDAE

Castor canadensis: Beaver

Castor canadensis canadensis

Beavers are known to occur in the Bristol Bay region, and they were trapped there. McKay obtained a specimen at Kokwok on December 17, 1881. Osgood (1904, p. 32) found evidence of beaver at various points in the wooded region about the base of Alaska Peninsula. A. G. Maddren obtained a skull at Becharof Lake in October 1903. But the designation of the range of beaver in this country must await further field work.

Kellogg (1936, p. 37) found beaver bones in native midden remains from Kodiak Island. This would suggest that beavers occupied Kodiak Island at one time, though it is possible that these beaver remains might have been brought there by natives. At any rate, beavers were introduced on Kodiak Island in 1925 by the Alaska Game Commission. In 1936, we found them to be well established there. In 1938, Scheffer noted heavy utilization of Sitka spruce by beavers in a pond near Kodiak; "Several hundred stumps 1-6 inches in diameter were seen around the shore. Peeled and unpeeled spruce sticks were used in the dam and edge—We noted some utilization of willow and *Veratrum*. . . . The Salmonberry, though abundant, was apparently not utilized."

Family CRICETIDAE

Crinaptomys borealis: Lemming Mouse

Crinaptomys borealis dalli

This mouse is confined to the basal parts of the Alaska Peninsula, and eastward. In Fish and Wildlife Service collections there are specimens from Lake Clark, Lake Iliamna, Chulitna River, Lake Aleknagik, and Kokwok, on Nushagak River.

Lemmus trimucronatus*: Lemming**Lemmus trimucronatus minusculus***

As might be expected, this mouse ventures out a considerable distance on Alaska Peninsula. Its range is roughly shown by the following specimens in the Fish and Wildlife Service collection: from Chogiung, 11 from Kakhtul, 24 from Kakhtul River, 20 from Chulitna River, 2 from Kokwok River, 2 from Kokwok, 6 from Nushagak River, 6 from Nushagak, and 5 from Chignik Bay. The last mentioned show that further collecting will undoubtedly show a greater distribution on the more westerly part of the Peninsula.

Dicrostonyx groenlandicus*: Collared Lemming**Dicrostonyx groenlandicus rubricatus***

Lemmings that, for the present, are referred to this subspecies are found throughout the length of Alaska Peninsula and Unimak Island. The few specimens we have from the western part of Alaska Peninsula and Unimak Island do not entirely agree in color with the typical *rubricatus* coloration.

These specimens suggest a strong tendency toward the gray pelage of *stevensoni* from Umnak Island. But in view of the variations in the characters of this lemming, and the small number of specimens at hand, it is difficult to state the relationship of the lemmings in this interesting region.

In 1925, when I visited the west end of Alaska Peninsula and Unimak Island, an attempt was made to collect a good series of specimens, but the lemmings were scarce that year and only four were obtained on Unimak Island. They had their burrows on the higher tundra and among the lava beds.

Dicrostonyx groenlandicus unalascensis

The lemming from Unalaska Island was described in 1900 on the basis of skulls taken from owl pellets, and for a long time we knew nothing of its external characters. Many attempts have been made to trap specimens, and during our brief stops on Unalaska in 1936 and 1937 we tried to obtain some, but without result. We did find remains of these mice, however, in red fox droppings.

In 1931, Gilmore succeeded in trapping two specimens on Unalaska Island, and he has described them in detail (1933, p. 257). Apparently, this form, like the one on Umnak Island, does not acquire a white winter coat.

Dicrostonyx groenlandicus stevensoni

This lemming, described by Nelson in 1929, is similar to *D. g. malascensis* in that it is grayer in coloration than *rubricatus*, and does not become white in winter. It is quite common on Umnak Island, but no lemmings or other native mice are found farther west in the Aleutians.

In 1937, we were informed by Mr. Stacey, owner of the domestic sheep on Umnak Island, that about 1927, as nearly as he could remember, lemmings became abundant. "Millions," he said, and "so hard on the grass" that he feared they would "run him out of the sheep business." The following year the lemmings were scarce.

The dates were a little uncertain, but apparently it was about that time that a Captain Nelson, passing by Umnak Island, came upon big "schools" of lemmings out at sea.

A news account in the "Seward Gateway," dated April 18, 1932, possibly refers to this same incident, and may fix the date more accurately:

Trappers on Umnak Island, in the Aleutian group, report the recent migration of millions of lemmings from the island. It is said the lemmings traveled in immense multitudes, in a straight line to the seashore, apparently in obedience to some blind mechanical impulse of nature.

During the migration they moved onward in parallel columns. One trapper could not induce them to deviate from the straight line. The remarkable migration terminated in Bering Sea and ended in the drowning of all that survived the rough journey down from the higher regions of Umnak Island.

In his interesting book, "Fifty Years below Zero," Charles Brower mentions a striking lemming migration (1943, p. 123). It occurred in the latter part of May 1888, near Point Barrow. The lemmings came from the southeast, at first a few bands, then in "solid masses," until the "whole land was black with them." "The main body, moving seaward on a 10-mile front, took 4 days to pass the station. They kept on over the sea ice, finally leaping into the water and swimming offshore until drowned."

These are striking examples of lemming migrations entering the sea, in the historic manner of those of Norway. It illustrates an innate tendency of this rodent group as a whole, shared by the lemmings of Point Barrow (which turn white in winter), and their grayer and southernmost relatives of Umnak Island.

In the spring of 1924 I observed numbers of mice of the genus *Lemmus* in the edge of the shore ice at Hooper Bay, in the Yukon Delta region. Some of these were wet. Though no actual migration was noted, nor any massed concentrations, the circumstances

suggested that this lemming may have in some degree the tendency that is so strong in *Dicrostonyx*.

Clethrionomys rutilus: Red-backed Mouse

Clethrionomys rutilus dawsoni

The wide-ranging red-backed mouse is found practically throughout the whole length of the Alaska Peninsula, for Wetmore obtained a specimen at Frosty Peak, which is not far from the west tip of the peninsula. Furthermore, in 1925, I was informed that in the general vicinity of False Pass there was a "red" mouse, whose description accurately fitted that of *Clethrionomys*. No evidence of its presence on Unimak Island was obtained.

Microtus oeconomus: Meadow Mouse

Microtus oeconomus kadiacensis

Osgood (1904, p. 34) discussed the specimens from the base of the Alaska Peninsula, and remarked that—

All of these seem to be more similar to *kadiacensis* than to typical *operarius*, though to a slight extent they partake of the characters of each. From the examination of a very large series of both it appears that in color *operarius* and *kadiacensis* are absolutely alike, and that in cranial characters they are very closely related.

After careful and painstaking study of this material, it seems best to assign *M. o. kadiacensis* to Kodiak Island exclusively. It is indeed only slightly differentiated, but it may be recognized. It is possible that age has something to do with the character of the skulls from Kodiak, but they appear less robust than those of *M. oeconomus operarius*. The nasals are slightly different in shape, and the incisive foramen in skulls of *kadiacensis* tend to be a little shorter and wider.

Microtus oeconomus operarius

Aleut (dialect?): *Asookitak* (Wetmore)

Meadow mice inhabiting the Bering Sea coast, including Bristol Bay, the Alaska Peninsula, and Unimak Island, appear to be referable to *operarius*. Those found on Unimak Island do not appear to be quite typical, but the differences are so slight (if they really exist in comparable specimens) that there seems to be no sound basis for separating them.

Four specimens of meadow mice were obtained on Sanak Island. Curiously enough, these could hardly be said to differ from the mice on Unimak Island and the Peninsula, though they are

ore isolated than *popofensis* of the Shumagin group. The feet and tail of those from Sanak are dark (as on the Peninsula); the feet and tail are darker than on *unalascensis* and duskier than *kadiacensis*, the latter being essentially browner. On the whole, this small series from Sanak Island cannot be differentiated from *operarius*, and should be included in that form.

Meadow mice were abundant on Dolgoi Island in 1937, but none were trapped, and they were plentiful on Sanak Island, where they are known as "gophers." In 1936, they were extremely abundant at Cape Pankof, Unimak Island, but they were exceedingly scarce on other parts of the same island. Some signs of mice were seen on Ushagat Island, in the Barren Island group, but no specimens were obtained.

In 1911, Wetmore found meadow mice to be scarce in the places he visited at the west end of Alaska Peninsula. In 1925, I found meadow mice to be fairly common on Unimak Island, but found them to be scarce on the mainland and almost unknown in some localities. Specimens were obtained by finding limited colonies here and there. These mice preferred grassy locations, in contrast with the lemmings' choice of the mossy tundra, yet an occasional group could be found on the mossy tundra living on a stray patch of grass. In general, they were common about lagoons and the grassy lowlands, and could be found among lava rocks, particularly about the edge of rock masses, where grass generally occurs. These mice were fond of the beaches and the sand dunes, where the principal vegetation is the coarse wild rye (*Elymus*). In grassy places, where the snow had recently melted, the winter runways were conspicuous. The mice had a liking for the banks of little gullies, where they had numerous burrows—quite often, there were single burrows, at least there was a single entrance with a little pile of excavated dirt. In the sand dunes, the mice run about without well-defined runways; they have routes of travel among the coarse grass stems, as shown by their tracks, but the shifting sand prevents establishment of permanent paths.

On May 17, 1925, at St. Catherine Cove, several food caches were found in the sand dunes, just out of reach of the tide. A small external opening led into a tunnel that slanted downward about 1 foot beneath the surface, to the stored food. In one case, the cache consisted of about 17,560 seeds of beach sandwort, *Monckenia peploides*, together with dried stems and fragments of fruit capsules, and 403 large seeds of a composite, as well as a trace of *Elymus* (bits of stem and leaves and fruit). In another cache, 2 feet distant, there were only undetermined roots—both

caches totaled about half a peck. The shifting sands must have covered those openings repeatedly, therefore the mouse undoubtedly found the spot by a sense of location and scent.

At Uruilia Bay, we found another cache that was made up of bases of stems of undetermined plants and roots.

Microtus oeconomus popofensis

This is another slightly differentiated form, occupying the Shumagin Islands. Specimens have been obtained on Popof and Unga Islands. This mouse is, of course, very similar to *operarius* but the skull appears to have a more slender rostrum, with a little longer and definitely wider incisive foramen. Judging from specimens at hand, the underparts of *popofensis* are more tawny than in the specimens from the mainland.

In 1936, these mice were extremely abundant at one place on Unga Island, near a bird colony. The ground was honeycombed with burrows, and mice were seen running about occasionally.

They are known in the Shumagins as well as on Sanak Island as "gophers," while shrews are called "mice."

Microtus oeconomus amakensis

Strangely enough, this form, which has the most restricted range, is one of the best defined. The skull differs from all other mice in this species, particularly in the occipital region—the flat occipital surface contrasts with the convex surface in the other forms. In this feature, the skull of *amakensis* suggests the appearance of skull of *M. o. kamtschaticus*, though the series of the latter is small and not entirely comparable. Also, the incisive foramen of *amakensis* is short and blunt, contrasting with the attenuated foramina in other forms. The feet and top of tail are paler than in the other forms.

It is puzzling that this form, which is confined to small Amak Island located only 14 miles north of the coast of Alaska Peninsula, is more distinct than the mice on other islands that are equally as far, or farther, from the mainland. It is possible that unfavorable transportation aspects have tended to isolate this island, thus emphasizing a distinct form.

In 1925, when I visited Amak Island, meadow mice were extremely abundant. Runways were everywhere, in the grass underground, under driftwood, among old whale bones on the beach, as well as among the lava rocks and moss on the higher portions of the island. When walking over the low ground, w

ten broke through into a maze of underground burrows. When setting traps, I could hear the traps snapping a short distance behind, as the mice were already being caught. Many of those caught were young mice, and there was a remarkable preponderance of females.

Several mice were infested with ticks, *Ixodes angustus*, sometimes three or four on one mouse. Many others were covered with mites, a gamasid, probably *Hacogamasus* sp.

There were numerous beetles in the mouse runways, some of which fed on the trapped mice. One of these was the common carrion beetle, *Necrophorus* sp., and two others, *Necbria* sp. and *Aphinotus marginatus*, were obtained there, though these latter were not seen feeding. Dung beetles, *Aphodius* sp., and rove beetles gathered at the anus of dead mice, attracted by the odors of dung.

Such an aggregation of more or less parasitic invertebrates in a dense mouse population could be an important element in the cyclic behavior of these rodents.

At the time of this heavy peak population on Amak Island, both lemmings and meadow mice were scarce on Alaska Peninsula. And none of the beetles, mentioned above, were noticed that summer, either on Alaska Peninsula or on Unimak Island.

Microtus oeconomus unalascensis

This form is more readily distinguished from *M. o. operarius* than most of the other subspecies. The skull shows wider nasals, the convexity of the occipital plane is greater, and apparently it is a somewhat larger animal.

This mouse occupies Unalaska Island, and a specimen from nearby Unalga Island is referable to this form. There is no knowledge concerning its presence on Akutan and Akun Islands, or on other smaller islands in that vicinity. Meadow mice apparently are not found on Umnak Island; at least, we obtained only lemmings when we trapped there. Therefore, Unalaska may be the westernmost point reached by *Microtus* in the Aleutians.

On Unalaska Island, in 1936, I found meadow mice in the characteristic grassy meadow habitat, just as on Alaska Peninsula and Unimak Island. And, in 1925, Stevenson stated that in times of heavy mouse population on Unalaska Island, numerous beetles had ruined mouse specimens in the traps, just as they did on Unimak Island.

***Microtus pennsylvanicus*: Meadow Mouse**
Microtus pennsylvanicus drummondii

This form of meadow mouse barely enters the area here under discussion. There are specimens in the Fish and Wildlife Service collection from Lake Clark, Kakhtul River, and Nushagak. Probably, the Drummond meadow mouse does not range much farther west than the base of Alaska Peninsula.

***Ondatra zibethicus*: Muskrat**
Ondatra zibethicus zolophus

Muskrats are common in the Bristol Bay region and the eastern part of Alaska Peninsula. Specimens have been taken in many localities of this area, including one as far west as Ugashik, which was obtained by C. L. McKay in 1881. There is a series of specimens in the Fish and Wildlife Service collection from Becharof Lake, including the type. In 1925, I was told by residents of False Pass that muskrats are not found farther west than Port Moller, the implication being that they do occur in this locality. This is not supported by specimens at present.

Stevenson reported that L. A. Levigne, "a few years ago" (before 1920), brought some muskrats to Unalaska and turned them loose in a fresh-water pond near Captain's Harbor. "They were observed the next spring but have not been seen since, may have starved, or possibly have migrated to some other location."

About 1925, the Alaska Game Commission introduced muskrats on the Kodiak-Afognak group of islands, and they have become established. Scheffer obtained three specimens on Afognak Island in 1938.

Apparently there are no muskrats on Nunivak Island, in Bering Sea, and the distribution here recorded suggests that muskrats require a habitat that is associated with vegetation found in, or near, forested areas. They do not thrive on islands or other areas where the vegetation is low to the ground.

Family MURIDAE

***Mus musculus*: House Mouse**
Mus musculus domesticus

Presumably, the house mouse has been introduced in most of the settlements of southwestern Alaska, and we made no particular effort to study its distribution. In the Aleutian Islands proper, where native rodents are nearly always absent, exotic introductions

ions have a peculiar interest, because of possible adaptation to a rodent-free environment. We do not have specific information for Unalaska Island, where presumably the house mouse must have been introduced in the settlement. In the western, rodent-free islands we took pains to study this question and found a single record—on Kiska Island. In the summer of 1937, signs of mice were found in a cabin on Kiska Island and many traps were set. A single house mouse was caught, possibly the only one on the island, although since the occupation of the Aleutians by military forces it is to be expected that mice and rats have been brought to this and other islands.

The mouse from Kiska evidently came from Seattle in freight shipments. It proved to be *Mus musculus domesticus*, rather than the form from the Asiatic side. Schwartz and Schwartz (1943, p. 66) have shown that the West European house mouse, from which our American commensal mice were derived, is *M. m. domesticus*, and not *M. m. musculus* as heretofore assumed.

Rattus norvegicus: House Rat

Russian: *Krisi*

Rats were introduced in the Aleutian Islands during the Russian occupation. Rat Island had received its name from the Russians as early as 1790, hence the rats must have arrived at an earlier date. Rats also are found at Unalaska and at Atka. At Atka Village, the rats were very troublesome. The natives could not raise gardens at Atka because of these pests, so they crossed over to rat-free Amlia Island and planted their gardens. The rats have managed to cross over to the little islands in Nazan Bay, and they may soon invade Amlia Island (if they have not already done so since the military occupation of that island). Rats are reported from Kiska by G. A. Amman (correspondence). They were not there before World War II. It is probable that rats have been introduced to Attu, Amchitka, and Adak as a result of military operations.

In addition to Atka Village, rats have become feral on both Atka and Rat Islands. On Atka Island, we found their runways in the heavy grass, and we saw cut plant stems, which were much like those of *Microtus*, but longer. Burrows were found in some places. In the spring, we found large areas where the rats had dug up the bulbs of *Fritillaria camschatcensis*, and Scheffer found that the rats had eaten the basal parts of the stems of *Anemone*

narcissiflora, much in the manner of ground squirrels on Unalaska and Kavalga Islands.

On Rat Island, these rodents were confined to the beaches in or near, the fringe of heavy vegetation. They found a convenient refuge among the boulders on the beach and proved to be extremely wary. The interior of this island supports a very short type of vegetation, not at all suitable for cover—hence the choice of the shoreline by the rats.

To what extent blue foxes prey on rats is not certain. These rodents are extremely wary and alert, and the foxes may not find them easy hunting. Bald eagles get an occasional one, but rats had tunneled into the peatlike foundations of two eagle's nests on rock pinnacles on Rat Island and were living there below while the eagles were raising their young.

On one occasion, a short-eared owl had appeared at Atka Island, far out of the range of native rodents, and it was promptly shot. When we found the remains about a year later, in 1936, we were able to determine that the stomach contained parts of a rat.

Family ZAPODIDAE

Zapus hudsonius: Jumping Mouse

Zapus hudsonius alascensis

Jumping mice occur throughout the length of Alaska Peninsula. There are specimens from Lake Aleknagik, Chulitna River, Lake Clark, Lake Iliamna, Kokwok, Nushagak, Chignik, Frosty Peak and Izembek Bay.

I obtained a male specimen at Izembek Bay on June 23, 1925, in the grass at the edge of a pond. At that time, I learned that jumping mice are found on Unimak Island. Several people had observed them there; 1 man, in the course of some excavation work, caught 4 of them. Harry Wilson, on Ikatan Peninsula, had one of these mice in a tin can, but when I arrived there a few days later, the mouse had escaped. In 1941, Beals and Longworth reported that Nick Kristensen had found one of these mice at his house at False Pass, where several others had drowned in a shallow dug well, and Arthur Neuman had reported them as being plentiful about Ikatan Village several years previously. In these instances, though no specimens were obtained, the mouse is easily identified, and there is no reason to doubt the report. Therefore, we may conclude that Unimak Island is occupied by *Zapus*.

Family ERETHIZONTIDAE

Erethizon dorsatum: American Porcupine*Erethizon dorsatum myops*

Morzhovoi Bay: *Noon* (Wetmore)

Porcupines are found along the entire length of the Alaska Peninsula. Osgood (1904, p. 38) suggested that their fondness for the aments and young leaves of the alders may cause them to wander some distance beyond the forest proper. In fact, recent records prove that some of them live several hundreds of miles beyond the forest. At Izembek Bay, in 1925, I found alder cuttings that had been made by porcupines in winter. Evidently, in the summer they were living on green herbaceous plants.

In 1911, near Frosty Peak, Wetmore observed that a porcupine had shuffled along the beach for more than 2 miles before turning inland, evidently nosing around bunches of kelp.

So far as we know, the porcupine is not found on Unimak Island.

Family OCHOTONIDAE

Ochotona collaris: Collared Pika

Apparently, pikas are rare at the base of Alaska Peninsula, though True (1886, p. 221) quotes from McKay's notebook: "Said to be very plentiful in the mountains. The Indians in their vicinity have a superstitious dread about killing them, and can not be hired to do so."

McKay obtained two specimens in the Chigmit Mountains. We have no other specimens from this region.

Family LEPORIDAE

Lepus americanus: Varying Hare*Lepus americanus dalli*

Osgood (1904, p. 39) found these hares to be abundant about Lake Clark and along Chulitna River. Specimens have been taken at Nushagak, Lake Aleknagik, Ekwok, and Kakwok River. They probably do not range far beyond the timbered areas.

Varying hares were introduced to the Kodiak-Afognak Islands by the Alaska Game Commission and are now established there. The introduced stock was obtained from territory along the Alaska Railroad on the mainland.

Lepus othus*: Arctic Hare**Lepus othus podromus***Russian: *Zaisch* (Buxton)Siberian (Chukchi?), Okhotsk, Gichiga, Marcova: *Oo-skon* (Buxton)

Arctic hares are found throughout the Alaska Peninsula and the Bristol Bay region (which is the principal range). So far as we know, none are found on Unimak Island. There is a specimen in the Fish and Wildlife Service collection, which is understood to have been collected by Kleinschmidt on June 9, 1913, on Popoff Island—which is rather surprising. We have no information of its presence on the Shumagins.

In 1936, we found abundant signs of Arctic hares at Snag Point near Nushagak, and learned that they live in the alder thicket. In 1925, I observed them at the west end of Alaska Peninsula and obtained a specimen. There, too, they inhabited the thicket and in summer, when the vegetation was leafed out, they were next to impossible to see, but they came out of the thickets in the evenings to feed.

Family CERVIDAE***Cervus canadensis*: Elk (Wapiti)*****Cervus canadensis roosevelti***

The wapiti is not indigenous to Alaska, but it was introduced on the Kodiak-Afognak Island group. At present, the animals are mostly on Afognak Island, though individuals have crossed over to Whale Island and Derenof Island. The original animals were obtained from the Olympic Mountains in Washington. These elk appear to be thriving in their new environment.

Odocoileus hemionus*: Black-tailed Deer**Odocoileus hemionus sitkensis***

The Sitka black-tailed deer was introduced on Long Island, a rather small island not far from Kodiak. This deer became extremely abundant before 1935, then it began to die. A. W. Bennett, who uses the island for fur farming, found many carcasses, and he noted that raccoons, which he had placed on the island, also were dying during that period. The surviving deer were very poor.

Alces alces*: Moose**Alces alces gigas***

Russian: *Los* (Buxton)

Moose are found throughout the basal part of Alaska Peninsula, where Osgood and others noted their presence in the wooded regions. Griggs (1922, p. 314) found them in the Katmai Region. Osgood (1904, p. 29) wrote:

Moose are scatteringly distributed on the Alaska Peninsula and extend farther west than has been generally supposed. In a native's camp on the Ugaguk River I saw fresh meat and pieces of the skin of a moose which was killed about October 1 on the upper waters of the King Salmon River, a northeastern tributary of the Ugaguk. One of our guides, from Igagik, said that he killed two small moose near the Ugashik Lakes in the fall of 1901. During the spring of 1903 A. G. Maddren received reports that nearly 20 moose were killed by natives in the vicinity of the Naknek River. A moose was said to have been killed several years before as far west as Port Moller, but no confirmation of the report could be obtained.

It is not surprising to find moose beyond the limits of coniferous forest, for this happens in many parts of their range. Stragglers could easily find their way as far west as Port Moller.

Rangifer arcticus*: Barren Ground Caribou**Rangifer arcticus granti***

Atka: *Itkayech* (Saur)

Unalaska: *Ithayok* (Saur)

Morzhovoi Bay: *Ikthinkh* (Wetmore)

Grant caribou range throughout the Alaska Peninsula and Unimak Island. It is said that they were on Unga Island, in the Shumagins, in considerable numbers at one time (Allen 1902, p. 127), and caribou were reported on Deer Island. In July 1925, I found a caribou skeleton on Amak Island, 12 or 14 miles north of Alaska Peninsula. The bones were very old, partly buried in moss and other vegetation. Part of an antler from another individual also was unearthed. Kellogg (1936, p. 37) found caribou bones in midden material from old village sites on Kodiak Island. In primitive times, it is evident that caribou were more plentiful on Alaska Peninsula and Unimak Island and "overflowed" to other islands, possibly to more islands than is shown by these meager records.

Jochelson (1925, p. 36) found a "reindeer" antler spoon in a village midden on Umnak Island. This spoon, or the antler, may possibly have come from Unimak Island in trade.

As reported elsewhere (Murie 1935, p. 59), caribou of Alaska Peninsula were at one time more closely associated with main-

land herds by way of the Bristol Bay region. This is suggested by Osgood (1904, p. 28) who mentions particularly the Lake Clark and Lake Iliamna district as caribou country. Johnson (1886, p. 65) saw them on the tundra near Nushagak in April 1886, and McKay had obtained specimens there in 1882.

The field reports and conversations of Donald Stevenson, fur warden in the Aleutians from 1920 to 1925, revealed great fluctuations in the numbers of caribou on Unimak Island. In the early eighties and nineties, there was much caribou hunting by sea otter hunters, with the result that caribou were greatly reduced in numbers about 1894. When only a few hundred remained, hunting decreased and, as caribou were more plentiful on the peninsula at that time, annual migrations brought an influx of new stock which raised the herd to "full carrying capacity" of the island by 1905.

Stevenson said that no large migrations across Isanotski Strait have taken place since 1908. A few crossed since then, in both directions, but the last known crossing was made by 46 caribou that passed over near St. Catherine Cove in December 1916. He said that the caribou began to decline in numbers after 1908, but that they had been increasing again more recently (as of 1925). At that time (1925), he had made a tentative estimate of 7,000 to 10,000 animals. After my season's work, I accepted the lesser figure as the more probable one.

On Unimak Island, Urilia Bay seemed to be one of the favored caribou habitats. On April 29, we saw more than 40 caribou on the grass flats around the lagoon, and, a few days later, 51 were counted from one point. During this period the caribou subsisted chiefly on dead vegetation, except for *Heracleum lanatum* and *Coelopleurum gmelini*, two robust plants that were just appearing in green rosettes—these plants were eagerly eaten by the caribou.

Winters often are stormy and disagreeable on Unimak, and Stevenson suggested that a series of severe winters might have been one cause of caribou fluctuations. In 1925, there were reports of finding many dead caribou, and I found a number of skeletons. In one instance, the animal (a bull) obviously had died in a resting attitude. On May 8, I found a diseased yearling bull that was blind in both eyes.

As there has been public concern in recent years about the increase of wolves, it is important to note that wolves were scarce during the periods of decline of caribou on Unimak Island in those earlier years, and at the time that so many caribou died, in 1925, there were no wolves. Obviously, much additional investigation is necessary for an understanding of the caribou.

In 1925, we had estimated that there were about 5,000 caribou on Alaska Peninsula, which was a decline in numbers since earlier times. Wolves were not a problem at that time. Speaking at the Alaska Science Conference at Washington, D. C., on November 10, 1950, on "Predator Control Problems in Alaska," Dorr D. Green reported that "The Alaska Peninsula, which once supported hundreds of thousands of caribou, has a herd that is now reduced to about 2,500 animals, of which 2,000 are probably reindeer-caribou hybrids."

In a letter of January 1959, David L. Spencer, supervisor of Kenai National Moose Range, wrote me concerning caribou on Unimak Island:

For a long time there were none, but about 3 years ago we found 14 during a rather incomplete survey. Last winter Jones and Burkholder estimated 150 on the island. . . . Apparently there is a movement back and forth over False Pass at the end of the Peninsula. We do know this occurs, as it has been witnessed.

The population of caribou at the end of the Alaska Peninsula has for a long time been low but appears to be building up somewhat now. . . . 5,000 animals would be a rather rough current estimate of the entire Peninsula herd.

Whatever the actual numbers in early times, the fact that today the caribou have interbred so extensively with the domesticated reindeer spells the doom of *Rangifer arcticus granti* as a subspecies, perhaps as a wild game animal.

Rangifer sp.: Reindeer

Russian: *O-láin* (Buxton)

Reindeer herds have been introduced in the Bristol Bay region, and, in more recent years, they have been placed on Alaska Peninsula. When one considers the scarcity of lichens, and the inevitable hybridization with reindeer, it becomes obvious that the native caribou undoubtedly will be supplanted.

Many years ago, reindeer had been placed on Umnak Island. They were not serving any useful purpose and were finally sold by the Federal Government to the owners of domestic sheep on the island. The sheep owners wished to kill off the reindeer because they competed for forage with the sheep. However, the reindeer had not been entirely eliminated as late as 1937, and we were informed that the principal use being made of them was as fox bait in trapping operations.

Reindeer also had been placed on Atka Island. As long as these animals remained close to the village, the Aleuts utilized them, but

when the reindeer moved to more-distant parts of the island, the natives lost interest.

The Government teacher would sometimes organize an expedition to procure reindeer meat, but, on the whole, the Aleuts preferred fishing.

According to the Government teacher stationed on Atka Island in 1937, some of the reindeer appeared to be diseased and very poor. Some had "pus in the joints" and some had lesions above the hoofs.

It must be concluded that reindeer have proven to be a failure in the Aleutian district and that, while they are able to subsist to some extent, the forage in this area is not suitable for intensive reindeer raising.

Family BOVIDAE

Ovis dalli: Dall Sheep (White Sheep)

Ovis dalli dalli

Russian: *Dee-ke bar-an* "Wild Sheep" (Buxton)

Osgood (1904, p. 30) says—

White sheep are found in small numbers in the mountains between Lake Clark and Cook Inlet, and are probably more or less continuously distributed from there northward along the Alaska Range. They are not reported from the mountains near Iliamna Bay, so it is probable that they do not occur farther west than the vicinity of Lake Clark.

There are two specimens in the National Museum obtained by McKay from the Chigmit Mountains (which proves to be an indefinite locality designation, meaning somewhere in the mountains back from Nushagak).

Family HYDRODAMALIDAE

Hydrodamalis gigas: Steller Sea Cow

Russian: *Morskaiia korova* (Steller)

Our knowledge of the sea cow depends mainly on the account of Steller, who, in the disastrous winter when Bering's expedition was wrecked on Bering Island after discovery of Alaska in 1741, had ample opportunity to study this animal at first hand. The sea cow furnished food for Bering's party, as well as for other expeditions that used the Commander Islands as a starting point for Alaska. It was exterminated by 1768.

There has always been a question whether this animal had

er occupied the Aleutian Islands. Stejneger (1883, p. 84) and Wosnessenski had obtained a rib of a sea cow from Attu Island, and, in conversation, Stejneger expressed the belief that a cow remains might be found on Agattu Island.

Goode et al. (1884, p. 136), wrote as follows concerning this animal:

Wosnessenski found a rib of the animal on Attu, the last island of the archipelago, but as Brandt suggests, it may have been derived from a *Rhytina* washed thither by the waves. Mr. Lucien Turner kindly informed me that an aged Aleut woman stated that *Rhytina* had been seen at Attu by her father, but such testimony is, perhaps, not altogether satisfactory.

Thus, we have some evidence that the sea cow may have occurred on the westernmost Aleutian Islands, and it would be extremely interesting to have identification of bones from old Aleut village sites. To date, studies of such midden material have not revealed the presence of sea cow remains, and, on the whole, it is likely that this animal never inhabited these islands except as an accidental straggler.

Family BALAENIDAE

Balaena sieboldii: Pacific Right Whale

Aleut (Umnak?): *Kulámáx* (Jochelson)

This whale ranged in the Aleutian waters in former times, but since whales of all kinds have been destroyed so extensively, some species have become exceedingly rare, and the right whale is seldom, if ever, seen any more. Osgood (1904, p. 27) mentions a stranded whale between Kanatak and Wide Bay in 1902, which he tentatively assumed to be the right whale. True (1904, p. 270) quotes Pechuel to the effect that a right whale was killed near the Aleutians. Birkeland (1926, p. 26) stated that he knows of only two right whales that were killed at the Akutan whaling station, dating from about 1914 (he has a photograph of one of the two whales mentioned). We saw none of this species on our expeditions to the Aleutians.

Balaena mysticetus: Bowhead Whale

Aleut (Umnak?): *Ugamáxcax'* (Jochelson)

Essentially, this is an Arctic whale that came into Bering Sea and visited the Kuril and Aleutian Islands, but it has become rare in the Aleutians. We obtained no certain records of it during our visits.

Family ESCHRICHTIDAE

Eschrichtius glaucus: Gray Whale

The gray whale is known to range northward through Berin Sea, but we did not identify this species on any of our trip. It should be explained that no one in our party felt himself expert enough to identify many of the whales that were seen. The Captain and some of the ship's crew had had some experience with whales, but they were unable to identify many that were seen. Under such circumstances, our observations were exceedingly sketchy, except for the more-easily identified species. Turner (1886, p. 200) reported seeing several gray whales in Unimak Pass in June 1878.

Family BALAENOPTERIDAE

Balaenoptera physalus: Finback Whale

Aleut: *Chi kakh' lukh* (Turner was uncertain about the application of the name.)

The finback is still present in considerable numbers in the Aleutians, though it is not as plentiful now as in the past. We saw several and they were being taken in 1937 at the whaling station on Akutan Island. At the latter place, we obtained data on several fetuses that had been collected by S. Halvorsen, who had been stationed there by the Coast Guard. This data follows:

Finback fetus, female, collected June 9, 1937, latitude 53° 25', longitude 164° 39'. The fetus was 4 feet long; the mother was 67 feet long.

Finback fetus, female, collected June 10, 1937, latitude 53° 22', longitude 166° 30'. The fetus was 3 feet 4 inches long; the mother was 60 feet long.

Finback fetus, male, collected July 28, 1937, latitude 54° 06', longitude 166° 45'. This fetus was 16.7 inches long; the mother was 67 feet long.

Balaenoptera borealis: Sei Whale

The sei whale was observed at various times among the Aleutian Islands; identification was made by Captain Sellevold. It was recorded various times at Segula and Atka Islands and in Unimak Pass, and at Atka Island a whale spent most of a day cruising about in the harbor and often came near the ship. A few motion pictures of it were obtained.

On September 3, 1938, Scheffer recorded 2 sei whales near the ship in Umnak Pass, and later in the day, he noted 3 more.

In 1937, the United States Bureau of Fisheries reported the

capture of a sei whale among 376 whales taken in Alaska that year.

***ibbaldus musculus*: Blue Whale**

We did not definitely identify a blue whale on our trip. On July 14, 1937, Captain Sellevold believed a number of whales seen spouting near Unalaska were blue whales. A number of this species were taken by the Akutan whaling station that summer, and we were given the head of a fetus for a specimen.

***Megaptera novaeangliae*: Humpback Whale**

Aleut (dialect?): *Chí thukh* (Turner was uncertain about the application of this name.)

Humpback whales were seen at various times. In 1937, we recorded 1 at Agattu Island, 1 at Semichi, at least 4 (possibly more) at Kiska, and 3 at Amchitka. Sometimes this whale would dive straight down in shallow water, practically stand on its head, then fall over with a resounding splash of its flukes. This action was seen often.

Family PHYSETERIDAE

***Physeter catodon* Sperm Whale**

Aleut (dialect?): *Agthá gik* (Turner)

Sperm whales were very scarce. One was definitely identified near Kiska Island on June 3, 1937, and they were being taken at the Akutan whaling station. Sperm whales are not difficult to identify, and we felt that most of our identifications were accurate.

Family DELPHINIDAE

***Orcinus rectipinna*: Pacific Killer Whale**

Attu: *A'-ga-ghi-ach*

Atka: *Ah'-ga-loh*

Ah'-ga-luch

Aleut (dialect?): *Aǵ-lyuk* (Turner)

In the Atka dialect, the name is very similar to that of the fulmar. The difference appears to be one of syllable length, or stress, which was not possible to record satisfactorily.

The killer whale of the Aleutian district clearly shows the white elongated spot posterior to the eye and the gray patch posterior to the dorsal fin. These marks were noted on every

killer whale that we saw closely enough for identification. It is of interest to note Turner's remarks on the killers (1886, p. 198)

The Aleuts speak of the killer as *Aǵ-lyuk*; and, to another species, which they recognize, they give the name *Um-gú-likh*. I have seen what I believe to be 2 species, and perhaps 3 species, of the so-called "killers," swimming together, all moving in the same direction.

Dall (1870, p. 579) lists two killers for Alaska, *Orca ater*, and *Orca rectipinna*. We did not obtain the impression of more than one kind of killer whale, but our observations could not be conclusive on that point.

The killer whale is common along Alaska Peninsula and throughout the Aleutians. We found a dead one on Agattu Island. We generally saw them in small groups, or alone, but as many as 25 in a school were recorded. The most common number for a group was three. Ernest P. Walker (unpublished notes) has recorded some large schools of killer whales. On September 16, 1913, in Icy Straits, he saw a school of 500 or more; on July 19, 1915, near Port Armstrong he saw another school of about 300. He quotes Captain Louis L. Lowe to the effect that he had seen schools of 400 to 1,500 off the southwestern end of Kodiak Island, and, in April 1922, he saw a school of about 1,000 off Uga Island near the Kodiak coast. "They were apparently headed northward and were no doubt keeping close company with the fur seals."

Again, Walker says—

Captain Haynes says that on only one occasion has he seen a large school of killers or thrashers. This was early in June near Unimak Island, when he encountered a remarkable assemblage of various whales, seals, and other life feeding and many killers were present. There was a great deal of fighting accompanied by leaping.

Turner (1886, p. 198) reported seeing as many as 150 at one time, in the Aleutians.

Such large aggregation suggest a migration, and, as Walker says, they probably are rare occurrences.

We frequently found killer whales cruising along the border of kelp beds. On one occasion, a killer passed directly under our dory—a rather disconcerting experience. We obtained no direct evidence of their food habits, but Turner saw a killer whale kill a nearly full-grown sea lion at Bogoslof Island, and, at Tigald Island, he watched two killers attacking a large finback whale. He had also seen them following schools of smelt, which suggests a diet including fish.

***Iobicephala scammonii*: Pacific Blackfish**

Our information on this dolphin is very meager. Dall (1869, 333) reported it in Bering Sea, and Osgood (1901, p. 25) reported it in the Queen Charlotte Islands. We found no evidence of its presence in the Aleutians.

***Esodelphis borealis*: Right-whale Porpoise**

This species is rather vaguely listed as ranging into Bering Sea. Turner mentioned it briefly in his report on the Aleutians, and he mentioned native names for some porpoises which he was unable to identify, but he had no positive information to offer on this form. I have been unable to find precise information for the Aleutian district.

***Urogorychus obliquidens*: Pacific Striped Porpoise**

Aleut (dialect?): *A-ga-makh'-chikh* (Turner)

Turner (1886, p. 197) reported that he saw a number of dolphins sporting about the ship at Amchitka Island, and he described them thus:

These creatures were only about eight or nine feet in length and had numerous markings, stripes, or bars, along the sides and throat. These markings were two or three inches wide and of a sulphur-yellow color, while the back and sides were bluish-black.

Two or three persons on the vessel declared they had seen the same species in the waters of the Japan coast, and gave the name Japan Dolphins to those seen near Amchitka. I do not know to what species they should be referred.

We saw none of these dolphins in the Aleutian area, but Turner's description suggests the striped dolphin.

***Phocoena vomerina*: Pacific Harbor Porpoise**

Aleut (dialect?): *A-lá gikh* (Turner)

Russian: *Svinka* (Turner)

Osgood (1904, p. 27) records two skulls obtained at Kanatak by Maddren in the fall of 1903. Preble and McAtee record a number of specimens from the Pribilof Islands. True (*in* Jordan 1899, 353) reported—

Several bones of a small porpoise, apparently of this species, were picked up at St. Paul June 3, 1890, and two small schools were seen in the harbor of Unalaska May 20 and 21, the same year. A specimen of this species was obtained by Mr. Charles H. Townsend at Captain's Harbor, Unalaska, August 17, 1895.

Turner (1886, p. 200) stated that he saw these porpoises in the

Aleutians and near Kodiak, and he said that they were common in Captains Harbor, at Unalaska, where they came up close to the wharf. He stated that two were caught on hooks baited for codfish.

On May 23, 1937, among the Shumagin Islands, we saw 2 of these porpoises near our ship, and, on August 13, 1937, 3 were seen in the harbor at Atka Island.

Phocoenoides dalli: Dall Porpoise

The type locality for Dall porpoise is near Adak Island, but we did not find them plentiful in the Aleutians. On July 20, 1937, a school of these porpoises was playing about the ship, between Kasatochi and Atka Islands, and a few were seen in the Aleutians in 1937. On August 8, 1938, Scheffer recorded two porpoises north of Yunaska Island. We found them to be much more plentiful in the waters of southeastern Alaska. Walker (unpublished notes) likewise found them scarce in southwestern Alaska, and, during a 3-month cruise in the summer of 1922, in a small boat between Juneau and Unalaska, he saw these porpoises only once. He wrote that Captain T. S. Haynes did not recall having seen *dalli* in Bering Sea and said they are not plentiful along Alaska Peninsula.

Walker found that one male weighed 199 pounds, and he measured the length of four specimens as follows: male, 1,760 mm.; female, 1,575 mm.; female, 1,817 mm.; and another (sex unknown), 1,880 mm.

The stomach of one of Walker's specimens contained only the flesh and beaks of squids. One contained mainly squid, with a trace of fish; one contained squid and a few bones of fish; and another contained a few squid beaks and at least 1/2 pound of small fish.

Family MONODONTIDAE

Delphinapterus leucas: White Whale (Beluga)

Aleut (dialect?): *Há-thakh* (Turner)

Russian: *Bi-loo-hah* (Buxton)

We saw no white whales on any of our expeditions. Osgood (1904, p. 27) wrote:

White whales or belugas often came into the mouth of the Nushagak River and the neighboring small bays in pursuit of salmon, on which it is said to feed quite extensively . . . Belugas are said to occur also on the south side of the peninsula, about the mouth of Cook Inlet.

Kellogg (1936) found bones of this whale in midden material from ancient village sites on Kodiak Island.

Family ZIPHIIDAE

Berardius bairdii: Baird Beaked Whale

This species is generally spoken of as ranging in Bering Sea, and Turner mentions it tentatively for the Aleutian Islands. We did not obtain evidence of its presence in the Aleutians, nor for the waters of southwest Alaska.

Desoplodon stejnegeri: Stejneger Beaked Whale

This rare whale was described from Bering Island, and it could be expected to occur in the Aleutians. The Ziphiidae have seldom been observed, and we have very little information about them.

Ziphius cavirostris: Cuvier Beaked Whale

This is another whale that may occur in the Aleutian district, but we did not identify any. True (1910, p. 2) lists a specimen found in Kiska Harbor in September 1904. Walker (unpublished notes) mentions descriptions of whales by Captain Earling taken on the southeast Alaskan coast, which suggest both *Berardius bairdii* and *Ziphius cavirostris*. The Aleuts of Attu Island assured me that there were "many other" whales in the Aleutians, but the difficulty of describing the different species to the Aleuts precluded any satisfactory listing of names.

On several occasions, we found remains of unknown whales on beaches. Further work is necessary to clarify whale distribution in the Aleutian Islands.

References

ALDRICH, JOHN W.

1946. Speciation in the white-cheeked geese. *Wilson Bulletin*, vol. No. 2, pp. 94-103.

1948. Additional light on the races of the dowitcher. *Auk*, vol. 65, 1948, pp. 285-286.

ALLAN, ALEXANDER.

1910. *Hunting the sea otter*. Horace Cox Press, London, England.

ALLEN, J. A.

1870. The eared seals (Otariadae), with detailed descriptions of North Pacific species With an account of the habits of the northern fur seal (*Callorhinus ursinus*), by Charles Bryant. *Bull. Harvard Museum Comparative Zoology*, vol. 2, No. 1, pp. 1-108.

1878. The geographical distribution of the mammalia, considered in relation to the principal ontological regions of the earth, and the laws that govern the distribution of animal life. U.S. Geological and Geographical Survey, *Bulletin*, vol. 4, No. 2, pp. 313-377.

1880. History of North American pinnipeds: a monograph on the walrus, sea lions, sea bears, and seals of North America. U. S. Geological Survey Misc. Publ. 12, 785 pp.

1893. The geographical origin and distribution of North American birds, considered in relation to faunal areas of North America. *Auk*, vol. 10, No. 2, pp. 97-150.

1898. The sea otter. A review of C. L. Hooper's "Report on the sea otter banks of Alaska." *American Naturalist*, vol. 32, pp. 356-363.

1902a. A new bear from the Alaska Peninsula. *Bull. American Museum Natural History*, vol. 16, pp. 141-143.

1902b. A new caribou from the Alaska Peninsula. *Bull. American Museum Natural History*, vol. 16, pp. 119-127.

1902c. *Vulpes alascensis*. *Bull. American Museum Natural History*, vol. 16, p. 225.

1902d. The hair seals (Family Phocidae) of the North Pacific Ocean and Bering Sea. *Bull. American Museum Natural History*, vol. 16, pp. 459-499.

1902e. The American and European herring gulls. *Auk*, vol. 19, No. 2, pp. 283-284.

1903a. Report on the mammals collected in northeastern Siberia by the Jesup North Pacific expedition, with itinerary and field notes by N. G. Buxton. *Bull. American Museum Natural History*, vol. 19, art. 4, pp. 101-184.

1903b. Mammals collected in Alaska and northern British Columbia by the Andrew J. Stone expedition of 1902. *Bull. American Museum Natural History*, vol. 19, art. 21, pp. 521-567.

1904. Mammals collected in Alaska by the Andrew J. Stone expedition of 1903. *Bull. American Museum Natural History*, vol. 20, art. 1, pp. 273-292.

American Ornithologists' Union.

1931. Check-list of North American birds. Fourth edition.

1957. Check-list of North American birds. Fifth edition.

NDERSON, J. WYLIE.

1909. Hunting *Ursus gyas* on Unimak (Alaska). *Outdoor Life*, vol. 24, pp. 533-544.

NDERSON, R. M.

1934. Notes on the distribution of the hoary marmots. *Canadian Field-Naturalist*, vol. 48, No. 4, pp. 61-63.

NDERSON, R. M., and A. L. RAND.

1943. Variation in the porcupine (genus *Erethizon*) in Canada. *Canadian Jour. Research*, vol. 21, pp. 292-309.

NDREWS, C. L.

1938. Children of the sea. *Alaska Sportsman*, vol. 4, No. 7, pp. 8-9, 27-28, 31-32.

NDREWS, ROY C.

- 1909a. Observations on the habits of the finback and humpback whales of the eastern North Pacific. *Bull. American Museum Natural History*, vol. 26, pp. 213-226.

- 1909b. A summer with the Pacific coast whalers. *Jour. American Museum Natural History*, vol. 9, No. 2, pp. 21-30.

NTHONY, A. W.

1895. The fulmars of southern California. *Auk*, vol. 12, p. 100.

1906. Random notes on Pacific coast gulls. *Auk*, vol. 23, No. 2, pp. 129-137.

1934. A new petrel for North America. *Auk*, vol. 51, No. 1, p. 77.

NTHONY, H. E.

1928. *Field book of North American mammals*. Putnam and Sons, New York, N. Y.

RNOLD, LEE W.

1948. Observations on populations of North Pacific pelagic birds. *Auk*, vol. 65, No. 4, pp. 553-558.

RNY, SAMUEL A.

1952. Taxonomic status of the bank swallow of North America. *Condor*, vol. 54, No. 6, pp. 356-357.

USTIN, O. L., JR.

1949. The status of Steller's albatross. *Pacific Science*, No. 3, pp. 283-295.

AER, K. E. VON.

1838. Anatomische und zoologische Untersuchungen über das Walross (*Trichechus rosmarus*) und Vergleichung dieses Thiers mit anderen See-säugethieren. *Mem. Ac. Sci. Leningrad* s. 6, sec. 2, *Sci. Nat.*, vol. 4, pp. 97-236.

AILEY, ALFRED M.

1922. Notes on the yellow-billed loon. *Condor*, vol. 24, No. 6, pp. 204-205.

- 1925-26. A report on the birds of northwestern Alaska and regions adjacent to Bering Strait. Parts I to X. *Condor*, vol. 27, Nos. 1-6; vol. 28, Nos. 1-4.

1927. Notes on the birds of southeastern Alaska. *Auk*, vol. 44, Nos. 1, 2, 3, pp. 1-23, 184-205, 351-367.

1928. An unusual migration of the spotted and ribbon seals. *Jour. Mammalogy*, vol. 9, No. 3, pp. 250-251.

1930. The pintails of northwestern Alaska. *Condor*, vol. 32, No. 5, pp. 264-265.

1931. Specimens from Point Barrow, Alaska. *Condor*, vol. 33, No. 2, p. 78.
1932. Additional records from Cape Prince of Wales, Alaska. *Condor*, vol. 34, No. 1, p. 47.
1933. The Baikal teal from King Island, Alaska. *Auk*, vol. 50, No. 1, p. 97.
1934. Additional records for the Barrow region, Arctic Alaska. *Condor*, vol. 36, No. 4, p. 169.
1943. Birds of Cape Prince of Wales, Alaska. *Proceed. Colorado Museum Natural History*, vol. 18, No. 1, pp. 1-113.
- BAIRD, S. F.
1869. On additions to the bird fauna of North America, made by the Scientific Corps of the Russo-American Telegraph Expedition. *Transactions Chicago Academy Science*, vol. I, pp. 311-325.
- BANCROFT, HUBERT HOWE.
1886. *History of Alaska, 1730-1885*. San Francisco.
- BARABASH-NIKIFOROV, I. I.
1935. The sea otters of the Commander Islands. *Jour. Mammalogy*, vol. 16, No. 4, pp. 255-261.
1937. Taxonomic observations on white whales. *Jour. Mammalogy*, vol. 18, No. 4, pp. 507-509.
1938. Mammals of the Commander Islands and the surrounding sea. *Jour. Mammalogy*, vol. 19, No. 4, pp. 423-429.
- BARRETT-HAMILTON, G. E. H.
1897. Remarks on the Pacific walrus. *Proceed. Zoological Society London*, pp. 266-267.
- BARTSCH, P., and H. A. REHDER.
1939. Two new marine shells from the Aleutian Islands. *Nautilus*, vol. 52, No. 4, pp. 110-112, pl. 8.
- BEAN, TARLETON H.
1882. Notes on birds collected during the summer of 1880 in Alaska and Siberia. *Proceed. U. S. National Museum*, pp. 144-173.
1889. Birds, bears, and fishes. *Forest and Stream*, vol. 33, pp. 348-36
1891. The pike family (in two parts). *Forest and Stream*, vol. 36, pp. 210, 233.
- BEHLE, WILLIAM H.
1941. Additional data concerning the subspecific status of the cormorants of Great Salt Lake. *Condor*, vol. 43, No. 6, pp. 286-289.
- BENDIRE, CHARLES.
1895. Notes on the ancient murrelet (*Synthliboramphus antiquus*) by Chase Littlejohn, with annotations. *Auk*, vol. 12, No. 3, p. 270.
- BENSON, SETH B., and THOMAS C. GROODY.
1942. Notes on the Dall porpoise. *Jour. Mammalogy*, vol. 23, No. 1, pp. 41-51.
- BENT, ARTHUR CLEVELAND.
1912. Notes on birds observed during a brief visit to the Aleutian Islands and Bering Sea in 1911. *Smithsonian Misc. Collections*, vol. 56, No. 32.
1919. Life histories of North American diving birds. *U. S. National Museum Bull.* 107.

1921. Life histories of North American gulls and terns. U. S. National Museum Bull. 113.
1922. Life histories of North American petrels and pelicans and their allies. U. S. National Museum Bull. 121.
1923. Life histories of North American wildfowl order Anseres (Part I). U. S. National Museum Bull. 126.
1925. Life histories of North American wildfowl order Anseres (Part II). U. S. National Museum Bull. 130.
1926. Life histories of North American marsh birds. U. S. National Museum Bull. 135.
1927. Life histories of North American shore birds order Limicolae (Part I). U. S. National Museum Bull. 142.
1929. Life histories of North American shore birds order Limicolae (Part II). U. S. National Museum Bull. 146.
1932. Life histories of North American gallinaceous birds. U. S. National Museum Bull. 162.
1937. Life histories of North American birds of prey order Falconiformes (Part I). U. S. National Museum Bull. 167.
1938. Life histories of North American birds of prey order Falconiformes and Strigiformes (Part II). U. S. National Museum Bull. 170.
- ANT, SILAS.
1857. The Japanese gulf stream. Bull. American Geographical Society, vol. 2, pp. 203-213.
- ARKELAND, KNUT B.
1926. The whalers of Akutan. Yale University Press, New Haven, Conn.
- SHOP, LOUIS B.
- 1900a. Birds of the Yukon region, with notes on other species. *In* Results of a biological reconnaissance of the Yukon River region. North American Fauna, No. 19, pp. 47-96. U. S. Biological Survey, Washington, D. C.
- 1900b. Descriptions of three new birds from Alaska. *Auk*, vol. 17, No. 2, pp. 113-120.
1905. The gray sea-eagle (*Haliaeetus albicilla*) in British Columbia. *Auk*, vol. 22, No. 1, pp. 79-80.
1915. Description of a new race of Savannah sparrow and suggestions on some California birds. *Condor*, vol. 17, No. 5, pp. 185-189.
- 1927a. The status of the Point Barrow gull. *Condor*, vol. 29, No. 4, pp. 204-205.
- 1927b. The plumages of certain gulls. *Condor*, vol. 29, No. 4, pp. 201-202.
- SHOP, S. E.
1904. The cold-current system of the Pacific, and source of the Pacific coast current. *Science* (new ser.), vol. 20, pp. 338-340.
- OLIN, ROLF L.
1938. Reappearance of the southern sea otter along the California coast. *Jour. Mammalogy*, vol. 19, No. 3, pp. 301-303.
- ND, R. M.
1949. Characteristics of the gyrfalcons from the Bering Sea area. *Condor*, vol. 51, No. 5, pp. 228-229.

BONE, SCOTT C.

1922. Annual report of Governor of Alaska on the Alaska game law.
1921. U. S. Department Agriculture Circ. 225.

BRETHERTON, BERNARD J.

1896. Kodiak Island, a contribution to the avifauna of Alaska. *Oregon Naturalist*, vol. 3, p. 45.

BROCH, HJALMAR.

1936. Some zoogeographical problems of the northern Pacific. *Scientific Results of the Swedish Arctic Expedition* (new ser.), vol. 83, pp. 101-103.

BRODKORB, PIERCE.

1933. Remarks on the genus *Limnodromus* Wied. *Proceedings Biological Society Washington*, vol. 46, pp. 123-128.

BROOKS, ALFRED H.

1906. The geography and geology of Alaska. U. S. Geological Survey Professional Paper 45.

BROOKS, ALLAN.

1922. Notes on the American pine grosbeaks with a description of new subspecies. *Condor*, vol. 24, No. 3, pp. 86-88.
1926. Notes on the status of the Peale falcon. *Condor*, vol. 28, No. 3, pp. 77-79.

BROOKS, S. C.

1934. Oceanic currents and the migration of pelagic birds. *Condor*, vol. 36, No. 5, pp. 185-190.

BROOKS, W. SPRAGUE.

1915. Notes on birds from east Siberia and arctic Alaska. *Bulletin of the Harvard Museum Comparative Zoology*, vol. 59, No. 5, pp. 361-400.

BYERS, H. R.

1934. Air masses of the North Pacific. *Bulletin Scripps Institute Oceanography Technology*, ser. 3, pp. 311-353.

CAHALANE, VICTOR H.

1943. Notes on the birds of the Kodiak-Afognak Island group. *Auk*, vol. 60, No. 4, pp. 536-541.
1944. Birds of the Katmai Region, Alaska. *Auk*, vol. 61, No. 3, pp. 351-375.

CAHN, ALVIN R.

1947. Notes on the birds of the Dutch Harbor Area of the Aleutian Islands. *Condor*, vol. 49, No. 2, pp. 78-82.

CAPPS, STEPHEN R.

1934. Notes on the geology of the Alaska Peninsula and Aleutian Islands. U. S. Geological Survey, Bulletin 857-D, pp. 141-153.

CARVER, W. H.

1928. Notes from St. George's Island, Alaska. *Murrelet*, vol. 9, No. 1, pp. 63-65.
1929. More observations from St. George's Island, Alaska. *Murrelet*, vol. 10, No. 1, pp. 15-17.

CHAPMAN, FRANK M.

1902. List of birds collected in Alaska by the Andrew J. Stone Expedition of 1901. *Bulletin American Museum Natural History*, vol. 16, pp. 231-247.
1904. A common loon at Seldovia, June 30, 1903. *Bulletin American Museum Natural History*, vol. 20.

HASE, EARL, and RALPH DONAHUE.

1944. Report from the services. Pvt. Donahue finds plenty of life in the barren Aleutians. *Animal Kingdom*, vol. 47, No. 1, pp. 11-13.

HINARD, GILBERT.

1937. *Le Voyage de La Pérouse sur les Côtes de l' Alaska et de la Californie* (1786). Baltimore, Md.

LARK, AUSTIN H.

1887. The Pacific walrus fishery. *In* The fisheries and fishery industries of the United States, 1887, Sec. 5, Part 2, pp. 311-318.

1907. Eighteen new species and one new genus of birds from eastern Asia and the Aleutian Islands. *Proceed. U. S. National Museum*, vol. 32, pp. 467-475.

1910. The birds collected and observed during the cruise of the United States Fisheries Steamer "Albatross" in the North Pacific Ocean, and in the Bering, Okhotsk, Japan, and Eastern Seas, from April to December, 1906. *Proceed. U. S. National Museum*, vol. 38, pp. 25-74.

OLLINS, GRENOLD.

1940. Habits of the Pacific walrus. *Jour. Mammalogy*, vol. 21, No. 2, pp. 138-144.

OLLINS, HENRY B., JR., AUSTIN H. CLARK, and EGBERT H. WALKER.

1945. The Aleutian Islands: Their people and natural history. *Smithsonian Institute War Background Studies* 21, Pub. 3775.

ONOVER, H. B.

1941. A study of the dowitchers. *Auk*, vol. 58, No. 3, pp. 376-380.

1943. Races of the knot (*Calidris canutus*). *Condor*, vol. 45, No. 6, pp. 226-228.

1944. The North Pacific allies of the purple sandpiper. *Zoological Ser., Field Museum Natural History*, vol. 29, No. 11, pp. 169-179.

1945a. Notes on some American shorebirds. *Condor*, vol. 47, No. 5, pp. 211-214.

1945b. The breeding golden plover of Alaska. *Auk*, vol. 62, No. 4, pp. 568-574.

OOK, JAMES.

1842. *Voyages of Captain James Cook*. Vol. II (Home Library), Burt Press.

OOK, J. A.

1926. *Pursuing the whale; a quarter-century of whaling in the Arctic*. Houghton Press.

OOKE, WELLS W.

1915. The yellow-billed loon; a problem in migration. *Condor*, vol. 17, No. 6, pp. 213-214.

ORNEY, PETER.

1821. *Voyages in Northern Pacific in 1813-18*. Honolulu, 1896. (Reprinted from the *London Literary Gazette* of 1821.)

OTTAM, CLARENCE, and PHOEBE KNAPPEN.

1939. Food of some uncommon North American birds. *Auk*, vol. 56, No. 2, pp. 138-169.

OUTURIER, MARCEL A. J.

1954. *L'Ours Brun*. Grenoble France.

OWAN, I. MCT.

1939. The sharp-headed finner whale of the eastern Pacific. *Jour. Mammalogy*, vol. 20, pp. 215-225.

CRABB, EDWARD D.

1922. The Sykes Alaskan Expedition of the University of Oklahoma of 1921. *Proceed. Oklahoma Academy Science*, vol. 2, pp. 60-65.
 1923. A note on the economic status of the bald eagle in Alaska. *Auk*, vol. 40, No. 3, pp. 419-423.

DALL, WILLIAM H.

1869. Note on the "blowing" of whales. *American Naturalist*, vol. 3, pp. 333-334.
 1870. Alaska and its resources. Boston, Mass.
 1873. Notes on the avifauna of the Aleutian Islands, from Unalaska eastward. *Proceed. California Academy Sciences*, vol. 5.
 1874. Notes on the avifauna of the Aleutian Islands, especially the west of Unalaska. *Proceed. California Academy Sciences*, vol. 6, pp. 270-281.
 1875. Alaskan mummies. *American Naturalist*, vol. 9, pp. 435-438.
 1876. On the marine faunal regions of the North Pacific: An introductory note to the report on Alaskan hydroids, by S. F. Clark. *Proceed. Academy Sciences Philadelphia*, vol. 3, No. 28, pp. 205-210.
 1920. The Pliocene and Pleistocene fossils from the Arctic coast of Alaska and the auriferous beaches of Nome, Norton Sound, Alaska. U. S. Geological Survey Professional Paper 125-C, pp. 23-37.

DALL, WILLIAM H., and H. M. BANNISTER.

1869. List of the birds of Alaska, with biographical notes. *Transactions Chicago Academy Science*, vol. I, pp. 267-310.

DAVIS, WILLIAM B.

1944. Geographic variation in brown lemmings (genus *Lemmus*). *Murrelet*, vol. 25, No. 2, pp. 19-25.

DEIGNAN, H. G.

1951. The genus *Cuculus* in North America, a reconsideration. *Condor*, vol. 53, No. 3, pp. 154-155.

DELACOUR, JEAN, and ERNST MAYR.

1945. The family Anatidae. *Wilson Bulletin*, vol. 57, No. 1, pp. 3-10.

DICE, LEE R.

1922. Biotic areas and ecologic habitats as units for the statement of animal and plant distribution. *Science*, vol. 55, No. 1422, p. 104.
 1923. Life zones and mammalian distribution. *Jour. Mammalogy*, vol. 4, No. 1, pp. 39-47.
 1932. A preliminary classification of the major terrestrial ecological communities of Michigan, exclusive of Isle Royale. *Papers Michigan Academy Science, Arts and Letters*, vol. 16, pp. 217-239.

DIXON, JOSEPH.

1916. Migration of the yellow-billed loon. *Auk*, vol. 33, No. 4, pp. 370-376.
 1938. Fauna of the National Parks of the United States. Birds and Mammals of Mount McKinley National Park. U. S. National Park Service Fauna Ser. 3.

DUVALL, ALLEN J.

1945. Distribution and taxonomy of the black-capped chickadees of North America. *Auk*, vol. 62, No. 1, pp. 49-69.

DWIGHT, JONATHAN, JR.

1904. The exaltation of the sub-species. *Auk*, vol. 21, pp. 64-68.

1906. Status and plumages of the white-winged gulls of the genus *Larus*. *Auk*, vol. 23, No. 1, pp. 25-43.
1919. Reasons for discarding a proposed race of the glaucous gull (*Larus hyperboreus*). *Auk*, vol. 36, No. 2, pp. 242-248.
1925. The gulls (Laridae) of the world; their plumages, moults, variations, relationships, and distribution. *Bull. American Museum Natural History*, vol. 52, pp. 63-401.
- NARSON, ARTHUR S.
1922. Alaska Notes. *Murrelet*, vol. 3, No. 3, p. 4.
- LIOT, DANIEL GIRAUD.
1896. Descriptions of an apparently new species and sub-species of ptarmigan from the Aleutian Islands. *Auk*, vol. 13, No. 1, pp. 24-29.
1901. A synopsis of the mammals of North America and the adjacent seas. *Publ. Field Columbian Museum Zoological Ser.*, vol. 2.
1903. Description of an apparently new subspecies of marten from the Kenai Peninsula, Alaska. *Field Museum Natural History, Zool. Ser.* 1903, pp. 151-173. Chicago.
- LIOTT, HENRY W.
1897. Our Arctic province. Scribner's Sons, 1886.
- ERMANN, BARTON WARREN.
1913. Eighteen species of birds new to the Pribilof Islands, including four new to North America. *Auk*, vol. 30, No. 1, pp. 15-18.
1921. The Ano Nuevo Steller sea lion rookery. *Jour. Mammalogy*, vol. 2, No. 1.
1922. Why not save the marine mammals of the Pacific? *Pan-Pacific Union Bull.* 34, pp. 12-16.
- ERDAM, WALTER J.
1933. Sea otters in the Aleutian Islands. *Jour. Mammalogy*, vol. 14, No. 1.
- 1936a. Notes on birds collected or observed during the summer of 1932 in the eastern Aleutian Islands, Alaska. *Murrelet*, vol. 17, Nos. 2-3, pp. 48-52.
- 1936b. Mammal remains from an Aleut Stone Age village. *Jour. Mammalogy*, vol. 17, No. 1.
- GGINS, J. D.
1904. Field notes on the birds and mammals of the Cook's Inlet region of Alaska. *Abstracts of Proceed. Linnean Society New York*, Nos. 15-16, pp. 15-39.
- NDLEY, JAMES S.
1955. Speciation of the wandering shrew. *University of Kansas Publications* vol. 9, No. 1, pp. 1-68.
- NLEY, WILLIAM L.
1927. Camera hunting in the Northland. *Nature*, vol. 9, No. 2, pp. 72-78.
- SHER, A. K.
1900. The occurrence of Steller's eider (*Enicometta stelleri*) in the Gulf of St. Lawrence. *Auk*, vol. 17, No. 1, p. 65.
- SHER, EDNA M.
1939. Habits of the southern sea otter. *Jour. Mammalogy*, vol. 20, No. 1, pp. 21-36.
- 1940a. A sea otter with gastric perforations. *Jour. Mammalogy*, vol. 21, No. 3, pp. 357-359.

- 1940b. Early life of a sea-otter pup. *Jour. Mammalogy*, vol. 21, No. 2, pp. 132-137.
- 1941a. Notes on the teeth of the sea otter. *Jour. Mammalogy*, vol. 2 No. 4, pp. 428-433.
- 1941b. Prices of sea-otter pelts. *California Fish and Game*, vol. 27, No. 4, pp. 261-265.
- FOERSTE, A. F.
1931. Ancient life in the Arctic. *Ohio Jour. Science*, vol. 31, pp. 245-254.
- FORD, EDWARD R.
1936. Kittlitz's murrelet breeding at Wales, Alaska. *Auk*, vol. 53 No. 2, pp. 214-215.
- FOREST AND STREAM.
1893. The sea otter and the Aleuts. Vol. 40, No. 6, p. 111.
- FRIEDMANN, HERBERT.
- 1933a. The Chinese cormorant on Kodiak Island, Alaska. *Condor* vol. 35, No. 1, pp. 30-31.
- 1933b. Notes on some birds of Goodnews Bay, Alaska. *Condor*, vol. 3 No. 6, pp. 239-240.
- 1934a. The Mongolian plover and other birds at Goodnews Bay, Alaska. *Condor*, vol. 36, No. 2, p. 89.
- 1934b. Bird bones from old Eskimo ruins in Alaska. *Jour. Washington Academy Science*, vol. 24, No. 5.
- 1934c. The Siberian rough-legged hawk in Alaska. *Condor*, vol. 3 No. 6, p. 246.
1935. The birds of Kodiak Island, Alaska. *Bull. Chicago Academy Science*, vol. 5, No. 3, pp. 13-54.
1936. Notes on Alaskan birds. *Condor*, vol. 38, No. 4, p. 173.
1937. Bird bones from archeological sites in Alaska. *Jour. Washington Academy Science*, vol. 27, No. 10.
- GABRIELSON, IRA N.
1940. America's greatest bird concentrations. *Bird Lore*, vol. 42, No. 6, pp. 496-506.
1941. America's greatest bird concentrations, Part 2. *Audubon Magazine*, vol. 43, No. 1, pp. 15-23.
1943. Additional bird records from Alaska. *Auk*, vol. 60, No. 4, p. 60.
1944. Some Alaskan notes. *Auk*, vol. 61, Nos. 1-2, pp. 105-130, 270-287.
- GABRIELSON, IRA N., and FREDERICK C. LINCOLN.
1949. A new race of ptarmigan in Alaska. *Proceed. Biological Society Washington*, vol. 62, pp. 175-176.
- 1951a. Post-mortem color change in bird specimens. *Condor*, vol. 53 No. 6, pp. 298-299.
- 1951b. A new race of ptarmigan from Alaska. *Proceed. Biological Society Washington*, vol. 64, pp. 63-64.
- 1951c. The races of song sparrows in Alaska. *Condor*, vol. 53, No. 6, pp. 250-255.
- 1951d. A new Alaskan race of the winter wren. *Proceed. Biological Society Washington*, vol. 64, pp. 73-74.
1959. Birds of Alaska. *Wildlife Mgmt. Inst.*, Washington. 922 pp.
- GEIST, OTTO WILLIAM.
1939. Sea birds found far inland in Alaska. *Condor*, vol. 41, No. 6, pp. 68-70.

ANINI, CHARLES A.

1917. Some Alaska Peninsula bird notes. *Auk*, vol. 34, No. 4, pp. 394-402.

BERT, CHARLES H.

1922. Kamchatka sea eagle at Kodiak, Alaska. *Condor*, vol. 24, No. 2, p. 66.

MORE, RAYMOND M.

1933. Notes on the Unalaska collared lemming. *Jour. Mammalogy*, vol. 14, No. 3, pp. 257-258.
1946. Arctic mammalogy. *In* A program of desirable scientific investigations in Arctic North America. *Arctic Institute of North America Bull.* 1.

LDER, F. A.

1922. Bering's voyages and an account of the efforts of the Russians to determine the relation of Asia and America. *American Geographic Society*, vols. 1 (1922) and 2 (1925) New York, N. Y.

LDMAN, EDWARD A.

1935. New American mustelids of *Martes*, *Gulo*, *Lutra*. *Proceed. Biological Society Washington*, vol. 48, p. 180.
1936. A new otter from Kamchatka. *Jour. Mammalogy*, vol. 17, No. 2.

ODE, GEORGE BROWN, and others.

1884. The fisheries and fishery industries of the United States, sec. 1, part 1. 47th Cong., 1st Sess., Senate, Misc. Doc. 124. Washington.

IGGS, ROBERT FISKE.

1922. The Valley of Ten Thousand Smokes. *National Geographic Society*, vol. 15, No. 1, 341 pp.
- 1934a. The problem of Arctic vegetation. *Jour. Washington Academy Science*, vol. 24, No. 4, pp. 153-175.
- 1934b. Growth of liverworts from Katmai in nitrogen-free media. *American Jour. Botany*, vol. 21, pp. 265-277.
- 1934c. The edge of the forest in Alaska and the reasons for its position. *Ecology*, vol. 15, No. 2, pp. 80-96.
1936. The vegetation of the Katmai district. *Ecology*, vol. 17, No. 2, pp. 380-417.
1938. Timberlines in the northern Rocky Mountains. *Ecology*, vol. 19, No. 4, pp. 548-564.
1946. The timberlines of northern America and their interpretation. *Ecology*, vol. 27, No. 4, pp. 275-289.

INNELL, JOSEPH.

1900. Birds of the Kotzebue Sound Region, Alaska. *Pacific Coast Avifauna*, No. 1, pp. 1-80.
- 1901a. Record of Alaskan birds in the collection of Leland Stanford University. *Condor*, vol. 3, No. 1, pp. 19-23.
- 1901b. The proper name for the Kodiak Savannah sparrow. *Condor*, vol. 3, p. 85.
- 1901c. Two races of the varied thrush. *Auk*, vol. 18, No. 2, pp. 142-145.
1902. The western barn swallow. *Condor*, vol. 4, No. 3, p. 71.
1909. Birds and mammals of the 1907 Alexander expedition to South-eastern Alaska. *University California Publ. Zoology*, vol. 5, No. 2, p. 1.

- 1910a. Miscellaneous records from Alaska. *Condor*, vol. 12, No. 3, pp. 41-43.
- 1910b. Birds of the 1908 Alexander Alaska expedition. *University California Publ. Zoology*, vol. 5, pp. 361-428.
1920. The existence of sea birds a relatively safe one. *Condor*, vol. 22, No. 3, pp. 101-103.
1938. Ocean waifs and what they mean for distribution. *Condor*, vol. 40, No. 6, pp. 242-245.
1939. Proposed shifts of names in *Passerculus*—a protest. *Condor*, vol. 41, No. 3, pp. 112-119.
- GRINNELL, JOSEPH, and FREDERICK H. TEST.
1939. Geographic variation in the fork-tailed petrel. *Condor*, vol. 41, No. 4, pp. 170-172.
- GUBERLET, MRS. M.
1936. *Animals of the seashore*. 412 pp. Metropolitan Press, Portland, Ore.
- HALL, E. RAYMOND.
1929. Mammals collected by C. D. Brower at Point Barrow, Alaska. *University California Publ. Zoology*, vol. 30, No. 4.
1936. Mustelid mammals from the Pleistocene of North America. *Carnegie Inst. Washington Publ.* 473, pp. 41-119.
- 1945a. Chase Littlejohn, 1854-1943: Observations by Littlejohn hunting sea otters. *Jour. Mammalogy*, vol. 26, No. 1, pp. 89-91.
- 1945b. Four new ermines from the Pacific Northwest. *Jour. Mammalogy*, vol. 26, No. 1, pp. 75-85.
1957. Vernacular names for North American mammals north of Mexico. *U. Kans. Museum Nat. Hist., Misc. Pub.* 14. 16 pp.
- HANNA, G. DALLAS.
1917. The summer birds of the St. Matthew Island bird reservation. *Auk*, vol. 34, No. 4, pp. 403-410.
1919. Additions to the avifauna of the Pribilof Islands, Alaska, including species new to North America. *Jour. Washington Academy Science*, vol. 9, No. 6, pp. 176-177.
- 1920a. Additions to the avifauna of the Pribilof Islands, Alaska, including four species new to North America. *Auk*, vol. 37, No. 2, pp. 248-254.
- 1920b. Mammals of the St. Matthew Islands, Bering Sea. *Jour. Mammalogy*, vol. 1, No. 3.
1921. The Pribilof sandpiper. *Condor*, vol. 23, No. 2, pp. 50-57.
1922. The Aleutian rosy finch. *Condor*, vol. 24, No. 3, pp. 88-91.
- 1923a. Random notes on Alaska snow buntings. *Condor*, vol. 25, No. 2, pp. 60-65.
- 1923b. Rare mammals of the Pribilof Islands, Alaska. *Jour. Mammalogy*, vol. 4, No. 4.
1924. Sperm whales of St. George Island, Bering Sea. *Jour. Mammalogy*, vol. 5, No. 1.
1940. Siberian peregrine falcon in North America. *Condor*, vol. 42, No. 3, pp. 166-167.
- HARTERT, ERNST.
- 1910-22. *Die Vögel der palaarktischen Fauna. Systematische Übersicht der in Europa, Nord-Asien und der Mittelmeerregion vorkommenden Vögel*. 3 vols. (vol. 1, 1910; vol. 2, 1912-21; vol. 3, 1921-22). Berlin, Germany.

1915. Notes on falcons. *Novitates Zoologicae*, vol. 22, pp. 167-185. London.
1920. The birds of the Commander Islands. *Novitates Zoologicae*, vol. 27, pp. 128-158. London.
- ARTLAUB, G.
1883. Beitrag zur Ornithologie von Alaska. *Jour. für Ornithologie*, vol. 31, pp. 257-286.
- BATTER, JAMES.
1949. The status of moose in North America. *Trans. 14th North American Wildlife Conference*, pp. 492-501.
- BATH, HAROLD.
1920. The nesting habits of the Alaska wren. *Condor*, vol. 22, No. 2, pp. 49-55.
- BELLER, EDMUND.
1910. Mammals of the 1908 Alexander Alaska expedition, with descriptions of the localities visited and notes on the flora of the Prince William Sound region. *University California Publ. Zoology*, vol. 5, No. 11, pp. 321-360.
- BENSHAW, H. W.
1878. On the species of the genus *Passerella*. *Bull. Nuttall Ornithological Club*, vol. 3, No. 1, p. 3.
1884. On a new gull from Alaska. *Auk*, vol. 1, No. 3, pp. 250-252.
- BRENDEEN, E. P.
1892. Hunting the sea otter. *Forest and Stream*, June 1892.
- BURSEY, F. S.
1916. A list of birds observed in Alaska and northeastern Siberia during the summer of 1914. *Smithsonian Misc. Collections*, vol. 66, No. 2.
1917a. The status of the black-throated loon (*Gavia arctica*) as a North American bird. *Auk*, vol. 34, No. 3, pp. 283-290.
1917b. The present abundance of birds in the vicinity of Fort St. Michael, Alaska. *Auk*, vol. 34, No. 2, pp. 147-159.
1920. The probable breeding of the Aleutian tern in southeastern Alaska. *Condor*, vol. 22, No. 6, pp. 203-204.
- BIBBEN, MRS. FRANK C.
1942. Pacific eider nesting at Glacier Bay, Alaska. *Condor*, vol. 44, No. 4, p. 182.
- BIRNIE, JAMES S.
1919. Scientific results of the Katmai expedition of the National Geographic Society. Part X. Birds of the Katmai Region. *Ohio Jour. Science*, vol. 19, No. 8, pp. 475-486.
- BOLLISTER, NED.
1913. A synopsis of the American minks. *Proceed. U. S. National Museum*, vol. 44, pp. 471-480.
- BOMEYER, E. F. VON.
1880. Meine ornithologische Sammlung. *Jour. für Ornithologie*, vol. 28, pp. 152-157.
- BOOPER, C. G.
1897. Report on the sea-otter banks of Alaska. *Treasury Doc. 1977*, Washington, D. C., 35 pp.

HOWELL, A. BRAZIER.

1935. Observations on the white whale. *Jour. Mammalogy*, vol. No. 2.

HOWELL, ARTHUR H.

1915. Revision of the North American marmots. *North American Fauna* No. 37. U. S. Biological Survey, Washington, D. C.
 1936. A revision of the American Arctic hares. *Jour. Mammalogy*, vol. 17, No. 4, pp. 315-337.
 1938. Revision of the North American ground squirrels. *North American Fauna* No. 56. U. S. Biological Survey, Washington, D. C.

HOWELL, JOSEPH.

1948. Observations on certain birds of the region of Kodiak, Alaska. *Auk*, vol. 65, No. 3, pp. 352-358.

HUBBS, CARL L.

1941. Predator control in relation to fish management in Alaska. *Trans. 5th North American Wildlife Conference* (1940), pp. 153-160.

HUBBS, CARL L., and L. P. SCHULTZ.

1929. The northward occurrence of southern forms of marine life along the Pacific Coast in 1926. *California Fish and Game*, vol. 15, pp. 234-240.

HUEY, LAWRENCE M.

1931. Three noteworthy bird records from Barrow, Alaska. *Condor*, vol. 33, No. 1, pp. 36-37.

HULTÉN, ERIC.

1933. Aleutiska Öarne, en Geografisk och naturhistorisk översikt. *Svensk Geografisk Årsbok. Meddel. fran Lunds Universitets Geografiska Institution, Ser. C*, No. 85.
 1937a. Flora of the Aleutian Islands and westernmost Alaska Peninsula with notes on the flora of Commander Islands. Stockholm.
 1937b. Outline of the history of Arctic and Boreal biota during the Quaternary period. Stockholm.
 1939. Two new species from Alaska. *Contribution to the flora of Alaska II. Botaniska Notiser*, Lund.
 1941-1950. Flora of Alaska and Yukon. *Lund Universitets Årsskrift N. F. Avd. 2. Band 37-46. Nr. 1. Kingl. Fysiografiska Sällskapets Handlingar. N. F. Bd. 52-61. Nr. 1. Parts I to X.*

HUTCHINSON, ISOBEL WYLIE.

1937. Stepping stones from Alaska to Asia. 246 pp. Blackie & Sons Ltd., London and Glasgow.

JACKSON, H. H. T.

1928. A taxonomic review of the American long-tailed shrews. *North American Fauna* No. 51. U. S. Biological Survey, Washington, D. C.

JACOBI, A.

1939. Etwas vom Seeotter. *Aus der Natur*, vol. 16, No. 6, pp. 180-183.

JAGGAR, T. R., JR.

1907. Expedition to the Aleutian Islands. *Technical Review*, Boston, Mass.
 1929. Mapping the home of the great brown bear. *National Geographic Magazine*, vol. 55, No. 1, pp. 109-134.

JAQUES, FRANCIS LEE.

1929. Cranes crossing Bering Strait. *Auk*, vol. 46, p. 230.

1930. Water birds observed on the Arctic Ocean and the Bering Sea in 1928. *Auk*, vol. 47, No. 3, pp. 353-366.
- ETT, STANLEY G.
1921. Pribilof fur seal on the Oregon coast. *Jour. Mammalogy*, vol. 2, No. 4.
1933. Fourth record of the Pribilof fur seal on the Oregon coast. *Jour. Mammalogy*, vol. 14, No. 4.
- HELSON, WALDEMAR.
1925. Archeological investigations in the Aleutian Islands. Carnegie Inst. Washington Pub. 367.
1933. History, ethnology, and anthropology of the Aleut. Carnegie Inst. Washington Pub. 432.
- NSON, J. W.
1886. Reindeer in Alaska snows. *Forest and Stream*, vol. 27, No. 65.
- NSON, R. A.
1928. Predation of gulls in murre colonies. *Wilson Bulletin*, vol. 50, No. 3, pp. 161-170.
- ES, E. LESTER.
1915. Report of Alaska investigations in 1914. U. S. Bur. Fisheries.
- DAN, DAVID STARR, and others.
1899. The fur seals and fur-seal islands of the North Pacific Ocean. U. S. Treas. Dept. Comm. on fur-seal invest. U. S. Government Printing Office, Washington, D. C., 1898-99.
- RDAIN, F. C. R.
1933. On the Palaearctic element in the A. O. U. Checklist (4th ed.). *Auk*, vol. 50, No. 2, pp. 201-204.
- GE, JAMES.
1909. The blue foxes of the Pribilof Islands. *Science* (new ser.), vol. 29, No. 745, pp. 598-599.
1912. The blue foxes of St. Paul and Otter Island, Alaska. *Ann. Rept. American Breeders' Association*, vol. 7-8.
- LOGG, REMINGTON.
1929. What is known of the migrations of some of the whale-bone whales. *Smithsonian Rept. Publ.* 2997 (1928), pp. 267-494.
1931. Whaling statistics for the Pacific Coast of North America. *Jour. Mammalogy*, vol. 12, No. 1, pp. 73-77.
1932. New names for mammals proposed by Borowski in 1780 and 1781. *Proceed. Biological Society Washington*, vol. 45, p. 147.
1936. Mammals from a native village site on Kodiak Island. *Proceed. Biological Society Washington*, vol. 49, pp. 37-38.
- NYON, KARL W.
1949a. Distribution of the Pacific kittiwake in November and December of 1948. *Condor*, vol. 51, No. 4, p. 188.
1949b. Fur seals and murre chicks. *Condor*, vol. 51, No. 6, pp. 273-274.
1950. Distribution of albatrosses in the North Pacific and adjacent waters. *Condor*, vol. 52, No. 3, pp. 97-103.
- TLITZ, F. H. VON.
1858. *Denkwürdigkeiten einer Reise nach dem russischen Amerika, nach Mikronesien und durch Kamtschatka*. 2 vols., Gotha.

KLEINSCHMIDT, F. E.

1919. Killing a flock of brown bears in Alaska. *Outdoor Life*, vol. pp. 69-72, 139-142.

KNOPF, ADOLF.

1910. The probable Tertiary land connection between Asia and North America. *University California Bull.*, Dept. Geology, vol. 5, 413-420.

KOBBE, WILLIAM H.

1902. The status of certain supposed species of the Genus *Larus*. *Auk*, vol. 19, No. 1, pp. 19-24.

KUMLEIN, LUDWIG.

1879. Contributions to the natural history of Arctic America, made in connection with the Howgate Polar Expedition, 1877-78. *Bull. U. S. National Museum*, No. 15.

KURODA, NAGAMICHI.

1924. Two new murine rodents from Kurile Islands, Japan. *Journal of Mammalogy*, vol. 5, No. 2.

LAING, HAMILTON M.

1925. Birds collected and observed during the cruise of the "Thiepsv" in the North Pacific, 1924. *Victoria Memorial Museum, Canada Museum Bull.* 40, Biol. Ser. 9.

LINCOLN, FREDERICK C.

1926. The migration of the cackling goose. *Condor*, vol. 28, No. 4, 153-157.

LITTLEJOHN, CHASE.

1904. The capture of *Totanus glareola* in Alaska. *Condor*, vol. 6, No. 5, p. 138.
1916. Habits and hunting of the sea otter. *California Fish and Game*, vol. 2, No. 2, pp. 79-82.

LÖPPENTHIN, BERNT.

1932. Har Maagerne bestemte Aedepladser? *Dansk Ornithol. Forening Tidsskr.*, vol. 26, Nos. 3-4, p. 143.

LORING, J. ALDEN.

1907. The bears of North America. *Outdoor Life*, vol. 19, pp. 225, 325-332, 433-438, 565-572.

LYON, M. W., and W. H. OSGOOD.

1909. Catalogue of the type-specimens of mammals in the U. S. National Museum, including the Biological Survey collection. *U. S. National Museum Bull.* 62.

McCORMICK, C. M.

1898. Bear hunting on the Alaska Peninsula. *American Field*, vol. 50, No. 9, pp. 162-163.

McCracken, Harold L.

- 1920a. When the sea otter flourished. *Forest and Stream*, vol. 90, No. 6, pp. 298, 332, 333.
1920b. The Alaskan grizzly. *Field and Stream*, vol. 24, pp. 903-904.
1920c. After the Arctic caribou. *Field and Stream*, vol. 25, pp. 448-449.
1924. The game situation in Alaska. *American Forests*, vol. 30, No. 3, pp. 366, pp. 323-362.
1925a. The mysterious sea otter. *Nature Magazine*, vol. 5, pp. 169-170.

- 1925b. The great Alaskan brown bear. *Nature Magazine*, vol. 6, pp. 212-216.
1929. The mysterious sea otter. *The Sportsman*, vol. 6, No. 5, pp. 71-72.
- CFARLANE, RODERICK ROSS.
1905. Notes on mammals collected and observed in the northern Mackenzie River district, Northwest Territories of Canada, with remarks on explorers and explorations of the Far North. *Proceed. U. S. National Museum*, vol. 28, p. 717.
- GREGOR, RICHARD C.
1901. New Alaskan birds. *Condor*, vol. 3, No. 1, p. 8.
1902. A list of birds collected in Norton Sound, Alaska. *Condor*, vol. 4, No. 5, pp. 135-144.
1906. Birds observed in the Krenitzin Islands, Alaska. *Condor*, vol. 8, No. 5, pp. 114-122.
- ILLIARD, JOSEPH.
1898. Notes on the nesting of the fork-tailed petrel (*Oceanodroma furcata*). *Auk*, vol. 15, pp. 230-233.
1922. Eggs of the Aleutian rosy finch. *Condor*, vol. 24, No. 3, pp. 92-93.
- ILLIARD, JOSEPH, and G. HANNA.
1921. New bird records for North America with notes on the Pribilof Island list. *Condor*, vol. 23, No. 3, pp. 93-95.
- MARSHALL, EDISON.
1923. In the land of the Kodiak. *Outdoor Life*, vol. 52, pp. 333-338.
- RAY, ALAN G.
1943. The northern sea otter. *Natural History*, vol. 52, No. 1.
- SEINERTZHAGEN, R.
1926. Introduction to a review of the genus *Corvus*. *Novitates Zoologicae*, vol. 33, pp. 57-121, pls. 1-12. London.
- ERRIAM, C. HART.
1897. Descriptions of five new rodents from the coast region of Alaska. *Proceed. Biological Society Washington*, vol. 11, pp. 221-223.
1900. Descriptions of twenty-six new mammals from Alaska and British North America. *In Papers from the Harriman Alaska expedition*. *Proceed. Washington Academy Science*, vol. 2, pp. 13-30.
- 1902a. Two new bears from the Alaska Peninsula. *Proceed. Biological Society Washington*, vol. 15, p. 78.
- 1902b. Four new Arctic foxes. *Proceed. Biological Society Washington*, vol. 15, p. 168.
1918. Review of the grizzly and big brown bears of North America. *North American Fauna No. 41*. U. S. Biological Survey, Washington, D. C.
- ERTENS, ROBERT.
1935. Aus dem leben des seeotters. *Natur und Volk*, jahrg. 65, heft 9, 401-407.
- DEENDORFF, A. T. VON.
1853. Reise in den äussersten Norden und Osten Sibiriens während. . . 1843 und 1844. . . St. Petersburg, 1847-1875. Vol. 2, tl. 2. Zoologie. Wirbelthiere. Säugethiere, Vögel und Amphibien. 256 pp.

MILLER, ALDEN H.

1941. Speciation in the avian genus *Junco*. University California Publ. Zoology, vol. 44, No. 3, pp. 173-434.
 1949. Some concepts of hybridization and intergradation in wild populations of birds. *Auk*, vol. 66, No. 4, pp. 338-342.

MILLER, GERRIT S., JR.

1899. Description of a new vole from eastern Siberia. *Proceedings Biological Society Washington*, vol. 13, p. 11.
 1923. List of North American Recent mammals. U. S. National Museum Bull. 128.
 1929. The gums of the porpoise *Phocoenoides dalli* (True). *Proceedings U. S. National Museum*, vol. 74, p. 1.
 1930. A note on the skeletons of two Alaskan porpoises. *Smithsonian Misc. Collections*, vol. 82, No. 13, 2pp.

MILLER, GERRIT S., JR., and REMINGTON KELLOGG.

1955. List of North American recent mammals. U. S. National Museum Bulletin 205. Washington.

MILLER, LOYE.

1940. Observations on the black-footed albatross. *Condor*, vol. 42, No. 5, pp. 229-238.
 1942. Some tagging experiments with black-footed albatrosses. *Condor*, vol. 44, No. 1, pp. 3-9.

MILLER, MAX.

1936. Fog and men on Bering Sea. E. P. Dutton & Co. Inc., New York, N. Y.

MURIE,OLAUS J.

1930. A new Alaskan *Microtus*. *Jour. Mammalogy*, vol. 11, No. 1, pp. 74-75.
 1935. The Alaska-Yukon caribou. *North American Fauna* No. 54.
 1936. The birds of St. Lawrence Island, Alaska. Appendix V, Archeological excavations at Kukulik, St. Lawrence Island, Alaska. *Misc. Pubs. 2, University Alaska*. Washington, D. C.
 1940a. Notes on the sea otter. *Jour. Mammalogy*, vol. 21, No. 2, pp. 119-131.
 1940b. Food habits of the northern bald eagle in the Aleutian Islands, Alaska. *Condor*, vol. 42, No. 4, pp. 198-202.
 1944. Two new subspecies of birds from Alaska. *Condor*, vol. 46, No. 3, pp. 121-123.
 1945. *Larus ridibundus sibiricus* from the Aleutian Islands. *Auk*, vol. 62, No. 2, p. 313.
 1952. Additional records of *Cuculus* in North America. *Condor*, vol. 54, No. 2, p. 114.

MURPHY, ROBERT CUSHMAN.

1936. Oceanic birds of South America. *American Museum Natural History*, vols. 1 and 2.

NELSON, EDWARD W.

1878. The rock ptarmigan (*Lagopus rupestris*) in the Aleutian Islands. *Bull. Nuttall Ornithological Club*, vol. 2, No. 1, p. 38.
 1883. Birds of Bering Sea and the Arctic Ocean. *In Cruise of the revenue steamer Corwin in Alaska and the N. W. Arctic Ocean*.
 1881. U. S. Revenue Cutter Service. Washington.

1887. Report upon natural history collections made in Alaska between the years 1877 and 1881. Arctic Ser. Pub. No. 3, issued in connection with the Signal Service, U. S. Army. Washington, D. C.
- 1893a. Description of a new species of *Lagomys* from Alaska. Proceed. Biological Society Washington, vol. 8, pp. 117-120.
- 1893b. Description of a new species of *Arvicola* of the Mynomes group, from Alaska. Proceed. Biological Society Washington, vol. 8, pp. 139-142.
1898. Notes on the wild fowl and game animals of Alaska. National Geographic Magazine, vol. 9, pp. 121-132, April.
1909. The rabbits of North America. North American Fauna No. 29. U. S. Biological Survey, Washington, D. C.
1929. Description of a new lemming from Alaska. Proceed. Biological Society Washington, vol. 42, pp. 143-146.
1931. A new vole of the subgenus *stenocranium* from Alaska. Jour. Mammalogy, vol. 12, No. 3.

NICHOLS, JOHN TREADWELL.

1927. Tubinares off the Northwest coast. Auk, vol. 44, No. 3, pp. 326-328.

ORDENSKIÖLD, A. E.

1885. Reply to criticisms upon "The voyage of the *Vega*, around Asia and Europe." Bull. American Geographic Society, vol. 17, pp. 267-298.

BERNHOLSER, HARRY C.

1900. A new wren from Alaska. Auk, vol. 17, No. 1, pp. 25-26.
1905. The forms of *Vermivora celata* (Say). Auk, vol. 22, No. 3, pp. 242-247.
1918. The subspecies of *Larus hyperboreus* Gunnerus. Auk, vol. 35, No. 4, pp. 467-474.
- 1919a. Notes on North American birds, VII. Auk, vol. 36, No. 1, pp. 81-85.
- 1919b. The status of *Larus hyperboreus barrovianus* Ridgway. Proceed. Biological Society Washington, vol. 32, pp. 173-176.
- 1919c. Notes on North American birds, IX. Auk, vol. 36, No. 4, pp. 556-559.
- 1919d. Notes on the wrens of the genus *Nannus* Billberg. Proceed. U. S. National Museum, vol. 55, pp. 223-236.
1930. Another new subspecies of *Nannus troglodytes* from Alaska. Proc. Biological Society Washington, vol. 43, pp. 151-152.

DORR, ROBERT T.

1939. Extension of the range of *Sorex tundrensis*. Jour. Mammalogy, vol. 20, No. 2, p. 251.
1945. A study of the *Clethrionomys dawsoni* group of red-backed mice. Jour. Mammalogy, vol. 26, No. 1, pp. 67-74.

OSGOOD, WILFRED H.

1901. Natural history of the Queen Charlotte Islands, British Columbia. Natural history of the Cook Inlet Region, Alaska. North American Fauna No. 21, U. S. Biological Survey, Washington, D. C.
- 1904a. A biological reconnaissance of the base of the Alaska Peninsula. North American Fauna No. 24. U. S. Biological Survey.
- 1904b. Lake Clark, a little-known Alaskan lake. National Geographic Magazine, vol. 15, No. 8, pp. 326-331.

1909. The big game of Alaska. *National Geographic Magazine*, vol. 1, No. 7, pp. 624-636.
- PALMER, WILLIAM.
1894. An Asiatic cuckoo on the Pribilof Islands, Alaska. *Auk*, vol. 1, No. 4, p. 325.
1899. The avifauna of the Pribilof Islands. *In* The fur seals and fur seal islands of the North Pacific Ocean, part 3, pp. 355-431. U. S. Treasury Dept., Commission on Fur-Seal Investigations. Washington.
- PARKES, KENNETH C., and DEAN AMADON.
1948. The winter range of the Kennicott willow warbler. *Condor*, vol. 50, No. 2, pp. 86-87.
- PECHUEL-LOESCHE, M. E.
1871. Wale und Walfang. *Ausland*, 44.
- PETERS, JAMES L.
1931. Check-list of birds of the world. Vol. 1.; Harvard University Press, Cambridge, Mass.
- PETERS, JAMES L., and LUDLOW GRISCOM.
1938. Geographical variation in the Savannah sparrow. *Bull. Museum of Comparative Zoology*, vol. 80, No. 13, pp. 445-448. Harvard University.
- PETROFF, IVAN.
1882. The limit of the Inuit tribes on the Alaskan coast. *American Naturalist*, vol. 16.
1884. Report on the population, industries, and resources of Alaska. *In* Tenth census of the United States, 1880, vol. VIII, 177 pp.
- PITELKA, FRANK A.
1948. The problematical relationship of the Asiatic shorebird *Limnodromus semipalmatus*. *Condor*, vol. 50, No. 6, pp. 259-269.
1950. Geographic variation and the species problem in the shorebird genus *Limnodromus*. *University California Publ. Zoology*, vol. 1, No. 1, pp. 1-100.
- PLESKE, THEODORE.
1928. Birds of the Eurasian tundra. *Memoirs Boston Society Natural History*, vol. 6, No. 3, pp. 111-485.
- PREBLE, EDWARD A., and W. L. MCATEE.
1923. A biological survey of the Pribilof Islands, Alaska. *North American Fauna* No. 46, U. S. Biological Survey, Washington, D. C.
- RADCLIFFE, LEWIS.
1932. Status of international convention for protection of whales. *Jour. Mammalogy*, vol. 13, No. 3.
- RAINEY, FROELICH.
1940. Eskimo methods of capturing bowhead whales. *Jour. Mammalogy*, vol. 21, No. 3.
- RAND, A. L.
1950. Critical notes on *Limnodromus semipalmatus*. *Condor*, vol. 52, No. 5, pp. 228-231.
- RAUSCH, ROBERT.
1953. On the status of some arctic mammals. *Arctic*, vol. 6, No. 1, pp. 91-148.
- REIMANN, EDWARD J.
1938. Bald eagle takes live fish. *Auk*, vol. 55, No. 3, pp. 524-525.

HOADS, SAMUEL N.

1893. The Hudsonian chickadee and its allies, with remarks on the geographic distribution of bird races in boreal America. *Auk*, vol. 10, No. 4, pp. 321-333.
1902. Synopsis of the American marten. *Proceed. Academy Natural Science Philadelphia*.

RICHMOND, CHARLES W.

1895. On the status of Bischoff's song sparrow (*Melospiza insignis* Baird). *Auk*, vol. 12, No. 2, pp. 144-150.

RIDGWAY, ROBERT.

1880. On a new Alaskan sandpiper. *Bull. Nuttall Ornithological Club*, vol. 5, No. 3, pp. 160-163.
1883. Description of a new petrel from Alaska. *Proceed. U. S. National Museum* (1882), pp. 656-658.
1886. On the glaucous gull of Bering's Sea and contiguous waters. *Auk*, vol. 3, No. 3, pp. 330-331.
1887. Clarke's nutcracker (*Picicorvus columbianus*) in the Bristol Bay region, Alaska. *Auk*, vol. 4, No. 3, p. 255.
1895. On Fisher's petrel (*Aestrelata fisheri*). *Auk*, vol. 12, No. 4, pp. 319-322.
1898. Descriptions of supposed new genera, species, and subspecies of American birds. I. Fringillidae. *Auk*, vol. 15, No. 3-4, pp. 223-230, 319-324.
1900. Descriptions of supposed new genera, species, and subspecies of American birds, VI. Fringillidae. *Auk*, vol. 17, No. 1, pp. 29-30.

RIGGS, THOMAS.

1919. Annual report of the Governor to the Secretary of the Interior, Alaska Game Law.

ROBINSON, G. D., and others.

1947. Alaskan volcano investigations: Report No. 2, Progress of investigations in 1946. *U. S. Geol. Survey Preliminary Report*.

ROWAN, WILLIAM.

1932. The status of the dowitchers with a description of a new subspecies from Alberta and Manitoba. *Auk*, vol. 49, No. 1, pp. 14-35.

ROWLEY, JOHN.

1929. Life history of the sea-lions on the California coast. *Jour. Mammalogy*, vol. 10, No. 1.

SALOMONSEN, FINN.

1931. On the geographical variation of the snow bunting (*Plectrophenax nivalis*). *Ibis* (ser. 13), vol. 1, pp. 57-70, pls. 1-11.
1932. Description of three new guillemots (*Uria aalge*). *Ibis* (ser. 13), vol. 2, pp. 128-132.
1939. Moults and sequences of plumages in the rock ptarmigan (*Lagopus mutus* (Moutin)). *Videnskabelige Meddelelser fra Danske Naturhist. Forening*, vol. 103, 491 pp. Copenhagen, Denmark.

SCAMMON, C. M.

1869. On the cetaceans of the western coast of the North America. *Proceed. Academy Science Philadelphia*, ser. 2, vol. 21, pp. 13-62.
1874. The marine mammals of the northwestern coast of North America. J. H. Carmany and Co., San Francisco; Putnam and Sons, New York.

SCHALOW, HERMAN.

1891. J. F. von Brandt: Ueber die Vogelfauna der Aleuten. Jour. für Ornithologie, vol. 39, pp. 235-271.

SCHEFFER, VICTOR B.

1939. Organisms collected from whales in the Aleutian Islands. Murrelet, vol. 20, No. 3, pp. 67-69.
 1940. The sea otter on the Washington coast. Pacific Northwest Quarterly, pp. 370-388, October.
 1942a. A list of the marine mammals of the west coast of North America. Murrelet, vol. 23, No. 2, pp. 42-47.
 1942b. Further records of the Dall porpoise in California. Jour. Mammalogy, vol. 23, No. 2.
 1943. Fish bites bird. Nature Magazine, vol. 36, No. 1, pp. 41-42.
 1949. The Dall porpoise, *Phocoenoides dalli*, in Alaska. Jour. Mammalogy, vol. 30, No. 2, pp. 116-121.
 1958. Seals, Sea Lions and Walruses—A review of the Pinnipeds. Stanford Univ. Press. 179 pp.

SCHWARTZ, ERNST.

1942. The harbor seal of the Western Pacific. Jour. Mammalogy, vol. 23, No. 2.

SCHWARTZ, ERNST, and HENRIETTA K. SCHWARTZ.

1943. The wild and commensal stocks of the house mouse, *Mus musculus* Linnaeus. Jour. Mammalogy, vol. 24, No. 1, pp. 59-72.

SEALE, ALVIN.

1898. Notes on Alaskan water birds. Proceed. Academy Science Philadelphia, vol. 50, pp. 126-140.

SEFTON, JOSEPH W., JR.

1926. Exhaustion of migrating sea birds. Condor, vol. 28, No. 5, p. 24.

SETCHELL, W. A.

1912. Kelps of the United States and Alaska. In Fertilizer resources of the United States. Senate Doc. 190, 62nd Cong., 2nd sess., pp. 130-178.

SHELFORD, VICTOR E., and others.

1935. Some marine biotic communities of the Pacific Coast of North America. Ecological Monographs, vol. 5, pp. 249-354.

SHORTT, T. M.

1939. The summer birds of Yakutat Bay, Alaska. Contrib. Roy. Ontario Museum Zoology, vol. 17. 30 pp.
 1940. Eared grebe at Yakutat, Alaska—a correction. Condor, vol. 42, No. 3, p. 170.

SIMPSON, GEORGE GAYLORD.

1940. Mammals and land bridges. Jour. Washington Academy Science, vol. 30, No. 4, pp. 137-163.

SMITH, PHILIP S.

1927. Some post-Tertiary changes in Alaska of climatic significance. National Research Council Bull. 61, pp. 35-39.

STEJNEGER, LEONHARD.

1883. Contributions to the history of the Commander Islands. No. 1. Notes on the natural history, including descriptions of new cetaceans. Proceed. U. S. National Museum, vol. 6, No. 4, pp. 58-59.
 1884a. A brief review of the Lagopodes belonging to the group *Attagis* Kaup. Zeitschrift für die gesammte Ornithologie, pp. 86-92.

- 1884b. Die wichtigsten ornithologischen publicationen aus den vereinigten staaten. Vom. 1. Januar 1883 bis 1. Mai 1884. Zeitschrift für die Gesammte Ornithologie, pp. 179-189.
- 1885a. Results of ornithological explorations in the Commander Islands and in Kamtschatka. U. S. National Museum Bull. 29, 382 pp.
- 1885b. Notes on some apparently preoccupied ornithological generic names. Proceed. U. S. National Museum, vol. 8, No. 26, pp. 409-410.
- 1886a. Fra det yderste østen. Rejsebreve af Leonhard Stejneger. Reprint from Naturen, 1885-86, pp. 1-56. Kristiania, Norway.
- 1886b. On *Brachyrhamphus perdix* (Pall) and its nearest allies. Zeitschrift f. ges. Ornith., pp. 210-219, 1 pl.
- 1886c. On the status of *Synthliboramphus wumizusume* as a North American bird. Proceed. U. S. National Museum, vol. 9, p. 524.
- 1887a. Notes on the northern palaeartic bullfinches. Proceed. U. S. National Museum, vol. 10, pp. 103-110.
- 1887b. Contributions to the natural history of the Commander Islands, No. 7, Revised and annotated catalogue of the birds inhabiting the Commander Islands. Proceed. U. S. National Museum, vol. 10, pp. 117-145.
- 1887c. How the great northern sea-cow (*Rytina*) became exterminated. American Naturalist, vol. 21, pp. 1047-1054.
1889. Contributions to the history of Pallas cormorant. Proceed. U. S. National Museum, vol. 12, pp. 83-94.
1895. Arctic notes on the habits of certain rare northern birds in Commander Islands and Kamtschatka. Museum, Albany, N. Y., vol. 1, pp. 53-58, 85, 87, 101-102.
1896. The Russian fur-seal islands. Bull. U. S. Fish Commission. (1896), vol. 16, pp. 1-148.
1898. Ross's gull (*Rhodostethia rosea*) on Bering Island. Auk, vol. 15, No. 2, p. 183.
1906. Isolation versus natural selection. Auk, vol. 23, No. 3, pp. 265-270.
1928. Unsolved problems in arctic zoogeography. Special Publ. American Geographic Society, vol. 7, pp. 155-165.
- STEVENSON, CHARLES H.
1902. Utilization of the skins of aquatic mammals. In Rept. of Commissioner, U. S. Commission Fish and Fisheries, Part 28, pp. 281-352.
- STONE, ANDREW J.
1900. Some results of a natural history journey to northern British Columbia, Alaska, and the Northwest Territory, in the interests of the American Museum of Natural History. Bull. American Museum Natural History, vol. 13, p. 60.
- STONE, WITMER.
1900. Report on the birds and mammals collected by the McIlhenny Expedition to Point Barrow, Alaska. Proceed. Academy Natural Sciences Philadelphia, pp. 4-49.
- STORER, ROBERT W.
1950. Geographic variation in the pigeon guillemots of North America. Condor, vol. 52, No. 1, pp. 28-31.
- SUTTON, GEORGE MIKSCH, and ROWLAND S. WILSON.
1946. Notes on the winter birds of Attu. Condor, vol. 48, No. 2, pp. 83-91.

SWALES, BRADSHAW H.

1926. Ruby-throated hummingbird near St. Michael, Alaska. *Condor* vol. 28, No. 3, p. 128.

SWARTH, HARRY S.

1909. Birds and mammals of the 1909 Alexander Expedition. University California Publ. Zoology, vol. 7, No. 2.
1920. Revision of the avian genus *Passerella*, with special reference to the distribution and migration of the races in California. University California Publ. Zoology, vol. 21, No. 4, pp. 75-224.
1926. Birds of the Atlin district, British Columbia. University California Publ. Zoology, vol. 30, No. 4.
1928. Occurrence of some Asiatic birds in Alaska. *Proceed. California Academy Science*, vol. 17, No. 8, pp. 247-251.
1931. The tyranny of the trinomial. *Condor*, vol. 33, No. 4, pp. 160-162.
1933. The savannah sparrows of northwestern North America. *Condor* vol. 35, No. 6, pp. 243-245.
1934. Birds of Nunivak Island, Alaska. *Pacific Coast Avifauna* No. 2 pp. 1-64. Cooper Ornithological Club.
1935. Systematic status of some northwestern birds. *Condor*, vol. 37, No. 4, pp. 199-204.
1936. Savannah sparrow migration routes in the Northwest. *Condor* vol. 38, No. 1, pp. 30-32.

SYKES, C. E.

1923. On the Alaska Peninsula for brown bear. *Outdoor Life*, vol. 51, pp. 77-81, 157-162, 237-242.

TABER, RICHARD D.

1946. The winter birds of Adak, Alaska. *Condor*, vol. 48, No. 6, pp. 272-277.

TAVERNER, P. A.

1929. A study of the Canadian races of rock ptarmigan. Bull. No. 6 National Museum Canada, pp. 28-37.
1931. A study of *Branta canadensis* (Linnaeus), the Canada goose. Annual Rept. National Museum Canada for 1929, pp. 28-40.
1935. Continental land masses and their effect upon bird life. *Condor* vol. 37, No. 3, pp. 160-162.
1936. Taxonomic comments on red-tailed hawks. *Condor*, vol. 38, No. 1, pp. 66-71.

TAYLOR, WALTER P.

1914. The problem of aquatic adaptation in the Carnivora, as illustrated in the osteology and evolution of the sea otter. Bull. University California, vol. 7, p. 472.

THAYER, JOHN E.

1914. Nesting of the Kittlitz murrelet. *Condor*, vol. 16, No. 3, pp. 117-118.

THAYER, JOHN E., and OUTRAM BANGS.

1921. The black-backed Kamchatkan wagtail, *Motacilla lugens* Kittlitz in Alaska. *Auk*, vol. 38, No. 3, p. 460.

THONE, FRANK.

1942. Aleutian weather. *Science-Supplement*, vol. 96.

ODD, W. E. CLYDE.

1935. Geographical variation in the American titlark. *Proceed. Biological Society Washington*, vol. 48, pp. 63-66.

OWNSSEND, CHARLES H.

1887. Notes on the natural history and ethnology of northern Alaska. *In Report of the Cruise of the Revenue Steamer "Corwin" in the Arctic Ocean in the year 1885, by Captain M. A. Healy*; pp. 81-102. U. S. Government Printing Office, Washington, D. C.

1913. The crested auklet. *National Association Audubon Societies, Bird Lore*, vol. 15, p. 133.

QUE, FREDERICK W.

1884. The manatees and the Arctic sea cow, pp. 114-136. *In Fisheries and Fishing Industries of the United States*, by George Brown Goode. U. S. Government Printing Office, Washington, D. C.

1885. On a new species of porpoise, *Phocaena dalli*, from Alaska. *Proceed. U. S. National Museum*, vol. 8, No. 7, p. 95.

1886. An annotated list of the mammals collected by the late Charles L. McKay in the vicinity of Bristol Bay, Alaska. *Proceed. U. S. National Museum*, vol. 9, pp. 221-224.

1904a. The whalebone whales of the western North Atlantic compared with those occurring in European waters with some observations on the species of the North Pacific. *Smithsonian Institute, Washington, D. C. (Smithsonian contributions to knowledge, vol. 33.)*

1904b. Note on three very large beaked whales from the North Pacific. *Science (new ser.)*, vol. 20, No. 521, pp. 888-889.

1910. An account of the beaked whales of the family Ziphiidae in the collection of the United States National Museum, with remarks on some specimens in other American Museums. *Bull. U. S. National Museum*, vol. 73.

URNER, LUCIEN M.

1885. Notes on the birds of the Nearer Islands, Alaska. *Auk*, vol. 2, No. 2, pp. 154-159.

1886. Contributions to the natural history of Alaska. Arctic series of publications in connection with the Signal Service, U. S. Army, No. 2. Washington, D. C.

AN KAMMEN, I. J.

1916. Relative to the bald eagle in Alaska. *Oölogist*, vol. 33, pp. 156-158.

ENIAMINOF, I. E. P.

1840. *Zapiski ob ostrovakh Unalashkinskago*. 3 vols. in 2. St. Petersburg.

FALES, JOSEPH H.

1927. Fearlessness of shearwaters. *Condor*, vol. 29, No. 2, pp. 119-120.

FAALKER, ERNEST P.

1920. Probable breeding of the Aleutian tern in southeastern Alaska. *Condor*, vol. 32, No. 3, pp. 111-112.

1923. Definite breeding record for the Aleutian tern in southern Alaska. *Condor*, vol. 25, No. 4, pp. 113-117.

FALLACE, GEORGE J.

1939. Bicknell's thrush, its taxonomy, distribution, and life history. *Proceed. Boston Society Natural History*, vol. 41, No. 6, pp. 211-402.

WETMORE, ALEXANDER, and others.

1944. Nineteenth supplement to the American Ornithologists' Union Checklist of North American Birds. *Auk*, vol. 61, No. 3, pp. 441-464.
1945. Twentieth supplement to the American Ornithologists' Union Checklist of North American Birds. *Auk*, vol. 62, No. 3, pp. 436-449.

WEYER, EDWARD M.

1929. An Aleutian burial. *American Museum Natural History Anthropological Papers XXXI, Part III*, pp. 219-238.

WHELEN, TOWNSEND.

1946. Hunting big game, The Americas. Vol. II. Military Service Publ. Co., Harrisburg, Pa.

WILLETT, GEORGE.

1915. Summer birds of Forrester Island, Alaska. *Auk*, vol. 32, No. 3, pp. 295-305.
1920. Comments upon the safety of seabirds and upon the "probable occurrence of the northern bald eagle in California. *Condor*, vol. 22, No. 6, pp. 204-205.
1921. Bird notes from southeastern Alaska. *Condor*, vol. 23, No. 1, pp. 156-159.
1927. Notes on the occurrence and distribution of some southeastern Alaskan birds. *Condor*, vol. 29, No. 1, pp. 58-60.
1928. Notes on some birds of southeastern Alaska. *Auk*, vol. 45, No. 4, pp. 445-449.
1939. Remarks on Alaska Savannah sparrows. *Condor*, vol. 41, No. 1, p. 86.

WILLIAMS, CECIL S.

1938. Notes on food of the sea otter. *Jour. Mammalogy*, vol. 19, No. 1, pp. 105-107.

WILSON, ROWLAND STEELE.

1948. The summer bird life of Attu. *Condor*, vol. 50, No. 3, pp. 124-129.

WISMER, N. M., and J. H. SWAINSON.

1935. Some marine biotic communities of the Pacific coast of North America. Part 2. A study of the communities of a restricted area of soft bottom in San Juan channel. *Ecological Monographs*, vol. 5, pp. 333-354.

ZANDER, H.

1853. Kurze Uebersicht der europaischen Peiper, *Anthus Bechs*. *Jour. für Ornithologie*, vol. 1, pp. 60-65.

INVERTEBRATES AND FISHES COLLECTED IN THE ALEUTIANS, 1936-38

By Victor B. Scheffer, *Biologist*

Introduction

In the expeditions to the Aleutian Islands conducted by the Fish and Wildlife Service from 1936 to 1938, chief emphasis was placed on investigations of birds and mammals. Limited studies were made of the lesser forms of animal life that inhabit the subarctic waters of the Northeast Pacific and the Bering Sea and that live on the shores and slopes of the islands. With relation to the birds and the mammals, the myriad lesser organisms may collectively be termed the "supporting fauna."

One must actually visit the northern seas to realize the abundance of small animal life in the water and along the shore—abundance not of kinds but of numbers. From the deck of a ship, it is often possible to see swarms of reddish microcrustaceans drifting along on the surface of the water in such profusion that they impart a reddish cast to the water. At night, the churn of the ship's propeller sometimes turns up a glowing wake as it brings countless bodies of luminescent organisms to the surface. These organisms are recovered in the stomachs and crops of auklets and petrels. Where the ocean currents cause an upwelling of water rich in plankton, shearwaters and fulmars flock to the scene and baleen whales soon appear. On one occasion, at Nimak Pass, it was estimated that the surface of the ocean for 5 square miles was covered with feeding shearwaters, each separated from its neighbor by 10 or 20 feet. If the carcass of a bird or fish, weighing about 5 pounds, is lowered to the bottom of the sea and hauled up on the following day, the bones usually will have been picked clean by small amphipod crustaceans.

On certain of the Aleutian beaches that are covered with flat, singly rocks the size of a man's hand, it is possible to uncover as much as a half pint of amphipod crustaceans or sand fleas hiding beneath a single rock. Such organisms, on islands with ex-

tensive beaches, are often the main source of food of the blue fox. In certain quiet waters it is possible to look down from a rowing boat and see a green carpet of sea urchins covering the floor of the ocean. These animals make up the largest single item in the diet of the sea otter. More specific information on the food relations of Aleutian organisms will be presented, but some indication has here been given of the importance of the invertebrates and fishes in the teeming, complex fauna of the northern seas.

Specimens of invertebrates and fishes were collected at every opportunity, but the time made available for this phase of the work was very limited, therefore the collection is not complete. It includes, however, 255 species, or subspecies, of invertebrates and 48 species, or subspecies, of fishes, representing many of the forms that are encountered in the Aleutian area. Two new genera and six new species have been described to date on the basis of material in the collection, and many other species have had their ranges extended.

With the exceptions noted, all of the specimens collected by members of the Aleutian expeditions have been identified by staff members of the United States National Museum or by collaborating agencies. The indispensable help of the following persons is gratefully acknowledged: Paul Bartsch, S. S. Berry, H. J. Bigelow, Austin H. Clark, Wesley R. Coe, J. E. Cornwall, Irving Fox, Theodore C. Frye, C. T. Greene, David G. Hall, Melville I. Hatch, Trevor Kincaid, J. T. Lucker, J. O. Maloney, J. Percival Moore, E. W. Price, Harald A. Rehder, Clarence Shoemaker, Waldo L. Schmitt, Leonard P. Schultz, Alan Stone, William Randolph Taylor, Margaret E. Van Winkle, Arthur Welander, and C. B. Wilson.

In the following pages, notes are presented on the invertebrates and fishes that were most commonly observed or, because of some special relationship to the birds and mammals, attracted the attention of members of the 1936-38 party. Some of the conspicuous marine algae are also discussed briefly. There is no attempt in this report to list *all* of the species of organisms collected, because, in the first place, such an array would be only an approach to a complete check list of the organisms of the Aleutian Islands. In the second place, a complete list of the specimens collected in 1936-38 would serve no useful purpose, because the specimen records, field data, and (in most cases) the specimens are already in the hands of specialists who have published, or will publish, on any material of outstanding value. It is hoped that the present report will be of interest to future workers in the Aleutian Islands National Wildlife Refuge.

Marine Algae

Samples of the commoner seaweeds found in the Aleutian Islands were identified by T. C. Frye. The genus *Alaria* (the most abundant) is found in shoal water along the entire archipelago. Its long, brown, leathery fronds are a nuisance in small-boat navigation. The thallus is 4 to 8 inches wide with a bladderlike midrib that is $\frac{1}{2}$ to 1 inch wide. This midrib remains floating after the sides of the thallus have decomposed and washed away. Masses of *Alaria* are seen floating detached at sea and piled on the beaches after the first of August.

Laminaria has a similar structure, but the fronds are wider (as much as 2 feet) and the plant has the general appearance of slick leather apron.

Nereocystis, the common bull-whip kelp of the Pacific Coast, is a long, hollow, floating stem increasing in diameter to a half inch at the free end. Very common along the mainland, this plant is observed only rarely west of the Alaska Peninsula. At King Cove, east end of the Peninsula, *Nereocystis* is definitely the dominant kelp as compared with *Alaria* to the westward. *Nereocystis*, in all cases a single plant drifting at sea or washed up dead on the beach, was seen on the following Islands: Unalaska, East Adak, Agassiz, Atka, Oogliuga, and Amchitka.

Fucus is common along the beach; locally it is called "popweed" from the sound made by the bursting of the bladders when they are trod upon (fig. 1).

The bright-green sheets of sea lettuce, *Ulva*, are on every beach.

Spongomorpha has the texture and appearance of coarse green moss and grows attached to rocks. On spray-covered rocks, the cylindrical floats of *Halosaccion* occur in clumps suggestive of the local name "dead man's fingers".

Cystophyllum is a brown seaweed that occasionally washes up on the beach. It has a mass of fine branches covered with small brown bladders, each of which is the size and shape of a grain of wheat.

Thallassiophyllum is easily distinguished by its wide brown fronds covered with holes like a colander.

A number of lime-secreting marine algae, locally called corals,

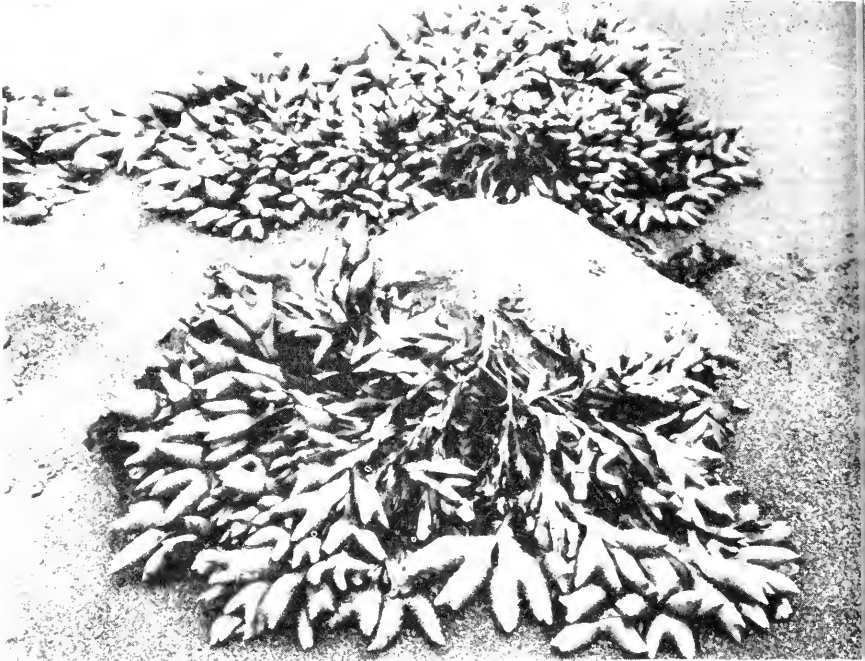


FIGURE 1.—*Fucus*, a brown seaweed common along the beaches of the Aleutian Islands. Rat Island, June 29, 1937.



FIGURE 2.—Calcareous algae of the *Lithothamnion* group commonly attach to the holdfasts of kelp and are stranded during storms. Oogliuga Island, August 4, 1937.

are conspicuous on the Aleutian beaches (fig. 2). Members of the *Lithothamnion* group form chalk-white crusts around the zooids of kelps, these crusts being later washed up on the beach windrows. *Corallina* grows in branched tufts on the rocks, looks like an ornamental coral, and is wine colored to dirty white. Its stalks are commonly found attached to pebbles brought up by dredging.

A list, accompanied by brief field notes, of 40 species of marine algae collected in the Aleutian Islands has been published by Kamura (1933), who stated that "the Aleutian algae are almost equally dispersed westward to Japan, and eastward to California."

(The vascular plant *Zostera*, or eel grass, an important waterfowl food, was observed growing in a lagoon on Vsevidof Island, near Umnak Island, but it was not seen farther west.)

Marine Invertebrates

SPONGES

The vase sponge, *Esperiopsis quatsinoensis*, is common throughout the islands. It washes up on the beach and eventually bleaches out to a creamy-white color. In size and general shape, it resembles a flattened ice cream cone. A large specimen from Aiktak Island measured 28 centimeters from base to lip and was 30 centimeters wide.

COELENTERATES

HYDROIDS

Abietinaria filicula is a small hydroid about 5 centimeters long, resembling a feather. It is often washed up in tangles of seaweed.

Another hydroid, *Thuaria robusta*, has been collected in sea otter scats.

JELLYFISHES

The common crystal jellyfish of the West Coast (*Aequorea aequorea*) is observed almost daily after the first of July in the Aleutian Islands. It is a transparent, lens-shaped medusa that at first glance, appears to have no organized structure, but close scrutiny will show a delicate central manubrium and a fringe of fine tentacles. The body mass is firmer than that of the large red jellyfishes and may be turned over readily in the hand. A few specimens reach a diameter of 150 millimeters.

Aurelia aurita is transparent, but it has a conspicuous structure in the center—a set of four yellowish-brown gonads arranged like the leaves of a four-leafed clover. Of the two species, *Aequorea* appears much more frequently during the summer.

Cyanea capillata is one of the large, trailing, red jellyfishes frequently seen from July to September, especially in the calm bays. The rim of the medusa is divided into eight pairs of short lobes, or a total of 16 lobes. Each lobe has a medial notch about

centimeters deep. Muscle fibrils can be seen extending into these lobes in bundles of 12 or more.

A number of small medusae were collected in plankton hauls, including *Aegina*, *Hybocodon*, *Mitrocoma?*, *Rathkea*, *Sarsia*, and *tomotoca*.

FLATWORMS

A monogenetic fluke, *Entobdella hippoglossi*, was collected from the skin of a halibut (*Hippoglossus stenolepis*) off Nikolski, Unalakleet Island, on August 30, 1938. (See also Annelid Worms.)

ROUNDWORMS

Sperm whales (*Physeter catodon*) brought to the Akutan whaling station are, without exception, infested with intestinal worms. According to Coast Guard Inspector A. Van De Venter the baleen whales are commonly infested as well. *Anisakis physeteris* was collected from the intestine of sperm whales here (Scheffer 1939).

Contraeacum clavatum is a thready white worm found in masses in the stomach of nearly every cod (*Gadus macrocephalus*) examined in Aleutian waters. A single specimen of *Cystidicola* sp. was also collected in the cod. *Porrocaecum decipiens* was found encysted in larval stage in the mesenteries of the cod.

An undetermined species (larval) of *Porrocaecum* was taken from the stomach of a sea otter.

NEMERTEAN WORMS

Paranemertes peregrina is a long, thready worm found in the littoral zone under rocks; it is colored dark brown to purple above and white to yellow below.

BRACHIOPODS

Three specimens of a single species, *Diestothyris frontalis*, were collected.

ANNELID WORMS

Two leeches from the skin of fishes were collected: *Ottoniobdella corpii* is a cream-colored worm, 25–50 millimeters long, commonly found attached to the dorsal surface of the sculpin (*Hemilepidotus*). *Platybdella quadrioculata* was collected once, in the operculum of a cod (*Gadus macrocephalus*).

Many free-living worms doubtless are present in the sand and among the tide-pool rocks of the Aleutian beaches, but the collections of the present expedition have not been studied. A species

of *Nereis* was found in small numbers in blue-fox droppings on Attu Island.

A small, tan-colored earthworm was noticed on several occasions, well up in the grass of the islands.

ECHINODERMS

BRITTLE STARS

Gorgonocephala eucnemis var. *caryi*, the basket star, has five arms which branch and rebranch profusely toward the periphery into a tangled mass of tendrils. The terminal branches writhe slowly in the living specimen and are tan in color. Specimens were snagged occasionally on codfish hooks.

Ophiopholis aculeata is a small reddish species often streaked or mottled with lighter colors. It was collected on three islands.

Ophiura sarsii is grayish or tan. It was collected on three islands.

STARFISHES

Two specimens of *Aleutiaster schefferi*, a small stubby star-rayed starfish were taken; 1 on Attu Island and 1 on Amchitka in both cases by dredging. They formed the basis of a new genus and species (Clark 1939). The family Ganeriidae, to which *Aleutiaster* was assigned, hitherto included 4 genera in the Arctic and 2 in the West Indies. "It is especially interesting therefore, to find a member of this family in the North Pacific. The topotype has a radius of only 5 millimeters.

Two species of *Henricia* were collected. *H. leviuscula*, taken only once, was noted as purple above and tan beneath. *sanguinolenta* form *tumida*, taken on five islands was noted as red. The latter is a slender, five-rayed "blood star" with a radius of about 20-30 millimeters. In a tide pool on Umnak Island it was associated with other starfishes of the same size, but with six-rays (*Leptasterias*).

The only large species of starfish in the Aleutian Islands, according to A. H. Clark, is *Asterias amurensis* (fig. 3). A specimen taken at Unalaska was wine-colored above, crossed by white channels and spots, and was light tan below. A pronounced light radial streak on the dorsal surface of each ray extends from a pentagonal hub at the center. The limp, floppy attitude of this starfish is quite different from the rigidity of the common mainland *Pisaster*.

Four species of *Leptasterias* were collected, *L. alaskensis* mo

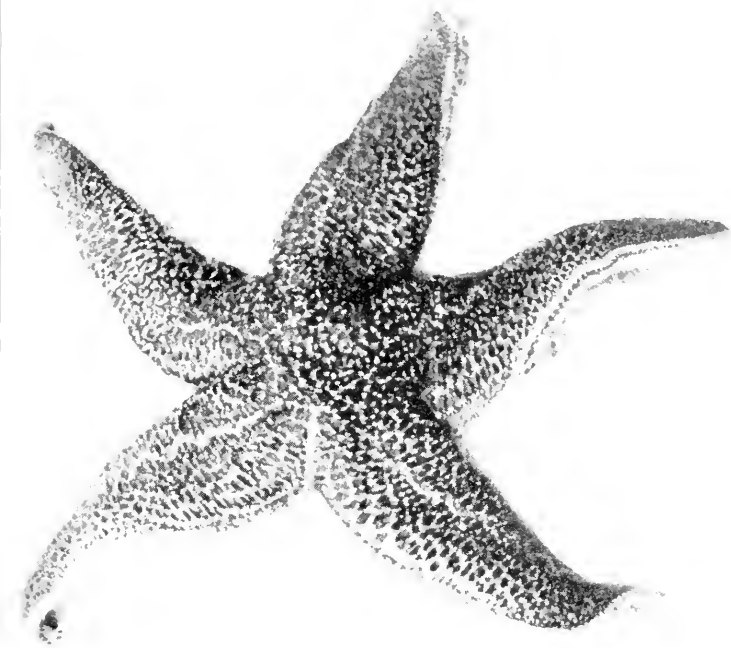


FIGURE 3.—The only large 5-rayed starfish of the Aleutian Islands, *Asterias nurensis*. This species is about 1 foot in diameter. Unalaska, August 18, 1937.

requently (on six islands). These are slender, six-rayed starfishes, noted as dark green, gray, tan, or purplish red.

No other Pacific Coast form resembles the 20-rayed starfish, *Yenopodia helianthoides* (fig. 4). Specimens were taken at King Cove, 35 miles east of Unimak Island, but not in the Aleutian Islands proper. No doubt it occurs at the east end, at least, of the chain.

SEA URCHINS

Strongylocentrotus dröbachiensis, the green sea urchin, is one of the most common inshore animals of the Aleutian Islands (fig. 5). In many places it is possible to look down from a boat through the clear water and see thousands of individuals side by side in a submarine garden of green. It occurs on rocky bottoms more frequently than on sand. Several specimens dredged from deep water (30 fathoms) off Sanak Island were a faded brown in color. Sea urchin spines are so predominant in the refuse heaps

of ancient Aleut villages that the middens are grayish in color. Sea urchins are eaten by the present-day natives. A small chiton was seen sucking the brown contents of one at Nikolski. The shell was cracked open and the orange part (gonad and liver) was eaten with the fingers. Sea urchins do not seem to be particularly palatable to fish. For example, in 20 cod stomachs examined at Chuginadak Island, only 1 small urchin was found. The occurrence of sea urchin remains in sea-otter, blue-fox, and sea-gull droppings has been mentioned elsewhere.

According to Clark, no other species of *Strongylocentrotus* occur in the Aleutians. A fisherman stated that he had seen the large purple *S. franciscanus* at Sitka, Alaska, but he had not seen it in the Aleutians.

The sand dollar, or sea biscuit, *Echinarachnius parma*, is thin and scattered along the Aleutians. Dead shells were seen or collected on the beaches of seven islands. Clark says that this is the only species of sand dollar in the Aleutians.

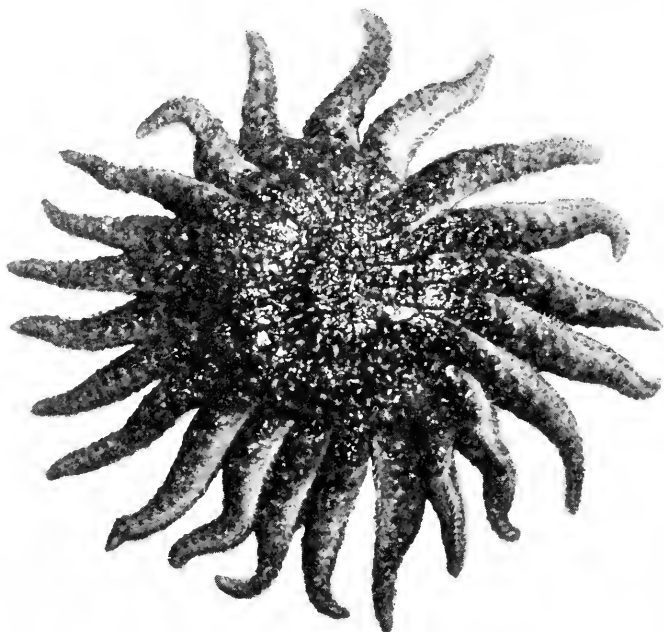


FIGURE 4.—Twenty-rayed starfish, *Pycnopodia helianthoides*. King C. September 9, 1938.



FIGURE 5.—Green sea urchin, *Strongylocentrotus dröbachiensis*, ventral or oral view. Rat Island, June 30, 1937.

SEA CUCUMBERS

The sea cucumber, *Cucumaria populifer*, was collected at Kiska Island and was observed at other places in the archipelago.

CRUSTACEANS

COPEPODS

Eighteen species of copepods were identified in marine-plankton collections. Concerning *Acartia pacifica*, Dr. Wilson states (in correspondence), that—

This species was established by Steuer in 1915 with figures of the fifth legs of the two sexes and a statement of the size but with no description. These are the first to be reported since that date and the species is much in need of detailed description.

The predominant species, judging from the number of collections in which it appears, is *Eucalanus clongatus*.

Several parasitic copepods were collected, *Lepeophtheirus*

parviventris, on a cod at Tanaga Island, and *L. salmonis*, on humpback salmon (*Oncorhynchus gorbuscha*), also at Tanaga land.

A species of *Pennella* occasionally is recovered from whales Akutan Island. Inspector Van De Venter at the whaling station said that no specimens were seen in 1938 and only one was seen in 1937.

BARNACLES

Ordinary rock barnacles are common throughout the Aleutian Islands (fig. 6). *Balanus crenatus* was collected by dredge at Atka Island.

Two interesting species of barnacles attach to the skin of the humpback whale (*Megaptera novaeangliae*) in the North Pacific (Scheffer, 1939). *Coronula diadema* is a white, hard barnacle that attaches to the skin, and *Conchoderma auritum* is a fleshy, elongated species that attaches, in turn, to *Coronula* (fig. 7). A fisherman said that *Coronula* is also found, though rarely, on the lower jaw of the sperm whale (*Physeter catodon*) just below the teeth. Two employees of the whaling station said that they had seen barnacles only on the humpback.



FIGURE 6.—Rock barnacles, *Balanus* sp., in tidal zone. Unalaska Island, July 10, 1937.



FIGURE 7.—Two species of barnacles collected from the skin of a humpback whale. The dark stalks of *Conchoderma auritum* attach to the white plates of *Coronula diadema*. Akutan Island, August 6, 1938.

Lepas, the goose barnacle, was collected at Otter Cove, Unimak Island, after a severe storm in September, 1937. Many tons of seaweeds were washed up on the beach, and *Lepas* was observed attached near the rhizoids of the brown kelp, *Nereocystis*. *Lepas* was not seen west of Unimak Island.

AMPHIPODS

Several genera of marine amphipods were collected: *Gammarus*, *Odius*, *Opisa*, *Orchestia*, *Orchestoidea*, and *Melita*.

Orchestia traskiana was the most commonly observed species living under the shelter of stranded seaweed or rocks throughout the Aleutians. The principal food of this crustacea seems to be decaying seaweed, of which there is a limitless supply; it also eats decaying fish, shellfish, sea birds, and mammal cast up from the sea. *Orchestia* is often found associated with the isopod *Lygia pallasi* and carabid beetles.

Beach fleas are of more than passing interest for, in spite of their small size, they may form the major item of food for the blue fox. As a general rule, on islands where sea birds are plentiful the fox droppings contain mostly feathers and few or no beach fleas. Where birds are not available, however, the droppings are characteristically whitish in color and are composed of the chitinous exoskeletons of beach fleas and isopods, together with traces of other beach organisms.

Paracyamus boopis (fig. 8) occurs on the skin of the humpback

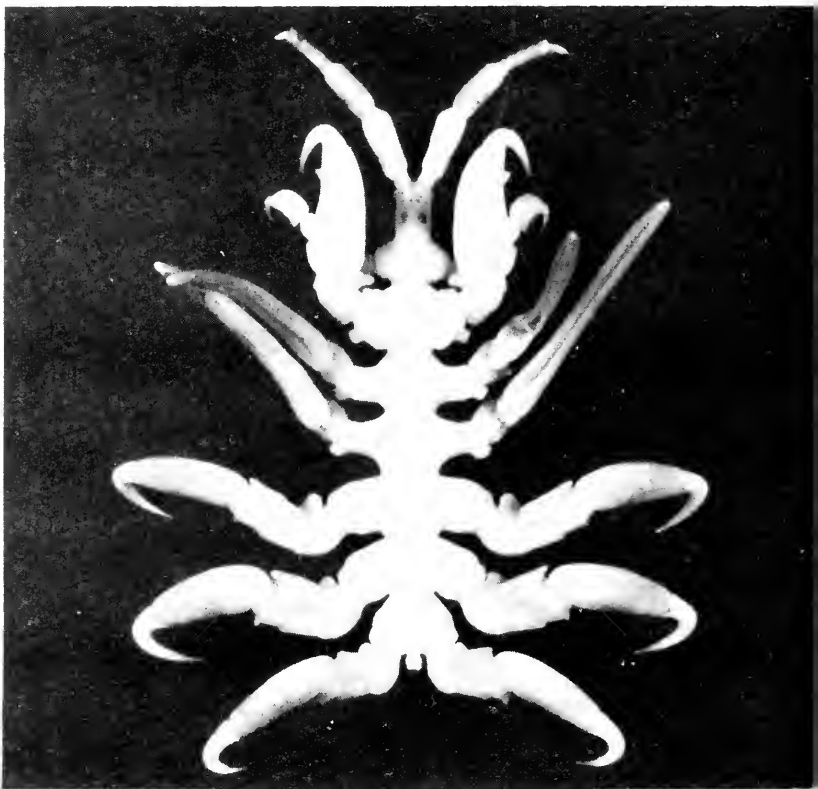


FIGURE 8.—Parasitic amphipod, *Paracyamus boopis*, from skin of humpback whale. Akutan Island, August 6, 1938.

male (Scheffer 1939). Known at the Akutan whaling station as a "whale louse," this amphipod clings tenaciously to the skin of the whale around the genital opening and, to a certain extent, over the entire body. When pried loose, it immediately seizes the collector's fingers with sickle-shaped claws.

ISOPODS

The isopods or sea slaters commonly are found clinging to damp rocks in the tidal zone. A few species are parasitic on fish.

Exosphaeroma oregonensis is common throughout the islands, not only in the tidal zone but also in brackish pools some distance from the sea. In Nikolski Lake, on Umnak Island, this isopod was living in water that had, to the taste, no perceptible salt content. The animal curls up into a round ball when disturbed.

Idothea ochotensis, a large, dark species, was taken only once, at Chichagof Harbor, Attu Island.

Lygia pallasii is 1 of the 2 most common isopods; it is flat, lead-gray or blackish brown, with a broadly oval outline. It is found on, or under, damp stones, and it was found from the mainland of Attu Island. It has been taken from fox droppings.

Idothea wosnessenskii also is abundant. It is somewhat more slender than *Lygia* and occupies a similar habitat.

Mesidotaea, *Munna*, and *Synidotaea* were each collected once.

Rocinela belliceps is a flesh-colored isopod about 25 millimeters long, with a suffusion of reddish and brown, paler on the ventral side; eyes are black. It attaches to the body, fins, or operculum of the cod throughout the Aleutian Islands.

DECAPODS

Shrimps of many species are found in dredge hauls or are recovered from the stomachs of cod, sculpins, and halibut. In the 36-38 collections, *Argis*, *Crago*, *Pandalus*, *Spirontocaris*, *Leb- us*, *Eualus*, and *Heptacarpus* are represented. *Crago alaskensis* and *Spirontocaris dalli* are represented from more collecting stations than any other species.

HERMIT CRABS

Six species of *Pagurus* are represented in the collections, of which *P. hirsutiuseculus* is by far the most common. Hermit crabs are found everywhere along the beaches, in shells of periwinkles and larger molluscs.



FIGURE 9.—Common crab, *Cancer magister*, taken by trawling at a depth 15-20 fathoms. Petersburg, Alaska, September 17, 1937.



FIGURE 10.—King crab, *Paralithodes* sp., taken by trawling at a depth 15-20 fathoms. Petersburg, Alaska, September 17, 1937.

MURAN CRABS

Dermapterus mandti was taken at three localities, and *Oedithus inermis* and *Placentron wosnessenskii* each at one locality.

OTHER CRABS

Cancer magister, the large edible crab of commercial importance on the Pacific coast, was taken as far west as Tanaga Island, and it probably occurs still farther west (fig. 9). *Cancer gonensis* is distinguished from the preceding species by its very walking legs. *Chionoecetes*, *Erimacrus*, *Hyas*, *Oregonia*, *Paralithodes*, *Pugettia*, and *Telmessus* are also represented in the 1936-38 collection. *Paralithodes camtschatica* was taken for the first time in the Bay of Islands by the ship's crew (fig. 10). It is one of the huge king crabs for which the Japanese have fished in recent years in Aleutian waters. It seems to be restricted to certain localities or to certain water conditions, for it was not found in dredge hauls made at other stations along the islands.

MOLLUSKS

GASTROPODES

The species of marine mollusks in the North Pacific are numbered by the hundreds. Only a few of the more conspicuous and more readily obtainable species are represented in the 1936-38 collections.

Bankia setacea, one of the shipworms or teredos, possibly may be present, although only the calcareous tubes in driftwood were collected (Unimak Island).

Three members of the family Cardiidae were collected. *Macardium nuttalli*, the giant cockle, is rather common and is used for food by the natives. In digging the mollusk, a two-tined potato fork bent like a hoe is raked through sand until it strikes a solid object. It is said that the flesh makes good chowder, comparable in sweetness to that of the razor clam.

Thlamys islandica, the scallop or pecten, was found in sea-otter droppings and on the beaches of Ogliuga and Vsevidof islands. Some shells are white, others are pinkish both inside and out. Two species of *Liocyma* were collected, one of which was hitherto undescribed (Bartsch and Rehder 1939). *Liocyma* is a common small white clam about 25 millimeters long; oval with fine concentric rings; occasionally greenish when living. It was noted only on tideflats of the Alaska mainland.

Five species of *Macoma* were collected.

Two small mussels, *Musculus discors* and *M. vernicosus*, were collected. Each is about 10 to 15 millimeters long, and is reddish brown or tan. The latter has a shining, varnished surface.

The mud clam or gaper, *Mya truncata*, was collected once, Unalaska.

The larger, abundant mussels are of two kinds. *Mytilus edulis*, the edible or blue mussel, is smooth and regular and is purple blue to black in color with a bluish nacre (fig. 11). The umbo is apical, unlike that of the horse mussel. The edible mussel is used for food by the natives and is said to be best when there is a layer of snow-white fat on either side of the body. When yellow and lean, the flesh is unpalatable. *Volsella modiolus*, the horse mussel, can be distinguished from the former by its larger, thicker shell and by the presence of a brown periostracum. The umbo is never at the apex, and the nacre is gray. The horse mussel usually grows solitary or in clusters of a few, while the edible mussel may cover the rocks in an area many feet in diameter. Both attach to rocks by a thready byssus, but the horse mussel usually is partly buried in sand. (A third large mussel, *Mytilus californicus*, was collected only once—at a depth of 30 fathoms off Sanak Island.)



FIGURE 11.—Edible or blue mussels, *Mytilus edulis*, in tidal zone. Unalaska Island, July 10, 1937.

The rock oyster, or jingle, *Pododesmus macrochisma*, is fairly common throughout the Aleutian chain. It is especially abundant near the Peninsula. The rock oyster can not usually be collected between tide lines, but its empty shells are strewn along the beach here they have been cast up from shallow water. The oysters grow solitary or in clusters (seldom more than four), on rocks just below low tide and never are buried in the sand. The attached valve is perforated by a conspicuous hole. The oysters are eaten by natives who fry the reddish flesh in butter.

Protothaca staminea is a small cocklelike clam with concentric ridges more conspicuous than the radiating lines.

The butter clam, *Saxidomus giganteus*, has a thick white shell, glossy within and chalky outside, with the growth lines not pronounced. It is used as food by whites and natives.

The razor clam, *Siliqua patula*, was collected only at Atka and Nimak islands. The flesh is considered by local natives to have finer taste than that of any other mollusk. It is difficult to gather any number of the clams, however, because they grow in fairly deep water, and the tides in the Aleutians do not fall low enough to expose the beds. It is possible to dig these light-shelled clams by backing a power boat up to the beach, throwing out two anchors astern, and letting the wash of the propeller lift the clams out of the sand. A native of Unalaska stated that they used to be abundant in front of the village.

Spisula polynyma is widespread among the islands. It is a rather large bivalve with brown periostracum and acute dorsal angle.

NAILS AND SEA SLUGS

Five species of limpets, *Acmaea*, were collected (fig. 12). Limpets are very common throughout the Aleutian Islands, in pools or clinging to wet rocks above low tide. The only species found in sea-otter and blue-fox droppings was *A. digitalis*. *A. pelta* was collected most often (at 10 stations) and is the largest of the Aleutian limpets, reaching a diameter of 5 centimeters. *A. mitra* is a strongly peaked species. *A. scutum* was collected at seven stations.

An odd, tiny snail *Anabathron muriei* was described from specimens found in sea-otter droppings (Bartsch and Rehder, 1939).

Eight species of *Buccinum* were collected.

Fusitriton oregonensis was the only large, cornucopialike snail that was collected; it has a length of about 5 centimeters, and is

olive colored and hairy. *Beringius kennicotti* is similar in shape but is slightly smaller and is not hairy.

Three species of periwinkles, *Littorina*, were collected (fig. 13). The periwinkles are characteristic animals of the tidal zone. They are able to withstand drying for a long time, and they crawl well above the waterline to rocks and seaweed where they cling in clusters that often number in the hundreds. The periwinkle is edible, but the flesh is not particularly tasty. Picking out the small fragments of meat becomes tiresome, like eating sunflower seeds. *L. sitkana* was by far the most abundant species (at nine stations). On Amlia Island the empty shells of this species served as homes for small hermit crabs (*Pagurus hirsutiunculus*). The species was also found in sea-otter scats.

Five species of *Margarites* were collected, most of them smooth globular, white snails.

Four species of *Nucella* were collected. *Nucella lamellosa* forms collarlike egg cases of cemented sand, often washed up on the beach.

A single sea slug, or nudibranch, *Diaulula sandiegensis*, was collected. Other species are reported from the Aleutians. *Diaulula* was taken by dredge from sandy bottoms at Attu and Tanaga.

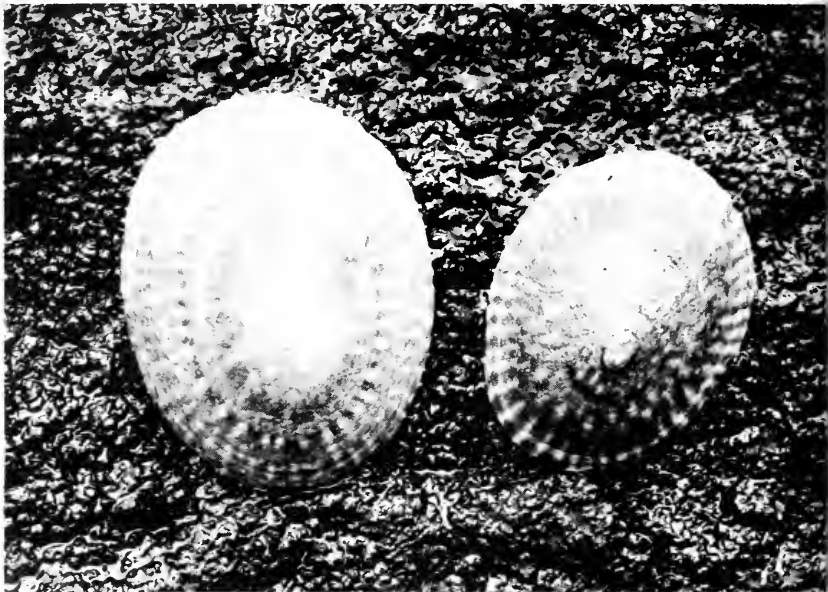


FIGURE 12.—Limpets, *Acmaea* sp., clinging to rocks in the tidal zone, Unalaska, July 10, 1937.



FIGURE 13.—Periwinkles, *Littorina* sp., clinging to rocks in the tidal zone. Unalaska, July 27, 1937.

HITONS

Murie picked up a fragment of the giant chiton, *Amicula stelleri* on Amchitka Island. The species is brick red, as large as 10 by 20 centimeters, and has a leathery girdle completely covering the eight dorsal plates.

Katharina tunicata is fairly common. Many individuals were noted at Umnak Island in shallow tidal pools and at Amlia Island on a rocky, kelp-covered ledge. The body is black and leathery, with a row of eight plates down the back. Its local name "bidarka" is also applied to the skin boat of the Aleuts. The natives prepare the chiton for eating by boiling it in sea water for 10 minutes, then peeling off the skin, scales, and viscera and soaking in fresh water. The general color of the live chiton is dark brown with brown and tan plates.

Mopalia ciliata wosnessenskii is a small chiton about 25 millimeters long that is pink on the dorsal surface. Its fringed edges have given it the name of mossy or hairy chiton. It was collected at three stations.

Schizoplax brandti and *Tonicella ruber* were collected in sea-water droppings, and, in addition, 24 specimens of *Schizoplax brandti* were collected on the rocks of Herbert Island.

DEVILFISHES

Two cephalopods were observed. A large devilfish, *Octopus apollyon*, was taken at Nikolski Village, Umnak Island, in a beach seine drag for salmon. The water here was not more than 10 feet deep at the mouth of a small stream. The ship's cook fried a steak of white meat from the dome of the devilfish and we found it much tender than we anticipated. The natives usually boil the head steaks before frying, and they boil the tentacles before eating. S. Halvorsen, Coast Guard inspector at the Akutan whaling station, stated that the stomach of a sperm whale killed in 1937 contained 16 devilfish, presumably of this species. The natives are said to take good-sized specimens in Nazan Bay, Atka Island, although we were able to get only two small ones here.

A squid, *Rossia pacifica*, was found on the beach at Unimak Island after a storm in September. The color of the dead specimen was white, peppered with fine brown spots. Kenneth Newell, who is familiar with the "ink-fish" of Puget Sound said that he had never seen one in the Aleutian Islands. S. Halvorsen, however, reported that they were common in the stomachs of sperm whales brought into the Akutan whaling station. Possibly the species does not range much farther west than the Alaska Peninsula.

Fresh-Water Invertebrates

The Aleutian Islands are dotted with shallow pools. In only a few cases are the pools larger than 5 or 10 acres, and most of them are depressions only a few feet across. Standing on a hillside on Agattu Island, and looking over an expanse of about 2 by 3 miles, we estimated that there were 200 pools in sight.

In 1937, collections of fresh-water organisms were made in 24 lakes scattered along the Aleutian chain. Crustaceans were collected with a plankton net; mollusks and aquatic insects were collected by hand. (A discussion of the insects is presented later in the section devoted to land invertebrates.)

The pools and lakes may be classed loosely in three groups, according to their size and the amount of vascular plant life present, as follows:

Type 1: Small, clear pools (fig. 14). Shallow; vegetation absent



FIGURE 14.—A fresh-water pool of type 1 (small and clear). Attu Island, August 17, 1938.

or, if present, consisting of sparse patches of emergent *Hippu* and *Carex*; bottom consisting of clean volcanic sand or occasional silt. This type is by far the most abundant. Many of the clear pools do not support plankton because they overflow and are flushed out by each rain. The water in type 1 pools usually is slightly tea-colored, like that of sphagnum bog pools on the mainland. We discovered that it was possible to determine whether a pool contained enough plankton to warrant taking a haul by looking for aquatic bugs and beetles. A pool highly productive of plankton is generally well populated with aquatic insects. The clear pools are characterized by the presence of *Diatomus*, often in such numbers that a tow over a course of 300 feet may net a haul of 50 cubic centimeters of these red-bodied crustaceans. One such haul on Sanak Island consisted almost entirely of *Diatomus shoshone* var. *wardi*, *D. ashlandi*, and *D. eiseni*. *Cyclops serrulatus* is also commonly present in type 1 pools.



FIGURE 15.—A fresh-water pool of type 2 (small and weedy). Atka Island, Alaska, August 13, 1937.

Type 2: Small, weedy pools (fig. 15). Shallow depressions in the tundra, 50–100 feet in diameter, with oozy silt bottoms. This type is not common. Hultén (1937) concludes that the vegetation in Aleutian lakes is so sparse that real associations are hard

formed: "The few aquatic plants, such as *Potamogeton perfoliatus*, *Myriophyllum spicatum*, *Sparganium hyperboreum*, and *Anunculus tricophyllus*, *Hippuris vulgaris* and *Isoetes Braunii aritima*, usually occur single or in patches." We found that the dominant organism in plankton of type 2 pools is *Chydorus thaeiricus*. Amphipods are usually present in the weeds.



FIGURE 16.—A fresh-water pool of type 3 (large and barren), about 0.2 x 1.5 miles. Semisopchnoi Island, August 23, 1938.

Type 3: Large, barren lakes (fig. 16). Scant vegetation around shore; clean sand and rubble bottom; windswept. The largest examples are about 2 miles long. Only about 10 of the 75 islands have lakes of this type. The temperature of the water in three lakes at least 1 mile long was measured in August and was found to be 56° F., 57° F., and 58° F. respectively. The plankton is uniformly sparse; in fact, hauls made in the lake at Unalaska Village in June and July were discarded for lack of a discernible catch. Again, in a lake measuring 1 by 2 miles, on Unimak Island, a haul was made in late August with negative results.

The surface temperature of fresh-water bodies in the Aleutian Islands fluctuates greatly from day to day because of the shallowness of the water and the open surroundings (see table, p. 390). The lowest temperature recorded was 44° F. on September 10;

cold wind was blowing at the time. The highest temperature recorded was 66° F. on July 22, after one of the rare days of sunshine.

*Mean surface temperature of the water of Aleutian Island
pools and lakes, 1937-38*

Month	Number of observations	Mean temperature (°F.)
June.....	2	56.5
July.....	6	58.6
August.....	33	55.8
September.....	4	51.2
Mean.....	45	55.8

The fresh-water plankton crustaceans have been identified by Trevor Kincaid, of the University of Washington. His remarks on the material are as follows:

Very little is known regarding the fresh-water plankton of Alaska, and this is particularly true of the region including the Aleutian Islands which is practically a blank in so far as records are concerned.

The writer has been assembling plankton from various parts of Alaska with a view to determining the geographic distribution of the species occurring in the fresh water bodies in that territory, and to discovering what relation exists between the fauna of Asia and that of Alaska and of North America in general. It is becoming clear that this relationship is much closer than has been suspected.

In the genus of fresh-water copepods *Diaptomus* it has been supposed that no species was common to both continents, but we now find several species of this group ranging across Europe and Asia into Alaska, with at least one species having a wide range over western North America and having been reported from a lake in Siberia.

The series of tows brought back by the expedition from the Aleutian Islands was regarded as particularly important since the archipelago forms a series of natural stepping stones extending from the Siberian region to the Alaskan Peninsula and southward, and as one might expect to find here the collection extends the known westerly range of several American species, and expands the easterly range of at least one Asiatic form.

Diaptomus ashlandi was originally described from Wisconsin and is known to be widely distributed over the northern portion of the Pacific Coast. It appears in tows taken on the islands of Sanak and Unalaska. *Diaptomus shoshone* var. *wardi* was first reported from Spokane, Washington and has since been reported from the Island of St. Paul in the Pribilof Islands. It appears in a tow taken on Sanak Island. *Diaptomus eiseni* was described from California, but has since appeared in collections taken at widely separated localities of the Pacific Coast. It has been reported from a lake in Siberia. A single specimen was found in a tow taken on Sanak Island. *Arctodiaptomus kurilensis* was recently described from the Kurile Islands by Kiefer. It appears in a tow taken on the islands Kanaga, Tanaga and Adak which lie near the middle of the Aleutian chain.

The cyclopoid copepods found in the collection are, as might be expected, species already known to be common to both continents, or as in the case

Cyclops serrulatus, with a cosmopolitan distribution. The same is true of most the Cladocera, the majority of which are common to Europe, Asia and America. However, even in the case of widely distributed forms it is interesting to determine their existence as part of the local fresh-water fauna."

Trevor Kincaid has recently (1953) published a report which mentions the 1937-38 Aleutian collection of plankton crustaceans.

CRUSTACEANS

LADOCERANS

- Daphnia pulex* (de Geer)
- Daphnia longispina* (O. F. Müller)
- Bosmina obtusirostris* Sars
- Macrothrix hirsuticornis* Norman and Brady
- Alona rectangula* Sars
- Pleuroxus denticulatus* Birge
- Chydorus sphaericus* (O. F. Müller)
- Chydorus latus* Sars
- Alonella nana* (Baird)

COPEPODS

- Eurytemora affinis* Poppe
- Arctodiaptomus kurilensis* Kiefer
- Diaptomus ashlandi* Marsh
- Diaptomus shoshone* var. *wardi* Pearse
- Diaptomus eiseni* Lilljeborg
- Cyclops (Acanthocyclops) viridis* Jurine
- Cyclops (Cyclops) strenuus* Fischer
- Cyclops (Eucyclops) serrulatus* Fischer

STRACODS

- Cyclocypris* sp.

MOLLUSKS

Eleven species of mollusks were collected from fresh-water pools and lakes. All of them were small bivalves or snails found clinging to submerged vegetation or in the bottom mud; none were as large as the fresh-water mussels of the mainland. A full list of the species collected is as follows:

- Fossaria truncatula*, *Gyraulus deflectus*, *Menetus opercularius*, *Planorbis planulatus*, *Pisidium abditum?*, *Pisidium liljeborgi*, *Pisidium vivum?*, *Retinella binneyana pellucida*, *Sphaerium tenue*, *Stagnicola atkaensis* (9 out of 12 were infested with trematode rediae), *Stagnicola randolphi*, *Stagnicola yukonensis atlinensis*.

Land Invertebrates

MOLLUSKS

Two land snails and one slug were collected in the Aleutian Islands, all of them at Unalaska. *Haplotrema sportella* is a dark greenish-yellow snail collected in damp grass on a hillside, September 6, 1938. *Vespericola columbiana*, collected at the same time and place, is light horn-colored and is slightly more globular than *Haplotrema*. *Prophysaon andersoni* is a common slug around Unalaska Village.

BETLES

As might be anticipated in a treeless, windblown region, the insect fauna is poor. The most commonly observed insects are small flies breeding under decaying seaweed along the beach, under damp stones, and in shallow pools. Pools also may contain water bugs, caddisflies, true flies, and collembola. No butterflies were observed though a tan moth was not uncommon. Bumblebees were occasionally seen in the flower fields. No grasshoppers or crickets were noted.

Hatch (1938) has previously reported on a collection of 27 species of beetles taken on the islands in 1937. Of these 27 species, 8 had not apparently been recorded previously from the Aleutian Islands, and 11 had their distribution extended westward by the 1937 records. A discussion of the importance and habitat relations of certain of the species listed by Hatch follows.

Scaphionotus marginatus is a large, iridescent ground beetle that is known (elsewhere) to feed on snails. (Snails and slugs were collected on Unalaska Island.) Several species of *Nebrida* were collected on the mouldering debris of Aleut middens.

Three species of *Hydroporus*, minute beetles about 3 millimeters long, are common in fresh-water pools. *Agabus* is an aquatic beetle about 6 millimeters long. *Ilybius* is an aquatic form about 8 millimeters long, dark in color, with four small orange spots on the wing covers. *Colymbetes* is the commonest large beetle (about 10 millimeters long) observed in fresh-water pools. A single specimen of a very large beetle, 30 millimeters long, was taken on Sanak Island, the first record of this *Dytiscus* from the islands. *Gyrinus*

the whirligig beetle, apparently is present on all of the islands. Of the carrion-feeding beetles, *Nebria*, a small brown form, is fairly common in rotting kelp. *Catops* is the smallest beetle (about 25 millimeters long) observed on the islands. Specimens of a large black staphylinid were collected under a decomposing sea lion at Attu Village.

Eurystethes, whose habitat is on rocks by the sea, was collected once on Amchitka Island and once on Ogluga Island, both times in sea-otter droppings.

Several click beetles, *Ludius*, and weevils, *Lophalophus*, were collected. A click beetle, *Cryptohypnus littoralis* (not reported by Hatch), was found by Cecil Williams in droppings of a blue fox on Attu Island.

BIRD LICE

A small series of biting bird lice (Mallophaga) was collected from the slender-billed shearwater, *Puffinus tenuirostris*, at Rat Island and at Unimak Island. The following determinations were made by the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture:

Esthiopterum diversum, *Giebelia mirabilis*, *Ancistrona* sp., *Lenopon* sp., and species of Analgesidae.

DIPTERA

The following species of true flies were identified in the 1936-38 collections:

Bibio variabilis, *Calliphora vomitoria*, *Chironomus hyperboreus*, *Gnomonia hirta*, *Dilophus tibialis*, *Empis* sp., *Platychirus* sp., *Protophormis terranova*, *Scatophaga* sp., *Syrphus* sp.

SPIDERS

Only two kinds were commonly observed, *Pardosa* and *Cybaeus*, both of which were medium-sized, dark-bodied spiders collected on mats of damp lichens and low vegetation. A single specimen (female) of a huge, milk-white *Aranea* sp. was collected near its orb web on a low bush at Unalaska.

Cybaeus reticulatus was collected on eight islands. Members of this family (Agelenidae) spin sheet-like webs, usually in the form of a funnel with a tubular retreat.

Four wolf spiders (family Lycosidae) were collected. Members of this group do not spin webs and are commonly found running over damp fields. *Lycosa* sp. was taken once. *Pardosa tarsalis* was taken on six islands. *Pirata piratica* was taken once. The

latter species is said to live in the vicinity of water, upon which runs freely, and beneath which it dives when alarmed. *Tarentula aquilonaris* was newly described by Fox (1940) from specimen taken on Attu Island.

A tick, whose identity is not known to us, apparently is abundant on Bogoslof Island at certain seasons. According to Morris (1931, p. 952),

The murre were pestered with a tick about the size and appearance of small wood tick. These became especially numerous on the second week of August. As many as 100 were picked off the inner walls of the tent each day for a week. Several got on members of the party but only one tick drew blood.

We recall picking lead-gray ticks from the body of a bird killed somewhere at sea in the Aleutian Islands, but the specimens have been mislaid.

Fishes

Forty-eight species of fish were collected in the Aleutian Islands proper. These were identified by Dr. Leonard P. Schultz, and two of them were described by him as being new (1939). The following list, alphabetically arranged, includes remarks on the noteworthy species only. A few descriptive notes in quotation marks from Evermann and Goldsborough (1907) are included.

Alepisaurus ferox, the lancet fish, is a fearsome species with large, glassy eyes and an array of needle-sharp teeth. The only specimen taken was one that had been caught in a crevice of rock between tide levels on Amchitka Island, where it had been badly eroded. (Murie also saw a beach-worn specimen in 1936.) The body was about 2 feet long and scarcely larger in diameter than a broom handle. Schultz says that there is only one species of *Alepisaurus* in the North Pacific and that the usual length is 4 to 5 feet.

Ammodytes tobianus personatus is very common along the beaches and was often taken in large numbers with the seine; it is a bright silvery little fish that is called locally "needlefish". Evermann and Goldsborough (1907) say, "they quickly bury themselves in the sand when disturbed. . . more delicious little fish probably do not exist. They are usually prepared by rolling in fine cornmeal or cracker crumbs and frying in butter."

Aspicottus bison is one of the smaller sculpins reaching a length of about 10 inches. (See *Hemilepidotus*.)

Atheresthes stomias, one of the flounders, is called locally "turbot." It swims with its right side up.

Bathymaster signatus, a beautiful little fish, was taken once in the Bay of Waterfalls, Adak Island. It is reddish-brown with blue-green spots; also it has a blue line along base of ventral fin, a reddish line adjoining, and then another blue line near tips of fin rays.

Chiropsis decagrammus. Only small specimens of this greenling, or rock trout, were taken, at Unimak Island.

Clupea pallasii. Pedler, agent of the Alaska Commercial Co. at Unalaska, told us of the herring industry near Unalaska and Dutch Harbor. In 1938, the first run was from June 26 to July 27,

and the second run, much smaller, was from August 26 to September 6. The run varies greatly in size from year to year. In 1938 there were 165 tons of bloaters and 2,000 barrels (250 pounds to a barrel) of gibbed herring prepared at Dutch Harbor. The gibbed, or Scotch-cured, herring are cleaned and are salted only once. All herring are taken by gill nets near Dutch Harbor. Gibbed herring sold in Seattle for about \$15 a barrel.

Cyclopteridae, the members of which family are commonly known as lumpsuckers, are characterized by a round sucking disc on the ventral surface of the body. By this means they attach to rocks and sometimes to kelp in the region of wave action along shore. They are able to attach or release themselves almost instantly. The only adult taken was found on the beach in poor condition. The larvae of *Elephantichthys copeianus?* were taken at two dredge stations. These were handsome little fish about 2 millimeters long, tan colored with pale-blue "spectacles" between the eyes.

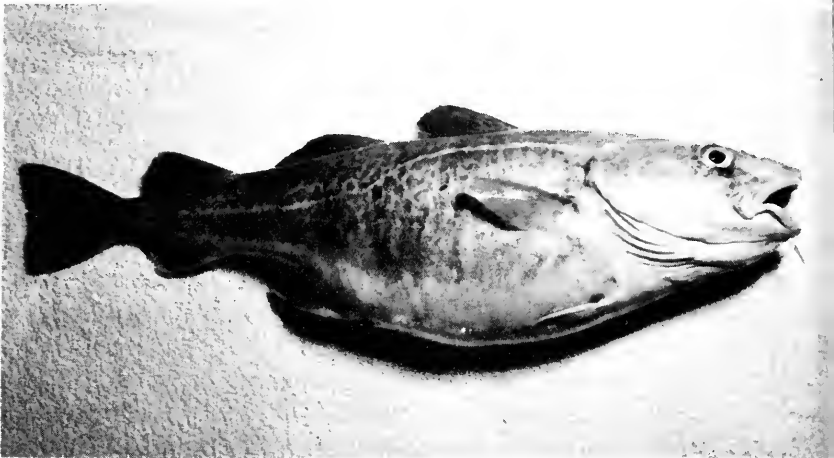


FIGURE 17.—Alaska cod, *Gadus macrocephalus*, False Pass, August 5, 1938

Gadus macrocephalus, the common Alaska cod, was taken with hook and line at nearly every anchorage (fig. 17). In deep water near Atka Island on August 10 the ship's crew caught more than 80 fish in half a day. Most of them were later salted down. All specimens taken during the summer were wormy, although not unfit for eating. Stomach contents from three localities contained masses of the nematode *Contracaecum clavatum*. In one stomach a female *Cystidicola* sp. was found. The mesenteries of the cod were usually knotted with masses of cysts of the nematode *Porro*

ecum decipiens—this worm also was taken from the stomach of an adult hair seal on Khwostof Island. External parasites of the cod included a copepod, *Lepophtheirus parviventris*, an isopod, *Aspelecinella belliceps*, and a leech, *Platybdella quadrioculata*.

Stomach contents of cod were examined from time to time, partly out of curiosity and partly to recover specimens of invertebrates for the general collection. Common items in the diet included large amphipods (often half a pint or more in a single stomach), shrimp, octopus or squid beaks, sea urchins, snails, crabs, and many small fishes. Near Chuginadak Island, on August 21, the head of an adult cormorant *Phalacrocorax* sp. was found in a cod stomach. Off Ogliuga Island, on August 12, the entire body, considerably softened, of a parakeet auklet (*Cyrorrhynchus psittacula*) was recovered (Scheffer 1943).

Gasterosteus aculeatus aculeatus, the three-spined stickleback, was taken on three islands in fresh-water pools. *G. a. microcephalus* was taken on four islands, also in fresh-water pools or streams. Both races of *aculeatus* may be found in both salt and fresh water, but the resident salt-water form is more heavily plated and is given the subspecific name *aculeatus*, while the resident fresh-water form is given the name *microcephalus*. In fresh water, all but four or five plates near the head are eventually lost.

In some places, as on Kavalga Island, sticklebacks occur in ponds on plateaus isolated from the sea and now inaccessible to fish. It is our opinion that the fish gained access to such ponds before the outlet streams became steep.

In several cases, sticklebacks were noted heavily infested with



FIGURE 18.—Red sculpin, *Hemilepidotus hemilepidotus*; color: red and brown. Kagamil Island, August 29, 1938.

tapeworms, which filled the body cavity to the extent that the fish had a pot-bellied appearance. (See also *Pungitius*, the many-spined stickleback.)

Gymnocanthus pistilliger is a bullhead, or cottoid, of interest because it was found in a sea-otter scat on Ogliuga Island. There are many species of cottoids in the shoal water and tide pools of the Aleutian Islands.

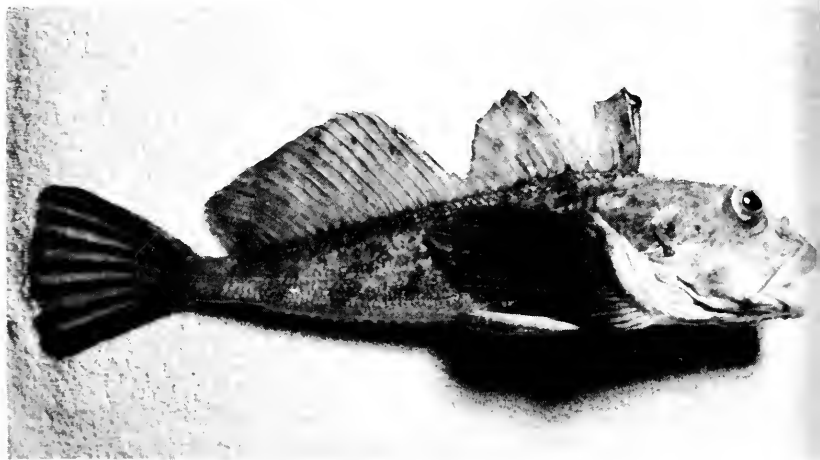


FIGURE 19.—Irish lord, *Hemilepidotus jordani*; color: dirty olive and black. Kiska Island, August 19, 1938.

Two species of *Hemilepidotus* are very common in the islands. *H. hemilepidotus*, the red sculpin, is brick red to brown in color (fig. 18); *H. jordani*, the Irish Lord, is a dirty, olivaceous brown with irregular dark bars (fig. 19). Sculpins are bottom feeders with an amazing capacity to swallow large objects. When caught with hook and line, it is often necessary to dissect the fish to recover the hook. When the boat was at anchor, sculpins were so attracted to the spot by garbage thrown overboard from the galley. Among other items found in sculpin stomachs, we have noted a match box, a boiled potato, a good-sized chicken leg, and the entire carcass of small bird specimens discarded from the skinning room. Invertebrates seem to make up most of the natural diet: brittle stars, snails, clams, crabs, shrimps, amphipods, and many others.

Color notes were taken of a specimen of *H. hemilepidotus* from Kagamil Island: red, mottled with brown, belly is white with chocolate spots; color fades rapidly. A specimen from Vsevid Island: head appears as though bright-red paint had been poured

ver it; a few red splotches on body; general body color is light brown and red; belly is light with small chocolate specks; a dark-colored stripe runs along each side near dorsal line, and a dark horizontal stripe runs across each eyeball.

Color of a specimen of *H. jordani* from Kiska Island: dirty olive with several short, vertical, irregular dark bars near the dorsal line; lips are yellow; belly is light.

Hippoglossus stenolepis, the halibut, is fished on certain banks, but it may be encountered anywhere among the islands (fig. 20). It is the largest of the flounders and is said to reach a weight of almost 400 pounds. We took a 100-pound fish off Bogoslof Island in the deeper waters that it frequents. The halibut swims with its right side up.

Lebius supereiliosus, the pogie, greenfish, or red rock trout, was taken on seven islands (fig. 21). Color notes on one specimen: general ground color of skin is black with greenish cast, covered



FIGURE 20.—Halibut, *Hippoglossus stenolepis*, weighing approximately 100 pounds. Bogoslof Island, August 31, 1938.

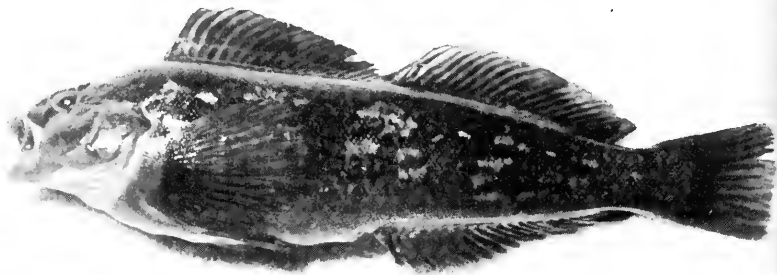


FIGURE 21.—Pogie, *Lebius superciliosus*. The flesh may be vivid green or white. Attu Island, August 16, 1938.

with irregular spots of light tan. Inside of mouth and under jaw is light green; flesh and viscera are green. Another specimen back and sides are brownish olive mottled with black, and are spotted with bluish green; under-parts are yellowish; flesh is white. On many specimens, the skin is a rich dark red, almost matching the fronds of kelp, among which the fish swim. The vivid green flesh of the majority of specimens is a startling sight to a person seeing it for the first time. Dr. L. P. Schultz says that the presence, or absence, of green color throughout the flesh is not to the best of his knowledge, a sex character. The flesh color is sometimes more of a blue than a green. O. J. Murie reports that the fish comes up to the shallow water along the beach at night and makes a popping noise like kelp bladders exploding. The fish was found in nests of the bald eagle on several occasions, suggesting that it is a shoal-water species.

Lepidopsetta bilineata, was called "flounder" on one occasion and "sole" on another, by the same fisherman. It swims with its right side up. Evermann and Goldsborough (1907) state that the flounder is widely distributed and that it takes the hook readily.

Myoxocephalus polyacanthocephalus was taken on four islands. This is said to be a large sculpin, but we have no field notes on it.

All five species of Northeast Pacific salmon were collected in the Aleutians, the humpback and the silver salmon were found most frequently:



FIGURE 22.—Pink or humpback salmon, *Oncorhynchus gorbuscha*, breeding male. Amchitka Island, August 22, 1938.

Oncorhynchus gorbuscha, the humpback, or pink salmon is identified by Evermann and Goldsborough to be the most common species in Alaska (fig. 22). Some of our specimens were adults, and others were fingerlings caught on hook and line in streams. A parasitic copepod, *Lepeophtheirus salmonis*, was collected from the back of a humpback salmon on Tanaga Island.

Oncorhynchus keta, the dog, or chum salmon, was collected only once—on Atka Island. The natives had constructed a crude fish trap at the outlet to Korovin Lake. On August 13, the silver salmon were running and there were also a few dog salmon in the trap. These were not recognized by the natives as dog salmon, but were termed "winter salmon" and were given an Aleut name slightly different from that of the silver. Four specimens examined were males with apparently mature testes but without the external hump that is characteristic of the breeding fish.

Oncorhynchus kisutch, the silver salmon, was collected on several islands.

Oncorhynchus nerka, the sockeye, or red salmon, was running into a lake on Attu Island in early June 1937 (figs. 23 and 24). The species runs only into streams that have lakes somewhere in the headwaters.

Oncorhynchus tshawytscha, known as the king, spring, or chinook salmon, was collected only in the fingerling stage. The adults frequent deep, or offshore waters, occasionally reaching a size of 100 pounds. They are taken by trolling.

Orycottus acuticeps is one of the many species of tide-pool bullheads.



FIGURE 23.—Native boy netting sockeye salmon, *Oncorhynchus nerka*. Attu Island, August 17, 1938.



FIGURE 24.—Red or sockeye salmon, *Oncorhynchus nerka*, taken in gill net by Attu Island natives and dried for winter food. June 8, 1937.

is a bizarre little fish, colored bright grass green over the entire body, matching the sea lettuce (*Ulva*) among which it lives. The webs of the fins are transparent, with yellow at the base. There is little silver color on the jaws; otherwise, the body is uniformly green. Another bullhead, *Oligocottus*, is also commonly green.

Phallocottus obtusus, a cottoid taken on Igitkin Island, was the basis for the description of a new species and genus by Schultz (1939).

Pallasina barbata, a sea poacher, is a very slender fish with a long sturgeon-like snout. Specimens about 5 inches long were taken in a seine haul in the surf at Umnak Island.

Pholis laetus is one of the many blennies that inhabit the tide pools. It is a small, smooth fish, shaped like a slender cigar; it is yellowish with a series of paired transverse black bands on the dorsal surface.

Platichthys stellatus was taken only at Unimak Island. The starry flounder is said by Evermann and Goldsborough (1907) to be the most abundant and most widely-distributed flounder in Alaska. It has black spots along both dorsal and ventral fins, and, unlike other species in the North Pacific. It swims with its left side up.

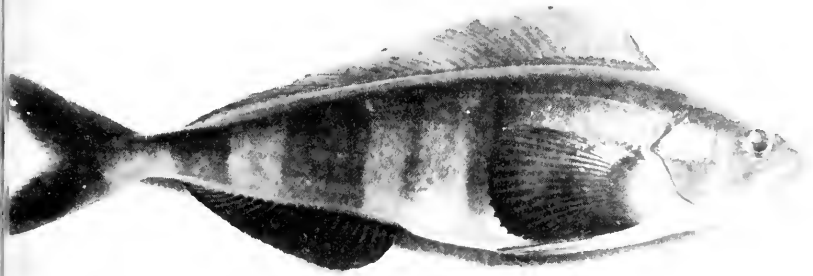


FIGURE 25.—Atka mackerel, *Pleurogrammus monoptyerygius*. Attu Island, August 16, 1938.

Pleurogrammus monoptyerygius, the Atka or Attu mackerel, occurs along the Aleutian chain, but apparently it is most abundant near the west end (fig. 25). At the mouth of Chichagof Harbor, Attu Island, we were able to look down into the clear water and see dozens of Atka mackerel swimming among the kelp fronds.

The body is strikingly marked with broad bands of black and yellow. A number of specimens were taken by the crew "jigging" (jerking a hook with an artificial lure up and down the water). Specimens were also found in nests of the bald eagle.

Pungitius pungitius, the many-spined stickleback, was taken in fresh water pools on Afognak Island and the Semichi Island, both localities east of the Aleutian Islands proper.

Salmo? William Gardner, employee at the salmon cannery at False Pass, told us that there are at least four streams on Umnak Island where steelhead trout run. No species of *Salmo* were collected in the Aleutian Islands by our party, and it is unlikely that any occur far from the Alaska mainland. Evermann and Goldsborough state that there are no records for rainbow trout (*S. gairdneri*) in any waters off, or north of, the Alaska Peninsula and that there are no records for cutthroat trout (*S. clarki*) beyond Kodiak Island. However, there may be more recent records extending the range of these species. Salmonoid fingerlings collected along the Aleutians by our party invariably were young salmon or Dolly Varden trout.

Salvelinus malma spectabilis, the Dolly Varden trout, is abundant throughout the islands, both in fresh-water streams and salt water near the mouths of the streams. Locally, it is regarded as an important predator on salmon eggs, but there is no conclusive evidence to this effect. We found the flesh of the Dolly Varden to be quite tasty, although it was scorned by some members of the party. On Amchitka Island, July 19, 52 specimens were taken with a single haul of a small beach seine. An interesting landlocked form of Dolly Varden was observed on Unalaska. On August 17, Captain H. A. Searles presented us with six specimens taken with hook and line in Pyramid Creek above an impassable falls. This form is much smaller and less silvery than the sea-run form, but the body colors are more brilliant. The belly is bright orange, back of the ventral and anal fins it is scarlet, and the body spots are bright orange.

On Attu Island, on August 17, the natives were removing dozens of large Dolly Vardens from gill nets set for red salmon, leaving them to rot on the lakeshore. Several odd-looking trout, said by the natives to be different "kinds" of trout, proved to be *spectabilis*.

Sebastodes ciliatus. A few sea bass were taken with hook and line over the rail of the ship. The fish is not particularly common on the Aleutians.

Sigmistes smithi, a small cottoid, was described by Schultz (1939) from a collection made on Igitkin Island.

Theragra chalcogramma chalcogramma, the Alaska pollack, or liver hake, was not observed in the islands, although it was discovered that a young specimen had been taken in a beach haul made on Igitkin Island (fig. 26). Adults were taken readily at Eward and Petersburg, on the mainland.

Trichodon trichodon was taken several times among kelp. It is a small sand fish with an undershot jaw studded with fine, sharp teeth. Its odd appearance attracts immediate attention.

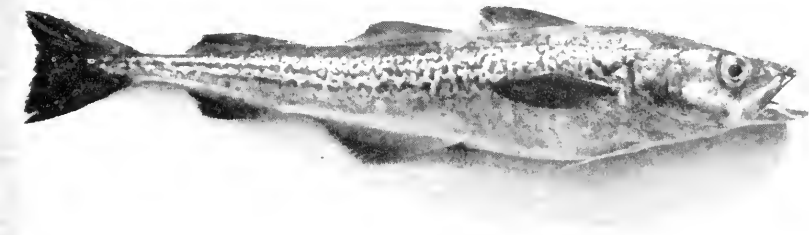


FIGURE 26.—Silver hake or Alaska pollack, *Theragra chalcogramma*. Chignik, Alaska, September 14, 1938.

Zaprora silenus. A specimen was taken by one of the ship's crew while he was fishing for Atka mackerel from a dory. The ungainly body so startled the man that his first impulse was to drop it back into the ocean. Another specimen, not recognized at the same time, was observed off Umnak Island, hovering under a large range jellyfish (*Cyanea*) at a depth of about 1 foot. It followed the shelter of the umbrella and the hanging tentacles. When the jellyfish was netted, the fish darted into the bell and was later found in the center. Color: belly is white, sides and back are olive gray; from above, it appeared orange because of the reflected light from the *Cyanea*. The jellyfish was taken about ¼ mile offshore (Scheffer 1940).

Literature Cited

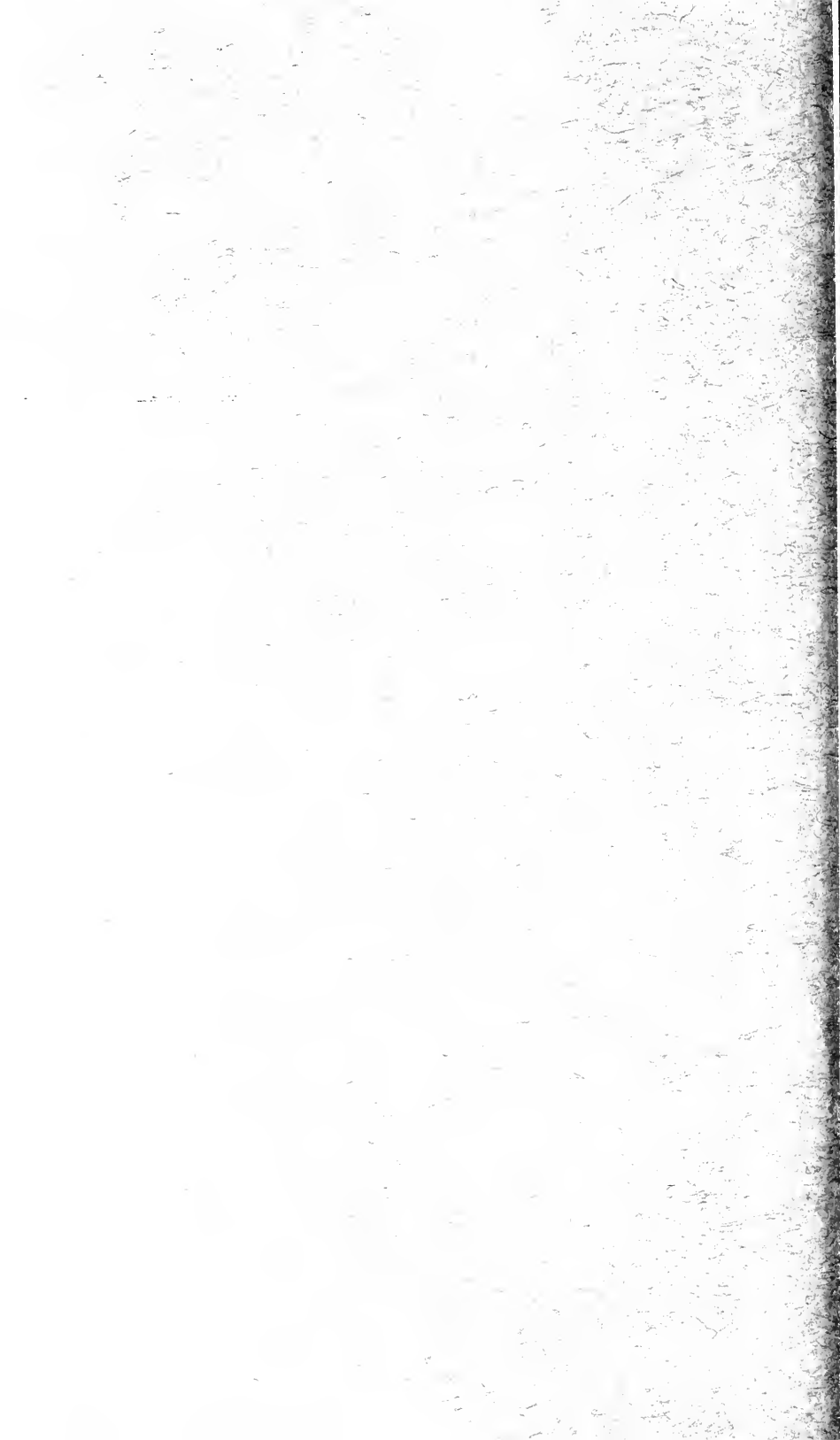
- BARTSCH, PAUL, and H. A. REHDER.
1939. Two new marine shells from the Aleutian Islands. *Nautilus*,
52, No. 4, pp. 110-112, pl. 8.
- CLARK, AUSTIN H.
1939. A new genus of starfishes from the Aleutian Islands. *Proc.*
U. S. National Museum, vol. 86, No. 3061, pp. 597-600, pl. 57, figs.
- EVERMANN, B. W., and E. L. GOLDSBOROUGH.
1907. The fishes of Alaska. U. S. Bur. Fisheries Doc. 624, vol. 26,
221-376, pls. 16-32.
- FOX, IRVING.
1940. Notes on Nearctic spiders chiefly on the family Theridii.
Proceed. Biological Society Washington, vol. 53, pp. 39-46, figs. 1-4.
- HATCH, MELVILLE H.
1938. Report on the Coleoptera collected by Victor B. Scheffer on
Aleutian Islands in 1937. *Pan-Pacific Entomology*, vol. 14, No. 4,
pp. 145-149.
- HULTÉN, ERIC.
1937. Flora of the Aleutian Islands. *Bökforlags Aktiebolaget Thales*
Stockholm, Sweden, 397 pp.
- KINCAID, TREVOR.
1953. A contribution to the taxonomy and distribution of the American
fresh-water calanoid crustacea. 73 pp., 5 pls. The Calliostoma
Seattle, Wash.
- MORRIS, GEORGE E.
1937. Bogoslof Island. *Proceed. U. S. Naval Institute*, vol. 63, No. 4,
pp. 950-952.
- OKAMURA, K.
1933. On the algae from Alaska collected by Y. Kobayashi. *Records*
of Oceanographic Works in Japan, vol. 5, No. 1, pp. 85-98, pls. 4-10.
- SCHEFFER, VICTOR B.
1939. Organisms collected from whales in the Aleutian Islands. *Mammal*
Report, vol. 20, No. 3, pp. 67-69, figs. 1-5.
1940. Two recent records of *Zaprora silenus* Jordan from the Aleutian
Islands. *Copeia*, No. 3, p. 203.
1943. Fish bites bird. *Nature Magazine*, vol. 36, No. 1, pp. 41-42,
4 figs.
- SCHULTZ, LEONARD P.
1939. A new genus and two new species of cottoid fishes from the
Aleutian Islands. *Proceed. U. S. National Museum*, vol. 85, No. 3061,
pp. 187-191.

BIRDS OF MARYLAND AND THE DISTRICT OF COLUMBIA



NUMBER 62

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE



BIRDS OF MARYLAND AND THE DISTRICT OF COLUMBIA

By

Robert E. Stewart and Chandler S. Robbins

Wildlife Biologists, Branch of Wildlife Research

BUREAU OF SPORT FISHERIES AND WILDLIFE



NUMBER 62

UNITED STATES
DEPARTMENT OF THE INTERIOR

Fred A. Seaton, *Secretary*

FISH AND WILDLIFE SERVICE

Arnie J. Suomela, *Commissioner*

Boston Public Library
Superintendent of Documents

AUG 13 1953



UNITED STATES GOVERNMENT PRINTING OFFICE • WASHINGTON • 1958

For sale by the Superintendent of Documents, United States Government Printing Office
Washington 25, D. C. : Price \$1.75

CONTENTS

	Page
Introduction	1
Objectives and Plan.....	2
Acknowledgments	4
Historical Sketch.....	6
Birdlife and Land Use.....	11
Geographical Distribution of Birds.....	15
Birds of the Oak-Pine Forest Region.....	20
Eastern Shore section.....	23
Western Shore section.....	25
Upper Chesapeake section.....	26
Birds of the Oak-Chestnut Forest Region.....	28
Piedmont section.....	29
Ridge and Valley section.....	31
Birds of the Mixed Mesophytic Forest Region.....	33
Allegheny Mountain section.....	33
Species Account.....	37
Literature Cited.....	375
Appendix A—Common and Scientific Names of Plants Referred to in Text.....	387
Appendix B—Species Dropped From Hypothetical List.....	388
Appendix C—Important Records Since October 1956.....	388
Species Index.....	391

MAPS

1. Biotic areas of Maryland and the District of Columbia.....	19
2. Geographical localities in Maryland.....	38
3. Breeding colonies of Great Blue Heron and Black-crowned Night Heron	52
4. Breeding ranges of Least Bittern, Black Duck, Osprey, and Long-billed Marsh Wren.....	60
5. Breeding range of American Bittern.....	62
6. Canada Goose banding recoveries.....	66
7. Mallard banding recoveries.....	71
8. Black Duck banding recoveries.....	73
9. Pintail banding recoveries.....	76
10. Green-winged Teal banding recoveries.....	78

11. Breeding ranges of Blue-winged Teal and Ruffed Grouse.....	10
12. Blue-winged Teal banding recoveries.....	10
13. American Widgeon banding recoveries.....	11
14. Wood Duck banding recoveries.....	11
15. Redhead banding recoveries.....	11
16. Ring-necked Duck banding recoveries.....	11
17. Canvasback banding recoveries.....	11
18. Lesser Scaup banding recoveries.....	11
19. Breeding range of Black Vulture.....	11
20. Breeding range of Marsh Hawk.....	11
21. Peregrine Falcon banding recoveries.....	11
22. Sparrow Hawk banding recoveries.....	11
23. Breeding ranges of King Rail and Virginia Rail.....	11
24. Breeding ranges of Clapper Rail and Saw-whet Owl.....	11
25. Breeding ranges of Upland Plover and Willet.....	11
26. Common Tern banding recoveries.....	10
27. Breeding colonies of Least Tern.....	10
28. Mourning Dove banding recoveries.....	11
29. Breeding ranges of Chuck-will's-widow and Traill's Flycatcher.....	11
30. Chimney Swift banding recoveries.....	11
31. Breeding range of Pileated Woodpecker.....	11
32. Breeding range of Yellow-bellied Sapsucker, Solitary Vireo, Magnolia Warbler, Black-throated Blue Warbler, Northern Waterthrush, Purple Finch, and Slate-colored Junco.....	11
33. Breeding range of Least Flycatcher.....	20
34. Breeding range of Tree Swallow.....	21
35. Breeding ranges of Bank Swallow and Cliff Swallow.....	21
36. Blue Jay banding recoveries.....	21
37. Breeding range of Fish Crow.....	22
38. Breeding ranges of Black-capped Chickadee and Carolina Chickadee.....	22
39. Breeding range of White-breasted Nuthatch.....	22
40. Breeding ranges of Brown-headed Nuthatch and Hermit Thrush.....	22
41. Breeding range of Bewick's Wren.....	22
42. Breeding range of Short-billed Marsh Wren.....	22
43. Robin banding recoveries.....	24
44. Breeding range of Veery.....	25
45. Breeding ranges of Blue-gray Gnatcatcher and Golden-crowned Kinglet.....	25
46. Breeding range of Warbling Vireo.....	26
47. Breeding range of Prothonotary Warbler.....	27
48. Breeding ranges of Swainson's Warbler and Nashville Warbler.....	27
49. Breeding range of Worm-eating Warbler.....	27
50. Breeding ranges of Golden-winged Warbler and Blue-winged Warbler.....	27
51. Breeding range of Black-throated Green Warbler.....	28

	Page
52. Breeding range of Cerulean Warbler.....	289
53. Breeding ranges of Blackburnian Warbler and Yellow-throated Warbler	291
54. Breeding range of Chestnut-sided Warbler.....	293
55. Breeding range of Pine Warbler.....	296
56. Breeding range of Prairie Warbler.....	298
57. Breeding ranges of Kentucky Warbler and Mourning Warbler.....	305
58. Breeding ranges of Hooded Warbler and American Redstart.....	311
59. Breeding ranges of Canada Warbler and Rose-breasted Grosbeak	314
60. Breeding ranges of Bobolink and Boat-tailed Grackle.....	318
61. Common Grackle banding recoveries.....	328
62. Breeding range of Blue Grosbeak.....	336
63. Purple Finch banding recoveries.....	342
64. Breeding range of Savannah Sparrow.....	350
65. Breeding ranges of Sharp-tailed Sparrow and Seaside Sparrow.....	354
66. Slate-colored Junco banding recoveries.....	360
67. White-throated Sparrow banding recoveries.....	367
68. Breeding range of Swamp Sparrow.....	370
69. Song Sparrow banding recoveries.....	372



Louis Agassiz Fuertes

The Bald Eagle, national bird of the United States. (From the Fish and Wildlife Service painting by Louis Agassiz Fuertes.)

BIRDS OF MARYLAND AND THE DISTRICT OF COLUMBIA

Birds hold an important position in our economy and culture. Their recreational value is shared by the gunner, the photographer, and an increasing number of bird students who both singly and in organized parties take frequent trips to make Christmas-season or spring counts, to record the progress of migration, or to seek rare species. If the amount of money spent annually for such items as field clothes, gasoline, food, lodging, tents, shells, boats, binoculars, telescopes, cameras, film, and bridge tolls by persons in quest of birds for one purpose or another were known, the total would doubtless surprise even the most ardent participants.

Aside from their recreational and direct economic value, birds have esthetic appeal to most of our citizens. Countless thousands of people derive daily enjoyment from the sight of birds in their feeding shelves, in their birdbaths, or on their lawns, from hearing their varied songs, or from watching distant flocks of waterfowl by day or hearing their calls by night. The majestic Bald Eagle, which nests throughout our tidewater area, so inspired our ancestors that it was selected as our national emblem. Frequent references to other birds in prose and poetry attest to the more subtle influences these creatures have upon our civilization.

The United States Fish and Wildlife Service is directed by several acts of Congress to obtain information on the protection and management of all birdlife in the United States. To carry out these directives the Service has made surveys of the birdlife of characteristic segments of the nation. For convenience of delineation, State boundaries have usually been used to indicate survey areas. It has been noticeable that during the past two decades the approach has changed from very generalized surveys or more elaborate treatments with detailed descriptions of habits, to the most recent approach with primary emphasis on numerically changing populations in response to human utilization of the land.

The importance of quantitative studies is stressed in the present work, which deals with a part of the United States where human populations are high and land use relatively intensive and diversified. This area is ideally situated for appraisal of the effects upon our birdlife of the growing demands upon our natural resources.

OBJECTIVES AND PLAN

The chief purpose of this book is to describe the birdlife of an important segment of the eastern United States in terms of its geographical, ecological, and seasonal distribution in each of the natural or biotic regions that extend into Maryland and the District of Columbia. An attempt is made to show where and when populations of each species may be expected to occur within these regions and to indicate some of the more important environmental factors. Related information on numerical status and breeding and migration periods is given in detail for most species. Banding data that furnish important clues to migration routes and breeding and wintering grounds are included.

Unlike most State bird books of the past, this volume does not include descriptions of plumages, field marks, songs, and habits. That type of information is readily available in many other books and need not be repeated here. Instead the pages that follow are devoted to information on the time and place of occurrence of each species, its ecological requirements, and its abundance, often in terms of population densities by habitat type. With respect to population densities this volume initiates a new approach among regional bird books. In the past, abundance of a species has generally been described in vague terms, and seldom with reference to a particular type of environment. This has made difficult if not impossible to make comparisons of one area with another or to measure changes within a given area over a period of years. To the casual bird watcher the population figures will indicate where he can expect to find a certain species of bird. To the more serious student they will indicate preferred habitats in which he may carry out further study. To the farmer they may suggest ways of making the farmyard, field borders, or woodlots more attractive to certain species of birds. For those entrusted with the protection of our Nation's wildlife resources, the present population figures can be used in future comparisons to measure decreases or increases in abundance of any of our nesting species as a result of changing farming, forestry, or other land-use practices.

The information in this book is based almost entirely on data

obtained within the boundaries of Maryland and the District of Columbia. However, it is organized by major biotic regions that extend into and cover large areas in many eastern States. Thus, the book actually serves as a cross-sectional study of the more important biotic regions in the mideastern part of the country. These regions cover the central and southern Appalachian Mountains, the Piedmont Plateau, and the northern and central parts of the Atlantic Coastal Plain. Much of the information applies in a general way wherever the appropriate regions are found.

During the course of this study it was found that each species is to a large extent independent of all other associated birds so far as its habitat requirements and distributional patterns are concerned. The habitat niche occupied by each species within a given biotic community was invariably found to be somewhat different from the habitat niche occupied by any other species. Definite ecologic associations of two or more species occurred only in areas where the required habitat niches of all species concerned were present. Such associations are usually quite local in scope, since all habitats vary from one area to another, and the presence or absence of a single critical factor in the environment can cause a change in species composition. Because of this variation in species composition within most biotic communities it was decided to emphasize the "species approach" rather than the "community approach" in reporting the results of our investigations. A general discussion of habitat conditions and characteristic bird populations may be found in the descriptions of the major biotic regions of the area, but the bulk of the information is summarized under the various species headings in the species account.

This report is based to a large extent on systematic field work by the authors. Intensive field work was begun on the Patuxent Research Refuge near Laurel in 1941, and during the period 1945 through 1955 this was expanded to include all of the State of Maryland. A thorough coverage of all counties was attempted during the height of one or more breeding seasons in order to record the geographical distribution, habitat, and relative abundance of each nesting species. Similar studies were carried out in the winter, and intensive observations were conducted during the migration seasons at numerous strategic localities throughout the State. An effort was made to determine breeding-population densities in at least one or two typical habitats for nearly all species of birds that nest regularly within the boundaries of Maryland and the District of Columbia. More than 1,500 records of eggs and nestlings of noncolonial species were obtained in addi-

tion to 2 or 3 thousand nests of colonial species. We banded approximately 18,000 birds during the period and collected specimens of nearly all species that have been recorded.

The field work by the authors was supplemented by gathering together the sight observations and specimen records of many professional and amateur ornithologists. The ornithological literature, including the bird-distribution files of the Fish and Wildlife Service, has been critically examined for all Maryland and District of Columbia records. These files contain reports from cooperators since the year 1883, as well as clippings and abstracts from the more important ornithological literature during the same period.

Frequent reference is made to recoveries of banded birds. Upwards of 100,000 birds have been banded in Maryland and the District of Columbia since the inception of the banding program. Several thousand recovery reports are on file at the Bird Banding Office at Patuxent Research Refuge. These have all been examined, as have the reports of birds banded in other States and Canadian Provinces and recovered in Maryland and the District of Columbia. Through the use of serially numbered aluminum bird bands we are learning where the individual birds that nest in Maryland spend the winter, where those that winter here raise their young during the summer months, and the routes these birds take during migration. This information is especially important in the case of our migrant game birds, and has practical applications for species such as the Redwinged Blackbird and Common Grackle, which damage ripening grain crops in late summer but are beneficial to the farmer at other times. Be it for purposes of protection, for selective control, or for improvement of hunting, banding recoveries are constantly supplying more information on the distribution, migration, and abundance of a greater variety of birds.

ACKNOWLEDGMENTS

The late Frank Coates Kirkwood heads the list of persons to whom special thanks are due; his long series of detailed notes from 1881 through 1930 are the foundation for subsequent field investigations throughout Maryland. The present volume was first conceived by the late Robert C. McClanahan, who met his untimely death a few months after he had started serious work on the project.

To each person mentioned in the historical sketch—in fact, to each whose name appears anywhere in the species account—ou

ncere thanks are tendered. Staff members of the Patuxent Research Refuge, nearly all field observers of the various affiliated clubs of the Maryland Ornithological Society, and most active members of the Audubon Society of the District of Columbia have contributed in one way or another to this manuscript. Dr. Irston C. Barnes, Dr. Edwin G. Davis, Clara Schoenbauer, and Donald C. Thatcher, in particular, have assisted by making the Audubon Society's field records available. We are especially indebted to W. Bryant Tyrrell for help in assembling valuable data recorded by several of the earlier Maryland ornithologists.

Our gratitude is extended to those active field observers who have critically read the entire species account and supplied additional notes to clarify the distribution, migration, abundance, and nesting summaries: Dr. Maurice G. Brooks, Mr. and Mrs. A. J. Fletcher, Richard L. Kleen, C. Haven Kolb, Jr., Dr. John W. Richards, Dr. Ralph S. Stauffer, John W. Terborgh, Dr. Alexander Wetmore, and Edwin Willis. We express our deep appreciation to officials of the Museum of Comparative Zoology, the United States National Museum, and the Natural History Society of Maryland for the use of their collections. Thanks are extended to Dr. Ira N. Gabrielson for the use of his personal collection of Maryland birds.

There are so many contemporary observers active throughout Maryland and the District of Columbia that it would not be practical to list them here. Nearly all who have contributed records to this book will find their names used as authority for some of the observations. It is difficult indeed to single out a few for special mention, but the following names stand out for their work on migration or on nesting activities: John H. Buckalew, James B. Cope, Edward J. Court, Mrs. W. L. Henderson, Richard L. Kleen, M. Brooke Meanley, Dr. John W. Richards, Allen R. Sibley, Jr., Mrs. Gail Tappan, John W. Terborgh, and Edwin Willis. Others who have made important contributions to this phase of the work are Dr. John W. Aldrich, Robert J. Beaton, Robert M. Bowen, John W. Brainerd, Dr. Maurice G. Brooks, Mary Catherine Crone, the late Frank C. Cross, Philip A. DuMont, Allen J. Duvall, John H. Fales, C. Douglas Hackman, Marvin W. Hewitt, Duvall A. Jones, Mrs. Alice Kaestner, the late Renwick Kerr, J. Ellsworth Knudson, Samuel Mason, R. Bruce Overton, K. Friel Sanders, H. Elizabeth Slater, Paul F. Springer, Dr. and Mrs. R. S. Stauffer, John W. Taylor, Jr., and Dr. Alexander Wetmore. Most of the persons mentioned in the following paragraph have also supplied detailed notes on migration.

In addition to our own banding-recovery records we have summarized recoveries from all other cooperators in Maryland and the District of Columbia. Those who made the greatest contribution to banding were the following: Cooperators who have banded over 5,000 birds in Maryland and/or the District of Columbia are Seth H. Low (11,000 banded, mostly at Unity), Rev. Edward Stoehn (9,000, some of them at Capuchin College in Washington, the others at St. Conrad's Friary on the Severn River in Anne Arundel County), William M. Davidson (9,000 birds, mostly at Silver Spring and Takoma Park), the Maryland Department of Game and Inland Fisheries (6,000 wild birds, almost all of them waterfowl), and Leonard M. Llewellyn (5,000, mostly at Patuxent Refuge and in Allegany County). The majority of the recoveries have resulted from the work of these persons. We wish also to acknowledge the contribution of Blackwater National Wildlife Refuge, and of all other banders in the Maryland and District of Columbia area. The following banders, in particular, have contributed materially to the recovery data summarized under the various species; each of these cooperators has banded over 1,000 birds: Hervey Brackbill, John H. Buckalew, A. E. Clattenburg, Mr. and Mrs. Richard D. Cole, James B. Cope, Compton Crook, Orville W. Crowder, Dr. David E. Davis, Mr. and Mrs. A. J. Fletcher, Irving E. Hampe, Kendrick Y. Hodgdon, Dr. E. R. Kalmbach, Rev. Fabian Kekich, Dr. Frederick C. Lincoln, John R. Longwell, Stephen W. Simon, Frank R. Smith, and Capt. J. E. M. Wood. More than 40 other cooperators have operated bird-banding stations in this area.

HISTORICAL SKETCH

Early references to the birdlife of Maryland are few and vague. During colonial times the settlers frequently mentioned in their writings the waterfowl, turkeys, grouse, and other game species that were conspicuous inhabitants of this area. But it seems that Audubon, Alexander Wilson, and the earlier ornithologists and collectors chose to concentrate their efforts in other States, and left little in writing about the birds they found while travelling through the Free State.

The first list of birds of this area of which we have knowledge was published in Paris in 1816 by David Baillie Warden in "Chorographical and Statistical Description of the District of Columbia." Translated into current nomenclature, this list was as follows:

Canada Goose	Snowy Owl	Eastern Bluebird
Wood Duck	Whip-poor-will	Loggerhead Shrike
Redhead	Common Nighthawk	Myrtle Warbler
Canvasback	Ruby-throated	Yellowthroat
Sharp-shinned Hawk	Hummingbird	Eastern Meadowlark
White	Yellow-shafted Flicker	Redwinged Blackbird
Virginia Rail	Horned Lark	Orchard Oriole
Empidonax	Barn Swallow	Baltimore Oriole
Sandpiper	Blue Jay	Indigo Bunting
Messenger Pigeon	Mockingbird	American Goldfinch
Great Horned Owl	Catbird	Fox Sparrow
	Robin	

In addition to these 32 species, Mr. Warden mentioned that the turkey had disappeared by that time. He made mention of the Common Grackle as a natural enemy of the Mockingbird, but neglected to include the Common Grackle in his list.

Not until 1862 did another list of the birds of the District of Columbia appear. Prepared by Elliott Coues and Daniel Webster Prentiss, this list of 226 species was the first comprehensive publication on the avifauna of the District of Columbia. Several short papers published from 1876 to 1882 added a few new species to the District list. In 1883 Drs. Coues and Prentiss' "Avifauna of the District of Columbia," an expansion of their original paper, was published as Bulletin 26 of the United States National Museum. This served as the standard reference for Maryland and the District of Columbia until Frank Coates Kirkwood completed his "List of the Birds of Maryland" in 1895.

Except in the immediate vicinity of Washington, no systematic recording of bird distribution and migration in Maryland is known to have been done before 1881. On January 1 of that year, Frank Coates Kirkwood began his lifelong study of the distribution and migration of Maryland birds. Interest in collecting and studying birds spread rapidly during the 1880's, stimulated in part by the founding of the American Ornithologists' Union and the inception of the cooperative bird migration observer program by Wells W. Cooke of the Division of Entomology of the United States Department of Agriculture (forerunner of the Biological Survey and the Fish and Wildlife Service). Bird students (that is, bird collectors and egg collectors) also became acquainted with others of like interest through publications such as *The Ornithologist and Oölogist* (1876-93), and *The Oölogist* (1884-1941).

Kirkwood drew about him a circle of close friends who were active collectors and field observers in the Baltimore area. On

the first page of his "List of the Birds of Maryland" he acknowledges the ornithological contributions of the following Baltimore friends: William H. Fisher, Arthur Resler, W. N. Wholey, A. T. Hoen, George H. Gray, Percy Thayer Blogg, and J. Hall Pleasant. Mr. Blogg, who was active in the Natural History Society of Maryland until his death in 1946, was the last survivor of this friendship of 50 years before. So far as is known, none of these men, with the exception of Kirkwood, has received the honor of a detailed obituary in an ornithological periodical; so to the present generation they remain only familiar names associated with many important observations of the nineteenth century. J. M. Sommer, a close associate of Kirkwood after the beginning of the current century, obtained many observations and nest records of interest, chiefly from the Baltimore area and from western Maryland.

In other parts of the State, Kirkwood had faithful correspondents in the early days in J. E. Tylor of Easton, H. W. Stabler, Jr., of Sandy Spring, Edgar Albert Small of Hagerstown, and Robert Shriver of Cumberland. A note in *The Auk* tells us that Edgar Small, who died in 1884 in his twentieth year, "was widely known as a young ornithologist of much promise." From June to June 14, 1895, just before the publication of his book, Kirkwood made his first trip to western Maryland during the breeding season. He worked the area in the vicinity of Vale Summit, Allegany County. Since he had had neither correspondents nor personal experience in the higher mountains of Garrett County his book has no reference to the nesting of the northern species that are restricted to that end of the State. It remained for Edward A. Preble of the Biological Survey to make the first ornithological expedition to Garrett County in May, June, and July, 1899. Preble made a fine collection of specimens, and the Maryland Geological Survey published his findings the following year.

From 1899 to 1903, Rev. Charles William Gustave Eifried (1871-1949) was pastor of the Lutheran church in Cumberland. During these four short years he accumulated the first detailed information on the migration of birds through Allegany and Garrett Counties and contributed significantly to the knowledge of the nesting and wintering birds of the area. He obtained specimens of 165 species, and this collection is now the property of Saint Mary of the Lake Seminary at Mundelein, Ill. His work during this period and his later visits to western Maryland are nicely summarized in his publications, listed in Literature Cited.

Shortly before his death, Dr. Eifrig referred to his sojourn in Maryland as the happiest period of his life.

While ornithology was getting its start in Maryland as a whole, the District of Columbia and its suburbs served as the collecting and observing grounds for several of the founding fathers of the American Ornithologists' Union: Spencer Fullerton Baird (1823-37), Walter Bradford Barrows (1855-1923), Charles Emil Bendire (1836-97), Dr. Elliott Coues (1842-99), Dr. Albert Kenrick Fisher (1856-1948), Dr. Clinton Hart Merriam (1855-1942), Dr. Daniel Webster Prentiss (1843-99), Robert Ridgway (1850-1929), and Dr. Robert Wilson Shufeldt (1850-1934). Many other Washingtonians joined the ranks before the turn of the century; among the most active of these were Dr. Charles Wallace Richmond (1868-1932), Henry Wetherbee Henshaw (1850-1930), Pierre Louis Jouy (1856-94), Dr. Sylvester Dwight Judd (1871-1905), Dr. Edwin Marble Hasbrouck (1866-1956), William Palmer (1856-1921), Vernon Orlando Bailey (1864-1944), Dr. Paul Bartsch (1871-), Edward J. Court (1877-), Arthur Holmes Howell (1872-1940), Henry Worthington Olds (also Oldys, 1859-1925), Dr. Harry Church Oberholser (1870-), Wilfred Hudson Osgood (1875-1947), Dr. Theodore Sherman Palmer (1868-1955), Jesse Dade Figgins (1867-1944), and Joseph Harvey Riley (1873-1941).

Many of the distinguished ornithologists listed in the preceding paragraph were still active in the field through the first quarter of the 20th century, during which time they were joined by Mr. and Mrs. L. D. Miner, Dr. Frederick C. Lincoln, Dr. Alexander Wetmore, W. L. McAtee, Dr. Ira N. Gabrielson, Dr. Clarence Cottam, William Marshall, and many other field workers in the Washington area. Activity seemed to slacken a bit during the 1920's and 1930's, but during this period Robert Overing, William Howard Ball, and many of the Biological Survey staff continued to make observations. Two publications by May Thacher Cooke (1921 and 1929) brought up to date the earlier works of her father, Wells W. Cooke, and kept field workers of the Washington region abreast of current observations.

In the 1920's, Ralph W. Jackson of Cambridge was the most ardent field ornithologist on the Eastern Shore. The majority of Dorchester County records before the 1930's are a result of his work. From the late thirties on, the staff members of the Blackwater National Wildlife Refuge (including David V. Black, Leonard M. Llewellyn, Cornelius W. Wallace, and W. Steele Webster) have furnished much valuable information. Frazer Poole

contributed considerable information on the birds of Caroline County, as well as several nesting records from Worcester County.

The Ocean City area has never had a resident naturalist who kept notes on the birds of that area. Kirkwood was about the only person to supply detailed records from the Maryland coast before the 1930's. For the 15-year period from 1928 to 1942 there were only occasional trips to this area by various observers, including Irving E. Hampe, C. Haven Kolb, Jr., Gorman M. Bond, W. Bryant Tyrrell, G. A. Ammann, and Robert C. McClanahan. These, with the addition of M. Brooke Meanley, were also among the most active reporters in the Baltimore area and the Maryland suburbs of Washington. Mr. Meanley, a protege of Kirkwood, carried on in his footsteps during the 1930's and 1940's, obtaining valuable information on breeding birds in Baltimore County and elsewhere.

During the first half of the 20th century several natural-history organizations have stimulated conservation education and have brought amateur and professional ornithologists together at meetings and on field trips. The Biological Society of Washington founded in 1880, has published lists of birds of the District of Columbia area (Cooke, 1908, 1913, 1921, and 1929; Fisher, 1935) as well as McAtee's "Sketch of the Natural History of the District of Columbia" (1918). The Audubon Society of the District of Columbia, founded in 1897, has had an especially active program from 1946 on, when it began publishing *The Wood Thrush* (now *The Atlantic Naturalist*). Two separate organizations under the name of Maryland Audubon Society were formed in the early part of the 20th century, and at one time one of them had 80 members; one of these clubs persisted until about 1937.

The Natural History Society of Maryland, founded in Baltimore in 1929, has had an active program in ornithology, maintains a study skin collection and an ornithological library, and has published two booklets on birds: "Birds of Baltimore and Vicinity," by Irving E. Hampe and "A Preliminary List of Birds of Maryland and the District of Columbia," by Irving E. Hampe and C. Haven Kolb. The latter has been the only available list of Maryland birds since Kirkwood's book went out of print. The Natural History Society also publishes the quarterly periodical *Maryland Naturalist* (formerly, *Bulletin of the Natural History Society of Maryland*, and *Maryland—A Journal of Natural History*). The Maryland Ornithological Society, founded in 1945, now has branch clubs in Baltimore and in Allegany, Frederick, Montgomery, Anne Arundel, Harford, Caroline, and Talbot Counties. In addition to

At local meetings and field trips the society has an annual statewide meeting and several statewide field trips, and publishes Maryland Birdlife quarterly.

BIRDLIFE AND LAND USE

Birdlife is never static. Changes are constantly taking place, not only in the total number of individuals of a species, but in their distribution as well. Being winged creatures, capable of easy movement from place to place, and having definite environmental requirements, birds are very sensitive to habitat changes. It is hard to visualize all of the changes that have taken place since Audubon's time, scarcely a hundred years ago. Clearing, cutting, and burning of forests, cultivating of open land, elimination of hedgerows, draining and filling of marshes, pollution of streams and estuaries, flooding of stream valleys to form reservoirs, and introduction of foreign birds—all of these practices have caused drastic changes in the distribution and abundance of many species. Three species that have been recorded in Maryland are now extinct, and several others have been extirpated from much of their original range. Equally important, though perhaps less noticeable, have been the many pronounced local changes in abundance of more common species.

The importance of the habitat niche as the principal controlling factor in the distribution and abundance of birds cannot be emphasized too strongly. The occurrence of a particular species in any area is governed largely by certain critical environmental elements that comprise its habitat niche. These habitat requirements may be quite obvious to the observer, or they may be more subtle in character. The effects of such controls are especially pronounced during the breeding season, when the populations of each species are restricted within more limited ecological boundaries. Because of the differential in habitat requirements among birds at all seasons, any major environmental change is reflected in independent reactions of each species in terms of its distribution and abundance.

Land-use practices frequently involve major habitat changes that have a marked effect on the species composition and numbers of birds. Ordinarily, certain species benefit from these changes while others are unfavorably affected, depending in each case upon the creation or destruction of the required habitat niche. The initial clearing of hundreds of thousands of acres of Maryland forests in order to raise field crops undoubtedly eliminated

many hundreds of thousands of woodland birds that were deprived of their needed environment. At the same time, field and edge inhabiting species rapidly expanded into the new territory that was opened up for them. Widespread lumbering and forest fires have greatly increased the areas of brushland habitats that represent transitory secondary stages in the natural forest successions. As a consequence, thicket-inhabiting birds are now much more numerous and more widely distributed than formerly, while populations of typical forest birds have been correspondingly reduced.

As our human populations continue to increase at a rapid rate the demands on the soil, water, forest, and recreational resources of Maryland may be expected to increase proportionately. Within our lifetimes we may see many wildlife habitats so altered in character that the species composition of breeding, migrating and wintering birds will differ radically from that found at present. Certain trends are already evident. During the past 5 years we have seen the wild natural character of Assateague Island transfigured into a bulldozed wasteland of street signs and lot markers. In less than one generation from now there may be no more natural barrier beach in the State. As these areas are "developed," many wintering and migrant coastal birds will be unfavorably affected and several of our most interesting and picturesque breeding birds will probably disappear, including such species as the American Oystercatcher, the Piping Plover and the Wilson's Plover. Eventually, birds of this type would be largely supplanted by common, widespread species such as the Robin, the Chipping Sparrow, and the Starling, characteristic of suburban or residential areas.

Foresters are developing methods of timber-stand improvement that favor the growth of the most valuable crop trees by eliminating the less desirable species of trees. The widespread use of arsenic tabs to kill all hardwoods in the Eastern Shore pulp plantations, would eradicate the Red-eyed Vireo and many other deciduous forest birds from vast tracts of land where they are now common, while populations of certain species, particularly the Pine Warbler, would be increased by such measures. In the mountains the common forestry practice of girdling so-called weed trees such as black gum and certain other fruit-producing species greatly reduces the available food supply for Turkey Ruffed Grouse, thrushes, and others. Elimination of understory shrubs and saplings from a woodlot removes nesting cover for such species as the Wood Thrush, Hooded Warbler, and Acadian Flycatcher, and the removal of "wolf" trees, dead snags, and

ranches destroys the nesting cavities so necessary to owls, woodpeckers, chickadees, titmice, and Great Crested Flycatchers.

The American public is constantly demanding greater perfection in fruit and other agricultural crops. This forces the farmer and orchardist to exercise extra precautions to reduce damage from insects, to eliminate weeds from the fields, and to keep fruit trees well pruned. The rank grasses and weeds that provided cover for large numbers of Field Sparrows, Indigo Buntings, and Yellowthroats in grandfather's orchard have been largely replaced by specific cover crops or mowed grass in today's orchard, with a resulting decrease in avian inhabitants. The use of sprays, applied by high-pressure sprayers, has further lowered the bird population through destruction of insect food and dislodging of nests. Natural hedgerows have been replaced to a large extent by single-species hedges or clean fences, with a corresponding drop in the variety and number of birds. The recent planting of multiflora-rose hedges in some areas has provided food and cover for a limited number of species, notably the Mockingbird and Song Sparrow, and has established pathways whereby birds that are not prone to venture far from cover can travel from one woodlot to another or can forage farther out into large fields than they otherwise would. Growing use of mechanical cornickers has greatly increased the available food supply for farm birds during the colder months because of substantial amounts of waste grain left behind. Many species of birds, including Mourning Doves and various blackbirds, are responding in increasing numbers to this abundant repast. Locally, especially near dewaters on the Eastern Shore, Canada Geese, Mallards, Black Ducks, and recently Pintails, have learned to take advantage of this new food resource, and frequently great flocks can be seen converging on some of the larger fields.

The impact of man's activities on Chesapeake Bay and other dewaters of Maryland is a continuous threat to the welfare of large numbers of waterfowl and numerous other water birds that utilize these areas. Aside from a steadily growing hunting pressure, the decline in quality of large areas of waterfowl habitat has been noticeable during recent years. In the fresher parts of Chesapeake Bay and its estuaries, the feeding activities of the introduced European carp have greatly increased the turbidity of the water, thereby reducing the sunlight penetration and resulting in lowered production of aquatic food plants. The Patapsco, Back, and Middle Rivers have been polluted with industrial wastes so that their value to waterfowl is now negligible. It is suspected

that the recent use of dredges for taking soft-shell clams may destroy large beds of aquatic plants, particularly on the Eastern Shore. Many salt and brackish bay marshes have been severely impaired by ditching for mosquito control, while large areas of fresh estuarine marsh on the Potomac and Patapsco Rivers have been completely eradicated to make way for building sites, agricultural fields, and parks.

In certain resort areas such as Eastern Bay, there has been growing public pressure to eliminate the "seaweed" because of its interference with boating and swimming. Unfortunately, the chief reason that Eastern Bay remains one of the outstanding waterfowl areas in Maryland is because the so-called seaweed is composed almost entirely of excellent aquatic food plants, including such species as sago pondweed, red-head pondweed, ditch grass, and eel grass. It is becoming increasingly evident that if we are going to maintain a reasonable population of waterfowl in our area, many of the land-use practices causing disturbance and destruction of waterfowl habitat will have to be stopped or modified soon. The regulation of hunting pressure is probably one of secondary importance in the maintenance of waterfowl populations, while the preservation and improvement of waterfowl habitat is the approach that reaches the core of the problem.

The widespread use of insecticides is becoming more of a threat to wildlife each year. Agricultural experts, faced with the problem of obtaining the greatest possible yield per acre, are not only refining techniques of soil improvement, but are also giving a great deal of attention to insect control. Foresters, concerned with our dwindling timber resources, are devoting more time to the control of injurious forest insects. Residents in the tidewater areas have become especially agitated during recent years over the scourge of mosquitoes and other biting insects that are so prevalent in these areas. New and more powerful insecticides are appearing on the market, and many of these are being applied at ever-heavier concentrations over larger areas of woodland, marsh, and field, and on orchards, roadsides, and garden crops. It must be admitted that insecticides have their place in the economy of our State and Nation and that they are destined to partially replace natural biological controls in many areas. It is a fact, however, that interference with the balance of nature can have disastrous and unforeseen results. When man, in his attempts to control harmful insects, unwittingly eliminates beneficial insects that have helped keep the harmful ones in check, the harmful species often increase to greater abundance than before and cause great

conomic loss. Nature has its own ways of combating man's interference: many insects formerly vulnerable to DDT have developed a resistance to this chemical, necessitating substitution of other poisons. This suggests that ultimately our insecticides may be of much more deadly types than those currently in use, with an ever greater potential danger to birds and other wildlife.

Much of the information in this book, including population densities by habitat units, should permit comparison with data from similar studies that may be conducted in the future. The comparison of population data should be especially significant, since this would afford a definite measure of the responses of birds to changing environments. It is to be hoped that this type of information, aside from any scientific value it may have, will prove useful in interpreting past changes and predicting future changes in the distribution and numerical status of bird populations. Through a better understanding of these natural phenomena, more effective management programs may be instituted that will serve to protect endangered or diminishing species.

GEOGRAPHICAL DISTRIBUTION OF BIRDS

Stretching from the Allegheny Mountains to the Atlantic Ocean, the area within Maryland and the District of Columbia contains a great variety of breeding birds. Owing to its peculiar shape and position in relation to the ranges of birds with southern and northern affinities, unusual and interesting combinations of northern and southern breeding species are included. The westernmost part of Maryland, for example, although not rising more than 3,360 feet above sea level, has such breeding birds as the Saw-whet Owl, Hermit Thrush, Nashville Warbler, Northern Waterthrush, Mourning Warbler, and Purple Finch. In southeastern Maryland the breeding birds include such southern species as the Louisiana Heron, Royal Tern, Chuck-will's-widow, Red-bellied Woodpecker, Brown-headed Nuthatch, and Boat-tailed Grackle. Few other States can exceed Maryland's record of 28 species of regularly nesting warblers.

The Chesapeake Bay region is probably the outstanding area in Maryland from an ornithologist's point of view. With its adjoining estuaries and tidal marshes, the bay is a focal point for vast numbers of migrating waterfowl that furnish one of the most spectacular ornithological sights in North America. Hundreds of thousands of ducks and thousands of swans, geese, and coots are attracted by the extensive beds of wild celery, sago pondweed, red-head pondweed, ditch grass, and eel grass, and the lush stands of

wild rice and three-square. Most sections of the bay also teem with animal food in the form of fish and mollusks, crustaceans and other invertebrates. Numerous birds besides waterfowl—loons, grebes, cormorants, herons, rails, sandpipers, gulls, and terns—take advantage of this and concentrate here in large numbers.

Maryland is traversed by a maze of migration routes. The largest flights of Whistling Swan, Canvasback, Lesser Scaup, Ruddy Duck, American Widgeon, and many other ducks occur along the Susquehanna River and Chesapeake Bay. Brant and Snow Geese follow the coast for the most part along with scoter, Greater Scaup, Red-breasted Merganser, Red-throated Loon, Double-crested Cormorant, Gannet, and others. The Common Loon, Horned Grebe, Canada Goose, and Black Duck appear regularly on both routes. Shorebirds are most plentiful along the mud flats of the coastal bays; but the Sanderling, Willet, and Knot-tail are most frequently seen flying along the outer beach. The Western Sandpiper is most common along Chesapeake Bay. Large numbers of Soras and Bobolinks stop over in the marshes along the tidal rivers on their way south and are especially abundant in the wild-rice marsh along the Patuxent River.

The Potomac River westward from Washington, D. C., is used as a flyway by Ring-billed Gulls and by a variety of ducks. Concentrated fall hawk flights may be seen along all of the mountain ridges, at Hooper and Barren Islands in Chesapeake Bay, and along the outer coast. Falcons, Ospreys, and accipiters predominate on coastal routes, buteos inland. Tremendous flocks of Tree Swallows move down the Delmarva Peninsula (the area east of Chesapeake Bay) in late September and early October; Cliff Swallows congregate in the Allegheny Mountains. The Purple Martin roost in downtown Washington is a spectacular sight in late July and early August, when more than 20,000 birds may be observed. All parts of Maryland have excellent flights of passerine birds, though the species composition varies greatly from the western end (with Mississippi drainage) to the coast. Species that migrate down the Mississippi Valley and are absent in the southeastern States are found in abundance in the Allegheny Mountains of western Maryland but become progressively rarer eastward; some of them seldom occur east of Chesapeake Bay. Concentration points for migrating passerines are in the thickets on the barrier beaches (especially during periods of strong westerly winds), the Pocomoke and Potomac River valleys, the wooded valleys of other streams, and the mountaintops.

Winters are usually mild except in the Allegheny Mountains and the extreme western part of Maryland, where conditions approximate those of central New York or New England. In the coastal areas, snow seldom stays on the ground more than 2 or 3 days at a time. Most interesting at this season are the concentrations of waterfowl and other water birds throughout tidewater Maryland. A fine variety of land birds is also present all winter, except in the Allegheny Mountains. In most areas the bird student may observe 50 or more species in a day, and as many as 100 along the coast. The more common and widespread wintering species include the Downy Woodpecker, Common Crow, Chickadee (Carolina or Black-capped), Golden-crowned Kinglet, Slate-colored Junco, and Tree Sparrow.

In the eastern and central sections, permanent residents such as the Turkey Vulture, Tufted Titmouse, Carolina Wren, and Cardinal are common. Several species that occur in winter in southeastern Maryland are near the northern limits of their regular wintering range. These include the Eastern Phoebe, Brown-headed Nuthatch, Short-billed Marsh Wren, Catbird, Brown Thrasher, Water Pipit, Palm Warbler, Boat-tailed Grackle, Vesper Sparrow, and Chipping Sparrow. During recent years, the White-throated Sparrow has been rapidly increasing and extending its wintering range through central Maryland and sparingly down the Delmarva Peninsula. Northern visitors, such as the Rough-legged Hawk, Purple Sandpiper (Ocean City), Snow Bunting, and quite recently the Evening Grosbeak, appear regularly in small numbers. Hawks are particularly conspicuous in the area east of Chesapeake Bay, where the birdwatcher may observe 50 individuals of 8 or more species in a day's trip. Redwinged Blackbirds, Eastern Meadowlarks, Common Grackles, and Brown-headed Cowbirds winter abundantly in this same area, and more sparingly elsewhere.

Five principal physiographic provinces are represented in the area within Maryland and the District of Columbia: the Appalachian Plateaus, the Ridge and Valley province, the Blue Ridge province, the Piedmont province, and the Coastal Plain (Fenneman, 1938). The portion of the Appalachian Plateaus in Maryland is known as the Allegheny Mountains and occurs in the westernmost part of the State, extending westward from the Allegheny front (Dans Mountain). This area is a high, undulating plateau, averaging about 2,500 feet above sea level and crossed diagonally, northeast to southwest, by several ridges that rise some 500 feet above it. The highest point in the State (3,360 feet) is located

here, on Backbone Mountain. Extending eastward from the Allegheny Front to Catoclin Mountain, through the Ridge and Valley and Blue Ridge provinces, there are numerous parallel ridges that range up to 2,000 feet elevation. Except for the wide and fertile Hagerstown Valley, most of the valleys in this area are narrow, and little used for farming. The Piedmont province extends eastward from the eastern base of Catoclin Mountain to the fall line of the rivers, which passes through Washington, D. C., Baltimore, and Elkton. The greater part of this area is gently rolling with elevations ranging from 300 to 800 feet, and consists mainly of agricultural lands with scattered woodlots. The Coastal Plain, comprising all of the area below the fall line, is bisected by Chesapeake Bay. Most of the Coastal Plain west of the bay has a rolling topography with elevations ranging from 100 to 300 feet, while that portion found east of the bay is flatter and low, with elevations under 100 feet. The river flood plains of the Coastal Plain are much wider and more swampy than are those in the other provinces.

There are several hundred miles of tidewater frontage, owing to the ragged shoreline of Chesapeake Bay and its numerous arms and inlets. The ocean coastline, however, is only 31 miles. The salinity of the tidewater in Maryland varies greatly; the waters of upper Chesapeake Bay and the upper sections of many of the estuaries are nearly fresh, while the waters of the lower Chesapeake and coastal bays are almost as salty as the ocean. This variation accounts for the great variety of aquatic plants and types of marshes found in the State.

The boundaries of the principal biotic or natural areas in Maryland and the District of Columbia appear to coincide quite closely with the units proposed by Dr. E. Lucy Braun (1950) for classifying the regions of the Eastern Deciduous Forest of North America. According to this system a forest region is characterized by the prevalence of a specific climax type, or by a mosaic of types. However, each forest region also contains other climax types that are more restricted in area, including some that are prevalent in other regions. Many other habitats, both forest and nonforest, are present in these regions; some of these habitats actually occur in much greater areas than the climax types. These include stages in natural succession from open country to forest and man-made habitats such as towns, cities, and agricultural areas.

According to Braun's classification, the area embraced by Maryland and the District of Columbia lies within three major forest regions that are designated the Oak-Pine Forest Region, the Oak

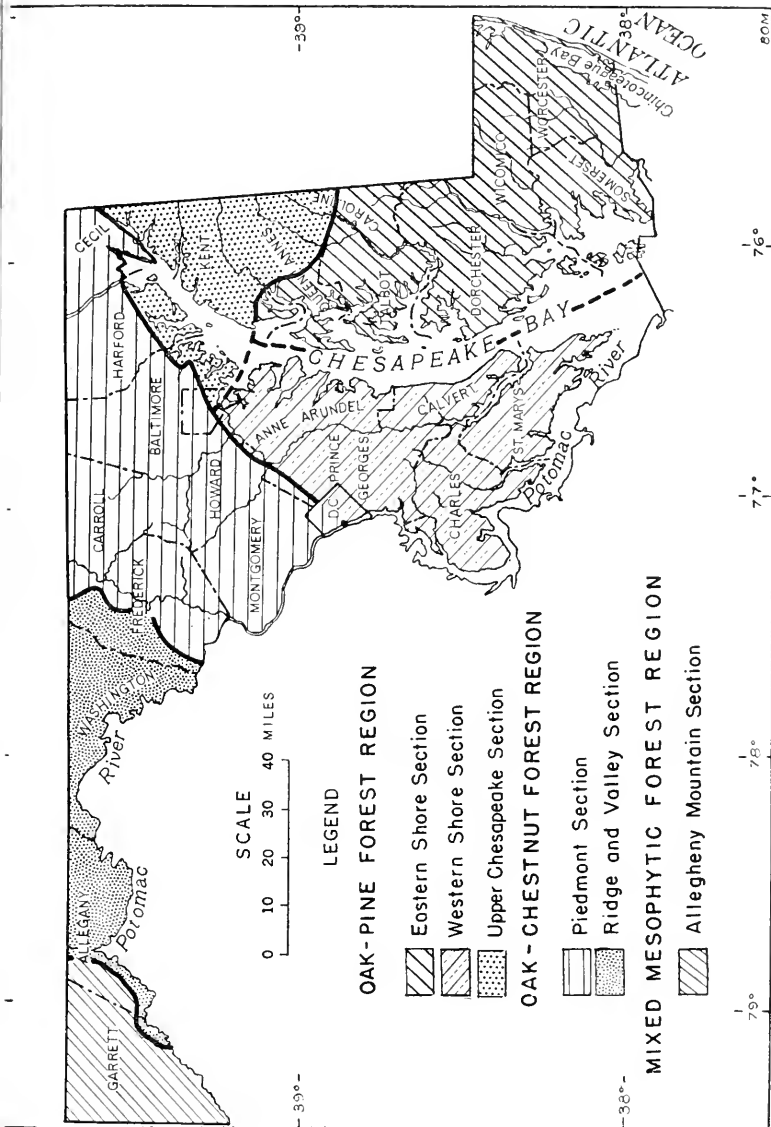


FIGURE 1.—Biotic areas of Maryland and the District of Columbia.

Chestnut Forest Region, and the Mixed Mesophytic Forest Region. Our data on distribution and ecology of birds are closely correlated with the distribution of these forest regions, so we have decided to follow Braun's classification except for slight changes in the regional boundaries (see fig. 1). The most noticeable shift was made on the boundary separating the Oak-Pine and Oak-Chestnut Forest Regions. For our purpose it seemed best to include the "necks" of Baltimore and Harford Counties in the Oak-Pine Forest Region rather than in the Oak-Chestnut Forest Region.

Each of the three forest regions, here considered as major biotic regions, may be subdivided into sections that represent areas showing floral and faunal differences of a secondary nature. In Maryland and the District of Columbia we have found it expedient to recognize six sections—the Eastern Shore, Western Shore, and Upper Chesapeake sections of the Oak-Pine Forest Region; the Piedmont and the Ridge and Valley sections of the Oak-Chestnut Forest Region; and the Allegheny Mountain section of the Mixed Mesophytic Forest Region. While attempting to follow Braun's classification of these subdivisions as far as we could, we found it necessary to modify her concept of the sectional boundaries with the following results: The Allegheny Mountain section is the same as described; the Ridge and Valley section includes Braun's Northern Blue Ridge section as well as her Ridge and Valley section; the Piedmont section is the same as described except for a slight westward shift of the eastern boundary; the Upper Chesapeake, Western Shore, and Eastern Shore sections are new subdivisions of the Oak-Pine Forest Region that have not been previously described.

BIRDS OF THE OAK-PINE FOREST REGION

The Coastal Plain of Maryland and the District of Columbia, except for Elk Neck in Cecil County, occurs within the Oak-Pine Forest Region. This region is intermediate in many respects between the Southeastern Evergreen Forest Region of the Southern States and the more central Oak-Chestnut Forest Region. Under the old life-zone concept it would probably be considered a transitional belt between the Lower Austral (Australoriparian) and Upper Austral (Carolinian) Life Zones. Over the greater part of this region in Maryland the upland forests are composed of a combination of pine stands and oak-hickory forests or a mixture of the two. An exception to this is found in the areas adjoining the upper Chesapeake Bay (designated as the Upper

esapeake section), where the upland forests are almost entirely deciduous, although still of a type characteristic of the Oak-Pine Forest Region. Interesting associations of southern and eastern plants occur in the region. Locally, extensive stands of loblolly pine and even bald-cypress swamps are present, reminding one of more southern latitudes. Other species of pines, as well as most of the deciduous trees, are those which are also characteristic of the Oak-Chestnut Forest Region or are widely distributed throughout the Atlantic Coastal Plain.

The associations of plants and animals in the tidewater habitats of the Oak-Pine Forest Region are quite different from other communities found in Maryland and the District of Columbia. There are numerous types of tidal marshes along the bays and estuaries, and almost every one has a distinct assortment of breeding birds. Fresh and brackish marsh types include American three-square, bay three-square, river bulrush, cattail, wild rice, reed, salt marsh grass, and switchgrass. Salt-marsh types are salt-water cordgrass, salt-meadow grass, spike-grass, needlerush, saltmarsh bulrush, black grass, and glasswort. Many tidewater birds may be considered edge species, since they feed in the open water or marsh areas but nest in adjacent patches of brush or trees. All other species nest on small islands, on beaches, or in banks along the shore.

The breeding birds of the region include several species of definite southern affinities, while associated with them are many others that are widely distributed throughout the greater part of the Eastern Deciduous Forest area. Interestingly enough, a few breeding species that are generally considered characteristic of more northern portions of the Eastern Deciduous Forest area are also present. The species of birds that have been known to breed in the Oak-Pine Forest Region in recent years are as follows:

PRIMARY SPECIES

Green Heron	Least Tern (local)	Pileated Woodpecker
Great Bittern	Black Skimmer (local)	(local)
King Duck	Mourning Dove	Red-bellied
Wood Duck	Yellow-billed Cuckoo	Woodpecker
Great Blue Heron	Great Horned Owl	Downy Woodpecker
Black Vulture (local)	(local)	Eastern Kingbird
Sharp-shinned Hawk	Barred Owl	Great Crested
Great Egret	Chuck-will's-widow	Flycatcher
White Ibis	(local)	Acadian Flycatcher
Virginia Rail	Whip-poor-will	Eastern Wood Pewee
Least Tern (local)	Chimney Swift	Barn Swallow

PRIMARY SPECIES—Continued

Purple Martin (local)	Starling	American Redstart
Common Crow	White-eyed Vireo	(local)
Carolina Chickadee	Red-eyed Vireo	House Sparrow (lo
Tufted Titmouse	Prothonotary Warbler	Eastern Meadowla
Brown-headed	(local)	Redwinged Blackbi
Nuthatch (local)	Parula Warbler	Common Grackle
House Wren	Yellow-throated	(local)
Carolina Wren	Warbler (local)	Scarlet Tanager
Long-billed Marsh	Pine Warbler (local)	Cardinal
Wren	Prairie Warbler	Indigo Bunting
Short-billed Marsh	Ovenbird (local)	Rufous-sided Towh
Wren (local)	Louisiana	Grasshopper Sparr
Mockingbird	Waterthrush (local)	Sharp-tailed Sparr
Catbird	Kentucky Warbler	(local)
Robin	Yellowthroat	Seaside Sparrow
Wood Thrush	Yellow-breasted Chat	(local)
Blue-gray Gnatcatcher	Hooded Warbler	Chipping Sparrow
(local)	(local)	Field Sparrow
		Song Sparrow

SECONDARY SPECIES

Great Blue Heron	American Woodcock	Brown Thrasher
Little Blue Heron	Spotted Sandpiper	Eastern Bluebird
(local)	(local)	Loggerhead Shrike
Common Egret (local)	Willet (local)	(local)
Snowy Egret (local)	Gull-billed Tern (local)	Yellow-throated Vi
Black-crowned Night	Forster's Tern (local)	Warbling Vireo (lo
Heron	Barn Owl	Black-and-white
American Bittern	Screech Owl (local)	Warbler
(local)	Common Nighthawk	Swainson's Warble
Mallard (local)	(local)	(local)
Blue-winged Teal	Ruby-throated	Worm-eating Warl
(local)	Hummingbird	(local)
Cooper's Hawk	Belted Kingfisher	Yellow Warbler
Red-tailed Hawk	Yellow-shafted Flicker	Orchard Oriole
Broad-winged Hawk	Hairy Woodpecker	Boat-tailed Grackle
Bald Eagle	Eastern Phoebe	(local)
Marsh Hawk (local)	Horned Lark	Brown-headed Cow
Sparrow Hawk	Tree Swallow (local)	Summer Tanager
King Rail	Bank Swallow (local)	(local)
Clapper Rail (local)	Rough-winged Swallow	Blue Grosbeak (loc
Common Gallinule	Blue Jay	American Goldfinch
(local)	Fish Crow	Henslow's Sparrow
Piping Plover (local)	White-breasted	Vesper Sparrow
Killdeer	Nuthatch (local)	

MINOR SPECIES

Pied-billed Grebe	Yellow-crowned Night	Gadwall (local)
Louisiana Heron	Heron (local)	Sora (local)
(local)	Glossy Ibis (local)	Black Rail (local)

MINOR SPECIES—Continued

American Oyster-	Red-headed	Baltimore Oriole
catcher (local)	Woodpecker (local)	(local)
Mason's Plover (local)	Red-cockaded	Savannah Sparrow
Ring Gull (local)	Woodpecker (local)	(local)
Laughing Gull (local)	Least Flycatcher	Bachman's Sparrow
Least Tern (local)	(local)	(local)
Royal Tern (local)	Cedar Waxwing	Swamp Sparrow
Black-billed Cuckoo		(local)

EASTERN SHORE SECTION

This part of the Oak-Pine Forest Region (see fig. 1) is in the Coastal Plain of southeastern Maryland, east of Chesapeake Bay. Weather stations in this section (Weeks, 1941) yield the following data (based on mean weather records over a period of from 10 to 67 years):

Annual temperature—55.4° F. (at Easton) to 57.9° F. (at Crisfield)
 January temperature—35.2° F. (at Easton) to 38.6° F. (at Crisfield)
 July temperature—76.0° F. (at Snow Hill) to 77.8° F. (at Pocomoke City)
 Snowing season—178 days (at Princess Anne) to 210 days (at Crisfield)
 Annual precipitation—39.35 inches (at Snow Hill) to 43.37 inches (at Cambridge)
 Annual snowfall—10.2 inches (at Crisfield) to 21.1 inches (at Rock Hall)

The upland forests are composed chiefly of loblolly-pine stands and oak-hickory forests or a mixture of the two. Along the margins of the tidal marshes, loblolly pine characteristically occurs in somewhat open stands without deciduous associates. Much of the Eastern Shore section is poorly drained with the result that upland swamps are numerous and extensive lowland swamps occur along many of the streams. Sweetgum, black gum, red maple, and pin oak are typical trees in most of these swamps, and locally American holly is common. The large swamp along the Pocomoke River and its tributaries is especially interesting because it includes many southern plants including bald cypress, bay, horse-sugar, water oak, cross vine, and laurel-leaved penbrier. In the coastal area of Worcester County many other interesting habitats are found, such as the littoral zone of the bay, the coastal bays or lagoons, the barrier beaches, and the tidal marshes. Along the Chesapeake Bay shore there are numerous brackish estuaries that abound in aquatic plant food, while adjoining many of them are extensive brackish marshes. Oysters, crabs, and fish are plentiful in the tidewater areas of the Eastern Shore section, and support a fairly large fishing industry. The agricultural areas of this section are largely devoted to truck

farming and chicken raising and to apple and peach orchards (Hamilton and Johnson, 1940).

Many of the southern birds that breed within the Oak-Pine Forest Region are more common and widespread in the Eastern Shore section than elsewhere, and this is true also of those species that are associated with salt-water habitats. These include various southern herons, Clapper Rail, American Oystercatcher, Wilson's Plover, Royal, Gull-billed, and Forster's Terns, Black Skimmer, Chuck-will's-widow, Red-cockaded Woodpecker, Broad-headed Nuthatch, Swainson's Warbler, Boat-tailed Grackle, Sharp-tailed and Seaside Sparrows. Paradoxically, several breeding species generally associated with cooler climates occur regularly in certain tidewater habitats of the Eastern Shore section but are absent or rare in other sections of the Oak-Pine Forest Region. These include the American Bittern, Gadwall, Black-winged Teal, Marsh Hawk, Herring Gull, Tree Swallow, Shore-billed Marsh Wren, and Swamp Sparrow.

During the migration and wintering periods, most of the mallards (Anatinae) and shorebirds (Charadriidae and Scolopacidae), as well as various other species associated with salt-water habitats, are much more abundant in the Eastern Shore section than elsewhere. The greatest variety and numbers of marsh ducks are to be found in the brackish marshes of Dorchester County while the majority of the shorebirds are most numerous in the coastal area of Worcester County. Spectacular concentrations of diving ducks and other open-water species are to be seen on numerous brackish estuaries and inlets along the Chesapeake Bay shore and are especially abundant on Eastern Bay and the Chester River. In fall, many land birds, including several species of hawks and quite a few passerine species, tend to follow the coast while migrating and therefore are numerous in this section. In spring, several passerine species, particularly some of the warblers, tend to follow inland migration routes and therefore are rare or absent in the Eastern Shore section.

In winter, several half-hardy species that are characteristic wintering birds in the Southern States regularly range as far north as the Eastern Shore section but are not ordinarily found in the other sections. These include the Tree Swallow, House Wren, Palm Warbler, Vesper Sparrow, and Chipping Sparrow. Among other wintering birds of interest could be listed the Purple Sandpipers at the Ocean City Inlet and Ipswich Sparrows and Sand Buntings on the barrier beaches. Turkey Vultures and Myrtle Warblers winter in unusually large numbers throughout much

the Eastern Shore section, and waterfowl are plentiful wherever appropriate aquatic habitats occur.

WESTERN SHORE SECTION

This section is found on the Coastal Plain west of Chesapeake Bay and south of the Patapsco River (see map, fig. 1). Weather conditions within this section (Weeks, 1941) yield the following average data:

Annual temperature—54.5° F. (near Glenn Dale) to 57.1° F. (at Solomons)
January temperature—34.3° F. (near Glenn Dale) to 36.7° F. (at La Plata)
July temperature—75.8° F. (near Glenn Dale) to 78.2° F. (at Solomons)
Annual growing season—172 days (near Glenn Dale) to 213 days (at Solomons)
Annual precipitation—35.62 inches (at Solomons) to 44.33 inches (at Annapolis)
Annual snowfall—15.8 inches (at Solomons) to 21.5 inches (at Annapolis)

Over the greater part of the Western Shore section, the upland forests are composed of scrub-pine stands and oak-hickory forests a mixture of the two. On the lower Coastal Plain terraces near the water, and especially in the southern part of the section, loblolly pine is common, often taking the place of the scrub pine. On sandy soils in the northern part of the section in the Fall-line or Piedmont Hills district (Harper, 1918), pitch pine is frequently predominant. Rich, moist upland forests, composed chiefly of white oak and tulip-poplar, occur locally and are especially prominent in the east-central Prince Georges County on the fertile soils of the Tidewater sand district (Harper, 1918). Small seepage areas are frequent throughout the section and usually support an upland swamp forest type that contains a well-developed understory composed chiefly of ericaceous shrubs. The flood-plain forests are particularly luxuriant in the Western Shore section and support a great variety of plants and animals. The best example of this type occurs along the Patuxent River and its tributaries; bald cypress occurs commonly in the swamp along Battle Creek. Quite a few brackish estuaries are present that contain abundant aquatic life and food, and many of these are fringed by various tidal-marsh associations. The most extensive and interesting marsh areas occur near the head of the Patuxent estuary southeast of Upper Marlboro. Most of the agricultural areas in the Western Shore section are largely devoted to tobacco farming; locally truck farming is also important (Hamilton and Johnson, 1940). In the Western Shore section, breeding birds that show the most definite southern affinities, such as the Chuck-will's-widow and down-headed Nuthatch, are restricted to the southernmost por-

tions in the areas where loblolly pine is prevalent. Other southern birds, such as the Black Vulture, Yellow-throated Warbler, Summer Tanager, and Blue Grosbeak, occur regularly throughout most of the section. Two species, the Warbling Vireo and Baltimore Oriole, which nest regularly in the other biotic sections of the State, are very rare or absent in the Western Shore section. The White-breasted Nuthatch and Loggerhead Shrike have a peculiar breeding distribution within this section in that they appear to be almost entirely restricted to habitats in the fertile Greensand district, mostly in east-central Prince Georges County. Nearly all of the other breeding species are those that are widely spread and regular throughout the Oak-Pine and Oak-Chestnut Forest Regions.

During the migration periods, thousands of ducks, coots, and other water birds put in their appearance on many of the brackish estuaries and are especially numerous on the Potomac, Wicomico, Patuxent, South, and Magothy Rivers. Other outstanding concentration areas include the wild-rice marshes, particularly those along the Patuxent River, where hordes of Soras, Bobolinks, Red-winged Blackbirds and many other species may be found. The characteristic wintering birds of the Western Shore section are composed almost entirely of the species that are widely distributed at this season throughout the Oak-Pine and Oak-Chestnut Forest Regions.

UPPER CHESAPEAKE SECTION

The Upper Chesapeake section is found on the northern portions of the Coastal Plain on both sides of Chesapeake Bay (see fig. 1). East of the bay it extends south to the area where loblolly-pine stands represent an important forest type, while west of the bay it extends southward to the Patapsco River. Weather stations within this section (Weeks, 1941) yield the following average data:

Annual temperature—53.9° F. (at Aberdeen) to 55.7° F. (at Baltimore)
 January temperature—33.1° F. (at Aberdeen) to 35.1° F. (at Ridgely)
 July temperature—75.7° F. (at Aberdeen) to 77.7° F. (at Baltimore)
 Annual growing season—179 days (at Elkton) to 200 days (at Coleman)
 Annual precipitation—40.16 inches (at Aberdeen) to 44.27 inches (at V
 Bibber)

Annual snowfall—18.3 inches (at Aberdeen) to 21.8 inches (at Millington)

Although here placed in the Oak-Pine Forest Region, this section actually represents in many respects a transitional area between the Oak-Pine and Oak-Chestnut Forest Regions. The upland forests of the Upper Chesapeake section are almost entirely

aciduous and are mostly of the oak-hickory type. The principal species include white oak, black oak, Spanish oak, willow oak, coccinifer, pignut, and sweetgum. Locally, chestnut oak is common in these forests, and formerly chestnut was present. Scattered upland swamps are present in the Upper Chesapeake section; these the most common trees are usually pin oak, red maple, black gum, and sweetgum. Narrow strips of well-drained floodplain forests occur along some of the streams, and here tulip-plar, American elm, white ash, hornbeam, and sweetgum are often the prevailing species.

Many brackish and nearly fresh estuaries are found in this section; these contain an abundant aquatic-plant growth. The famous Susquehanna Flats with its extensive beds of wild celery is the largest of these. Tidal marshes are frequent, especially in that portion west of Chesapeake Bay; the more important types are the Olney three-square, American three-square, river bulrush, cordgrass, and wild rice.

A large part of the Upper Chesapeake section has been cleared for farming, particularly the portion lying east of Chesapeake Bay. Most of these agricultural areas are devoted to dairy farming or to the raising of cash grain crops; locally truck farming is also important (Hamilton and Johnson, 1940).

The breeding birds of the Upper Chesapeake section differ from those of the Eastern Shore and Western Shore sections principally because of the fact that most of the species that are associated with pine and salt-water habitats, as well as most of those that would indicate southern affinities, are rare or absent. Only two southern species are of regular occurrence—the Blue Grosbeak is fairly common locally while the Black Vulture occurs sparingly. Five warblers, the Black-and-white Warbler, Prairie Warbler, Ovenbird, Hooded Warbler, and American Redstart, are unaccountably scarce as breeding species throughout the greater part of this section. On the other hand, the Kentucky Warbler is unusually abundant.

The Upper Chesapeake section is outstanding as a concentration area for migrating waterfowl. Thousands of Whistling Swans and Canada Geese and hundreds of thousands of ducks are to be found in the shallow estuarine waters of the Susquehanna Flats, the Patuxent River, the Gunpowder River area, and elsewhere. Various species of diving ducks and particularly the Canvasback are sometimes seen in almost unbelievable numbers. In winter, another outstanding feature of the Upper Chesapeake section is the enormous number of Redwinged Blackbirds, Common Grackles,

and Brown-headed Cowbirds that move over the area in great flocks.

BIRDS OF THE OAK-CHESTNUT FOREST REGION

The area in Maryland and the District of Columbia that embraces the Piedmont, Blue Ridge, and Ridge and Valley physiographic provinces (Fenneman, 1938), extending from the fall line to the Allegheny Front, lies within the Oak-Chestnut Forest Region. A small hilly portion of the Coastal Plain, known as the Neck in Cecil County, is also included on the basis of the known relations of its plant and animal life. Various species of oak, particularly white, scarlet, black, and chestnut oaks, are especially abundant in the upland forests of the Oak-Chestnut Forest Region and locally tulip-poplar is predominant. Chestnut was formerly an important constituent of most of these forests, but now has largely disappeared, at least as a forest tree, owing to the chestnut blight. Mixed mesophytic forest communities are to be found in some of the cooler ravines and on steep north slopes; these include such species as hemlock, white pine, sugar maple, basswood, sweet birch, beech, northern red oak, white oak, and tulip-poplar.

The majority of the breeding birds in the region are those which are characteristic and widespread throughout the central portions of the Eastern Deciduous Forest area and, using life-zone terminology, could be considered as typically Carolinian. Local on the higher ridges or in the cooler ravines, a few species characteristic of more northern climates also occur. The species of birds that have been known to breed in the Oak-Chestnut Forest Region in the past few years are as follows:

PRIMARY SPECIES

Turkey Vulture	Red-eyed Vireo	Scarlet Tanager
Mourning Dove	Black-and-white	Cardinal
Chimney Swift	Warbler (local)	Indigo Bunting
Downy Woodpecker	Ovenbird	American Goldfinch
Eastern Kingbird	Hooded Warbler	Rufous-sided Towhee
Eastern Wood Pewee	(local)	Grasshopper Sparrow
Barn Swallow	American Redstart	Vesper Sparrow
Common Crow	(local)	Chipping Sparrow
House Wren	House Sparrow	Field Sparrow
Robin	Eastern Meadowlark	Song Sparrow
Wood Thrush	Redwinged Blackbird	
Starling	Common Grackle	

SECONDARY SPECIES

Green Heron	Pileated Woodpecker	Cedar Waxwing
Wood Duck	(local)	(local)
Black Vulture (local)	Red-bellied	White-eyed Vireo
Screeper's Hawk	Woodpecker	(local)
Red-tailed Hawk	Hairy Woodpecker	Yellow-throated Vireo
Red-shouldered Hawk	Great Crested	Warbling Vireo (local)
Broad-winged Hawk	Flycatcher	Worm-eating Warbler
Sharp-shinned Hawk	Eastern Phoebe	Golden-winged
Spotted Grouse (local)	Acadian Flycatcher	Warbler (local)
White-throated	Least Flycatcher	Blue-winged Warbler
Parula (local)	(local)	(local)
Golden-crowned	Horned Lark	Parula Warbler
American Woodcock	Rough-winged Swallow	Yellow Warbler
(local)	Cliff Swallow (local)	Black-throated Green
Virginia Plover (local)	Purple Martin	Warbler (local)
Spotted Sandpiper	Blue Jay	Cerulean Warbler
(local)	Carolina Chickadee	(local)
Yellow-billed Cuckoo	(local)	Chestnut-sided
Screech Owl (local)	Black-capped	Warbler (local)
Great Horned Owl	Chickadee (local)	Prairie Warbler
Eastern Screech Owl	Tufted Titmouse	(local)
Whip-poor-will	White-breasted	Louisiana Water-
Common Nighthawk	Nuthatch	thrush
(local)	Bewick's Wren (local)	Kentucky Warbler
Blue-throated	Carolina Wren	(local)
Hummingbird	Mockingbird (local)	Yellowthroat
Spotted Kingfisher	Catbird	Yellow-breasted Chat
Yellow-shafted Flicker	Brown Thrasher	Orchard Oriole
	Eastern Bluebird	Baltimore Oriole
	Blue-gray Gnatcatcher	Brown-headed Cowbird

MINOR SPECIES

Chipping Sparrow	Bank Swallow (local)	Bobolink (local)
Black Duck (local)	Fish Crow (local)	Summer Tanager
Sharp-shinned Hawk	Short-billed Marsh	(local)
Golden Eagle (local)	Wren (local)	Blue Grosbeak (local)
Screech Falcon	Veery (local)	Dickcissel (local)
(local)	Loggerhead Shrike	Savannah Sparrow
King Rail (local)	(local)	(local)
Virginia Rail (local)	Prothonotary Warbler	Henslow's Sparrow
Black-billed Cuckoo	(local)	(local)
Red-headed	Blackburnian Warbler	Bachman's Sparrow
Woodpecker (local)	(local)	(local)
Swainson's Flycatcher	Pine Warbler (local)	
(local)		

PIEDMONT SECTION

The Piedmont physiographic province (Fenneman, 1938) as well as a small part of the Coastal Plain known as Elk Neck in Cecil County is classified as the Piedmont section of the Oak-

Chestnut Forest Region (see fig. 1). Weather stations within the section (Weeks, 1941) yield the following average data:

Annual temperature—52.6° F. (at Fallston) to 54.3° F. (at Frederick)
 January temperature—31.3° F. (at Emmitsburg) to 34.8° F. (at Pretty Boy Dam)

July temperature—74.2° F. (at Fallston) to 76.7° F. (at Frederick)
 Annual growing season—173 days (at Boyds) to 188 days (at Emmitsburg)

Annual precipitation—38.66 inches (at Great Falls) to 44.84 inches (at Maryland Line)

Annual snowfall—22.4 inches (at Woodstock) to 32.5 inches (at Emmitsburg)

The gently rolling topography and the well-drained fertile soil of this section are conducive to the establishment of widespread upland, rich, moist forest types. In most of these forests, white oak, black oak, tulip-poplar, and smooth-barked hickories are the predominant species, with flowering dogwood as an ever-present understory tree. Locally, and especially on some of the drier or more sterile sites, chestnut oak or scarlet oak is predominant, while occasionally associated with them may be four stands of scrub pine or pitch pine that represent stages of the secondary succession. Beech is frequently a common tree on ravine slopes, and mixed mesophytic forest communities occur in some of the larger valleys with steep north slopes. These communities are composed of a mixture of central and northern hardwoods and frequently contain hemlock as well. Narrow strips of rich, well-developed flood-plain forest communities are to be found along the larger streams and are characteristic. They are composed of a great variety of bottomland species. Good-size reservoirs have been created along some of the streams by the construction of dams.

A very large proportion of the Piedmont section has been cleared for agricultural purposes. Most of these areas are devoted chiefly to dairy farming, while locally truck farming and the raising of livestock and cash grain crops are important (Hamilton and Johnson, 1940).

A marked uniformity in environment, resulting in a rather restricted number of habitats, is to be noted throughout the Piedmont section. Because of this, the variety of birds to be found in the area is not ordinarily impressive. The vast majority of the birds are those that may be classified as field or field-margin species or those that are characteristic of upland well-drained forests. Most of the water, marsh, and bottomland habitats are quite restricted in area, so that the number of species to be found

them is somewhat limited. Nearly all of the characteristic birds of the Piedmont section are of species that are widespread and common throughout the central portions of the Eastern Deciduous Forest area. A slight southern influence is to be noted along the Potomac River Valley, which apparently is serving as an invasion route for breeding species such as the Black Vulture, Summer Tanager, and Blue Grosbeak. Locally a trace of a more northern element in the avifauna may be discerned, especially in the more elevated portions of the section, where breeding species such as the Traill's Flycatcher, Chestnut-sided Warbler, and Savannah Sparrow may be found in small numbers. Other local breeding populations of special interest in the Piedmont section include the Upland Plovers in the Frederick and Worthington valleys, the Veeries of Rock Creek Park in the District of Columbia, the Blue-winged Warblers in the Susquehanna River Valley, the Cerulean Warblers in the flood-plain forests along the Susquehanna, Patapsco, and Potomac Rivers, and the Dickcissels in southern Frederick and western Montgomery Counties.

During the migration periods many of the field and edge species are more numerous in this section than elsewhere. Of these, the Water Pipit and White-crowned Sparrow are especially noteworthy since in spring they both occur in unusually large numbers in the Frederick Valley. Fair-sized migrating flocks of waterfowl and other water birds are sometimes seen on the reservoirs and larger streams, and frequently some of these remain into the winter. Wintering birds in general are less numerous than they are in the Oak-Pine Forest Region, with the noted exception of the Common Crow, which is to be found in exceptionally large flocks, particularly in Carroll County.

RIDGE AND VALLEY SECTION

Both the Blue Ridge and the Ridge and Valley physiographic provinces (Fenneman, 1938) are included in the Ridge and Valley section of the Oak-Chestnut Forest Region (see fig. 1). Weather stations within this section (Weeks, 1941) yield the following average data:

- Annual temperature—52.2° F. (at Clear Spring) to 54.0° F. (at Keedysville)
- January temperature—31.2° F. (at Chewsville) to 34.0° F. (at Picardy)
- July temperature—73.7° F. (at Western Port) to 75.9° F. (at Keedysville)
- Annual growing season—155 days (at Hancock) to 188 days (at State Sanatorium)
- Annual precipitation—35.10 inches (at Western Port) to 43.52 inches (at State Sanatorium)
- Annual snowfall—22.7 inches (at Picardy) to 34.6 inches (at Clear Spring)

Forest types in which chestnut oak is common are prevalent throughout most of the Ridge and Valley section. On rocky ridge tops and upper slopes this species is often found in nearly pure stands. On some of the drier sites, and especially on slopes with southern or western exposures, scarlet oak is predominant, while interspersed with it may be found occasional secondary stands of scrub pine, pitch pine, or Table Mountain pine. Locally, fairly large areas of scrubby bear oak thickets occur on some of the more level expanses of the mountain tops. Most of the ravines as well as steep north slopes are occupied by mixed mesophytic forest communities. The characteristic trees in these communities are hemlock, white pine, and numerous deciduous species including beech, sweet birch, basswood, sugar maple, tulip-poplar, white oak, and northern red oak. On the valley floors another type of mesophytic forest is found in which white oak, black oak, and tulip-poplar are ordinarily dominant, with flowering dogwood as a common understory tree; locally, secondary stands of white pine are found interspersed with these species. In the limestone area of the Hagerstown Valley, occasional groves of red cedar are present. The only prominent flood-plain forest type occurs as a rather narrow stretch along the Potomac River.

With the exception of the Hagerstown Valley, which is very intensively farmed, a relatively small proportion of the Ridge and Valley section has been cleared for agricultural purposes. In the Hagerstown Valley most of the agricultural areas have been developed for dairy farming or for the raising of cash grain crops, while the scattered smaller farms elsewhere in the section are devoted chiefly to apple orchards or are general, self-sufficient farms (Hamilton and Johnson, 1940).

While most of the breeding birds in the Ridge and Valley section are characteristic species of the central portions of the Eastern Deciduous Forest area, there is also a noticeable tinge of more northern species. Species that show more northern affinities are most numerous in the cooler ravines or on the higher ridges, and include the Ruffed Grouse, Least Flycatcher, Black-capped Chickadee, Golden-winged Warbler, Black-throated Green Warbler, Blackburnian Warbler, and Chestnut-sided Warbler. The Cliff Swallow, Bewick's Wren, and Cerulean Warbler are regularly distributed throughout the greater part of this section, the latter species occurring in upland forests of the mountains as well as in the flood-plain forests. Other noteworthy breeding birds include Turkeys in Allegany County, Blue-winged Warblers in

Blue Ridge Mountains of Frederick County, and Bachman's arrows on Green Ridge Mountain.

During the migration periods, warblers, vireos, and other insectivorous birds as well as several species of hawks tend to concentrate along the ridgetops. Wintering birds in the Ridge and Valley section are usually rather sparse except along the Potomac River, where fairly good numbers may be found.

BIRDS OF THE MIXED MESOPHYTIC FOREST REGION

The part of the Appalachian Plateaus (Fenneman, 1938) that extends into western Maryland (Garrett County and western Allegany County) lies within the Mixed Mesophytic Forest region. This region is generally characterized by the fact that mixed mesophytic forest communities are prevalent throughout. The portion in Maryland, being restricted to the Allegheny Mountains, is comparatively high in elevation, so that most of the forest communities are actually intermediate between the typical mixed mesophytic forest types and the more northern hemlock-northern hardwood types. Because of this, the area is considered a well-marked subdivision of the Mixed Mesophytic Forest Region and is designated the Allegheny Mountain section.

ALLEGHENY MOUNTAIN SECTION

Weather stations within this section (Weeks, 1941) yield the following average data:

Annual temperature—47.2° F. (Sines, Deep Creek) to 51.0° F. (Frostburg)
January temperature—27.7° F. (Grantsville) to 30.7° F. (Friendsville)
July temperature—67.3° F. (Oakland) to 71.8° F. (Frostburg)
Annual growing season—124 days (Oakland) to 159 days (Frostburg)
Annual precipitation—41.56 inches (Frostburg) to 46.19 inches (Oakland)
Annual snowfall—47.7 inches (Frostburg) to 70.2 inches (Grantsville)

The communities of plants and animals in the Allegheny Mountain section (see fig. 1) are much more northern in character than are those in the various sections of the Oak-Chestnut and Oak-Pine Forest Regions. Hemlock and occasional white pine occur regularly in many of the forests on the slopes and in the valleys, although deciduous trees are generally predominant. These include such species as sweet birch, sugar maple, red maple, black cherry, basswood, beech, shagbark hickory, white oak, and northern red oak. On the higher ridges, northern red oak and red maple are usually predominant, with chestnut oak, black oak, yellow birch, and other northern hardwoods as frequent associates. Occasionally interspersed with them are scattered red

spruce. In the valleys at elevations above 2,400 feet there are quite a few relict bogs; these consist of sedge meadows and bogs and heaths interspersed with patches of taller shrubs, predominant alder and great laurel, and trees, usually red spruce, hemlock, yellow birch, and red maple. In sandy situations on some of the lower ridges, open stands of pitch pine are present.

The agricultural areas of the Allegheny Mountain section occur in exceptionally picturesque surroundings and are located on the more rounded ridgetops as well as in the valleys. Most of the farms are of the general, self-sufficing type (Hamilton and Johnson, 1940). Locally, many farmers supplement their farm income with profits derived from the production of maple syrup. The creation of several artificial lakes has greatly improved the recreational facilities of the area, and as a consequence large numbers of tourists are attracted during the warmer months.

Most of the breeding birds in the Allegheny Mountain section are those that are typical of the more northern portion of the Eastern Deciduous Forest, an area that is sometimes referred to as the Transition or Alleghenian Life Zone. Associated with them in much smaller numbers are such species as the Tufted Titmouse, Yellow-breasted Chat, Hooded Warbler, and Cardinal, which are more characteristic of the central portions of the Eastern Deciduous Forest. The scattered boreal bogs in Garrett County are especially interesting since they harbor large numbers of the more typical northern species. Two of the best-preserved bogs are Wolf Swamp (about 4 miles southeast of Grantsville) and Craneyville Swamp (just east of Cranesville, W. Va.) also contain small breeding populations of the Saw-whet Owl, Golden-crowned Kinglet, and Nashville Warbler. Backbone Mountain is worth of note as being the only area in Maryland where breeding populations of the elusive Mourning Warbler may be found.

The species of birds that have been known to breed in the Allegheny Mountain section of Maryland in the past 10 years are as follows:

PRIMARY SPECIES

Ruffed Grouse	House Wren	Starling
Yellow-shafted Flicker	Catbird	Red-eyed Vireo
Barn Swallow	Brown Thrasher	Magnolia Warbler
Cliff Swallow (local)	Robin	(local)
Common Crow	Wood Thrush	Black-throated Blue
Black-capped	Veery	Warbler
Chickadee	Cedar Waxwing	

PRIMARY SPECIES—Continued

ack-throated Green Warbler	Northern Water-thrush (local)	Savannah Sparrow (local)
ackburnian Warbler	Canada Warbler (local)	Chipping Sparrow
chestnut-sided Warbler	Rufous-sided Towhee	Swamp Sparrow (local)
venbird		Song Sparrow

SECONDARY SPECIES

reen Heron	Red-headed	Yellowthroat
ood Duck	Woodpecker (local)	Hooded Warbler
urkey Vulture	Yellow-bellied	(local)
harp-shinned Hawk	Sapsucker (local)	American Redstart
ed-tailed Hawk	Hairy Woodpecker	House Sparrow
road-winged Hawk	Downy Woodpecker	Bobolink (local)
marsh Hawk (local)	Eastern Kingbird	Eastern Meadowlark
parrow Hawk	Great Crested	Redwinged Blackbird
obwhite (local)	Flycatcher	Baltimore Oriole
irginia Rail (local)	Eastern Phoebe	Common Grackle
illdeer	Least Flycatcher	Brown-headed Cowbird
merican Woodcock	Eastern Wood Pewee	Scarlet Tanager
otted Sandpiper (local)	Horned Lark	Rose-breasted
ourning Dove	Purple Martin (local)	Grosbeak
ellow-billed Cuckoo	Blue Jay	Indigo Bunting
lack-billed Cuckoo	White-breasted	Purple Finch (local)
reat Horned Owl	Nuthatch	American Goldfinch
arred Owl	Eastern Bluebird	Grasshopper Sparrow
hip-poor-will	Solitary Vireo	Henslow's Sparrow (local)
himney Swift	Black-and-white	Warbler
tuby-throated	Golden-winged Warbler	Vesper Sparrow
Hummingbird	Yellow Warbler	Slate-colored Junco (local)
belted Kingfisher	Mourning Warbler	Field Sparrow
ileated Woodpecker	(local)	

MINOR SPECIES

Mallard	Tree Swallow (local)	Warbling Vireo
looded Merganser	Rough-winged Swallow	Nashville Warbler (local)
ooper's Hawk	Common Raven (local)	(local)
ed-shouldered Hawk	Tufted Titmouse (local)	Parula Warbler
urkey		Cerulean Warbler (local)
pland Plover (local)	Bewick's Wren (local)	(local)
Screech Owl	Carolina Wren (local)	Louisiana Water-thrush (local)
aw-whet Owl (local)	Short-billed Marsh Wren (local)	Kentucky Warbler (local)
Common Nighthawk	Hermit Thrush (local)	
Red-bellied	Woodpecker (local)	Yellow-breasted Chat
Woodpecker (local)	Golden-crowned Kinglet (local)	Cardinal (local)
Acadian Flycatcher (local)	Yellow-throated Vireo	

In spring and fall the Garrett County lakes, especially Deep Creek Lake and Mountain Lake, serve as resting and feeding places for migrating waterfowl. Maurice Brooks (1936a),

Elizabeth Slater, and Friel Sanders have observed 25 species of waterfowl in these two lakes. The best concentrations occur when birds arriving from the northwest in fall run into widespread precipitation along or just east of the Allegheny Plateau. Deep Creek Lake and Mountain Lake also attract a wide variety of shorebirds, primarily in fall when water levels are low and extensive flats are exposed; no less than 17 species of plovers and sandpipers have been identified in the Allegheny Mountain section.

The ridgetops are favored pathways for migrating hawks, particularly in fall. Major flights occur regularly along Backbone Mountain (including Big Savage Mountain) and Dans Mountain (including Wills and Haystack Mountains), and may be witnessed on almost any cool day with northwest winds in September or October. Occasionally, good flights may be witnessed regardless of wind direction, though the birds usually fly so high on a southwest wind as to be very difficult to see.

Nowhere in Maryland is the diurnal migration of warblers more impressive than along the ridgetops early on a fall morning. Flying at treetop height, singly or in small groups, and occasionally stopping to rest or feed for a few minutes, warblers, vireos, nuthatches, woodpeckers, and many other birds are conspicuous on migration from dawn until 9 a.m. or later. These flights are most pronounced on cool mornings with northwesterly winds.

In both spring and fall, transient species that nest in the northeastern States and Provinces and migrate primarily through the lower Mississippi Valley move in relatively large numbers through the Allegheny Mountain section. The Least, Traill's, Yellow-bellied, and Olive-sided Flycatchers, Cliff Swallow, Philadelphia Vireo, Nashville, Tennessee, Magnolia, Bay-breasted, Blackburnian, Mourning, and Wilson's Warblers, and the Rose-breasted Grosbeak occur regularly during migration in this section, and in much larger numbers than in the central and eastern parts of the State.

In the dead of winter, birds in general are conspicuous by their absence. One may tramp through the woods and fields for an hour or more without seeing or hearing a single bird. There again, spots may be found where small flocks can be seen regularly throughout the cold months. Feeding stations are effective in inducing such species as Rufous-sided Towhees and White-throated Sparrows to remain in this part of the State where they do not otherwise winter. The main ornithological attraction

f the Allegheny Mountain section in winter is furnished by northern finches, such as crossbills and Pine Grosbeaks, which though irregular in their appearance, can be found much more easily here than in the other parts of Maryland.

SPECIES ACCOUNT

A total of 333 species is included in the regular list of birds for Maryland and the District of Columbia. Nineteen additional species that have been recorded are considered to be of hypothetical status only. One species not yet recorded, the Buff-breasted Sandpiper (*Tryngites subruficollis*) undoubtedly does occur as a regular, rare transient near the coast. Specimens have been collected for all species on the regular list with the exception of the following: Greater Shearwater, Cattle Egret, Common Noddy, Harlequin Duck, American Oystercatcher, American Avocet, Glaucous Gull, Iceland Gull, Red-cockaded Woodpecker, Brewer's Blackbird, and Lapland Longspur. The regular list includes three introduced species, the Ring-necked Pheasant, Starling, and House Sparrow, and four extinct or extirpated species, the Greater Prairie Chicken (Heath Hen), Eskimo Curlew, Passenger Pigeon, and Carolina Parakeet. Sufficient evidence has been found to indicate that at least 192 species have occurred in Maryland as breeding birds, although apparently 9 of these do not breed in Maryland at the present time.

The information presented under the species headings is based on data from all readily available sources, chiefly for the period beginning about 1860 and ending on December 31, 1955. In addition, data from a few earlier articles are included, and scattered records of particular interest through October 1956 are also listed. Reference to subspecies is purposely omitted in nearly all cases, since most of the information is derived from field observations rather than study of collected specimens. A species is considered to be on the regular accepted list for Maryland and the District of Columbia if any one of three prerequisites is satisfied: (1) A specimen preserved; (2) a satisfactory photograph taken; or (3) three or more reliable sight observations made. If a recorded species does not meet at least one of these standards, it is considered to be of hypothetical status only, and is so indicated by placing the common name of the species in brackets.

Throughout the species account, the authors are responsible for all general statements and for any specific records (except banding records) unless authority is otherwise indicated. Several hundred thousand records from various sources were carefully

screened, and only those believed reliable beyond reasonable doubt are included. Every Maryland and District of Columbia card in the bird-distribution files of the United States Fish and Wildlife Service has been examined. In addition, all national and all Maryland and District of Columbia ornithological periodicals have been covered—as well as publications from other localities that we believed might contain information on Maryland birds. The specimen-card file of the United States Fish and Wildlife Service was checked, as were a large percentage of the Maryland and District of Columbia specimens in the Fish and Wildlife Service and United States National Museum collections.

Unusual occurrence, nesting, or migration records listed in the text are often located by county or the District of Columbia. Records referable to Baltimore County include those made in Baltimore City; it was found to be impractical to separate the records from these two areas, particularly in the case of many of the earlier observations which were often characterized by vague or generalized locality data. Not more than two authorities are listed for any one record, regardless of how many persons were involved. The abbreviation "USNM" indicates that a specimen or clutch of eggs is in the collection of the United States National Museum (including the United States Fish and Wildlife Service collection) in Washington, D. C. Many of the localities referred to in the text are shown on the map of geographical location (fig. 2).

The relative abundance of each species is usually indicated for breeding, transient, and wintering periods in each biotic section in which it occurs. In a few cases, where wandering nonbreeding birds are found during the breeding season, the relative abundance of a species as a vagrant is also shown. Terms used to indicate relative abundance are defined as follows:

Abundant: Means that a species, considering its habits and conspicuousness, was found in very large numbers.

Common: Means that a species, considering its habits and conspicuousness, was found in large numbers.

Fairly Common: Means that a species, considering its habits and conspicuousness, was found in moderate or fair numbers.

Uncommon: Means that a species, considering its habits and conspicuousness, was found in rather small numbers.

Rare: Means that a species, within its normal range, was recorded in very small numbers.

Casual: Means that a species, slightly beyond its usual range for the season indicated, was recorded very few times.

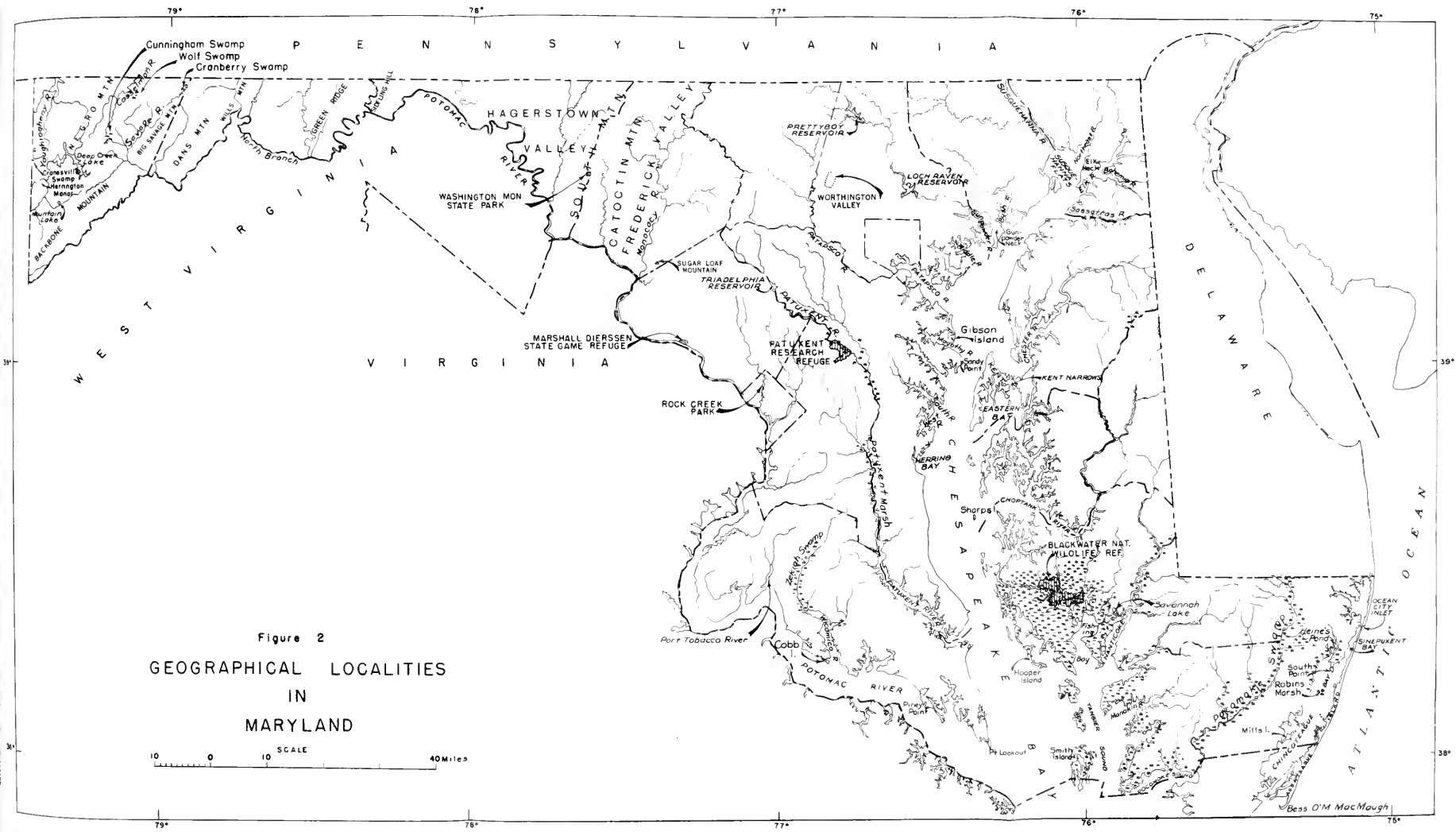


Figure 2
 GEOGRAPHICAL LOCALITIES
 IN
 MARYLAND

10 0 10 40 Miles
 SCALE

Accidental: Means that a species, well beyond its usual range, was recorded only once or twice.

These general terms are supplemented in many cases by breeding-population densities and maximum 1-day counts at other seasons.

General and specific calendar dates are used to indicate the nesting seasons for species that breed in Maryland and the District of Columbia. In describing the nesting seasons, the prefixes "early," "mid," and "late," applied to a month, are often used. "Early" refers to the period from the 1st through the 10th day of the month; "mid" is used to designate the period from the 11th through the 20th; and "late" indicates the period from the 21st through the last day of the month. The nesting peak represents the approximate period when three-fourths or more of the individuals of a given species are engaged in nesting activities. Egg dates refer to the extreme dates on which nests with viable eggs (not necessarily full clutches) were found. Nestling dates indicate the extreme dates on which nests containing young birds were recorded. Corresponding dates for downy young are used instead of nestling dates in the case of precocial species. The total number of nest records from which the egg-date and nestling-date extremes are derived is indicated for each species. A single nesting record may be included in both the egg count and the nestling count if observed in both stages. Only nest records reported from Maryland or the District of Columbia are included.

In the descriptions of spring and fall migration, the "normal periods" represent the dates when a species is ordinarily migrating, while extreme dates may be considered to be unusual records. In order to make allowance for yearly variation in migration dates, a limited amount of leeway is usually indicated for the beginning and ending of normal migration periods. For example, a normal period listed as "April 15-25 to May 10-20" means that the migration usually begins some time between April 15 and April 25, and usually ends some time between May 10 and May 20. Migration peaks represent the approximate periods when the greatest numbers of individuals are migrating.

For widespread breeding or transient species that occur in good numbers in several biotic sections, the nesting peak and normal migration periods as given in the text are applicable only to the more centrally located areas, including the Upper Chesapeake, Piedmont, and Ridge and Valley sections and the northern part of the Western Shore section (Prince Georges and Anne Arundel Counties). As a general rule the nesting peaks and normal spring

migration periods as given here may be expected to be as much as 1 week earlier than corresponding dates in the Allegheny Mountain section, and as much as 1 week later than corresponding dates in southeastern Maryland (Eastern Shore section and southern part of Western Shore section). On the other hand, the normal fall migration periods as given in the text for wide-ranging species may be as much as 1 week later than corresponding dates in the Allegheny Mountain section and as much as 1 week earlier than corresponding dates in southeastern Maryland. The difference may vary up to 3 weeks or more for such species as the Black-and-white Warbler and may not vary to any appreciable extent for others such as the Rose-breasted Grosbeak and Cliff Swallow.

The appropriate habitats of most species are briefly described. It should be remembered that whenever an appraisal of the relative abundance of a species within a given biotic section is made, consideration is always given to the required habitat of the species. The common names of plants used in the description of habitats are taken from the eighth edition of Gray's Manual of Botany (Fernald, 1950). The scientific as well as the common names of all plants referred to are listed in Appendix A.

For nesting species, breeding-population densities by habitats are frequently listed. These figures are derived from intensive population studies of breeding territorial males or pairs, using the spot-mapping method (see Audubon Field Notes 4 (2) : 185, 1950). An effort has been made to include all known breeding-population studies of uniform habitats that have been conducted in Maryland and the District of Columbia. The unpublished studies from Prince Georges County were made on, or within 3 miles of, the Patuxent Research Refuge. Population densities based on only 1 pair of birds in a study area (or a fractional part of the territory of 1 pair, or fractional parts of the territories of 2 or more pairs if their combined total amounts to less than 1.0 territory) have not been included. In the cases of wide-ranging or rare species, it has been necessary to set up study areas of several hundred acres in order to obtain significant density figures. Altogether, breeding-population densities have been obtained for 103 species. In addition, counts or careful estimates of 12 colonial species are listed. It is hoped that these population figures will prove helpful in appraising changes in abundance in years to come.

Maximum nonbreeding counts are also listed for many species. These represent the highest number of individuals recorded in 1 day by 1 party of observers (except in the case of Christmas counts, which include the total number recorded in 1 day by a

rties taking a given count). These counts were all taken either land or by boat. No attempt was made to include all high counts of a species; instead, selection was made of the highest representative counts for each general area in which the species occurs. It should be pointed out that in most cases these high counts were obtained incidental to other observations. A party observer that set out at the proper season under favorable weather conditions with the express intent of beating the high count for a given species should have little trouble in exceeding any of the counts listed here. The counts are intended as an indication of relative abundance rather than a series of extraordinary figures. The inclusion of more than one count for most species helps to make the few really exceptional counts stand out from the others.

Most of the Christmas counts have been published in Audubon Field Notes. The present Washington, D. C., Christmas count is the only one of any importance that overlaps into an adjacent State. In several other areas, a circle 15 miles in diameter would have included parts of Pennsylvania, West Virginia, or Virginia, but observers have made a point of restricting their observations to the Maryland portions of the circle. In the case of the recent Washington, D. C., figures, the breakdown by areas has always been published, so it has been possible to eliminate all counts that were made in Virginia and to include only those birds known to have been seen or heard within Maryland or the District of Columbia.

The presentation of banding data for many species is restricted to an analysis, mapping, or listing of recoveries that were made at a distance of 10 miles or more from the points of banding. Only out-of-State records are plotted on the maps, including the recovery localities of birds banded in Maryland and the banding locations of birds recovered in Maryland. Four types of symbols on the maps represent: records of birds banded during the summer; records of birds banded during the fall, winter, and spring; records of birds recovered during the summer; and records of birds recovered during the fall, winter, and spring. Only one symbol of each type is plotted within a State or Province, regardless of the number of records involved. When a symbol represents two or more records it is plotted in a central location as indicated by the distribution of the records.

Family GAVIIDAE

COMMON LOON *Gavia immer* (Brünnich)

STATUS.—*Transient*: Common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Allegheny Mountain section; uncommon in the interior of all other sections. *Wintering*: Fairly common in the tidewater areas of the southern portions of the Eastern Shore and Western Shore sections; uncommon in the tidewater areas of the northern portions of the Eastern Shore and Western Shore sections and in the Upper Chesapeake section; casual in the interior (recorded on Dec. 15, 1935, Dec. 16, 1936, Jan. 8, 1937, and Jan. 31, 1937, at Deep Creek Lake in Garrett County—M. Brooks). *Summer vagrant*: Casual in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections (recorded between June 11 and June 28 in Worcester, Charles Anne Arundel, Baltimore, and Kent Counties).

HABITAT.—*Transient*: Tidewaters of the ocean, bays, and estuaries; also inland fresh waters of ponds, lakes, reservoirs, and rivers. *Wintering*: Chiefly salt water of the coastal bays and lower Chesapeake Bay; occurs sparingly on the ocean and on brackish bays and estuaries.

SPRING MIGRATION.—*Normal period*: April 5–15 to May 25–30; peak, April 20 to May 5. *Extreme arrival dates*: April 4, 1941, Prince Georges County; April 8, 1950, in Garrett County (M. Brooks). *Extreme departure dates*: June 2, 1907, in Montgomery County (A. K. Fisher); June 1, 1938, in Baltimore County (H. Brackbill).

FALL MIGRATION.—*Normal period*: September 10–15 to November 20–30; peak, October 10 to November 15. *Extreme arrival dates*: September 8, 1940, in Baltimore County (H. Brackbill); September 8, 1950, in Queen Annes County (Mr. and Mrs. W. Henderson). *Extreme departure date*: December 28, 1948, Baltimore County (H. Kolb).

MAXIMUM COUNTS.—*Spring*: 90 at Point Lookout, St. Mary's County, on April 12, 1952 (L. Griffin, J. W. Terborgh, et al.); 70 at Patuxent Refuge on April 25, 1944; 45 at Emmitsburg, Frederick County, on April 30, 1955 (J. W. Richards); 35 on lower Patuxent River on April 13, 1954; 30 in the Conowingo area, Harford and Cecil Counties, on April 23, 1950 (H. F. Kuch); 25 in the South Marsh Island area, Somerset County, on April 2, 1946. *Fall*: 200 in the Ocean City area, Worcester County, on November 2, 1945; 50 on the Chester River and Eastern Bay of

October 31 and again on November 1, 1953 (Mr. and Mrs. W. L. Henderson); 40 on Fishing Bay, Dorchester County, on October 5, 1954; 36 on Mountain Lake, Garrett County, on October 24, 1936 (M. G. Brooks). *Winter* (Christmas counts): 29 in the Ocean City area on December 27, 1950; 18 in southeastern Worcester County on December 22, 1947; 18 in the Solomons Island area, Calvert County, on December 21, 1946.

RED-THROATED LOON *Gavia stellata* (Pontoppidan)

STATUS.—*Transient*: Common in the coastal area of Worcester County; fairly common in the tidewater areas elsewhere in the Eastern Shore and Western Shore sections; uncommon in the tidewater areas of the Upper Chesapeake section; casual in the interior of all sections—recorded in Garrett (Brooks, 1936a), Allegheny (Eifrig, 1904), and Montgomery (3 records—A. K. Fisher, J. F. Deed, J. W. Terborgh) Counties. *Wintering*: Common in the coastal area of Worcester County; fairly common elsewhere in the tidewater areas of the Eastern Shore and Western Shore sections; rare in the tidewater areas of the Upper Chesapeake section. *Summer vagrant*: Rare in the coastal area of Worcester County.

HABITAT.—Usually in salt-water areas, including the ocean, coastal bays, and lower Chesapeake Bay; during migration also occurs sparingly on brackish tideswaters and rarely on fresh water.

SPRING MIGRATION.—*Normal period*: March 5–15 to May 15–20; peak, March 20 to April 15. *Extreme arrival dates*: March 2, 1885, in Kent County (H. Brown); March 21, 1937, in Garrett County (M. G. Brooks). *Extreme departure dates*: May 23, 1948, May 21, 1949, and May 21, 1953 (J. M. Cadbury, D. A. Cutler), all in the Ocean City area.

FALL MIGRATION.—*Normal period*: October 25–30 to December 5–20; peak, November 5 to December 10. *Extreme arrival date*: September 24, 1954, in Anne Arundel and Kent Counties (Mrs. V. L. Henderson, Mrs. G. Tappan). *Extreme departure date*: December 19, 1900, in Allegany County (Eifrig, 1904).

MAXIMUM COUNTS.—*Spring*: 50 on March 24, 1947, and 29 on April 6, 1946, in the Ocean City area. *Fall*: 84 in the Ocean City area on November 24, 1946. *Winter* (Christmas counts): 292 in the Ocean City area on December 27, 1953; 35 in the Wicomico River area, Charles and St. Marys Counties, on December 31, 1950; 33 in the Solomons Island area, Calvert County, on December 21, 1946.

Family PODICIPEDIDAE

RED-NECKED GREBE *Podiceps grisegena* (Boddaert)

STATUS.—*Transient*: Rare (uncommon in spring of 1948) in tidewater and inland fresh water areas of all sections. *Wintering*: Rare in the tidewater areas of the Eastern Shore and Western Shore sections.

HABITAT.—Open salt, brackish, and fresh waters, including the ocean, bays, estuaries, lakes, reservoirs, and rivers.

SPRING MIGRATION.—*Normal period*: March 1–10 to April 1–10, peak, March 10 to March 25. *Extreme arrival date*: February 28, 1894, in Baltimore County (F. C. Kirkwood). *Extreme departure date*: May 11, 1929, in Prince Georges County (H. C. Oberholser).

FALL MIGRATION.—*Normal period*: About November 5 to December 5. *Extreme departure dates*: December 26, 1951, in Montgomery County (S. H. Low); December 3, 1938, in Garrett County (M. G. Brooks).

MAXIMUM COUNTS.—*Spring*: 6 in the District of Columbia during March 16–21, 1948 (F. R. Bell, I. R. Barnes); 5 at Ocean City on March 14, 1948 (J. E. Willoughby); 5 at Seneca, Montgomery County, on March 19–21, 1948 (T. W. Donnelly, I. R. Barnes); 3 at Cobb Island, Charles County, on March 20, 1948; 3 at Triadelphia Reservoir, Montgomery County, on March 20 and April 1, 1948 (W. M. Davidson, S. H. Low). *Fall*: 2 at Deep Creek Lake, Garrett County, on November 11, 1937 (M. G. Brooks). *Wintering*: 8 at Ocean City on December 27, 1955 (Christmas count); 5 at Sycamore Island, Montgomery County, on January 3, 1953 (E. J. Stivers).

HORNED GREBE *Podiceps auritus* (Linnaeus)

STATUS.—*Transient*: Abundant in the tidewater areas of Eastern Bay and the Choptank River; common elsewhere in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the interior of all sections. *Wintering*: Common in the tidewater areas of the Eastern Shore and Western Shore sections; uncommon in the tidewater areas of the Upper Chesapeake section; casual elsewhere—recorded at Lake Ashburton, Baltimore, in 1938, 1940, and 1942 (H. Brackbill), at New Market, Carroll County, in 1881 (H. H. Hopkins), on Triadelphia Reservoir on December 24, 1955, and on Deep Creek Lake in Garrett County on January 3, 1954 (M. G. Brooks). *Summer vagrant*: Casual in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections—recorded

Worcester, Somerset, Anne Arundel (A. E. Conway), Harford, and Cecil (M. B. Meanley) Counties.

HABITAT.—Salt, brackish, and fresh waters, including the ocean, bays, estuaries, lakes, ponds, and reservoirs. In winter, most numerous on the ocean, coastal bays, and central and lower Chesapeake Bay.

SPRING MIGRATION.—*Normal period:* March 5–15 to May 10–15; peak, March 25 to April 25. *Extreme arrival date:* March 4, 1953, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan). *Extreme departure dates:* June 2, 1950, in Anne Arundel County (Mrs. W. L. Henderson); May 28, 1927, in the District of Columbia (W. H. Ball); May 23, 1952, in Prince Georges County.

FALL MIGRATION.—*Normal period:* October 10–20 to December 10–15; peak, October 25 to November 20. *Extreme arrival date:* September 21, 1954, in Anne Arundel County (Mrs. W. L. Henderson, et al.). *Extreme departure dates:* December 29, 1949 (H. Colb), and December 14, 1940 (H. Brackbill), in Baltimore County; December 3, 1935, in Garrett County (M. G. Brooks).

MAXIMUM COUNTS.—*Spring:* 1,000 at Point Lookout, St. Marys County, on April 13, 1955 (P. G. DuMont, E. Hall); 210 at Parsonage Island, Queen Annes County, on April 1, 1948; 123 in the South River area, Anne Arundel County, on April 9, 1954; 122 on lower Patuxent River on April 13, 1954; 17 at Lake Ashburton, Baltimore County, on April 12, 1940 (H. Brackbill). *Fall:* 830 in Charles and St. Marys Counties on November 26, 1955 (P. G. DuMont, E. Hall); 113 on the Patuxent River on November 22, 1955; 50 in the District of Columbia on October 30, 1930 (W. L. McAtee); 30 at Mountain Lake, Garrett County, on November 2, 1951 (H. E. Slater). *Winter:* 1,737 at St. Michaels, Talbot County, on December 29, 1953 (Christmas count); 371 at Ocean City on December 27, 1954 (Christmas count); 250 at Point Lookout, St. Marys County, on January 31, 1954 (J. W. Terborgh); 229 in the Annapolis area on January 2, 1955 (Christmas count).

PIED-BILLED GREBE *Podilymbus podiceps* (Linnaeus)

STATUS.—*Breeding:* Uncommon in the tidewater areas of the Eastern Shore and Western Shore sections; rare in the interior of the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections. Eggs or small young have been recorded in Anne Arundel and St. Marys Counties (Court, 1936), in Baltimore County (C. M. Buchanan), and in Prince Georges and Worcester Counties. *Transient:* Common in tidewater and inland-water areas of all sections. *Wintering:* Uncommon in the tidewater

areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare or casual on inland areas of all sections (no definite winter records for the Ridge and Valley section). *Summer vagrant*: Rare in all sections.

HABITAT.—Usually on ponds or streams that are fringed with emergent marsh vegetation; occasional in open bays and estuaries.

NESTING SEASON.—Nests with eggs were found in Anne Arundel County on June 3, 1932 (Court, 1936), and in Prince Georges County on June 4, 1954. Downy young were observed in Worcester County on July 9, 1948, and August 11, 1955; in Baltimore County (C. M. Buchanan) on June 15, 1951; and in Prince Georges County on July 10, 1956 (C. G. Webster).

SPRING MIGRATION.—Normal period: February 25–March 5 to May 1–10; peak, March 20 to April 20. *Extreme arrival dates*: February 14, 1949, in Prince Georges County; February 22, 1922, in the District of Columbia (Mrs. C. A. Aspinwall). *Extreme departure dates*: May 25, 1950, in Baltimore County (P. Heaps); May 15, 1920, in Montgomery County (Mrs. C. A. Aspinwall).

FALL MIGRATION.—*Normal period*: August 10–20 to December 1–10; peak, September 10 to November 10. *Extreme arrival dates*: July 15, 1899 (E. A. Preble), and July 21, 1929 (W. H. Ball), in District of Columbia; July 21, 1944, in Prince Georges County. *Extreme departure dates*: December 17, 1953, in Prince Georges County; December 15, 1935, in Garrett County (M. G. Brooks).

MAXIMUM COUNTS.—*Spring*: 82 in the Port Tobacco area, Charles County, on March 7, 1954 (A. R. Stickley, Jr.); 29 at Beltsville, Prince Georges County, on March 28, 1954 (L. W. Oring, S. Karlin); 20+ in the District of Columbia on April 1, 1922 (M. J. Pellew). *Summer vagrant*: 8 in the District of Columbia during early June 1922 (L. P. Callaghan). *Fall*: 80 in the Newport Bay area, Worcester County, on November 1, 1951; 5 on Bush River, Harford County, on October 3, 1948; 34 in the District of Columbia on October 9, 1929 (W. H. Ball); 33 in the Elliott Island area, Dorchester County, on October 2, 1948; 30 on Northeast River, Cecil County, on September 30, 1952 (Mrs. W. L. Henderson); 26 on Mountain Lake, Garrett County, on November 3, 1951 (H. E. Slater). *Winter*: 79 in the Annapolis area on January 2, 1955 (Christmas count); 46 at Port Tobacco, Charles County, on January 27, 1953 (A. R. Stickley, Jr.); 43 in Ocean City area on December 21, 1952 (Christmas count); 33 in Wicomico River area, Charles and St. Marys Counties, on December 28, 1952 (Christmas count); 26 in the Susquehanna Flats area

urford and Cecil Counties, on January 2, 1950 (Christmas
nt).

BANDING.—One banded in Prince Georges County on September
1943, was found dead in central Minnesota (Kandiyohi County)
November 21, 1944.

Family PROCELLARIIDAE

MORY'S SHEARWATER *Puffinus diomedea* (Scopoli)

STATUS.—Fairly common summer visitor along the coast. This
pecies was recorded between 2 and 10 miles offshore from Ocean
ty as follows: 29 observed on August 8, 1947; 3 on August 21,
48 (S. H. Low, P. F. Springer); 65 on August 24, 1946; 2 on
eptember 9, 1950. On June 22, 1956, approximately 80 were
served between 15 and 25 miles offshore from Assateague
land.

GREATER SHEARWATER *Puffinus gravis* (O'Reilly)

STATUS.—Casual visitor along the coast. Seven were observed
short distance offshore from Assateague Island on May 17,
1947. Five or 6 were repeatedly seen a short distance offshore
om Ocean City during the period May 9–13, 1949 (E. G. Davis,
. J. Beaton, E. G. Baldwin), and 2 were seen in this same area
n May 14, 1955.

AUDUBON'S SHEARWATER *Puffinus lherminieri* Lesson

STATUS.—Hypothetical. After the great storm of August 1842,
shearwater, doubtfully referred to as this species, was captured
n the District of Columbia (Coues and Prentiss, 1861). Coues
1864) later referred to this record and stated that it "has since
een definitely ascertained to be this species." The specimen can-
ot now be found.

MEECH'S PETREL *Oceanodroma leucorhoa* (Vieillot)

STATUS.—Rare vistor along the coast and in tidewater areas
lsewhere in the Eastern Shore and Western Shore sections. On
une 11, 1894 (not 1895 as in Kirkwood, 1895), 2 were seen 3
miles out from Ocean City; and 2 others were noted 8 miles out on
August 9, 1901 (F. C. Kirkwood). Specimens (USNM) have been
aken in the District of Columbia as follows: 2 in August 1842;
about 1859; 1 on June 7, 1891 (W. Bayley); 1 on August 29
nd 1 on August 30, 1893 (W. Palmer); 1 (out of 5 seen) on
October 4, 1930 (Ball, 1931a); and 1 on August 24, 1933 (Lin-
coln, 1934). Another specimen was obtained at Royal Oak, Tal-
ot County, on October 17, 1954 (R. L. Kleen). On August 25,

1933, 25 were seen on the Potomac River between Haines Point in the District of Columbia and Mount Vernon, Virginia (H. Deignan).

HARCOURT'S PETREL *Oceanodroma castro* (Harcourt)

STATUS.—Accidental visitor. Two were collected (USNM) in the District of Columbia, 1 on August 28 and 1 on August 29, 1893, after a hurricane had passed up the Atlantic coast (Pomeroy, 1897b).

WILSON'S PETREL *Oceanites oceanicus* (Kuhl)

STATUS.—*Summer visitor*: Common offshore along the coast, rare in the coastal bays and other tidewater areas of the Eastern Shore and Western Shore sections. Records on inland bays and estuaries are as follows: One taken near Washington, D. C., August 1842 (McAtee, 1918); 1 collected in 1859 (USNM—catalogued on July 20, 1859) on the Potomac River (Wetmore, 1925); 1 collected (USNM) at Marshall Hall, Prince Georges County, June 27, 1914 (Swales, 1920); 1 seen near Chesapeake Beach, Calvert County, on July 31, 1915 (A. K. Fisher) and 1 collected there (USNM) on June 21, 1924 (Wetmore, 1925); 1 collected at Kenwood Beach in Calvert County on July 24, 1935 (Kolb and Bond, 1943); 9 seen (1 collected—USNM) on Chincoteague Beach, Worcester County, on July 3, 1945 (Stewart and Robbins, 1947).

HABITAT.—Preferably the pelagic zone of the ocean, 2 or more miles offshore.

EXTREME DATES OF OCCURRENCE.—June 21, 1924, in Calvert County (Wetmore, 1925) and September 9, 1950, off Ocean City.

MAXIMUM COUNTS.—162 on August 8, 1947, off Ocean City; 50 on August 21, 1948, off Ocean City (P. F. Springer); 30 on September 9, 1950, off Ocean City. On June 22, 1956, approximately 750 were observed between 15 and 25 miles offshore from Assateague Island, Maryland.

Family PELECANIDAE

WHITE PELICAN *Pelecanus erythrorhynchos* Gmelin

STATUS.—Accidental visitor. A male was shot in Garrett County near Oakland on April 31, 1887, by a 14-year-old boy; the head was mounted—Anon., Forest and Stream 28 (16): 345, March 12, 1887. One was recorded as having been shot near the mouth of the Chester River and another in Upper Chesapeake Bay, dates not given (Burns, 1932). One bird, recorded by Cooper (1929) as having been collected in the District of Columbia in 1863 by C. Drexler, was actually taken by Drexler near Alexan-

ria, Virginia, in April 1864; this specimen was correctly catalogued (USNM) under the number 33701, but was later mistakenly reentered under number 41793 as having been collected in the District of Columbia in 1863.

ROWN PELICAN *Pelecanus occidentalis* Linnaeus

STATUS.—Casual visitor in the tidewater areas of the Eastern Shore and Western Shore sections. A specimen in the old collection of the Maryland Academy of Sciences was reported to have been taken on the lower Potomac River (Kirkwood, 1895). A mounted bird that had been shot on Chincoteague Bay on April 1, 1906, was examined in Worcester County (F. C. Kirkwood). Another mounted specimen owned by Mr. Ethan A. Carey of Berlin, Maryland, was reported to have been shot about 1922 near the Isle of Wight Coast Guard Station, north of Ocean City; and Mr. Carey claimed that he had seen single birds on 2 occasions since that time (Stewart and Robbins, 1947a). A flock of 4 was seen on Assateague Island, 6 miles south of Ocean City, on May 2, 1935 (Cottam and Uhler, 1935). One was seen at Solomons Island in Calvert County during the period September 28 to November 1, 1935, by Dr. R. V. Truitt (Hampe and Kolb, 1947) and another was seen there by the same observer on October 10, 1936. One was seen on the Potomac River in Prince Georges County, 5 miles south of Alexandria, Virginia, on June 13, 1953 (C. Cottam), and 1 at St. Michaels, Talbot County, on September 1, 1956 (R. L. Kleen, et al.).

Family SULIDAE

WANNET *Morus bassanus* (Linnaeus)

STATUS.—*Transient*: Fairly common in the coastal area of Worcester County; uncommon in the lower part of Chesapeake Bay (St. Marys, Calvert, Somerset, and Dorchester Counties); rare in the upper part of Chesapeake Bay—records for Anne Arundel (C. Symington), Kent (A. P. Sharp), and Queen Annes (A. J. Duvall) Counties. *Wintering*: Uncommon in the coastal area of Worcester County and in the lower part of Chesapeake Bay.

HABITAT.—Littoral and pelagic zones of the ocean and the deeper salt water portions of Chesapeake Bay.

PERIOD OF OCCURRENCE.—*Extreme dates*: September 16, 1901, at Ocean City (E. F. Armstrong) and May 20, 1950, near Ocean City. *Approximate periods of greatest abundance*: October 25 to December 5, and March 25 to May 5.

MAXIMUM COUNTS.—*Spring*: 80 during the period May 1-1953, off Assateague Island (R. Strosnider); 35 off Point Lookout in St. Marys County on April 3, 1954 (J. W. Terborgh, et al. *Fall*: 100+ on December 5, 1915, on Chesapeake Bay below the Patuxent River (C. R. Shoemaker); 75 on November 4, 1951, Ocean City (W. B. and D. C. Grautoff). *Winter*: 9 on February 20, 1949, at Ocean City; 5 at Solomons Island, Calvert County, December 21, 1946.

Family PHALACROCORACIDAE

[GREAT CORMORANT] *Phalacrocorax carbo* (Linnaeus)

STATUS.—Hypothetical. Sight records of single birds believed to be this species were reported from the Ocean City inlet on the following dates: December 13 and December 27, 1950 (Buckalew 1951a); December 31, 1952 (S. Fisher, L. W. Oring, J. L. Wright); February 26, 1950. A specimen collected on June 1859, in the District of Columbia (USNM) was said to have been of this species, but in view of the lateness of the date and the fact that the specimen cannot now be found, the record must remain hypothetical.

DOUBLE-CRESTED CORMORANT *Phalacrocorax auritus* (Lesson)

STATUS.—*Transient*: Common in the coastal area of Worcester County; fairly common in tidewater areas elsewhere in the Eastern Shore and Western Shore sections; uncommon in the Allegheny Mountain section and in the tidewater areas of the Upper Chesapeake section; rare elsewhere in the interior of all sections. *Wintering and summer vagrant*: Uncommon in the tidewater areas of the Eastern Shore and Western Shore sections. One adult in breeding plumage was observed in the Pocomoke River swamp on June 16, 1946.

HABITAT.—Mostly on open salt water, including the ocean, bays, and larger estuaries; occasional on brackish and fresh water.

SPRING MIGRATION.—*Normal period*: February 25–March 5; May 20–30; peak, March 25 to May 15. *Extreme arrival dates*: February 8, 1953, in Charles County (M. C. Crone, A. R. Stickle, Jr.). *Extreme departure dates*: June 13, 1955, in Prince George's County (F. M. Uhler); June 5, 1948, in Calvert County; June 1953, in Queen Annes County (Mrs. G. Tappan, Mrs. W. L. Henderson); June 2, 1927, in the District of Columbia (W. W. Rubey).

FALL MIGRATION.—*Normal period*: August 5–15 to November 15–25; peak, September 10 to November 1. *Extreme arrival dates*: August 4, 1945, in Worcester County; August 4, 1946,

alvert County (F. M. Uhler); August 4, 1952, in Prince Georges county.

MAXIMUM COUNTS.—*Spring*: 4,600 in the Ocean City area on May 11, 1952 (D. A. Cutler); 4,000 at Gibson Island, Anne Arundel County, on May 5, 1956 (Mrs. W. L. Henderson); 450 at Point Lookout, St. Marys County, on April 6, 1953; 388 on Chesapeake Bay, Calvert County, on April 20, 1954; 300 in the South Marsh Island area, Somerset County, on April 28, 1946. *Fall*: 1,200 in the Ocean City area on October 25, 1949; 42 in the mouth of the Chester River, Queen Annes County, on September 3, 1952 (Mr. and Mrs. W. L. Henderson). *Winter*: 29 at Cobb Island, Charles County, on January 8, 1953 (A. R. Stickley, Jr., I. C. Crone); 16 in the Ocean City area on December 27, 1955 (Christmas count).

BANDING.—Twelve birds, recovered in tidewater Maryland during spring (April 21–May 11) and fall (September 26–November 18), had been banded on the breeding grounds as young birds during the period June 26–August 4 in the following areas: 3 in central Ontario (southern Algoma District); 7 on the coast of Maine (Lincoln County); and 2 in southeastern Quebec (Kamouraska County).

Family ANHINGIDAE

ANHINGA *Anhinga anhinga* (Linnaeus)

STATUS.—Accidental visitor. A specimen in the old collection of the Maryland Academy of Sciences was reported to have come from the Pocomoke River (Kirkwood, 1895). Another specimen, formerly in the old Peale collection, was reported to have been shot prior to 1805 at Elkridge Landing on the Patapsco River (Burns, 1932).

Family ARDEIDAE

GREAT BLUE HERON *Ardea herodias* Linnaeus

STATUS.—*Breeding*: Fairly common locally in the Eastern Shore and Western Shore sections (nesting colonies have been located in Worcester, Wicomico, Talbot, Queen Annes, St. Marys, Calvert, Charles, Prince Georges, and Anne Arundel Counties); uncommon and local in the Upper Chesapeake section (one large colony located in Cecil County). See figure 3. *Transient*: Common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the interior of all sections. *Wintering*: Uncommon in the tidewater areas; rare

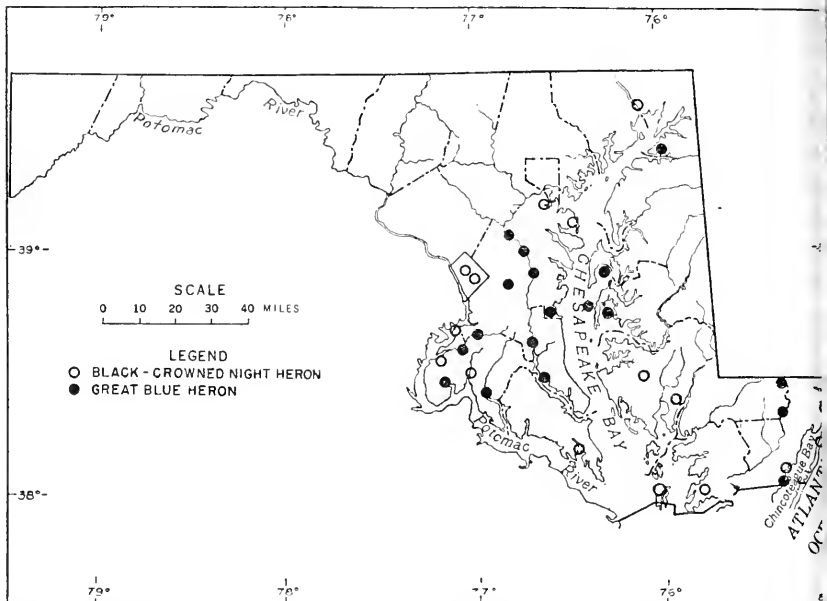


FIGURE 3.—Breeding colonies of Great Blue Heron and Black-crowned Night Heron.

in the interior of the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections. *Summer vagrant*: Fairly common in all sections.

HABITAT.—*Breeding*: Heavily wooded flood-plain or swampland forests along streams; also in dense patches of scrubby, coniferous and deciduous trees that are located adjacent to salt marshes. *Transient and wintering*: Various water margin types along ponds, lakes, streams, bays, and estuaries.

NESTING SEASON.—Mid-March to mid-July. *Extreme nesting dates* (21 records): March 20, 1949, in Anne Arundel County (Mrs. W. L. Hunt) and July 20, 1941, in Charles County (F. M. Uhler). Nestlings were banded in Cecil County as early as March 21, 1939 (F. C. Schmid).

APPROXIMATE MIGRATION PERIODS.—*Spring*: February 25 to May 15; peak, March 15 to April 25. *Fall*: July 15 to December 15; peak, August 1 to November 1.

MAXIMUM BREEDING POPULATIONS.—300 nests in the colony near Earleville, Cecil County in 1943 (R. O. Bender); 100 occupied nests in a colony in the Pocomoke Swamp in Wicomico County in 1948.

MAXIMUM COUNTS.—*Spring*: 60 at Allens Fresh, Charles County, on March 29, 1953 (J. W. Terborgh). *Fall*: 82 along the

omac River in Prince Georges and Charles Counties on September 19, 1927 (H. H. T. Jackson). *Winter* (Christmas counts): in the Ocean City area on December 27, 1954; 60 near Port Jaccos, Charles County, on December 27, 1941; 54 in the Annapolis area on January 2, 1955.

BANDING.—Out of 245 nestlings banded in Cecil County in late May and early June of 1938, 1939, 1940, and 1941 by F. C. Schmid and J. A. Gillespie, 18 were subsequently recovered away from the nesting colony. Fifteen of these were killed during the first fall winter and show the same pattern of northward wandering as is typical of other species of herons. As early as July 9 a young bird was found dead on the coast of Long Island. Between mid-May and mid-October another was taken in southern New York, 1 in Connecticut, 3 in New Jersey, and 1 along the Big Gunpowder River in Carroll County, Maryland. It is interesting that birds recovered during their first winter are scattered from Maryland (Carroll and Harford Counties) and New Jersey (2 records) to southern Florida and northern Cuba (Matanzas). Adult birds as well as young ones take long migratory flights as shown by recoveries of 1½ to 6-year-old birds in central Florida and the Bahamas (Man-of-War Cay), respectively.

GREEN HERON *Butorides virescens* (Linnaeus)

STATUS.—*Breeding and transient:* Common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections (during the breeding season, scattered pairs and occasional colonies comprising from 6 to 20 pairs occur); fairly common in the interior of all sections. *Wintering:* Casual in the Eastern Shore, Western Shore, and Upper Chesapeake sections—recorded in Worcester (1953–54), St. Marys (1940–41), Anne Arundel (1952–53, 1954–55), and Baltimore (1952–53, 1953–54) counties.

HABITAT.—*Breeding:* In tidewater areas that contain a combination of wooded or brush habitats and tidal marshes; also in the interior along wooded stream bottoms and along the wooded margins of lakes and ponds. *Transient:* Various water-margin or shallow-water habitats.

NESTING SEASON.—Mid-April to early August (peak, mid-May to late June). *Extreme egg dates* (82 nests): April 21, 1948, in Worcester County and July 8, 1891 (H. B. Stabler) in Montgomery County. *Extreme nestling dates* (13 nests): May 30, 1901, in Kent County (Fisher, 1892) and August 3, 1954, in Dorchester County.

PERIOD OF REGULAR OCCURRENCE.—*Normal period*: April 1 to November 1–10. *Period of greatest abundance*: April 25 September 10. *Extreme dates of spring arrival*: March 16, 19 in Harford County (S. Mason, Jr.); March 23, 1947, in Dorches County; March 28, 1948, in the District of Columbia; March 1946, in St. Marys County. *Extreme fall departure date*: November 20, 1948, in Dorchester County (M. B. Meanley).

MAXIMUM COUNTS.—27 in the Ocean City area on May 11, 1921 in the District of Columbia on May 11, 1917 (H. C. Okholser); 18 at Port Tobacco, Charles County, on May 6, 1938 (Cottam, A. L. Nelson).

LITTLE BLUE HERON *Florida caerulea* (Linnaeus)

STATUS.—*Breeding*: Fairly common in the coastal area of Worcester County (3 colonies located); rare and local elsewhere in Eastern Shore and Western Shore sections—nesting in Dorches County (P. J. Van Huizen) and in St. Marys County (E. Court); probably nesting along the Pocomoke River, and in vicinity of Port Tobacco, Charles County, since repeated observations of adult birds have been made in these two areas during April, May, and June in recent years. Adults have also been recorded during the breeding season at Cobb Island and Zek Swamp in Charles County and at the Marshall Dierssen Refuge (J. W. Terborgh, et al.) in Montgomery County. *Postbreeding transient*: Common in the Eastern Shore, Western Shore, Upper Chesapeake sections; fairly common in the Piedmont, Ridge and Valley sections; uncommon in the Allegheny Mountain section. *Wintering*: Rare in the tidewater areas of the Eastern Shore and Western Shore sections.

HABITAT.—*Breeding*: Usually in dense patches of scrubby young trees adjacent to tidal marshes. *Transient*: Nearly all types of water-margin or shallow-water habitats.

NESTING SEASON.—Mid-April to mid-July. *Extreme nesting dates* (5 records): June 6, 1953, and July 15, 1946.

SPRING MIGRATION.—*Extreme arrival dates*: March 26, 1950 in Worcester County (Mr. and Mrs. J. Enoch Johnson); March 1948, in Calvert County (F. M. Uhler); April 1, 1948, in Wicon County. *Spring vagrant*: One on June 1, 1950, at Patuxent Refuge in Prince Georges County (K. Laub); and another in Howard County on May 5, 1956.

POSTBREEDING MOVEMENT.—*Normal period*: July 1–10 to October 5–15; peak, July 25 to September 10. *Extreme arrival date*: June 20, 1929, in the District of Columbia (W. H. Ball); June

9, in Prince Georges County. *Extreme departure dates*: November 23, 1946, in Dorchester County; November 5, 1951, in Queen Annes County (Mrs. W. L. Henderson).

MAXIMUM BREEDING POPULATIONS.—125 pairs in the colony on Assateague Island, Worcester County, on July 6, 1946.

MAXIMUM COUNTS.—*Postbreeding*: 650 along the Potomac River in Prince Georges County and the District of Columbia on August 28, 1930 (H. C. Oberholser); 90 in the District of Columbia on August 8, 1928 (W. H. Ball); 75 on Assateague Island, Worcester County, on August 14, 1948; 60 on the Gunpowder River marshes on August 5, 1902 (W. B. Evans); 52 in Dorchester County on August 31, 1946. *Wintering*: 2 in the District of Columbia on December 18, 1948 (F. C. Cross); 1 in the Ocean City area on February 20, 1949.

TITLE EGRET *Bubulcus ibis* Linnaeus

STATUS.—Casual visitor. One was recorded on April 25, 1953, in Berlin, Worcester County. Another was seen near Bucktown, Dorchester County, on May 1 and 8, 1955 (E. Rogers, K. Stecher).

COMMON EGRET *Casmerodius albus* (Linnaeus)

STATUS.—*Breeding*: Fairly common locally in the coastal area of Worcester County and in the Pocomoke River swamp; rare and local elsewhere in the Eastern Shore and Western Shore sections—and nesting near Marbury in Charles County in 1931 (Court, 1936) and on Bodkin Island in Queen Annes County in 1954 (V. Stotts). *Postbreeding transient*: Common in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Piedmont, Ridge and Valley, and Allegheny Mountain sections. *Wintering*: Rare in the tidewater areas of the Eastern Shore and Western Shore sections; casual in the Upper Chesapeake section—1 remained during the winter of 1952–53 near Chase in Baltimore County (O. W. Crowder). *Spring migrant*: Casual in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections.

HABITAT.—*Breeding*: Near streams in heavily wooded swamp forests; also in dense patches of scrubby coniferous and deciduous forests adjacent to salt marshes. *Transient*: Water-margin habitats including ponds, lakes, and streams, and in marshes.

NESTING SEASON.—Early April to early July. *Extreme nesting dates* (9 records): April 1, 1950, in Wicomico County and July 6, 1946, in Worcester County.

POSTBREEDING MOVEMENT.—*Normal period*: June 10–20 to November 5–15; peak, July 15 to September 10. *Extreme arrival*

dates: May 27, 1926, in the District of Columbia (Mrs. T. Knappen); May 30, 1891, in the District of Columbia (W. P. Mer); June 1, 1950, in Prince Georges County. *Extreme departure date*: November 19, 1948, in Dorchester County.

MAXIMUM COUNTS.—*Transient*: 1,000+ at Fort Foote, Prince Georges County, on August 26, 1951 (J. M. Abbott); 120 in the Elliott Island area, Dorchester County, on October 2, 1948; 100 in the District of Columbia on September 9, 1930 (W. L. McAtee); 87 in the Chincoteague Bay area on August 7, 1948; 85 near Nottingham along the Patuxent River on August 21, 1947; 75 near Baltimore on August 26, 1945 (H. Brackbill); 71 at Sandy Point, Anne Arundel County, on July 17, 1948 (J. E. Willoughby). *Winter*: 8 in Dorchester County on December 22, 1952 (Christman count).

SNOWY EGRET *Leucophoyx thula* (Molina)

STATUS.—*Breeding*: Fairly common in the coastal area of Worcester County and on Smith Island in Somerset County; possibly breeds elsewhere near tidewater in Somerset, Wicomico, and southern Dorchester Counties, since numerous observations of adults have been recorded in this area during the breeding season in recent years. *Postbreeding transient*: Fairly common in the tidewater areas of the Eastern Shore and Western Shore sections; uncommon in the tidewater areas of the Upper Chesapeake section; rare in the interior of the Eastern Shore, Western Shore, and Upper Chesapeake sections. *Spring vagrant*: Casual in the Eastern Shore, Western Shore, and Upper Chesapeake sections.

HABITAT.—*Breeding*: Dense patches of scrubby or second-growth coniferous and deciduous trees adjacent to extensive areas of salt marsh. *Transient*: Usually in tidewater areas along ponds and streams, and in marshes.

NESTING SEASON.—Late April to mid-July. *Extreme nesting dates* (5 records): May 1, 1946, and July 15, 1946, in Worcester County.

SPRING MIGRATION.—*Extreme arrival dates*: March 31, 1948, in Dorchester County; April 2, 1955 (A. S. Kaestner), in Anne Arundel County. *Spring vagrant records*: 1 at Middle River, Baltimore County, on May 2, 1950 (E. Willis); 1 at Patuxent Refuge, Prince Georges County, on May 16, 1945.

POSTBREEDING MOVEMENT.—*Normal period*: July 10–20 to October 25–November 5; peak, August 1 to October 5. *Extreme arrival date*: July 8, 1947, in Prince Georges County. *Extreme*

parture date: November 6, 1948, at the mouth of the Patapsco river (E. La Fleur).

MAXIMUM BREEDING POPULATIONS.—50 pairs at the Mills Island lony in Worcester County on July 6, 1946, and 100 pairs on ne 25, 1956.

MAXIMUM COUNTS.—*Postbreeding*: 175 at Mills Island, Worcester County, on July 15, 1946; 104 at West Ocean City on September 7, 1955 (Mr. and Mrs. I. C. Hoover); 101 on Assateague and, Worcester County, on September 5, 1948; 25 in the Elliott and marsh, Dorchester County, on October 2, 1948; 20 at Sandy Point, Anne Arundel County, on September 1, 1947 (J. W. Taylor, .); 20 at Fairhaven, Anne Arundel County, on August 25, 1948 (M. Thatcher).

BANDING.—One banded as a nestling on July 13, 1947, in Worcester County was trapped and released on August 16, 1947, on Chincoteague National Wildlife Refuge on the coast of Virginia (1 miles from the point of banding).

LOUISIANA HERON *Hydranassa tricolor* (Müller)

STATUS.—*Breeding*: Uncommon and local in the Chincoteague area of Worcester County—from 3 to 5 pairs in a mixed heron lony on Mills Island in 1946 and 1947, at least 8 pairs in 1953, and about 25 pairs in 1956. *Postbreeding transient*: Uncommon in the coastal area of Worcester County; rare in the tidewater areas elsewhere in the Eastern Shore and Western Shore sections. *Wintering vagrant*: Casual in the Western Shore section—4 observed at Point Lookout, St. Marys County, on April 12, 1952 (J. W. Rborgh).

HABITAT.—*Breeding*: Patches of scrubby or second-growth trees adjacent to salt marshes. *Transient*: Marginal habitats in salt marshes.

NESTING SEASON.—Late April to mid-July. *Extreme nesting dates* (4 records): June 6, 1953, and July 13, 1947.

POSTBREEDING MOVEMENT.—*Normal period*: July 20–25 to September 10–20; peak, July 25 to September 1. *Extreme arrival date*: July 17, 1927, in the District of Columbia (W. H. Ball). *Extreme departure date*: September 27, 1949, at Ocean City.

MAXIMUM COUNTS.—*Postbreeding*: 10 at Sandy Point, Anne Arundel County, on July 31, 1948 (E. Arnold); 5 at Blackwater Refuge, Dorchester County, on August 23, 1956 (P. F. Springer); 1 at Ocean City on July 24, 1949.

BLACK-CROWNED NIGHT HERON *Nycticorax nycticorax* (Linnaeus)

STATUS.—*Breeding*: Fairly common locally in the Eastern Shore and Western Shore sections—colonies have been located in Worcester, Somerset, Dorchester, Baltimore (F. C. Kirkwood), Charles (E. J. Court), Prince Georges (E. J. Court), and Annapolis (Le Compte, 1937) Counties and the District of Columbia; uncommon and local in the Piedmont section—colonies located along the Susquehanna River (O. W. Crowder) and in the District of Columbia (numerous observers). See figure 1. *Transient*: Fairly common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon in the interior of all sections. *Wintering*: Uncommon within the Eastern Shore section in the tidal marshes along Chesapeake Bay; rare elsewhere in the Eastern Shore section and in the Western Shore, Upper Chesapeake, and Piedmont sections; casual in the Ridge and Valley section—1 collected near Hagerstown on January 31, 1923 (R. Trovinger).

HABITAT.—*Breeding*: Usually in dense stands of young scrubby trees (occasionally in stands of mature trees) near tidewater or near inland ponds and streams. *Transient*: Various types of water-margin or shallow-water habitats.

NESTING SEASON.—Early February to early August (nesting peak, late March to mid-June). *Extreme egg dates* (6 records): February 3, 1950, in the District of Columbia (Davis, 1945) and May 19, 1899, in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (6 records): February 22, 1909, in the District of Columbia (A. K. Fisher) and July 15, 1946, in Worcester County.

MIGRATION DATES.—*Extreme spring arrival dates*: March 1945, in Prince Georges County; March 27, 1952, in Carroll County. *Extreme fall departure date*: October 17, 1894, in Baltimore County (A. Resler).

BREEDING POPULATIONS.—One hundred pairs at Linthicum Heights, Anne Arundel County, on May 17, 1936 (M. B. Meanley); 50 pairs at Mills Island, Worcester County, on July 6, 1946, and 75 pairs there on June 25, 1956.

MAXIMUM COUNTS.—*Spring*: 80 from the District of Columbia to Great Falls on May 12, 1913 (Mr. and Mrs. V. Bailey); 80 at the Elliott Island marsh, Dorchester County, on April 30, 1952; 75 in the Ocean City area on May 11, 1952 (D. A. Cutler). *Fall*: 64 in the Elliott Island marsh on September 26, 1949. *Winter*: 64 in the Elliott Island marsh on December 28, 1955 (Christman count).

BANDING.—Five birds recovered in the Eastern Shore section.

d been banded as nestlings in coastal localities from Cape Cod, Massachusetts, to Delaware. A Cape Cod bird was found wintering at Salisbury, while the others were all taken during the fall migration period. One of these was recovered as an adult on August 12, 1928, on the ocean $\frac{1}{2}$ mile off Ocean City.

YELLOW-CROWNED NIGHT HERON *Nyctanassa violacea* (Linnaeus)

STATUS.—*Breeding*: Rare and local in the Eastern Shore, Western Shore, and Piedmont sections—a small colony, comprising 7 nests in 1939, 5 nests in 1940, 2 nests in 1946 (Lawrence, 1946), and 3 nests in 1953 (L. Kilham), is located in Montgomery County near the junction of Seneca Creek and the Potomac River; in 1946 and 1947, at least one pair was present in the large mixed-species colony on Mills Island in Chincoteague Bay; an occupied nest was found in the District of Columbia in 1950 and 1951 (Criswell, 1951), and in 1952 (J. Criswell). It is probable that during recent years a small colony has existed in the vicinity of West Ocean City in Worcester County, since from 2 to 5 adults have been observed in this area repeatedly during the breeding season. Scattered observations of adults have been made during the breeding season on Assateague Island, along the Pocomoke River, near Chance in Somerset County, near St. Marys City in St. Marys County, along the Patuxent River in Prince Georges County, in Zekiah Swamp in Charles County (F. C. Cross), and near Emmitsburg (J. W. Richards) in Frederick County. *Post-breeding transient*: Uncommon in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare on the interior of all sections.

HABITAT.—*Breeding*: Flood-plain or swamp forests near streams; also in dense stands of young or scrubby trees adjacent salt marshes. *Transient*: Various water-margin or shallow-water types.

NESTING SEASON.—Mid-April to mid-July (probably). In 1953, a newly completed nest was found in Montgomery County on April 18, and on April 25 an adult was observed on the nest (L. Kilham). An occupied nest in the District of Columbia was found during the period May 6 to June 30, 1950 (Criswell, 1951). In 1939 a Montgomery County nest contained eggs on May 15 (W. H. Lawrence) and young on June 10 (E. Stoehr); in 1953, another nest at this location contained eggs on May 20, and young on June 6 (J. W. Terborgh).

PERIOD OF OCCURRENCE.—*Probable normal period*: April 10–20 to October 10–20; period of greatest abundance, April 25 to Sep-

tember 10. *Extreme occurrence dates*: April 18, 1953, in Montgomery County (L. Kilham) and October 18, 1947, in Baltimore County (R. M. Bowen).

MAXIMUM COUNTS (nonbreeding).—7 in the Ocean City area on August 22, 1948 (S. H. Low, P. F. Springer); 4 in the Ocean City area on September 4, 1948.

LEAST BITTERN *Ixobrychus exilis* (Gmelin)

STATUS.—*Breeding*: Common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake section during the breeding season, occasional birds have been observed in the interior in all sections—however, definite evidence of breeding is lacking from these inland areas except that 2 nests were found on Patuxent Refuge, Prince Georges County, in 1955 (F. Uhler). See figure 4. *Transient*: Common in the tidewater area

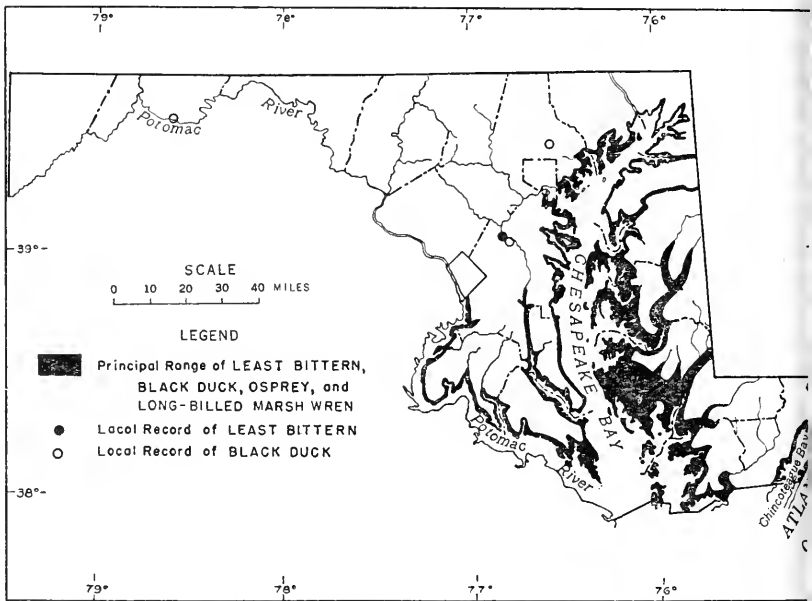


FIGURE 4.—Breeding ranges of Least Bittern, Black Duck, Osprey, Long-billed Marsh Wren.

of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon in the interior in all sections. *Wintering*: Casual in the tidewater areas—1 in the District of Columbia January 8, 1880 (P. L. Jouy); 1 on Carroll Island in Baltimore County on January 5, 1952 (T. A. Imhof).

HABITAT.—*Breeding*: Especially common in narrow-leaved (

il marshes; fairly common in other coarse marsh types, including reed and salt reed-grass; also of regular occurrence in weakly brackish marsh types, such as Olney three-square, when altered shrubs are present; occurs sparingly in the salt marshes needlerush and in salt-meadow grass when scattered shrubs of marsh elder or sea myrtle are present. *Transient*: Occurs in early all marsh habitats.

NESTING SEASON.—Late April to early August. *Extreme egg dates* (23 nests): May 10, 1916, in Dorchester County (Jackson, 1941) and July 12, 1950, in Baltimore County (E. Willis). *Extreme nestling dates* (7 nests): June 8, 1954, in Baltimore County (E. Willis) and July 14, 1950, in Baltimore County (E. Willis). One nestling observed on June 8, 1954, voluntarily left the nest upon the approach of the observer.

PERIOD OF REGULAR OCCURRENCE.—*Normal period*: April 20–30 to September 10–20; peak, May 5 to September 1. *Extreme arrival dates*: April 12, 1929, in the District of Columbia (W. H. Hall); April 18, 1936, at Mountain Lake, Garrett County (Brooks, 1936a). *Extreme departure dates*: November 7, 1954, in Montgomery County (R. R. Kerr); October 11, 1954, in Prince Georges County; September 25, 1954, in Montgomery County (S. H. Low).

AMERICAN BITTERN *Botaurus lentiginosus* (Rackett)

STATUS.—*Breeding*: Fairly common in the tidewater areas of Somerset, Wicomico, and Dorchester Counties; uncommon elsewhere in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare in the Allegheny Mountain section (Eifrig, 1904, and Brooks, 1944). See figure 5. *Transient*: Fairly common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon in the interior of all sections. *Wintering*: Uncommon in the tidewater areas of the Eastern Shore and Western Shore sections; rare in the tidewater areas of the Upper Chesapeake section. *Summer vagrant*: Casual in the interior of all sections.

HABITAT.—*Breeding*: Various marsh or marsh-meadow types, chiefly tidal and including narrow-leaved cattail, Olney three-square, needlerush, and switchgrass. *Transient*: Various marsh and marsh-meadow types. *Wintering*: Brackish and salt marsh and marsh-meadow types.

NESTING SEASON.—Three nests were found in or very near the District of Columbia on June 3, 1917, 1 containing 3 young ready to fly, another 3 young, 10 days old, and the third 4 hard-set eggs (Court, 1921); another nest containing 3 young and 1 egg was

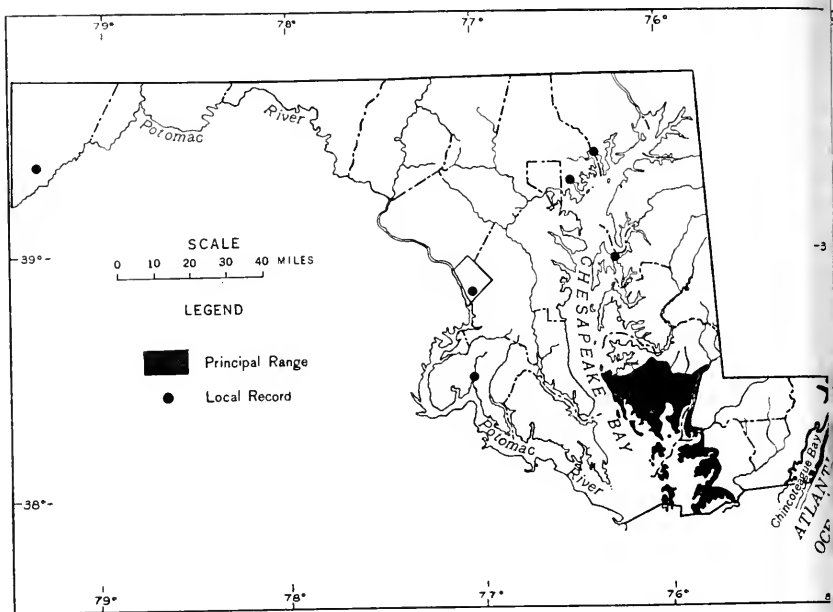


FIGURE 5.—Breeding range of American Bittern.

found near Dames Quarter in Somerset County on June 18, 1948; large nestlings were found on the Blackwater National Wildlife Refuge, Dorchester County, in early July 1953 (J. H. Steenis, V. R. Nicholson). Young birds out of the nest were recorded in Baltimore County on July 18, 1936 (M. B. Meanley), in Anne Arundel County on August 28, 1937 (E. A. McGinity), and in western Maryland (Allegheny or Garrett County) on June 30, 1902 (Eifrig, 1904).

SPRING MIGRATION.—*Normal period:* March 10–20 to May 15; peak, March 25 to April 25. *Extreme departure date:* May 21, 1949, in the District of Columbia (E. Arnold).

FALL MIGRATION.—*Normal period:* September 1–10 to November 1–10; peak, September 20 to October 20. *Extreme dates of arrival:* August 19, 1953, in Prince Georges County; August 22, 1917 (R. W. Moore) in the District of Columbia. *Extreme date of departure:* December 7, 1952, at Pennyfield in Montgomery County (R. M. Cole); November 29, 1949, in Dorchester County; November 16, 1937, in Garrett County (M. G. Brooks).

MAXIMUM COUNTS.—*Spring:* 5 at Chesapeake Beach, Calverton County, on March 27, 1948; 5 at Port Tobacco, Charles County, on May 6, 1933 (C. Cottam, A. L. Nelson). *Fall:* 3 in the Elliott Island marsh, Dorchester County, on November 17, 1948, and November

, 1949. *Winter* (Christmas counts): 7 in the Blackwater refuge area in Dorchester County on December 28, 1953; 6 in the Ocean City area on December 27, 1953.

Family CICONIIDAE

WOOD IBIS *Mycteria americana* Linnaeus

STATUS.—*Casual visitor*. One was collected (USNM) in Prince Georges County on July 28, 1851 (W. R. Young). One was reported to have been shot near Cumberland in Allegany County, about 1865 (Kirkwood, 1895). Two, an adult and an immature, were collected (USNM) "a short distance from the Washington Monument and on the Maryland side of the Potomac" on July 2, 1892 (Hasbrouck, 1893). One was reported seen in Baltimore County in Dulaney Valley on October 15, 1893 (Kirkwood, 1895). Three were shot in Prince Georges County in 1896 including an adult and an immature at Silver Hill on July 20, and an immature taken near Laurel on July 27 (Palmer, 1897a).

No other observations of this species were recorded until 1955 when 18 or 20 birds arrived at Gibson Island, Anne Arundel County, on June 24; many of these remained until July 23 (first seen by Capt. G. Fisher, and subsequently by numerous observers); were also observed in Anne Arundel County along the Patuxent River near Nottingham on July 12, 1955; a single was seen at the Patuxent Refuge, Prince Georges County, on July 24 and 30, 1955; were observed at Tilghman Island, Talbot County, on August 10, 1955 (J. Cummings); and 1 was recorded at Towson, Baltimore County, in mid-July (Mrs. W. Royal). On June 17, 1956, another was seen at Gibson Island (Dr. and Mrs. M. Stout).

Family THRESKIORNITHIDAE

GLOSSY IBIS *Plegadis falcinellus* (Linnaeus)

STATUS.—*Breeding*: Rare and local in the coastal area of Worcester County—2 pairs of adults and 2 young, three-fourths grown, recorded on Mills Island on June 25, 1956. *Transient*: Rare and irregular in the Eastern Shore and Western Shore sections—a specimen was procured near Baltimore and 2 others in the District of Columbia in about 1817, and the species was described as occurring on the Eastern Shore of Maryland at very irregular intervals in spring (Baird, et al., 1884); 1 was shot in the District of Columbia in September, 1900 (Daniel, 1901a); 1 was closely observed on Assateague Island, Worcester County, on June 11, 1950 (J. H. Buckalew, E. O. Mellinger); in Charles County, 1 was recorded at Port Tobacco on May 2, 1953 (M. C.

Crone, K. Keeley), and another was seen on Cobb Island on September 2, 1953 (Taylor, 1953); 2 were seen at Ocean City on September 4, 1955 (R. L. Kleen), and a single was recorded there on April 7, 1956 (P. A. Buckley).

Family ANATIDAE

[MUTE SWAN] *Cygnus olor* (Gmelin)

STATUS.—Hypothetical. This introduced species has been recorded twice in the tidewater areas of Maryland—3 were reported near Ocean City on February 12, 1954 (Mr. and Mrs. I. C. Hoover) and 3 immature birds were recorded at Gibson Island, Anne Arundel County, on January 22, 1955 (J. M. Abbott); 1 of the latter birds remained until January 28 (Mrs. W. L. Henderson; Mrs. G. Tappan).

WHISTLING SWAN *Olor columbianus* (Ord)

STATUS.—*Transient*: Locally common on Chesapeake Bay and adjoining estuaries in the Eastern Shore, Western Shore, and Upper Chesapeake sections (concentration areas include the Susquehanna Flats, Eastern Bay, and the Potomac, Patuxent, Magothy, Middle, Gunpowder, Bush, Sassafras, Chester, and Choptank Rivers); uncommon in the coastal area of Worcester County and in the interior of all sections. *Wintering*: Locally common on Chesapeake Bay and adjoining estuaries in the Eastern Shore, Western Shore, and Upper Chesapeake sections (concentration areas, same as during migration). *Summer vagrant*: Casual visitor—11 on Gunpowder River marsh on June 2, 1951 (W. A. Warns); 2 near Neavitt, Talbot County, through the summer of 1952 (R. L. Kleen); 12 on the Chester River during June and July 1955 (V. D. Stotts).

HABITAT.—Chiefly shallow, brackish estuarine waters that contain an abundance of aquatic plants such as wild celery, sago pondweed, and red-head pondweed. During migration, also occurs occasionally on inland ponds and lakes.

SPRING MIGRATION.—*Normal period*: March 1–10 to April 20–30; peak, March 10 to April 5. *Extreme arrival date*: February 14, 1947, in Prince Georges County. *Extreme departure dates*: May 27, 1955, in Washington County (S. C. Stauffer); May 28, 1951, in Queen Annes County (M. W. Hewitt); May 22, 1953, in Anne Arundel County; May 18, 1952, in Baltimore County (F. C. Cross).

FALL MIGRATION.—*Normal period*: October 15–25 to November 20–30; peak, October 25 to November 15. *Extreme arrival dates*

September 26, 1893, in Washington County (J. Leopold); 40 on the Patuxent River near Nottingham on October 1, 1938 (D. R.ascoyne). *Extreme departure dates*: December 16, 1902, in Garrett County (G. Eifrig); December 4, 1901, in Prince Georges county (B. Greenwood).

MAXIMUM COUNTS.—*Spring*: 15,000 on Susquehanna Flats on March 15, 1931 (C. Marburger); 3,000 in Gunpowder River area on March 15, 1951 (T. A. Imhof); 1,900 on Eastern Bay on March 5, 1950; 945 on the Bush River on March 18, 1951 (T. A. Imhof); 100 at Sandy Point, Anne Arundel County, on March 20, 1952 (S. H. Low); 400 on the Patuxent River on March 25, 1948. *Fall*: 1,000 on the Chester River on November 29, 1945 (E. R. Quortrup); 3,000 on Eastern Bay on November 18, 1950 (Mr. and Mrs. W. L. Henderson); 600 in the Carroll Island area, Baltimore county, on November 19, 1950; 177 near Unity, Montgomery county, on November 12, 1950 (S. H. Low); 50 at Mountain Lake, Garrett County, on November 2, 1951 (H. E. Slater). *Winter*: 1,654 in the St. Michaels area, Talbot County, on December 29, 1953 (Christmas count); 4,940 on the Susquehanna Flats on January 2, 1950 (Christmas count); 2,000 on the Sassafras River on December 4, 1949 (E. Arnold); 1,505 in the Gibson Island area, Anne Arundel County, on January 3, 1954 (Christmas count); 1,500 in the Gunpowder River area on January 20, 1952 (T. A. Imhof).

ANADA GOOSE *Branta canadensis* (Linnaeus)

STATUS.—*Transient*: Abundant in the tidewater areas of the Eastern Shore and Upper Chesapeake sections (concentration areas include the Susquehanna Flats, Bohemia River, Sassafras River, Chester River, Eastern Bay, Choptank River, Honga River, Dorchester County marshes, Fishing Bay, Nanticoke River, Tangier Sound, Pocomoke Sound, Chincoteague Bay, and Sineuxent Bay); fairly common in the tidewater areas of the Western Shore section and in the interior (mostly flying overhead) of all sections. *Wintering*: Common in the tidewater areas of the Eastern Shore and Upper Chesapeake sections (concentration areas, same as during migration); fairly common in the interior of the Eastern Shore and Upper Chesapeake sections; uncommon in the Western Shore and Piedmont sections.

HABITAT.—Shallow water with aquatic vegetation in tidal bays, estuaries, and ponds, and inland ponds and lakes; also occurs regularly on tidal marshes, and in many areas feeds extensively in wheat, rye, and corn fields near tidewater.

FALL MIGRATION.—*Normal period:* September 25–October 5 to November 20–30; peak, October 15 to November 5. *Extreme arrival dates:* September 8, 1955, in Talbot County (R. L. Kleen); September 12, 1954, in Montgomery County (S. H. Low); September 13, 1955, in Caroline County (M. W. Hewitt); September 14, 1954, in Baltimore County (S. W. Simon); September 18, 1953, in Prince Georges County (F. M. Uhler).

MAXIMUM COUNTS.—*Spring:* 7,000 on the Susquehanna Flats, Cecil County, on March 31, 1955; 7,000 in the Sassafras River area on April 1, 1955; 5,000 in the Newport Bay area in Worcester County on April 1, 1950; “thousands” in Prince Georges County on March 24, 1929 (W. R. Maxon); 2,400 on Eastern Bay on March 25, 1950 (J. E. Johnson); 1,250 on Savannah Lake, Dorchester County, on March 3, 1955; 1,000 in the Gibson Island area, Anne Arundel County, on March 25, 1953 (Mrs. G. Tappan, Mrs. W. L. Henderson); 800 near Emmitsburg, Frederick County, on March 20, 1955 (J. W. Richards). *Fall:* 15,000 on Blackwater National Wildlife Refuge, Dorchester County, on November 16, 1947 (I. R. Barnes); 10,000 on Hooper Island, Dorchester County, on November 24, 1951 (I. C. Hoover); 2,000 in the Newport Bay area, Worcester County, on November 11, 1951. *Winter:* 25,000 in the Turner Creek area, Kent County, during January and February, 1955 (R. T. Smith); 19,346 in the St. Michaels area, Talbot County, on December 29, 1953 (Christmas count); 17,440 on Chester River on December 6, 1955; 15,000 in Dorchester County on December 22, 1952 (Christmas count); 9,300 on the Susquehanna Flats on January 1, 1951 (Christmas count); 6,700 on Ocean City on December 27, 1953 (Christmas count).

BANDING.—See figure 6.

VAGRANT *Branta bernicla* (Linnaeus)

STATUS.—*Transient and wintering:* Common in the coastal area of Worcester County; also occurs regularly in the tidewater areas along the Chesapeake Bay side of the Eastern Shore section, being fairly common in Somerset and Dorchester Counties and uncommon in Talbot and Queen Annes Counties (north to Eastern Bay); rare in tidewater areas of the Western Shore and Upper Chesapeake sections. *Summer vagrant:* Casual visitor—1 flying bird at South Point, Worcester County, on July 6, 1951 (J. H. Bucklew), and 1 at Kent Island, Queen Annes County, on June 28, 1954 (P. F. Springer).

HABITAT.—Shallow salt water in bays or sounds in which sea-lettuce (*Enteromorpha* spp.) or eel grass abound—most numerous along the barrier beach side of the coastal bays.

SPRING MIGRATION.—*Normal period:* February 10–20 to April 20–30; peak, February 20 to April 10. *Extreme arrival date:* February 6, 1954 (large flight), in Worcester County. *Extreme departure dates:* May 20, 1950 (R. J. Beaton), and May 15, 1954 (D. C. Aud. Soc.), in Worcester County; May 8, 1955, in Queen Annes County (S. W. Simon).

FALL MIGRATION.—*Normal period:* October 10–20 to December 10–20; peak, October 25 to December 10.

MAXIMUM COUNTS.—10,000 off South Point near the south end of Sinepuxent Bay on December 27, 1948 (E. Arnold, S. H. Low); 2,500 in the Ocean City area on February 25, 1951; 2,130 in the St. Michaels area, Talbot County, on December 29, 1953 (Christmas count); 72 in the District of Columbia on February 20, 1937 (Mr. and Mrs. W. J. Whiting).

[BARNACLE GOOSE] *Branta leucopsis* (Bechstein)

STATUS.—Hypothetical. One reported killed near Langford Kent County, on November 12, 1947 (T. A. Geiser).

WHITE-FRONTED GOOSE *Anser albifrons* (Scopoli)

STATUS.—Casual visitor. A specimen (USNM) bought in the Washington market in March 1856 was reported to have been shot on the Potomac River (Baird, 1858). A specimen, formerly in the collection of the Maryland Academy of Sciences but apparently no longer extant, was shot on the Gunpowder River on November 12, 1892 (Fisher, 1894). One was captured alive with a flock of Canada Geese near Cambridge in Dorchester County on December 15, 1937 (D. V. Black). Another was observed at Oxford, Talbot County, in mid-October 1956 (S. Hersloff).

SNOW GOOSE *Chen hyperborea* (Pallas)

STATUS.—*Transient and wintering:* Fairly common in the coastal area of Worcester County (somewhat irregular in winter) rare elsewhere in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; casual visitor in the interior—recorded in Garrett, Frederick, Montgomery, and Prince Georges Counties.

HABITAT.—Usually in marshes of salt-water cordgrass or other bays adjacent to them.

PERIOD OF OCCURRENCE.—*Normal period:* October 15–25 to March 20–30; peak, November 20 to March 5. *Extreme dates of arrival:* Early October, 1890, in Baltimore County (W. E. Fisher); October 13, 1950, in Dorchester County (C. W. Wallace, W. S. Webster). *Extreme dates of departure:* April 21, 1954

Worcester County (P. G. DuMont); April 19, 1935, in Montgomery County (Bagg, 1935).

MAXIMUM COUNTS.—*Spring*: 206 in the Ocean City area on March 4, 1950 (R. J. Beaton); 50 at Emmitsburg, Frederick County, on March 9, 1955 (Mrs. J. W. Richards). *Fall*: 700 in the Ocean City area on November 28, 1950 (J. H. Buckalew); 125 at Beavitt, Talbot County, on December 3, 1955 (J. Reese). *Winter*: 300 in the Ocean City area on February 11, 1907 (F. C. Kirkwood); 1,997 and 1,986 in the Ocean City area on December 27, 1954, and December 27, 1950, respectively (Christmas counts); 1 on Blackwater National Wildlife Refuge in Dorchester County on December 23, 1951 (Christmas count).

BLUE GOOSE *Chen caerulescens* (Linnaeus)

STATUS.—*Transient and wintering*: Rare in the Eastern Shore, Western Shore, and Upper Chesapeake sections; casual in the Piedmont section—1 at Marshall Dierssen Refuge in Montgomery County, May 6-8, 1949, and 1 near Buckeystown in Frederick County during the period April 23-30, 1950. Prior to 1930 this species apparently occurred as a casual visitor only.

HABITAT.—Usually on ponds in tidal marshes; rarely on ponds in the interior.

PERIOD OF OCCURRENCE.—*Extreme dates of arrival*: October 18, 1950, in Dorchester County (C. W. Wallace, W. S. Webster); October 18, 1952, in Prince Georges County; October 24, 1949, in Queen Annes County. *Extreme dates of departure*: May 15, 1951, in Harford County (T. A. Imhof); May 8, 1949, in Montgomery County (R. Wright).

MAXIMUM COUNTS.—55 (1 flock) over Berwyn, Prince Georges County, on October 18, 1952; 14 (1 flock) on Gunpowder Neck, Harford County, on May 15, 1951 (T. A. Imhof); 11 on Blackwater Refuge on December 28, 1954 (Christmas count); 10 near Westertown, Kent County, on November 24, 1950 (J. H. Buckalew); 4 on Mills Island in Worcester County on February 9, 1938 (G. A. Ammann).

MALLARD *Anas platyrhynchos* Linnaeus

STATUS.—*Breeding*: The true status of "wild" Mallards during the breeding season is difficult to determine because of the fact that considerable numbers of semiwild birds have been released into the State from time to time. Scattered pairs of nesting birds that give every appearance of being feral have been noted in wetland areas and on inland ponds, lakes, and streams in all sections. Whether any of these are derived from the introduced

stock is problematical. It may be significant that Kirkwood (1895) in his book on Maryland birds does not refer to any breeding records for the species. During the past 12 years (1942-1953), downy young or nests with eggs have been recorded in the following areas: Worcester, Dorchester, Kent, Calver Prince Georges, Baltimore, Montgomery, and Garrett Counties and the District of Columbia. *Transient*: Fairly common on tidal water and inland areas in all sections (concentrations occur along the Potomac River in Montgomery County, on Triadelphia Reservoir, on Blackwater National Wildlife Refuge, and on the Chester River). *Wintering*: Fairly common on tidewater and inland areas of the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections; uncommon in the Ridge and Valley and Allegheny Mountain sections.

HABITAT.—*Breeding*: Usually ponds or streams that are fringed with marsh vegetation. *Transient and wintering*: All types of fresh-water and tidal ponds, lakes, and streams; also feeds extensively in corn fields that are located nearby.

NESTING SEASON.—Mid-March to late July. *Extreme egg dates* (5 nests): March 20, 1949, in Montgomery County (I. Shelton) and May 14, 1950, in Baltimore County (E. Willis). *Extreme downy young dates* (13 broods): May 7, 1949, in the District of Columbia (W. W. Rubey) and July 20, 1952, in Baltimore County (E. Willis).

SPRING MIGRATION.—*Normal period*: February 5-15 to March 1-10; peak, February 20 to March 20. *Extreme arrival date*: January 18, 1947, in Prince Georges County; January 22, 1939, in Baltimore County (H. Kolb); January 28, 1949, in Anne Arundel County (Mrs. F. H. Vinup). *Extreme departure dates*: May 1, 1931, in Charles County (C. Cottam); May 14, 1949, in Worcester County (E. G. Davis); May 14, 1922, in the District of Columbia (J. Kittredge, Jr.).

FALL MIGRATION.—*Normal period*: September 10-20 to December 15-25; peak, October 25 to December 5. *Extreme arrival dates*: August 20, 1927, in the District of Columbia (A. We more); August 28, 1896, in Prince Georges County (B. Greenwood). *Extreme departure dates*: December 31, 1940, in Prince Georges County; December 28, 1948, in Baltimore County (I. Kolb).

MAXIMUM COUNTS.—*Spring*: 1,690 on the Potomac River below Washington, D. C., on March 10, 1928 (H. H. T. Jackson). *Fall*: 11,500 on the Chester River on December 6, 1955; 7,000 along the Potomac River in Prince Georges and Charles Counties on November

er 30, 1925 (F. C. Lincoln); 1,245 in the Patuxent River marsh
 October 27, 1955; 600 at Blackwater National Wildlife Refuge,
 orchester County, on November 16, 1947 (I. R. Barnes). *Winter*:
 885 on the Potomac River in the District of Columbia area on
 uary 7, 1928 (A. Wetmore, H. H. T. Jackson); 5,250 in south-
 n Dorchester County on December 28, 1955 (Christmas count);
 500 at Triadelphia Reservoir on January 1, 1954, and December
 1, 1955 (Christmas counts); 1,240 on the Susquehanna Flats on
 uary 2, 1950 (Christmas count); 1,110 in the Ocean City area
 December 27, 1953 (Christmas count).

BANDING.—See figure 7.

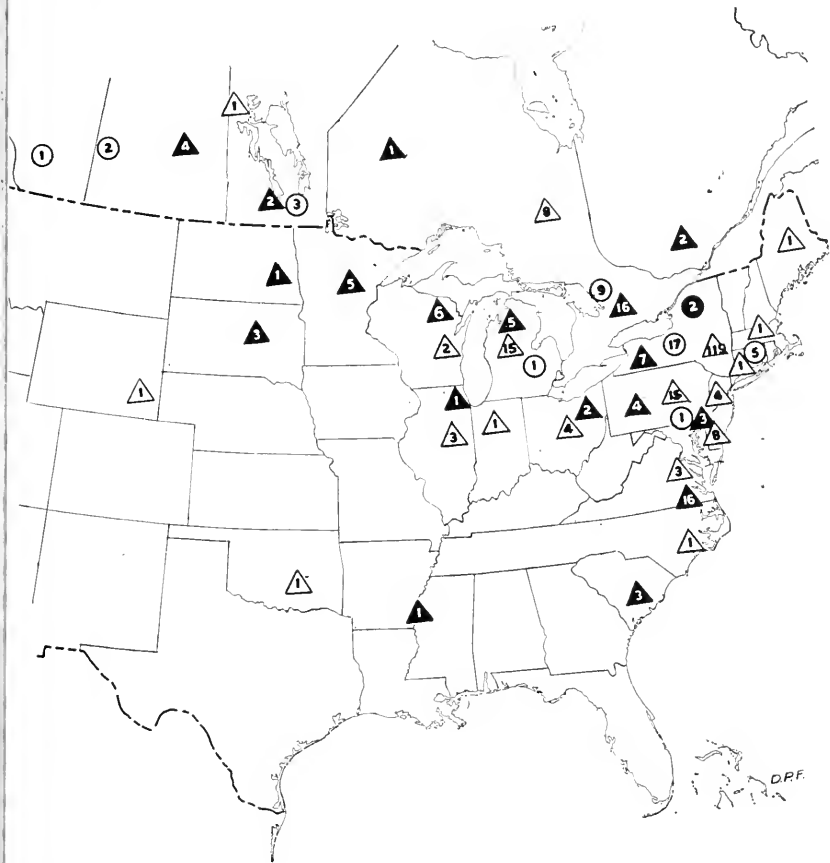


FIGURE 7.—Mallard banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid circle = recovered June through August; solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August; open triangle = banded September through May.

BLACK DUCK *Anas rubripes* Brewster

STATUS.—*Breeding*: Common in the tidewater areas of the Eastern Shore section (greatest numbers in the marshes of Dorchester County and in the Chester River–Eastern Bay area); uncommon in the tidewater areas of the Western Shore and Upper Chesapeake sections; rare in the interior of all sections; definite inland-breeding records for Baltimore (H. Kolb), Prince George and Allegany (K. A. Wilson) Counties. See figure 4. *Transient*: Abundant in the tidewater areas of Dorchester County and in the Chester River–Eastern Bay area; common in tidewater areas elsewhere in the Eastern Shore section; fairly common in tidewater areas of the Western Shore and Upper Chesapeake section and in the interior of all sections. *Wintering*: Common in tidewater areas of the Eastern Shore section; fairly common in tidewater areas of the Western Shore and Upper Chesapeake section; uncommon in the interior of all sections. Outstanding wintering and transient concentration areas include the Chester River–Eastern Bay, the Blackwater National Wildlife Refuge, and the large marsh extending from Savannah Lake to Elliott Island in southern Dorchester County.

HABITAT.—*Breeding*: Various types of tidal marshes and marsh meadows, including Olney three-square, switch grass, salt reed grass, salt-water cordgrass, salt-meadow grass, and needlerush also along margins of islands situated in bays or estuaries; also on inland ponds and streams that are fringed with marsh vegetation. *Transient and wintering*: Nearly all types of marsh ponds, and streams; occasionally fairly large numbers are also found on the open bays and estuaries.

NESTING SEASON.—Mid-March to early September; peak, early April to late June. *Extreme egg dates* (217 nests): March 28, 1914, in Queen Annes County (V. D. Stotts) and August 24, 1914, in Dorchester County (Jackson, 1941). *Extreme downy young dates* (54 broods): April 8, 1949, in Dorchester County (W. S. Webster) and August 12, 1954, in Dorchester County.

SPRING MIGRATION.—*Normal period*: February 15–25 to April 15–25; peak, February 25 to March 25. *Extreme arrival dates*: January 28, 1951, in Harford County (T. A. Imhof). *Extreme departure dates*: May 21, 1922, in the District of Columbia (Kittredge, Jr.); May 7, 1936, in Garrett County (M. G. Brooks); May 6, 1893, in Baltimore County (G. H. Gray).

FALL MIGRATION.—*Normal period*: September 10–20 to December 1–10; peak, October 20 to November 25. *Extreme arrival dates*: August 20, 1927, in the District of Columbia (A. W.

Charles Counties on November 10, 1928 (H. C. Oberholser); 10,000 on the marsh between Savannah Lake and Elliott Island in Dorchester County on November 12, 1948; 6,941 on the Potomac River below Washington, D. C., on October 28, 1930 (H. C. Oberholser); 4,000 on Middle River in Baltimore County on November 12, 1927 (G. A. Edwards); 1,400 on Gunpowder Neck in Harford County on October 22, 1950 (T. A. Imhof). *Winter*: 40,243 on the Potomac River, below Washington, D. C., on February 1928 (H. H. T. Jackson); 10,125 in southern Dorchester County on December 28, 1955 (Christmas count); 7,102 in the St. Michaels area, Talbot County, on December 29, 1954 (Christmas count); 7,000 on the Susquehanna Flats on January 7, 1928 (J. A. Crier); 2,210 in the Ocean City area on December 22, 1955 (Christmas count); 2,000 on Triadelphia Reservoir, Montgomery and Howard Counties, on January 1, 1954 (Christmas count).

BANDING.—See figure 8.

GADWALL *Anas strepera* Linnaeus

STATUS.—*Breeding*: During the late spring of 1948, at least 7 pairs were found nesting in a tidal marsh in Somerset County located from 1 to 2 miles southeast of Dames Quarter (Springer and Stewart, 1950)—several pairs were noted in this same area during 1949 and 1950, and in 1955 a nest with eggs was found about 2 miles south of there on Fish Island in the Manokin River in 1956, a nest with eggs was found in southern Dorchester County, 6 miles northeast of Elliott. *Transient*: Common in tidewater areas of Charles County along the Potomac and Wicomico Rivers; fairly common in tidewater areas of Dorchester County, uncommon elsewhere on tidewater and inland areas of all sections. *Wintering*: Same as transient status, except that it is absent or rare in the Allegheny Mountain, Ridge and Valley, and Piedmont sections. *Summer vagrant*: Casual in the Western Shore section—recorded in the District of Columbia on June 7, 1930 (W. Ball), and June 12, 1952 (J. W. Taylor, Jr.), in Prince George's County on June 13 to 24, 1949, and in Anne Arundel County (Maryland) on June 30, 1955 (W. L. Henderson, Mrs. G. Tappan).

HABITAT.—*Breeding*: In Somerset County, occurs in a tidal marsh in which salt-meadow grass is predominant with scattered patches of switch grass, salt-marsh bulrush, and needlerush; scattered shrubs of wax-myrtle, sea-myrtle and marsh-elder. *Transient and wintering*: Brackish estuaries, ponds in tidal marshes, and occasionally on inland ponds, lakes, and rivers.

NESTING SEASON.—Late April to early August. *Extreme*

tes (4 nests): May 4, 1956, in Dorchester County and July 19, 55, in Somerset County. A brood of 10 young about 4 or 5 days old was observed on July 3, 1948, in Somerset County (F. M. Miller).

SPRING MIGRATION.—*Normal period*: March 10–20 to April 25–May 5. *Extreme arrival date*: February 25, 1955, in Anne Arundel County (Mrs. W. L. Henderson). *Extreme departure dates*: May 16, 1954, in Dorchester County (J. K. Wright); May 5, 1951, Harford County (T. A. Imhof) and in Baltimore County (H. Holb, E. Willis).

FALL MIGRATION.—August 20–30 to November 20–30; peak, October 10 to November 10. *Extreme arrival dates*: August 19, 50, in Montgomery County (J. W. Taylor, Jr.); August 20, 27, in Charles County (E. A. Preble). *Extreme departure date*: December 1, 1951, in Montgomery County (L. Kilham).

MAXIMUM COUNTS.—*Spring*: 1,300 on the Potomac River below Washington, D. C., on March 13, 1928 (H. H. T. Jackson); 670 in Savannah Lake, Dorchester County, on March 3, 1955; 260 in Charles County on March 22, 1953 (A. R. Stickley, Jr.); 220 in Andy Point–Matapeake area on March 23, 1946. *Fall*: 6,000 on the Potomac River in Charles County on November 1, 1927 (H. C. Berholser); 650 in southern Dorchester County on November 1, 1950. *Winter*: 3,804 on the Potomac River in Prince Georges County and upper Charles County on December 5, 1930 (H. C. Berholser); 1,889 in the Wicomico River area in Charles County on January 1, 1950 (Christmas count); 1,300 in the Port Tobacco area in Charles County on January 27, 1953 (A. R. Stickley, Jr.); 400 in the Savannah Lake–Elliott Island area, Dorchester County, on February 25, 1950, and February 22, 1954.

BANDING.—Two Gadwalls recovered in Somerset and Harford Counties (November 22–27) had been banded as juvenals (August 17) in north-central North Dakota and Saskatchewan (Woodraver, Courval).

NTAIL *Anas acuta* Linnaeus

STATUS.—*Transient and wintering*: Common in the tidewater areas of the Upper Chesapeake section (east of Chesapeake Bay); fairly common in other tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon in the interior of all sections.

HABITAT.—Brackish estuaries, and ponds in tidal marshes; also in inland ponds, lakes, and rivers.

SPRING MIGRATION.—*Normal period*: January 15–25 to April 5–May 5; peak, February 15 to March 20. *Extreme arrival*

J. A. Imhof); 200 in the District of Columbia on November 13, 40 (W. L. McAtee). *Winter*: 30,000 near Chestertown, Kent county, during January–February, 1955 (R. T. Smith); 3,625 southern Dorchester County on December 22, 1952 (Christmas count); 550 in the Wicomico River area, Charles County, on January 2, 1949 (Christmas count); 535 in the Ocean City area on December 22, 1951 (Christmas count); 506 on Susquehanna Flats December 20, 1947 (Christmas count).

BANDING.—See figure 9.

COMMON TEAL *Anas crecca* Linnæus

STATUS.—Rare winter visitor in the coastal area of Worcester county; casual elsewhere. One or two have been recorded nearly every winter since February 1950 on Heine's Pond.

PERIOD OF OCCURRENCE.—*Extreme dates*: December 27, 1950, 1953, 1954, and 1955 (S. H. Low, et al.) in Worcester County and April 1885 on the Potomac River near Washington (USNM—J. Marshall).

GREEN-WINGED TEAL *Anas carolinensis* Gmelin

STATUS.—*Transient*: Common in the tidewater areas of Dorchester County; fairly common in tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon in the interior of all sections. *Wintering*: Fairly common in tidewater areas of Dorchester County; uncommon in tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare in the interior of the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections. *Summer vagrant*: 1 observed in Dorchester County on June 21, 1956 (P. F. Springer).

HABITAT.—Tidal ponds and creeks of brackish marshes; also occurs more sparingly in salt marshes, on estuarine waters, and in inland ponds, lakes, and streams.

SPRING MIGRATION.—*Normal period*: February 25–March 5 to May 1–10; peak, March 10 to April 20. *Extreme arrival date*: February 19, 1949, in Prince Georges County. *Extreme departure date*: May 19, 1954, in Dorchester County.

FALL MIGRATION.—*Normal period*: September 5–15 to December 1–10; peak, October 10 to November 25. *Extreme dates of arrival*: August 19, 1950 (J. W. Taylor, Jr.), in Montgomery County; August 24, 1956, in Prince Georges County (P. F. Springer). *Extreme dates of departure*: December 23, 1926, in the District of Columbia (A. Wetmore); December 12, 1948, in Montgomery County (I. R. Barnes).

BLUE-WINGED TEAL *Anas discors* Linnaeus

STATUS.—*Breeding*: Fairly common in tidewater areas of Dorchester County; uncommon in tidewater areas elsewhere in the Eastern Shore Section; rare in tidewater areas of the Western Shore and Upper Chesapeake sections. Definite records of nests with eggs or broods of downy young are from Worcester (G. A. Amann), Somerset, Dorchester, St. Marys (E. J. Court), Anne Arundel (R. R. Kerr), and Baltimore (W. A. Putnam) Counties. See figure 11.

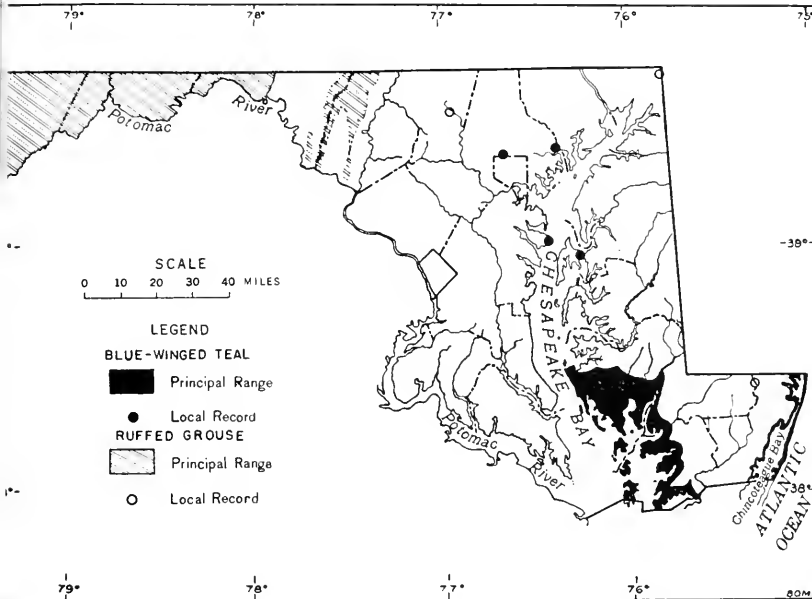


FIGURE 11.—Breeding ranges of Blue-winged Teal and Ruffed Grouse.

Transient: Common in the tidewater areas of Dorchester County; fairly common in tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common locally in the Allegheny Mountain Section; uncommon elsewhere in the interior of all sections. *Wintering*: Uncommon in the tidewater areas of Dorchester County; casual elsewhere in the Eastern Shore section—1 recorded at Heine's Pond, Worcester County, on December 27, 1950, and 1 on December 27, 1954 (S. H. Low). **HABITAT.**—*Breeding*: Usually in short-growth, tidal marsh-meadow types such as salt-meadow grass. *Transient*: Various types of tidal and inland ponds and marshes. **NESTING SEASON.**—Mid-April to early August (nesting peak,

early May to late June). *Extreme egg dates* (9 nests): May 1954, in Dorchester County and June 16, 1931 (A. L. Nelson) Dorchester County. *Extreme downy young dates* (25 brood) May 25, 1919, in Baltimore County (W. A. Warner) and Aug. 4, 1954, in Dorchester County.

SPRING MIGRATION.—*Normal period*: March 10–20 to May 20; peak, April 5 to May 5. *Extreme arrival dates*: March 1954, in Montgomery County (E. Hall, P. G. DuMont); March 1926, on the Potomac River below Washington, D. C. (H.



FIGURE 12.—Blue-winged Teal banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid circle = recovered June through August; solid triangle = recovered September through May. Recovered in Maryland banded elsewhere: open circle = banded June through August.

erholser). *Extreme departure dates*: June 6, 1953, in Montgomery County (J. W. Terborgh); June 2, 1892, in Prince Georges county (C. W. Richmond).

FALL MIGRATION.—*Normal period*: August 20–30 to November 20; peak, September 5 to October 15. *Extreme arrival dates*: August 7, 1928, in the District of Columbia (W. H. Ball); August 1, 1898, in Baltimore County (F. C. Kirkwood). *Extreme departure dates*: December 10, 1927, on the Potomac River below Washington, D. C. (H. H. T. Jackson); December 9, 1899, on Annapowitchee River marsh (J. Thomas).

BREEDING POPULATION DENSITY (pairs per 100 acres).—(10 in 160 acres) in brackish bay marsh (study tract included tidal ponds and creeks and extensive areas of salt-meadow grass) in Dorchester County in 1956.

MAXIMUM COUNTS.—*Spring*: 173 on the Patuxent River marsh at Upper Marlboro on April 5, 1955; 150 at Marshall Dierssen Refuge, Montgomery County, on April 26, 1953, and March 30, 1954 (both by J. W. Terborgh); 75 on the marsh between Savannah Lake and Elliott Island, Dorchester County, on April 30, 1949; 50 on Mills Island, Worcester County, on April 23, 1938 (L. A. Ammann). *Fall*: 500+ in Elliott Island marsh on September 21, 1954; 185 on the Patuxent River marsh on October 1, 1955; 150 on Savannah Lake on October 2, 1948; 80 in the District of Columbia on September 20, 1930 (C. Cottam); 75 at the Dierssen Refuge on September 8, 1952. *Winter*: 80 on Blackwater Refuge, Dorchester County, on February 22, 1952; 39 in Southern Dorchester County on December 28, 1953 (Christmas Count).

BANDING.—See figure 12.

[ANNAMON TEAL] *Anas cyanoptera Vieillot*

STATUS.—Hypothetical. B. H. Warren reported observing a male on the Bohemia River in Cecil County on April 9, 1910.

ROPEAN WIDGEON *Mareca penelope (Linnaeus)*

STATUS.—*Transient and wintering*: Rare in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; casual in the Piedmont and Allegheny Mountain sections. A total of 41 records, including specimens, have been reported from Maryland and the District of Columbia. These include 18 from the Upper Chesapeake section (including 10 from Harford and Cecil Counties, and 2 each from Kent and Baltimore Counties); 11 from the Eastern Shore section (6 from Dorchester

County, 4 from Worcester County, and 1 from Caroline County, 10 from the Western Shore section (6 from Anne Arundel County, 2 from the District of Columbia, and 1 each from Charles and Prince Georges Counties); 1 from the Piedmont section (near Seneca, in Montgomery County—L. Kilham); and 1 from the Allegheny Mountain section (at Mountain Lake on April 1954—M. G. Brooks).

HABITAT.—Brackish and fresh estuaries and marsh ponds usually associated with the American Widgeon.

PERIOD OF OCCURRENCE.—*Extreme dates:* October 16, 1931 (USNM), in the Washington, D. C., market (J. R. Massie) and April 17, 1954, in Garrett County (M. G. Brooks). Number of records by month: October, 6; November, 6; December, 7; January, 2; February, 4; March, 7; April, 5. All records were single birds except for 2 seen at Gibson Island in Anne Arundel County on October 30, 1951 (Mrs. W. L. Henderson, Mrs. Tappan); and 2 seen near Perryville in Cecil County on April 1931 (W. Yoder).

BANDING.—One recovered in Dorchester County on November 27, 1929, had been banded at Husavik, Iceland, on August 1, 1929. This was the fourth North American recovery of a European Widgeon from Iceland.

AMERICAN WIDGEON *Mareca americana* (Gmelin)

STATUS.—*Transient:* Common, locally abundant, in the tidewater areas along Chesapeake Bay and adjoining estuaries in the Eastern Shore, Western Shore, and Upper Chesapeake sections (concentration areas include the Susquehanna Flats, Eastern Bay, Dorchester County marshes, and the Choptank, Chester, Sassafras, Northeast, Bush, Gunpowder, Middle, and Magothy Rivers and portions of the Potomac and Wicomico Rivers in southern Charles County); fairly common in the interior of all sections and in the coastal area of Worcester County. *Wintering:* Local common in tidewater areas along Chesapeake Bay and adjoining estuaries in the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon in the coastal area of Worcester County; rare in the interior of all sections. *Summer vagrant:* Casual visitor—recorded in Harford County on July 14, 1931 (P. F. Springer); in Queen Annes County on June 17, 1953 and July 21, 1953, and June 8–15, 1954 (P. F. Springer); in Montgomery County on July 12–16, 1953 (S. H. Low); and in the District of Columbia, July 8–12, 1933 (E. N. Grinnell).

HABITAT.—Brackish estuarine waters, and ponds in brackish

al marshes that contain a plentiful aquatic plant growth, including such species as wild celery, red-head pondweed, sago pondweed and ditch grass; also occurs more sparingly on inland ponds and lakes.

SPRING MIGRATION.—*Normal period*: March 1-10 to May 10-20; peak, March 15 to April 15. *Extreme date of arrival*: February 1, 1949, in Prince Georges County. *Extreme dates of departure*: June 1, 1953, in Montgomery County (S. H. Low); May 31, 1951, Harford County (T. A. Imhof); May 26, 1953, in Prince Georges County (P. F. Springer).

FALL MIGRATION.—*Normal period*: September 5-15 to December 10-20; peak, October 10 to December 10. *Extreme arrival*

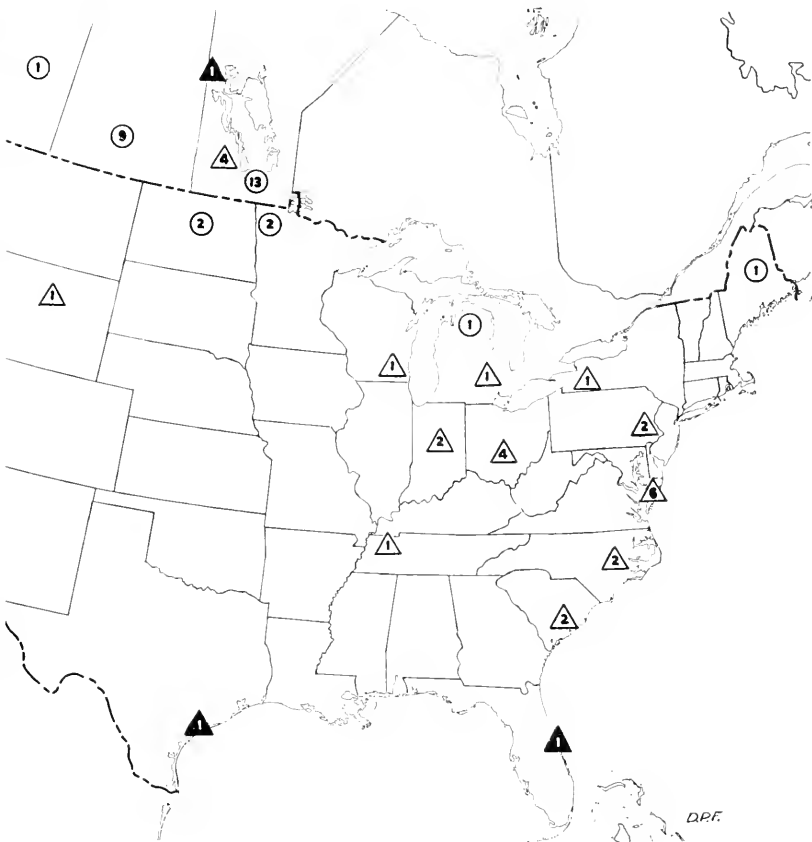


FIGURE 13.—American Widgeon banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August; open triangle = banded September through May.

dates: August 28, 1935, in Prince Georges County (R. B. Wallace); September 2, 1952, in Frederick County (J. W. Richards).

MAXIMUM COUNTS.—*Spring*: 7,900 in the Carroll Island area, Baltimore County, on March 16, 1947; 6,100 on Gunpowder Neck, Harford County, on March 18, 1951 (T. A. Imhof). *Fall*: 19,000 on Gunpowder Neck on December 7, 1951 (T. A. Imhof); 14,000 on the Potomac River below Washington, D. C., on November 19, 1929 (H. C. Oberholser); 14,000 in the Carroll Island area, November 19, 1950; 5,650 in southern Charles County on December 11, 1948. *Winter*: 19,281 near St. Michaels in Talbot County on December 29, 1953 (Christmas count); 11,000 at Gunpowder Neck on January 2, 1952 (T. A. Imhof); 4,830 on the Susquehanna Flats on January 2, 1950 (Christmas count); 3,165 in the Kent Island area, Queen Annes County, on December 29, 1949 (Christmas count); 2,670 in southern Charles County on December 11, 1948 (Christmas count).

BANDING.—See figure 13.

SHOVELER *Spatula clypeata* (Linnaeus)

STATUS.—*Transient*: Fairly common in tidewater areas of Dorchester County; uncommon elsewhere in tidewater and inland water areas of all sections. *Wintering*: Uncommon in tidewater areas of Dorchester County; rare in tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections; casual in the Piedmont section—2 observed throughout the winter of 1955–56 at Owings Mills, Baltimore County (E. and J. R. Worthley).

HABITAT.—Shallow ponds in brackish marshes; occasional in other tidewater habitats and on inland ponds and lakes.

SPRING MIGRATION.—*Normal period*: March 1–10 to May 1–10; peak, March 15 to April 25. *Extreme date of arrival*: February 28, 1953, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. Tappan). *Extreme dates of departure*: May 19, 1952, in the District of Columbia (M. W. Mulloy); May 17, 1954, in Dorchester County.

FALL MIGRATION.—*Normal period*: August 25–September 5 to December 1–10; peak, September 25 to November 10. *Extreme arrival date*: August 6, 1944, in Prince Georges County. *Extreme departure date*: December 11, 1899, on the Gunpowder River marsh (F. C. Kirkwood).

MAXIMUM COUNTS.—*Spring*: 55 on Blackwater Refuge, Dorchester County, on March 25, 1950 (J. E. Johnson); 40 at Ellicott City marsh, Dorchester County, on March 21, 1956; 35 at Indiantown

Marys County, on April 3, 1954, and April 8, 1953 (J. W. rborgh); 20 on Mills Island, Worcester County, on April 23, 38 (G. A. Ammann). *Fall*: 410 on the Potomac River below Washington, D. C., on October 19, 1929 (H. C. Oberholser); 40+ the District of Columbia on September 6, 1930 (W. H. Ball); in Worcester County on November 8, 1952 (M. Gilbert). *Winter*: 90 on Blackwater Refuge on February 25, 1950; 40 in Newport Bay area, Worcester County, on February 21, 1954; on the Sassafras River on December 26, 1948 (J. E. Willoughby, W. Taylor, Jr.).

WOOD DUCK *Aix sponsa* (Linnaeus)

STATUS.—*Breeding*: Fairly common in the Eastern Shore, Western Shore, Upper Chesapeake, Piedmont, and Ridge and Valley sections; uncommon in the Allegheny Mountain section. *Transient*: Common in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Piedmont, Ridge and Valley, and Allegheny Mountain sections. *Wintering*: Uncommon in the Eastern Shore and Western Shore sections; rare in the Upper Chesapeake, Piedmont, and Ridge and Valley sections.

HABITAT.—Inland streams, ponds, and lakes that are bordered by trees; also in the upper fresh-water marshes of the tidal waters.

NESTING SEASON.—Early March to early September (nesting March, late March to early July). *Extreme egg dates* (76 nests): March 10, 1951 (12 eggs in another nest on March 14, 1953), and July 25, 1950 (both extremes in Prince Georges County by G. Webster). *Extreme downy young dates* (88 broods): April 1, 1953, and September 2, 1953, both in Prince Georges County (G. Webster).

SPRING MIGRATION.—*Normal period*: February 20–March 1 to April 10–20; peak, March 1 to April 1. *Extreme date of arrival*: February 18, 1946, in Prince Georges County.

FALL MIGRATION.—August 15–25 to November 15–25; peak, September 5 to November 5. *Extreme date of arrival*: August 12, 1944, in Prince Georges County. *Extreme dates of departure*: December 10, 1927, on the Potomac River below Washington, D. C. (H. H. T. Jackson); December 4, 1951, in Anne Arundel County (Mrs. W. L. Henderson).

BREEDING POPULATION DENSITY (pairs per 100 acres).—

(3 in 714 acres) in flood-plain forest along Patuxent River, Prince Georges and Anne Arundel Counties, in 1943.

MAXIMUM COUNTS.—*Spring*: 150 near Seneca, Montgomery County, on March 19, 1948 (T. W. Donnelly). *Fall*: 184 Patuxent Refuge, Prince Georges County, on October 29, 1947 (N. Hotchkiss, F. M. Uhler); 150 on Mataponi Creek, Prince Georges County, on September 13, 1947 (N. Hotchkiss, F. M. Uhler); 90 on the Nanticoke River on November 3, 1955; 40 on Gunpowder Neck, Harford County on September 5, 1951 (T. A. Imhof); 35 in the District of Columbia on September 13, 1930 (W. H. Ball). *Winter* (Christ

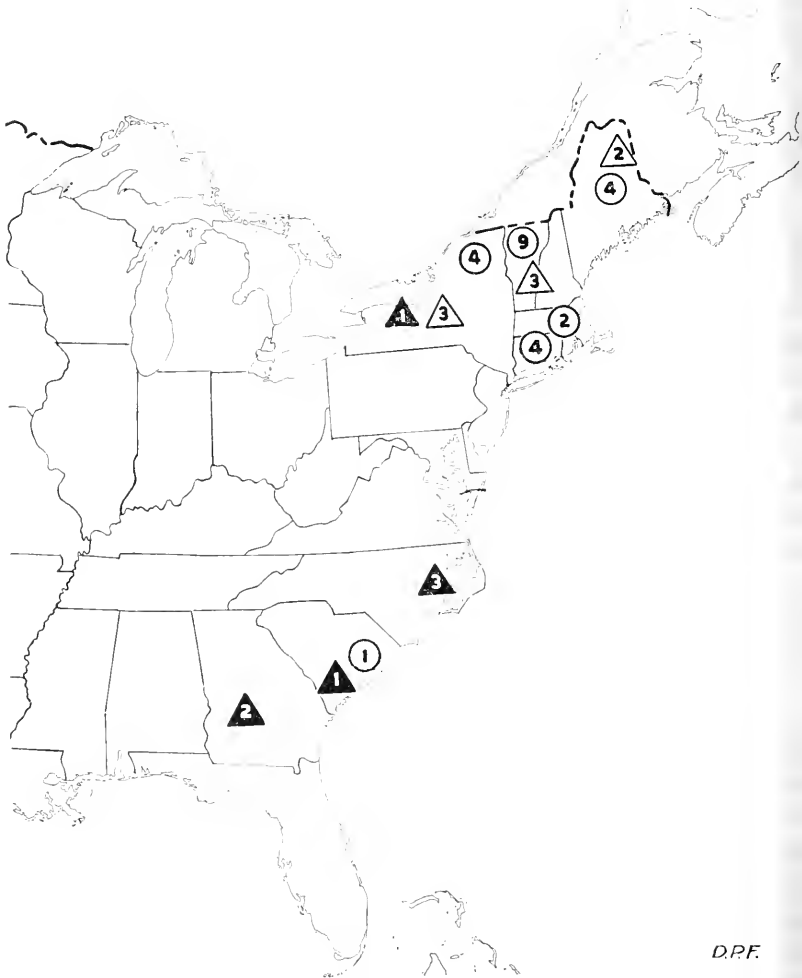


FIGURE 14.—Wood Duck banding recoveries. Each symbol represents number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August. Banded in Maryland, recovered elsewhere: open triangle = banded September through May.

nts): 12 in the Ocean City area on December 28, 1949; 6 at Patuxent Refuge on December 27, 1940.

BANDING.—See figure 14.

HEAD *Aythya americana* (Eyton)

STATUS.—*Transient and wintering*: Locally common in the coastal estuaries adjoining Chesapeake Bay in the Upper Chesapeake, Eastern Shore, and Western Shore sections (concentrations include the Gunpowder–Middle River area, the Bush River, Chester River, Eastern Bay, Choptank River, and Patuxent River); uncommon (rare in winter) in the coastal area of Worcester County and in the interior of all sections. *Summer vagrant*: usual in the Eastern Shore, Western Shore, and Upper Chesapeake sections.

HABITAT.—Brackish estuarine waters with a plentiful aquatic plant growth, including such species as red-head pondweed, sago pondweed, and wild celery; occasional on inland lakes and ponds.

SPRING MIGRATION.—*Normal period*: March 1–10 to May 1–10; peak, March 15 to April 20. *Extreme dates of departure*: May 1939, in Baltimore County (H. Kolb); May 20, 1949, in Queen Annes County; May 15, 1954, in Worcester County (J. K. Wright).

FALL MIGRATION.—*Normal period*: October 5–15 to December 1–25; peak, November 10 to December 10. *Extreme arrival dates*: October 1, 1956, in Cecil County (C. D. Evans, D. P. Ankhauser); October 3, 1889, in Harford County (F. C. Kirkwood).

MAXIMUM COUNTS.—*Spring*: 10,500 in the Carroll Island area, Baltimore County, on March 16, 1947; 4,000 on the Bush River, Harford County, on March 17, 1946 (Mrs. R. C. Simpson); 2,200 on the Potomac River below Washington, D. C., on March 13, 1928 (H. H. T. Jackson). *Fall*: 9,340 on Eastern Bay, Queen Annes County, on December 12, 1955; 5,000 on the Potomac River in Prince Georges and Charles Counties on November 29, 1926 (H. C. Oberholser), and November 30, 1925 (F. C. Lincoln); 4,000 on Chester River on December 6, 1955; 1,500 on Gunpowder River, Harford County, on December 10, 1950 (T. A. Imhof). *Winter*: 7,050 in the Kent Island area, Queen Annes County, on December 29, 1949 (Christmas count); 3,000 at Cove Point, Kent County, on February 5, 1949 (L. K. Couch); 3,000 in the Gunpowder River area on January 6, 1952 (T. A. Imhof); 1,500 on the lower Patuxent River on February 18, 1951 (E. G. Davis).

BANDING.—See figure 15.

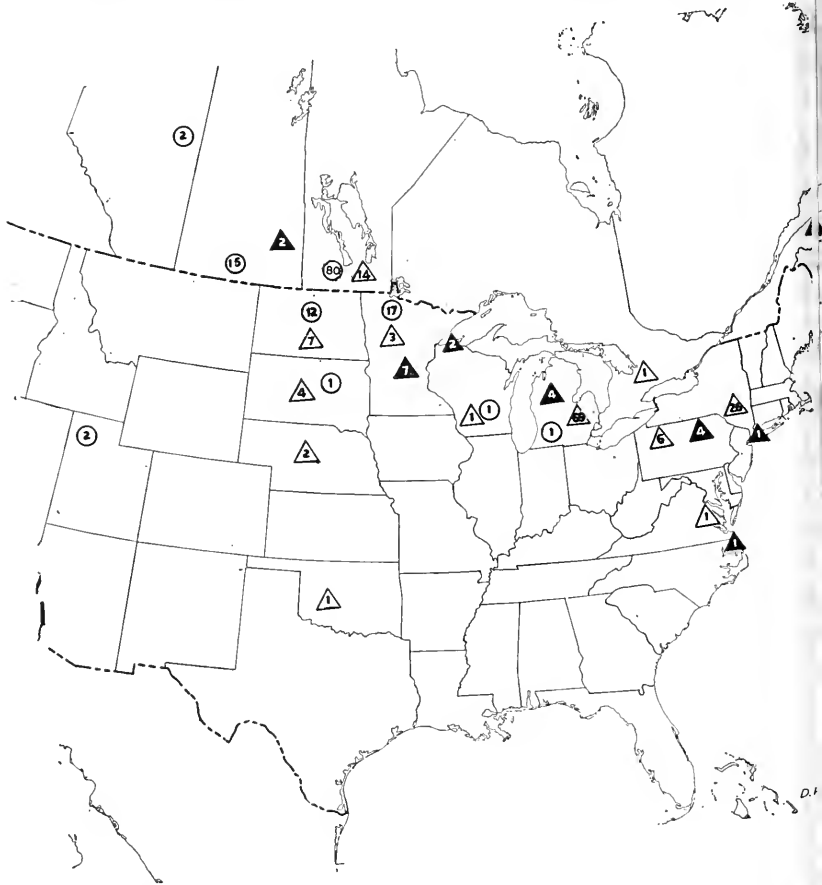


FIGURE 15.—Redhead banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid triangle = recovered September through May. Recovered Maryland, banded elsewhere: open circle = banded June through August. Open triangle = banded September through May.

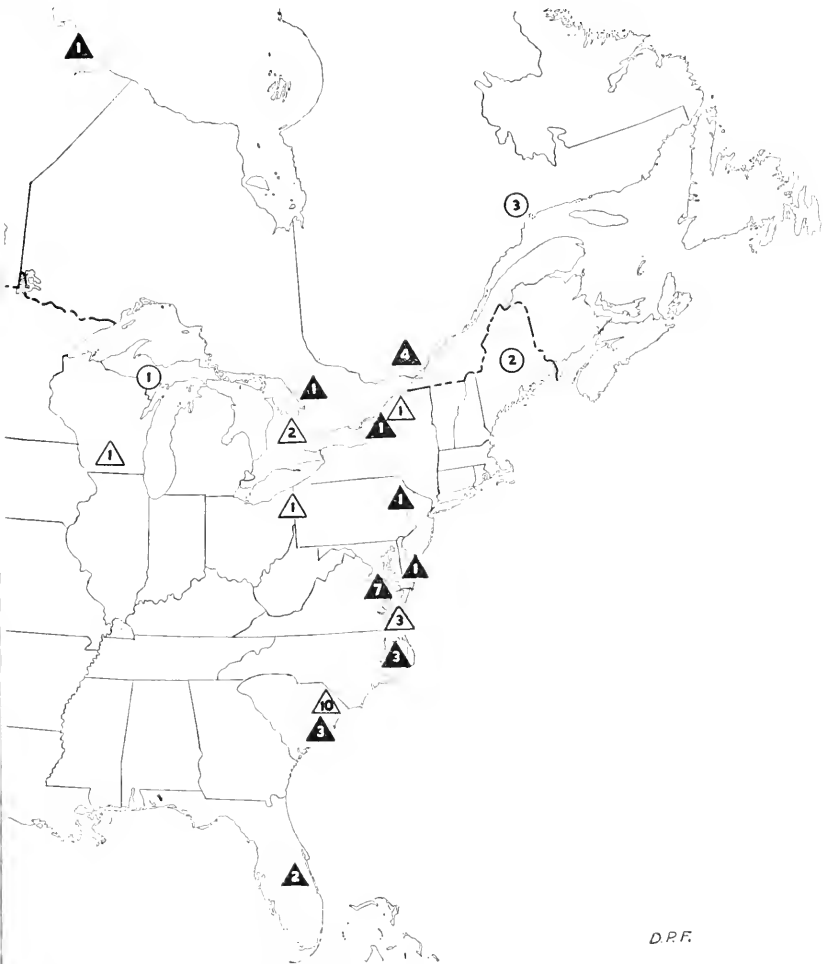
RING-NECKED DUCK *Aythya collaris* (Donovan)

STATUS.—*Transient*: Fairly common in all sections. *Wintering*: Uncommon in the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare in the Piedmont section. *Summer vagrant*: Casual visitor—recorded at Marshall Dierssen Refuge, Montgomery County, on June 6, 1953 (J. W. Terborgh) and Patuxent Refuge, Prince Georges County, throughout the summers of 1953 (F. M. Uhler) and 1955. This species has become decidedly more common since about 1945, coincident with its general increase as a breeding bird in the Northeast.

HABITAT.—Brackish or fresh estuarine waters and inland ponds and lakes.

SPRING MIGRATION.—*Normal period:* February 10–20 to May –10; peak, February 20 to April 5. *Extreme arrival date:* February 5, 1950, in Prince Georges County. *Extreme departure date:* May 18, 1938, in Baltimore County (H. Brackbill).

FALL MIGRATION.—*Normal period:* October 5–15 to December –10; peak, October 25 to November 30. *Extreme arrival dates:* September 17, 1935, in Garrett County (M. G. Brooks); October 1948, in Queen Annes County. *Extreme departure date:* December 12, 1948, in Montgomery County (I. R. Barnes).



D.P.F.

FIGURE 16.—Ring-necked Duck banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August; open triangle = banded September through May.

MAXIMUM COUNTS.—*Spring*: 3,000 on the Bush River, Harford County, on March 26, 1933 (S. Cramer); 720 at Patuxent Refuge, Prince Georges County, on March 10, 1953; 250 at Dierssee Refuge, Montgomery County, on February 28, 1954 (J. W. Teborgh); 200 in the Carroll Island area, Baltimore County, on March 30, 1947. *Fall*: 45 in Montgomery County on November 27, 1949 (S. A. Briggs). *Winter*: 1,715 in southern Dorchester County on December 22, 1952 (Christmas count); 1,500 at Gibson Island, Anne Arundel County, on January 20, 1951 (Mrs. W. L. Henderson); 730 on the Susquehanna Flats on January 2, 1952 (Christmas count).

BANDING.—See figure 16.

CANVASBACK *Aythya valisineria* (Wilson)

STATUS.—*Transient*: Abundant on the Susquehanna Flats in Harford and Cecil Counties; locally common elsewhere in the tidewater areas along Chesapeake Bay and adjoining estuaries in the Eastern Shore, Western Shore, and Upper Chesapeake sections (concentration areas include Eastern Bay, Fishing Bay, Tangier Sound, Pocomoke Sound, and Northeast, Sassafras, Chester, Choptank, Honga, Nanticoke, Gunpowder, Magothy, and South Rivers, the lower Patuxent River, and portions of the Potomac and Wicomico Rivers within Charles County); uncommon in the coastal area of Worcester County and in the interior of all sections. *Wintering*: Common in tidewater areas along Chesapeake Bay and adjoining estuaries in the Eastern Shore, Western Shore, and Upper Chesapeake sections (concentration areas same as during transient periods); usually uncommon in the coastal area of Worcester County; rare in the interior of the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections. *Summer vagrant*: Casual in the Eastern Shore and Western Shore sections.

HABITAT.—Estuarine waters that contain a plentiful aquatic plant growth, including such species as wild celery, sago pondweed, and eel grass; also on inland lakes and ponds. Locally, Canvasbacks occur in large numbers in certain bays and estuaries that contain a rich and varied molluscan fauna.

SPRING MIGRATION.—*Normal period*: February 25–March 5 to May 1–10; peak, March 5 to April 5. *Extreme arrival date*: February 23, 1930, in Montgomery County (A. K. Fisher). *Extreme departure dates*: June 3, 1950, in Anne Arundel County (Mrs. W. L. Henderson); May 28, 1948, in Prince Georges County; May 24, 1952, in Montgomery County (P. A. DuMont).

FALL MIGRATION.—*Normal period*: October 15–25 to December 5–25; peak, November 15 to December 15. *Extreme arrival date*: October 3, 1889, on the Gunpowder River (F. C. Kirkwood).

MAXIMUM COUNTS.—*Spring*: 40,000 on the Potomac River in Prince Georges and Charles Counties on March 7, 1925 (H. C. Berholser); 30,000 on the Susquehanna Flats on March 15, 1931 (C. Marburger); 3,000 on Bird River, Baltimore County, on

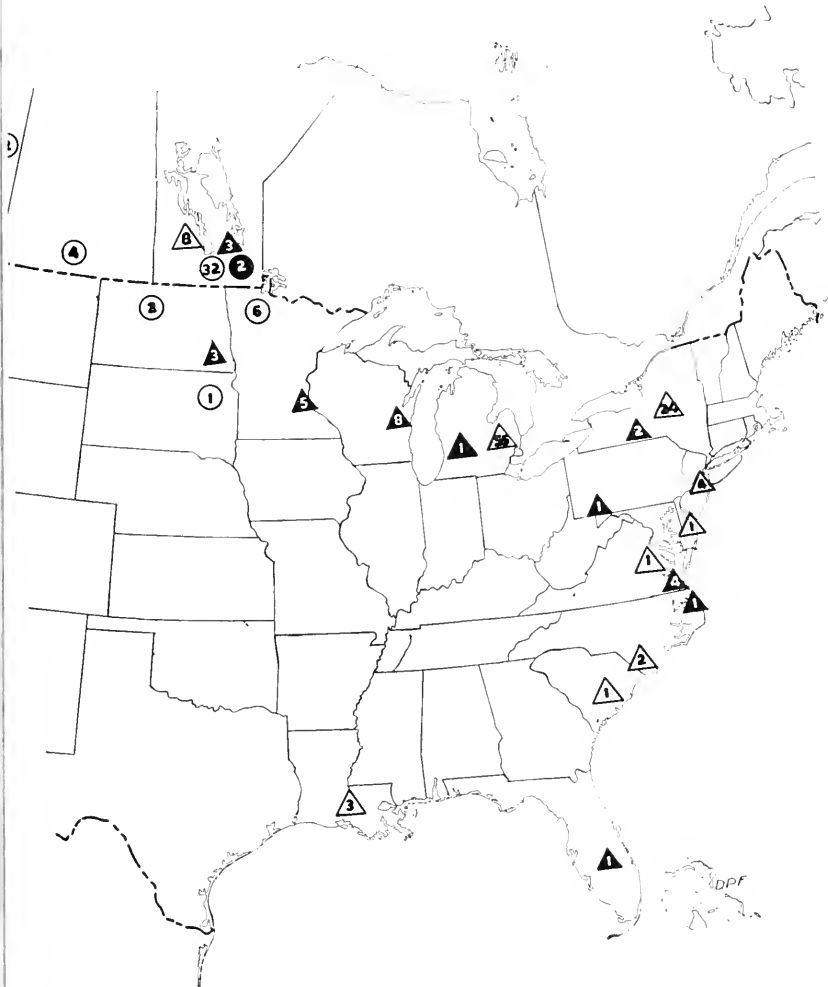


FIGURE 17.—Canvasback banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid circle = recovered June through August; solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August; open triangle = banded September through May.

March 7, 1948 (O. W. Crowder); 1,000+ at Gibson Island, Annapolis, Arundel County, on March 18, 1952 (Mrs. W. L. Henderson); 800 on Fishing Bay, Dorchester County, on March 25, 1949. *Fall*: 100,000+ on the Susquehanna Flats on December 7, 1949; 50,000 on the Potomac River, Charles County, on December 11, 1924 (H. C. Oberholser); "thousands" on Fishing Bay on December 9 and 10, 1949; 2,500 in southern Charles County on December 11, 1948. *Winter*: 105,000 on the Potomac River in Prince Georges and Charles Counties on February 13, 1926 (H. C. Oberholser); 91,000 on the Susquehanna Flats on December 27, 1949 (Christmas count); 17,750 in the Ocean City area on December 27, 1955 (Christmas count); 15,424 in the Annapolis area on January 1, 1956 (Christmas count); 12,000 near the Army Chemical Center, Harford County, on January 2, 1952 (T. A. Imhof); 8,520 in southern Charles County on December 30, 1951 (Christmas count); 5,450 on the lower Patuxent River on January 1, 1955; 3,085 in southern Dorchester County on December 28, 1949 (Christmas count); 3,040 in the Kent Island area, Queen Anne's County, on December 29, 1949 (Christmas count). *Summer*: *vagrant*: About 100 in the District of Columbia on September 1, 1931 (W. L. McAtee); about 30 in the District of Columbia on August 25, 1929, and June 7, 1930 (W. H. Ball).

BANDING.—See figure 17.

GREATER SCAUP *Aythya marila* (Linnaeus)

STATUS.—*Transient and wintering*: Common in the coastal areas of Worcester County; fairly common in tidewater areas along Chesapeake Bay and adjoining estuaries in the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare in the interior of all sections.

HABITAT.—Bays and estuaries (both salt and brackish); occasional on inland lakes and ponds.

SPRING MIGRATION.—*Normal period*: March 1–10 to May 10–20; peak March 15 to April 20. *Extreme dates of departure*: May 31, 1951, in Harford County (T. A. Imhof); May 27, 1901, in Montgomery County (H. C. Oberholser); May 24, 1901, in Allegany County (G. Eifrig); May 23, 1920, in the District of Columbia (J. Kittredge, Jr.).

FALL MIGRATION.—*Normal period*: October 1–10 to December 1–10. *Extreme date of arrival*: September 26, 1920, in the District of Columbia (J. Kittredge, Jr.).

MAXIMUM COUNTS.—High counts for the Greater Scaup and Lesser Scaup are combined under the latter species.

terior of all sections. *Summer vagrant*: Casual visitor—recorded in Worcester, Dorchester, Queen Annes (P. F. Springer), Anne Arundel (I. E. Hampe), Prince Georges, Charles (A. R. Stickley, Jr.), Montgomery (J. Hailman, K. Stecher), and Garrett Counties, and in the District of Columbia (numerous observers).

HABITAT.—Bays and estuaries (both salt and brackish water) and inland ponds, reservoirs, and lakes.

SPRING MIGRATION.—*Normal period*: March 1–10 to May 10–20; peak, March 15 to April 20. *Extreme departure dates*: June 8, 1921 (A. Wetmore), and June 8, 1931 (W. L. McAtee), in the District of Columbia; June 8, 1929, in Prince Georges and Charles Counties (H. C. Oberholser); June 8, 1953, in Garrett County.

FALL MIGRATION.—*Normal period*: September 25–October 5 to December 15–25; peak, November 10 to December 10. *Extreme arrival dates*: September 19, 1927, in the District of Columbia (H. H. T. Jackson); September 24, 1953, in Dorchester County.

MAXIMUM COUNTS (Greater and Lesser Scaup).—*Spring*: 73,000 on the Potomac River in Prince Georges and Charles Counties on March 17, 1926 (H. C. Oberholser); 6,250 in the Carro Island area, Baltimore County, on March 16, 1947 (O. W. Crowder); 5,000 in the District of Columbia on March 10, 1926 (A. Wetmore); 1,790 in Anne Arundel County on March 30, 1946; 1,500 at Eastern Neck Island, Kent County, on April 1, 1938 (G. A. Ammann); 1,350 on the Choptank River on March 25, 1946. *Fall*: 118,000 on the Potomac River in Charles County on November 17, 1926 (H. C. Oberholser); 25,000 on the Susquehanna Flats on December 7, 1947. *Winter*: 10,000 in southeastern Worcester County on December 22, 1947 (Christmas count); 2,100 on Seneca Creek, Baltimore County, on February 14, 1952; 2,000 on the Susquehanna Flats on December 26, 1952 (Christmas count); 1,400 on the lower Patuxent River on February 18, 1951. *Summer vagrant*: 9 in the District of Columbia on June 21 and August 15, 1930 (W. J. Whiting); 4 at Port Tobacco, Charles County, on June 27, 1953 (A. R. Stickley, Jr.).

BANDING.—See figure 18.

COMMON GOLDENEYE *Bucephala clangula* (Linnaeus)

STATUS.—*Transient and wintering*: Common in tidewater areas of the Eastern Shore and Western Shore sections; fairly common (uncommon in winter) in tidewater areas of the Upper Chesapeake section; uncommon (fairly common locally) in the interior of the Eastern Shore, Western Shore, Upper Chesapeake Piedmont, and Ridge and Valley sections; uncommon (rare in winter) in the Allegheny Mountain section. Concentration area

include the lower Potomac River, lower Patuxent River, Chester River, Eastern Bay, Choptank River, Honga River, Fishing Bay, Anticoke River, Tangier Sound, Pocomoke Sound, and Chincoteague Bay. *Summer vagrant*: Casual visitor—recorded in Charles (J. W. Taylor, Jr.), Calvert (M. H. Martin), Anne Arundel (Mrs. W. L. Henderson, R. R. Kerr), and Baltimore (C. D. Hackman) Counties.

HABITAT.—Bays and estuaries (both salt and brackish waters); also on inland lakes, reservoirs, and large streams.

SPRING MIGRATION.—*Normal period*: March 1–10 to April 20–0; peak, March 15 to April 10. *Extreme departure dates*: May 1, 1953, in Anne Arundel County (Mrs. G. Tappan, Mrs. W. L. Henderson); May 5, 1939, in Charles County (C. Cottam, F. M. Jhler).

FALL MIGRATION.—*Normal period*: October 15–25 to December 5–25; peak, November 10 to December 10. *Extreme arrival dates*: September 17, 1935, in Garrett County (M. G. Brooks); October 8, 1901, on the Potomac River below Washington, D. C. (B. Greenwood).

MAXIMUM COUNTS.—*Spring*: 250 on Chesapeake Bay, Queen Annes County, on March 29, 1955; 150 on the Chester River on March 2, 1946; 100 near Solomons Island, Calvert County, on March 15, 1952 (L. Griffin). *Fall*: 1,500 on Fishing Bay, Dorchester County, on December 10, 1949; 600 in the Kent Island area, Queen Annes County, on December 1, 1951 (Mr. and Mrs. C. Hoover). *Winter*: 2,000 on the Potomac River off Mt. Vernon, Virginia, on December 27, 1920 (A. Wetmore); 1,947 near St. Michaels, Talbot County, on December 29, 1953 (Christmas count); 1,646 in the Annapolis area on January 1, 1956 (Christmas count); 1,200 in southern Dorchester County on December 28, 1953 (Christmas count); 1,066 in the Kent Island area on December 29, 1949 (Christmas count); 567 in St. Marys County on January 2, 1956 (Christmas count); 432 in the Solomons Island area on December 21, 1946 (Christmas count); 387 in the Ocean City area on December 27, 1948 (Christmas count); 400 at Dierssen Refuge, Montgomery County, on January 31, 1953 (E. D. Cooley); 80 near Green Spring in Allegany County on February 7, 1924 (M. G. Brooks).

BARROW'S GOLDENEYE] *Bucephala islandica* (Gmelin)

STATUS.—Hypothetical. About December 20, 1922, 1 was reported to have been taken at the mouth of Bush River by A. J. Dando (Hasbrouck, 1944). As no specimen is available, and particularly because of the similarity of this species to the Com-

mon Goldeneye, this record must remain hypothetical. The female specimen reported by Richmond (1891) as shot on the Potomac River was found to be a Common Goldeneye.

BUFFLEHEAD *Bucephala albeola* (Linnaeus)

STATUS.—*Transient*: Common in tidewater areas of the Eastern Shore and Western Shore sections; fairly common in tidewater areas of the Upper Chesapeake section and in the interior of all sections. *Wintering*: Common in tidewater areas of the Eastern Shore section; fairly common in the tidewater areas of the Western Shore section; uncommon in the tidewater areas of the Upper Chesapeake section; rare in the interior of all sections. One of the outstanding concentration areas is found on the Little Choptank River in Dorchester County. Other concentration areas include Chincoteague and Sinepuxent Bays, Choptank River, Eastern Bay, Chester River, and tides of Anne Arundel and Calvert Counties. *Summer vagrant*: Casual visitor—1 at Sand Point, Anne Arundel County, on July 7, 1952 (R. R. Kerr).

HABITAT.—Bays and estuaries (both salt and brackish waters) also inland ponds, reservoirs, lakes, and (rarely) streams.

SPRING MIGRATION.—*Normal period*: March 10–20 to April 20–30; peak, March 25 to April 15. *Extreme arrival date*: February 25, 1950, in Prince Georges County (P. F. Springer). *Extreme departure dates*: June 9, 1951, in Charles County (J. W. Taylor Jr.); June 3, 1955, in Prince Georges County (F. M. Uhler); June 2, 1953, in Anne Arundel County (Mr. and Mrs. W. I. Henderson).

FALL MIGRATION.—*Normal period*: October 20–30 to December 10–20; peak, November 1 to November 30. *Extreme arrival dates*: September 3, 1956, in Caroline County (M. W. Hewitt); October 10, 1893, in Frederick County (W. H. Fisher).

MAXIMUM COUNTS.—*Spring*: 201 on the South River, Anne Arundel County, on April 9, 1954; 77 in southern St. Marys County on April 12, 1954. *Fall*: 500 on Eastern Bay, Queen Annes County, on November 23, 1951 (V. B. Daiker); 280 in the North Beach area, Calvert County, on November 23, 1952 (L. W. Sieck); 240 on South River, Anne Arundel County, on November 14, 1954; 75 on Mountain Lake, Garrett County, on November 2, 1951 (H. E. Slater). *Winter*: 650 in the Ocean City area on December 27, 1948 (Christmas count); 646 in southeastern Worcester County on December 22, 1947 (Christmas count); 591 in the Annapolis area on January 2, 1955 (Christmas count); 553 in St. Marys County on January 2, 1956 (Christmas count); 150

in Chester River, Kent County, on December 17, 1926 (T. Dennead).

BANDING.—Two Buffleheads recovered in Anne Arundel and St. Marys Counties in winter (December 12–January 1) had been banded during late summer (July 22–August 8) in southern Manitoba. Two others banded in Queen Annes County on March 15 and March 18, 1956, were recovered in eastern Wisconsin and northwestern Saskatchewan on October 19, 1956, and September 5, 1956, respectively.

OLDsquaw *Clangula hyemalis* (Linnaeus)

STATUS.—*Transient and wintering:* Common in tidewater areas of the Eastern Shore and Western Shore sections; uncommon in tidewater areas of the Upper Chesapeake section; rare in the interior of all sections. *Summer vagrant:* Casual visitor—recorded in Anne Arundel County in 1946 (F. M. Uhler), in 1950 (E. La Fleur, R. Beasley) and 1953 (Mr. and Mrs. S. Henderson), and in Prince Georges County in 1897 (G. Marshall).

HABITAT.—Bays and estuaries (chiefly salt-water); more sparingly in the ocean; rarely on inland ponds, lakes, and streams.

SPRING MIGRATION.—*Normal period:* March 1–10 to April 20–30; peak, March 15 to April 15. *Extreme departure dates:* May 11, 1952, in Worcester County (D. A. Cutler); May 8, 1950, in Anne Arundel County (Mrs. W. L. Henderson).

FALL MIGRATION.—*Normal period:* October 20–30 to December 10–20; peak, November 5 to December 5. *Extreme arrival dates:* October 18, 1956, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); October 19, 1956, in Dorchester County.

MAXIMUM COUNTS.—*Spring:* 4,000 in Talbot County on March 18, 1931 (H. C. Oberholser); 664 in the Western Shore section (West River to St. Georges Island) on March 25, 1920 (A. Wetmore); 540 on the Potomac River near the mouth of the Wicomico River on March 26, 1920 (A. Wetmore). *Fall:* “Thousands” near the mouth of the Chester River on November 29, 1945 (E. R. Quortrup); “thousands” at the mouth of the Manokin River, Somerset County, on December 6, 1911 (F. C. Kirkwood); 500 on Eastern Bay and the Choptank River on November 23, 1951; 200 near South Point in Chincoteague Bay on November 11, 1950; 10 near Seneca, Montgomery County, on November 28, 1953 (P. A. DuMont). *Winter:* 7,032 near St. Michaels in Talbot County on December 29, 1953 (Christmas count); 2,413 in Ocean City area on December 27, 1955 (Christmas count); 1,020 in southern Anne Arundel County on January 6, 1955; 927 in southeastern Wor-

chester County on December 22, 1947 (Christmas count). *Summer vagrant*: 12 at Gibson Island, Anne Arundel County, on June 1953 (Mr. and Mrs. W. L. Henderson).

HARLEQUIN DUCK *Histrionicus histrionicus* (Linnaeus)

STATUS.—Casual visitor along the coast. One was recorded Ocean City on December 28, 1949 (Davis and Willoughby, 1950). Another was observed on March 1, 1955, and April 30, 1955 (D. A. Cutler), at the Ocean City Inlet.

[LABRADOR DUCK] *Camptorhynchus labradorium* (Gmelin)

STATUS.—Hypothetical. Now extinct, this species probably occurred in the Chesapeake Bay area at one time. Audubon (1838 and 1843) mentions seeing them in a market at Baltimore.

COMMON EIDER *Somateria mollissima* (Linnaeus)

STATUS.—Casual visitor. A specimen, formerly in the old collection of the Maryland Academy of Sciences (but no longer extant), was reported to have been collected in Charles County, below Marshall Hall (Kirkwood, 1895). An immature male was closely observed at Ocean City on February 20, 1949 (I. I. Barnes, P. F. Springer), and 1 was observed at the same location on May 15, 1949 (J. Cadbury, D. A. Cutler). Five were seen at Ocean City on December 26 and 27, 1955 (E. G. Baldwin, P. A. DuMont), and 2 on February 26, 1956 (Mr. and Mrs. I. C. Hoover).

KING EIDER *Somateria spectabilis* (Linnaeus)

STATUS.—Casual visitor. One was collected (USNM) on the lower Potomac River (purchased at D. C. market on December 12, 1866). A female was collected on the Severn River on December 12, 1895 (F. C. Kirkwood). Another female, killed on the Honga River in Dorchester County on November 9, 1928, was mounted and exhibited in a store at Hooper Island (Perkins, 1933). Two, a female (McDonogh Museum) and an immature male (McDonogh Acad. Sci.), were collected on November 18, 1933, at the mouth of the Little Choptank River in Dorchester County (H. Matthai). 2 others (a female collected—USNM) were seen by Mr. Matthai at the same location on November 25, 1933. One immature male and 1 female were seen at Ocean City on January 29, 1950 (Barnes and Handley, 1950); the immature male was observed several times after this, through February 26. A single bird was observed at Ocean City on October 28 and December 28–29, 1951 (J. W. Taylor, Jr.). Another was seen at Ocean City on December 28 and 29, 1952.

WHITE-WINGED SCOTER *Melanitta deglandi* (Bonaparte)

STATUS.—*Transient*: Abundant in the coastal area of Worcester County; common in tidewater areas elsewhere in the Eastern Shore and Western Shore sections; fairly common in tidewater areas of the Upper Chesapeake section; rare in the interior of all sections. *Wintering*: Common in tidewater areas of the Eastern Shore section; fairly common in tidewater areas of the Western Shore section; uncommon in tidewater areas of the Upper Chesapeake section. *Summer vagrant*: Rare in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections.

HABITAT.—Most numerous on littoral zone of ocean; also regular in bays and estuaries and occasional on inland lakes and ponds.

SPRING MIGRATION.—*Normal period*: March 10–20 to May 1–10; peak, March 25 to April 25. *Extreme departure dates*: May 1, 1939, in Queen Annes County (H. Kolb); May 21, 1950, between Sandy Point and Kent Island (S. H. Low); May 15, 1954, Worcester County (J. K. Wright).

FALL MIGRATION.—*Normal period*: October 5–15 to December 1–15; peak, October 20 to December 1. *Extreme arrival date*: September 24, 1954, in Kent County (Mr. and Mrs. W. L. Henderson).

MAXIMUM COUNTS.—*Spring*: 8,000 between Ocean City and the Delaware line on April 6, 1946; 1,000+ on Eastern Bay on May 1, 1925 (F. C. Kirkwood). *Fall*: 3,000 in the Kent Island area, Queen Annes County, on December 1, 1951 (R. R. Kerr); 400 at North Beach, Calvert County, on November 23, 1952 (L. W. Dieck). *Winter* (Christmas counts): 3,391 near St. Michaels, Calvert County, on December 29, 1954; 2,636 in the Ocean City area on December 27, 1954; 565 in southeastern Worcester County on December 22, 1947; 203 in the Solomons Island area, Calvert County, on December 21, 1946.

PIPER SCOTER *Melanitta perspicillata* (Linnaeus)

STATUS.—*Transient*: Abundant in the coastal area of Worcester County; common in tidewater areas elsewhere in the Eastern Shore and Western Shore sections; uncommon in tidewater areas of the Upper Chesapeake section; casual in the Piedmont section—1, March 29–30, 1954, at Dierssen Refuge, Montgomery County (J. W. Terborgh, E. G. Baldwin). *Wintering*: Common in the coastal area of Worcester County; fairly common in tidewater areas elsewhere in the Eastern Shore and Western Shore sections; rare in tidewater areas of the Upper Chesapeake section.

Summer vagrant: Casual in the Eastern Shore section—recorded in Worcester County (L. T. Berry).

HABITAT.—Most numerous on littoral zone of ocean; also regular on bays and estuaries (chiefly salt-water).

SPRING MIGRATION.—*Normal period*: February 20–March to May 1–10; peak, March 1 to April 20. *Extreme departure dates*: May 20, 1950, and May 19, 1906 (F. C. Kirkwood), at Ocean City.

FALL MIGRATION.—*Normal period*: October 1–10 to December 1–10; peak, October 15 to November 25. *Extreme arrival date*: September 27, 1949, at Ocean City.

MAXIMUM COUNTS.—Spring: 19,000 between Ocean City and the Delaware line on March 1, 1955. *Winter* (Christmas counts) 5,352 in the Ocean City area on December 27, 1954; 1,066 in southeastern Worcester County on December 23, 1946.

COMMON SCOTER *Oidemia nigra* (Linnaeus)

STATUS.—*Transient*: Common in the coastal area of Worcester County; fairly common elsewhere in tidewater areas of the Eastern Shore and Western Shore sections; uncommon in tidewater areas of the Upper Chesapeake section. *Wintering*: Fairly common in the coastal area of Worcester County; uncommon in tidewater areas elsewhere in the Eastern Shore and Western Shore sections; rare in the tidewater areas of the Upper Chesapeake section.

HABITAT.—Most numerous in littoral zone of ocean; also regular in bays and estuaries (chiefly salt-water).

SPRING MIGRATION.—*Normal period*: February 10–20 to May 5–15; peak, February 25 to April 25. *Extreme date of arrival*: February 6, 1954, in Worcester County. *Extreme dates of departure*: May 22, 1949, and May 20, 1950, at Ocean City.

FALL MIGRATION.—*Normal period*: September 10–20 to November 20–30; peak, October 10 to November 10. *Extreme arrival dates*: August 4, 1945, and August 27, 1900 (F. C. Kirkwood), at Ocean City.

MAXIMUM COUNTS.—*Spring*: 6,300 between Ocean City and the Delaware line on April 6, 1946. *Winter* (Christmas counts) 2,368 in the Ocean City area on December 27, 1954; 71 in southeastern Worcester County on December 22, 1947.

RUDDY DUCK *Oxyura jamaicensis* (Gmelin)

STATUS.—*Transient*: Common, locally abundant, in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common on inland water areas of all sec

ns. *Wintering*: Common in tidewater areas of the Eastern Shore and Western Shore sections; fairly common in tidewater areas of the Upper Chesapeake section; rare on inland water areas of the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections. Concentration areas include: the Potomac River in Charles County, Wicomico River in Charles and St. Marys Counties, lower Patuxent River, South River, West River, Mathy River, Patapsco River, Gunpowder River, Susquehanna River, Sassafras River, Chester River, Eastern Bay, Choptank River, Fishing Bay, and the Nanticoke River. *Summer vagrant*: Rare visitor in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections.

HABITAT.—Brackish bays and estuaries that contain plentiful aquatic plant growth, or a rich molluscan fauna; also on inland lakes and ponds.

SPRING MIGRATION.—*Normal period*: March 1–10 to May 10–15; peak, March 15 to April 10. *Extreme arrival date*: February 1, 1948, in Prince Georges County. *Extreme departure dates*: June 7, 1930, in the District of Columbia (W. H. Ball); June 2, 1953, in Dorchester County (Mr. and Mrs. W. L. Henderson); May 31, 1948, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 15–25 to December 5–15; peak, October 25 to November 30. *Extreme arrival dates*: August 27, 1935, in Garrett County (M. G. Brooks); September 2, 1950, in Anne Arundel County. *Extreme departure date*: December 15, 1935, in Garrett County (M. G. Brooks).

MAXIMUM COUNTS.—*Spring*: 12,500 on Fishing Bay, Dorchester County, on March 21 and March 25, 1946; 6,150 in the South River area, Anne Arundel County, on April 9, 1954; 3,520 in southern Charles County on March 20, 1948; 2,500 in the Point Lookout area, St. Marys County, on March 29, 1953 (J. W. Berborgh); 2,300 in the Carroll Island area, Baltimore County, on March 16, 1947 (O. W. Crowder). *Fall*: 26,330 in northern Anne Arundel County on November 23, 1955; 5,650 in southern Charles County on December 11, 1948; 1,000+ in St. Marys County on November 8, 1946 (F. M. Uhler); 200 at Mountain Lake, Garrett County, on November 2, 1951 (H. E. Slater). *Winter*: 14,190 in the Annapolis area on January 2, 1955 (Christmas count); 10,000 in the Port Tobacco area, Charles County, on December 27, 1941 (Christmas count); 7,500 in the Wicomico River area, St. Marys County, on February 11, 1950 (R. J. Beaton, W. Taylor, Jr.); 6,880 on the South and West Rivers, Anne Arundel County, on January 2, 1949; 5,000 on the lower Patuxent

River on February 18, 1951; 4,400 on the Patapsco River on January 25, 1955. *Summer vagrant*: 40 on June 11, 1953, and ; on June 27, 1953, in the Port Tobacco area, Charles County (A. Stickley, Jr.).

BANDING.—One Ruddy Duck recovered in Baltimore County December 9, 1931, had been banded as a young bird in eastern Wisconsin on September 25, 1931.

MASKED DUCK *Oxyura dominica* (Linnaeus)

STATUS.—Accidental visitor. An adult male was collected (USNM) in Cecil County near Elkton on September 8, 1906 (Houghton, 1906).

HOODED MERGANSER *Lophodytes cucullatus* (Linnaeus)

STATUS.—*Breeding*: Rare in the Allegheny Mountain and Piedmont sections—an adult female and 8 small young were observed on Cherry Creek in Garrett County on June 21, 1946 (Stewart and Robbins, 1947a), and an adult with young was seen near Seneca in Montgomery County on May 1, 1954 (W. B. Tyrrell). *Transient*: Common in tidewater areas of the Eastern Shore section; fairly common in tidewater areas of the Western Shore and Upper Chesapeake sections and in the interior of all sections. *Wintering*: Fairly common in tidewater areas of the Eastern Shore section; uncommon in tidewater areas of the Western Shore and Upper Chesapeake sections; rare in the interior of the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections. *Summer vagrant*: Rare in all sections.

HABITAT.—Creeks and ponds in tidal marshes; also on inland streams, lakes, and ponds.

SPRING MIGRATION.—*Normal period*: February 15–25 to March 5–15; peak, March 10 to April 20. *Extreme arrival date*: February 14, 1953, in Frederick County (J. W. Richards). *Extreme departure date*: May 27, 1949, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 25–October 5 to December 5–15; peak, November 1 to November 30. *Extreme arrival dates*: September 17, 1895, in Montgomery County (E. J. Brown); September 20, 1948, in Prince Georges County.

MAXIMUM COUNTS.—*Spring*: 80 on Blackwater Refuge, Dorchester County, on March 21, 1946. *Fall*: 50 in the Port Tobacco area, Charles County, on November 19, 1950; 31 at Patuxent Refuge, Prince Georges County, on November 26, 1947; 24 at Great Falls, Montgomery County, on November 14, 1948 (K. F. Weber). *Winter*: 100 on the Potomac River, off Mt. Vernon, Virginia, on February 8, 1920 (F. Harper); 70 on Blackwater

fuge on December 27, 1949 (Christmas count); 50 in the Port Tobacco area on December 27, 1941 (Christmas count); 35 on Powder Neck, Harford County, on December 31, 1950 (T. A. Hof).

COMMON MERGANSER *Mergus merganser* Linnaeus

STATUS.—*Transient and wintering*: Common in tidewater areas of the Upper Chesapeake section; fairly common in tidewater areas of the Eastern Shore and Western Shore sections and in the interior of the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections; uncommon in the Ridge and Valley, and Allegheny Mountain sections. *Summer vagrant*: Casual visitor—recorded in Montgomery (D. M. Thatcher), Anne Arundel (J. W. Taylor, Jr.), and Prince Georges Counties.

HABITAT.—Brackish bays, estuaries, and marshes, and inland ponds, lakes, and streams (rare in salt-water habitats).

SPRING MIGRATION.—*Normal period*: February 15–25 to May 5; peak, March 5 to April 25. *Extreme arrival dates*: February 7, 1903, in Allegany County (G. Eifrig); February 12, 1945, in Prince Georges County. *Extreme departure dates*: May 26, 1905 (H. C. Oberholser), and May 24, 1952 (J. M. Abbott), in the District of Columbia; May 18, 1944, in Prince Georges County.

FALL MIGRATION.—October 20–30 to December 15–25; peak, November 15 to December 10. *Extreme dates of arrival*: September 22, 1951, in the District of Columbia (C. L. Clagett); September 23, 1932, in Prince Georges County (H. C. Oberholser); September 29, 1894, in Baltimore County (F. C. Kirkwood). *Extreme date of departure*: December 27, 1940, in Prince Georges County.

MAXIMUM COUNTS.—*Spring*: 195 in the Carroll Island area, Baltimore County, on March 16, 1947 (O. W. Crowder); 150 in the District of Columbia on March 13, 1931 (W. L. McAtee); 100+ at Port Tobacco, Charles County, on March 22, 1952 (H. A. Patton, P. A. DuMont); 85 near Perry Point, Cecil County, on March 5, 1949 (I. R. Barnes). *Winter*: 1,171 on Blackwater fuge, Dorchester County, on December 23, 1951 (Christmas count); 438 on the Susquehanna Flats on December 28, 1951 (Christmas count); 400 near Accokeek, Prince Georges County, on December 29, 1944 (Christmas count); 350 on Loch Raven reservoir, Baltimore County, on January 11, 1947 (H. Kolb); 2 in the Wicomico River area, southern Charles County, on January 2, 1949 (Christmas count).

RED-BREASTED MERGANSER *Mergus serrator* Linnaeus

STATUS.—*Transient*: Common, occasionally abundant, in the coastal area of Worcester County; fairly common elsewhere in the tidewater areas of the Eastern Shore and Western Shore sections; uncommon in tidewater areas of the Upper Chesapeake section and in the interior of all sections. *Wintering*: Fairly common in the coastal area of Worcester County; uncommon elsewhere in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare in the interior of the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections. *Summer vagrant*: Rare in the coastal area of Worcester County and in the tidewater areas of Somerset County; casual visitor in tidewater areas elsewhere—recorded in Dorchester, Anne Arundel, and Prince Georges Counties.

HABITAT.—Bays and estuaries (chiefly salt-water); also occurs on the ocean and occasionally on inland ponds, lakes, and streams.

SPRING MIGRATION.—*Normal period*: March 5–15 to May 15; peak, March 25 to April 25. *Extreme dates of departure*: May 30, 1927, in the District of Columbia (W. H. Ball); May 3, 1948, in Frederick County.

FALL MIGRATION.—*Normal period*: October 15–25 to December 10–20; peak, November 1 to November 30. *Extreme arrival date*: September 19, 1945, in Worcester County. *Extreme departure date*: December 23, 1901, in Allegany County (G. Eifrig).

MAXIMUM COUNTS.—*Spring*: 200 on Deep Creek Lake, Garrett County, on April 18–19, 1936 (M. G. Brooks); 153 in the Ocean City area on April 6, 1946; 19 in the District of Columbia on April 17, 1918 (R. W. Moore); 15 near Seneca, Montgomery County, on April 18, 1949 (F. C. Cross). *Fall*: 5,000 on Sinepuxent Bay, south of Ocean City, on November 2–3, 1945; 50 on Gunpowder Neck, Harford County, on October 21, 1950 (T. A. Imhof); 1 on Mountain Lake, Garrett County, on November 3, 1951 (H. Slater). *Winter* (Christmas counts): 462 in the Ocean City area on December 28, 1949; 77 near St. Michaels, Talbot County, on December 29, 1953.

Family CATHARTIDAE**TURKEY VULTURE *Cathartes aura* (Linnaeus)**

STATUS.—*Breeding and transient*: Common in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections; fairly common in the Ridge and Valley section; uncommon (occasionally fairly common during migration) in the Allegheny Mountain section. *Wintering*: Abundant in the Eastern Shore section

common in the Western Shore, Upper Chesapeake, and Piedmont sections; fairly common in the Ridge and Valley section; rare in the Allegheny Mountain section.

HABITAT.—A wide-ranging edge species that occurs regularly in agricultural, marsh, and other open areas as well as in adjacent wooded tracts.

NESTING SEASON.—Early April to late August (nesting peak, late April to mid-July). *Extreme egg dates* (91 nests): April 1943, in Anne Arundel County and June 10, 1923 (F. C. Kirkwood), in Baltimore County. *Extreme nestling dates* (25 nests): May 13, 1954, in Caroline County (A. J. Fletcher) and August 29, 1942, in Anne Arundel County.

MIGRATION PERIODS.—*Approximate spring period*: January 25 to March 20. *Approximate fall period*: October 25 to December 10.

BREEDING POPULATION DENSITIES (pairs per 100 acres).—(7 in 2,656 acres) in mixed habitats (including forest and brush, with scattered agricultural areas and abandoned farmlands) along the border between Anne Arundel and Prince Georges Counties in 1943. (7 in 11,520 acres) in "general farmland" (various agricultural habitats, chiefly hayfields and pastures, with little cover owing to widespread clean-farming practices) in Frederick County in 1950 (Stewart and Meanley, 1950).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 1,334 in the Annapolis area on December 27, 1955; 704 near Denton, Caroline County, on December 26, 1953; 400 near Crisfield, Somerset County, on December 26, 1949.

BANDING.—Some of the Turkey Vultures, occurring in Maryland during the summer, range farther south during the colder months as shown by the following records: 1 banded in Howard County on August 24 and recovered in northeastern North Carolina on January 23; and 2 recovered in Somerset and Frederick Counties on April 7 and July 19, respectively, that had been banded in northeastern Virginia (Elizabeth City County) in winter (December 15–January 6). A movement from Maryland to the north also shown by a bird that was banded in Dorchester County on March 12 and recovered in central New Jersey on August 15. Local movements are indicated by 5 birds banded in Prince Georges County in fall and winter (October 4–January 9), all of which were recovered in winter and spring (December 10–April 20) between 12 and 35 miles from the point of banding. Another banded in Worcester County on June 5 was recovered the following year on July 3 in Dorchester County (37 miles from

point of banding). Occasional erratic seasonal movements are shown by the following records: 1 recovered in Prince Georges County on December 23 that had been banded in southeastern Virginia on April 19; 1 recovered in Howard County on December 3, that had been banded in northern Virginia (Alexandria) August 26, and 1 banded in Prince Georges County on October 6 and recovered in south-central Pennsylvania on December 6 years later.

BLACK VULTURE *Coragyps atratus* (Bechstein)

STATUS.—Permanent resident (see fig. 19): Common in the southern part of the Western Shore section (St. Marys, Charles and Calvert Counties and southern Prince Georges County) fairly common in the Potomac River Valley, extending from the

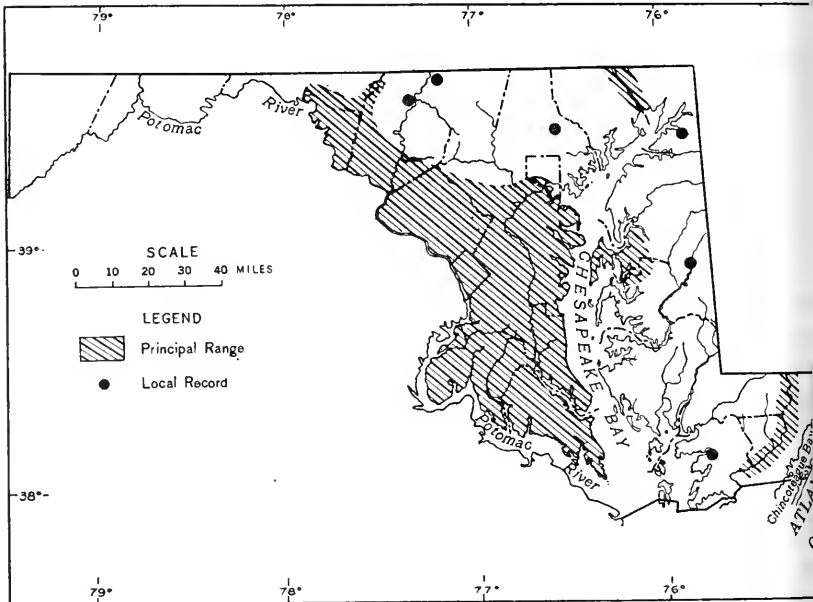


FIGURE 19.—Breeding range of Black Vulture.

District of Columbia to Williamsport in Washington County; common in the northern part of the Western Shore section (Annapolis, St. Marys, Arundel and northern Prince Georges Counties), in the southern part of the Piedmont section (Howard and Montgomery Counties), in western Frederick County (Frederick Valley), eastern Washington County (Hagerstown Valley and the Blue Ridge), the Susquehanna River Valley (Harford and Cecil Counties), the northern part of the Eastern Shore section (southern Queen Anne's County).

nes and northern Talbot Counties), and along the Pocomoke river (in Wicomico and Worcester Counties); rare, elsewhere in the Eastern Shore, Upper Chesapeake, and Piedmont sections and the western part of the Ridge and Valley section. Definite nest records are from St. Marys (Court, 1924), Charles (A. D. Jones), Montgomery (Wimsatt, 1939; S. H. Low), Prince Georges (Stewart and Robbins, 1947a), Anne Arundel (Dorsey, 1947), Harford (Kolb, 1949b), Baltimore (Smyth, 1952), and Wicomico Counties. Alexander Wetmore states that this species was rare in Maryland until about 30 years ago.

HABITAT.—A wide-ranging edge species that occurs in agricultural and other open habitats as well as in adjacent forested areas.

NESTING SEASON.—Mid-March to early July. *Extreme egg dates* (12 nests): March 14, 1952, in Charles County (A. D. Jones) and May 17, 1947, in Harford County (Kolb, 1949b). *Extreme hatching dates* (4 nests): April 29, 1951, in Baltimore County (Smyth, 1952) and July 4, 1953, in Montgomery County (S. H. Low).

MAXIMUM COUNTS.—*Spring*: 75 at Carderock, Montgomery County, on March 28, 1948 (E. J. Stivers); 40 near Buckeystown, Frederick County, on April 29, 1950. *Winter*: 100 near Plummers Landing, Montgomery County, on February 11, 1945 (A. Wetmore); 75 in St. Marys County on January 31, 1954 (J. W. Terborgh, et al.); 69 in the District of Columbia area on December 20, 1952 (Christmas count); 65 near Accokeek, Prince Georges County, on December 22, 1947 (Christmas count); 62 in the Wicomico river area in southern Charles County on December 28, 1952 (Christmas count); 51 in the Point Lookout area, St. Marys County, on December 22, 1937 (Christmas count); 16 near Denton, Caroline County, on December 26, 1953 (Christmas count); 15 in the Catoclin Mountain area, Frederick County, on December 25, 1951 (Christmas count).

BANDING.—One Black Vulture recovered in Kent County on March 6, 1939, had been banded as an adult in southeastern Virginia (Elizabeth City County) on May 5, 1935.

Family ACCIPITRIDAE

WALLOW-TAILED KITE *Elanoïdes forficatus* (Linnaeus)

STATUS.—*Casual visitor.* A specimen (USNM) was collected at Pocomoke City, Howard County, on August 7, 1879. A mounted specimen examined by Kirkwood (1895) was shot near Catonsville, Baltimore County, in late July or early August, 1889. An-

other was collected in Montgomery County on August 3, 1891 (Bent, 1937).

GOSHAWK *Accipiter gentilis* (Linnaeus)

STATUS.—*Breeding*: Formerly rare (one nest record) in the Allegheny Mountain section—in 1901, a pair was present in summer and nested about 3 miles above Jennings in Garrett County (Behr, 1914). *Transient and wintering*: Uncommon and irregular in the Allegheny Mountain section; rare and irregular in all other sections. Definite transient and wintering records have been made in Garrett (Brooks, 1936c), Allegany (specimen—Kirkwood, 1895), Washington (specimen—J. N. Hamlet), Montgomery (specimens—USNM), Baltimore (F. C. Kirkwood), Prince Georges (specimen—Fisher, 1918; also several significant records), Talbot (fide R. L. Kleen), and Dorchester (specimen—Cottam and Uhler, 1935) Counties.

HABITAT.—*Breeding*: Behr (1914) mentions that this species disappeared as a breeding bird in Garrett County, with the cutting of spruce and hemlock. *Transient and wintering*: Occurs in various forest edge habitats.

PERIOD OF OCCURRENCE.—The dates of occurrence of transient and wintering birds are uniformly distributed between the extremes of September 28, 1944 (Stewart et al., 1952) and the middle of March, 1918 (Cottam and Uhler, 1935).

SHARP-SHINNED HAWK *Accipiter striatus* Vieillot

STATUS.—*Breeding*: Fairly common in the Allegheny Mountain section; uncommon in the Ridge and Valley section; rare (formerly more numerous) in the Piedmont section. *Transient*: Common in all sections (a concentration area during the fall flight found on Hooper and Barren Islands in Dorchester County). *Wintering*: Uncommon in the Eastern Shore and Western Shore sections; rare in the Upper Chesapeake, Piedmont, and Ridge and Valley sections.

HABITAT.—Occurs most commonly in areas with extensive wooded tracts. During migration, especially in the fall, the species concentrates along the ridge tops of the Allegheny Mountain, and Ridge and Valley sections, along the Chesapeake Bay shores of the Eastern Shore and Western Shore sections, and along the coast.

NESTING SEASON.—Early May to mid-July. *Extreme egg dates* (5 nests): May 15, 1910, in the District of Columbia (E. J. Courtenay) and May 31, 1891, in Montgomery County (Stabler, 1891).

stling date (1 nest): July 11, 1938, in Garrett County (L. M. Jewellyn).

SPRING MIGRATION.—*Normal period*: February 25–March 5 to May 10–20; peak, April 5 to May 5. *Extreme date of arrival*: February 8, 1943, in Prince Georges County. *Extreme date of departure*: May 28, 1953, in Charles County (A. R. Stickley, Jr.).

FALL MIGRATION.—*Normal period*: September 1–10 to November 15–25; peak, September 15 to October 25. *Extreme dates of arrival*: August 16, 1943, in Prince Georges County; August 20, 1939, in the District of Columbia (C. W. Richmond). *Extreme date of departure*: December 6, 1953, in Prince Georges County.

MAXIMUM COUNTS.—*Spring*: 105 at Patuxent Refuge, Prince Georges County, on April 26, 1946. *Fall*: 190 at Monument Knob on the boundary between Frederick and Washington Counties on October 11, 1953 (R. J. Beaton); 113 at White Marsh, Baltimore County, on October 1, 1954 (C. D. Hackman); 89 at Seneca, Montgomery County, on September 22, 1951 (D. Power). *Winter* (Christmas counts): 17 in the Ocean City area on December 27, 1953; 5 in the Point Lookout area, St. Marys County, on December 1, 1937; 5 in southern Dorchester County on December 28, 1955.

HOOPER'S HAWK *Accipiter cooperii* (Bonaparte)

STATUS.—*Breeding*: Fairly common in the Western Shore section; uncommon elsewhere in all sections. *Transient*: Fairly common in all sections (a concentration area during the fall flight is found on Hooper and Barren Islands in Dorchester County). *Wintering*: Uncommon in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections; rare in the Ridge and Valley, and Allegheny Mountain sections.

HABITAT.—Forest and wood margin habitats, occurring most commonly in areas that contain extensive forested tracts.

NESTING SEASON.—Mid-April to late July. *Extreme egg dates* (9 nests): April 21, 1918, in the District of Columbia (E. J. Murt) and June 5, 1892, in Montgomery County (H. B. Stabler). *Extreme nestling dates* (10 nests): June 5, 1892, in Montgomery County (H. B. Stabler) and July 23, 1937, in Worcester County (Laughn, 1937).

SPRING MIGRATION.—March 1–10 to May 5–15; peak, April 5 to April 30. *Extreme date of arrival*: February 24, 1949, in Prince Georges County. *Extreme dates of departure*: May 18, 1921, and May 17, 1917, in the District of Columbia area (McAtee, 1921).

FALL MIGRATION.—*Normal period*: September 1–10 to November 15–25; peak, September 15 to October 25. *Extreme dates of*

arrival: August 24, 1945, in Worcester County; August 27, 1945, in Talbot County (R. L. Kleen). *Extreme date of departure*: November 28, 1951, in Frederick County (J. W. Richards).

BREEDING POPULATION DENSITY (pairs per 100 acres).—

0.2 (3 in 1,856 acres) in upland forest and brush (both pine and deciduous) with scattered small agricultural areas and abandoned farmlands, Prince Georges County in 1943.

MAXIMUM COUNTS.—*Spring*: 19 on Patuxent Refuge, Prince Georges County, on April 26, 1945. *Fall*: 16 on Patuxent Refuge on September 23, 1944; 14 on South Mountain along the boundary between Frederick and Washington Counties on October 15, 1944 (Beaton, 1951); 14 at White Marsh, Baltimore County, on October 1, 1954 (C. D. Hackman). *Winter* (Christmas count): 8 in the Crisfield area, Somerset County, on December 26, 1947; 8 in the Ocean City area, Worcester County, on December 26, 1955; 7 in southern Dorchester County on December 21, 1947.

BANDING.—A southward movement of Cooper's Hawks from Maryland is shown by the record of an adult banded in Prince Georges County on August 1, 1945, that was recovered in southeastern North Carolina on November 12, 1947. The more northern origin of some of the migrating Cooper's Hawks in Maryland is indicated by the following records of 5 birds recovered in Maryland during early spring (March 6–20) and fall (September 22–October 28) that had been banded as nestlings in summer (June 20–July 12) farther north: 3 recovered in Dorchester, Prince Georges, and Washington Counties had been banded in Massachusetts (eastern and southwestern portions); and six birds recovered in Dorchester and Carroll Counties had been banded in northeastern New Jersey and southeastern Ontario (Leeds County) respectively. More local movements are illustrated by 2 birds recovered in Caroline County in fall (September 3–26, 1931) that had been banded as nestlings (June 18–20, 1931) in central Delaware; and a bird banded as a nestling in Prince Georges County on June 16, 1943, that was recovered about 10 miles distant in Anne Arundel County on April 20, 1944.

RED-TAILED HAWK *Buteo jamaicensis* (Gmelin)

STATUS.—*Breeding*: Fairly common in the Eastern Shore and Western Shore sections; uncommon elsewhere in all sections. *Transient*: Fairly common in all sections. *Wintering*: Common in the Eastern Shore and Upper Chesapeake sections; fairly common in the Western Shore and Piedmont sections; uncommon in the Ridge and Valley, and Allegheny Mountain sections.

HABITAT.—A wide-ranging edge species that occurs regularly agricultural, marsh, and other open areas as well as in extensive forested tracts.

NESTING SEASON.—Mid-March to late June (peak, late March early June). *Extreme egg dates* (49 nests): March 12, 1899, and May 3, 1917, in Baltimore County (both extremes by F. C. Kirkwood). *Extreme nestling dates* (9 nests): April 25, 1923, and June 24, 1896, in Baltimore County (both by F. C. Kirkwood).

SPRING MIGRATION.—*Normal period*: February 10–20 to April 20; peak, February 25 to April 1. *Extreme date of departure*: April 30, 1944, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 5–15 to December 1–10; peak, October 10 to November 15.

BREEDING POPULATION DENSITY (pairs per 100 acres).—(5 in 10,560 acres) in mixed habitats (forest and brush, including deciduous and pine types, with scattered small agricultural areas and abandoned farmlands) along the boundary between Anne Arundel and Prince Georges Counties in 1951.

MAXIMUM COUNTS.—*Spring*: 28 near Emmitsburg, Frederick County, on March 21, 1953 (J. W. Richards); 15 (12 in one hour) Patuxent Refuge, Prince Georges County, on February 28, 1948. *Fall*: 231 over South Mountain along the boundary between Frederick and Washington Counties on October 30, 1954 (E. G. Davis); 65 at White Marsh, Baltimore County, on November 12, 1952 (C. D. Hackman); 50 (in 15 minutes) in the District of Columbia on November 6, 1947 (E. G. Davis). *Winter* (Christmas counts): 35 in the Ocean City area on December 27, 1955; 23 near Pocomoke, Caroline County, on December 26, 1953; 16 in the Susquehanna Flats area in Harford and Cecil Counties on December 27, 1952; 15 in southern Dorchester County on December 28, 1953; 12 in the Catoctin Mountain area on January 1, 1955; 12 in the District of Columbia area on December 31, 1951.

BANDING.—A nestling banded in Montgomery County on May 19, 1937, was recovered in southwestern Illinois (St. Clair County) on August 30, 1937. Another nestling banded in Montgomery County on May 12, 1940, was recovered in northern Virginia (Page County) on February 19, 1941. An immature bird banded in Prince Georges County on November 1, 1943, was recovered in north-central North Carolina (Union County) on January 21, 1944. One banded near Hagerstown, Washington County, on November 8, 1952, was recovered near Savage River dam, Garrett County, on October 28, 1954. One recovered in the District of Columbia on December 1, 1951, had been banded as a nestling

in central New York (Tompkins County) on May 28, 1951. Another bird recovered in Harford County on December 28, 1943 had been banded in south-central Pennsylvania on December 1943.

RED-SHOULDERED HAWK *Buteo lineatus* (Gmelin)

STATUS.—Regular occurrence throughout the year. Locally common in the Eastern Shore and Western Shore sections—most numerous along the Pocomoke and Patuxent Rivers and their tributaries, and in the Zekiah Swamp (Charles County); fairly common in the Upper Chesapeake and Piedmont sections; uncommon (rare in winter) in the Ridge and Valley, and Allegheny Mountain sections. During migration in the fall this species tends to concentrate along the fall line of the Piedmont section (Haman, 1954).

HABITAT.—Chiefly flood-plain or river swamp forests (Stewart, 1949); in the Ridge and Valley, and Allegheny Mountain sections also occurs in moist well-drained forests on the upland.

NESTING SEASON.—Mid-March to late June (nesting peak, late March to late May). *Extreme egg dates* (53 nests): March 19, 1910, in Prince Georges County (E. J. Court) and May 31, 1895, in Baltimore County (Kirkwood, 1895). *Extreme nestling dates* (75 nests): April 3, 1939, in Prince Georges County (E. M. Colgan) and June 16, 1941, in Prince Georges County (L. Dargan).

MIGRATION PERIODS.—*Spring*: February 15–25 to April 10–15; peak, March 1 to April 5. *Fall*: September 10–20 to November 20–30; peak, September 20 to November 15.

BREEDING POPULATION DENSITY (pairs per 100 acres).—0.2 (51 in 26,880 acres) in lowland forest (flood-plain forest and adjacent small clearings and areas of river terrace and river bluff forests) along the Patuxent River in Anne Arundel and Prince Georges Counties (Stewart, 1943).

MAXIMUM COUNTS.—*Spring* (migrants): 36 at Bethesda, Montgomery County, on March 26, 1954 (J. C. Boyd); 8 near White Marsh, Baltimore County, on February 25, 1953 (C. D. Haman); 8 near Emmitsburg, Frederick County, on April 14, 1945 (J. W. Richards); 7 on Patuxent Refuge, Prince Georges County on March 25, 1945. *Fall*: 115 migrating along the fall line near White Marsh on November 12, 1952 (C. D. Hackman); 56 migrating along the fall line at Laurel, Prince Georges County, on October 24, 1954; 22 on South Mountain along the boundary between Frederick and Washington Counties on October 15, 1949 (Beat

51). *Winter* (Christmas counts): 21 in the Ocean City area December 27, 1954; 12 at Patuxent Refuge on January 12, 1950; 12 in the Point Lookout area, St. Marys County, on December 23, 1938; 11 in southern Dorchester County on December 23, 1951; 10 in the Triadelphia Reservoir area on December 24, 1955.

BANDING.—Ten banded as nestlings in Anne Arundel, Prince Georges, and Montgomery Counties and the District of Columbia spring (April 3–June 4), were recovered as follows: 5 were recovered in spring and early summer (April 7–June 30), including 1 in Maryland (between 10 and 55 miles from point of banding), 1 in each in central New York and east-central Virginia; 4 were recovered in fall (September 15–October 25), all in Maryland, between 10 and 48 miles from the point of banding; and 1 was taken in winter (January 20) in central North Carolina. An adult banded in Prince Georges County on March 18, 1944, was recovered in east-central Virginia (reported in letter dated April 10, 1945). One immature banded in Dorchester County on October 29, 1951, was recovered in central Massachusetts on November 11, 1955. Five recovered in fall, winter, and spring (October 12–April 1) in Prince Georges, Carroll, Kent, Baltimore, and Wicomico Counties had been banded as nestlings (May 2–June 17) in western Massachusetts, central New York, northern New Jersey, southeastern Pennsylvania, and central Delaware, respectively. One immature banded in southeastern Pennsylvania on September 19, 1954, was recovered in Baltimore County on January 17, 1955.

ROAD-WINGED HAWK *Buteo platypterus* (Vieillot)

STATUS.—*Breeding*: Common in the Allegheny Mountain, and Ridge and Valley sections; fairly common in the Piedmont and Eastern Shore sections; uncommon in the Upper Chesapeake and Western Shore sections. *Transient*: Common, occasionally abundant, in the Allegheny Mountain, Ridge and Valley, Piedmont, and Eastern Shore sections; fairly common in the Upper Chesapeake and Eastern Shore sections. Concentration areas during migration, especially in the fall, include most of the higher ridges in the Allegheny Mountain, and Ridge and Valley sections.

HABITAT.—Chiefly well-drained upland deciduous forest or upland deciduous forest mixed with pine.

NESTING SEASON.—Late April to mid-July (nesting peak, early May to late June). *Extreme egg dates* (30 nests): April 23, 1903, in Montgomery County (USNM—M. Clarke) and June 6, 1936, in Baltimore County (M. B. Meanley). *Extreme nestling dates* (7 nests): June 3, 1886, in the District of Columbia (Riley, 1902) and July 14, 1935, in Baltimore County (M. B. Meanley).

SPRING MIGRATION.—*Normal period*: April 5–15 to May 1–10; peak, April 15 to April 30. *Extreme dates of arrival*: March 1, 1884 (H. W. Henshaw), and March 31, 1919 (M. T. Cooke), in the District of Columbia.

FALL MIGRATION.—*Normal period*: September 1–10 to October 10–20; peak, September 15 to September 30. *Extreme dates of arrival*: August 11, 1955, in Talbot County (R. L. Kleen); August 28, 1946, in Prince Georges County (J. N. Hamlet). *Extreme dates of departure*: November 27, 1891, in Montgomery County (USNM—C. W. Richmond); October 21, 1950, along the boundary between Frederick and Washington Counties (R. S. Stauffer).

BREEDING POPULATION DENSITY (pairs per 100 acres).—0.2 (4.5 in 1,856 acres) in upland forest and brush (mixed pine and deciduous forest with small scattered agricultural areas and abandoned farmland) in Prince Georges County in 1943.

MAXIMUM COUNTS.—*Spring*: 171 at Patuxent Refuge, Prince Georges County on April 16, 1944; 94 on South Mountain along the boundary between Frederick and Washington Counties on April 21, 1951 (R. J. Beaton); 51 at Laurel, Prince Georges County, on April 20, 1952; 40 near Deep Creek Lake, Garrett County, on April 17, 1954 (M. G. Brooks); 36 near Emmitsburg, Frederick County, on April 19, 1954 (J. W. Richards). *Fall*: 2,500 (in 15 minutes) near Emmitsburg, Frederick County, September 18, 1953 (J. W. Richards); 2,169 at Lore's Pond, Calvert County, on September 21, 1949 (G. Kelly); 1,430 on South Mountain on September 24, 1950 (E. G. Baldwin); 1,399 along the fall line above White Marsh, Baltimore County, on September 23, 1954 (C. D. Hackman); 1,047 (in 75 minutes) on Patuxent Refuge on September 22, 1944; 1,000 in the District of Columbia on September 22, 1918 (M. T. Cooke).

ROUGH-LEGGED HAWK *Buteo lagopus* (Pontoppidan)

STATUS.—*Transient and wintering*: Fairly common in District of Columbia and Chester County; uncommon elsewhere in the Upper Chesapeake and Eastern Shore sections; rare in all other sections. Birds in the dark phase of this species predominate in Maryland.

HABITAT.—Chiefly, open agricultural areas and tidal marshes.

PERIOD OF OCCURRENCE.—*Normal period*: October 25–November 5 to April 5–15; peak, November 20 to March 25. *Extreme dates of arrival*: October 1, 1949, along the boundary between Frederick and Washington Counties (R. J. Beaton). *Extreme dates of departure*: April 21, 1948, in Queen Annes County; April 21, 1948, along the boundary between Frederick and Washington Counties (R. J. Beaton).

MAXIMUM COUNTS.—*Spring*: 3 in Talbot and Dorchester Counties on March 22, 1953 (E. Willis). *Winter*: 6 in Dorchester County on December 22, 1952 (Christmas count).

OLDEN EAGLE *Aquila chrysaëtos* (Linnaeus)

STATUS.—*Transient*: Uncommon in the Ridge and Valley, and Allegheny Mountain sections; rare elsewhere in all sections. *Wintering*: Rare in the Piedmont, Upper Chesapeake, Western Shore, and Eastern Shore sections. *Summer vagrant*: Casual in the Allegheny Mountain section—1 seen over Negro Mountain, Garrett County, on August 31, 1931 (A. Wetmore).

HABITAT.—A wide-ranging edge species.

SPRING MIGRATION.—*Normal period*: March 1–10 to April 10. *Extreme date of departure*: April 21, 1951, along the boundary between Frederick and Washington Counties (R. J. Beaton).

FALL MIGRATION.—*Normal period*: September 20–30 to November 20–30. *Extreme dates of arrival*: September 16, 1951, White Marsh, Baltimore County (C. D. Hackman) and September 17, 1950, along the boundary between Frederick and Washington Counties (R. J. Beaton). *Extreme date of departure*: September 3, 1949, along the boundary between Frederick and Washington Counties (R. J. Beaton).

MAXIMUM COUNTS.—*Fall*: 3 at Monument Knob along the boundary between Frederick and Washington Counties on September 24, 1950, and October 15, 1949 (Beaton, 1951).

OLD EAGLE *Haliaeetus leucocephalus* (Linnaeus)

STATUS.—*Breeding*: Fairly common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare in the Piedmont section. Definite nest records for Dorchester, Somerset, Dorchester, Talbot, Caroline, Queen Annes, Kent, Cecil, Harford, Baltimore, Prince Georges, Anne Arundel, Wicomico, St. Marys, Charles, and Montgomery Counties and the District of Columbia. *Transient and wintering*: Fairly common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon in the Piedmont section and in the interior of the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare in the Ridge and Valley, and Allegheny Mountain sections. *Summer vagrant*: Uncommon in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections.

HABITAT.—Most numerous in tidewater habitats; also occurs among inland lakes, ponds, and streams.

NESTING SEASON.—Early February to early August (peak,

mid-February to early June). *Extreme egg dates* (63 nest February 8, 1915, in Baltimore County (F. C. Kirkwood) ; April 29, 1936, in Baltimore County (W. B. Tyrrell). *Extreme nestling dates* (34 nests) : March 18, 1934, in Anne Arundel County (Tyrrell, 1934) and July 9, 1947, in the District of Columbia (J. W. Taylor, Jr.). A nest containing young about 4 weeks old was found on June 26, 1934; these young would not have been in the nest until August (W. B. Tyrrell).

PERIODS OF GREATEST ABUNDANCE (transients and vagrants) *Spring*: March 1 to April 30. *Fall*: August 25 to December 31.

MAXIMUM COUNTS.—*Fall*: 12 along the Potomac River in Prince Georges and Charles Counties on September 19, 1927 (H. H. Jackson) ; 7 near White Marsh, Baltimore County, on September 17, 1953 (C. D. Hackman). *Winter*: 36 in southern Dorchester County on December 22, 1952 (Christmas count) ; 34 in the Carver Island area, Baltimore County, on December 29, 1951 (Christmas count) ; 27 at Army Chemical Center, Harford County, on January 2, 1952 (T. A. Imhof) ; 17 in the Susquehanna Flats area in Harford and Cecil Counties on December 28, 1951 (Christmas count).

BANDING.—A nestling banded in Charles County on May 19, 1940, was recovered in central North Carolina on September 19, 1940. Another nestling banded in Montgomery County on August 23, 1936, was recovered in northeastern Ohio in August 1937. Two other nestlings banded in Baltimore and Anne Arundel Counties on June 23, 1936, and May 26, 1934, were recovered in Maryland on October 10, 1937, and December 30, 1936, respectively within 35 miles of the points of banding. Two Bald Eagles recovered in winter in Kent and Worcester Counties had been banded as nestlings in southeastern Ontario and southern New Jersey respectively. Two others recovered in Dorchester and Calvert Counties in winter and 1 recovered in Calvert County in September had all been banded as nestlings in northern Delaware.

MARSH HAWK *Circus cyaneus* (Linnaeus)

STATUS.—*Breeding* (see fig. 20) : Fairly common in the Appomattox Valley section and in the tidewater areas of Somerset, Wicomico, and Dorchester Counties; uncommon elsewhere in the tidewater areas of the Eastern Shore section. Definite nesting records for Somerset, Dorchester, and Garrett Counties. *Transient* : Common in the Eastern Shore and Upper Chesapeake sections; fairly common in all other sections. *Wintering* : Common in the Eastern Shore and Upper Chesapeake sections; fairly common in the Western Shore and Piedmont sections; uncommon in

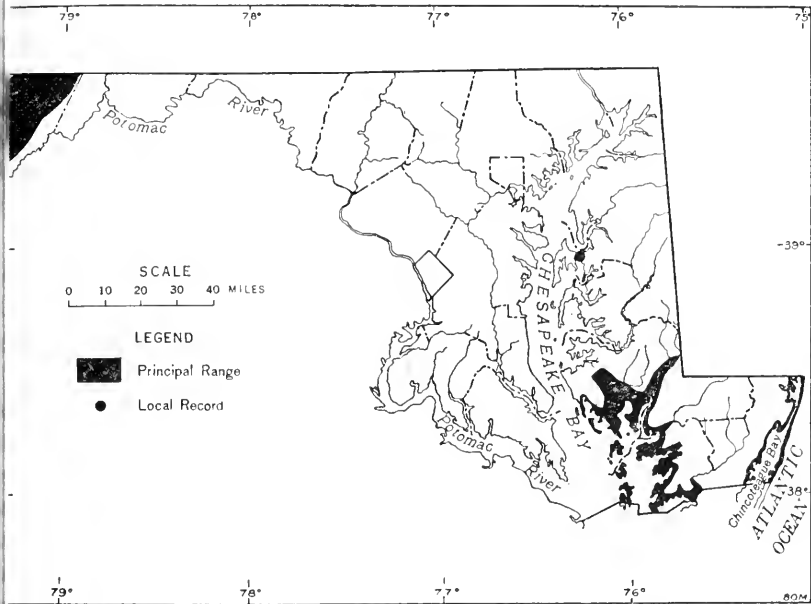


FIGURE 20.—Breeding range of Marsh Hawk.

lge and Valley section; rare in the Allegheny Mountain section.
ummer vagrant: Rare in all sections.

HABITAT.—*Breeding*: Tidal marsh and marsh-meadow types and (Allegheny Mountain section) upland sedge-meadows. *Transit and wintering*: Open agricultural areas and tidal marshes.

NESTING SEASON.—Late April to mid-July. *Extreme egg dates* (nests): April 28, 1954, in Dorchester County and June 23, 1950 (W. B. Tyrrell), in Garrett County. *Extreme nestling dates* (nests): June 12, 1925, in Garrett County (F. C. Kirkwood) and July 1, 1937 (downy young), in Garrett County (John, 1937).

SPRING MIGRATION.—*Normal period*: March 1–10 to May 1–10; peak, March 20 to April 20. *Extreme date of arrival*: February 19, 1948, in Prince Georges County. *Extreme dates of departure*: May 13, 1946, in Baltimore County (H. Kolb); May 12, 1913, in Prince Georges County (T. H. Kearney, W. R. Maxon).

FALL MIGRATION.—*Normal period*: August 10–20 to November 10–30; peak, October 10 to November 15. *Extreme dates of arrival*: July 27, 1894, in St. Marys County (A. W. Ridgway); July 19, 1938, in Baltimore County (H. Kolb).

MAXIMUM COUNTS.—*Fall*: 20 along South Mountain on the boundary between Frederick and Washington Counties on November 12, 1949 (Beaton, 1951); 13 in Dorchester County on Novem-

ber 23, 1946. *Winter*: 73 in Dorchester County on December 1952 (Christmas count); 50+ near Seneca, Montgomery County on January 25, 1947 (S. A. Gatti); 45 in the Ocean City area December 27, 1955 (Christmas count); 31 in the Crisfield area Somerset County, on December 26, 1949 (Christmas count); 31 southeastern Worcester County on December 22, 1947 (Christmas count).

BANDING.—Two birds recovered in winter (December 30–January 12) in Caroline and Queen Annes Counties had been banded as nestlings in western New York and northeastern New Jersey. Another, recovered in September in Wicomico County, had been banded as a nestling in southern New Jersey. An adult banded in east-central New York was recovered in Talbot County (date not known).

OSPREY *Pandion haliaetus* (Linnaeus)

STATUS.—Breeding (see fig. 4): Common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections. *Transient*: Common in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Piedmont Ridge and Valley, and Allegheny Mountain sections. *Winter resident*: Rare in the Eastern Shore, Western Shore, and Upper Chesapeake sections; casual in the Piedmont section—recorded in Montgomery County on February 1, 1918 (A. Wetmore), and December 1952 (L. E. Morgan). *Summer vagrant*: Uncommon in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections.

HABITAT.—Along open tidewater and inland ponds and streams.

NESTING SEASON.—Late March to late August (nesting period late April to early July). Nest-building was recorded as early as March 22, 1953, in Caroline County (Mr. and Mrs. A. J. Fletcher). *Extreme egg dates* (173 nests): April 20, 1887, in Cecil County (USNM) and July 20, 1953, in Caroline County (Mr. and Mrs. A. J. Fletcher). *Extreme nestling dates* (68 nests): "About 10–20" in Caroline County (Poole, 1942b) and August 19, 1893, in Talbot County (Kirkwood, 1895).

SPRING MIGRATION.—*Normal period*: March 10–20 to May 20; peak, April 10 to April 30. *Extreme dates of arrival*: March 2, 1954, in St. Marys County (H. N. Page, V. C. Kirtley); March 5, 1952, in Anne Arundel County (Mrs. W. L. Henderson, I. G. Tappan); March 7, 1954, in Caroline County (S. Some). *Extreme date of departure*: May 24, 1953 in Frederick County (J. W. Richards).

FALL MIGRATION.—*Normal period:* September 5–15 to November 1–10; peak, September 15 to October 5. *Extreme date of arrival:* August 31, 1942, in Prince Georges County. *Extreme dates of departure:* November 30, 1907, in the District of Columbia (A. K. Fisher); November 23, 1951, in Dorchester County.

MAXIMUM COUNTS.—*Spring:* 45 in Charles County on April 18, 1953 (J. W. Terborgh); 43 (in 6½ hours) on Patuxent Refuge on April 26, 1945. *Fall:* 23 in the Ocean City area on September 1, 1945; 16 along the fall line above White Marsh, Baltimore County, on September 20, 1952 (C. D. Hackman), 13 on South Mountain along the boundary between Frederick and Washington Counties on September 23, 1950 (Dr. and Mrs. R. S. Stauffer).

BANDING.—One banded as a nestling at Turkey Point, Cecil County, on July 2, 1954, was recovered in western Mato Grosso, Brazil, on September 25, 1954; another banded as a nestling on Long Marsh Island in Eastern Bay, Queen Annes County on July 1, 1954, was recovered in Oriente Province, Cuba, on November 1, 1955. One shot near Grasonville, Queen Annes County, on April 5, 1956, had been banded on Gardiners Island, New York, July 20, 1951.

Family FALCONIDAE

REGRINE FALCON *Falco peregrinus* Tunstall

STATUS.—*Breeding:* Occurs locally in the Piedmont, Ridge and Valley, and Allegheny Mountain sections (during the period 1932–1952, 10 occupied nest sites found were in Harford, Montgomery, Frederick, Washington, and Allegany Counties). *Transient:* Fairly common along the coast in Worcester County (Assateague Island is an outstanding concentration area during the fall migration); uncommon in the tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections and in the interior in the Ridge and Valley, and Allegheny Mountain sections; rare on inland areas of the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections. *Wintering:* Rare in the Eastern Shore, Western Shore, Upper Chesapeake, Piedmont, and Ridge and Valley sections.

HABITAT.—*Breeding:* Usually in the vicinity of cliffs in the mountains or along deep gorges of some of the larger streams. *Transient and wintering:* Occurs most commonly along the ocean beach; also regular along the bay shores and tidal marshes and the higher ridges in the mountains; in downtown Washington, D. C., 1 or 2 birds are frequently found in the vicinity of the taller buildings.

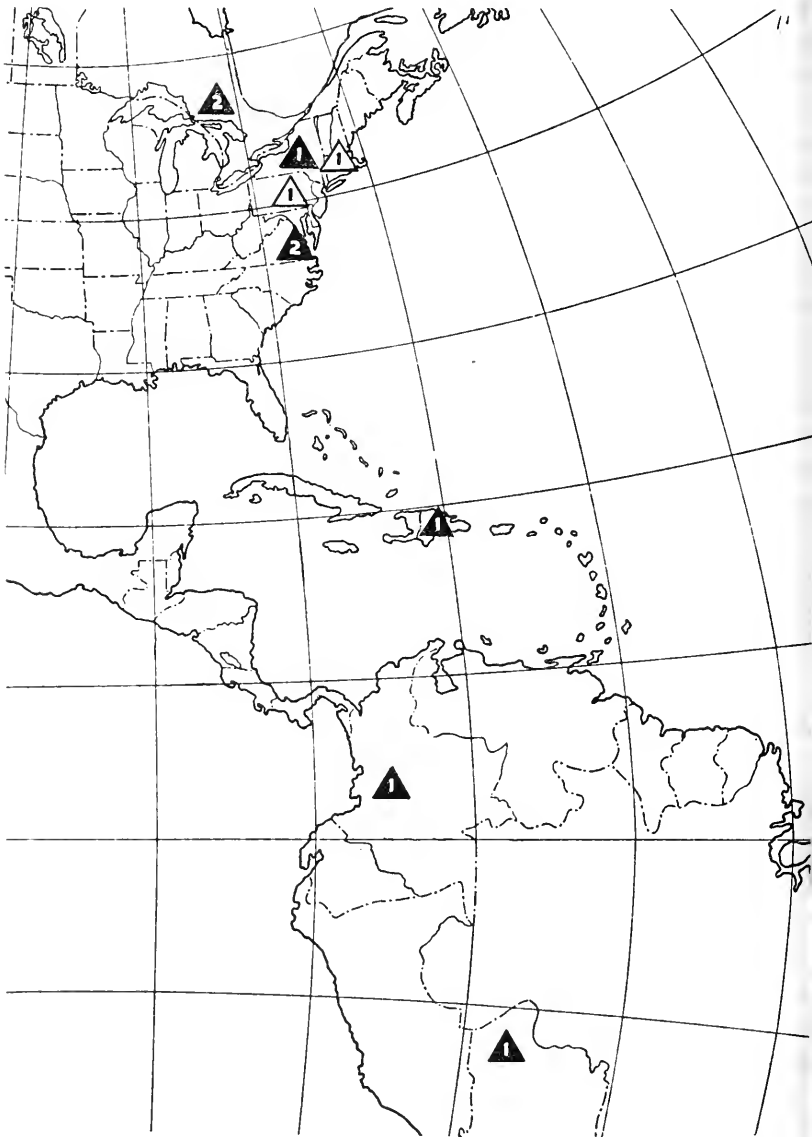


FIGURE 21.—Peregrine Falcon banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open triangle = banded September through May.

NESTING SEASON.—Mid-February to early June (Wimsatt, 1939 and 1940). *Extreme egg dates* (3 nests): about February 12, 1939 (Wimsatt, 1940), and about May 7, 1937 (allowing for incubation period—Wimsatt, 1939)—both records in Washington County. *Extreme nestling dates* (2 nests): about March 15, 1939 (Wimsatt, 1940), and about June 10, 1937 (Wimsatt, 1939)—both records in Washington County.

SPRING MIGRATION.—*Normal period*: February 20–March 1 to May 10–20. *Extreme date of arrival*: February 19, 1922, in Montgomery County (Fisher, 1935). *Extreme date of departure*: May 22, 1918, in the District of Columbia (L. Griscom).

FALL MIGRATION.—*Normal period*: September 10–20 to November 20–30; peak, September 25 to November 5. *Extreme date of arrival*: August 30, 1943, in Prince Georges County. *Extreme date of departure*: December 9, 1949, in Dorchester County.

MAXIMUM COUNTS.—*Spring*: 5 at Gibson Island, Anne Arundel County, on February 25, 1955 (Mrs. W. L. Henderson, S. Henderson). *Fall*: 75 (12 captured) on Assateague Island in Worcester County on October 13, 1946 (T. H. Cunningham); 4 on South Mountain on October 3, 1953 (R. J. Beaton); 4 on Backbone Mountain, Garrett County, on September 25, 1955 (M. G. Brooks, et al.).

BANDING.—See map, figure 21.

SEASON HAWK *Falco columbarius* Linnaeus

STATUS.—*Transient*: Fairly common in the coastal area of Worcester County; uncommon elsewhere in all sections. *Wintering*: rare in the Eastern Shore and Western Shore sections.

HABITAT.—Especially characteristic of the coastal barrier beaches in the zone containing brush and patches of loblolly pine; also occurs in other brush and forest edge habitats and along the bay shores.

SPRING MIGRATION.—*Normal period*: March 20–30 to May 1–10; peak, April 10 to April 30. *Extreme dates of arrival*: March 19, 1955, in Prince Georges County (F. C. Schmid); March 7, 1937, in Anne Arundel County (M. B. Meanley); March 10, 1956, in Calvert County (R. L. Kleen, E. Adams); March 18, 1942, in Caroline County (K. B. Corbett). *Extreme dates of departure*: May 1, 1954, in Worcester County (J. K. Wright); May 13, 1950, in Charles County (M. C. Crone, R. S. Farr); May 11, 1917, in the District of Columbia (H. C. Oberholser).

FALL MIGRATION.—*Normal period*: August 20–30 to November 10–20; peak, September 15 to October 20. *Extreme dates of ar-*

rival: August 13, 1948, in Worcester County; August 17, 1894, in the District of Columbia (W. B. Barrows). *Extreme dates departure*: November 14, 1943, in Prince Georges County; November 11, 1951, in Worcester County.

MAXIMUM COUNTS.—*Fall*: 8 on Assateague Island, Worcester County, on September 20, 1945; 5 near Emmitsburg, Frederick County, on September 23, 1951 (J. W. Richards).

SPARROW HAWK *Falco sparverius* Linnaeus

STATUS.—*Breeding*: Fairly common in all sections. *Transient*: Locally abundant in the Eastern Shore section (Hooper Island, Dorchester County is one of the principal concentration areas fall); common elsewhere in all other sections. *Wintering*: Common in the Eastern Shore and Upper Chesapeake sections; fairly common in the Western Shore and Piedmont sections; uncommon in the Ridge and Valley section; rare in the Allegheny Mountain section.

HABITAT.—Chiefly open agricultural areas. During migration also occurs regularly along the wooded ridges in the Ridge and Valley, and Allegheny Mountain sections; along the fall line in the Piedmont section; and in brush and edge habitats near tidal water.

NESTING SEASON.—Late March to late August (nesting period mid-April to early July). *Extreme egg dates* (39 nests): March 31, 1894, in the District of Columbia (USNM—J. H. Riley) and August 4, 1889, in or near the District of Columbia (USNM—Robinette). *Extreme nestling dates* (10 nests): May 17, 1894, in Baltimore County (F. C. Kirkwood) and August 5, 1946, in the District of Columbia (J. W. Taylor, Jr.).

NORMAL MIGRATION PERIODS.—*Spring*: March 1–10 to May 10; peak, March 15 to April 25. *Fall*: September 1–10 to November 10–20; peak, September 15 to October 10.

MAXIMUM COUNTS.—*Spring*: 75 in Dulaney Valley, Baltimore County, on March 18, 1893 (Kirkwood, 1895). *Fall*: 51 on Hooper Island, Dorchester County, on September 24, 1950; 42 near Whiting Marsh, Baltimore County, on September 20, 1952 (C. D. Haman); 20 on South Mountain along the boundary between Frederick and Washington Counties on September 24, 1950. *Wintering* (Christmas counts): 66 in Caroline County on December 20, 1952; 52 in the Ocean City area on December 27, 1953.

BANDING.—See figure 22.



FIGURE 22.—Sparrow Hawk banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August.

19). This species was also recorded near Marshall Hall, Prince Georges County, during the spring of 1860 (Bent, 1932).

Family PHASIANIDAE

WHITE COLINUS *Colinus virginianus* (Linnaeus)

STATUS.—Permanent resident. Common in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Piedmont, and Ridge and Valley sections; uncommon in the Allegheny Mountain section.

HABITAT.—In or near hedgerows, wood margins, and brushy fields, in agricultural areas or on abandoned farmland.

NESTING SEASON.—Early May to late September (nesting peak, mid-May to mid-August). *Extreme egg dates* (39 nests): May 1, 1935, in Baltimore County (M. B. Meanley) and September 1, 1891, in the District of Columbia (Farnham, 1891). *Extreme young dates* (25 broods): June 16, 1953, in Caroline County (M. W. Hewitt) and September 25, 1949, in Montgomery County (W. B. Tyrrell).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

(3 in 66 acres) in field and edge habitat (including strips of flood-plain forest, brushy fields, and hedgerows) in Baltimore County in 1947 (Hampe, et al., 1947).

(25 in 1,694 acres) in upland pine and deciduous forest and brush with small agricultural areas and abandoned farmlands near the boundary between Anne Arundel and Prince Georges Counties in 1943.

MAXIMUM COUNTS.—Winter (Christmas counts): 122 in the Ocean City area on December 27, 1954; 77 in the St. Michaels area, Talbot County, on December 29, 1954; 74 in southern Dorchester County on December 28, 1953; 67 in the Annapolis area on January 2, 1955; 42 at Patuxent Refuge on December 23, 1943; 40 in the Catoctin Mountain area on December 30, 1951.

RING-NECKED PHEASANT *Phasianus colchicus* Linnaeus

STATUS.—Permanent resident. Introductions of this species have been made on numerous occasions, at many locations in Maryland. However, the Ring-necked Pheasant has been unable to maintain itself in numbers except locally in the Piedmont, Ridge and Valley, and Allegheny Mountain sections. This species may be found most commonly near the Pennsylvania boundary in Cecil, Harford, Baltimore, Carroll, Frederick, and Washington Counties. Haven Kolb reports that this species was first noted at Loch Raven in Baltimore County about 1939, and that territories of several young males have been maintained there since the spring of 1951.

HABITAT.—Agricultural fields, abandoned fields, hedgerows, and brushy or weedy field margins.

Family MELEAGRIDAE

TURKEY *Meleagris gallopavo* Linnaeus

STATUS.—Permanent resident. Fairly common locally in Allegany County; uncommon and local in western Washington County; rare in Garrett County. Formerly occurred throughout the Allegheny Mountain, Ridge and Valley, and Piedmont sections, and portions of the Western Shore section near the fall line; but was extirpated from the greater part of its range during the last half of the nineteenth century. Turkeys were of regular occurrence in some of the wilder sections of Montgomery County until 1890, the latest record occurring on October 28, 1894, when 4 birds were observed at Seneca (C. W. Richmond). Two were shot at Blue Ridge Summit, Frederick County, on November 11, 1900 (J. V. L. Cook). During recent years the wild populations in Allegany and Washington Counties have been augmented from time to time with introductions of game farm stock. Introduced birds have also become established in Worcester County in the vicinity of the Pocomoke State Forest.

HABITAT.—Occurs only where extensive tracts of forest are found.

NESTING SEASON.—A nest with 2 eggs was found in Montgomery County near Rockville on June 4, 1859 (USNM—W. M. M. Lain). A nest, containing 7 eggs, was found in Allegany County in May during the mid 1940's, and poults were seen on numerous occasions in June, July, and August; earliest date for poults was June 14, 1945 (K. A. Wilson).

Family RALLIDAE

KING RAIL *Rallus elegans* Audubon

STATUS.—*Breeding* (see fig. 23): Fairly common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon and local in the Piedmont section and in the interior of the Eastern Shore, Western Shore, and Upper Chesapeake sections. *Transient*: Fairly common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon elsewhere in all sections. *Wintering*: Fairly common in tidewater areas of the Eastern Shore section; uncommon in tidewater areas of the Western Shore and Upper Chesapeake sections.

HABITAT.—Various brackish and fresh-water marsh types, and

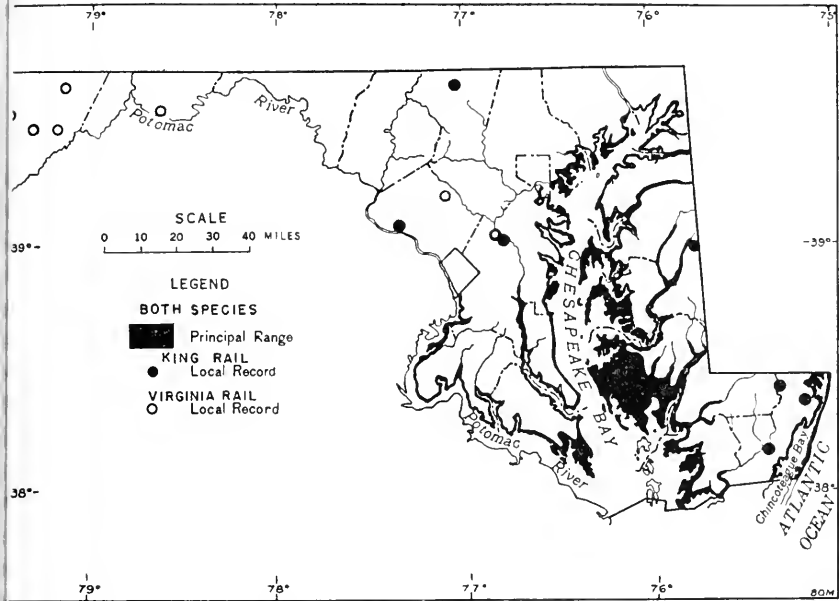


FIGURE 23.—Breeding ranges of King Rail and Virginia Rail.

cluding narrow-leaved cattail, Olney three-square and switchgrass; occurring most commonly in the higher areas of marsh that contain scattered shrubs.

NESTING SEASON.—Early May to mid-August. *Extreme egg dates* (16 nests): May 17, 1930, in St. Marys County (W. H. Ball) and June 23, 1950, in Caroline County (Mrs. A. J. Fletcher). *Extreme downy young dates* (6 broods): May 29, 1949, in Montgomery County (Cross, 1949) and August 13, 1954, in Dorchester County.

MAXIMUM COUNTS.—*Winter*: 23 in southern Dorchester County on December 28, 1953 (Christmas count); 10 at Cove Point, Calvert County, on February 17, 1946 (R. T. Peterson).

CLAPPER RAIL *Rallus longirostris* Boddaert

STATUS.—*Breeding and transient* (see fig. 24): Fairly common in the coastal area of Worcester County and in the tidewater areas of Somerset County; uncommon and local in the outer fringe of other tidal marshes along Chesapeake Bay, occurring in the Eastern Shore section (north to Parson Island in Queen Annes County—D. E. Davis) and in southern St. Marys County; casual occurrence elsewhere—recorded in the Patapsco River marsh (Kirkwood, 1895) and in the District of Columbia (Coues and

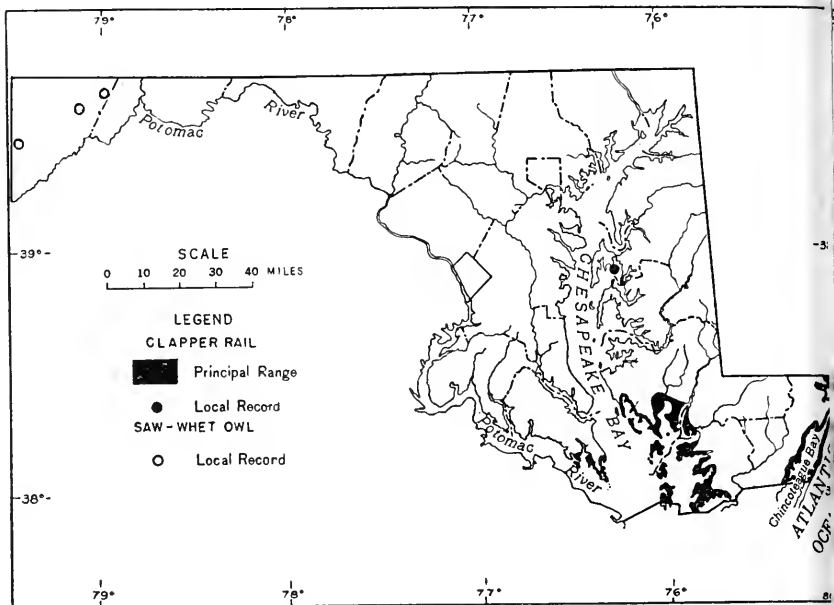


FIGURE 24.—Breeding ranges of Clapper Rail and Saw-whet Owl.

Prentiss, 1883). *Wintering*: Uncommon in the coastal area of Worcester County; rare in tidal areas of Somerset County; casual in the tidewater areas elsewhere in the Eastern Shore and Western Shore sections.

HABITAT.—Restricted to salt marshes, usually either salt-water cordgrass or needlerush.

NESTING SEASON.—Early May to early August. *Extreme egg dates* (4 nests): May 20, 1950 (S. H. Low), and July 20, 1951; both in Worcester County. Half-grown young were seen at Ocean City on August 13, 1949.

MAXIMUM COUNTS.—*Spring*: 6 at Ocean City on May 12, 1949. *Fall*: 12 at Ocean City on September 3, 1953 (J. W. Terborgh). *Winter*: 27 in the Ocean City area on December 27, 1953 (Christmas count).

VIRGINIA RAIL *Rallus limicola* Vieillot

STATUS.—*Breeding and transient* (see fig. 23): Common in tidewater areas of the Eastern Shore and Upper Chesapeake sections; fairly common in the Allegheny Mountain section (locally abundant) and in tidewater areas of the Western Shore section; rare in the Piedmont, and Ridge and Valley sections and in the interior of the Eastern Shore, Western Shore, and Upper Chesapeake sections.

Wintering: Common in tidewater areas of the Eastern Shore section; uncommon in tidewater areas of the Western Shore and Upper Chesapeake sections.

HABITAT.—Brackish tidal marshes, being especially characteristic of Olney three-square type, but also occurring regularly in narrow-leaved cattail, switchgrass and in other types; in the interior it is characteristic of sedge meadows and is occasionally found in stands of common cattail.

NESTING SEASON.—Late April to late August. *Extreme egg dates* (16 nests): May 14, 1933, in Dorchester County (F. R. Smith) and August 16, 1956, in Dorchester County (P. F. Springer). *Extreme downy young dates* (5 broods): May 23, 1944, in Dorchester County (L. M. Llewellyn) and July 8, 1950, in Montgomery County (S. H. Low).

MIGRATION PERIODS.—The periods of migration for this species are imperfectly known. The probable periods would extend through April and early May in spring and through late August, September, and early October in fall; the latest definite migration date is October 8, 1954, in Talbot County (R. L. Kleen).

MAXIMUM COUNTS.—*Fall*: 42 in the Elliott Island area, Dorchester County, on August 31, 1946. *Winter* (Christmas counts): 58 in southern Dorchester County on December 23, 1951; 17 in the Gunpowder River marshes, Baltimore and Harford Counties, on December 29, 1951; 16 in southern Charles County on January 1, 1954.

SORA *Porzana carolina* (Linnaeus)

STATUS.—*Breeding*: Rare and local in the tidewater areas of the Upper Chesapeake and Western Shore sections—a nest with eggs (photograph, p. 469 in Bent, 1926) was found along the Bush River in Harford County on May 25, 1899 (W. H. Fisher); a female, with an egg ready to lay, was killed by a dog on the Gunpowder River marsh on May 5, 1899 (J. Thomas); 4 were seen at North Point, Baltimore County, on July 25, 1893 (G. Todd); 2 were heard calling at Sandy Point, Anne Arundel County, on June 27, 1952 (R. R. Kerr). *Transient*: Common (locally abundant in fall) in the tidewater areas of the Upper Chesapeake and Western Shore sections (concentration areas include the Elk, Bush, Gunpowder, Back, Patapsco, and Patuxent Rivers, and formerly the Anacostia River); fairly common elsewhere in all sections. *Wintering*: Rare in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections.

HABITAT.—Various fresh and brackish marsh types; especially

numerous (in fall) in wildrice marshes; but also occurring regularly in narrow-leaved cattail, reed, and many other types; also found sparingly in salt marshes.

SPRING MIGRATION.—*Normal period*: April 20–25 to May 15–20. *Extreme date of arrival*: April 19, 1953, in Anne Arundel County (L. W. Oring).

FALL MIGRATION.—*Normal period*: August 10–20 to October 20–30; peak, August 25 to September 30. *Extreme date of arrival*: August 7, 1895, in the Washington, D. C., area (B. Greenwood). *Extreme dates of departure*: November 9, 1878, in the District of Columbia (S. F. Baird); November 3, 1880, in Prince Georges County (USNM).

MAXIMUM COUNTS.—*Spring*: 8 at Sandy Point, Anne Arundel County, on May 2, 1953 (P. A. DuMont). *Fall*: 55 at Allens Fresh, Charles County, on September 26, 1953; about 50 (21 shot) in the Patuxent River marsh on September 1, 1942; 50 at Seneca, Montgomery County, on September 7, 1953 (J. W. Terborgh); 30 at Sandy Point on September 2, 1953 (J. W. Terborgh, R. R. Kerr); 28 at Mountain Lake, Garrett County, on September 26, 1953 (M. G. Brooks).

BANDING.—One recovered in Cecil County on September 18, 1933, had been banded in northeastern New Jersey on September 7, 1933.

YELLOW RAIL *Coturnicops noveboracensis* (Gmelin)

STATUS.—*Transient*: Rare in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections. Records from Worcester, Dorchester, Talbot, Prince Georges, Anne Arundel, Baltimore, and Harford Counties, and the District of Columbia.

HABITAT.—Chiefly, fresh and brackish tidal marshes.

MIGRATION PERIODS.—*Spring* (8 records): March 12, 1909, at Laurel, Prince Georges County (USNM—E. B. Marshall) to May 20, 1917, in the District of Columbia (USNM—Mrs. E. Paminetti). *Fall* (8 records): October 2, 1929, in Patuxent River marsh, Prince Georges County (J. Trennis), to November 19, 1898, on Carroll Island, Baltimore County (F. C. Kirkwood).

BLACK RAIL *Laterallus jamaicensis* (Gmelin)

STATUS.—*Breeding and transient*: Fairly common locally in tidewater areas of Dorchester County; rare and local in tidewater areas elsewhere in the Eastern Shore and Western Shore sections (recorded in Worcester, Anne Arundel, Calvert, St. Marys, Charles, and Prince Georges Counties, and the District of Co-

mbia). There are definite nest records for Calvert (E. J. Court) and Dorchester Counties, and adults were collected in the District of Columbia on May 29, 1891 (R. L. Jones), and June 6, 1879 (Shekells).

HABITAT.—Principally areas of salt meadow that contain a mixture of salt-meadow grass and spike-grass.

NESTING SEASON.—Nests with eggs were found in Dorchester County on June 16, 1931 (A. L. Nelson, F. M. Uhler), and on May 10, 1953. Dates on Calvert County records are not available.

MIGRATION PERIOD.—*Spring* (5 records): April 26, 1954, in Dorchester County (W. R. Nicholson) to May 22, 1952, in Anne Arundel County (J. W. Terborgh). *Fall* (9 records): September 1, 1908, in the District of Columbia (USNM—H. M. Bailey) to October 19, 1906, in the Patuxent River marsh, Prince Georges County (W. F. Roberts).

MAXIMUM COUNT.—*Summer*: 100+ calling at 11:30 p.m. on June 2, 1954, in Elliott Island marsh, Dorchester County (J. W. Terborgh, J. E. Knudson).

CORN CRAKE *Crex crex* (Linnaeus)

STATUS.—Accidental visitor. One was shot in Worcester County, at Hursley (now Stockton) on November 28, 1900, by John Livesey. The mounted specimen was exhibited at the December 6, 1900, meeting of the Delaware Valley Ornithological Club (*Abstr. Proc. D.V.O.C.* 4:6). Hampe and Kolb (1947) state that Dr. Witmer Stone "well remembered the specimen." This Old World species, which normally winters in Africa, has been taken in a dozen North American tidal localities from Maryland north to Baffin Island.

PURPLE GALLINULE *Porphyryla martinica* (Linnaeus)

STATUS.—Casual visitor. An adult male was collected in the District of Columbia on April 30, 1845 (Deignan, 1943a). One that had been shot on the Potomac River was seen in a market in Washington, D. C., on August 24, 1889 (Kirkwood, 1895). An immature female was collected on the Patuxent River marsh in lower Anne Arundel County on October 12, 1938 (Hampe, et al., 1939). An adult was observed repeatedly during the period June 24–26, 1947, at the Patuxent Research Refuge, Prince Georges County (Stewart, et al., 1952). Another adult was observed repeatedly at Seneca, Montgomery County, during the period July 19–25, 1953 (R. R. Kerr).

COMMON GALLINULE *Gallinula chloropus* (Linnaeus)

STATUS.—*Breeding*: Fairly common in the marshes along the Gunpowder River estuary (Baltimore and Harford Counties) uncommon and local in tidewater areas of the southern half of Dorchester County; possibly breeds sparingly in other tidewater areas—recorded in summer on the Patapsco River (H. Brackbill) and in the District of Columbia (several observers) and 1 bird was observed at the Patuxent Refuge, Prince Georges County on June 9, 1949. *Transient*: Uncommon in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections rare in the Piedmont section and in the interior of the Eastern Shore, Western Shore, and Upper Chesapeake sections. *Wintering*: Casual visitor in the coastal area of Worcester County—recorded at Heine's Pond near Berlin on December 27, 1954 (J. H. Buckalew, S. H. Low), and 2 at West Ocean City on December 27, 1955 (P. A. DuMont).

HABITAT.—Occurs in the vicinity of ponds in brackish marsh types, including narrow-leaved cattail, Olney three-square, and needlerush; during migration, also occurs on inland marshes.

NESTING SEASON.—Early May to mid-July. *Extreme egg dates* (7 nests): May 10, 1916, in Dorchester County (Jackson, 1941) and June 21, 1936, on the Gunpowder River (M. B. Meanley).

MIGRATION PERIODS.—*Spring* (12 records): April 7, 1954, in Anne Arundel County (N. B. Wells) to May 19, 1946, in the District of Columbia (J. W. Taylor, Jr.). *Fall* (16 records): September 22, 1955, in Talbot County (M. Gifford), to November 22, 1953, in Worcester County (E. Arnold).

MAXIMUM COUNTS.—13 on August 31, 1946, and 5 on October 2, 1948, in the Elliott Island area, Dorchester County.

BANDING.—One killed at Ridgely, Caroline County (letter of September 26, 1955), had been banded at Oshawa, Ontario, on August 24, 1955.

AMERICAN COOT *Fulica americana* Gmelin

STATUS.—*Transient*: Locally common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections (concentration areas include the Potomac, Wicomico, Patuxent, and South Rivers in the Western Shore section, the Middle, Gunpowder, Northeast, and Sassafras Rivers and Susquehanna Flats in the Upper Chesapeake section, and the Chester River, Eastern Bay, and Heine's Pond near Berlin, in the Eastern Shore section); fairly common in the Allegheny Mountain section; uncommon elsewhere in all sections. *Wintering*: Locally common in tide-

ater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections (concentration areas, same as during migration); rare in the Piedmont section and in the interior of the Eastern Shore, Western Shore, and Upper Chesapeake sections. *Summer vagrant*: Casual—recorded in the District of Columbia (several records), and in Queen Annes and Prince Georges Counties (P. F. Springer).

HABITAT.—Brackish estuaries, and ponds in brackish marshes that contain a plentiful aquatic-plant growth, including such species as wild celery, red-head pondweed, and sago pondweed; also occurs on inland ponds and lakes.

SPRING MIGRATION.—*Normal period*: March 10–20 to May 5–15; peak, March 25 to April 25. *Extreme date of arrival*: March 8, 1849, in Prince Georges County. *Extreme dates of departure*: June 10, 1954, in Baltimore County (E. Willis); May 30, 1949, in Garrett County; May 23, 1886, in the District of Columbia (C. W. Richmond); May 20, 1926, in Charles County (A. Wetmore).

FALL MIGRATION.—*Normal period*: September 20–30 to December 1–10; peak, October 15 to November 25. *Extreme dates of arrival*: August 28, 1930, on the Potomac River, below Washington, D. C. (H. C. Oberholser); September 14, 1953, in Dorchester County; September 14, 1954, in Queen Annes County (P. F. Springer).

MAXIMUM COUNTS.—*Spring*: 11,350 on the Susquehanna Flats and Northeast River on March 31, 1955; 10,000 on the Middle River, Baltimore County, on March 21, 1953 (E. Willis); 1,500 on the Port Tobacco area, Charles County, on March 21, 1954 (A. Stickley, Jr.); 1,000 in the Kent Island area, Queen Annes County, on April 9, 1949 (R. A. Grizzell). *Fall*: 10,000 on the Potomac River in Prince Georges and Charles Counties on November 10, 1928 (H. C. Oberholser); 4,000 in the Carroll Island area, Baltimore County, on November 19, 1950; 1,200 on Heine's Pond, Dorchester County, on November 22, 1953 (E. Arnold); 590 on Wannah Lake, Dorchester County, on November 23, 1946; 500 on Deep Creek Lake, Garrett County, on November 2, 1954 (M. Brooks). *Winter*: 8,050 in the Carroll Island area, Baltimore County, on December 31, 1949 (Christmas count); 5,460 on the Susquehanna Flats on December 27, 1952 (Christmas count); 1,000 in the Wicomico River area, Charles County, on December 1, 1948; 1,700 in the Kent Island area, Queen Annes County, on December 31, 1948 (Christmas count).

BANDING.—One recovered in the District of Columbia (letter June 5, 1945) had been banded in northeastern Illinois on No-

ember 10, 1944. Another recovered in Kent County in the fall of 1954 had been banded in Connecticut on February 25, 1954. Five banded in Kent County between February 18 and March 1, 1954. Five were shot during the fall, 1 in northern Minnesota, 2 in east-central Wisconsin, 1 in southeastern Michigan, and 1 in eastern Ontario.

Family HAEMATOPODIDAE

AMERICAN OYSTERCATCHER *Haematopus palliatus* Temminck

STATUS.—*Breeding and transient*: Rare in the coastal area of Worcester County.

HABITAT.—Sandy, shell-strewn beaches on islands along the coast.

NESTING SEASON.—A pair with small downy young (photographed) was observed on Assateague Island about 8 miles south of Ocean City on June 6, 1939 (M. B. Meanley). In 1951, in the northern part of Chincoteague Bay, a pair with large young that could barely fly was seen on an island on July 3 (J. H. Buckalew) and another pair with small young (1 banded) was seen on another island on July 12; in 1952, another young bird was banded in the same area on July 4 (J. H. Buckalew).

PERIOD OF OCCURRENCE.—*Extreme dates*: April 25, 1900 (Ludlam), and August 9, 1902 (F. C. Kirkwood), in Worcester County.

Family CHARADRIIDAE

SEMIPALMATED PLOVER *Charadrius semipalmatus* Bonaparte

STATUS.—*Transient*: Common in the coastal area of Worcester County; fairly common in other tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon elsewhere in all sections. *Wintering and summer vagrant*. Rare in the coastal area of Worcester County.

HABITAT.—Mud flats and wet sand flats, usually along the margins of bays, estuaries, ponds, and lakes; occasional along the ocean beach.

SPRING MIGRATION.—*Normal period*: April 5–15 to June 5–15; peak, May 5 to May 25. *Extreme date of arrival*: April 1, 1954, in the Ocean City area. *Extreme dates of departure*: June 1, 1950, in the Ocean City area; June 22, 1954, in Queen Anne's County (P. F. Springer); June 19, 1946, in the District of Columbia (W. H. Ball).

FALL MIGRATION.—*Normal period*: July 15–25 to November 10; peak, August 5 to September 15. *Extreme date of arrival*

ily 10, 1949, in the Ocean City area. *Extreme dates of departure*: November 30, 1949, in Dorchester County; November 16, 1947, in the Ocean City area.

MAXIMUM COUNTS.—*Spring*: 525 in the Ocean City area on May 12, 1956; 300 on Mills Island in Chincoteague Bay on May 7, 1938 (G. A. Ammann); 25 in the District of Columbia on May 14, 1927 (W. W. Rubey). *Fall*: 280 on Assateague Island on August 11, 1950; 90 in the Crisfield area, Somerset County, on August 11, 1950; 60 at Sandy Point, Anne Arundel County, on August 21, 1947.

PING PLOVER *Charadrius melodus* Ord

STATUS.—*Breeding*: Uncommon in the coastal area of Worcester County. *Transient*: Uncommon in the coastal area of Worcester County; rare in tidewater areas elsewhere in the Eastern Shore and Western Shore sections. *Wintering*: Rare and irregular in the coastal area of Worcester County.

HABITAT.—Coastal barrier beach; occasional on sandy beaches bordering bays and estuaries.

NESTING SEASON.—Early May to late July. *Extreme egg dates* (nests): May 17, 1948 (J. E. Willoughby), and June 5, 1939 (M. Meanley), both in Worcester County. *Extreme downy young* (8 broods): June 16, 1935 (Tyrrell, 1935), and July 23, 1949, both in Worcester County.

PERIOD OF OCCURRENCE (excluding wintering dates).—*Extreme dates*: March 12, 1949, on Assateague Island (J. H. Buckalew) and November 12, 1950, in the Ocean City area.

MAXIMUM COUNTS.—*Spring*: 7 on Assateague Island on April 11, 1951 (J. H. Buckalew). *Summer*: 22 on Assateague Island on July 23, 1949. *Fall*: 6 on Assateague Island on October 5, 1946. *Winter*: 14 in the Ocean City area on December 27, 1954 (Christmas count).

BANDING.—A juvenal banded in Worcester County on July 12, 1947, was recovered in the Bahama Islands (Grand Bahama) on October 22, 1947 (Robbins and Stewart, 1948).

WILSON'S PLOVER *Charadrius wilsonia* Ord

STATUS.—*Breeding and transient*: Rare (formerly more numerous—H. H. Bailey) in the coastal area of Worcester County.

HABITAT.—Sandy shores on the barrier beach or on sandy banks in the coastal bays.

NESTING SEASON.—A pair was observed in courtship at West Ocean City on April 16, 1949. A nest containing 2 newly hatched young and 1 egg was found 1½ miles north of Ocean City on June

26, 1948 (S. H. Low). Downy young were banded on Assateag Island, 2 miles south of Ocean City, on July 10, 1947 (L. Cool, Jr.).

PERIOD OF OCCURRENCE.—*Extreme dates*: April 16, 1949, and August 17, 1925 (F. C. Kirkwood), both in the Ocean City area.

BANDING.—A juvenal banded in Worcester County, 2 miles south of Ocean City on July 10, 1947, was collected on Cedar Island, Accomack County, Virginia, on June 3, 1948.

KILLDEER *Charadrius vociferus* Linnaeus

STATUS.—Breeding: Fairly common in all sections. *Transient*: Common in all sections. *Wintering*: Fairly common in the Eastern Shore section; uncommon in the Western Shore and Upper Chesapeake sections; rare (occasionally more numerous) in the Piedmont section.

HABITAT.—Pastures, golf courses, and other extensive areas of short-grass turf; sparsely vegetated agricultural and fallow fields; sand and gravel areas; mud flats and shores.

NESTING SEASON.—Mid-March to late July (nesting peak, mid-April to late June). *Extreme egg dates* (159 nests): March 1, 1919, in Dorchester County (Jackson, 1941) and July 17, 1919, in Caroline County (Mr. and Mrs. A. J. Fletcher). *Extreme downy young dates* (48 broods): April 14, 1952 (Mr. and Mrs. W. L. Henderson), and July 27, 1950 (R. W. Dickerman), Anne Arundel County.

SPRING MIGRATION.—*Normal period*: February 5–15 to April 1–10; peak, March 1 to March 20. *Extreme dates of arrival*: January 23, 1953, in Prince Georges County; January 24, 1919, in Montgomery County (P. F. Springer).

FALL MIGRATION.—*Normal period*: July 5–15 to December 15; peak, August 20 to November 25. *Extreme date of arrival*: July 1, 1943, in Prince Georges County. *Extreme dates of departure*: December 22, 1946, in Prince Georges County; December 17, 1951, in Anne Arundel County (Mrs. G. Tappan).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—3.9 (3 in 77½ acres) in recently plowed fields and sprout-wheat fields, Prince Georges County in 1949.

1.4 (4 in 275 acres) in mixed agricultural habitats (including residential areas) in Prince Georges County in 1943 and 1947.

0.2 (22 in 11,520 acres) in "general farmland" (chiefly hayfields and pastures, with little cover owing to widespread clean-farming practices) in Frederick County in 1950 (Stewart and Meanley, 1950).

MAXIMUM COUNTS.—*Fall*: 200 in the Patuxent River marsh, November 23, 1946; 125 on Deep Creek Lake, Garrett County,

September 23, 1936 (M. G. Brooks) ; 100 in the District of Columbia on November 21-24, 1917 (C. H. M. Barrett) ; 100 at Emmitsburg, Frederick County, on October 27, 1955 (J. W. Richards) ; 5 on the Beltsville Research Center, Prince Georges County, on July 24, 1945. *Winter* (Christmas counts) : 539 in the Ocean City area on December 27, 1953 ; 115 in the District of Columbia area on January 1, 1955 ; 109 in the Denton area, Caroline County, on December 20, 1952 ; 80 in the Triadelphia Reservoir area (Montgomery and Howard Counties), on December 26, 1952.

BANDING.—One banded as a juvenal in Dorchester County on April 20, 1952, was recovered in eastern North Carolina on January 2, 1954. Another banded in Montgomery County on August 3, 1952, was recovered in south-central Virginia on March 5, 1953.

AMERICAN GOLDEN PLOVER *Pluvialis dominica* (Müller)

STATUS.—*Fall transient*: Rare in all sections. *Spring transient*: Casual occurrence—1 collected on Nanjemoy Creek, Charles County, on March 28, 1911 (Swales, 1920) ; 1 seen on Assateague Island, Worcester County, on May 1, 1946 (Stewart and Robbins, 1947a) ; 1 seen at Ocean City on April 16, 1949 ; and 1 recorded along Sinepuxent Bay on May 12, 1956 (R. L. Kleen).

HABITAT.—Mud flats, sand bars, beaches, cultivated fields, and pastures.

PERIOD OF FALL MIGRATION.—*Extreme dates*: August 14, 1955, in Talbot County (R. L. Kleen) and November 22, 1953, in Anne Arundel County (P. A. DuMont). *Migration peak*: September 15 to October 15.

MAXIMUM COUNTS.—20 on October 5, 1930, in the District of Columbia (Mr. and Mrs. W. J. Whiting) ; 6 on October 8, 1953, at Emmitsburg, Frederick County (J. W. Richards, P. O'Brien).

BLACK-BELLIED PLOVER *Squatarola squatarola* (Linnaeus)

STATUS.—*Transient*: Common in the coastal area of Worcester County ; fairly common in tidewater areas elsewhere in the Eastern Shore and Western Shore sections ; uncommon in tidewater areas of the Upper Chesapeake section ; rare in the Piedmont section and in the interior of the Eastern Shore, Western Shore, and Upper Chesapeake sections. *Wintering*: Uncommon in the coastal area of Worcester County ; rare elsewhere in tidal areas of the Eastern Shore section. *Summer vagrant*: Rare in the coastal area of Worcester County.

HABITAT.—Sandy beaches and mud flats, usually near salt water

(ocean or bays); occasional on fields and pastures, especially near salt water.

SPRING MIGRATION.—*Normal period:* April 20–30 to June 15; peak, May 10 to May 30. *Extreme date of arrival:* March 20, 1954, in Charles County (J. W. Terborgh).

FALL MIGRATION.—*Normal period:* July 20–30 to November 20–30; peak, August 15 to September 30. *Extreme date of arrival:* July 15, 1946, in Worcester County. *Extreme date of departure:* December 9, 1949, in Dorchester County.

MAXIMUM COUNTS.—*Spring:* 200 in the Ocean City area on May 24, 1953, and 115 at Sandy Point, Anne Arundel County, on the same day (J. W. Terborgh); 100 in the Crisfield area, Somerset County, on May 18, 1947; 11 in the District of Columbia on May 26, 1928 (W. H. Ball, P. Knappen). *Fall:* 199 on Assateague Island on August 30, 1950; 183 in the Ocean City area on August 23, 1945. *Winter:* 97 in the Ocean City area on December 27, 1954 (Christmas count).

RUDDY TURNSTONE *Arenaria interpres* (Linnaeus)

STATUS.—*Transient:* Fairly common in the coastal area of Worcester County; uncommon in tidewater areas elsewhere in the Eastern Shore section; rare in tidewater areas of the Western Shore and Upper Chesapeake sections; casual in the Piedmont section—1 seen at Seneca, Montgomery County, on September 1, 1953 (J. W. Terborgh). *Wintering and summer vagrant:* Rare in the coastal area of Worcester County.

HABITAT.—Tidal salt-water flats with a short sparse growth of salt-water cordgrass or glasswort; also on jetties and sand beaches at tidewater.

SPRING MIGRATION.—*Normal period:* April 20–30 to June 5–15; peak, May 10 to June 1. *Extreme date of arrival:* April 4, 1948, in Worcester County (S. H. Low). *Extreme date of departure:* June 16, 1935, in Worcester County (W. B. Tyrrell).

FALL MIGRATION.—*Normal period:* July 25–30 to November 10; peak, August 5 to September 30. *Extreme dates of arrival:* July 23, 1947, and July 23, 1949, on Assateague Island. *Extreme date of departure:* November 12, 1950, in the Ocean City area.

MAXIMUM COUNTS.—*Spring:* 420 near Ocean City on May 11, 1954 (D. C. Aud. Soc.); 300 on Assateague Island on May 21, 1947; 75 in the District of Columbia on May 26, 1928 (W. H. Ball, P. Knappen). *Fall:* 100 on Assateague Island on September 25, 1931 (H. E. Richardson).

Family SCOLOPACIDAE

AMERICAN WOODCOCK *Philohela minor* (Gmelin)

STATUS.—*Breeding*: Fairly common locally in the Eastern Shore, Western Shore, Upper Chesapeake, Ridge and Valley, and Allegheny Mountain sections; uncommon and local in the Piedmont section. *Transient*: Fairly common in all sections. *Wintering*: Uncommon in the Eastern Shore section; rare in the Western Shore section; casual in the Piedmont and Allegheny Mountain sections—1 near Thurmont in Frederick County on January 2, 1954 (Christmas count), and 1 seen along Bear Creek in Garrett County on December 31, 1954 (R. B. McCartney).

HABITAT.—*Breeding*: Thickets or open stands of shrubs and small trees on or adjacent to damp or wet areas; pine and sweet-gum fields, alder swamps, and slashings on recently cutover or burned-over areas are characteristic habitats. *Transient and wintering*: Various types of shrub and forest swamps.

NESTING SEASON.—Late February to mid-June (nesting peak, mid-March to early May). *Extreme egg dates* (23 nests): February 25, 1891, in Baltimore County (USNM) and May 8, 1943, in Prince Georges County. *Extreme downy young dates* (19 broods): April 5, 1936, in Baltimore County (M. B. Meanley) and June 16, 1896, in Baltimore County (G. Holland).

SPRING MIGRATION.—*Normal period*: February 10–20 to March 10–30; peak, February 25 to March 15. *Extreme dates of arrival*: January 19, 1953, in Prince Georges County; January 27, 1953, in Charles County (M. C. Crone, A. R. Stickley, Jr.). *Extreme date of departure*: April 11, 1952, in Frederick County (Mrs. W. Richards).

FALL MIGRATION.—*Normal period*: October 1–10 to December 1–10; peak, October 25 to November 25. *Extreme date of departure*: December 12, 1894, in Allegany County (Z. Laney).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

3 (7 in 125 acres) in brushy, poorly drained, abandoned farmland in Prince Georges County in 1943.

5 (19 in 1,280 acres) in upland, poorly drained brushland (cutover and burned-over forest land with scattered, small abandoned clearings) in Prince Georges County in 1951 (Stewart, 1952).

MAXIMUM COUNTS.—*Spring*: 19 on Patuxent Refuge (in half-mile walk) on March 4, 1945; 18 near Elliott, Dorchester County, on February 22, 1954 (J. W. Terborgh, J. E. Knudson). *Fall*: on Patuxent Refuge on November 12, 1947. *Winter*: 12 in Anne

Arundel County on December 26, 1950 (Christmas count); 6 at Allens Fresh, Charles County, on January 31, 1953 (J. W. Terborgh); 5 in the Ocean City area on December 27, 1953 (Christmas count).

COMMON SNIPE *Capella gallinago* (Linnaeus)

STATUS.—*Transient*: Fairly common in all sections. *Wintering*: Uncommon in tidewater areas of the Eastern Shore and Western Shore sections; rare in the Piedmont and Upper Chesapeake sections and in the interior of the Western Shore and Eastern Shore sections.

HABITAT.—Usually on wet grassy areas such as low pastures and wet meadow types in tidal marshes; also occurs on mud flat and shores that are adjacent to open water, and occasionally occurs on cultivated fields following heavy rains.

SPRING MIGRATION.—*Normal period*: March 1–10 to May 5–15 peak, March 15 to April 25. *Extreme dates of arrival*: February 24, 1895, in Baltimore County (F. C. Kirkwood); February 28–18—, in Allegany County (Z. Laney). *Extreme dates of departure*: May 23, 1937, in Baltimore County (M. B. Meanley); May 21, 1903, in Allegany County (G. Eifrig); May 18, 1947, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 15–25 to December 10–20; peak, October 1 to December 5. *Extreme dates of arrival*: August 3, 1955, in Prince Georges County; August 23, 1956 in Dorchester County (P. F. Springer); August 26, 1928, in the District of Columbia (W. H. Ball); September 2, 1898, at Patapsco Marsh (John W. Edel). *Extreme dates of departure*: December 23, 1950, in Frederick County (R. T. Smith); December 23, 1951, in Garrett County (J. G. Smart).

MAXIMUM COUNTS.—*Spring*: 120 at Allens Fresh, Charles County, on March 29, 1953, and March 20, 1954 (J. W. Terborgh et al.); 110 near Easton, Talbot County, on March 25, 1956 (C. Welsh, R. L. Kleen); 100 in Frederick County on March 17, 1955 (R. T. Smith); 55 at Sandy Point, Anne Arundel County, on March 22, 1953 (E. Willis, D. A. Jones). *Fall*: 100 at Allens Fresh on December 6, 1952 (J. W. Terborgh); 25 in Frederick County on December 23, 1950 (R. T. Smith); 24 on Bush River, Harford County, on October 3, 1948. *Winter*: 130 at Allens Fresh on January 31, 1953 (J. W. Terborgh); 61 in the Wicomico River area (Charles and St. Marys Counties) on January 1, 1955 (Christmas count); 20 in the Ocean City area on December 27, 1955 (Christmas count); 12 in southern Dorchester County on December 28, 1953 (Christmas count).

LONG-BILLED CURLEW *Numenius americanus* Bechstein

STATUS.—Casual visitor: A specimen (USNM) was taken in the District of Columbia on April 11, 1842, by W. Walker (Swales, 1920). Another specimen (USNM) was collected in September 1843 in St. Marys County (Deignan, 1943a). One was shot from a flock of 6 or 7 on the Gunpowder River marsh on May 19, 1899 (J. Thomas—head and wings examined by F. C. Kirkwood). There are also several sight records for the nineteenth century.

WHIMBREL *Numenius phaeopus* (Linnaeus)

STATUS.—*Transient*: Fairly common in the coastal area of Worcester County; rare in tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections.

HABITAT.—Salt-marsh flats with a sparse growth of short vegetation, usually either glasswort or salt-water cordgrass; also occurs on the ocean beach and on mud flats adjoining the coastal bays. This species often concentrates in areas of salt marsh that contain high populations of fiddler crabs (*Uca pugnax*).

SPRING MIGRATION.—*Normal period*: April 25–30 to May 20–25; peak, May 1 to May 20. *Extreme arrival date*: April 21, 1906, in Worcester County (F. C. Kirkwood). *Extreme departure date*: May 27, 1935, in the District of Columbia (Ball, 1928b).

FALL MIGRATION.—*Normal period*: July 5–10 to September 10–15; peak, July 15 to August 15. *Extreme arrival date*: July 3, 1906, in Worcester County (F. C. Kirkwood). *Extreme departure date*: September 25, 1931, in Worcester County (H. E. Richardson).

MAXIMUM COUNTS.—*Spring*: 40 at Ocean City on May 15, 1906 (F. C. Kirkwood); 37 on Assateague Island on May 1, 1946; 18 in the District of Columbia on May 26, 1928 (Ball, 1928b). *Fall*: 16 in the Ocean City area on July 27, 1952.

SKIMO CURLEW *Numenius borealis* (Forster)

STATUS.—Now probably extinct. Apparently formerly occurred in Maryland as a rare transient. A specimen (USNM) was taken on the Potomac River (cataloged in Baird's handwriting in 1861). One was reported seen at Ocean City in 1913 by R. C. Walker, who had personally collected nearly all other species of Maryland shorebirds and who gave a detailed description of this bird.

WYOMING PLOVER *Bartramia longicauda* (Bechstein)

STATUS.—*Breeding* (see fig. 25): Fairly common in the Frederick Valley (in Frederick County between the Monocacy River and Catoclin Mountain); uncommon locally elsewhere in the

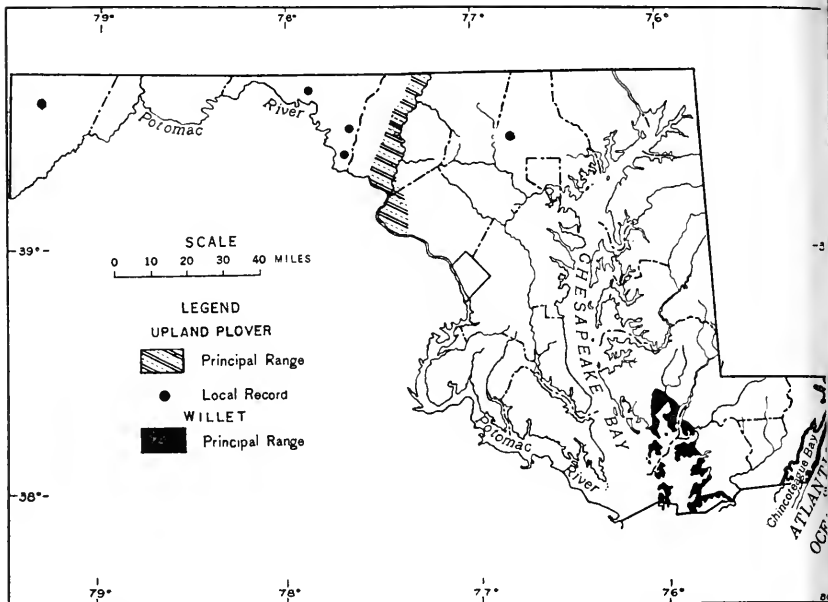


FIGURE 25.—Breeding ranges of Upland Plover and Willet.

Piedmont section and in the Ridge and Valley, and Alleghen Mountain sections—occurring in Baltimore County in the Worthington Valley and (formerly) in Dulaney Valley; in Montgomery County in the vicinity of Dickerson, Poolesville, Whites Ferry, and (formerly) Sandy Spring; in Washington County in the Hagerstown Valley; in Garrett County in the vicinity of Accident; and (formerly) in Allegany County at Vale Summit. *Transient*: Uncommon in all sections. *Summer vagrant*: Casual—2, apparently non-breeding, recorded in the District of Columbia from June 1 to June 26, 1935 (Ball and Wallace, 1936).

HABITAT.—*Breeding*: Agricultural areas with extensive hay fields and pastures, usually on land with a slightly concave contour. *Transient*: Various types of open fields and meadows and less frequently, in marsh and shore habitats with short or sparse vegetation.

NESTING SEASON.—Early May to late June. *Extreme egg date* (12 nests): May 10, 1942, and June 10, 1940, both in Baltimore County (Meanley, 1943b). *Extreme downy young dates* (broods): May 25, 1947, in Frederick County and June 21, 1941 in Baltimore County (both by M. B. Meanley).

SPRING MIGRATION.—*Normal period*: April 1–10 to May 5–15 peak, April 10 to May 5. *Extreme dates of arrival*: March 21

396, in the District of Columbia (P. W. Shufeldt); March 25, 1944, in Prince Georges County. *Extreme dates of departure*: May 27, 1952, in Prince Georges County (G. B. Saunders); May 1, 1903, in Allegany County (G. Eifrig).

FALL MIGRATION.—*Normal period*: July 5–15 to September 15–5; peak, July 15 to September 5. *Extreme dates of arrival*: June 9, 1902, in the District of Columbia (W. W. Cooke); July 3, 1895, in Baltimore County (Kirkwood, 1895). *Extreme date of departure*: September 26, 1919, in Montgomery County (A. Wetmore).

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

2 (20 in 11,520 acres) in “general farmland” (various agricultural habitats, chiefly hayfields and pastures, with little cover owing to widespread clean-farming practices) in Frederick County near Buckeystown in 1950 (Stewart and Meanley, 1950).

MAXIMUM COUNTS (nonbreeding).—*Fall*: 20 near Emmitsburg, Frederick County, on July 18, 1952 (J. W. Richards); 12 near Lilypons, Frederick County, on August 5, 1951 (L. M. Vendt).

POTTED SANDPIPER *Actitis macularia* (Linnaeus)

STATUS.—*Breeding*: Fairly common in the tidewater areas of the Eastern Shore section; uncommon elsewhere in all sections. *Transient*: Common in all sections. *Wintering*: Accidental—1 seen along the Choptank River near Cambridge on December 27, 1949 (T. W. Donnelly).

HABITAT.—Various shore habitats along inland ponds and streams, tidal bays, and estuaries. During the breeding season also frequents various field and meadow habitats that are adjacent to open water.

NESTING SEASON.—Early May to late July (nesting peak, mid-May to late June). *Extreme egg dates* (35 nests): May 11, 1911, in Dorchester County (Jackson, 1941) and July 15, 1946, in Anne Arundel County (F. M. Uhler). *Extreme downy young dates* (9 broods): June 4, 1939, in Prince Georges County (M. B. Meanley) and July 9, 1949, in Worcester County.

SPRING MIGRATION.—*Normal period*: April 5–15 to May 25–June 5; peak, April 25 to May 20. *Extreme dates of arrival*: April 2, 1905, in Montgomery County (W. L. McAtee); April 3, 1861, in the District of Columbia (C. E. Schmidt). *Extreme date of departure*: June 6, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: July 5–15 to October 1–10;

peak, July 25 to September 5. *Extreme date of arrival*: July 1948, in Prince Georges County. *Extreme dates of departure*: November 13, 1949, in Dorchester County; October 28, 1906, in Montgomery County (A. K. Fisher); October 25, 1947, in Baltimore County (R. M. Bowen); October 25, 1954, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); October 2, 1936, in Garrett County (Brooks, 1938).

MAXIMUM COUNTS.—*Spring*: 127 at Rosedale, Baltimore County on May 6, 1950 (D. A. Jones); 63 in the District of Columbia area on May 11, 1917 (H. C. Oberholser); 45 in the Port Tobacco area, Charles County, on May 7, 1940 (I. N. Gabrielson, A. L. Nelson). *Fall*: 50 near Centerville, Queen Annes County, on July 4, 1906 (F. C. Kirkwood); 20 on Gibson Island, Anne Arundel County, on July 25, 1952 (Mrs. W. L. Henderson, Mrs. G. Tappan).

SOLITARY SANDPIPER *Tringa solitaria* Wilson

STATUS.—*Transient*: Fairly common in all sections. *Summer vagrant*: Casual—small numbers, presumably non-breeding, were observed throughout June, during several summers at Deep Creeper Lake in Garrett County (Brooks, 1936b), and 1 was seen at Middle River in Baltimore County on June 17 and 19, 1951 (E. Willis).

HABITAT.—Mud flats and other marginal habitats along fresh water ponds and streams.

SPRING MIGRATION.—*Normal period*: April 10–20 to May 20–25; peak, April 25 to May 15. *Extreme dates of arrival*: March 29, 1954, in Caroline County (M. W. Hewitt); March 30, 1888, in the District of Columbia (H. W. Henshaw); March 30, 1952, in Baltimore County (E. Willis). *Extreme dates of departure*: May 30, 1891, in Montgomery County (H. W. Stabler); May 27, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: July 15–25 to October 10–20; peak, August 10 to September 25. *Extreme dates of arrival*: July 12, 1948, in Prince Georges County; July 12, 1956, in Queen Annes County (R. P. Dubois); July 14, 1893, in Baltimore County (P. T. Blogg, G. H. Gray). *Extreme dates of departure*: November 2, 1906, in Calvert County (J. H. Riley); October 28, 1916, in the District of Columbia (L. D. Miner).

MAXIMUM COUNTS.—*Spring*: 50 in the Port Tobacco area, Charles County, on May 11, 1943 (A. L. Nelson, F. M. Uhler); 37 in St. Marys County on May 8, 1954 (J. W. Terborgh, J. W. Taylor, Jr.); 30 near Seneca, Montgomery County, on April 26, 1953 (J. W. Terborgh); 13 at Patuxent Refuge, Prince Georges County, on May 12, 1945. *Fall*: 8 at Chesapeake Beach, Calver

ounty, on August 10, 1946; 7 at Sandy Point, Anne Arundel county, on August 20, 1947.

WILLET *Catoptrophorus semipalmatus* (Gmelin)

STATUS.—*Breeding* (see fig. 25): Locally common in tidewater areas of Somerset and Wicomico Counties and southern Dorchester County; uncommon in the coastal area of Worcester county. *Transient*: Common in the coastal area of Worcester county; uncommon in tidewater areas elsewhere in the Eastern Shore and Western Shore sections; rare in tidewater areas of the Upper Chesapeake section.

HABITAT.—Tidal salt marshes, including salt-water cordgrass, salt-meadow grass and glasswort types. During the spring and fall also occurs on the ocean beach, bay shores, mud flats, and sand bars.

NESTING SEASON.—Mid-May to late July. *Extreme egg dates* (11 nests): May 10, 1904 (R. W. Jackson), and July 12, 1951 (both extremes in Worcester County).

SPRING MIGRATION.—*Extreme date of arrival*: April 15, 1953, in Dorchester County (W. R. Nicholson). *Migration peak*: April 15 to May 15. One bird was observed in the District of Columbia as late as June 11, 1926 (Ball, 1927).

FALL MIGRATION.—*Normal period*: July 10–20 to October 1–10; peak, July 25 to September 1. *Extreme date of arrival*: July 10, 1949, in Worcester County. *Extreme date of departure*: A fresh bird found in the Baltimore market on November 3, 1894, had been shot nearby, possibly 1 or 2 days before (Kirkwood, 1895).

BREEDING POPULATION DENSITY (pairs per 100 acres).—0.5 (21 in 200 acres) in brackish bay marsh (strip 220 yards wide along tidal creek and containing extensive areas of salt-meadow grass) in Dorchester County in 1956.

MAXIMUM COUNTS.—*Spring*: 65 in the Ocean City area on May 1, 1953 (R. Strosnider). *Fall*: 200 on Assateague Island on August 23, 1947; 50 in the District of Columbia on August 10–11, 1893 (Cooke, 1929); 9 at Sandy Point, Anne Arundel County, on August 14, 1947 (J. W. Taylor, Jr.).

GREATER YELLOWLEGS *Totanus melanoleucus* (Gmelin)

STATUS.—*Transient*: Common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common elsewhere in all sections. *Wintering*: Uncommon in tidewater areas of the Eastern Shore section; rare in tidewater areas of the Western Shore and Upper Chesapeake sections.

Summer vagrant: Rare in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections.

HABITAT.—Shallow flats in marshes or at the margins of ponds, bays, and estuaries.

SPRING MIGRATION.—*Normal period*: March 25–April 5 to May 25–June 5; peak, April 20 to May 15. *Extreme dates of arrival*: March 16, 1904, in the Patapsco River marsh (F. C. Kirkwood); March 18, 1946, in Dorchester County. *Extreme dates of departure*: June 13, 1946, in Dorchester County; June 12, 1946, in Somerset County; June 8, 1938, in Worcester County (G. A. Ammann).

FALL MIGRATION.—*Normal period*: July 25–August 5 to November 15–25; peak, August 25 to September 30. *Extreme date of arrival*: July 15, 1946, in Worcester County. *Extreme date of departure*: November 28, 1953, in St. Marys County (J. W. Teborgh).

MAXIMUM COUNTS.—*Spring*: 500 on Mills Island in Chincoteague Bay on May 7, 1938 (G. A. Ammann); 113 in the Ocean City area on May 2, 1953 (R. Strosnider). *Fall*: 60 near Ellicott Island, Dorchester County, on November 19, 1948; 50 on Blackwater National Wildlife Refuge, Dorchester County, on September 4, 1948. *Winter*: 26 in southern Dorchester County on December 28, 1953 (Christmas count).

LESSER YELLOWLEGS *Totanus flavipes* (Gmelin)

STATUS.—*Transient*: Common in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; fair common in the Allegheny Mountain section; uncommon elsewhere in all sections. *Wintering*: Rare in tidewater areas of the Eastern Shore section (most numerous in vicinity of Blackwater National Wildlife Refuge, Dorchester County); casual elsewhere—recorded in the District of Columbia on January 2, 1954 (J. M. Abbott). *Summer vagrant*: Casual—recorded in the District of Columbia on June 21, 1929 (W. H. Ball).

HABITAT.—Shallow flats in marshes or at the margins of ponds, bays, and estuaries.

SPRING MIGRATION.—*Normal period*: April 1–10 to May 25–June 5; peak, April 15 to May 20. *Extreme dates of arrival*: March 12, 1906, in the District of Columbia (Cooke, 1929); March 15, 1895, in Harford County (Kirkwood, 1895); March 18, 1953, in Queen Annes County (J. W. Aldrich). *Extreme date of departure*: June 13, 1946, in Dorchester County.

FALL MIGRATION.—*Normal period*: July 15–25 to November :

0; peak, August 10 to September 30. *Extreme dates of arrival:* July 12, 1947, in Worcester County; July 13, 1952, in Baltimore County (E. Willis). *Extreme dates of departure:* November 23, 1951, in Dorchester County (E. J. Stivers); November 16, 1941, in Garrett County (M. G. Brooks); November 14, 1948, in Harford County.

MAXIMUM COUNTS.—*Spring:* 45 at Kent Island, Queen Annes County, on May 5, 1956 (R. P. and M. Dubois); 30+ at Chincoteague Bay on May 29, 1922 (A. H. Howell). *Fall:* 500 (50 shot) at Ocean City on September 16, 1901 (E. F. Armstrong); 225 on Blackwater National Wildlife Refuge, Dorchester County, on August 24, 1947; 79 in the District of Columbia on August 27, 1928 (W. H. Ball). *Winter:* 16 on Blackwater Refuge on February 19, 1949.

(NOT *Calidris canutus* (Linnaeus))

STATUS.—*Transient:* Fairly common in the coastal area of Worcester County; rare in tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections.

HABITAT.—Ocean beach, and sandy flats on the inland side of the barrier beaches that adjoin the coastal bays.

SPRING MIGRATION.—*Extreme dates:* May 1, 1953, in Worcester County (R. Strosnider) and June 4, 1954, in Worcester County (J. W. Terborgh, J. E. Knudson).

FALL MIGRATION.—*Extreme dates:* August 4, 1945, in the Ocean City area and November 2, 1952, at Heine's Pond, Worcester County. *Migration peak:* August 10 to September 20.

MAXIMUM COUNTS.—*Spring:* 175 in the Ocean City area on June 1, 1952 (E. G. Baldwin); 170 on May 22, 1948, and 76 on May 17, 1947, on Assateague Island; 15 in the District of Columbia on May 26, 1928 (W. H. Ball). *Fall:* 46 on Assateague Island on August 30, 1950; 34 at Ocean City on August 17, 1925 (F. C. Kirkwood).

PURPLE SANDPIPER *Erolia maritima* (Brünnich)

STATUS.—*Transient and wintering:* Fairly common in the vicinity of the Ocean City Inlet in Worcester County; casual elsewhere—1 observed at Sandy Point in Anne Arundel County on November 22, 1953 (P. A. DuMont).

HABITAT.—Usually found on the rocky jetties that border the Ocean City Inlet.

PERIOD OF OCCURRENCE.—*Extreme dates:* October 28, 1950 (I. R. Barnes) and May 21, 1950, at Ocean City. *Peak:* November 20 to May 15.

MAXIMUM COUNTS.—68 on December 27, 1954 (Christmas count), and 61 on May 5, 1956 (P. A. DuMont), at Ocean City Inlet.

PECTORAL SANDPIPER *Erolia melanotos* (Vieillot)

STATUS.—*Transient*: Fairly common in the Allegheny Mountain section and in tidewater areas of the Upper Chesapeake, Western Shore, and Eastern Shore sections; uncommon elsewhere in all sections. *Summer vagrant*: Casual—recorded in the District of Columbia on June 21, 1929 (W. H. Ball).

HABITAT.—Marshes with short vegetation and mud flats. On the barrier beaches they are especially characteristic of the grass sloughs just back of the sand dunes—American three-square and *Fimbristylis* sp. are usually the principal plant species in this type of habitat.

SPRING MIGRATION.—*Normal period*: April 1–10 to May 25; peak, April 25 to May 20. *Extreme date of arrival*: March 20, 1954, in Charles County (J. W. Terborgh, R. R. Kerr). *Extreme date of departure*: June 11, 1926, in the District of Columbia (Ball, 1927).

FALL MIGRATION.—*Normal period*: July 20–30 to November 10; peak, August 10 to October 25. *Extreme date of arrival*: July 15, 1952, in Baltimore County (E. Willis). *Extreme date of departure*: November 12, 1945, in Prince Georges County.

MAXIMUM COUNTS.—*Spring*: 34 near Essex, Baltimore County on May 8, 1949 (D. A. Jones); 31 in Anne Arundel County on May 10, 1952; 22 at Allens Fresh, Charles County, on April 3, 1951 (J. W. Terborgh). *Fall*: 350+ in the District of Columbia on September 7, 1928 (W. H. Ball); 220 on Assateague Island on August 14, 1948; 75 near Elliott, Dorchester County, on September 22, 1954; 50 at Sandy Point, Anne Arundel County, on August 20, 1947.

WHITE-RUMPED SANDPIPER *Erolia fuscicollis* (Vieillot)

STATUS.—*Transient*: Uncommon in the coastal area of Worcester County; rare elsewhere in all sections.

HABITAT.—Sandy beaches and mud flats at the margins of ponds, bays, and estuaries. Occurs in greater numbers on the barrier beaches than elsewhere.

SPRING MIGRATION.—*Extreme dates*: May 2, 1953, in Worcester County (R. Strosnider) and June 14, 1926, in the District of Columbia (Ball, 1927). *Migration peak*: May 10 to June 10.

FALL MIGRATION.—*Normal period*: August 1–10 to October 20; peak, August 20 to September 30. *Extreme date of arrival*: July 26, 1947, in Worcester County. *Extreme dates of departure*: August 10 to September 10.

November 13, 1954, in Dorchester County; November 12, 1949, in Worcester County.

MAXIMUM COUNTS.—*Spring*: 20 in the District of Columbia on May 20, 24, and 26, 1928 (W. H. Ball). *Fall*: 18 in the District of Columbia on September 12, 1930 (W. J. Whiting); 14 on Assateague Island on August 30, 1950.

HAIRD'S SANDPIPER *Erolia bairdii* (Coues)

STATUS.—*Fall transient*: Rare—recorded in the Eastern Shore, Western Shore, and Allegheny Mountain sections.

HABITAT.—Mud flats at the margins of ponds, bays, and estuaries.

PERIOD OF OCCURRENCE.—Single birds were recorded as follows: August 14, 1948, on Assateague Island; August 17, 1952, at Sandy Point, Anne Arundel County (C. N. Mason); August 19, 1928, at Scotland Beach, St. Marys County (Ball, 1930a); September 3, 1928, and September 28, 1930, in the District of Columbia (Ball, 1931b); September 29, 1945 (USNM), at Ocean City; October 3 and 24, 1936, at Deep Creek Lake in Garrett County (Brooks, 1938).

EAST SANDPIPER *Erolia minutilla* (Vieillot)

STATUS.—*Transient*: Common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common elsewhere in all sections. *Wintering*: Uncommon in the coastal area of Worcester County; rare in tidewater areas elsewhere in the Eastern Shore section. *Summer vagrant*: Unusual—recorded in the District of Columbia on June 21, 1929 (W. H. Ball).

HABITAT.—Marshes with short vegetation, and mud flats at the margins of ponds, bays, and estuaries.

SPRING MIGRATION.—*Normal period*: April 15–25 to May 25–June 5; peak, May 1 to May 20. *Extreme dates of arrival*: March 2, 1947, in Dorchester County; April 4, 1953, in Worcester County. *Extreme dates of departure*: June 14, 1926, in the District of Columbia (Ball, 1927); June 12, 1946, in Somerset County.

FALL MIGRATION.—*Normal period*: July 10–20 to November 1–10; peak, July 25 to September 25. *Extreme date of arrival*: July 1, 1951, in Baltimore County (E. Willis). *Extreme dates of departure*: November 29, 1945, in Worcester County; November 1, 1954, in Dorchester County; November 22, 1917, in the District of Columbia (C. H. M. Barrett).

MAXIMUM COUNTS.—*Spring*: 900 in the Crisfield area, Somerset County, on May 18, 1947; 549 in the Ocean City area on May

2, 1953; 500+ on Mills Island in Chincoteague Bay on May 1938 (G. A. Ammann); 150 at Sandy Point, Anne Arundel County on May 23, 1954 (C. N. Mason). *Fall*: 210 on Assateague Island on August 14, 1948; 194 in the Ocean City area on August 5, 1949; 51 on Blackwater Refuge, Dorchester County, on August 24, 1949. *Wintering*: 25 in the Ocean City area on December 21, 1949 (Christmas count).

DUNLIN *Erolia alpina* (Linnaeus)

STATUS.—*Transient*: Abundant in the coastal area of Worcester County; common in tidewater areas elsewhere in the Eastern Shore section; uncommon in the Allegheny Mountain section and in the tidewater areas of the Western Shore and Upper Chesapeake sections; rare elsewhere in all sections. *Wintering*: Fairly common in the coastal area of Worcester County; uncommon in tidewater areas elsewhere in the Eastern Shore section; rare in tidewater areas of the Western Shore section.

HABITAT.—Sandy beaches and mud flats at the margins of ponds, bays, and estuaries. This species is especially characteristic of the tidal mud flats along the coastal bays and lower Chesapeake Bay.

SPRING MIGRATION.—*Normal period*: March 20–30 to June 10; peak, May 1 to May 25. *Extreme date of arrival*: March 1892, in Baltimore County (W. N. Wholey). *Extreme date of departure*: June 11, 1949, in Worcester County (B. Williams).

FALL MIGRATION.—*Normal period*: July 25–August 5 to December 10–20; peak, October 15 to November 30. *Extreme date of arrival*: July 23, 1949, in Worcester County. *Extreme date of departure*: December 30, 1951, in Anne Arundel County (Mrs. L. Henderson).

MAXIMUM COUNTS.—*Spring*: 700 in the Crisfield area, Somerset County, on May 18, 1947; 315 in the Ocean City area on May 2, 1953 (R. Strosnider); 130 (1 flock) near Elliott Island, Dorchester County, on May 20, 1953; 60 in the District of Columbia on May 26, 1928 (W. H. Ball, P. Knappen). *Fall*: 400 in the Ocean City area on November 27, 1945; 200+ in the Elliott Island area on October 30, 1949, and on November 18, 1947; 150 at Kent Narrows, Queen Annes County, on October 24, 1949. *Wintering* (Christmas counts): 1,102 in the Ocean City area on December 27, 1955; 177 in southern Dorchester County on December 27, 1954.

SHORT-BILLED DOWITCHER *Limnodromus griseus* (Gmelin)

STATUS.—*Transient*: Common in the tidewater areas of W

ester, Somerset, Wicomico, and Dorchester Counties; fairly common in tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare elsewhere in all sections. *Wintering*: Casual in the coastal area of Worcester County—1 at Ocean City on December 27, 1950 (F. M. Packard). *Summer vagrant*: Rare in the coastal area of Worcester County.

HABITAT.—Mud flats at the margins of ponds, bays, and estuaries.

SPRING MIGRATION.—*Normal period*: April 1–10 to May 25–June 5; peak, May 1 to May 25. *Extreme date of arrival*: March 1, 1875, in Baltimore County (A. Resler). *Extreme date of departure*: June 6, 1939, in Worcester County (M. B. Meanley).

FALL MIGRATION.—*Normal period*: July 1–10 to November 10–20; peak, July 15 to September 5. *Extreme dates of arrival*: June 26, 1950, and June 27, 1948 (M. A. Elliott), in Worcester County. *Extreme date of departure*: November 20, 1948, in Dorchester County.

MAXIMUM COUNTS.—*Spring*: 525 in the Crisfield area, Somerset County, on May 18, 1947; 300 on Assateague Island on May 1, 1946; 17 at Rosedale, Baltimore County, on May 6, 1950 (D. A. Jones). *Fall*: 104 on Assateague Island on August 23, 1947; 44 in the Crisfield area on July 27, 1947; 40 along the Blackwater River, Dorchester County, on November 1, 1952.

LONG-BILLED DOWITCHER *Limnodromus scolopaceus* (Say)

STATUS.—Rare spring and fall transient. Seven were killed from a flock on the Anacostia River, District of Columbia, in April 1884 (Smith and Palmer, 1888). One was collected (USNM) at Plains Point in the District of Columbia on September 10, 1929 (Ball, 1932a). Two were seen on Columbia Island in the District of Columbia on September 27, 1930 (Mr. and Mrs. W. J. Whiting). One was seen on Triadelphia Reservoir in both Montgomery and Howard Counties on October 28, 1951 (S. H. Low).

TILT SANDPIPER *Micropalama himantopus* (Bonaparte)

STATUS.—*Fall transient*: Fairly common in the coastal area of Worcester County; uncommon in tidewater areas elsewhere in the Eastern Shore section; rare in the Western Shore, Upper Chesapeake, and Allegheny Mountain sections. *Spring transient*: Casual—1 seen in the District of Columbia on June 3, 1926 (Ball, 1927); 1 seen at Middle River on May 9, 1954 (D. A. Jones); 1 seen at Ocean City on May 16, 1954 (D. A. Cutler, J. K. Wright); and 1 at Kent Narrows, Queen Annes County, on May 5, 1956 (R. P. and M. Dubois).

HABITAT.—Mud flats at the margins of ponds, bays, and estuaries.

FALL MIGRATION.—*Normal period:* July 25–August 1 to October 5–15; peak, August 5 to September 30. *Extreme date of arrival:* July 23, 1949, in Worcester County. *Extreme date of departure:* October 26, 1916, in the District of Columbia (F. Harper).

MAXIMUM COUNTS.—126 on Assateague Island on August 1, 1948; 14 at Heine's Pond in Worcester County on September 1, 1954 (J. W. Terborgh); 12 in the District of Columbia on September 30, 1930 (W. J. Whiting); 7 at Kent Narrows, Queen Anne's County, on October 2, 1948.

SEMIPALMATED SANDPIPER *Ereunetes pusillus* (Linnaeus)

STATUS.—*Transient:* Abundant in the coastal area of Worcester County; common in other tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Allegheny Mountain section; uncommon elsewhere in all sections. *Wintering:* Uncommon or rare in the coastal area of Worcester County. *Summer vagrant:* Uncommon or rare in the coastal area of Worcester County; casual elsewhere—recorded in the District of Columbia on June 21, 1929 (W. H. Ball).

HABITAT.—Sandy beaches and mud flats at the margins of ponds, bays, and estuaries; less commonly on the ocean beach. This species is especially characteristic of the tidal sandy mud flats along the coastal bays and lower Chesapeake Bay.

SPRING MIGRATION.—*Normal period:* April 20–30 to June 5–15; peak, May 5 to June 1. *Extreme date of arrival:* April 4, 1955, in Worcester County (J. H. Buckalew). *Extreme dates of departure:* June 15, 1954, in Queen Anne's County (P. F. Springer); June 14, 1926, in the District of Columbia (Ball, 1927); June 1, 1944, in Anne Arundel County.

FALL MIGRATION.—*Normal period:* July 1–10 to November 15; peak, July 25 to September 20. *Extreme dates of arrival:* June 26, 1950, in Worcester County; June 27, 1954, in Queen Anne's County (P. A. DuMont).

MAXIMUM COUNTS.—*Spring:* 1,660 in the Ocean City area, May 12, 1956; 700 in the Crisfield area, Somerset County, on May 18, 1947. *Fall:* 1,700 on Assateague Island on August 13, 1955; 700 in the Crisfield area on August 11, 1950; 325 on Blackwater National Wildlife Refuge, Dorchester County, on August 24, 1948; 200 at Sandy Point, Anne Arundel County, on August 20, 1948; 75+ in the District of Columbia on August 24, 1928 (W. H. Ball). *Winter:* 34 in the Ocean City area on December 27, 1955 (Christmas count).

WESTERN SANDPIPER *Ereunetes mauri* Cabanis

STATUS.—*Fall transient*: Fairly common in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare elsewhere in all sections. *Spring transient*: Rare in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections. *Wintering*: Usually rare in the coastal area of Worcester County.

HABITAT.—Sandy beaches and mud flats at the margins of ponds, bays, and estuaries.

FALL MIGRATION.—*Normal period*: July 15–20 to October 25–November 5; peak, July 25 to October 5. *Extreme dates of arrival*: July 1, 1951, in Baltimore County (E. Willis); July 13, 1947, in Worcester County.

SPRING MIGRATION.—*Extreme dates*: May 2, 1953, in Worcester County (R. Strosnider) and June 5, 1948, in Calvert County.

MAXIMUM COUNTS.—*Fall*: 260 on Blackwater National Wildlife Refuge, Dorchester County, on August 24, 1947; 200 on Assateague Island on August 13, 1950; 100 at Sandy Point, Anne Arundel County, on August 21, 1947; 90 at Elliott Island, Dorchester County, on October 2, 1948. *Wintering*: 65 in the Ocean City area on December 22, 1951 (Christmas count).

MARBLED GODWIT *Limosa fedoa* (Linnaeus)

STATUS.—*Fall transient*: Rare in the coastal area of Worcester County; casual elsewhere—recorded at Sandy Point in Anne Arundel County on August 14, 1953 (E. G. Davis), August 28, 1954 (C. N. Mason), and on September 15 and 18, 1951 (I. C. Hoover, Mrs. W. L. Henderson). *Spring transient*: Casual—singles recorded at Gibson Island, Anne Arundel County, on May 1, 1950 (Mrs. G. Tappan); at Ocean City on May 14, 1955; and at West Ocean City on May 19, 1956 (P. G. DuMont).

HABITAT.—Sandy beaches, and mud flats at the margins of tidal ponds and bays, chiefly along the coast.

FALL MIGRATION.—*Extreme dates*: July 23, 1949, and October 10, 1948 (J. H. Buckalew), in Worcester County. *Peak*: August 10 to October 5.

MAXIMUM COUNTS.—14 in the Ocean City area on August 31, 1952 (L. Griffin, L. Westhaver); 8 in the Ocean City area on September 6, 1952 (D. E. Power); 4 on Assateague Island on October 2, 1948 (J. H. Buckalew).

HUDSONIAN GODWIT *Limosa haemastica* (Linnaeus)

STATUS.—*Fall transient*: Rare in the coastal area of Worcester

County; casual in the Western Shore section—1 seen in the District of Columbia on August 27–28, 1933 (Deignan, 1943b). *Spring transient*: Accidental—1 was reported shot at West River, Anne Arundel County, on May 16, 1886 (Kirkwood, 1895).

HABITAT.—Sandy beaches, and mud flats at the margins of tidal ponds and bays, chiefly along the coast.

FALL MIGRATION.—*Extreme dates*: July 17, 1948 (J. H. Buckalew), and September 24, 1950 (J. H. Buckalew, E. O. Mellinger) in Worcester County.

MAXIMUM COUNTS.—6 (2 collected) on September 17, 1950, and 6 on September 24, 1950, all on Assateague Island (J. H. Buckalew, E. O. Mellinger).

[RUFF] *Philomachus pugnax* (Linnaeus)

STATUS.—Hypothetical. One was seen on August 6, 1948, at Green Run on Assateague Island (Buckalew, 1948).

SANDERLING *Crocethia alba* (Pallas)

STATUS.—*Transient*: Abundant in the coastal area of Worcester County; uncommon in other tidewater areas of the Eastern Shore Western Shore, and Upper Chesapeake sections; rare elsewhere in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections. *Wintering*: Fairly common in the coastal area of Worcester County; rare in tidewater areas elsewhere in the Eastern Shore and Western Shore sections. *Summer vagrant*: Uncommon in the coastal area of Worcester County.

HABITAT.—Especially characteristic of the ocean beach; also found sparingly on sandy beaches that border bays and estuaries.

SPRING MIGRATION.—*Normal period*: April 20–30 to June 5–15; peak, May 5 to June 5. *Extreme date of departure*: June 16, 1935 in Worcester County (W. B. Tyrrell).

FALL MIGRATION.—*Normal period*: July 10–20 to October 20–30; peak, July 25 to September 20.

MAXIMUM COUNTS.—*Spring*: 500 on Assateague Island on June 3, 1938 (G. A. Ammann); 300 in the Ocean City area on May 9, 1948, and on May 23, 1948. *Fall*: 2,800 on August 14, 1948, and 2,385 on August 30, 1950, on Assateague Island; 1,925 in the Ocean City area on August 4, 1945. *Winter*: 775 in the Ocean City area on December 27, 1955 (Christmas count).

Family RECURVIROSTRIDAE

AMERICAN AVOCET *Recurvirostra americana* Gmelin

STATUS.—Casual fall visitor. Two were seen (photographs taken) in Dorchester County at the Blackwater Refuge during the

period September 30 to October 17, 1940, and 1 remained until November 2, 1940 (Black, 1941). Another was recorded in Somerset County at Deal Island on December 11, 1941 (T. Denmead), and 1 at Cove Point, Calvert County, on November 5, 1947 (G. Kelly). One was observed in St. Marys County at Point No Point on October 23, 1951 (J. H. Buckalew). One was seen at Ocean City on September 4, 1955 (R. L. Kleen, T. Lord), and September 7, 1955 (Mr. and Mrs. I. C. Hoover).

Family PHALAROPODIDAE

RED PHALAROPE *Phalaropus fulicarius* (Linnaeus)

STATUS.—Rare transient in the Eastern Shore, Western Shore, and Piedmont sections.

SPRING RECORD.—Two were seen at Ocean City on May 20, 1950 (J. H. Buckalew, S. H. Low).

FALL RECORDS.—One was photographed at Solomons, Calvert County, on July 10, 1947 (G. Kelly); 1 was seen off Ocean City on August 21, 1948 (S. H. Low, P. F. Springer); 1 was collected (USNM) in the District of Columbia on October 3, 1912 (W. Palmer); 1 was collected (USNM) at Whites Ferry, Montgomery County, on October 4, 1897 (Swales, 1920); 1 was collected (USNM) in the District of Columbia on October 17, 1885 (F. S. Webster).

WILSON'S PHALAROPE *Steganopus tricolor* Vieillot

STATUS.—Rare transient in the Eastern Shore, Western Shore, Piedmont, and Allegheny Mountain sections.

SPRING RECORD.—An adult female was seen at Dickerson, Montgomery County, on May 12, 1929 (Wetmore, 1929).

FALL RECORDS.—On August 3, 1949, 1 was collected on Assa-league Island (Buckalew, 1949); in late August, 1953, 1 was seen at Deep Creek Lake, Garrett County (M. G. Brooks); on September 8, 1947, 1 was seen on Triadelphia Reservoir along the boundary between Howard and Montgomery Counties (Hastorouck, 1948); in 1930, 1 was seen in the District of Columbia on September 19 (W. J. Whiting), 3 were seen there on September 27, 3 on September 30, and 1 was collected (USNM) on October 1 (Ball, 1948).

NORTHERN PHALAROPE *Lobipes lobatus* (Linnaeus)

STATUS.—Rare spring and fall transient in the Eastern Shore and Western Shore sections.

SPRING RECORDS.—One was seen on the Potomac River in Charles County on May 10 and June 7, 1930 (H. C. Oberholser);

1 was seen at Ocean City on May 20, 1950 (J. H. Buckalew, S. H. Low), and another on May 13, 1951 (D. A. Cutler, et al.); 1 was observed near Elliott, Dorchester County, on May 23, 1954; 1 single remained on the Patuxent Refuge, Prince Georges County from May 26 to June 3, 1955 (photographed—F. M. Uhler).

FALL RECORDS.—One was seen on Assateague Island on August 14, 1948; 3 at Ocean City on August 21, 1948 (P. F. Springer); 1 in the District of Columbia on August 29, 1916 (R. W. Moore C. R. Shoemaker); 1 (collected, USNM) on Assateague Island on August 30, 1950; 1 (collected, USNM) in the District of Columbia on August 31, 1891 (T. Marron); 1 at Gibson Island, Anne Arundel County, on September 20, 1950 (Mrs. W. L. Henderson Mrs. G. Tappan); 2 flocks of 12 each and several singles at Ocean City on October 5, 1928 (A. Wetmore); and 3 at Cornfield Harbor, St. Marys County, on October 14, 1928 (A. Wetmore).

Family STERCORARIIDAE

[POMARINE JAEGER] *Stercorarius pomarinus* (Temminck)

STATUS.—Hypothetical. One was reported on the Potomac River in Prince Georges County on January 12, 1929 (H. C. Oberholser), and 2 were recorded 13 miles offshore from Ocean City on September 9, 1950.

[PARASITIC JAEGER] *Stercorarius parasiticus* (Linnaeus)

STATUS.—Rare visitor. An immature male was collected in the District of Columbia on September 23, 1899 (Ball, 1932b). One was seen in Worcester County, a short distance offshore from Maryland Beach on May 11, 1946 (Stewart and Robbins, 1947a).

[LONG-TAILED JAEGER] *Stercorarius longicaudus* Vieillot

STATUS.—Hypothetical. F. C. Kirkwood recorded 1 on a fish pound off Ocean City on May 1, 1906.

Family LARIDAE

GLAUCOUS GULL *Larus hyperboreus* Gunnerus

STATUS.—*Transient and wintering*: Rare in the tidewater area of the Eastern Shore and Western Shore sections.

RECORDS.—One on the Potomac River, Charles County, on November 1, 1927 (H. C. Oberholser); 1 at South Point, Worcester County, on December 21, 1952 (S. H. Low); 1 in the District of Columbia from January 28 to March 31, 1937 (A. L. Curl); 1 at Tilghman, Talbot County, on February 12, 1949 (J. B. May, O. W. Crowder); 1 in Prince Georges County on February 17, 1935 (R.

overing); 1 on the Potomac River, Charles County, on February 8, 1926 (H. C. Oberholser); 1 at Annapolis on March 23-28, 1920 (A. Wetmore); 1 in the District of Columbia on April 5-9, 1914 (E. A. Preble); several at Ocean City on April 28, 1929 (A. Wetmore); and 1 at Ocean City on May 6, 1949 (Buckalew, 1950).

MARYLAND GULL *Larus glaucoides* Meyer

STATUS.—Rare visitor in the Eastern Shore, Western Shore, and Upper Chesapeake sections.

RECORDS.—Kirkwood (1895) reports observing an immature at Baltimore on November 23, 1893; single adults were seen along the former ferry route between Sandy Point, Anne Arundel County, and Matapeake, Queen Annes County, on January 18, 1946, February 18 and 25, 1945 (Hampe, 1945), May 8, 1950 (Mr. and Mrs. W. L. Henderson), May 12, 1945, and May 12, 1946; an immature was recorded in the District of Columbia on March 12, 1945 (Stewart and Robbins, 1947a); 1 was seen at Ocean City on May 15, 1948 (P. B. Street); and 1 at Gibson Island, Anne Arundel County, on June 4 and June 6, 1956 (Mrs. W. L. Henderson, Mrs. G. Tappan).

GREAT BLACK-BACKED GULL *Larus marinus* Linnaeus

STATUS.—*Transient and wintering:* Fairly common in the coastal area of Worcester County; uncommon in tidewater areas elsewhere in the Eastern Shore and Western Shore sections; rare in tidewater areas in the Upper Chesapeake section. *Summer migrant:* Single birds were seen at Ocean City on July 7, 1951 (D. A. Cutler), and July 19, 1955; 2 on Sharps Island, Talbot County, on July 15, 1953 (J. Hailman); and 1 in Dorchester County on July 30, 1953 (Mr. and Mrs. W. L. Henderson).

HABITAT.—Open water and adjacent beaches of the ocean, bays, and larger estuaries.

PERIOD OF OCCURRENCE.—*Normal period:* August 5-15 to May 15-25; peak, August 25 to May 10. *Extreme date of departure:* June 3, 1938, in Worcester County (G. A. Ammann).

MAXIMUM COUNTS.—*Spring:* 12 in the Ocean City area on May 5, 1951; 6 at Point Lookout, St. Marys County, on April 6, 1953 (J. W. Terborgh). *Fall:* 18 in the Ocean City area on November 11, 1950. *Winter* (Christmas counts): 26 in the Ocean City area on December 27, 1954; 24 in Talbot County on December 29, 1953; 13 in the Annapolis area on January 2, 1955.

LESSER BLACK-BACKED GULL *Larus fuscus* Linnaeus

STATUS.—Accidental visitor. An adult female was collected (USNM) on Assateague Island, Worcester County, on October 7,

1948 (Buckalew, 1950). One was closely observed at Gibbs Island, Anne Arundel County, on October 7, 1952 (Mrs. W. Henderson, Mrs. G. Tappan).

HERRING GULL *Larus argentatus* Pontoppidan

STATUS.—*Breeding*: Three nests with eggs were found on Sharps Island, Talbot County, on July 24, 1955, and 7 nests with eggs, or eggs and young) on July 1, 1956 (R. L. Kleen). *Transient and wintering*: Abundant in the coastal area of Worcester County; common in other tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; fair common (in spring) in the Allegheny Mountain section; uncommon elsewhere in all sections. *Summer vagrant*: Fairly common in the coastal area of Worcester County; uncommon in tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections. Immature birds predominate during the summer months.

HABITAT.—Ocean, bays, estuaries, and adjacent beaches and fields; also on inland bodies of water, including lakes, reservoirs and the larger streams.

SPRING MIGRATION.—*Normal period*: February 20–March 10; peak, May 20–30; peak, March 20 to May 15.

FALL MIGRATION.—*Normal period*: August 1–10 to November 10–20; peak, September 15 to October 20.

MAXIMUM COUNTS.—*Spring*: 3,000 in the District of Columbia on March 7, 1936 (H. C. Oberholser); 1,238 in the Ocean City area on May 17, 1947; nearly 1,000 along the Potomac River in Charles and Prince Georges Counties in mid-March, 1926. *Fall*: 2,090 in the Ocean City area on October 6, 1946. *Winter* (Christmas counts): 2,554 in the Ocean City area on December 27, 1951; 1,231 in the Kent Island area, Queen Annes County, on December 29, 1949; 730 in the Susquehanna Flats area on December 28, 1951.

BANDING.—A total of 68 recovered throughout the year in tidewater Maryland had been banded as young birds in the following areas: New Brunswick, 25; coast of Maine, 10; northern Michigan, 9; coast of New Hampshire, 8; coast of Massachusetts, 7; southeastern Ontario, 3; coast of New York, 2; southern Quebec, 2; southern Nova Scotia, 1; northeastern Wisconsin, 1. A full grown immature bird banded in west-central Florida on December 28, 1937, was recovered in Baltimore County on November 1, 1939.

RING-BILLED GULL *Larus delawarensis* Ord

STATUS.—*Transient*: Abundant in the tidewater areas of the

Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common elsewhere in all sections. *Wintering*: Common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon elsewhere in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections. *Summer vagrant*: Uncommon in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections. In spring, a noticeable westward flight occurs along the Potomac River into western Maryland.

HABITAT.—Ocean, bays, estuaries, and adjacent beaches and fields; also inland lakes, reservoirs, and rivers.

SPRING MIGRATION.—*Normal period*: February 15–25 to May 20–30; peak, March 1 to May 10.

FALL MIGRATION.—*Normal period*: July 5–15 to November 10–20; peak, August 15 to October 25.

MAXIMUM COUNTS.—*Spring*: “Thousands” in the District of Columbia on April 10, 1940 (W. L. McAtee); 1,200 in Susquehanna Flats area on March 25, 1947; 1,000 at Seneca, Montgomery County, on February 28, 1954 (J. W. Terborgh). *Fall*: 840 on August 30, 1950, and 590 on August 13, 1950, on Assateague Island; 400 in the District of Columbia on October 19, 1937 (W. L. McAtee); 302 in the Middle River area, Baltimore County, on August 27, 1950 (E. Willis). *Winter* (Christmas counts): 1,270 in the Ocean City area on December 21, 1952; 878 in the Carroll Island area, Baltimore County, on December 22, 1946; 801 in the District of Columbia area on January 1, 1955.

BANDING.—A total of 29 recovered throughout the year in tide-water Maryland had been banded as young birds in the following areas: northeastern Michigan, 17; southeastern Ontario, 11; and northwestern New York, 1.

LAUGHING GULL *Larus atricilla* Linnaeus

STATUS.—*Breeding*: Uncommon and local in Chincoteague Bay—a colony of about 100 pairs was located on Striking Marsh in 1915 (H. H. Bailey); in 1951 a colony of about 15 pairs was found on Robins Marsh, but in 1955 only half a dozen pairs were present; in 1953 a colony of 25 pairs was found on an island one mile southeast of South Point and by 1955 this colony had doubled; rare and local elsewhere in tidewater areas of the Eastern Shore and Western Shore sections—a small colony was located at Cornfield Harbor, St. Marys County, during the period 1935–1946 (A. Wetmore), and a colony was found on Sharps Island, Talbot County, during the summer of 1954 (fide Mrs. W. L. Henderson).

Transient: Common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; casual in the Allegheny Mountain section—1 at Deep Creek Lake on October 18, 1936 (Handlan, 1936). *Summer vagrant*: Fairly common in the coastal area of Worcester County; uncommon in tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections. *Wintering*: Rare in tidewater areas of the Eastern Shore and Western Shore sections.

HABITAT.—Ocean, bays, and estuaries, and adjacent beaches and fields. Usually nests on islands of salt marsh, chiefly salt-water cordgrass.

NESTING SEASON.—Late May to early August. *Extreme egg dates* (5 records, about 40 nests): June 6, 1953, and July 18, 1955, in Worcester County. *Downy young dates* (3 records, 175 young in all stages): June 6, 1954, in Talbot County (fide Mrs. W. L. Henderson) and July 25, 1956, in Worcester County (E. F. Mashburn).

SPRING MIGRATION.—*Normal period*: April 1–10 to May 10–20. *Extreme dates of arrival*: March 27, 1948, in Calvert County; March 27, 1949, in Worcester County. *Extreme date of departure*: May 22, 1940, in the District of Columbia (W. L. McAtee).

FALL MIGRATION.—*Normal period*: July 20–30 to November 20–30; peak, August 15 to November 1. *Extreme date of arrival*: July 18, 1927, in Calvert County (W. H. Ball). *Extreme dates of departure*: December 10, 1927, on the Potomac River below Washington, D. C. (H. H. T. Jackson); December 3, 1950, in Anne Arundel County (A. M. Smith).

MAXIMUM COUNTS.—*Fall*: 3,000 on Back River, Baltimore County, on September 3, 1948 (E. Willis); 1,000 at Gibson Island, Anne Arundel County, on September 14, 1950, and November 1, 1951 (Mrs. W. L. Henderson, Mrs. G. Tappan); 500–1,200 on the Potomac River off Alexandria, Virginia, in late September and early October 1951 (E. G. Davis). *Winter* (Christmas count): 6 near St. Michaels, Talbot County, on December 29, 1953.

BANDING.—Eight recovered throughout tidewater Maryland in fall (September 1–October 15) had been banded as young birds in the following areas: Cobb Island, Virginia (Northampton County), 6; and southern New Jersey (Cape May County), 2. One banded as a juvenal near South Point, Worcester County, on July 18, 1955, was recovered at Coco Solo, Canal Zone, on December 11, 1955.

SNAPARTE'S GULL *Larus philadelphia* (Ord)

STATUS.—*Transient*: Fairly common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon elsewhere in all sections. *Wintering*: Fairly common in the coastal area of Worcester County; uncommon in tidewater areas elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections.

HABITAT.—Open water and adjacent beaches of the ocean, bays, and estuaries; also on inland bodies of water, including lakes, reservoirs, and the larger streams.

SPRING MIGRATION.—*Normal period*: March 5-15 to May 10-15; peak, March 25 to May 1. *Extreme dates of arrival*: February 18, 1950, in St. Marys County (R. J. Beaton, J. W. Taylor, Jr.); February 22, 1938, in Baltimore County (H. Kolb); February 23, 1927, in the District of Columbia (H. C. Oberholser). *Extreme dates of departure*: June 8, 1929, in the District of Columbia (H. C. Oberholser); June 7, 1930, in Prince Georges County (H. C. Oberholser).

FALL MIGRATION.—*Normal period*: September 10-20 to December 10-20; peak, October 20 to November 30. *Extreme dates of arrival*: August 9, 1901, 8 miles off Ocean City (F. C. Kirkwood); August 17, 1955, in Anne Arundel County (L. W. Oring); August 13, 1928, in the District of Columbia (W. J. Whiting); August 5, 1948, in Queen Annes County (S. H. Low). *Extreme date of departure*: December 30, 1922, in the District of Columbia (M. J. Pelletier).

MAXIMUM COUNTS.—Spring: 225 at Ocean City on April 1, 1948; 200+ at Annapolis on May 1, 1925 (F. C. Kirkwood); about 100 at Washington, D. C., on March 8, 1935 (W. L. McAtee); 130 in Chesapeake Bay, between Sandy Point in Anne Arundel County and Kent Island in Queen Annes County on April 6, 1946. *Fall*: 100+ on Deep Creek Lake, Garrett County, during October 1939 (M. G. Brooks); 170 on December 10, 1927, and 52 on September 2, 1928, on the Potomac River below Washington, D. C. (H. H. Jackson). *Winter*: 332 at Ocean City on December 27, 1953 (Christmas count).

LACK-LEGGED KITTIWAKE *Rissa tridactyla* (Linnaeus)

STATUS.—Casual visitor in the coastal area of Worcester County. An immature Kittiwake was closely observed on Assateague Island on August 30, 1950 (Stewart, 1951). An adult female was found dead near Ocean City on March 4, 1951 (Cutler, 1952).

GULL-BILLED TERN *Gelochelidon nilotica* (Gmelin)

STATUS.—*Breeding*: Fairly common locally in the coastal area of Worcester County. *Transient*: Uncommon in the coastal area of Worcester County; casual in tidewater areas in the Western Shore section—1 seen in the District of Columbia on May 4, 1928 (Ball, 1928a), recorded in St. Marys County at Point Lookout on July 21, 1928, and at Cornfield Harbor on September 1, 1931 (A. Wetmore), 1 seen at Sandy Point, Anne Arundel County on September 4, 1949 (R. D. Cole, E. H. La Fleur), and 2 seen there on September 11, 1949 (R. J. Beaton, I. E. Hampe).

HABITAT.—Ocean and coastal bays and adjacent sandy beaches. Nests on sandy islands in the coastal bays.

NESTING SEASON.—Mid-May to early August. *Extreme early dates* (26 nests): June 6, 1953, and July 18, 1955, in Worcester County. *Extreme downy young dates* (about 31 broods): June 1, 1946, and July 18, 1949 (J. H. Buckalew), in Worcester County.

PERIOD OF OCCURRENCE.—*Extreme dates*: April 30, 1955 (D. Aud. Soc.), and September 25, 1949 (K. H. Weber), in Worcester County.

HIGH BREEDING POPULATIONS.—Twenty-five pairs on the group of islands about 1 mile south-southeast of South Point in Chincoteague Bay on July 12, 1951.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 10 in the Ocean City area on May 14, 1949 (E. G. Davis). *Fall*: 5 on Assateague Island on September 5, 1948.

BANDING.—A juvenal, banded near South Point in Chincoteague Bay on July 4, 1952, was recovered in Cuba during the fall of 1952. Another juvenal, banded near South Point on July 1, 1951, was recovered near Quimby in Accomack County, Virginia on August 16, 1951.

FORSTER'S TERN *Sterna forsteri* Nuttall

STATUS.—*Breeding*: Locally common in the coastal area of Worcester County (north to Ocean City); rare in tidewater areas of Somerset County. *Fall transient*: Common in the tidewater areas of the Eastern Shore and Western Shore sections; fairly common in tidewater areas of the Upper Chesapeake section; casual in the Piedmont section—recorded in Montgomery County on October 4, 1942, and August 25–26, 1945 (A. Wetmore). *Spring transient*: Uncommon in the coastal area of Worcester County; rare elsewhere in tidewater areas of the Eastern Shore and Western Shore sections; probably casual in the Allegheny Mountain section—2 believed seen on Deep Creek Lake on May 3, 1951.

M. G. Brooks). *Wintering*: Rare in the coastal area of Worcester County; casual elsewhere—1 recorded in the District of Columbia on December 28, 1928 (W. H. Ball), and several seen here on December 29–30, 1946 (D. Berkheimer, E. L. Poole); 1 recorded at Denton, Caroline County, on February 16, 1955 (A. Knotts). *Summer vagrant*: Casual—10 seen on Chesapeake Bay out from Gibson Island, Anne Arundel County, on June 2, 1953 (Mr. and Mrs. W. L. Henderson).

HABITAT.—*Breeding*: Salt marshes and adjacent open water; nesting colonies are usually located on islands of salt marsh, chiefly salt-water cordgrass in the coastal bays. *Transient*: Ocean, bays, estuaries, and adjacent beaches or salt marsh.

NESTING SEASON.—Late April to late July (nesting peak, early May to late June). *Extreme egg dates* (9 records, about 1,200 nests): May 7, 1938 (G. A. Ammann), and July 18, 1955, in Worcester County. *Extreme downy young dates* (6 records, about 450 broods): June 6, 1953, and July 20, 1951, in Worcester County.

SPRING MIGRATION.—*Extreme dates*: April 3, 1954, in Charles and St. Marys Counties (J. W. Terborgh, et al.), and May 9, 1953, in Charles County (J. K. Merritt, J. W. Terborgh).

FALL MIGRATION.—*Normal period*: July 5–15 to November 15–25; peak, August 15 to October 20. *Extreme date of arrival*: June 28, 1953, in Anne Arundel County (E. J. and A. Besson). *Extreme dates of departure*: December 6, 1953, in Charles County (M. C. Crone, R. L. Farr); November 28, 1953, in St. Marys County (J. W. Terborgh).

HIGH BREEDING POPULATIONS.—Approximately 1,000 pairs on a marshy island near North Beach (Assateague Island) on June 6, 1894 (Kirkwood, 1895); about 700 pairs on Robins Marsh Island in Chincoteague Bay on July 11, 1951.

MAXIMUM COUNTS (nonbreeding).—*Fall*: 150 at Beverly Beach, Anne Arundel County, on September 9, 1947; 75 in the Ocean City area on September 29–30, 1945; 60 at Point Lookout, St. Marys County, on November 23, 1935 (W. H. Ball); 45 in the District of Columbia area on October 9, 1928 (Lincoln, 1928). *Winter*: 7 in the Ocean City area on January 10, 1945, and 7 in the same area on December 27, 1954 (Christmas count).

BANDING.—Two juvenals, banded in Worcester County (Robins Marsh) on June 19, 1953, were recovered on the wintering ground, in central Florida (Orange County) on December 13, 1953, and 1 in eastern North Carolina on January 2, 1954. A juvenal, banded on Robins Marsh on July 11, 1951, was recovered in Dorchester County, near Cambridge (letter of April 30, 1952). An-

other juvenal, banded on the Clam Harbor Tumps (near the south tip of Mills Island in Chincoteague Bay) on July 6, 1946, was trapped about 10 miles distant, on Robins Marsh on July 11, 1951.

COMMON TERN *Sterna hirundo* Linnaeus

STATUS.—*Breeding:* Common in the coastal area of Worcester County; fairly common locally in tidewater areas of Somerset County; rare and local in tidewater areas of Dorchester, Talbot and St. Marys Counties—colonies were found near Holland Island, Dorchester County, in 1919 and 1920 (Jackson, 1941) and in 1951 (F. C. Kirkwood), on Sharps Island, Talbot County, on July 23, 1955 (R. L. Kleen), and at Point Lookout, St. Marys County, 1937 (E. G. Holt, W. L. McAtee). *Transient:* Common in the coastal area of Worcester County; fairly common in other tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon or rare elsewhere in all sections.

HABITAT.—Ocean, bays, and adjacent sandy beaches; also inland ponds, lakes, and rivers. This species usually nests in colonies on sandy islands in the coastal bays. Three colonies found on the Manokin River in Somerset County in 1954 and 1955 were situated on marshy islands, comprised chiefly of salt-water cordgrass.

NESTING SEASON.—Mid-May to mid-August (nesting peak, early June to late July). *Extreme egg dates* (34 records, about 1,600 nests): May 30, 1937, in St. Marys County (E. G. Holt, W. L. McAtee) and August 5, 1950, in Worcester County (R. W. Dickerman). *Extreme downy young dates* (34 records, about 1,000 broods): June 6, 1953, and August 5, 1939 (Kolb, 1939), in Worcester County.

SPRING MIGRATION.—*Normal period:* April 5–15 to May 25–30; peak, April 20 to May 25. *Extreme date of arrival:* April 4, 1951, in Worcester County (J. H. Buckalew). *Extreme date of departure:* June 8, 1929, in the District of Columbia (H. C. Oberholser).

FALL MIGRATION.—*Normal period:* July 5–15 to November 10–20; peak, August 10 to September 30. *Extreme date of arrival:* July 2, 1950, in Baltimore County (E. Willis). *Extreme date of departure:* November 30, 1953, in Worcester County (E. G. Davis).

HIGH BREEDING POPULATIONS.—About 415 pairs on the group of islands 1 mile south-southeast of South Point in Chincoteague Bay on July 3, 1945.

MAXIMUM COUNTS (nonbreeding).—*Spring:* 3,050 in the Ocean City area on May 11, 1952 (D. A. Cutler); 112 on the Potomac

river below Washington, D. C., on May 12, 1928 (H. H. T. Jackson). *Fall*: 285 on Assateague Island on August 23, 1947.

BANDING.—See figure 26.

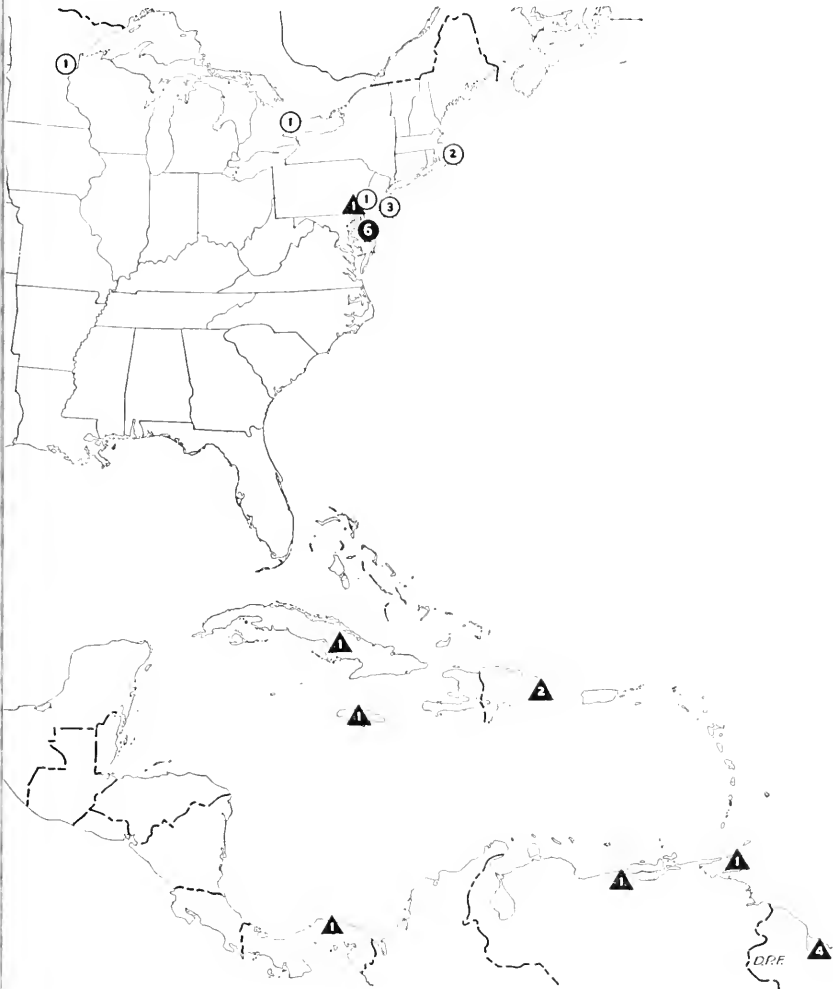


FIGURE 26.—Common Tern banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid circle = recovered June through August; solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August.

ASSATEAGUE TERN *Sterna dougallii* Montagu

STATUS.—*Breeding*: Formerly nested in the coastal area of Worcester County—a good-sized colony was found on the barrier beach 5 miles south of Ocean City on June 10, 1933, and adults and

8 sets of eggs were collected (Court, 1936); nested commonly on islands in Sinepuxent Bay during June 1936 and 1938 (Pool, 1942b); an adult was collected on Assateague Island on June 1, 1938 (G. A. Ammann). There are no definite breeding records in recent years although a single adult was closely observed at Ocean City on June 18, 1948. *Spring transient*: Rare in the coastal area of Worcester County.

HABITAT.—Ocean and coastal bays, and adjacent sandy beaches.

PERIOD OF OCCURRENCE—*Extreme dates*: May 11, 1952 (D. A. Cutler), and June 18, 1948, in Worcester County.

SOOTY TERN *Sterna fuscata* Linnaeus

STATUS.—Accidental visitor. One was collected at Baltimore on October 1, 1876, by Alexander Wolle (Kirkwood, 1895). This specimen was given to the U. S. National Museum (cat. 70756) and later (on January 28, 1881) was sent to the Chicago Academy of Sciences. Another specimen was found alive at Baltimore on October 17, 1954 (H. Kolb). Both specimens were collected shortly following the passage of hurricanes.

LEAST TERN *Sterna albifrons* Pallas

STATUS.—*Breeding* (see fig. 27): Common in the coastal area of Worcester County; fairly common locally in tidewater area

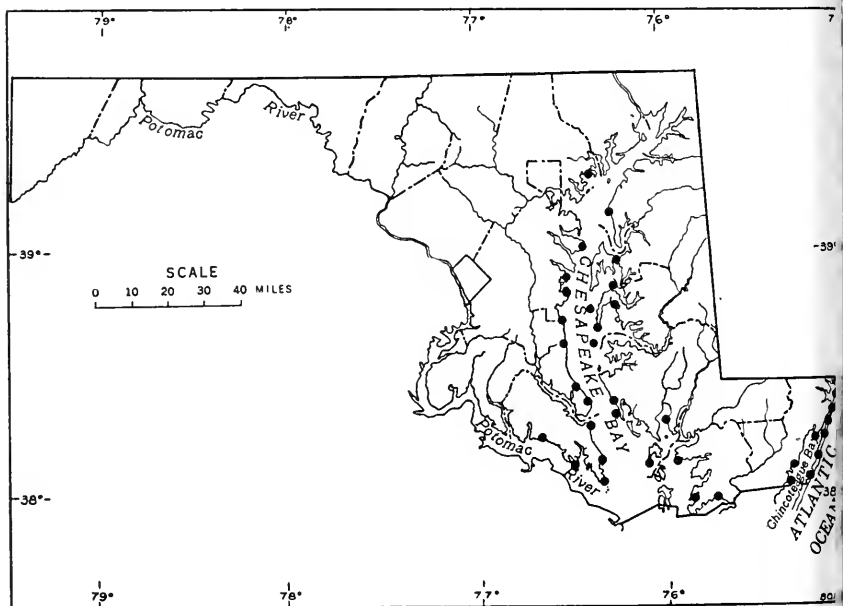


FIGURE 27.—Breeding colonies of Least Tern.

along Chesapeake Bay, occurring along the eastern shore of the bay north to Swan Point in Kent County (W. L. Henderson) and along the western shore north to Strawberry Point in Baltimore County (E. Willis); also occurs up the Potomac River to Leonardtown (E. J. Court). *Transient*: Uncommon in tidewater areas of the Eastern Shore and Western Shore sections; rare in tidewater areas of the Upper Chesapeake section; casual in the interior—recorded on August 13, 1955, following the passage of a hurricane when 16 were seen near Emmitsburg, Frederick County (J. W. Richards), 4 near Laytonsville, Montgomery County (S. H. Low), 2 at Patuxent Refuge, Prince Georges County, and 2 at Goldsboro, Caroline County (Mr. and Mrs. A. J. Fletcher).

HABITAT.—Ocean, bays, and estuaries, and adjacent sandy beaches; nests on sandy islands or beaches.

NESTING SEASON.—Late May to early August (nesting peak, early June to mid-July). *Extreme egg dates* (32 records, about 115 nests): May 20, 1953, in Queen Annes County and July 24, 1955 (R. L. Kleen), in Talbot County. *Extreme downy young dates* (16 records, about 250 broods): June 18, 1945, in Worcester County and July 24, 1955 (R. L. Kleen), in Talbot County.

SPRING MIGRATION.—*Extreme dates*: April 21, 1948, in Worcester County and May 27, 1950 (E. Willis), in Baltimore County.

FALL MIGRATION.—*Normal period*: July 15–25 to September 1–10; peak, August 1 to August 20. *Extreme date of arrival*: July 10, 1952, in Baltimore County (E. Willis). *Extreme dates of departure*: September 28, 1952, in Queen Annes County (Mrs. W. L. Henderson); September 27, 1953, in Charles County (M. C. Crone, K. Keeley).

HIGH BREEDING POPULATIONS.—About 285 pairs on the barrier beach between Ocean City and the Delaware line, on June 17, 1948; about 100 pairs at Kent Narrows, Queen Annes County, on July 6, 1935 (M. B. Meanley).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 150 in the Ocean City area on May 12, 1951. *Fall*: 74 in the Ocean City area on August 4, 1945; about 50 along the Potomac River in the District of Columbia on August 13, 1955, following a hurricane (E. G. Davis).

ROYAL TERN *Thalasseus maximus* (Boddaert)

STATUS.—*Breeding*: First recorded in July 1950 when 2 nests with eggs (collected) were found on an island in Chincoteague Bay, about 1 mile south of South Point (J. H. Buckalew); 165 nests with eggs and young were found in the same area on July

6, 1953 (J. H. Buckalew); on June 26, 1954, about 500 adults were noted there (P. A. DuMont); on July 18, 1955, 76 large young (nearly all that were present) were caught and banded and on July 25, 1956 (E. F. Mashburn), 31 young (all that were present) were caught and banded. *Fall transient*: Fairly common in the coastal area of Worcester County; uncommon in tidewater areas elsewhere in the Eastern Shore and Western Shore sections. *Spring transient and summer vagrant*: Rare in the coastal area of Worcester County; casual in lower Chesapeake Bay—1 observed at Plum Point, Calvert County, on April 23, 1955 (J. H. Fales). *Wintering*: Casual in the coastal area of Worcester County—1 seen at Ocean City on December 21, 1955.

HABITAT.—Ocean and bays, and adjacent sandy beaches.

SPRING MIGRATION.—Extreme dates of arrival: April 23, 1955, in Calvert County (J. H. Fales); April 25, 1953, in Worcester County (D. A. Cutler).

FALL MIGRATION.—Normal period: July 15–25 to November 15–25; peak, August 20 to October 25. *Extreme date of arrival*: July 12, 1951, in Worcester County. *Extreme date of departure*: November 27, 1945, in Worcester County.

MAXIMUM COUNTS.—*Fall*: 69 on Assateague Island on September 17, 1950 (J. H. Buckalew, E. O. Mellinger); 32 at Point Lookout, St. Marys County, on October 24, 1953 (J. W. Terborgh); 3 at Tilghman Island, Talbot County, on August 31, 1956 (E. Armistead). *Spring*: 18 near South Point, Worcester County, on May 2, 1953 (R. Strosnider).

BANDING.—One banded as a juvenal near South Point, Worcester County, on July 18, 1955, was recovered in the Province of Pinar del Rio, Cuba, on February 19, 1956.

[SANDWICH TERN] *Thalasseus sandvicensis* (Latham)

STATUS.—Hypothetical. On September 19, 1945, 1 day after a tropical hurricane, 2 were observed at Ocean City (Stewart and Robbins, 1947a).

CASPIAN TERN *Hydroprogne caspia* (Pallas)

STATUS.—*Spring transient*: Uncommon in tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; casual in the Piedmont section—1 seen at Plummers Island, Montgomery County, on May 5, 1918 (Fisher, 1935), and recorded at Loch Raven in Baltimore County on April 18, 1942, and April 23, 1943 (H. Kolb). *Fall transient*: Fairly common in the coastal area of Worcester County; uncommon in other tidewater areas of the Eastern Shore and Western Shore sections; rare in tidewater

s of the Upper Chesapeake section; casual elsewhere—1 seen Plummers Island, Montgomery County, on October 30, 1938 (Wetmore) and 1 seen near Seneca, Montgomery County, on November 5, 1953 (H. A. Sutton). *Summer vagrant*: Rare in water areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections. *Wintering*: Casual—1 seen at Matapeake, Queen Anne's County, on December 22, 1948 (T. W. Donnelly).

HABITAT.—Ocean, bays, estuaries, and adjacent beaches.

SPRING MIGRATION.—*Normal period*: April 10–20 to May 25–June 5; peak, April 25 to May 20. *Extreme date of arrival*: April 1953, in Worcester County (J. W. Terborgh). *Extreme dates of departure*: June 11, 1930, in the District of Columbia (W. J. King); June 9, 1951, in Charles County (J. W. Taylor, Jr.); June 6, 1953, in Anne Arundel County (Mrs. W. L. Henderson, and G. Tappan).

FALL MIGRATION.—*Normal period*: August 10–20 to October 5; peak, August 20 to September 30. *Extreme date of arrival*: August 7, 1949, in Anne Arundel County (C. N. Donnelly). *Extreme date of departure*: November 7, 1948, in Worcester County.

MAXIMUM COUNTS.—*Spring*: 31 on Middle River, Baltimore County, on May 13, 1950 (E. Willis); 13 at Deal Island, Somerset County, on April 28, 1946; 9 at Gibson Island, Anne Arundel County, on April 30, 1952 (Mrs. W. L. Henderson); 7 in the District of Columbia on May 21, 1927 (W. W. Rubey). *Fall*: 59 at Annapolis on September 19, 1945; 8 in the District of Columbia on September 19, 1927 (H. H. T. Jackson). *Summer vagrant*: 1 in the District of Columbia on June 28, 1927 (H. C. Oberholser).

CAPTURING.—One recovered at Breezy Point, Calvert County, on October 29, 1944, had been banded as a juvenal on Gravelly Island, Queen Anne's County, Wisconsin, on June 21, 1944.

BLACK TERN *Chlidonias niger* (Linnaeus)

STATUS.—*Breeding(?)*: Possibly nests occasionally in the Allegheny Mountain section—on June 9, 1935, 2 were seen on a pond near Grantsville, Garrett County, and, according to the people living on the property, had been there since spring (Denmead, 1935). *Fall transient*: Fairly common in the coastal area of Worcester County; uncommon in other tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections and in the Allegheny Mountain section; rare elsewhere in all sections. *Spring transient*: Uncommon in tidewater areas of the Eastern

Shore, Western Shore, and Upper Chesapeake sections; rare elsewhere in all sections.

HABITAT.—Ocean, bays, estuaries, and adjacent beaches and marshes; also on inland ponds, lakes, reservoirs, and rivers.

SPRING MIGRATION.—*Normal period:* May 1–10 to June 1; peak, May 10 to May 30. *Extreme date of arrival:* April 29, 1952, in Prince Georges County. *Extreme date of departure:* June 1, 1952, in Montgomery County (J. W. Taylor, Jr.).

FALL MIGRATION.—*Normal period:* July 5–15 to September 25; peak, July 20 to September 20. *Extreme date of arrival:* July 28, 1927, in Prince Georges County (Mr. and Mrs. L. D. Minner). *Extreme dates of departure:* October 16, 1899, in Baltimore County (F. C. Kirkwood); September 28, 1952, in Queen Anne's County (Mr. and Mrs. W. L. Henderson); September 26, 1952, in the District of Columbia (W. H. Ball).

MAXIMUM COUNTS.—*Spring:* 24 at Ocean City on May 5, 1952 (P. A. DuMont); about 20 in the District of Columbia on July 27, 1926 (Mrs. T. M. Knappen); 8 in Anne Arundel County on May 8, 1954 (P. A. DuMont); 6 at Ocean City on May 11, 1952 (D. A. Cutler). *Fall:* 81 on September 5, 1948, and 70 on September 23, 1949, on Assateague Island; 37 in the District of Columbia on September 17, 1930 (W. H. Ball); 12 at Oxford, Talbot County on July 13, 1950 (Mr. and Mrs. W. L. Henderson); 12 at Sandy Point, Anne Arundel County, on September 13, 1947 (J. W. Taylor, Jr.); 8 at Seneca, Montgomery County, on September 8, 1952 (J. W. Terborgh).

Family RYNCHOPIDAE

BLACK SKIMMER *Rynchops nigra* Linnaeus

STATUS.—*Breeding:* Common in the coastal area of Worcester County. *Transient:* Common in the coastal area of Worcester County; casual elsewhere—1 on the Potomac River on September 8, 1858 (Coues and Prentiss, 1883), singles in the District of Columbia on April 14, 1928 (C. H. M. Barrett), and on August 1, 1952 (Johnson, 1952), 2 at Sandy Point, Anne Arundel County on August 28, 1955, and 1 at Tilghman Island on May 18 and 19, 1956 (R. L. Kleen). *Wintering:* Casual visitor—1 seen in Marys County on December 29, 1940 (Dargan, et al., 1941), 1 seen at Ocean City on December 27, 1954 (I. N. Gabrielson), and 1 at Ocean City on January 24, 1947.

HABITAT.—Coastal bays and adjacent sandy beaches. Nesting on sandy islands in the coastal bays.

NESTING SEASON.—Late May to late August (nesting peak, 1952).

to late July). *Extreme egg dates* (23 records, about 635 eggs): June 1, 1938 (Poole, 1942b), and August 3, 1939 (Kolb, 1939), in Worcester County. *Extreme downy young dates* (23 records, about 640 broods): June 18, 1945, and August 12, 1955, Worcester County.

SPRING MIGRATION.—*Extreme arrival dates*: April 14, 1928, in the District of Columbia (C. H. M. Barrett); April 20, 1900, in Worcester County (Ansley Ludlam). *Migration peak*: May 5 to May 20.

FALL MIGRATION.—*Normal period*: August 10–20 to November 10–20; peak, September 1 to November 1. *Extreme date of departure*: November 24, 1946, in Worcester County.

HIGH BREEDING POPULATIONS.—About 250 pairs on islands in Pocomoke Bay and northern Chincoteague Bay on July 12, 1951.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 560 in the Ocean City area on May 11, 1952 (D. A. Cutler). *Fall*: 400 in the Ocean City area on September 27, 1949, and September 29, 1945.

BANDING.—Five, banded as juvenals in Worcester County in summer (June 24–July 4), were recovered in Florida during the period September 12–April 6; 3 of these were recovered on the west coast of central Florida, and 2 were taken on the Gulf coast of southern Florida. Five others, banded as juvenals in Worcester County, were recovered as follows: 2 in Georgia on January 1 and April 1; 1 in South Carolina in late December; 1 in southern Delaware on August 9; and 1 at Salisbury, Wicomico County, during the hurricane of August 12, 1955.

Family ALCIDAE

[AZORBILL] *Alca torda* Linnaeus

STATUS.—Hypothetical. One was seen on the barrier beach 2 miles south of Ocean City on December 4, 1926 (Wetmore, 1927). Another was seen near the former Isle of Wight Coast Guard Station (north of Ocean City) on February 3, 1938 (J. H. Buckner).

BLACK-BILLED MURRE *Uria lomvia* (Linnaeus)

STATUS.—Casual visitor. Five specimens (USNM), found in Washington, D. C., market, were taken in the District of Columbia during the period, December 14, 1896, to January 1, 1897 (Bartsch, 1897). A specimen was collected at Havre de Grace, Harford County, on November 5, 1899 (examined by F. C. Clarkwood). Another was taken near Kensington, Montgomery County, on November 24, 1899 (USNM—R. S. Shepherd), and on

the same day at least 2 other freshly killed birds were offered for sale in Washington.

DOVEKIE *Plautus alle* (Linnaeus)

STATUS.—*Transient and wintering*: Rare (occasionally more numerous) in the coastal area of Worcester County.

HABITAT.—Pelagic and littoral zones of the ocean.

PERIOD OF OCCURRENCE.—*Extreme dates*: November 18, 1951 (F. C. Kirkwood), and March 11, 1952 (J. H. Buckalew), both in Worcester County. *Occurrence peak*: December 10 to February 10.

MAXIMUM COUNT.—Thousands were reported 10 to 15 miles offshore from Ocean City (hundreds caught in mackeral net) during early January 1949 (J. H. Buckalew).

[BLACK GUILLEMOT] *Cepphus grylle* (Linnaeus)

STATUS.—Hypothetical. Audubon (1840-1844) reported that he had seen this species "as far south as the shores of Maryland."

Family COLUMBIDAE

MOURNING DOVE *Zenaidura macroura* (Linnaeus)

STATUS.—*Breeding and transient*: Common in the Piedmont, Upper Chesapeake, and Western Shore sections; fairly common in the Allegheny Mountain, Ridge and Valley, and Eastern Shore sections. *Wintering*: Fairly common in the Eastern Shore and Western Shore sections; uncommon in the Upper Chesapeake, Piedmont, and Ridge and Valley sections; rare in the Allegheny Mountain section.

HABITAT.—Agricultural areas and adjacent hedgerows, wetland margins, woodlots, and residential areas.

NESTING SEASON.—Early March to early October (nesting period mid-April to mid-July). *Extreme egg dates* (151 nests): March 10, 1953, in the District of Columbia (J. A. Madden) and September 21, 1949, in Montgomery County (S. H. Low). *Extreme nesting dates* (67 nests): March 29, 1950, in the District of Columbia (W. B. Tyrrell) and October 4, 1952, in Baltimore County (C. Hackman).

SPRING MIGRATION.—*Normal period*: February 10-20 to April 20-30; peak, March 10 to April 10.

FALL MIGRATION.—July 20-30 to November 1-10; peak, August 15 to October 15.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

(32 in 2,563 acres) in mixed forest and brush habitats with clearings (both pine and deciduous trees with small scattered agricultural areas and abandoned farmlands) along the border between Anne Arundel and Prince Georges Counties in 1943.

(50 in 11,520 acres) in "general farmland" (various agricultural habitats, chiefly hayfields and pastures with little cover, owing to widespread clean-farming practices) in Frederick County in 1950 (Stewart and Meanley, 1950).

MAXIMUM COUNTS.—*Fall*: 200 near Baltimore on August 26, 1933 (W. H. Fisher); 115 on Patuxent Refuge, Prince Georges County, on September 28, 1946. *Winter* (Christmas counts): 24 in the Ocean City area on December 27, 1955; 370 near Annapolis in Caroline County on December 26, 1953; 319 in the St. Michaels area, Talbot County, on December 29, 1955; 317 in the Philadelphia Reservoir area on December 24, 1955; 316 in the District of Columbia area on January 1, 1955; 218 in southern Dorchester County on December 28, 1955; 215 in southern Charles County on January 1, 1954. *Spring*: 200 in Anne Arundel County March 1933 (T. Denmead).

BANDING.—See figure 28.

PASSENGER PIGEON *Ectopistes migratorius* (Linnaeus)

STATUS.—Now extinct. Formerly abundant at times, at least locally. Grant (1951) states that this species formerly nested in Garrett County in the vicinity of Deer Park, Mountain Lake Park, Oakland, and Grantsville. An immense roost was located near Oakland according to Eifrig (1904). In Allegany County during the 1870's (Grant, 1951) the Passenger Pigeon was a regular spring and fall migrant arriving from the south in about the middle of April and returning during the Indian summer, probably about the first of October. The last big flight was reported in western Allegany County in the vicinity of Barton (Grant, 1951) and Vale Summit (Kirkwood, 1895) on the unusual date of January 1, 1877 (mistakenly published by Grant as 1876). Grant reported a flock containing thousands of birds, and Kirkwood stated that at that time the sky was black with them and that large numbers were killed.

In Howard County (Fisher, 1896) during the period about 1840-45, "large flocks would be seen reaching as far as the eye could see—the birds making their appearance in the fall and remaining until about Christmas although at times a few would winter with us." Large numbers were killed at night while roosting and their bodies fed to the hogs (Fisher, 1894). Until about 1880, Passenger Pigeons were seen regularly in the vicinity of



FIGURE 28.—Mourning Dove banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August; open triangle = banded September through May.

Baltimore almost every season, generally migrating in September and October in flocks of from 15 to several hundred individuals (Fisher, 1896). In 1878, for about 10 days in October, flocks consisting from 5 to 20 birds were seen flying over Baltimore between 7:00 and 7:30 a.m., 6 to 12 flocks being seen each day (Kirkwood, 1895). In the vicinity of Washington, D. C., this species appeared in flocks at irregular intervals throughout the fall, winter, and spring; the last large flight took place in the fall of about 1858 or 1859 (Coues and Prentiss, 1883).

By 1880, this species had become quite rare throughout its range. The latest records were made during the period 1888-1903. In Dorchester County several were shot during the latter part of the 1880's (Hampe and Kolb, 1947). In the District of Columbia and nearby sections of Maryland (Cooke, 1929) a few were seen and specimens collected in 1887, 1889 (small flock near Laurel and flock of 12 at Jefferson), and 1891 (latest collected on May 2, 1891). In the vicinity of Baltimore 1 was shot near Bradshaw in September 1888 and another, with a flock of Mourning Doves in Dulaney Valley in September 1889 (Fisher, 1896); quite a few were seen in the fall of 1893, including a record of 3 on August 27, a flock of 50 or 60 on September 17, and a flock of about 40 on September 19 (Kirkwood, 1895). The last record of the mountains was of 3 birds seen on the ridge near Loch Raven Station in Baltimore County about August 15, 1899, by Baltimore. Near Hancock, in Washington County, a flock of 8 or 10 birds was observed several times during the year, 1889 (Denwood, 1954). In Garrett County, Eifrig (1904) believed that he saw 5 on July 19, 1901, and a pair on July 17, 1903. He states further that farmers and others in Garrett County at that time were occasionally seeing small flocks of from 2 to 12 individuals.

ROUND DOVE *Columbigallina passerina* (Linnaeus)

STATUS.—Accidental visitor. Two female specimens (USNM) have been taken. One was collected in the District of Columbia on September 1, 1844 (entered in catalog as 1843), by J. C. McGuire, and the other was collected at Broad Creek in Prince Georges County on October 14, 1888, by Thomas Marron.

Family PSITTACIDAE

CAROLINA PARAKEET *Conuropsis carolinensis* (Linnaeus)

STATUS.—Now extinct. "In September, 1865, while gunning for Sora on the Potomac River, Mr. Edward Derrick fired into a flock of strange birds flying overhead, killing several, which

proved to be Carolina Paroquets. He had one mounted, and kept the specimen in his house for a number of years. Other parties on the marsh at the same time shot numbers of the birds. Descriptions furnished by Mr. Derrick and careful questioning of ourselves, leave no doubt as to the identity of the birds" (Smith and Palmer, 1888). Kirkwood (1895) states that this species was originally well known in tidewater Maryland. Wright (1911) quotes Rev. Andrew White as reporting in about 1677: "A Relation of the Colony of Lord Baron of Baltimore, in Maryland, near Virginia, etc." recorded, that "During the winter it abounds in . . . parrots, and many others unknown to our parts of the world."

Family CUCULIDAE

YELLOW-BILLED CUCKOO *Coccyzus americanus* (Linnaeus)

STATUS.—*Breeding and transient*: Fairly common in the Eastern Shore, Western Shore, Upper Chesapeake, Piedmont, and Ridge and Valley sections; uncommon in the Allegheny Mountain section.

HABITAT.—Swamp or moist, brushy open forest and wood margin types; also in orchards and residential areas.

NESTING SEASON.—Mid-May to mid-September (nesting peak late May to mid-August). *Extreme egg dates* (38 nests): May 15, 1946, in Prince Georges County (R. B. Overington) and August 28, 1951, in Baltimore County (C. D. Hackman). *Extreme nesting dates* (18 nests): May 26, 1935, in Baltimore County (M. Meanley) and September 16, 1951, in Baltimore County (C. Willis).

SPRING MIGRATION.—*Normal period*: May 1-5 to June 1-2 peak, May 10 to May 25. *Extreme dates of arrival*: April 9, 1951, in Anne Arundel County (Col. and Mrs. U. Amoss); April 2, 1954, in Allegany County (L. McCollough, Mrs. G. M. Miller); April 28, 1888, in Baltimore County (A. Resler); April 28, 1951, in Caroline County (Mrs. A. J. Fletcher); April 29, 1948, Prince Georges County. In 1951 very few arrivals were noted before June 10, and the major influx occurred in July.

FALL MIGRATION.—*Normal period*: August 1-10 to October 10-20; peak, August 15 to September 25. *Extreme dates of departure*: November 12, 1954, in Baltimore County (S. W. Simon); November 6, 1954, in Caroline County (A. J. Fletcher); November 3, 1954, in Prince Georges County (L. M. Llewellyn); October 2, 1954, in Frederick County (J. W. Richards); October 25, 1951, in Montgomery County (A. Baugnness).

BREEDING POPULATION DENSITIES (territorial males per 100 res).—

(2 in 23 $\frac{3}{4}$ acres) in upland oak forest (white, scarlet, and black oaks) in Prince Georges County in 1944.

(1.5 in 24 $\frac{1}{2}$ acres) in river terrace forest (beech-white oak) in Prince Georges County in 1944.

(2 in 32 $\frac{3}{4}$ acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) in Prince Georges County in 1944; 3 (2.6 in 85 acres) in other areas of this habitat in 1945 (Stewart, et al., 1946).

(2 in 47 $\frac{3}{4}$ acres) in hedgerows in agricultural areas and abandoned farmlands (including strip 27 $\frac{1}{2}$ yards wide on each side of hedgerow) in Prince Georges County in 1945.

(1.5 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1948 (Trever, 1952); absent in 1949, 1951, 1952, 1953, and 1954.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 7 at Patuxent efuge in Prince Georges County on May 9, 1943, and on May 2, 1944; 7 in Worcester County on May 11, 1952 (D. A. Cutler). *all*: 10 in Carroll County on August 18, 1953 (D. H. McIntosh); 1 near Seneca, Montgomery County, on September 1, 1953 (J. K. Wright); 8 on Patuxent Refuge on August 16, 1943; 8 in Dorchester County on September 25, 1953.

LACK-BILLED CUCKOO *Coccyzus erythrophthalmus* (Wilson)

STATUS.—*Breeding*: Fairly common in the Allegheny Mountain section; uncommon in the Ridge and Valley, Piedmont, and Upper Chesapeake sections; rare in the Western Shore and Eastern Shore sections. *Transient*: Uncommon in all sections.

HABITAT.—Brushy open forest and wood margin types.

NESTING SEASON.—Early May to late July. *Extreme egg dates* (8 nests): May 18, 1935 (H. Kolb), and July 19, 1950 (E. Willis), both in Baltimore County. *Extreme nestling dates* (5 nests): May 23, 1946, in Prince Georges County (E. G. Cooley) and July 6, 1950 (E. Willis), in Baltimore County.

SPRING MIGRATION.—*Normal period*: April 25–May 5 to June 5; peak, May 5 to May 20. *Extreme dates of arrival*: April 18, 1931, in Harford County (S. Mason, Jr.); April 20, 1905, in Baltimore County (F. C. Kirkwood). *Extreme dates of departure*: June 30, 1951 (a year of exceptionally late cuckoo migration), and June 7, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: July 25–August 5 to October 15; peak, August 10 to September 1. *Extreme date of arrival*: July 20, 1952, in Prince Georges County. *Extreme dates of departure*: November 2, 1955, in Caroline County (Mrs. A. J. Fletcher); October 28, 1925, in the District of Columbia (Mr. and Mrs. L. D. Miner); October 19, 1947, in Prince Georges County.

MAXIMUM COUNTS.—*Spring*: 7 at Patuxent Refuge, Prince Georges County, on May 8, 1943; 6 at Gibson Island, Anne Arundel County, on May 11, 1952 (Mrs. W. L. Henderson).

Family TYTONIDAE

BARN OWL *Tyto alba* (Scopoli)

STATUS.—Fairly common locally in the Eastern Shore section, uncommon locally in the Western Shore, Upper Chesapeake, Piedmont, and Ridge and Valley sections; rare in the Allegheny Mountain section (Brooks, 1944). There are definite breeding records for Worcester, Dorchester, Talbot, Caroline, Queen Annes, Calvert, St. Marys, Charles, Anne Arundel, Prince Georges, Montgomery, Baltimore, Harford, and Washington Counties and the District of Columbia.

HABITAT.—Open agricultural lands or marshes in the vicinity of woodlots or buildings or other man-made structures; also in towns and cities.

NESTING SEASON.—Throughout the year (nesting peak, early March to late July). *Extreme egg dates* (20 nests): January 2, 1949, in the District of Columbia (J. W. Aldrich) and September 20, 1956, in Dorchester County (P. F. Springer). *Extreme nesting dates* (25 nests): April 11, 1930, in Montgomery County (E. J. Court) and November 6, 1956, in Dorchester County (P. F. Springer). Young just out of the nest were seen on December 8, 1893, and on February 27, 1895, in the District of Columbia (Bendire, 1895). Young not over 2 weeks out of the nest were also seen in the District of Columbia on January 7, 1896 (A. Fisher).

MAXIMUM COUNTS.—12 on Blackwater Refuge, Dorchester County, on May 10, 1952 (W. S. Webster); 5 in the Ocean City area on December 27, 1954 (Christmas count).

BANDING.—Two adults banded in Prince Georges County in spring (April 2-8) were recovered the same or the following spring (April 30-May 14) in central and southeastern Pennsylvania. A nestling banded in Montgomery County on June 1, 1939, was recovered on September 7 of the same year just across the Pennsylvania line from Grantsville, Garrett County, Maryland. Two banded as nestlings in Dorchester County on April 23, 1952, were recovered in southern New Jersey and near Maryland (12 miles from the point of banding) on (letter of) February 21, 1955, and June 24, 1952, respectively. Two recovered in Howard and Worcester Counties in fall (September 2-8 and November 8) had been banded as nestlings the same year the

ere recovered (July 16, July 30) in southeastern Pennsylvania and southeastern Massachusetts, respectively. Another banded west-central New Jersey on November 14, 1925, was caught Talbot County, Maryland, on April 5, 1926.

Family STRIGIDAE

SCREECH OWL *Otus asio* (Linnaeus)

STATUS.—Permanent resident. Uncommon (fairly common locally) in all sections. Alexander Wetmore states that this species "has decreased decidedly over abundance of 40 years ago in the area adjacent to Washington."

HABITAT.—Woodlots, orchards, and other wood-margin types near agricultural areas; also in towns and suburban areas.

NESTING SEASON.—Late March to mid-July (nesting peak, early April to mid-June). *Extreme egg dates* (16 nests): March 25, 1889, in the District of Columbia (C. W. Richmond) and May 4, 1899, in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (17 nests): April 24, 1890, in Montgomery County (H. B. Tabler) and June 20, 1950, in Baltimore County (T. C. Buck). Nearly full-grown young, still being fed by the parents, were recorded as late as July 24, 1893, in Baltimore County (Kirkwood, 1895).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 5 in the Ocean City area on December 27, 1953; 5 in the St. Michaels area, Talbot County, on December 29, 1955.

GREAT HORNED OWL *Bubo virginianus* (Gmelin)

STATUS.—Permanent resident. Common in the tidewater areas of Dorchester County; fairly common elsewhere in the Eastern Shore section and in the Allegheny Mountain section; uncommon in all other sections.

HABITAT.—Forests and woodlots and adjacent agricultural fields and marshes.

NESTING SEASON.—Late January to late May (nesting peak, early February to late April). *Extreme egg dates* (44 nests): January 27, 1933, in Dorchester County (Jackson, 1941) and April 2, 1893, in Baltimore County (A. Wolle). *Extreme nestling dates* (22 nests): February 24, 1945, in Prince Georges County (J. N. Hamlet) and May 14, 1932, in Anne Arundel County (M. B. Meanley).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 27 in the Ocean City area on December 27, 1955; 25 in southern Dorchester County on December 28, 1954; 9 in Garrett County on January 1, 1950.

SNOWY OWL *Nyctea scandiaca* (Linnaeus)

STATUS.—Rare and irregular winter visitor in all sections (usually most numerous in the tidewater areas).

PERIOD OF OCCURRENCE.—*Extreme arrival dates:* November 13, 1954, in Anne Arundel County (H. A. Sutton); November 15, 1876, in the District of Columbia (W. Holmead). *Extreme departure date:* March 21, 1950, in St. Marys County (R. J. Beaton, J. W. Taylor, Jr.). *Peak of abundance:* November 25 to February 20.

NUMBERS.—During most years, this species was either absent or only a few scattered records of singles were made. Occasionally, however, larger numbers were recorded. About 15 specimens were taken in the vicinity of Washington, D. C., during the winter of 1876–77 (C. W. Richmond). There were 12 records from Maryland during the flight of 1926–27 (Gross, 1927). On February 16, 1936, 6 were found in pole traps on Spesutie Island in Harford County (M. B. Meanley). At least 5 were taken in Maryland and brought to a taxidermist in Baltimore during the winter of 1941–46 (Brackbill, 1946). During the great flight of 1949–50 at least 25 were recorded in Maryland and the District of Columbia; 3 of these were observed at Mills Point on the Wicomico River in St. Marys County on March 21, 1950 (R. J. Beaton, J. W. Taylor, Jr.).

BARRED OWL *Strix varia* Barton

STATUS.—Permanent resident. Common in the Eastern Shore and Western Shore sections; fairly common in the Upper Chesapeake, Piedmont, Ridge and Valley, and Allegheny Mountain sections.

HABITAT.—Flood-plain and swamp forests; also in various moist forest types on the upland.

NESTING SEASON.—Late February to late June (nesting peaks early March to early May). *Extreme egg dates* (45 nests): February 25, 1931, in the District of Columbia (J. C. Jones) and March 26, 1943, in Prince Georges County. *Extreme nestling dates* (3 nests): March 23, 1935, in Baltimore County (M. B. Meanley) and June 21, 1947, in Montgomery County (T. H. Cunningham).

BREEDING POPULATION DENSITY (pairs per 100 acres).—0.5 (6 in 1,142 acres) in lowland forest (flood-plain forest with small adjacent clearings and areas of river terrace and river bluff forest) along the Patuxent River in Anne Arundel and Prince Georges Counties in 194

MAXIMUM COUNTS.—*Winter* (Christmas counts): 15 in the Ocean City area on December 27, 1954; 9 in the District of Colum

area on January 1, 1955; 6 at Patuxent Refuge on December 1945.

BANDING.—One recovered in Montgomery County on October 1942, had been banded in northeastern Ohio on May 1, 1942.

NG-EARED OWL *Asio ofus* (Linnaeus)

STATUS.—Rare and local permanent resident in the Piedmont and Western Shore sections. Also occurs, at least occasionally, in the Allegheny Mountain, Ridge and Valley, Upper Chesapeake, and Eastern Shore sections. There are definite breeding records in Baltimore County near Randalstown in 1893 (Kirkwood, 1905), in Dulaney Valley in 1898 (F. C. Kirkwood), near Sweetair in 1936 (F. C. Kirkwood), and near Loch Raven Reservoir in 1946 (Kolb, 1947); for Montgomery County near Rockville (Baird, 1874), near Brighton in 1892 and Olney in 1950 (H. B. Stabler); for Prince Georges County near College Park in 1945 (N. Hamlet); for Anne Arundel County (E. J. Court); and for the District of Columbia in 1890 (C. W. Richmond, E. M. Hasbrouck) and 1894 (W. Palmer, E. M. Hasbrouck). Other records of occurrence in fall and winter have been made in Dorchester County (Willis), Caroline (M. W. Hewitt, A. J. Fletcher), Calvert (E. Barry), Charles (F. M. Uhler), Harford (M. B. Meanley), Washington (E. A. Small), and Garrett Counties. Alexander Wetmore states that this species "has decreased greatly over the recorded abundance of 50–60 years ago."

HABITAT.—Usually this species is found in or near dense stands of young pine.

NESTING SEASON.—Mid-March to early June. *Extreme egg dates* (5 nests): April 3, 1898, in Baltimore County (F. C. Kirkwood) and May 1, 1950, in Montgomery County (H. B. Stabler). *Extreme nestling dates* (4 nests): April 14, 1946, in Baltimore County (Kolb, 1947) and June 1, 1950, in Montgomery County (H. B. Stabler).

SHORT-EARED OWL *Asio flammeus* (Pontoppidan)

STATUS.—*Breeding* (?): A "marsh owl" nest with eggs was reported found in Dorchester County in June 1923 by Orrille Mills (F. C. Kirkwood); an adult was seen near the Blackwater Refuge in Dorchester County on July 22, 1938 (N. Hotchkiss); 1 was collected on Assateague Island, Worcester County, on August 6, 1906 (W. H. Fisher); an adult was collected in the District of Columbia on May 23, 1871 (R. Ridgway); a pair was observed on May 1956, at Kent Narrows, Queen Annes County (R. P. and M. Bois). *Transient and wintering*: Uncommon in the Upper Chesapeake and Eastern Shore sections and locally (Point Look-

out) in the Western Shore section; rare (formerly more numerous—Kirkwood, 1895) in other sections.

HABITAT.—Usually most numerous on extensive areas of tidal marsh; also occurs on large, open agricultural areas.

PERIOD OF OCCURRENCE (transient and wintering).—*Normal period*: October 20–30 to April 5–15. *Extreme date of arrival*: October 16, 1953, in Prince Georges County (S. F. Blake). *Extreme dates of departure*: April 21, 1939, in Garrett County (M. G. Brooks); April 20, 1861, in the District of Columbia (D. W. Prentiss); April 19, 1953, in Anne Arundel County (L. W. Orin).

SAW-WHET OWL *Aegolius acadicus* (Gmelin)

STATUS.—*Breeding* (see fig. 24): Uncommon and local in the Allegheny Mountain section—recorded in summer near Cumberland on July 6, 1903 (Eifrig, 1904); in Cranberry Swamp (3 miles south of Finzel) on July 5, 1945; in the Maryland portion of Cranesville Swamp (just east of Cranesville, West Virginia) on July 7, 1945; and in Wolf Swamp (about 4 miles southeast of Grantsville) during the period May 30 to June 16, 1951. *Transient and wintering*: Rare or uncommon in the Eastern Shore, Western Shore, Upper Chesapeake, Piedmont, and Ridge and Valley sections (probably also occurs in the Allegheny Mountain section although there are no definite records during fall and winter).

HABITAT.—During the breeding season this species appears to be restricted to boreal wooded bogs that contain stands of spruce, hemlock, or tamarack. At other seasons, it occurs in various wood margin thickets or in forest types with an understory brush layer.

NESTING SEASON.—A full-grown young bird was captured near Cumberland on July 6, 1903 (Eifrig, 1904), and a young bird in juvenal plumage was seen at Wolf Swamp on June 16, 1951. Another young bird in juvenal plumage was found in the West Virginia portion of Cranesville Swamp on June 22, 1932 (Brooks, 1936c).

PERIOD OF OCCURRENCE (transient and wintering).—*Normal period*: October 20–30 to March 20–30. *Extreme dates of arrival*: October 3, 1886, in the District of Columbia (F. S. Webster); October 15, 1944, in Prince Georges County. *Extreme dates of departure*: May 2, 1953, in Frederick County, near Emmitsburg (J. W. Richards); April 6, 1953, in Prince Georges County. F. Kirkwood recorded 1 in Baltimore County on the unusual date June 24, 1921.

Family CAPRIMULGIDAE

CHUCK-WILL'S-WIDOW *Caprimulgus carolinensis* Gmelin

STATUS.—*Breeding* (see fig. 29) : Common in or near the tidewater areas of the Eastern Shore section and the southern part of the Western Shore section (occurring regularly north to the Patuxent line along the coast, north to Kent Island in Queen Anne's County along the eastern shore of Chesapeake Bay, north to the Shadyside Peninsula in Anne Arundel County on the western shore of Chesapeake Bay; north along the Patuxent River to Poolesville, and north along the Potomac River to Morgantown (Charles County)); uncommon in the interior of the Eastern Shore section and in the interior of the southern part of the Western Shore section (St. Marys, Charles, and Calvert Counties). This species occurs only as a casual visitor in the northern part of the Western Shore section, having been recorded in the vicinity of Laurel in Prince Georges County in the summer of 1916 (C. W. Richmond), in the fall of 1929 (R. B. Overington), and on May 12, 1935 (Wetmore, 1936); at Cheverly in Prince Georges County on May 4, 1944 (W. M. Perrygo); in Anne Arundel County at Odenton on 2 occasions (Kirkwood, 1895); at Sandy Point on June 2, 1954 (J. W. Terborgh); and in the District of

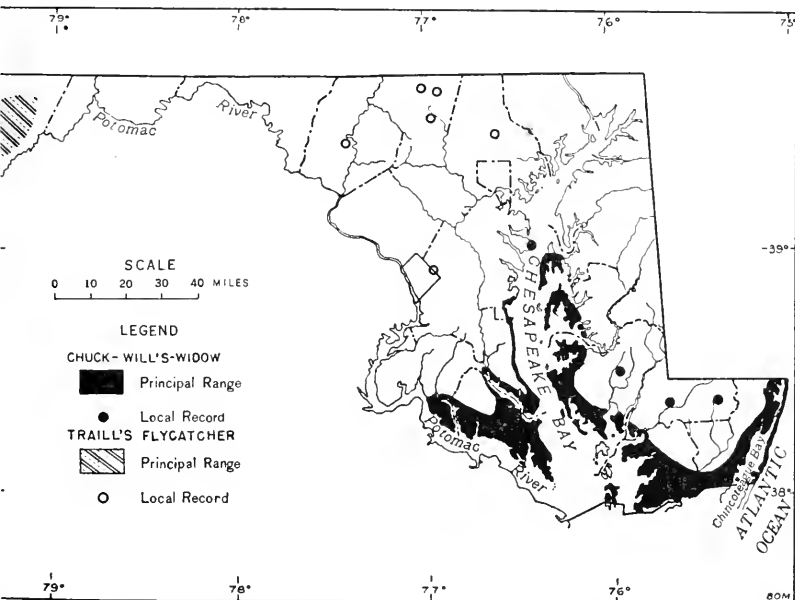


FIGURE 29.—Breeding ranges of Chuck-will's-widow and Traill's Flycatcher.

Columbia on July 22, 1895 (R. Ridgway), and in the summer 1896 (C. W. Richmond).

HABITAT.—Brushy open stands or wood margins of loblolly pine, usually near tidewater.

NESTING SEASON.—*Egg dates* (3 nests): May 10, — (Coulter 1921), and May 27, 1930 (F. C. Kirkwood), in St. Marys County and July 8, 1954, in Talbot County (J. Spurry).

PERIOD OF OCCURRENCE.—*Extreme arrival dates*: April 19, 1919, in Talbot County (J. Reese); April 23, 1955, in Anne Arundel County (H. E. Slater, K. F. Sanders); April 25, 1953, in Worcester County; April 26, 1952, in St. Marys County (J. W. Taborgh); April 26, 1955, in Caroline County (V. Wright). *Extreme departure date*: September 1, 1954, in Talbot County (R. Kleen).

MAXIMUM COUNTS.—*Spring*: 32 in Talbot County on May 1954 (R. L. Kleen); 16 in the Ocean City area on May 5, 1954.

WHIP-POOR-WILL *Caprimulgus vociferus* Wilson

STATUS.—*Breeding and transient*: Common in the Eastern Shore, Western Shore, and Ridge and Valley sections; fairly common in the Upper Chesapeake, Piedmont, and Allegheny Mountain sections.

HABITAT.—Various types of upland forest in the vicinity of clearings or wood margins.

NESTING SEASON.—Late April to mid-July (nesting peak, early May to early July). *Extreme egg dates* (15 nests): April 1922, in Dorchester County (Jackson, 1941) and June 27, 1919, in Prince Georges County (L. M. Dargan). *Extreme nestling dates* (7 nests): May 25, 1941, in Prince Georges County (W. Lawrence) and July 17, 1908, in Garrett County (G. Eifrig).

SPRING MIGRATION.—*Normal period*: April 5–15 to May 15–20; peak, April 20 to May 10. *Extreme dates of arrival*: March 1948, in Prince Georges County (H. Severance); March 26, 1919, in Dorchester County (R. W. Jackson); March 29, 1903, in Baltimore County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: August 10–20 to October 10; peak, September 1 to September 20. *Extreme date of arrival*: July 29, 1920, in Dorchester County (R. W. Jackson). *Extreme dates of departure*: October 27, 1937, October 24, 1935, and October 23, 1936, in the District of Columbia (R. Overing).

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

1.4 (15 in 1,047 acres) in upland forest and brush habitats (pine and deciduous).

ous trees and brush, with small scattered agricultural areas and abandoned farmlands) in Prince Georges County in 1943. total of 66 Whip-poor-wills was recorded between 9:28 p.m. and 12:30 a.m. during the evening of May 20, 1945, at 29 stops along the highway from southern St. Marys County to north-central Prince Georges County.

MAXIMUM COUNTS.—*Spring*: 200 on May 7, 1949, in Washington County (Dr. R. S. Stauffer, M. Stauffer); 33 in the Ocean City area on May 5, 1951; 24 on Patuxent Refuge in Prince Georges County on May 6, 1950.

COMMON NIGHTHAWK *Chordeiles minor* (Forster)

STATUS.—*Breeding*: Uncommon and somewhat local in all sections. *Fall transient*: Common, occasionally abundant, in all sections. *Spring transient*: Uncommon in all sections.

HABITAT.—Open country such as agricultural fields and marshes; also in towns and cities.

NESTING SEASON.—Late May to mid-July. *Extreme egg dates* (6 nests): May 31, 1955, in Caroline County (A. J. Fletcher) and July 4, 1931, in St. Marys County (E. J. Court). One small fledgling was observed in Baltimore County on June 8, 1891 (Kirkwood, 1895). Two juvenals were collected in St. Marys County July 18, 1894 (R. Ridgway).

SPRING MIGRATION.—*Normal period*: May 1–10 to May 25–30; peak, May 10 to May 20. *Extreme dates of arrival*: April 14, 1949, in the District of Columbia (C. N. Mason); April 19, 1955, in Baltimore (C. M. Buchanan); April 19, 1891, in Wicomico County (F. C. Kirkwood); April 20, 1927, in Baltimore County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: July 20–30 to September 1–October 5; peak, August 15 to September 10. *Extreme date of arrival*: July 17, 1944, in Prince Georges County. *Extreme dates of departure*: October 14, 1929, in Baltimore County (F. C. Kirkwood); October 14, 1947, in the District of Columbia (T. W. Connelly).

MAXIMUM COUNTS.—*Spring*: 13 near Emmitsburg in Frederick County on May 26, 1954 (P. J. O'Brien); 11 at Westminster, Carroll County, on May 10, 1952 (D. A. Jones); 10 in the District of Columbia on May 11, 1917 (H. C. Oberholser). *Fall*: 700 at Emmitsburg, Frederick County, on August 30, 1953 (J. W. Richards); 500 over the Gunpowder River marsh on September 3, 1953 (F. C. Kirkwood); 250 at Rockville, Montgomery County, September 3, 1954 (J. W. Terborgh); 200 at Patuxent Refuge September 4, 1942, and on September 2, 1943.

Family APODIDAE

CHIMNEY SWIFT *Chaetura pelagica* (Linnaeus)

STATUS.—*Breeding*: Common in all sections. *Transient*: Common, occasionally abundant, in all sections.



FIGURE 30.—Chimney Swift banding recoveries. Each symbol represents the number of records for a State or Province. Recovered in Maryland, banded elsewhere: open triangle = banded September through May.

HABITAT.—Aerial, usually most numerous in the vicinity of towns and cities.

NESTING SEASON.—Early May to early September (nesting peak, late May to early August). *Extreme egg dates* (40 nests): May 9, 1918, in Dorchester County (Jackson, 1941) and July 14, 1911, in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (27 nests): June 22, 1949, in Prince Georges County and September 1, 1907 (F. C. Kirkwood), in Allegany County. Flying young were recorded as early as June 29, 1924, in Baltimore County (F. C. Kirkwood).

SPRING MIGRATION.—*Normal period*: April 5–15 to May 10–20; peak, April 15 to May 5. *Extreme dates of arrival*: March 30, 1905, in Baltimore County (P. T. Blogg); April 4, 1950, in Frederick County (R. T. Smith).

FALL MIGRATION.—*Normal period*: August 15–25 to October 15–20; peak, September 5 to October 10. *Extreme dates of departure*: November 2, 1954, in Talbot County (J. Spurry); October 1, 1906 (W. W. Cooke), October 25, 1915 (E. A. Preble), and October 25, 1925 (V. Bailey), all in the District of Columbia.

BREEDING POPULATION DENSITY (pairs per 100 acres).—

(16 in 2,656 acres) in mixed forest, brush and field habitats (in an area that included 12 buildings with chimneys) along the border between Anne Arundel and Prince Georges Counties in 1943.

MAXIMUM COUNTS.—*Spring*: “Thousands” in the District of Columbia on April 20, 1925 (M. J. Pellew), and during April 26–May 2, 1931, and 2,000 on May 9, 1932 (Cottam, 1932); 1,000 at Port Tobacco, Charles County, on May 7, 1940 (C. Cottam, F. M. Miller); 500+ at Emmitsburg, Frederick County, on April 15, 1953 (J. W. Richards); 500 at Gunpowder River marsh on April 1, 1901 (F. C. Kirkwood). *Fall*: 4,100 on October 2, 1947, and 4,000–5,000 about September 18, 1924 (H. C. Oberholser), in the District of Columbia; “several thousand” at College Park, Prince Georges County, on October 5, 1948 (A. C. Martin); 950 on September 12, 1954, at Swallow Falls, Garrett County (L. W. Oring).

BANDING.—See figure 30.

Family TROCHILIDAE

RED-BELLIED HUMMINGBIRD *Archilochus colubris* (Linnaeus)

STATUS.—*Breeding and transient*: Fairly common in all sections.

HABITAT.—*Breeding*: In moist forest types and in hedgerows, wood margins, and other edge types that contain brush or small trees. *Transient*: Various edge habitats; usually most numerous in areas that contain an abundance of showy flowers. Native

flowers that are particularly attractive to this species include the jewelweed and trumpet creeper.

NESTING SEASON.—Mid-May to early September (nesting peak late May to mid-July). One was observed on a nest as early as May 10, 1953, in Worcester County (J. M. Cadbury, D. A. Cutler). *Extreme egg dates* (58 nests): May 17, 1949, in Prince Georges County (M. B. Meanley) and August 20, 1904 (hatching eggs) in Washington County (Harlow, 1906). *Extreme nestling dates* (11 nests): June 8, 1898, in Baltimore County (J. Sommer) and August 20, 1904 (hatching), in Washington County (Harlow, 1906).

SPRING MIGRATION.—*Normal period*: April 20–30 to May 25; June 1; peak, May 5 to May 25. *Extreme dates of arrival*: April 11, 1954, in Caroline County (A. M. Thompson); April 12, 1953, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tapan); April 13, 1893, in Baltimore County (W. H. Fisher); April 14, 1954, in Montgomery County (P. G. DuMont).

FALL MIGRATION.—*Normal period*: August 1–10 to September 25–October 5; peak, August 15 to September 10. *Extreme dates of departure*: October 20, 1913, in the District of Columbia (A. T. Fisher); October 15, 1918 (A. T. Hoen), and October 15, 1904 (F. C. Kirkwood), in Baltimore County; October 14, 1950, in Anne Arundel County (Mrs. W. L. Henderson).

BREEDING POPULATION DENSITIES (breeding pairs per 100 acres).—

- 15 (13 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the border between Anne Arundel and Prince Georges Counties in 1945 (Stewart et al., 1946).
- 8 (1.5 in 20 acres) in "virgin hemlock forest" in Garrett County in 1948 (Robbins, 1949a).
- 8 (2 in 23 $\frac{2}{3}$ acres) in upland oak forest (white, scarlet, and black oaks) in Prince Georges County in 1944.
- 7 (2.4 in 34 $\frac{2}{3}$ acres) in pine field (weedy, abandoned fields with overgrowth of young scrub pine) in Prince Georges County in 1945.
- 6 (1.5 in 24 $\frac{1}{2}$ acres) in river terrace forest (beech-white oak) in Prince Georges County in 1944.
- 6 (1.5 in 23 $\frac{1}{4}$ acres) in "mature northern hardwood forest" (black cherry, beech, hemlock, sugar maple, sweet birch, etc.) in Garrett County in 1951 (Robbins and Stewart, 1951a).
- 4 (2 in 47 $\frac{3}{4}$ acres) in hedgerows in agricultural areas and abandoned farmlands (including strip 27 $\frac{1}{2}$ yards wide on each side of hedgerow) in Prince Georges County in 1945.
- 4 (1.5 in 36 acres) in "virgin central hardwood deciduous forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
- 3 (2 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1948 and 1949; absent in 1951 (Trever, 1952) and in 1952, 1953, and 1954.

MAXIMUM COUNTS.—*Spring*: 9 at Patuxent Refuge on May 22, 1945; 9 at Gibson Island, Anne Arundel County, on May 8, 1955 (Mrs. W. L. Henderson, Mrs. G. Tappan). *Fall*: 35 on Patuxent river marsh near Nottingham on August 21, 1947; 30 in Dorchester County (Hurlock to Salem) on August 30, 1930 (H. B. Curry); 30 at Seneca, Montgomery County, on September 12, 1954 (J. W. Terborgh); 25+ on 1 tree in Deer Park, Garrett County, on August 18, 1894 (J. E. Tylor); 20 on the Patapsco River marsh on August 25, 1896 (F. C. Kirkwood).

[RUFIOUS HUMMINGBIRD] *Selasphorus rufus* (Gmelin)

STATUS.—Hypothetical. On November 8, 1952, a hummingbird with a rufous back was closely observed in flight by J. W. Richards at Emmitsburg (Richards, 1954). Twenty-two days later another was observed at Jamesville on the Eastern Shore of Virginia (Fuller, 1953). The Rufous Hummingbird now occurs regularly in fall and winter as far east as Louisiana. The only specimen for the Atlantic Coast was taken at Charleston, South Carolina, on December 18, 1909. Any hummingbird seen in Maryland after early October should be studied with care.

Family ALCEDINIDAE

DELTA KINGFISHER *Megaceryle alcyon* (Linnaeus)

STATUS.—*Breeding and transient*: Fairly common in the tidal areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon elsewhere in all sections. *Wintering*: Fairly common in the Eastern Shore section and in the tidal areas of the Western Shore section; uncommon elsewhere in the Western Shore section and in the Upper Chesapeake section; rare in the Piedmont, Ridge and Valley, and Allegheny Mountain sections.

HABITAT.—Margins of inland streams, ponds, and lakes, and tidal bays and estuaries.

NESTING SEASON.—Late March to mid-July. Two were observed entering a fresh hole in a bank in the District of Columbia as early as March 26, 1922 (W. W. Rubey). *Extreme egg dates* (27 nests): April 11, 1930, in Baltimore County (M. B. Meanley) and June 4, 1911, in Dorchester County (Jackson, 1941). *Extreme nestling dates* (12 nests): May 30, 1881, in Kent County (Fisher, 1892) and July 7, 1954, in Baltimore County (J. R. Worthley).

SPRING MIGRATION.—*Normal arrival*: March 5 to March 15. *Extreme dates of arrival*: February 13, 1898, in Baltimore County (F. C. Kirkwood); February 19, 1949, in Montgomery County (J. Griswell).

FALL MIGRATION.—*Normal departure*: November 1 to November 10. *Extreme date of departure*: November 18, 1945, in Prince Georges County.

MAXIMUM COUNTS.—*Winter* (Christmas counts): 104 in the Annapolis area on January 2, 1955; 22 in the Ocean City area on December 27, 1954; 22 in southern Dorchester County on December 28, 1954; 22 in the District of Columbia area on January 1, 1955; 19 in the Wicomico River area in Charles and St. Mary's Counties on January 1, 1954.

Family PICIDAE

YELLOW-SHAFTED FLICKER *Colaptes auratus* (Linnaeus)

STATUS.—*Breeding*: Common in the Allegheny Mountain section; uncommon (formerly common) in all other sections. *Transient*: Common in all sections (during the fall flight this species concentrates in exceptionally large numbers on Hooper and Barren Islands in Dorchester County). *Wintering*: Fairly common in the Eastern Shore and Western Shore sections; uncommon in the Upper Chesapeake, Piedmont, and Ridge and Valley sections; rare in the Allegheny Mountain section.

HABITAT.—Marginal areas that include forest, wood margins, and fields, as well as brushland and hedgerows.

NESTING SEASON.—Early April to late July (nesting peak, late April to mid-June). Nest building was recorded as early as April 7, 1950, in Baltimore County (E. Willis). *Extreme egg dates* (92 nests): April 18, 1910, in Dorchester County (Jackson 1941) and June 23, 1893, in Baltimore County (Kirkwood, 1895). *Extreme nestling dates* (68 nests): May 22, 1892, in Baltimore County (F. C. Kirkwood) and July 30, 1940, in Baltimore County (E. Brackbill).

SPRING MIGRATION.—*Normal period*: March 5–15 to May 1–5; peak, March 20 to April 25. *Extreme dates of arrival*: February 12, 1913, in Dorchester County (R. W. Jackson); February 24, 1890, in Montgomery County (H. W. Stabler); February 25, 1891, in Talbot County (R. H. Blain); February 27, 1910, in the District of Columbia (A. H. Howell).

FALL MIGRATION.—*Normal period*: September 5–15 to November 5–15; peak, September 25 to October 20. *Extreme dates of arrival*: August 24, 1931, in the District of Columbia (W. L. McAtee); September 4, 1901, in Baltimore and Washington Counties (F. C. Kirkwood). *Extreme dates of departure*: December 3, 1941, in Baltimore County (H. Brackbill); November 17, 1944, in Prince Georges County.

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

(2 in 66 acres) in field and edge habitats (including strips of flood-plain forest, brushy fields, and hedgerows) in Baltimore County in 1947 (Hampe, et al., 1947).

(2 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1948 (Trever, 1952) and in 1954 (Wright, 1955); 1 (1 in 80 acres) in 1949, 1951, 1952, and 1953 (Trever, 1952; Clagett, 1952 and 1953).

MAXIMUM COUNTS.—*Spring*: "Hundreds" near Baltimore on March 25, 1893 (F. C. Kirkwood). *Fall*: "Nearly 1,000" on Hooper Island, Dorchester County, on September 30, 1933 (W. B. Tyrrell); a flock of 200+ at Patuxent Refuge on October 15, 1942. *Winter* (Christmas counts): 239 in the Ocean City area on December 27, 1954; 107 in the Annapolis area on January 1, 1956; 104 in the District of Columbia area on January 2, 1954; 80 in southern Dorchester County on December 28, 1953; 79 in the Wicomico River area of Charles and St. Marys Counties on January 1, 1954; 75 on Patuxent Refuge on December 23, 1941.

PILEATED WOODPECKER *Dryocopus pileatus* (Linnaeus)

STATUS.—Permanent resident (see fig. 31). Fairly common in the Allegheny Mountain section and in the western part of the Ridge and Valley section (west of Hagerstown Valley); fairly common locally in the Eastern Shore section (most numerous

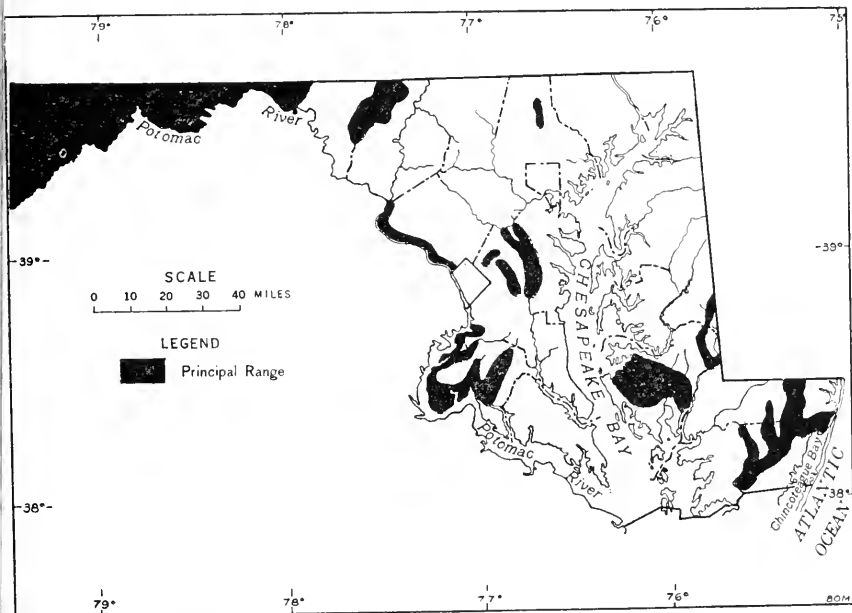


FIGURE 31.—Breeding range of Pileated Woodpecker.

along the Pocomoke River and its tributaries, and in Dorchester County), in the Western Shore section (most numerous along the Patuxent River and its tributaries in Prince Georges and Anne Arundel Counties and in the Zekiah Swamp in Charles County), and in the Piedmont section (chiefly along Potomac River valley of Montgomery County); uncommon locally in the eastern part of the Ridge and Valley section (mountains of eastern Washington County and northwestern Frederick County).

HABITAT.—Extensive areas of upland, moist forest types in the mountains of the Allegheny Mountain, and Ridge and Valley sections; also in extensive areas of flood-plain or swamp forests in the Eastern Shore, Western Shore, and Piedmont sections.

NESTING SEASON.—Early April to late June. Nest-building was recorded as early as April 2, 1950, in Montgomery County (S. B. Van Meter, M. G. Van Meter). *Extreme egg dates* (7 nests) April 17, 1949 (probable—adult flushed from nest), in Montgomery County (P. A. DuMont) and “early June” 1895 in Dorchester County (Kirkwood, 1895). *Extreme nestling dates* (14 nests) May 2, 1949, in Montgomery County (S. B. Van Meter, M. G. Van Meter) and June 23, 1950 (W. B. Tyrrell), in Garrett County

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

0.6 (5 in 775 acres) in flood-plain forest (including forest and brush habitats) along the border between Anne Arundel and Prince George Counties in 1950, 1951, and 1952; 0.5 (4 in 775 acres) in 1949; about 0.2 (1.5 in 775 acres) during the period 1942-48.

MAXIMUM COUNTS.—*Winter* (Christmas counts): 20 in the Ocean City area (Pocomoke swamp) on December 27, 1954; 15 in southeastern Worcester County (Pocomoke swamp) on December 22, 1947; 11 in Garrett County on December 31, 1954; 8 in the Blackwater Refuge area on December 21, 1947, on December 28, 1948, and on December 23, 1951; 8 on Patuxent Refuge on January 14, 1952.

RED-BELLIED WOODPECKER *Centurus carolinus* (Linnaeus)

STATUS.—Permanent resident. Common in the Western Shore section; locally common in the Eastern Shore section (most numerous along the Pocomoke River and its tributaries); fairly common in the Upper Chesapeake and Piedmont sections; rare in the Ridge and Valley, and Allegheny Mountain Sections.

HABITAT.—Flood-plain or swamp forests; also rich moist forests on the upland.

NESTING SEASON.—Mid-April to mid-June. An occupied nest was found as early as April 25, 1953, in Montgomery County (L.

lham). *Extreme egg dates* (6 nests): May 2, 1919, in Dorchester County (Jackson, 1941) and May 16, 1936, in Harford County (M. B. Meanley). *Extreme nestling dates* (9 nests): May 4, 1945, in Prince Georges County (J. B. Cope) and June 10, 191, in Baltimore County (Kirkwood, 1895).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

(7 in 36 acres) in "virgin central hardwood deciduous forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).

(6 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the border between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946); 6 (2 in 32¼ acres) in another area of this habitat in 1944.

(4.5 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1951, 2 (1.5 in 80 acres) in 1948 and 1949 (Trever, 1952); 1 (1 in 80 acres) in 1952 and 1953 (Clagett, 1952 and 1953), and in 1954 (Wright, 1955).

(2 in 44¾ acres) in river bluff forest (beech-white oak) in Prince Georges County in 1944, 2 (1 in 44½ acres) in 1945 (J. W. Aldrich, A. J. Duvall).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 111 in the Annapolis area on January 1, 1956; 94 in the Ocean City area on December 27, 1955; 86 in the District of Columbia area on January 1, 1955; 72 in the Triadelphia Reservoir area on December 24, 1955; 56 on Patuxent Refuge on January 12, 1950; 56 in the Vicomico River area in Charles and St. Marys Counties on December 28, 1952.

RED-HEADED WOODPECKER *Melanerpes erythrocephalus* (Linnaeus)

STATUS.—*Breeding and transient*: Fairly common locally in the Allegheny Mountain section; rare or uncommon and local in the Ridge and Valley, Piedmont, Western Shore, and Eastern Shore sections (breeds in Washington, Frederick, Montgomery, Baltimore, Harford, Prince Georges, and Anne Arundel Counties and the District of Columbia, and formerly in Caroline, Dorchester, and Talbot Counties). *Wintering*: Uncommon and local in the Piedmont, Upper Chesapeake, and Western Shore sections (common near Seneca, Montgomery County—L. Kilham, and near Accokeek, Prince Georges County—E. T. McKnight); rare and local in the Eastern Shore section. Alexander Wetmore states that this species has become "greatly reduced in numbers since 10 years ago."

HABITAT.—Woodlots, parks, and open woodland; usually most numerous in open stands of oak trees or in areas with an abundance of dead trees.

BREEDING SEASON.—Late April to early July. *Extreme egg dates* (11 nests): May 3, 1891, in Baltimore County (Kirkwood 1895) and June 23, 1885, in the District of Columbia (USNM). *Extreme nestling dates* (11 nests): May 8, 1920, in Baltimore County (F. C. Kirkwood) and July 6, 1945, in Garrett County.

SPRING MIGRATION.—*Normal period*: April 25–May 5 to May 15–25; peak, May 5 to May 15. *Extreme arrival dates*: March 31, 1890, in Wicomico County (A. E. Acworth); April 7, 1902, in Carroll County (R. Watts); April 7, 1940, in Baltimore County (E. A. McGinity); April 8, 1905, in the District of Columbia (W. W. Cooke). *Extreme departure dates*: June 2, 1916, and May 31, 1905, in the District of Columbia (H. C. Oberholser).

FALL MIGRATION.—*Normal period*: August 25–September 5 to October 5–15; peak, September 10 to October 1. *Extreme arrival date*: August 23, 1952, in Frederick County (J. W. Richards). *Extreme departure dates*: October 20, 1950, in Anne Arundel County (Mrs. G. Tappan); October 19, 1948, in Baltimore County (H. Brackbill).

MAXIMUM COUNTS.—*Spring*: 50 near Seneca, Montgomery County, on April 13, 1939 (W. H. Lawrence); 11 in the District of Columbia area on May 11, 1917 (H. C. Oberholser). *Fall*: 1 near Seneca, Montgomery County, on October 2, 1948 (I. I. Barnes, D. M. Thatcher). *Winter*: 100 near Accokeek, Prince Georges County, on December 22, 1940 (Christmas count); 50 near Seneca, Montgomery County, on November 13, 1955 (H. I. Smith); 5 at Port Tobacco, Charles County, on December 26, 1920 (Christmas count).

YELLOW-BELLIED SAPSUCKER *Sphyrapicus varius* (Linnaeus)

STATUS.—*Breeding* (see fig. 32): Fairly common locally in the Allegheny Mountain section (most numerous in Garrett County in the Cherry Creek swamps and in the vicinity of Herrington Manor—uncommon elsewhere). *Transient*: Fairly common in all sections. *Wintering*: Uncommon in the Eastern Shore and Western Shore sections; rare in the Upper Chesapeake, Piedmont, and Ridge and Valley sections. *Summer vagrant*: Accidental—1 seen at Denton on June 20, 1956 (A. M. Thompson).

HABITAT.—*Breeding*: Moist or swamp forests in or near boreal type bogs at elevations of 2,400 feet or more; also in forests on the higher ridges at elevations over 3,000 feet. *Transient and wintering*: Swamps and flood-plain forests and moist forest type on the upland; also in orchards, parks, and in wooded areas around houses.

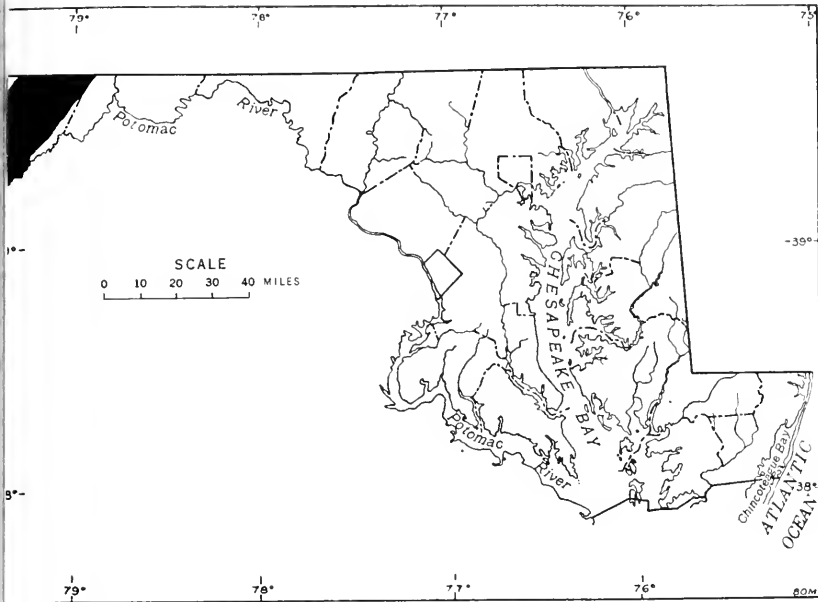


FIGURE 32.—Breeding range of Yellow-bellied Sapsucker, Solitary Vireo, Magnolia Warbler, Black-throated Blue Warbler, Northern Waterthrush, Purple Finch, and Slate-colored Junco.

NESTING SEASON.—A nest containing eggs was found in Garrett County on June 5, 1925 (F. C. Kirkwood). Nests containing young were observed in Garrett County on May 29, 1949, and on July 7, 1945. Adults were recorded feeding young out of the nest in Garrett County on June 12, 1949 (R. S. Stauffer), and on July 6, 1895 (Kirkwood, 1895).

SPRING MIGRATION.—*Normal period:* March 20–30 to May 1–10; peak, April 5 to April 25. *Extreme arrival dates:* March 12, 1892, in Baltimore County (G. H. Gray); March 15, 1908, in the District of Columbia (W. L. McAtee); and March 17, 1907, in Montgomery County (W. L. McAtee). *Extreme departure date:* May 17, 1953, in Frederick County (Mr. and Mrs. A. J. Fletcher).

FALL MIGRATION.—*Normal period:* September 15–25 to October 10–20; peak, September 25 to October 10. *Extreme arrival date:* September 10, 1905, in the District of Columbia (W. W. Cooke). *Extreme departure dates:* November 1, 1947, in Baltimore County (H. Kolb); October 24, 1935, in Prince Georges County (R. Overing); October 24, 1951, in Anne Arundel County (K. Brooks).

MAXIMUM COUNTS.—*Spring:* 6 in the District of Columbia on April 12, 1891 (C. W. Richmond). *Fall:* 15 near Seneca, Mont-

gomery County, on October 10, 1953 (A. Baugness, H. Oberlin); 12 at Gibson Island, Anne Arundel County, on September 28, 1955 (Mrs. W. L. Henderson, Mrs. G. Tappan); 7 at Patuxent Refuge on September 28, 1944, and on October 2, 1944. *Winter* (Christmas counts): 15 in the District of Columbia area on December 30, 1955; 11 at Patuxent Refuge on December 29, 1944; 10 at Accokeek, Prince Georges County, on December 21, 1937; 8 in the St. Michaels area on December 29, 1955; 8 in the Ocean City area on December 27, 1955; 6 near the eastern base of Catoctin Mountain in Frederick County on December 30, 1951, and December 29, 1952.

HAIRY WOODPECKER *Dendrocopos villosus* (Linnaeus)

STATUS.—Permanent resident. Fairly common in all sections.

HABITAT.—Extensive tracts of deciduous forest.

NESTING SEASON.—Early April to mid-June. *Extreme egg dates* (5 nests): April 19, 1934, in Montgomery County (E. Court) and April 29, 1935, in Baltimore County (M. B. Meanley). *Extreme nestling dates* (26 nests): April 25, 1953, in Wicomico County (J. C. Miller) and June 13, 1931, in Baltimore County (M. B. Meanley)—also an extremely early record of young on April 9, 1900, in the District of Columbia (Daniel, 1901b).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

- 2 (2 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1949, 1951, and 1952 (Trever, 1952; Clagett, 1953); 1 (1 in 80 acres) in 1952 and 1953 (Clagett, 1952; Wright, 1955).
- 2 (1.5 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the border between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 45 in the Ocean City area (including Pocomoke swamp) on December 27, 1955; 29 in the Catoctin Mountain area in Frederick and Washington Counties on January 2, 1954; 27 at Patuxent Refuge on January 12, 1951; 27 in the Triadelphia Reservoir area on December 24, 1955; 19 near Chase in Baltimore and Harford Counties on December 31, 1950; 16 in Garrett County on December 31, 1954.

DOWNY WOODPECKER *Dendrocopos pubescens* (Linnaeus)

STATUS.—Permanent resident. Common in the Eastern Shore and Western Shore, Upper Chesapeake, Piedmont, and Ridge and Valley sections; fairly common in the Allegheny Mountain section.

HABITAT.—Wood margins, open woodland, orchards, and other forest edge habitats.

NESTING SEASON.—Late April to mid-June. An occupied nest was found as early as April 23, 1945, in Prince Georges County (J. W. Brainerd). *Extreme egg dates* (16 nests): May 1, 1930, in the District of Columbia (E. J. Court) and May 30, 1907, in Allegany County (F. C. Kirkwood). *Extreme nestling dates* (41 nests): May 7, 1945 (J. B. Cope), and June 17, 1956, both in Prince Georges County.

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

- 4 (5 in 36 acres) in "virgin central hardwood deciduous forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
- (2 in 30 acres) in "damp deciduous scrub with standing dead trees" (burned-over, poorly drained upland forest) in Prince Georges County in 1948 (Oresman, et al., 1948).
- (5 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1954 (Wright, 1955); 6 (4.5 in 80 acres) in 1953 (Clagett, 1953); 5 (4 in 80 acres) in 1952 (Clagett, 1952); 4 (3 in 80 acres) in 1948, 1949, and 1951 (Trever, 1952).
- (4.7 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the border between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946); 6 (2 in 32¼ acres) in another area in 1944.
- (2 in 40 acres) in "mixed oak forest" (white, scarlet, and chestnut oaks, etc.) in Baltimore County in 1948 (Kolb, et al., 1948), and in 1949 (Kolb, 1949a); 5 (2 in 37 acres) in 1952 and 1953 (Kaufmann, et al., 1952; Cole and Kolb, 1953); 3 (1 in 40 acres) in 1950 (Kolb, 1950); 3 (1 in 37 acres) in 1951 (Kolb and Cole, 1951).
- (3 in 66 acres) in field and edge habitats (including strips of flood-plain forest, brushy fields, and hedgerows) in Baltimore County in 1947 (Hampe, et al., 1947).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 207 in the District of Columbia area on December 31, 1955; 168 in the Annapolis area on January 1, 1956; 141 in the Ocean City area on December 27, 1954; 100 at Patuxent Refuge on January 12, 1950; 36 in the Catoctin Mountain area in Frederick and Washington Counties on January 2, 1954.

RED-COCKADED WOODPECKER *Dendrocopos borealis* (Vieillot)

STATUS.—Rare and local permanent resident in the Eastern Shore section. Small numbers occur in a rather restricted area in the vicinity of Golden Hill in Dorchester County. They were first recorded there by F. R. Smith, who observed singles or small flocks during the periods, June 2–November 29, 1932, and April 8–September 30, 1933. More recent records in the Golden Hill area include 1 seen on October 8, 1955 (P. Hurlock) and 2 seen on September 20, 1956 (P. F. Springer). Elsewhere, a young bird

was observed on Assateague Island, Worcester County, on June 9, 1939 (Meanley, 1943a).

HABITAT.—Open stands of loblolly pine along the margins of tidal marshes.

[IVORY-BILLED WOODPECKER] *Campephilus principalis* (Linnaeus)

STATUS.—Hypothetical. Audubon (1831 and 1842) records this species as occurring in Maryland.

Family TYRANNIDAE

EASTERN KINGBIRD *Tyrannus tyrannus* (Linnaeus)

STATUS.—*Breeding*: Fairly common in all sections. *Spring transient*: Common in all sections. *Fall transient*: Common in the Eastern Shore section; fairly common elsewhere in all sections. *Wintering*: Accidental—1 was closely observed on Assateague Island, Worcester County, on December 23, 1946 (J. H. Buckalew).

HABITAT.—Marginal habitats such as orchards, farmyards, residential areas, cut-over forests, etc.

NESTING SEASON.—Early May to late August (nesting peak late May to mid-July). Nest-building was recorded as early as May 6, 1953, in Caroline County (Mr. and Mrs. A. J. Fletcher). *Extreme egg dates* (108 nests): May 21, 1899, and July 18, 1923, both in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (66 nests): May 31, 1946, in Prince Georges County (E. G. Cooley) and August 22, 1953, in Carroll County (D. H. McIntosh).

SPRING MIGRATION.—*Normal period*: April 20–30 to May 20–25; peak, May 1 to May 20. *Extreme arrival dates*: March 10, 1955, in Anne Arundel County (Mrs. W. L. Henderson); April 12, 1922, in Dorchester County (R. W. Jackson); April 13, 1883, in Washington County (E. A. Small); April 14, 1895, in Baltimore County (F. C. Kirkwood). *Extreme departure date*: May 26, 1901, in Baltimore County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: July 15–25 to September 15–25; peak, August 5 to September 5. *Extreme arrival dates*: July 12, 1926, and July 13, 1911, in Baltimore County (F. C. Kirkwood). *Extreme departure dates*: October 13, 1955, in Caroline County (M. W. Hewitt); October 7, 1931, in Baltimore County (F. C. Kirkwood); October 5, 1947, in Prince Georges County; October 4, 1936, in Anne Arundel County (E. A. McGinity).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—10 (2 in 20 acres) in suburban type residential area (including small orchards and large expanses of lawn) in Prince Georges County in 1942.

(7 in 260 acres) in mixed agricultural habitats (including hedgerows and wood margins) in Prince Georges County in 1949.

MAXIMUM COUNTS.—*Spring*: 150 at Gibson Island, Anne Arundel County, on May 8, 1955 (Mrs. W. L. Henderson, Mrs. J. Tappan); 117 near Greenbelt, Prince Georges County, on May 1, 1954 (L. W. Oring); 100+ (on 1 plowed field) in Baltimore County on May 14, 1920 (W. Marshall); 75 at Port Tobacco, Charles County, on May 6, 1938, and on May 8, 1937 (I. N. Gabrielson, F. M. Uhler). *Fall*: 2,000 on Gunpowder River marsh on September 2, 1902 (J. Thomas); 250 in Worcester County on September 4, 1953 (R. R. Kerr, J. W. Terborgh); 57 on Assaheague Island, Worcester County, on September 1, 1945; 40 in Dorchester County on August 22, 1930 (H. B. Curry).

WESTERN KINGBIRD *Tyrannus verticalis* Say

STATUS.—Rare fall transient; accidental winter visitor and spring transient. A specimen (USNM) found in the Washington, D. C., market on September 30, 1874, had been collected in nearby Maryland (Coues and Prentiss, 1883). Another specimen was obtained near Denton in Caroline County on September 28, 1931, by S. E. Perkins III (Lincoln, 1932). Two were seen at St. Marys City, St. Marys County, on September 18, 1938 (Wetmore, 1939). One was recorded at South Point, Worcester County, on November 14, 1954 (H. Sutton). Two were observed at Wye Island, Queen Annes County, on September 9, 1956 (N. Nevius, et al.), and 2 others at Ocean City on September 17, 1956 (R. D. Cole, et al.); 1 was banded at the latter location on the following day. One was collected (USNM) in Worcester County, about 4 miles southwest of Snow Hill on December 23, 1946. One was seen near Claiborne, Talbot County, on May 22 and 23, 1956 (R. L. Kleen).

[SCISSOR-TAILED FLYCATCHER] *Muscivora forficata* (Gmelin)

STATUS.—Hypothetical. A bird, presumably of this species, was reported seen in the District of Columbia on May 6, 1861 (Coues and Prentiss, 1883). Another was reported near the Potomac River in Prince Georges County during August of about the year 1865 (Palmer, 1896). A third sight record was reported in this same area during April 1881 (C. W. Richmond).

GREAT CRESTED FLYCATCHER *Myiarchus crinitus* (Linnaeus)

STATUS.—*Breeding*: Common in the Eastern Shore and Western Shore sections; fairly common in the Upper Chesapeake, Piedmont, and Ridge and Valley sections; uncommon in the Allegheny Mountain section. *Transient*: Fairly common in all sections.

HABITAT.—Wood margin habitats and open stands of pine on upland deciduous forest.

NESTING SEASON.—Mid-May to early August (nesting peak late May to early July). *Extreme egg dates* (112 nests): May 13 1881, in the District of Columbia (USNM—M. Thompson) and July 15, 1913, in Dorchester County (Jackson, 1941). *Extreme nestling dates* (26 nests): June 11, 1912, in Dorchester County (R. W. Jackson) and August 4, 1949, in Prince Georges County (J. S. Cooley).

SPRING MIGRATION.—*Normal period*: April 20–30 to May 15–20; peak, May 5 to May 15. *Extreme arrival dates*: April 18 1931 (J. C. Jones), and April 19, 1914 (W. W. Cooke), in the District of Columbia.

FALL MIGRATION.—*Normal period*: August 15–25 to September 15–25; peak, August 25 to September 10. *Extreme departure dates*: November 21, 1948, in Baltimore County (E. Willis); October 29, 1952, in Montgomery County (M. G. Van Meter).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

- 8 (3 in 36 acres) in "virgin central hardwood deciduous forest" (white oak–tulip–poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
- 8 (3 in 40 acres) in "mixed oak forest" (white, scarlet, and chestnut oaks etc.) in Baltimore County in 1950 (Kolb, 1950); 5 (2 in 40 acres) in 1948 (Kolb, et al., 1948); 3 (1 in 40 acres) in 1949 (Kolb, 1949a); 3 (1 in 37 acres) in 1951 (Kolb and Cole, 1951) and 1952 (Kaufmann et al., 1952); none in 1953.
- 7 (2 in 28 acres) in partially opened flood-plain forest (sycamore, elm, ash, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 7 (1.5 in 21 acres) in "dense second growth" (oak–maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 6 (5 in 80 acres) in "central hardwood forest (oaks–tulip–poplar) with scattered pine" in the District of Columbia in 1948; 4 (3 in 80 acres) in 1949, 2 (2 in 80 acres) in 1951 (Trever, 1952); 4 (3.5 in 80 acres) in 1954 (Wright, 1955); 4 (3 in 80 acres) in 1952 (Clagett, 1952); 3 (2.5 in 80 acres) in 1953 (Clagett, 1953).
- 5 (2 in 44½ acres) in river bluff forest (beech, white oak, scarlet oak) in Prince Georges County in 1944 and 1945 (J. W. Aldrich, A. J. Duvall).
- 4 (2 in 47¼ acres) in hedgerows in agricultural areas and abandoned fields (including strip 27½ yards wide on each side of hedgerow) in Prince Georges County in 1945.

MAXIMUM COUNTS.—*Spring*: 41 in Talbot County on May 8, 1954 (R. L. Kleen); 22 in Worcester County on May 11, 1952 (D. A. Cutler); 21 in the District of Columbia area on May 12, 1913 (Oberholser, 1917a); 20 in Frederick County on May 9, 1953 (J. W. Richards). *Fall*: 9 in Dorchester County on August 31, 1946.

H-THROATED FLYCATCHER *Myiarchus cinerascens* (Lawrence)

STATUS.—Accidental visitor. A specimen (USNM) was collected at Beltsville, Prince Georges County, on November 25, 1911, E. B. Marshall.

STERN PHOEBE *Sayornis phoebe* (Latham)

STATUS.—*Breeding*: Fairly common in all sections. *Transient*: Common in all sections. *Wintering*: Fairly common in Worcester county; uncommon elsewhere in the Eastern shore section and in the southern part of the Western Shore section (Calvert, St. Marys, and Charles Counties); rare in the northern part of the Eastern Shore section (Anne Arundel and Prince Georges Counties), and in the Upper Chesapeake and Piedmont sections; usual in the Ridge and Valley section—1 seen in the Hagerstown Valley of Washington County during the winter of 1882–83 (Hall, 1883a).

HABITAT.—Various edge habitats including wood margin and field edge types. During the breeding season, this species is usually restricted to areas near bridges, culverts, buildings, or other man-made structures.

NESTING SEASON.—Late March to early August (nesting peak, mid-April to late June). *Extreme egg dates* (272 nests): March 1, 1929, in Prince Georges County (R. V. Truitt) and July 21, 1956, in Prince Georges County. *Extreme nestling dates* (183 nests): May 1, 1929, in the District of Columbia (G. B. Roth) and August 1, 1956, in Prince Georges County (P. F. Springer).

SPRING MIGRATION.—*Normal period*: March 5–15 to April 20–25; peak, March 20 to April 15. *Extreme arrival dates*: February 23, 1902, in the District of Columbia (H. W. Oldys); February 1, 1953, in Prince Georges County (L. M. Horn, A. C. Martin); February 28, 1954, in Montgomery County (J. W. Terborgh); March 1, 1953, in Caroline County (A. Knotts).

FALL MIGRATION.—*Normal period*: September 10–20 to November 1–10; peak, September 25 to October 15. *Extreme arrival date*: September 1, 1944, in Prince Georges County. *Extreme departure dates*: November 29, 1893, in Montgomery County (H. B. Abler); November 29, 1896, in Baltimore County (F. C. Kirkwood); November 28, 1954, in Prince Georges County; November 1, 1948, in Caroline County (Mrs. A. J. Fletcher).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

(6 in 84 acres) in mixed agricultural habitats (including bridges and buildings) in Prince Georges County in 1949; 6 (5 in 84 acres) in 1947 and 1948; 5 (4 in 84 acres) in 1950 and 1951.

0.6 (15 in 2,656 acres) in mixed forest and field habitats (containing scattered bridges, culverts, and buildings that are used for nesting sites) in Anne Arundel and Prince Georges Counties in 1943; 0.4 (11 in 2,656 acres) in 1942.

MAXIMUM COUNTS.—*Spring*: 20 on the Gunpowder River marsh on March 22, 1904 (J. Thomas); 20 at Port Tobacco, Charles County, on April 7, 1953 (J. Hailman); 18 on Patuxent Refuge on March 16, 1945; 15 at Seneca, Montgomery County, on February 28, 1954 (J. W. Terborgh). *Fall*: 13 on Patuxent Refuge on October 7, 1945. *Winter* (Christmas counts): 32 in the Ocean City area on December 27, 1953; 11 in southeastern Worcester County on December 22, 1947; 8 near Denton, Caroline County, on December 23, 1950; 3 in the Triadelphia Reservoir area of Montgomery and Howard Counties on January 1, 1954.

YELLOW-BELLIED FLYCATCHER *Empidonax flaviventris*

(Baird and Baird)

STATUS.—*Transient*: Uncommon in the Allegheny Mountain Ridge and Valley, and Piedmont sections; rare in the Upper Chesapeake, Western Shore, and Eastern Shore sections.

HABITAT.—Various types of evergreen and deciduous forests with some preference shown for the former.

SPRING MIGRATION.—*Normal period*: May 10–15 to May 31; June 1; peak, May 20 to May 30. *Extreme arrival dates*: May 19, 1949, in Montgomery County (M. C. Crone, L. M. Wendt); May 9, 1886 (W. Palmer), and May 9, 1902 (A. K. Fisher), in the District of Columbia. *Extreme departure dates*: June 1, 1917, in the District of Columbia (F. Harper); June 1, 1925, in Garrett County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: August 10–20 to September 25–October 5; peak, August 25 to September 25. *Extreme arrival dates*: July 28, 1859, in the District of Columbia (E. Coues-USNM); August 3, 1893, in Baltimore County (G. H. Gray); August 5, 1894, in the District of Columbia (C. W. Richmond). *Extreme departure dates*: October 26, 1955 (banded), in Baltimore County (S. W. Simon); October 11, 1926, and October 1905, in Baltimore County (F. C. Kirkwood); October 6, 1881, in the District of Columbia (H. M. Smith).

MAXIMUM COUNTS.—*Spring*: 17 near Laurel, Prince Georges County, on May 30, 1917 (W. L. McAtee, A. Wetmore); 5 in Baltimore County on May 21, 1893 (W. N. Wholey). *Fall*: 8+ at Holm Point, Baltimore County, on September 23, 1896 (F. C. Kirkwood); 6 banded at Ocean City, Worcester County, on September

, 1955; 3 in the District of Columbia on September 18, 1930 (W. McAtee).

ADIAN FLYCATCHER *Empidonax virescens* (Vieillot)

STATUS.—*Breeding*: Common in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Piedmont, and Ridge and Valley sections; uncommon and local in the Allegheny Mountain section—occurs along Bear Creek in Garrett County (Brooks, 1936c). *Transient*: Fairly common in the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon in the Piedmont, and Ridge and Valley sections.

HABITAT.—Flood-plain and swamp forests; also rich, moist woods rests on the upland.

NESTING SEASON.—Late May to mid-August (nesting peak, early June to early July). *Extreme egg dates* (71 nests): May 26, 1843, in Prince Georges County (J. B. Cope) and July 30, 1893, in Baltimore County (Kirkwood, 1895). *Extreme nestling dates* (21 nests): June 9, 1952, in Caroline County (M. W. Hewitt) and August 11, 1953, in Calvert County (W. B. Tyrrell).

PERIOD OF OCCURRENCE.—*Normal period*: May 1–10 to September 5–15; peak, May 10 to August 1. *Extreme arrival dates*: April 1, 1845, in the District of Columbia (USNM—Hutton); April 1, 1951, in Prince Georges County. *Extreme departure dates*: October 2, 1927, in Baltimore County (F. C. Kirkwood, J. Sommer); September 28, 1952, in St. Marys County (J. W. Terborgh); September 24, 1950, in Montgomery County (S. A. Briggs); September 19, 1947, and September 19, 1951, in Prince Georges County.

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

(6 in 12¼ acres) in lowland seepage swamp (red maple, sweetgum, pin oak with brushy understory of sweet-bay, winterberry, arrow-wood, etc.) in Prince Georges County in 1946.

(33.7 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the border between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946); 34 (11 in 32¼ acres) in another area of this type in 1944.

(12 in 36 acres) in "virgin central hardwood deciduous forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).

(4 in 14½ acres) in poorly drained flood-plain forest (pin oak, sweetgum, red maple, red ash, etc.) in Prince Georges County in 1946.

(22.5 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1954 (Wright, 1955); 28 (22 in 80 acres) in 1949, 26 (21 in 80 acres) in 1948 and 1953, 19 (15 in 80 acres) in 1951 (Trever, 1952; Clagett, 1953); 20 (16 in 80 acres) in 1952 (Clagett, 1952).

- 23 (6.5 in 28 acres) in partially opened flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 12 (3 in 24½ acres) in river terrace forest (beech-white oak) in Prince Georges County in 1944.
- 12 (1.5 in 13 acres) in upland oak forest (white, northern red, chestnut, and black oaks) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 9 (4 in 44¾ acres) in river bluff forest (beech, white oak, scarlet oak) in Prince Georges County in 1945; absent in 1944 (J. W. Aldrich, A. J. Duvall).
- 9 (3.5 in 37 acres) in "mixed oak forest" (white, scarlet, and chestnut oaks, etc.) in Baltimore County in 1953 (Cole and Kolb, 1953); 8 (3 in 37 acres) in 1951 and 1952 (Kolb and Cole, 1951; Kaufmann, et al., 1952); 5 (2 in 40 acres) in 1948 (Kolb, et al., 1948); 4 (1.5 in 4 acres) in 1949 (Kolb, 1949a) and 1950 (Kolb, 1950).

MAXIMUM COUNTS.—*Spring*: 34 in Charles and St. Mary Counties on May 9, 1953 (J. W. Terborgh, et al.); 30 along the C. & O. Canal in Montgomery County on May 9, 1953 (E. J. Stivers, et al.); 25 at Patuxent Refuge on May 10, 1952. *Fall*: 9 at Patuxent Refuge on August 17, 1944.

TRAILL'S FLYCATCHER *Empidonax traillii* (Audubon)

STATUS.—*Breeding* (see fig. 29): Uncommon in the Allegheny Mountain section; uncommon and local in the Piedmont section—in late June of 1951, territorial males were recorded at 6 locations in the northern half of Carroll County and at 1 location a mile west of Frederick in Frederick County, while in 1954, C. M. Buchanan found an occupied nest at Loch Raven in Baltimore County; rare in the District of Columbia—1 singing male was closely observed at Kenilworth on July 15, 1950 (E. G. Davis, J. E. Willoughby), and on June 27, 1951 (R. F. Deed). *Transient*: Rare in the Allegheny Mountain, Ridge and Valley, Piedmont Upper Chesapeake, and Western Shore sections, and (in fall only) in the Eastern Shore section.

HABITAT.—Alder thickets, located along streams or in swamps occasionally in other types of brushy thickets in damp situations.

NESTING SEASON.—A nest containing 3 dead young was found at Mountain Lake in Garrett County on June 11, 1939 (M. G. Brooks). A nest, just completed, found at Loch Raven, Baltimore County, on July 10, contained 3 young on July 31, 1954 (C. M. Buchanan). Another nest containing young was found in Garrett County, near Bittinger, on August 24, 1938 (L. M. Llewellyn).

SPRING MIGRATION.—*Normal period*: May 10–15 to May 25–June 1. *Extreme arrival dates*: May 5, 1893 (collected), in Baltimore County (A. Resler); May 7, 1922, in the District of Columbia (H. C. Oberholser); May 8, 1954, in Howard County

Extreme departure dates: June 9, 1953, in Frederick County (J. J. Richards); June 2, 1943 (USNM), in Prince Georges County.

FALL MIGRATION.—*Normal period:* August 20–25 to September 0–15. *Extreme arrival dates:* August 16, 1886, in the District of Columbia (A. K. Fisher); August 18, 1927, in Baltimore County (F. C. Kirkwood). *Extreme departure dates:* September 4, 1955, in Baltimore County (C. M. Buchanan); September 17, 1890, in the District of Columbia (USNM—C. W. Richmond).

MAXIMUM COUNTS (nonbreeding).—*Spring:* 5 near Seneca, Montgomery County, on May 14, 1949 (L. M. Ashley); 3 in the District of Columbia on June 1, 1917 (F. Harper).

EAST FLYCATCHER *Empidonax minimus* (Baird and Baird)

STATUS.—*Breeding* (see fig. 33): Fairly common in the Allegheny Mountain section; uncommon in the western part of the Ridge and Valley section (Alleghany County); rare and local in the Piedmont and Western Shore sections—occurring irregularly in the vicinity of Baltimore (A. A. Brandenburg, A. Stokes), in the northern part of Baltimore County, in Carroll County, and in Prince Georges County in the vicinity of the Patuxent Research Refuge. *Transient:* Fairly common in the Allegheny Mountain, Ridge and Valley, and Piedmont sections; uncommon in the Upper

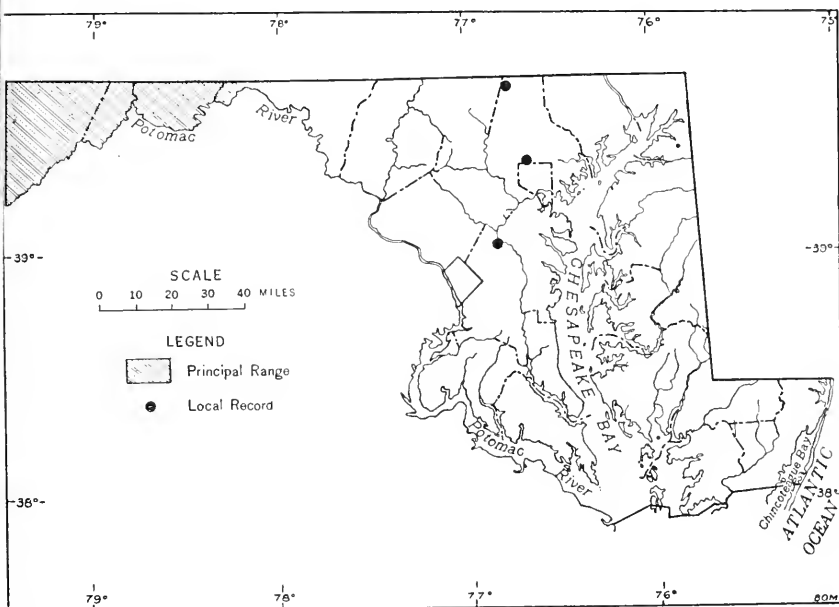


FIGURE 33.—Breeding range of Least Flycatcher.

Chesapeake and Western Shore sections; rare in the Eastern Shore section.

HABITAT.—*Breeding*: Open deciduous woodland, and orchards
Transient: Various types of deciduous forests and forest edge.

NESTING SEASON.—Early May to mid-August (nesting peak late May to early July). Nest building was recorded in Baltimore County as early as May 4, 1951 (A. A. Brandenburg) *Extreme egg dates* (8 nests): May 19, 1935, in Allegany County (L. M. Llewellyn) and June 17, 1949, in Prince Georges County. Nestlings were observed in Baltimore County during the period June 2–10, 1951 (A. A. Brandenburg). An occupied nest was found in Garrett County at Friendsville on about August 15, 1949 (A. Wright).

SPRING MIGRATION.—*Normal period*: April 25–May 5 to May 15–25; peak, May 5 to May 15. *Extreme arrival dates*: April 19, 1880, in Prince Georges County (USNM—G. Marshall); April 20, 1881, in the District of Columbia (W. Palmer); April 20, 1954, in Baltimore County (Mrs. R. E. Kaestner). *Extreme departure dates*: June 11, 1953, in Frederick County (J. W. Richards); June 6, 1953, in Montgomery County (R. F. Deed); June 2, 1905, in Baltimore County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: August 20–25 to September 15–25; peak, August 25 to September 15. *Extreme arrival dates*: August 13, 1887, in the District of Columbia (A. K. Fisher); August 18, 1927, in Baltimore County (F. C. Kirkwood); August 19, 1942, in Prince Georges County. *Extreme departure dates*: October 1, 1916, in Montgomery County (D. C. Mabbott); September 28, 1892, in Baltimore County (A. Resler); September 28, 1901, in Allegany County (G. Eifrig).

EASTERN WOOD PEWEE *Contopus virens* (Linnaeus)

STATUS.—*Breeding and transient*: Fairly common in all sections.

HABITAT.—Wood margins or open stands of upland deciduous and pine forests; also in mature orchards and in wooded residential areas. During the fall migration period, this species also occurs in more open habitats such as field margins and hedgerows.

NESTING SEASON.—Late May to mid-September (nesting peak, early June to late July). *Extreme egg dates* (116 nests): May 21, 1953, in Charles County (A. R. Stickley, Jr.) and August 15, 1897, in Baltimore County (J. Sommer). *Extreme nestling dates* (53 nests): June 13, 1950, in Harford County (R. B. Thomas) and September 13, 1951, in Baltimore County (E. Willis).

SPRING MIGRATION.—*Normal period*: May 1–10 to May 25–June 5; peak, May 10 to May 25. *Extreme arrival dates*: April, 1930, in Montgomery County (F. C. Lincoln); April 24, 1932, Baltimore County (W. B. Tyrrell); April 26, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 1–10 to October 15; peak, September 10 to October 1. *Extreme departure dates*: October 31, 1950, in Anne Arundel County (Mrs. W. L. Henderson); October 25, 1937, in St. Marys County (J. C. Jones, F. H. Hay); October 19, 1901, in Allegany County (G. Eifrig); October, 1883, on the Patapsco River marsh (A. Resler).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

(7 in 36 acres) in “virgin central hardwood deciduous forest” (white oak–tulip–poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).

(3.5 in 21 acres) in “immature loblolly–shortleaf pine stand” in Worcester County in 1948 (Springer and Stewart, 1948c).

(4.5 in 40 acres) in “mixed oak forest” (white, scarlet, and chestnut oaks, etc.) in Baltimore County in 1949 (Kolb, 1949a); 10 (4 in 40 acres) in 1948 (Kolb, et al., 1948); 8 (3 in 37 acres) in 1951 and 1953 (Kolb and Cole, 1951; Cole and Kolb, 1953); 4 (1.5 in 37 acres) in 1952 (Kaufmann, et al., 1952); 3 (1 in 40 acres) in 1950 (Kolb, 1950).

(8 in 80 acres) in “central hardwood forest (oaks–tulip–poplar) with scattered pine” in the District of Columbia in 1954 (Wright, 1955); 8 (6 in 80 acres) in 1948 and 1953; 6 (5 in 80 acres) in 1949 and 6 (4.5 in 80 acres) in 1951 (Trever, 1952; Claggett, 1953); 7 (5.5 in 80 acres) in 1952 (Claggett, 1952).

(1.5 in 22 acres) in “unsprayed apple orchard with infrequently mowed ground cover” in Worcester County in 1948 (Springer and Stewart, 1948b).

(1.4 in 23½ acres) in upland oak forest (white, scarlet, and black oaks) in Prince Georges County in 1944.

(2 in 44½ acres) in river bluff forest (beech, white oak, scarlet oak) in Prince Georges County in 1945; 2 (1 in 44½ acres) in 1944 (J. W. Aldrich, A. J. Duvall).

(1.6 in 32½ acres) in pine–oak forest (pitch pine, scrub pine, Spanish oak) in Prince Georges County in 1944.

(1.5 in 30 acres) in “damp deciduous scrub with standing dead trees” in Prince Georges County in 1947 (Stewart, et al., 1947).

MAXIMUM COUNTS.—*Spring*: 20 at Unity, Montgomery County, on May 9, 1953 (S. H. Low); 16 in St. Marys and Charles Counties on May 8, 1954 (J. W. Terborgh, J. W. Taylor, Jr.); 16 in the District of Columbia and southern Montgomery County on May 10, 1952 (P. A. DuMont, et al.). *Fall*: 16 near Seneca, Montgomery County, on September 5, 1953 (H. A. Sutton); 16 at Port Tobacco, Charles County, on September 2, 1954 (A. R. Stickley, Jr.); 15 on September 9, 1944, at Patuxent Refuge.

OLIVE-SIDED FLYCATCHER *Nuttallornis borealis* (Swainson)

STATUS.—*Breeding*: Formerly found sparingly in summer in Garrett County at Cranesville Swamp (Brooks, 1936c), being a regular occurrence there until about 1937 (M. G. Brooks). *Transient*: Uncommon in the Allegheny Mountain section; rare in the Ridge and Valley, Piedmont, Upper Chesapeake, and Western Shore sections; casual in the Eastern Shore section—1 seen in the Pocomoke Swamp on May 17, 1952 (P. A. DuMont); 1 seen at Royal Oak, Talbot County, on September 26, 1953 (R. L. Kleen); and 1 seen at Tilghman, Talbot County, on September 14, 1955 (R. L. Kleen).

HABITAT.—Brushy, cut-over or burned-over forest land with scattered standing dead trees.

SPRING MIGRATION.—*Normal period*: May 10–15 to June 1–5; peak, May 15 to June 1. *Extreme arrival dates*: May 5, 1956, in Prince Georges County; May 9, 1912, in the District of Columbia (A. K. Fisher); May 9, 1953, in Frederick County (J. W. Richards). *Extreme departure date*: June 10, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: August 15–25 to September 15–25; peak, August 25 to September 15. *Extreme arrival dates*: August 10, 1943 (USNM), in Prince Georges County; August 13, 1917, in the District of Columbia (R. W. Moore). *Extreme departure dates*: October 2, 1928, in Baltimore County (F. C. Kirkwood); September 30, 1950, in Montgomery County (C. N. Mason).

MAXIMUM COUNTS.—*Fall*: 3 near Seneca, Montgomery County on September 5, 1953 (H. A. Sutton); 3 at Herrington Manor in Garrett County on September 11, 1954 (L. W. Oring).

Family ALAUDIDAE**HORNED LARK *Eremophila alpestris* (Linnaeus)**

STATUS.—*Breeding*: Fairly common in the Allegheny Mountain, Ridge and Valley, and Piedmont sections, and in the coastal area of Worcester County; uncommon elsewhere in the Eastern Shore section and in the Western Shore and Upper Chesapeake sections. *Transient*: Fairly common in all sections. *Wintering*: Fairly common in the Eastern Shore section; uncommon in all other sections.

This species has been gradually expanding its breeding range southeastward during the past 50 years. In Garrett and Allegheny Counties it was first recorded in summer in about 1900 and the first definite breeding records were obtained in 1904 (Eifrig,

923). Farther east, the first indication of breeding was evident when an adult and 2 juvenals were collected near Laurel, Prince Georges County, on June 23, 1922 (Swales, 1922).

HABITAT.—Cultivated fields, pastures, golf courses, airfields, sandy beaches, and other open habitats with sparse or short vegetation.

NESTING SEASON.—Early March to late July (nesting peak, mid-March to mid-May). Nest-building was recorded as early as March, 1939, in Prince Georges County (M. B. Meanley). *Extreme egg dates* (17 nests): March 18, 1952, in Baltimore County (E. Willis) and July 6, 1931, in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (15 nests): March 19, 1954, in Baltimore County (E. Willis) and July 14, 1946, in Worcester County. fledglings were observed being fed by a parent in Baltimore County on August 2, 1954 (C. D. Hackman).

SPRING MIGRATION.—*Normal period*: January 15–25 to March 10–30; peak, January 25 to March 10. *Extreme departure date*: April 9, 1931, in the District of Columbia (W. L. McAtee).

FALL MIGRATION.—*Normal period*: September 25–October 5 to December 10–20; peak, October 10 to December 1.

MAXIMUM COUNTS.—*Spring*: 400 in Worcester County on February 22, 1948 (E. Arnold); 200 in Baltimore County on March 20, 1928 (W. Marshall); 100 (1 flock) near Emmitsburg, Frederick County, on February 7, 1952 (J. W. Richards). *Fall*: 300 on the Gunpowder River marsh on December 7, 1902 (J. Thomas); 200 in Baltimore County on November 12, 1929 (W. Marshall); 150 on Taylors Island, Dorchester County, on December 1, 1893 (R. C. Watters). *Winter*: 500 at Indiantown, St. Marys County, on January 31, 1952 (J. W. Terborgh); “hundreds” at Cumberland during February 1901 (Eifrig, 1902b); 270 at Ocean City on December 27, 1948 (Christmas count); 240 in the Catoctin Mountain area of Frederick County on January 2, 1954 (Christmas count); 154 in southeastern Worcester County on December 22, 1947 (Christmas count); 127 near Denton, Caroline County, on December 26, 1953 (Christmas count).

Family HIRUNDINIDAE

TREE SWALLOW *Iridoprocne bicolor* (Vieillot)

STATUS.—*Breeding* (see fig. 34): Fairly common in the tidewater areas of Somerset, Wicomico, and Dorchester Counties; uncommon or rare in the tidewater areas elsewhere in the Eastern Shore section and in the Western Shore and Upper Chesapeake sections; locally uncommon or rare in the Allegheny Mountain

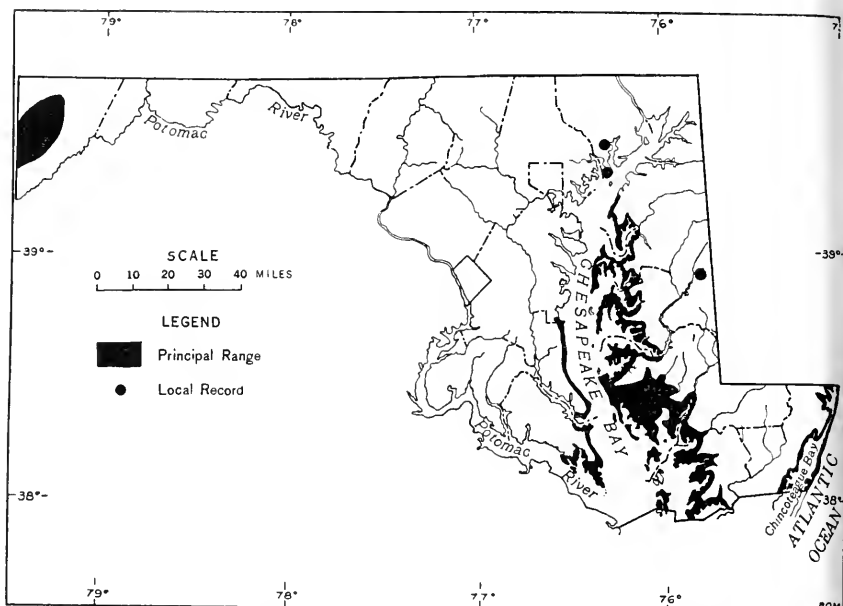


FIGURE 34.—Breeding range of Tree Swallow.

section—recorded in Garrett County at Cranesville Swamp, Deep Creek Lake (Brooks, 1936c), Crellin (Eifrig, 1920b), Hammel Glade and Lake Louise. *Spring transient*: Common in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Piedmont, Ridge and Valley, and Allegheny Mountain sections. *Fall transient*: Abundant in the Eastern Shore section; common in the tidewater areas of the Upper Chesapeake and Western Shore sections; uncommon elsewhere in all sections. *Wintering*: Uncommon and irregular in the coastal area of Worcester County and in the tidewater areas of Somerset and Dorchester Counties; casual elsewhere in the Eastern Shore section and in the Western Shore and Piedmont sections—1 seen at Cobb Island, Charles County, on January 7, 1950 (F. M. Uhler), a small flock recorded at Gibson Island, Anne Arundel County, on January 15, 1950 (Mrs. W. L. Henderson), 1 seen at Westminster, Carroll County, on January 12, 1952 (D. A. Jones).

HABITAT.—*Breeding*: Usually near open water or marsh in areas with standing dead trees. *Transient*: Most numerous in the vicinity of open water or marsh, but also occurring regularly over agricultural fields and other open habitats. *Wintering*: Usually found in the vicinity of wax-myrtle thickets on the barrier beaches or adjacent to salt marshes.

NESTING SEASON.—Early May to mid-July. *Extreme egg dates* (3 nests): May 12, 1894 (W. H. Fisher), and July 3, 1893 (P. T. Logg), in Baltimore County. *Extreme nestling dates* (9 nests): June 3, 1954, in Caroline County (Mrs. A. J. Fletcher) and June 3, 1920, in Garrett County (Eifrig, 1920b).

SPRING MIGRATION.—*Normal period*: March 25–April 5 to May 1–20; peak, April 5 to May 5. *Extreme arrival dates*: February 2, 1954, in Dorchester County (J. W. Terborgh); February 28, 1953, in St. Marys County (J. E. Knudson); March 4, 1903, in Baltimore County (F. C. Kirkwood); March 10, 1956, in Caroline County (Mrs. A. J. Fletcher). *Extreme departure dates*: June 1, 1953, in Frederick County (R. F. Deed); May 28, 1949, in Montgomery County (P. A. DuMont); May 26, 1908, in Allegany County (F. C. Kirkwood); May 24, 1951, in Prince Georges County.

FALL MIGRATION.—*Normal period*: July 1–10 to November 5–15; peak, August 25 to October 25. *Extreme arrival dates*: June 1, 1950, in Prince Georges County; June 30, 1906, in Worcester County (F. C. Kirkwood). *Extreme departure dates*: November 6, 1900, in Baltimore County (F. C. Kirkwood); November 17, 1948, in Dorchester County.

MAXIMUM COUNTS.—*Spring*: 2,500 at Allens Fresh, Charles County, on April 12, 1952 (L. Griffin, et al.); 1,000 in Baltimore County on April 7, 1901 (F. C. Kirkwood). *Fall*: 50,000+ in the Elliott Island area, Dorchester County, on October 22, 1949; 10,000+ between Vienna and Cambridge in Dorchester County on October 2, 1948; 5,000 in Baltimore County on August 29, 1903, and October 18, 1901 (F. C. Kirkwood); 3,800 on Assateague Island, Worcester County, on September 5, 1948. *Winter*: 200 on Assateague Island on February 8, 1938 (G. A. Ammann); 150 in the Ocean City area on January 31, 1906 (F. C. Kirkwood); 50 near Westover, Somerset County, on December 8, 1911 (W. H. Fisher).

BLANK SWALLOW *Riparia riparia* (Linnaeus)

STATUS.—*Breeding* (see fig. 35): Fairly common locally in the tidewater areas of the Western Shore and Upper Chesapeake sections and along the Chesapeake Bay shores of the Eastern Shore section (south to the Choptank River); uncommon and local in the Piedmont, and Ridge and Valley sections—recorded in Baltimore County at Herring Run and Dulaney Valley (F. C. Kirkwood), in Harford County along Broad Creek near Pylesville (P. Leaps) and Darlington (S. Mason, Jr.) and occurring along the

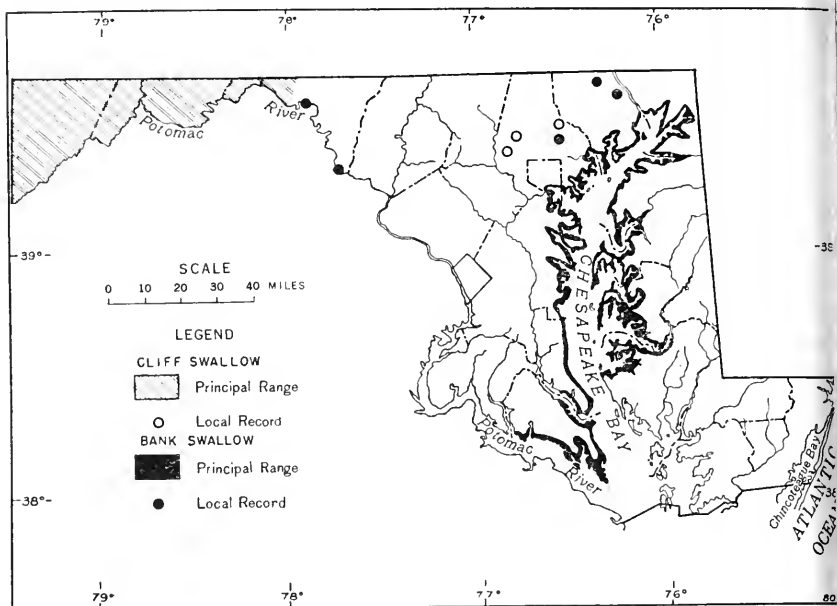


FIGURE 35.—Breeding ranges of Bank Swallow and Cliff Swallow.

Potomac River in Washington County (M. G. Brooks). *Spring transient*: Fairly common in all sections. *Fall transient*: Common in the tidewater areas of the Upper Chesapeake section; fairly common in the Allegheny Mountain section and in the tidewater areas of the Eastern Shore and Western Shore sections; uncommon elsewhere in all sections.

HABITAT.—*Breeding*: Restricted to areas near water with suitable sandy banks for nesting. *Transient*: In the vicinity of open water and marshes; also over pastures, agricultural fields, barrier beaches, and other open habitats.

NESTING SEASON.—Mid-April to mid-July (nesting peak, early May to late June). In Baltimore County, this species was observed excavating nest burrows as early as April 19, 1895 (W. H. Fisher). *Extreme egg dates* (50 nests): May 10, 1916, in the District of Columbia (E. J. Court) and June 23, 1912, in Anne Arundel County (J. Sommer). *Extreme nestling dates* (100+ nests): May 30, 1950, in Cecil County (A. A. Brandenburg) and July 17, 1892, in Baltimore County (F. C. Kirkwood).

SPRING MIGRATION.—*Normal period*: April 10–20 to May 15–25; peak, April 25 to May 10. *Earliest arrival dates*: April 4, 1918, in the District of Columbia (I. N. Gabrielson); April 5, 1916, in Dorchester County (R. W. Jackson); April 5, 1952, in Mont-

mery County (E. J. Stivers). *Extreme departure dates*: May 1, 1886, in the District of Columbia (C. W. Richmond); May 26, 1849, in Prince Georges County.

FALL MIGRATION.—*Normal period*: July 5–15 to September 5–15; peak, July 15 to September 5. *Extreme departure dates*: September 29, 1930, in Kent County (W. Baker); September 21, 1920, in the District of Columbia (F. C. Lincoln); September 21, 1840, in Baltimore County (E. A. McGinity).

MAXIMUM COUNTS.—*Spring*: 110 in the District of Columbia on May 11, 1917 (Oberholser, 1918). *Fall*: 10,000 on the Gunpowder River marsh on July 15, 1900 (F. C. Kirkwood); 3,000 on Back River, Baltimore County, on July 17, 1891 (F. C. Kirkwood); "hundreds" on the Patapsco River marsh on August 16, 1897 (F. C. Kirkwood); 500 in Kent County on August 10, 1954; 250 in Seneca, Montgomery County, on September 7, 1953 (J. W. Terborgh).

ROUGH-WINGED SWALLOW *Stelgidopteryx ruficollis* (Vieillot)

STATUS.—*Breeding*: Fairly common along the Potomac River in Montgomery County; uncommon and local elsewhere in all sections. *Transient*: Uncommon in all sections.

HABITAT.—Usually in the vicinity of open water, including rivers, ponds, bays, and estuaries.

NESTING SEASON.—Mid-April to late June (nesting peak, mid-May to mid-June). Nest-building was recorded in Caroline County as early as April 19, 1952 (Mr. and Mrs. A. J. Fletcher). *Extreme egg dates* (42 nests): May 13, 1886, in Baltimore County (F. C. Kirkwood) and June 20, 1887, in the District of Columbia (USNM—H. Thompson). *Extreme nestling dates* (10 nests): May 22, 1953, in Caroline County (Mr. and Mrs. A. J. Fletcher) and June 27, 1893, in Baltimore County (P. T. Blogg).

SPRING MIGRATION.—*Normal period*: April 1–10 to May 5–15; peak, April 10 to May 5. *Extreme arrival dates*: March 22, 1952, in Caroline County (Mr. and Mrs. A. J. Fletcher); March 26, 1950, in Montgomery County (J. W. Taylor, Jr.). *Extreme departure date*: May 25, 1952, in Prince Georges County.

FALL MIGRATION.—*Normal period*: June 25–July 5 to August 5–September 5. *Extreme arrival date*: June 20, 1945, in Prince Georges County. *Extreme departure dates*: September 14, 1954, in Charles County (R. R. Kerr, J. W. Terborgh); September 11, 1920, in Montgomery County (H. C. Oberholser).

MAXIMUM COUNTS.—*Spring*: 125 at Allens Fresh, Charles County, on April 12, 1952 (R. R. Kerr); 87 at Gibson Island, Anne

Arundel County, on May 5, 1956 (Mrs. W. L. Henderson, et al. 80 near Cabin John, Montgomery County, on April 17, 1949 (A. DuMont). *Fall*: 50 in the District of Columbia on August 3, 1917 (H. C. Oberholser).

BARN SWALLOW *Hirundo rustica* Linnaeus

STATUS.—*Breeding*: Common in all sections. *Transient*: Abundant in the Eastern Shore, Western Shore, and Upper Chesapeake sections; common in the Piedmont, Ridge and Valley, and Allegheny Mountain sections. *Wintering*: Accidental—1 recorded in the District of Columbia on December 27, 1935 (G. Petrides).

HABITAT.—*Breeding*: In open country, usually in the vicinity of barns, bridges, and other types of buildings. *Transient*: In open country, usually most numerous near water.

NESTING SEASON.—Late April to late August (nesting peak late May to early July). Nest-building was recorded as early as April 13, 1956, in Caroline County. *Extreme egg dates* (38 nests): May 5, 1955, in Caroline County (A. Bilbrough) and August 4, 1950, in Prince Georges County. *Extreme nestling dates* (297 nests): May 18, 1949, in Prince Georges County and August 21, 1950 (E. Willis), in Baltimore County.

SPRING MIGRATION.—*Normal period*: April 1–10 to May 10–20 peak, April 20 to May 5. *Extreme arrival dates*: March 20, 1888 in Washington County (E. A. Small); March 20, 1900, on the Gunpowder River marsh (J. Thomas); March 25, 1954, in Caroline County (A. J. Fletcher); March 26, 1954, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan). *Extreme departure date*: May 28, 1940, in Baltimore County (H. Brackbill).

FALL MIGRATION.—*Normal period*: July 1–10 to September 10–20; peak, July 10 to September 1. *Extreme arrival dates*: June 22, 1956, in Worcester County; June 27, 1914, in Baltimore County (F. C. Kirkwood). *Extreme departure dates*: November 6, 1948 in Worcester County (K. H. Weber); October 12, 1917, in Dorchester County (R. W. Jackson); October 12, 1954, in Prince Georges County; October 6, 1929, in the District of Columbia (M. T. Donoho).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—11 (31 in 275 acres) in mixed agricultural and residential habitats (including several barns and sheds) in Prince Georges County in 1949; 5 (13 in 275 acres) in 1947; 3 (9 in 275 acres) in 1943.

MAXIMUM COUNTS.—*Spring*: 283 in Worcester County on May 11, 1952 (D. A. Cutler); 200 at Gibson Island, Anne Arundel County, on May 8, 1955 (Mrs. W. L. Henderson, Mrs. G. Tappan).

Ill.: 10,000 on the Gunpowder River marsh on July 15, 1900 (F. Kirkwood); 1,600 in Montgomery County on July 26, 1953 (R. Kerr); 1,000 in Worcester County on August 14, 1948.

IFF SWALLOW *Petrochelidon pyrrhonota* (Vieillot)

STATUS.—*Breeding* (see fig. 35): Common in the Allegheny Mountain section; fairly common in the western part of the Ridge and Valley section (Allegheny County and western Washington County, east to Indian Springs); rare and local in the Piedmont section, the most recent records occurring in Baltimore and Harford Counties—including a colony found 20 miles north of Baltimore in 1924 (Kirkwood, 1925), 2 occupied nests between Glyndon and Shawan on June 5, 1948 (M. B. Meanley), and 2 nests at Norville in 1955 (O. W. Crowder); formerly common in Baltimore and Harford Counties and occurring in Frederick County (F. C. Kirkwood); formerly occurred sparingly in the District of Columbia (Coues and Prentiss, 1861), and in Prince Georges County near Hyattsville—a colony of 15 pairs in 1898 (E. J. Court). *Transient*: Common in the Allegheny Mountain section; fairly common in the Ridge and Valley section; uncommon in the Piedmont, Upper Chesapeake, and Western Shore sections; rare in the Eastern Shore section.

HABITAT.—*Breeding*: Open country, usually in the vicinity of unpainted barns. *Transient*: Open country generally, frequently near water.

NESTING SEASON.—Early May to late July (nesting peak, late May to early July). Nest-building was recorded as early as May 1953, in Garrett County (M. Taylor), and May 12, 1902, in Baltimore County (F. C. Kirkwood). *Extreme egg dates* (10 colonies): May 22, 1898, in Prince Georges County (E. J. Court) and June 17, 1883, in Harford County (F. C. Kirkwood). *Extreme hatching dates* (9 colonies): June 17, 1883, in Harford County and July 27, 1902, in Baltimore County (F. C. Kirkwood).

SPRING MIGRATION.—*Normal period*: April 20–30 to May 15–25; peak, May 1 to May 15. *Extreme arrival dates*: April 6, 1952, in Charles County (M. C. Crone); April 10, 1887 (A. K. Fisher), April 10, 1908 (W. W. Cooke), and April 10, 1916 (L. D. Miner), in the District of Columbia; April 13, 1930, in Baltimore County (F. C. Kirkwood). *Extreme departure dates*: June 4, 1883, in the District of Columbia (H. W. Henshaw); May 31, 1903, in Baltimore County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: July 1–10 to September 5–15; peak, July 10 to September 5. *Extreme departure dates*:

September 23, 1950, along the boundary between Frederick and Washington Counties (M. W. Goldman); September 17, 1929, Baltimore County (F. C. Kirkwood); September 16, 1944, Prince Georges County.

MAXIMUM COUNTS.—*Spring*: 36 at Patuxent Refuge on May 12, 1945; 35 near Seneca, Montgomery County, on May 8, 1948. *Fall*: 1,500 on the Patapsco River marsh on September 15, 1894 (F. C. Kirkwood); 1,000 in Long Green Valley, Baltimore County, on July 11, 1909 (F. C. Kirkwood); "hundreds" in Garrett County, on August 14, 1903 (G. Eifrig).

PURPLE MARTIN *Progne subis* (Linnaeus)

STATUS.—*Breeding*: Common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Piedmont section; uncommon elsewhere. *Transient*: Fairly common in all sections (abundant during the fall flight in the District of Columbia—see Oberholser, 1917b and Cooke, 1929).

HABITAT.—Open country, frequently near water (in the vicinity of martin houses during breeding season).

NESTING SEASON.—Late April to late August (nesting peak mid-May to mid-July). Nest-building was recorded as early as April 28, 1949, in Caroline County (A. J. Fletcher). *Extreme egg dates* (20 colonies): May 29, 1894, and July 9, 1895, in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (79 nests): June 12, 1894, in Worcester County (Kirkwood, 1895) and August 24, 1951, in Caroline County (A. J. Fletcher).

SPRING MIGRATION.—*Normal period*: March 25–April 5 to May 10–20; peak, April 5 to April 25. *Extreme arrival dates*: March 1, 1940, in St. Marys County (R. C. McClanahan); March 13, 1952, in Caroline County (R. Maloney); March 13, 1953, in Washington County (R. S. Stauffer). *Extreme departure dates*: May 26, 1888, in the District of Columbia (C. W. Richmond); May 24, 1942, in Prince Georges County.

FALL MIGRATION.—*Normal period*: July 1–10 to September 1–15; peak, July 15 to September 1. *Extreme arrival date*: June 2, 1919, in the District of Columbia (M. J. Pellew). *Extreme departure dates*: October 15, 1893, in Baltimore County (F. C. Kirkwood); October 12, 1911, in the District of Columbia (F. G. Heaton); October 11, 1936, in Anne Arundel County (E. A. McGinity).

MAXIMUM COUNTS.—*Spring*: 40 at Patuxent Refuge on April 6, 1944; 30 at Magnolia, Harford County, on April 4, 1895 (F. C.

(Kirkwood). *Fall*: 100,000 in the District of Columbia during the bird week in July 1947; 3,000 near Riverview, Baltimore County, on September 12, 1908 (F. C. Kirkwood); 2,000 on Coaches Island, Talbot County, on August 30, 1952 (Judge and Mrs. W. L. Henderson); 1,500 at Cambridge, Dorchester County, on August 1, 1947 (I. R. Barnes).

BANDING.—One bird, banded as a juvenal near Laurel, Prince Georges County, on July 1, 1945, was recovered in the District of Columbia on July 27, 1950.

Family CORVIDAE

BLUE JAY *Cyanocitta cristata* (Linnaeus)

STATUS.—*Breeding*: Fairly common in the Allegheny Mountain, Ridge and Valley, Piedmont, Upper Chesapeake, and Western Shore sections; uncommon in the Eastern Shore section. *Transient*: Common in the Allegheny Mountain, Ridge and Valley, Piedmont, Upper Chesapeake, and Western Shore sections; uncommon in the Eastern Shore section. *Wintering*: Fairly common in the Piedmont, Upper Chesapeake, and Western Shore sections; uncommon in the Allegheny Mountain, Ridge and Valley, and Eastern Shore sections.

HABITAT.—Various types of forests, wood margins, and hedge-rows.

NESTING SEASON.—Early April to mid-August (nesting peak, late April to mid-June). Nest-building was recorded as early as April 1, 1945, in Prince Georges County (E. Ediger). *Extreme egg dates* (46 nests): April 12, 1929, in Baltimore County (J. Sommer) and July 26, 1925, in the District of Columbia (K. Baird). *Extreme nestling dates* (60 nests): May 8, 1943, in the District of Columbia (Fr. F. Kekich) and August 16, 1951, in Baltimore County (E. Willis).

SPRING MIGRATION.—*Normal period*: April 15–25 to May 15–25; peak, April 25 to May 15. *Extreme arrival date*: April 8, 1954, in Prince Georges County. *Extreme departure date*: May 27, 1888, in the District of Columbia (C. W. Richmond).

FALL MIGRATION.—*Normal period*: September 5–15 to November 1–10; peak, September 25 to October 20. *Extreme arrival date*: September 3, 1944, in Baltimore County (H. Brackbill). *Extreme departure date*: November 12, 1945, in Prince Georges County.

BREEDING POPULATION DENSITIES (pairs per 100 acres).—5 (4.2 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam,

river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946).
 5 (2 in 44½ acres) in river bluff forest (beech, white oak, scarlet oak) in Prince Georges County in 1944 and 1945 (J. W. Aldrich, A. J. Duvall).
 4 (1.5 in 40 acres) in "mixed oak forest" (white, scarlet, and chestnut oak, etc.) in Baltimore County in 1948 (Kolb, et al., 1948); 3 (1 in 40 acres) in 1949 (Kolb, 1949a) and 1950 (Kolb, 1950); 3 (1 in 37 acres) in 1951 (Kolb and Cole, 1951) and in 1952 (Kaufmann, et al., 1952).

MAXIMUM COUNTS.—*Spring*: 597 at Laurel, Prince Georges County, on May 5, 1955; 346 in the District of Columbia and adjacent Montgomery County on May 10, 1952 (P. A. DuMont, et al.); 200 near Emmitsburg, Frederick County, on April 27 and again on April 28, 1954 (J. W. Richards); 134 at Patuxent Refuge on May 6, 1950; 100 over the Gunpowder River marsh on May 7, 1900 (F. C. Kirkwood). *Fall*: 862 in one-half hour, migrating along the fall line in Prince Georges County on September 29, 1954; 532 in 1½ hours along the fall line in Montgomery County on October 5, 1955 (K. A. Goodpasture); 500 in the Gunpowder River area on October 2, 1902 (F. C. Kirkwood); 150 in Baltimore County on October 4, 1898, and October 30, 1901 (F. C. Kirkwood). *Winter* (Christmas counts): 326 in the Catoclin Mountain area in Frederick County on December 30, 1951; 324 in the Triadelphia Reservoir area on December 24, 1955; 246 in the Annapolis area on January 2, 1955; 246 in the District of Columbia area on January 1, 1955; 237 at Patuxent Refuge on January 12, 1951; 89 in Garrett County on December 31, 1954; 72 in southern Dorchester County on December 28, 1953.

BANDING.—See figure 36.

[BLACK-BILLED MAGPIE] *Pica pica* (Linnaeus)

STATUS.—Hypothetical. This western species has been recorded from St. Marys (June 28, 1931), Frederick (August 1950 to January 2, 1951), Allegany (December 23, 1950), and Montgomery (July 3 to December 18, 1952) Counties. Two of the birds, those in Frederick and Montgomery Counties, later proved to be escaped cage birds, and there is no assurance that the other 2 had not also been transported here in captivity.

COMMON RAVEN *Corvus corax* Linnaeus

STATUS.—Uncommon and local resident in the Allegheny Mountain, and Ridge and Valley sections (formerly more numerous, but increasing in recent years). This species also occurs as a rare visitor in the Piedmont section—records in this area are as follows: Montgomery County, 1 seen near Woodside on January 9, 1949 (J. H. Fales), 1 seen near Rockville on July 4, 1938 (W. H.



FIGURE 36.—Blue Jay banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid circle = recovered June through August; solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August; open triangle = banded September through May.

Lawrence), and 2 seen near Unity on April 10, 1949 (S. H. Low); Baltimore County, 1 shot at Sunnybrook on November 8, 1922 (Kirkwood, 1930), 1 seen on the Back River Road on February 11, 1930 (F. C. Kirkwood, J. Sommer), and 1 seen at White Mars on October 12, 1951 (C. D. Hackman); District of Columbia, 1 seen on December 29, 1952 (A. Wetmore). A few other records from the Piedmont section were found to be birds that had escaped from captivity.

HABITAT.—Usually on the higher ridges and in the vicinity of cliffs.

NESTING SEASON.—A pair found in Garrett County at Finzel during the summer of 1899 was reported to have nested there for several years (Preble, 1900), and an occupied nest was found there on May 15, 1903 (Eifrig, 1904). In Allegany County, about 25 pairs were found nesting in a colony at Rocky Gap, 6 miles east of Cumberland (Eifrig, 1904), and on May 15, 1902, several were observed carrying food there (G. Eifrig). A nest containing nearly full-grown young was observed on March 28 and April 4, 1904, on Will's Mountain at the Narrows, a mile northwest of Cumberland (Eifrig, 1905). Three young were banded in an Allegany County nest on May 7, 1950 (S. F. Sigwald).

COMMON CROW *Corvus brachyrhynchos* Brehm

STATUS.—*Breeding and transient:* Common in all sections. *Wintering:* Abundant in the Piedmont section, in the eastern part of the Ridge and Valley section (Hagerstown Valley in Washington County), and in or near the tidewater areas of the Eastern Shore section; common elsewhere in the Eastern Shore section and in the Upper Chesapeake and Western Shore sections; fairly common in the western part of the Ridge and Valley section (west of Hagerstown Valley); uncommon in the Allegheny Mountain section.

HABITAT.—Agricultural lands and adjacent woodland.

NESTING SEASON.—Early March to early June (nesting peak late March to mid-May). *Extreme egg dates* (243 nests): March 13, 1888, in Baltimore County (W. N. Wholey) and May 20, 1900 in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (73 nests): April 7, 1917, in Dorchester County (R. W. Jackson) and June 10, 1948, in Montgomery County.

SPRING MIGRATION.—*Normal period:* February 1–10 to April 10–20; peak, February 20 to March 20.

FALL MIGRATION.—*Normal period:* September 10–20 to November 20–30; peak, October 20 to November 20.

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

- 6 (16 in 2,656 acres) in mixed forest and brush habitats (both pine and deciduous) with small scattered agricultural areas and abandoned fields, near the boundary between Anne Arundel and Prince Georges Counties in 1943.
- 1 (9 in 11,520 acres) in "general farm land" (various agricultural habitats, chiefly hayfields and pastures, with little cover owing to widespread clean-farming practices) in Frederick County in 1950 (Stewart and Meanley, 1950).

MAXIMUM COUNTS.—*Winter*: 200,000 in a roost in the District of Columbia during the winter of 1919-20 (Oberholser, 1920); 1,000 at Elliott Island, Dorchester County, on December 28, 1953 (J. W. Terborgh, et al.); 10,000 near Hampstead, Carroll County, on January 2, 1950 (Christmas count); 6,542 near St. Michaels, Talbot County, on December 29, 1954 (Christmas count).

BANDING.—One banded as a young bird in St. Marys County on July 26, 1939, was recovered in Montgomery County (letter of December 2, 1939), and an adult banded in Prince Georges County on June 18, 1947, was recovered in Anne Arundel County (about 12 miles from point of banding) on December 27, 1948. Two birds, recovered in Howard and Washington Counties in late fall and winter (November 14, January 7), had both been banded as juvenals in southeastern Quebec in late spring (May 15, June 7).

FISH CROW *Corvus ossifragus* Wilson

STATUS.—*Breeding* (see fig. 37): Fairly common in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; uncommon and local in the Piedmont, and Ridge and Valley sections (occurring in Frederick and Hagerstown Valleys). *Transient*: Common in the Eastern Shore section; fairly common in the Upper Chesapeake section and in the tidewater areas of the Western Shore section; uncommon elsewhere in the Western Shore section and in the Piedmont, and Ridge and Valley sections. *Wintering*: Uncommon in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare in the interior of these sections and in the Piedmont and Ridge and Valley sections.

HABITAT.—Wood margin, field, shore, and marsh habitats that are adjacent to tidewater; in the interior, also occurs sparingly in Frederick and Washington Counties in agricultural fields and field borders.

NESTING SEASON.—Late March to late June (nesting peak, late April to early June). *Extreme egg dates* (27 nests): March 30.

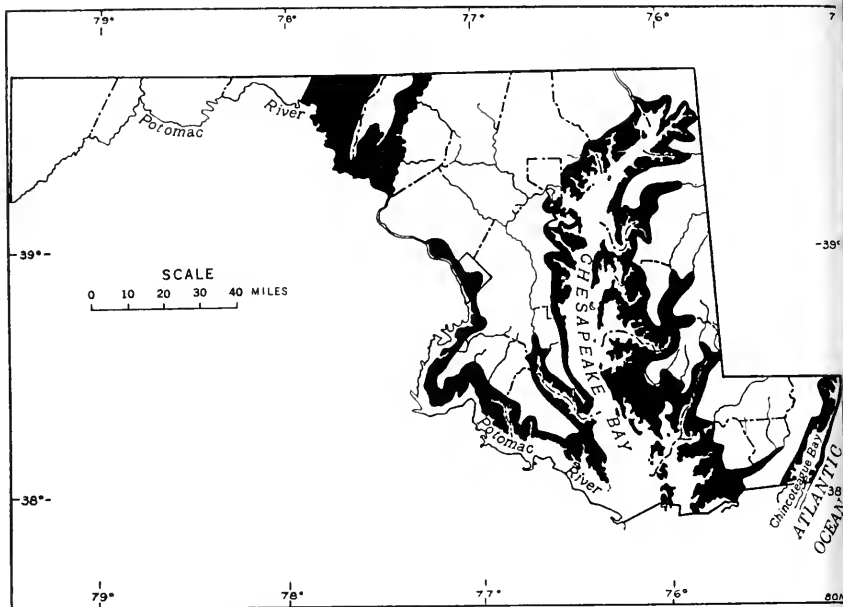


FIGURE 37.—Breeding range of Fish Crow.

1864, in Montgomery County, near the District of Columbia line (USNM—T. B. Rice) and June 8, 1894, in Worcester County (Kirkwood, 1895). *Extreme nestling dates* (4 nests): May 14, 1932, in Anne Arundel County (M. B. Meanley) and June 8, 1894, in Worcester County (Kirkwood, 1895).

SPRING MIGRATION.—*Normal period:* February 1–10 to May 1–10; peak, March 1 to April 15.

FALL MIGRATION.—*Normal period:* September 20–30 to December 15–25; peak, October 20 to December 10.

MAXIMUM COUNTS.—*Spring:* 250 at Allens Fresh, Charles County, on March 29, 1953 (J. W. Terborgh); 160 in Talbot County on April 2, 1946; 125 in Worcester County on April 7, 1946. *Fall:* 75 in southern Dorchester County on November 27, 1954; 50 in the District of Columbia on October 13, 1950 (I. R. Barnes). *Winter:* 200 in the District of Columbia on December 23, 1906 (W. L. McAtee); 175 at Pt. Lookout, St. Marys County, on December 23, 1938 (Christmas count); 103 at the Susquehanna Flats on December 20, 1947 (Christmas count).

Family PARIDAE

BLACK-CAPPED CHICKADEE *Parus atricapillus* Linnaeus

STATUS.—*Breeding* (see fig. 38): Common in the Allegheny

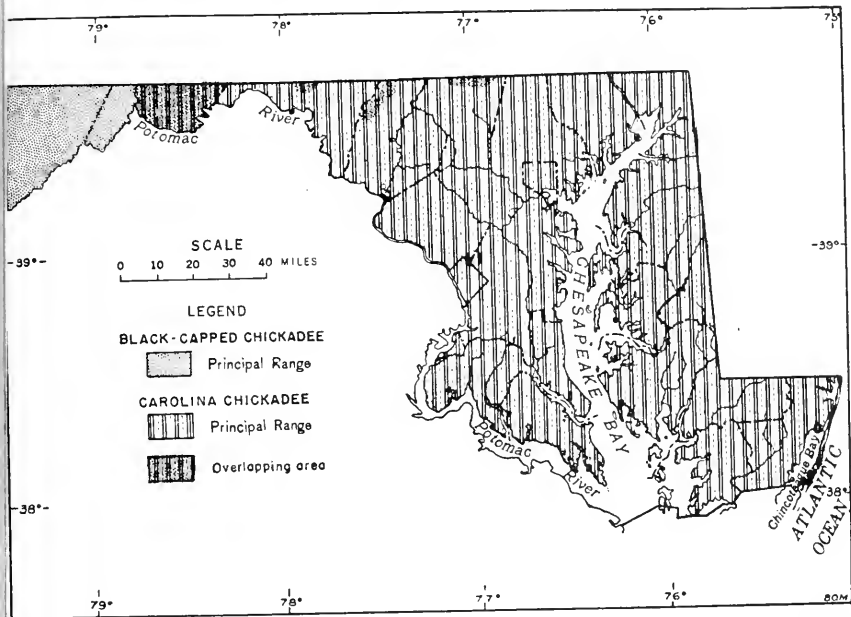


FIGURE 38.—Breeding ranges of Black-capped Chickadee and Carolina Chickadee.

Mountain section; fairly common in the western part of the Ridge and Valley section (Allegany County); rare and local in the eastern part of the Ridge and Valley section and in the northern part of the Piedmont section (occurring near the Pennsylvania line in Carroll County and on the higher ridges of Washington and Frederick Counties). *Transient and wintering*: Common in the Allegheny Mountain section and in the western part of the Ridge and Valley section (Allegany County); uncommon in the eastern part of the Ridge and Valley section and in the northern part of the Piedmont section (most numerous in the mountains and along the Potomac River in Washington and Frederick Counties and in the tier of counties along the Pennsylvania State line); rare and irregular (fairly common in flight years) elsewhere in the Piedmont, Upper Chesapeake, Western Shore, and Eastern Shore sections—much more numerous than usual during the winter of 1884–85 in Baltimore County (A. H. Jennings) and the District of Columbia (Palmer, 1885), and during the winter of 1954–55 throughout the State.

HABITAT.—Various forest and wood margin types; in winter shows a greater preference for weedy fields and pine stands than does the Carolina Chickadee.

NESTING SEASON.—In Garrett County an occupied nest was found on May 29, 1949, and nest-building was observed on June 26, 1949. *Extreme nestling dates* (3 nests): June 12, 1955 (J. R. Worthley), and June 17, 1955 (Dr. and Mrs. J. R. Travis), all in Garrett County.

PERIOD OF OCCURRENCE OUTSIDE OF BREEDING AREAS.—*Extreme arrival dates*: October 15, 1892, and October 15, 1893, in Baltimore County (F. C. Kirkwood); October 22, 1954, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); October 23, 1954, in Baltimore County (C. M. Buchanan); October 24, 1954, in Prince Georges County; October 24, 1896, in the District of Columbia (USNM—W. Palmer). *Occurrence peak*: November 1 to March 1. *Extreme departure dates*: May 8, 1955, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); May 6, 1955, in Baltimore County (S. W. Simon); April 24, 1955, in Prince Georges County; April 23, 1885, in the District of Columbia (USNM—A. H. Jennings).

MAXIMUM COUNTS.—*Spring*: 25+ near Oakland, Garrett County, on March 14, 1953 (K. F. Sanders, H. E. Slater). *Winter* (Christmas counts during flight year, 1954-55): 173 in the District of Columbia area on January 1, 1955; 158 in Garrett County on December 31, 1954; 138 in the Catoclin Mountain area in Frederick and Washington Counties on January 1, 1955; 14 in the St. Michaels area, Talbot County, on December 29, 1954; 12 in the Ocean City area on December 27, 1954. *Winter* (Christmas counts during other years): 104 in Allegany County on December 31, 1949; 85 in the Catoclin Mountain area, Frederick County, on January 2, 1950; 7 near Perry Point, Cecil County, on December 27, 1952.

BANDING.—One banded in north-central Connecticut on January 13, 1925, was recovered in Baltimore County on April 12, 1930.

CAROLINA CHICKADEE *Parus carolinensis* Audubon

STATUS.—Permanent resident (see fig. 38). Common in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Piedmont section and the eastern part of the Ridge and Valley section (Frederick and Washington Counties); uncommon in Allegany County.

HABITAT.—Various forest and wood margin types.

NESTING SEASON.—Mid-March to late June (nesting peak, mid-April to late May). Nest-building was observed in Montgomery County as early as March 18, 1950 (W. B. Tyrrell). A female

with an egg nearly ready to be laid was collected in the District of Columbia on April 11, 1888 (Cooke, 1929). *Extreme egg dates* (47 nests): April 16, 1913, in Dorchester County (Jackson, 1941) and May 29, 1950, in Prince Georges County. *Extreme nestling dates* (45 nests): April 30, 1949, and June 29, 1944, both in Prince Georges County. Young not long out of the nest were observed on July 23, 1893 (Kirkwood, 1895).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

(7 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1951; 6 (5 in 80 acres) in 1949; 5 (4 in 80 acres) in 1948, 1952, and 1953 (Trever, 1952; Clagett, 1952 and 1953); 4 (3½ in 80 acres) in 1954 (Wright, 1955).

(2 in 32¼ acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1944; 5 (4.3 in 85 acres) in other areas of this habitat in 1945 (Stewart, et al., 1946).

(1.5 in 28 acres) in partially opened flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).

(1.5 in 30 acres) in "damp deciduous scrub with standing dead trees" (burned-over, poorly drained upland forest) in Prince Georges County in 1948 (Oresman, et al., 1948).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 816 in the District of Columbia area on January 1, 1955; 508 in the Ocean City area on December 27, 1954; 372 in the Annapolis area on January 1, 1956; 347 in the St. Michaels area, Talbot County, on December 29, 1955; 219 at Patuxent Refuge on January 12, 1950; 185 in southern Dorchester County on December 28, 1953.

OREAL CHICKADEE *Parus hudsonicus* Forster

STATUS.—Accidental visitor. One was seen near Rockville, Montgomery County, on December 12 (P. G. DuMont, K. Stecher) and was collected (USNM) at the same location on December 19, 1954 (Stecher, 1955). On January 25, 1955, 1 was seen at the feeding station of Mrs. H. W. Smith in Cumberland, and at about the same time another was seen, also in Cumberland (fide N. Livingston).

RUFTED TITMOUSE *Parus bicolor* Linnaeus

STATUS.—Permanent resident. Common in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections; fairly common in the Ridge and Valley section; uncommon in the Allegheny Mountain section.

HABITAT.—Various types of deciduous forest.

NESTING SEASON.—Mid-March to mid-July (nesting peak, mid-April to early June). Nest-building was recorded as early as

March 14, 1939, in Montgomery County (W. B. Tyrrell). *Extreme egg dates* (73 nests): April 14, 1946, in Montgomery County (J. N. Hamlet) and June 26, 1918, in Dorchester County (Jackson, 1941). *Extreme nestling dates* (36 nests): May 1914, in Prince Georges County (A. Wetmore) and July 10, 1951, in Caroline County (M. W. Hewitt). Young not long out of the nest were recorded on August 3, 1919 (Cooke, 1929), and on August 4, 1894 (Kirkwood, 1895).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

- 13 (11 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946); 12 (432¼ acres) in another area of the same habitat in 1944.
- 13 (3 in 23¾ acres) in upland oak forest (white, scarlet, and black oaks) in Prince Georges County in 1944.
- 12 (10 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1951; 6 (5 in 80 acres) in 1948, 1949, 1953, and 1954 (Trever, 1952; Clagett, 1953; Wright, 1955); only 2 pairs were present in 1952 (Clagett, 1952).
- 11 (4 in 37 acres) in "mixed oak forest" (white, scarlet, and chestnut oak etc.) in Baltimore County in 1951, 1952, and 1953 (Kolb and Cole, 1951; Kaufmann, et al., 1952; Cole and Kolb, 1953); 6 (2.5 in 40 acres) in 1948 (Kolb, et al., 1948); 5 (2 in 40 acres) in 1949 and 1950 (Kolb, 1949a and 1950).
- 11 (2 in 18¾ acres) in "second growth river swamp" (red maple, sweetgum, black gum, etc. with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).
- 10 (3.5 in 36 acres) in "central hardwood deciduous forest" (white oak, tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
- 9 (4 in 44¾ acres) in river bluff forest (beech, white oak, and scarlet oak) in Prince Georges County in 1945; 7 (3 in 44¾ acres) in 1944 (J. V. Aldrich, A. J. Duvall).
- 7 (2 in 28 acres) in partially opened flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 6 (2 in 32½ acres) in pine-oak forest (pitch pine, scrub pine, and Spanish oak) in Prince Georges County in 1944.
- 6 (1.5 in 24½ acres) in river terrace forest (beech-white oak) in Prince Georges County in 1944.

MAXIMUM COUNTS.—*Winter* (Christmas counts): 476 in the District of Columbia area on December 31, 1955; 290 in the Ocean City area on December 27, 1954; 217 in the Annapolis area on January 1, 1956; 180 on Patuxent Refuge on December 28, 1945; 112 in the Catocin Mountain area in Frederick and Washington Counties on January 2, 1954; 92 in southern Dorchester County on December 28, 1955; 84 in Allegany County on December 31, 1949.

Family SITTIDAE

WHITE-BREADED NUTHATCH *Sitta carolinensis* Latham

STATUS.—*Breeding* (see fig. 39): Fairly common in the Allegheny Mountain and Piedmont sections; fairly common locally in the Eastern Shore and Western Shore sections (most numerous in the swamp along the Pocomoke River and its tributaries, and in the Greensand District of east-central Prince Georges County—see Harper, 1918; rare and irregular elsewhere); uncommon in the Ridge and Valley section; rare or absent in the Upper Chesapeake section. *Transient and wintering*: Usually fairly common in all sections, but varying considerably in abundance from year to year.

HABITAT.—Flood-plain and swamp forests; and moist deciduous forest types on the upland.

NESTING SEASON.—Late March to mid-July (nesting peak, mid-April to late May). Nest-building was recorded as early as March 31, 1894, in Baltimore County (P. T. Blogg). *Extreme egg dates* (11 nests): April 7, 1894, in Baltimore County (P. T. Blogg) and May 17, 1881, in Washington County (Small, 1881b). *Extreme nestling dates* (11 nests): April 30, 1948, in the District of Columbia (T. W. Donnelly) and June 10, 1956, in Garrett

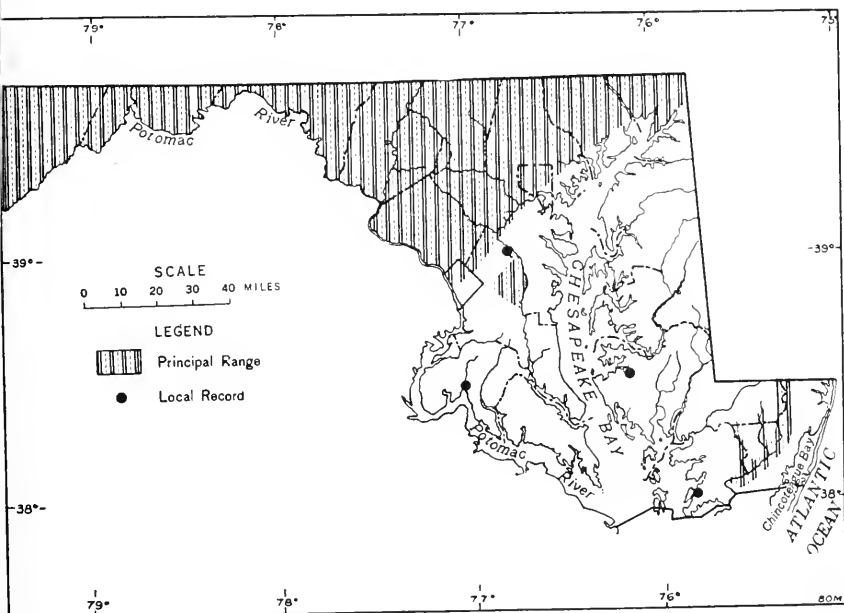


FIGURE 39.—Breeding range of White-breasted Nuthatch.

County (G. Knight). Nest-building was recorded as late as June 1, 1935, in Allegany County (L. M. Llewellyn). Kirkwood (1895) recorded young just out of the nest as late as July 20, 1894.

SPRING MIGRATION.—*Normal period*: February 25–March 5 to April 25–May 5; peak, March 5 to April 10.

FALL MIGRATION.—*Normal period*: September 15–25 to November 1–10; peak, October 10 to November 1. As early as the first week in July there frequently is a light movement of White-breasted Nuthatches into areas that are within 5 or 10 miles of their nesting range.

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

- 6 (2 in 36 acres) in "virgin central hardwood forest" (white oak–tulip–poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
- 6 (5 in 80 acres) in "central hardwood forest (oaks–tulip–poplar) with scattered pine" in the District of Columbia in 1948; 5 (4 in 80 acres) in 1951, 3 (2.5 in 80 acres) in 1949 (Trever, 1952); and 2.5 (2 in 80 acres) in 1952 and 1953 (Clagett, 1952 and 1953).
- 5 (2 in 40 acres) in "mixed oak forest" (white, scarlet, and chestnut oak etc.) in Baltimore County in 1949 (Kolb, 1949a); 5 (2 in 37 acres) in 1951, 1952, and 1953 (Kolb and Cole, 1951; Kaufmann, et al., 1952; Cole and Kolb, 1953); 3 (1 in 40 acres) in 1948 (Kolb, et al., 1948) and in 1950 (Kolb, 1950).
- 5 (1.5 in 28 acres) in partially opened flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 188 in the District of Columbia area on January 1, 1955; 71 at Patuxent Refuge on January 14, 1952; 71 in the Catoclin Mountain area on December 30, 1951; 36 near Chase, Baltimore County, on December 29, 1951; 25 in southeastern Worcester County on December 22, 1947; 22 in Garrett County on December 31, 1954

RED-BREASTED NUTHATCH *Sitta canadensis* Linnaeus

STATUS.—*Breeding* (?): Rare and irregular in the Allegheny Mountain section. "A small flock of these birds, evidently a family, was seen on the branches of a tall dead tree, in the deep woods near Bittinger [during the period June 17–July 24, 1899]. It was also seen near Finzel about the middle of May when it was undoubtedly breeding" (Preble, 1900). A singing male was observed along the Youghiogheny River on June 4, 1919 (J. M. Sommer), and this species has also been referred to as nesting along the Youghiogheny River by Brooks (1937). Brooks reports that 1 was seen in the Maryland portion of Cranesville Swamp in June, 1932. *Transient and wintering*: Of irregular occurrence in all sections but usually most numerous in the Piedmont and

Western Shore sections. This species is very erratic in its movements and extremely variable in abundance from year to year, ranging from being entirely absent to locally common. *Summer migrant*: One was seen in Prince Georges County on July 22, 1943 (Stewart, et al., 1952).

HABITAT.—*Breeding*: Stands of red spruce and hemlock. *Transient and wintering*: Most numerous in stands of pine, particularly scrub pine and pitch pine; also occurs occasionally in various deciduous forest types.

SPRING MIGRATION.—*Normal period*: March 5–15 to May 5–15; peak, March 20 to April 10. *Extreme departure dates*: May 23, 1949, in Prince Georges County; May 18, 1886 (H. M. Smith), and May 18, 1913 (J. H. Riley), in the District of Columbia.

FALL MIGRATION.—*Normal period*: September 1–10 to October 5–November 5; peak, September 20 to October 20. *Extreme arrival dates*: August 22, 1903, in the District of Columbia (W. L. McAtee); August 30, 1948, in Prince Georges County; August 1, 1918, in Montgomery County (R. W. Moore).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 109 in the District of Columbia area on January 1, 1955; 58 at Patuxent Refuge on January 14, 1952; 36 near Denton, Caroline County, on January 1, 1955; 24 in the Ocean City area on December 27, 1954; 23 at Point Lookout, St. Marys County, on December 22, 1937.

BROWN-HEADED NUTHATCH *Sitta pusilla* Latham

STATUS.—Permanent resident (see fig. 40). Common in the tidewater areas of Somerset, Wicomico, Dorchester, and Talbot Counties, and locally in the coastal area of Worcester County; fairly common in the tidewater areas of southern St. Marys County; uncommon and local in the tidewater areas of Queen Annes County and southern Calvert County.

HABITAT.—Open stands of loblolly pine near tidewater (usually at the margins of tidal marshes).

NESTING SEASON.—Early April to mid-June. *Extreme egg dates* (7 nests): April 15, 1931, in St. Marys County (E. J. Court) and May 7, 1920, in Dorchester County (Jackson, 1941). *Extreme nestling dates* (4 nests): May 5, 1925, in Talbot County (R. W. Jackson) and June 10, 1896, in Somerset County (F. C. Kirkwood). Kirkwood (1895) also recorded a pair building a nest in Queen Annes County as late as May 25, 1892.

MAXIMUM COUNTS.—*Winter*: 214 in southern Dorchester County on December 28, 1953 (Christmas count); 130 in the St.

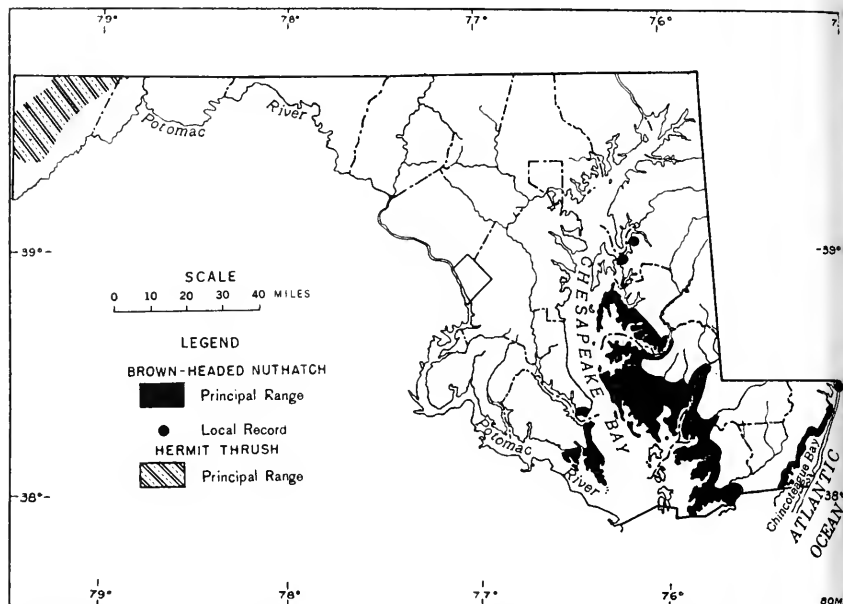


FIGURE 40.—Breeding ranges of Brown-headed Nuthatch and Hermit Thrush.

Michaels area, Talbot County, on December 29, 1955 (Christmas count); 127 along the western shores of Sinepuxent and Newport Bays on December 27, 1953 (Ocean City Christmas count); 70 at Point Lookout, St. Marys County, on January 31, 1954 (J. W. Terborgh, et al.).

Family CERTHIIDAE

BROWN CREEPER *Certhia familiaris* Linnaeus

STATUS.—*Breeding* (?): Possibly nests occasionally in the Allegheny Mountain section—a female was collected in Garrett County at Bittinger on June 28, 1899 (Preble, 1900). This species has been found during the nesting season in the West Virginia portion of Cranesville Swamp (Brooks, 1936c). *Transient and wintering*: Fairly common in all sections. *Summer vagrant*: A singing bird was observed on Patuxent Refuge, Prince Georges County, on June 2, 1944 (Stewart, et al., 1952); 1 was observed near Pikesville, Baltimore County, on July 22, 1949 (I. K. Kuch); 1 was recorded at Gibson Island, Anne Arundel County, on August 30, 1953 (Mrs. W. L. Henderson).

HABITAT.—Various types of deciduous and coniferous forests.

SPRING MIGRATION.—*Normal period*: March 15–25 to April 20–30; peak, March 25 to April 15. *Extreme departure dates*:

May 13, 1930, in Baltimore County (W. Marshall); May 12, 1951, in Montgomery County (C. N. Mason, K. Niles); May 8, 1954, in Caroline County (N. W. Hewitt).

FALL MIGRATION.—*Normal period*: September 25–October 5 to November 10–20; peak, October 15 to November 10. *Extreme arrival dates*: September 11, 1911, in Montgomery County (R. V. Moore); September 14, 1913, in Baltimore County (J. M. Sommer).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 87 in the District of Columbia area on January 1, 1955; 58 in the Ocean City area on December 27, 1954; 48 at Patuxent Refuge on January 14, 1952; 31 in southern Dorchester County on December 8, 1955; 21 in the Catoctin Mountain area of Frederick and Washington Counties on January 2, 1954.

Family TROGLODYTIDAE

HOUSE WREN *Troglodytes aedon* Vieillot

STATUS.—*Breeding and transient*: Common in all sections. *Wintering*: Uncommon in Worcester County; rare in Somerset, Wicomico, Dorchester, and St. Marys Counties; casual elsewhere—recorded in Prince Georges County on February 11, 1953 (L. W. Oring), in Baltimore County on December 11, 1948 (H. Kolb), December 16, 1928 (J. M. Sommer), December 30, 1952–January 2, 1953, and January 3, 1954 (E. Willis), in Frederick County on December 27, 1952 (Mrs. J. W. Richards), in Charles County on January 30, 1954 (J. W. Terborgh, R. R. Kerr).

HABITAT.—Various edge habitats, including brushland, wood margins, hedgerows, orchards, and residential areas.

NESTING SEASON.—Early May to early September (nesting peak, mid-May to late July). *Extreme egg dates* (248 nests): May 3, 1946, in Prince Georges County and August 12, 1947, in Prince Georges County (E. G. Cooley). *Extreme nestling dates* (317 nests): May 22, 1945, in Prince Georges County (E. G. Cooley) and September 2, 1919, in Baltimore County (W. Marshall).

SPRING MIGRATION.—*Normal period*: April 10–20 to May 10–20; peak, April 20 to May 5. *Extreme arrival dates*: March 26, 1910, in the District of Columbia (E. B. Gregg); March 26, 1950, in Montgomery County (P. A. DuMont); April 2, 1949, in Prince Georges County (E. G. Davis).

FALL MIGRATION.—*Normal period*: September 1–10 to October 10–20; peak, September 10 to September 25. *Extreme departure dates*: November 19, 1950, in the District of Columbia (T. D.

Burleigh); November 13, 1954, in Baltimore County (C. M. Buchanan).

BREEDING POPULATION DENSITIES (territorial males per 10 acres).—

- 100 (5 in 5 acres) in farmyard and orchard in Prince Georges County in 1948.
- 58 (13 in 22½ acres) in abandoned field saturated with nesting boxes in Prince Georges County in 1949.
- 50 (15 in 30 acres) in "damp deciduous scrub with standing dead trees" (burned-over poorly drained upland forest) in Prince Georges County in 1947 (Stewart, et al., 1947).
- 47 (7 in 15 acres) in abandoned farmyard in Prince Georges County in 1947.
- 15 (3 in 20 acres) in suburban-type residential area (including small orchard and large expanses of lawn) in Prince Georges County in 1942.
- 14 (3 in 22 acres) in "unsprayed apple orchard with infrequently mowed ground cover" in Worcester County in 1948 (Springer and Stewart 1948b).
- 11 (2 in 17½ acres) in "lightly sprayed apple orchard with rye planted a ground cover" in Worcester County in 1948 (Springer and Stewart 1948b).

MAXIMUM COUNTS.—*Spring*: 135 at Gibson Island, Anne Arundel County, on May 8, 1955 (Mrs. W. L. Henderson, Mrs. G. Tappan); 75 at Unity, Montgomery County, on May 9, 1953 (S. H. Low); 31 at Greenbelt, Prince Georges County, on May 9, 1953 (L. W. Oring, et al.). *Fall*: 13 at Patuxent Refuge on September 13, 1943. *Winter*: 4 in the Ocean City area on December 27, 1950 (Christmas count); 3 at Point Lookout, St. Marys County, on January 31, 1954 (R. R. Kerr, J. W. Terborgh).

BANDING.—One banded as a nestling at Unity, Montgomery County, on July 26, 1953, was recovered 15 miles away at Beltsville, Prince Georges County, on May 28, 1954.

WINTER WREN *Troglodytes troglodytes* (Linnaeus)

STATUS.—*Breeding*: Formerly locally common in the Allegheny Mountain section, occurring in Garrett County along the headwaters of the Casselman River in the valley between Negro and Meadow Mountains (Behr, 1914); they were last recorded in this area by Eifrig (1915 and 1920), who found a small colony during the summer of 1914; the only recent indication of this species breeding in Garrett County was 1 seen in summer in the Maryland portion of Cranesville Swamp (M. G. Brooks). *Transient*: Fairly common in all sections. *Wintering*: Locally common in the Eastern Shore section (most numerous along the Pocomoke River and its tributaries); fairly common in the Western Shore and Upper Chesapeake sections; uncommon in

, Piedmont, and Ridge and Valley sections; rare in the Allegheny Mountain section.

HABITAT.—*Breeding*: To be looked for in boreal types of forest that contain red spruce. *Transient and wintering*: Swamp and upland forests and rich, moist forests on the upland.

SPRING MIGRATION.—*Normal period*: March 25–April 5 to April 10–May 5; peak, April 10 to April 25. *Extreme departure dates*: May 10, 1950, in Prince Georges County; May 9, 1909, in Montgomery County (A. M. Stimson); May 9, 1950, in Baltimore County (A. A. Brandenburg).

FALL MIGRATION.—*Normal period*: September 25–October 5 to November 15–25; peak, October 10 to November 10. *Extreme arrival dates*: September 19, 1953, in Washington County (R. S. Scaffer); September 20, 1947, in Baltimore County (H. Kolb); September 21, 1901, in Allegany County (G. Eifrig); September 21, 1948, in Frederick and Prince Georges Counties.

MAXIMUM COUNTS.—*Spring*: 11 on April 27, 1950, on Patuxent Refuge. *Fall*: 10 on October 27, 1943, on Patuxent Refuge. *Winter (Christmas counts)*: 68 in the Ocean City area on December 27, 1954; 47 in southeastern Worcester County on December 23, 1946; 33 in southern Dorchester County on December 28, 1953; 33 in the District of Columbia area on January 1, 1955; 26 in the Annapolis River area in Charles and St. Marys Counties on January 1, 1954; 19 at Patuxent Refuge on December 29, 1944; 13 in the Catoctin Mountain area in Frederick and Washington Counties on January 2, 1954; 5 in Garrett County on December 29, 1954.

BANDING.—One banded in southeastern Massachusetts on October 10, 1940, was recovered in Somerset County on April 8, 1941.

BREWICK'S WREN *Thryomanes bewickii* (Audubon)

STATUS.—*Breeding* (see fig. 41): Fairly common in the western part of the Ridge and Valley section (east to Indian Springs); uncommon in the Allegheny Mountain section and in the eastern part of the Ridge and Valley section; casual in the Piedmont section—found nesting near Cooksville, Howard County, in 1949 (D. H. McIntosh), and at Millers, Carroll County, in 1954 (J. H. Worthley). *Transient*: Uncommon in the Ridge and Valley, and Allegheny Mountain sections; rare in the Piedmont section; casual in the Western Shore, Upper Chesapeake, and Eastern Shore sections—1 collected in Prince Georges County on April 8, 1944 (Stewart, et al., 1952), 1 seen in Baltimore County on

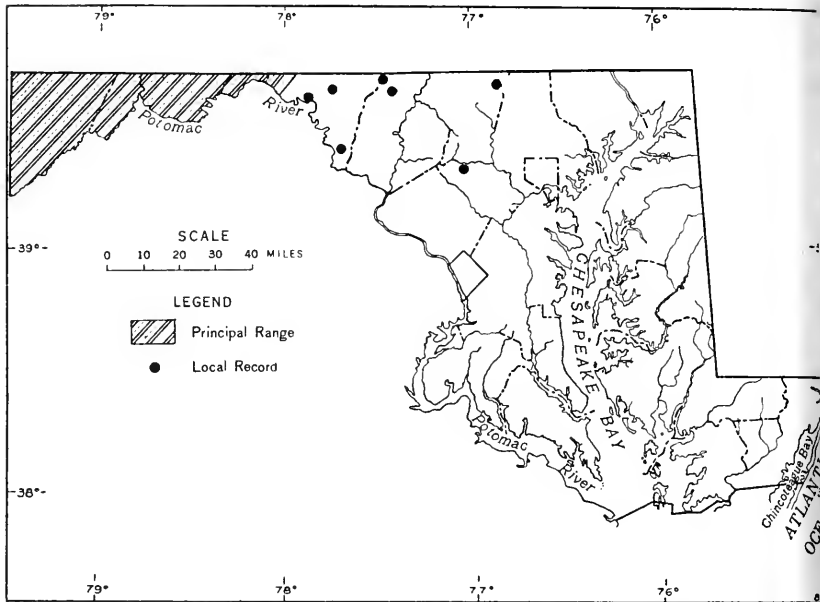


FIGURE 41.—Breeding range of Bewick's Wren.

April 16, 1950 (E. Willis), 1 seen in Worcester County on April 1948 (S. H. Low). *Summer vagrant*: Rare and irregular in the Piedmont section. *Wintering*: Casual—recorded in Worcester County in 1953 (J. E. Knudson), in Caroline County in 1954-5 (Mr. and Mrs. A. J. Fletcher), in Baltimore County in 1953-5 (Worthley, 1954), in Montgomery County in 1954 (S. W. Simon), R. P. Dubois), and in the District of Columbia in 1890 (C. V. Richmond).

HABITAT.—Various edge habitats in the vicinity of farm houses or in towns.

NESTING SEASON.—Late April to mid-July. *Extreme egg date* (8 nests): April 30, 1890, in Washington County (G. H. Gray) and June 26, 1907, in Allegany County (F. C. Kirkwood). *Extreme nestling dates* (10 nests): May 12, 1907 (young left nest) and July 13, 1907, both in Allegany County (F. C. Kirkwood).

SPRING MIGRATION.—*Normal period*: March 25–April 5 to April 25–May 5; peak, April 5 to April 25. *Extreme arrival date*: March 12, 1901, in Allegany County (G. Eifrig). *Extreme departure date*: May 9, 1953, in Montgomery County (S. H. Low).

FALL MIGRATION.—*Extreme arrival date*: September 9, 1928, in Montgomery County (H. H. T. Jackson). *Extreme departure dates*: November 23, 1954, in Washington County (Mrs. R. F.

een); November 22, 1953, in Montgomery County (T. W. Lewis).

ROLINA WREN *Thryothorus ludovicianus* (Latham)

STATUS.—Permanent resident. Common in the Eastern Shore and Western Shore sections; fairly common in the Upper Chesapeake, Piedmont, and Ridge and Valley sections; rare in the Catoctin Mountain section. Periodically, large numbers of this species are winter-killed; during subsequent years, a gradual build-up to usual population levels may be noted.

HABITAT.—Brushy swamps and flood-plain forests and rich, moist forests on the upland.

NESTING SEASON.—Late March to late September (nesting peak, mid-April to early July). Nest-building was recorded as early as March 22, 1954, in Baltimore County (E. Willis). *Extreme egg dates* (43 nests): April 5, 1949, in Baltimore County (I. K. Kuch) and August 10, 1893, in Baltimore County (Kirkwood, 1895). *Extreme nestling dates* (34 nests): April 25, 1926, in the District of Columbia (W. H. Ball) and September 26, 1955, in Baltimore County (M. R. Gatchell).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

(9 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1951, absent in 1948 and 1949 (Trever, 1952); also absent in 1952 and 1954, 1 pair in 1953 (Clagett, 1953).

(3 in 36 acres) in "virgin central hardwood deciduous forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).

(4.8 in 85 acres) in "well-drained flood-plain forest" (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946); 6 (2 in 32% acres) in another area of this habitat in 1944.

MAXIMUM COUNTS.—*Winter* (Christmas counts): 286 in the Ocean City area on December 27, 1954; 207 in the Annapolis area on January 2, 1955; 181 in the District of Columbia area on January 1, 1955; 148 in the St. Michaels area, Talbot County, on December 29, 1955; 55 in the Catoctin Mountain area on January 2, 1954.

LONG-BILLED MARSH WREN *Telmatodytes palustris* (Wilson)

STATUS.—*Breeding* (see fig. 4): Abundant in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sections. *Transient*: Abundant in the tidewater areas of the Eastern Shore, Western Shore, and Upper Chesapeake sec-

tions; uncommon elsewhere in all sections. *Wintering*: Fairly common in the tidewater areas of Somerset, Wicomico, and Dorchester Counties; uncommon in the tidewater areas elsewhere in the Eastern Shore and Western Shore sections; rare in the tidewater areas of the Upper Chesapeake section.

HABITAT.—In the salt marshes during the breeding season this species occurs in the greatest numbers in stands of needlerush but also occurs regularly in areas of salt-meadow grass and salt water cordgrass that contain scattered shrubs of marsh elder and sea myrtle. In brackish tidal marshes, this species is found abundantly in marshes of cattail, salt reed-grass and reed. It also occurs commonly in Olney three-square marshes, especially when scattered shrubs are present. Transients occur in large numbers in many types of tidal marsh, and are found sparingly in the interior marshes and marsh-meadows. Wintering birds are usually most common in stands of salt reed-grass.

NESTING SEASON.—Early May to late August (nesting peak early June to late July). *Extreme egg dates* (217 nests): May 1938, in St. Marys County (R. C. McClanahan) and August 1950, in Baltimore County (E. Willis). *Extreme nestling date* (78 nests): June 9, 1950, and August 24, 1952, both in Baltimore County (E. Willis).

SPRING MIGRATION.—*Normal period*: April 15–25 to May 10–20 peak, April 25 to May 10.

FALL MIGRATION.—*Normal period*: September 5–15 to October 25–November 5; peak, September 15 to October 15. *Extreme arrival date*: August 31, 1916, in the District of Columbia (Mr. and Mrs. L. D. Miner). *Extreme departure date*: November 1, 1926, in the District of Columbia (W. H. Ball).

BREEDING POPULATION DENSITIES (territorial males per 10 acres).—

104 (23.2 in 22¼ acres) in a uniform, nearly pure stand of "needlerush marsh" in Somerset County in 1948 (Springer and Stewart, 1948a).
36 (6 in 16½ acres) in "cattail marsh" (mostly narrow-leaved cattail with scattered swamp rose-mallow) in Calvert County in 1948 (Springer and Stewart, 1948a).

MAXIMUM COUNTS.—*Fall*: 50 in the Gunpowder River marsh on October 25, 1900 (F. C. Kirkwood). *Winter* (Christmas counts): 127 in southern Dorchester County on December 28, 1953; 27 in the Ocean City area on December 21, 1952.

SHORT-BILLED MARSH WREN *Cistothorus platensis* (Latham)

STATUS.—*Breeding* (see fig. 42): Common in the tidewater

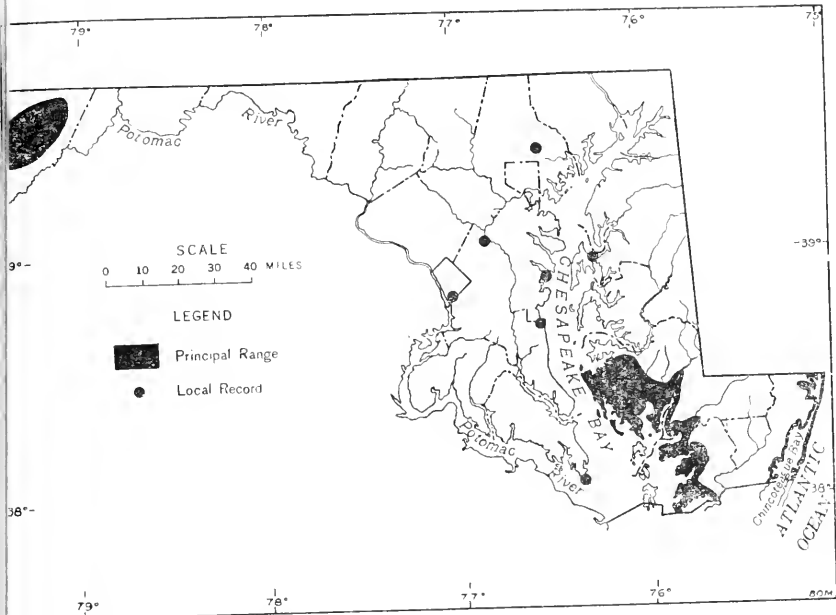


FIGURE 42.—Breeding range of Short-billed Marsh Wren.

areas of Somerset, Wicomico, and Dorchester Counties; uncommon in the tidewater areas elsewhere in the Eastern Shore and Western Shore sections; uncommon and local in the Allegheny Mountain section; rare and irregular in the interior of the Western Shore section and in the Piedmont section—recorded in summer from Baltimore County (F. C. Kirkwood, H. Kolb), Montgomery County (P. F. Springer), Prince Georges County (Stewart, et al., 1952), and Frederick County. *Transient*: Fairly common in the tidewater areas of the Eastern Shore section; rare elsewhere in all sections. *Wintering*: Common in the tidewater areas of Somerset, Wicomico, and Dorchester Counties; uncommon in the coastal area of Worcester County; rare in the tidewater areas of Talbot, Queen Annes, St. Marys, and Charles Counties.

HABITAT.—In the Eastern Shore and Western Shore sections, this species is most commonly found in switchgrass meadows situated along the inner margins of the tidal marshes; in the Allegheny Mountain section, the open sedge-meadows situated in boreal bogs are preferred. Other marsh types, including mixed brush-wet meadow areas of the barrier beaches, saltmarsh bulrush stands, and mixed stands of Olney three-square and salt-meadow grass are occasionally inhabited. This species also

occurs irregularly on the upland in orchard grass hayfields and pastures.

NESTING SEASON.—In the District of Columbia, 1 was seen that was apparently nest-building on May 26, 1935, and a cock nest was found on June 15, 1935 (Ball and Wallace, 1936). Other cock nests were found in this same area on June 25, 1935 (Ulke, 1935). At least 8 cock nests were found near Dam Quarter in Somerset County on June 20, 1952 (N. Hotchkiss and E. Miller). A nest containing heavily incubated eggs was found on June 25, 1935, in St. Marys County near Point Lookout (Wetmore, 1935). On September 13, 1896, a young bird was observed begging an adult for food in Dulaney Valley in Baltimore County (F. C. Kirkwood).

SPRING MIGRATION.—*Normal period:* May 1–5 to May 20–21; peak, May 5 to May 20. *Extreme arrival dates:* April 27, 1951, in Prince Georges County; April 30, 1929, in Montgomery County (W. H. Ball). *Extreme departure date:* June 8, 1948, in Prince Georges County.

FALL MIGRATION.—*Extreme dates:* September 23, 1951, in Charles County (M. C. Crone) and November 13, 1929, in Calvert County (Ball, 1930b). In Garrett County this species was reported to be fairly common during early September (M. C. Brooks).

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

10 (3 in 30 acres) in "switchgrass marsh-meadow" in Somerset County in 1948 (Springer and Stewart, 1948a).

MAXIMUM COUNTS.—*Spring:* 8 at Patuxent Refuge on May 9, 1953; 7 at White Marsh, Baltimore County, on May 9, 1953 (C. D. Hackman). *Fall:* 8 at Plum Point, Calvert County, on November 13, 1929 (Ball, 1930c). *Winter* (Christmas counts): 164 in southern Dorchester County on December 23, 1951; 35 in the Ocean City area on December 21, 1952.

Family MIMIDAE

MOCKINGBIRD *Mimus polyglottos* (Linnaeus)

STATUS.—Semi-permanent resident (slight migratory movement between September 10 and October 10). Common in the Western Shore and Eastern Shore sections; fairly common in the Upper Chesapeake section and in the southern part of the Piedmont section (Howard and Montgomery Counties); uncommon elsewhere in the Piedmont section and in the eastern part of the Ridge and Valley section (Frederick and Washington

counties); rare in the western part of the Ridge and Valley region (Allegany County) and in the Allegheny Mountain region.

Coues and Prentiss (1883) called the Mockingbird a rare summer resident at Washington, D. C., arriving on April 25 and departing in the middle of September. Kirkwood (1895) stated that in 1895, it was resident in the southern counties of Maryland and regular in summer as far north as Kent and Anne Arundel counties; in the remainder of the State, he considered it only a straggler, and he cited all known occurrences in the Baltimore area, including 2 nests with eggs at Towson in 1882. Starting in 1901 this species began a gradual increase in the Baltimore area, but it was not until 1905 in Washington, D. C., and 1908 in Baltimore County, that it began to be seen regularly throughout the year. The first nesting record for western Maryland was obtained in 1909 at Oldtown, Allegany County (Eifrig, 1909), and the first wintering bird was recorded in Allegany County in 1920-21 (Eifrig, 1921).

HABITAT.—Hedgerows, wood margins, and other edge habitats in the vicinity of residential and agricultural areas.

NESTING SEASON.—Early April to early September (nesting season, late April to mid-July). Nest-building was recorded in Prince Georges County as early as April 7, 1948 (A. C. Martin). *Extreme egg dates* (98 nests): April 10, 1945 (B. Hoyland), and August 21, 1954, both in Prince Georges County. *Extreme nesting dates* (103 nests): April 19, 1945, in Prince Georges County (B. Hoyland) and September 1, 1953, in Carroll County (D. H. McIntosh).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

(3 in 20 acres) in suburban-type residential area (including small orchards and large expanses of lawn) in Prince Georges County in 1951 and 1952; 10 (2 in 20 acres) in 1942.

(3 in 175 acres) in mixed agricultural habitats (including hedgerows and wood margins) in Prince Georges County in 1951.

MAXIMUM COUNTS.—*Winter* (Christmas counts): 278 in the Annapolis area on January 1, 1956; 179 in the Triadelphia reservoir area on December 24, 1955; 163 in the Washington, D. C., area on January 1, 1955; 137 in the St. Michaels area, Calvert County, on December 29, 1955; 70 in the Ocean City area on December 27, 1955; 33 in the Catoclin Mountain area of Frederick and Washington Counties on December 31, 1955.

BANDING.—Two young birds banded in Prince Georges County

in summer (June 7, July 9) were recovered in Anne Arundel and Baltimore Counties in May and September (both between 15 and 20 miles from the point of banding). One banded Anne Arundel County on September 12, 1954, was recovered north-central West Virginia on May 20, 1956.

CATBIRD *Dumetella carolinensis* (Linnaeus)

STATUS.—*Breeding and transient:* Common in all sections. *Wintering:* Uncommon in Worcester County and uncommon locally in Charles and St. Marys Counties; rare elsewhere in the Eastern Shore and Western Shore sections; casual in the Upper Chesapeake and Piedmont sections (see Cooke, 1929, and Brackbill, 1942—also other scattered records); accidental in the Ridge and Valley section—1 recorded at Cumberland on January 23, 1921 (Eifrig, 1921), and 1 seen at McCooles, Allegany County on December 21, 1947 (L. M. Llewellyn).

HABITAT.—Especially characteristic of shrub swamps and other brush areas on wet or moist sites; also in hedgerows and wood margins, and in edge habitats in residential areas.

NESTING SEASON.—Late April to late August (nesting peak late May to mid-July). Nest building was recorded as early as April 30, 1953, in Anne Arundel County (Mrs. W. L. Henderson). *Extreme egg dates* (589 nests): May 6, 1956, in Prince Georges County (E. C. Robbins) and August 17, 1950, in Baltimore County (E. Willis). *Extreme nestling dates* (298 nests): May 25, 1900, in the District of Columbia (Bartsch, 1900) and August 27, 1950, in Baltimore County (E. Willis).

SPRING MIGRATION.—*Normal period:* April 20–30 to May 15–20, peak, May 1 to May 15. *Extreme arrival dates:* April 14, 1953, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tapan); April 15, 1922, in the District of Columbia (L. D. Miner); April 15, 1938, in Prince Georges County (R. Overing); April 15, 1940, in Baltimore County (E. A. McGinity). *Extreme departure date:* May 31, 1914, in the District of Columbia (Oberholser, 1919).

FALL MIGRATION.—*Normal period:* September 1–10 to October 20–30. *Extreme departure dates:* December 1, 1955, in Frederick County (J. W. Richards); November 28, 1950, in Anne Arundel County (Mr. and Mrs. G. Englar); November 23, 1936, in Baltimore County (E. A. McGinity); November 20, 1949, in Prince Georges County.

BREEDING POPULATION DENSITIES (territorial males per 10 acres).—

- (10.4 in 13 acres) in shrub swamp (alder, poison sumac, sweet pepperbush, swamp rose, etc.) in Prince Georges County in 1945.
- (7 in 9½ acres) in "open hemlock-spruce bog" (brush-meadow stage with young red spruce, hemlock, alder, etc.) in Garrett County in 1949 (Robbins, 1949c).
- (9 in 19.2 acres) in "shrubby field with stream-bordered trees" in Baltimore County in 1947, 42 (8 in 19.2 acres) in 1946 (Cooley, 1947).
- (19 in 53½ acres) in brushy, poorly drained abandoned farmland in Prince Georges County in 1948; 22 (13 in 58 acres) in another area of similar habitat in 1947.
- (1.5 in 17½ acres) in "lightly sprayed apple orchard with rye planted as ground cover" in Worcester County in 1948 (Springer and Stewart, 1948b).

MAXIMUM COUNTS.—*Spring*: 200+ in the Port Tobacco area, Charles County, on May 11, 1943 (I. N. Gabrielson, et al.); 150 at Gibson Island, Anne Arundel County, on May 8, 1955 (Mrs. V. L. Henderson, Mrs. G. Tappan); 77 in the Rosedale area, Baltimore County, on May 6, 1950 (D. A. Jones); 65 in Howard County on May 8, 1954; 59 each in 2 District of Columbia areas on May 12, 1913 (Oberholser, 1917a). *Winter* (Christmas counts): 30 in the Wicomico River area in Charles and St. Marys Counties on January 1, 1954; 17 in the Ocean City area on December 27, 1954; 12 in southern Dorchester County on December 28, 1953.

BANDING.—One banded in Cecil County on May 13, 1951, was recovered in northeastern New Jersey on June 10, 1951. Another recovered in Somerset County on May 6, 1950, had been banded in southeastern Pennsylvania on May 14, 1948. One bird banded in the District of Columbia on September 29, 1937, was recovered in southeastern New York on May 30, 1938. One banded at Ocean City on May 13, 1956, was found dead at Amityville, New York, on May 16, 1956.

BROWN THRASHER *Toxostoma rufum* (Linnaeus)

STATUS.—*Breeding and transient*: Fairly common in all sections. *Wintering*: Uncommon in Worcester County; rare (locally uncommon) elsewhere in the Eastern Shore and Western Shore sections; casual in the Upper Chesapeake section.

HABITAT.—Upland, dry or moist brushland; also in hedgerows, wood margins, and in edge habitats in residential areas.

NESTING SEASON.—Mid-April to early August (nesting peak, mid-May to early July). *Extreme egg dates* (195 nests): April 22, 1954, in Caroline County (Mrs. A. J. Fletcher) and July 20, 1897, in Baltimore County (J. M. Sommer). *Extreme nestling dates* (166 nests): May 10, 1921, in the District of Columbia

(S. F. Blake) and August 6, 1893, in Baltimore County (Kirkwood, 1895).

SPRING MIGRATION.—*Normal period*: March 25–April 5 to May 1–10; peak, April 15 to April 30. *Extreme arrival dates*: March 17, 1953, in Caroline County (Mrs. A. J. Fletcher); March 22, 1908, in the District of Columbia (A. H. Howell); March 22, 1953, in Baltimore County (E. Willis). *Extreme departure dates*: May 12, 1946, in Baltimore County (H. Brackbill).

FALL MIGRATION.—*Normal period*: September 5–15 to October 5–15. *Extreme departure dates*: November 7, 1955, in Frederick County (Mrs. J. W. Richards); November 5, 1893, in Baltimore County (F. C. Kirkwood); November 4, 1935, in Prince George's County (R. Overing); November 3, 1930, in Kent County (W. Baker).

BREEDING POPULATION DENSITIES (territorial males per 10 acres).—

15 (3 in 20 acres) in suburban-type residential area (including small orchards and large expanses of lawn) in Prince Georges County in 1951 and 1952; 7 (2 in 30 acres) in "damp deciduous scrub with standing dead trees (burned-over, poorly drained upland forest) in Prince Georges County in 1948 (Oresman, et al., 1948); 5 (1.5 in 30 acres) in 1947 (Stewart et al., 1947).

MAXIMUM COUNTS.—*Spring*: 100 at Gibson Island, Anne Arundel County, on May 8, 1955 (Mrs. W. L. Henderson, Mrs. G. Tappan); 35 in Washington County on May 7, 1949 (R. S. and M. Stauffer); 24 in Charles and St. Marys Counties (J. W. Terborgh) and in Howard County on May 8, 1954; 23 in Baltimore County on May 5, 1951 (E. Willis, D. A. Jones). *Winter* (Christmas counts): 60 in the Ocean City area on December 27, 1955; 42 in the Wicomico River area in Charles and St. Marys Counties on January 1, 1954; 20 in southern Dorchester County on December 28, 1954.

BANDING.—The winter distribution of Brown Thrashers that nest in Maryland is indicated by 3 records of banded birds that were recovered in the coastal plain of South and North Carolina. Another bird banded as a juvenal in the District of Columbia was found dead the following May in Baltimore, 35 miles to the north. The recovery of a south-bound bird of the year in Hanover County, Virginia, on September 28, 1950, is directly in line between its hatching locality in Prince Georges County, Maryland, and the coastal plain of South Carolina. Another Brown Thrasher, found dead in summer in Connecticut, had been banded at Baltimore during spring migration 4 years earlier, on May 9, 1943.

Family TURDIDAE

OBIN *Turdus migratorius* Linnaeus

STATUS.—*Breeding*: Common in all sections. *Transient*: Abundant in all sections. *Wintering*: Common in Worcester County; fairly common elsewhere in the Eastern Shore section and locally in the Western Shore section; uncommon in the Upper Chesapeake section; rare in the Piedmont, and Ridge and Valley sections; usual (usually) in the Allegheny Mountain section (Brooks, 1936)—regular occurrence throughout Garrett County during the winter of 1952-53.

HABITAT.—*Breeding*: Marginal habitats with a short-grass herbaceous cover in agricultural and residential areas. *Transient and wintering*: Various marginal and forest habitats that are situated on wet or rich, moist sites.

NESTING SEASON.—Late March to late August (nesting peak, late April to mid-June). Nest-building was recorded as early as March 25, 1921, in Baltimore County (J. M. Sommer). *Extreme egg dates* (476 nests): April 4, 1945, in Prince Georges County (E. G. Cooley) and August 3, 1894, in Baltimore County (F. C. Kirkwood). In Carroll County, an adult was observed building a nest on August 6, 1953, and on August 25 was observed on the nest and turning eggs that were probably infertile (D. H. McIntosh), *Extreme nestling dates* (440 nests): April 22, 1945, in Baltimore County (Brackbill, 1947b) and August 24, 1951, in Caroline County (Mr. and Mrs. A. J. Fletcher).

SPRING MIGRATION.—February 1-10 to April 20-30; peak, March 5 to April 10. *Extreme arrival dates*: January 21, 1922, in Anne Arundel County (fide T. Denmead); January 21, 1944, in Prince Georges County. *Extreme departure dates*: May 2, 1944, and May 2, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 10-20 to November 10-20; peak, October 10 to November 1. *Extreme departure date*: December 5, 1944, in Prince Georges County.

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

5 (9 in 20 acres) in suburban-type residential area (including small orchards and large expanses of lawn) in Prince Georges County in 1942.

4 (5 in 20½ acres) in "moderately sprayed apple orchard with infrequently mowed ground cover" in Worcester County in 1948 (Springer and Stewart, 1948b).

1 (4 in 19.2 acres) in "shrubby field with stream-bordered trees" in Baltimore County in 1947, 16 (3 in 19.2 acres) in 1946 (Cooley, 1947).

1 (2 in 9½ acres) in "open hemlock-spruce bog" (brush-meadow stage with young hemlock, red spruce, alder, etc.) in Garrett County in 1949 (Robbins, 1949c.)



FIGURE 43.—Robin banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August; open triangle = banded September through May.

(3 in 17½ acres) in "lightly sprayed apple orchard with rye planted as ground cover" in Worcester County in 1948 (Springer and Stewart, 1948b).

(6 in 84 acres) in mixed agricultural habitats (including hedgerows and wood margins) in Prince Georges County in 1949, 5 (4 in 84 acres) in 1952, 4 (3 in 84 acres) in 1950 and 1951.

MAXIMUM COUNTS.—*Spring*: 3,000 near Emmitsburg, Frederick County, on March 19, 1952 (J. W. Richards); 1,500 on the unpowder River marsh on March 4, 1902 (F. C. Kirkwood); 750 near Rockville, Montgomery County, on March 20, 1951 (R. F. Reed). *Fall*: 500 on the Gunpowder River marsh on October 23, 1901, and on October 26, 1903 (F. C. Kirkwood); 344 on Patuxent refuge on October 26, 1944. *Winter* (Christmas counts): 2,931 in the Annapolis area on January 1, 1956; 2,080 in the St. Michaels area, Talbot County, on December 29, 1955; 1,301 in the Ocean City area on December 27, 1953; 1,103 in St. Marys County on January 2, 1956; 620 in southern Dorchester County on December 2, 1952; 369 near Denton, Caroline County, on December 20, 1952; 270 in the Triadelphia Reservoir area on December 24, 1955; 179 in the Catoctin Mountain area on December 31, 1955.

BANDING.—See figure 43.

FOOD THRUSH *Hylocichla mustelina* (Gmelin)

STATUS.—*Breeding and transient*: Common in all sections. *Wintering*: Accidental—1 was closely observed at South Point, Worcester County, on December 22, 1951 (J. H. Buckalew).

HABITAT.—Flood-plain, swamp and upland rich, moist deciduous forests that contain an understory of small trees and shrubs.

NESTING SEASON.—Early May to mid-August (nesting peak, late May to late July). *Extreme egg dates* (353 nests): May 8, 1949, in Montgomery County (W. B. Tyrrell) and July 29, 1900, in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (197 nests): May 25, 1907, in the District of Columbia (R. H. Rue) and August 12, 1900, in Baltimore County (F. C. Kirkwood).

SPRING MIGRATION.—*Normal period*: April 20–30 to May 15–5; peak, May 1 to May 15. *Extreme arrival dates*: April 13, 1888, in the District of Columbia (E. M. Hasbrouck); April 13, 1892, in Baltimore County (F. C. Kirkwood); April 13, 1930, in Washington County (W. Middlekauff).

FALL MIGRATION.—*Normal period*: August 20–30 to October 5–5; peak, September 1 to September 20. *Extreme departure dates*: November 27, 1931, in the District of Columbia (P. Knappen); November 21, 1926, in Montgomery County (W. W.

Rubey); November 14, 1948, in Prince Georges County (M. J. Meanley).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 40 (14.5 in 36 acres) in "virgin central hardwood deciduous forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
- 24 (19.5 in 80 acres) in "central hardwood (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1949, 18 (14 in 80 acres) in 1951 and 16 (13 in 80 acres) in 1948 and 1953 (Trever, 1952; Clagett, 1953); 18 (16 in 80 acres) in 1954 (Wright, 1955); 19 (15.5 in 80 acres) in 1952 (Clagett, 1952).
- 24 (20.1 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946); 15 (5 in 32¼ acres) in another area of this habitat in 1944.
- 20 (4 in 20 acres) in "virgin hemlock forest" in Garrett County in 1949 (Robbins, 1949a).
- 18 (2 in 11 acres) in upland seepage swamp forest (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, clammy azalea, maleberry, etc.) in Prince Georges County in 1946.
- 16 (2 in 13 acres) in shrub swamp (alder, poison sumac, sweet pepperbush, swamp rose, red maple, etc.) in Prince Georges County in 1945.
- 12 (3.5 in 28 acres) in partially opened flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 12 (1.5 in 13 acres) in upland oak forest (white, northern red, chestnut, and black oaks) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 11 (2.5 in 23¼ acres) in "mature northern hardwood forest" (black cherry, beech, hemlock, sugar maple, sweet birch, etc.) in Garrett County in 1951 (Robbins and Stewart, 1951a).
- 10 (4 in 40 acres) in "mixed oak forest" (white, scarlet, and chestnut oaks, etc.) in Baltimore County in 1949 (Kolb, 1949a); 8 (3 in 40 acres) in 1948 (Kolb, et al., 1948); 5 (2 in 37 acres) in 1951, 1952, and 1953 (Kolb and Cole, 1951; Kaufmann, et al., 1952; Cole and Kolb, 1953); 3 (1 in 40 acres) in 1950 (Kolb, 1950).
- 10 (2 in 19½ acres) in "shrubby field with stream-bordered trees" in Baltimore County in 1946; 5 (1 in 19½ acres) in 1947 (Cooley, 1947).
- 9 (4 in 44¾ acres) in river bluff forest (beech, white oak, scarlet oak) in Prince Georges County in 1945; 7 (3 in 44¾ acres) in 1944 (J. W. Aldrich, A. J. Duvall).
- 8 (2 in 24½ acres) in river terrace forest (beech-white oak) in Prince Georges County in 1944.
- 8 (2 in 23¾ acres) in upland oak forest (white, scarlet, and black oaks) in Prince Georges County in 1944.
- 6 (3 in 47¾ acres) in hedgerows in agricultural areas and abandoned farm lands (including strip 27½ yards wide on each side of hedgerow) in Prince Georges County in 1945.
- 4 (1.3 in 32½ acres) in pine-oak forest (pitch pine, scrub pine, and Spanish oak) in Prince Georges County in 1944.

MAXIMUM COUNTS.—*Spring*: 160 at Greenbelt, Prince Georges County, on May 9, 1953 (L. W. Oring, et al.); 124 at Middlever, Baltimore County, on May 5, 1951 (E. Willis, D. A. Jones); 2 in Howard County on May 8, 1954. *Fall*: 100 near Gwynns Falls, Baltimore County, on September 21, 1897 (E. Armstrong); 2 on Patuxent Refuge on September 6, 1944.

BANDING.—One banded as a nestling in Baltimore County on June 18, 1949, was found in southern Alabama on March 11, 1950. Bennett (1949) gives March 16 as the earliest spring arrival date for anywhere in the United States, so this bird was either an exceptionally early migrant or a winter straggler.

PERMIT THRUSH *Hylocichla guttata* (Pallas)

STATUS.—*Breeding* (see fig. 40): Uncommon and local in the Allegheny Mountain section at elevations above 2,500 feet—occurring in Garrett County near Grantsville, on Little Savage Mountain near Finzel and at Mountain Lake Park (Preble, 1900); on Negro Mountain near Accident (Eifrig, 1938); in Cranberry Swamp near Finzel (G. Eifrig); in Cherry Creek Swamps near Mttinger and Piney Creek Swamps near Finzel (Stewart and Robbins, 1947a); in Wolf Swamp; in Cranesville Swamp; in the vicinity of Herrington Manor; and in the vicinity of Deep Creek Lake. *Transient*: Fairly common in all sections. *Wintering*: Common in the swamp along the Pocomoke River and its tributaries; fairly common elsewhere in the Eastern Shore and Western Shore sections; uncommon in the Upper Chesapeake, Piedmont, and Ridge and Valley sections; casual in the Allegheny Mountain section—1 seen at Cranesville swamp on December 31, 1954 (B. Miller, Mrs. G. M. Miller). *Summer vagrant*: Accidental—1 was collected in Howard County on July 9, 1890 (A. Esler).

HABITAT.—*Breeding*: Usually open spruce-hemlock bogs, pine plantations in the vicinity of bogs, and oak and pine barrens on the ridge tops. *Transient and wintering*: Wood margins; hedgerows; and swamp, flood-plain, and upland moist forest types with lushy understory.

SPRING MIGRATION.—*Normal period*: March 20–30 to May 1–10; peak, April 5 to April 25. *Extreme arrival dates*: March 15, 1907, in the District of Columbia (W. W. Cooke); March 15, 1953, in Frederick County (J. W. Richards). *Extreme departure dates*: May 21, 1892, in Baltimore County (G. H. Gray); May 19, 1898, in Harford County (F. C. Kirkwood); May 17, 1891, in the District of Columbia (C. W. Richmond).

FALL MIGRATION.—*Normal period*: October 1–10 to November 25–December 5; peak, October 10 to October 30. *Extreme arrival dates*: September 18, 1900, in the District of Columbia (W. Shufeldt); September 19, 1914, in Dorchester County (R. V. Jackson); September 21, 1954, in Frederick County (J. V. Richards).

MAXIMUM COUNTS.—*Spring*: 100+ at Waverly, Baltimore County, on April 15, 1893 (W. N. Wholey); 100 on Negro Mountain, Garrett County, on April 20, 1903 (G. Eifrig). *Fall*: 50 at Tilghman, Talbot County, on October 14, 1953 (R. L. Kleen); 50 at Patuxent Refuge on October 26, 1944. *Winter* (Christmas counts): 130 in the Ocean City area on December 27, 1955; 72 in the Wicomico River area of Charles and St. Marys Counties on January 1, 1954; 64 in southern Dorchester County on December 28, 1953; 44 in the Annapolis area on January 2, 1954; 34 at Patuxent Refuge on December 29, 1944.

BANDING.—One banded at Monkton, Baltimore County, on October 3, 1955, was recovered in north-central South Carolina on October 25, 1955.

SWAINSON'S THRUSH *Hylocichla ustulata* (Nuttall)

STATUS.—*Breeding*: Formerly a regular summer resident in Garrett County—occurring in the vicinity of Jennings, until about 1908 when the last of the spruce was cut (Behr, 1914); a nest with eggs (in sapling 4 feet above ground) near Oakland on June 13, 1917, was reported by J. M. Sommer; there are no recent records. *Transient*: Common in all sections (uncommon in spring in the Eastern Shore section). *Wintering*: Accidental—1 reported at Gibson Island, Anne Arundel County, from January 1 to 18, 1954 (Mrs. W. L. Henderson, Mrs. G. Tappan), and 1 near Berlin, Worcester County, on December 27, 1955 (J. R. Worthley, R. Dubois).

HABITAT.—Flood-plain, swamp, and upland moist forest type with brushy understory.

SPRING MIGRATION.—*Normal period*: May 1–10 to May 20–30; peak, May 10 to May 20. *Extreme arrival dates*: April 20, 1954, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); April 24, 1948, in Montgomery County (I. R. Barnes); April 25, 1921, in the District of Columbia (H. C. Oberholser); April 28, 1953, in Frederick County (J. W. Richards); April 28, 1954, in Talbot County (R. L. Kleen). *Extreme departure dates*: June 5, 1945, in Prince Georges County; June 4, 1917, in Baltimore County (C. H. Grace).

FALL MIGRATION.—*Normal period*: September 5–15 to October 15; peak, September 15 to October 5. *Extreme arrival dates*: August 25, 1944, in Montgomery County (A. Wetmore); August 9, 1955, in Prince Georges County; September 2, 1888, in the District of Columbia (A. K. Fisher). *Extreme departure dates*: November 7, 1954, in Talbot County (R. L. Kleen); October 26, 1954, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Appan); October 24, 1948, in the District of Columbia (J. W. Aylor, Jr.).

MAXIMUM COUNTS.—*Spring*: 66 at Patuxent Refuge on May 10, 1950; 35 in the District of Columbia on May 9, 1953 (C. L. Lagett). *Fall*: 60 at Tilghman, Talbot County, on September 23, 1953 (R. L. Kleen); 18 at Patuxent Refuge on September 6, 1944. Occasionally large numbers are heard calling while migrating overhead at night; high counts include 1,900 at Laurel, Prince Georges County on September 29, 1950; 1,300 in northeastern Harrett County on September 20, 1952; 1,200 in the District of Columbia on October 15, 1947 (I. R. Barnes).

RAY-CHEEKED THRUSH *Hyllocichla minima* (Lafresnaye)

STATUS.—*Transient*: Fairly common in all sections.

HABITAT.—Forest types with brushy understory, particularly flood-plain and swamp forests, and rich moist forests on the upland.

SPRING MIGRATION.—*Normal period*: May 5–15 to May 25–30; peak, May 15 to May 25. *Extreme arrival dates*: April 30, 1956, in Anne Arundel County (Mrs. W. L. Henderson); May 2, 1956, in Prince Georges County; May 3, 1930, in the District of Columbia (W. J. Whiting); May 3, 1953, in Charles County (M. C. Trone, A. R. Stickley, Jr.). *Extreme departure dates*: June 2, 1927, in Baltimore County (J. M. Sommer); June 1, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 10–20 to October 10–20; peak, September 20 to October 5. *Extreme arrival dates*: September 5, 1950, in Baltimore County (Mr. and Mrs. R. D. Cole); September 5, 1952, in Prince Georges County. *Extreme departure dates*: October 30, 1927, in Montgomery County (W. L. Ball); October 21, 1954, in Prince Georges County.

MAXIMUM COUNTS.—The maximum number seen per day during both spring and fall flights, would usually range between 5 and 10 birds. Much larger numbers were occasionally heard calling while migrating overhead at night; high counts include 90 on May 24, 1947, at Patuxent Refuge; 1,000 on September 29, 1950,

at Laurel, Prince Georges County; and 600 on September 20, 1952, in northeastern Garrett County.

VEERY *Hylocichla fuscescens* (Stephens)

STATUS.—*Breeding* (see fig. 44): Common in the Alleghen Mountain section; rare in the Ridge and Valley section; rare and local in the Piedmont section. Summer occurrence in the Piedmont section was recorded as follows: In the District of Columbia along Rock Creek (Halle, 1943 and 1948) and in Glover-Archbold Park (Briggs, 1954); in Montgomery County at Forest Glen (in 1952—E. Miller) and Cabin John Park (E. J. Court, 1952); in Baltimore County along Gunpowder Fall near the Carroll County line (M. B. Meanley) and near Lak Roland (A. Simon); in northwest Baltimore City (R. D. Cole) and in Harford County near Norrisville (O. W. Crowder) *Transient*: Fairly common in all sections (in spring, uncommon in the Eastern Shore and Western Shore sections).

HABITAT.—*Breeding*: Swamp and bog forests and moist forest on the upland; also in plantations of pine situated on moist sites *Transient*: Forest types with brushy understory, particularly flood-plain and swamp forests, and rich moist forests on the upland.

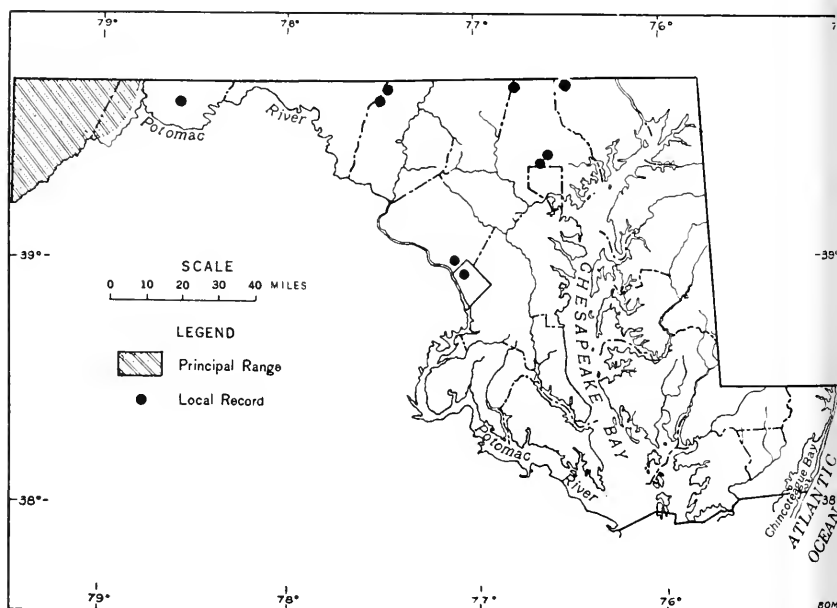


FIGURE 44.—Breeding range of Veery.

NESTING SEASON.—Early May to mid-July. *Extreme egg dates* (nests): May 12, 1945, in Montgomery County (E. J. Court) and June 26, 1948, in the District of Columbia (Halle, 1948). *Extreme nestling dates* (6 nests): June 17, 1918, in Garrett County (G. Eifrig) and July 10, 1948, in the District of Columbia (Halle, 1948).

SPRING MIGRATION.—*Normal period*: April 25–May 5 to May 25; peak, May 5 to May 15. *Extreme arrival dates*: April 20, 1881, in the District of Columbia (A. K. Fisher); April 24, 1881, Washington County (E. A. Small). *Extreme departure dates*: June 8, 1947, in Baltimore County (E. G. Cooley); June 2, 1907, in the District of Columbia (A. K. Fisher).

FALL MIGRATION.—*Normal period*: August 20–30 to September 25; peak, September 1 to September 15. *Extreme arrival dates*: August 17, 1927, in Baltimore County (F. C. Kirkwood); August 18, 1889, in the District of Columbia (J. D. Figgins). *Extreme departure dates*: October 16, 1952, in Montgomery County (J. S. Moon); October 11, 1947, in Prince Georges County.

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

(1.5 in 20 acres) in "virgin hemlock stand" in Garrett County in 1949 (Robbins, 1949a).

MAXIMUM COUNTS.—*Spring*: 22 in Rock Creek Park, District of Columbia, on May 9, 1953 (C. L. Clagett); 15 at Patuxent Refuge on May 10 and again on May 13, 1950. *Fall*: 12 at Patuxent Refuge on September 5, 1943. On May 5, 1952, 130 were heard calling, while migrating overhead at night at the Patuxent Refuge.

STERN BLUEBIRD *Sialia sialis* (Linnaeus)

STATUS.—*Breeding*: Fairly common in all sections. *Transient*: Common in all sections. *Wintering*: Common in the Eastern Shore and Western Shore sections; fairly common in the Upper Chesapeake and Piedmont sections; uncommon in the Ridge and Valley section; rare in the Allegheny Mountain section.

HABITAT.—Chiefly marginal habitats in agricultural and residential areas.

NESTING SEASON.—Early March to late August (nesting peak, early April to mid-July). Nest-building was recorded as early as March 4, 1900, in Baltimore County (F. C. Kirkwood). *Extreme egg dates* (232 nests): March 12, 1898, in Baltimore County (W. H. Fisher) and July 27, 1881, in Baltimore County

(F. C. Kirkwood). *Extreme nestling dates* (161 nests): April 17, 1946, in Prince Georges County (E. G. Cooley) and August 24, 1945, in Prince Georges County (J. B. Cope).

SPRING MIGRATION.—*Normal period*: February 5–15 to April 10–20; peak, March 1 to April 1. *Extreme arrival dates*: February 3, 1900, in Allegany County (G. Eifrig); February 3, 1919, in Baltimore County (H. Brackbill). *Extreme departure date*: May 11, 1941, in Baltimore County (H. Brackbill).

FALL MIGRATION.—*Normal period*: September 15–25 to November 10–20; peak, October 5 to November 15. *Extreme arrival dates*: August 30, 1896, in Baltimore County (F. C. Kirkwood); August 31, 1901, in Allegany County (G. Eifrig). *Extreme departure date*: December 28, 1938, in Baltimore County (H. Brackbill).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

23 (5 in 21½ acres) in an abandoned field saturated with nesting boxes

Prince Georges County in 1949 and 1950, 19 (4 in 21½ acres) in 1950
20 (4 in 20 acres) in suburban-type residential area (including small orchards and large expanses of lawn) in Prince Georges County in 1943, 1944, and 1945; 15 (3 in 20 acres) in 1942.

14 (3 in 22 acres) in “unsprayed apple orchard with infrequently mowed ground cover” in Worcester County in 1948 (Springer and Stewart 1948b).

7 (2 in 30 acres) in “damp deciduous scrub with standing dead trees” (burned over, poorly drained upland forest) in Prince Georges County in 1947 (Stewart et al., 1947).

4 (3 in 75 acres) in mixed agricultural habitats (including hedgerows and wood margins) in Prince Georges County in 1947.

MAXIMUM COUNTS.—*Spring*: 100 at Point Lookout, St. Marys County, on March 2, 1954 (H. N. Page, V. C. Kirtley); 61 at Patuxent Refuge on March 22, 1944. *Fall*: 5,000 on the Gunpowder River marsh on October 26, 1903 (J. Thomas); 400 at Cambridge, Dorchester County, on November 1 and 2, 1903 (R. W. Jackson); “hundreds” at Cumberland, Allegany County, on October 3, 1901, October 18, 1902, and October 24, 1900 (G. Eifrig). *Winter* (Christmas counts): 378 in the Annapolis area on January 2, 1955; 336 at Port Tobacco, Charles County, December 21, 1941; 231 in the Ocean City area on December 2, 1954; 102 in the Triadelphia Reservoir area on December 2, 1952.

BANDING.—One recovered in Calvert County on October 1, 1934, had been banded as a juvenal in southwestern New Hampshire on August 10, 1933. Another banded in Prince Georges County on October 13, 1943, was recovered on April 15, 1944, in northern Virginia (about 20 miles from the point of banding).

Family SYLVIIDAE

BLUE-GRAY GNATCATCHER *Polioptila caerulea* (Linnaeus)

STATUS.—*Breeding and transient* (see fig. 45): Common in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Ridge and Valley section and in the Potomac River valley of the Piedmont section; uncommon elsewhere in the Piedmont section; rare in the Allegheny Mountain section. *Wintering*: Accidental—1 was observed in the District of Columbia on January 1, 1924 (Blake, 1924); 1 in Caroline County on December 20, 1953, and January 1 and 5, 1954 (Mr. and Mrs. A. J. Fletcher); and 2 near Annapolis on January 2, 1955 (E. P. Wilson).

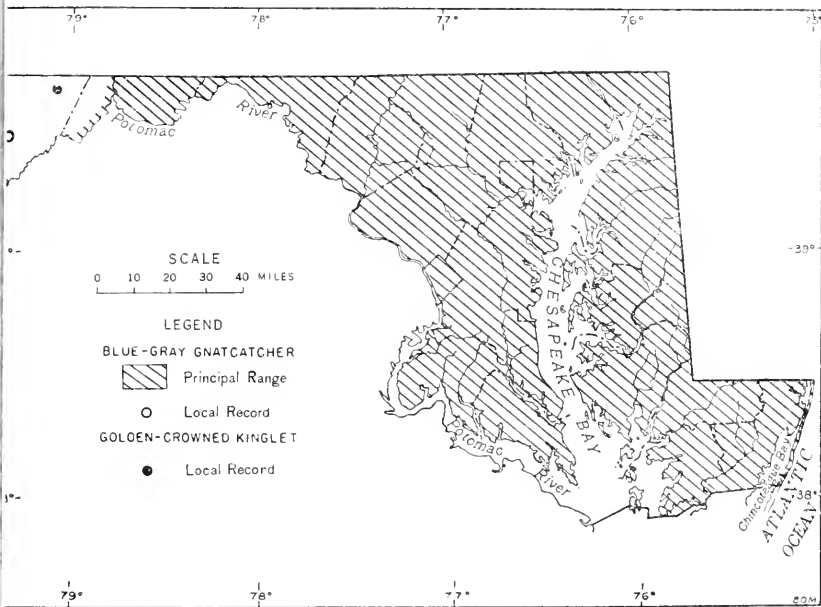


FIGURE 45.—Breeding ranges of Blue-gray Gnatcatcher and Golden-crowned Kinglet.

HABITAT.—Brushy, partially open swamp and flood-plain rests; in the Ridge and Valley, and Allegheny Mountain sections is also found in orchards and in open stands of upland forest. NESTING SEASON.—Early April to late June (nesting peak, late April to early June). Nest-building was recorded as early as April 8, 1945, in Prince Georges County. *Extreme egg dates* (32 nests): April 11, 1953, in Montgomery County (J. Love) and June 8, 1940, in Montgomery County (W. H. Lawrence).

Extreme nestling dates (18 nests): May 6, 1950, in Charles County (M. C. Crone) and June 16, 1946, in Calvert County.

SPRING MIGRATION.—*Normal period*: April 1–10 to May 1–10 peak, April 10 to April 25. *Extreme arrival dates*: March 28, 1921, in Dorchester County (R. W. Jackson); March 29, 1921, in Montgomery County (C. L. Clagett, et al.); March 29, 1921, in Caroline County (Mrs. A. J. Fletcher). *Extreme departure dates*: May 18, 1901, in Allegany County (G. Eifrig); May 18, 1934, in Prince Georges County (R. Overing).

FALL MIGRATION.—*Normal period*: August 5–15 to September 5–15. *Extreme departure dates*: December 1, 1953, in Anne Arundel County (J. W. Taylor, Jr.); November 23, 1890, in the District of Columbia (C. W. Richmond); November 11, 1951, in Baltimore County (E. Willis); October 3, 1954, in Montgomery County (P. A. DuMont); October 2, 1951, in Caroline County (Mrs. A. J. Fletcher).

BREEDING POPULATION DENSITIES (pairs per 100 acres).—
7 (2 in 28 acres) in partially opened, flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich and A. J. DuVal);
6 (1.5 in 25 acres) in "unsprayed apple orchard with unmowed ground cover" in Allegany County in 1948 (Springer and Stewart, 1948b).
2 (1.4 in 85 acres) in well-drained, flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 77 at Greenbelt, Prince Georges County, on April 10, 1954 (L. W. Oring); 70 along the Pocomoke River on April 21, 1954 (P. G. DuMont); 65 near Allens Fresh, Charles County, on April 12, 1952; 64 near Largo, Prince Georges County, on April 19, 1947; 18 in Washington County on May 7, 1949 (R. S. and M. Stauffer). *Fall*: 17 near Seneca in Montgomery County on August 20, 1949 (I. R. Barnes).

GOLDEN-CROWNED KINGLET *Regulus satrapa* Lichtenstein

STATUS.—*Breeding* (see fig. 45): Uncommon and local in the Allegheny Mountain section at elevations above 2,500 feet—occurring in Garrett County during recent years in Wolf Swamp (about 4 miles southeast of Grantsville); in the Maryland portion of Cranesville Swamp (just east of Cranesville, West Virginia) and on the east slope of Backbone Mountain (2 to 3 miles west-southwest of Bayard, West Virginia)—also formerly occurred regularly in the vicinity of Jennings before the last of the spruce was cut in 1908 (Behr, 1914). *Transient*: Common in all sections. *Wintering*: Common in the Eastern Shore and Western

hore sections; fairly common in the Upper Chesapeake and Piedmont sections; uncommon in the Ridge and Valley section; rare in the Allegheny Mountain section. *Summer vagrant*: Accidental—1 recorded in the District of Columbia on July 25, 1932 (Burleigh, 1932); 1 recorded at Cumberland, Allegany County, on August 7, 1901 (G. Eifrig).

HABITAT.—*Breeding*: Largely restricted to areas with fairly dense stands of mature red spruce. *Transient and wintering*: Most numerous in stands of scrub pine, pitch pine and loblolly pine; also of regular occurrence in various deciduous forest types.

NESTING SEASON.—Dependent young out of the nest were observed in Garrett County on July 6, 1945.

SPRING MIGRATION.—*Normal period*: March 15–25 to April 5–25; peak, March 25 to April 15. *Extreme departure dates*: May 23, 1903, in Allegany County (Eifrig, 1904); May 12, 1919, in Baltimore County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: September 25–October 5 to December 1–10; peak, October 15 to November 10. *Extreme arrival dates*: September 20, 1910, in the District of Columbia (E. J. Brown); September 22, 1942, in Prince Georges County (M. B. Meanley); September 24, 1950, in Baltimore County (E. Willis). *Extreme departure dates*: December 28, 1919, in the District of Columbia (F. Harper); December 20, 1946, in Baltimore County (H. Brackbill).

BREEDING POPULATION DENSITY (pairs per 100 acres).—2 (4 in 12½ acres) in "virgin spruce-hemlock bog forest" (red spruce and hemlock with dense understory of great laurel) in Garrett County in 1951 (Stewart and Robbins, 1951a).

MAXIMUM COUNTS.—*Spring*: 50 at Emmitsburg, Frederick County, on both April 8 and 9, 1953 (J. W. Richards); 35 at Patuxent Refuge on April 7, 1944. *Fall*: "Hundreds" at Ocean City on October 2, 1949 (M. B. Meanley); 100 at Gibson Island, Anne Arundel County, on October 16, 1952 (Mrs. W. L. Henderson, Mrs. G. Tappan); 70 at Patuxent Refuge on October 27, 1943. *Winter* (Christmas counts): 380 at Patuxent Refuge on December 23, 1943; 354 in the District of Columbia area on January 2, 1954; 156 in the Ocean City area on December 27, 1955; 105 in southern Dorchester County on December 28, 1953; 92 in the Wicomico River area in Charles and St. Marys Counties on January 1, 1954.

RUBY-CROWNED KINGLET *Regulus calendula* (Linnaeus)

STATUS.—*Transient*: Common in all sections. *Wintering*: Un-

common in the Eastern Shore and Western Shore sections; rare in the Upper Chesapeake and Piedmont sections; casual in the Ridge and Valley section.

HABITAT.—Brushy forested areas including pine and deciduous types.

SPRING MIGRATION.—*Normal period:* March 25–April 5 to May 1–10; peak, April 10 to April 25. *Extreme arrival date:* March 20, 1905, in the District of Columbia (T. H. Levering). *Extreme departure dates:* May 19, 1950, in Washington County; May 10, 1954, in Worcester County (J. K. Wright); May 15, 1920, in Montgomery County (D. C. Aud. Soc.).

FALL MIGRATION.—*Normal period:* September 20–30 to November 10–20; peak, October 5 to October 30. *Extreme arrival dates:* September 6, 1935, in the District of Columbia (Overing 1936); September 9, 1955, in Frederick County (J. W. Richards); September 13, 1880, in Washington County (E. A. Small); September 14, 1913, in Prince Georges County (W. W. Cooke). *Extreme departure date:* November 30, 1901, in Allegany County (G. Eifrig).

MAXIMUM COUNTS.—*Spring:* 50 at Emmitsburg, Frederick County, on April 11, 1952, and April 18, 1953 (J. W. Richards); 36 at Patuxent Refuge on April 21, 1944. *Fall:* 155 at Patuxent Refuge on October 27, 1943. *Winter* (Christmas counts): 29 in the Ocean City area on December 27, 1953; 23 at Patuxent Refuge on January 14, 1949; 22 in the Wicomico River area of Charles and St. Marys Counties on January 1, 1954; 16 in southern Dorchester County on December 27, 1949; 16 in the Catoctin Mountain area in Frederick County on December 30, 1951.

Family MOTACILLIDAE

WATER PIPIT *Anthus spinoletta* (Linnaeus)

STATUS.—*Transient:* Common in the Piedmont section; fairly common in all other sections. *Wintering:* Fairly common in the Eastern Shore section and in the southern part of the Western Shore section (St. Marys and southern Charles Counties); rare elsewhere in the Western Shore, Upper Chesapeake, and Piedmont sections.

HABITAT.—Open agricultural fields with short or sparse vegetation, including pastures, and grain fields with young sprout growth; also occurs on mud flats and tidal marshes with sparse vegetation.

SPRING MIGRATION.—*Normal period:* March 1–10 to May 1–10; peak, March 10 to April 10. *Extreme arrival dates:* February

3, 1908, in the District of Columbia (W. W. Cooke); February 4, 1924, in Baltimore County (F. C. Kirkwood). *Extreme departure dates*: May 21, 1925, in Dorchester County (R. W. Jackson); May 18, 1949, in Prince Georges County; May 18, 1950, in Washington County.

FALL MIGRATION.—*Normal period*: September 20–30 to November 25–December 5; peak, October 10 to November 5. *Extreme arrival dates*: September 12, 1901, in Harford County (W. H. Fisher); September 12, 1911, in Baltimore County (F. C. Kirkwood); September 15, 1951, in Allegany County. *Extreme departure dates*: January 12, 1949, in Prince Georges County; December 23, 1914, in Baltimore County (F. C. Kirkwood).

MAXIMUM COUNTS.—*Spring*: 600 at Emmitsburg, Frederick County, on April 7, 1953 (J. W. Richards); 200 near Lanham, Prince Georges County, on March 26, 1949; 150 near Loch Raven Reservoir, Baltimore County, on March 13, 1940 (I. E. Hampe, I. Kolb); 150 at Queen Anne, Queen Annes County, on April 15, 1956 (W. Rittenhouse). *Fall*: 2,000 near Seneca, Montgomery County, on October 25, 1952 (J. W. Terborgh); 1,500 at Monkton, Baltimore County, on November 13, 1955 (S. W. Simon); 1,000 at Oxon Hill, Prince Georges County, on November 26, 1938 (W. Perrygo); 300 in Montgomery County near Triadelphia Reservoir on October 28, 1951 (S. H. Low). *Winter* (Christmas counts): 830 in the Ocean City area on December 27, 1948; 250 near Denton, Caroline County, on December 20, 1952; 235 in the Kent Island area, Queen Annes County, on December 31, 1948; 165 in the Wicomico River area in Charles and St. Marys Counties on December 26, 1948.

Family BOMBYCILLIDAE

CEDAR WAXWING *Bombycilla cedrorum* Vieillot

STATUS.—*Breeding*: Common in the Allegheny Mountain section; uncommon in the Ridge and Valley, Piedmont, and Upper Chesapeake sections; rare in the Western Shore and Eastern Shore sections. *Transient*: Common in all sections. *Wintering*: Uncommon in the Eastern Shore, Western Shore, Upper Chesapeake, Piedmont, and Ridge and Valley sections; rare in the Allegheny Mountain section (Brooks, 1936c).

HABITAT.—Open or brushy woodland and marginal habitats in agricultural and residential areas.

NESTING SEASON.—Late May to mid-September (nesting peak, mid-June to mid-August). In Montgomery County, a new nest was found as early as May 30, 1905 (Oberholser, 1905). *Extreme*

egg dates (21 nests): June 7, 1936, in Harford County (W. J. Tyrrell) and Anne Arundel County (M. B. Meanley), and August 21, 1892, in Baltimore County (Kirkwood, 1895). *Extreme nestling dates* (5 nests): June 18, 1950, in Baltimore County (C. D. Hackman) and September 11, 1923, in the District of Columbia (S. F. Blake).

SPRING MIGRATION.—*Normal period*: April 25–May 5 to May 25–June 5; peak, May 5 to May 25. In 1952, the migration was much earlier than usual, large numbers arriving at the close of February (earliest record, February 24, 1952, in Prince Georges County), and high counts were made in numerous areas throughout March and early April, while a few small flocks lingered until the end of April. *Extreme departure dates*: June 15, 1902, in Baltimore County (J. Thomas); June 8, 1887, in the District of Columbia (C. W. Richmond); June 8, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: August 15–25 to January 1–10; peak, September 25 to November 10. *Extreme arrival date*: August 9, 1944, in Prince Georges County. *Extreme departure date*: January 12, 1940, in Prince Georges County.

BREEDING POPULATION DENSITIES (pairs per 100 acres).—

- 16 (1.5 in 9½ acres) in "open hemlock-spruce bog" (brush-meadow stage with young hemlock, red spruce, alder, etc.) in Garrett County in 1949 (Robbins, 1949c).
- 15 (4 in 27½ acres) in "red pine plantation" (young trees about 20 feet height) in Garrett County in 1949 (Robbins and Barnes, 1949).
- 15 (3 in 20 acres) in suburban-type residential area (including small orchards and large expanses of lawn) in Prince Georges County in 1946; absent in other years during the period 1942–52.

MAXIMUM COUNTS.—*Spring*: 450 near Port Tobacco, Charles County, on March 23, 1952 (A. R. Stickley, Jr., M. C. Crone); 350 near College Park, Prince Georges County, on March 25 and 27, 1952 (C. L. Clagett); 150 near the Gunpowder River marsh on May 24, 1903 (J. Thomas). *Fall*: 400 in Baltimore County on October 23, 1896 (W. H. Fisher); 350 near Seneca, Montgomery County, on October 17, 1953 (J. K. Wright); 268 at Patuxent Refuge on October 26, 1944. *Winter*: 1,325 at Patuxent Refuge on February 23, 1956 (L. M. Llewellyn); 300 in the Port Tobacco area on December 23, 1931 (Christmas count).

Family LANIIDAE

NORTHERN SHRIKE *Lanius excubitor* Linnaeus

STATUS.—*Wintering*: Rare and irregular in all sections. Ordinarily, during most winters this species is absent; and during

the occasional flight years, only a few scattered individuals are recorded. The latest flights occurred during the winters of 1950-51 and 1954-55, when the species was recorded in Garrett, Washington, Frederick, Montgomery, Anne Arundel, and Worcester Counties (various observers). The only previous winters when more than single specimens or observations were recorded were 1887-88 and 1892-93.

HABITAT.—Brushy wood-margins, hedgerows, and other "edge" habitats, chiefly in agricultural areas.

PERIOD OF OCCURRENCE.—*Extreme dates:* October 26, 1887 (collected), on the Patapsco River marsh (A. Resler) and March 9, 1951, in Worcester County (J. H. Buckalew). *Occurrence peak:* December 20 to February 20.

LOGGERHEAD SHRIKE *Lanius ludovicianus* Linnaeus

STATUS.—*Breeding:* Uncommon in the east-central portion of Prince Georges County; rare and local elsewhere in the Western Shore section and in the Eastern Shore, Upper Chesapeake, Piedmont, and Ridge and Valley sections. *Transient:* Fairly common in the Eastern Shore section; uncommon in the Western Shore, Upper Chesapeake, Piedmont, and Ridge and Valley sections; rare in the Allegheny Mountain section. *Wintering:* Uncommon in the Eastern Shore section and the southern part of the Western Shore section; rare in the Upper Chesapeake and Piedmont sections and in the northern part of the Western Shore section; casual in the Ridge and Valley section. A. Wetmore states that in Maryland, this species "has decreased appreciably in the past 15 years."

HABITAT.—Hedgerows, wood margins, and other edge types in agricultural areas; during the breeding season usually found in the vicinity of hedgerows or groves of red cedar.

NESTING SEASON.—Mid-April to late June. *Extreme egg dates* (4 nests): April 19, 1925, in the District of Columbia and May 1, 1924, in Montgomery County (both by S. F. Blake). *Extreme nestling dates* (5 nests): May 20, 1910, in Prince Georges County (R. H. True) and June 29, 1931, in Montgomery County (W. M. Davidson).

SPRING MIGRATION.—*Normal period:* March 5-15 to April 10-20; peak, March 20 to April 10. *Extreme arrival date:* March 2, 1954, in St. Marys County (H. N. Page, V. C. Kirtley). *Extreme departure dates:* April 23, 1893, in Baltimore County (G. H. Gray); April 21, 1904, in the District of Columbia (T. H. Levering).

FALL MIGRATION.—*Normal period*: August 10–20 to November 1–10; peak, August 25 to October 25. *Extreme arrival dates* July 31, 1906, in Montgomery County (H. W. Maynard); August 1, 1917, in Dorchester County (R. W. Jackson); August 5, 1898 in Prince Georges County (S. J. Judd). *Extreme departure date*: November 27, 1919, in the District of Columbia (J. Kittredge, Jr.).

MAXIMUM COUNTS.—*Winter* (Christmas counts): 20 in the Ocean City area on December 27, 1954; 13 in the Wicomico River area in Charles and St. Marys Counties on January 1, 1954; 11 near Denton, Caroline County, on January 1, 1955; 6 in the Triadelphia Reservoir area in Howard and Montgomery Counties on January 1, 1954.

Family STURNIDAE

STARLING *Sturnus vulgaris* Linnaeus

STATUS.—Permanent resident. Common (locally abundant) in all sections.

HABITAT.—Marginal habitats in agricultural and residential areas. In winter, large numbers roost on buildings in the business sections of Baltimore and Washington, D. C.

NESTING SEASON.—Early February to mid-July (nesting peak, mid-April to mid-June). Nest-building was recorded as early as February 1, 1939, in Baltimore County (H. Brackbill). *Extreme egg dates* (68 nests): April 7, 1950, in Prince Georges County and June 12, 1950, in Prince Georges County (R. W. Dickerman). *Extreme nestling dates* (173 nests): April 12, 1933, in the District of Columbia (W. H. Ball) and July 18, 1940, in Baltimore County (H. Brackbill).

BREEDING POPULATION DENSITY (pairs per 100 acres).—5 (15 in 275 acres) in mixed agricultural habitats (including residential areas and hedgerows and wood margins) in Prince Georges County in 1943.

MAXIMUM COUNTS (nonbreeding).—*Winter*: 100,000 in Washington, D. C. (Barnes, 1950); 30,000 in Susquehanna Flats area on December 27, 1952 (Christmas count); 9,338 in the Ocean City area on December 27, 1955 (Christmas count); 7,166 near Chase, Baltimore County, on December 28, 1952 (Christmas count); 6,000 in the Port Tobacco area, Charles County, on December 22, 1928 (Christmas count).

HISTORY OF STARLING INVASION.—This European species became established in the United States following its successful introduction in New York City on March 6, 1890, and April 25,

891 (Chapman, editorial in *Bird Lore*, 1907, Vol. 9, p. 206). Its first appearance in Maryland was reported in 1906 at Baltimore by Chapman. On February 15, 1910, 1 was found dead following a storm in Talbot County near Easton (A. K. Fisher); on January 19-20, 1912, 2 were collected in the District of Columbia (USNM—C. Zeller). In the vicinity of Baltimore, this species was again recorded at the town of Cockeyville on October 24, 1913, when 2 were seen (D. C. Clark); the first nest containing young was found in Baltimore on May 27, 1917 (F. C. Kirkwood); at this time the species had become fairly common in that area, as several hundred were seen on January 27, 1917, and about 10,000 on December 4, 1917 (W. H. Fisher). In the vicinity of Washington, D. C., this species was next recorded on January 9, 1914, when a flock of about 200 was seen (A. Wetmore); young of the year were seen on June 26, 1916 (F. Harper), and on April 25, 1917, a nest with young was found nearby in Montgomery County (Oldys, 1917); by late January, 1922, this species had become quite common, as thousands were roosting on the buildings of downtown Washington (Cooke, 1929).

Other early records in the Eastern Shore section include a flock of over 75 seen at Cambridge, Dorchester County, on February 14, 1916 (Jackson, 1916), and a nesting record at Cambridge on May 2, 1920 (Jackson, 1941). In its spread westward over the State, the Starling was first recorded at Frederick on June 1, 1918, when an occupied nest was found (J. B. Semple); at Cumberland it was first reported during February 1920, when a flock of about 100 was observed (Eifrig, 1920b); in the Allegheny Mountain section it was first recorded during the summer of 1928, when a flock of 40 was seen near Accident (Eifrig, 1933).

BANDING.—Forty-five banded in Maryland and the District of Columbia during December, January, February, and March were subsequently taken outside the Maryland-District of Columbia-Virginia area. Only 2 of these were recovered in the spring immediately following the winter of banding. Both were taken in southern Pennsylvania, 1 on an unspecified date in February, the other on March 15. These data as well as recoveries from subsequent years indicate that the principal northward movement takes place in February and March. Kessel (1953) shows a map of all recoveries of Starlings banded in the vicinity of the District of Columbia in winter. The records are fairly evenly distributed within a "V" stretching from Washington northward through Buffalo on the west and Albany on the east. An examination of the dates of recovery shows that the migrants which

winter in the Washington roosts nest primarily in central New York State and adjacent counties of Ontario, Quebec and Vermont. All of the 24 Pennsylvania recoveries were made during the migration periods or in subsequent winters.

Recovery records indicate that the great majority of Starling that winter in the Washington roosts nest within 20 miles of the Capitol; 4 out of every 5 summer recoveries of winter-banded birds were taken within 20 miles of the place of banding. Recoveries of Maryland and District of Columbia Starlings south of a 40-mile radius from the banding station are very few—perhaps due in part to the relatively small number banded during the nesting season. Four birds banded in Washington (January to March) were taken at various seasons of the year from 40 to 160 miles away in Virginia; and 1 banded at Raleigh, North Carolina, in mid-February was killed on the lower Patuxent River 2 years later in January. There have been too few bandings on the Eastern Shore to yield recoveries, but Kessel (1953) has shown that a coastal flight from New England and another flight from the Hudson and Connecticut River valleys probably account for many of the wintering birds in our Eastern Shore section.

Family VIREONIDAE

WHITE-EYED VIREO *Vireo griseus* (Boddaert)

STATUS.—*Breeding and transient*: Common in the Eastern Shore and Western Shore sections; fairly common in the Upper Chesapeake section and in the Potomac River valley of the Piedmont section; uncommon elsewhere in the Piedmont section and in the Ridge and Valley section; rare in the Allegheny Mountain section.

HABITAT.—Chiefly shrub swamps and brushy cutover forest swamps; also in hedgerows and wood margins in agricultural areas.

NESTING SEASON.—Mid-April to early August (nesting peak, early May to late June). Nest-building was recorded as early as April 16, 1949, in Worcester County (J. H. Buckalew). *Extreme egg dates* (24 nests): April 25, 1949, in Worcester County (J. H. Buckalew) and July 11, 1901, in Harford County (W. H. Fisher). *Extreme nestling dates* (13 nests): June 1, 1902, in Washington County (J. M. Sommer) and August 6, 1893, in Baltimore County (Kirkwood, 1895).

SPRING MIGRATION.—*Normal period*: April 15–25 to May 10–20; peak, April 25 to May 10. *Extreme arrival dates*: April 10, 1912, in the District of Columbia (W. D. Appel); April 12, 1953, in

Charles County (M. C. Crone, K. Keeley); April 12, 1954, in Caroline County (M. W. Hewitt); April 14, 1929, in Baltimore County (J. M. Sommer).

FALL MIGRATION.—*Normal period:* August 15–25 to September 25–October 5; peak, August 25 to September 15. *Extreme departure dates:* October 30, 1927, in Baltimore County (F. C. Kirkwood, J. M. Sommer); October 28, 1910, in the District of Columbia (M. D. Suter); October 28, 1933, in Prince Georges County (R. Overing).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

10 (5.2 in 13 acres) in shrub swamp (alder, poison sumac, sweet pepperbush, swamp rose, red maple, etc.) in Prince Georges County in 1945.

32 (6 in 18¼ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).

28 (16 in 58 acres) in brushy, poorly drained, abandoned farmland in Prince Georges County in 1947.

Seventy-four singing males were counted during a 20 mile canoe trip on the Pocomoke River, from Poorhouse Branch to Pocomoke City, on June 16, 1946.

MAXIMUM COUNTS (nonbreeding).—*Spring:* 59 in the Ocean City area (including the upper Pocomoke River) on May 5, 1951; 40 in Charles and St. Marys Counties on May 8, 1954 (J. W. Terborgh). *Fall:* 18 killed at the Washington Monument in Washington, D. C., on September 12, 1937 (Overing, 1938); 15 at Patuxent Refuge on September 9, 1943.

YELLOW-THROATED VIREO *Vireo flavifrons* Vieillot

STATUS.—*Breeding and transient:* Fairly common in the Eastern Shore, Western Shore, and Upper Chesapeake sections and in the Potomac River valley of the Piedmont section; uncommon elsewhere in the Piedmont section and in the Ridge and Valley section; rare in the Allegheny Mountain section.

HABITAT.—Flood-plain and lowland swamp forests and rich, moist forests on the upland; usually occurring in forest areas with a partially opened canopy.

NESTING SEASON.—Mid-April to late July (nesting peak, mid-May to late June). Nest building was recorded as early as April 19, 1949, in Worcester County (J. H. Buckalew). *Extreme egg dates* (18 nests): May 9, 1917, in Dorchester County (Jackson, 1941) and July 21, 1922, in the District of Columbia (S. F. Blake). *Extreme nestling dates* (15 nests): June 4, 1916, and July 18, 1915, both in Baltimore County (J. M. Sommer).

SPRING MIGRATION.—*Normal period:* April 20–30 to May 15–

25; peak, May 1 to May 15. *Extreme arrival dates*: April 5 1953, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); April 11, 1922, in the District of Columbia (J. Kittredge); April 13, 1890, in Baltimore County (J. H. Pleasants).

FALL MIGRATION.—*Normal period*: August 20–30 to September 20–30; peak, September 1 to September 20. *Extreme departure dates*: October 9, 1897, along the Patapsco River marsh (F. C. Kirkwood); October 4, 1953, in Charles County (M. C. Crone A. R. Stickley, Jr.).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 19 (7 in 36 acres) in "virgin central hardwood deciduous forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins 1947b).
- 9 (2.5 in 28 acres) in partially opened, flood-plain forest (sycamore, ash, elm etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 9 (4 in 44 $\frac{3}{5}$ acres) in river bluff forest (beech, white oak, scarlet oak) in Prince Georges County in 1945; absent in 1944 (J. W. Aldrich, A. J. Duvall).
- 8 (6 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1948 and 1949; 2 (2 in 80 acres) in 1951 (Trever, 1952); 4 (3.5 in 80 acres) in 1954 (Wright, 1955); 3 (2.5 in 80 acres) in 1952 (Clagett, 1952); 2 (1.5 in 80 acres) in 1953 (Clagett, 1953).
- 8 (1.5 in 18 $\frac{3}{4}$ acres) in "second-growth river swamp (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).
- 7 (2.5 in 37 acres) in "mixed oak forest" (white, scarlet, and chestnut oaks etc.) in Baltimore County in 1952 (Kaufmann, et al., 1952); 4 (1.5 in 37 acres) in 1953 (Cole and Kolb, 1953); 3 (1 in 37 acres) in 1951 (Kolb and Cole, 1951); 3 (1 in 40 acres) in 1949 and 1950 (Kolb, 1949 and 1950); 1 (0.5 in 40 acres) in 1948 (Kolb, et al., 1948).
- 3 (2.9 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart et al., 1946).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 20 on May 11, 1952, at Port Tobacco, Charles County (M. C. Crone); 20 at Patuxent Refuge on May 8, 1954. *Fall*: 25 at Wills Mountain, Allegany County, on September 3, 1901 (F. C. Kirkwood).

SOLITARY VIREO *Vireo solitarius* (Wilson)

STATUS.—*Breeding* (see fig. 32): Fairly common in the Allegheny Mountain section at elevations above 2,000 feet. *Transient*: Fairly common in the Allegheny Mountain, and Ridge and Valley sections; uncommon in the Piedmont, Upper Chesapeake, and Western Shore sections; rare in the Eastern Shore section.

HABITAT.—*Breeding*: Hemlock and white pine forests and

ixed mesophytic forests. *Transient*: Various types of deciduous and coniferous forests.

NESTING SEASON.—Late May to mid-July. The earliest record of nest-building was made on May 27, 1919, in Garrett County (J. M. Sommer). *Egg dates* (2 nests): June 1, 1925 (J. M. Sommer), and June 1, 1951, both in Garrett County. *Nestling dates* (2 nests): June 15, 1918 (J. M. Sommer), and June 25, 1949, both in Garrett County. Nest-building was recorded as late as June 25, 1949.

SPRING MIGRATION.—*Normal period*: April 10–20 to May 5–15; peak, April 20 to May 5. *Extreme arrival dates*: April 3, 1932, in the District of Columbia (E. N. Grinnell); April 6, 1952, in Baltimore County (E. Willis); April 7, 1946, in Worcester County. *Extreme departure dates*: June 2, 1924, in the District of Columbia (A. Wetmore); June 1, 1930, in Calvert County (H. E. Ewing); May 30, 1947, in Prince Georges County (J. E. Willoughby).

FALL MIGRATION.—*Normal period*: September 20–30 to October 20–30; peak, October 1 to October 20. *Extreme arrival dates*: August 30, 1953, in Frederick County (J. W. Richards); September 2, 1951, in Montgomery County (M. C. Merrill, C. K. Schoenbauer); September 6, 1903 (W. L. McAtee), and September 6, 1935 (R. Overing), in the District of Columbia; September 11, 1927, in Baltimore County (J. M. Sommer). *Extreme departure dates*: November 15, 1955, in Frederick County (J. W. Richards); November 10, 1951, in Anne Arundel County (F. C. Cross); November 5, 1911, in Montgomery County (A. K. Fisher).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

27 (5.5 in 20 acres) in "virgin hemlock forest" in Garrett County in 1949 (Robbins, 1949a);

17 (4 in 23¼ acres) in "mature northern hardwood forest" (black cherry, beech, hemlock, sugar maple, sweet birch, etc.) in Garrett County in 1951 (Robbins and Stewart, 1951a).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 10 at Patuxent Refuge on April 29, 1944. *Fall*: 20 at Patuxent Refuge on October 15, 1947.

RED-EYED VIREO *Vireo olivaceus* (Linnaeus)

STATUS.—*Breeding and transient*: Abundant in all sections except the Eastern Shore section where it is common.

HABITAT.—Various types of deciduous forests.

NESTING SEASON.—Mid-May to mid-August (nesting peak, late May to mid-July). *Extreme egg dates* (165 nests): May 19,

1945, in Prince Georges County (J. B. Cope) and July 31, 1893 in Baltimore County (Kirkwood, 1895). *Extreme nestling date.* (75 nests): June 4, 1945, in Prince Georges County (J. B. Cope) and August 18, 1954, in Caroline County (Mrs. A. J. Fletcher). Young birds, still partly dependent on their parents, were observed at Baltimore on September 11, 1940 (H. Brackbill).

SPRING MIGRATION.—*Normal period:* April 25–May 1 to May 15–25; peak, May 1 to May 15. *Extreme arrival dates:* April 17, 1954, in St. Marys County (J. W. Terborgh); April 17, 1954 in Prince Georges County (L. W. Oring); April 19, 1954, in Baltimore County (A. S. Kaestner); April 21, 1895, in the District of Columbia (H. W. Oldys). *Extreme departure date.* May 28, 1914, in the District of Columbia (Oberholser, 1919).

FALL MIGRATION.—*Normal period:* August 10–20 to October 5–15; peak, August 25 to September 25. *Extreme departure dates:* November 11, 1888, in Montgomery County (J. D. Figgins); November 11, 1917, in the District of Columbia (P. Bartsch).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 100 (36 in 36 acres) in "virgin central hardwood deciduous forest" (white oak–tulip–poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
- 92 (78.2 in 85 acres) in well-drained, flood-plain forest (sweetgum, hornbeam, river birch, tulip–poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946); 55 (18 in 32¼ acres) in another area of this habitat in 1944.
- 65 (29 in 44⅔ acres) in river bluff forest (beech, white oak, scarlet oak) in Prince Georges County in 1946, and 40 (18 in 44⅓ acres) in 1945 (J. W. Aldrich, A. J. Duvall).
- 62 (8 in 13 acres) in upland forest (white, northern red, chestnut, and black oaks) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 61 (8.5 in 14¼ acres) in poorly drained flood-plain forest (pin oak, sweetgum, red maple, red ash, etc.) in Prince Georges County in 1946.
- 60 (14 in 23¼ acres) in "mature northern hardwood forest" (black cherry, beech, hemlock, sugar maple, sweet birch, etc.) in Garrett County in 1951 (Robbins and Stewart, 1951a).
- 53 (42 in 80 acres) in "central hardwood forest (oaks–tulip–poplar) with scattered pine" in the District of Columbia in 1948, 51 (41 in 80 acres) in 1949, 49 (39 in 80 acres) in 1951 (Trever, 1951); 51 (41 in 80 acres) in 1954 (Wright, 1955); 48 (38.5 in 80 acres) in 1953 (Clagett, 1953); 41 (32.5 in 80 acres) in 1952 (Clagett, 1952).
- 52 (11 in 21 acres) in "dense second-growth" (oak–maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 50 (20 in 40 acres) in "mixed oak forest" (white, scarlet, and chestnut oaks, etc.) in Baltimore County in 1948 (Kolb, et al., 1948); 49 (18 in 37 acres) in 1951 (Kolb and Cole, 1951); 38 (15 in 40 acres) in 1949 (Kolb,

1949a); 38 (14 in 37 acres) in 1953 (Cole and Kolb, 1953); 33 (13 in 40 acres) in 1950 (Kolb, 1950); 33 (12 in 37 acres) in 1952 (Kaufmann, et al., 1952).

- 45 (5 in 11 acres) in upland seepage swamp forest (red maple, sweetgum, black gum, with dense understory of holly, sweet pepperbush, clammy azalea, maleberry, etc.) in Prince Georges County in 1946.
- 44 (5.5 in 12½ acres) in "mature oak-maple ridge forest" in Garrett County in 1949 (Robbins, 1949b);
- 39 (5 in 12¼ acres) in lowland seepage swamp forest (red maple, sweetgum, pin oak, with brushy understory of sweet bay, winterberry, arrow-wood, etc.) in Prince Georges County in 1946.
- 37 (8.2 in 24½ acres) in river terrace forest (beech-white oak) in Prince Georges County in 1944.
- 34 (8 in 23¾ acres) in upland oak forest (white, scarlet, and black oaks) in Prince Georges County in 1944.
- 34 (11 in 32½ acres) in pine-oak forest (pitch pine, scrub pine, Spanish oak) in Prince Georges County in 1944.
- 28 (3.6 in 13 acres) in shrub swamp (alder, poison sumac, sweet pepperbush, swamp rose, red maple, etc.) in Prince Georges County in 1945.
- 21 (6 in 28 acres) in partially opened, flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 16 (3 in 18¾ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).
- 10 (2 in 21 acres) in "immature loblolly-shortleaf pine stand" in Worcester County in 1948 (Springer and Stewart, 1948c).
- 10 (1.5 in 15 acres) in "open slash area" (cutover oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 205 at Patuxent Refuge on May 3, 1947; 200+ near Port Tobacco, Charles County, on May 11, 1943 (I. N. Gabrielson); 195 in Montgomery County on May 9, 1953 (E. J. Stivers, et al.). *Fall*: 209 killed at the Washington Monument in Washington, D. C., on September 12, 1937 (Overing, 1938); 47 at Patuxent Refuge on September 5, 1943.

PHILADELPHIA VIREO *Vireo philadelphicus* (Cassin)

STATUS.—*Transient*: Uncommon in the Allegheny Mountain, and Ridge and Valley sections; rare in the Piedmont, Upper Chesapeake, and Western Shore sections, and (in fall only) in the Eastern Shore section.

HABITAT.—Various types of deciduous forests.

SPRING MIGRATION.—*Normal period*: May 5-10 to May 25-30; peak, May 10 to May 20. *Extreme arrival date*: May 3, 1931, in Baltimore County (F. C. Kirkwood). *Extreme departure date*: June 8, 1927, in Baltimore County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: September 1-5 to October

1-5; peak, September 5 to September 25. *Extreme arrival dates:* August 25, 1951, in Baltimore County (Mr. and Mrs. R. D. Cole) and Montgomery County (I. R. Barnes); August 29, 1931, in Baltimore County (F. C. Kirkwood); August 29, 1953, in Talbot County (R. L. Kleen). *Extreme departure dates:* October 21, 1948, in the District of Columbia (E. G. Davis); October 11, 1941 (collected), in Baltimore County (Kolb and Hampe, 1941).

MAXIMUM COUNTS.—*Spring:* 3 near Rosedale, Baltimore County, on May 6, 1950 (D. A. Jones). *Fall:* 10 at Towson, Baltimore County, on August 27, 1951 (Mr. and Mrs. R. D. Cole); 4 at Chevy Chase, Montgomery County, on September 16, 1928 (W. H. Ball); 3 at Emmitsburg, Frederick County, on September 17, 1952 (J. W. Richards); 3 on South Mountain, along the boundary between Frederick and Washington Counties on September 20, 1952 (R. J. Beaton); 3 banded on the barrier beach north of Ocean City on September 13, 1955.

WARBLING VIREO *Vireo gilvus* (Vieillot)

STATUS.—*Breeding* (see fig. 46): Fairly common in the Ridge and Valley, and Upper Chesapeake sections; uncommon in the Piedmont section and in the northern part of the Eastern Shore section (Queen Annes, Caroline, and Talbot Counties); uncommon and local in the southern part of the Eastern Shore section

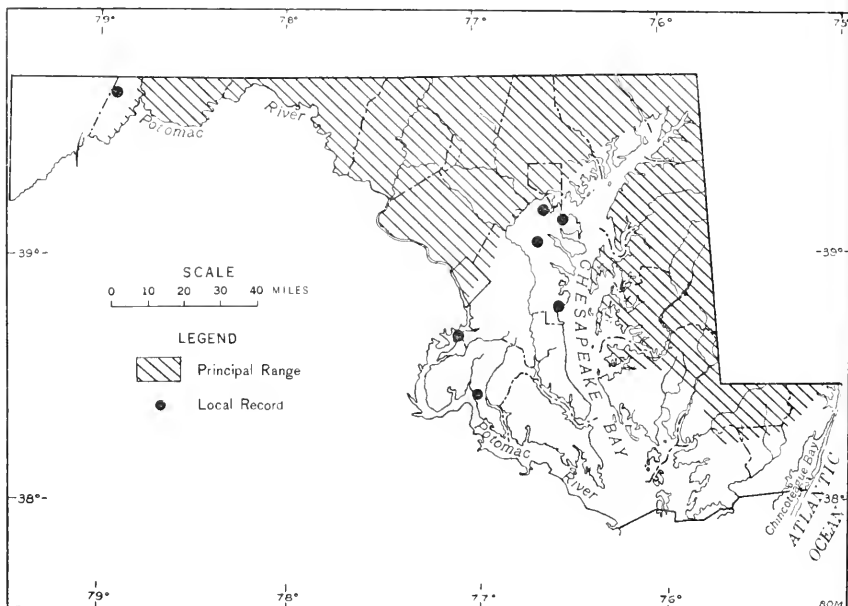


FIGURE 46.—Breeding range of Warbling Vireo.

(occurring in the vicinity of the towns of Cambridge, Hurlock, Vienna, Salisbury, Berlin, and Princess Anne); rare in the Allegheny Mountain section (Brooks, 1936c); rare and local in the Western Shore section—summer records in Charles County at Marshall Hall (S. F. Judd) and Chapel Point (A. Wetmore), in Anne Arundel County near Deale (N. Hotchkiss) and Rock Creek (J. M. Sommer), in Prince Georges County at Hyattsville (N. Hotchkiss), and in the District of Columbia. *Transient*: Uncommon in the Ridge and Valley, and Piedmont sections; rare in the Allegheny Mountain, Upper Chesapeake, Western Shore, and Eastern Shore sections.

HABITAT.—Open stands of shade trees in residential areas of towns and farms; in Ridge and Valley, and Piedmont sections, also occurs in open-growth flood-plain forests.

NESTING SEASON.—Mid-May to mid-July (probably). Nest-building was recorded as early as May 17, 1917, in Dorchester County (R. W. Jackson). *Extreme egg dates* (15 nests): May 24, 1925, and June 22, 1925, both in Dorchester County (R. W. Jackson).

SPRING MIGRATION.—*Normal period*: April 20–25 to June 1–10; peak, May 1 to May 20. *Extreme arrival date*: April 19, 1919, in Dorchester County (R. W. Jackson). *Extreme departure dates*: June 12, 1951, in Howard County; June 11, 1946, in Prince Georges County.

FALL MIGRATION.—*Normal period*: August 20–30 to September 20–30; peak, September 1 to September 15. *Extreme arrival dates*: August 17, 1927, and August 17, 1930, in Baltimore County (F. C. Kirkwood). *Extreme departure date*: October 9, 1892, in Baltimore County (F. C. Kirkwood).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

10 (2 in 19½ acres) in “shrubby field with stream-bordered trees” in Baltimore County in 1946; 5 (1 in 19½ acres) in 1947 (Cooley, 1947).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 75 in Washington County on May 7, 1949 (R. S. and M. Stauffer); 9 near Seneca, Montgomery County, on May 12, 1956 (C. N. Mason); 7 in the District of Columbia on May 12, 1913 (Oberholser, 1917a); 3 at Patuxent Refuge on May 9, 1953.

Family PARULIDAE

BLACK-AND-WHITE WARBLER *Mniotilta varia* (Linnaeus)

STATUS.—*Breeding*: Common in the Allegheny Mountain, and Ridge and Valley sections; fairly common in the Piedmont and

Western Shore sections; fairly common locally in the Eastern Shore section (most numerous in Worcester County, and in eastern portions of Wicomico and Somerset Counties); rare in the Upper Chesapeake section. *Transient*: Common in all sections. *Wintering*: Casual—2 seen at Chestertown, Kent County, on December 27, 1932 (W. Baker); 1 banded at Cambridge, Dorchester County, on December 27, 1952 (J. H. Buckalew); 1 seen at Denton, Caroline County, on December 9, 1953 (Mrs. A. J. Fletcher).

HABITAT.—Various types of deciduous and coniferous forests, usually with partly opened canopy (apparently absent during the breeding season in flood-plain forests).

NESTING SEASON.—Early May to early July. *Extreme egg dates* (9 nests); May 14, 1901, in the District of Columbia (Bartsch, 1901) and June 7, 1886, in the District of Columbia (C. W. Richmond). *Extreme nestling dates* (9 nests): May 17, 1948, in Worcester County (P. F. Springer) and July 4, 1892, in Baltimore County (Kirkwood, 1895).

SPRING MIGRATION.—*Normal period*: April 5–15 to May 15–25; peak, April 20 to May 10. *Extreme arrival dates*: March 28, 1929, in Prince Georges County (L. McCormick-Goodhart); March 30, 1908, in the District of Columbia (H. W. Oldys); March 31, 1952, in Montgomery County (E. J. Stivers). *Extreme departure date*: May 30, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: August 5–15 to October 1–10; peak, August 25 to September 25. *Extreme arrival dates*: July 19, 1951, in Caroline County (A. Knotts); July 24, 1951, in Baltimore County (E. Willis); July 31, 1886, in the District of Columbia (A. K. Fisher). *Extreme departure dates*: November 26, 1953, in Montgomery County (L. Kilham); November 14, 1931, in the District of Columbia (W. L. McAtee); October 30, 1952, in Caroline County (M. W. Hewitt).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 21 (4.5 in 21 acres) in "dense second-growth" (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 16 (3 in 18¾ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).
- 13 (2 in 15 acres) in "open slash area" (cut-over oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 11 (4 in 36 acres) in "virgin central hardwood deciduous forest (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).

(1.5 in 21 acres) in "immature loblolly-shortleaf pine stand" in Worcester County in 1948 (Springer and Stewart, 1948c).

(4 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1948, 3 (2 in 80 acres) in 1949, 1 (1 in 80 acres) in 1951 (Trever, 1952); 1 (1 in 80 acres) in 1952 (Claggett, 1952); none in 1953 or 1954.

MAXIMUM COUNTS (nonbreeding).—Spring: 46 in the Pocomoke River area on May 5, 1951; 46 at Patuxent Refuge on May 6, 1950. **Fall:** 65 at Greenbelt, Prince Georges County, on August 27, 1954 (L. W. Oring); 50 at Patuxent Refuge on August 28, 1943; 30 near Cabin John, Montgomery County, on September 24, 1947 (I. R. Barnes, E. G. Davis).

PROTHONOTARY WARBLER *Prothonotaria citrea* (Boddaert)

STATUS.—*Breeding and transient* (see fig. 47): Abundant in the swamps along the Pocomoke and upper Nanticoke Rivers and their tributaries; fairly common elsewhere in the Eastern Shore section and in the southern part of the Western Shore section (St. Marys, Calvert, and Charles Counties, and southern Prince Georges County); uncommon in the northern part of the Western Shore section, in the Upper Chesapeake section, and along the Potomac and Susquehanna River valleys in the Piedmont section; rare elsewhere in the Piedmont section, and along the Potomac River and larger tributaries in the Ridge and Valley section.

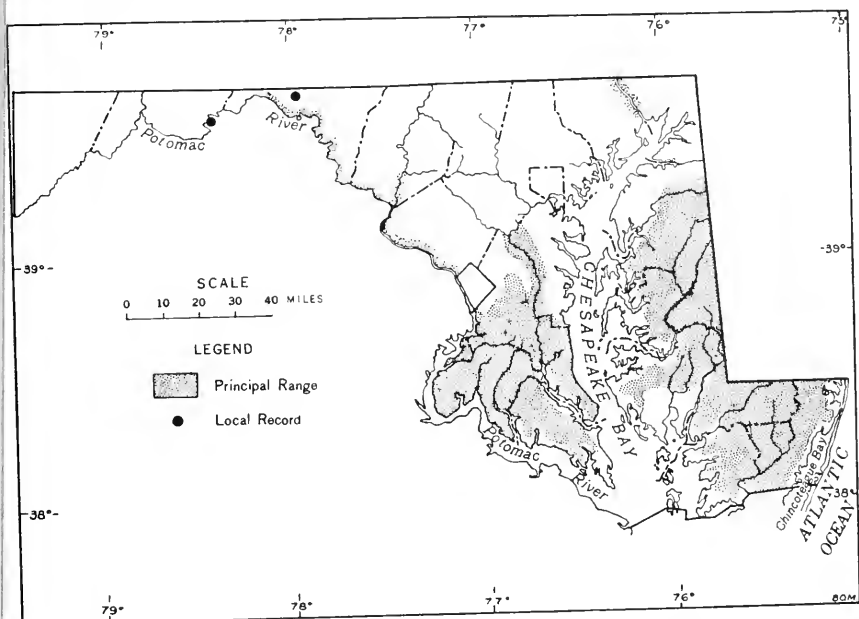


FIGURE 47.—Breeding range of Prothonotary Warbler.

HABITAT.—Most numerous in river or stream swamp forests also occurs in well-drained flood-plain forests.

NESTING SEASON.—Late April to late June (peak, mid-May to mid-June). Nest-building was recorded as early as April 26, 1953, in Caroline County (Mr. and Mrs. A. J. Fletcher). *Extreme egg dates* (12 nests): May 10, 1953, in Caroline County (Mr. and Mrs. A. J. Fletcher) and June 22, 1931, in Dorchester County (F. C. Kirkwood). *Extreme nestling dates* (17 nests): May 24, 1955, in Montgomery County (E. Meyer) and June 30, 1951, in Caroline County (Mr. and Mrs. A. J. Fletcher).

PERIOD OF OCCURRENCE.—*Normal period*: April 15–20 to September 10–20; peak, April 25 to September 10. *Extreme arrival date*: April 8, 1951, in Worcester County (D. A. Cutler). *Extreme departure date*: September 25, 1949, in Montgomery County (I. R. Barnes).

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

40 (7.5 in 18¼ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).

A total of 180 singing males was counted during a 20-mile canoe trip on the Pocomoke River, from Poorhouse Branch to Pocomoke City, on June 16, 1946.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 49 along the Pocomoke River on May 5, 1951; 15 near Cabin John, Montgomery County, on May 12, 1956 (H. A. Sutton); 8 near Seneca, Montgomery County, on April 25, 1948 (R. E. Lawrence). *Fall*: 15 along the Pocomoke River on September 10, 1950; 12 near Cabin John, Montgomery County, on September 3, 1947 (T. W. Donnelly).

SWAINSON'S WARBLER *Limnothlypis swainsonii* (Audubon)

STATUS.—*Breeding* (see fig. 48): Uncommon in the swamp along the Pocomoke River and its tributaries; rare in other stream swamps in Worcester County.

HABITAT.—River and stream swamps, being most numerous in the drier portions with partially opened canopy, and with dense understory brush composed of greenbrier, sweet pepperbush, and other shrubs (Meanley, 1950).

NESTING SEASON.—On May 15, 1955, a female that had been captured in a mist net in the Pocomoke swamp, Worcester County, laid an egg in a gathering cage. Newly hatched young were observed in the Pocomoke swamp on June 13, 1948 (Meanley, 1950). Adults were observed feeding young out of the nest near Pocomoke City, on June 20, 1953 (E. Fleisher, L. G. Worley).

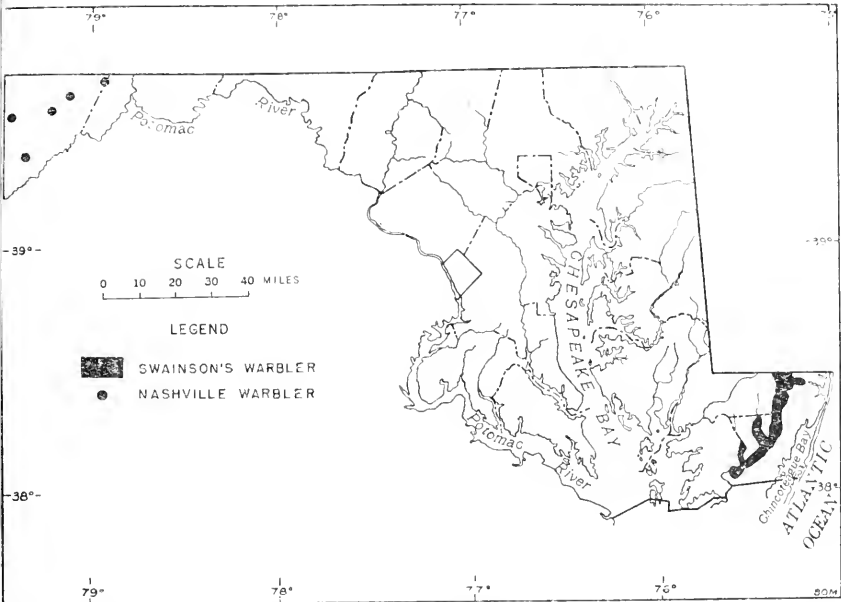


FIGURE 48.—Breeding ranges of Swainson's Warbler and Nashville Warbler.

PERIOD OF OCCURRENCE.—*Extreme arrival date:* April 21, 1948, in Worcester County. *Extreme departure date:* August 30, 1948, in Worcester County (M. B. Meanley). Future observations will undoubtedly show that this species remains on the breeding grounds at least until early September. Two migrants, probably from the Pocomoke swamp area, were seen on Tangier Island, Virginia, September 17 to 19, 1939, by A. H. Clark (Murray, 1952).

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

11 (2 in 18¼ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).

WORM-EATING WARBLER *Helmitheros vermivorus* (Gmelin)

STATUS.—*Breeding* (see fig. 49): Fairly common in the Ridge and Valley section, and locally in the Piedmont section; uncommon in the Western Shore section, and in the swamp along the Pocomoke River and its tributaries; rare elsewhere in the Eastern Shore section, and in the Upper Chesapeake and Allegheny Mountain sections. *Transient:* Uncommon in the Ridge and Valley, Piedmont, and Western Shore sections; rare in the Allegheny Mountain, Upper Chesapeake, and Eastern Shore sections.

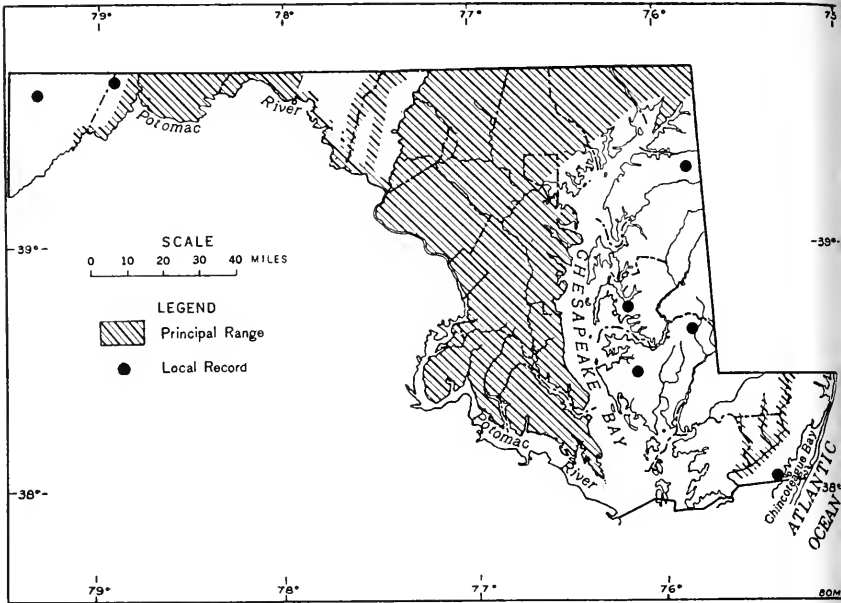


FIGURE 49.—Breeding range of Worm-eating Warbler.

HABITAT.—*Breeding:* Well-drained upland deciduous forests, usually with understory of mountain laurel or other shrubs; in the Eastern Shore section, occurs in the drier portions of river or stream swamps that contain an understory of mountain laurel. *Transient:* Various types of deciduous forests.

NESTING SEASON.—Mid-May to mid-July. *Extreme egg dates* (8 nests): May 29, 1892, in Charles County (W. Palmer) and July 4, 1885, in the District of Columbia (USNM). *Extreme nestling dates* (8 nests): May 28, 1930, in St. Marys County (F. C. Kirkwood) and June 25, 1893, in Baltimore County (W. N. Wholey).

SPRING MIGRATION.—*Normal period:* April 25–30 to May 10–15; peak, May 1 to May 10. *Extreme arrival dates:* April 17, 1942, in Harford County (S. Mason, Jr.); April 21, 1948, in Worcester County. *Extreme departure date:* May 18, 1923, in the District of Columbia (J. Kittredge, Jr.).

FALL MIGRATION.—*Normal period:* August 10–20 to September 10–20; peak, August 20 to September 10. *Extreme arrival dates:* July 31, 1886, in the District of Columbia (A. K. Fisher); August 8, 1906, in Montgomery County (A. K. Fisher). *Extreme departure dates:* October 15, 1920, in Baltimore County (F. C. Kirk-

wood); October 1, 1951, in Caroline County (M. W. Hewitt); September 23, 1952, in Prince Georges County.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 8 in Washington County on May 7, 1949 (R. S. and M. Stauffer); 6 on Warrior Mountain, Allegany County, on April 28, 1907 (F. C. Kirkwood); along the Pocomoke River in Worcester County on April 21, 1948; 6 at Patuxent Refuge on May 10, 1950. *Fall*: 9 at Patuxent Refuge on August 21, 1953; 5 in Dulaney Valley, Baltimore County, on August 13, 1899 (F. C. Kirkwood).

GOLDEN-WINGED WARBLER *Vermivora chrysoptera* (Linnaeus)

STATUS.—*Breeding* (see fig. 50): Fairly common in the Allegheny Mountain section, and in the western part of the Ridge and Valley section (Allegany County); uncommon in western Washington County (west of Hagerstown Valley). *Transient*: Fairly common in all sections except the Eastern Shore section where it is rare.

HABITAT.—*Breeding*: Brushy cutover oak-chestnut, mixed mesophytic, and bog forests. *Transient*: Various types of forest, although usually most numerous in flood-plain and swamp forests.

NESTING SEASON.—In Garrett County, a nest with eggs was found on June 2, 1925, and a nest with young nearly ready to fly

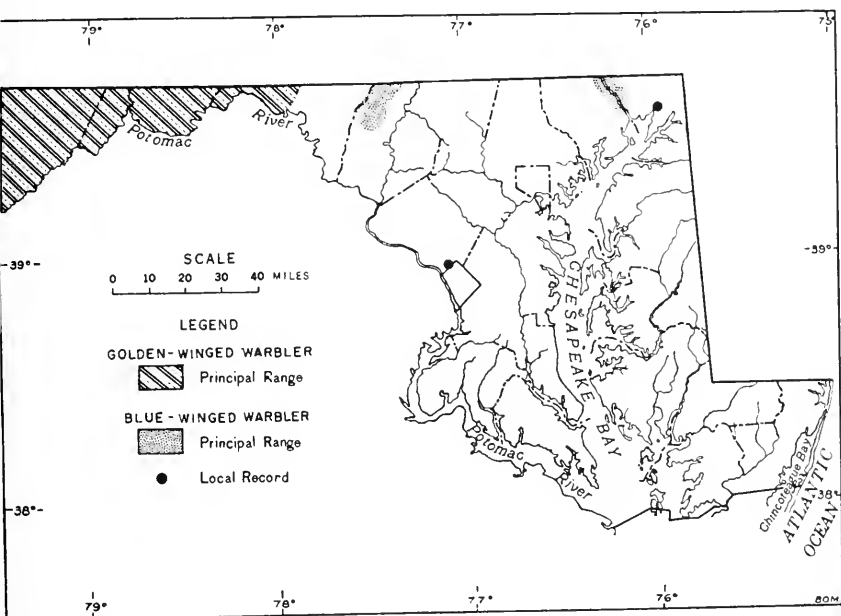


FIGURE 50.—Breeding ranges of Golden-winged Warbler and Blue-winged Warbler.

on June 16, 1918 (both records by J. M. Sommer). Another nest containing young, was observed in Garrett County on June 16 and June 17, 1956 (G. Knight).

SPRING MIGRATION.—*Normal period*: April 25–30 to May 10–15; peak, May 1 to May 10. *Extreme arrival dates*: April 2, 1952, in Prince Georges County; April 24, 1924, in the District of Columbia (M. T. Cooke). *Extreme departure dates*: May 2, 1892, in Baltimore County (W. N. Wholey); May 20, 1882, in the District of Columbia (H. W. Henshaw); May 20, 1952, in Carroll County (A. J. Fletcher, M. W. Hewitt).

FALL MIGRATION.—*Normal period*: August 15–20 to September 1–10; peak, August 20 to August 30. *Extreme arrival dates*: August 2, 1896, in Baltimore County (F. C. Kirkwood); August 6, 1953, in Prince Georges County; August 8, 1889 (USNM), in the District of Columbia (H. M. Smith). *Extreme departure dates*: September 24, 1950, in Baltimore County (E. Willis); September 16, 1955, in Worcester County; September 14, 1924, in Montgomery County (A. Wetmore); September 13, 1921, in the District of Columbia (B. H. Swales, A. Wetmore).

BREEDING POPULATION DENSITY (territorial males per 10 acres).—

17 (3.5 in 21 acres) in "dense second-growth" (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 17 at Patuxent Refuge on May 8, 1943; 12 near Seneca, Montgomery County, on May 3, 1952 (J. W. Terborgh); 6 at Port Tobacco, Charles County on May 5, 1939 (I. N. Gabrielson, A. L. Nelson). *Fall*: 14 at Patuxent Refuge on August 28, 1943; 6 near Seneca, Montgomery County, on August 22, 1951 (R. R. Kerr, J. W. Terborgh).

BLUE-WINGED WARBLER *Vermivora pinus* (Linnaeus)

STATUS.—*Breeding* (see fig. 50): Fairly common locally in the eastern part of the Ridge and Valley section (occurring north of Myersville in the Blue Ridge Mountains of western Frederick County) and in the northeastern part of the Piedmont section (in the Susquehanna River valley of Cecil and Harford Counties) also recorded in 1951 at Chevy Chase, Montgomery County (nest with eggs—C. P. Scheid), and in 1954 in the vicinity of Northeast Cecil County (J. W. Day); prior to 1900, this species occurred regularly in Baltimore County (Kirkwood, 1895) and Harford County (W. H. Fisher), in the area between Baltimore and Van Bibber; this species was also found nesting in 1880 near the District of Columbia (Richmond, 1888) and in Prince Georges

ounty, in the vicinity of Laurel (eggs, USNM—G. Marshall).
Transient: Fairly common in the Piedmont, Upper Chesapeake,
 Eastern Shore, and Western Shore sections; uncommon in the
 Edge and Valley section; rare in the Allegheny Mountain section
 Brooks, 1936c).

HABITAT.—*Breeding*: Wet or moist brushy cut-over forests.
Transient: Most numerous in flood-plain and swamp forests; oc-
 sional in other deciduous forest types.

NESTING SEASON.—Mid-May to early July. Nest-building was
 corded as early as May 20, 1893, in Baltimore County (G. H.
 Gray). *Extreme egg dates* (5 nests): May 27, 1893 (G. H. Gray),
 and June 18, 1896 (F. C. Kirkwood), in Baltimore County. *Ex-
 treme nestling dates* (3 nests): June 13, 1892, and July 1, 1893, in
 Baltimore County (G. H. Gray).

SPRING MIGRATION.—*Normal period*: April 25–30 to May 10–15;
 peak, May 1 to May 10. *Extreme arrival dates*: April 21, 1954, in
 Worcester County (P. G. DuMont); April 23, 1925, in the District
 of Columbia (Mrs. T. M. Knappen); April 23, 1954, in Talbot
 County (R. L. Kleen). *Extreme departure dates*: May 26, 1905
 (Oberholser, 1905), May 26, 1906 (D. C. Aud. Soc.), May 26, 1907
 (W. L. McAtee), all in the District of Columbia; May 22, 1948, in
 Baltimore County (H. Kolb).

FALL MIGRATION.—*Normal period*: August 15–20 to September
 10–20; peak, August 20 to September 5. *Extreme arrival dates*:
 August 5, 1949, in the District of Columbia (A. R. Stickley, Jr.);
 August 6, 1953, in Prince Georges County; August 8, 1950 and
 1951, in Baltimore County (E. Willis). *Extreme departure dates*:
 October 4, 1947, in Prince Georges County; September 27, 1952,
 in Montgomery County (M. M. Snow).

MAXIMUM COUNTS.—*Spring*: 23 in the Pocomoke River area on
 May 5, 1951; 17 at Patuxent Refuge on May 10, 1950; 8 at Port
 Tobacco, Charles County, on May 5, 1939 (I. N. Gabrielson, A. L.
 Nelson). *Fall*: 4 at Patuxent Refuge on August 20, 1943, and
 August 24, 1942.

GOLDEN-WINGED WARBLER X BLUE-WINGED WARBLER HYBRIDS

RECORDS OF BREWSTER'S WARBLER (*Vermivora leucobron-
 chialis*).—This hybrid form has been recorded as follows: 1 seen
 at Glen Echo, Montgomery County, on April 26, 1953 (I. R.
 Barnes, P. A. DuMont); 1 collected at Beltsville, Prince Georges
 County, on May 1, 1895 (USNM—A. H. Thayer); 1 seen at
 Middle River, Baltimore County, on May 3, 1950 (E. Willis); 1
 seen along the C. and O. Canal, Montgomery County, on May 3.

1953 (I. R. Barnes); 1 seen at Port Tobacco, Charles County, May 4, 1953 (Mrs. J. Cooley, Jr.); 1 collected at Loch Raven, Baltimore County, on May 7, 1940 (Seibert, 1941); 2 seen at Patuxent Refuge on May 8, 1943 (Stewart, et al., 1952); 1 seen in the District of Columbia on May 9, 1947 (I. R. Barnes); 1 seen at Patuxent Refuge on May 10, 1950; 1 seen in the District of Columbia on May 13, 1950 (T. W. Donnelly); 1 banded in the District of Columbia on May 16, 1939 (Fr. E. Stoehr).

RECORDS OF LAWRENCE'S WARBLER ("*Vermivora lawrencei*"). This hybrid form has been recorded as follows: 1 seen in the District of Columbia on May 2, 1905 (T. H. Levering); and another on May 5, 1943 (A. Wetmore); 1 male collected at Plumme Island, Montgomery County, on May 12, 1907 (Osgood, 1907); 1 seen in Garrett County on June 28, 1936 (Brooks, 1936c); 1 seen at Patuxent Refuge on September 4, 1942 (Meanley, 1944).

TENNESSEE WARBLER *Vermivora peregrina* (Wilson)

STATUS.—*Transient*: Fairly common in the Allegheny Mountain, Ridge and Valley, and Piedmont sections; uncommon in the Upper Chesapeake and Western Shore sections; rare in the Eastern Shore section.

HABITAT.—Various types of deciduous forest.

SPRING MIGRATION.—*Normal period*: May 5–10 to May 20–25; peak, May 10 to May 20. *Extreme arrival dates*: April 28, 1955 in Frederick County (J. W. Richards); April 29, 1956, in Prince Georges County; May 1, 1954, in Montgomery County (J. L. Fales, C. N. Mason). *Extreme departure dates*: June 3, 1910, in the District of Columbia (R. W. Williams); May 30, 1917, in Prince Georges County (W. L. McAtee, A. Wetmore).

FALL MIGRATION.—*Normal period*: September 1–10 to October 5–15; peak, September 15 to October 5. *Extreme arrival date*: August 20, 1955, in Baltimore County (C. M. Buchanan); August 25, 1951, in Montgomery County (I. R. Barnes); August 27, 1899 in Baltimore County (G. H. Gray); August 29, 1953, in Talbot County (R. L. Kleen). *Extreme departure dates*: November 3, 1889, in Frederick County (J. D. Figgins); November 17, 1950 in Montgomery County (1 banded—S. H. Low, J. H. Buckalew); October 22, 1922, in the District of Columbia (J. Kittredge, Jr.).

MAXIMUM COUNTS.—*Spring*: 66 at Patuxent Refuge on May 10, 1950; 15 in the Seneca area, Montgomery County, on May 9, 1950 (I. R. Barnes, et al.). *Fall*: 50 at Seneca, Montgomery County, on September 12, 1954 (J. W. Terborgh); 36 at Swallow Falls, Garrett County, on September 11, 1954 (L. W. Oring); 18 at Midd-

iver, Baltimore County, on September 25, 1951 (E. Willis); 12
t Patuxent Refuge on October 3, 1947.

RANGE-CROWNED WARBLER *Vermivora celata* (Say)

STATUS.—*Fall transient*: Rare (15 records)—recorded in Mont-
gomery, Baltimore, Prince Georges, and Worcester Counties.
Wintering: Casual—recorded in Worcester County in 1952 (S. H.
ow), 1953 (A. J. Fletcher, R. R. Kerr), 1954 (I. N. Gabrielson,
.. R. Stickley, Jr.), and 1955 (3 seen—J. W. Terborgh); in Balti-
more County in 1949-50 (R. D. Cole); and in the District of Colum-
ia in 1928 (E. T. Wherry). *Spring transient*: Casual—1 observed
in Baltimore County on May 11, 1892 (P. T. Blogg); and 1 seen on
three dates, April 10-26, 1956, at Emmitsburg (J. W. Richards).

HABITAT.—Usually found in hedgerows or wood margins.

FALL MIGRATION.—*Extreme arrival date*: September 30, 1952,
in Montgomery County (Cross, 1952). *Extreme departure dates*:
November 12, 1950, in Baltimore County (E. Willis); November
, 1952, in Worcester County (M. Gilbert).

NASHVILLE WARBLER *Vermivora ruficapilla* (Wilson)

STATUS.—*Breeding* (see fig. 48): Uncommon and local in the
Allegheny Mountain section—occurring in Garrett County at the
following locations: Mountain Lake (near Mt. Lake Park—M. G.
Brooks); Cranberry Swamp (1/2 mile east of Finzel); Wolf
Swamp (about 4 miles southeast of Grantsville); Cunningham
Swamp (near Bittering); and the Maryland portion of Cranesville
Swamp (just east of Cranesville, West Virginia). *Transient*:
Fairly common in the Allegheny Mountain, and Ridge and Valley
sections; uncommon in the Piedmont, Upper Chesapeake, and
Western Shore sections; rare in the Eastern Shore section.

HABITAT.—*Breeding*: Brushy, cutover spruce bogs. *Transient*:
Wood margins or open stands of swamp and flood-plain forests,
and rich, moist forests on the upland.

NESTING SEASON.—A nest found in Wolf Swamp contained eggs
on May 30, and nearly full-grown young on June 16, 1951. On
June 12, 1949, adults were observed carrying food in the Maryland
portion of Cranesville Swamp.

SPRING MIGRATION.—*Normal period*: April 25-30 to May 15-20;
peak, May 1 to May 15. *Extreme arrival dates*: April 20, 1925,
in the District of Columbia (W. H. Ball); April 23, 1946, in Prince
Georges County; April 23, 1952, in Frederick County (J. W.
Richards). *Extreme departure dates*: May 25, 1949, in Prince
Georges County; May 24, 1917, in Montgomery County (A. Wet-
more).

FALL MIGRATION.—*Normal period*: September 5–10 to October 5–15; peak, September 10 to October 5. *Extreme arrival date* September 4, 1898, in Baltimore County (F. C. Kirkwood). *Extreme departure dates*: November 6, 1949, in Worcester County (M. B. Meanley); October 25, 1938, in the District of Columbia (W. B. McIlwaine, Jr.); October 23, 1954, in Baltimore County (C. M. Buchanan); October 19, 1950, in Prince Georges County (J. H. Fales).

BREEDING POPULATION DENSITIES (territorial males per 10 acres).—

39 (3.5 in 9 acres) in “scrub spruce bog” (brush-meadow stage with young red spruce) in Garrett County in 1951 (Robbins and Stewart, 1951b).

21 (2 in 9½ acres) in “open hemlock-spruce bog” (brush-meadow stage with young hemlock, red spruce, alder, etc.) in Garrett County in 1949 (Robbins, 1949c).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 20+ at Waverly Baltimore County, on May 12, 1892 (W. N. Wholey); 14 in the District of Columbia, and adjacent Prince Georges County, Maryland, on May 11, 1917 (Oberholser, 1917a); 10 at Emmitsburg Frederick County, on April 27 and 28, 1954 (P. J. O'Brien, J. W. Richards). *Fall*: 3 at Patuxent Refuge on September 9, 1953, and October 3, 1947; 3 at Seneca, Montgomery County, on September 12, 1954 (J. W. Terborgh).

PARULA WARBLER *Parula americana* (Linnaeus)

STATUS.—*Breeding*: Common in the Western Shore section locally common in the Eastern Shore section (most numerous along the Pocomoke River and its tributaries, uncommon elsewhere); fairly common in the Piedmont section; uncommon in the Ridge and Valley, and Allegheny Mountain sections; rare in the Upper Chesapeake section. *Transient*: Fairly common in all sections.

HABITAT.—Flood-plain and swamp forests, and rich, moist forests on the upland, including both deciduous and coniferous types.

NESTING SEASON.—Late April to late June. Nest-building was recorded as early as April 24, 1946, in Montgomery County (Peterson, 1946). *Extreme egg dates* (6 nests): May 15, 1947 and June 14, 1947, in Prince Georges County (M. B. Meanley) *Extreme nestling dates* (9 nests): May 28, 1930, in St. Mary County (F. C. Kirkwood) and June 25, 1893, in Baltimore County (W. N. Wholey).

SPRING MIGRATION.—*Normal period*: April 15–20 to May 20–25 peak, April 20 to May 10. *Extreme arrival dates*: April 6, 1928

n the District of Columbia (A. H. Howell); April 7, 1946, in Worcester County; April 7, 1949, in Montgomery County (L. M. Wendt). *Extreme departure dates*: May 30, 1905, in the District of Columbia (H. C. Oberholser); May 30, 1944 and 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: August 20–30 to October 5–15; peak, September 10 to October 5. *Extreme departure dates*: December 14, 1936 (found dead, in “excellent condition”), in the District of Columbia (Lincoln, 1937); October 29, 1952, in Caroline County (M. W. Hewitt); October 20, 1948, in the District of Columbia (E. G. Davis).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 17 (40.1 in 85 acres) in well-drained, flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946); 22 (7.2 in 32¼ acres) in another area of this habitat in 1944.
- 29 (4 in 14¼ acres) in poorly-drained, flood-plain forest (pin oak, sweetgum, red maple, red ash, etc.) in Prince Georges County in 1946.
- 19 (3.5 in 18¼ acres) in “second-growth river swamp” (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).
- 16 (4.5 in 28 acres) in partially opened, flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 14 (1.5 in 11 acres) in upland seepage swamp forest (red maple, sweetgum, black gum, with dense understory of holly, sweet pepperbush, clammy azalea, maleberry, etc.) in Prince Georges County in 1946.
- 12 (4 in 32½ acres) in pine-oak forest (pitch pine, scrub pine and Spanish oak) in Prince Georges County in 1944.
- 12 (1.5 in 13 acres) in upland oak forest (white, northern red, chestnut, and black oaks) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 8 (1.5 in 20 acres) in “virgin hemlock stand” in Garrett County in 1949 (Robbins, 1949a).
- 6 (1.5 in 23¼ acres) in “mature northern hardwood forest” (black cherry, beech, hemlock, sugar maple, sweet birch, etc.) in Garrett County in 1951 (Robbins and Stewart, 1951a).
- 4 (1.5 in 36 acres) in “virgin central hardwood deciduous forest” (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 112 at Patuxent Refuge on May 6, 1950; 102 in Montgomery County on May 8, 1954 (K. Stecher); 100 at Port Tobacco, Charles County, on May 11, 1943 (I. N. Gabrielson, F. M. Uhler); 49 in the Pocomoke River area of Worcester and Wicomico Counties on May 5, 1951. *Fall*: 80 in the District of Columbia on October 1, 1948 (I. R. Barnes, K. H. Weber); 35 near Cabin John, Montgomery County, on September 18, 1954 (P. A. DuMont); 23 found dead at the

Washington Monument, in the District of Columbia, on September 12, 1937 (Overing, 1938); 19 at Greenbelt, Prince Georges County on October 6, 1954 (L. W. Oring).

YELLOW WARBLER *Dendroica petechia* (Linnaeus)

STATUS.—*Breeding*: Fairly common in the Allegheny Mountain Ridge and Valley, and Upper Chesapeake sections, and in the tide water areas of the Eastern Shore and Western Shore sections; un- common elsewhere in the Eastern Shore and Western Shore sec- tions, and in the Piedmont section. *Transient*: Common in the Allegheny Mountain section; uncommon in all other sections.

HABITAT.—Open growth of willow, and other small trees and shrubs on wet ground; also occurs in orchards, and in residential areas that contain an open growth of small ornamental trees.

NESTING SEASON.—Early May to early July (nesting peak, mid May to mid-June). Nest-building was recorded as early as May 1, 1954, in Baltimore County (E. K. Lubbert). *Extreme egg dates* (99 nests): May 7, 1921, in the District of Columbia (M. J. Pel- lew) and June 17, 1951, in Baltimore County (E. Willis). *Extreme nestling dates* (27 nests): May 23, 1902 (F. C. Kirkwood), and July 10, 1951 (E. Willis), in Baltimore County. Fledglings out of the nest were recorded as early as May 26, 1935, in Allegany County (L. M. Llewellyn).

SPRING MIGRATION.—*Normal period*: April 15–25 to May 25–30, peak, May 1 to May 20. *Extreme arrival dates*: April 3, 1953, in St. Marys County (R. R. Kerr); April 4, 1862 (USNM), in the District of Columbia (C. E. Schmidt); April 6, 1893, in Dorchester County (R. C. Watters). *Extreme departure dates*: June 11, 1916, in the District of Columbia (Oberholser, 1919); June 7, 1952, in Prince Georges County.

FALL MIGRATION.—*Normal period*: July 15–25 to September 20–30; peak, July 25 to September 1. *Extreme arrival dates*: July 9, 1933, in the District of Columbia (E. N. Grinnell); July 12, 1917, in Dorchester County (R. W. Jackson). *Extreme departure dates*: October 12, 1910, in the District of Columbia (E. J. Brown); Octo- ber 6, 1927, in Montgomery County (W. H. Ball).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

63 (12 in 19.2 acres) in shrubby field with stream-bordered trees in Baltimore County in 1946, 47 (9 in 19.2 acres) in 1947 (Cooley, 1947).

5 (3 in 66 acres) in field and edge habitat (including strips of flood-plain forest, brushy fields, and hedgerows) in Baltimore County in 1947 (Hampe, et al., 1947).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 200 at Port To-

oacco, Charles County, on May 7, 1940 (C. Cottam, I. N. Gabrielson); 60 in the District of Columbia on May 4, 1952 (Mr. and Mrs. F. L. Zapf).

MAGNOLIA WARBLER *Dendroica magnolia* (Wilson)

STATUS.—*Breeding* (see fig. 32): Common in the Allegheny Mountain section at elevations above 2,500 feet (locally down to 2,100 feet). *Transient*: Common in all sections except the Eastern Shore section where it is uncommon.

HABITAT.—*Breeding*: Hemlock, red spruce, and mixed mesophytic forests that contain an understory of conifers. *Transient*: Various types of deciduous and coniferous forests, being most numerous in those that contain an understory shrub layer.

NESTING SEASON.—Probably late May to early July. *Extreme egg dates* (5 nests): June 3, 1925 (F. C. Kirkwood), and June 28, 1899 (Preble, 1900), in Garrett County. *Nestling dates* (3 nests): June 12, 1918 (J. M. Sommer); June 12, 1925 (G. Eifrig); and June 13, 1949, all in Garrett County.

SPRING MIGRATION.—*Normal period*: May 1–10 to May 25–30; peak, May 10 to May 20. *Extreme arrival dates*: April 22, 1891, in the District of Columbia (C. W. Richmond); April 28, 1905, in Baltimore County (F. C. Kirkwood); April 28, 1954, in Anne Arundel County (Mrs. G. Tappan, Mrs. W. L. Henderson). *Extreme departure dates*: June 8, 1954, in Baltimore County (S. W. Simon); June 3, 1945, in Prince Georges County; June 2, 1917, in the District of Columbia (F. Harper).

FALL MIGRATION.—*Normal period*: August 20–30 to October 5–15; peak, September 10 to September 25. *Extreme arrival dates*: August 15, 1886, in the District of Columbia (A. K. Fisher); August 19, 1952, in Baltimore County (E. Willis). *Extreme departure dates*: October 28, 1916, in the District of Columbia (Mr. and Mrs. L. D. Miner); October 27, 1951, in Garrett County (H. E. Slater).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 80 (16 in 20 acres) in "virgin hemlock forest" in Garrett County in 1949 (Robbins, 1949a).
- 63 (6 in 9½ acres) in "open hemlock-spruce bog" (brush-meadow stage with young hemlock, red spruce, alder, etc.) in Garrett County in 1949 (Robbins, 1949c).
- 40 (5 in 12½ acres) in "virgin spruce-hemlock bog forest" (red spruce and hemlock with dense understory of great laurel) in Garrett County in 1951 (Stewart and Robbins, 1951a).
- 33 (3 in 9 acres) in "scrub spruce bog" (brush-meadow stage with young red spruce) in Garrett County in 1951 (Robbins and Stewart, 1951b).

- 26 (6 in 23¼ acres) in "mature northern hardwood forest" (black cherry, beech, hemlock, sugar maple, sweet birch, etc.) in Garrett County 1951 (Robbins and Stewart, 1951a).
- 22 (6 in 27½ acres) in "red pine plantation" (young trees about 20 feet height) in Garrett County in 1949 (Robbins and Barnes, 1949).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 69 at Patuxent Refuge on May 10, 1950. *Fall*: 48 at Middle River, Baltimore County, on September 24, 1950 (E. Willis); 34 killed at the Washington Monument in the District of Columbia on September 11, 1937 (Overing, 1938); 29 at Patuxent Refuge on September 21, 1943; 25 at Cumberland, Allegany County, on September 21, 1900 (G. Eifrig).

CAPE MAY WARBLER *Dendroica tigrina* (Gmelin)

STATUS.—*Spring transient*: Uncommon in all sections except the Eastern Shore section where it is rare. *Fall transient*: Fairly common in all sections. *Wintering*: Accidental—1 recorded in the District of Columbia on December 16, 1888, and another on December 16, 1916 (Richmond, 1917); 1 seen in Frederick County on March 12, 1950 (R. T. Smith).

HABITAT.—Various types of forest, with preference generally shown for young pine stands.

SPRING MIGRATION.—*Normal period*: May 1-5 to May 15-20; peak, May 5 to May 15. *Extreme arrival dates*: April 26, 1950, in the District of Columbia (F. C. Cross); April 27, 1954, in Prince Georges County; April 27, 1954, in Montgomery County (J. H. Fales); April 28, 1954, in Frederick County (J. W. Richards). *Extreme departure dates*: June 1, 1924, in Baltimore County (J. M. Sommer); May 30, 1917, in Prince Georges County (A. Wetmore); May 30, 1921, in the District of Columbia (J. Kittredge Jr.).

FALL MIGRATION.—*Normal period*: September 1-10 to October 15-25; peak, September 10 to October 10. *Extreme arrival dates*: August 23, 1942 (USNM), in Prince Georges County; August 25, 1890, in Montgomery County (J. D. Figgins); August 25, 1951, in Baltimore County (R. D. Cole, E. Willis); August 25, 1955, in Talbot County (R. L. Kleen). *Extreme departure dates*: November 26, 1915, in the District of Columbia (P. Bartsch); November 10, 1951, in Queen Annes County; October 26, 1944 and 1954, in Prince Georges County.

MAXIMUM COUNTS.—*Spring*: 36 near Seneca, Montgomery County, on May 12, 1951 (R. F. Deed, C. N. Mason); 21 at Patuxent Refuge on May 13, 1950. *Fall*: "Thousands" at Ocean City on October 2, 1949 (M. B. Meanley); 41 at Patuxent Refuge on Octo-

er 7, 1944; 15 at South Mountain, along the boundary between Frederick and Washington Counties, on September 25, 1949 (R. J. Eaton).

BANDING.—One banded at Monkton, Baltimore County, on May 1955, was recovered near Chatham, New Brunswick, on June 1, 1955.

LACK-THROATED BLUE WARBLER *Dendroica caerulescens* (Gmelin)

STATUS.—*Breeding* (see fig. 32): Common in the Allegheny Mountain section at elevations above 2,000 feet. *Transient*: Common in all sections except the Eastern Shore section, where it is uncommon. *Wintering*: Accidental—1 was recorded in the District of Columbia on December 22, 1930 (Booker, 1931), and remained throughout the months of January, February, and March, 1931 (Oberholser, 1931).

HABITAT.—*Breeding*: Mixed mesophytic, oak-chestnut, hemlock, and red spruce forests with understory of great laurel, mountain laurel, or various deciduous shrubs. *Transient*: Various types of deciduous forest.

NESTING SEASON.—Probably late May to early July. *Egg dates* (3 nests): All on June 3, 1925, in Garrett County (F. C. Kirkwood). *Nestling dates* (2 nests): June 11, 1918 (J. M. Sommer), and June 25, 1949, both in Garrett County.

SPRING MIGRATION.—*Normal period*: April 25–30 to May 20–25; peak, May 1 to May 15. *Extreme arrival dates*: April 15, 1928, in Harford County (F. C. Kirkwood); April 19, 1896, in the District of Columbia (J. D. Figgins); April 21, 1929, in Baltimore County (F. C. Kirkwood, J. M. Sommer). *Extreme departure dates*: June 5, 1949, in Prince Georges County (R. C. Simpson); June 5, 1952, in Frederick County (J. W. Richards); May 30, 1897, in Baltimore County (F. C. Kirkwood); May 30, 1888, in the District of Columbia (C. W. Richmond).

FALL MIGRATION.—*Normal period*: August 25–September 5 to October 10–20; peak, September 20 to October 10. *Extreme arrival dates*: August 19, 1951, in Baltimore County (E. Willis); August 21, 1887, in the District of Columbia (A. K. Fisher); August 21, 1944, in Prince Georges County; August 22, 1930, in Dorchester County (H. B. Curry). *Extreme departure dates*: October 31, 1953, in Montgomery County (P. G. DuMont); October 29, 1913, in the District of Columbia (L. D. Miner).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

58 (11.5 in 20 acres) in "virgin hemlock forest" in Garrett County in 1949 (Robbins, 1949a).

- 52 (6.5 in 12½ acres) in "virgin spruce-hemlock bog forest" (red spruce and hemlock with dense understory of great laurel) in Garrett County in 1951 (Stewart and Robbins, 1951a).
- 48 (3 in 6¼ acres) in "young second-growth resulting from cutting" (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 17 (1.5 in 9 acres) in "scrub spruce bog" (brush-meadow stage with young red spruce) in Garrett County in 1951 (Robbins and Stewart, 1951b).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 119 at Patuxent Refuge on May 10, 1950; 50 at Port Tobacco, Charles County, on May 11, 1943 (I. N. Gabrielson, A. L. Nelson); 40 at Unity, Montgomery County, on May 9, 1953 (S. H. Low). *Fall*: 29 at Patuxent Refuge on October 11, 1947; 17 at Greenbelt, Prince Georges County, on October 7, 1954 (L. W. Oring); 9 banded on the barrier beach north of Ocean City on September 13, 1955.

MYRTLE WARBLER *Dendroica coronata* (Linnaeus)

STATUS.—*Breeding*: Accidental—an adult male and female, the latter with a broken wing, and 3 young about one-half grown were reported near Havre de Grace, Harford County, in June 1879 (Kumlien, 1880). *Transient*: Abundant in all sections. *Wintering*: Abundant in the southern part of the Eastern Shore section (Worcester, Somerset, Wicomico, and Dorchester Counties); common elsewhere in the Eastern Shore section, and in St. Marys County; fairly common elsewhere in the Western Shore and Upper Chesapeake sections; uncommon in the Piedmont, and Ridge and Valley sections. *Summer vagrant*: One was collected on August 7, 1859, in the District of Columbia (E. Coues); 1 was seen at Middle River, Baltimore County, on July 4 and July 24, 1951 (E. Willis).

HABITAT.—*Transient*: Various types of forest. *Wintering*: Flood-plain and swamp forests, and brushy areas near tidewater—at this season, usually found where either bayberry or poison ivy is common; also occurs locally in red-cedar thickets.

SPRING MIGRATION.—*Normal period*: March 10–20 to May 15–25; peak, April 15 to May 15. *Extreme arrival dates*: March 8, 1917, in Dorchester County (R. W. Jackson); March 8, 1953, in Caroline County (A. M. Thompson). *Extreme departure dates*: May 31, 1915, in Baltimore County (J. M. Sommer); May 30, 1917, in Prince Georges County (W. L. McAtee, A. Wetmore); May 30, 1954, in Charles County (A. R. Stickley, Jr.).

FALL MIGRATION.—*Normal period*: September 20–30 to November 20–30; peak, October 5 to November 10. *Extreme arrival dates*: August 27, 1954, in Caroline County (M. W. Hewitt); August 30, 1913 (F. C. Kirkwood), and August 31, 1950 (Mr. and Mrs. R. D.

sole), in Baltimore County; September 4, 1955, in Talbot County (R. L. Kleen). *Extreme departure dates*: December 20, 1944, in Prince Georges County; December 16, 1903, in the District of Columbia (A. K. Fisher).

MAXIMUM COUNTS.—*Spring*: 300 at Port Tobacco, Charles County, on May 5, 1939 (I. N. Gabrielson, F. M. Uhler); 300 along the C. and O. Canal in Montgomery County, on May 13, 1950 (P. A. DuMont); 240 at Greenbelt, Prince Georges County, on May 9, 1953 (L. W. Oring, et al.). *Fall*: 300 in the Ocean City area on October 25, 1949; 196 at Patuxent Refuge on October 26, 1944; 100 at Herring Run, Baltimore County, on October 16, 1930 (J. M. Sommer). *Winter* (Christmas counts): 6,500 in southern Dorchester County on December 28, 1953; 4,001 in the Ocean City area on December 27, 1954; 1,138 in the Wicomico River area, Charles and St. Marys Counties, on January 1, 1954.

BANDING.—One recovered in Dorchester County, on February 12, 1956, had been banded on Nantucket Island, Massachusetts, on October 20, 1955.

BLACK-THROATED GREEN WARBLER *Dendroica virens* (Gmelin)

STATUS.—*Breeding* (see fig. 51): Common in the Allegheny Mountain section; fairly common in the western part of the Ridge and Valley section (Alleghany County); uncommon in the eastern

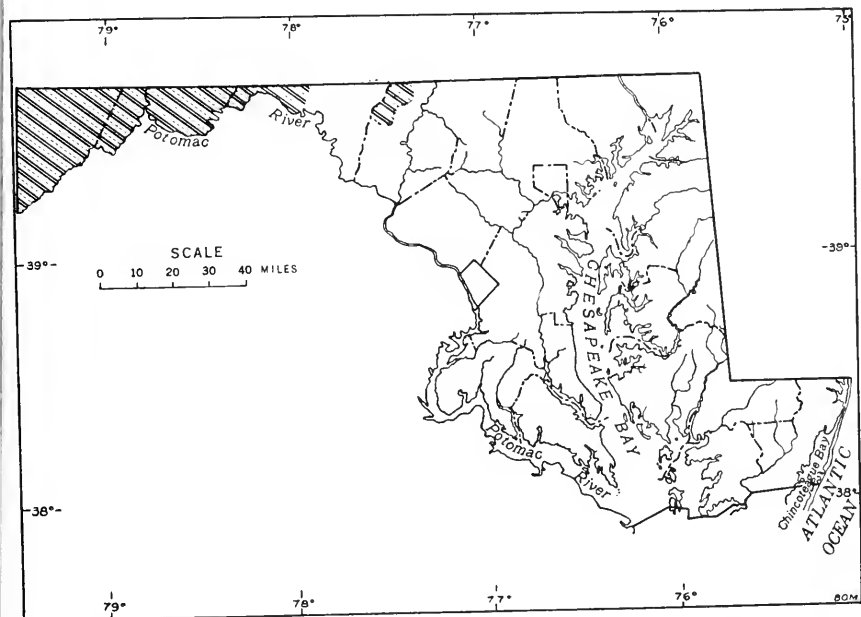


FIGURE 51.—Breeding range of Black-throated Green Warbler.

part of the Ridge and Valley section (Washington County, and in western Frederick County from Myersville north to the Pennsylvania line; also recorded in summer (July 20, 1947, and June 26, 1948) in the Piedmont section at Cabin John, Montgomery County. *Transient*: Common in all sections except the Eastern Shore section where it is uncommon.

HABITAT.—*Breeding*: Hemlock stands, and mixed mesophytic forest (including deciduous types as well as mixed stands of coniferous and deciduous trees). *Transient*: Various types of deciduous forest.

NESTING SEASON.—Probably mid-May to early July. Although no nests have been located, young birds out of the nest have been recorded several times. The earliest of these observations was made on June 12, 1949, in Garrett County. A pair was observed copulating as early as May 19, 1935, in Allegany County (L. M. Llewellyn).

SPRING MIGRATION.—Normal period: April 20–25 to May 15–25; peak, May 1 to May 15. *Extreme arrival dates*: April 16, 1950 (P. A. DuMont), and April 18, 1920 (B. H. Swales), in Montgomery County; April 19, 1934, in the District of Columbia (C. H. Benjamin); April 19, 1946, and April 19, 1949, in Prince Georges County. *Extreme departure dates*: June 10, 1917, in the District of Columbia (D. C. Mabbott); June 5, 1954, in Baltimore County (S. W. Simon); May 30, 1917 (W. L. McAtee, A. Wetmore), and May 30, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: August 25–September 5 to October 10–20; peak, September 10 to October 5. *Extreme arrival dates*: August 9, 1952, in the District of Columbia (A. R. Stickley, Jr.); August 10, 1942, in Baltimore County (H. Kolb); August 21, 1949, in Prince Georges County. *Extreme departure dates*: October 31, 1953, in Montgomery County (P. G. DuMont); October 31, 1954, in Anne Arundel County (Mr. and Mrs. H. N. Page); October 27, 1956, in Prince Georges County; October 23, 1954, in Frederick County (J. W. Richards).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 36 (4.5 in 12½ acres) in “mature oak-maple ridge forest” in Garrett County in 1949 (Robbins, 1949b).
- 30 (6 in 20 acres) in “virgin hemlock forest” in Garrett County in 1949 (Robbins, 1949a).
- 21 (2 in 9½ acres) in “open hemlock-spruce bog” (brush-meadow stage with young hemlock, red spruce, alder, etc.) in Garrett County in 1949 (Robbins, 1949c).
- 9 (2 in 23¼ acres) in “mature northern hardwood forest” (black cherry,

beech, hemlock, sugar maple, sweet birch, etc.) in Garrett County in 1951 (Robbins and Stewart, 1951a).

(2 in 27½ acres) in "red pine plantation" (young trees about 20 feet in height) in Garrett County in 1949 (Robbins and Barnes, 1949).

MAXIMUM COUNTS (nonbreeding).—Spring: 37 at Patuxent refuge on May 10, 1950. **Fall:** 35 at Middle River, Baltimore county, on September 24, 1950 (E. Willis); 30 near Seneca, Montgomery County, on September 25, 1949 (I. R. Barnes, S. A. Riggs); 28 at Patuxent Refuge on September 25, 1943.

ERULEAN WARBLER *Dendroica cerulea* (Wilson)

STATUS.—Breeding (see fig. 52): Fairly common in the western part of the Ridge and Valley section (Alleghany and Washington Counties, west of Hagerstown Valley); fairly common locally in the Piedmont section—occurring in the Susquehanna River valley, in the Potomac River valley, along the Patapsco River, and in the vicinity of Dulaney Valley northeast of Baltimore City, in Baltimore County (Kolb, 1943); uncommon in the Savage River valley in Garrett County; rare elsewhere in the Allegheny Mountain section. **Transient:** Uncommon in the Ridge and Valley section; rare in all other sections.

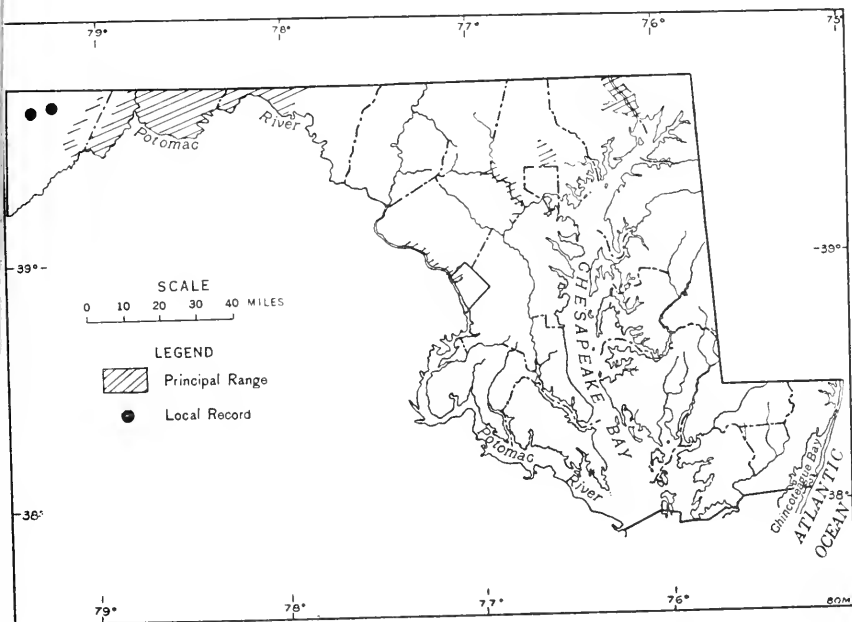


FIGURE 52.—Breeding range of Cerulean Warbler.

HABITAT.—Flood-plain forests, and rich, moist deciduous forest on the upland.

NESTING SEASON.—Probably late May to early July. *Egg dates* (2 nests): June 9, 1901 (F. C. Kirkwood), and June 10, 1900 (Kirkwood, 1901), in Baltimore County. *Nestling dates* (2 nests) June 9, 1901, and June 14, 1903, in Baltimore County (F. C. Kirkwood).

SPRING MIGRATION.—*Occurrence peak*: May 1 to May 15. *Extreme arrival dates*: April 20, 1954, in Allegany County (L. McCollough, E. Minke); April 25, 1953, in Frederick County (J. W. Richards); April 26, 1953, in Worcester County; April 27, 1902, in Baltimore County (F. C. Kirkwood). *Extreme departure dates*: May 31, 1949, in Prince Georges County; May 29, 1902, in Montgomery County (USNM—W. R. Maxon).

FALL MIGRATION.—*Extreme arrival dates*: August 8, 1953, in Prince Georges County; August 18, 1948, in Montgomery County (N. Jenison); August 19, 1948, in Baltimore County (I. E. Hampe). *Extreme departure dates*: September 25, 1955, in Montgomery County (P. A. DuMont); September 23, 1951, in Baltimore County (E. Willis).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 11 near Seneca, Montgomery County, on May 5, 1951 (F. C. Cross); 5 near Emmitsburg, Frederick County, on May 3, 1954 (J. W. Richards); 3 at Patuxent Refuge on May 8, 1948. *Fall*: 7 near Seneca, Montgomery County, on August 25, 1951 (I. R. Barnes).

BLACKBURNIAN WARBLER *Dendroica fusca* (Müller)

STATUS.—*Breeding* (see fig. 53): Common in the Allegheny Mountain section; uncommon in the western part of the Ridge and Valley section (Allegany County); rare and local in the eastern part of the Ridge and Valley section (occurring in Frederick County along Hunting Creek, at elevations above 1,280 feet). *Transient*: Fairly common in all sections except the Eastern Shore section where it is rare.

HABITAT.—*Breeding*: Red spruce, hemlock, and white pine stands, and mixed mesophytic forests. *Transient*: Various types of forest.

NESTING SEASON.—Probably late May to early July. Nest-building was recorded in Garrett County on May 31, 1951, and on June 15, 1918 (Eifrig, 1920a). Adults were observed carrying food in Garrett County on June 25, 1949.

SPRING MIGRATION.—*Normal period*: April 25–May 5 to May 20–30; peak, May 5 to May 20. *Extreme arrival date*: April 23,

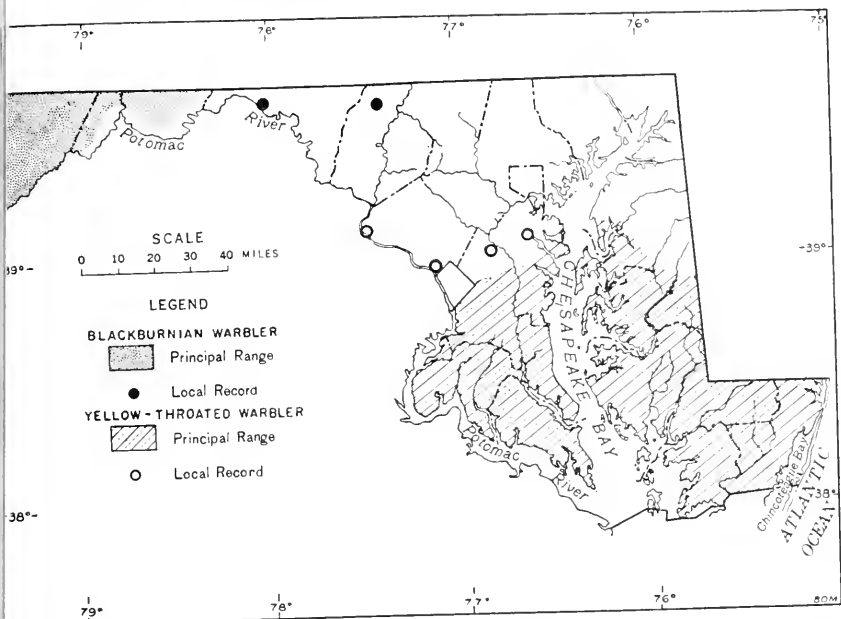


FIGURE 53.—Breeding ranges of Blackburnian Warbler and Yellow-throated Warbler.

1920, in Montgomery County (A. Wetmore). *Extreme departure dates*: June 4, 1945, in Prince Georges County; June 3, 1907, in the District of Columbia (W. W. Cooke).

FALL MIGRATION.—*Normal period*: August 20–25 to September 25–October 5; peak, September 5 to September 25. *Extreme arrival dates*: August 2, 1872, in the District of Columbia (USNM—E. Coues); August 14, 1886, in the District of Columbia (A. K. Fisher); August 18, 1951, in Baltimore County (Mr. and Mrs. R. D. Cole); August 19, 1942, and August 19, 1949, in Prince Georges County. *Extreme departure dates*: October 17, 1953, in Montgomery County (P. G. DuMont); October 17, 1954, in Anne Arundel County (Mr. and Mrs. H. N. Page); October 16, 1954, in Baltimore County (S. W. Simon).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 110 (22 in 20 acres) in “virgin hemlock forest” in Garrett County in 1949 (Robbins, 1949a).
- 96 (12 in 12½ acres) in “virgin spruce-hemlock bog forest” (red spruce and hemlock, with dense understory of great laurel) in Garrett County in 1951 (Stewart and Robbins, 1951a).
- 39 (3.5 in 9 acres) in “scrub spruce bog” (brush-meadow stage with young red spruce) in Garrett County in 1951 (Robbins and Stewart, 1951b).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 89 at Patuxent Refuge on May 10, 1950; 30 at Emmitsburg, Frederick County, on May 5, 1956 (J. W. Richards). *Fall*: 12 near Seneca, Montgomery County, on September 25, 1949 (I. R. Barnes, S. A. Briggs); 8 at Patuxent Refuge on September 11, 1943.

YELLOW-THROATED WARBLER *Dendroica dominica* (Linnaeus)

STATUS.—*Breeding and transient* (see fig. 53): Common in the Eastern Shore section and in the southern part of the Western Shore section (St. Marys County and southern portions of Charles and Calvert Counties); uncommon near tidewater in the northern part of the Western Shore section; rare in the interior of the northern part of the Western Shore section and along the Potomac River in the Piedmont section (recorded up to Harrison Island—J. V. Dennis). *Vagrant*: One singing at an elevation of 800 feet near Alesia, Carroll County, June 21, 1951; also several records from the Upper Chesapeake section in spring.

HABITAT.—Stands of loblolly pine, and bald cypress swamps; also occurs sparingly in mature stands of scrub pine and pitch pine.

NESTING SEASON.—Mid-April to early July. Nest-building was recorded as early as April 18, 1949, just across the Maryland boundary at Dyke, Virginia. In Dorchester County, Maryland, nest-building was recorded on May 9, 1920, and a nest with eggs was found on May 16, 1919 (Jackson, 1941). Adults were observed feeding young out of the nest on June 8, 1929, in Dorchester County (F. C. Kirkwood). A nest with young was found in Charles County on June 9, 1951 (J. W. Taylor, Jr.). A pair was observed feeding young on Harrison Island in the Potomac River on June 28, 1953 (J. V. Dennis). An occupied nest was found in Anne Arundel County as late as July 10, 1954 (Mrs. W. L. Henderson, Mrs. G. Tappan).

PERIOD OF OCCURRENCE.—*Normal period*: April 1–10 to September 10–20. *Extreme arrival dates*: March 27, 1948, in Calvert County; March 30, 1927, in the District of Columbia (K. H. Stuart); March 30, 1946, in Anne Arundel County. *Extreme departure dates*: September 27, 1919, in the District of Columbia (M. J. Pellew); September 26, 1953, in Montgomery County (P. G. DuMont, E. Hall).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

29 (6 in 21 acres) in "immature loblolly-shortleaf pine stand" (trees from 45 to 65 feet in height) in Worcester County in 1948 (Springer and Stewart, 1948c).

1 (2 in 18¾ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 25 along the Pocomoke River in Worcester County on May 5, 1951; 16 in St. Marys County on May 8, 1954 (J. W. Terborgh).

CHESTNUT-SIDED WARBLER *Dendroica pensylvanica* (Linnaeus)

STATUS.—*Breeding* (see fig. 54): Common in the Allegheny Mountain, and Ridge and Valley sections (chiefly at elevations above 1,200 feet); fairly common locally in the northern part of the Piedmont section, occurring in northern Carroll County, and in the valley of Gunpowder Falls in northern Baltimore County; rare and local in the southern part of Baltimore County, occurring in the vicinity of Reisterstown (first recorded by Brumbaugh, 1915) and once near the north boundary of Baltimore City (Meanley, 1938). *Summer vagrant*: One singing at Fulton, Howard County on June 26, 1951; 10 July specimens (USNM) from Laurel, Maryland, and the District of Columbia taken during the period 1888-1891. *Transient*: Common in all sections except the Eastern Shore section where it is uncommon.

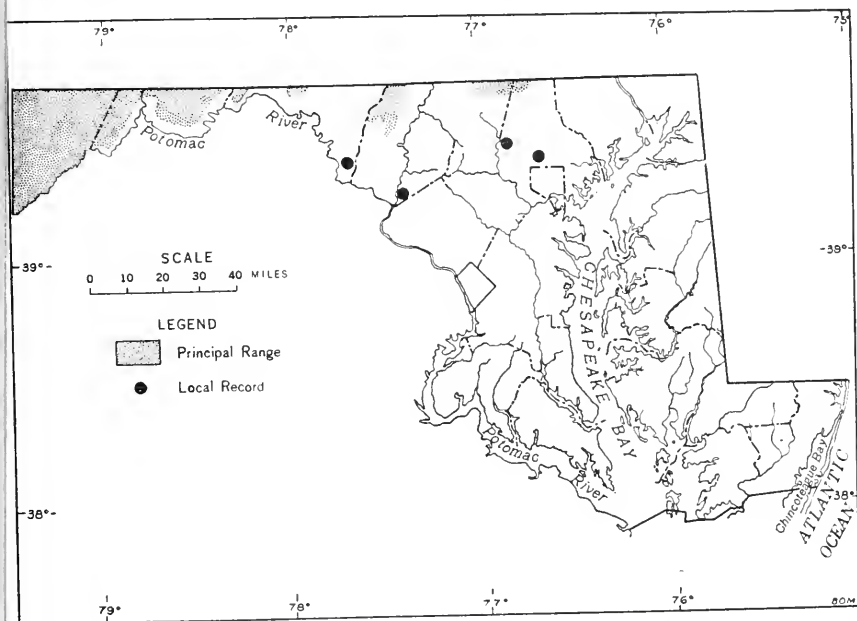


FIGURE 54.—Breeding range of Chestnut-sided Warbler.

HABITAT.—*Breeding*: Brushy, cut-over areas of oak-chestnut mixed mesophytic, and northern hardwood forests; also in bear oak barrens. *Transient*: Various types of deciduous forest.

NESTING SEASON.—Late May to mid-July. *Extreme egg date* (18 nests): May 28, 1919, in Garrett County (J. M. Sommer), and June 26, 1937, in Baltimore County (Meanley, 1938). A nest containing young was observed in Garrett County on June 15, 1951 (L. McCollough, E. Minke). Young out of the nest, but not fully fledged, were recorded on July 17, 1915, in Baltimore County (Brumbaugh, 1915).

SPRING MIGRATION.—*Normal period*: April 25–May 5 to May 15–25; peak, May 5 to May 15. *Extreme arrival dates*: April 19 1902, in the District of Columbia (H. W. Maynard); April 23 1893, in Baltimore County (F. C. Kirkwood). *Extreme departure dates*: May 30, 1891, in the District of Columbia (C. W. Richmond); May 30, 1917, in Prince Georges County (W. L. McAtee A. Wetmore); May 30, 1946, in Anne Arundel County.

FALL MIGRATION.—*Normal period*: August 15–20 to September 25–October 5; peak, August 20 to September 10. *Extreme arrival dates*: August 10, 1889 (C. W. Richmond), and August 10, 1894 (J. D. Figgins), in the District of Columbia; August 12, 1889, in Baltimore County (A. H. Jennings); August 12, 1944, in Prince Georges County; August 14, 1951, in Caroline County (M. W. Hewitt). *Extreme departure dates*: October 14, 1906, in Montgomery County (A. K. Fisher); October 11, 1880, in Prince Georges County (W. Palmer); October 11, 1947, in Baltimore County (R. M. Bowen).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

79 (16.5 in 21 acres) in "dense second-growth" (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).

67 (10 in 15 acres) in "open slash area" (cut-over oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 161 at Patuxent Refuge on May 10, 1950; 36 near Buckeystown, Frederick County, on May 6, 1950. *Fall*: 32 near Baltimore on September 5, 1893 (G. H. Gray); 32 at Patuxent Refuge on August 20, 1943.

BAY-BREASTED WARBLER *Dendroica castanea* (Wilson)

STATUS.—*Transient*: Fairly common in all sections except the Eastern Shore section where it is rare.

HABITAT.—Various types of forest. In spring, a preference is shown for stands of young pine.

SPRING MIGRATION.—*Normal period*: May 5–10 to May 20–25;

ak, May 10 to May 20. *Extreme arrival dates*: May 1, 1932, in Montgomery County (F. C. Lincoln); May 2, 1896, in the District of Columbia (H. W. Oldys). *Extreme departure dates*: June 7, 1950, in Anne Arundel County (M. McLean); June 2, 1917, in Baltimore County (C. H. Grace); June 2, 1917, in the District of Columbia (F. Harper).

FALL MIGRATION.—*Normal period*: August 20–30 to October 1–15; peak, September 5 to September 25. *Extreme arrival dates*: August 17, 1921, in the District of Columbia (B. H. Swales); August 18, 1939, in Garrett County (H. Kolb); August 19, 1942, in Prince Georges County; August 19, 1952, in Frederick County (J. W. Richards). *Extreme departure dates*: November 6, 1887, in the District of Columbia (H. W. Henshaw); November 1, 1896, in Baltimore County (F. C. Kirkwood); October 19, 1888, in the District of Columbia (R. Ridgway).

MAXIMUM COUNTS.—*Spring*: 43 at Greenbelt, Prince Georges County, on May 12, 1956 (L. W. Oring); 30 along the Potomac River in Washington County on May 12, 1952 (Dr. and Mrs. R. S. Stauffer); 24 at Patuxent Refuge on May 13, 1950; 15 near Emmitsburg, Frederick County, on May 17, 1952 (J. W. Richards). *Fall*: 22 at Patuxent Refuge on September 13, 1943; 18 at Seneca, Montgomery County, on September 12, 1954 (J. W. Terborgh).

LACKPOLL WARBLER *Dendroica striata* (Forster)

STATUS.—*Transient*: Common, occasionally abundant, in all sections except the Eastern Shore section where it is fairly common. *Summer vagrant*: Accidental—1 seen in Montgomery County on June 27, 1951 (J. H. Fales); 1 seen in Calvert County on July 6, 1928 (Ball, 1930a); one collected in the District of Columbia on July 30, 1893 (Brown, 1894).

HABITAT.—Various types of coniferous and deciduous forests. During the latter part of the spring migration they usually concentrate in stands of young pine.

SPRING MIGRATION.—*Normal period*: May 1–5 to June 1–10; peak, May 10 to May 30. *Extreme arrival dates*: April 21, 1916, in the District of Columbia (L. D. Miner, R. W. Moore); April 23, 1954, in Anne Arundel County (Mrs. G. Tappan); April 25, 1953 (L. W. Oring), and April 25, 1948, in Prince Georges County. *Extreme departure dates*: June 16, 1907 (R. W. Williams, Jr.), June 16, 1915 (A. H. Howell), and June 16, 1926 (S. F. Blake), in the District of Columbia; June 14, 1907 in Allegany County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: September 10–20 to October

15-25; peak, September 25 to October 10. *Extreme arrival dates*: September 1, 1889, in the District of Columbia (USNM—C. W. Richmond); September 3, 1872, in the District of Columbia (USNM—D. W. Scott). *Extreme departure dates*: November 12, 1949, in Worcester County; November 9, 1930, in the District of Columbia (H. C. Oberholser).

MAXIMUM COUNTS.—*Spring*: 145 at Patuxent Refuge on May 24, 1949; 100+ at Port Tobacco, Charles County, on May 11, 1949 (I. N. Gabrielson, A. L. Nelson); 100 at Sycamore Island in Montgomery County on May 28, 1949 (P. A. DuMont). *Fall*: 140 at Patuxent Refuge on October 11, 1947.

PINE WARBLER *Dendroica pinus* (Wilson)

STATUS.—*Breeding and transient* (see fig. 55): Abundant in the Eastern Shore section, and in the southern part of the Western Shore section (St. Marys County, and southern portions of Calver and Charles Counties); fairly common elsewhere in the Western Shore section; uncommon in the western part of the Ridge and Valley section (Allegany County), and locally in the Allegheny Mountain section (in the vicinity of Deep Creek Lake—M. G. Brooks); rare in the Piedmont and Upper Chesapeake sections and in the eastern part of the Ridge and Valley section (Washing-

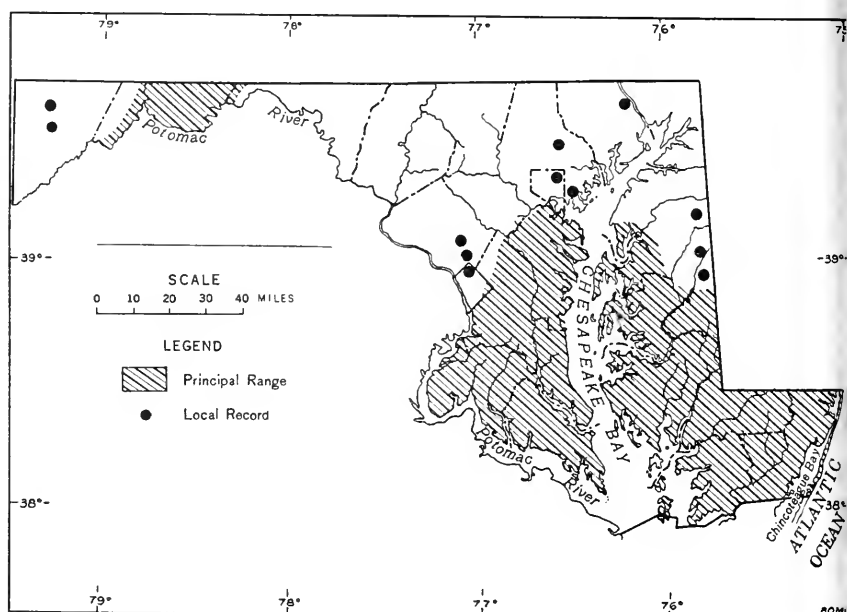


FIGURE 55.—Breeding range of Pine Warbler.

and Frederick Counties). *Wintering*: Rare in the Eastern Shore section, and near tidewater in the Western Shore section; usual in the interior of the Western Shore section, and in the Piedmont section—recorded at Darlington, Harford County, during the winter of 1933-34 (S. Mason, Jr.), and at Greenbelt, Prince Georges County, during the winter of 1953-54 (L. W. Oring).

HABITAT.—*Breeding*: Most numerous in stands of loblolly pine and pitch pine; also occurs sparingly in mature stands of scrub pine and white pine. *Transient*: Pine stands; also occurs in marginal habitats in residential and agricultural areas in fall, and to lesser extent in spring.

NESTING SEASON.—Probably early April to mid-June. Nest-building was recorded as early as April 5, 1921, in Dorchester County (R. W. Jackson). *Extreme egg dates* (7 nests): April 19, 1920, and May 20, 1919, in Dorchester County (Jackson, 1941). *Extreme nestling dates* (3 nests): May 2, 1919, in Dorchester County (R. W. Jackson) and May 26, 1930, in St. Marys County (C. C. Kirkwood).

SPRING MIGRATION.—*Normal period*: March 10-20 to April 20-25; peak, March 20 to April 20. *Extreme arrival dates*: March 3, 1945, in Prince Georges County; March 5, 1922, in the District of Columbia (C. S. Baer). *Extreme departure date*: May 3, 1947, in Prince Georges County.

FALL MIGRATION.—*Normal period*: August 15-25 to October 1-25; peak, September 5 to October 5. *Extreme departure dates*: October 31, 1943, in Prince Georges County; October 28, 1952, in Anne Arundel County (Mrs. W. L. Henderson); October 27, 1900, in Allegany County (G. Eifrig).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

(16 in 21 acres) in "immature loblolly-shortleaf pine stand" (trees from 45 to 65 feet in height) in Worcester County in 1948 (Springer and Stewart, 1948c).

(6.4 in 32½ acres) in pine-oak forest (pitch pine, scrub pine, and Spanish oak) in Prince Georges County in 1944.

(2 in 20 acres) in mature scrub pine stand in Prince Georges County in 1946.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 250 at Point Lookout, St. Marys County, on April 9, 1953 (J. Hailman); 50 in Charles County on March 29, 1953 (J. W. Terborgh); 15 at Patuxent Refuge on April 6, 1947. *Fall*: 20 at Patuxent Refuge on September 27, 1947. *Winter* (Christmas counts): 11 in the Ocean City area on December 27, 1955; 4 in the St. Michaels area, Calvert County, on December 29, 1953.

PRAIRIE WARBLER *Dendroica discolor* (Vieillot)

STATUS.—*Breeding* (see fig. 56) : Common in the Eastern Shore, Western Shore, and Ridge and Valley sections; fairly common (locally) in the Piedmont section; rare in the Upper Chesapeake and Allegheny Mountain sections. *Transient*: Uncommon in the Eastern Shore, Western Shore, Piedmont, and Ridge and Valley sections; rare in the Upper Chesapeake section.

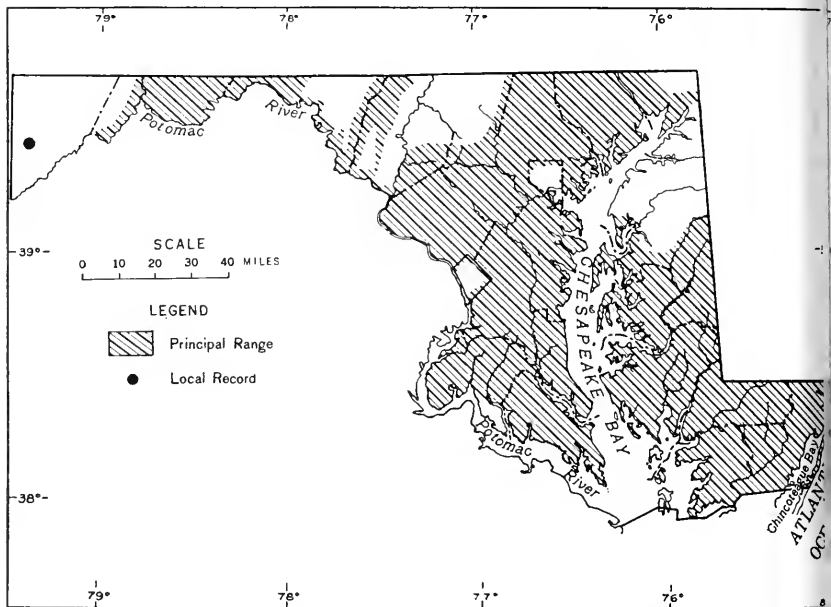


FIGURE 56.—Breeding range of Prairie Warbler.

HABITAT.—Especially characteristic of abandoned fields with open stands of young pine, including scrub pine, pitch pine, and loblolly pine; also occurs locally in abandoned fields with open stands of young sweetgum, in brushy cut-over or burned-over upland forests, and in weedy or abandoned orchards.

NESTING SEASON.—Mid-May to late July (nesting peak, late May to early July). *Extreme egg dates* (30 nests) : May 14, 1899 (W. B. Barrows), and July 19, 1926 (S. F. Blake), in the District of Columbia. *Extreme nestling dates* (20 nests) : May 25, 1949 in Prince Georges County (E. C. Robbins) and July 12, 1947, in Baltimore County (H. Kolb).

SPRING MIGRATION.—*Normal period*: April 15–25 to May 15–25; peak, April 25 to May 15. *Extreme arrival dates*: April 12, 1883

the District of Columbia (H. W. Henshaw) ; April 12, 1949, in the Arundel County (Mrs. W. L. Henderson).

FALL MIGRATION.—*Normal period:* August 5–15 to September 25; peak, August 15 to September 5. *Extreme arrival dates:* July 31, 1951 and 1953, in Prince Georges County. *Extreme parture dates:* November 19, 1954, in Caroline County (Mrs. J. Fletcher) ; October 20, 1952, in Anne Arundel County (Mrs. L. Henderson, Mrs. G. Tappan) ; October 6, 1910, in the District Columbia (E. J. Brown).

BREEDING POPULATION DENSITIES (territorial males per 100 res).—

- (22 in 26 acres) in “dry deciduous scrub” (burned-over upland oak forest) in Prince Georges County in 1947 (Robbins, et al., 1947).
- (4 in 7 acres) in pine field (abandoned field with open growth of young scrub pine) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- (15 in 30 acres) in “damp deciduous scrub with standing dead trees” (burned-over, poorly drained upland forest) in Prince Georges County in 1947 (Stewart, et al., 1947).
- (9 in 18 acres) in brushy, well-drained, abandoned farmland in Prince Georges County in 1947.
- (10 in 21 acres) in “immature loblolly-shortleaf pine stand” (trees 45 to 65 feet in height) in Worcester County in 1948 (Springer and Stewart, 1948c).
- (16 in 34½ acres) in pine field (abandoned field with open growth of young scrub pine) in Prince Georges County in 1945.
- (6.5 in 19½ acres) in sweetgum field (abandoned field with open growth of young sweetgum) in Prince Georges County in 1945.
- (4.5 in 25 acres) in “unsprayed apple orchard with unmowed ground cover” in Allegany County in 1948 (Springer and Stewart, 1948b).
- (4 in 22 acres) in “unsprayed apple orchard with infrequently mowed ground cover” in Worcester County in 1948 (Springer and Stewart, 1948b).
- (4 in 47¾ acres) in hedgerows in agricultural and abandoned farmland areas (including strip 27½ yards wide on each side of hedgerow) in Prince Georges County in 1945.

MAXIMUM COUNTS (nonbreeding).—*Spring:* 75 at Port Tobacco, Charles County, on May 11, 1943 (I. N. Gabrielson, F. M. Uhler) ; 13 in Anne Arundel County on May 10, 1952 (J. W. Terborgh, et al.) ; 37 at Patuxent Refuge on May 3, 1947. *Fall:* 7 at Patuxent Refuge on August 17, 1944.

PALM WARBLER *Dendroica palmarum* (Gmelin)

STATUS.—*Transient:* Fairly common in all sections. *Wintering:* Uncommon in Worcester County; rare elsewhere in the Eastern Shore section, and near tidewater in the Western Shore and Upper Chesapeake sections; casual in the Piedmont, and Ridge and Valley sections—recorded in Baltimore County on December 17,

1911 (J. L. Ulman), in Montgomery County during the winter of 1949-50 (S. H. Low) and on December 19, 1954, in Howard County on December 13, 1955 (S. H. Low), and December 26, 1952, and in Allegany County at McCoole (L. M. Llewellyn) on December 28, 1947.

HABITAT.—Wood margins, hedgerows, roadsides and other marginal habitats.

SPRING MIGRATION.—*Normal period:* April 1-10 to May 1-10 peak, April 10 to April 25. *Extreme arrival dates:* March 2, 1952, in Caroline County (M. W. Hewitt); March 26, 1929, in Montgomery County (Mr. and Mrs. W. J. Whiting); March 2, 1947, in Howard County; March 29, 1953, in Baltimore County (H. Kolb). *Extreme departure dates:* May 27, 1897, and May 2, 1931, in Baltimore County (F. C. Kirkwood); May 20, 1917, in the District of Columbia (W. L. McAtee); May 13, 1923, in Montgomery County (F. C. Lincoln); May 12, 1950, in Prince George's County; May 12, 1951, in Frederick County (J. W. Richards). The extreme dates for the Yellow Palm Warbler (*Dendroica palmarum hypochrysea*) are March 22, 1952 (M. W. Hewitt), and May 2, 1931 (F. C. Kirkwood). The Western Palm Warbler (*Dendroica palmarum palmarum*) has been recorded only 16 times in spring, the extreme dates being April 12, 1947, in the District of Columbia (R. Tousey) and May 27, 1897, in Baltimore (F. C. Kirkwood).

FALL MIGRATION.—*Normal period:* September 10-20 to November 1-10; peak, September 25 to October 25. *Extreme arrival dates:* August 30, 1939, in Montgomery County (J. H. Fales); September 4, 1887 (H. W. Henshaw), and September 4, 1924 (L. D. Miner), in the District of Columbia; September 5, 1944 (USNM), in Prince Georges County. *Extreme departure dates:* November 20, 1943, in Prince Georges County; November 18, 1914, in the District of Columbia (J. H. Riley); November 14, 1948, in Anne Arundel County (E. J. Stivers). The bulk of the Western Palms pass through before October 10; the bulk of the Yellow Palms after that date. Extremes for the Western Palm Warbler are September 5, 1942, and November 14, 1947. Extremes for the Yellow Palm Warbler are September 15, 1946 (J. H. Fales), and November 14, 1948 (E. J. Stivers).

MAXIMUM COUNTS.—*Spring:* 63 (Yellow Palm) at Patuxent Refuge on April 21, 1944. *Fall:* 25 (Western Palm) north of Ocean City, Worcester County, on September 14, 1955; 18 (Western Palm) at Point Lookout, St. Marys County, on September 27, 1953 (J. W. Terborgh); 15 (Yellow Palm) at Patuxent Refuge on October 15, 1942. *Winter:* 41 (39 Western, 2 Yellow) in the Ocean.

ty area on December 27, 1955 (Christmas count); 30 (20 Yellow, 10 Western) in the Denton area, Caroline County, on December 15, 1954 (Mrs. A. J. Fletcher); 12 (9 Western, 3 Yellow) in the southeastern Worcester County on December 23, 1946; 7 (6 Western, 1 Yellow) near Rockville, Montgomery County, on December 19, 1954; 6 in the Chase area in Baltimore and Harford counties on January 3, 1954 (Christmas count).

VENBIRD *Seiurus aurocapillus* (Linnaeus)

STATUS.—*Breeding*: Abundant in the Ridge and Valley section; common in the Allegheny Mountain, Piedmont, and Western Shore sections; fairly common locally in the Eastern Shore section; uncommon and local in the Upper Chesapeake section. *Transient*: Fairly common in all sections.

HABITAT.—*Breeding*: Various types of well-drained, deciduous forest on the upland; also in pine stands with deciduous undergrowth. *Transient*: All types of forest.

NESTING SEASON.—Early May to mid-July (nesting peak, mid-May to late June). *Extreme egg dates* (52 nests): May 10, 1945 (E. G. Cooley), and July 6, 1943 (J. B. Cope), in Prince Georges County. *Extreme nestling dates* (27 nests): May 22, 1939, in the District of Columbia (W. B. Tyrrell) and July 17, 1893, in Baltimore County (G. H. Gray).

SPRING MIGRATION.—*Normal period*: April 15–25 to May 15–25; peak, April 25 to May 10. *Extreme arrival dates*: April 9, 1893, in Baltimore County (F. C. Kirkwood); April 10, 1904, in the District of Columbia (J. H. Riley); April 10, 1919, in Dorchester County (R. W. Jackson).

FALL MIGRATION.—*Normal period*: August 15–25 to October 5–15; peak, September 5 to September 25. *Extreme arrival date*: August 6, 1953, in Prince Georges County. *Extreme departure dates*: November 25, 1955, in Queen Annes County (W. Rittenhouse); November 13, 1887, in the District of Columbia (H. W. Henshaw); November 10, 1954, in Talbot County (R. L. Kleen); November 8, 1949, in Baltimore County (E. Willis); October 21, 1954, in Prince Georges County (L. W. Oring).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

51 (49 in 80 acres) in "central hardwood forest (oaks–tulip–poplar) with scattered pine" in the District of Columbia in 1952 (Clagett, 1952); 59 (47 in 80 acres) in 1951 (Trever, 1952) and 1953 (Clagett, 1953); 55 (43.5 in 80 acres) in 1948, 43 (34 in 80 acres) in 1949 (Trever, 1952); 50 (40 in 80 acres) in 1954 (Wright, 1955).

53 (19 in 36 acres) in "virgin central hardwood deciduous forest" (white oak–

- tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins 1947b).
- 45 (9.5 in 21 acres) in "immature loblolly-shortleaf pine stand" (trees 45 to feet in height) in Worcester County in 1948 (Springer and Stewa 1948c).
- 40 (16 in 40 acres) in "mixed oak forest" (white, scarlet, and chestnut oak etc.) in Baltimore County in 1948 (Kolb, et al., 1948); 34 (12.5 in acres) in 1953 (Cole and Kolb, 1953); 31 (12.5 in 40 acres) in 19 (Kolb, 1949a); 30 (12 in 40 acres) in 1950 (Kolb, 1950); 24 (9 in acres) in 1951 (Kolb and Cole, 1951), and 1952 (Kaufmann, 1952).
- 32 (4 in 12½ acres) in "mature oak-maple ridge forest" in Garrett County 1949 (Robbins, 1949b).
- 26 (5.5 in 21 acres) in "dense second-growth" (oak-maple ridge forest) Garrett County in 1949 (Robbins, 1949b).
- 25 (6 in 23¾ acres) in upland oak forest (white, scarlet, and black oaks) Prince Georges County in 1944.
- 24 (1.5 in 6¼ acres) in "young second-growth resulting from cutting" (oak maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 23 (5.6 in 24½ acres) in river terrace forest (beech-white oak) in Prince Georges County in 1944.
- 20 (3 in 15 acres) in "open slash area" (cut-over oak-maple ridge forest) Garrett County in 1949 (Robbins, 1949b).
- 17 (5.5 in 32¾ acres) in pine-oak forest (pitch pine, scrub pine, and Spanish oak) in Prince Georges County in 1944.
- 11 (5 in 44¾ acres) in river bluff forest (beech, white oak, scarlet oak) Prince Georges County in 1945; 9 (4 in 44¾ acres) in 1944 (J. W. Aldridge A. J. Duvall).
- 10 (2 in 20 acres) in mature scrub pine stand in Prince Georges County 1946.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 66 in Baltimore County on May 6, 1950 (D. A. Jones); 63 at Patuxent Refuge on May 6, 1950. *Fall*: About 15 killed at the Friendship International Airport ceilometer, Anne Arundel County, on September 10, 1954; 13 killed at the Washington Monument, Washington D. C., on September 12, 1937 (Overing, 1938); 10 at Patuxent Refuge on September 16, 1943.

NORTHERN WATERTHRUSH *Seiurus noveboracensis* (Gmelin)

STATUS.—*Breeding* (see fig. 32): Common in the Alleghen Mountain section. *Transient*: Fairly common in all sections. *Wintering*: Accidental—1 was recorded at Solomons Island, Calvert County, on December 12, 1949 (G. Kelly).

HABITAT.—*Breeding*: Occurs at elevations above 2,200 feet in bogs or along streams in brushy, cut-over forests or in swamp forests with a well-developed understory of shrubs. *Transient*: Shrub swamps, and swamp and flood-plain forests.

NESTING SEASON.—A nest containing 1 egg and 3 newly hatched

Young was found in Garrett County on May 29, 1949. Young just out of the nest were observed in Garrett County on June 13, 1918 (J. M. Sommer), and on June 25, 1949.

SPRING MIGRATION.—*Normal period:* April 25–30 to May 20–30; *peak,* May 1 to May 20. *Extreme arrival dates:* April 15, 1951, in Worcester County (J. H. Buckalew); April 16, 1921, in the District of Columbia (M. J. Pellew). *Extreme departure dates:* June 5, 1949, in Frederick County (M. B. Meanley); June 2, 1907, in Montgomery County (A. K. Fisher).

FALL MIGRATION.—*Normal period:* August 1–10 to October 1–10; *peak,* August 25 to September 20. *Extreme arrival dates:* July 26, 1952, in Baltimore County (E. Willis); July 27, 1907, in Allegany County (F. C. Kirkwood); July 27, 1955, in Caroline County (Mrs. A. J. Fletcher); July 28, 1889, in the District of Columbia (J. D. Figgins). *Extreme departure dates:* October 16, 1892, in Baltimore County (W. N. Wholey); October 16, 1919, in the District of Columbia (M. J. Pellew); October 14, 1955, in Caroline County (Mrs. A. J. Fletcher).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

34 (8 in 9½ acres) in “open hemlock-spruce bog” (brush-meadow stage with young hemlock, red spruce, alder, etc.) in Garrett County in 1949 (Robbins, 1949c).

34 (8 in 12½ acres) in “virgin spruce-hemlock bog forest” (red spruce and hemlock with dense understory of great laurel) in Garrett County in 1951 (Stewart and Robbins, 1951a).

33 (3 in 9 acres) in “scrub spruce bog” (brush-meadow stage, with young red spruce) in Garrett County in 1951 (Robbins and Stewart, 1951b).

MAXIMUM COUNTS (nonbreeding).—*Spring:* 19 at Patuxent Refuge on May 12, 1951; 9 at Port Tobacco, Charles County, on May 11, 1943 (I. N. Gabrielson, A. L. Nelson). *Fall:* 17 at Greenbelt, Prince Georges County, on September 19, 1954 (L. W. Oring); 10 banded on the barrier beach north of Ocean City on September 11, 1955; 9 near Seneca, Montgomery County, on September 8, 1952 (J. W. Terborgh); 8 at Patuxent Refuge on September 9, 1953.

LOUISIANA WATERTHRUSH *Seiurus motacilla* (Vieillot)

STATUS.—*Breeding and transient:* Common in the Eastern Shore and Western Shore sections; fairly common in the Upper Chesapeake, Piedmont, and Ridge and Valley sections; fairly common locally in the Allegheny Mountain section at elevations below 2,300 feet (rare up to 2,560 feet). *Wintering:* Accidental—a female in excellent condition was collected (USNM) along the

Patuxent River, near Bowie, Prince Georges County, on December 29, 1953.

HABITAT.—Flood-plain and swamp forests; also in rocky wooded ravines along streams.

NESTING SEASON.—Mid-April to mid-June. Nest-building was recorded as early as April 10, 1888, in the District of Columbia (Cooke, 1929). *Extreme egg dates* (24 nests): May 8, 1921, in the District of Columbia (Cooke, 1929) and June 11, 1899, in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (1 nests): May 12, 1954, in Prince Georges County (L. W. Oring) and June 16, 1938, in the District of Columbia (W. H. Lawrence)

SPRING MIGRATION.—*Normal period*: April 1–10 to May 1–10 peak, April 15 to April 30. *Extreme arrival dates*: March 25, 1948, in the District of Columbia (E. G. Davis, R. D. Widman) March 26, 1929, in Montgomery County (Mr. and Mrs. W. J. Whiting); March 27, 1948, in Calvert County.

FALL MIGRATION.—*Normal period*: August 1–10 to September 10–20; peak, August 15 to September 5. *Extreme arrival date*: July 31, 1953, in Prince Georges County. *Extreme departure dates*: October 4, 1920, in the District of Columbia (M. J. Pellow) October 2, 1948, in Baltimore County (I. E. Hampe); September 30, 1950, in Montgomery County (C. N. Mason); September 28, 1945, in Prince Georges County.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).

- 16 (3 in 18¼ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d)
- 4 (3.5 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 35 along Western Branch, Prince Georges County, on April 19, 1947; 28 along the Potomac River, Montgomery County, on May 9, 1953 (E. J. Stivers, et al.); 25 along the Pocomoke River, Worcester County, on April 1, 1948. *Fall*: 6 at Patuxent Refuge on September 1, 1943.

KENTUCKY WARBLER *Oporornis formosus* (Wilson)

STATUS.—*Breeding and transient* (see fig. 57): Abundant in the Upper Chesapeake section; common in the Eastern Shore and Western Shore sections; fairly common in the Piedmont section, and in the eastern part of the Ridge and Valley section (Blue Ridge Mountains and Hagerstown Valley); uncommon and local

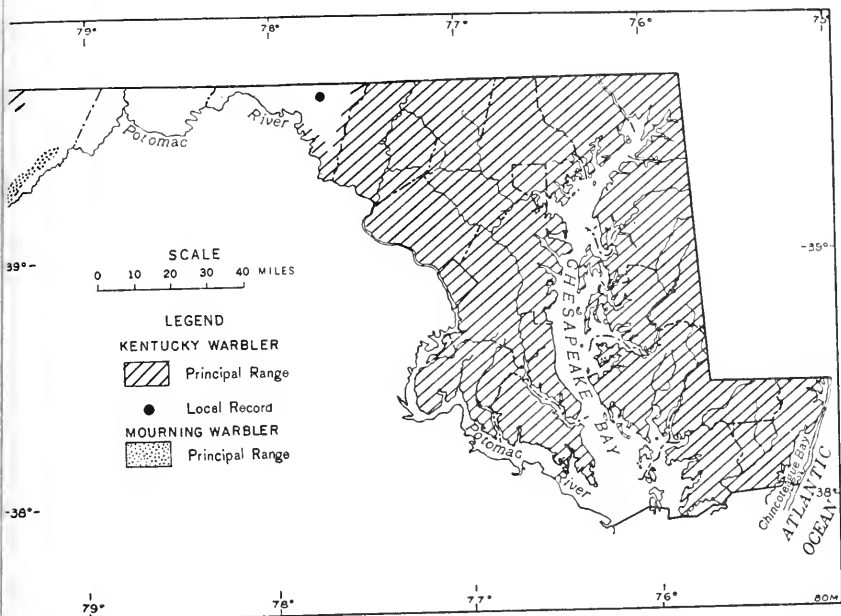


FIGURE 57.—Breeding ranges of Kentucky Warbler and Mourning Warbler.

in the northwestern part of the Allegheny Mountain section (chiefly at elevations below 1,700 feet); rare in the western part of the Ridge and Valley section (Allegheny and Washington Counties, west of Hagerstown Valley).

HABITAT.—Swamp and flood-plain forests, and rich, moist deciduous forests on the upland.

NESTING SEASON.—Mid-May to mid-August (nesting peak, late May to late June). *Extreme egg dates* (42 nests): May 16, 1918, in Dorchester County (Jackson, 1941), and July 31, 1933, in Baltimore County (DeGaris, 1936). *Extreme nestling dates* (38 nests): June 4, 1944, in Prince Georges County and August 11, 1933 (DeGaris, 1936), in Baltimore County.

SPRING MIGRATION.—*Normal period*: April 25–30 to May 20–25; peak, May 10 to May 20. *Extreme arrival dates*: April 19, 1949, in St. Marys County (M. B. Meanley); April 24, 1938, in Montgomery County (W. L. McAtee); April 24, 1954, in Caroline County (M. W. Hewitt).

FALL MIGRATION.—*Normal period*: August 1–10 to September 1–10. *Extreme arrival dates*: July 25, 1951, in Baltimore County (E. Willis); July 26, 1951, in Caroline County (Mrs. A. J. Fletcher). *Extreme departure dates*: September 20, 1954, in Caroline County (M. W. Hewitt); September 19, 1954, in Prince

Georges County (L. W. Oring) ; September 18, 1951, in Baltimore County (R. D. Cole).

BREEDING POPULATION DENSITIES (territorial males per 10 acres).—

- 32 (3.5 in 11 acres) in upland seepage swamp forest (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, clammy azalea, maleberry, etc.) in Prince Georges County in 1946.
- 31 (4 in 13 acres) in upland oak forest (white, northern red, chestnut, and black oaks) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 23 (6.5 in 28 acres) in partially opened flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 23 (19.6 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946).
- 17 (6 in 36 acres) in "virgin central hardwood forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
- 14 (1.8 in 12¼ acres) in lowland seepage swamp forest (red maple, sweetgum, pin oak, with dense understory of sweet-bay, winterberry, arrow-wood, etc.) in Prince Georges County in 1946.
- 13 (2.5 in 18¼ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).
- 8 (2 in 24½ acres) in river terrace forest (beech-white oak) in Prince Georges County in 1944.
- 8 (3 in 37 acres) in "mixed oak forest" (white, scarlet, and chestnut oaks) in Baltimore County in 1953 (Cole and Kolb, 1953) ; 6 (2.5 in 40 acres) in 1948 (Kolb, et al., 1948) ; 5 (2 in 37 acres) in 1952 (Kaufmann, et al., 1952) ; 4 (1.5 in 40 acres) in 1950 (Kolb, 1950) ; 3 (1 in 40 acres) in 1949 (Kolb, 1949a) ; absent in 1951 (Kolb and Cole, 1951).
- 6 (4.5 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1951 ; 4 (3 in 80 acres) in 1953 (Claggett, 1953) ; 2.5 (2 in 80 acres) in 1954 (Wright, 1955) ; 1 (1 in 80 acres) in 1948 and 1949 (Trever, 1952) ; 1 (1 in 80 acres) in 1952 (Claggett, 1952).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 40 near Emmitsburg, Frederick County, on May 10, 1952 (J. W. Richards) ; 39 at Patuxent Refuge on May 10, 1950. *Fall*: 5 at Patuxent Refuge on September 3, 1951 (C. H. Mayhood).

CONNECTICUT WARBLER *Oporornis agilis* (Wilson)

STATUS.—*Fall transient*: Uncommon in all sections. *Spring transient*: Rare and irregular (all reliable records from the vicinity of the District of Columbia and Baltimore).

HABITAT.—Wood margins and other brushy areas in moist situations.

SPRING MIGRATION (11 records, including 5 specimens).—*Ex-*

reme dates: May 5, 1901, in Baltimore County (F. C. Kirkwood) and May 30, 1882, in the District of Columbia (USNM—E. W. Nelson). *Occurrence peak* (7 records): May 11 to May 24. Four of the specimens were collected in 1882 on May 22 (D. W. Prentiss), May 24 (H. W. Henshaw), May 28 (W. Palmer), and May 30 (E. W. Nelson), all in the District of Columbia. The other specimen was collected at Plummers Island, Montgomery County, on May 17, 1909 (W. H. Osgood).

FALL MIGRATION.—*Normal period*: September 10–20 to October 10–20; peak, September 25 to October 10. *Extreme arrival dates*: August 28, 1886, in the District of Columbia (USNM—A. K. Fisher); September 3, 1950, in Baltimore County (C. M. Buchanan); September 6 and 7, 1939, in the District of Columbia (F. C. Lincoln); September 9, 1943, in Prince Georges County. *Extreme departure dates*: November 7, 1948, in Prince Georges County (M. B. Meanley); October 29, 1947, in Anne Arundel County; October 24, 1889, in the District of Columbia (W. Palmer).

MAXIMUM COUNTS.—*Fall*: 7 in Prince Georges County on October 3, 1947; 4 banded in Worcester County on September 13, 1955.

MOURNING WARBLER *Oporornis philadelphia* (Wilson)

STATUS.—*Breeding* (see fig. 57): Uncommon locally in the Allegheny Mountain section—occurring regularly in Garrett County on Backbone Mountain at elevations above 3,000 feet (rare and local on the east slope of Backbone Mountain, down to 2,640 feet). *Transient*: Uncommon in the Ridge and Valley, Piedmont, Upper Chesapeake, and Western Shore sections (probably also as numerous in the Allegheny Mountain section, although there are no definite transient records from that area); rare in the Eastern Shore section.

HABITAT.—*Breeding*: Brushy, cut-over oak–chestnut and northern hardwood forests—especially those areas that contain blackberry thickets. *Transient*: Wood margins and moist, brushy, cut-over forests.

NESTING SEASON.—No definite nest records; however, adults were observed carrying food on June 26, 1949, in Garrett County.

SPRING MIGRATION.—*Normal period*: May 15–20 to June 1–5; peak, May 20 to June 1. *Extreme arrival dates*: May 4, 1928, in the District of Columbia (W. J. Whiting); May 5, 1951, in Montgomery County (S. A. Briggs); May 7, 1932, in Cecil County (J. W. Brown). *Extreme departure dates*: June 11, 1945, in Prince

Georges County; June 7, 1917, in the District of Columbia (F. Harper).

FALL MIGRATION.—*Normal period*: August 20–25 to October 1–5; peak, August 25 to October 1. *Extreme arrival dates*: August 17, 1894, in Prince Georges County (USNM—G. Marshall); August 19, 1877, in the District of Columbia (W. Palmer). *Extreme departure dates*: October 13, 1946, in Prince Georges County; October 9, 1897, along the Patapsco River marsh (F. C. Kirkwood).

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

10 (2 in 21 acres) in “dense second-growth” (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 5 at Patuxent Refuge on May 31, 1943.

YELLOWTHROAT *Geothlypis trichas* (Linnaeus)

STATUS.—*Breeding*: Abundant in the Eastern Shore, Western Shore, and Upper Chesapeake sections; common in the Allegheny Mountain section; fairly common in the Piedmont, and Ridge and Valley sections. *Transient*: Common, occasionally abundant, in all sections. *Wintering*: Rare in the Eastern Shore section and in the tidewater areas of the Western Shore and Upper Chesapeake sections; casual in the Piedmont section—recorded at Lake Roland, Baltimore County, on December 22, 1935 (Meanley, 1936b).

HABITAT.—Brushy wet meadows and marshes, and thickets of shrubs and small trees in swampy situations.

NESTING SEASON.—Early May to mid-August (nesting peak, late May to early July). *Extreme egg dates* (41 nests): May 4, 1954, in Dorchester County and August 4, 1895 (F. C. Kirkwood), in Baltimore County. *Extreme nestling dates* (24 nests): May 23, 1954, in Worcester County (J. Travis) and August 13, 1893, in Baltimore County (Kirkwood, 1895).

SPRING MIGRATION.—*Normal period*: April 15–25 to May 15–25; peak, May 1 to May 15. *Extreme arrival dates*: April 10, 1954, in Allegany County (L. McCollough, E. Minke) and Caroline County (M. W. Hewitt); April 11, 1929, in the District of Columbia (W. H. Ball); April 11, 1954, in Charles County (M. C. Crone, A. R. Stickley, Jr.); April 12, 1929 in Baltimore County (F. C. Kirkwood); April 12, 1947, in Queen Annes County (E. G. Davis); April 12, 1948, in Prince Georges County.

FALL MIGRATION.—*Normal period*: August 15–25 to October 15–25; peak, September 1 to October 1. *Extreme arrival date*:

August 12, 1943, in Prince Georges County. *Extreme departure dates*: November 13, 1949, in Prince Georges County (M. B. Jeanley); November 2, 1919, in the District of Columbia (F. Harper).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 11 (5 in 4½ acres) in hedgerow along brook between agricultural fields (including strip 27½ yards wide on each side of hedgerow) in Prince Georges County in 1948.
- 08 (14 in 13 acres) in shrub swamp (alder, poison sumac, sweet pepperbush, swamp rose, young red maple, etc.) in Prince Georges County in 1945.
- 0 (24 in 30 acres) in "damp deciduous scrub with standing dead trees" (burned-over, poorly drained upland forest) in Prince Georges County in 1947 (Stewart, et al., 1947).
- 8 (11 in 19.2 acres) in "shrubby field with stream-bordered trees" in Baltimore County in 1947, 47 (9 in 19.2 acres) in 1946 (Cooley, 1947).
- 5 (9 in 16½ acres) in "cattail marsh" (narrow-leaved cattail stand with scattered swamp rose-mallow) in Calvert County in 1948 (Springer and Stewart, 1948a).
- 6 (12 in 26 acres) in "dry deciduous scrub" (burned-over upland oak forest) in Prince Georges County in 1947 (Robbins, et al., 1947b).
- 1 (23 in 58 acres) in brushy, poorly drained, abandoned farmland in Prince Georges County in 1947.
- 9 (10 in 34¾ acres) in pine field (abandoned field with open growth of young scrub pine) in Prince Georges County in 1945.
- 2 (2 in 9 acres) in "scrub spruce bog" (brush-meadow stage with young red spruce) in Garrett County in 1951 (Robbins and Stewart, 1951b).
- 1 (2 in 9½ acres) in "open hemlock-spruce bog" (brush-meadow stage with young hemlock, red spruce, alder, etc.) in Garrett County in 1949 (Robbins, 1949c).
- 6 (4 in 25 acres) in "unsprayed apple orchard with unmowed ground cover" in Allegany County in 1948 (Springer and Stewart, 1948b).
- 4 (9 in 66 acres) in field and edge habitat (including strips of flood-plain forest, brushy fields, and hedgerows) in Baltimore County in 1947 (Hampe, et al., 1947).
- 3 (4 in 30 acres) in "switchgrass marsh-meadow" in Somerset County in 1948 (Springer and Stewart, 1948a).
- 3 (2 in 15 acres) in "open slash area" (cut-over oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 1 (2 in 18¾ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).
- 7 (2 in 28 acres) in partially opened flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 2 (2 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 200+ at Port Tobacco, Charles County, on May 11, 1943 (I. N. Gabrielson, A.

L. Nelson) ; 135 near Greenbelt, Prince Georges County, on May 8, 1954 (L. W. Oring) ; 108 in the Middle River area, Baltimore County, on May 5, 1951 (E. Willis, D. A. Jones). *Fall*: 189 found dead at the Washington Monument, Washington, D. C., on September 12, 1937 (Overing, 1938). *Winter*: 5 in the Wicomico River area of Charles and St. Marys Counties on December 30, 1951 (J. W. Terborgh, R. R. Kerr).

YELLOW-BREASTED CHAT *Icteria virens* (Linnaeus)

STATUS.—*Breeding and transient*: Common in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Piedmont, and Ridge and Valley sections; uncommon in the Allegheny Mountain section. *Wintering*: Casual in the Eastern Shore and Western Shore sections—recorded in Worcester, Talbot, Baltimore, Anne Arundel, and St. Marys Counties and the District of Columbia. This species was not recorded in winter before 1952.

HABITAT.—Hedgerows, wood margins, and other brushy habitats, including cut-over and burned-over upland forests.

NESTING SEASON.—Mid-May to late July (nesting peak, late May to early July). *Extreme egg dates* (102 nests): May 18, 1887, in the District of Columbia (Cooke, 1929) and July 16, 1939, in Prince Georges County (E. G. Cooley). *Extreme nestling dates* (29 nests): June 1, 1946, in Baltimore County (H. Kolb) and July 26, 1891, in Baltimore County (F. C. Kirkwood).

PERIOD OF OCCURRENCE.—*Normal period*: April 25–May 5 to September 15–25; peak, May 10 to August 15. *Extreme arrival dates*: April 3, 1951, at Gibson Island—possibly a wintering bird (Mrs. M. North) ; April 14, 1917, in Montgomery County (Miss H. P. Childs) ; April 16, 1952, in Talbot County (Mrs. S. Henderson). *Extreme departure dates*: October 14, 1954, in Prince Georges County (L. W. Oring) ; October 11, 1954, in Frederick County (J. W. Richards) ; October 10, 1953, in Baltimore County (C. M. Buchanan). Several November records, possibly representing wintering birds, have been omitted.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 36 (7 in 19.2 acres) in "shrubby field with stream-bordered trees" in Baltimore County in 1947; 31 (6 in 19.2 acres) in 1946 (Cooley, 1947).
- 28 (8.5 in 30 acres) in "damp deciduous scrub with standing dead trees (burned-over, poorly drained upland forest) in 1948 (Oresman, et al. 1948) ; 13 (4 in 30 acres) in 1947 (Stewart, et al., 1947).
- 15 (4 in 26 acres) in "dry deciduous scrub" (burned-over upland oak forest in Prince Georges County in 1947 (Robbins, et al., 1947).

5 (8.5 in 58 acres) in brushy, poorly drained, abandoned farmland in Prince Georges County in 1947.

3 (5 in 66 acres) in field and edge habitat (including strips of flood-plain forest, brushy fields, and hedgerows) in Baltimore County in 1947 (Hampe, et al., 1947).

3 (2 in 25 acres) in "unsprayed apple orchard with unmowed ground cover" in Allegany County in 1948 (Springer and Stewart, 1948b).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 100+ at Port Tobacco, Charles County, on May 11, 1953 (I. N. Gabrielson, et al.); 56 in Howard County on May 8, 1954; 34 in the Pocomoke Swamp on May 16, 1954 (J. K. Wright). *Fall*: 13 near Seneca, Montgomery County, on September 5, 1953 (H. A. Sutton); 4 banded on the barrier beach north of Ocean City on September 12, 1955.

HOODED WARBLER *Wilsonia citrina* (Boddaert)

STATUS.—*Breeding and transient* (see fig. 58): Common in the Western Shore, and Ridge and Valley sections; common locally in the Eastern Shore section (during the breeding season largely restricted to the swamp along the Pocomoke River and its tributaries); fairly common in the Piedmont section and locally in the Allegheny Mountain section (at elevations under 2,000 feet in the northwestern part, and on the higher ridges above 2,800 feet);

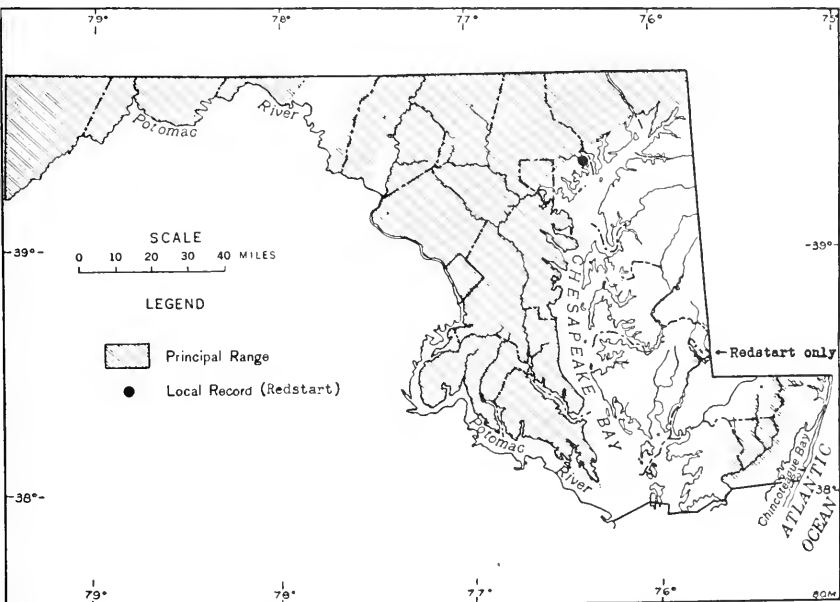


FIGURE 58.—Breeding ranges of Hooded Warbler and American Redstart.

uncommon elsewhere in the Allegheny Mountain section; rare in the Upper Chesapeake section.

HABITAT.—Swamp forests or rich, moist forests on the upland that contain a fairly dense understory of shrubs, including such species as sweet pepperbush, southern arrow-wood, spicebush, mountain laurel, and great laurel.

NESTING SEASON.—Mid-May to mid-August (nesting peak, late May to early July). *Extreme egg dates* (12 nests): May 22, 1943 and July 30, 1943, in Prince Georges County. *Extreme nestling dates* (7 nests): June 9, 1933, in Anne Arundel County (M. B. Meanley) and July 11, 1944, in Prince Georges County (J. B. Cope). Young birds out of the nest were recorded as early as June 4, 1949, in Montgomery County (D. M. Thatcher), and partially dependent young were observed being fed by parents as late as August 27, 1955, in Prince Georges County.

SPRING MIGRATION.—*Normal period*: April 20–30 to May 20–30 peak, May 1 to May 15. *Extreme arrival dates*: April 3, 1950, in Anne Arundel County (Mrs. W. L. Henderson); April 13, 1919 (A. Wetmore), and April 13, 1947 (Gunn and Crocker, 1951), in the District of Columbia; April 16, 1949, in Worcester County; April 17, 1945, in Prince Georges County.

FALL MIGRATION.—*Normal period*: July 25–August 5 to September 20–30; peak, August 15 to September 10. *Extreme departure dates*: October 16, 1953, in the District of Columbia (C. O. Handley, Jr.); October 8, 1952, in Prince Georges County (L. W. Oring).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 63 (8 in 12¼ acres) in lowland seepage swamp forest (red maple, sweetgum, pin oak with brushy understory of sweet-bay, winterberry, arrow-wood etc.) in Prince Georges County in 1946.
- 48 (11.6 in 24½ acres) in river terrace forest (beech–white oak) in Prince Georges County in 1944.
- 36 (4 in 11 acres) in upland seepage swamp forest (red maple, sweetgum, black gum, pitch pine with dense understory of holly, sweet pepperbush, clammy azalea, maleberry, etc.) in Prince Georges County in 1946.
- 32 (6 in 18¼ acres) in “second-growth river swamp” (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d).
- 32 (2 in 6¼ acres) in “young second-growth resulting from cutting” (oak–maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 29 (6 in 21 acres) in “dense second-growth” (oak–maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 18 (8 in 44¾ acres) in river-bluff forest (beech, white oak, and scarlet oak) in Prince Georges County in 1944; 14 (6 in 44¾ acres) in 1945 (J. W. Aldrich, A. J. Duvall).

- 7 (2.5 in 15 acres) in "open slash area" (cut-over, oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 6 (5.2 in 32½ acres) in pine-oak forest (pitch pine, scrub pine, Spanish oak) in Prince Georges County in 1944.
- 3 (3 in 36 acres) in "virgin central hardwood deciduous forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
- 3 (2 in 22½ acres) in upland oak forest (white, scarlet, and black oaks) in Prince Georges County in 1944.
- 3 (5 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1948, 4 (3.5 in 80 acres) in 1949 (Trever, 1952); 4 (3 in 80 acres) in 1952 and 1953 (Clagett, 1952 and 1953); and in 1954 (Wright, 1955); 2 (2 in 80 acres) in 1951 (Trever, 1952).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 100 at Gibson Island, Anne Arundel County, on May 8, 1955 (Mrs. W. L. Henderson, Mrs. G. Tappan); 50 at Patuxent Refuge on May 6, 1950; 40 near Emmitsburg, Frederick County, on May 10, 1952 (J. W. Richards). *Fall*: 16 at Patuxent Refuge on September 5, 1943.

WILSON'S WARBLER *Wilsonia pusilla* (Wilson)

STATUS.—*Transient*: Uncommon, occasionally fairly common, in all sections, except the Eastern Shore section where it is rare. *Wintering*: Accidental—1 was collected (USNM) in Worcester County on December 22, 1947 (Robbins, 1949d).

HABITAT.—Wood margins, hedgerows, and other brushy habitats, usually in moist situations.

SPRING MIGRATION.—*Normal period*: May 5–10 to May 20–30; peak, May 10 to May 20. *Extreme arrival dates*: April 26, 1953, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); April 29, 1932, in the District of Columbia (E. N. Grinnell). *Extreme departure dates*: June 10, 1928, in Harford County (F. C. Kirkwood); June 4, 1910, in the District of Columbia (V. Bailey); May 31, 1943, in Prince Georges County; May 31, 1951, in Montgomery County (S. H. Low).

FALL MIGRATION.—*Normal period*: August 20–25 to September 20–25; peak, August 25 to September 15. *Extreme arrival dates*: August 15, 1953, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); August 17, 1945, in Prince Georges County. *Extreme departure dates*: October 13, 1919 (M. J. Pellew), and October 6, 1904 (W. W. Cooke), in the District of Columbia; October 5, 1954, in Prince Georges County (L. W. Oring).

MAXIMUM COUNTS.—*Spring*: 10 along the C. and O. Canal, Montgomery County, on May 12, 1951 (P. A. DuMont); 10 at Greenbelt, Prince Georges County, on May 12, 1956 (L. W.

Oring); 9 at Patuxent Refuge on May 18, 1947. *Fall*: 10 at Seneca, Montgomery County, on September 12, 1954 (J. W. Terborgh).

CANADA WARBLER *Wilsonia canadensis* (Linnaeus)

STATUS.—*Breeding* (see fig. 59): Common in the Allegheny Mountain section at elevations above 2,100 feet. *Transient*: Common in all sections except the Eastern Shore section where it is uncommon.

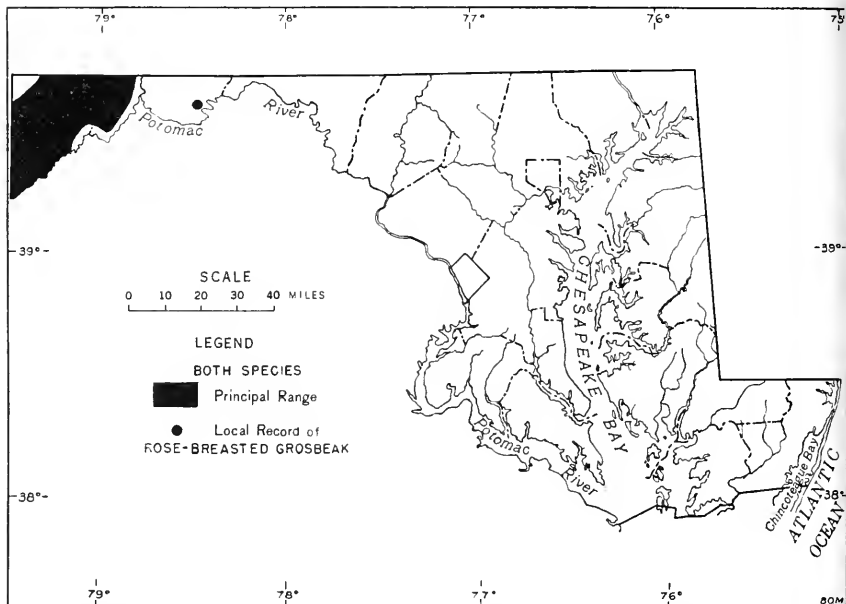


FIGURE 59.—Breeding ranges of Canada Warbler and Rose-breasted Grosbeak.

HABITAT.—*Breeding*: Swamp and moist forests, in bogs and along streams with understory of great laurel and other shrubs; also occurs in brushy cut-over oak-chestnut and northern hardwood forests on the ridges. *Transient*: Flood-plain and swamp forests, and rich moist forests on the upland.

NESTING SEASON.—Probably late May to mid-July. *Egg dates* (2 nests): May 28, 1935, in Allegany County (L. M. Llewellyn) and June 2, 1919, in Garrett County (J. M. Sommer). Kirkwood (1895) refers to a nest with young, found in Allegany County in 1895, sometime later than June 10. Several observations have been made of adults carrying food in Garrett County, the earliest record occurring on June 11, 1918 (F. C. Kirkwood).

SPRING MIGRATION.—*Normal period*: May 1–10 to May 25–June

; peak, May 10 to May 25. *Extreme arrival dates*: April 26, 1925, in Baltimore County (F. C. Kirkwood); April 28, 1954, in Howard County. *Extreme departure dates*: June 4, 1945, in Prince Georges County; June 2, 1907 (A. K. Fisher), and June 2, 1917 (F. Harper), in the District of Columbia.

FALL MIGRATION.—*Normal period*: August 10–15 to September 5–25; peak, August 20 to September 5. *Extreme arrival dates*: July 31, 1887, in the District of Columbia (A. K. Fisher); August 1, 1951, in Baltimore County (E. Willis); August 6, 1953, in Prince Georges County. *Extreme departure dates*: October 23, 1921, in Montgomery County (A. Wetmore); October 12, 1947, in Prince Georges County; October 11, 1908, in the District of Columbia (R. W. Williams).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 5 (9.5 in 21 acres) in "dense second-growth" (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 4 (5.5 in 12½ acres) in "virgin spruce-hemlock bog forest" (red spruce and hemlock with dense understory of great laurel) in Garrett County in 1951 (Stewart and Robbins, 1951a).
- 2 (2 in 6¼ acres) in "young second-growth resulting from cutting" (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 7 (4 in 15 acres) in "open slash area" (cut-over oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 2 (2 in 9 acres) in "scrub spruce bog" (brush-meadow stage with young red spruce) in Garrett County in 1951 (Robbins and Stewart, 1951b).
- 21 (2 in 9½ acres) in "open hemlock-spruce bog" (brush-meadow stage with young hemlock, red spruce, alder, etc.) in Garrett County in 1949 (Robbins, 1949c).
- 7 (1.5 in 20 acres) in "virgin hemlock stand" in Garrett County in 1949 (Robbins, 1949a).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 100+ along the Choptank River, Caroline County, on May 10–11, 1952 (A. J. Fletcher, M. W. Hewitt); 91 at Greenbelt, Prince Georges County, on May 12, 1956 (L. W. Oring); 72 at Patuxent Refuge on May 11, 1950; 42 in the District of Columbia on May 13, 1950 (P. A. DuMont, et al.). *Fall*: 33 at Patuxent Refuge on August 20, 1943; 14 near Great Falls, Montgomery County, on August 29, 1948 (D. C. Aud. Soc.).

AMERICAN REDSTART *Setophaga ruticilla* (Linnaeus)

STATUS.—*Breeding* (see fig. 58): Common in the Allegheny Mountain, Ridge and Valley, Piedmont, and Western Shore sections; locally common in the Eastern Shore section (largely restricted to the swamps along the Pocomoke and upper Nanticoke Rivers and their tributaries); uncommon and local in the Upper

Chesapeake section. *Transient*: Common in all sections. *Wintering*: Accidental—1 seen at White Marsh, Baltimore County, on December 6, 1950 (C. D. Hackman); 1 seen in the District of Columbia on December 4, 1951 (A. M. Stimson).

HABITAT.—*Breeding*: Second-growth river swamps and flood-plain forests in all sections; also in second-growth mixed mesophytic and northern hardwood forests in the Ridge and Valley, and Allegheny Mountain sections. *Transient*: Various types of deciduous forest.

NESTING SEASON.—Late April to early July (nesting peak, mid-May to mid-June). Nest-building was recorded as early as April 19, 1949, in Worcester County (J. H. Buckalew). *Extreme egg dates* (39 nests): April 25, 1949, in Worcester County (J. H. Buckalew) and June 30, 1890, in the District of Columbia (E. M. Hasbrouck). *Extreme nestling dates* (19 nests): May 23, 1954, in Worcester County (A. A. Brandenburg) and July 9, 1898 (F. C. Kirkwood), in Baltimore County.

SPRING MIGRATION.—*Normal period*: April 15–25 to May 20–30; peak, May 1 to May 15. *Extreme arrival dates*: April 7, 1946, in Worcester County; April 10, 1954, in Prince Georges County (L. W. Oring); April 13, 1952, in Charles County (A. R. Stickley, Jr.); April 14, 1927, in Baltimore County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: August 1–10 to October 1–10; peak, August 25 to September 20. *Extreme arrival dates*: July 22, 1918, in the District of Columbia (A. H. Howell); July 22, 1955, in Prince Georges County (W. H. Stickel); July 25, 1951, in Baltimore County (E. Willis). *Extreme departure dates*: November 16, 1948, in the District of Columbia (E. G. Davis); October 18, 1955, in Caroline County (Mrs. A. J. Fletcher); October 17, 1953, in Montgomery County (P. G. DuMont); October 16, 1947 and October 16, 1954 (L. W. Oring), in Prince Georges County.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 91 (17 in 18¾ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d)
- 51 (43.4 in 85 acres) in well-drained flood-plain forest (sweetgum, hornbeam, river birch, tulip-poplar, etc.) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946).
- 16 (3 in 19.2 acres) in "shrubby field with stream-bordered trees" in Baltimore County in 1947, absent in 1946 (Cooley, 1947).
- 12 (3.5 in 28 acres) in partially opened flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 12 (1.6 in 13 acres) in shrub swamp (alder, poison sumac, sweet pepperbush, swamp rose, young red maple, etc.) in Prince Georges County in 1945.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 130+ at Port Tobacco, Charles County, on May 11, 1943 (I. N. Gabrielson, A. L. Nelson); 130 in Baltimore County on May 6, 1950; 115 in Montgomery County on May 8, 1954 (K. Stecher); 91 at Patuxent Refuge on May 6, 1950; 72 in the Pocomoke Swamp on April 21, 1954 (P. G. DuMont). *Fall*: 150 at Tilghman, Talbot County, on September 8, 1955 (R. L. Kleen); 110 on August 27, 1954, and 55 on September 19, 1954, at Greenbelt, Prince Georges County (L. W. Oring); 40 in Baltimore County on August 31, 1893 (F. C. Kirkwood); 27 killed at the Washington Monument in the District of Columbia on September 12, 1937 (Overing, 1938); about 25 killed at the Friendship International Airport ceilometer, Anne Arundel County, on September 10, 1954.

Family PLOCEIDAE

HOUSE SPARROW *Passer domesticus* (Linnaeus)

STATUS.—Permanent resident. Common (locally abundant) in the Upper Chesapeake and Piedmont sections; fairly common (locally abundant) in the Eastern Shore, Western Shore, Ridge and Valley, and Allegheny Mountain sections.

HABITAT.—Most numerous in the vicinity of barnyards in the country; also characteristic of small towns and the business sections of cities. In the rural areas, this species generally concentrates wherever livestock are kept.

NESTING SEASON.—Mid-February to mid-November (nesting peak, early March to mid-August). Nest-building was recorded as early as February 14, 1894, in the District of Columbia (C. W. Richmond) and as late as November 3, 1893, in Baltimore County (F. C. Kirkwood). *Extreme egg dates* (86 nests): March 29, 1930 (M. B. Meanley), and August 6, 1882 (F. C. Kirkwood), in Baltimore County. *Extreme nestling dates* (45 nests): April 15, 1945, in Prince Georges County and September 6, 1917 (W. Marshall), in Baltimore County.

MAXIMUM COUNTS.—*Winter* (Christmas counts): 1,329 in the Ocean City area on December 27, 1955; 1,311 in the Catoctin Mountain area, Frederick County, on December 30, 1951; 793 in the Triadelphia Reservoir area on January 1, 1954; 607 in Caroline County on December 26, 1953.

HISTORY OF INTRODUCTION.—The following description of the early history of the House Sparrow in Maryland is largely derived from data presented by Kirkwood (1895). Beginning in 1851, when this European species was first introduced into the United States at Brooklyn, New York, importations were made at widely

different points during the next 30 years. Its first appearance in Maryland was recorded in 1865 at Hancock in Washington County. After this it soon appeared at other locations, including importations which were made in the District of Columbia in 1871 (Cooke, 1929) and in Baltimore in 1874. The establishment of this species in the various sections of the State may be described as having taken place in the following order: Ridge and Valley section during the period 1865-70; Allegheny Mountain and Piedmont sections during the period 1872-76; Upper Chesapeake Western Shore, and Eastern Shore sections during the period 1877-80.

Family ICTERIDAE

BOBOLINK *Dolichonyx oryzivorus* (Linnaeus)

STATUS.—*Breeding* (see fig. 60): Fairly common in the Allegheny Mountain section at elevations above 2,500 feet; rare and local in the Piedmont section, occurring in Baltimore County in Worthington Valley (M. B. Meanley) and in Frederick County in the vicinity of Buckeystown. *Spring transient*: Fairly common in all sections. *Fall transient*: Common, occasionally abundant, in the Upper Chesapeake and Western Shore sections; fairly com-

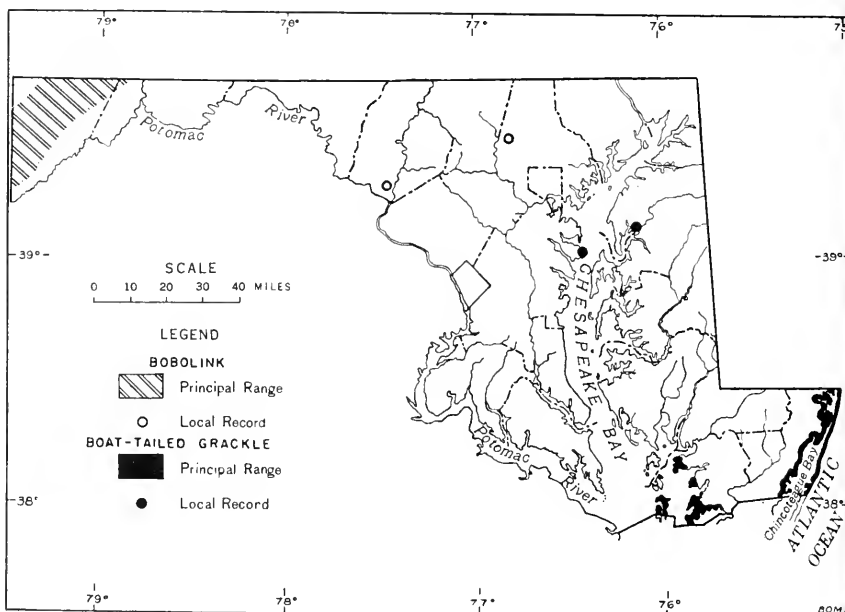


FIGURE 60.—Breeding ranges of Bobolink and Boat-tailed Grackle.

non in the Eastern Shore section; uncommon in the Piedmont, Ridge and Valley, and Allegheny Mountain sections.

HABITAT.—*Breeding*: Hayfields and over-grown pastures. *Transient*: In spring this species frequents various field and field border habitats; in fall, it concentrates in fresh or brackish tidal marshes, especially those that contain wild rice. Concentration areas, in fall, include the marshes of the Patuxent, Patapsco, Gunpowder, Elk, and (formerly) the Potomac Rivers.

NESTING SEASON.—In 1932, a nest in Garrett County contained eggs on June 20 (Brooks, 1936c) and young birds on June 24 (Brooks, 1934).

SPRING MIGRATION.—*Normal period*: May 1–5 to May 20–30; peak, May 5 to May 20. *Extreme arrival dates*: April 16, 1905, April 25, 1898 and 1904, in Baltimore County (F. C. Kirkwood); April 25, 1931 (Mr. and Mrs. L. D. Miner), in the District of Columbia; April 26, 1911 and 1914, in Dorchester County (R. W. Jackson). *Extreme departure dates*: June 12, 1921, in Anne Arundel County (T. Denmead); June 12, 1931, in Baltimore County (F. C. Kirkwood); June 6, 1909, in the District of Columbia (H. W. Henshaw); June 6, 1914, in Dorchester County (R. W. Jackson); June 5, 1948, in Calvert County.

FALL MIGRATION.—*Normal period*: July 25–August 5 to October 1–10; peak, August 25 to September 15. *Extreme arrival dates*: July 18, 1944, in Prince Georges County; July 21, 1900, in Baltimore County (F. C. Kirkwood); July 24, 1954, in St. Marys County (R. R. Kerr). *Extreme departure dates*: November 8, 1888, on the Patapsco River (A. Resler); November 5, 1901, on the Gunpowder River (F. C. Kirkwood); October 30, 1943, in Prince Georges County.

MAXIMUM COUNTS.—*Spring*: 5,000 on the Gunpowder River marsh on May 21, 1902 (F. C. Kirkwood); 990 in Howard County on May 8, 1954; 500 near Blackwater Refuge, Dorchester County, on May 10, 1952 (W. S. Webster); 431 in Anne Arundel County on May 8, 1954 (P. A. DuMont). *Fall*: 20,000 at Snows Marsh, Baltimore County, on September 12, 1899 (F. C. Kirkwood); 5,000 at the Gunpowder River marsh on August 26, 1904 (F. C. Kirkwood); 2,000 along the Pocomoke River, Worcester County, on September 16, 1950 (J. H. Buckalew).

EASTERN MEADOWLARK *Sturnella magna* (Linnaeus)

STATUS.—*Breeding and transient*: Common in all sections. *Wintering*: Common in the Eastern Shore section; fairly common in the Western Shore and Upper Chesapeake sections; uncommon

in the Piedmont, and Ridge and Valley sections; rare in the Allegheny Mountain section.

HABITAT.—*Breeding*: Hayfields and over-grown pastures in agricultural areas; marsh-meadow types in the tidal marshes, including salt-meadow grass, black grass, and switchgrass, and American three-square meadows on the coastal barrier beaches. *Transient and wintering*: Agricultural fields and field borders, and salt marshes.

NESTING SEASON.—Early May to early August (nesting peak, mid-May to mid-July). Nest-building was recorded as early as May 1, 1926, in Dorchester County (R. W. Jackson). *Extreme egg dates* (68 nests): May 10, 1941, in Montgomery County (E. J. Court) and July 25, 1922, in Dorchester County (Jackson, 1941). *Extreme nestling dates* (16 nests): May 18, 1891, in the District of Columbia (C. W. Richmond) and July 26, 1931, in Garrett County (J. A. Molter).

SPRING MIGRATION.—*Normal period*: March 5–15 to April 25–May 5; peak, March 25 to April 20. *Extreme arrival dates*: February 21, 1908 (H. W. Oldys), and February 22, 1917 (Mr. and Mrs. L. D. Miner), in the District of Columbia; February 28, 1945, in Prince Georges County; March 1, 1902, in Allegany County (G. Eifrig); March 1, 1917, in Washington County (M. A. Murphy); March 12, 1953, in Garrett County (H. E. Slater, K. F. Sanders).

FALL MIGRATION.—*Normal period*: October 1–10 to November 25–December 5; peak, October 15 to November 15. *Extreme arrival date*: September 16, 1943, in Prince Georges County.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 7 (6 in 90 acres) in mixed hayfields and pastures in Prince Georges County in 1951.
- 7 (1.3 in 17 acres) in salt-meadow grass marsh-meadow in Somerset County in 1948 (Springer and Stewart, 1948a).
- 5 (1.5 in 30 acres) in switchgrass marsh-meadow in Somerset County in 1948 (Springer and Stewart, 1948a).

MAXIMUM COUNTS (nonbreeding).—*Winter* (Christmas counts): 4,167 in the Ocean City area on December 27, 1955; 671 in Caroline County on December 26, 1953; 633 in southern Dorchester County on December 28, 1954; 387 near the Wicomico River in Charles and St. Marys Counties on December 28, 1952.

YELLOW-HEADED BLACKBIRD

Xanthocephalus xanthocephalus (Bonaparte)

STATUS.—Casual visitor. On September 10, 1891, a male was

collected at Baltimore (Kirkwood, 1895), and on August 29, 1892, a female was collected in the District of Columbia (Hasbrouck, 1893). Two other females were collected in the vicinity of Baltimore, 1 on September 18, 1893 (Md. Acad. Sci.), the other on October 1, 1894 (Kirkwood, 1895). Another male was seen at West Ocean City on May 11, 12, and 13, 1956 (C. M. Buchanan, et al.).

REDWINGED BLACKBIRD *Agelaius phoeniceus* (Linnaeus)

STATUS.—*Breeding*: Common, locally abundant, in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections; fairly common in the Ridge and Valley, and Allegheny Mountain sections. *Transient*: Abundant in the Eastern Shore, Western Shore, and Upper Chesapeake sections; common in the Piedmont, Ridge and Valley, and Allegheny Mountain sections. *Wintering*: Abundant in the Upper Chesapeake section; common in the Eastern Shore section; fairly common near tidewater in the Western Shore section; uncommon in the interior of the Western Shore section, and in the Piedmont, and Ridge and Valley sections; rare in the Allegheny Mountain section.

HABITAT.—*Breeding*: Various types of marsh and marsh-meadow with or without scattered shrubs and small trees; in the Upper Chesapeake and Piedmont sections and to a lesser extent elsewhere, this species also occurs regularly in hayfields and weedy fallow fields and occasionally in grainfields. *Transient and wintering*: Marshes, agricultural fields, and field borders.

NESTING SEASON.—Late April to early August (nesting peak, mid-May to early July). *Extreme egg dates* (717 nests): April 28, 1951 (E. Willis), and July 27, 1947 (E. G. Cooley), in Baltimore County. *Extreme nestling dates* (350 nests): May 12, 1951, and August 9, 1950, in Baltimore County (E. Willis). Young birds out of the nest were observed in Baltimore County as early as May 12, 1951 (E. Willis).

SPRING MIGRATION.—*Normal period*: February 15–25 to May 5–15; peak, February 25 to March 30. *Extreme arrival dates*: January 23, 1916, in the District of Columbia (W. W. Cooke); February 5, 1941, in Prince Georges County. *Extreme departure dates*: May 18, 1902, in the District of Columbia (H. W. Maynard); May 18, 1947, in Prince Georges County.

FALL MIGRATION.—*Normal period*: July 20–30 to December 1–10; peak, October 15 to November 20. *Extreme arrival dates*: July 8, 1933, in the District of Columbia (E. N. Grinnell); July

11, 1919, in Baltimore County (F. C. Kirkwood). *Extreme departure date*: December 15, 1942, in Prince Georges County.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

73 (12 in 16½ acres) in "cattail marsh" (narrow-leaved cattail with scattered swamp rose-mallow) in Calvert County in 1948 (Springer and Stewart 1948a).

37 (7.2 in 19½ acres) in "saltmarsh bulrush-saltgrass marsh" in Somerset County in 1948 (Springer and Stewart, 1948a).

36 (7 in 19½ acres) in "shrubby field with stream-bordered trees" in Baltimore County in 1947, 26 (5 in 19½ acres) in 1946 (Cooley, 1947).

23 (7 in 30 acres) in "switchgrass marsh-meadow" in Somerset County in 1948 (Springer and Stewart, 1948a).

MAXIMUM COUNTS (nonbreeding).—*Spring*: "Millions" at Carroll Island, Baltimore County, on March 15, 1896 (F. C. Kirkwood); 10,000 in Baltimore County on March 8, 1900 (F. C. Kirkwood); 6,000 at Port Tobacco, Charles County, on March 2, 1954 (V. C. Kirtley, H. N. Page). *Fall*: 10,000 in Baltimore County on November 11, 1894 (F. C. Kirkwood); 5,000+ along the Choptank River, Talbot County, on September 9, 1947 (N. Hotchkiss). *Winter* (Christmas counts): 800,000 in the Susquehanna Flats area, Cecil County, on December 26, 1948; 26,825 in the Ocean City area on December 27, 1954; 17,393 in southern Dorchester County on December 28, 1955; 5,000 at Port Tobacco, Charles County, on December 23, 1937, and December 27, 1941.

BANDING.—Three recovered in winter (December 31–February 15) in Somerset County had been banded in spring (April 22–May 15) in the following areas: 2 in southeastern Massachusetts and 1 in southern New Jersey. One banded at Patuxent Refuge on March 18, 1950, was recovered in central Vermont on May 16, 1952, and another banded at Patuxent Refuge on August 14, 1946, was recovered in northeastern North Carolina on April 4, 1947.

ORCHARD ORIOLE *Icterus spurius* (Linnaeus)

STATUS.—*Breeding and transient*: Common in the Eastern Shore and Western Shore sections; fairly common in the Upper Chesapeake and Piedmont sections; uncommon in the Ridge and Valley section; rare in the Allegheny Mountain section (Brooks, 1936c).

HABITAT.—Orchards and residential areas of farms, towns, and suburbs; also occurs regularly in open stands of loblolly pine along the margins of the tidal marshes in the Eastern Shore section.

NESTING SEASON.—Early May to early August (nesting peak, late May to late June). Nest-building was recorded as early as

May 2, 1953, in Worcester County (P. A. DuMont). *Extreme egg dates* (65 nests): May 20, 1916, in Dorchester County (Jackson, 1941) and July 14, 1953, in Caroline County (E. Bilbrough). *Extreme nestling dates* (48 nests): May 29, 1953, and August 1, 1953, in Caroline County (E. Bilbrough).

SPRING MIGRATION.—*Normal period*: April 25–May 5 to May 15–25; peak, May 5 to May 15. *Extreme arrival dates*: April 7, 1947, in Prince Georges County; April 19, 1952, in Caroline County (Mr. and Mrs. A. J. Fletcher); April 20, 1916, in Dorchester County (R. W. Jackson); April 21, 1917, in Baltimore County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: July 1–10 to August 20–30. *Extreme departure dates*: October 13, 1952, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); September 21, 1952, in Charles County (M. C. Crone, A. R. Stickley, Jr.); September 18, 1954, in Montgomery County (P. A. DuMont); September 13, 1940 (A. V. Davis, Jr.), and September 13, 1948 (W. B. Green), in Washington County. The resident birds usually depart during the last half of July, while during some years, small numbers of transients are of regular occurrence during August.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 29 (3 in 10.5 acres) in farmyards (including small orchards) in Prince Georges County in 1951.
- 15 (3 in 20 acres) in suburban residential area (including small orchards and large expanses of lawn) in Prince Georges County in 1942.
- 10 (2 in 19½ acres) in "shrubby field with stream-bordered trees" in Baltimore County in 1946, 5 (1 in 19½ acres) in 1947 (Cooley, 1947).

MAXIMUM COUNTS.—*Spring*: 50 along the Gunpowder River on May 5, 1904 (J. Thomas); 30 at Port Tobacco, Charles County, on May 6, 1938, and May 11, 1943 (I. N. Gabrielson, F. M. Uhler); 29 in Caroline County on May 10, 1952 (Mr. and Mrs. A. J. Fletcher).

BALTIMORE ORIOLE *Icterus galbula* (Linnaeus)

STATUS.—*Breeding*: Fairly common in the Allegheny Mountain, Ridge and Valley, and Piedmont sections; uncommon in the Upper Chesapeake and Eastern Shore sections; rare (or absent—no definite records) in the Western Shore section. *Transient*: Fairly common in all sections. *Wintering*: Rare and irregular in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont Sections.

HABITAT.—*Breeding*: Shade trees in residential areas on farms,

and in towns and suburbs; also in open stands of flood-plain forests and moist forests on the upland. *Transient*: Various types of deciduous forest.

NESTING SEASON.—Early May to early July (nesting peak, mid-May to mid-June). Nest-building was recorded as early as May 2, 1891, in Baltimore County (Kirkwood, 1895) and May 2, 1954 in Caroline County (Mrs. A. J. Fletcher). *Extreme egg dates* (19 nests): May 18, 1880, in Washington County (E. A. Small) and June 12, 1931, in Baltimore County (M. B. Meanley). *Extreme nestling dates* (40 nests): May 26, 1954, in Caroline County (Mrs. A. J. Fletcher) and July 4, 1898, in Baltimore County (F. C. Kirkwood).

SPRING MIGRATION.—*Normal period*: April 25–May 5 to May 15–25; peak, May 5 to May 15. *Extreme arrival dates*: April 9, 1913, in Dorchester County (R. W. Jackson); April 17, 1896, in Wicomico County (A. E. Acworth); April 18, 1917, in Baltimore County (F. C. Kirkwood). *Extreme departure dates*: June 12, 1946, in Prince Georges County; June 10, 1899, in the District of Columbia (A. H. Howell).

FALL MIGRATION.—*Normal period*: August 1–10 to September 20–30; peak, August 20 to September 15. *Extreme arrival date*: July 28, 1943, in Prince Georges County. *Extreme departure dates*: October 20, 1945, in Prince Georges County; October 15, 1922, in the District of Columbia (J. Kittredge, Jr.); October 10, 1930, in Kent County (W. Baker).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

10 (2 in 19½ acres) in “shrubby field with stream-bordered trees” in Baltimore County in 1947, 5 (1 in 19½ acres) in 1946 (Cooley, 1947).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 100 along the Gunpowder River marsh on May 8, 1904 (J. Thomas); 40 at Patuxent Refuge on May 10, 1950; 40 in Washington County on May 7, 1949 (Dr. R. S. and M. Stauffer). *Fall*: 11 at Patuxent Refuge on August 29, 1944; 10 (8 banded) on the barrier beach north of Ocean City on September 13, 1955.

[BULLOCK'S ORIOLE] *Icterus bullockii* (Swainson)

STATUS.—Hypothetical. One was banded at Ruxton, Baltimore County, on January 17, 1955 (R. D. Cole). Another was seen at Claiborne, Talbot County, on March 3 and 8, 1955 (R. L. Kleen).

RUSTY BLACKBIRD *Euphagus carolinus* (Müller)

STATUS.—*Transient*: Fairly common in all sections. *Wintering*: Uncommon in the Eastern Shore, Western Shore, and Upper

hesapeake sections; rare in the Piedmont, Ridge and Valley, and Allegheny Mountain sections.

HABITAT.—Brushy, cut-over swamp and flood-plain forests; also occasional in agricultural fields and field borders.

SPRING MIGRATION.—*Normal period:* February 25–March 5 to April 25–May 5; peak, March 25 to April 15. *Extreme arrival dates:* February 12, 1929 (W. H. Ball), and February 15, 1900 (P. Bartsch), in the District of Columbia; February 21, 1926, in Montgomery County (W. W. Rubey). *Extreme departure dates:* May 24, 1931, in Harford County (F. C. Kirkwood); May 18, 1893, in Baltimore County (G. H. Gray, W. N. Wholey); May 15, 1954, in Worcester County (J. K. Wright); May 12, 1951, in Montgomery County (P. A. DuMont).

FALL MIGRATION.—*Normal period:* October 1–10 to December 1–10; peak, October 20 to November 15. *Extreme arrival dates:* September 11, 1928, in Baltimore County (F. C. Kirkwood); September 16, 1885, in the District of Columbia (H. W. Henshaw); September 18, 1946, in Baltimore County (I. E. Hampe). *Extreme departure date:* December 28, 1945, in Prince Georges County.

MAXIMUM COUNTS.—*Spring:* 500+ in Baltimore County on April 27, 1924 (F. C. Kirkwood); 250 on the Gunpowder River marsh on March 30, 1904 (J. Thomas); 100+ at Port Tobacco, Charles County, on May 5, 1939 (C. Cottam, F. M. Uhler). *Fall:* 1,200 along the Patapsco River, Anne Arundel County, on November 13, 1899 (W. H. Fisher); 1,000 in Dulaney Valley, Baltimore County, on October 24, 1901 (F. C. Kirkwood); 165 at Patuxent Refuge on October 25, 1944. *Winter (Christmas counts):* 242 near Chase, Baltimore County, on December 28, 1952; 223 in the Ocean City area on December 27, 1955; 106 near the Wicomico River in Charles and St. Marys Counties on December 28, 1952; 103 at Port Tobacco, Charles County, on December 26, 1944; 102 at Patuxent Refuge on January 14, 1953.

BREWER'S BLACKBIRD *Euphagus cyanocephalus* (Wagler)

STATUS.—Casual visitor—1 seen repeatedly near Emmitsburg, Frederick County, during the period November 24–December 3, 1951 (Richards, 1953); also recorded in the same area on November 8–9, 1955 (J. W. Richards). Two were seen near Newark, Worcester County, on December 23, 1946 (J. W. Aldrich). Three were seen near Port Tobacco, Charles County, on December 28, 1946 (I. N. Gabrielson). On April 8, 1956, 3 were observed near Easton, Talbot County, and 4 were seen at the

Blackwater National Wildlife Refuge, Dorchester County (P. A. Buckley).

BOAT-TAILED GRACKLE *Cassidix mexicanus* (Gmelin)

STATUS.—*Breeding* (see fig. 60): Fairly common in the coastal area of Worcester County and in the tidewater areas of Somerset County; rare, local, and irregular elsewhere in the tidewater area of the Eastern Shore and Western Shore sections, occurring as far north as Pomona in Kent County (Small, 1883b) and Gibson Island in Anne Arundel County (Mrs. W. L. Henderson). *Wintering*: Uncommon in the coastal area of Worcester County and in the tidewater areas of Somerset County; casual in the tidewater areas of the Western Shore section—10 seen on Gibson Island, Anne Arundel County, on December 21, 1951, 50 on February 5, 1952, and 100 on March 14, 1952 (Mrs. W. L. Henderson).

HABITAT.—Salt marshes and marsh borders, including patches of loblolly pine and thickets of sea myrtle, marsh elder, and wax-myrtle.

NESTING SEASON.—Mid-April to early July. Nest building and nearly completed nests were recorded in Worcester County on April 21, 1948. Nests with eggs were recorded in one colony in Worcester County on June 3, 1938 (G. A. Ammann). *Extreme nestling dates* (5 colonies): May 13, 1952 (J. H. Buckalew) and July 7, 1892 (W. N. Wholey), in Worcester County.

MAXIMUM COUNTS.—*Spring*: 200 in the Ocean City area on May 12, 1951 (E. G. Baldwin, J. W. Terborgh). *Fall*: 128 in the Ocean City area on November 11, 1951; 70 on Assateague Island on August 30, 1950. *Winter*: 130 in the Ocean City area on December 21, 1952 (Christmas count); 95 near Crisfield, Somerset County, on January 25, 1947.

COMMON GRACKLE *Quiscalus quiscula* (Linnaeus)

STATUS.—*Breeding*: Abundant in the Eastern Shore and Upper Chesapeake sections and in the southern part of the Western Shore section (St. Marys County and southern Charles and Calvert Counties); common in the Piedmont section and in the eastern part of the Ridge and Valley section (Frederick and eastern Washington Counties); fairly common (somewhat local) in the Allegheny Mountain section, in the western part of the Ridge and Valley section (Alleghany County and western Washington County), and in the northern part of the Western Shore section (Prince Georges and Anne Arundel Counties, northern Calvert County, and northern Charles County). *Transient*: Common, occasionally abundant, in all sections. *Wintering*: Abundant

in the Upper Chesapeake section; common in the Eastern Shore section; fairly common in the southern part of the Western Shore section (Calvert, Charles, and St. Marys Counties); uncommon in the northern part of the Western Shore section (Anne Arundel and Prince Georges Counties) and in the Piedmont section; rare in the Ridge and Valley section.

HABITAT.—*Breeding*: Agricultural fields and field borders, armyards, orchards, evergreen patches, and residential areas in towns and suburbs. *Transient and wintering*: Chiefly agricultural fields and field borders; occasional in various forest types.

NESTING SEASON.—Late March to late June (nesting peak, mid-April to late May). Nest-building was recorded as early as March 21, 1951, in Baltimore County (E. Willis). *Extreme egg dates* (239 nests): April 6, 1952 (E. Willis), and June 12, 1897 (E. J. Cook), in Baltimore County. *Extreme nestling dates* (184 nests): April 20, 1952 (E. Willis), and June 24, 1891 (F. C. Kirkwood), in Baltimore County.

SPRING MIGRATION.—*Normal period*: February 10–20 to April 1–10; peak, February 25 to March 25. *Extreme arrival dates*: January 17, 1919, in Baltimore County (E. O. Donovan); January 21, 1916, in the District of Columbia (Mrs. F. M. Bailey); January 28, 1944, in Prince Georges County. *Extreme departure dates*: April 20, 1929, in Baltimore County (F. C. Kirkwood); April 17, 1886, in the District of Columbia (USNM—C. W. Richmond); April 14, 1944, in Prince Georges County.

FALL MIGRATION.—*Normal period*: July 10–20 to December 1–10; peak, October 25 to November 20. During occasional years the peak movement is greatly delayed, occurring as late as December 16–21 at the Patuxent Refuge in 1944 (Stewart, et al., 1952).

MAXIMUM COUNTS.—*Spring*: 5,000+ at Dulaney Valley, Baltimore County, on February 27, 1930 (F. C. Kirkwood); 5,000+ at Patuxent Refuge on March 20, 1937 (I. N. Gabrielson). *Fall*: 60,000 at Patuxent Refuge on December 20, 1944 (late flight); 15,000 on Gunpowder River marsh on November 9, 1901 (J. Thomas); 10,000+ in Baltimore County on November 9, 1901, November 4, 1929, November 7, 1929, and November 10, 1928 (F. C. Kirkwood); 10,000 on the Patuxent River marsh near Upper Marlboro on November 14, 1946; 10,000 near Easton, Talbot County, on August 18, 1953. *Winter*: 350,000 over Sassafras River, Cecil County, on December 27, 1952 (Christmas count); 50,000 on December 18, 1902 (W. H. Fisher), and 31,500 on January 25, 1947, in Somerset County.

BANDING.—See figure 61.



FIGURE 61.—Common Grackle banding recoveries. Each symbol with numerals represents the number of records for each State or Province. Banded Maryland, recovered elsewhere: solid circle = recovered June through August; solid triangle = recovered September through May. Recovered Maryland, banded elsewhere: open circle = banded June through August; open triangle = September through May.

BROWN-HEADED COWBIRD *Molothrus ater* (Boddaert)

STATUS.—*Breeding*: Fairly common in the Allegheny Mountain Ridge and Valley, Piedmont, Upper Chesapeake, and Eastern

more sections; uncommon in the Western Shore section. *Transient*: Common in all sections. *Wintering*: Common in the Eastern Shore and Upper Chesapeake sections; fairly common in the southern part of the Western Shore section (Calvert, Charles, and St. Marys Counties); uncommon in the northern part of the Western Shore section (Anne Arundel and Prince Georges counties) and in the Piedmont, and Ridge and Valley sections; rare in the Allegheny Mountain section.

HABITAT.—Agricultural areas and adjacent woodland.

NESTING SEASON.—Late April to early August (nesting peak, early May to early July). *Extreme egg dates* (125 nests): April 24, 1921, in Montgomery County (E. J. Court) and July 28, 1929, in Baltimore County (M. B. Meanley). A young bird out of the nest was recorded as early as May 17, 1919, in Dorchester County (R. W. Jackson).

BREEDING HOST SPECIES.—A total of 223 instances of cowbird parasitism have been recorded in Maryland and the District of Columbia, including 59 on sparrows (Emberizinae), 53 on warblers (Parulidae), 44 on vireos (Vireonidae), 15 on buntings (Richmondinae), 12 on thrushes (Turdidae), 10 on icterids (Icteridae), 10 on flycatchers (Tyrannidae), 8 on tanagers (Thraupidae), and 12 on miscellaneous species. By species, records of parasitism are as follows: 39, Red-eyed Vireo; 23, Song Sparrow; 18, Chipping Sparrow; 11, Field Sparrow; 9 each for Yellow Warbler, Yellow-throat, and Cardinal; 7, Summer Tanager; 6 each for Wood Thrush and Orchard Oriole; 5 each for Eastern Phoebe, Hooded Warbler, American Redstart, Indigo Bunting, and Henslow's Sparrow; 4 each for Robin, White-eyed Vireo, and Redwinged Blackbird; 3 each for Carolina Wren, Ovenbird, Kentucky Warbler, and Yellow-breasted Chat; 2 each for Great Crested Flycatcher, Mockingbird, Blue-gray Gnatcatcher, Prothonotary Warbler, Parula Warbler, Pine Warbler, Prairie Warbler, Louisiana Waterthrush, and Rufous-sided Towhee; 1 each for Black-billed Cuckoo, Eastern Kingbird, Acadian Flycatcher, Least Flycatcher, Barn Swallow, Carolina Chickadee, Veery, Eastern Bluebird, Starling, Solitary Vireo, Black-and-white Warbler, Worm-eating Warbler, Blue-winged Warbler, Magnolia Warbler, Blackburnian Warbler, Yellow-throated Warbler, Scarlet Tanager, Blue Grosbeak, and American Goldfinch.

SPRING MIGRATION.—*Normal period*: February 5–15 to April 15–25; peak, March 10 to April 10. *Extreme arrival date*: January 25, 1941, in Prince Georges County. *Extreme departure*

dates: May 10, 1910, in the District of Columbia (F. M. Bailey) May 7, 1943, in Prince Georges County.

FALL MIGRATION.—*Normal period*: August 15–25 to December 1–10; peak, September 25 to November 1. *Extreme arrival dates* August 10, 1917, and August 11, 1927, in Dorchester County (R. W. Jackson). *Extreme departure dates*: December 23, 1944 in Prince Georges County; December 19, 1951, in Anne Arundel County (Mrs. G. Tappan).

MAXIMUM COUNTS.—*Spring*: 3,000 in Anne Arundel County on March 21, 1954 (D. A. Jones, E. Willis); 3,000 at Middle River Baltimore County, on March 21, 1955 (E. Willis); 2,000 in Cecil County on March 25, 1947; 500 near Emmitsburg, Frederick County, on April 14 and 15, 1953 (J. W. Richards). *Fall*: 1,500 in Dulaney Valley, Baltimore County, on November 11, 1894 (F. C. Kirkwood); “thousands” near Cumberland, Allegany County, on November 3, 1901 (G. Eifrig); 600 on Kent Island Queen Annes County, on October 17, 1953 (V. B. Daiker, E. Rogers); 500 near Beltsville, Prince Georges County, on August 29, 1952. *Winter*: 200,000 in Cecil County on December 27, 1952 (Christmas count); 15,772 in the Ocean City area on December 27, 1955 (Christmas count); 8,700 on Kent Island, Queen Annes County, on January 26, 1947; 2,095 in southern Dorchester County on December 28, 1953 (Christmas count).

BANDING.—Nine banded in Baltimore, Anne Arundel, Prince Georges, and Montgomery Counties in spring and summer (March 30–August 23) were recovered in fall and winter (November 6–February 10) in the following areas: 7 in eastern South Carolina and 2 in eastern North Carolina. Six recovered in late fall and winter (November 15–February 5) in Kent, Dorchester, Wicomico, and Worcester Counties had been banded in late spring and summer (April 16–September 22) in the following areas: 5 from southeastern Massachusetts and 1 from southeastern Connecticut.

Family THRAUPIDAE

SCARLET TANAGER *Piranga olivacea* (Gmelin)

STATUS.—*Breeding and transient*: Common in the Ridge and Valley, Piedmont, and Western Shore sections; fairly common in Allegheny Mountain, Upper Chesapeake, and Eastern Shore sections. *Wintering*: Accidental—1 seen near Berlin, Worcester County, on December 27, 1953 (C. L. Clagett, E. G. Baldwin) and 1 observed at Annapolis on January 2, 1955 (E. R. Seeders)

HABITAT.—Various types of deciduous forest—usually most

numerous in swamp and flood-plain forests, and in rich, moist forests on the upland.

NESTING SEASON.—Early May to early August (nesting peak, late May to mid-July). Nest-building was recorded as early as May 8, 1945, in Prince Georges County. *Extreme egg dates* (32 nests): May 12, 1953, in Caroline County (M. W. Hewitt) and August 1, 1892, in Howard County (A. Resler). *Extreme nestling dates* (12 nests): June 4, 1953, in Caroline County (M. W. Hewitt) and August 8, 1895, in Baltimore County (H. J. Muller). Stub-tailed young, just out of the nest, were recorded as early as June 10, 1953, in Prince Georges County.

SPRING MIGRATION.—*Normal period*: April 25–30 to May 20–25; peak, May 1 to May 15. *Extreme arrival dates*: April 17, 1896 (P. W. Schufeldt), and April 18, 1930 (L. McCormick-Goodhart), in the District of Columbia; April 20, 1952, in Montgomery County (I. R. Barnes); April 20, 1954, in Prince Georges County (C. G. Webster, L. W. Oring).

FALL MIGRATION.—*Normal period*: August 15–25 to October 1–10; peak, September 10 to September 30. *Extreme departure dates*: November 13, 1896, in the District of Columbia (USNM—R. Ridgway); October 23, 1952, in Baltimore (H. Kolb, E. Willis).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 26 (9.3 in 36 acres) in "virgin central hardwood deciduous forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
- 19 (15.7 in 85 acres) in "well-drained, flood-plain forest" (sweetgum, hornbeam, river birch, tulip-poplar) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946).
- 17 (4 in 24½ acres) in river terrace forest (beech-white oak) in Prince Georges County in 1944.
- 15 (3.5 in 23¼ acres) in "mature northern hardwood forest" (black cherry, beech, hemlock, sugar maple, sweet birch, etc.) in Garrett County in 1951 (Robbins and Stewart, 1951a).
- 14 (3 in 21 acres) in "dense second-growth" (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 13 (6 in 44¾ acres) in river bluff forest (beech, white oak, scarlet oak) in Prince Georges County, in 1944, 7 (3 in 44¾ acres) in 1945 (J. W. Aldrich, A. J. Duvall).
- 13 (1.8 in 14¼ acres) in "poorly drained, flood-plain forest" (pin oak, sweetgum, red maple, red ash, etc.) in Prince Georges County in 1946.
- 12 (1.5 in 13 acres) in upland oak forest (white, northern red, chestnut, and black oaks) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 10 (8 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scattered pine" in the District of Columbia in 1948, 8 (6.5 in 80 acres) in 1949, 7 (5.5 in 80 acres) in 1951 (Trever, 1952); 5 (4 in 80 acres) in 1952 (Clagett, 1952); 4 (3 in 80 acres) in 1953 (Clagett, 1953).

- 10 (2 in 20 acres) in "virgin hemlock forest" in Garrett County in 1944 (Robbins, 1949a).
- 9 (3 in 32½ acres) in pine-oak forest (pitch pine, scrub pine, Spanish oak) in Prince Georges County in 1944.
- 9 (2.5 in 28 acres) in partially opened, flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 8 (2.5 in 30 acres) in "damp deciduous scrub with standing dead trees (burned-over, poorly drained upland forest) in Prince Georges County in 1948 (Oresman, et al., 1948).
- 6 (1.4 in 23¾ acres) in upland oak forest (white, scarlet, and black oaks) in Prince Georges County in 1944.
- 4 (1.5 in 37 acres) in "mixed oak forest" (white, scarlet, and chestnut oaks, etc.) in Baltimore County in 1952 (Kaufmann, et al., 1952); 3 (1 in 4 acres) in 1950 (Kolb, 1950); 3 (1 in 37 acres) in 1951 and 1953 (Kolb and Cole, 1951; Cole and Kolb, 1953); 1 (0.5 in 40 acres) in 1949 (Kolb, 1949a); absent in 1948 (Kolb, et al., 1948).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 110 at Patuxent Refuge on May 10, 1950; 42 along the C. and O. Canal in Montgomery County on May 9, 1953 (E. J. Stivers, et al.). *Fall*: 11 at Patuxent Refuge on September 25, 1943.

SUMMER TANAGER *Piranga rubra* (Linnaeus)

STATUS.—*Breeding and transient*: Fairly common in the southern half of Worcester County, and near tidewater in the Western Shore section; uncommon elsewhere in the Eastern Shore and Western Shore sections, and along the Potomac River valley and on Sugarloaf Mountain in the Piedmont section; rare elsewhere (formerly more numerous) in the Piedmont, and Ridge and Valley sections, and in northern Caroline County.

HABITAT.—Upland oak-hickory and oak-chestnut forests; also occurs in upland stands of loblolly pine and scrub pine.

NESTING SEASON.—Late May to late July (nesting peak, early June to early July. *Extreme egg dates* (41 nests): May 24, 1912, in St. Marys County (E. J. Court) and July 13, 1902, in Baltimore County (J. M. Sommer). *Extreme nestling dates* (7 nests): June 13, 1899, in Baltimore County (J. M. Sommer) and July 27, 1954, in Caroline County (Mr. and Mrs. A. J. Fletcher).

SPRING MIGRATION.—*Normal period*: April 25–30 to May 20–25; peak, May 1 to May 15. *Extreme date of arrival*: April 21, 1896, in Montgomery County (P. W. Schufeldt). *Extreme date of departure*: May 29, 1954, in Prince Georges County.

FALL MIGRATION.—*Normal period*: August 15–25 to September 20–25. *Extreme departure date*: September 29, 1898, in Baltimore County (W. H. Fisher).

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

0 (2 in 21 acres) in "immature loblolly-shortleaf pine stand" (trees 45 to 65 feet in height) in Worcester County in 1948 (Springer and Stewart, 1948c).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 9 in St. Marys County on May 8, 1954 (J. W. Terborgh, J. W. Taylor, Jr.); 8 at Port Tobacco, Charles County, on May 12, 1951 (M. C. Crone); 6 in Seneca area, Montgomery County, on May 9, 1953 (I. R. Barnes, et al.). *Fall*: 7 at Port Tobacco on September 23, 1951 (M. C. Crone, R. L. Farr).

Family FRINGILLIDAE

CARDINAL *Richmondena cardinalis* (Linnaeus)

STATUS.—Permanent resident. Common in the Eastern Shore, Western Shore, Upper Chesapeake, Piedmont, and Ridge and Valley sections. Uncommon and local in the Allegheny Mountain section except along Bear Creek and lower Youghiogheny River where it is fairly common.

HABITAT.—Brushy, cut-over flood-plain and swamp forests, and rich, brushy, moist forests on the upland; also in hedgerows and wood margins, and in residential areas of farms, towns, and suburbs.

NESTING SEASON.—Early April to late August (nesting peak, late April to early July). Nest-building was recorded as early as April 1, 1945, in Baltimore County (H. Brackbill). *Extreme egg dates* (206 nests): April 5, 1931, in the District of Columbia (J. C. Jones) and August 19, 1900, in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (104 nests): April 24, 1947 (H. Brackbill), and August 29, 1915 (J. M. Sommer), both in Baltimore County.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 23 (3 in 13 acres) in upland oak forest (white, northern red, chestnut, and black oaks) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
 19 (7 in 36 acres) in "virgin central hardwood deciduous forest" (white oak-tulip-poplar) in Prince Georges County in 1947 (Stewart and Robbins, 1947b).
 18 (5 in 28 acres) in partially opened, flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
 13 (11 in 85 acres) in "well-drained flood-plain forest" (sweetgum, hornbeam, river birch, tulip-poplar) along the boundary between Anne Arundel and Prince Georges Counties in 1945 (Stewart, et al., 1946).
 9 (7.5 in 80 acres) in "central hardwood forest (oaks-tulip-poplar) with scat-

- tered pine" in the District of Columbia in 1951; 3 (2 in 80 acres) in 1952 (Clagett, 1953); 2 (1.5 in 80 acres) in 1949 and 1952 (Clagett, 1952); 1 (1 in 80 acres) in 1948 (Trever, 1952).
- 8 (1.5 in 18¼ acres) in "second-growth river swamp" (red maple, sweetgum, black gum, etc., with dense understory of holly, sweet pepperbush, and greenbrier) in Worcester County in 1948 (Springer and Stewart, 1948d)
- 5 (2.4 in 47¼ acres) in hedgerows in agricultural areas and abandoned farmlands (including strip 27½ yards wide on each side of hedgerow) in Prince Georges County in 1945.
- 5 (3 in 66 acres) in field and edge habitat (including strips of flood-plain forest, brushy fields, and hedgerows) in Baltimore County in 1947 (Hampe, et al., 1947).

MAXIMUM COUNTS (nonbreeding).—*Winter* (Christmas counts): 640 in the Annapolis area on January 1, 1956; 467 in the Ocean City area on December 27, 1953; 436 in the District of Columbia area on January 1, 1955; 310 in Caroline County on December 26, 1953; 284 in the Catoctin Mountain area in Frederick County on December 30, 1951; 266 near Triadelphia Reservoir in Montgomery and Howard Counties on December 26, 1954; 171 in Allegany County on December 31, 1949; 73 in Garrett County on December 31, 1954.

BANDING.—An adult banded in Montgomery County on March 10, 1939, was recovered in western Pennsylvania (New Kensington) on July 20, 1940. An immature bird banded in Montgomery County on August 20, 1943, was recovered in southeastern Pennsylvania on November 2, 1943. Two birds banded in Prince Georges County on March 29, 1946, and September 10, 1946, were recovered on April 23, 1947, and January 17, 1948, respectively, at distances of 13 and 17 miles from the points of banding.

ROSE-BREADED GROSBEAK *Pheucticus ludovicianus* (Linnaeus)

STATUS.—*Breeding* (see fig. 59): Fairly common in the Allegheny Mountain section; rare, irregular, and local in the Western Shore, Piedmont, and Ridge and Valley sections—recorded as follows: in Calvert County (where a pair bred at Governor's Run in 1925 and one was seen at Plum Point on July 25, 1928—Ball, 1930a), in Frederick County (E. J. Court reports that several pairs were found nesting on Sugarloaf Mountain, elevation 1,281 feet, many years ago), and in Allegany County (one was seen at 1,100 feet on Green Ridge on June 8, 1947). *Transient*: Fairly common in all sections except the Eastern Shore section, where it is rare.

HABITAT.—*Breeding*: Brushy, cut-over bog, mixed mesophytic

forests, and northern hardwood forests. *Transient*: Various types of deciduous forests and wood margins.

NESTING SEASON.—Late May to early July (probably). *Extreme egg dates* (10 nests): May 27, 1919, and June 13, 1917, in Garrett County (J. M. Sommer). *Nestling dates* (2 nests): June 8–14, 1895, in Allegany County (Kirkwood, 1895) and June 11, 1918, in Garrett County (J. M. Sommer).

SPRING MIGRATION.—*Normal period*: May 1–5 to May 20–25; peak, May 5 to May 15. *Extreme arrival dates*: April 8, 1929, at Chestnut Grove, Baltimore County (F. C. Kirkwood); April 17, 1902, in the District of Columbia (H. W. Maynard); April 20, 1952, in Charles County (M. C. Crone, A. R. Stickley, Jr.); April 22, 1950, in Montgomery County (F. C. Cross). *Extreme departure dates*: June 3, 1917, in the District of Columbia (A. H. Howell); June 2, 1948, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 5–15 to October 1–10; peak, September 15 to September 30. *Extreme arrival dates*: August 22, 1953, in Harford County (D. McIntosh); August 29, 1887, in the District of Columbia (R. Ridgway); August 29, 1954, in Charles County (A. R. Stickley, Jr.); August 30, 1950, in Baltimore County (E. Willis); August 31, 1900, in Prince Georges County (C. W. Richmond). *Extreme departure dates*: November 25, 1901, in Allegany County (G. Eifrig); November 23, 1952, in Montgomery County (J. E. Willoughby); November 15, 1953, in Prince Georges County (L. W. Oring); November 2, 1930, in Kent County (W. Baker).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 31 at Patuxent Refuge on May 13, 1950; 17 at Rosedale, Baltimore County, on May 6, 1950 (D. A. Jones). *Fall*: 5 at Patuxent Refuge on September 23, 1943.

BLUE GROSBEAK *Guiraca caerulea* (Linnaeus)

STATUS.—*Breeding and transient* (see fig. 62): Fairly common in Kent and Queen Annes Counties, and in northern Caroline County and western Talbot County; uncommon elsewhere in the Upper Chesapeake section, in the Western Shore section, and in the southern part of the Piedmont section (along Potomac River valley and in southern Howard County); rare in the southern part of the Eastern Shore section (south of Talbot and Caroline Counties), in the northern Piedmont section, and along the Potomac River valley of the Ridge and Valley section.

HABITAT.—Wood margins, hedgerows, and orchards in open agricultural areas.

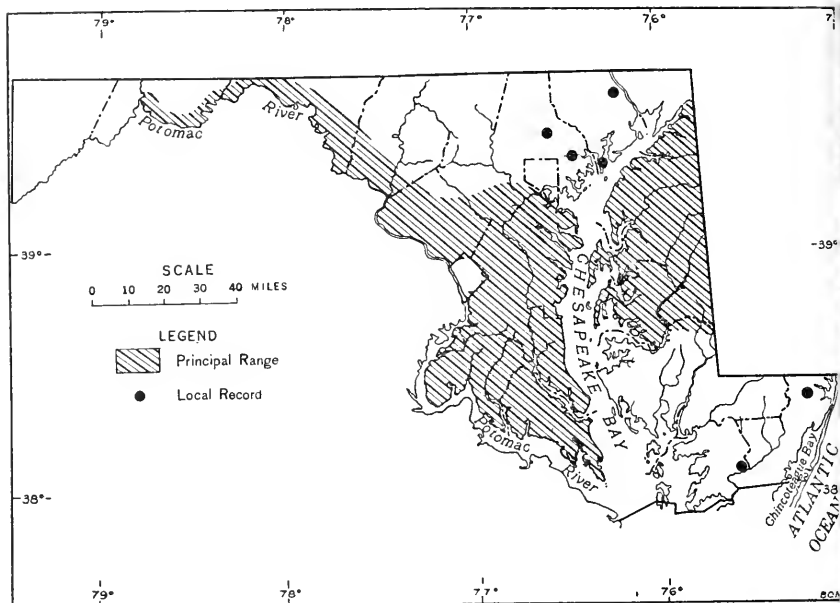


FIGURE 62.—Breeding range of Blue Grosbeak.

NESTING SEASON.—Late May to early August. *Extreme egg dates* (6 nests) : May 28, 1863, in the District of Columbia (H. W. Elliott) and June 24, 1887, in Prince Georges County (Farnham 1891). *Extreme nestling dates* (4 nests) : June 8, 1956, in Prince Georges County (E. Mashburn) and August 8, 1953, in Montgomery County (Abbott, 1953).

PERIOD OF OCCURRENCE.—*Normal period*: May 1–5 to September 25–30; peak, May 10 to September 15. *Extreme arrival dates* April 22, 1956, in Prince Georges County (F. C. Schmid); April 23, 1950 (Mrs. F. H. Vinup), in Anne Arundel County; April 25, 1955, in Caroline County (Mrs. A. J. Fletcher); April 30, 1950, in Frederick County (M. B. Meanley). *Extreme departure dates* October 24, 1953, and October 18, 1953, at different locations in Talbot County (Mrs. W. L. Henderson, R. L. Kleen); October 6, 1955, in Caroline County (Mrs. A. J. Fletcher); October 3, 1947 in Prince Georges County; October 3, 1953, in Montgomery County (A. Wetmore).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 1.7 (3 in 175 acres) in mixed agricultural habitats (including hedgerows and wood margins) in Prince Georges County in 1952.
- 0.5 (8 in 1,600 acres) in mixed agricultural habitats (including wood margins and hedgerows) in Howard County in 1951.

INDIGO BUNTING *Passerina cyanea* (Linnaeus)

STATUS.—*Breeding and transient:* Abundant in the Ridge and Valley, and Piedmont sections; common in the Allegheny Mountain, Upper Chesapeake, and Western Shore sections; fairly common in the Eastern Shore section. *Wintering:* Accidental—a specimen was collected in the District of Columbia on December 3, 1887 (M. M. Green).

HABITAT.—Hedgerows, wood margins, and orchards; also in rushy cut-over areas of swamp forest and of rich, moist forest on the upland.

NESTING SEASON.—Mid-May to late August (nesting peak, early June to late July). A nest, nearly complete, was found as early as May 17, 1943, in Baltimore County (H. Kolb). *Extreme egg dates* (109 nests): May 24, 1896 (F. C. Kirkwood), May 24, 1948 (H. Kolb), and August 16, 1891 (F. C. Kirkwood), all in Baltimore County. *Extreme nestling dates* (41 nests): June 5, 1942 (H. Kolb), and August 30, 1896 (F. C. Kirkwood), in Baltimore County.

SPRING MIGRATION.—*Normal period:* April 25–May 5 to May 25–June 5; peak, May 10 to May 25. *Extreme arrival dates:* March 13, 1938, in Prince Georges County (L. McCormick-Goodhart); March 22, 1953 (1 bird), and April 8, 1953 (6 birds), at Gibson Island, Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); April 11, 1953, in Caroline County (A. Knotts); April 15, 1921 (H. D. Wise), and April 18, 1918 (E. A. Chapin), in the District of Columbia.

FALL MIGRATION.—*Normal period:* August 20–30 to October 5–15; peak, September 5 to September 25. *Extreme arrival date:* August 16, 1944, in Prince Georges County. *Extreme departure dates:* November 1, 1955, in Frederick County (J. W. Richards); October 19, 1930, in Kent County (W. Baker); October 19, 1953, in Dorchester County (P. F. Springer); October 18, 1930, in Washington County (W. Middlekauff); October 17, 1945, in Prince Georges County.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 52 (13 in 25 acres) in “unsprayed apple orchard with unmowed ground cover” in Allegany County in 1948 (Springer and Stewart, 1948b).
- 30 (6.5 in 22 acres) in “unsprayed apple orchard with infrequently mowed ground cover” in Worcester County in 1948 (Springer and Stewart, 1948b).
- 19 (4 in 21 acres) in “dense second-growth” (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).

- 18 (4.5 in 25 acres) in "heavily sprayed apple orchard with frequently mowed ground cover" in Allegany County in 1948 (Springer and Stewart, 1948b).
- 17 (3.5 in 20½ acres) in "moderately sprayed apple orchard with infrequently mowed ground cover" in Worcester County in 1948 (Springer and Stewart, 1948b).
- 16 (3 in 19½ acres) in "shrubby field with stream-bordered trees" in Baltimore County in 1947, 10 (2 in 19½ acres) in 1946 (Cooley, 1947).
- 14 (10.5 in 72½ acres) in mixed agricultural habitats (including hedgerows and wood margins) in Prince Georges County in 1948; 13 (9.5 in 72 acres) in 1949.
- 14 (9 in 66 acres) in field and edge habitat (including strips of flood-plain forest, brushy fields, and hedgerows) in Baltimore County in 1947 (Hampe, et al., 1947).
- 6 (1.5 in 26 acres) in "dry deciduous scrub" (burned-over upland oak forest) in Prince Georges County in 1947 (Robbins, et al., 1947).
- 5 (1.5 in 28 acres) in partially opened, flood-plain forest (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 200+ at Potomac Tobacco, Charles County, on May 14, 1936 (C. Cottam, I. M. Gabrielson); 112 near Seneca, Montgomery County, on May 14, 1951 (C. N. Mason, K. Niles); 45 in Howard County on May 14, 1954; 43 at Patuxent Refuge on May 13, 1950. *Fall*: 45 in Dulaney Valley, Baltimore County, on September 6, 1896 (F. C. Kirkwood); 35 near Seneca, Montgomery County, on September 25, 1949 (I. R. Barnes).

DICKCISSEL *Spiza americana* (Gmelin)

STATUS.—*Breeding*: Regular, but variable in abundance (rare to fairly common) locally, in the western part of the Piedmont section and eastern part of the Ridge and Valley section—occurring in Montgomery County in the vicinity of Dickerson (first noted in 1928—Wetmore and Lincoln, 1928b); in Frederick County in the vicinity of Emmitsburg (J. W. Richards), Buckeys town, and Doub, and formerly near Jefferson (1890-92—J. I. Figgins); and in Washington County near Spickler (R. S. Stauffer), and in the vicinity of Ashton. Rare and irregular elsewhere in the Piedmont section—recent records of singing males include 1 seen in the District of Columbia during June 20-28, 1935 (Ball and Wallace, 1936), 1 seen near West Friendship, Howard County, on June 19, 1946 (Stewart and Robbins, 1947a), and 1 seen near Uniontown, Carroll County, about June 10-15, 1953 (D. McIntosh); casual in the Eastern Shore section—1 singing near Wye Mills, Queen Annes County, on June 19, 1953 (N. Hotchkiss, E. Miller). Formerly (about 1860) this species was found breeding commonly in the District of Columbia (Smith

391; Coues and Prentiss, 1883) and near Baltimore (Kirkwood, 1895), but it gradually decreased in numbers until 1875, by which time it had become extremely rare. *Transient*: Rare in the Ridge and Valley, Piedmont, Upper Chesapeake, Western Shore, and Eastern Shore sections. *Wintering*: Rare and irregular—recorded during the winter of 1950–51 in Montgomery County (H. E. Slater); in 1953–54 (M. W. Hewitt) and 1954–55 (Mr. and Mrs. A. J. Fletcher) in Caroline County; on March 13, 1954, in Frederick County (J. E. Knudson) and in the winter of 1954–55 in Anne Arundel County (Mrs. W. L. Henderson).

HABITAT.—Agricultural fields and weedy field borders, usually most numerous in the vicinity of alfalfa or clover hayfields.

NESTING SEASON.—A nest with eggs was found near Ashton, Washington County, on June 15, 1951. A young bird, barely grown, was seen near Dickerson, Montgomery County, on July 2, 1928 (Wetmore and Lincoln, 1928b).

SPRING MIGRATION DATES.—April 24, 1938, in Cecil County (Clark); April 26, 1953, in Montgomery County (H. S. Haller); April 27, 1956, in Anne Arundel County (H. Wierenga); May 2, 1950, in Frederick County; May 6, 1950, in Prince Georges County; May 7, 1892, in Baltimore County (W. N. Wholey); May 7, 1939, in Montgomery County (H. C. Oberholser); May 20, 1876, in Baltimore County (A. Resler); May 22, 1953, in Prince Georges County.

FALL MIGRATION DATES.—September 2, 1956, in Prince Georges County; September 4, 1956, in Kent County; September 12–13, 1955, in Worcester County; September 18, 1954 (P. G. DuMont), in Montgomery County; September 21, 1956 (banded) in Worcester County; September 30, 1953, in Anne Arundel County (Prof. and Mrs. D. Howard); October 2, 1880 (collected), in Baltimore County (A. Resler); October 30, 1898, in Baltimore County (F. C. Kirkwood); November 18, 1954, in Frederick County (Mrs. J. W. Richards); November 22, 1951 (banded), in Montgomery County (S. H. Low).

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

1.4 (7 in 500 acres) in mixed agricultural land (chiefly wheat and red clover) in Washington County in 1951.

MAXIMUM COUNTS.—*Summer*: 25 were recorded in the Dickerson area of Montgomery County on June 7, 1952 (R. R. Kerr, J. W. Terborgh), and 17 singing males were recorded in the same area on July 21, 1951 (R. J. Beaton).

EVENING GROSBEAK *Hesperiphona vespertina* (Cooper)

STATUS.—Irregular visitor during the fall, winter, and spring in all sections. Although frequently absent, during flight years it is usually rare or uncommon, while during the winters of 1951–52, 1954–55, and 1955–56 it could be considered fairly common locally.

HABITAT.—Deciduous flood-plain forests, and stands of conifers.

PERIOD OF OCCURRENCE.—Noticeable flights occurred during the winters of 1921–22 (Wetmore, 1923), 1945–46, 1949–50, 1951–52, 1954–55, and 1955–56, while 1 or 2 records were reported during the winters of 1941–42, 1946–47, 1948–49, 1950–51, 1952–53, and 1953–54. *Extreme arrival dates:* October 4, 1949, in the District of Columbia (R. W. Peakes); October 22, 1954, in Baltimore County (S. W. Simon); October 23, 1951 and 1954, in Prince Georges County. *Extreme departure dates:* May 18, 1952, in Prince Georges County (Mrs. R. McCeney); May 16, 1952, in Baltimore County (Mrs. R. C. Stewart, Sr.); May 13, 1946, in Baltimore County (Brackbill, 1947a); May 12, 1922, in the District of Columbia (Cooke, 1929).

MAXIMUM COUNTS.—Hundreds migrating over Frederick about May 15, 1952 (Partridge, 1953); 80 in Garrett County on December 31, 1954 (Christmas count); 72 at Laurel, Prince Georges County, on November 6, 1954; 68 at Beltsville, Prince Georges County, on February 25, 1955 (J. H. Fales); 50 at Seneca, Montgomery County, on March 9, 1952 (P. A. DuMont); 40 at Chase, Baltimore County on March 15, 1952 (O. W. Crowder).

BANDING.—The greatest flight on record for our area occurred during the winter of 1951–52. One hundred and fifteen Evening Grosbeaks were banded at Laurel in Prince Georges County between April 6 and May 11, 1952. Four that had been banded elsewhere were trapped or seen at Laurel during this same period: 1 banded at Lexington, Massachusetts, on May 9, 1950, 1 at Alexandria, Virginia, on January 11, 1952, and 2 color-banded in the winter or spring of 1952 at Pine Ridge, Virginia (Robbins, 1953). Two that had been banded in central Connecticut on March 13, 1950, and February 22, 1953, were recovered in Wicomico County, Maryland, on April 16, 1952, and Worcester County about April 18, 1955, respectively. One bird banded at Laurel on April 20, 1952, was trapped and released at a feeding station in central New York on March 5, 1953. Another banded at Laurel on April 26, 1952, was recovered near Alpena, Michigan, on April 1, 1955.

PURPLE FINCH *Carpodacus purpureus* (Gmelin)

STATUS.—*Breeding* (see fig. 32): Uncommon, occasionally fairly common, in the Allegheny Mountain section. *Transient*: Fairly common in the Allegheny Mountain, Ridge and Valley, Piedmont, and Western Shore sections; uncommon in the Upper Chesapeake and Eastern Shore sections. *Wintering*: Uncommon in all sections except the Allegheny Mountain section where it is rare or absent.

HABITAT.—*Breeding*: Occurs at elevations above 2,500 feet in bogs or on the higher ridges in open stands of red spruce or open mixed stands of red spruce and hemlock. *Transient and wintering*: Chiefly flood-plain and swamp forests; occasional in moist, deciduous forests on the upland and in pine stands. In winter, this species is usually most numerous in areas where seed-laden ash or tulip-poplar occur.

NESTING SEASON.—A nest found in the Maryland portion of Cranesville Swamp, Garrett County, contained eggs on May 29, and young birds on June 12, 1949.

SPRING MIGRATION.—*Normal period*: March 10–20 to May 5–15; peak, March 20 to May 5. *Extreme arrival dates*: February 22, 1904 (W. W. Cooke), and February 26, 1905 (T. H. Levering), in the District of Columbia; February 29, 1956, in Prince Georges County; March 4, 1952, in Baltimore County (R. D. Cole). *Extreme departure dates*: June 3, 1907, on Warrior Mountain, Allegany County (F. C. Kirkwood); May 29, 1860, in the District of Columbia (USNM); May 26, 1907, in Montgomery County (A. K. Fisher); May 21, 1892, in Baltimore County (G. H. Gray).

FALL MIGRATION.—*Normal period*: September 20–30 to November 10–20; peak, October 15 to November 5. *Extreme arrival dates*: August 26, 1923, and August 31, 1919, in the District of Columbia (J. Kittredge, Jr.); September 4, 1951, in Howard County; September 4, 1955, in Baltimore County (C. M. Buchanan). *Extreme departure dates*: December 9, 1943, in Prince Georges County; December 6, 1901, in Allegany County (G. Eifrig).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 500 near Cabin John, Montgomery County, on April 17, 1949 (P. A. DuMont); 500 (1 flock) at Glen Echo, Montgomery County, on April 6, 1946 (E. G. Davis); 100 in Baltimore County on April 4, 1891, and April 28, 1905 (F. C. Kirkwood); 100 in Prince Georges County on April 28, 1944. *Fall*: 200 in Baltimore County on November 26, 1893 (F. C. Kirkwood); 104 in Prince Georges County on November 8, 1954; 66 in Baltimore County on Novem-

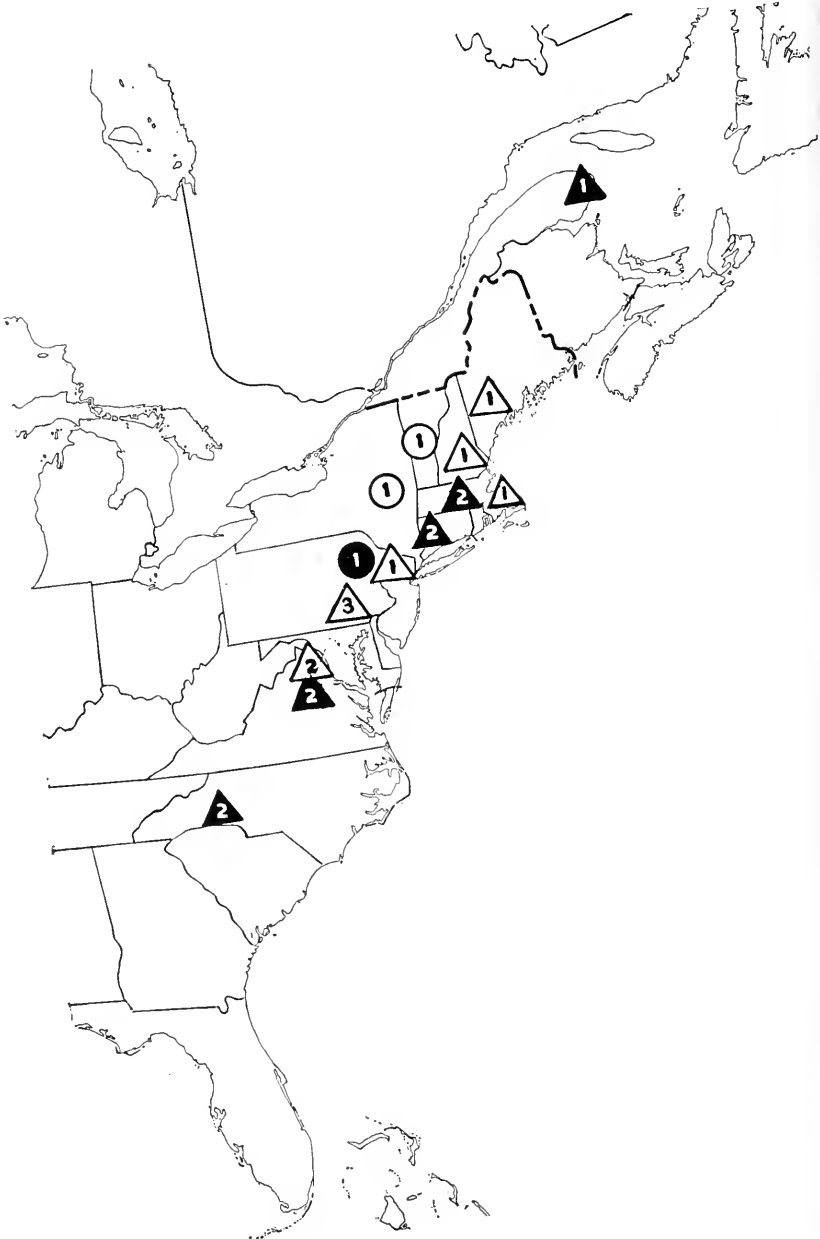


FIGURE 63.—Purple Finch banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid circle = recovered June through August; solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August; open triangle = banded September through May.

per 2, 1930 (F. C. Kirkwood). *Winter* (Christmas counts): 185 in the District of Columbia area on December 31, 1955; 126 in the Wicomico River area of Charles and St. Marys Counties on January 1, 1954; 102 in the Triadelphia Reservoir area on December 24, 1955; 72 in Allegany County on December 31, 1949; 70 at Patuxent Refuge on January 12, 1950.

BANDING.—See figure 63.

PINE GROSBEAK *Pinicola enucleator* (Linnaeus)

STATUS.—Rare and irregular winter visitor. This species has been recorded during the following winters: in 1903-04 near the District of Columbia (Chapman, 1904); in 1945-46—1 collected in Worcester County (Buckalew, 1950); in 1950-51 in Garrett County (J. H. Buckalew); in 1951-52 in Baltimore County (W. P. Braker) and in Frederick County (Richards, 1953); in 1952-53 in Garrett County (K. F. Sanders, H. E. Slater); in 1954-55 in Baltimore County (S. W. Simon), in Washington County (R. J. Beaton), and in Prince Georges, Frederick, and Garrett Counties; and in 1955-56 in Allegany County (Mr. and Mrs. J. Workmeister).

PERIOD OF OCCURRENCE.—*Extreme arrival dates*: November 6, 1954, in Washington County (R. J. Beaton); November 16, 1945, in Garrett County (Buckalew, 1950). *Extreme departure dates*: March 1, 1953, in Garrett County (K. F. Sanders, H. E. Slater); February 17, 1952, in Baltimore County (W. P. Braker).

MAXIMUM COUNTS.—12 in Frederick County on November 25, 1951 (J. W. Richards); 10 in Baltimore County on February 17, 1952 (W. P. Braker); 9 in Garrett County on December 31, 1954.

HOARY REDPOLL *Acanthis hornemanni* (Holboell)

STATUS.—Accidental winter visitor. An adult male was collected (USNM) at South Point, Worcester County, on February 20, 1949 (Buckalew, 1950). This is the only specimen of this species from south of New York City.

COMMON REDPOLL *Acanthis flammea* (Linnaeus)

STATUS.—Rare and irregular winter visitor in all sections.

HABITAT.—Abandoned weedy fields and hedgerows.

PERIOD OF OCCURRENCE.—*Extreme arrival dates*: December 6, 1901, in Allegany County (Eifrig, 1902b); December 21, 1952, in Worcester County (R. B. Bates, E. O. Mellinger). *Occurrence peak*: January 15 to February 25. *Extreme departure dates*: March 12, 1914, in the District of Columbia (M. T. Cooke); March 11, 1934, in Dorchester County (F. R. Smith).

MAXIMUM COUNTS.—40 near Sweet Air, Baltimore County, on February 13, 1914 (F. C. Kirkwood); 12–15 in Dulaney Valley, Baltimore County, on February 8, 1920 (F. C. Kirkwood); 11 near Rockville, Montgomery County, on January 14, 1940 (J. C. Jones); 10 in Baltimore on February 18, 1917 (J. M. Sommer); 9 near Girdletree, Worcester County, on February 10, 1938 (G. A. Ammann); 8 at Cumberland on December 6, 1901 (Eifrig 1902b); 7 in the District of Columbia on February 12, 1899 (W. Palmer).

PINE SISKIN *Spinus pinus* (Wilson)

STATUS.—*Breeding* (?): ["On July 1, 1937, a number of Pine Siskins. . . , some of them young birds of the season, were noted in Swallow Falls State Forest along the Youghiogheny River in Garrett County, Maryland. The birds were feeding and calling in hemlock trees, and it seems reasonable to suppose that they may have bred locally. Individuals of this species were again noted on July 3, by Mr. M. Graham Netting, of the Carnegie Museum, Pittsburgh." (Brooks, 1937)]. *Transient and wintering*: Irregular, rare or uncommon (absent during some years) in all sections; much more numerous than usual during the fall, winter, and spring of 1952–53, when it could be considered as common.

HABITAT.—*Transient and wintering*: Pine stands and flood plain and swamp deciduous forests; also in hedgerows and wood margins. This species is usually most numerous in areas where seed-laden conifers or sweetgum are common.

PERIOD OF OCCURRENCE (nonbreeding).—*Normal period*: October 10–20 to May 1–10. *Extreme arrival dates*: October 3, 1946 in Prince Georges County; October 7, 1918, in Baltimore County (W. Marshall). *Extreme departure dates*: May 29, 1949, in Garrett County; May 22, 1926, in Prince Georges County (R. V. Truitt); May 22, 1950, in Baltimore County (D. A. Jones); May 19, 1888, in the District of Columbia (Cooke, 1908).

MAXIMUM COUNTS.—*Fall, winter, and spring of 1952–53*: 40 near Emmitsburg, Frederick County, on October 18, 1952 (J. W. Richards); 280 near Kent Narrows, Queen Annes County on February 21, 1953; 250 at Patuxent Refuge on January 14, 1953 (Christmas count); 225 in the Ocean City area on December 21, 1952 (Christmas count); 220 near Greenbelt, Prince Georges County, on January 4, 1953 (L. W. Oring); 200 near Oakland, Garrett County, on March 1, 1953 (K. F. Sanders, H. E. Slater). *Other years*: 225 at Greenbelt, Prince Georges County, on April 8, 1955 (L. W. Oring); 100 on November 2, 1913, and 75 on

November 2, 1919, near Cambridge, Dorchester County (R. W. Jackson); 55 near Ocean City on November 24, 1946.

AMERICAN GOLDFINCH *Spinus tristis* (Linnaeus)

STATUS.—*Breeding*: Common in the Allegheny Mountain, Ridge and Valley, Piedmont, and Upper Chesapeake sections; fairly common in the Western Shore and Eastern Shore sections. *Transient*: Common in all sections. *Wintering*: Common in the Eastern Shore, Western Shore, Upper Chesapeake, and Piedmont sections; fairly common in the Ridge and Valley, and Allegheny Mountain sections.

HABITAT.—*Breeding*: Hedgerows, wood margins, brushy fields, shrub swamps, and orchards. *Transient and wintering*: Chiefly flood-plain and swamp forests; occasional in pine stands and in hedgerows, wood margins, and brushy fields. In winter, this species often concentrates in areas where seed-laden sweetgums common.

NESTING SEASON.—Early July to early October (nesting peak, late July to early September). Nest-building was recorded as early as July 6, 1952, in Baltimore County (E. Willis). *Extreme egg dates* (55 nests): July 12, 1885, in the District of Columbia (C. W. Richmond) and September 15, 1935, in Baltimore County (Meanley, 1936a). *Extreme nestling dates* (31 nests): August 3, 1912, in Dorchester County (R. W. Jackson) and October 4, 1948, in Baltimore County (H. F. Kuch).

SPRING MIGRATION.—*Normal period*: March 20–30 to June 1–10; peak, April 5 to May 15. *Extreme arrival date*: March 11, 1906, in the District of Columbia (W. W. Cooke). *Extreme departure date*: June 11, 1946, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 20–30 to November 20–30; peak, October 15 to November 15.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 1 (4 in 19½ acres) in "shrubby field with stream-bordered trees" in Baltimore County in 1946 and 1947 (Cooley, 1947).
- 2 (3 in 26 acres) in "dry, deciduous scrub" (burned-over upland oak forest) in Prince Georges County in 1947 (Robbins, et al., 1947).
- (1.5 in 25 acres) in "unsprayed apple orchard with unmowed ground cover" in Allegany County in 1948 (Springer and Stewart, 1948b).
- (1.5 in 25 acres) in "heavily sprayed apple orchard with frequently mowed ground cover" in Allegany County in 1948 (Springer and Stewart, 1948b).
- (3 in 66 acres) in field and edge habitat (including strips of flood-plain forest, brushy fields, and hedgerows) in Baltimore County in 1947 (Hampe, et al., 1947).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 2,000 at Port Tobacco, Charles County, on May 7, 1940 (C. Cottam, F. M. Uhler); 2,000 near Cabin John, Montgomery County, on April 17, 1949 (P. A. DuMont); 1,320 at Greenbelt, Prince Georges County, on May 5, 1956 (L. W. Oring); 1,000 on Gibson Island, Anne Arundel County, on April 28 and 29, 1952 (Mrs. W. L. Henderson). *Fall*: About 750 (382 banded) near Berwyn, Prince Georges County, on October 23, 1952 (S. H. Low); 200 at Unity, Montgomery County, on October 28, 1951 (S. H. Low); 150 at Kent Island, Queen Annes County, on November 11, 1951 (Mrs. W. L. Henderson). *Winter*: 1,607 in the Ocean City area on December 22, 1951 (Christmas count); 724 in the Triadelphia Reservoir area on December 24, 1955 (Christmas count); 670 in the Annapolis area on January 1, 1956 (Christmas count); 500 near Emmitsburg, Frederick County, on February 21, 1955 (J. W. Richards); 366 in St. Michaels area, Talbot County, on December 29, 1953 (Christmas count); 300 at Port Tobacco, Charles County, on December 27, 1941, and December 21, 1944 (Christmas counts).

BANDING.—One banded in Montgomery County on October 12, 1952, was recovered in southern South Carolina on February 28, 1953; another banded in Prince Georges County on April 28, 1954, was recovered in Kamouraska County, Quebec, on August 7, 1955.

RED CROSSBILL *Loxia curvirostra* Linnaeus

STATUS.—*Breeding* (?): A female collected near Laurel, Prince Georges County, on May 23, 1884, showed "unmistakable evidence of having lately incubated" (Ridgway, 1884), and several were seen at Laurel on June 30, 1884 (C. W. Richmond); a young bird barely able to fly was seen with an adult near the District of Columbia on May 17, 1885 (Smith, 1885); recorded in Dorchester County near Golden Hill during the periods May 15 to June 24, 1932, and June 4 to August 7, 1933 (F. R. Smith). *Transient and wintering*: Rare and irregular in all sections (recorded during 5 of the past 10 winters, 1944-1955). This species has been recorded from the District of Columbia and from Worcester, Dorchester, Talbot, Caroline, Anne Arundel, Prince Georges, Montgomery, Howard, Baltimore, Harford, Allegany, and Garrett Counties. The records indicate that Red Crossbills were much more regular and numerous in the Piedmont section during the period 1884-1900 than at the present time. Especially large flights were noted in the Piedmont section during

the winters of 1887-88 (numerous specimens—USNM), 1894-95 (Kirkwood, 1895; C. W. Richmond), and 1916-17 (H. C. Oberholser). In Allegany County this species was noted in fair numbers in winter during the period 1902-07 (G. Eifrig). Since 1940, only scattered records of this species have been made.

HABITAT.—Usually in stands of pine or other conifers.

PERIOD OF OCCURRENCE (nonbreeding).—*Extreme arrival dates:* September 12, 1956, in Worcester County (S. W. Simon); October 10, 1886 (H. W. Henshaw), October 17, 1921 (J. Kittredge, Jr.), and October 28, 1906 (A. H. Howell), in the District of Columbia; "late October, 1889" in Talbot County (J. E. Tylor). *Extreme departure dates:* June 5, 1895 (R. Ridgway), and June 2, 1902 (C. W. Richmond), in the District of Columbia.

MAXIMUM COUNTS.—75 in the District of Columbia on November 6, 1887 (H. W. Henshaw); 50 at Long Green Valley, Baltimore County, on December 27, 1899 (F. C. Kirkwood); 50 at Bethesda, Montgomery County, on May 4, 1953 (V. F. Hogan); 40 on Warrior Mountain, Allegany County, on May 24, 1907 (F. C. Kirkwood).

WHITE-WINGED CROSSBILL *Loxia leucoptera* Gmelin

STATUS.—Rare and irregular winter visitor; accidental summer visitor—1 collected at Oxon Hill, Prince Georges County, on August 13, 1907 (Oldys, 1907). Definite records are from Garrett, Frederick, Montgomery, Baltimore, Harford, Anne Arundel, Prince Georges, and Talbot Counties, and the District of Columbia.

HABITAT.—Stands of pine or other conifers.

PERIOD OF OCCURRENCE (wintering).—*Extreme arrival dates:* October 23, 1913, in the District of Columbia (Williams, 1914); November 13, 1954, in Prince Georges County. *Extreme departure dates:* April 7, 1955, in Montgomery County (H. E. Smith); March 1, 1953, in Frederick County (P. J. O'Brien); March 1, 1953, in Garrett County (K. F. Sanders, H. E. Slater); February 25, 1923, in the District of Columbia (E. R. Kalmbach); February 25, 1953, in Anne Arundel County (Mrs. W. L. Hensler, Mrs. G. Tappan). Only 2 well-marked flights of this species have been recorded in our area, 1 during the winter of 1916-17 and the other during the winter of 1952-53. During the winter of 1916-17, this species was recorded repeatedly in the District of Columbia and nearby Maryland from December 14 to the latter part of February (W. L. McAtee, A. Wetmore). During the winter of 1952-53 it was recorded from January 4

to March 1 in Garrett (K. F. Sanders, H. E. Slater), Frederick (J. W. Richards, P. J. O'Brien), Harford (R. W. Peakes), Anne Arundel (Mrs. W. L. Henderson, Mrs. G. Tappan), Prince Georges (Mrs. R. McCeney), and Talbot (H. McCullogh) Counties, and the District of Columbia (J. H. Benn, H. Friedmann). Other scattered records of this species were made during the winter of 1863-64, about 1874, 1906-07, 1913-14, 1922-23, and 1954-55.

MAXIMUM COUNTS.—40 on December 24, 1916 (McAtee, et al. 1917), 23 on December 25, 1916 (E. G. Holt, D. C. Mabbott), and 15 on February 25, 1923 (E. R. Kalmbach)—all in the District of Columbia; and 12 at Silver Spring, Montgomery County, on April 17, 1955 (H. E. Smith).

RUFOUS-SIDED TOWHEE *Pipilo erythrophthalmus* (Linnaeus)

STATUS.—*Breeding and transient*: Common, locally abundant in all sections. *Wintering*: Fairly common in Worcester County, uncommon elsewhere in the Eastern Shore, Western Shore, and Upper Chesapeake sections; rare in the Piedmont, and Ridge and Valley sections; casual in the Allegheny Mountain section.

HABITAT.—Brushy cut-over upland forests; dry brushy fields and thickets; hedgerows and wood margins.

NESTING SEASON.—Mid-April to late August (nesting peak mid-May to late July). *Extreme egg dates* (115 nests): April 22, 1945, in Prince Georges County (E. G. Cooley), April 22, 1955, in Caroline County (Mr. and Mrs. A. J. Fletcher), and August 16, 1939, in Prince Georges County (E. G. Cooley). *Extreme nestling dates* (72 nests): April 30, 1945, and August 22, 1939, in Prince Georges County (E. G. Cooley). A nest with eggs (pipped) was also recorded on the extremely late date of August 28, 1891, in Baltimore County (W. H. Fisher).

SPRING MIGRATION.—*Normal period*: March 15-25 to May 5-15; peak, April 15 to May 5. *Extreme arrival dates*: March 8, 1894 (F. C. Kirkwood), and March 11, 1945 (E. A. McGinity), in Baltimore County; March 13, 1952 and 1953, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); March 14, 1943, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 20-30 to October 25-November 5; peak, October 1 to October 25. *Extreme departure dates*: November 24, 1949, in Baltimore County (E. Willis); November 12, 1931, in the District of Columbia (J. A. Molter).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

57 (17 in 30 acres) in "damp deciduous scrub with standing dead trees"

- (burned-over, poorly drained upland forest) in Prince Georges County in 1947 (Stewart, et al., 1947).
- 50 (13 in 26 acres) in "dry deciduous scrub" (burned-over, upland oak forest) in Prince Georges County in 1947 (Robbins, et al., 1947).
- 15 (9.5 in 21 acres) in "immature loblolly-shortleaf pine stand" (trees 45 to 65 feet in height) in Worcester County in 1949 (Springer and Stewart, 1948c).
- 33 (5 in 15 acres) in "open slash area" (cut-over oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 33 (7 in 21 acres) in "dense second-growth" (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 32 (2 in 6¼ acres) in "young second-growth resulting from cutting" (oak-maple ridge forest) in Garrett County in 1949 (Robbins, 1949b).
- 23 (13.5 in 58 acres) in brushy, abandoned farmland in Prince Georges County in 1947.
- 22 (2 in 9 acres) in "scrub spruce bog" (brush-meadow stage with young red spruce) in Garrett County in 1951 (Robbins and Stewart, 1951b).
- 17 (6 in 34¾ acres) in pine field (abandoned field with open growth of young scrub pine) in Prince Georges County in 1945.
- 14 (3.5 in 25 acres) in "unsprayed apple orchard with unmowed ground cover" in Allegany County in 1948 (Springer and Stewart, 1948b).
- 3 (1.6 in 19½ acres) in sweetgum field (abandoned field with open growth of young sweetgum) in Prince Georges County in 1945.
- 7 (2 in 27½ acres) in "red pine plantation" (young trees about 20 feet in height) in Garrett County in 1949 (Robbins and Barnes, 1949).
- 6 (1.8 in 32½ acres) in pine-oak forest (pitch pine, scrub pine, Spanish oak) in Prince Georges County in 1944.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 320 at Rosedale, Baltimore County, on May 6, 1950 (D. A. Jones); 200 at Gibson Island, Anne Arundel County, on May 8, 1955 (Mrs. W. L. Henderson, Mrs. G. Tappan); 135 at Middle River, Baltimore County, on May 5, 1951 (E. Willis, D. A. Jones). *Fall*: 100+ at Baltimore on October 10, 1917 (F. C. Kirkwood). *Winter* (Christmas counts): 487 in the Ocean City area on December 27, 1954; 112 in the Wicomico River area of Charles and St. Marys Counties on January 1, 1954; 94 in southern Dorchester County on December 28, 1954; 91 near Chase, Baltimore County, on December 29, 1951.

BANDING.—Two birds recovered in spring (April 28–May 2) in St. Marys and Baltimore Counties had been banded in eastern Massachusetts and northeastern New Jersey on August 11 and April 25, respectively.

IPSWICH SPARROW *Passerculus princeps* Maynard

STATUS.—*Transient and wintering*: Uncommon along the coast in Worcester County; casual in the Western Shore section—singles recorded in Anne Arundel County along the West River

on March 24, 1920 (Wetmore, 1927), and at Gibson Island on April 15, 1956 (Mrs. W. L. Henderson, Mrs. G. Tappan).

HABITAT.—Sand dune zone of the barrier beaches, usually occurring in areas where beachgrass is common.

PERIOD OF OCCURRENCE.—*Extreme arrival dates:* November 9, 1929 (A. Wetmore), and November 16, 1947 (I. R. Barnes), in Worcester County. *Extreme departure dates:* April 15, 1956, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); April 5, 1938, in Worcester County (G. A. Ammann).

MAXIMUM COUNTS.—About 30 near Ocean City on December 30 and 31, 1927 (Wetmore and Lincoln, 1928a); 25 on Assateague Island on November 28, 1945; 12 on Assateague Island on December 23, 1946 (Christmas count).

SAVANNAH SPARROW *Passerculus sandwichensis* (Gmelin)

STATUS.—*Breeding* (see fig. 64): Common in the Allegheny Mountain section (usually in areas that are over 2,500 feet in elevation); uncommon and local in the Ridge and Valley, and Piedmont sections—occurring in the Hagerstown Valley in Washington County, in the Frederick Valley in Frederick County, and in the Worthington Valley in Baltimore County; rare and local in the Upper Chesapeake, Western Shore, and Eastern Shore sections—occurring near Fort Howard in Baltimore County, near

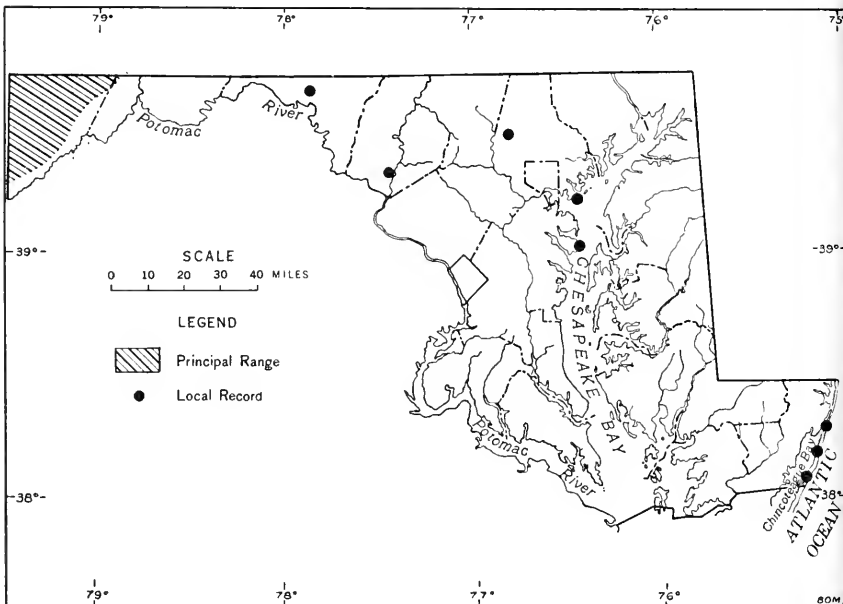


FIGURE 64.—Breeding range of Savannah Sparrow.

Sandy Point in Anne Arundel County, and on Assateague Island in Worcester County. *Transient*: Abundant (at least locally) in the Eastern Shore section; fairly common elsewhere in all sections. *Wintering*: Common in the Eastern Shore section; fairly common in the southern part of the Western Shore section (Calvert, Charles, and St. Marys Counties); uncommon in the Upper Chesapeake section; rare in the Piedmont section and in the northern part of the Western Shore section (Anne Arundel and Prince Georges Counties).

HABITAT.—*Breeding*: Hayfields and over-grown pastures; also occurs in grassy areas on the bay shores and barrier beach. *Transient and wintering*: Especially characteristic of weedy fallow and cultivated fields, and of marsh-meadow types in the tidal marshes; also commonly found on the barrier beaches where beachgrass occurs.

NESTING SEASON.—Fledglings just out of the nest were observed in Garrett County on June 3, 1951.

SPRING MIGRATION.—*Normal period*: March 15–25 to May 5–15; peak, March 25 to April 20. *Extreme arrival dates*: March 6, 1944, in Harford County (S. Mason, Jr.); March 11, 1949, in Prince Georges County; March 12, 1892, in Baltimore County (J. H. Pleasants). *Extreme departure dates*: May 23, 1947, in Prince Georges County; May 18, 1921, in the District of Columbia (W. L. McAtee); May 18, 1948, in Worcester County; May 16, 1931, in Charles County (E. R. Kalmbach, C. C. Sperry).

FALL MIGRATION.—*Normal period*: September 15–25 to November 1–10; peak, October 5 to October 30. *Extreme arrival dates*: September 4, 1898, in Baltimore County (F. C. Kirkwood); September 11, 1948, in Montgomery County (F. R. Bell, R. C. Simpson); September 13, 1945, in Prince Georges County. *Extreme departure dates*: November 22, 1886, in the District of Columbia (H. W. Henshaw); November 16, 1902, in Baltimore County (F. C. Kirkwood).

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

50 (12.5 in 25 acres) in "lightly-grazed pasture" in Garrett County in 1951 (Stewart and Robbins, 1951b).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 68 in Anne Arundel County on April 18, 1954 (L. W. Oring); 50+ near Emmitsburg, Frederick County, on March 30, 1952, and April 11, 1955 (J. W. Richards); 50 at Port Tobacco, Charles County, on May 5, 1939 (C. Cottam, A. L. Nelson); 30–40 in Baltimore County

on April 8, 1898 (F. C. Kirkwood). *Fall*: 100 in Worcester County on October 5, 1946; 50 in Dulaney Valley, Baltimore County, on November 2, 1902 (F. C. Kirkwood). *Winter*: 471 in the Ocean City area on December 27, 1954 (Christmas count); 145 in southeastern Worcester County on December 23, 1946 (Christmas count); 115 in southern Dorchester County on December 28, 1955 (Christmas count); 85 at Point Lookout, St. Marys County, on January 31, 1954 (J. W. Terborgh).

GRASSHOPPER SPARROW *Ammodramus savannarum* (Gmelin)

STATUS.—*Breeding and transient*: Common in all sections. *Wintering*: Casual occurrence—recorded in Baltimore County on January 2, 1893, and January 16, 1898 (F. C. Kirkwood), and collected on December 10 and 22, 1892 (W. H. Fisher); 1 collected at Marshall Hall, Charles County, on February 21, 1900 (S. D. Judd); recorded at Cambridge, Dorchester County, on February 22, 1913 (R. W. Jackson).

HABITAT.—Chiefly, various types of hayfields; also in overgrown pastures and weedy, fallow fields and occasionally in broomsedge fields.

NESTING SEASON.—Early May to early September (nesting peak, late May to early August). *Extreme egg dates* (83 nests): May 15, 1921, in Baltimore County (W. Marshall) and August 19, 1952, in Harford County (D. McIntosh). *Extreme nestling dates* (24 nests): May 25, 1953, in Prince Georges County (P. F. Springer) and September 2, 1919, in the District of Columbia (F. Harper). Young birds unable to fly were seen in Baltimore County on September 10, 1920 (F. C. Kirkwood).

PERIOD OF OCCURRENCE.—*Normal period*: April 5–15 to October 20–30. *Extreme arrival dates*: March 17, 1912, in Dorchester County (R. W. Jackson); March 18, 1939, in Prince Georges County (M. B. Meanley); March 20, 1898 (F. C. Kirkwood), and March 20, 1927 (J. M. Sommer), in Baltimore County; March 25, 1950, in Frederick County (R. T. Smith). *Extreme departure dates*: November 23, 1892, in Somerset County (collected—W. H. Fisher); November 20, 1899, in the District of Columbia (E. A. Preble).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

77 (4 in 5½ acres) in weedy fallow field in Prince Georges County in 1945.

42 (5 in 12 acres) in orchard grass–Korean lespedeza hayfield in Prince Georges County in 1948.

32 (3 in 9½ acres) in weedy pasture in Prince Georges County in 1945.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 108 near Westminster, Carroll County, on May 9, 1953 (D. A. Jones); 85 in Howard County on May 8, 1954; 50 near Buckeystown, Frederick County, on May 6, 1950. *Fall*: 5 (banded) near Unity, Montgomery County, on October 19, 1952 (S. H. Low).

HENSLOW'S SPARROW *Passerherbulus henslowii* (Audubon)

STATUS.—*Breeding and transient*: Fairly common in the Eastern Shore, Western Shore, and Upper Chesapeake sections (rare in Caroline County); uncommon in the Piedmont and Allegheny Mountain sections; rare in the Ridge and Valley section. *Wintering*: Casual occurrence—1 observed near Newark, Worcester County, on December 23, 1946; another seen at Point Lookout, St. Marys County, on January 26, 1953 (R. R. Kerr).

HABITAT.—Chiefly broomsedge fields and weedy sedge-meadows; also occasional in hayfields.

NESTING SEASON.—Mid-May to mid-July. *Extreme egg dates* (13 nests): May 18, 1944, in Montgomery County (E. J. Court) and June 26, 1924, in Dorchester County (J. M. Sommer). Nestlings were recorded in St. Marys County on June 1, 1930 (E. J. Court).

PERIOD OF OCCURRENCE.—*Normal period*: April 5–15 to November 1–10. *Extreme arrival dates*: March 16, 1947, in Baltimore County (O. W. Crowder); March 24, 1945, in Prince Georges County; March 25, 1917, in the District of Columbia (M. T. Cooke); March 27, 1921, in Dorchester County (R. W. Jackson). *Extreme departure dates*: November 21, 1897, in Baltimore County (F. C. Kirkwood); November 17, 1945 (collected), in Anne Arundel County; November 16, 1930, in the District of Columbia (J. A. Molter).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 16 (2 in 12½ acres) in weedy, unimproved pasture in Prince Georges County in 1950.
- 15 (3 in 20 acres) in abandoned broomsedge field in Prince Georges County in 1948.
- 7 (2 in 30 acres) in "switchgrass marsh-meadow" in Somerset County in 1948 (Springer and Stewart, 1948a).

MAXIMUM COUNTS (nonbreeding).—23 in Charles and St. Marys Counties on May 9, 1953 (J. W. Terborgh, et al.); 18 in the Ocean City area on May 11, 1952 (D. A. Cutler, et al.).

SHARP-TAILED SPARROW *Ammospiza caudacuta* (Gmelin)

STATUS.—*Breeding and transient* (see fig. 65): Common,

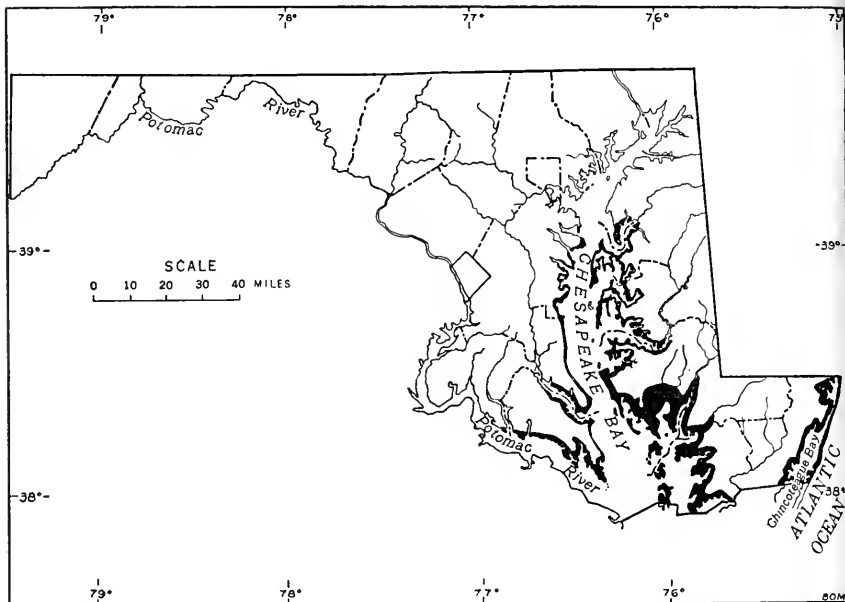


FIGURE 65.—Breeding range of Sharp-tailed Sparrow and Seaside Sparrow.

locally abundant, in the Eastern Shore section, occurring in the coastal area of Worcester County, and in the tidewater areas along Chesapeake Bay north to Kent Narrows in Queen Annes County; uncommon and local in the Western Shore section, occurring in the tidewater areas along Chesapeake Bay, north to Sandy Point in Anne Arundel County, and up the Potomac River to Cobb Island in Charles County; casual elsewhere during migration—recorded in the District of Columbia (Cooke, 1929) and at Strawberry Point, Baltimore County (E. Willis, D. A. Jones). *Wintering*: Uncommon in the coastal area of Worcester County; rare in the tidewater areas of Somerset, Wicomico, Dorchester, and St. Marys (R. R. Kerr, J. W. Terborgh) Counties.

HABITAT.—*Breeding*: Chiefly salt marshes in which salt-meadow grass is predominant; also common locally in salt marshes where black grass is prevalent, and sparingly in marshes of salt-water cordgrass.

NESTING SEASON.—Mid-May to late August. *Extreme egg dates* (6 nests): May 14, 1955, in Worcester County (J. E. M. Wood) and August 21, 1947, in Anne Arundel County. *Nestling dates* (2 nests): June 4, 1944, in Queen Annes County and June 16, 1940 (M. B. Meanley), in Worcester County.

PERIOD OF OCCURRENCE.—Throughout the year. *Population*

peak: May 10 to September 30. *Extreme date of spring departure*: June 3, 1951, at Strawberry Point in Baltimore County (E. Willis, D. A. Jones).

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

100 (approximately 17 in 17 acres) in saltmeadow grass marsh-meadow in Somerset County in 1948 (Springer and Stewart, 1948a).

MAXIMUM COUNTS (nonbreeding).—*Fall*: 47 in Worcester County on September 27, 1949. *Winter*: 61 in the Ocean City area on December 21, 1952 (Christmas count).

SEASIDE SPARROW *Ammodramus maritimus* (Wilson)

STATUS.—*Breeding and transient* (see fig. 65): Common in the Eastern Shore section—occurring in the coastal area of Worcester County and in the tidewater areas along Chesapeake Bay, north to Kent Narrows, Queen Annes County (rarely north to Langford Bay, Kent County—Kirkwood, 1895); uncommon and local in the Western Shore section, occurring in the tidewater areas along Chesapeake Bay, north to Idlewilde, Anne Arundel County (rarely north to Gunpowder River area, where recorded by F. C. Kirkwood on April 21, 1897, by W. H. Fisher on June 7, and 10, 1900, and by T. A. Imhof on May 6, 1951). *Wintering*: Rare in the tidewater areas of Somerset, Wicomico, and Dorchester Counties, and in the coastal area of Worcester County; casual in the tidewater areas of the Western Shore section—single birds seen at Point Lookout, St. Marys County, on January 26, 1953 (R. R. Kerr), and January 2, 1956 (J. W. Terborgh).

HABITAT.—Tidal salt marshes, occurring most commonly in salt-water cordgrass and salt-meadow grass types that contain scattered shrubs of marsh elder and sea myrtle; also occurs sparingly in stands of needlerush.

NESTING SEASON.—Early May to early July (probably). *Extreme egg dates* (11 nests): May 20, 1953, in Dorchester County and June 21, 1940 (Kolb, 1941), in Worcester County. *Nestling dates* (2 nests): May 20, 1953, in Dorchester County and June 4, 1944, in Queen Annes County.

POPULATION PEAK.—About April 20 to October 10.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

10 (2 in 19½ acres) in "saltmarsh bulrush-saltgrass marsh" in Somerset County in 1948 (Springer and Stewart, 1948a).

9 (2 in 22¼ acres) in "needlerush marsh" in Somerset County in 1948 (Springer and Stewart, 1948a).

NOTE.—Populations in optimum habitats have not been studied in detail.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 50 in the Elliott Island marsh, Dorchester County, on May 23, 1954. *Fall*: 24 in Worcester County on September 27, 1949. *Winter* (Christmas counts): 13 in the Ocean City area on December 27, 1955; 7 near Elliott, Dorchester County, on December 27, 1949.

VESPER SPARROW *Pooecetes gramineus* (Gmelin)

STATUS.—*Breeding*: Common in the Allegheny Mountain, Ridge and Valley, and Piedmont sections; fairly common in the Upper Chesapeake section; uncommon in the Eastern Shore section and in the northern part of the Western Shore section (Anne Arundel and Prince Georges Counties); rare in the southern part of the Western Shore section (Calvert, Charles, and St. Marys Counties). *Transient*: Fairly common in all sections. *Wintering*: Uncommon in Worcester County; rare elsewhere in the Eastern Shore section and in the southern part of the Western Shore section (Calvert, Charles, and St. Marys Counties); casual in the northern part of the Western Shore section (Anne Arundel and Prince Georges Counties) and in the Upper Chesapeake and Piedmont sections.

HABITAT.—Short-growth or sparsely vegetated pastures, hay-fields, and fallow fields.

NESTING SEASON.—Mid-April to mid-August (nesting peak, early May to early July). Nest-building was recorded in Baltimore County as early as April 14, 1924 (F. C. Kirkwood). *Extreme egg dates* (39 nests): May 5, 1915, in Baltimore County (F. C. Kirkwood) and August 1, 1901, in Garrett County (G. Eifrig). *Extreme nestling dates* (13 nests): May 14, 1949, in Frederick County (M. B. Meanley) and July 2, 1931, in Baltimore County (W. Marshall).

SPRING MIGRATION.—*Normal period*: March 10–20 to May 1–10; peak, March 25 to April 25. *Extreme arrival dates*: March 1, 1951, in Caroline County (M. W. Hewitt); March 4, 1893, in Queen Annes County (F. C. Kirkwood); March 5, 1919, in Baltimore County (F. C. Kirkwood); March 5, 1945, in Prince Georges County. *Extreme departure dates*: May 23, 1893, in Baltimore County (W. N. Wholey); May 16, 1906, in Worcester County (F. C. Kirkwood).

FALL MIGRATION.—*Normal period*: September 10–20 to November 1–10; peak, September 25 to October 30. *Extreme arrival dates*: September 1, 1886, in the District of Columbia (A. K. Fisher); September 2, 1947, in Talbot County (W. M. Davidson); September 9, 1943, in Prince Georges County. *Extreme departure dates*: November 21, 1886, in the District of Columbia (A. K.

Fisher); November 16, 1919, in Prince Georges County (F. Harper).

MAXIMUM COUNTS (nonbreeding).—*Spring*: "Several hundred" at Roland Park, Baltimore County, on April 10, 1897 (W. H. Fisher); 50 in Queen Annes County on March 4, 1893 (F. C. Kirkwood); 30 near Emmitsburg, Frederick County, on March 26, 1953 (J. W. Richards). *Fall*: 25 in Dulaney Valley, Baltimore County, on October 23, 1898 (F. C. Kirkwood). *Winter*: 34 in the Ocean City area on December 27, 1954 (Christmas count); 21 in southeastern Worcester County on December 22, 1947 (Christmas count); 8 near the Wicomico River in Charles and St. Marys Counties on February 8, 1953 (J. W. Terborgh); 7 in southern Dorchester County on December 22, 1952 (Christmas count).

LARK SPARROW *Chondestes grammacus* (Say)

STATUS.—*Breeding*: Formerly occurred in the Allegheny Mountain section—a colony of about 50 birds, including young, was found near Accident, Garrett County, on July 24, 1901, and 1 was seen there on July 29, 1903 (Eifrig, 1902a); also recorded as being common near Red House until about 1926 (Brooks, 1936c). *Spring transient*: Casual—1 seen at West Ocean City on May 13, 1951 (D. A. Cutler). *Late summer and fall transient*: Rare in the coastal area of Worcester County (7 records); casual elsewhere in the Eastern Shore and Western Shore sections—recorded in Somerset County in 1955 (F. McLaughlin), in Calvert County in 1948 (McKnight, 1950), in Anne Arundel County in 1948 (Davis, 1948), in Prince Georges County in 1947 (Stewart, et al., 1952), and in the District of Columbia in 1877 (2 seen—Ridgway, 1878) and 1886 (Henshaw, 1886).

HABITAT.—*Breeding*: Agricultural fields and field borders. *Transient*: Most records were made in brushy, sandy areas on the ocean barrier beach and along the bay shores.

LATE SUMMER AND FALL MIGRATION.—*Extreme arrival dates*: July 17, 1947, in Prince Georges County (Stewart, et al., 1952); July 22, 1948, in Calvert County (McKnight, 1950). *Extreme departure dates*: October 21, 1950, in Worcester County (R. J. Beaton); September 29, 1955, in Somerset County (F. McLaughlin).

MAXIMUM COUNT (nonbreeding).—5 on the barrier beach between Ocean City and the Delaware line on September 4, 1954 (R. L. Kleen).

BACHMAN'S SPARROW *Aimophila aestivalis* (Lichtenstein)

STATUS.—*Breeding and transient*: Rare and local in the Western Shore, Piedmont, and Ridge and Valley sections; formerly occurred in the Allegheny Mountain section. During the period 1896–1954, scattered observations of from 1 to 6 singing males or pairs have been recorded in the District of Columbia and in the area within 12 miles of the District boundary in Prince Georges and Montgomery Counties, at the following locations: Kensington (Figgins, 1897, and R. W. Moore), Congress Heights (P. Bartsch), Lanham (W. R. Maxon), Cabin John (A. Wetmore), District of Columbia (F. Lees), Beltsville Research Center (Stewart and Meanley, 1943), Patuxent Refuge (Stewart, et al., 1952), town of Potomac (R. Tousey), and College Park (Meanley, 1949). One was also recorded near Simpsonville, Howard County, on May 8, 1955. In Allegany County, 3 pairs were found during the summer of 1947 and 2 pairs in 1948 on Green Ridge, about 1 mile north of the Potomac River (Springer and Stewart, 1948b). This species was also found in Garrett County during the period 1900–10, and in June, 1923, a singing male was observed near Oakland (Brooks, 1936c). *Wintering*: Accidental—a specimen recently killed by a car was found on January 25, 1951, in Somerset County between Princess Anne and Deal Island (USNM—Buckalew, 1951b).

HABITAT.—Weedy, abandoned fields with open growth of shrubs and small pine or deciduous trees; also in weedy, abandoned orchards.

NESTING SEASON.—Mid-May to mid-July (probably). *Egg dates* (2 nests): May 20, 1946 (E. J. Court), and May 26, 1942 (Stewart and Meanley, 1943), both on the Beltsville Research Center, Prince Georges County. The nest found in 1942 contained young birds on June 3. During the period June 22–25, 1948, adults were observed feeding fledglings, just out of the nest, on Green Ridge, Allegany County.

PERIOD OF OCCURRENCE (transient and breeding).—*Extreme arrival dates*: April 11, 1956 (P. A. DuMont), and April 19, 1925 (F. Lees), in the District of Columbia; April 29, 1896 (Figgins, 1897), and April 29, 1953 (P. A. DuMont), in Montgomery County. *Extreme departure date*: “middle of August,” 1949, in Prince Georges County (Meanley, 1949).

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

43 (3 in 7 acres) in brushy field (abandoned field with open growth of young

hickory, scrub pine, and shrubs) in Prince Georges County in 1942 (Stewart and Meanley, 1943).

8 (2 in 25 acres) in "unsprayed apple orchard with unmowed ground cover" in Allegany County in 1948 (Springer and Stewart, 1948b).

SLATE-COLORED JUNCO *Junco hyemalis* (Linnaeus)

STATUS.—*Breeding* (see fig. 32): Fairly common on Backbone Mountain, Garrett County, at elevations above 3,000 feet; uncommon elsewhere in the Allegheny Mountain section at elevations above 2,500 feet. *Transient*: Abundant in all sections. *Wintering*: Abundant in all sections except the Allegheny Mountain section, where it may be considered as fairly common. *Summer vagrant*: Casual occurrence—singles recorded at Old Town in Allegany County on June 7, 1907 (F. C. Kirkwood), at Hampstead in Carroll County on June 18, 1952 (D. H. McIntosh), at Towson in Baltimore County on June 15, 1953 (D. A. Jones), and in the District of Columbia on June 13, 1953 (J. H. Criswell, K. Dale).

HABITAT.—*Breeding*: Brushy, cut-over forests in the boreal bogs and in ravines and on north slopes at elevations above 2,500 feet (1 record as low as 1,850 feet); also occurs in brushy cut-over oak-chestnut and northern hardwood forests on the higher ridges at elevations above 3,000 feet. *Transient and wintering*: Hedgerows, wood margins, thickets, brushy fields, and brushy cut-over or burned-over forests; also in residential areas of farms, towns, and suburbs.

NESTING SEASON.—Mid-May to mid-July (probably). *Extreme egg dates* (5 nests): May 18, 1899 (Preble, 1900), and July 9, 1920 (G. Eifrig), in Garrett County. *Extreme nestling dates* (6 nests): May 31, 1919 (J. M. Sommer), and July 5, 1920 (G. Eifrig), in Garrett County.

SPRING MIGRATION.—*Normal period*: March 1–10 to May 1–10; peak, March 20 to April 15. *Extreme arrival date*: February 25, 1944, in Prince Georges County. *Extreme departure dates*: May 30, 1956, in Baltimore County (S. W. Simon); May 24, 1956, in Montgomery County (S. H. Low); May 17, 1908, in the District of Columbia (A. M. Stimson).

FALL MIGRATION.—*Normal period*: September 25–October 5 to November 20–30; peak, October 20 to November 15. *Extreme arrival dates*: September 5, 1955, in Talbot County (R. L. Kleen); September 13, 1955, in Worcester County (M. Broun); September 14, 1918, in the District of Columbia (Mr. and Mrs. L. D. Miner); September 15, 1953, in Baltimore County (D. A. Jones); September 19, 1950, in Anne Arundel County (Mrs. W. L. Hen-



FIGURE 66.—Slate-colored Junco banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open triangle = banded September through May.

person); September 20, 1914 (J. M. Sommer), and September 20, 1950 (E. Willis), in Baltimore County. *Extreme departure date*: December 5, 1944, in Prince Georges County.

MAXIMUM COUNTS (nonbreeding).—*Spring*: 1,000 at Waverly, Baltimore County, on April 9, 1897 (A. M. Hoen); 800 at Emmitsburg, Frederick County, on April 7, 1953 (J. W. Richards). *Fall*: 1,933 at Patuxent Refuge on October 27, 1943. *Winter* (Christmas counts): 2,508 in the Annapolis area on January 1, 1956; 1,772 in the Ocean City area on December 27, 1955; 1,725 in the Annapolis area on January 2, 1955; 1,616 in the Triadelphia Reservoir area on December 24, 1955; 1,494 in the St. Michaels area on December 29, 1955; 1,283 at Patuxent Refuge on December 29, 1944.

BANDING.—See figure 66.

OREGON JUNCO *Junco oreganus* (Townsend)

STATUS.—Casual visitor. One was collected near Laurel, Prince Georges County, on April 28, 1890 (USNM—Ridgway, 1890). One was seen on Gunpowder Neck, Harford County, on March 2 and March 7, 1952 (T. A. Imhof). One was banded at Denton, Caroline County, on October 31, 1955 (Mr. and Mrs. A. J. Fletcher).

TREE SPARROW *Spizella arborea* (Wilson)

STATUS.—*Transient and wintering*: Common in the Allegheny Mountain, Ridge and Valley, Piedmont, and Upper Chesapeake sections and in the northern part of the Western Shore section (all except St. Marys County); fairly common in the coastal area of Worcester County; uncommon, rare, or absent elsewhere in the Eastern Shore section and in the southern part of the Western Shore section (St. Marys County).

HABITAT.—Agricultural and abandoned fields and field borders, including hedgerows and wood margins; also in brushy marsh-meadows in the interior and in brushy sandy areas on the barrier beaches.

PERIOD OF OCCURRENCE.—*Normal period*: November 1–10 to March 25–April 5; peak, November 25 to March 15. *Extreme arrival dates*: October 18, 1947, in Allegany County (M. G. Brooks); October 20, 1946 (O. W. Crowder), and October 20, 1948 (P. F. Springer), in Frederick County. *Extreme departure dates*: April 14, 1949, in Montgomery County (S. H. Low); April 14, 1956, in Prince Georges County (P. F. Springer); April 13, 1924, in the District of Columbia (C. H. M. Barrett); April 12, 1902, in Allegany County (G. Eifrig).

MAXIMUM COUNTS (Christmas counts).—544 in the Triadelphia Reservoir area on December 24, 1955; 540 in Allegany County on December 31, 1949; 500 at Port Tobacco, Charles County, on December 26, 1936; 401 in the Catoctin Mountain area, Frederick County, on December 31, 1955.

CHIPPING SPARROW *Spizella passerina* (Bechstein)

STATUS.—*Breeding and transient*: Common in all sections. *Wintering*: Fairly common in the southern half of Worcester County; uncommon in the northern half of Worcester County; rare elsewhere in the Eastern Shore section and near tidewater in the Western Shore section.

HABITAT.—*Breeding*: Chiefly residential areas and orchards on farms, and in towns and suburbs, that contain a combination of scattered trees or shrubs and short grass or sparsely vegetated ground cover. *Transient and wintering*: Residential areas, orchards, and agricultural fields and field borders.

NESTING SEASON.—Mid-April to early September (nesting peak, late April to late July. *Extreme egg dates* (331 nests): April 14, 1946, in Prince Georges County (E. G. Cooley) and August 28, 1892, in Baltimore County (Kirkwood, 1895). *Extreme nestling dates* (205 nests); May 7, 1945, in Prince Georges County (E. G. Cooley) and September 4, 1892 (F. C. Kirkwood), in Baltimore County. Young just out of the nest were observed in Baltimore County as late as September 16, 1894 (Kirkwood, 1895).

SPRING MIGRATION.—*Normal period*: March 20–30 to May 1–10; peak, April 10 to April 30. *Extreme arrival dates*: March 2, 1952, in Charles County (A. R. Stickley, Jr., M. C. Crone); March 7, 1954, in Baltimore County (A. S. Kaestner); March 8, 1950, in Prince Georges County (P. F. Springer); March 12, 1890, in the District of Columbia (J. D. Figgins).

FALL MIGRATION.—*Normal period*: September 5–15 to November 5–15; peak, September 20 to October 15. *Extreme departure dates*: December 4, 1892, in Baltimore County (F. C. Kirkwood); December 3, 1950, in Anne Arundel County (R. D. Cole); November 29, 1943, in Prince Georges County.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 90 (18 in 20 acres) in suburban type residential area (including small orchards and large expanses of lawn) in Prince Georges County in 1942.
51 (9 in 17½ acres) in "lightly sprayed apple orchard with rye planted as ground cover" in Worcester County in 1948 (Springer and Stewart, 1948b).
48 (10.5 in 22 acres) in "unsprayed apple orchard with infrequently mowed

ground cover" in Worcester County in 1948 (Springer and Stewart, 1948b).

- 42 (10.5 in 25 acres) in "unsprayed apple orchard with unmowed ground cover" in Allegany County in 1948 (Springer and Stewart, 1948b).
- 28 (6 in 20½ acres) in "moderately sprayed apple orchard with infrequently mowed ground cover" in Worcester County in 1948 (Springer and Stewart, 1948b).
- 18 (13 in 72 acres) in mixed agricultural habitats (including hedgerows and wood margins) in Prince Georges County in 1948.
- 14 (3.5 in 25 acres) in "heavily sprayed apple orchard with frequently mowed ground cover" in Allegany County in 1948 (Springer and Stewart, 1948b).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 44 at Patuxent Refuge on April 9, 1945. *Fall*: "Hundreds" at Cumberland, Allegany County, on October 3, 1901 (G. Eifrig); 129 at Patuxent Refuge on September 28, 1943. *Winter* (Christmas counts): 141 in southeastern Worcester County on December 23, 1946; 70 in the Ocean City area on December 27, 1950; 11 in the District of Columbia area on January 2, 1954.

BANDING.—A Chipping Sparrow banded in Prince Georges County on September 13, 1943, was recovered in northern South Carolina on April 8, 1944. Another recovered in St. Marys County on February 13, 1933, had been banded in southeastern Massachusetts on July 6, 1930. One banded in the District of Columbia on April 15, 1942, was recovered in northern Virginia on June 24, 1944 (18 miles from point of banding).

FIELD SPARROW *Spizella pusilla* (Wilson)

STATUS.—*Breeding and transient*: Common in all sections. *Wintering*: Common in the Eastern Shore section; fairly common in the Western Shore, Upper Chesapeake, and Piedmont sections; uncommon in the Ridge and Valley section; rare and local in the Allegheny Mountain section (occurring along Bear Creek and the Youghiogheny River in Garrett County at elevations under 1,700 feet). This species has been steadily expanding its wintering range northward during the past 10 years (1946–55).

HABITAT.—Weedy, abandoned fields with scattered shrubs or small trees; also in agricultural areas along hedgerows, wood margins, and in weedy orchards.

NESTING SEASON.—Mid-April to early September (nesting peak, early May to late July). *Extreme egg dates* (265 nests): April 21, 1952, in Baltimore County (C. D. Hackman) and August 25, 1919 (R. W. Jackson), in Dorchester County. *Extreme nestling dates* (121 nests): May 10, 1945, in Prince Georges County (E. G. Cooley) and August 23, 1950, in Baltimore County (E. Willis).

SPRING MIGRATION.—*Normal period*: March 10–20 to May 1–10; peak, March 20 to April 25. *Extreme arrival dates*: March 5, 1911, in the District of Columbia (W. W. Cooke); March 8, 1944, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 20–30 to December 1–10; peak, October 10 to November 1. *Extreme arrival dates*: September 13, 1930, and September 15, 1895, in Baltimore County (F. C. Kirkwood). *Extreme departure date*: December 20, 1944, in Prince Georges County.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

- 80 (20 in 25 acres) in “unsprayed apple orchard with unmowed ground cover” in Allegany County in 1948 (Springer and Stewart, 1948b).
- 79 (5.5 in 7 acres) in pine field (abandoned field with open growth of young scrub pine) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).
- 50 (11 in 22 acres) in “unsprayed apple orchard with infrequently mowed ground cover” in Worcester County in 1948 (Springer and Stewart, 1948b).
- 48 (16.7 in 34½ acres) in pine field (abandoned field with open growth of young scrub pine) in Prince Georges County in 1945.
- 36 (7 in 19½ acres) in sweetgum field (abandoned field with open growth of young sweetgum) in Prince Georges County in 1945.
- 23 (13.5 in 58 acres) in brushy, abandoned farmland in Prince Georges County in 1948.
- 22 (4.5 in 20½ acres) in “moderately sprayed apple orchard with infrequently mowed ground cover” in Worcester County in 1948 (Springer and Stewart, 1948b).
- 18 (13 in 72 acres) in mixed agricultural habitats (including hedgerows and wood margins) in Prince Georges County in 1948.
- 12 (3 in 26 acres) in “dry deciduous scrub” (burned-over upland oak forest) in Prince Georges County in 1947 (Robbins, et al., 1947).
- 11 (2 in 17½ acres) in “lightly sprayed apple orchard with rye planted as ground cover” in Worcester County in 1948 (Springer and Stewart, 1948b).
- 7 (2 in 30 acres) in “damp deciduous scrub with standing dead trees” (burned-over poorly drained upland forest) in Prince Georges County in 1947 (Stewart, et al., 1947).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 350 at Port Tobacco, Charles County, on April 7, 1953 (J. Hailman); 90 at Patuxent Refuge on March 23, 1945. *Fall*: “Hundreds” along Evitts Creek, Allegany County, on October 3, 1901 (G. Eifrig); “hundreds” in the District of Columbia on October 20, 1935 (Overing, 1936); 232 at Patuxent Refuge on October 30, 1950. *Winter* (Christmas counts): 849 in the Ocean City area on December 27, 1950; 302 in the Triadelphia Reservoir area in Montgomery and Howard Counties on January 1, 1954; 272 in Caroline

County on December 26, 1953; 175 in the Catoctin Mountain area of Frederick and Washington Counties on January 2, 1954; 175 near the Susquehanna Flats in Harford and Cecil Counties on January 1, 1951.

BANDING.—One banded in Prince Georges County on October 20, 1943, was recovered in northeastern Massachusetts on May 5, 1944.

[HARRIS' SPARROW] *Zonotrichia querula* (Nuttall)

STATUS.—Hypothetical. At least 2 were closely observed at Elkridge, Howard County, on October 21, 1956 (G. M. Bond, I. E. Hampe, et al.).

WHITE-CROWNED SPARROW *Zonotrichia leucophrys* (Forster)

STATUS.—*Transient*: Fairly common in the Allegheny Mountain, Ridge and Valley, and Piedmont sections; uncommon in the Upper Chesapeake and Western Shore sections; rare in the Eastern Shore section. *Wintering*: Now uncommon in the Ridge and Valley, Piedmont, and Upper Chesapeake sections, and rare in the Western Shore and Eastern Shore sections; prior to 1947, this species was only of casual occurrence in winter anywhere in Maryland.

HABITAT.—Hedgerows and wood margins in agricultural areas, especially where hayfields and pastures are predominant; also in residential areas on farms and in towns and suburbs with abundant ornamental shrubs and small trees.

SPRING MIGRATION.—*Normal period*: April 25–May 5 to May 15–20; peak, May 5 to May 15. *Extreme arrival dates*: April 10, 1952, in Anne Arundel County (Dr. and Mrs. F. H. Vinup); April 11, 1905 (W. W. Cooke), and April 12, 1914 (E. A. Preble), in the District of Columbia; April 20, 1948, in Montgomery County (S. H. Low). *Extreme departure dates*: May 26, 1929, in Baltimore County (W. Marshall); May 22, 1952, in Prince Georges County; May 21, 1892, in Montgomery County (H. B. Stabler); May 21, 1935, in the District of Columbia (M. M. Snow).

FALL MIGRATION.—*Normal period*: October 1–10 to November 10–20; peak, October 10 to October 30. *Extreme arrival date*: September 27, 1896, in Baltimore County (F. C. Kirkwood). *Extreme departure dates*: December 6, 1896, in Baltimore County (F. C. Kirkwood); December 4, 1944, in Prince Georges County; November 28, 1886, in the District of Columbia (H. W. Henshaw).

MAXIMUM COUNTS.—*Spring*: 11 in Caroline County on May 5, 1956 (A. J. Fletcher, et al.); 10 at Cumberland, Allegany County, on May 2, 1902 (G. Eifrig); 10 near Buckeystown, Frederick

County, on May 6, 1950. *Fall*: "Hundreds" in the Frederick Valley, Frederick County, on October 29, 1949 (C. O. Handley, Jr., M. B. Meanley); 12 at Patuxent Refuge on October 9, 1943. *Winter* (Christmas counts): 83 in the Triadelphia Reservoir area on December 24, 1955; 42 in the Catoctin Mountain area on December 31, 1955; 26 in Caroline County on December 24, 1956; 25 at McCoole, Allegany County, on December 27, 1949; 12 near Cecilton, Cecil County, on January 1, 1951.

BANDING.—One banded in Prince Georges County on October 13, 1947, was recovered in southern Texas (letter of January 10, 1950).

WHITE-THROATED SPARROW *Zonotrichia albicollis* (Gmelin)

STATUS.—*Breeding* (?): Probably rare and irregular in the Allegheny Mountain section—2 pairs in the Maryland portion of Cranesville Swamp on June 17, 1952, indicated that they were probably nesting; this belief is supported by the fact that 2 occupied nests were found on June 18 and 19, 1952, only 3½ miles away in West Virginia (Ganier and Buchanan, 1953). *Transient*: Abundant in all sections. *Wintering*: Abundant in the Eastern Shore section; common in the Western Shore and Upper Chesapeake sections; fairly common in the Piedmont, and Ridge and Valley sections; rare in the Allegheny Mountain section. *Summer vagrant*: Casual occurrence—1 seen in the District of Columbia on August 9 and 10, 1907 (Wood, 1907); singles observed in Prince Georges County during June and July 1936 (B. Carow), and on June 26, 1947; and in Calvert County on June 28, 1955 (K. Stecher).

HABITAT.—Wood margins, hedgerows, and brushy cut-over areas of swamp and flood-plain forests and rich moist forests on the upland.

SPRING MIGRATION.—*Normal period*: March 20–30 to May 20–30; peak, April 15 to May 10. *Extreme arrival dates*: March 5, 1949, in Baltimore County (I. E. Hampe); March 11, 1903, in the District of Columbia (W. W. Cooke); March 16, 1945, in Prince Georges County; March 17, 1918, in Anne Arundel County (F. Harper). *Extreme departure dates*: June 15, 1955, in Anne Arundel County (A. L. Varrieur); June 14, 1899, in the District of Columbia (A. H. Howell); June 13, 1933 (R. Overing), and June 10, 1946, in Prince Georges County; June 10, 1952, in Baltimore County (E. Willis).

FALL MIGRATION.—*Normal period*: September 20–30 to December 1–10; peak, October 10 to October 30. *Extreme arrival dates*:



FIGURE 67.—White-throated Sparrow banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open triangle = banded September through May.

September 13, 1955, in Worcester County (S. W. Simon); September 14, 1918 (L. D. Miner, R. W. Moore), and September 15, 1889 (C. W. Richmond), in the District of Columbia. *Extreme departure dates*: December 20, 1944, in Prince Georges County; December 13, 1933, in the District of Columbia (C. H. Benjamin).

MAXIMUM COUNTS.—*Spring*: 355 in Montgomery County on May 10, 1952 (P. A. DuMont, et al.); 336 at Patuxent Refuge on April 29, 1944; 200 near Emmitsburg, Frederick County, on May 7, 1953 (J. W. Richards). *Fall*: "Hundreds" in the Ocean City area on October 2, 1949 (M. B. Meanley); 196 at Patuxent Refuge on October 30, 1943. *Winter* (Christmas counts): 5,154 in the Ocean City area on December 27, 1955; 2,765 in the St. Michaels area on December 29, 1955; 1,983 in the Annapolis area on January 1, 1956; 1,550 in southern Dorchester County on December 28, 1953; 904 in the Wicomico River area of Charles and St. Marys Counties on January 1, 1954; 807 in Talbot County on December 29, 1953; 704 in Caroline County on December 26, 1953.

BANDING.—See figure 67.

FOX SPARROW *Passerella iliaca* (Merrem)

STATUS.—*Transient*: Fairly common (occasionally more numerous) in all sections. *Wintering*: Uncommon in the Eastern Shore and Western Shore sections; rare in all other sections.

HABITAT.—Wood margins, hedgerows, and brushy cut-over areas of swamp, flood-plain, and moist upland forest.

SPRING MIGRATION.—*Normal period*: February 10–20 to April 5–15; peak, February 25 to March 25. *Extreme arrival dates*: January 23, 1950, in Prince Georges County; January 26, 1950, in Baltimore County (E. Willis); January 31, 1954, in St. Marys County (J. W. Terborgh). *Extreme departure dates*: May 11, 1882 (W. Palmer), and May 11, 1917 (M. J. Pellew), in the District of Columbia; May 8, 1956, in Montgomery County (S. H. Low); May 6, 1950, in Frederick County (Md. Ornith. Soc.); May 5, 1956, in Caroline County (A. J. Fletcher, et al.).

FALL MIGRATION.—*Normal period*: October 15–25 to November 20–30; peak, November 1 to November 20. *Extreme arrival dates*: October 3, 1906, in the District of Columbia (A. K. Fisher); October 8, 1943, in Prince Georges County; October 9, 1921, in Montgomery County (A. K. Fisher). *Extreme departure dates*: December 16, 1894 and 1928, in Baltimore County (F. C. Kirkwood); December 8, 1900, in Allegany County (G. Eifrig).

MAXIMUM COUNTS.—*Spring*: 200 near Unity, Montgomery County, on March 14, 1954 (S. H. Low); 145 at Patuxent Refuge

on March 22, 1944; 90 in St. Marys County on January 31, 1954 (J. W. Terborgh). *Fall*: 400-500 in Dulaney Valley, Baltimore County, on November 5, 1893 (F. C. Kirkwood); 25 at Patuxent Refuge on November 17, 1951. *Winter* (Christmas counts): 107 in the Ocean City area on December 27, 1955; 47 in St. Marys County on January 2, 1956; 38 in the District of Columbia area on December 30, 1950; 30 at Port Tobacco, Charles County, on December 23, 1931; 20 in southern Dorchester County on December 21, 1947.

BANDING.—One banded in Baltimore County on March 27, 1947, was recovered on May 1, 1948, in the St. Pierre and Miquelon Islands (about 20 miles offshore from southern Newfoundland); 1 banded in Montgomery County on November 24, 1951, was re-trapped in Harford County on March 21, 1956.

LINCOLN'S SPARROW *Melospiza lincolni* (Audubon)

STATUS.—*Transient*: Fairly common in the Allegheny Mountain section; uncommon in all other sections except the Eastern Shore section, where it is rare. *Wintering*: Casual in the Eastern Shore section—1 closely observed near Berlin, Worcester County, on December 27, 1948 (J. E. Willoughby).

HABITAT.—Hedgerows, wood margins, and brushy marsh-meadows.

SPRING MIGRATION.—Normal period: May 1-5 to May 20-25; peak, May 5 to May 20. *Extreme arrival dates*: April 21, 1918 (L. Griscom), and April 25, 1923 (J. Kittredge, Jr.), both in the District of Columbia. *Extreme departure dates*: May 30, 1917, in Prince Georges County (W. L. McAtee, A. Wetmore); May 26, 1952, in Baltimore County (Mr. and Mrs. R. D. Cole).

FALL MIGRATION.—*Normal period*: September 15-25 to October 15-25; peak, September 25 to October 15. *Extreme arrival date*: September 12, 1943, in Prince Georges County. *Extreme departure dates*: October 30, 1927, in Baltimore County (F. C. Kirkwood, J. M. Sommer); October 30, 1943, in Prince Georges County.

MAXIMUM COUNTS.—*Spring*: 4 along the C. and O. Canal, Montgomery County, on May 10, 1952 (P. A. DuMont); 3 at Rosedale, Baltimore County, on May 6, 1950 (D. A. Jones). *Fall*: 9 or 10 in Dulaney Valley, Baltimore County, on October 4, 1896 (F. C. Kirkwood); 6 at College Park, Prince Georges County, on September 26, 1952 (C. L. Clagett); 4 near Emmitsburg, Frederick County, on October 10, 1953 (J. W. Richards).

SWAMP SPARROW *Melospiza georgiana* (Latham)

STATUS.—*Breeding* (see fig. 68): Common in the Allegheny

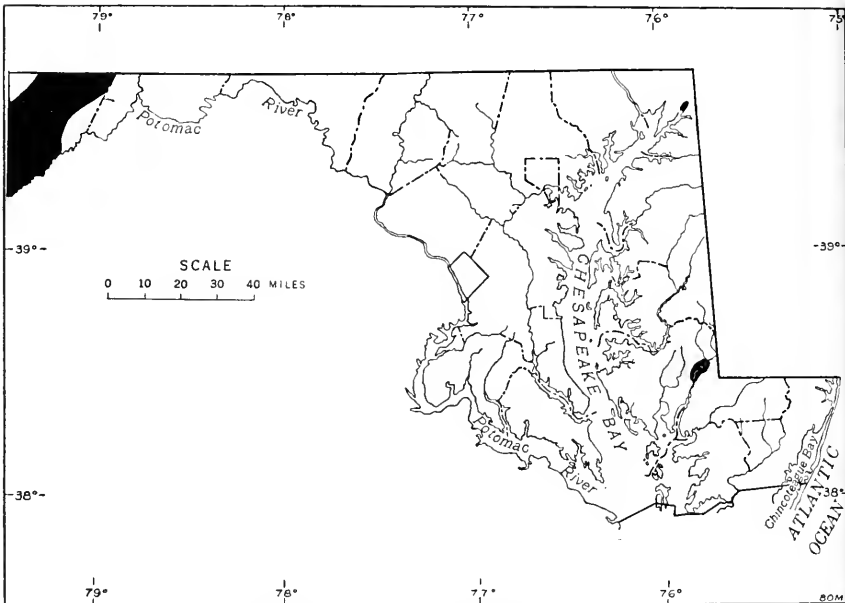


FIGURE 68.—Breeding range of Swamp Sparrow.

Mountain section at elevations above 2400 feet; fairly common locally in the Eastern Shore section, occurring in the marshes along the Nanticoke River in the vicinity of Vienna (Bond and Stewart, 1951); also occurs in the Elk River marshes near Elkton. *Transient*: Common, locally abundant, in the Eastern Shore, Western Shore, and Upper Chesapeake sections; fairly common in the Piedmont, Ridge and Valley, and Allegheny Mountain sections. *Wintering*: Common, locally abundant, in the Eastern Shore section; fairly common in the Western Shore and Upper Chesapeake sections; uncommon in the Piedmont section; rare in the Ridge and Valley section.

HABITAT.—Marshes and sedge meadows with open growth of shrubs and small trees.

NESTING SEASON.—Probably mid-May to mid-July. *Extreme egg dates* (7 nests): June 5, 1917 (J. M. Sommer), and June 22, 1946, in Garrett County. *Extreme nestling dates* (3 nests): June 10, 1956 (G. H. Cole), and June 14, 1956 (R. Wilson), both in Garrett County.

SPRING MIGRATION.—*Normal period*: March 15–25 to May 15–25; peak, April 15 to May 10. *Extreme arrival dates*: March 9, 1922 (C. H. M. Barrett), and March 10, 1909 (W. W. Cooke), in the District of Columbia. *Extreme departure dates*: May 27, 1917,

in the District of Columbia (A. Wetmore); May 26, 1945, in Prince Georges County.

FALL MIGRATION.—September 15–25 to November 10–20; peak, October 5 to October 30. *Extreme arrival dates*: August 21, 1913, in the District of Columbia (W. D. Appel); August 24, 1954, in Anne Arundel County (Fr. E. Stoehr); September 5, 1901, in Allegany County (G. Eifrig); September 10, 1949, in Prince Georges County (M. B. Meanley). *Extreme departure dates*: December 3, 1922, in the District of Columbia (J. Kittredge, Jr.); November 30, 1943, in Prince Georges County.

BREEDING POPULATION DENSITY (territorial males per 100 acres).—

21 (2 in 9½ acres) in "open hemlock-spruce bog" (brush-meadow stage with young hemlock, red spruce, alder, etc.) in Garrett County in 1949 (Robbins, 1949c).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 53 at Rosedale, Baltimore County, on May 6, 1950 (D. A. Jones); 40 at Gibson Island, Anne Arundel County, on May 8, 1955 (Mrs. W. L. Henderson, Mrs. G. Tappan); 38 at Patuxent Refuge on April 29, 1944. *Fall*: About 100 at Patuxent Refuge on October 12, 1946; 75 at Seneca, Montgomery County, on October 11, 1953 (J. W. Terborgh). *Winter* (Christmas counts): 1,271 in southern Dorchester County on December 28, 1953; 759 in the Ocean City area on December 27, 1953; 286 near the Wicomico River in Charles and St. Marys Counties on January 1, 1954; 113 at Patuxent Refuge on January 12, 1951.

SONG SPARROW *Melospiza melodia* (Wilson)

STATUS.—*Breeding*: Common in the Allegheny Mountain, Ridge and Valley, Piedmont, and Upper Chesapeake sections and in the tidewater areas of the Western Shore and Eastern Shore sections; uncommon (fairly common, locally) in the interior of the Western Shore and Eastern Shore sections. *Transient*: Abundant in all sections. *Wintering*: Common in the Eastern Shore and Western Shore sections; fairly common in the Upper Chesapeake, Piedmont, and Ridge and Valley sections; uncommon in the Allegheny Mountain section.

HABITAT.—Hedgerows and wood margins in agricultural areas; residential areas (with ornamental shrubs, small trees, and lawns) of farms, towns, and suburbs; brushy pastures; and sedge meadows and marshes with open growth of shrubs or small trees.

NESTING SEASON.—Early April to mid-September (nesting peak, late April to early August). *Extreme egg dates* (306 nests):



FIGURE 69.—Song Sparrow banding recoveries. Each symbol represents the number of records for a State or Province. Banded in Maryland, recovered elsewhere: solid circle = recovered June through August; solid triangle = recovered September through May. Recovered in Maryland, banded elsewhere: open circle = banded June through August.

April 12, 1901, in Allegany County (G. Eifrig) and August 21, 1892, in Baltimore County (F. C. Kirkwood). *Extreme nestling dates* (179 nests): May 1, 1953, in Prince Georges County (E. C. Robbins) and September 11, 1892, in Baltimore County (Kirkwood, 1895).

SPRING MIGRATION.—*Normal period*: February 15–25 to April 15–25; peak, March 1 to March 25. *Extreme arrival date*: January 30, 1949, in Baltimore County (H. Brackbill). *Extreme departure date*: April 29, 1944, in Prince Georges County.

FALL MIGRATION.—*Normal period*: September 20–30 to November 20–30; peak, October 10 to October 30.

BREEDING POPULATION DENSITIES (territorial males per 100 acres).—

109 (21 in 19½ acres) in “shrubby field with stream-bordered trees” in Baltimore County in 1947, 67 (13 in 19½ acres) in 1946 (Cooley, 1947).

32 (3 in 9½ acres) in “open hemlock-spruce bog” (brush-meadow stage with young hemlock, red spruce, alder, etc.) in Garrett County in 1949 (Robbins, 1949c).

22 (4.5 in 20½ acres) in “moderately sprayed apple orchard with infrequently mowed ground cover” in Worcester County in 1948 (Springer and Stewart, 1948b).

12 (9 in 72 acres) in mixed agricultural habitats (including hedgerows and wood margins) in Prince Georges County in 1951.

9 (6 in 66 acres) in field and edge habitat (including strips of flood-plain forest, brushy fields, and hedgerows) in Baltimore County in 1947 (Hampe, et al., 1947).

9 (1.5 in 17½ acres) in “lightly sprayed apple orchard with rye planted as ground cover” in Worcester County in 1948 (Springer and Stewart, 1948b).

7 (2 in 28 acres) in “partially opened flood-plain forest” (sycamore, ash, elm, etc.) in Montgomery County in 1943 (J. W. Aldrich, A. J. Duvall).

MAXIMUM COUNTS (nonbreeding).—*Spring*: 300 at Emmitsburg, Frederick County, on March 22, 1953 (J. W. Richards); 200 at Patuxent Refuge on March 4, 1945. *Fall*: 127 at Patuxent Refuge on October 27, 1943. *Winter* (Christmas counts): 1,287 in the Ocean City area on December 27, 1953; 771 in southern Dorchester County on December 28, 1953; 508 in the Annapolis area on January 2, 1955; 100 in Allegany County on December 31, 1949.

BANDING.—See figure 69.

LAPLAND LONGSPUR *Calcarius lapponicus* (Linnaeus)

STATUS.—Rare and irregular winter visitor. About half a dozen were recorded in Baltimore City during the period February 4–10, 1895 (A. Resler), and a flock of about 20 was observed at Lake Roland, Baltimore County, on February 10, 1895 (Kirk-

wood, 1895). At Ocean City a small flock was recorded on December 29, 1927 (A. Wetmore), 3 were observed on December 25, 1939 (Stewart, 1947), and 1 was recorded on January 23, 1948 (I. R. Barnes).

CHESTNUT-COLLARED LONGSPUR *Calcarius ornatus* (Townsend)

STATUS.—Accidental visitor. One was collected at Ocean City on August 20, 1906 (USNM—Kirkwood, 1908).

SNOW BUNTING *Plectrophenax nivalis* (Linnaeus)

STATUS.—*Transient and wintering*: Uncommon (occasionally more numerous) in the coastal area of Worcester County; rare elsewhere in all sections (no definite records for Allegheny Mountain section).

HABITAT.—Sand-dune zone of the barrier beaches; also along sandy shores of Chesapeake Bay and in extensive agricultural fields and pastures.

PERIOD OF OCCURRENCE.—*Normal period*: November 10–20 to March 1–10; peak, November 25 to February 20. *Extreme arrival dates*: October 31, 1953, in Anne Arundel County (Mrs. W. L. Henderson, Mrs. G. Tappan); November 2, 1947, in Worcester County (I. R. Barnes). *Extreme departure dates*: April 1, 1906, and March 13, 1907, in Worcester County (F. C. Kirkwood).

MAXIMUM COUNTS.—150 on January 29, 1906 (F. C. Kirkwood), 146 on December 27, 1955 (Christmas count), and 50 on November 28, 1945, in the Ocean City area; about 100 on February 18, 1905, in the District of Columbia (F. M. Finley); 45 at Triadelphia Reservoir, Montgomery County, on December 26, 1954 (Christmas count); 25 at Gibson Island, Anne Arundel County, on November 28, 1952 (Mrs. W. L. Henderson, Mrs. G. Tappan).

LITERATURE CITED

Abbott, Jackson M.

1953. Blue Grosbeak nest at Seneca. *Atlantic Naturalist* 9:35.

Audubon, John James.

1831. *Ornithological biography*, xxiv + 512 pp. Philadelphia.

1838. *Ornithological biography*, xxiv + 618 pp. Edinburgh.

1840-44. *The birds of America*. 7 vols. 1840-44. New York and Philadelphia.

Bagg, Aaron C.

1935. Snow Geese (*Chen hyperborea*) near Washington, D. C. *Auk* 52:302.

Baird, Spencer F.

1858. North American birds. *Pac. Rail Road Rep.* 9:761.

Baird, Spencer F., Thomas M. Brewer, and Robert Ridgway.

1874. *A history of North American birds*. Little, Brown, and Co., Boston. lxiv + 560 pp.

1884. *The water birds of North America*. Little, Brown, and Co., Boston. xi + 537 pp.

Ball, William Howard.

1927. Notes from Washington, D. C. *Auk* 44:257-259.

1928a. The Gull-billed Tern (*Gelochelidon nilotica*) at Washington, D. C. *Auk* 45:367.

1928b. The Hudsonian Curlew (*Numenius hudsonicus*) at Washington, D. C. *Auk* 45:371.

1930a. Notes from eastern Maryland. *Auk* 47:94-95.

1930b. Short-billed Marsh Wren (*Cistothorus stellaris*) in Maryland. *Auk* 47:262.

1931a. Leach's Petrel (*Oceanodroma leucorhoa*) in the District of Columbia. *Auk* 48:106.

1931b. Baird's Sandpiper (*Pisobia bairdi*) at Washington, D. C. *Auk* 48:260.

1932a. Some notes on rare birds of the Washington region. *Proc. Biol. Soc. Wash.* 45:165-166.

1932b. Notes from the Washington, D. C. region. *Auk* 49:362.

1948. Wilson's Phalarope in the District of Columbia and Virginia. *Auk* 65:312.

Ball, William Howard, and Robert Browne Wallace.

1936. Further remarks on birds of Bolling Field, D. C. *Auk* 53:345-346.

Barnes, Irston R.

1950. The Starling's conquest. *Atlantic Naturalist* 6:64-68.

Barnes, Irston R., and Charles O. Handley, Jr.

1950. King Eiders seen at Ocean City. *Atlantic Naturalist* 5:183-184.

Bartsch, Paul.

1897. *Uria lomvia*, an addition to the Avifauna Columbiana. *Auk* 14:312-313.

1900. Birds of the road: VI, nesting time. *Osprey* 4:147-150.

1901. Tenants of Uncle Sam. *Osprey* 5:88-91.

Beaton, Robert J.

1951. Hawk migration at South Mountain. *Atlantic Naturalist* 6:166-168.

Behr, Herman.

1914. Some breeding birds of Garrett Co., Md. *Auk* 31:548.

Bendire, Chas. E.

1895. The American Barn Owl breeding at Washington, D. C., in winter. *Auk* 12:180-181.

Bent, Arthur Cleveland.

1926. Life histories of North American marsh birds. U. S. Natl. Mus. Bull. 135. xii + 490 pp.

1932. Life histories of North American gallinaceous birds. U. S. Natl. Mus. Bull. 162. xi + 490 pp.

1937. Life histories of American birds of prey. U. S. Natl. Mus. Bull. 167. viii + 409 pp.

Black, David V.

1941. Avocets in Maryland. *Auk* 58:405.

Blake, S. F.

1924. Blue-gray Gnatcatcher in the District of Columbia in winter. *Auk* 41:349.

Bond, Gorman M., and Robert E. Stewart.

1951. A new Swamp Sparrow from the Maryland coastal plain. *Wilson Bull.* 63:38-40.

Booker, Y. E.

1931. A wintering Black-throated Blue Warbler. *Bird-Lore* 33:124.

Brackbill, Hervey.

1942. Catbird wintering in Maryland. *Auk* 59:112-113.

1946. Snowy Owls in the winter of 1945-46. *Maryland Birdlife* 2:28.

1947a. Evening Grosbeaks and Purple Finches at Baltimore. *Auk* 64:321-322.

1947b. Period of dependency in the American Robin. *Wilson Bull.* 59:114-116.

Braun, E. Lucy.

1950. Deciduous forests of eastern North America. Blackiston Co., Philadelphia. xiv + 596 pp.

Briggs, Shirley A.

1954. Veeries in Glover-Archbold Park. *Atlantic Naturalist* 10:38.

Brooks, A. B.

1934. Some ornithological contributions by the nature school. *Redstart* 1:1-3.

Brooks, Maurice G.

1936a. Waterfowl on four Allegheny Lakes. *Redstart* 3:71-76, 82-85.

1936b. Solitary Sandpiper in summer at Deep Creek Lake, Maryland. *Auk* 53:444.

1936c. Notes on the land birds of Garrett County, Maryland. *Nat. Hist. Soc. Md. Bull.* 7:6-14.

1937. Pine Siskins in western Maryland. *Wilson Bull.* 49:294.

1938. Shorebirds at a western Maryland lake. *Auk* 55:126-127.

1944. A check-list of West Virginia birds. *Bull. 316 Agric. Exp. Sta., West Virginia University.* 56 pp.

Brown, Edward J.

1894. *Dendroica striata* in summer at Washington, D. C. Auk 11:79.

Brumbaugh, Chalmers S.

1915. Chestnut-sided Warbler nesting near Baltimore. Bird-Lore 17: 456-457.

Buckalew, John H.

1948. Ruff in Maryland. Wood Thrush 4:22.

1949. Wilson's Phalarope in Maryland. Wood Thrush 5:26.

1950. Records from the Del-Mar-Va Peninsula. Auk 67:250-252.

1951a. European Cormorant observed at Ocean City, Maryland. Maryland Birdlife 7:17.

1951b. First winter record of the Bachman's Sparrow in Maryland. Maryland Birdlife 7:40.

Burleigh, Thomas D.

1932. The Golden-crowned Kinglet, a summer visitor in the District of Columbia. Auk 49:485-486.

Burns, Frank L.

1932. Charles W. and Titian R. Peale and the ornithological section of the old Philadelphia Museum. Wilson Bull. 44:23-35.

Chapman, Frank M.

1904. The Pine Grosbeak at Washington, D. C. Bird-Lore 6:17.

1907. The Starling in America. Bird-Lore 9:206.

Clagett, Charles L.

1952. 1952 breeding-bird population studies. Atlantic Naturalist 8:87-88.

1953. 1953 breeding-bird population studies. Atlantic Naturalist 9:88-89.

Cole, Richard, and Haven Kolb.

1953. Seventeenth breeding-bird census; Mixed Oak Forest. Audubon Field Notes 7:341-342.

Cooke, May Thacher.

1921. Birds of the Washington region. Proc. Biol. Soc. Wash. 34:1-22.

1929. Birds of the Washington, D. C., region. Proc. Biol. Soc. Wash. 42:1-80.

Cooke, Wells W.

1908. Bird migration in the District of Columbia. Proc. Biol. Soc. Wash. 21:107-118.

1913. Bird migration in the District of Columbia. Proc. Biol. Soc. Wash. 26:21-26.

Cooley, Eleanor G.

1947. Breeding-bird census; Shrubby field with stream-bordered trees. Maryland Birdlife 3:59-61.

Cottam, Clarence.

1932. Nocturnal habits of the Chimney Swift. Auk 49:479-481.

Cottam, Clarence, and F. M. Uhler.

1935. Bird records new or uncommon to Maryland. Auk 52:460-461.

Coues, Elliott

1864. Critical review of the family Procellariidae: Part II, embracing the Puffineae. Proc. Acad. Nat. Sci. Phila. 116-144.

Coues, Elliott, and Daniel W. Prentiss.

1862. List of birds ascertained to inhabit the District of Columbia, etc. In: 16th Ann. Rep. Smithsonian Inst. 399-421.

1883. Avifauna Columbiana. 133 pp. Washington, D. C.

Court, Edward J.

1921. Some records of breeding birds for the vicinity of Washington, D. C. *Auk* 38:281-282.

1924. Black Vulture (*Coragyps urubu*) nesting in Maryland. *Auk* 41:475-476.

1936. Four rare nesting records for Maryland. *Auk* 53:95-96.

Criswell, Joan H.

1951. Yellow-crowned Night Heron nesting in Washington. *Atlantic Naturalist* 6:120.

Cross, Frank C.

1949. King Rails nest at Seneca. *Wood Thrush* 5:26.

1952. Status of the Orange-crowned Warbler in the Washington area. *Atlantic Naturalist* 8:91.

Cutler, David A.

1952. First Kittiwake specimen for Maryland. *Maryland Birdlife* 8:16.

Cuvier, M. Le Baron.

1826. *Oeuvres complètes de Buffon (Oiseaux)* 21:249-255.

Daniel, John W., Jr.

1901a. Occurrence of the Glossy Ibis at Washington, D. C. *Auk* 18:271.

1901b. Nesting of the Hairy Woodpecker near Washington, D. C. *Auk* 18:272.

Dargan, Lucas, Phoebe Knappen, and Robert C. McClanahan.

1941. A Maryland winter record for the Black Skimmer. *Auk* 58:406.

Davis, Edwin G.

1948. Bird notes. *Wood Thrush* 4:22.

Davis, Edwin G., and John E. Willoughby.

1950. Harlequin Duck in Maryland. *Wood Thrush* 5:124.

Davis, Malcolm.

1945. Black-crowned Night Heron in Washington, D. C. *Auk* 62:458.

De Garis, Charles F.

1936. Notes on six nests of the Kentucky Warbler (*Oporornis formosus*). *Auk* 53:418-428.

Deignan, H. G.

1943a. Some early bird-records for Maryland and the District of Columbia. *Proc. Biol. Soc. Wash.* 56:69.

1943b. Occurrence of the Hudsonian Godwit in the District of Columbia. *Proc. Biol. Soc. Wash.* 56:70.

1943c. Hoyt's Horned Lark on the Eastern Shore, Maryland. *Proc. Biol. Soc. Wash.* 56:71.

Denmead, Talbott.

1937. Black Tern in Maryland. *Auk* 54:206.

1954. Letter to the editor. *Maryland Birdlife* 10:56.

Dorsey, Caleb.

1947. Observations on the nesting habits of the Black Vulture in Anne Arundel County, Maryland. *Maryland, A Jour. of Nat. Hist.* 17:27-29.

Eifrig, C. W. G.

1902a. Lark Sparrow and Olive-sided Flycatcher in western Maryland. *Auk* 19:83-84.

1902b. Northern birds at Cumberland, Md. *Auk* 19:211-212.

1904. Birds of Allegany and Garrett Counties, western Maryland. *Auk* 21:234-250.

1905. Nesting of the Raven at Cumberland, Md. Auk 22:312.
 1909. Additions to the list of birds of Allegany and Garrett Counties, western Maryland. Auk 26:437-438.
 1915. Notes on some birds of the Maryland Alleghanies; an anomaly in the check-list. Auk 32:108-110.
 1920a. In the haunts of Cairns' Warbler. Auk 37:551-558.
 1920b. Additions to the "Birds of Allegany and Garrett Counties, Maryland." Auk 37:598-600.
 1921. Mockingbird and Catbird wintering at Cumberland, Maryland. Auk 38:608-609.
 1923. Prairie Horned Lark (*Otocoris alpestris praticola*) in Maryland in summer. Auk 40:126.
 1933. In the haunts of Cairn's Warbler—a retrospect and a comparison. Wilson Bull. 45:60-66.
 1938. Hermit Thrush, Swamp and Savannah Sparrows as summer residents in western Maryland. Auk 55:281.

Farnham, A. B.

1891. Ornithologists Association Secretary's report. Oologist 8:219-220.

Fenneman, Nevin M.

1938. Physiography of eastern United States. McGraw-Hill Book Company, Inc. New York and London. xiii + 714 pp.

Figgins, J. D.

1897. Bachman's Sparrow in Maryland. Auk 14:219.

Fisher, A. K.

1918. Occurrence of Goshawks (*Astur a. atricapillus*) and Saw-whet Owl (*Cryptoglaux acadica*) in the vicinity of Washington, D. C. Auk 35:351.
 1935. Natural history of Plummers Island, Maryland. Proc. Biol. Soc. Wash. 48:159-167.

Fisher, Wm. H.

1892. A trip to Tolchester Beach. Orn. and Ool. 17:38.
 1894. Maryland birds that interest the sportsman. Oologist 11:94-97, 137-139.
 1896. Wild Pigeon and Dove. Nidologist 3:139.

Fuller, Arthur B.

1953. A strange Hummingbird in Northampton County, Virginia. Raven 24:24-25.

Ganier, Albert F., and Forest W. Buchanan.

1953. Nesting of the White-throated Sparrow in West Virginia. Wilson Bull. 65:277-279.

Grant, Edward R.

1951. The last Maryland flight of the Passenger Pigeon. Maryland Birdlife 7:27-29.

Grinnell, George Bird.

1910. American game-bird shooting. Forest and Stream Publishing Co., New York. xviii + 558 pp.

Gross, Alfred O.

1927. The Snowy Owl migration of 1926-27. Auk 44:479-493.

Gunn, W. W. H., and A. M. Crocker.

1951. Analysis of unusual bird migration in North America during the storm of April 4-7, 1947. Auk 68:139-163.

Hackman, C. Douglas.

1954. A summary of hawk flights over White Marsh, Baltimore County, Maryland. *Maryland Birdlife* 10:19-26.

Halle, Louis J., Jr.

1943. The Veery breeding in Washington, D. C. *Auk* 60:103.
1948. Veeries breed in Washington. *Wood Thrush* 4:2-7.

Hamilton, A. B., and J. D. Johnson.

1940. Types of farming in Maryland. University of Maryland Agriculture Experiment Station Bull. 432. 271 pp.

Hampe, Irving E.

1945. The Iceland Gull in Maryland. *Maryland, A Jour. Nat. Hist.* 15:77.

Hampe, Irving E., Robert M. Bowen, and Gorman M. Bond.

1947. The breeding bird census and bird watching. *Maryland, A Jour. Nat. Hist.* 17:67-72.

Hampe, Irving E., and Haven Kolb.

1947. A preliminary list of the birds of Maryland and the District of Columbia. *Nat. Hist. Soc. Md. Baltimore.* xi + 76 pp.

Hampe, Irving E., H. Seibert, and H. Kolb.

1939. Purple Gallinule in Maryland. *Auk* 56:475.

Handlan, J. W.

1936. A brief inspection of lakes in the Allegheny tableland. *Redstart* 4:12-13.

Harlow, R. C.

1906. Late nesting of the Hummingbird. *Oologist* 23:156.

Harper, Roland M.

1918. A phytogeographical sketch of southern Maryland. *Jour. Wash. Acad. Sci.* 8:581-589.

Hasbrouck, Edwin M.

1893. Rare birds near Washington, D. C. *Auk* 10:91-92.
1944. The status of Barrow's Golden-eye in the eastern United States. *Auk* 61:544-554.
1948. Wilson's Phalarope near Washington, D. C. *Auk* 65:609-610.

Henshaw, H. M.

1886. Occurrence of *Chondestes grammacus* about Washington, D. C. *Auk* 3:487.

Houghton, C. O.

1906. The Masked Duck in Maryland. *Auk* 23:335.

Jackson, Ralph W.

1916. Occurrence of Starlings in Dorchester County, Md. *Bird-Lore* 18:175.
1941. Breeding birds of the Cambridge area, Maryland. *Bull. Nat. Hist. Soc. Md.* 11:65-74.

John, Thomas.

1937. A Maryland Marsh Hawk nest. *Redstart* 4:10.

Johnson, J. Enoch.

1952. Black Skimmer in Washington. *Atlantic Naturalist* 8:90.

Kaufmann, Jack, Richard D. Cole, and Haven Kolb.

1952. Sixteenth breeding-bird census; Mixed oak forest. *Audubon Field Notes* 6:308-309.

Kessel, Brina.

1953. Distribution and migration of the European Starling in North America. *Condor* 55:49-67.

Kirkwood, Frank Coates.

1895. A list of the birds of Maryland. *Trans. Maryland Acad. Sci.* 2:241-382.

1901. The Cerulean Warbler (*Dendroica cerulea*) as a summer resident in Baltimore County, Maryland. *Auk* 18:137-142.

1908. Chestnut-collared Longspur (*Calcarius ornatus*) in Maryland. *Auk* 25:84.

1925. Cliff Swallow (*Petrochelidon lunifrons*) again nesting in Baltimore County, Maryland. *Auk* 42:275-276.

1930. A Raven in Baltimore County, Maryland. *Auk* 47:255.

Kolb, C. Haven, Jr.

1939. Ornithological observations at Ocean City. *Bull. Nat. Hist. Soc. Md.* 10:26-34.

1941. Further ornithological notes from Ocean City, Maryland. *Bull. Nat. Hist. Soc. Md.* 11:115-120.

1943. Status of *Dendroica cerulea* in eastern Maryland. *Auk* 60:275-276.

1947. Breeding of the Long-eared Owl near Baltimore. *Maryland, A Jour. of Nat. Hist.* 17:23-25.

1949a. Thirteenth breeding-bird census; Mixed oak forest. *Audubon Field Notes* 3:266.

1949b. Northward extension in the breeding range of the Black Vulture. *Maryland Naturalist* 19:7-9.

1950. Fourteenth breeding-bird census; Mixed oak forest. *Audubon Field Notes* 4:300.

Kolb, C. Haven, Jr., and Gorman Bond.

1943. Unusual records for eastern Maryland. *Auk* 60:451.

Kolb, C. Haven, Jr., and Richard D. Cole.

1951. Fifteenth breeding-bird census; Mixed oak forest. *Audubon Field Notes* 5:323.

Kolb, C. Haven, Jr., and Irving E. Hampe.

1941. Recent records from Baltimore and vicinity. *Bull. Nat. Hist. Soc. Md.* 12:28-29.

Kolb, C. Haven, Jr., Chandler S. Robbins, and Eleanor C. Robbins.

1948. Twelfth breeding-bird census; Mixed oak forest. *Audubon Field Notes* 2:234.

Kumlien, Ludwig.

1880. The Yellow-rumped Warbler (*Dendroica coronata*) breeding in eastern Maryland. *Bull. Nuttall Ornith. Club* 5:182-183.

Lawrence, R. E.

1946. Trips of the month. *Wood Thrush* 1:23.

Le Compte, E. Lee.

1937. Rare birds. *Maryland Conserv.* 14(3):8-9.

Lincoln, Frederick C.

1928. Forster's Tern in the District of Columbia. *Proc. Biol. Soc. Wash.* 41:209-210.

1932. State of the Arkansas Kingbird (*Tyrannus verticalis*) in Maryland. *Auk* 49:88-90.

1934. An influx of Leach's Petrels. *Auk* 51:74-75.

1937. Parula Warbler in Washington in December. *Auk* 54:395.

McAtee, W. L.

1918. Early bird records for the vicinity of Washington, D. C. *Auk* 35:85.
 1921. Ten spring bird lists made near Washington, D. C. *Wilson Bull.* 33:183-192.

McAtee, W. L., E. A. Preble, and Alexander Wetmore.

1917. Winter birds about Washington, D. C., 1916-1917. *Wilson Bull.* 29:183-187.

McKnight, Edwin T.

1950. Summer occurrence of juvenile Lark Sparrow in southern Maryland. *Wood Thrush* 5:125.

Meanley, M. Brooke.

- 1936a. Late nesting of the Goldfinch at Baltimore, Md. *Auk* 53:90.
 1936b. Maryland Yellow-throat in winter in Maryland. *Auk* 53:220.
 1938. Chestnut-sided Warbler nesting near Baltimore, Maryland. *Auk* 55:542-543.
 1943a. Red-cockaded Woodpecker breeding in Maryland. *Auk* 60:105.
 1943b. Nesting of the Upland Plover in Baltimore County, Maryland. *Auk* 60:603.
 1944. Lawrence's Warbler in Maryland. *Auk* 61:477.
 1949. Bachman's Sparrow at College Park, Maryland. *Wood Thrush* 5:73.
 1950. Swainson's Warbler on coastal plain of Maryland. *Wilson Bull.* 62:93-94.

Murray, Joseph James.

1952. A check-list of the birds of Virginia. *Virginia Soc. Ornith., Lexington, Va.* 113 pp.

Oberholser, Harry C.

1905. Two bird days near Washington, D. C. *Wilson Bull.* 11:84-88.
 1917a. A cooperative bird census at Washington, D. C. *Wilson Bull.* 29:18-29.
 1917b. A remarkable Martin roost in the City of Washington. *Bird-Lore* 19:315-317.
 1918. A second bird survey at Washington, D. C. *Wilson Bull.* 30:34-48.
 1919. Birds of a Washington City dooryard. *Amer. Midland Nat.* 6(1):1-13.
 1920. The season; xviii, December 15, 1919, to February 15, 1920. *Bird-Lore* 22:106.
 1931. The season, Washington region. *Bird-Lore* 33:194-195.

Oldys, Henry.

1907. Occurrence of a White-winged Crossbill at Oxen Hill, Md., in August. *Auk* 24:442.
 1917. Starlings nesting near Washington, D. C. *Auk* 34:338.

Oresman, Stephen, John Tiffany, and Chandler S. Robbins.

1948. Twelfth breeding-bird census; Damp deciduous scrub with numerous standing dead trees. *Audubon Field Notes* 2:226-227.

Osgood, Wilfred H.

1907. '*Helminthophila lawrencei*' near the District of Columbia. *Auk* 24:342-343.

Overing, Robert.

1936. The 1935 fall migration at the Washington monument. *Wilson Bull.* 48:222-224.

1938. High mortality at the Washington monument. *Auk* 55:679.

Palmer, William.

1885. Abundance of *Parus atricapillus* near Washington. *Auk* 2:304.

1896. The Scissor-tailed Flycatcher in Virginia and Maryland. *Auk* 13:83.

1897a. The Wood Ibis in Virginia and Maryland. *Auk* 14:208-209.

1897b. An addition to North American Petrels. *Auk* 14:297-299.

Partridge, Mrs. Melvin H.

1953. A northward flight of Evening Grosbeaks. *Maryland Birdlife* 9:14.

Perkins, S. E. III.

1933. Notes from Dorchester Co., Maryland. *Auk* 50:367-368.

Perkins, S. E. III, and Robert P. Allen.

1931. Notes on some winter birds of Maryland. *Maryland Conserv.* 8(2):3-5.

Peterson, Roger Tory.

1946. Nesting sites of the Parula Warbler in the Potomac valley. *Wilson Bull.* 58:197.

Poole, Frazer G.

1942a. A list of the birds of Caroline County, Maryland. *Bull. Nat. Hist. Soc. Md.* 12:51-56.

1942b. Breeding notes Eastern Shore birds. *Bull. Nat. Hist. Soc. Md.* 12:56-58.

Preble, Edward A.

1900. The summer birds of Western Maryland. *Maryland Geological Survey* 294-307.

Richards, John W.

1953. Some records new to Frederick County. *Maryland Birdlife* 9:3-4.

1954. Rufous Hummingbird seen at Emmitsburg. *Maryland Birdlife* 10:36-37.

Richmond, Charles W.

1888. An annotated list of birds breeding in the District of Columbia. *Auk* 5:18-25.

1891. Barrow's Golden-eye (*Glaucionetta islandica*) near Washington, D. C. *Auk* 8:112.

1917. The Cape May Warbler at Washington, D. C., in winter. *Auk* 34:343.

Ridgway, Robert.

1878. Eastward range of *Chondestes grammaca*. *Bull. Nuttall Ornith. Club* 3:43-44.

1884. Probable breeding of the Red Crossbill in central Maryland. *Auk* 1:292.

1890. *Junco hyemalis shufeldti* in Maryland. *Auk* 7:289.

Riley, J. H.

1902. Notes on the habits of the Broad-winged Hawk (*Buteo platypterus*) in the vicinity of Washington, D. C. *Osprey* 6:21-23.

Robbins, Chandler S.

1949a. Thirteenth breeding-bird census; Virgin hemlock forest. *Audubon Field Notes* 3:257-258.

- 1949b. Thirteenth breeding-bird census; Mature and lumbered oak-maple ridge forest. Audubon Field Notes 3:259-261.
- 1949c. Thirteenth breeding-bird census; Open hemlock-spruce bog. Audubon Field Notes 3:269.
- 1949d. Wilson's Warbler in Maryland in late December. Auk 66:207-208.
1953. The Evening Grosbeak in Maryland. Maryland Birdlife 9:19-23.
- Robbins, Chandler S., and Irston R. Barnes.
1949. Thirteenth breeding-bird census; Red pine plantation. Audubon Field Notes 3:258.
- Robbins, Chandler S., and Robert E. Stewart.
1948. Maryland Piping Plover recovered in the Bahamas. Bird-Banding 19:73-74.
- 1951a. Fifteenth breeding-bird census; Mature northern hardwood forest. Audubon Field Notes 5:320-321.
- 1951b. Fifteenth breeding-bird census; Scrub spruce bog. Audubon Field Notes 5:325.
- Robbins, Chandler S., Robert E. Stewart, and Martin Karplus.
1947. Eleventh breeding-bird census; Dry deciduous scrub. Audubon Field Notes 1:200-201.
- Seibert, Henri C.
1941. Brewster's Warbler in Maryland. Auk 58:410.
- Small, Edgar A.
1881. Notes from Maryland. Ornithologist and Oologist 6:79.
- 1883a. Phoebe birds in winter. Ornithologist and Oologist 8:32.
- 1883b. Boat-tailed Grackle. Ornithologist and Oologist 8:76.
- Smith, Hugh M.
1885. Breeding of *Loxia americana* in the District of Columbia. Auk 2:379-380.
1891. On the disappearance of the Dick Cissel (*Spiza Americana*) from the District of Columbia. Proc. U. S. Natl. Mus. 13:171-172.
- Smith, Hugh M., and William Palmer.
1888. Additions to the avifauna of Washington and vicinity. Auk 5:147-148.
- Smyth, Thomas, Jr.
1952. Black Vulture nesting in Baltimore County. Maryland Naturalist 22:18-19.
- Springer, Paul F., and Robert E. Stewart.
- 1948a. Twelfth breeding-bird census; Tidal marshes. Audubon Field Notes 2:223-226.
- 1948b. Twelfth breeding-bird census; Apple orchards. Audubon Field Notes 2:227-229.
- 1948c. Twelfth breeding-bird census; Immature loblolly-shortleaf pine stand. Audubon Field Notes 2:239.
- 1948d. Twelfth breeding-bird census; Second-growth river swamp. Audubon Field Notes 2:240-241.
1950. Gadwall nesting in Maryland. Auk 67:234-235.
- Stabler, Harold B.
1891. Nesting of the Sharp-shinned Hawk. Oologist 8:161-162.
- Stecher, Karl.
1955. Brown-capped Chickadee at Rockville. Atlantic Naturalist 10:214.

Stewart, Robert E.

1947. The distribution of Maryland birds. *Maryland Birdlife* 3:55-57.
1949. Ecology of a nesting Red-shouldered Hawk population. *Wilson Bull.* 61:26-35.
1951. Kittiwake—seen on Assateague Island. *Atlantic Naturalist* 6:175, 222.
1952. Census of Woodcock breeding population in vicinity of Patuxent Refuge, Md. in 1951 [*in investigations of Woodcock, Snipe, and Rails in 1951 by John W. Aldrich and others*]. U. S. Fish and Wildlife Service, Special Scientific Report—Wildlife No. 14:29.

Stewart, Robt. E., James B. Cope, Chandler S. Robbins, and John W. Brainerd.

1946. Effects of DDT on birds at the Patuxent Research Refuge. *Journal of Wildlife Management* 10:195-201.
1952. Seasonal distribution of bird populations at the Patuxent Research Refuge. *Amer. Midl. Nat.* 47:257-363.

Stewart, Robert E., Martin Karplus, and Chandler S. Robbins.

1947. Eleventh breeding-bird census; Damp deciduous scrub with numerous standing dead trees. *Audubon Field Notes* 1:200.

Stewart, Robert E., and M. Brooke Meanley.

1943. Bachman's Sparrow in Maryland. *Auk* 60:605-606.
1950. Fourteenth breeding-bird census; General farm land. *Audubon Field Notes* 4:305.

Stewart, Robert E., and Chandler S. Robbins.

- 1947a. Recent observations on Maryland birds. *Auk* 64:266-274.
1947b. Eleventh breeding-bird census; Virgin central hardwood deciduous forest. *Audubon Field Notes* 1:211-212.
1951a. Fifteenth breeding-bird census; Virgin spruce-hemlock bog forest. *Audubon Field Notes* 5:317-318.
1951b. Fifteenth breeding-bird census: Lightly grazed pasture. *Audubon Field Notes* 5:326-327.

Swales, B. H.

1919. A former record of the Heath Hen (*Tympanuchus cupido*) at Washington, D. C. *Proc. Biol. Soc. Wash.* 32:198.
1920. Records of several rare birds from near Washington, D. C. *Proc. Biol. Soc. Wash.* 33:181-182.
1922. Prairie Horned Lark (*Otocoris alpestris praticola*) in Maryland in summer. *Auk* 39:568-569.

Taylor, John W.

1953. Glossy Ibis at Cobb Island. *Atlantic Naturalist* 9:91.

Trever, Karl.

1952. 1951 breeding-bird population studies. *Atlantic Naturalist* 7:133-135.

Tyrrell, W. Bryant.

1934. The youth of the Eagle—in Maryland. *Maryland Conserv.* 11(4): 8-9.
1935. Bird notes from Ocean City, Maryland. *Nat. Hist. Soc. Md. Bull.* 6:21-23.

Ulke, Titus.

1935. Rare birds in the District of Columbia. *Auk* 52:461.

Vaughn, Ernest A.

1937. Wildlife's public enemy No. 1. *Maryland Conserv.* 14(4):19-20.

Warden, David Baillie.

1816. A chorographical and statistical description of the District of Columbia. Smith, Rue Montmorency, Paris. vii + 212 pp.

Weeks, John R.

1941. Our climate: Maryland and Delaware. Maryland State Weather Service. 66 pp.

Wendt, Lorina M.

1951. Upland Sandpipers near Lilypons. Atlantic Naturalist 7:37.

Wetmore, Alexander.

1923. The Evening Grosbeak near Washington, D. C. Auk 40:130.
 1925. Wilson's Petrel in Maryland. Auk 42:262-263.
 1927. Records from the coast of Maryland. Auk 44:256-257.
 1929. Wilson's Phalarope in Maryland. Auk 46:538-539.
 1935. The Short-billed Marsh Wren breeding in Maryland. Auk 52:455.
 1936. The Chuck-will's-widow in Maryland. Auk 53:333.
 1939. Arkansas Kingbird in Maryland. Auk 56:86.

Wetmore, Alexander, and Frederick C. Lincoln.

- 1928a. Recent records for Maryland. Auk 45:225-226.
 1928b. The Dickcissel in Maryland. Auk 45:508-509.

Williams, R. W.

1914. The White-winged Crossbill (*Loxia leucoptera*) in the District of Columbia. Auk 31:251-252.

Wimsatt, William A.

1939. Black Vulture and Duck Hawk nesting in Maryland. Auk 56:181-182.
 1940. Early nesting of the Duck Hawk in Maryland. Auk 57:109.

Wood, Nelson R.

1907. A White-throated Sparrow in Washington, D. C., in August. Auk 24:442.

Wright, Albert Hazen.

1912. Early records of the Carolina Paroquet. Auk 29:343-363.

Wright, J. Kenneth.

1955. 1954 breeding-bird population studies. Atlantic Naturalist 10:150-151.

APPENDIX A—Common and Scientific Names of Plants Referred to in Text

[Names taken from eighth edition of Gray's Manual of Botany (Fernald, 1950)]

- | | |
|---|---|
| Alder (<i>Alnus</i> spp.) | Maleberry (<i>Lyonia ligustrina</i>) |
| American elm (<i>Ulmus americana</i>) | Marsh elder (<i>Iva frutescens</i>) |
| American holly (<i>Ilex opaca</i>) | Mockernut (<i>Carya tomentosa</i>) |
| American three-square (<i>Scirpus americanus</i>) | Mountain laurel (<i>Kalmia latifolia</i>) |
| Arrow-wood (<i>Viburnum dentatum</i>) | Narrow-leaved cattail (<i>Typha angustifolia</i>) |
| Ash (<i>Fraxinus</i> spp.) | Needlerush (<i>Juncus roemerianus</i>) |
| Bald cypress (<i>Taxodium distichum</i>) | Northern red oak (<i>Quercus rubra</i>) |
| Basswood (<i>Tilia americana</i>) | Olney three-square (<i>Scirpus olneyi</i>) |
| Bay berry (<i>Myrica pensylvanica</i>) | Orchard grass (<i>Dactylis glomerata</i>) |
| Beachgrass (<i>Ammophila breviligulata</i>) | Pignut (<i>Carya cordiformis</i>) |
| Bear oak (<i>Quercus ilicifolia</i>) | Pin oak (<i>Quercus palustris</i>) |
| Beech (<i>Fagus grandifolia</i>) | Pitch pine (<i>Pinus rigida</i>) |
| Black cherry (<i>Prunus serotina</i>) | Poison ivy (<i>Rhus radicans</i>) |
| Black grass (<i>Juncus gerardi</i>) | Poison sumac (<i>Rhus vernix</i>) |
| Black gum (<i>Nyssa sylvatica</i>) | Red ash (<i>Fraxinus pennsylvanica</i>) |
| Black oak (<i>Quercus velutina</i>) | Red bay (<i>Persea borbonia</i>) |
| Broomsedge (<i>Andropogon virginicus</i>) | Red cedar (<i>Juniperus virginiana</i>) |
| Cattail (<i>Typha</i> spp.) | Red-head pondweed (<i>Potamogeton perfoliatus</i>) |
| Chestnut (<i>Castanea dentata</i>) | Red maple (<i>Acer rubrum</i>) |
| Chestnut oak (<i>Quercus prinus</i>) | Red pine (<i>Pinus resinosa</i>) |
| Clammy azalea (<i>Rhododendron viscosum</i>) | Red spruce (<i>Picea rubens</i>) |
| Common cattail (<i>Typha latifolia</i>) | Reed (<i>Phragmites communis</i>) |
| Cross vine (<i>Bignonia capreolata</i>) | River birch (<i>Betula nigra</i>) |
| Ditch grass (<i>Ruppia maritima</i>) | River bulrush (<i>Scirpus fluviatilis</i>) |
| Eel grass (<i>Zostera marina</i>) | Sago pondweed (<i>Potamogeton pectinatus</i>) |
| Elm (<i>Ulmus</i> sp.) | Saltmarsh bulrush (<i>Scirpus robustus</i>) |
| Flowering dogwood (<i>Cornus florida</i>) | Salt-meadow grass (<i>Spartina patens</i>) |
| Glasswort (<i>Salicornia</i> spp.) | Salt reed-grass (<i>Spartina cynosuroides</i>) |
| Great laurel (<i>Rhododendron maximum</i>) | Salt-water cordgrass (<i>Spartina alterniflora</i>) |
| Greenbrier (<i>Smilax</i> spp.) | Scarlet oak (<i>Quercus coccinea</i>) |
| Hemlock (<i>Tsuga canadensis</i>) | Scrub pine (<i>Pinus virginiana</i>) |
| Hickory (<i>Carya</i> spp.) | Sea myrtle (<i>Baccharis halimifolia</i>) |
| Hornbeam (<i>Carpinus caroliniana</i>) | Shagbark hickory (<i>Carya ovata</i>) |
| Horse-sugar (<i>Symplocos tinctoria</i>) | Shortleaf pine (<i>Pinus echinata</i>) |
| Jewelweed (<i>Impatiens capensis</i>) | Southern arrow-wood (<i>Viburnum dentatum</i>) |
| Laurel-leaved greenbrier (<i>Smilax laurifolia</i>) | Spanish oak (<i>Quercus falcata</i>) |
| Loblolly pine (<i>Pinus taeda</i>) | |

Spicebush (<i>Lindera benzoin</i>)	Tamarack (<i>Larix laricina</i>)
Spike-grass (<i>Distichlis spicata</i>)	Three-square (<i>Scirpus</i> spp.)
Sugar maple (<i>Acer saccharum</i>)	Trumpet creeper (<i>Campsis radicans</i>)
Swamp rose (<i>Rosa palustris</i>)	Tulip-poplar (<i>Liriodendron tulipifera</i>)
Swamp rose-mallow (<i>Hibiscus palustris</i>)	Water oak (<i>Quercus nigra</i>)
Sweet-bay (<i>Magnolia virginiana</i>)	Wax-myrtle (<i>Myrica cerifera</i>)
Sweet birch (<i>Betula lenta</i>)	White ash (<i>Fraxinus americana</i>)
Sweetgum (<i>Liquidambar styraciflua</i>)	White oak (<i>Quercus alba</i>)
Sweet pepperbush (<i>Clethra alnifolia</i>)	White pine (<i>Pinus strobus</i>)
Switchgrass (<i>Panicum virgatum</i>)	Wild celery (<i>Vallisneria americana</i>)
Sycamore (<i>Platanus occidentalis</i>)	Wild rice (<i>Zizania aquatica</i>)
Table Mountain pine (<i>Pinus pungens</i>)	Willow oak (<i>Quercus phellos</i>)
	Winterberry (<i>Ilex verticillata</i>)
	Yellow birch (<i>Betula lutea</i>)

APPENDIX B—List of Species Dropped From Hypothetical List

The following species have been reported as having occurred in Maryland or the District of Columbia, but the records are too indefinite to warrant their inclusion as probable members of the avifauna.

Sooty Shearwater *Puffinus griseus* (Gmelin). Specimen cannot be found (Hampe and Kolb, 1947).

Egyptian Goose *Alopochen aegyptiaca* (Linnaeus). There is no assurance that the specimen recorded by Kirkwood (Auk 17:64-65) had not escaped from captivity.

European Quail *Coturnix coturnix* (Linnaeus). About 1,200 released in Baltimore County, 1879-92; 1 nest record. This introduced species did not become established.

Sandhill Crane *Grus canadensis* (Linnaeus). Specimen said to have been procured in the District of Columbia (Coues and Prentiss, 1862) cannot be located, and may never have been preserved or examined by an ornithologist.

Ivory Gull *Pagophila eburnea* (Phipps). Recorded in 1843 (McAtee, 1918), but there is no assurance it was correctly identified.

Rock Dove *Columba livia* Gmelin. The great majority of observations refer to privately owned or escaped birds. No truly wild population is recognized in this area.

APPENDIX C—Important Records Since October 1956

As stated on page 37, it was the intent of the authors to have the text complete through the calendar year 1955. The more important changes in status, migration and nesting dates, popu-

lation densities, and high counts for the period January through October 1956 were incorporated into the text. The maps and the bibliography, however, have not been amended since 1955.

Several new records of interest occurred while the manuscript was in press and are of sufficient importance to be included here.

White Pelican *Pelecanus erythrorhynchos* Gmelin. One was seen at Gibson Island, Anne Arundel County, on October 4 and 5, 1957 (R. Dwight, Mrs. E. G. Tappan).

Cattle Egret *Bubulcus ibis* Linnaeus. Five birds spent the summer of 1957 in the Mills Island heron colony (N. Hotchkiss), but there was no proof of nesting. One bird was reported seen near Easton, Talbot County, on May 6, 1957.

Knot *Calidris canutus* (Linnaeus). Three seen at Ocean City on December 30, 1957 (D. A. Cutler et al.) constitute the first winter record for Maryland.

Buff-breasted Sandpiper *Tryngites subruficollis* (Vieillot). A sight record near Hurlock, Dorchester County, on September 24, 1957 (S. H. Dyke) places this species on the hypothetical list.

Ruff *Philomachus pugnax* (Linnaeus). One was observed in the District of Columbia on September 22, 1957 (P. A. DuMont). This is the second definite record for our area.

Black-legged Kittiwake *Rissa tridactyla* (Linnaeus). One was seen at Ocean City on December 30, 1957 (D. A. Cutler et al.). Another observed at the mouth of the South River in Anne Arundel County on December 30, 1956, represents the first record for the Chesapeake Bay area.

Common Tern *Sterna hirundo* Linnaeus. One observed at Ocean City on December 30, 1957 (J. W. Terborgh et al.) represents the first winter record for Maryland.

Ash-throated Flycatcher *Myiarchus cinerascens* (Lawrence). One collected (USNM) at Monkton, Baltimore County, on November 26, 1957 (S. W. Simon) represents the second record for Maryland.

Wilson's Warbler *Wilsonia pusilla* (Wilson). One spent the winter of 1956-57 at a feeding station in Easton, Talbot County; it was first noted on November 30, 1956 (J. Offutt). This is the second winter record for Maryland.

Bachman's Sparrow *Aimophila aestivalis* (Lichtenstein). One seen at Elliott, Dorchester County, on December 31, 1957 (K. Stecher) represents the second winter record for Maryland.

Harris' Sparrow *Zonotrichia querula* (Nuttall). This species is transferred from the hypothetical list to the regular list on the basis of a bird found near Darnestown, Montgomery County, on January 1, 1958, and subsequently seen by many observers.

With the above changes, the regular list of birds recorded in Maryland and the District of Columbia stands at 334 species. The revised hypothetical list still contains 19 additional species.

March 1958.

SPECIES INDEX

[Page numbers in **boldface** refer to principal entries; those in *italics* to maps]

A

- Acanthis flammea*, 343.
hornemanni, 343.
linaria. See *A. flammea*.
Accipiter cooperii, 22, 29, 35, **109**.
gentilis, **108**.
striatus, 7, 29, 35, **108**.
velox. See *A. striatus*.
Actitis macularia, 22, 35, **143**.
Aegolius acadicus, 15, 34, 35, **128**, **182**.
Agelaius phoeniceus, 4, 7, 17, 22, 26,
 27, 28, 35, **321**, **329**.
Aimophila aestivalis, 23, 29, 33, **358**,
 389.
Aix sponsa, 7, 21, 29, 35, 85, **86**.
Alca torda, **171**.
Alle alle. See *Plautus alle*.
Alopochen aegyptiaca, 388.
Ammodramus savannarum, 22, 28, 35,
 352.
Ammospiza caudacuta, 22, 24, **353**,
 354.
maritima, 22, 24, **354**, **355**.
Anas acuta, 13, 75, 76.
carolinensis, 77, 78.
crecca, 37, 77.
cyanoptera, 81.
discors, 22, 24, 79, **79**, **80**.
platyrhynchos, 13, 22, 29, 35, **69**,
 71.
rubripes, 13, 16, 21, 29, **60**, **72**, **73**.
strepera, 22, 24, 74.
 Anhinga, **51**.
Anhinga anhinga, 51.
Anser albifrons, 68.
Anthus spinoletta, 17, 31, 256.
Antrostomus. See *Caprimulgus*.
Aquila chrysaetos, **115**.
Archilochus colubris, 7, 22, 29, 35, **187**.
Ardea herodias, 22, **51**, **52**.
Arenaria interpres, **138**.
Arquatella maritima. See *Erolia*
maritima.

- Asio flammeus*, **181**.
otus, **181**.
wilsonianus. See *A. otus*.
Astur atricapillus. See *Accipiter*
gentilis.
 Auk, Razor-billed. See Razorbill.
 Avocet, American, 37, **154**.
Aythya affinis, 16, **92**, **93**.
americana, 7, 87, 88.
collaris, 88, **89**.
marila, 16, **92**, **94**.
valisineria, 7, 16, 27, **90**, **91**.

B

Baeolophus bicolor. See *Parus bicolor*.
 Bald Eagle, vi, 1, 22, 29, **115**.
 Baldpate. See Widgeon, American.
Bartramia longicauda, 29, 31, 35, **141**,
 142.
 Bittern, American, 22, 24, **61**, **62**.
 Least, 21, **60**, **60**.
 Blackbird, Brewer's, 37, **325**.
 Redwinged, 4, 7, 17, 22, 26, 27,
 28, 35, **321**, **329**.
 Rusty, **324**.
 Yellow-headed, **320**.
 Bluebird, Eastern, 7, 22, 29, 35, **251**,
 329.
 Blue Jay, 7, 22, 29, 35, **217**, **219**.
 Bobolink, 16, 26, 29, 35, **318**, **318**.
 Bobwhite, 7, 21, 29, 35, **125**.
Bombycilla cedrorum, 23, 29, 34, **257**.
Bonasa umbellus, 12, 29, 32, 34, **79**,
 124.
Botaurus lentiginosus, 22, 24, **61**, **62**.
 Brant, 16, 67.
Branta bernicla, 16, 67.
canadensis, 7, 13, 16, 27, **65**, **66**.
leucopsis, 68.
Bubo virginianus, 7, 21, 29, 35, **179**.
Bubulcus ibis, 37, 55, **389**.
Bucephala albeola, **96**.
clangula, **94**.
islandica, **95**.

- Bufflehead, 96.
 Bunting, Indigo, 7, 13, 22, 28, 35, 329, 337.
 Snow, 17, 24, 374.
Buteo borealis. See *B. jamaicensis*.
jamaicensis, 22, 29, 35, 110.
lagopus, 17, 114.
lineatus, 21, 29, 35, 112.
platypterus, 22, 29, 35, 113.
Butorides virescens, 21, 29, 35, 53.
- C**
- Calcarius lapponicus*, 37, 373.
ornatus, 374.
Calidris canutus, 16, 147, 389.
Campephilus principalis, 198.
Camptorhynchus labradorium, 98.
 Canvasback, 7, 16, 27, 90, 91.
Capella delicata. See *C. gallinago*.
gallinago, 140.
Caprimulgus carolinensis, 15, 21, 24, 25, 183, 183.
vociferus, 7, 21, 29, 35, 184.
 Cardinal, 17, 22, 28, 34, 35, 329, 333.
Carpodacus purpureus, 15, 35, 195, 341, 342.
Casmerodius albus, 22, 55.
Cassidix mexicanus, 15, 17, 22, 24, 318, 326.
 Catbird, 7, 17, 22, 29, 34, 240.
Cathartes aura, 17, 21, 24, 28, 35, 104.
Catoptrophorus semipalmatus, 16, 22, 142, 145.
Centurus carolinus, 21, 29, 35, 192.
Ceophloeus pileatus. See *Dryocopus pileatus*.
Cephus grylle, 172.
Certhia familiaris, 230.
Chaetura pelagica, 21, 28, 35, 186, 186.
Charadrius hiaticula. See *C. semipalmatus*.
melodus, 12, 22, 135.
semipalmatus, 134.
vociferus, 22, 29, 35, 136.
wilsonia, 12, 23, 24, 135.
Charitonetta. See *Bucephala*.
 Chat, Yellow-breasted, 22, 29, 34, 35, 310, 329.
Chen caerulescens, 69.
hyperborea, 16, 68.
 Chickadee, Black-capped, 17, 29, 32, 34, 222, 223.
 Boreal, 225.
 Carolina, 17, 22, 29, 223, 224, 329.
Chlidonias niger, 169.
Chondestes grammacus, 357.
Chordeiles minor, 7, 22, 29, 35, 185.
 Chuck-will's-widow, 15, 21, 24, 25, 183, 183.
Circus cyaneus, 22, 24, 35, 116, 117.
hudsonius. See *C. cyaneus*.
Cistothorus platensis, 17, 22, 24, 29, 35, 236, 237.
stellaris. See *C. platensis*.
Clangula hyemalis, 97.
Coccyzus americanus, 21, 29, 35, 176.
erythrophthalmus, 23, 29, 35, 177, 329.
Colaptes auratus, 7, 22, 29, 34, 190.
Colinus virginianus, 7, 21, 29, 35, 125.
Columba livia, 388.
Columbigallina passerina, 175.
Colymbus. See *Podiceps*.
Compsothlypis americana. See *Parula americana*.
Contopus virens, 21, 28, 35, 206.
Conuropsis carolinensis, 37, 175.
 Coot, American, 15, 132.
Coragyps atratus, 21, 26, 27, 29, 31, 106, 106.
 Cormorant, Double-crested, 16, 50.
 European. See Cormorant, Great.
 Great, 50.
 Corn Crane, 131.
Corthylio calendula. See *Regulus calendula*.
Corvus brachyrhynchos, 17, 22, 28, 31, 34, 220.
corax, 35, 218.
ossifragus, 22, 29, 221, 222.
Coturnicops noveboracensis, 130.
Coturnix coturnix, 388.
 Cowbird, Brown-headed, 17, 22, 28, 29, 35, 328.
 Crane, Corn, 131.
 Crane, Sandhill, 388.
Creciscus jamaicensis. See *Laterallus jamaicensis*.
 Creeper, Brown, 230.
Crex crex, 131.
Crocethia alba, 16, 154.

- Crossbill, Red, 346.
White-winged, 347.
- Crow, Common, 17, 22, 28, 31, 34, 220.
Fish, 22, 29, 221, 222.
- Cryptoglaux acadica*. See *Aegolius acadicus*.
- Cuckoo, Black-billed, 23, 29, 35, 177, 329.
Yellow-billed, 21, 29, 35, 176.
- Curlew, Eskimo, 37, 141.
Hudsonian. See Whimbrel.
Long-billed, 141.
- Cyanocitta cristata*, 7, 22, 29, 35, 217, 219.
- Cygnus columbianus*. See *Olor columbianus*.
olor, 64.
- D**
- Dendrocopos borealis*, 15, 23, 24, 37, 197.
pubescens, 17, 21, 28, 35, 196.
villosus, 22, 29, 35, 196.
- Dendroica aestiva*. See *D. ptechia*.
caerulescens, 34, 195, 285.
castanea, 36, 294.
cerulea, 29, 31, 32, 35, 289, 289.
coronata, 7, 24, 286.
discolor, 22, 27, 29, 298, 298, 329.
dominica, 22, 26, 291, 292, 329.
fusca, 29, 32, 35, 36, 290, 291, 329.
magnolia, 34, 36, 195, 283, 329.
palmarum, 17, 24, 299.
pensylvanica, 29, 31, 32, 35, 293, 293.
ptechia, 22, 29, 35, 282, 329.
pinus, 12, 22, 29, 296, 296, 329.
striata, 295.
tigrina, 284.
virens, 29, 32, 35, 287, 287.
- Dickcissel, 29, 31, 338.
- Dolichonyx oryzivorus*, 16, 26, 29, 35, 318, 318.
- Dove, Ground, 175.
Mourning, 13, 21, 28, 35, 172, 174.
Rock, 388.
- Dovekie, 172.
- Dowitcher, Eastern. See Dowitcher.
Short-billed.
Long-billed, 151.
Short-billed, 150.
- Dryobates*. See *Dendrocopos*.
- Dryocopus pileatus*, 21, 29, 35, 191, 191.
- Duck, Black, 13, 16, 21, 29, 60, 72, 73.
Harlequin, 37, 98.
Labrador, 98.
Masked, 102.
Ring-necked, 88, 89.
Ruddy, 16, 100.
Wood, 7, 21, 29, 35, 85, 86.
- Dumetella carolinensis*, 7, 17, 22, 29, 34, 240.
- Dunlin, 150.
- E**
- Eagle, Bald, vi, 1, 22, 29, 115.
Golden, 115.
- Ectopistes migratorius*, 7, 37, 173.
- Egret, American. See Egret, Common.
Cattle, 37, 55, 389.
Common, 22, 55.
Snowy, 22, 56.
- Eider, American. See Eider, Common.
Common, 98.
King, 98.
- Elanoides forficatus*, 107.
- Empidonax flaviventris*, 36, 202.
minimus, 23, 29, 32, 35, 36, 205, 205, 329.
trillii, 29, 31, 36, 183, 204.
virescens, 12, 21, 29, 35, 203, 329.
- Eremophila alpestris*, 7, 22, 29, 35, 208.
- Ereunetes mauri*, 16, 153.
pusillus, 7, 152.
- Erolia alpina*, 150.
bairdii, 149.
fuscicollis, 148.
maritima, 17, 24, 147.
melanotos, 148.
minutilla, 149.
- Euphagus carolinus*, 324.
cyaanocephalus, 37, 325.
- F**
- Falco columbarius*, 121.
peregrinus, 29, 119, 120.
sparverius, 22, 29, 35, 122, 123.
- Falcon, Peregrine, 29, 119, 120.
- Finch, Purple, 15, 35, 195, 341, 342.
- Flicker, Yellow-shafted, 7, 22, 29, 34, 190.
- Florida caerulea*, 22, 54.

- Flycatcher, Acadian, 12, 21, 29, 35, 203, 329.
 Alder. See Flycatcher, Traill's.
 Ash-throated, 201, 389.
 Crested. See Flycatcher, Great Crested.
 Great Crested, 13, 21, 29, 35, 199, 329.
 Least, 23, 29, 32, 35, 36, 205, 205, 329.
 Olive-sided, 36, 208.
 Scissor-tailed, 199.
 Traill's, 29, 31, 36, 183, 204.
 Yellow-bellied, 36, 202.
- Fulica americana*, 15, 132.
- G**
- Gadwall, 22, 24, 74.
Gallinula chloropus, 22, 132.
 Gallinule, Common, 22, 132.
 Florida. See Gallinule, Common.
 Purple, 131.
 Gannet, 16, 49.
Gavia immer, 16, 42.
stellata, 16, 43.
Gelochelidon nilotica, 22, 24, 162.
Geothlypis trichas, 7, 13, 22, 29, 35, 308, 329.
Glauconetta. See *Bucephala*.
 Gnatcatcher, Blue-gray, 22, 29, 253, 253, 329.
 Godwit, Hudsonian, 153.
 Marbled, 153.
 Goldeneye, American. See Goldeneye, Common.
 Barrow's, 95.
 Common, 94.
 Goldfinch, American, 7, 22, 28, 35, 329, 345.
 Eastern. See Goldfinch, American.
 Goose, Barnacle, 68.
 Blue, 69.
 Canada, 7, 13, 16, 27, 65, 66.
 Egyptian, 388.
 Snow, 16, 68.
 White-fronted, 68.
 Goshawk, 108.
 Grackle, Boat-tailed, 15, 17, 22, 24, 318, 326.
 Bronzed. See Grackle, Common.
 Common, 4, 7, 17, 22, 27, 28, 35, 326, 328.
 Purple. See Grackle, Common.
 Grebe, Holboell's. See Grebe, Red-necked.
 Horned, 16, 44.
 Pied-billed, 22, 45.
 Red-necked, 44.
 Grosbeak, Blue, 22, 26, 27, 29, 31, 329, 335, 336.
 Evening, 17, 340.
 Pine, 37, 343.
 Rose-breasted, 35, 36, 40, 314, 334.
 Grouse, Ruffed, 12, 29, 32, 34, 79, 124.
Grus canadensis, 388.
 Guillemot, Black, 172.
Guiraca caerulea, 22, 26, 27, 29, 31, 329, 335, 336.
 Gull, Bonaparte's, 161.
 Glaucous, 37, 156.
 Great Black-backed, 157.
 Herring, 23, 24, 158.
 Iceland, 37, 157.
 Ivory, 388.
 Laughing, 23, 159.
 Lesser Black-backed, 157.
 Ring-billed, 16, 158.
- H**
- Haematopus palliatus*, 12, 24, 37, 134.
Haliaeetus leucocephalus, vi, 1, 22, 29, 115.
 Hawk, Broad-winged, 22, 29, 35, 113.
 Cooper's, 22, 29, 35, 109.
 Duck, See Falcon, Peregrine.
 Marsh, 22, 24, 35, 116, 117.
 Pigeon, 121.
 Red-shouldered, 21, 29, 35, 112.
 Red-tailed, 22, 29, 35, 110.
 Rough-legged, 17, 114.
 Sharp-shinned, 7, 29, 35, 108.
 Sparrow, 22, 29, 35, 122, 123.
 Heath Hen. See Prairie Chicken, Greater.
Hedymeles ludovicianus. See *Pheucticus ludovicianus*.
Helminthos vermivorus, 22, 29, 273, 274, 329.

- Heron, Black-crowned Night, 22, 52, 58.
 Great Blue, 22, 51, 52.
 Green, 21, 29, 35, 53.
 Little Blue, 22, 54.
 Louisiana, 15, 22, 57.
 Yellow-crowned Night, 22, 59.
- Hesperiphona vespertina*, 17, 340.
Hirundo erythrogaster. See *H. rustica*.
rustica, 7, 21, 28, 34, 214, 329.
Histrionicus histrionicus, 37, 98.
 Hummingbird, Ruby-throated, 7, 22, 29, 35, 187.
 Rufous, 189.
Hydranassa tricolor, 15, 22, 57.
Hydroprogne caspia, 168.
Hylocichla fuscescens, 29, 31, 34, 250, 250, 329.
guttata, 15, 35, 230, 247.
minima, 249.
mustelina, 12, 22, 28, 34, 245, 329.
ustulata, 248.
- I**
- Ibis, Glossy, 22, 63.
 Wood, 63.
Icteria virens, 22, 29, 34, 35, 310, 329.
Icterus bullockii, 324.
galbula, 7, 23, 26, 29, 35, 323.
spurius, 7, 22, 29, 322, 329.
Ionornis martinica. See *Porphyryla martinica*.
Iridoprocne bicolor, 16, 22, 24, 35, 209, 210.
Ixobrychus exilis, 21, 60, 60.
- J**
- Jaeger, Long-tailed, 156.
 Parasitic, 156.
 Pomarine, 156.
 Jay, Blue, 7, 22, 29, 35, 217, 219.
Junco hyemalis, 17, 35, 195, 359, 360.
oreganus, 361.
 Junco, Oregon, 361.
 Slate-colored, 17, 35, 195, 359, 360.
- K**
- Killdeer, 22, 29, 35, 136.
 Kingbird, Arkansas. See Kingbird, Western.
 Eastern, 21, 28, 35, 198, 329.
 Western, 199.
- Kingfisher, Belted, 22, 29, 35, 189.
 Kinglet, Golden-crowned, 17, 34, 35, 253, 254.
 Ruby-crowned, 255.
 Kite, Swallow-tailed, 107.
 Kittiwake, Black-legged, 161, 389.
 Knot, 16, 147, 389.
- L**
- Lanius borealis*. See *L. excubitor*.
excubitor, 258.
ludovicianus, 7, 22, 26, 29, 259.
 Lark, Horned, 7, 22, 29, 35, 208.
Larus argentatus, 23, 24, 158.
atricilla, 23, 159.
delawarensis, 16, 158.
fuscus, 157.
glaucoides, 37, 157.
hyperboreus, 37, 156.
leucopterus. See *L. glaucoides*.
marinus, 157.
philadelphia, 161.
Laterallus jamaicensis, 22, 130.
Leucophoyx thula, 22, 56.
Limnodromus griseus, 150.
scolopaceus, 151.
Limnothlypis swainsonii, 22, 24, 272, 273.
Limosa fedoa, 153.
haemastica, 153.
Lobipes lobatus, 155.
 Longspur, Chestnut-collared, 374.
 Lapland, 37, 373.
 Loon, Common, 16, 42.
 Red-throated, 16, 43.
Lophodytes cucullatus, 35, 102.
Loxia curvirostra, 346.
leucoptera, 347.
- M**
- Magpie, American. See Magpie, Black-billed.
 Black-billed, 218.
 Mallard, 13, 22, 29, 35, 69, 71.
Mareca americana. 16, 82, 83.
penelope, 81.
 Martin, Purple, 16, 22, 29, 35, 216.
 Meadowlark, Eastern, 7, 17, 22, 28, 35, 319.
Megasceryle alcyon, 22, 29, 35, 189.
Melanerpes erythrocephalus, 23, 29, 35, 193.

- Melanitta deglandi*, 99.
fusca. See *M. deglandi*.
perspicillata, 99.
- Meleagris gallopavo*, 12, 29, 32, 35, 126.
- Melospiza georgiana*, 23, 24, 35, 369, 370.
lincolni, 369.
melodia, 13, 22, 28, 35, 329, 371, 372.
- Merganser, American. See Merganser, Common.
 Common, 103.
 Hooded, 35, 102.
 Red-breasted, 16, 104.
- Mergus merganser*, 103.
serrator, 16, 104.
- Micropalama himantopus*, 151.
- Mimus polyglottos*, 7, 13, 22, 29, 238, 329.
- Mniotilta varia*, 22, 27, 28, 35, 40, 269, 329.
- Mockingbird, 7, 13, 22, 29, 238, 329.
- Molothrus ater*, 17, 22, 28, 29, 35, 328.
- Morus bassanus*, 16, 49.
- Murre, Brünnich's. See Murre, Thick-billed.
 Thick-billed, 171.
- Muscivora forficata*, 199.
- Mycteria americana*, 63.
- Myiarchus crinitus*, 13, 21, 29, 35, 199, 329.
cinerascens, 201, 389.
- Myiochanes virens*. See *Contopus virens*.
- N**
- Nannus hiemalis*. See *Troglodytes troglodytes*.
- Nighthawk, Common, 7, 22, 29, 35, 185.
- Nomonyx dominicus*. See *Oxyura dominica*.
- Numenius americanus*, 141.
borealis, 37, 141.
phaeopus, 141.
- Nuthatch, Brown-headed, 15, 17, 22, 24, 25, 229, 230.
 Red-breasted, 228.
 White-breasted, 22, 26, 29, 35, 227, 227.
- Nuttallornis borealis*, 36, 208.
mesoleucus. See *N. borealis*.
- Nyctanassa violacea*, 22, 59.
- Nyctea nyctea*. See *N. scandiaca*.
scandiaca, 7, 180.
- Nycticorax nycticorax*, 22, 52, 58.
- Nyroca*. See *Aythya*.
- O**
- Oceanites oceanicus*, 48.
- Oceanodroma castro*, 48.
leucorhoa, 47.
- Oidemia nigra*, 100.
- Oldsquaw, 97.
- Olor columbianus*, 15, 16, 27, 64.
- Oporornis agilis*, 306.
formosus, 22, 27, 29, 35, 304, 305, 329.
philadelphia, 15, 34, 35, 36, 305, 307.
- Oriole, Baltimore, 7, 23, 26, 29, 35, 323.
 Bullock's, 324.
 Orchard, 7, 22, 29, 322, 329.
- Osprey, 16, 21, 60, 118.
- Otocoris alpestris*. See *Eremophila alpestris*.
- Otus asio*, 22, 29, 35, 179.
- Ovenbird, 22, 27, 28, 35, 301, 329.
- Owl, Barn, 22, 29, 178.
 Barred, 21, 29, 35, 180.
 Great Horned, 7, 21, 29, 35, 179.
 Horned. See Owl, Great Horned.
 Long-eared, 181.
 Saw-whet, 15, 34, 35, 128, 182.
 Screech, 22, 29, 35, 179.
 Short-eared, 181.
 Snowy, 7, 180.
- Oxyechus vociferus*. See *Charadrius vociferus*.
- Oxyura dominica*, 102.
jamaicensis, 16, 100.
- Oystercatcher, American, 12, 24, 37, 134.
- P**
- Pagolla wilsonia*. See *Charadrius wilsonia*.
- Pagophila eburnea*, 388.
- Pandion haliaetus*, 16, 21, 60, 118.
- Parakeet, Carolina, 37, 175.
- Parula americana*, 22, 29, 35, 280, 329.

- Parus atricapillus*, 17, 29, 32, 34, 222, 223.
bicolor, 17, 22, 29, 34, 35, 225.
carolinensis, 17, 22, 29, 223, 224, 329.
hudsonicus, 225.
Passer domesticus, 22, 28, 35, 37, 317.
Passerculus princeps, 24, 349.
sandwichensis, 23, 29, 31, 35, 350, 350.
Passerella iliaca, 7, 368.
Passerherbulus henslowii, 22, 29, 35, 329, 353.
Passerina cyanea, 7, 13, 22, 28, 35, 329, 337.
Pelecanus erythrorhynchos, 48, 389.
occidentalis, 49.
Pelican, Brown, 49.
White, 48, 389.
Pelidna alpina. See *Erolia alpina*.
Penthestes. See *Parus*.
Petrel, Harcourt's, 48.
Leach's, 47.
Madeira. See Petrel, Harcourt's.
Wilson's, 48.
Petrochelidon albifrons. See *P. pyrrhonota*.
pyrrhonota, 16, 29, 32, 34, 36, 40, 212, 215.
Pewee, Eastern Wood, 21, 28, 35, 206.
Phaeopus borealis. See *Numenius borealis*.
HUDSONICUS. See *Numenius phaeopus*.
Phalacrocorax auritus, 16, 50.
carbo, 50.
Phalarope, Northern, 155.
Red, 155.
Wilson's, 155.
Phalaropus fulicarius, 155.
Phasianus colchicus, 37, 125.
Pheasant, Ring-necked, 37, 125.
Phaethicus ludovicianus, 35, 36, 40, 314, 334.
Philohela minor, 22, 29, 35, 139.
Philomachus pugnax, 154, 389.
Phoebe, Eastern, 17, 22, 29, 35, 201, 329.
Pica pica, 218.
Pigeon, Passenger, 7, 37, 173.
Pinicola enucleator, 37, 343.
Pintail, 13, 75, 76.
Pipilo erythrophthalmus, 22, 28, 35, 36, 329, 348.
Pipit, American. See Pipit, Water.
Water, 17, 31, 256.
Piranga erythromelas. See *P. olivacea*.
olivacea, 22, 28, 35, 329, 330.
rubra, 22, 26, 29, 31, 329, 332.
Pisobia. See *Erolia*.
Plautus alle, 172.
Plectrophenax nivalis, 17, 24, 374.
Plegadis falcinellus, 22, 63.
Plover, American Golden, 137.
Black-bellied, 137.
Golden. See Plover, American Golden.
Piping, 12, 22, 135.
Semipalmated, 134.
Upland, 29, 31, 35, 141, 142.
Wilson's 12, 23, 24, 135.
Pluvialis dominica, 137.
Podiceps auritus, 16, 44.
grisegena, 44.
Podilymbus podiceps, 22, 45.
Polioptila caerulea, 22, 29, 253, 253, 329.
Poocetes gramineus, 17, 22, 24, 28, 35, 356.
Porphyryla maritima, 131.
Porzana carolina, 16, 22, 26, 129.
Prairie Chicken, Greater, 37, 124.
Progne subis, 16, 22, 29, 35, 216.
Protonotaria citrea, 22, 29, 271, 271, 329.
Puffinus diomedea, 47.
gravis, 37, 47.
griseus, 388.
therminieri, 47.
Purple Finch, 15, 35, 195, 341, 342.
- Q**
- Quail, European, 388.
Querquedula. See *Anas*.
Quiscalus quiscula, 4, 7, 17, 22, 27, 28, 35, 326, 328.
- R**
- Rail, Black, 22, 130.
Clapper, 22, 24, 127, 128.
King, 22, 29, 126, 127.
Virginia, 7, 21, 29, 35, 127, 128.
Yellow, 130.

- Rallus elegans*, 22, 29, 126, 127.
limicola, 7, 21, 29, 35, 127, 128.
longirostris, 22, 24, 127, 128.
 Raven, Common, 35, 218.
 Razorbill, 171.
Recurvirostra americana, 37, 154.
 Redhead, 7, 87, 88.
 Redpoll, Common, 343.
 Hoary, 343.
 Redstart, American, 22, 27, 28, 35, 311, 315, 329.
 Redwing, Eastern. See Blackbird, Redwinged.
Regulus calendula, 255.
 satrapa, 17, 34, 35, 253, 254.
Richmondia cardinalis, 17, 22, 28, 34, 35, 329, 333.
Riparia riparia, 22, 29, 211, 212.
Rissa tridactyla, 161, 389.
 Robin, 7, 12, 22, 28, 34, 243, 244, 329.
 Ruddy Duck, 16, 100.
 Ruff, 154, 389.
 Ruffed Grouse, 12, 29, 32, 34, 79, 124.
Rynchops nigra, 21, 24, 170.
- S**
- Sanderling, 16, 154.
 Sandpiper, Baird's, 149.
 Buff-breasted, 37, 389.
 Least, 149.
 Pectoral, 148.
 Purple, 17, 24, 147.
 Red-backed. See Dunlin.
 Semipalmated, 7, 152.
 Solitary, 144.
 Spotted, 22, 35, 143.
 Stilt, 151.
 Western, 16, 153.
 White-rumped, 148.
 Sapsucker, Yellow-bellied, 35, 194, 195.
Sayornis phoebe, 17, 22, 29, 35, 201, 329.
 Scaup, Greater, 16, 92, 94.
 Lesser, 16, 92, 93.
 Scoter, American. See Scoter, Common.
 Common, 100.
 Surf, 99.
 White-winged, 99.
Sciurus aurocapillus, 22, 27, 28, 35, 301, 329.
 motacilla, 22, 29, 35, 303, 329.
 noveboracensis, 15, 35, 195, 302.
Selasphorus rufus, 189.
Setophaga ruticilla, 22, 27, 28, 35, 311, 315, 329.
 Shearwater, Audubon's, 47.
 Cory's, 47.
 Greater, 37, 47.
 Sooty, 388.
 Shoveler, 84.
 Shrike, Loggerhead, 7, 22, 26, 29, 259.
 Migrant. See Shrike, Loggerhead.
 Northern, 258.
Sialia sialis, 7, 22, 29, 35, 251, 329.
 Siskin, Pine, 344.
Sitta canadensis, 228.
 carolinensis, 22, 26, 29, 35, 227, 227.
 pusilla, 15, 17, 22, 24, 25, 229, 230.
 Skimmer, Black, 21, 24, 170.
 Snipe, Common, 140.
 Wilson's. See Snipe, Common.
Somateria mollissima, 98.
 spectabilis, 98.
 Sora, 16, 22, 26, 129.
 Sparrow, Bachman's 23, 29, 33, 358, 389.
 Chipping, 12, 17, 22, 24, 28, 35, 329, 362.
 English. See Sparrow, House.
 Field, 13, 22, 28, 35, 329, 363.
 Fox, 7, 368.
 Grasshopper, 22, 28, 35, 352.
 Harris', 365, 390.
 Henslow's, 22, 29, 35, 329, 353.
 House, 22, 28, 35, 37, 317.
 Ipswich, 24, 349.
 Lark, 357.
 Lincoln's, 369.
 Savannah, 23, 29, 31, 35, 350, 350.
 Seaside, 22, 24, 354, 355.
 Sharp-tailed, 22, 24, 353, 354.
 Song, 13, 22, 28, 35, 329, 371, 372.
 Swamp, 23, 24, 35, 369, 370.
 Tree, 17, 361.
 Vesper, 17, 22, 24, 28, 35, 356.
 White-crowned, 17, 31, 365.
 White-throated, 36, 366, 367.
Spatula clypeata, 84.
Sphyrapicus varius, 35, 194, 195.

- Spinus pinus*, 344.
tristis, 7, 22, 28, 35, 329, 345.
- Spiza americana*, 29, 31, 338.
- Spizella arborea*, 17, 361.
passerina, 12, 17, 22, 24, 28, 35, 329, 362.
pusilla, 13, 22, 28, 35, 329, 363.
- Squatrola squatarola*, 137.
- Starling, 12, 22, 28, 37, 260, 329.
- Steganopus tricolor*, 155.
- Stelgidopteryx ruficollis*, 22, 29, 35, 213.
- Stercorarius longicaudus*, 156.
parasiticus, 156.
pomarinus, 156.
- Sterna albifrons*, 21, 166, 166.
antillarum. See *S. albifrons*.
dougallii, 23, 165.
forsteri, 22, 24, 162.
fuscata, 166.
hirundo, 21, 164, 165, 389.
- Strix varia*, 21, 29, 35, 180.
- Sturnella magna*, 7, 17, 22, 28, 35, 319.
- Sturnus vulgaris*, 12, 22, 28, 37, 260, 329.
- Swallow, Bank, 22, 29, 211, 212.
 Barn, 7, 21, 28, 34, 214, 329.
 Cliff, 16, 29, 32, 34, 36, 40, 212, 215.
 Rough-winged, 22, 29, 35, 213.
 Tree, 16, 22, 24, 35, 209, 210.
- Swan, Mute, 64.
 Whistling, 15, 16, 27, 64.
- Swift, Chimney, 21, 28, 35, 186, 186.
- T**
- Tanager, Scarlet, 22, 28, 35, 329, 330.
 Summer, 22, 26, 29, 31, 329, 332.
- Teal, Blue-winged, 22, 24, 79, 79, 80.
 Cinnamon, 81.
 Common, 37, 77.
 European. See Teal, Common.
 Green-winged, 77, 78.
- Telmatodytes palustris*, 22, 60, 235.
- Tern, Black, 169.
 Caspian, 168.
 Common, 21, 164, 165, 389.
 Forster's, 22, 24, 162.
 Gull-billed, 22, 24, 162.
 Least, 21, 166, 166.
 Roseate, 23, 165.
 Royal, 15, 23, 24, 167.
- Sandwich, 168.
 Sooty, 166.
- Thalasseus maximus*, 15, 23, 24, 167.
sandvicensis, 168.
- Thrasher, Brown, 17, 22, 29, 34, 241.
- Thrush, Gray-cheeked, 249.
 Hermit, 15, 35, 230, 247.
 Olive-backed. See Thrush, Swainson's.
 Swainson's, 248.
 Wood, 12, 22, 28, 34, 245, 329.
- Thryomanes bewickii*, 29, 32, 35, 233, 234.
- Thryothorus ludovicianus*, 17, 22, 29, 35, 235, 329.
- Titmouse, Tufted, 17, 22, 29, 34, 35, 225.
- Totanus flavipes*, 146.
melanoleucus, 145.
- Towhee, Red-eyed. See Towhee, Rufous-sided.
 Rufous-sided, 22, 28, 35, 36, 329, 348.
- Toxostoma rufum*, 17, 22, 29, 34, 241.
- Tringa solitaria*, 144.
- Troglodytes aedon*, 22, 24, 28, 34, 231.
troglodytes, 232.
- Tryngites subruficollis*, 37, 389.
- Turdus migratorius*, 7, 12, 22, 28, 34, 243, 244, 329.
- Turkey, 12, 29, 32, 35, 126.
- Turnstone, Ruddy, 138.
- Tympanuchus cupido*, 37, 124.
- Tyrannus tyrannus*, 21, 28, 35, 198, 329.
verticalis, 199.
- Tyto alba*, 22, 29, 178.
- U**
- Upland Plover, 29, 31, 35, 141, 142.
- Uria lomvia*, 171.
- V**
- Veery, 29, 31, 34, 250, 250, 329.
- Vermivora celata*, 279.
chrysoptera, 29, 32, 35, 275, 275.
lawrencei, 278.
leucobronchialis, 277.
peregrina, 36, 278.
pinus, 29, 31, 32, 275, 276, 329.
ruficapilla, 15, 34, 35, 36, 273, 279.

- Vireo flavifrons*, 22, 29, 35, 263.
gilvus, 22, 26, 29, 35, 268, 268.
griseus, 22, 29, 262, 329.
olivaceus, 12, 22, 28, 34, 265, 329.
philadelphicus, 36, 267.
solitarius, 35, 195, 264, 329.
- Vireo, Blue-headed. See Vireo, Solitary.
- Philadelphia, 36, 267.
 Red-eyed, 12, 22, 28, 34, 265, 329.
 Solitary, 35, 195, 264, 329.
 Warbling, 22, 26, 29, 35, 268, 268.
 White-eyed, 22, 29, 262, 329.
 Yellow-throated, 22, 29, 35, 263.
- Vulture, Black, 21, 26, 27, 29, 31, 106, 106.
 Turkey, 17, 21, 24, 28, 35, 104.
- W**
- Warbler, Bay-breasted, 36, 294.
 Black-and-white, 22, 27, 28, 35, 40, 269, 329.
 Blackburnian, 29, 32, 35, 36, 290, 291, 329.
 Blackpoll, 295.
 Black-throated Blue, 34, 195, 285.
 Black-throated Green, 29, 32, 35, 287, 287.
 Blue-winged, 29, 31, 32, 275, 276, 329.
 Brewster's, 277.
 Canada, 35, 314, 314.
 Cape May, 284.
 Cerulean, 29, 31, 32, 35, 289, 289.
 Chestnut-sided, 29, 31, 32, 35, 293, 293.
 Connecticut, 306.
 Golden-winged, 29, 32, 35, 275, 275.
 Golden-winged X Blue-winged hybrids, 277.
 Hooded, 12, 22, 27, 28, 34, 35, 311, 311, 329.
 Kentucky, 22, 27, 29, 35, 304, 305, 329.
 Lawrence's, 278.
 Magnolia, 34, 36, 195, 283, 329.
 Mourning, 15, 34, 35, 36, 305, 307.
 Myrtle, 7, 24, 286.
 Nashville, 15, 34, 35, 36, 273, 279.
 Orange-crowned, 279.
 Palm, 17, 24, 299.
- Parula, 22, 29, 35, 280, 329.
 Pine, 12, 22, 29, 296, 296, 329.
 Prairie, 22, 27, 29, 298, 298, 329.
 Prothonotary, 22, 29, 271, 271, 329.
 Swainson's, 22, 24, 272, 273.
 Tennessee, 36, 278.
 Wilson's, 36, 313, 389.
 Worm-eating, 22, 29, 273, 274, 329.
 Yellow, 22, 29, 35, 282, 329.
 Yellow-throated, 22, 26, 291, 292, 329.
- Waterthrush, Louisiana, 22, 29, 35, 303, 329.
 Northern, 15, 35, 195, 302.
- Water-turkey. See Anhinga.
- Waxwing, Cedar, 23, 29, 34, 257.
 Whimbrel, 141.
 Whip-poor-will, 7, 21, 29, 35, 184.
 Widgeon, American, 16, 82, 83.
 European, 81.
 Willet, 16, 22, 142, 145.
Wilsonia canadensis, 35, 314, 314.
citrina, 12, 22, 27, 28, 34, 35, 311, 311, 329.
pusilla, 36, 313, 389.
- Woodcock, American, 22, 29, 35, 139.
 Woodpecker, Downy, 17, 21, 28, 35, 196.
 Hairy, 22, 29, 35, 196.
 Ivory-billed, 198.
 Pileated, 21, 29, 35, 191, 191.
 Red-bellied, 21, 29, 35, 192.
 Red-cockaded, 15, 23, 24, 37, 197.
 Red-headed, 23, 29, 35, 193.
- Wood Pewee, Eastern, 21, 28, 35, 206.
- Wren, Bewick's, 29, 32, 35, 233, 234.
 Carolina, 17, 22, 29, 35, 235, 329.
 House, 22, 24, 28, 34, 231.
 Long-billed Marsh, 22, 60, 235.
 Short-billed Marsh, 17, 22, 24, 29, 35, 236, 237.
 Winter, 232.
- X**
- Xanthocephalus xanthocephalus*, 320.
- Y**
- Yellowlegs, Greater, 145.
 Lesser, 146.
 Yellowthroat, 7, 13, 22, 29, 35, 308, 329.

Z

- Zenaidura macroura*, 13, 21, 28, 35,
172, 174.
- Zonotrichia albicollis*, 36, 366, 367.
leucophrys, 17, 31, 365.
querula, 365, 390.



