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THE REPTILES OF ONTARIO

by

E. B. S. LOGIER

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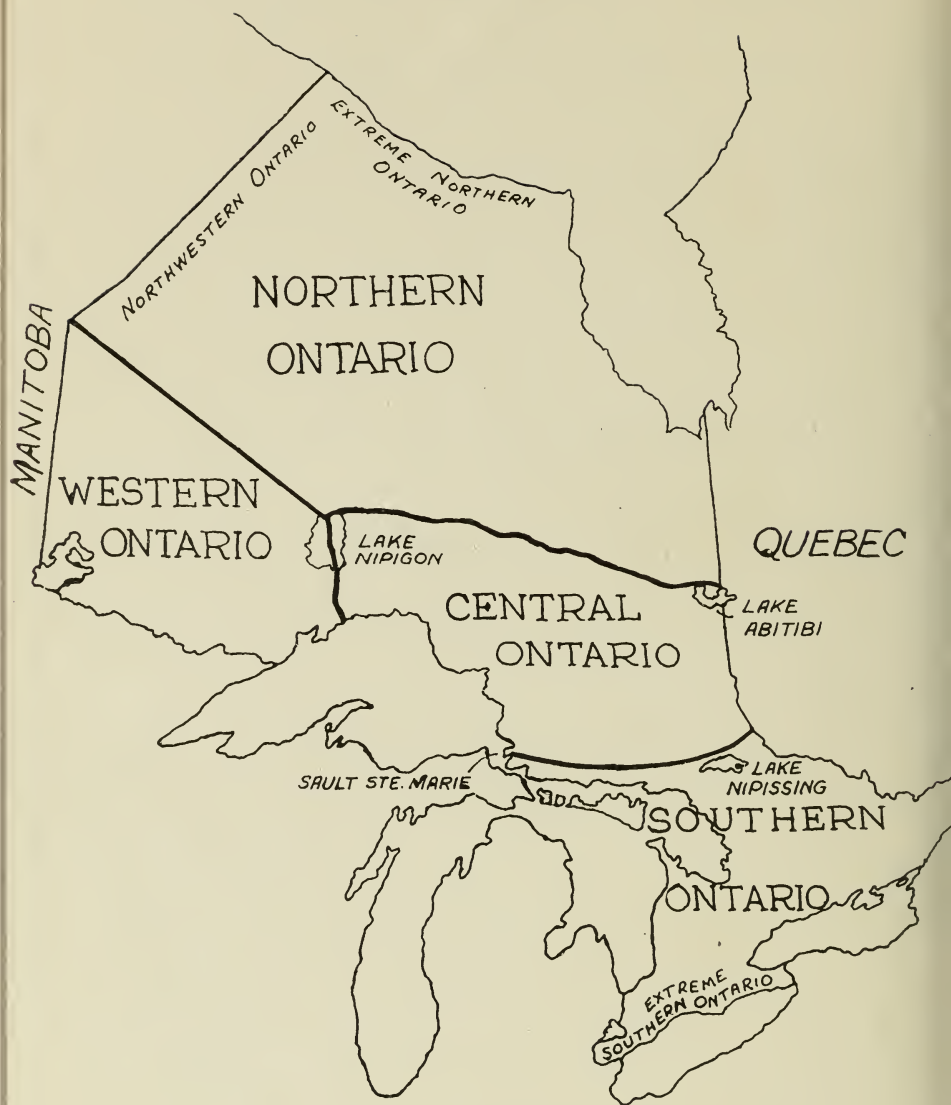
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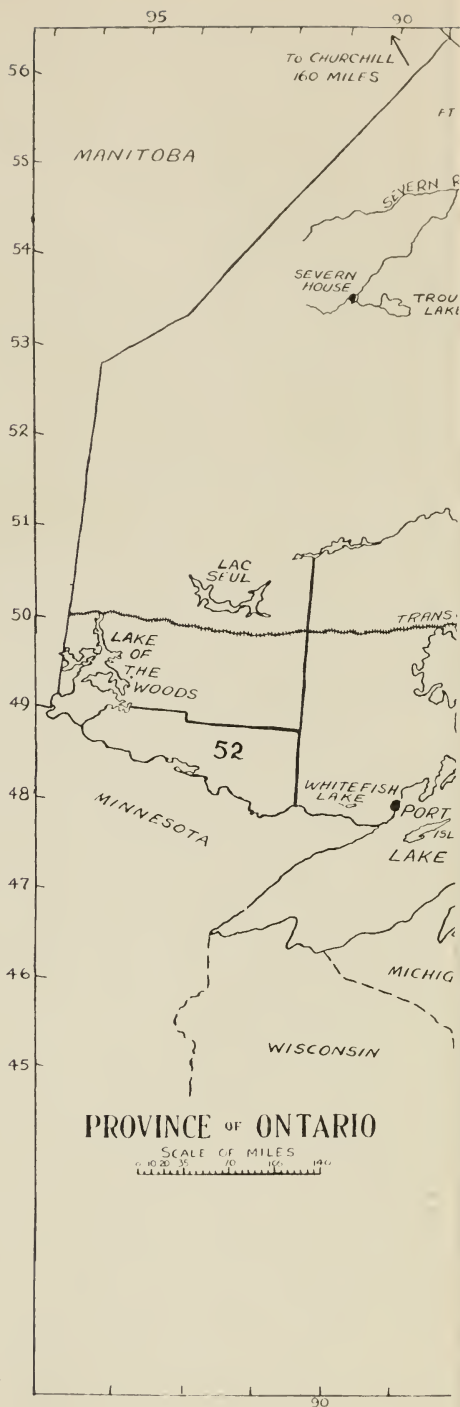
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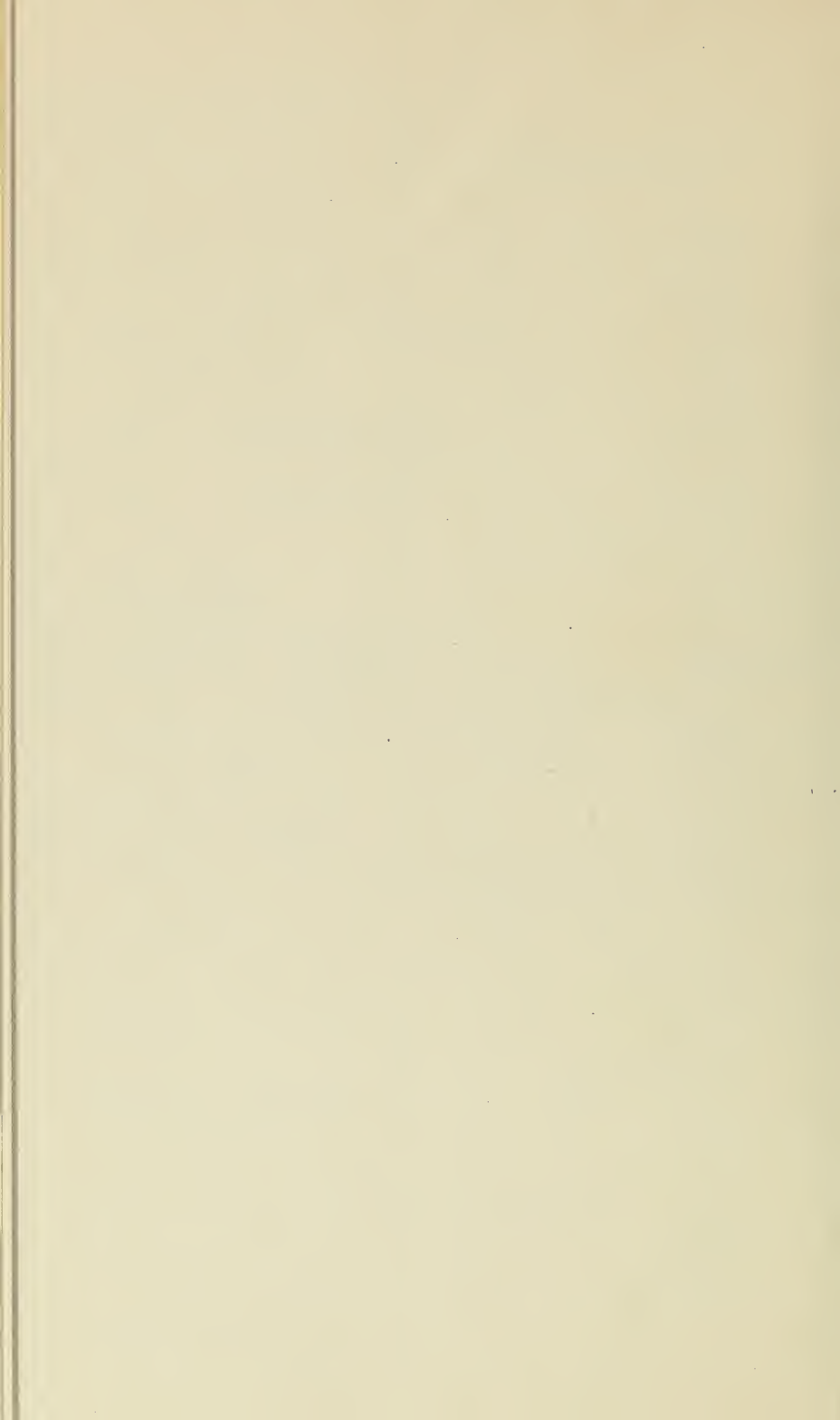


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LAKE ERIE

The Reptiles of Ontario

FOREWORD

The purpose of the present handbook is mainly to serve as a guide to the reptiles occurring in Ontario rather than as a natural history of them. Special attention has therefore been given to the keys and descriptions to keep them simple and yet comprehensive enough, and the illustrations were prepared with particular reference to the features discussed in them. The introductory account "Concerning reptiles in general" was written to give to those less familiar with the study of reptiles a general idea of the kinds of animals which are included in the term "reptile" and to point out some of the important features of the group. Throughout, the work has been kept as non-technical as is consistent with a reasonable understanding and accurate diagnosis of the forms in question.

INTRODUCTION

CONCERNING REPTILES IN GENERAL

Differences from amphibians. Reptiles are cold-blooded, air-breathing vertebrates (animals with a backbone) and are distinguished from amphibians which are also cold-blooded vertebrates, and mostly air-breathing in adult life, by various structural and physiological features only a few of the most obvious of which will be mentioned, as follow: The skin of a reptile is covered with scales, and dry, since no glandular secretions are discharged upon its surface to keep it moist and slimy; respiration is always by lungs and gills are never present at any stage of life; the young do not pass through a metamorphosis, i.e. there is no larval or tadpole stage, the young being hatched or born with the same general form which they will retain throughout life; the eggs are always laid, or the young born, on land, not in the water as is usually the case with amphibians; the eggs are protected by more or less calcified shells instead of being covered with soft membranous skin as in amphibians.

Meaning of cold-blooded. The term "cold-blooded" as applied to reptiles and amphibians does not mean that the blood is always of a very low temperature, but simply that these animals are not able to maintain a constant body heat as do birds and mammals which are known as "warm-blooded". The body temperature of a reptile rises or falls with, and always approximates fairly closely, the temperature of the surrounding medium of air or water. In hot weather amphibians may keep their bodies a little cooler than the air by evaporation of moisture from the surface of the skin, but this is effective only within a narrow limit and

they will soon die if the heat becomes too great or their skin too dry. Reptiles, on the average, are more tolerant of heat than are amphibians and have no mechanism for keeping their skin moist and thus cooling themselves, but their limit of heat toleration is lower than many people think and most species will die in a few minutes if unable to escape exposure to a really hot sun. For this reason, in hot regions and in hot weather basking is restricted to early morning and late afternoon, and many desert reptiles are active at night. Reptiles become sluggish when the surrounding temperature drops much below the optimum, and so, the great majority of them are restricted to warm climates and those living in temperate regions are forced to hibernate during the winter.

Body form and specialization. The many kinds of lizards which possess a moderately elongated body, four limbs each with five digits (fingers and toes), and a well developed tail, are good examples of the generalized reptilian form, while the snakes and tortoises, and some lizards, have, through specialization (modification, addition or loss of various structures) departed from this original rather salamander-like shape. Such changes or modifications of form as occur are usually associated with changes in habits or ways of life, and are in most cases in the nature of adaptations. This does not mean that we can assign a precise reason to every variation, because the factors effecting it may not be known, but in general the principle holds good and structure is concomitant of function. It was this inherent ability to vary and produce new forms which made it possible for living things to invade and successfully occupy, and meet the conditions of, the many different environments which the surface of the earth presents. The reptiles furnish us with many striking examples of this adaptive radiation.

The external appearance of a turtle or tortoise is characteristic enough to distinguish it at a glance from any other reptile (Plates VII, VIII). The body is enclosed between a pair of bony shields, an upper and a lower, which together form the shell. These shields are usually covered with horny scutes (Fig. 1, Pl. VII, Figs. 8, 9, Pl. VIII), but in some species are covered with leathery skin (Fig. 2, Pl. VII). The jaws are rather beak-like and devoid of teeth but furnished with sharp, horny cutting edges (Figs. 1-7, Pl. VIII). The tongue is thick and non-protrusible. The group contains both aquatic and terrestrial forms and many which lead a sort of amphibious life, frequenting both land and water. In the purely aquatic marine turtles the limbs are modified into paddles with the digits long and concealed within the webbing. In the purely terrestrial species they are cylindrical, the feet fitted for walking with the digits short and stout with thick stubby nails. The great majority of turtles, which inhabit fresh waters and land other than arid regions, are of the inter-

mediate sort with the limbs more or less flattened, the digits longish and webbed, extensively so in the more aquatic forms like our soft-shelled turtle and snapping turtle, and the nails long and sharp.

The lizards, which are numerically the largest group of reptiles, present a bewildering array of sizes, shapes, colours and habits. Most of them may be recognized by their general appearance as being lizards, but some, due to the suppression of limbs, have come to look very much like snakes.

The snakes, popularly believed to be very lowly creatures, are among the most specialized of reptiles. They are an offshoot from the lizards; their greatly elongated bodies and limbless condition, far from being primitive characters, are adaptations to special ways of life. Locomotion is effected by lateral undulations of the body and by the backward and forward movement of the enlarged transverse ventral scales. Each of these "ventrals" is connected with the distal end of a pair of ribs which in turn are movably articulated with the spine. The most outstanding modification of snakes is concerned with the swallowing apparatus (Fig. 5, Pl. 5). The lower jawbones of each side are loosely united in front by an elastic ligament, the suspending bones (quadrates) to which they are hinged behind are loosely connected by another pair of movable bones (squamosals) with the skull, so that they have great freedom of movement. The ribs, as mentioned above, are movably articulated with the vertebral column and the skin is very stretchable. This elastic arrangement of jaws, ribs and skin makes possible the swallowing of whole animals which are of much greater diameter than the snake's head or neck. The tooth-bearing bones of the upper jaw (maxillaries, pterygoids and palatines) are movably articulated with the skull, and like the bones of the lower jaw, those of either side can be moved independently of the other. Swallowing is accomplished by a "walking" movement of the jaws, those of one side being first pushed forward over the prey and then drawn backward while those of the other side are pushed forward. The needle-shaped, backward projecting teeth of each side naturally release their hold and slide over the prey during the forward movement and grip during the backward pull. In this manner the snake literally pulls itself outside of its victim which is forced down the gullet to the stomach by muscular contractions and slight sidewise bendings of the body.

Food and methods of feeding. The food of reptiles varies with different species and groups of species. Among the lizards and tortoises there are species which are vegetarian, others which are carnivorous, and still others which eat both animal and vegetable food. Snakes and crocodiles are strictly carnivorous. Closely associated with the kind of food taken and the method of eating is the structure of the mouth. Teeth are present in

crocodiles, lizards and snakes but are absent in turtles and tortoises, which, instead, have sharp-edged horny coverings to the jaws. Most reptiles do not chew their food but swallow it in chunks or entire, with or without some preliminary crushing, and possess simple conical or needle-shaped teeth. Among the lizards where there is most diversity in diet and manner of eating the teeth may be of the simple conical type or diversified into cutters and grinders.

Killing of prey by snakes. In general, three distinct methods are used by snakes in overpowering their prey: (1) that of seizing a small animal and swallowing it while alive, which is the most common and primitive method; (2) killing by constriction in coils of the body and swallowing after struggling has ceased; (3) poisoning with venom injected by means of enlarged fangs connected by ducts with special poison glands. The snakes which use this latter method are generally dangerous since they also use their fangs and venom in self defence.

Venom apparatus of snakes. In venomous snakes certain of the teeth of the upper jaw are enlarged into fangs and are either grooved along the exterior face or caniculated, i.e. with the lips of the groove closed together to form a canal which opens near the point of the tooth (Fig. 4, Pl. 5). The duct from the venom gland connects at the base of the tooth with the upper end of the groove or canal. In the Elapidae, the family to which the cobras and coral snakes belong, the fangs are short and rigid, of the grooved type, and inserted near the front of the jaw. In the Viperidae, to which most of the Old World vipers belong, and the Crotalidae, to which the rattlesnakes and moccasins belong, the fangs are long and of the caniculated type, and form perfect hypodermic needles to inject the venom deeply into the flesh of their victims. They are near the front of the jaw and rooted in the shortened maxillary bone which is rotatable through an angle of forty-five degrees so that they may be erected for biting (Fig. 5B, Pl. V) and folded back against the roof of the mouth when not in use and during swallowing (Fig. 5A, Pl. V). The erection of the fangs is a voluntary act, not automatic with the opening of the mouth.

There is a small group of mildly poisonous snakes which have enlarged, grooved fangs in the rear of the upper jaw.

Defence of harmless snakes. Some harmless snakes when handled or cornered will attempt to defend themselves by biting, but even should they succeed in breaking the skin and drawing blood no bad result need be feared. The commonest defence of our harmless snakes when first handled is in a strong smelling secretion poured out from the scent glands opening into the vent. The odour of this differs in different species but is usually highly offensive, and the snakes by violent thrashing about of their bodies smear it quickly over themselves and their captors.

Tongue. The character of the tongue varies in different groups of reptiles, its structural nature, in general, corresponding with its function. In crocodiles and tortoises it is thick and non-protrusible. In snakes and many lizards it is a slender, bifurcate, protractile and freely motile organ of high sensory development; in other lizards it is shorter and merely notched at the tip; in others again it is short and thick, functioning only as an organ of taste. Snakes have a habit of protruding the long, slender tongue which is deeply forked at the tip, and moving it rapidly up and down, and of touching with its tip objects which they wish to investigate; various lizards use their tongues in a rather similar way. People commonly make the mistake of confusing a snake's tongue with a "stinger", but no snake, nor any other vertebrate animal has a sting; some kinds of fish have poisoned spines which function for practical purposes in that way, but even these are not true stings. A snake's tongue is composed of soft flexible tissue, incapable of piercing, and is not in any way connected with the venom glands.

Senses. The sense of sight is usually well developed in reptiles. Many of them rely chiefly upon it for locating their prey which may often escape if it remains motionless. Most reptiles also depend on sight to warn them of approaching enemies. In general, it might be stated that night-roving species have elliptical eye pupils, like cats, while day-roving species have round ones, but while this is broadly true, species of either group may overlap in their activities with those of the other. Rattlesnakes, for instance, are fond of basking in the sun, and garter-snakes and water-snakes are sometimes found wandering after dark. In snakes, the eyes are protected by a transparent horny scale, they have no movable eyelids so they appear to be always open and staring. This "stary" appearance has probably contributed to the myth that snakes can "fascinate" their prey. Some lizards, most Geckos for instance, have similarly protected eyes, but the majority of lizards, and turtles and crocodiles have movable eyelids and can close their eyes.

The sense of hearing does not appear to be so universally important among reptiles as does sight. Most lizards, and crocodiles, have external ear openings and tympanic membranes (eardrums) and probably can hear very well. In turtles the tympanic membrane is stretched externally over the ear opening, like in frogs, closing it to the outside. In snakes there is no trace of an external ear, no tympanic cavity, nor eardrum, although certain organs of the internal ear are present and do function. Experiment has indicated that they are not sensitive to sound vibrations carried in air unless of very low pitch, but are sensitive to sound vibrations conveyed through solid objects or the ground. People sometimes

ask if rattlesnakes can hear their own rattles: we can only reply that there appears to be no evidence that they can.

The sense of smell is important and well developed in reptiles. It assists many species in finding their food, and some in recognizing their kind. The tongue, in snakes, is believed to assist in smelling by conveying odours to a pair of small olfactory cavities, Jacobson's organ, in the roof of the mouth.

Shedding of skin. In most reptiles the horny outer layer of the skin is shed periodically, peeling off in flakes as in most lizards, or in one piece as in snakes in which the shedding begins at the lips and the skin peels off backwards inside out. In turtles the horny covering of the scutes, when shed, peels off separately from each scute, and the skin of the body and limbs is shed in fragments. Snakes have to make a deliberate effort to shed their skin. This is accomplished by first rubbing the snout against the ground or some object to loosen the skin at the margins of the lips and start it peeling back. It is then drawn off inside out by the snake's movements in crawling slowly forward and rubbing itself against grasses or other objects, accompanied by an active peristaltic (wave-like) motion of the muscles beneath the skin. A few days before shedding the skin the eyes become clouded and whitish, and at this time snakes usually hide away and cease feeding and are probably very nearly blind. The eyes clear again a day or two before the shedding.

Reproduction. Most reptiles reproduce by means of eggs which are deposited and hatched outside the body of the parent, as with birds; animals which deposit such eggs are said to be *oviparous*. A number of kinds of snakes and a few lizards retain the eggs within the body until after hatching and then expel the living young; species which reproduce in this way are said to be *ovoviviparous*.

In reptiles, fertilization of the eggs takes place within the body of the female, as in warm-blooded animals, never outside as is commonly the case with amphibians. The males are furnished with copulatory organs which are single in crocodiles and tortoises but paired in lizards and snakes.

Some reptiles brood with their eggs or stay near the nest while the eggs are hatching, but most species do not take any interest in their young beyond that of depositing their eggs in a suitable situation, although they will often take considerable pains to do this. Live-bearing snakes are not usually found in association with their young and the young do not remain for long with the parent nor follow her, but soon scatter and shift for themselves.

ACKNOWLEDGMENTS

My sincere thanks for helpful assistance in various ways are cordially extended to the following persons: To Professor J. R. Dymond, Director of the Royal Ontario Museum of Zoology, for editing my MS and for many helpful criticisms; and to him and Mr. L. L. Snyder, Assistant Director of the Royal Ontario Museum of Zoology, Mr. T. B. Kurata, Mr. James L. Baillie and Mr. John Edmonds for cooperation in field work through many years and for numerous observations and specimens; and to Mr. Baillie for various records and references which would otherwise have escaped my notice. Other members of the Museum's staff who have collected specimens in the course of field work in recent years and contributed observations are Messrs. E. C. Cross, S. C. Downing, C. E. Hope, Morley Neal, J. P. Oughton, L. A. Prince, T. M. Shortt and F. A. Urquhart. Mr. W. J. LeRay of the Department of Biology, University of Toronto, cooperated in many field trips, read my MS, and contributed valuable information. Mr. Roger Conant of the Zoological Society of Philadelphia, and Mr. Clyde L. Patch of the National Museum of Canada, Ottawa, very kindly checked over my statements of ranges and I am indebted to them for helpful criticisms and information which made these statements more accurate and complete than they would otherwise have been. Mr. H. E. Miller of Stratford, Connecticut, Dr. W. P. Alexander of the Buffalo Museum of Science, Mrs. Ada H. Diaz and Mr. Harold V. Ellison, both of Niagara Falls, New York, contributed helpful information regarding recent occurrences of the timber rattlesnake at Niagara Glen, Ontario. Specimens were collected or observations reported to us by the following gentlemen: Professor A. F. Coventry, Mr. W. H. Bennett, Mr. L. V. Dixon, Mr. K. H. Doan, Dr. F. E. J. Fry, Professor W. J. K. Harkness, Mr. R. V. Lindsay, Dr. D. A. MacLulich, Mr. H. H. Southam, Mr. Sprague Troyer, Mr. S. L. Thompson and Mr. Grant Whatmough, all of Toronto; Dr. A. E. Allin, Fort William, Mr. L. H. Beamer, Meaford, Mr. Alfred Kay, Port Sydney, who also rendered valuable assistance in field work in years gone by; Mr. W. H. Lund, Hillier; Mr. Herbert Milnes, Woodstock, Mr. T. D. Patterson, London, Dr. W. E. Saunders, London Mr. John K. Steen, Tillsonburg, Mr. G. C. Toner, Gananoque, Mr. R. V. Whelan, Smoky Falls, Mr. Alex Wilson, Lake, all of Ontario. Field work at Long Point, Norfolk County, was made possible through the kindness of the Long Point Company and its former manager, the late Mr. H. B. Johnston, and by the cooperation of the resident superintendent, Mr. C. H. Ferris. Work at Turkey Point, Norfolk County, was greatly facilitated through the kindness and generosity of Mr. Munro Landon of Simcoe, who placed his cottage on the Point and his boats at our disposal

on the occasion of every visit, took much thought for our convenience in various ways, and spent considerable time with us in the field.

Among the illustrations, Fig. 5 on Plate V is a diagram based largely on Klauber's figures (Klauber 1936, 217); the other figures are original and were all drawn from Ontario material except Fig. 11 on Plate III which is a diagram and not drawn for any particular species, Fig. 4, Pl. IV and Fig. 7, Pl. V, which were drawn from extralimital material.

Permission to use the maps, the one showing the subdivisions of Ontario and the other an index to the counties, was kindly granted by Mr. L. L. Snyder and Mr. J. L. Baillie, respectively.

THE REPTILES OF ONTARIO

The reptiles of Ontario belong to three of the major groups, the lizards, snakes, and turtles. The total known to occur in the province numbers twenty-eight, i.e. one lizard, eighteen snakes and nine turtles, the count including subspecific forms.

Characters used in identification. The scales on the skin of a reptile vary in size, shape and arrangement on different parts of the body and head, have special names assigned to them according to their position, and are convenient aids in classification (Plates I, II; Figs. 1, 2, Pl. VI). Other characters used in the keys and descriptions will also be found illustrated in the plates. The number of scales in a series or the number of rows of scales often prove to be helpful characters in distinguishing between species. In most snakes the scales of the belly are broadened transversely into plates called *ventrals* or *gastrosteges* (Fig. 4, Pl. II). The scale immediately in front of the *vent* or *anus* is called the *anal plate* and may be either divided or entire (Figs. 9, 10, Pl. III); when counting the ventral plates this scale is usually not counted. The small rhombic-shaped scales of the back and sides in snakes, called *dorsal scales* (Fig. 1, Pl. II), are arranged in longitudinal rows and the scales of each row alternate with those of the next. These rows are numbered from below upward, from and including the first row above the ventrals to the *median* or *mid-dorsal* row. When counting the rows of scales they are counted completely around the body including the first row of each side. The number of dorsal scale rows is not always the same throughout the entire length of the body, so, when a single count of dorsal scale rows is given the count always refers to the maximum number of rows, which usually occurs near the middle of the body or toward the front. It is a common practice to make counts at several points along the body and record all the figures separating them by dashes, for example: the count in the common garter-

snake is 19-19-17, often written simply as 19-17, the maximum count of 19 occurring from the front end of the body backward to behind the middle; in the common water snake the count is usually 23-21-19-17, the maximum occurring at the front of the body and the next lower number occurring near the middle, or occasionally 21-23-21-19-17 with the maximum occurring a short distance behind the front end. Only that portion of the body behind the vent is the tail (Fig. 11, Pl. III). Some of the dorsal scale rows are continued on to the tail; the wide scales beneath the tail, called *subcaudals* (Fig. 4, Pl. II) may be divided, as in our harmless snakes, or undivided like the ventrals as in the rattlesnakes.

In turtles the structure and shape of the shell and its scutes are very useful in identification. The shell is composed of an upper portion, the *carapace* (Fig. 1, Pl. VI) and a lower, the *plastron* (Figs. 2-6, Pl. VI), and these are united by a narrower portion on each side called the *bridge*. The scutes are named according to their position on the shell (Figs. 1, 2, Pl. VI). The shapes and notching of the jaws also furnish helpful characters (Figs. 1-7, Pl. VIII).

Determination of sex. Determination of sex in young specimens of our reptiles may be impossible without careful dissection, but in adults it can usually be made from external features.

In the blue-tailed skink adult females retain at least a subdued striping of the juvenile condition; in males the striping almost or completely disappears except for a rather faint darkish brown band along the side, and the head becomes coppery red on the sides, and wider and more swollen through the base of the jaws than in females. The shape of the base of the tail as described below for snakes is also helpful with skinks.

In snakes, in most cases, the base of the tail behind the vent is narrower and more tapering in females (Fig. 11A, Pl. III); in males it is fuller, only slightly or not at all tapering, or even somewhat swollen in this region (Fig. 11B, Pl. III). This fulness is due to the *hemipenes*, or paired copulatory organs, which lie side by side in the basal portion of the tail, and may be exposed to view in dead specimens by making a short incision lengthwise behind the vent; in females only the scent glands and muscle tissue will be seen. In living specimens doubtful cases may be determined by use of a slender, blunt probe which may be gently passed into either penis sheath in males, but will be stopped by the posterior wall of the vent in females (Schaefer 1934, 181).

In turtles the plastron is full and often slightly convex in females while in males it is often slightly concave; the vent in females is situated close to the base of the tail while in males it is located more distally—farther from the base (Figs. 10, 11, Pl. VIII). In the soft-shelled turtle the vent is near the tip of the tail in both sexes, but the tail is longer in males, extend-

ing beyond the margin of the carapace, while in females it scarcely reaches the margin.

Distribution. The statement of general distribution in North America which opens the account of each species was compiled from various published sources which are listed in the bibliography, and was checked by other herpetologists (see acknowledgments, p. 11). The distribution in Ontario is both from published sources and from our Museum records, but is in many cases rather sketchy and incomplete for the simple reason that there are many areas of greater or less extent from which we have neither specimens nor reports. While there is no doubt that further work will add many new localities to our lists and extend some of the known ranges within the province, we feel that the inferences drawn are reasonably sound, and in some cases at least are not likely to be changed much by such work.

We cannot in the present little handbook undertake to discuss the significance of distribution, but the subject is of too great interest to pass without at least a brief reference to it. The factors affecting geographic distribution are among the most interesting in zoology, and this is especially true in the case of earth-bound animals of relatively slow progression, such as reptiles, which are unable to traverse unfavourable areas of much extent. How or why did the present distribution of any species come about, and what factors operated during past ages to extend, restrict or break up its range? Why, for instance does the blue-tailed skink appear to miss the Toronto region by a radius of about forty to eighty miles and yet occur to the west, north, east and south? Or, why should the pilot black snake be restricted in Ontario to Lake Erie region and the counties at the eastern end of Lake Ontario while it is apparently absent from the area between?

Blanding's turtle occurs from Nebraska to the Great Lakes and crops up again in the New England States. Some examples of this kind of distribution, known as *relict*, are discussed by Schmidt (1938), who refers the eastward range of this turtle and a number of our other reptiles to a former eastward extension of prairie or steppe conditions in postglacial times. In the case of Blanding's turtle those at the eastward end of the former range became isolated and formed an "island" cut off from the main body of the population. The wood turtle shows a somewhat similar kind of broken distribution.

There are several species which, like the blue-tailed skink, occur in Ontario east, west and north of Toronto but seem to miss the Toronto region by a wide margin. Some of those now absent from this general region may have been present but unrecorded in former years, but disappeared with the settlement of the country. It seems likely that post-

glacial repopulation of southern Ontario with reptiles must have taken place from the western and eastern ends of Lake Erie and the eastern end of Lake Ontario, because at those places the water barrier is most reduced. If this is what happened it might still affect the distribution of some forms; but why apparently not others? If this explanation is invoked to account for the restricted distribution in Ontario of the pilot black-snake in Lake Erie region and at the eastern end of Lake Ontario, but not between, one is inclined to ask how the much feebler little brown snake, and others, succeeded in spreading themselves completely across southern Ontario. An intelligent explanation of distribution of reptiles in Ontario must await more extensive and intensive collecting and some correlation of the results with such factors as geology, topography and climate. Some attention should also be given to the nature and extent of the wanderings of the various species under wild conditions, upon which dispersal largely depends.

KEYS TO THE REPTILES

The keys are purely artificial and based on characters which may easily be seen (and will work only for the assemblage of species occurring within the province). They are divided into successively inferior sections, each indexed with a capital letter. To each of these sections there is an alternative of equal rank indexed with the same letter doubled. To use a key, proceed as follows: Compare your specimen with the first alternative "A", and if it does not agree with this go on to the second alternative which is "AA". If it does agree with alternative "A" compare it with the next statement under this section, which is "B", and continue in this manner as long as the specimen agrees with each successive statement. If you come to a statement with which it does not agree, go on to the second alternative of this, which will be marked with the same letter doubled, and then continue as before so long as the specimen agrees with each successive statement, until you are led to a specific name.

The keys were made to cover the snakes and turtles only; since there is but one species of lizard definitely known to occur in the province, any lizard specimens may be compared directly with the description. If they do not appear to agree with it, they should be sent to the Royal Ontario Museum of Zoology for examination.

The key, in each case, will be found preceeding the group to which it applies.

DESCRIPTIONS

The descriptions of species are couched in terms of external characters which may easily be seen, and are restricted in the main to such features

as are of practical use in determination of Ontario material. They are not more comprehensive than is considered desirable for the purpose in mind and various details commonly included in descriptions have been omitted for the sake of simplicity and brevity. For example, counts of subcaudal scales of snakes are not given because they are of little practical value in dealing with the assemblage of forms which occurs in Ontario, and if a portion of the tail is missing, as is sometimes the case, they are useless.

In referring to the scales of the head, if two figures are joined by a plus sign, that indicates an association of numbers occurring together, as, for instance, temporals 2+3 means that there are two temporals in the first row and three in the second. In stating the counts of ventral scutes, the first pair of numbers, not in parenthesis, is, unless otherwise stated, the minimum and maximum count obtained from Ontario specimens; the second pair of numbers, in parenthesis, is the minimum and maximum count of extralimital material obtained from published sources. The reason for citing the extralimital counts is because the series of Ontario specimens examined was not always large enough to be certain of comprehending the possible upper and lower limits.

The colour descriptions are in common, non-technical language. The nomenclature of Ridgway's colour standards (Ridgway 1912) was not used because few people are familiar with it and copies of the work are not usually available for comparison; besides, our reptiles are subject to too much individual variation in colour to make any such precision very helpful.

THE LIZARDS

Family SCINCIDAE. THE SKINKS

Blue-tailed Skink *Eumeces fasciatus* (Linné)

This is, to our knowledge, the only species of lizard which has been positively identified from Ontario.*

Range: Eastern North America from the Atlantic Ocean west to eastern South Dakota, Kansas, Oklahoma and eastern Texas, from the

*Two other species, *E. anthracinus* (Baird) and *E. spetentrionalis spetentrionalis* (Baird), were recorded by J. H. Garnier (publication not cited) and on this authority were recorded by C. W. Nash in his Manual of Vertebrates of Ontario, 1908, and so should be mentioned. The whereabouts of Garnier's specimens is not known, if indeed they are still in existence, so his identifications can not be confirmed. He reported *E. anthracinus* from Kent county but we question the record, because, although it is known from New York State and Pennsylvania (Taylor 1935, 386) its apparent absence

Gulf of Mexico north to Massachusetts and to Lake Superior in Michigan. Not found in peninsular Florida.

Ontario records are from about twenty-five localities and fall definitely into two groupings: (a) the vicinity of lakes Erie and St. Clair and southern Lake Huron; (b) Frontenac and Peterborough counties and northwest to southern Parry Sound district. It is likely that this grouping is accidental rather than significant, and while the species misses the Toronto region by a wide radius, the two groupings will probably be found to be continuous through the western peninsula of southern Ontario and northward of Lake Simcoe.

It appears to be locally common in a number of the localities where it occurs in Ontario.

Size and structure. A small lizard attaining a length of about six to seven inches from snout to tip of tail. Our largest Ontario specimen measures just over six and three-quarter inches in total length, and about two and a half inches (70 mm.) from snout to vent (owing to the frequency of imperfect tails in skinks, measurements for scientific purposes are better taken from the snout to the vent). Limbs well developed with five fingers and five toes; body covered with smooth imbricating scales; tongue protrusible, notched at tip; portion of rostral scale visible from directly above much smaller than frontonasal (Fig. 2, Pl. I); postnasal scale usually present; postmental scale divided transversely (Fig. 3, Pl. I); six preanal scales, the median pair much enlarged (Fig. 4, Pl. I).

Colour: The ground colour varies with age and sex, being most brilliant in young specimens which are dark olive or nearly black above with five light yellow or greenish yellow lines, as follow: a mid-dorsal bifurcating on the nuchal region and reuniting on the snout; a pair of dorso-laterals originating on the outer edges of the supraoculars; a pair of laterals originating on the upper labials and passing backward through the ear, all five lines running the full length of the body and extending far on to the tail; tail bright blue. In older specimens the ground colour above becomes a paler brownish olive, the striping duller, and the brilliant blue of the tail becomes grayish or disappears. In old males the head becomes coppery and the light striping becomes obscure or vanishes, but a brown band persists along the side between the positions of the lateral and dorsolateral light stripes.

from Ohio, Michigan and Indiana cast much doubt on the possibility of its occurrence in Kent County, and none have been reported from there, or anywhere in Ontario, since Garner's time. The record of *E. s. septentrionalis* was certainly in error since the locality was given as southern Ontario, whereas the range of this species lies west of the 89th meridian. It has been recorded from Beltrami County, Minnesota (Taylor 1935, 404), near Lake of the Woods, so it might be looked for in Rainy River district of Ontario.

Habits and habitat: Frequents light dryish woods or partially wooded and rocky situations where it may be found beneath the bark of logs and stumps or under rocks. Active in the daytime and fond of basking in the sun. Alert and swift, basking specimens dart away and "lose" themselves with incredible quickness when approached. As is true of many small lizards, the tail breaks off easily, allowing the owner to escape if grasped by that organ. It is regenerated in time, but the new tail never attains the perfect development of the original. The food consists chiefly of insects, but ants, apparently, are not taken (Taylor 1935, 61). Reproduction is by eggs, which may number up to about fourteen, and are deposited in damp situations as in decaying logs, in July. The female broods with the eggs while they are hatching.

THE SNAKES

Two families of snakes are represented in the fauna of Ontario, i.e. the Colubridae, to which most of our snakes belong, and all of our species of which are totally nonpoisonous, and the Crotalidae, the rattlesnake family, of which we have two species, both venomous. Aside from the rattlesnakes there are no poisonous snakes in Ontario. There are no copperheads nor water moccasins. The common water snake is not a moccasin and is not venomous. The various reports of copperheads have been traceable to either the fox snake or the red-bellied snake, and a number of reports of timber rattlers are doubtless referable to the fox snake which is also known as the "hardwood rattler" and confused with the timber rattler which is of more restricted occurrence in Ontario.

KEY TO THE SNAKES OF ONTARIO

- A. No rattle on end of tail (Fig. 11, Pl. III); no pit between eye and nostril (Figs. 1-6, Pl. III).
- B. Snout rounded, not protruding, neither keeled above nor flattened beneath (Figs. 2-6, Pl. III).
- C. Anal plate divided (Fig. 9, Pl. III).
- D. Keels present on some or all of dorsal scales (Fig. 7, Pl. III).
- E. All scales, at least above first row, strongly keeled.
- F. Scales in fewer than 19 rows; no loreal plate (Fig. 4, Pl. III).
- G. Scales in 15 rows; a yellowish spot on back of neck; belly usually bright red; length up to twelve inches. **Red-bellied Snake**. *Storeria occipito-maculata*. P. 32.
- GG. Scales in 17 rows; no yellowish spot on back of neck; belly pale yellowish brown or pinkish; length up to fifteen inches. **Little Brown Snake** *Storeria dekayi*. P. 31.
- FF. Scales in 19 or more rows; loreal plate present (Fig. 1, Pl. II).

- H. Scales in 19 rows; no blotches; a yellow lateral stripe on adjacent halves of first and second scale rows (Fig. 5A, Pl. IV). **Queen Snake** *Natrix septemvittata*. P. 28.
- HH. Scales in 23 or 25 rows.
- I. Brown above, blotched; no lateral stripe (Fig. 6A, B, Pl. IV); ventral scutes dark mottled, usually with dark-edged half circles (Fig. 6C, Pl. IV). **Water Snake** *Natrix sipedon sipedon*. P. 29.
- II. Gray above, blotches absent or indistinct; ventral scutes white, unmottled. **Island Water Snake** *Natrix sipedon insularum*. P. 30. (Islands of western end of Lake Erie only).
- EE. Scales of first three to five rows smooth or nearly so, others weakly keeled.
- J. Brownish yellow above with large dark brown blotches. **Fox Snake** *Elaphe vulpina*. P. 25.
- JJ. Uniform black above, or obscurely blotched. **Pilot Black Snake** *Elaphe obsoleta obsoleta*. P. 24.
- DD. All dorsal scales smooth, no keels (Fig. 8, Pl. III).
- K. Scales in 15 rows; size small, less than twenty inches.
- L. Colour above slate gray; belly yellow or orange, a ring of same colour around neck. **Ring-necked Snake** *Diadophis punctatus edwardsii*. P. 20.
- LL. Colour above bright green; no ring around neck. **Smooth Green Snake** *Ophedrys vernalis*. P. 23.
- KK. Scales in 17 rows; size large, up to six feet; uniform bluish green above; young blotched. **Blue Racer** *Coluber constrictor flaviventris*. P. 23.
- CC. Anal plate entire (Fig. 10, Pl. III).
- M. All dorsal scales smooth, no keels (Fig. 8, Pl. III), in 21 or more rows; blotched. **Milk Snake** *Lampropeltis triangulum triangulum*. P. 26.
- MM. All scales, at least above first row, strongly keeled, in 19 rows; normally longitudinally three-striped (Figs. 1-4, Pl. IV).
- N. Lateral stripe anteriorly on third and involving adjacent halves of second and fourth scale rows; keels weak or absent on scales of first row; a light spot on preocular (Fig. 2, Pl. IV). **Butler's Garter-Snake** *Thamnophis butleri*. P. 33.
- NN. Lateral light stripe anteriorly on scales of third and fourth rows; a light spot on preocular (Fig. 3, Pl. IV); tail more than 0.27 of total length. **Ribbon Snake** *Thamnophis sauritus sauritus*. P. 35.
- NNN. Lateral stripe on second and third scale rows (Fig. 1, Pl. IV), or absent; tail less than 0.27 of total length.
- O. If dorsolateral spots visible, those of upper row not fused together (Fig. 1, Pl. IV), and interspaces of lower row not red (occasional specimens black with a white throat). **Common Garter-Snake** *Thamnophis sirtalis sirtalis*. P. 36.
- OO. If dorsolateral spots visible, those of upper row fused together (Fig. 4, Pl. IV), and interspaces of lower row more or less red. **Red-barred Garter-Snake** *Thamnophis sirtalis parietalis*. P. 37.

BB. Snout pointed and protruding, keeled above, flattened beneath (Fig. 1, Pl. III).

Hog-nosed Snake *Heterodon contortrix*. P. 21.

AA. A rattle on end of tail (Fig. 6, Pl. V); a deep pit between eye and nostril (Fig. 1, Pl. V).

P. Top of head with large symmetrical plates between eyes (Fig. 2, Pl. V); dorsal pattern of blotches. **Massasauga** *Sistrurus catenatus catenatus*. P. 39.

PP. Top of head with small and mostly unsymmetrical scales between eyes (Fig. 3, Pl. V); dorsal pattern of cross-bands, or black. **Timber Rattlesnake** *Crotalus horridus horridus*. P. 42.

Family COLUBRIDAE. HARMLESS SNAKES

Ring-necked Snake *Diadophis punctatus edwardsii* (Merrem)

Range: The Maritime provinces and northern Atlantic states west to Wisconsin, south through the Appalachians to the Carolinas and Tennessee (apparently replaced by *D. p. punctatus* in the coastal plane), north in Michigan and Wisconsin to Lake Superior and in Ontario to Timagami.

Not plentiful anywhere in Ontario, but appears to be generally distributed over the southern part of the province.

Size and structure: A small snake attaining a length of about seventeen inches. Dorsal scales in 15 rows for entire length of body, glossy, unkeeled; head broad and flattened; loreal plate present; eye small. Nasals 2; preoculars 2; postoculars 2; temporals 1+1, rarely 1+2; supralabials 8 or 7; infralabials 8 or 7; ventrals 145-170 (139-168); anal plate divided.

Colour: Gray to bluish slate above; belly yellow or orange, a ring of the same colour around the neck; top of head and borders of neck-ring darker than rest of upper surface; a row of dark spots along edges of ventrals. (In a specimen from Parry Sound district the ventral and subcaudal scales are mottled with darkish gray laterally and on their posterior margins).

Habits and habitat: Frequents light woods, clearings and pasture lands where it may be found hiding beneath the bark of logs or stumps, or under stones. Secretive and apparently nocturnal. It is reported to eat amphibians, reptiles, insects and earthworms, but the only food we have observed captive specimens to take was red-backed salamanders and young snakes (green, DeKay's and red-bellied). Young lizards would undoubtedly have been taken had they been tried. Conant (1938, 40) reports captive specimens taking earthworms.

The eggs are deposited in decaying logs, etc., in July. Blanchard (1926, 281) has shown that a clutch rarely exceeds three in number, and (p. 284) noted fifty-one to fifty-four days as the usual hatching period, with extremes of forty-six and sixty days. Several females may deposit

their complements in a single nest and Blanchard (1937a, 522) records one such nest with forty-eight eggs.

Hog-nosed Snake, Blowing Adder *Heterodon contortrix* (Linné)

Range: The United States from the Atlantic coast west to eastern Montana and central Texas, north from Florida and the Gulf of Mexico to northern Parry Sound district of Ontario, and Massachusetts.

Appears to be generally distributed over the western peninsula of southern Ontario, and at least in the western parts of Muskoka County and Parry Sound district. It formerly occurred at Toronto, the last record from there was in 1907. There is a specimen from Madawaska, Nipissing district, in the National Museum of Canada. We have a report of its occurrence at Kinmount, Victoria County, and at Lake, near Bancroft, Hastings County. The latter report was from an old resident of the district who said the first specimen was seen in 1878 "and in ten years they got extremely thick", and some time later, he does not state how long, "all at once they seemed to go away or die." He goes on to say, "Perhaps I have not got the correct name of this snake, but we called it that (blowing adder) on account of the hissing noise it made when alarmed." At the present time the hog-nosed snake is not very plentiful in Ontario.

Size and structure: A very stout-bodied snake attaining a length of about three feet. Head (Fig. 1, Pl. III) short and broad; snout protruding, pointed in profile, keeled above, flattened beneath (on anterior face of rostral plate); a small narrow scale, the *azygous*, interposed between the internasals; loreal present. Nasals 2; loreals 1 or 2; eye bordered in front, beneath and behind by a crescent of small scales, 9 to 12 in number; two large temporal scales in contact with last three labials and separated from parietals by several rows of small scales; supralabials usually 8; infra-labials 9, 10 or 11; dorsal scales 25-23-21-19, keeled; ventrals 120-137 (120-141); anal plate divided.

Colour: The colour and markings are variable. The ground colour above may be brown, gray, olive, yellowish, reddish or nearly black. There are usually three rows of dark blotches, i.e. a mid-dorsal row of large ones and a row of smaller ones along each side alternating with them; tail banded above. A dark band across the prefrontals from eye to eye and including the anterior margins of the frontal and supraoculars; another dark band across the parietals and posterior portion of frontal and supraoculars, partially interrupted at the middle; a dark stripe obliquely downward from behind eye to posterior labials; a pair of large dark, elongate blotches extending from the parietal plates on to the sides of the neck, and a small oval-shaped blotch between them behind the occipital

region. Ventral surface yellowish or whitish, often with brown or gray mottling which may be quite heavy posteriorly; under surface of tail abruptly light. In dark specimens the markings may be concealed by the darkness of the ground colour. In light specimens they are usually distinct, but may be lacking except for the pair of elongate blotches on the neck.

Habits and habitat: This snake prefers sandy situations, beaches and light, dry woods. Its food consists mainly of toads; frogs are occasionally taken. In the rear of the maxillary bone of each side, and separated by a space from the other teeth, is a pair of enlarged fang-like teeth which are not grooved or connected with poison glands, for the snake has none. The usefulness of these teeth lies probably not only in their ability to securely hold the sometimes large and troublesome prey, but in puncturing and deflating the body, for toads inflate themselves with air when attacked by snakes; they are not used in defence.

Reproduction is by eggs which are deposited in dampish situations such as decaying logs, usually in July. Conant (1938, 44) records sets of twelve and twenty-seven eggs; Mr. Herbert Milnes reported to us a set of thirty-one infertile eggs laid on July 12, 1936, by a specimen from near Woodstock, Ont.

When frightened, the hog-nosed snake assumes a threatening attitude, and with head and neck flattened, lunges at the enemy and hisses loudly, but never bites and cannot be induced to. If one persists in annoying it it will feign injury and death by turning on its back and writhing for a few moments with its mouth wide open and its tongue trailing in the dust, and then become perfectly relaxed and still. In this condition it remains limp if handled, unless turned right-side-up, in which case it will immediately flip over again on its back and again remain limp and still. If the observer should withdraw for a few yards and remain quiet the snake will slowly raise its head a little and survey its surroundings, and if all seems safe it will right itself and crawl away.

In spite of all the published observations on the bluffing behaviour and harmless nature of the blowing adder, it is still believed by many people to be dangerous and to spit venom and exhale poisonous breath. There are many amusing stories in circulation about the baneful effects of its bite or breath, and as each generation brings its crop of believers in witchcraft or a flat earth, it also brings its crop of livestock men who have actually seen their animals drop dead after walking too near to a hissing blowing adder, and of people who have seen a friend almost die from the poison of its breath.

Smooth Green Snake, Grass Snake *Opheodrys vernalis* (Harlan)

Range: Nova Scotia and New England States southwest to northern Texas and west to Utah, thence northeast to southern Manitoba, north in Michigan to the northern peninsula and in Ontario to Timagami.

Our most westerly Ontario record northward of the Great Lakes is from Copper Cliff region, Sudbury district. The species is common in southern Ontario.

Size and structure: A small snake attaining a length of about eighteen inches. Form slender, with body of nearly the same diameter for most of its length. Muzzle short; nasal scale single, pierced by nostril; loreal either distinct or fused with nasal (Figs. 5, 6, Pl. III); preoculars 1 or 2; postoculars 1 or 2; temporals usually 1+2; supralabials 7; infralabials 8, occasionally 7; dorsal scales in 15 rows for entire length of body, glossy, unkeeled; ventrals 121-134 (123-146); anal plate divided.

Colour: Grass green above, pale yellow or nearly white beneath.

Habits and habitat: Frequents meadows, clearings, light woods, and sometimes found above ground in low bushes. Its food consists chiefly of caterpillars, grasshoppers, spiders, and occasionally red-backed salamanders. Reproduction is by eggs, usually six or seven in number, which are deposited beneath stones or boards in late July or in August. The embryos are well advanced in development at the time of laying and hatching usually occurs within two weeks. The shortest and longest periods recorded by Blanchard (1933, 500) were four and twenty-three days. A two day period was observed once by Mr. W. J. LeRay.

August mating has been noted for this snake at Lake Nipissing by Dymond and Fry (1932, 102).

Blue Racer *Coluber constrictor flaviventris* Say

Range: West from central Ohio and from the Ohio and Mississippi rivers to the Rocky Mountains, north from the Gulf of Mexico and the Rio Grande to southern Michigan and southern Ontario, and almost to the Saskatchewan border in the west.

Not common in Ontario. Our records are from Essex and Huron counties.

Size and structure: A large snake attaining a length of about six feet. Form slender; sides of head high with concavity in front of eye; crown flat, profile sloping from eyes to snout; loreal present; eye large. Nasals 2; preoculars 2, the lower small, scarcely contacting loreal; postoculars 2; anterior temporals usually 2; supralabials 7 or 8; infralabials 8 or 9; dorsal scales 17-15, unkeeled; ventrals 175-192*; anal plate divided.

*Published counts for extralimital specimens.

Colour: Uniform bluish green above, brownish on snout; bluish or greenish white, or yellowish beneath. The young are marked dorsally with a row of large dark blotches, and on the sides with small irregular spots.

Habits and habitat: We have no records of the habitat preferences of this snake in Ontario. In Michigan it is reported as being most frequently found in dry, open situations, generally near or in thickets, and as frequenting hedgerows and stone walls (Ruthven, Thompson and Gaige 1928, 86). It is alert and swift and a good climber. Its food includes mammals, birds and their eggs, reptiles, amphibians and insects. Reproduction is by eggs, but we have no data for Ontario as to numbers laid, dates or nesting sites. Conant (1938, 55) records a set of twenty-five eggs laid on June 26, 1930, by a female from Lucas county, Ohio.

Pilot Black-Snake *Elaphe obsoleta obsoleta* (Say)

Range: From Massachusetts and North Carolina west to eastern Kansas and north to the southern parts of Wisconsin, Michigan and Ontario.

Ontario records are from Essex, Norfolk, Welland, Lincoln, Frontenac and southern Leeds counties. The range appears to be discontinuous north of Lake Ontario. Moderately common where it occurs.

Size and structure: A large snake occasionally reaching a length of eight feet, although most specimens seen are less than five feet. Form moderately slender; head rather wide through basal portion of jaws, tapering toward the snout; loreal plate present. Nasals 2; loreals 1, occasionally 2; preocular 1; postoculars 2; occasionally 3; temporals usually 2+3; supralabials 8; infralabials 11 or 12; dorsal scales 25-23-21-19-17 or 25-27-25-23-21-19, those of the first three to five rows smooth or nearly so, the rest feebly keeled; ventrals 233-243 (221-244); anal plate divided.

Colour: Almost uniform black above, usually with obscure blotches in three rows (in Ontario specimens examined), i.e. a vertebral row of large black blotches and a lateral row of smaller ones on each side alternating with those of the dorsal row; the blotches are apparent because of the pale yellowish colour of the skin between the scales in the interspaces, which is occasionally tinged with red. There is usually a faintly paler and not sharply defined dorsolateral band between the vertebral and lateral rows of blotches, two or three scales wide, and accentuated by a dusky band through the lateral row of blotches. Throat white; belly white or yellowish anteriorly, with or without squarish dark blotches, and becoming dark-mottled or totally dark posteriorly.

Habits and habitat: The habitats of which we have knowledge in Ontario are woodlands and rocky, scrubby country, and uplands often

away from lakes and swamps, giving rise to the name "high land black-snake". Its food consists chiefly, if not entirely, of mammals and birds; a frog was recorded from one stomach by Surface (1906, 160). The diet varies with the season and includes a fair percentage of birds in the early half of summer, but later chiefly mammals, and these largely mice. Reproduction is by eggs, but we have no observations as to the number laid, nesting sites or dates of laying in Ontario. Surface (1906, 159) gives the latter part of August and early part of September as the laying time. Ditmars (1907, 306) records a set of ten eggs being laid on June 26th. Conant (1938, 59) records a set of twelve eggs being laid on July 1st, and a set of twenty-two "nearly ready to be laid" in a female which died on July 19th.

Some specimens will vibrate their tails when annoyed, and will bite, but most of those which we have handled were docile and quickly became tame.

Fox Snake *Elaphe vulpina* (Baird and Girard)

Range: Western New York to eastern Nebraska, northeastern Missouri north through Wisconsin and northern Michigan to Lake Superior; southeastern Michigan and southwestern Ontario north to west central Parry Sound district.

Ontario records are from lakes Erie and St. Clair and the eastern shore of Georgian Bay. Our most easterly records at Lake Erie are from Norfolk County. Common where it occurs in Ontario.

Size and structure: A large snake occasionally reaching a length of six feet, but as with the pilot black-snake in Ontario, most specimens seen are less than five feet. Form moderately slender; head rather short and broad; loreal plate present. Nasals 2; loreal 1; preocular 1; postoculars 2; temporals 2+4 or 2+3; supralabials usually 8; infralabials usually 11, less often 10, 12 or 9; dorsal scales 25-27-25-23-21 or 25-23-21, those of the first three to five rows smooth or nearly so, the rest weakly keeled; ventrals 194-213 (194-215); anal plate divided.

Colour: Brownish yellow above with five series of dark blotches as follow: a median row of 28 to 39 large dark brown to black blotches between head and base of tail, the first one or two partly or completely divided along the mid-dorsal region; alternating with these is a row of smaller blotches along each side; below these and alternating with them is a row of still smaller spots on the lowest one or two scale rows and edges of ventrals. Belly yellow with alternating squarish black blotches. The head (Fig. 3, Pl. III) is somewhat coppery above and on the sides with some dark markings, the most prominent of which are: a brown band across the posterior half of the prefrontals from eye to eye; some brown

mottling on posterior part of frontal and on parietals; a black or nearly black nuchal spot; a dark band obliquely from eye to angle of mouth; a dark spot beneath eye on suture between 4th and 5th supralabials, and a similar but less extensive spot on the sutures in front of and behind it. The infralabial sutures are generally more or less darkened, especially that between the 5th and 6th, which usually falls almost directly beneath the subocular spot. The head markings become fainter in older specimens and may almost disappear.

Habits and habitat: We have found this snake only in the near vicinity of water, about beaches and marshes, etc. Its habit of vibrating its tail when excited has given rise to the name "hardwood rattler" by which it is commonly known in Ontario. Another commonly used name is "womper". It is supposed by many people to be poisonous and is often confused with the copperhead, a truly venomous snake of the viper group, which is not found in Canada. The fox snake is also believed by some to be able to sting with its tail like the mythical "hoop-snake", and occasionally we hear ridiculous stories about people being poisoned by its breath. In spite of all this it is a perfectly harmless and mild-tempered snake which will rarely even attempt to bite in self-defence.

The fox snake feeds chiefly upon mammals and occasionally upon birds or their eggs. That other food than warm-blooded vertebrates is occasionally taken is indicated by the disgorging of a bundle of undigested earthworms by a specimen captured at Long Point, Norfolk County (Logier 1931, 233) and of a living salamander *Ambystoma jeffersonianum* by a specimen caught at Go Home Bay, Muskoka County (Dr. A. L. Tester unpublished MS). Economically it is one of our most valuable snakes because of its persistent destruction of mice and rats.

Reproduction is by eggs which are deposited in decaying logs, manure heaps, sawdust piles, etc., in July. The number of eggs in a clutch varies and we have counts ranging from seven to seventeen. Often a large number of eggs may be found together in one nest, the product of several females. The eggs of a clutch are usually found adhering together through having been in contact with each other when freshly laid; they gradually increase in size by absorption of moisture. Hatching requires about seven or eight weeks.

Milk Snake *Lampropeltis triangulum triangulum* (Lacépède)

Range: Maine west to Minnesota, southern Canada to Florida; north in Ontario to central Parry Sound district. Appears to be uniformly distributed over southern Ontario where it is common but not abundant.

Size and structure: A medium sized snake attaining a length of about three and one half feet. Form slender and body of nearly the same

diameter throughout; head short; broad and rather flat; loreal plate present. Nasals 2; loreal 1; preocular 1; postoculars 2; temporals usually 2+3, occasionally 1 in the first row or 2 in the second; supralabials 7; infralabials usually 9, occasionally 8 or 10; dorsal scales usually 21-19-17; ventrals 192-210 (180-213); anal plate entire.

Colour: Ground colour above pale grayish or brownish with five rows of dark blotches. Those of the vertebral row are much the largest, are wider than long, and extend down on the sides to about the fifth scale row, are chocolate to chestnut brown, or sometimes reddish (especially in young), and conspicuously edged with black; alternating with them is a lateral series of smaller and similarly coloured blotches; below these and again alternating with them is a row of still smaller black spots on the lowest scale rows and edges of ventrals. The distinctly alternating pattern is sometimes more or less confused by shifting or fusion of blotches. Belly white with squarish black blotches, or occasionally unblotched. Head markings (Fig. 2, Pl. III) as follow: a black-edged brown dorsal blotch occupying neck region and top of head to between eyes, enclosing on neck region a light, usually Y-shaped spot; a small triangular or V-shaped spot on parietals immediately behind frontal; a brown band across prefrontals from eye to eye; a black or brown and black stripe from behind eye to angle of mouth; labial sutures, especially the uppers, marked with black. Variations of colour of the blotches are usually within tones of browns or reds, but in one specimen from Point Au Baril, Parry Sound district, the blotches were olive green.

Habits and habitat: This useful and harmless snake frequents light woods, clearings and farmlands, and is often found about barns and other outbuildings where it commonly prowls in search of mice which form the largest bulk of its food. It also eats a few birds or their eggs, and is very fond of small snakes and lizards. It is a most efficient mouser, ferreting out the nests and devouring whole litters of young before they are old enough to do any mischief. There is a common superstition that these snakes steal milk from cows, and the popular name "milk snake" is unfortunate in that it probably tends to perpetuate that foolish belief. In spite of its name, the milk-snake shows no particular liking for milk, and even if it did, a full-grown specimen could not drink more than a few teaspoonfuls. There are other difficulties too: the lips, and the muscles of a snake's mouth are not adapted for sucking and are incapable of performing a milking operation; and the sharp, lacerating teeth were not designed for lulling cows into a quiescent and generous frame of mind. It should not take much imagination on the part of a livestock man to picture what would happen if a snake were to seize a cow by the teat, and

the success of attempting to milk a thoroughly frightened and stampeding cow is a subject which he would hardly consider open for debate.

Reproduction is by eggs which are laid in June or July in rotting logs or manure piles, or other dampish protected situations. Ditmars (1907, 344, 345) records sets of eight, nine and eleven eggs. Blanchard (1921, 194) records a batch of thirteen. Conant (1938, 70) reports sixteen in a clutch. Hatching requires about two months.

The milk snake will often bite when first handled, but its bite is harmless. It soon becomes tame in captivity, but most specimens are indisposed to feed under such conditions and do not survive for long. It is probably the most beneficial of all our snakes because of its wide distribution through agricultural land, its fondness for the vicinity of human habitations, and its unceasing war on mice wherever it happens to be. It should be vigorously protected everywhere and at all times.

Queen Snake, Striped Water-Snake *Natrix septemvittata* (Say)

Range: Pennsylvania to Wisconsin, southern Ontario and southern Michigan south to South Carolina and central Alabama.

Ontario records are from Bruce, Huron, Middlesex, Waterloo and Brant counties. Not common.

Size and structure: A smallish snake attaining a length of about two feet. Form moderately slender; head flattened and shallower than in the common water-snake (*Natrix sipedon*), sloping from nape to snout; eye rather small; loreal plate present. Nasals 2, or partly fused; loreal 1; preoculars 2; postoculars 2; temporals 1+2; supralabials 7; infralabials 9 or 10, rarely 8 or 11; dorsal scales 19-17, keeled; ventrals 138-154*; anal plate divided.

Colour: Uniform brown above with a narrow black median dorsal line and a similar line on the fifth scale row of each side; a yellow stripe on the upper half of the first and lower half of the second scale rows (Fig. 5A, Pl. IV) continuous with the yellow of the upper labials and rostral; a dark band on the lower half of the first scale row and edges of ventrals; belly yellow with a dusky band on either side of the mid-ventral region (Fig. 5B, Pl. IV), and becoming generally darkened with grayish or brownish mottling posteriorly; head abruptly brown above supralabials; chin and throat yellow.

Habits and habitat: A decidedly aquatic snake, frequenting the margins of streams where it may be found at times resting in low bushes overhanging the water. Crayfish form the bulk of its food and fish and frogs are taken to some extent. The young, which are born in August, may number from six to twelve (Surface 1906, 151).

*Extralimital (Conant 1938, 77).

Northern Water-Snake, Common Water-Snake *Natrix sipedon sipedon* (Linné)

Range: Southern Maine to Minnesota and south and west to eastern Colorado, from Lake Nipissing in Ontario and northern Michigan south to northern South Carolina, Tennessee and eastern Oklahoma.

Very common in southern Ontario where proper habitat exists and where it has not been persecuted. Its numbers have been much reduced in the more settled areas.

Size and structure: A rather large snake occasionally attaining a length of a little over four feet. Form stout; head deep, high on the sides and wide through the base of the jaws; upper labials swollen; nostril directed upward; loreal plate present. Nasals 2; loreal 1; preoculars 1, occasionally 2; postoculars 3, occasionally 2; temporals 1+3, occasionally 1+2; supralabials 8, rarely 9; infralabials 10, occasionally 9 or 11; dorsal scales keeled, usually 23-21-19-17, less often 21-23-21-19-17, and a maximum of 25 or a minimum 19, 18 or 16 rows occasionally occurs; ventrals 140-152 (135-149); anal plate divided.

Colour: Ground colour above brown, of variable hue, often grayish; a mid-dorsal row of large dark quadrate blotches, and a lateral row of smaller blotches on each side involving the edges of the ventrals. These blotches are dark-edged, and those of the lateral series alternate with those of the dorsal series on most of the body length (Fig. 6B, Pl. IV), but on the anterior part, for about one-fifth to occasionally one-half of the body length, they shift their position to lie opposite the dorsal blotches, fusing with them and forming crossbands (Fig. 6A, Pl. IV). The ground colour of the belly is usually creamy whitish or pale yellowish, but sometimes shows considerable red. The ventral dark mottling, which is variable in pattern and intensity and becomes gradually darker and closer posteriorly, is heaviest on the anterior portion of each ventral plate, and tends to form up into half-moonshaped or roundly triangular dark-edged blotches with their apexes pointing backward (Fig. 6C, Pl. IV). The brown of the head usually extends well down onto the upper labials, and sometimes onto the lower; labial sutures marked with brown; chin and throat creamy.

In newly born specimens the ground colour above is pale grayish white and the blotches nearly black. In old specimens the dorsal pattern may become indistinct or even vanish, and such individuals present a uniform (or nearly so) brown colour above.

Habits and habitat: A decidedly aquatic snake frequenting lakes, streams and permanent ponds; an excellent swimmer and diver. It feeds chiefly upon fish, but amphibians also are readily taken. Surface (1906, 156) records a meadow mouse and a shrew among animals found in stom-

achs examined. Conant (1938, 86) records among other things crayfish and a small water-snake of its own species from stomachs of Ohio specimens. Insects found in stomachs by Surface were probably swallowed in the stomachs of amphibians or fish.

The charge of fish destruction levelled against this snake is probably much less serious than it sounds in loose verbiage because much of its food consists of species which are competitors with or enemies of the food and game fish, and of dead or diseased fish and of mudpuppies which are no favourite with fish culturists. Water-snakes and game fish existed in abundance together for centuries until the white man's activities depleted both in the more settled areas, and game fish are still plentiful in some of our lonelier waters where the snakes are also relatively undisturbed. Wherever man's wanton spoliation of nature has depleted certain desired and coveted elements of the fauna his imagination is quick in finding a scapegoat to bear the blame of his sins; the water-snake happens to be one, along with many other interesting animals which from time immemorial have naturally preyed to even a small extent upon forms of which he has belatedly desired a monopoly to kill for pleasure or for food.

The water-snake is a pugnacious fighter when first captured and is capable of lacerating the skin with its teeth, but no harmful result follows its bite. Some collectors wear gloves to protect their hands when collecting this snake. It soon gets over its pugnacity and becomes a tame and docile pet.

The young, which usually number between twenty and forty in a litter, are born in August or September.

Island Water-Snake *Natrix sipedon insularum* Conant and Clay

Range: The islands in the western end of Lake Erie. Ontario records are from Pelee Island, the type locality.

This is a subspecies of the common water-snake *Natrix sipedon* (Linné) described by Conant and Clay in 1937. In scutellation and size it is similar to the parent form, but differs in coloration, being uniform or nearly uniform gray above and cream white beneath, but "with occasional very faint traces of the lowermost portion of lateral spots (such as are present in *sipedon*) on the posterior part of the body." Intergrades between it and *sipedon* have been taken on some of the islands and on the mainland of Ohio at Catawba peninsula. Conant (1938, 88) records the eating of dead fish by wild specimens and the persistent refusal of frogs by captive specimens, which, nevertheless, took fish readily. The same author records broods of ten and nineteen young.

De Kay's Snake, Little Brown Snake *Storeria dekayi* (Holbrook)

Range: Southern Maine west to central Minnesota and central Kansas, north in Ontario into Parry Sound district and in Michigan throughout the southern peninsula, south to the Gulf of Mexico and along the coast to Guatemala; not in peninsular Florida.

Our most northern specimen is from near the town of Parry Sound and our most northern report is from French River, Parry Sound district.

Common in southern Ontario.

Size and structure: A small snake attaining a length of about fifteen inches. Body moderately stout, tapering toward neck and tail; head small; no loreal plate. (Fig. 4, Pl. III). Nasals 2; preocular 1; postoculars 2, occasionally 1 or 3; temporals 1+2, occasionally 1+3; supralabials 7, occasionally 6 or 8; infralabials 7, occasionally 6 or 8; dorsal scales 17 throughout, keeled; ventrals 119-138; anal plate divided.

Colour: Pale yellowish or grayish brown to dark brown or reddish brown above; a light vertebral stripe on the three median scale rows and halves of adjacent rows, margined by a tone darker than the ground colour; a row of dark spots on either side of the light vertebral stripe is usually conspicuous, and these may encroach upon or even fuse across it, but may be minute or absent. When this row is prominent, there is usually at least a trace of two alternating rows below it on the side. Belly pale yellowish brown or pinkish. Plates on top of head closely mottled with dark brown; a dark spot on labials beneath eye; a dark stripe obliquely down across first temporal and suture between last pair of upper labials on to lower lip; a crescent-shaped blotch on each side behind angle of jaw.

Habits and habitat: Frequents light woods, clearings, fields and roadsides. It remains concealed beneath stones, boards, logs or other cover during most of the day, coming out in late afternoon. Its food consists mainly of slugs and earthworms, and its great fondness for the former makes it a valuable animal about farms and gardens. Owing to its secretive habits, small size, dull coloration and easily obtained food, this little snake is able to survive for long in parks and vacant land in cities. The young are born in July or August. Clausen (1936, 101) obtained broods ranging in numbers from nine to twenty with an average of fourteen.

Newly-born individuals are very dark gray to nearly black above with a yellow band across the neck, and might, by the inexperienced, be confused with young ring-necked snakes, but their keeled scales which may be seen with a pocket lens will distinguish them from the latter.

Red-bellied Snake, Storer's Snake *Storeria occipito-maculata* (Storer)

Prince Edward Island and Maine to southern Manitoba, the Dakotas and Kansas, north in Ontario to Lake Timiskaming and the north shore of Lake Superior, south to the gulf of Mexico.

Common in southern and south central Ontario, but appears to be less so in the western peninsula of southern Ontario. A report from Silver Islet, Thunder Bay district, by Dr. D. A. MacLulich, and its occurrence on Isle Royal (Ruthven, Thompson and Gaige 1928, 113) suggest that its range is probably continuous northward around the Great Lakes.

Size and structure: A small snake rarely exceeding a foot in length. Body moderately stout, tapering toward neck and tail; head small; no loreal plate.* Nasals 2; preoculars 2; postoculars 2; temporals usually 1+2, occasionally 3 and rarely 1 in the second row; supralabials 6, occasionally 7; infralabials usually 7, occasionally 6, rarely 5 or 8; dorsal scale rows 15 throughout length of body, keeled; ventrals 115-132 (116-133); anal plate divided.

Colour: Variable, colour above pale to dark gray or brown, chestnut, or occasionally black. A light vertebral band three scales wide is usually present, and four longitudinal stripes of a tone darker than the ground colour disposed on the first and sixth scale rows (these may appear as rows of spots if the centres of the scales involved are darker than the edges). Three yellowish spots on the posterior part of the head, i.e. a median one behind the occipital plates and one on each side at the angle of the jaw. Top of head usually darker than ground colour of back. Belly red or pink with a lateral band of gray or black speckling.

A dark phase occurs in which the dorsal colour is uniform black and the vertebral band bright ochre yellow.

Habits and habitat: This little snake frequents the same kinds of situations as noted for DeKay's snake (the preceding species) and appears to be closely similar in habits. Most specimens which we have taken were found under stones or boards or some such cover on the ground, where they hide during much of the day. We have occasionally found them abroad in the evening, and in the afternoon in early October. Earthworms and slugs appear to constitute their main food supply. Their preference seems to be for the latter, and for this reason they are highly desirable about farms and gardens. The young are born in August or early September. Blanchard (1937b, 157) found the numbers of young in a brood to range from one to thirteen, with the average between seven and eight.

*A specimen from Sudbury was abnormal in possessing a loreal scale on each side.

Butler's Garter-Snake *Thamnophis butleri* (Cope)

Range: Extreme western New York and western Pennsylvania, through Ohio and Indiana into southern Michigan and southwestern Ontario; southeastern Wisconsin.

Our only locality record for Ontario was established in 1938 near Newbury, Middlesex County, where the species appears to be locally common (Logier 1939, 20-23). It seems likely that it has a wider range than this in Ontario but has been overlooked; it may be found in other places, especially westward to the Michigan border.

Size and structure: A rather small snake attaining a length of about twenty-two inches. Head small, scarcely demarked from neck; eye small; loreal plate present. The dorsal scales of the neck region are glossy like the head plates and those immediately behind the head are unkeeled; those of the first row are either unkeeled or only feebly keeled posteriorly, the rows above it are keeled. Nasals 2; loreal 1; preocular 1; postoculars usually 3, often 2, less often 1; temporals 1+1, occasionally 1+2; supralabials 6 or 7, occasionally 8; infralabials usually 8, occasionally 7 or 9; dorsal scales 19-17; ventrals 135-144 (130-154); anal plate entire.

Colour: Ground colour above olive brown; three light stripes—a mid-dorsal and two lateral, the lateral stripe centred on the third scale row on the anterior half of the body and involving the adjacent edges of the second and fourth rows (Fig. 2B, Pl. IV). The lateral stripes are yellow, but the dorsal stripe is more of a pale brownish hue. A dark brown or chestnut band along the first and lower half of the second scale rows, this colour descending well down on to the sides of the belly, or even completely across it posteriorly. The alternate arrangement of the two rows of black spots on the sides of the back between the dorsal and lateral stripes is generally confused. The spots crowd closely to the edges of the adjacent light stripes; those of the lower row are distinct from each other but those of the upper row usually coalesce together, especially their upper halves, and form a black border to the light dorsal stripe. The centres of the scales between the rows of spots may be much darkened, with yellow flecks at their upper and lower edges. Ventral plates each marked anteriorly near the lateral edge with a black crescent which may or may not be prolonged ventrally to meet its fellow of the other side. Chin and throat yellow; a vertical yellow spot on preocular (Fig. 2A, Pl. IV).

Habits and habitat: Butler's garter-snake normally occurs in the vicinity of water, near marshes, at the shores of lakes, on banks of streams, in wet meadows, etc., and all previously published habitat data have been of such character (Ruthven 1908, 89; Bishop 1927, 16, 17; Conant 1938, 98). Mr. Roger Conant in a letter kindly supplied the following

comments on one of the Ohio colonies of *butleri*: "In at least one place in Ohio they are found in rather dry country. This is in the New Haven Marsh, paradoxically enough, which lies partially in Seneca, Huron, Crawford and Richland counties. At one time it was very marshy, and geologically it is an old lake bed, now filled to a depth of several feet with peat. In the spring there is water almost everywhere and at that season of the year *butleri* is most in evidence. Later in the season, both as a result of less rainfall and the ditching done by the celery farmers, much of the area gets pretty dry. We did find a few *butleri* in the Marsh during the dry season, but they were not very numerous."

Our Ontario specimens were nearly all taken in the grass and beneath cover on the ground in a dry clearing and along an adjacent roadside. Although the immediate habitat was very dry there was a ditch with a little water on the opposite side of the road. The whole area lies within a swamp, which, though dry in the summer, is apparently quite wet in the spring. At the time of our observations, during the hot weather in early July, these snakes were found to be active only in the evening from sundown until dusk. In the longish grass where most of our specimens were taken they moved with a swiftness and grace nearly equal to that of the common garter-snake, but removed from the grass and placed on the bare earth the awkward gait commented upon by Ruthven (1908, 90) was apparent, with much lateral thrashing of the body effecting relatively little progression when the snakes were trying to hurry. When Butler's garter-snake is picked up it usually exhibits a behaviour quite different from that of the common garter-snake, wrapping itself around the fingers and clinging with a perceptible pressure and using its tail also as a prehensile organ.

The species feeds upon earthworms, frogs and fish. Ruthven recorded leeches from the stomach of a Michigan specimen.

The young are born in July or early August. Ditmars (1907, 224) records a brood of twelve born on August 4. Conant (1938, 99) records births of litters on July 2, 3, 28 and August 7, with broods ranging from four to fourteen in numbers of young. Females taken at Newbury in early July were much distended with young, and three of these kept at the Royal Ontario Museum of Zoology produced litters of eleven, fifteen and nineteen young between the mornings of July 27 and 28. The litter of fifteen included one stillborn example too embryonic to survive. Measurements ranging from five and one-eighth to six and three-quarter inches were obtained from these broods within a few hours of birth.

Ribbon Snake *Thamnophis suaritus suaritus* (Linné)

Range: Maine to Michigan, north in Michigan throughout the southern peninsula and in Ontario into Muskoka County, south to Georgia, Alabama and Mississippi.

Moderately common in southern Ontario.

Size and structure: A slender-bodied snake which reaches a length of about thirty inches. Head rather small, distinct from neck; loreal plate present; eye large; tail long, usually 29 per cent or more of total length. Nasals 2; loreal 1; preocular 1; postoculars usually 3, occasionally 2 or 4; temporals 1+2, occasionally 1+3; supralabials usually 7, occasionally 6 or 8; infralabials usually 10, occasionally 9 or 11; ventrals 155-167 (150-173); anal plate entire.

Colour: Ground colour above olive or chocolate brown to black with three yellow stripes—a vertebral and two lateral, the lateral stripe lying on the third and fourth scale rows on the anterior half of the body to behind the middle (Fig. 3B, Pl. IV) and bordered below by a chocolate brown band on the first and second scale rows. Upper labials, chin and throat bright yellow like the lateral stripe; a vertical yellow spot on preocular (Fig. 3A, Pl. IV). Belly pale greenish, sometimes quite dusky posteriorly. The slim body, long tail, brilliant colours and sharply defined pattern all contribute to the clean-cut appearance of this snake which readily distinguishes it in life from *sirtalis*. When the dorsal ground colour is brown, the dorsal yellow stripe and the upper edge of the lateral yellow stripe are usually bordered with black, accentuating the sharpness of the pattern.

Habits and habitat: The ribbon snake frequents damp situations such as wet meadows, the margins of streams and ponds and shores of small lakes. A rather aquatic species seldom found far from water. It is very agile and swift, and a fair climber, occasionally found several feet above ground among the lower limbs of bushes. It seems to feed entirely upon amphibians and fish. Captive specimens invariably refused earthworms and insects although Surface (1906, 142) recorded both of these items, and also spiders, from stomachs examined. He expressed the opinion that the insects and spiders came from the stomachs of amphibians which had fed on these items before being eaten by the snakes. The earthworms were found alone in one stomach.

The young are born in August (possibly late July to early September). The number of young in a litter average twelve according to Ruthven (1908, 112). Conant (1938, 102) records litters of five and seven. We have a record of a brood of twelve born on August 3.

Common Garter-Snake *Thamnophis sirtalis sirtalis* (Linné)

Range: Nova Scotia west to Minnesota and eastern Texas, north in Ontario and Quebec to James Bay, south to the Gulf of Mexico and peninsular Florida.

The commonest snake in Ontario; abundant in some localities.

Size and structure: A medium-sized snake which occasionally attains a length of about forty-two inches, although most specimens seen are less than thirty-six inches. Form moderate, stoutish in pregnant females; head long and distinct from neck; loreal plate present; eye large. Nasals 2; loreal 1; preocular 1; postoculars usually 3, occasionally 2 or 4; temporals usually 1+2, occasionally 1+3; supralabials usually 7, occasionally 8 or 6; infralabials usually 10, occasionally 9 or 11; ventrals 140-166 (137-168); anal plate entire.

Colour: Ground colour above black, brown or olive, normally with three light stripes—a vertebral and two lateral, the lateral stripe lying on the second and third scale rows (Fig. 1B, Pl. IV). Two rows of alternating black spots along each side of the back are visible if the ground colour is light, but if dark, are not apparent unless the skin be stretched. The colour and pattern are exceedingly variable: the light stripes may be lemon or bright yellow, orange, reddish, pale brown, greenish, soiled whitish or even bluish. They are often more brilliant on the anterior part of the body and may sometimes become very dull or almost disappear posteriorly. The dorsal stripe is occasionally absent. The first scale row is usually darker than the belly but lighter than the dorsal ground colour, but may occasionally be almost as dark as the dorsal colour or as light as the belly (in the latter case the colour of the lateral light stripe is continuous with that of the belly). The undersurface is usually pale yellowish or greenish, with a dark spot near the lateral edge of each ventral plate, but may be gray or darkly pigmented, especially posteriorly. Preocular scale with out a light spot (Fig. 1A, Pl. IV) and usually but slightly paler than loreal.

Some specimens show very brilliant colours: red or copper may occur on the skin between the scales on the lateral stripe, especially anteriorly, and may suffuse completely over the scales of this region and forward onto the sides of the head. The dorsal ground colour may be rich, deep reddish to purplish brown with blue or green flecks between the scales in the interspaces between the spots. In a specimen from Lake Abitibi the sides of the face, the lateral stripe, and the whole ventral surface to the tip of the tail were entirely blood-red, while the dorsal stripe was brilliant yellow suffused with red on the neck region.

Melanistic specimens which are entirely black except for a white throat and chin occur at Lake Erie.

Habits and habitat: The common garter-snake is the most widely distributed and hardiest snake in Ontario. It is the first to appear in the spring and the last to disappear in the autumn. Our earliest and latest records at Toronto are respectively March 19, 1927, and November 26, 1933. A dead specimen, apparently quite fresh, was found with the end of its tail frozen fast in the ice on December 28, 1932, which would suggest that in southern Ontario this snake may occasionally venture out to bask during the sunny hours of a mild winter day. This one evidently remained above ground too long.

The garter-snake frequents a great variety of country and may be found about woodlands, clearings, farms, roadsides, the shores of lakes, streams, ponds and marshes, and while it shows a fondness for water, which it readily enters, it nevertheless wanders far from it into high and dry situations. Its food consists chiefly of earthworms and amphibians, but it is also very fond of fish. Small mammals and birds are occasionally taken. Insects were reported by Surface (1906, 149) from stomachs examined, but as that author suggests, much of such material was doubtless swallowed in the stomachs of amphibians. We have never observed captive specimens to take insects.

The young are born from July to October and usually number from about ten to thirty in a litter, but as many as seventy-eight have been noted by Ruthven (1908, 178). A brood of seventy-three was noted by Wallace (1938, 203). Most of our counts have been above fifteen and counts of above thirty are common.

Prairie or Red-barred Garter-Snake *Thamnophis sirtalis parietalis* (Say)

Range: Extreme western Ontario, western Minnesota, Iowa and Missouri west to British Columbia, eastern Washington, Idaho and eastern Nevada, from the prairie provinces south to about the latitude of northern New Mexico.

Our only Ontario locality of record for positive material is Favourable Lake, Patricia district, about fifty miles east of the Manitoba border. Specimens from Rainy River district referred to below are probably of this form.

Parietalis is a subspecific form of *sirtalis* from which it differs mainly in coloration; in scutellation it is similar except for averaging higher in ventral and subcaudal counts. In the characteristic colour pattern of *parietalis* the spots of the dorsal series are fused together into a continuous black band while those of the lateral series are distinct from each other but fused with the dorsal series (Fig. 4, Pl. IV), producing a comb-teeth pattern, and the interspaces between the lateral spots normally show

more or less red above the lateral light stripe. The dorsolateral spots may be obscured by the darkness of the dorsal colour, as is true in some of our Manitoba specimens.

Three garter-snakes received from Favourable Lake, all females, are dark above with the pattern obscured except where the skin is stretched. Two of these which had been in formalin for three and two months respectively still showed a faint trace of red in the interspaces. In the third specimen, received a few days after poor preservation, the red was plainly evident and brilliant in the interspaces. The ventral counts for these three snakes are 155, 163 and 161 respectively.

In eight garter-snakes received from Emo, North Branch and Rainy River in Rainy River district of Ontario, the dorsal colour is black, obscuring the pattern, as is commonly the case with *sirtalis* in Ontario. The ventral counts for these snakes are as follow: Emo specimens, male 163, females 161 and 166; North Branch specimens, male 162, females 156, 157 and 157; Rainy River specimen, female 162. Since these snakes had been in preservative for some time before they were received and examined, any trace of red, had it been present in the interspaces, would have disappeared; and since a ventral count as high as 160 is only rarely reached or exceeded by females of *sirtalis*, while Ruthven (1908, 170) has recorded a count as low as 150 for females of *parietalis*, it seems possible that some or all of these are referable to *parietalis* in view of the locality from which they came, which we now know to be within the eastern fringe of the range of this form. It is impossible to make positive identification in such borderline cases from just a few preserved specimens, especially from a locality where the ranges of the two forms come together and intergradation might be expected, without access to a larger series and fresh material; perhaps not always then because of intergradation.

Family CROTALIDAE. PIT VIPERS

This family, which includes the rattlesnakes, copperheads and water moccasins, is distinguished from other vipers by the presence of a deep pit in the loreal region between the eye and nostril, but shares with other vipers the characteristic viperine venom apparatus consisting of long, hollow, erectile fangs connected by ducts with venom glands (page 8). A unique feature of rattlesnakes is the rattle which terminates the tail (Figs. 6, 7, Pl. V). It is composed of loosely interlocking segments which produce a buzzing sound when the tail is vibrated, and if complete, will taper at the distal end and terminate in a small rounded button which was the original first permanent rattle of the baby rattlesnake. If the

rattle segments are all of the same diameter it means that a number of them have already been lost by breakage or wear, a thing which is constantly happening. A new segment is added to the rattle with each shedding of the skin, which may happen three or more times in a year. These facts explode the popular notion that the segments in a rattle-snake's tail correspond with the years of its life and so reveal its age. The function of the rattle is to warn away enemies which are large enough to injure the snake, not to warn its prey and give it a sporting chance of escape for no wild animal would be so unreasonably gentlemanly. There is no evidence at all to indicate that it is used as a mating call or signal between individuals, but such experimental evidence as has been gathered suggests that these snakes are deaf to the sound of their own rattles.

The function of the pit is not known beyond that it is a sensory organ. There is some evidence to suggest that it is sensitive both to temperature and sound, but what other kinds of sensation it may receive or of information it may convey to its owner remain to be discovered.

Rattlesnakes can bite without striking as when stepped on or grasped and such a bite may be just as deadly as the bite at the end of a stroke. In order to strike, the snake must assume the characteristic striking posture in which the body is thrown into a loose coil with the forward portion raised and bent into an S-shaped curve, from which position the head may be lunged forward with incredible speed. At the end of the stroke the mouth is opened and the fangs erected for biting. A rattlesnake rarely strikes for more than half its own length and never jumps or hurls itself at its intended victim. It does not invariably rattle before striking or biting.

Massasauga, Swamp or Little Gray Rattlesnake *Sistrurus catenatus catenatus* (Rafinesque)

Range: Western New York and Western Pennsylvania southwest through Ohio, Indiana, Illinois, southern Iowa and Missouri to eastern Kansas; southern Wisconsin, southern peninsula of Michigan and Mackinac County in northern Michigan, southwestern Ontario at least to northern Parry Sound and Manitoulin districts.

Not now plentiful in Ontario. Still fairly common in Bruce peninsula and not rare along the eastern shore of Georgian Bay and on some of the adjacent islands; found occasionally in the general vicinity of Lake Erie. It probably occurs along the whole Georgian Bay-Lake Huron-Lake Erie shoreline, thinning out and disappearing inland. All of our positive records are within about twenty miles of this shoreline. We have reports from further east, the most easterly being from Prince Edward County. We have recently had a report of its occurrence at Cobalt.

Size and structure: A medium-sized, stout-bodied snake, attaining a

length from two and a half to three feet. Head (Figs. 1, 2, Pl. V) broad, somewhat triangular, wide through the angle of the jaws and distinct from neck, snout blunt. A deep pit in loreal region; plates on top of head symmetrical, presenting together an area of generally oval outline when viewed from above; frontal region concave; supraocular protruding over eye; pupil vertically elliptic. Tail terminating in a rattle. Nasals 2; loreal 1; preoculars 2, the upper in contact with postnasal; supralabials usually 12, less often 11 or 13; infralabials 12, less often 13 or 14; dorsal scales 25 or 27-25-23-21-19, or occasionally a maximum of 28 or 29, those above the second row keeled; ventrals 136-145 (130-147); anal plate entire; subcaudals mostly single.

Colour: Ground colour above gray or brown, with usually seven distinct series of alternating dark brown blotches. Those of the dorsal series largest; below these and alternating with them is a row of much smaller and paler spots; alternating with these and spaced to fall directly under the dorsal blotches is another series of moderately large blotches as dark as the dorsals; between these on the first and second scale rows lie the very dark blotches of the lowest series. The blotches, except in the small upper lateral series, dark-edged and outlined with cream or yellow borders. The dorsal blotches may occasionally extend down to fuse with those directly beneath them, forming wide crossbands, and the small spots of the upper lateral series may be absent, or the pattern may be confused in other ways. Tail with dark crossbands. Ventral surface black, more or less broken with white especially toward the neck region, and changing to gray and white mottling on throat and chin. The head markings are a dark band across prefrontals and another across posterior half of frontal and supraoculars, the latter joined at right angles by a pair of longitudinal dark blotches extending onto the neck; a small dark blotch centred on the parietals and scales immediately behind them; a broad dark band from eye to neck, touching angle of mouth, and bordered below by a brilliant yellowish or creamy line; two narrow yellowish lines bordering pit diverge downward on second and fourth supralabials.

Habits and habitat: This rattlesnake is found mostly in the vicinity of swamps and low ground, but occurs also in drier situations. LeRay (1930, 201) gives the following account of the habitat at Bruce peninsula, Ontario: "The majority of specimens collected were found in the immediate neighbourhood of swamps and along the old tote roads that run through stretches of low ground. Although these records indicate that they prefer low, wet grounds as their habitation, they may often be found far away from water, taking up their abode wherever there is sufficient cover, among which they can find at short notice a place of retreat. Several examples were taken in the clearings around the old lumber mill

and outer buildings of Johnson's Harbour. Some were found in dry, rocky situations, and others were taken on the farmland adjacent to the Crane river which runs across the peninsula."

The massasauga feeds chiefly upon mice and frogs and will not scorn such food that has been dead sufficiently long for decay to have set in. Its liking for frogs indicates, as does also the scutellation of the head, its closer relationship with the copperhead and moccasin group (*Agkistrodon*) than with the true rattlesnakes (*Crotalus*) which take only warm-blooded prey.

It is a mild-tempered and rather sluggish species which much prefers concealment or escape, to combat, and cases of bite in Ontario are exceedingly rare and none of which we know were attended by very serious consequences. However, its venom, according to a report of the Antivenin Institute of America, is about five times as toxic as that of the Texas rattler (*Crotalus cinereus*). The shortness of its fangs and the small quantity of venom injected at a bite must account for the relatively mild results as compared with the bites of the larger rattlesnakes. The foregoing facts taken together, while not giving cause for alarm over the presence of the snake in a locality, indicate that the careless handling of it is a dangerous pastime. It is now very scarce over much of its present range in Ontario and has been exterminated over much of its former range, and while its presence is not desirable in the immediate vicinity of human habitation, destruction of it in other situations should be discouraged. It is one of nature's agents in the control of rodents, and to those who appreciate wild life in its entirety rattlesnakes are as interesting as other natural forms. Persistent destruction of animals which are restricted in their range and habitat, as is this snake, must eventually lead to extermination, which, once accomplished is final, for a species so destroyed has gone forever. There will be multitudes of serious-minded people in the generations yet to come who will wish to see and study rattlesnakes as they will other forms of life, so there is a responsibility incumbent on us who are living today, and who by the very nature of the case are trustees of an estate to be passed on, not to wantonly destroy any living thing, regardless of whether from our point of view it is a desirable creature or not.

The number of young in a litter is not large. Ditmars (1907, 438) and Conant (1938, 116) record births of seven young and Conant records also twelve embryos in one female. Atkinson and Netting (1927, 42) judge the usual numbers to be from five to nine. The time of birth probably ranges from late July to early September.

Timber or Banded Rattlesnake *Crotalus horridus horridus* (Linné)

Range: Southern Maine and New England States southwest to northern Alabama and from southeastern Minnesota and southwestern Wisconsin to northeastern Texas (the southern limit of the range swings northward in the Mississippi Valley into the southern tip of Illinois). Found in extreme southern Ontario and on some of the islands in the western end of Lake Erie, but not in Michigan.

Ontario records are from Niagara region and from Point Pelee, Essex County, as follow: A specimen in the Royal Ontario Museum of Zoology collection was taken in 1877 in Welland County, about one mile southwest of Niagara Falls, by Dr. J. H. Garnier. A specimen in the National Museum of Canada, Ottawa, was killed at Point Pelee on September 29, 1918, by Captain G. Wilkinson (Patch 1919, 61). Two specimens killed in Niagara Glen were identified by Dr. W. P. Alexander of the Buffalo Museum of Science in the years 1934 and 1936. The first of these was killed on July 17, 1927, by Mr. Harold Ellison of Niagara Falls, N.Y., who informed us that it measured three feet, six and one-half inches in length, and had a full-grown, half-digested rat in its stomach. For the second of these specimens the data of capture was not available. We have reports of this snake at Niagara Glen as late as the years 1936, 1937 and 1938 and know of no reason to doubt their validity. Residents of Niagara Falls, Ontario, who know the Glen very well informed us that one or two rattlesnakes are killed on "the flats" every year in July or August. We have a number of reports from Sparrow Lake region but hesitate at the present time to include any of them as positive records.

That the early distribution of this snake in Ontario was more extensive and followed the outcroppings of limestone rock where they occur in the southern part of the province seems likely, and if the odd specimen should still be found in some such situations it would not surprise us greatly although we know of no positive records aside from those cited above. There are many references to rattlesnakes in the writings of early travellers in Upper Canada (now Ontario) but most of such references were probably to the massasauga.

The earliest identifiable reference specifically to the timber rattlesnake in Ontario, of which we know, was in September, 1669, in the journal of Rene de Brehart Galinée, who was attached to M. de La Salle's party, and is from a translation by B. E. Charlton (1884, 51, 52). The locality, according to Charlton, was near an Indian village called Otinaoustettaoua which "appears to have been situated on the borders of a small lake in the township of Nelson, about 10 miles from Hamilton, known as Lake Medad, not far from Waterdown" (in Halton County). Charlton's translation follows:

"We waited here until the chief of the village came to meet us with some men to carry our effects. M. de La Salle was seized, while hunting, with a severe fever, which, in a few days reduced him very low.

"Some said it was caused by the sight of three large rattlesnakes which he had encountered on his way while ascending a rocky eminence. At any rate it is certain that it is a very ugly spectacle, for those animals are not timid like other serpents, but firmly wait for a person, quickly assuming an offensive attitude, coiling half the body from the tail to the middle as if it were a large cord, keeping the remainder entirely straight, and darting forward, sometimes 3 or 4 paces, all the time making a loud noise, with the rattle which it carries at the end of its tail. There are many in this place as large as the arm, six or seven feet long, and entirely black. It vibrates its tail very rapidly, making a sound like a quantity of melon or gourd seeds shaken in a box." There is no question here as to which rattlesnake was referred to.

Robert Gourlay (1822, 185, 186) distinguishes between the massasauga and timber rattlesnake, and writes, "There are two species of rattlesnakes, vulgarly distinguished by the names of yellow, or large, and black, or small, rattlesnake. The former is from four to five feet in length, and the middle of the body seven or eight inches in circumference, from whence it tapers toward the head and tail. The neck is small, head flattened," etc. Of the colour he writes, "the back is brown, beautifully variegated with yellow and a tinge of red, and lined and barred with black; the belly a sky blue." As to the relative abundance of the two species he says, "Black rattlesnakes, though by no means common in the province, are not so rare as the yellow species. Of the latter I have seen only one and but few of the former. The yellow rattlesnake which I saw and examined, was kept in a cage, and as his keeper declared, had lived several weeks without food." He does not state where the yellow rattlesnake was seen or captured, but leaves one to understand that it was native to Upper Canada (Ontario) and of occasional occurrence.

Size and structure: A large stout-bodied snake which occasionally reaches a length of five feet or more. Body thickest near middle and tapering toward neck and tail; head (Fig. 3, Pl. V) broad and flat, triangular, and distinct from the much narrower neck. A deep pit between eye and nostril; scales on top of head between supraoculars small and irregular; supraoculars protruding over eyes; pupil vertically elliptical. Tail terminating in a rattle. The scutellation of our one Ontario specimen follows with some extralimital counts included in parenthesis. Nasals 2; loreals 2 (2 or 1); preoculars 2; supralabials 14, (10-16); infralabials 14, (11-19); dorsal scales 26-25-23-21-19; ventrals 173 (158-178); anal plate entire; subcaudals single.

Colour: We have little information as to the colour of Ontario specimens. Garnier's specimen in our collection is bleached almost white but still shows a trace of dark crossbanding. Some of those killed at Niagara Glen were reported to us (verbally) to have been yellowish with dark crossbands. Gourlay's account cited above furnishes the only colour description that we know for Ontario material, while Galinée's account indicates that a black colour phase also occurred here. For the species in general the ground colour above varies from sulphur yellow to olive, brown or black, with from fifteen to twenty-eight dark chevron-shaped crossbands of brown or black (obscured in black specimens), these widest on the mid-dorsal region and with their angles directed backward. The bands may be broken to form three series of blotches—a large dorsal row and two smaller lateral rows, or they may be interrupted by a brownish median line; they are usually outlined with pale coloured margins. Belly yellowish or mottled with black.

Habits and habitat: This snake prefers timbered situations with rocky ledges where deep and secure hiding places may be found. It is in such rocky places that they congregate in the autumn for hibernation, and according to Ditmars (1907, 444) when they scatter in the summer they follow the smaller outcroppings of the same rock system and rarely wander very far from them. In southern Ohio, Conant (1938, 119) found a favourite habitat to be dry hillsides and hilltops covered mostly with deciduous trees.

The food of the timber rattlesnake consists chiefly of small mammals. Stomach analyses by Surface (1906, 196) shows these to constitute ninety-four per cent in the stomachs examined, and snakes six per cent (this last item may be considered as unusual; it is shown in the diagram but not mentioned in the itemized table.) Of the mammals, thirty-seven and one-half per cent were field mice and six per cent common rats. Other rodents found in the stomachs included other species of mice, red squirrels and rabbits. The food habits of this snake place it on the economically valuable list, and while because of its venomous nature it is not desirable about human habitations or camping sites, it should not be destroyed when encountered in lonely, out-of-the-way places. People who wish to camp in such places should keep their eyes open for their own safety.

The young, according to the records of Ditmars (1907, 446) may number from seven to twelve in a litter, and he gives birth dates ranging from September 6 to 18.

THE TURTLES

The turtles are represented in Ontario by eight species and one subspecies, a total of nine forms belonging to four families, and all more or less aquatic.

KEY TO THE TURTLES OF ONTARIO

A. Carapace with rigid margins and covered with horny scutes (Fig. 1, Pl. VII, Figs. 8, 9, Pl. VIII).

B. Plastron small, not nearly filling opening of carapace (Figs. 3, 4, Pl. VI).

C. Bridge of plastron short and wide (Fig. 3, Pl. VI); lower jaw only hooked at tip (Fig. 1, Pl. VIII); carapace not serrated; tail short, no dorsal tubercles. **Musk Turtle** *Sternotherus odoratus*. P. 46.

CC. Bridge of plastron long and narrow (Fig. 4, Pl. VI); both jaws hooked at tip (Fig. 2, Pl. VIII); carapace serrated behind, tail long with prominent dorsal tubercles (Fig. 1, Pl. VII). **Snapping Turtle** *Chelydra serpentina*. P. 47.

BB. Plastron large, filling or nearly filling opening of carapace (Figs. 2, 5, 6, Pl. VI).

D. Plastron rigid, not movably attached to carapace; no transverse hinge.

E. Carapace rounded above, without keel, not serrated behind (Fig. 8, Pl. VIII).

F. Notch at front of upper jaw with a sharp tooth at either side (Fig. 6, Pl. VIII); marginal scutes brilliantly streaked with red or yellow.

G. Central dark blotch on plastron very large extending outward along sutures (Fig. 6, Pl. VI), vertebral and costal scutes crossed by wavy yellowish lines; neck and limbs striped with yellow or red. **Bell's Turtle** *Chrysemys bellii bellii*. P. 54.

GG. Central dark blotch of plastron small or absent, no extensions along sutures (Fig. 5, Pl. VI); vertebral and costal scutes not crossed by yellowish lines; neck and limbs striped with red. **Painted Turtle** *Chrysemys bellii marginata*. P. 55.

FF. Notch of upper jaw without teeth at either side (Fig. 3, Pl. VIII); marginal scutes not streaked with red or yellow.

H. Carapace (Fig. 8, Pl. VIII), head and limbs with rounded brilliant orange spots. **Spotted Turtle** *Clemmys guttata*. P. 49.

EE. Carapace roof-shaped with a median keel, serrated behind (Fig. 9, Pl. VIII).

I. Scutes with strong concentric grooves; upper jaw arched downwards in front and notched at tip (Fig. 4, Pl. VIII); neck and limbs unstriped. **Wood Turtle** *Clemmys insculpta*. P. 50.

II. Scutes without strong concentric grooves; upper jaw neither arched downward nor notched in front (Fig. 5, Pl. VIII); head,

neck and limbs striped with greenish yellow.

Map Turtle *Graptemys geographica*. P. 53.

DD. Plastron movably attached to carapace; a transverse hinge between abdominal and pectoral scutes. **Blanding's Turtle** *Emys blandingii*. P. 51.

AA. Carapace with flexible margins and covered with leathery skin (Fig. 2, Pl. VII); snout produced into tube-like process with nostrils at tip (Fig. 7, Pl. VIII).

Spiny Soft-shelled Turtle *Amyda spinifera*. P. 56.

Family KINOSTERNIDAE. MUSK TURTLES

Musk Turtle *Sternotherus odoratus* (Latreille)

Range: Eastern North America from the New England States to Florida (not in peninsular Florida), west to southeastern Kansas, eastern Oklahoma and eastern Texas, north to southeastern Wisconsin and southern Michigan and in Ontario into Parry Sound district.

Ontario records are from Parry Sound district and Muskoka County at Georgian Bay, Essex, Wentworth, Prince Edward, Frontenac and Leeds counties. There is no doubt that its distribution is more general than this would indicate, although it appears to miss the Toronto region by a wide radius.

Size and structure: A small turtle which attains a carapace length of about five inches. Carapace rigid, rather oval in outline, arched and rounded above (except in very young specimens which have a median keel), covered with horny scutes; margins not flaring. Plastron small, not nearly filling opening of carapace (Fig. 3, Pl. VI); anterior lobe rounded and somewhat movable on a transverse hinge; posterior lobe rigid, obtusely notched behind; all plastral sutures in adults covered by areas of skin which may be wide and extensive. Bridge short and wide. Head large; snout conical, protruding; lower jaw hooked at tip (Fig. 1, Pl. VIII); two or four barbels on chin, and a pair on throat. Skin soft with small fleshy papillae; about three long, curved scales on inner anterior side of front limb above foot, and several on heel. Tail short.

Colour: Carapace usually darkish brown and without pattern, but occasionally of a lighter grayish or yellowish hue with mottling of darker streaks and spots. Head and limbs dark above; two light yellowish lines pass backward from snout, one above the eye and ear, the other below them. Plastron yellowish; under fleshy parts grayish.

Habits and habitat: This very aquatic little turtle frequents quiet water in lakes, slow streams, marshes and ponds. It is mainly carnivorous taking any sort of animal food that it may find, living or dead, but also a certain amount of green aquatic weeds. Food that is too large to be swal-

lowed whole is seized in the jaws and torn to pieces with the claws of the front feet, a common practice with all of our turtles. The musk turtle is so named because of the musky odour which it emits when annoyed. The musk glands are situated beneath the edge of the carapace, a pair on each side, one in front of and one behind the bridge. It appears to be a surly-tempered little reptile and even individuals which have been kept as pets for months may open their jaws and assume a threatening attitude when handled.

The eggs are laid in June and may be placed in the soil, in the soft wood of decaying stumps, or beneath drifted trash at the edge of the water. At the Point Pelee marsh we found them in exceedingly wet locations. They number usually from three to six in a set; are white, or faintly pinkish about the middle, elliptical, about an inch or slightly more in length, and have a brittle shell. Hatching occurs in late August or in September.

Family CHELYDRIDAE. SNAPPING TURTLES

Snapping Turtle *Chelydra serpentina* (Linné)

Range: Eastern North America from Nova Scotia to the Rocky Mountains, and from the southern prairie provinces through the United States, Mexico and Central America to Costa Rica.

Common in southern Ontario north to Lake Nipissing. We have seen no specimens from anywhere in Ontario north of Lake Nipissing, but have reports from Long Lac and from Adrian township about forty miles west of Port Arthur, Thunder Bay district. The former of these was obtained verbally from a woodsman at Lake Nipigon who told us of very large turtles which he had occasionally seen resting on logs or rocks in Long Lac. The Adrian township report appeared in the Mail and Empire, Toronto, May 26, 1934, and told of a large "mud turtle" with a shell measurement of seventeen by eighteen inches having been killed with a pike pole by a fisherman named Fred Robillard in a small lake in Adrian township, the name of which he did not know. If these reports are correct they can refer only to the snapping turtle.

Size and structure: Our largest turtle, sometimes attaining a weight of forty pounds and a shell length of probably more than sixteen inches. A twenty-nine and three-quarter pound specimen* from the Rideau river, measured at the Royal Ontario Museum of Zoology, had a carapace sixteen inches long and twelve and a half inches wide, and a total length from snout to end of tail of thirty-eight and one-eighth inches. Carapace

*Sent to Toronto Parks Department by Mr. W. P. Bull, June, 1938.

rigid, covered with horny scutes and serrated behind. Young specimens have three prominent undulating keels—a vertebral and two costal, which form a peak at the rear margin of each vertebral and costal scute, and each scute is rugose with ridges radiating forward from this high point (Fig. 1, Pl. VII). These sculpturings gradually disappear with growth until in old specimens the shell is smooth. Plastron small, not nearly filling opening of carapace (Fig. 4, Pl. VI); bridge narrow and long. Head large, flattened on top and with bony ridges; snout rather pointed and protruding; both jaws hooked at tips (Fig. 2, Pl. VIII); chin with two small barbels; neck with papillae. Tail long with a median row of prominent dorsal tubercles and a row of smaller tubercles on either side. Limbs scaly, scales prominent on anterior surface of front leg; large, curved scales on heel.

Colour: Carapace medium to very dark brown; upper surface of head and limbs brown; under parts dull yellow in adults, grayish in small specimens and practically black in recently hatched young. Sides of head lighter brown, spotted and streaked with darker brown or black, and with two lightish bands, one backward from behind the eye, the other obliquely downward from beneath eye to angle of mouth.

Habits and habitat: The snapping turtle inhabits lakes, marshes and the quiet parts of streams. It is very aquatic, rarely leaving the water except to lay its eggs. Its food consists of any kind of small animal that may come within range of its jaws, including insects, crustaceans, fish, amphibians, reptiles, birds and mammals. It will eat animals that are dead and decaying and is probably a natural scavenger. Young captive specimens take green aquatic weeds and lettuce in small quantities. Surface (1906, 128, 29) found some vegetable food in five out of nineteen stomachs examined. The snapping turtle is unable to swallow except with its head under water.

The eggs are laid in June in holes dug by the females in soft earth or sand, often at some little distance from the water, and are not infrequently turned out by farmers when ploughing. The eggs in a set usually number from twenty to thirty; we have counts ranging from six to sixty-four. Hatching usually occurs in late August or September, but the young may winter in the ground as embryo, or as fully developed young in the case of late hatching. The eggs are spherical, white, with one hemisphere pinkish, and measure about an inch or a shade more in diameter. The shell is hard, tough, and somewhat brittle, and the eggs will bounce on a hard surface.

Because the snapping turtle takes some toll of water-fowl and fish, some "conservationists" advocate its destruction, but any such measure should be pursued with caution and only after proper ecological study of

the particular situation. While it cannot be tolerated in hatchery ponds or water-fowl enclosures, it must be remembered that in the open marshes, rivers and lakes the great bulk of its food is neither water-fowl nor game fish, but all sorts of miscellaneous things including snails, crayfish, insects, frogs, snakes, young turtles, etc., and much of its fish food would naturally consist of such forms as minnow, catfish, suckers, carp, sunfish and other species frequenting the shallower muddy-bottomed waters to which the snapping turtle resorts. Carrion, also, is no doubt extensively eaten, since rotting fish and other animal garbage seems to make such good bait for it. In pioneer days our lakes and rivers were alive with game fish and our marshes with water-fowl, and all this in spite of multitudes of turtles and snakes and other predacious animals which the white man now often wrongly blames with reducing the numbers of game.

Family TESTUDINIDAE. TERRAPINS AND TORTOISES

Spotted Turtle *Clemmys guttata* (Schneider)

Range: Maine to Florida through the Atlantic coast states, and westward in the northern United States and the western peninsula of southern Ontario to Lake Michigan; north in Ontario to southern Georgian Bay.

Ontario records are from Essex, Kent, Norfolk, Welland and Muskoka counties. Common in the Lake Erie region.

Size and structure: A small turtle attaining a shell length of four inches or a little more. Carapace rigid, covered with horny scutes, oval, widest behind the middle, flaring above the hind legs, without keels or serrations (Fig. 8, Pl. VIII). Plastron large, rigid, obtusely notched behind. Limbs scaly. Head small, upper jaw notched in front, without teeth bordering notch (Fig. 3, Pl. VIII).

Colour: Carapace and upper surface of head and limbs dark brown or black with rounded orange spots (Fig. 8, Pl. VIII); a large spot on each side of head above and behind ear. Plastron brown or black, usually with an irregular orange area centrally, which may be extensive, much reduced or absent; under surface of limbs orange, more or less mottled with black; throat marbled with orange and black or almost entirely black, generally darkest in males.

Habits and habitat: The spotted turtle seems to prefer small bodies of shallow water such as ponds and brooks. We have taken it in the big marshes of Point Pelee, Long Point and Turkey Point on Lake Erie, but always either in very shallow water or on dry land. At Turkey Point we found the greatest numbers in woodland ponds and about a decidedly

cool trout stream which rises in the cedar swamp and flows for some distance along the eastern edge of the marsh. Dr. A. L. Tester (unpublished MS) found it common in weedy bays at Go Home Bay, Georgian Bay, in the summer of 1928. It is only moderately aquatic, and spends much time on land.

The spotted turtle eats both animal and vegetable food: insects, snails, crustaceans, earthworms, spiders, frogs, fish and various green leaves enter its diet. Mr. W. J. LeRay informed the writer that he has seen it feeding on *Daphnia* when this entomostracan was present in swarms in the woodland ponds referred to above.

Egg-laying occurs in June when the eggs, up to three or less often four in number, are deposited in a hole dug in the ground by the female and covered over with earth. At Point Pelee a female was seen digging a hole with her hind feet in the sandy sod beside the marsh at about eight o'clock in the evening of June 22nd. The eggs are white, elliptical and about an inch and a quarter in length.

Wood Turtle *Clemmys insculpta* (Le Conte)

Range: "Eastern North America from Nova Scotia to Virginia, west to Michigan, Wisconsin, and Iowa; southwestern Ontario. Not found in Indiana or Illinois." (Stejneger and Barbour 1939, 158).

Conant (1938) does not record it from Ohio, but suggests (page 8) the possibility of its occurrence in the northeastern part of that state, and its natural occurrence is not known with certainty from any Ontario locality east of Huron County,* so it appears that the eastern population is isolated from the western one. The western population is split by Lake Michigan.

Ontario records of recent years are all from the vicinity of Clinton and Holmesville, Huron County, and number only six. Nash (1908, 18) reported it, apparently on J. H. Garnier's authority, as "tolerably common in western Ontario, less frequently found eastward" but cites no localities nor dates. Garnier died in 1898, and since his time we know of none having been found east of Huron County in Ontario.

Size and structure: A smallish to medium-sized turtle attaining a shell length of six to eight inches. Carapace rigid, strongly keeled, serrated and flaring behind, covered with horny scutes which are marked with strong concentric corrugations and less prominent radiating ones (Fig. 9, Pl. VIII). Plastron large, rigid, deeply notched behind. Head

*C. L. Patch reported to us a specimen having been found on a street in Ottawa, possibly an escape, and gave Sherbrook, P.Q., as the nearest Canadian locality of record to Ottawa, a distance of about 180 miles.

small, flat above, upper jaw arched downwards in front and notched at tip (Fig. 4, Pl. VIII). Limbs scaly.

Colour: Carapace dull brown, or dull grayish or yellowish brown; scutes with radiating dark pencillings. Plastron yellow with a large black blotch on outer posterior portion of each scute. The head is dark above, the neck, limbs and ventral fleshy surfaces are grayish and orange (in Ontario specimens).

Habits and habitat: In the early summer this turtle frequents ponds and streams and leads a rather aquatic existence. Later in the season it wanders off through meadows and woodlands where it lives as a land tortoise until the autumn, when it again returns to the water. Some of the Huron County specimens were found within six or eight feet of a stream which is flanked on one side by a wooded hill and on the other by a low, wet meadow, and were taken on the hill side of the stream among roots and debris that had been washed up by the spring floods.

Its food includes insects, snails, earthworms, fish, etc., and various berries and leaves.

We have no information as to egg-laying in Ontario. Babcock (1938, 24) gives the season as June in the New England States and the number of eggs as from four to seven. They are elliptical in shape.

Blanding's Turtle *Emys blandingii* (Holbrook)

Range: South shore of Lake Erie west to Nebraska, north to Minnesota, Michigan and southern Ontario. New England States and Long Island. (See p. 14).

In Ontario it ranges north to Lake Nipissing; it is common along Lake Erie and in the eastern counties of Frontenac and Leeds. Along the north shore of Lake Ontario we have no records west of Prince Edward and Hastings counties.*

Size and structure: A rather large turtle with a carapace length occasionally exceeding ten inches. Carapace rigid, covered with horny scutes, high and convex, or somewhat depressed on top in old specimens (keeled in the very young). Young specimens up to about six or seven-inch carapace length show concentric rings on the scutes which gradually smoothen with age. Plastron large, filling opening of carapace and attached to it by a ligament; the lobes movable, united by a transverse hinge; posterior lobe obtusely notched. Head moderately large; upper

*Except at Toronto, and the significance of these records is open to question. They were all close to the city, and two of them (seen in 1932 and 1939) are known to have been liberated or escaped specimens, and the other two (seen in 1937 and 1939) are suspected of so being. Prior to these recent cases this turtle was not known in the Toronto region.

jaw notched at tip but without tooth at either side of notch. Tail of moderate length; limbs scaly.

Colour: Carapace dark brown or nearly black with numerous irregular spots or streaks of dull yellow radiating forward on the vertebrals and forward and downward on the costals. The size and extent of the yellow markings is variable. In a recently hatched specimen in our possession the carapace is brown with some irregular black speckling. Head and limbs dark olive or brown above; head with light olivaceous spots; throat and chin abruptly yellow. Plastron yellow with a large dark blotch on outer posterior portion of each scute.

Habits and habitat: We have taken this turtle commonly in the shallow water of marshes and in ponds, and on the land in the vicinity of such waters. It is often to be found foraging in water so shallow as to barely cover its shell, or wandering on the land, or sunning itself near the water. When first picked up it hisses and withdraws the head and limbs beneath the carapace, closing the movable lobes of the plastron, but never under any circumstances have we known it to bite in self-defence. In captivity it soon loses its shyness and becomes very tame, feeding readily from the hand.

It is an omnivorous feeder, taking both animal and vegetable food, but more of the former. We have kept captive specimens on a diet of raw liver, beef, fish, earthworms and lettuce. It is able to swallow without submerging its head.

Egg-laying occurs in June. Snyder (1921, 17) observed nest-digging at Point Pelee: "At 6:30 P.M. on the 22nd of June I found two turtles preparing to deposit their eggs. . . . I kept one specimen under observation until excavation was fairly under way. Then crawling within ten feet of the turtle, I watched the procedure without its showing any signs of fear.

"Bracing itself up with its front feet, it dug with the hind feet, slowly carrying the sand to the surface on the upturned sole. In digging, the feet were always used alternately, the sand being placed first to the right and then to the left of the hole. While using one hind foot in scooping from the bottom, the other was rested against the side of the hole, helping the turtle to raise itself in order to lift the sand to the surface. After the hole was two or three inches deep, the turtle settled back so that the edge of the carapace rested on the rim of the hole. In this position, and by extending the hind legs, quite a depth was attained. After three quarters of an hour this operation was completed. . . .

"I estimated the hole to be seven inches deep with a surface opening of three and one half to four inches in diameter. This broadened out

below the surface, making a flask-shaped chamber about seven inches in diameter. After one egg had been dropped I returned to camp."

Mr. Snyder in company with the writer returned to the nest later in the evening, when upon digging it out we found eleven eggs. The eggs had a white, dull shell, were a little larger than those of the painted turtle, perhaps an inch and three-eighths in length, and elliptical in shape. They were set to hatch in a box of sand, but met with an accident on August 26th when the little turtles were nearly ready to emerge.

Map Turtle *Graptemys geographica* (Le Sueur)

Range: Mississippi Valley from northern Louisiana north to southern Wisconsin, southern Michigan and southern Ontario; from the St. Lawrence and Ottawa rivers, Lake Champlain, New York, Pennsylvania and southwestern Virginia west to Iowa, eastern Kansas, eastern Oklahoma and northwestern Texas.

In Ontario it ranges northern to southern Parry Sound district and the Ottawa region. Eastern records are from Leeds, Frontenac and Prince Edward counties, and from the Ottawa river at Norway Bay on the Quebec side (C. L. Patch 1925, 95, 96) about forty miles west of Ottawa; western records are from southern Parry Sound district and Muskoka County at Georgian Bay, Wellington, Wentworth, Norfolk, Kent and Essex counties, one of the Kent County localities being at Lake St. Clair. We have at present no records from the central portion of southern Ontario between Georgian Bay and Frontenac County nor from any point on the north shore of Lake Ontario west of Prince Edward County.

Size and structure: A rather large turtle with a shell length of sometimes ten inches or more. Carapace rigid, covered with horny scutes, keeled, obtusely notched in front, serrate behind, flaring above hind legs. Plastron large, rigid, notched behind, nearly filling opening of carapace. Head large in females, smaller in males; upper jaw without notch at tip (Fig. 5, Pl. VIII). Feet broadly webbed; tail rather short.

Colour: Carapace olive to brown, marked with a network of greenish or yellowish lines which are very conspicuous in young specimens but may become obsolete in old ones; under surface of marginals with blotches of concentric markings—a blotch centred forward of each suture. Plastron yellow, gray or brown on the sutures. Head, neck and limbs dark olive green with longitudinal greenish yellow lines; a greenish yellow spot behind eye.

Habits and habitat: This decidedly aquatic and exceedingly wary turtle inhabits lakes and the larger rivers. It is fond of basking and selects rocks or timbers commanding a good view, and from which it can

drop immediately into the water, and being alert, is most difficult to approach. Any unaccustomed movement even at several hundred feet away, or any sudden sound, will cause it to take fright and dive. The splashing of one individual into the water is a signal to all others in sight or earshot and they too promptly dive, and when their heads break the surface again they are always a long distance from where they dived in.

Snails and clams enter largely into the food of this turtle, and the broad crushing surfaces of the jaws appear to be a special adaptation for breaking the shells of such prey. It also takes other aquatic forms such as fish, crustaceans and water insects. Conant (1938, 144) reports captive specimens nibbling at such greens as lettuce, spinach and beet tops, and Ditmars (1907, 44) records it as eating the edges of water lily pads. Food is swallowed with the head submerged.

We have no observations as to nesting in Ontario. According to Newman (1906, 140, 41) it begins early in June and the time of day selected is early morning. A flask-shaped hole is dug in the ground with the hind feet of the female, often at some distance from the water, and the eggs are deposited in it in two layers and covered over with earth. They are white, elliptical in shape, with a soft flexible shell, and according to Babcock (1938, 34) may number from twelve to twenty in a set and average thirty-two millimetres (one and one-quarter inches) in length. Hatching usually occurs in late August or early September, but in the case of late laying may be retarded until the following spring (Newman, *loc. cit.*).

Bell's Turtle *Chrysemys bellii bellii* (Gray)

Range: Thunder Bay district of Ontario and northern peninsula of Michigan west to Vancouver Island, south into New Mexico and Texas, east to western Illinois.

Ontario specimens are from Blackwater river and Orient bay at Lake Nipigon (Logier 1928, 290), and Whitefish Lake about forty miles southwest of Port Arthur, Thunder Bay district. It was reported to us by Mr. W. H. Bennett as common at Whitefish bay, Kenora district.

Size and structure: In structural features this turtle is similar to the subspecies *marginata*, and these features will be discussed under that form (page 55), which is the common pond turtle of southern Ontario. *Bellii* reaches a larger size than *marginata*, attaining a shell length of about eight inches, and differs also in colour and pattern.

Colour: Carapace olive green to dark brown; scutes narrowly margined with yellow and crossed by more or less crescentic wavy yellow lines; marginals marked with red, yellow and black, the red in our specimens was restricted to a central blotch on the lower side of each marginal.

Plastron yellowish to pinkish with a very large central dark blotch which occupies most of its surface (Fig. 6, Pl. VI); this blotch is usually of a marbled pattern, and sends extensions outward along the sutures between the scutes to near the edge of the shell, and may enclose a light area in the centre. Head, neck and limbs marked with yellow longitudinal lines and spots.

Habits and habitat: We have no notes on the habits of this turtle in Ontario. It frequents similar kinds of situations to *marginata* and its habits are probably quite similar. It may lay a larger complement of eggs, up to thirteen have been recorded for it in British Columbia. (Thacker 1924, 164-67).

Western Painted Turtle *Chrysemys bellii marginata* Agassiz

Range: Southern Ontario and western Quebec north to Timagami and Biscotasing, west to Lake Superior; lower peninsula of Michigan south through Indiana to southeastern Illinois and northern Kentucky, east through Ohio to western Pennsylvania and northwestern New York.

Very common in southern Ontario. We have in our collection two specimens, one from Lake George, Algoma district, and one from Biscotasing, Sudbury district, which are intermediate between *bellii* and *marginata*. In these the dorsal markings agree with *marginata* but the plastral dark blotch is very large and more like that of *bellii*. Bishop and Schmidt (1931, 131) found intermediates between these two forms to occur in southeastern Wisconsin and northern and western Illinois.

Size and structure: A small turtle attaining a shell length of about six inches. Carapace rigid, covered with horny scutes, broad, depressed, subovate in outline, widest behind the middle, flaring posteriorly. Plastron rigid, large, nearly filling opening of carapace. Head moderate in size; upper jaw notched in front with a sharp tooth on either side of notch (Fig. 6, Pl. VIII). Tail medium; limbs scaly.

Colour: Carapace olive to brown or black, scutes with yellowish margins; usually a narrow mid-dorsal stripe of yellowish or reddish. Marginals brilliantly marked with red and black; crescentic-shaped streaks and spots of red and black on upper surface, and a central red blotch on lower surface with smaller red marks around it. Plastron yellow to pinkish, usually with a dark central blotch (Fig. 5, Pl. VI), smaller than that of *bellii* and not sending projections outward along the sutures. This blotch may be absent. Head with yellow stripes changing to red as they pass backward on the neck. Limbs and tail striped and spotted with red.

Habits and habitat: This rather aquatic little turtle is common in ponds, rivers and lakes all over southern Ontario, and may be seen on

sunny days basking on logs, rocks, muskrat houses, or along the banks. It is pretty wary and usually drops into the water before one gets very close to it. It prefers the quiet, weedy and more stagnant situations in the waters which it inhabits and is common about marshes. When first picked up it commonly hisses and withdraws the head. Some individuals will attempt to bite. After a few weeks in captivity it generally becomes tame and feeds readily from the fingers, but individuals vary in this respect and some remain nervous and wild.

It is a general feeder, taking both animal and vegetable food, but much more of the former. Such items as insects, earthworms, fish, snails, crayfish, frogs, carrion, and aquatic weeds enter its diet. It swallows with the head submerged.

Egg-laying takes place about the middle of June, when the females wander over beaches and fields seeking nesting sites. A flask-shaped hole is dug in the ground with the hind feet and the eggs, four to eight in number, usually about six, are deposited in it and covered over with soil which is trampled and smoothed down. When digging a nest in dry ground, the excavated earth, as we noted on several occasions, may be moistened with water ejected by the turtle, apparently to prevent it slipping back into the hole while digging was in process. Late afternoon appears to be the preferred time for nesting. The eggs are elliptical, about an inch and an eighth or slightly more in length, have a dullish white and rather smooth shell, which is easily indented. The young usually hatch out late in the same summer, but may winter in the ground as embryos.

Family **TRIONYCHIDAE.** **SOFT-SHELLED TURTLES**

Spiny Soft-shelled Turtle *Amyda spinifera* (Le Sueur)

Range: From the Gulf of Mexico northward spreading fanwise in the drainage systems of the Mississippi, Missouri and Ohio rivers north to southeastern Montana, southern Minnesota, Wisconsin, Michigan, Lake Erie and southern Ontario, and eastward in the St. Lawrence drainage southward of Lake Ontario to Vermont.

Ontario locality records are: Hamilton Bay and Dundas marsh in Wentworth County; Thames river at Beachville, Oxford County; Grand river at Dunnville, Haldimand County; Long Point, Norfolk County and Point Pelee, Essex County. Mr. C. L. Patch informs us that there are in the National Museum of Canada two specimens labelled "Ottawa", which were acquired from the old Fisheries Museum, but that "no local specimens have come to hand during the twenty-five years I have been

here." If these specimens were correctly labelled as to locality they are interesting as the only ones we know of from that locality and as indicating the occurrence of the soft-shelled turtle on the north side of the St. Lawrence river. Nash (1908, 17) states that there is one record from the Ottawa river but cites no data; the reference may be to the above. It will be noted that most of our records are from Lake Erie or the Lake Erie drainage. A report of *Amyda mutica* (Le Sueur) from Lake Erie by Nash (*loc. cit.*) for which no authority of other data are given was without doubt based on misidentification of *spinifera*.

Size and structure: A large turtle which attains a carapace length of fourteen inches or more. Form broad and flat (Fig. 2, Pl. VII). Carapace roundly oval in outline and covered with leathery skin instead of horny scutes, margins flexible; some small spines at anterior end in adults. Plastron small and set forward so that its anterior margin is about equal with that of the carapace, but leaving much of the posterior fleshy parts exposed. Head rather small, slender; snout produced into a narrow, flexible tube (Fig. 7, Pl. VIII) with the nostrils opening at the tip; the sharp-edged, horny jaws concealed by fleshy lips. Feet with five digits but with claws on only the first three, extensively webbed, the webs extending backward as a broad fringe; three large curved scales on anterior surface of forearm; a large scale on heel, and another above it posteriorly.

Colour: Carapace olive to grayish or brownish with a yellow margin bordered inside by a black line which narrows and disappears at the front, and marked with numerous dark spots which are small and solid black near its margin, but toward the middle of the back become larger and take the form of black rings with dusky centres. Plastron white or pale yellow. Head and limbs olive; a dark-bordered yellow line on each side of snout, through eye, and on to neck; neck more or less spotted with black and marbled on the sides with black and yellow. Limbs marbled and spotted with black. Tail with a black-bordered yellow line on either side.

Habits and habitat: A very aquatic species inhabiting lakes and larger rivers and preferring a muddy or sandy bottom. It is at home in either deep or shallow water, but has a liking for shallow situations where it can bury itself in the soft bottom with only its head uncovered, and where by stretching its long neck the tip of the snout may emerge through the surface of the water for convenience of breathing without disturbing itself. It feeds very largely upon crayfish but takes other aquatic animals too, and is not averse to any kind of meat or fish food. Newman (1906, 131) records the finding of a few plant buds in the stomach of one specimen, but suggests that they were accidental. Surface (1908, 123) records seeing the species feeding on grains of corn, and the finding of a considerable quantity of both white and red corn in the stomach of a specimen exam-

ined. Like most other turtles, it probably uses a small amount of vegetable food. The soft-shelled turtle, like the snapper, is of savage temperament and capable of biting severely. Large specimens are dangerous to handle and remain sullen for a long time in captivity. Small specimens soon become tame.

Nesting takes place near the middle of June. At Point Pelee the fishermen told us that that was the only time when the turtles were ever seen to come ashore, or seen at all unless caught in the pound nets. We have no observations on the nesting process in Ontario, but this would not differ from that observed for the species in Indiana by Newman (1906, 132-35). According to this author the majority of nests are in soft beach sand and not more than six feet from the water. The warmest hours of the day are selected for nesting, when the females come ashore and deposit their eggs in holes dug with the hind feet; the nests are then covered with sand and tamped down with the knuckles of the hind feet. The sets, he states, number from nine to twenty-four eggs each, and average eighteen. The eggs are spherical, "of a delicate pink color and with a very thin brittle shell." Most of the eggs probably hatch in the late summer or early autumn of the same year.

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APPENDIX

COLLECTING AND PRESERVING OF SPECIMENS

Collecting: Reptiles may be found in a great variety of natural country that has not been affected or altered too much by the activities of man. Light, open woods, clearings, meadows, farms, swamps, marshes, streams, ponds and the shore regions of lakes are often good collecting grounds. The more aquatic kinds such as turtles and water snakes, should, of course, be looked for in the vicinity of water. Snakes are most often found by turning logs, stones, planks or other cover lying on the ground, or within rotted logs or stumps or beneath loose bark. All our snakes except rattlesnakes may be picked up by hand. Gloves may be desirable when collecting the larger kinds of harmless snakes as some are disposed to bite. Rattlesnakes should not be collected alive by inexperienced persons; they are best picked up with a snake hook or a slip noose at the end of a stick. Turtles may be found on land when sunning themselves or searching for nesting sites, or may be taken in the water by means of a landing net or a seine, or in cone traps made of mosquito or chicken wire netting, set in shallow water and baited with meat or dead fish.

Cloth bags are the most satisfactory containers for carrying specimens in the field. Sugar or flour bags (rehemmed around the edges by a sewing machine) are very good, or inexpensive bags of assorted sizes may be made of factory cotton. A stout tie-string of about twenty-four inches in length should be attached by its middle, about two or three inches below the top of the bag. Bags containing specimens should not be left in the sun.

Killing: Reptiles may be killed with anaesthetics or by drowning. For the latter method enclose the specimens in a jar, perforated can, or weighted cloth bag, submerge in tepid or cool water, taking care to liberate all air bubbles. Drowning may require several hours. The quickest, most humane and convenient method of killing is by anaesthesia with the vapour of chloroform, ether or carbon tetrachloride. Carbon tetrachloride is the most satisfactory because it leaves the specimens limp in death (and incidentally is both non-inflammable and inexpensive). Place the specimen in an air-tight can or jar with a wisp of cloth or paper moistened with carbon tetrachloride. Snakes and lizards will be unconscious in about five minutes and will die in about half an hour. Turtles will require several hours.

The killing of reptiles in a formalin or strong alcohol solution is a cruel, barbaric method for which there is no excuse.

Preservatives: Dilute formalin is the cheapest and most convenient temporary preservative, and the solution used should not be weaker than five per cent (1 part formalin to 19 parts water) for immersing specimens; ten per cent is recommended for injecting. For permanent preservation it is best to use alcohol of seventy-five or eight per cent strength. If pure alcohol cannot be obtained a good grade of denatured alcohol will serve the purpose.

Preservation: To preserve a specimen inject the body cavity with ten per cent formalin and immerse in five per cent formalin (straightening or coiling the specimen into the desired position, for it cannot be changed afterwards). Allow some days for the formalin to penetrate and thoroughly harden the tissues; the time will depend on the size of the specimen. When well hardened rinse in water for a few hours and transfer to seventy-five or eight per cent alcohol (which should be renewed after a few weeks). Snakes and lizards should be injected ventrally by means of a hypo-

dermic syringe—snakes at intervals of one or two inches along the entire length of the body, and large specimens should also be injected in the basal part of the tail. Turtles should be injected into the sides of the abdominal cavity in front of the hind legs and into the thoracic region between the insertion of the front legs and the neck. If a hypodermic syringe is not available incisions should be made in the body cavity and base of tail to allow the preserving fluid to enter, otherwise the viscera will decay before the fluid penetrates the body wall. In snakes, incisions of about an inch in length should be made at one or two inch intervals for the entire body length; in turtles they will have to be made in the sides of the body.

Labelling: Before specimens are placed in preservative, a label should be tied to each, giving the date and locality in which it was captured and the collector's name. Labels should be of strong paper or parchment and written with a *soft graphite pencil* or *India ink*. Never use ordinary ink for writing labels since it soon bleaches out in formalin. Several specimens taken at the same time and place may be wrapped together in cheesecloth and a common label enclosed. Such lots of specimens should be carefully wrapped and tied to prevent them rubbing together, or against the label.

Containers: Glass jars are the best permanent containers for small specimens; large specimens may be stored in earthenware crocks, the tops being sealed down with heavy grease (a mixture of vaseline and bee's wax heated together and containing enough valenine to remain pliable when cold), or with cloth soaked in hot paraffin wax and applied hot. Wooden pails with tightly fitting lids make good containers in the field, or even a box lined with table oilcloth will serve for temporary purposes so long as the preserving fluid is only formalin in water.

Shipping: When packing specimens for shipment sufficient soft material such as cotton batting, cheesecloth, or rags should be included to prevent them from rubbing against each other or against the labels when in transit. Moss, excelsior or paper will do for packing material. The wrappings and packing should be well saturated with the preserving fluid, the surplus of which may then be drained off in order to reduce weight and danger of leakage. After specimens have been thoroughly hardened in formalin they may be removed from the solution and shipped long distances if packed to prevent drying. Corks of bottles should be tied down.

Specimens for the museum should be addressed: Royal Ontario Museum of Zoology, Queen's Park at Bloor Street, Toronto, Canada.

PLATE I

SCUTELLATION OF BLUE-TAILED SKINK

- Fig. 1. Side view of head.
- Fig. 2. Top view of head.
- Fig. 3. Under surface of lower jaw.
- Fig. 4. Anal region, showing pair of enlarged preanal scales.

PLATE I

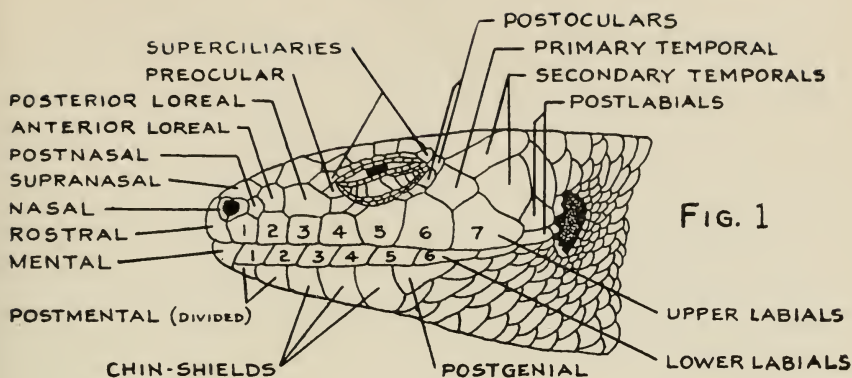


FIG. 1

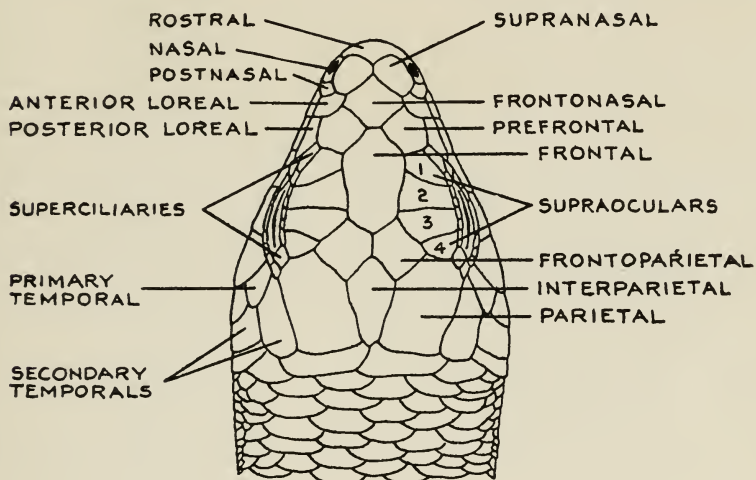


FIG. 2

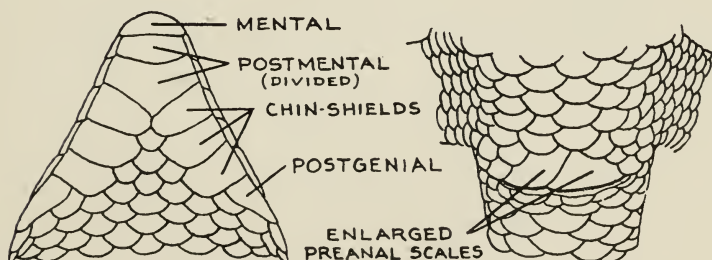


FIG. 3

FIG. 4

PLATE II

SCUTELLATION OF SNAKE

- Fig. 1. Side view of head and forward part of body.
- Fig. 2. Top view of head.
- Fig. 3. Under surface of head.
- Fig. 4. Under surface of anal region showing ventral, anal and subcaudal plates.

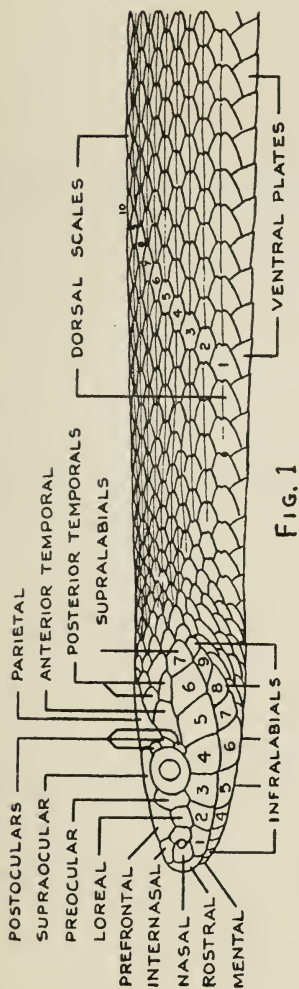


FIG. 1

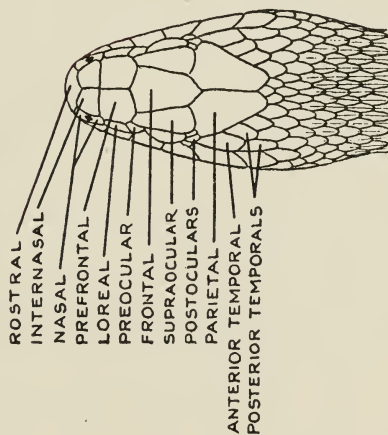


FIG. 2

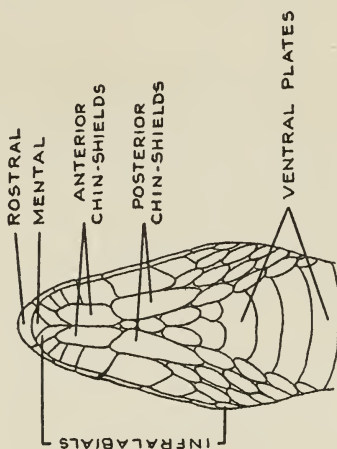


FIG. 3

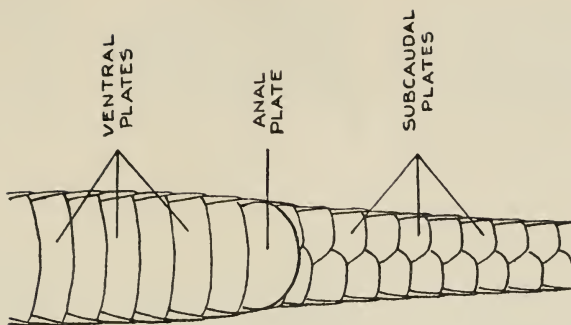


FIG. 4

PLATE III

DETAILS OF SNAKES

- Fig. 1. Head of hog-nosed snake showing pointed, protruding snout and the narrow azygous scale separating the internasals.
- Fig. 2. Head of milk snake showing pattern.
- Fig. 3. Head of fox snake showing pattern.
- Fig. 4. Head of DeKay's snake showing two nasal scales with nostril between; no loreal plate.
- Fig. 5. Head of smooth green snake showing single nasal scale with nostril in middle; loreal scale present and distinct from nasal.
- Fig. 6. Head of smooth green snake showing loreal scale fused with nasal.
- Fig. 7. Section of snake's body showing keeled scales.
- Fig. 8. Section of snake's body showing smooth (unkeeled) scales.
- Fig. 9. Under surface at anal region showing divided anal plate.
- Fig. 10. Under surface at anal region showing entire (undivided) anal plate.
- Fig. 11. Outline of tails of male and female snakes.
 - A. Female, tail tapering at base.
 - B. Male, tail swollen at base.

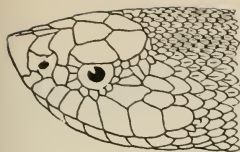


FIG. 1



FIG. 2



FIG. 3



FIG. 4



FIG. 5



FIG. 6

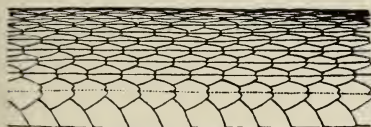


FIG. 7

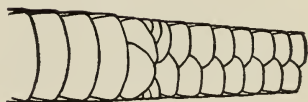


FIG. 9

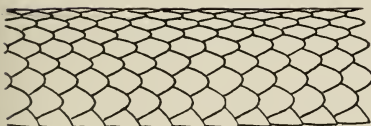


FIG. 8

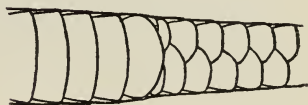
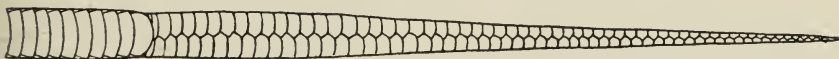


FIG. 10



A



B

FIG. 11

PLATE IV

COLOUR PATTERNS OF SNAKES

- Fig. 1. Common garter-snake, side view.
A. Head and neck region.
B. Middle of body.
- Fig. 2. Butler's garter-snake, side view.
A. Head and neck region.
B. Middle of body.
- Fig. 3. Ribbon snake, side view.
A. Head and neck region.
B. Middle of body.
- Fig. 4. Red-barred garter-snake, side view, middle of body, showing typical pattern.
- Fig. 5. Queen snake.
A. Side view at middle of body.
B. Ventral view at middle of body.
- Fig. 6. Common water snake.
A. Side view, forward part of body.
B. Side view, middle of body.
C. Ventral view, middle of body.

PLATE IV



A

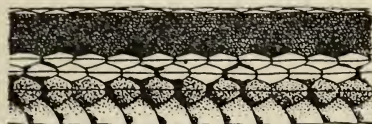
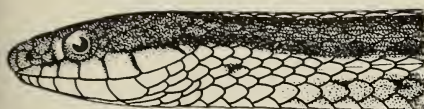


FIG. 1

B



A

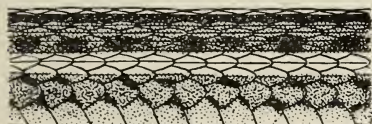
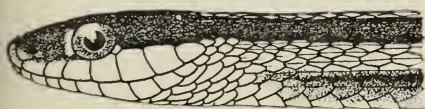


FIG. 2

B



A

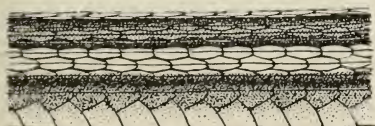


FIG. 3

B

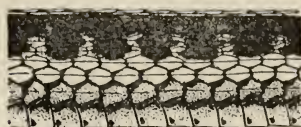


FIG. 4



A



FIG. 5

B



A



B



FIG. 6

C

PLATE V

FEATURES OF RATTLESNAKES

- Fig. 1. Head of massasauga, side view, showing pit and vertical eye pupil.
- Fig. 2. Head of massasauga, top view, showing large symmetrical scales between eyes.
- Fig. 3. Head of timber rattlesnake, top view, showing small irregular scales between eyes.
- Fig. 4. Diagram of venom apparatus of rattlesnake.
- Fig. 5. Diagram of bones involved in biting mechanism of rattlesnake.
 - A. Jaws closed, fang folded back against roof of mouth.
 - B. Jaws open and fang erected for biting.
- Fig. 6. Rattle of timber rattlesnake.
- Fig. 7. Diagram of section through basal portion of rattle showing interlocking attachment of rattle segments.

PLATE V



FIG. 1

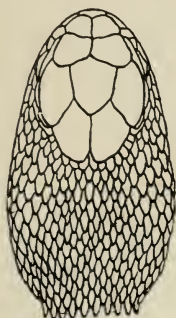


FIG. 2

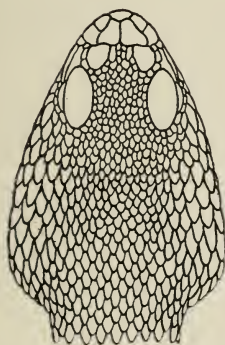


FIG. 3

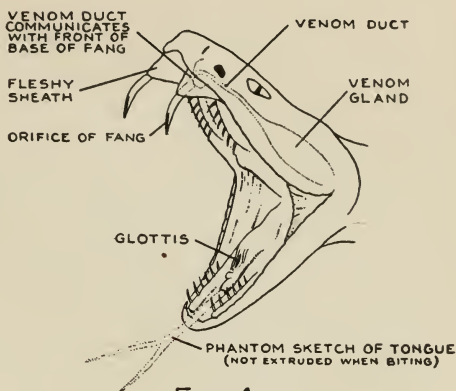


FIG. 4

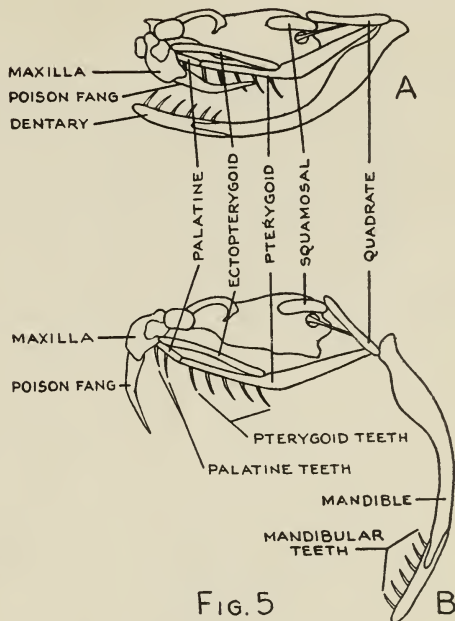


FIG. 5

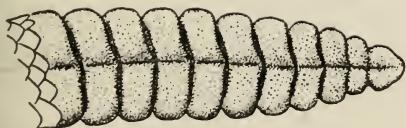


FIG. 6



FIG. 7

PLATE VI

DETAILS OF TURTLES

- Fig. 1. Scutes of carapace.
- Fig. 2. Scutes of plastron (showing also the axillary and inguinal scutes which are interposed between the carapace and plastron at the edges of the bridge.)
- Fig. 3. Plastron of musk turtle showing small size in relation to carapace (dotted), and relatively short, wide bridge.
- Fig. 4. Plastron of snapping turtle showing small size in relation to carapace (dotted), and relatively long, narrow bridge.
- Fig. 5. Plastron of western painted turtle. Median dark blotch restricted to central region.
- Fig. 6. Plastron of Bell's turtle. Median dark blotch covering most of plastron, with extensions outward along sutures.

PLATE VI

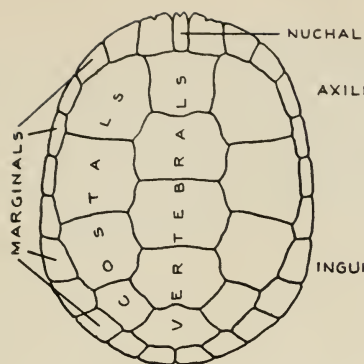


FIG. 1

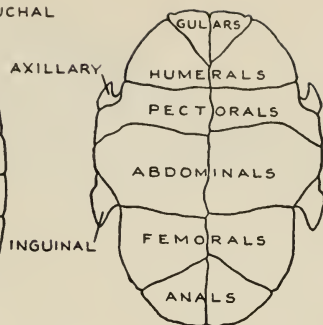


FIG. 2

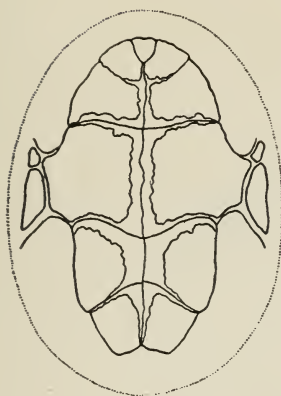


FIG. 3

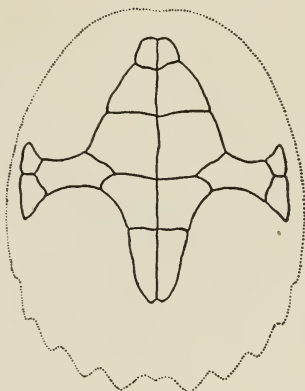


FIG. 4

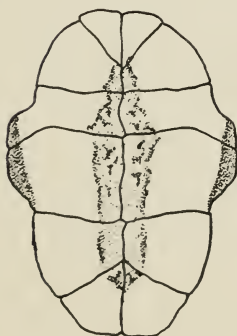


FIG. 5

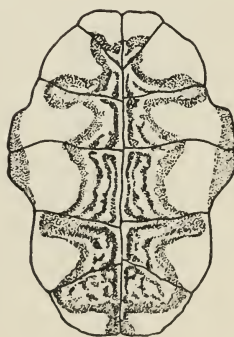


FIG. 6

PLATE VII

FIGURES OF TURTLES

- Fig. 1. Young snapping turtle, showing sculpturing of carapace, and long tail with dorsal tubercles.
- Fig. 2. Soft-shelled turtle, showing roundly oval outline of carapace and dorsal markings.

PLATE VII

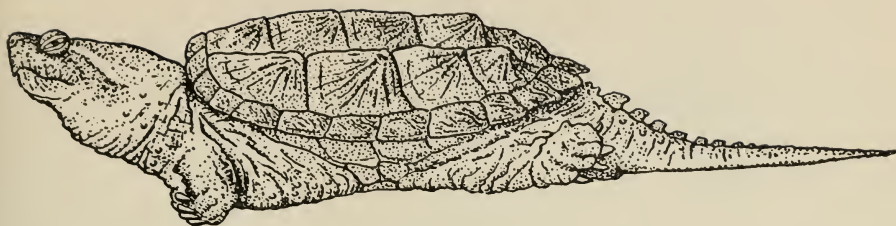


FIG. 1

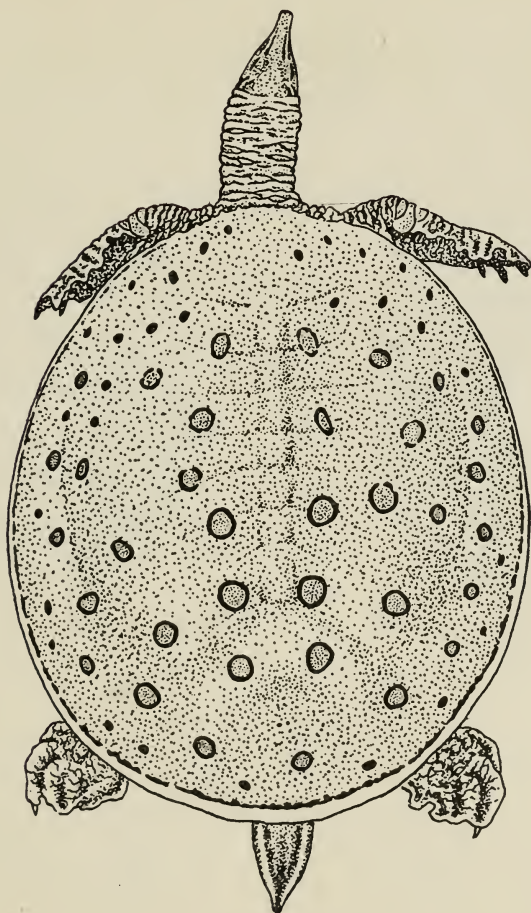


FIG. 2

PLATE VIII

DETAILS OF TURTLES

- Fig. 1. Head of musk turtle. Lower jaw only hooked at tip.
- Fig. 2. Head of snapping turtle. Upper and lower jaws hooked at tip.
- Fig. 3. Head of spotted turtle. Upper jaw notched at tip, but without teeth at sides of notch.
- Fig. 4. Head of wood turtle. Upper arched downwards in front and notched at tip.
- Fig. 5. Head of map turtle. Upper jaw without notch, lower not hooked at tip.
- Fig. 6. Head of painted turtle. Upper jaw notched at tip, a sharp tooth at either side of notch.
- Fig. 7. Head of soft-shelled turtle. Snout produced into tube-like form.
- Fig. 8. Carapace of spotted turtle. Covered with smooth (or nearly smooth) horny scutes, neither keeled or serrated.
- Fig. 9. Carapace of wood turtle. Scutes deeply sculptured; carapace serrated behind, and with a median keel.
- Fig. 10. Profile outline of male turtle (spotted). Plastron concave; vent distant from base of tail.
- Fig. 11. Profile outline of female turtle (spotted). Plastron slightly convex (or flat); vent close to base of tail.

PLATE VIII



FIG 1



FIG. 2



FIG. 3



FIG. 4



FIG. 5



FIG. 6



FIG. 7

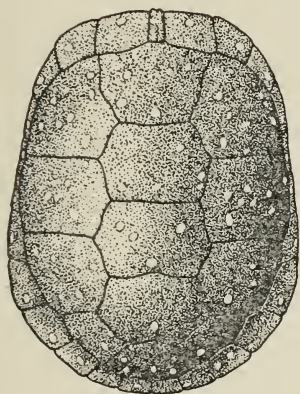


FIG. 8

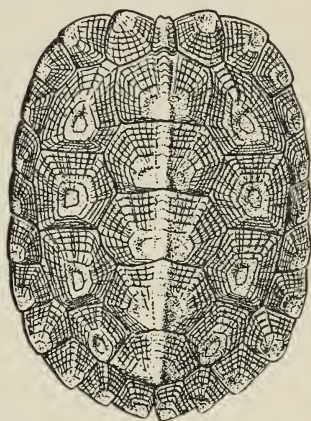


FIG. 9

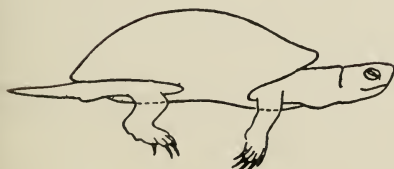
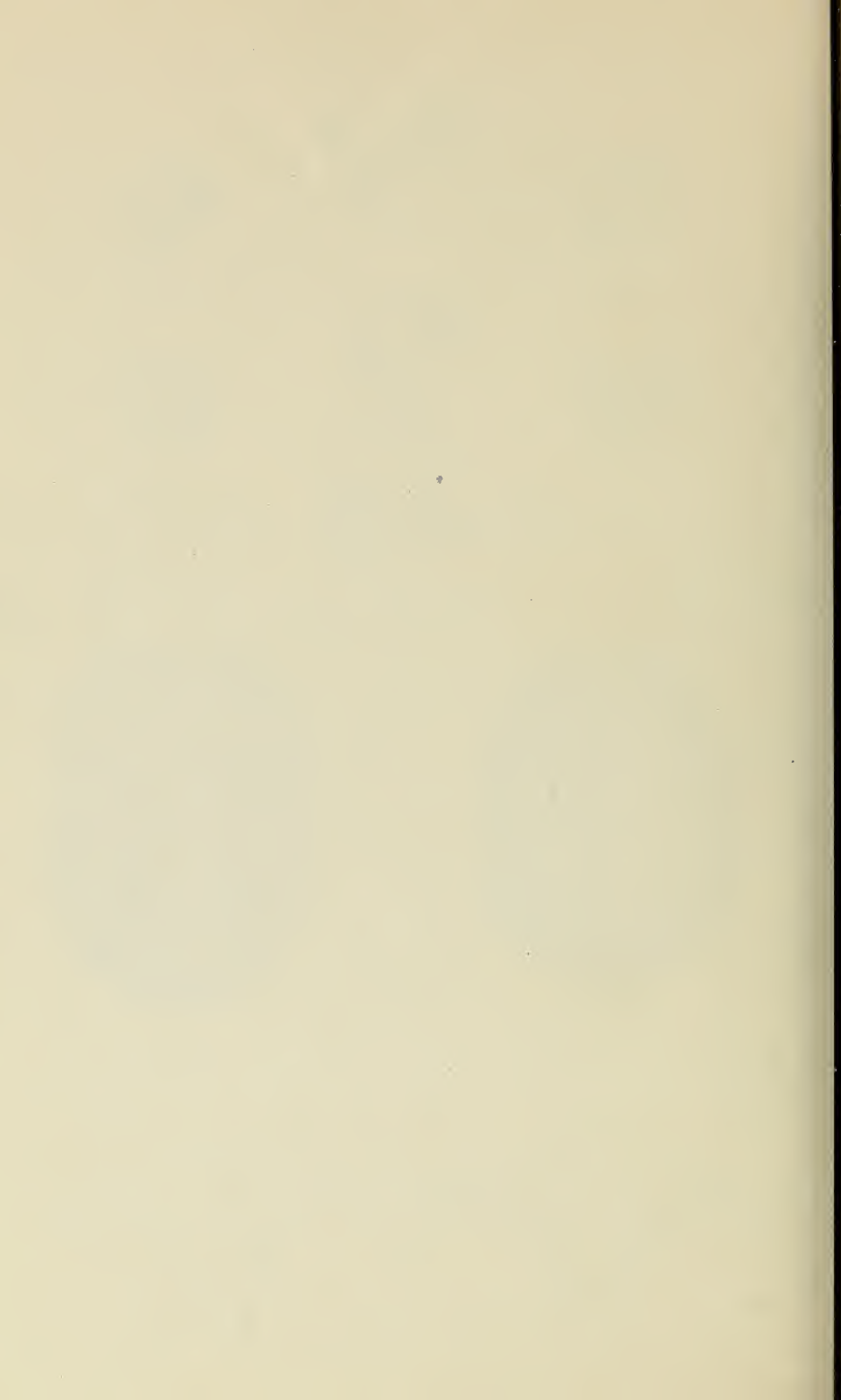


FIG. 10



FIG. 11



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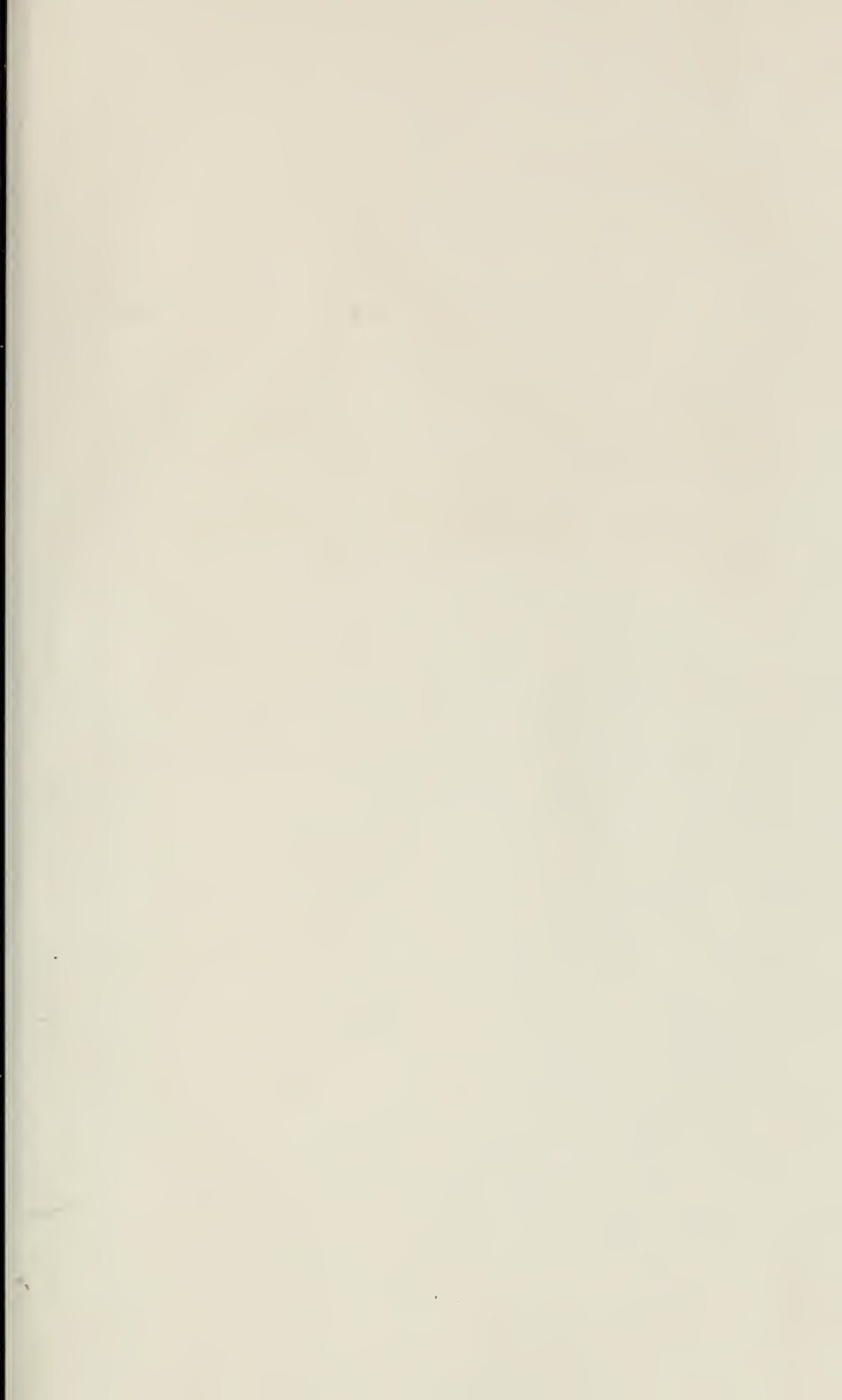
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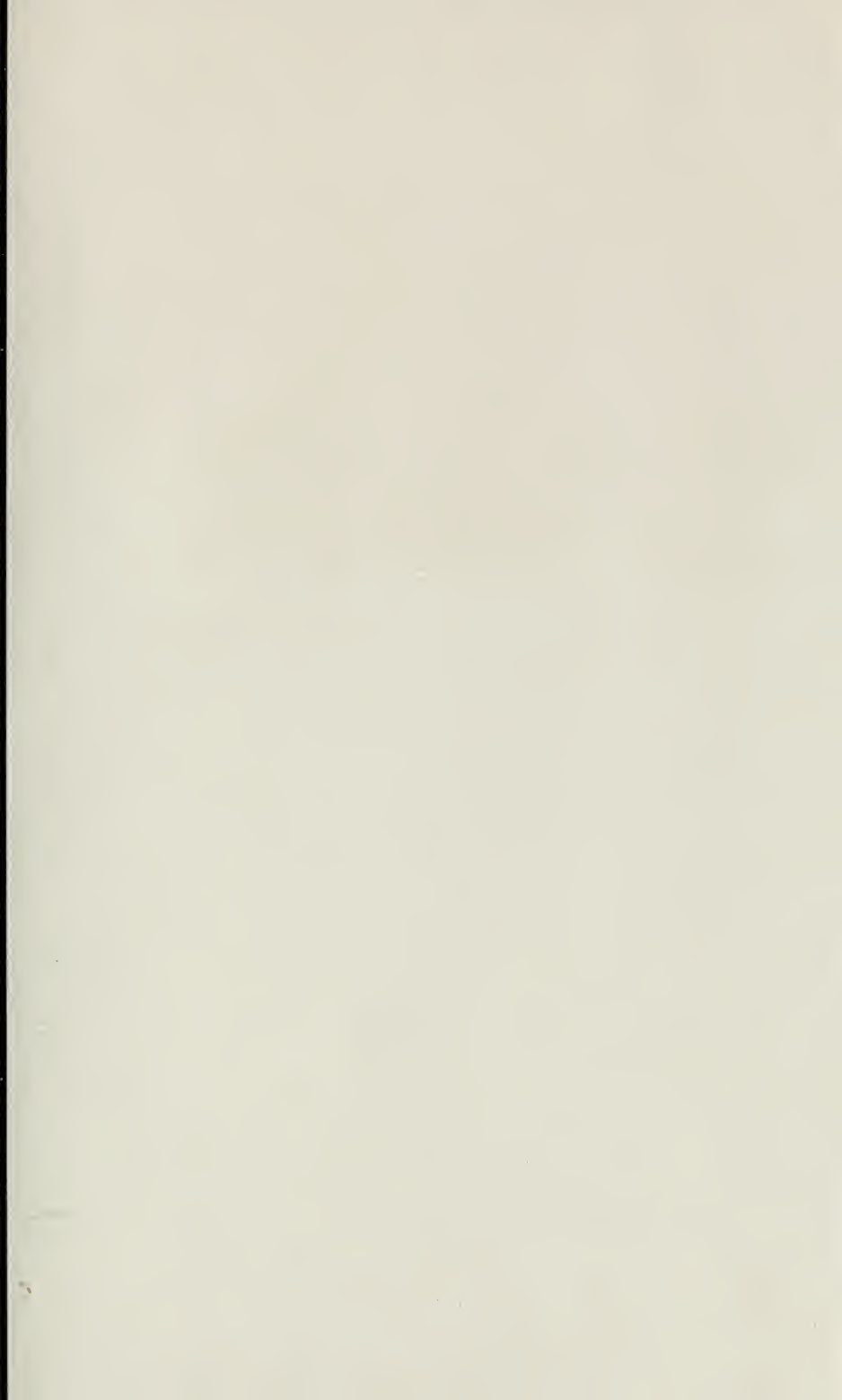
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