ARTHUR STUPKA

THE ZOOLOGICAL BULLETIN

OF THE

DIVISION OF ZOOLOGY.

OF THE

PENNSYLVANIA DEPARTMENT OF AGRICULTURE.

VOL. VI, No. 4 and 5 (For August and September).

SUBJECTS: { First Report on the Economic Features of Turtles of Pennsylvania.

September 1, 1908.

H. A. SURFACE, M. S., *Economic Zoologist, Editor.*

ENTERED MAY 1, 1903, AT HARRISBURG, PA., AS SECOND CLASS MATTER, UNDER ACT OF CONGRESS OF JUNE 6, 1900.

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THE MONTHLY BULLETIN OF THE DIVISION OF ZOOLOGY FOR AUGUST AND SEPTEMBER, 1908.

VOLUME VI, Nos. 4 and 5.

Established in April, 1903, at the office of the Economic Zoologist
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FIRST REPORT ON THE ECONOMY OF PENNSYLVANIA TURTLES.

PREFACE.

Classification or system is the most remarkable feature in the study of Nature. All living things are to be classified in certain larger and smaller groups, which are again divided and subdivided in regular systematic order until we come to the lowest or most remote group called the "species." This has been regarded as the unit in Nature. Thus, that great Class of Vertebrate animals which always breathe by means of lungs, and are called cold-blooded, have the body covered with scales or plates instead of feathers or hair, and have certain other anatomical characters in common, is called Reptilia or the Reptiles. This great Class is divided into four Orders, three of which are represented in the State of Pennsylvania: The Serpents, the Lizards and the Turtles. Thus it is correct to say that a Turtle is a Reptile.

Our Turtles belong to the Order Testudinata, so named from the Latin word meaning "a tortoise." The Pennsylvania species are included in four Families or major groups of this Order, while these Families are again composed of Genera or smaller groups, and Species, or the last group in the scheme of classification. The scientific name is that of the Genus and Species. Discussions of the individual kinds or species found in this State are here given under the respective scientific names, each of which is given its proper place in the scheme of classification.

There are a great many common names of Turtles, many of which are used for more than one species and are therefore confusing. For this reason we recommend that the first common name here given be used as the real common name for each respective species. However, others that are used in various parts of this State are given in order that readers may recognize the kind to which reference is made.

The authority for the classification here used is the Ninth Edition of the "Manual of the Vertebrate Animals of the Northern United States," by Dr. David Starr Jordan, President of Leland Stanford Junior University, Ninth Edition, 1904, by A. C. McClurg and Co., Chicago, Ill., which has been our standard of authority for the classification and nomenclature of the Bulletins on Vertebrate Zoology

previously issued by this office. However, a recent and undoubtedly more acceptable and proper series of scientific names of Turtles, has recently been published in the proceedings of the Philadelphia Academy of Sciences, by Dr. Arthur E. Brown, Director of the Philadelphia Zoological Garden. If it were not for our established plan to adopt Jordan's Manual as the authority on Vertebrates for our classification of names and Analytic Keys (because this is a book to be found in practically all zoological laboratories and libraries), we should here use the names given by Dr. Brown, but in order to bring these into general use for students, we publish them in brackets, after each of the synonymous names which Dr. Brown regards as needing to be changed.

We offer this Bulletin as a First or Preliminary Report on the Turtles of Pennsylvania, with the hope that it will aid in disseminating some knowledge upon this greatly neglected subject and in creating an interest that may lead to closer observations and further studies and collections, which may be the basis of a second and more extensive, useful and accurate Report on the same topic. Notes and specimens are earnestly solicited by the Economic Zoologist. Even slight observations upon such topics should be recorded in writing and sent to the office of the Economic Zoologist at Harrisburg, Pa. Specimens are greatly desired, particularly of those species which are indicated as being at present regarded as rare in this State. It is preferred that all specimens be killed as soon as collected, in order that the natural food may remain in the stomach and dissections may show something concerning their feeding habits. They can easily be killed by putting them into tightly closed vessels with cotton well saturated with chloroform and let them remain until entirely dead, or where that is impossible, the head of the Turtle can be drawn from the body and cut off at once. Both head and body should then be shipped by express to our office, at our expense. Persons who are willing to volunteer their services in making collections, in the different parts of this State, and also in making observations to aid in the preparation of a Second Report, should write to this office for further directions. Such persons will be the first to receive our further publication and otherwise be aided as much as is possible from this office. We hope to have many volunteers in different parts of this great State.

The acknowledgment and thanks of the Economic Zoologist are due to the various observers and contributors in different portions of this State and to his assistants and employes in the office, who have been faithful in their efforts to aid in collections, dissections, determinations, and otherwise have obtained facts for this Bulletin. Our thanks are also to be expressed to Dr. H. C. Bumpus, Director of the American Museum of Natural History, of New York City, for the

loan of plates previously used in their publication on "The Reptiles in the Vicinity of New York City," by Raymond L. Ditmars, from the American Museum Journal, Vol. V, No. 3, July, 1905.

H. A. SURFACE, Economic Zoologist,
Harrisburg, Pa.

GENERAL REMARKS ON THE TURTLES OF PENNSYLVANIA.

In consideration of the increasing numbers of insect pests destructive to forest, fruit and shade trees in this State, it becomes necessary to make a careful study of the economic features of all residents of woodland, field and orchard. According to what is doubtless correct theory, such pests were previously held in check in the balance of Nature by their natural enemies, but, due to the influence of man, either intentionally or thoughtlessly, the balance has been disturbed and the pests are increasing greatly, showing evidence that through one or more causes the enemies of such pests have decreased in number.

It is regrettable how few persons know which are really friends and which foes, not only in the insect world, but throughout the entire realm of the lower forms of animal life. Tens of thousands of individuals of various kinds inhabiting our forests, fields and gardens are placed under the general suspicion of being obnoxious or destructive to personal interests or property of mankind, which by a little investigation are shown to be beneficial in the extreme and which play an important part in the Plan of the Universe. It behooves the student of such subjects to look carefully along this line, prevent error, and see that truths are emphasized concerning such neglected and despised creatures.

Such students are forced to exclaim with Stillingsfleet:

> "Each moss, each shell, each crawling insect in the dust
> Holds a rank important in the plans of Him who fram'd
> their being;—
> Holds a rank, which, lost, would break the chain,
> And leave behind a gap that Nature's self would rue."

The study of the Turtles of Pennsylvania has been undertaken for the purpose of emphasizing the economic features of those species of which uninformed persons know so little, and which are consequently despised, neglected and often destroyed. The study is attended with unusual difficulties, such as (1) the lack of popular knowledge concerning it, in consequence of which it is almost impossible to secure by correspondence, notes and observations of the

occurrence of different species in various parts of this State; (2) the inaccessible places which are the haunts of most varieties of our turtles, and (3) the deplorable and almost entire absence of popular literature upon this subject.

What is a Turtle? Dr. David Starr Jordan, in his Manual of Vertebrates, has described the turtle as being "A reptile with the body enclosed between two more or less developed bony shields, which are usually covered by horny epidermal plates, but sometimes by a leathery skin. Upper shield (carapace) and lower shield (plastron) more or less united along the sides. Neck and tail the only flexible parts of the spinal column; these, together with the legs, usually retractile within the box made by the two shields. The bony part of the carapace is formed by the dorsal and sacral vertebræ, and the ribs co-ossified with a series of overlying bony plates, usually accompanied by a marginal row. The dorsal vertebræ have their

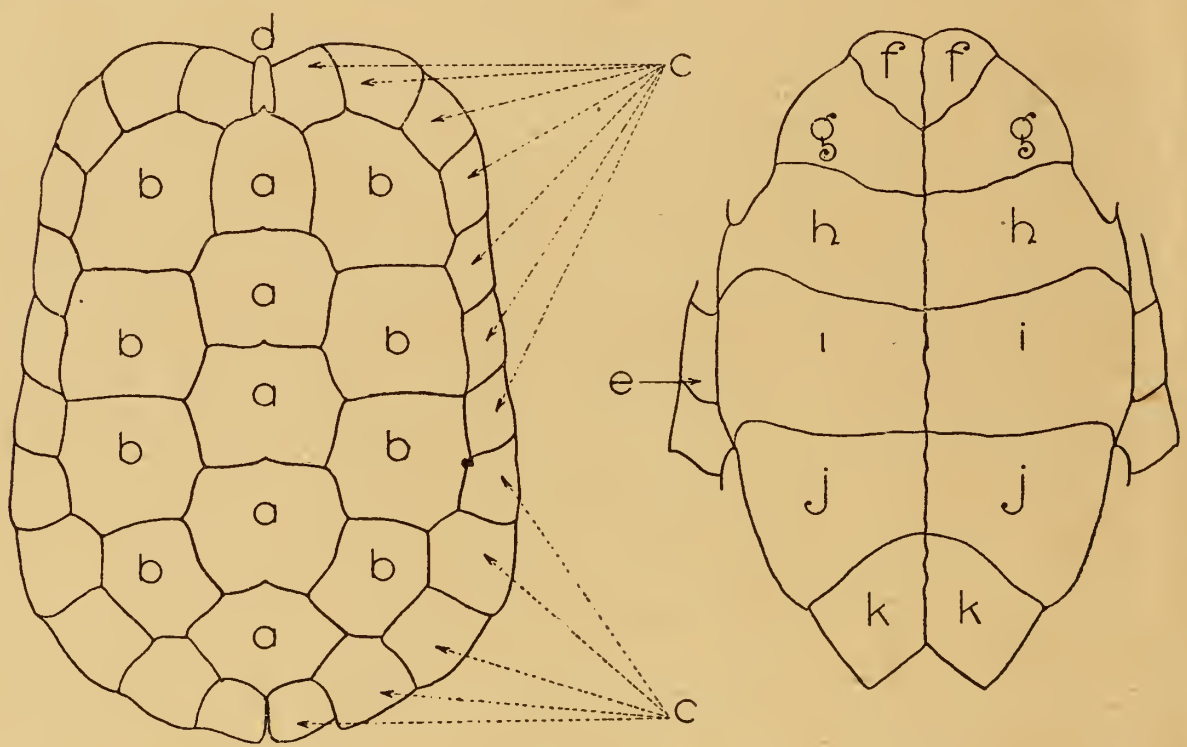

Fig. 1. A diagram of the upper shell or carapace, and under shell or plastron, with index to names of the dermal plates: Carapace, (a), Vertebral plates; (b), Costal plates; (c), Marginal plates; (d), Nuchal plate; Plastron, (e), Bridge; (f), Gular plates; (g), Humeral plates; (h), Pectoral plates; (i), Abdominal plates; (j), Femoral plates; (k), Anal plates.

ends flattened and immovably united by cartilage, and all of them, except the first and last, have their neural spines flattened horizontally so as to form the median line of plates. On either side of this series is a single row of ossified dermal plates, overlying the ribs and corresponding in number to the developed ribs, of which there are usually 8 pairs. No true sternum; plastron consisting of membrane bones, of which there are usually 9 pieces,—4 pairs and a single symmetrical median piece. The osseous plates, both above and below, correspond neither in number nor position with the overlying dermal plates.

"The skull is more compact than in the other reptiles. There are no teeth, but the jaws are encased in horny sheaths, usually with sharp cutting edges; the eye is furnished with two lids and a nictitating membrane as in the birds; the tympanic membrane is always present, although sometimes hidden by the skin. Respiration is effected by swallowing air."

Turtle, Tortoise or Terrapin? There has been an effort made by some writers to distinguish between Land and Water Turtles by using the word "Tortoise" for the former and "Turtle" for the latter, while the word "Terrapin" has been more or less generally used for small Turtles, without regard to definite reason for application. Among our Pennsylvania species we can find no line of demarcation between terrestrial or land and aquatic or water Turtles; neither can we find justification for applying the term "Tortoise" to one species in a Family, "Turtle" to another, and "Terrapin" to another of the same Family. We consider the use of these terms as confusing, misleading and unjustifiable. No attempt is made in this Report to confine their application within certain limits. They are therefore to be regarded as synonyms, and consequently no justifiable reason is to be found for discarding the word "Turtle" for any of our species that belong to the Order Testudinata. It would be very nice, indeed, if all writers and speakers should agree to apply the word "Terrapin" to those species of Turtles which live on really dry land, far away from the water, "Tortoise" to those which live mostly on land, near water, and "Turtle" to those which live in water, but there is really no sharp demarcation between the habits of these different species, and consequently it would in many cases be a very debatable point as to whether a certain kind of creature should be called a "Terrapin," a "Tortoise," or a "Turtle." To avoid this, the last term is preferred and here used generally.

Habits of Pennsylvania Turtles: Pennsylvania may have at least eighteen (18) different species of turtles within her borders, some of which, such as the famous Diamond-Back, are confined to the eastern margin of the State, and others, such as Agassiz's Turtle, are to be found only in the extreme western part of the Commonwealth. These turtles would represent the two distinct faunal areas of the Eastern Atlantic slope and the Mississippi Valley, separated by the Allegheny mountains. There are some species, such as the Painted Turtle and the Margined species, that are closely allied in appearance and habits, and yet almost sharply separated in distribution by the mountain system.

The turtles live in damp places such as swamps and ponds, except the common Box Turtle, which prefers hills and dry slopes. In

aquatic places they are able to escape from their enemies by diving into the water, burrowing into the mud, or swimming away.

The mouth of the turtle is provided with horny edges along the jaw, by which they are able to cut vegetation or flesh as with a pair of scissors, but they are not provided with teeth, as generally found in carnivorous creatures. They take their food either in the water or on land, and are able to eat or swallow in either air or water.

It is not generally known that turtles molt or cast the epidermis or outer portion of the skin as regularly as do the serpents. However, it is true that a specimen may become covered with moss-like vegetation and within a few days assume a bright, clean appearance, which is explainable only by the process of casting the horny epidemal plates covering the shell, as we have observed in aquaria.

Eggs and Nests: In turtles the sexes are distinct, but it is often impossible to recognize the difference between the male and female, although in many species the males are to be recognized by the concave or hollow plastron. All mate, and lay eggs, which may vary in number from three to one hundred, according to size and species. With some species, such as the Snapping Turtle and the Leather Back, the eggs are almost perfectly spherical, and in this regard differ from all Pennsylvania species of serpents' eggs, all of which are oval in one outline. Also their shells are hard and calcareous or somewhat stony, and in this feature differ from the serpents, which are only leathery. Some of the eggs of turtles are elongate or oval, as are those of the Common Box Turtles.

All species of turtles leave the water to lay their eggs, most of them preferring the loose warm sand along the shores. After finding a suitable place the female commences to make an excavation with her hind claws and body and also turns around in the hole in such a way that her body burrows deeper and deeper in the sand until she reaches such a depth that her body is covered with sand and only the head protrudes. The eggs are then laid, after which she crawls out in such a manner that the sand which covered her body drops over the eggs and covers them.

They are now left to hatch by the aid of the sun and ever afterward to shift for themselves. As soon as the young break their embryonic prisons they go trooping in a line down grade to water, where they find both food and protection, and where at the same time many of their natural enemies find them.

As the eggs are edible and sought for food by both man and beasts and as young turtles are a favorite delicacy of most carnivorous mammals, birds, reptiles and fishes, it is no wonder that the turtles are reduced in number by these agencies.

Hibernation and Capture: At the first approach of winter the Common Box and the Wood Turtles go into the woods where leaves and leaf mold are to be found and bury themselves from the danger of freezing, while the aquatic or water species go into deeper water, where they remain warm and safe, or bury themselves in mud under water or along the shore. They are fat and in fine condition in the fall, and it is the habit of hibernating in the mud that makes them such easy prey to turtle hunters who often secure scores of them in a day. They are found by pushing a pointed and barbed iron rod deep in the sand where they are expected to hibernate, and when the rod strikes their shell the experienced hunter is able to recognize it at once, and by means of the barb or hook the reluctant hibernating creatures are drawn from their winter retreat. They are then doomed to become the food of man, chiefly in restaurants and soup houses in the cities. The gathering of turtles for market is a very important occupation in some portions of this State.

Turtles are captured not only by the hook and line, and the barbed rod, which is used to find and remove them in the fall and spring, in the mud where they hibernate, as mentioned above, but also by set lines, traps, nets, seines and guns. One favorite method of catching turtles is to tie a hook to a wire so it can not be bitten off, bait with tainted meat, a clam, or cotton soaked in dough, tie the wire to a short green springy pole, three or four feet in length and stick this deeply into the mud along the bank, throwing the hook into deep water where the turtles may find it, and after swallowing they find that the springing of the short pole does not give them the opportunity to break away that they would have if it were tied to some solid object.

In seining for fishes they are often taken in the nets, although their effort is to burrow into the mud and pass out beneath the seine. Set nets are often placed for them, and one of the favorite methods of capturing them in certain rivers, is by a wire trap with funnel-shaped entrances, somewhat like those seen in wire rat traps. Inside these devices fasten ears of corn and immerse them in the water. After the corn has soaked a few days and becomes very sour it attracts the turtles, and in their efforts to get the sour grain to eat, they find their way into the trap and are unable to escape readily. This is lifted from the water at intervals by means of a rope or wire attached and the imprisoned turtles and sometimes fishes are removed. Similar traps are sometimes placed beside the favorite rocks or stones where turtles are liable to rest in the sun and in the immediate territories of which they appear to be the sole and entire monarchs.

Turtles are often captured by shooting, and one of the tests of marksmanship, especially along the tributaries of the Ohio River, is to shoot a turtle in the head and render it immediately insensible, so that it will not move from the spot where it was when shot. The Leather-back Turtles, which are much prized for food, are thus shot by marksmen and often remain on the rocks or logs where they were perched at the time of shooting. It is then an easy matter for the hunter to go to the rock and remove the insensible prey. We well remember having seen a Soft-shelled or Leather-backed Turtle when floating in deep water in a stream, shot in the head by a marksman and killed so suddenly that it did not have an opportunity to expel the air from its lungs to let it sink. Its head merely dropped and the body continued to float until boys swam out to it, placed their hands under it and brought it to shore, when it commenced floundering, which is merely the reflex action of the nerves immediately connected with the twitching muscles but not by any brain activity.

When the head of a turtle is chopped off or the neck is severed, the animal is killed as instantly as is a chicken or any other creature killed by the same process, although the ganglionic or reflex nervous action may continue for some hours or even days. Thus when persons kill turtles by shooting in the head or by decapitation they may have the satisfaction of knowing that the creatures are not alive though they may be twitching and jerking, showing that the muscles are yet active. There is, of course, no sensation or pain after the nerve connection with the brain is severed.

The chief commercial species at one time was the Diamond-back, but as this is confined to the salt marshes along the seashore, and has become very rare in Pennsylvania, it no longer plays an important part as an item of food. The next best turtle as food is doubtless the Common Soft Shell Turtle, found in the western part of the State, in the tributaries of the Ohio river; but this also is rare, and while most of our smaller turtles are edible, we are to depend for flesh and soup mostly upon the well known Snapping Turtle.

It is supposed that all our species of turtles are edible excepting those which at once give off such bad odors as to be very offensive, and also the Box Turtle. During the coal miners' strike of 1902, in the vicinity of Scranton, many miners roamed over the hills and captured and ate turtles and were made sick thereby. It is probable that these were the Box Turtles, and this is an evidence that the flesh of this species is, under some circumstances, unfit for human food.* It is not generally regarded as edible and this general supposition is doubtless correct.

*The flesh may have been rendered temporarily poisonous to man through the Box Turtle having eaten toad stools, of which it is fond, but which do not injure the animal.

More details concerning the habits of these creatures are to be found in the discussion of each respective species.

The Snapping Turtle is by far the most abundant and most sought turtle for food in this State, and it is common to see them fattening in swill barrels, getting into fine condition for market for hotels and restaurants.

Notes on Turtles.

The following interesting Notes are written by our valued contributor, Mr. R. W. Wehrle, of Indiana, Pa., as the results of his own experience and observations:

"There are many ways of capturing the Snapping Turtle. The sporting way is to catch them with hook and line. Take a heavy line and a good sized hook. Fasten hook on with wire to prevent biting hook off. Bait with tough beef. If you are fishing in daytime, lift lines once an hour, and if there is one in the fishing hole, he is sure to have the bait swallowed. The bait should always be tainted. They will bite from May until September.

In the spring they will travel up stream, and in the fall down stream until they find a deep hole, and there they will remain until spring in a musk rat hole, and if you should be lucky enough to find one in March they are just as fat as in summer. I have six Snappers in my cellar under the store and am keeping close watch on them. They have taken no food since the middle of October, and at this writing, in January, are fast asleep with heads close to the bottom of the barrel, and it is almost impossible to get them to move a foot. As far as I know they have but one enemy, and that is the otter. I saw an otter bring one up through the ice and eat off the head, which seemed to satisfy the animal.

The Soft-shelled Turtle is hard to capture and very few know how to catch it. The way I do it is to take a good thin line, fasten a small hook on the line with wire, use a cork to keep the bait near the surface of the water, and set it near a deep hole where the water is moving enough to keep the bait moving, and they will take the bait very much like a fish. A worm is the best bait to use."

Enemies:—The enemies of turtles are much more numerous than one might suppose. Though they appear to be firmly encased and safely protected by their strong, hard shells, it must be remembered that it is only when they are fairly well grown that they achieve such protection. As eggs, they are sought by mankind, by foxes, raccoons, musk rats, dogs, cats, weasels, skunks, etc., and as young

turtles they readily become the prey of nearly all carnivorous creatures, including serpents and fishes. Perhaps no form of animal living in this State has so little chance to escape or has greater numbers of natural enemies than the young turtle. However, after they become mature and are well protected, they may live for scores of years, or even a century.

Protection:—Mr. R. F. Baker, of Mechanicsburg, Pa., gave the writer a young Wood Turtle (C. insculptus), about two inches in diameter, which he took from the stomach of a large mouthed black bass in a stream in Cumberland county, June, 1908. Mr. Wehrle in his publication records having seen an otter bring a turtle from the depths of the water where it was hibernating in the winter and kill it by eating its head. Turtles are frequently attacked by leeches, or bloodsuckers, which in fact are nearly always found attached to turtles of certain species.

The plow and harrow are effective in injuring many specimens of the Common Box Turtle. Also defects are often seen in the backs of the shells of this species, and holes in the hinder margin of the shells tell the story of their having been cruelly used for the purpose of driving rabbits or other small mammals from their burrows in the ground. Sometimes a hole is made in the shell, a short wire attached thereto and some burning substance fastened to the wire and the turtle made to crawl into the hole. The fire keeps the reptile moving forward and when the depths of the burrow are reached the rabbit or other mammal is driven out in terror. The poor turtle may, of course, be badly burned, but this does not appear to count in the minds of many thoughtless persons. It would be well for the practice to be strictly prohibited. There is also an absurd notion that to build a fire on the back or shell of a turtle will cause the animal to crawl out of its shell. These practices account for some of the injuries which later and permanently result in defective shells on the backs of living creatures.

It is always interesting to study the manner of natural protection of any animal or group of animals. Turtles are protected, first, while in the egg state, by being buried in the sand, or loose earth, and when young by being so slow or inactive as to escape observation such as would be drawn by quickly-moving creatures, and also by their dull hues or colors, which render them the same color as the mud or damp earth on which they live. Also, all species of turtles are able to swim, and some swim with the rapidity of a fish, dart quickly, and are able to escape by plunging into the water, and either swimming away or stirring up the mud, thus rendering them invisible. The Common Soft-shelled Turtle takes

the bait readily, often eating live minnows, which are used in bass fishing. It swims, darts and cuts the water like a bass, and it is often mistaken for a gigantic fish until the angler is able to bring it near enough to see that he has hooked a turtle instead of a fish.

It is the hard bony shell that most turtles find to be their most effective means of protection. This is so strong that in most species when mature it will bear the weight of a man without injury. After the turtle arrives at such age that it can draw its extremities into its hard shell, it has a good means of protection and nature need do little more for it. However, most of them feed by night, and thus have the universal protection of darkness, given to most untamed creatures. Also, many live in inaccessible swamps or along streams, where they can watch the approach of their enemies and plunge into deep water upon the slightest alarm.

Economy:—In the economy of man the turtles fill their place not only as food in the form of eggs or flesh but also yield the important product commonly known as tortoise shell, used for making various ornamental and useful articles. It is especially valuable in destroying many obnoxious creatures, particularly destructive insects, and as scavengers, cleaning away dead animal material.

Comparatively little has been said concerning the work and value of turtles as scavengers in performing their important role in Nature by cleaning up dead animal matter in water which would otherwise became a serious source of pollution. Several species of turtles are scavengers and play an important part in this direction, which should be recognized. It is not to be presumed that the specimens of birds, such as robins, and the mammals, such as rabbits, that have been found in the stomachs of turtles, were captured alive by these reptiles, but rather that they were found dead and eaten as carrion. The details of food studies of each species, discussed in other pages of this Bulletin, call attention to this fact, which is here printed in such detailed positiveness and precision for the first time.

FAMILIES AND SPECIES OF PENNSYLVANIA TURTLES.

The families of turtles represented in this State are to be determined by the following Analytic Key:

A. Carapace leathery, margins flexible; dermal plates, absent; three claws on each foot: Family I. Trionychidæ. The Soft-shelled Turtles.

AA. Carapace firm, ossified; dermal plates present; five claws on front feet and four behind.

B. Tail very long and strong, with a crest of tubercles; plastron narrow and small, cross-shaped, with 9 plates (besides the bridge); body highest in front: Family II. Chelydridæ. The Snapping Turtles.

BB. Tail short, not crested; plastron broad.

C. Lower jaw ending in a long sharp point; carapace highest behind the middle, its edge not flaring outward; plastron with 9 or 11 plates: Family III. Kinosternidæ. The Box Turtles.

CC. Lower jaw without long point at symphsis; carapace highest at about the middle, its edge flaring outward; plastron with 12 dermal plates: Family IV. Emydidæ. The Pond Turtles.

In using the analytic key it must be remembered that this is prepared for the purpose of enabling the student to trace his specimen to its proper classification. It must belong in one of the two groups in each respective portion of the key. For example, suppose a person should find a specimen of turtle and wish to determine the common and scientific names of the same. The carapace is not leathery, and consequently does not belong to "A" and must belong to "AA," or to those which have the carapace firm or ossified, and dermal plates present. The tail is short and not crested, and consequently belongs to the group "BB" and not "B" of the above key. The lower jaw is not pointed, the carapace or shell is highest near the middle, and there are twelve plates forming the pastron or shell on the lower side. This places it in the group "CC" and proves it does not belong to "C." This has now traced it to the Family name Emydidæ, or Pond Turtles, to which family it belongs. To help in determining each of the eighteen species of turtles found in this State, we have prepared the above Analytic Key, which is applicable to any, and includes all of these species, but not others. After having traced the turtle to the correct family by the above Key the student should turn to the page upon which the family is discussed (page 139), and trace it to the correct genus and species in a similar manner.

FAMILY I. TRIONYCHIDÆ. THE SOFT-SHELLED TURTLES.

The turtles of this Family are described as having the body flat and nearly circular; the carapace or shell is not completely ossified or bony, and is covered by a thick leathery skin which is flexible at the margins. It is from this leathery covering that they are called the Leather Turtles or Soft-shell Turtles. The head is long and pointed, with a long flexible snout, and the neck is long and slender. The feet are broadly webbed, with 5 toes but only 3 claws to each foot. The soft shelled turtles are all aquatic and carnivorous in their diet and are very voracious creatures. While there are about 30 species known to science only two are found in Pennsylvania. These belong to different genera and are to be distinguished by the following characteristics:

A. Nostrils under tip of snout, and circular. Edge of upper jaw toothed behind. Genus Amyda.

AA. Nostrils not under tip of snout, but at the end, crescent shape, with a ridge projecting from each side of the partition in the nose. Edge of upper jaw, not toothed. Genus Aspidonectes.

There is but one species of Amyda, and this is commonly called the Leather Turtle.

Species 1. Amyda mutica (LeSueur). The Leather Turtle.

The Leather Turtle is variously known as the Leather-back, Leathery Turtle, Spineless Soft-shelled Turtle, Brown Soft-shelled Turtle and Unarmed Soft-shelled Turtle. It receives its common name, "Leather Turtle," from the fact that the covering is not hard, but leathery, and not shell-like.

The Leather Turtle is known by the depression along the middle line of the back, with no spines or tubercles along the front margin nor on the back. They are more or less uniformly olive color, white beneath the feet, not mottled or spotted although the young are spotted above.

Body flat, nearly circular; carapace not completely ossified; carapace and plastron covered by a thick, leathery skin, flexible at the margin. Head long and pointed, with a long, flexible, tubular snout, narrower than that of A. spinifer. Legs well developed, feet broadly webbed, not mottled below; toes long, 5-5, but the claws only 3-3. Front margin of carapace and back smooth. Carapace brown or olive, unicolor or with obscure line-like spots on dull blotches. A depression along the medio-dorsal line. Head markings obscure, but forking at base of proboscis. This species seldom attains a length of shell greater than ten inches, but may sometimes reach twelve inches in length.

This turtle occurs from Canada to the Ohio river and Northwest. Nash records a specimen caught in Lake Erie. It is therefore liable to be found in this State in Erie county and in the tributaries of the Ohio river. It is not liable to be common in any portion of this region as it is mostly a western species.

"This turtle is wholly aquatic, since they leave the water only on rare occasions. They delight to remain about the roots of trees which have fallen into the water, or in drifts of timber. Here they can watch for prey and not be observed by any supposed enemy. Away from such means of concealment, they are accustomed to bury themselves completely in the sand, leaving only their heads exposed. Since their heads do not differ much in color from the sand it is difficult for one to recognize them, even when the eye is directed to them. When air is required it is obtained by stretching out the neck until the pointed snout reaches the surface. The head is then again withdrawn. This species enjoys a true aquatic respiration." Hay, p. 552.

The flesh of the turtle, like that of the frog, has the property of absorbing oxygen from the air breathed and storing it for some length of time. This is why these animals which, although compelled to breathe air by means of lungs, are able to live such a long time under water.

"The eggs are spherical in form, about $\frac{7}{8}$ of an inch in diameter, and have a thick, but brittle, calcareous shell. They are deposited in the sand on the shores of the rivers where the adults live. The young are flatter and more nearly circular than the adults." Hay. p. 552.

Unfortunately, we have no specimen of this species collected in Pennsylvania, but they are supposed to survive upon insects, fishes, water snails and similar small animals. Agassiz found the larvæ of Neuropterous insects in their stomachs. Others report their having eaten worms, snails, fruits and even hard nuts. Hay says that if there are potatoes growing near water, the turtles find their way to them and devour their stems, of which they are very fond. We hope to receive specimens of this species, which may be found in any of the streams in the western portion of this State.

Genus Aspidonectes: There are two species belonging to this genus liable to be found in Pennsylvania. One is known as the Common Soft-shelled Turtle, and is distinguished by the dark spots on the lower part of the body and feet, while the other is Agassiz's Turtle, and is to be distinguished by the uniform white color on the lower part of the body and feet.

Species 2. Aspidonectes spinifer (LeSueur). The Common Soft-shelled Turtle.

The Common Soft-shelled Turtle is sometimes called the Leather Turtle or Leather-back, and also called the Soft-shell Turtle, the Fierce Tortoise and the Spiny Soft-shelled Turtle. The first common name is given because it is the most common of the species of

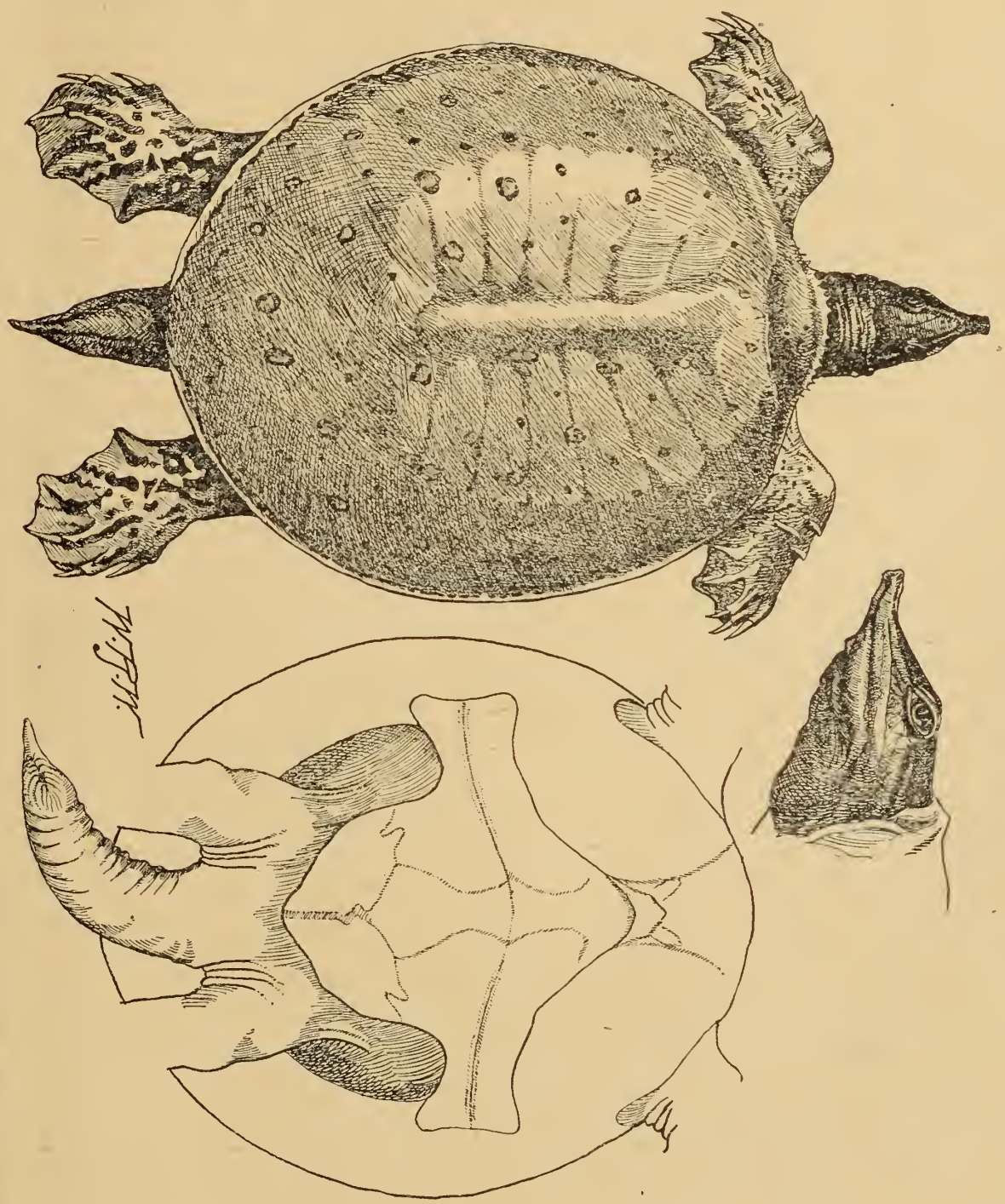

Fig. 2. Common Soft-shelled Turtle, dorsal and ventral view and side view of head. (One-half size of an immature specimen.) Drawn by W. R. Walton, in he Laboratory of H. A. Surface, State Zoologist of Pennsylvania.

Soft-shelled Turtles that may occur in this State. The last name is given because of the presence of projections on the front edge of the leathery covering.

This species is described as follows:

Body flat, nearly circular; carapace not completely ossified; carapace and plastron covered by a thick, leathery skin, flexible at the margin. Head long and pointed, with a long, flexible, tubular snout. Legs well developed, feet broadly webbed, mottled. Toes long, five in front and five behind, claws only three in front and three behind. Front margin of carapace and the back armed with conical tubercles, largest on front margin. Carapace olive, with numerous black rings, smaller rings or dots near the margin. Two pale bands on head, forking at base of proboscis. Carapace widest slightly back of middle, deepest before the middle. Dorsal keel obsolete, recognizable only at the front end. Eye moderate, high, prominent. Mouth with entire jaws, lower fitting into upper. Tail conical, robust, depressed above, with a conic, short-pointed tip. Plastron cream colored, a pale yellowish blotch along each side of head above and behind eye narrowly margined with blackish. Iris dull slaty gray.

The Common Soft-shelled Turtle is found from Canada to Kentucky and Minnesota, in the tributaries of the Mississippi, Ohio and St. Lawrence rivers, and in the lakes of Northern New York and the Great Lakes. Nash finds it in all marsh waters of Ontario, and Stone reports it in New Jersey in the Delaware Valley, and also occurring in the Allegheny River in Pennsylvania. This is the most common of the three species of Leather-back Turtles that occur in that State, and we have been fortunate in receiving specimens from our valued contributors, Messrs. R. W. Wehrle, of Indiana, who collected several in Indiana county, and John Custer, of Stoyestown, Somerset county.

Excepting the Diamond-back, this is considered the most delicious of turtles, and is much sought for food. It is captured by shooting, spearing and baiting hooks with meat, as well as by trapping. They are frequently seen in rows on rocks or logs in the tributaries of the Ohio River, where persons who will not eat that of any other species consider their flesh a delicacy. During calm weather they are often to be seen floating near the surface of the water more or less submerged, sometimes only with the tip of the nose reaching to the air. They rarely leave the water, excepting to deposit their eggs, or bask in the sunshine on partially submerged logs, but when captured fight ferociously and strike and bite viciously.

They have doubtless been introduced into the eastern part of Pennsylvania through the canal from the Western and Central part of New York. This may also have been the means of its introduction into New Jersey, which Fowler says was as early as the late '60's.

The eggs may reach about sixty in number and are pearly white in color, perfectly spherical, hard and smooth, one inch in diameter, and protected by a heavy brittle, calcareous shell. They are laid in May in sand along the river bank, and in August the young hatch and go immediately into the water.

Unfortunately, only two of the Soft-shelled Turtles available for examination contained food, although a greater number were examined and found to be empty. Of these neither had eaten any vegetable matter, but both contained Crayfish, which are common inhabitants of streams they frequent, and are doubtless among the chief elements of their food. In devouring Crayfish (or Crawfish), any creature is objectionable from the fact that it is one of the most important foods of the carnivorous fishes. Hay asserts that "it feeds on such fishes and reptiles as it can secure."

One Soft-shelled Turtle was found to contain fragments of beetles so broken as to be beyond recognition, but indicating the possibility of these creatures feeding upon insects which may be found floating on the water or in damp places frequented by such turtles.

We take this opportunity to record the fact that we have found the Soft-shelled Turtle feeding upon grains of corn obtained in or near the ponds which they inhabit. A specimen examined by us in Ohio some years ago contained both the yellow and red field corn, or Indian corn, to the extent of almost as much corn as would be produced upon two average ears of this plant.

From an economic standpoint this turtle is far more beneficial than injurious, because it contributes materially to the food of man. We hope to receive specimens captured within the boundaries of Pennsylvania, and invite observations upon the habits of this species.

Species No. 3. Aspidonectes agassizi Baur. Agassiz's Turtle.

This species is distinguished by the universal white color on the under part of the feet. It is known as Agassiz's Turtle, because named in honor of the famous naturalist. It is found mostly in the central and southern portions of the Mississippi Valley, although it is to be looked for along the Ohio river in Pennsylvania. We have no record of its occurrence in this State but it is not impossible for it to be found here. Both male and female have tubercles on the front of the carapace, but they are larger in the males. The back is blotched and mottled in color in the adult, while the young show dots or spots and two or three black lines around the margins. Its habits are very similar to those of the Common Soft-shelled Turtle.

We invite readers to watch for specimens of such turtles and help us in establishing records of their presence in this State.

Hay says that it occurs in the State of Indiana and should be sought for along the Ohio river. Upon this authority we are justified in suspecting its possibility as a Pennsylvanian species.

"Holbrook states that it is very voracious, feeding on fish and such reptiles as it can secure, and it is so greedy that it takes the hook readily when baited with any substance whatever, yet he had never known it to take food in captivity, even after several months.

"They swim with great rapidity, and often conceal themselves in the mud, buried two or three inches, leaving only a small breathing hole for the long neck and small head. This it occasionally thrusts out, but usually keeps it concealed so that a passer-by might think the hole the residence of some large insect. They are often seen basking in the sun, on rocks and apparently asleep."—Hay, page 553. Holbrook says that it "will sometimes leap up and give a loud hiss. Always ready to snap and bite."

"In the south they lay their eggs in May. These are about 60 in number, have a thick, smooth, brittle shell, and are a little less than an inch in diameter. They are hidden in the sand along the shores of streams."—Hay, page 554.

FAMILY II. CHELYDRIDÆ. THE SNAPPING TURTLES.

The Turtles of this family have a shell high in front, low behind, body heaviest forward, head and neck very large and strong, the snout narrower forward; jaws strong, hooked and very powerful; tail long, strong, with a crest or ridge of horny compressed tubercles; plastron small, cross-shaped, with nine plates besides a very narrow bridge. Claws five in front and four behind, strong, the web between the toes small.

These are large turtles of great strength and voracity, chiefly aquatic. Three species are known to science, of which two are found in America, but only one occurs in Pennsylvania.

Species 4. Chelydra serpentina (L.). The Snapping Turtle.

This is variously known as the Common Snapping Turtle, the Snapping Turtle, the Loggerhead, Loggerhead Terrapin, Snapper, Alligator Couta, Couter, Alligator Tortoise, Serrated Tortoise, Snapping Tortoise, Snake Tortoise, Alligator Turtle, Land Turtle, Alligator Terrapin and Soup Turtle. We have authority for each of these various names in literature at hand. The most common name is "The Snapping Turtle." This is, of course, named from its habit of snapping or biting at objects when angered, as it will catch sticks or other objects held toward it and often hold on with bulldog tenacity. There is a common superstitious belief, which of course is not

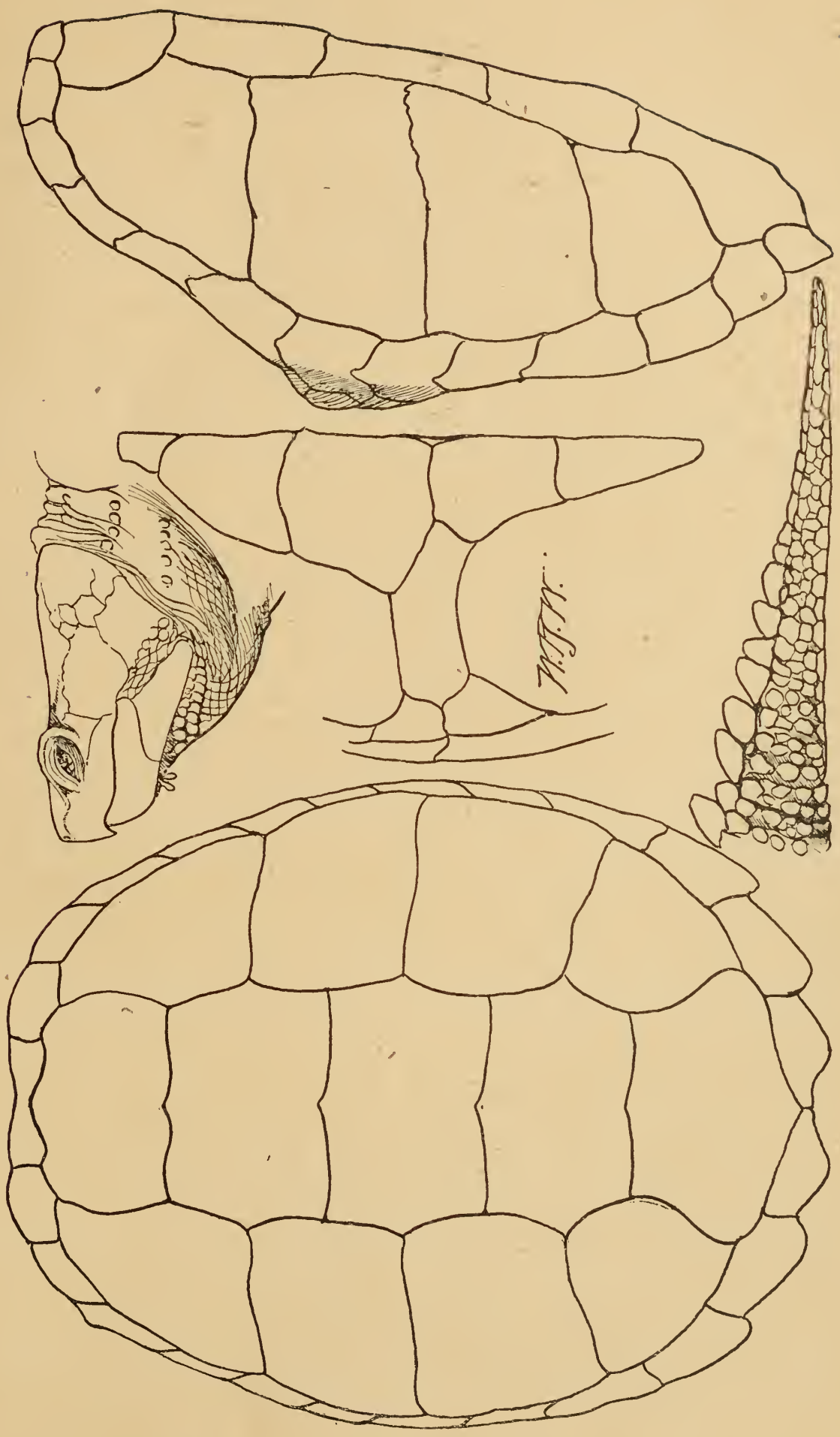

Fig. 3. Common Snapping Turtle, showing carapace (dorsal view), plastron (ventral view of right half) and left side view of shell, with side view of head and tail, (One-half size of original). Drawn by W. R. Walton in Laboratory of H. A. Surface, Harrisburg, Pa.

well founded, to the effect that it will hang on until thunder is heard or until sundown. The description is as follows:

Shell high in front, low behind; carapace with three moderate keels; margin sharply serrate behind; head large, powerful, not completely retractile; eyes close together, beak hooked; tail with sharp, tubercular crest above, moderate plates beneath, length about equal to shell; plastron small, forming a cross; claws 5-4, web small. Color of carapace is dark olive or brown, plastron dull yellow. Plates of carapace with concentric and radiating grooves, and some radiating black dashes. Carapace of young extremely rough, of old, rather smooth, both often moss-covered. Neck long, chin decorated with small barbels. The barbels under the chin are very sensitive, and no doubt serve the purpose of making the creature aware of any unevenness or obstruction on the bottom of muddy streams in which it crawls.

The Snapping Turtle is found from Canada to the Equator and throughout Ontario, occurring also westward to near the Rocky Mountains. It is one of the most common, widely distributed and best known turtles. The specific name "serpentina" refers to the serpent-like appearance of the head and neck.

Our collections from Pennsylvania are as follows:

Bucks county, ———————— Taylorsville.
Bucks county, Cox, E. C., Buckingham.
Clearfield county, Myer, G. L., Mahaffey.
Cumberland county, Heckman, J. P., Newville.
Cumberland county, Zoological Division, Eberlys Mills.
Dauphin county, Buffington, H. E., Lykens.
Dauphin county, Zoological Division, Harrisburg.
Delaware county, Lehman, G. H., Essington.
Erie county, Selden, F. H., Cranesville.
Erie county, Baron, E. A., McKean.
Fulton county, Jackson, R. L., McConnellsburg.
Indiana county, Wehrle, R. W., Indiana.
Luzerne county, Campbell, E. W., Pittston.
McKean county, Lehman, J. P., Port Allegany.
Perry county, Showalter, C. E., Landisburg.
Potter county, Lehman, F. A., Coudersport.
Somerset county, Moore, P. K., Trent.
Tioga county, Shephard, J. D., Wellsboro.
Venango county, Bean, Lavelle, Emlenton.
Warren county, Simpson, R., Warren.

Warren county, Zoological Division, Warren.
Washington county, Couch, Joseph, Canonsburg.
Wyoming county, Bunnell, F. D., Meshoppen.

It will be seen by the above that it is liable to occur in any part of this State.

The Snapping Turtle prefers muddy ponds as its place of abode, although it is often found in clear rivers. Dr. Hay says, "It is often seen far from any water, walking along with awkward gait. When seen on land it may be seeking some spot in which to deposit its eggs or seeking for food, or perhaps crossing from one stream to another. In water they do not seem to swim, but they may often be seen floating along just beneath the surface with the snout and eyes only above. When disturbed, they go immediately to the bottom and conceal themselves there. When traveling about they are often seen with a great amount of mud on their backs, as though they had been burrowing in the earth. This species is strong and courageous. When attacked they neither attempt to retreat nor retire passively into their shells. The jaws are opened, the head and long neck are suddenly thrust out, and at the same moment the animal leaps forward toward its tormentor. If the aim has been correct, the jaw closes on the enemy and the hold is doggedly retained. It is a curious notion held by many people that when it has once secured a hold, it will not let loose until it has thundered. It will sometimes permit itself to be carried around by a stick which it has seized.

"The flesh of the Snapping Turtle is often used for food, especially that of the younger individuals. When they grow old their flesh is likely to have a musky and disagreeable smell. These turtles are regularly seen in the markets (Washington) every spring."

When caught or angered they give out a strong odor which to many individuals may be very disagreeable. Mr. R. W. Wehrle, of Indiana, Pa., calls our attention to the fact that he finds this odor much stronger in the males than in the females. They are often fattened in swill barrels, and when well fed they fatten quickly, especially in the fall of the year, when they are naturally becoming in good condition for hibernation. They are then considered best for food. Holbrook says "They are brought in numbers to market and are esteemed excellent food, though I think they are far inferior to the Green Turtle, the Soft-shelled Turtle, or even several of the Emydes. They are kept for months in tubs of water and fed on offal." The older the animal the stronger and less palatable the flesh. The eggs are very nutritious and much sought for food, but

are of such nature that they can not be boiled hard, and they are consequently almost always cooked by breaking and frying them.

When disturbed the Snapping Turtle makes a sharp hissing noise by suddenly expelling its breath and partially drawing its neck and head into the shell. There is in some places a false idea to the effect that the breath thus expelled from turtles, as well as from serpents, is poisonous.

About the middle of June the female Snapping Turtle goes to a suitable place to lay her eggs, which is generally damp, warm, sandy earth, and may be some distance from the water. She scoops out a hole with her claws and by turning around, the earth falls over her and conceals her body and the eggs are all laid in one nest. After she is through laying she crawls out of the hole in such a way that as the body is elevated the earth falls back on the eggs and covers them. They are perfectly round, white and hard and are sought for food by man and the lower animals. From twenty to one hundred may be laid in one nest, according to the size of the parent. A correspondent in the American Naturalist, for July, 1895, page 676, gives the following description of a turtle's nest:

"On June 16, 1894, I saw a snapping turtle, Chelydra serpentina, in the course of two hours, dig a hole and in it lay twenty-two eggs. The hole was dug in gravel and was small at the top, but when an inch below the surface of the ground, it widened, and when finished was three inches in diameter and about four inches deep. The digging was done entirely by the hind feet used alternately.

"The eggs were crowded in place by the hind feet, as fast as they were laid. Then the hole was filled even with the rest of the ground. The nearest water was a small stream about thirty feet distant. —A."

Our laboratory studies of the food of the Common Snapping Turtle have given interesting results, as follows:

Food Chart of Snapping Turtle (C. serpentina).
(Number with food, 19).

	No.	Per Cent.
Vegetation,	5	26
Algæ (low water plants),	2	10.5
Seeds, undetermined,	1	5.2
Leaves, undetermined,	2	10.5
Apple seeds,	1	5.2
Skunk Cabbage (Symplocarpus fœtida) leaves,	1	5.2
Grass,	3	15.7

	No.	Per Cent.
Animal Matter,	19	100
Mollusca (Snails and Slugs),	7	36.8
Snails (Helix),	4	21.1
Pond Snails,	2	10.5
Slugs,	1	5.2
Crustacea, Cambarus sp. (Crayfish),	12	63.1
Insecta,	9	47.3
Undetermined Insects,	2	10.5
Hemiptera (Bugs),	1	5.2
Corisidæ, Corisa sp. (Water Bugs),	1	5.2
Pentatomidæ, (Stink Bugs),	1	5.2
Diptera (Flies),	3	15.7
Larvæ,	2	10.5
Stratiomyiid (Fly) larva,	1	5.2
Coleoptera (Beetles),	7	36.8
Undetermined,	5	26.3
Water Beetle larva,	1	5.2
Hydrophilidæ, Water Scavengers,	1	5.2
Dytiscidæ, Diving Beetles,	1	5.2
Gyrindiæ, Whirligig Beetles,	1	5.2
Vertebrata (Vertebrates),	7	36.8
Undetermined species (flesh),	2	10.5
Pisces (fishes),	2	10.5
Undetermined fish,	1	5.2
Catostomidæ (Suckers),	1	5.2
Batrachia (Frogs, etc.), Rana sp.,	1	5.2
Ophidia (Serpents),	2	10.5
Aves (Birds),	1	5.2
Mammalia (Mammals),	4	21.1
Undetermined,	1	5.2
Muridæ (Mice),	2	10.5
Leporidæ (Rabbits), Lepus sp.,	1	5.2

Nineteen specimens of Snapping Turtles were found to contain food, of which five contained vegetable matter. In two were found Algæ or low forms of aquatic plants, while in two others were found fragments of leaves, and in one seeds were found. Three had fed upon grasses, which were undeterminable, and one had eaten the leaves of the Skunk Cabbage. Another was found to contain apple seeds, indicating that it would feed upon such fruit when available.

All of the specimens of Snapping Turtles containing food were found to contain animal matter, seven of which had eaten Mollusks. Of these one had eaten a slug or shell-less snail (Limax), such as are

commonly destructive to garden plants, and four had devoured land snails with shells (Helix) while two had eaten pond snails of the species commonly found in the quiet waters of this State. In feeding upon the slugs and snails the Snapping Turtles show themselves to be decidedly beneficial. Twelve of the Snappers, or over half of the total number containing food, were found to have eaten crayfish. In making such a high record they show a particular fondness for these aquatic animals. In fact, they are the most extensive reptilian enemies of the crayfish, and in this feature come into keen competition with some of the best fishes, such as black bass, sun fish, pike, pickerel and trout.

Nine snapping turtles, or about half the number, were found to contain insects, of which two contained fragments so broken as to be undeterminable, and one had eaten a Stink Bug and another an aquatic insect, known as the Water Boatman (Corisa.) Two were found to have eaten the larvæ of moths, commonly known as worms, and in so doing were beneficial. Three had fed upon flies, all of which had eaten the flies in their immature stage, commonly called maggots. These were evidently the larvæ of flies which live in the mud or water and were thus easily obtained by the turtles in their aquatic haunts.

Seven specimens had eaten beetles, of which five contained fragments that were so broken as to be undeterminable. Among the other food elements in these stomachs were the Diving Beetle, the Whirligig Beetle, Water Scavengers, and the larvæ of other beetles. These show a direct contrast to the Coleopterous or beetle food of the Blue-tailed Lizard, which, while larger in percentage of land-inhabiting beetles, contained none of the aquatic forms. Of course, the Snapping Turtles live in and near the water and would be expected to feed on the water-inhabiting or sub-aquatic insects if on any. Thus we have a good example of the relationship of the surroundings to the food element.

Seven specimens, or more than one-third of the total number containing food, were found to have eaten vertebrate animals of some kind. In many cases there was more than one object in the stomach, and upon separating this material two were found to contain fishes, one of which was a sucker. One Snapping Turtle had eaten a frog, while two had devoured snakes, which were so nearly digested as to be undeterminable in regard to species. One had eaten a bird, and four had fed on mammals or so called quadrupeds. Two of these contained mice, while one had actually devoured a rabbit.

A review of the food of the Snapping Turtles shows that this consists chiefly of aquatic creatures, mostly crayfish, and also verte-

brates of such species as may be either captured or found dead. The Snapper is a scavenger and will often eat dead material. This may account for some of the unexpected food elements discovered.

It is well known that the Snapping Turtle is an enemy to young ducks and frequently pulls down these fowls as they swim on the water in which the reptiles live. It is also known that it feeds readily upon refuse of various kinds, as it is customary in many parts of the country to capture it and put it in a swill barrel, where it is kept to fatten upon the refuse from the table until such time as it is considered fit meat for the table.

We have found very young Snapping Turtles feeding upon insects especially beetles, and also upon small fishes, especially suckers, and upon crayfish or so-called fresh water crabs, and snails. These were very small specimens, being not over five centimeters or two inches in length.

Other authors have mentioned the food of the Snapping Turtle as follows:

"Any live thing it can overpower; fish and waterfowl."—Nash.

"Feeds largely on fish, at times apparently under water."—Fowler.

"Feeds on fish, reptiles or any animal substance,"—Holbrook.

"Wholly carnivorous, eats fish, frogs, waterfowl, crayfishes. Accused of capturing young ducks. Found a robin in one's stomach."—Hay.

"Fish and waterfowl."—Cuvier.

"Fish, ducklings."—Shaw.

"Fish."—LeConte.

"Fish, young waterfowl, always feeds under water."—Ditmars.

A tabulation of the materials definitely found in the stomachs of Snapping Turtles by other observers or writers is given in the following list:

Crayfish (Hay), Fish (Holbrook, Hay, Cuvier, Shaw, Ditmars, LeConte), Frog (Hay), Reptiles (Holbrook), Waterfowl (Hay, Cuvier, Ditmars), Robin (Hay), Young Ducks (Hay, Shaw),

Various writers give interesting points concerning the feeding habits of the Snapping Turtle, as follows:

"Destroy young ducks and fish, often attacking their own species."—Cuvier.

"Extremely voracious, feeding on fish, reptiles or any other animal substance that falls their way."—Holbrook.

"Feeds upon frogs and fishes and snaps greedily at ducks in ponds, dragging them under water to be devoured at leisure."—DeKay.

"Fish form the large portion of food. Young waterfowl are pulled below the surface to drown and to be quickly torn to pieces by the keen mandibles assisted by the front limbs. This Turtle is entirely carnivorous. It never feeds unless under water, even though sometimes seizing prey out of the water, it appears unable to swallow unless the head is under water."—Ditmars.

On the whole, the Snapping Turtle is more destructive than beneficial in its feeding habits, particularly as it is liable to be a very serious enemy of young ducks in ponds. It will continue to feed upon them until the entire number that frequent such waters will have disappeared. When this species occurs in a pond where waterfowl are desired, it is best to bait a strong fish hook with tainted meat or with cotton mixed with dough, and by means of a thin wire tie this to a stake three or four feet long, which is slender enought to spring or bend when pulled, and stick the stake into the mud at the bank of the stream, throwing the hook into the water. By this method the turtle is liable to be captured.

FAMILY III. KINOSTERNIDÆ. THE BOX TURTLES.

The Turtles of this family can be recognized by the claws being generally five in front and four behind. The tail is without crests or spines; the lower jaw ends in a sharp point; carapace in general highest behind the middle and composed of nine or eleven plates with its edge meeting the plastron nearly vertically, and not flaring out around the edge of the shell. The plastron has two lobes or doors, one in front and one behind, so arranged as to swing as on hinges, closing the shell more or less, forming a box, and thus being responsible for the name "Box Turtles" being applied to this family. Two genera and two species in this family are found in Pennsylvania. These may be distinguished as follows:

A. Hinder or posterior lobe of the plastron about the same length as front or anterior lobe, both moving freely on hinges and capable of closing the shell tightly. Carapace or upper shell without keel. Kinosternon pennsylvanicum (Bosc). Mud Turtle.

AA. Hinder lobe of plastron longer than the front and squarely cut off behind but not notched. Both lobes but little movable and incapable of closing the shell. Carapace with keel or ridge. Aromochelys odoratus (Latreille). Musk Turtle.

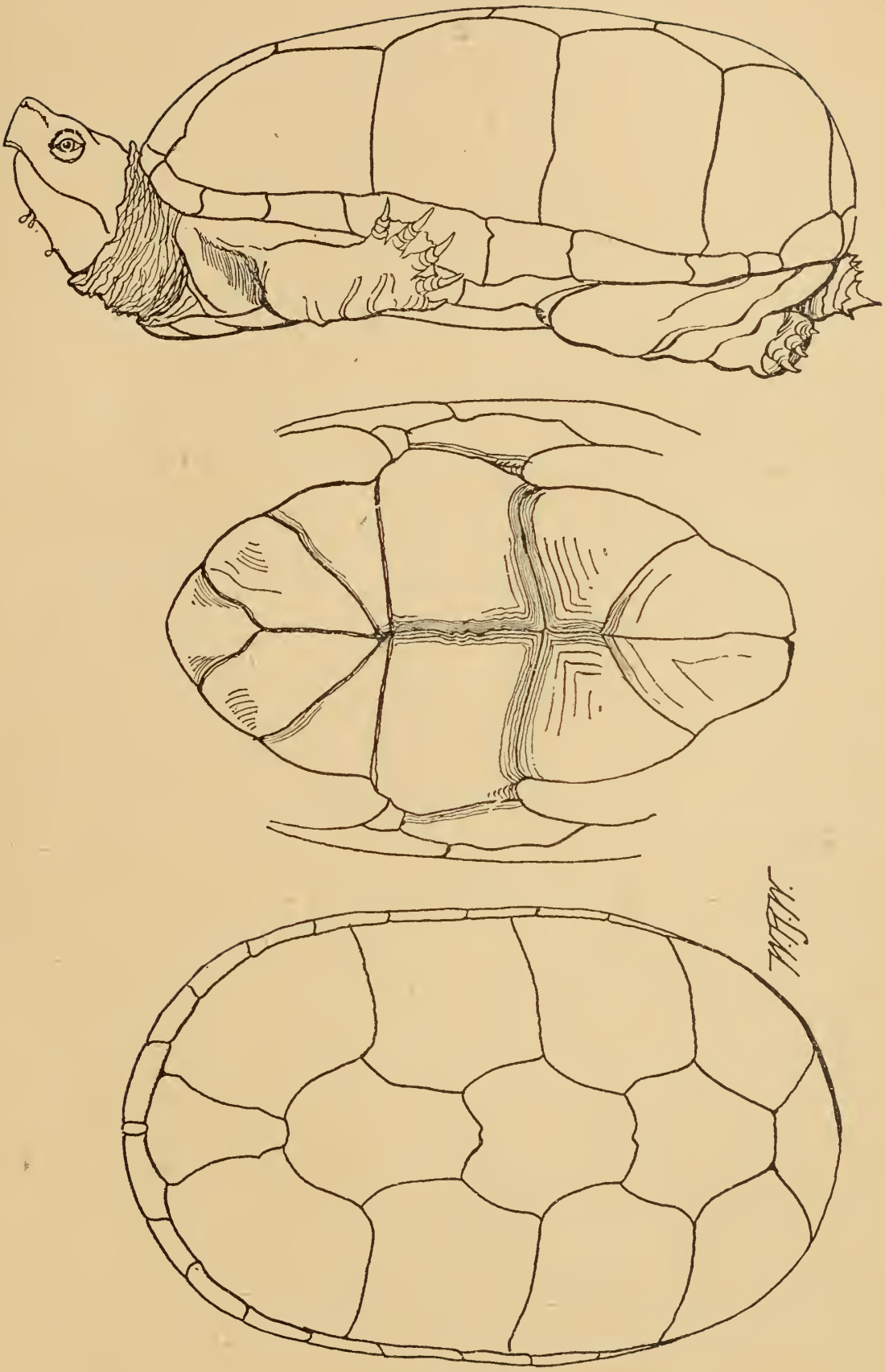

Fig. 4. Mud Turtle. View of carapace, plastron and left side view of complete specimen. (Slightly reduced). Drawn by W. R. Walton, Artist, in the Laboratory of H. A. Surface, State Zoologist.

Species 5. Kinosternon pennsylvanicum (Bosc). The Mud Turtle.
[*Cinosternum pennsylvanicum* (Bosc).]

This Turtle is variously known by the following names: Mud Turtle, Mud Terrapin, Eastern Mud Turtle, Common Mud Turtle, Pennsylvania Tortoise, Small Mud Turtle, Mud Digger, Mush Turtle and Mud Tortoise. The name of the genus is from the Greek and means "moving breast," in reference to the lobe of the plastron which can be moved to close the shell. The common name "Mud Turtle" is, of course, in reference to its frequenting muddy places, and the term "Musk Turtle" refers to its odor, although this name should be reserved for the next species.

The description of the Mud Turtle is as follows, taken mostly from Jordon and Fowler, and compared also with preserved specimens:

Carapace rather long and narrow, highest usually back of the middle, rising gradually from the front and terminating abruptly at posterior end; margin of carapace turning downward and inward rather than outward. Plastron nearly sufficient to enclose the whole body by hinge action, before and behind. The skin of the neck has some rounded fleshy tubercles. Eyes far forward, limbs small, slender, feet short. Posterior lobe of plastron notched. Carapace without a trace of keel, and scales smooth in adult. Size of adult rarely, if ever, exceeding four inches. Shell dusky brown; scales narrowly lined with black; head dark, with light dots. Plastron pale yellow to horny brown, or with both colors present, with angular striæ and scales with dull olive-tinted margins. Head, neck and exposed skin muddy-brown, paler on lower surfaces. Iris brown.

We are unfortunate in having no specimens of the Mud Turtle collected within the State of Pennsylvania, although it occurs in this Commonwealth. We invite friends to aid us in obtaining a few specimens from this State for further study. It is found throughout the Eastern United States from New York to the Gulf of Mexico, and westward to the Mississippi Valley.

Stone gives its occurrence in this region as the south-eastern part of Pennsylvania.

Hay says, "This turtle remains about ponds and muddy ditches, where it can bury itself in the mud whenever it becomes alarmed. It is more inclined to seek protection in its own shell than is *odoratus*. Takes the hook readily, but nibbles the angler's bait so slyly that their presence is not observed for some time."

Holbrook mentions the fact that this turtle takes a hook readily, and is therefore troublesome to anglers, seizing the bait so cautiously that it is some minutes before it is fairly hooked, when it

struggles violently. It is said to be less of a Water Turtle than others of its family, and may burrow in dry ground where it also hibernates.

Fowler says, "It was very abundant all about the swamps of Eastern New Jersey and was shy, but easily taken in a small dip net. They swim well, are nonresistant and not so odoriferous as the next species. It reaches about six inches in length of carapace, and many small ones were to be seen. This species is active as late as September."

Hays reports that the eggs are similar to those of the Musk Turtle, and are laid in like situations.

Ditmars says, "The abodes are practically identical with *odoratus*. This is at perfect ease in a deep aquarium with no means of leaving the water. They are strictly aquatic when in the wild state and prowl about the muddy bottom of rivers and ponds in search of food."

The Mud Turtle is reported by various authors as feeding upon aquatic animals, fish, reptiles and insects. In its feeding habits it is probably not seriously objectionable from an economic standpoint.

Species 6. Aromochelys odoratus (Latreille). The Musk Turtle, [*Sternothærus odoratus* (Latreille).]

The Musk Turtle is variously known by the common name here used, as well as the Musk Tortoise, Stink Pot, Mud Terrapin, Mud Turtle, Common Musk Turtle and Mud Tortoise. Various authors have used these different terms. To avoid confusion it would be better if we should adhere to the uniform term of "Musk Turtle", although customs can not well be changed.

The description is as follows:

Carapace long and narrow, high-arched, highest behind the middle, rising more gradually anteriorly than descending posteriorly. Margin of carapace turning downward and inward rather than outward; plastron insufficiently flexible or projecting back to close the shell. Head, large, pointed, jaws strong, eyes far forward, limbs slender, feet short. Plastron with posterior lobe truncated. Carapace somewhat keeled but plates not over-lapping in adult. Shell dusky, clouded, sometimes spotted or dashed with black, but usually with color and plates obscured with moss. Neck with two yellow stripes, one from above, the other from below, the eye. The skin of the neck has a number of pointed fleshy tubercles especially above. Odor musky. General appearance suggests a Snapping Turtle, though this species seldom if ever exceeds four inches in length. Plastron dark yellow or brown.

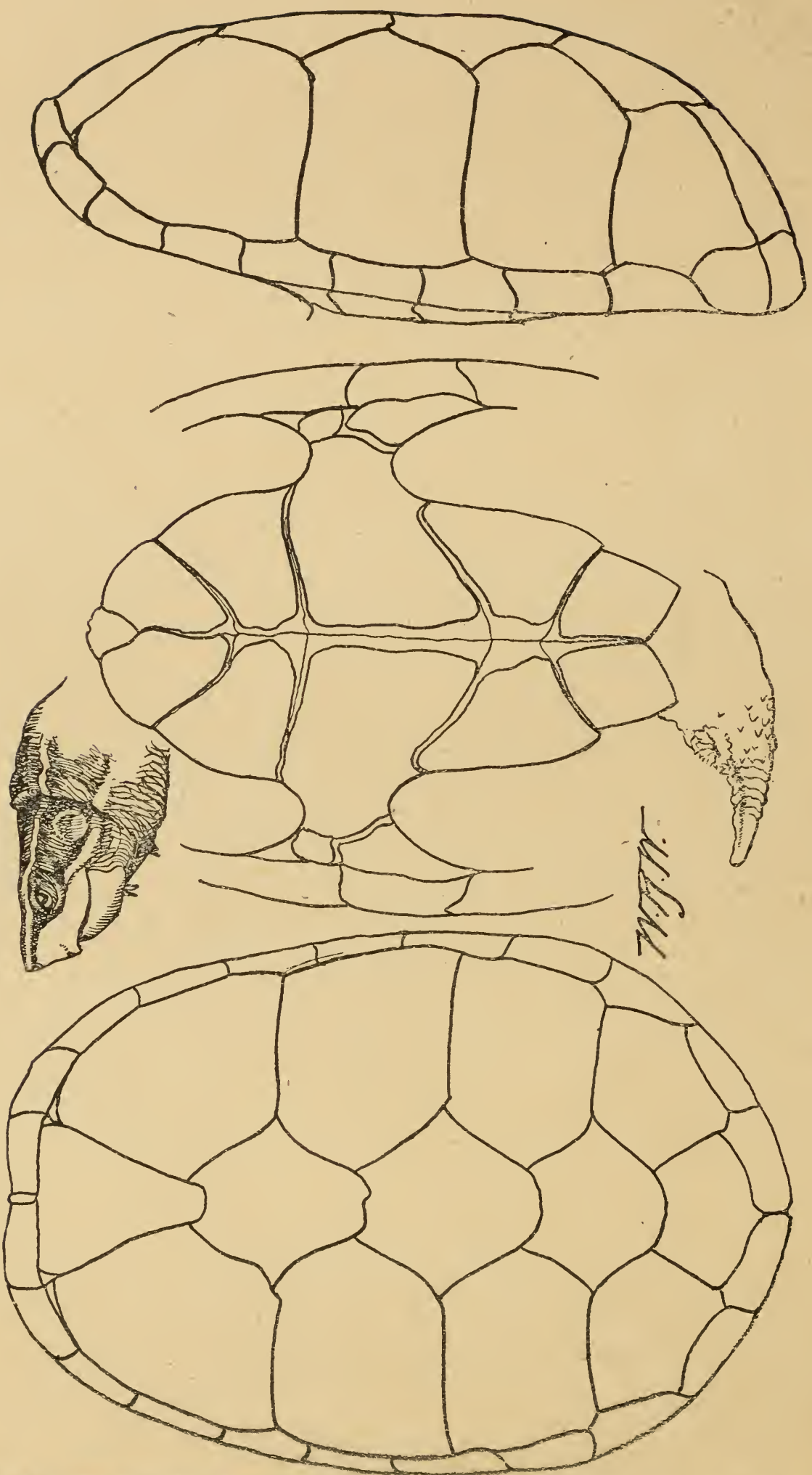

Fig. 5. Musk Turtle, showing carapace, plastron, left side view of shell and also of head and tail. (Nat. size.) Drawn by W. R. Walton, in Laboratory of H. A. Surface, State Zoologist.

The Musk Turtle occurs from Canada to the Gulf of Mexico and westward to Michigan and Northern Illinois. Nash reports it from Lake Erie and St. Clair. Smith reports it from Michigan, and Stone cites its occurrence in the southeastern part of Pennsylvania and New Jersey. It is a species which is probably confined in the State chiefly to the eastern and southeastern portions. Our Pennsylvania collections indicate its occurrence as follows:

Berks county, Gruber, C. L., Kutztown.
Chester county, Harker, Herbert, Westtown.
Cumberland county, Zoological Division, Eberley's Mill.
Dauphin county, Zoological Office, Harrisburg.
Dauphin county, Paine, F. J., Harrisburg.
Lebanon county, Derickson, S. H., Annville.
Monroe county, Roberts, Geo. C., Stroudsburg.
Perry county, Showalter, C. E., Landisburg.
Philadelphia county, Miller, Richard F., Bridesburg.

It is very common locally in certain waters, although apparently not found in others. It is one of our smallest turtles, well known for its strong musky odor.

Holbrook says this species chooses slow moving or muddy waters, and is very abundant in the ditches of rice fields in Carolina. "A very much bolder animal than *pennsylvanicum*, and bites very severely when provoked. When taken alive it emits a very strong and disagreeable odor of musk."

Hay gives the following very interesting account of its habits:

"It is essentially an aquatic tortoise. Frequents the deep parts of ponds and small lakes. Is timid and prefers to seek safety in concealment or in retreat, to defending itself actively. Nevertheless it is not altogether mild, since it will, when prevented from escaping, put out its head slowly and close its jaws on its assailant with a sudden snap. Is often seen basking in the sun on some projecting rock or on some fallen tree, from which on the smallest alarm it drops off into the water. Strong, musky odor."

Eugene Smith adds the following interesting comment:

"It gives off a fetid, musky odor. It is a very voracious animal, a vicious biter, and altogether is a small understudy of the Snapping Turtle. Older specimens frequently are overgrown with confervae and plentifully covered with leeches. They are quite active, and when very small can be kept with fishes in the aquarium. They are slow growers, and will live for years in captivity, apparently better than any other of our turtles."

"The eggs are laid in holes in the sand which the turtle excavates with the hind feet. These eggs are three to five in number, elon-

gate, elliptical, a little over one inch long, with a hard smooth shell. One which Agassiz kept in confinement laid after June."—(Hay.)

Our studies of the food of four specimens of this species have given the following facts:

	No.	Per Cent.
Mollusca,	2	50
Snails,	2	50
Insecta,	3	75
Orthoptera, (Crickets, Grasshoppers),	1	25
Gryllus pennsylvanicus.	1	25
Lepidoptera, (Moths, etc.),	2	50
Larvæ,	2	50
Coleoptera, (Beetles),	2	50
Undetermined fragments,	1	25
Carabidæ—Undet., (Ground Beetles),	1	25

Four specimens of Musk Turtle were found to contain food, of which two had eaten snails of the land-inhabiting species (Genus Helix), and three were found to contain insects. One of these had devoured a common cricket (Gryllus pennsylvanicus), and two had eaten beetles. One of the last-named insects was a Ground Beetle, but was so broken as to be undeterminable to species.

It is evident that they feed almost wholly upon mollusks and insects, and thus must be recognized as being decidedly beneficial rather than destructive. It will be noted that no fishes or other vertebrate animals were found in the stomachs thus examined. What may be revealed by further studies remains yet to be seen.

It is interesting to compare these results with the statements made by other authors, among which are the following:

"The food is small fish or smaller reptiles, such as tadpoles."—Holbrook.

"Food probably mostly or altogether of animal origin."—Hay.

"Takes fisherman's hook baited with small fish or worms, searches for food at the bottom of rivers or ponds, feeds readily in captivity."—Ditmars.

It will be seen that this turtle is charged in literature with feeding upon vertebrates, and no mention is made of its invertebrate food, excepting indirectly in the statement that "it eats worms on hooks." We are convinced that further study of the Musk Turtle will reveal the fact that these creatures feed far more upon invertebrates, such as mollusks and insects, than upon vertebrates, and consequently are to be classed as being more beneficial from an economic standpoint than has generally been supposed.

FAMILY IV. EMYDIDÆ. THE POND TURTLES.

The Fourth and last Family of Turtles found in this State includes eleven different species, and is consequently by far the largest. They are called Pond Turtles not because they are found exclusively in ponds, but because they are most common in such places. They are to be recognized by the twelve plates comprising the plastron or under shell, the carapace or upper part of the shell being higher at about the middle, its edge flaring outward, and the lower jaw without a long point at the union or tips. As with the Box Turtles, the tail is short and without a crest, and the plastron is broad. Also the claws are mostly five in front and four behind. Generally the lobes of the plastron are not hinged, but sometimes the anterior lobe moves on a transverse hinge, and rarely the posterior lobe can be so moved, thus enabling the animal to completely close the shell.

About eighty species of Pond Turtles are known, of which eleven are found or may reasonably be expected within the borders of Pennsylvania. These belong to seven Genera, which are distinguished by the following analytic key:

Key to Families and Species of Emydidæ or Pond Turtles.

(A) No hinged piece in plastron or lower shell.

(B) Alveolar or crushing surface of jaws broad; carapace low; toes short, broadly webbed.

(C) Crushing surface of jaws smooth with a deep groove in front; upper jaw not notched in front; head covered with soft skin; carapace more or less keeled.

(D) Lower jaw with a spoon-shaped dilation at tip. Genus Graptemys (Agassiz).

(E) Middle series of plates on back scarcely overlapping. Sp. 7. Graptemys geographicus. Map Turtle.

(EE) Middle series of plates on back distinctly overlapping. Sp. 8. Graptemys pseudogeographicus. False Map Turtle.

(DD) Lower jaw without spoon-shaped dilation at tip. Genus Malaclemmys; Sp. 9. Malaclemmys centrata. Diamond-back.

(CC) Crushing surface of upper jaw divided by a longitudinal ridge paralled with margin; upper jaw notched in front (in all but species 11); head with thin hard skin; carapace scarcely keeled. Genus Pseudemys.

(E) Jaws coarsely toothed. Sp. 10. Pseudemys rubriventris. Red-bellied Terrapin.

(EE) Jaws not toothed or serrated. Sp. 11. Pseudemys hieroglyphica. Hieroglyphic Turtle.

(BB) Crushing surface of jaws narrow.

(F) Shell low, never keeled; toes strong, broadly webbed; hind feet much larger. Genus Chrysemys. The Painted Turtles.

(G) Plates of carapace in straight rows across back. Sp. 12. Chrysemys picta. Painted Turtle.

(GG) Plates of carapace alternating, so that the two side rows are not in line with the middle one across back. Sp. 13. Chrysemys marginata. Margined Turtle.

(FF) Carapace much arched; feet nearly equal in size; toes narrowly webbed. Genus Clemmys.

(H) Carapace usually more or less keeled, upper jaw deeply notched and edge strongly arched downward.

(I) Head not notably narrower below than above. Sp. 14. Clemmys muhlenbergi. Muhlenberg's Turtle.

(II) Head decidedly narrower below than above. Sp. 15. Clemmys insculptus. Wood Turtle.

(HH) Carapace not keeled; upper jaw but slightly notched, its edge nearly straight. Sp. 16. Clemmys guttatus. Speckled Turtle.

(AA) Plastron or lower shell with a movable hinge across its middle.

(J) Body depressed or flattened; plasteron notched behind; toes well webbed, aquatic. Genus Emydoidea. Sp. 17. Emydoidea blandingi. Blanding's Turtle.

(JJ) Body short, high and well arched; plastron rounded or squarely cut off but not notched behind; toes scarcely webbed, not aquatic. Genus Terrapene. Sp. 18. Terrapene carolina. Common Box Turtle.

Species 7. Graptemys geographicus (Le Sueur). The Map Turtle. [*Malacoclemmys geographicus* (Le Sueur).]

The Map Turtle has been designated the Geographic Tortoise, the Map Tortoise, the Geographic Terrapin and the Lake Erie Tortoise. It is interesting to note that the last name was used by Baron Cuvier in 1831, Vol. IX, page 75.

It is described as follows:

Carapace ovate, not strongly convex, margin flaring out, median keel present, but dull; margin strongly notched behind; plastron fixed, notched behind, covering whole under surface. Upper jaw not notched, crushing surface smooth. Toes broadly webbed. Plastron yellowish, carapace, dark olive brown, with greenish and yellowish streaks and reticulations on edges; neck and legs similarly marked; plates of carapace scarcely overlaping. The marginal shields underneath show rounded marks within rounded marks, of

olive color, on yellowish ground. Female larger than male, sometimes attains the length (shell measure) of twelve inches. Lower jaw a spoon-shaped dilatation at tip.

This is mostly a western turtle, its range being given by Dr. Jordan as from Mississippi Valley east to New York. Nash says it is found in Western Ontario and has occurred in Eastern Ontario. Stone reports it from New Jersey, and Harlan from Lake Erie. It

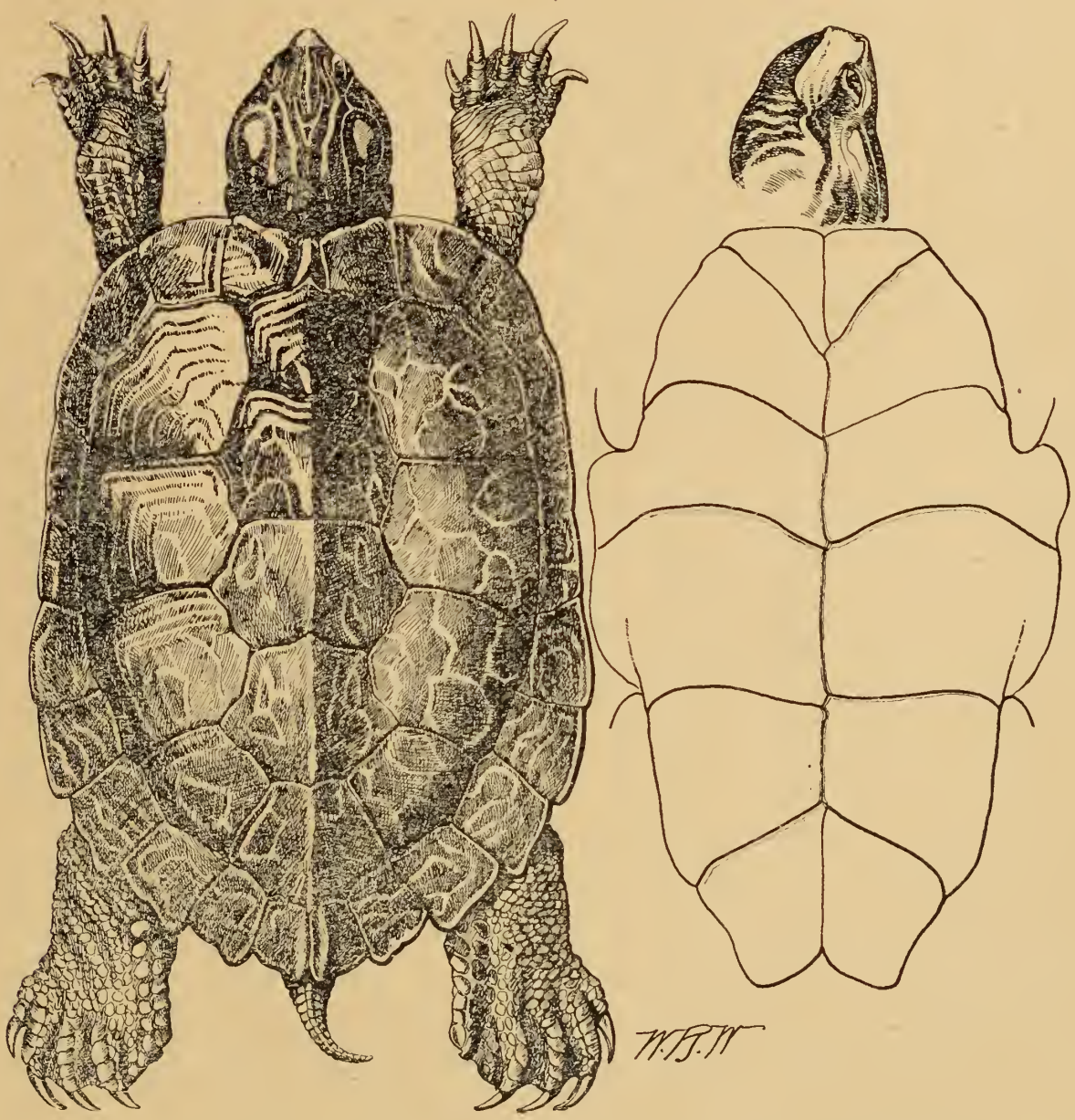

Fig. 6. Map Turtle, showing complete dorsal view, view of plastron and left side view of head. (About 1-3 size of original.) Drawn by W. R. Walton, in office of H. A. Surface, Harrisburg, Pa.

is possible that its chief occurrence in Pennsylvania would be in the western part of the State. The only specimen which we have was contributed by A. G. Riggle, of Cochran Mills, Armstrong county, Pa. This specimen contained only crayfishes or so-called freshwater crabs, and was valuable in giving us a definite point on location and food of this species as known within this State. We hope to receive or collect others and learn more about its distribution and food in this Commonwealth.

But little is to be found in literature concerning the habits and haunts of the Map Turtle, chiefly because it is rare as an eastern species, where most of our writers have made their observations. Hay says that "the food consists of animals of various kinds," and Prof. Gorman found by strict examinations that those which he dissected had fed exclusively upon mollusks, the young eating the thin-shelled species and the adults the larger and thicker kinds. "Thirty specimens caught at Lake Maxinkuckee, Indiana, were found to contain opercles of water gastropods, and one the remains of a crayfish, some fish scales and what were apparently caddice worm cases. Its broad masticatory surfaces are well fitted for crushing the shells of mollusks."—Hay, page 576.

"Will eat chopped fish, meat, meal worms, earth worms and soft-bodied grubs in captivity. Observed to eat the edges of water lily pads. None wintered alive in ponds in New York. Evidently some article of food was lacking."—Ditmars Reptile Book, page 44.

Hay found sixteen eggs in a large female Map Turtle, and reports a character in common with most species of turtles, that the females seemed to be larger than the males. There is very little published concerning the egg-laying habits, young or food of this turtle, but it is evident that it is more beneficial than obnoxious, because it feeds mostly upon invertebrates rather than upon fishes. DeKay, page 19, makes an interesting statement; "It is not uncommon in the streams of New York falling into Lake Erie. I am assured that their flesh is very palatable. They are exceedingly active and vigorous."

Species 8. Graptemys pseudogeographicus (Holb.). The False Map Turtle. [*Malacoclemmys pseudographicus* (Holb.).]

The False Map Turtle is given this common name by the plain translation of its specific name which means "false map.". The "map" refers to the marks on the shell. This turtle has been called the Pseudographic Tortoise and Le Sueur's Map Turtle. Both names seem unfitted as common names, and we offer this as one which would be distinctive and at the same time indicate the proper species to which it should be applied.

It is similar to geographicus, but grayer, the markings on the shell paler, less distinct and in larger pattern; keel of carapace stronger, each plate of the vertebral series with a blackish projection behind, which is more or less imbricated over the succeeding plate; plastron yellowish, marbled; with blackish head; neck and legs with bright yellow stripes.

This turtle is given in literature as occurring in Michigan, Ohio, Wisconsin, Missouri, Iowa, Kansas, Arkansas and Louisiana. DeKay also reports its occurrence in Lake Erie. We have no evi-

dence of its direct occurrence in Pennsylvania, but are satisfied that it should be listed in the Pennsylvania fauna on the basis of its occurrence in Lake Erie and Ohio.

"It is entirely aquatic; and though frequently seen on fallen trees or rocks that rise above the water, yet it only seeks the land in the breeding season. Inhabits many of the rivers that empty into the Mississippi, but has been found to the eastward of the Allegheny range."—Holbrook, page 106.

"It comes out of the water to deposit eggs. Eggs are large, being an inch and a half in the longest, and an inch in the shortest diameter. According to Agassiz, this species deposits its eggs earlier in the season than any other of our turtles. At Natchez, Miss., one was found to have laid her eggs as early as the first of June.

"An eminently aquatic tortoise, spending its life in rivers, lakes and ponds, and coming out of the water only to bask in the sun on some rock or fallen tree, or to deposit its eggs. This species does not appear to be employed to any considerable extent as food, yet there seems to be no reason why its flesh should not be as savory as that of many species which are highly esteemed."—Hay, page 574.

Comparatively little is known concerning the food and feeding habits of this Turtle, excepting that it is said to feed upon very small fish, reptiles, etc. While it is quite rare in this State, it can be expected in the western and northwestern portions, and we hope to hear from persons who are interested in aiding us to obtain specimens from those regions.

Species 9. Malaclemmys centrata (Latr.). Diamond-Back. [*Malacoclemmys centrata* (Latr.).]

The famous "Diamond-Back" or Diamond Back Turtle variously known by other names such as Salt Marsh Turtle, Concentric Turtle, The Terrapin and Diamond-Back Terrapin, Salt Marsh Terrapin, and Salt Water Terrapin, is mostly known as the Diamond-Back, but is frequently called the Salt Marsh Turtle. It receives its first common name from the diamond shaped markings on the carapace, but of course the other common name refers to its place of living.

The Diamond-Back occurs in salt marshes of the coast of the Atlantic and the Gulf from Massachusetts to Texas. Stone reports it as being rare in New Jersey. In Pennsylvania it is indeed more rare if found at all. It may have lived at one time in the extreme southeastern corner of Pennsylvania but owing to its high value as food and the great persistence with which it was hunted, it is no doubt exterminated in our Commonwealth at the present time.

The carapace is ovate, broadest behind, margin flaring, not strongly convex, plates usually with concentric grooves and stripes; plastron covering under surface, plates with concentric grooves and radiating stripes. Color of carapace greenish or dark olive, rarely black, the plates sometimes marked at center with yellow. Lower jaw without spoon-shaped dilation.

The Diamond-Back is found frequently in salt or brackish streams of the marshes, near the sea shore. It buries in mud in the winter and is taken from the mud in the fall, winter and spring at the time when it is fat and in the best possible condition for the table. They are now becoming rare and generally some less desirable turtle is substituted for them, as the price is very high. This has always been considered the most delicious of our turtles and in fact one of the most desirable kinds of food for mankind.

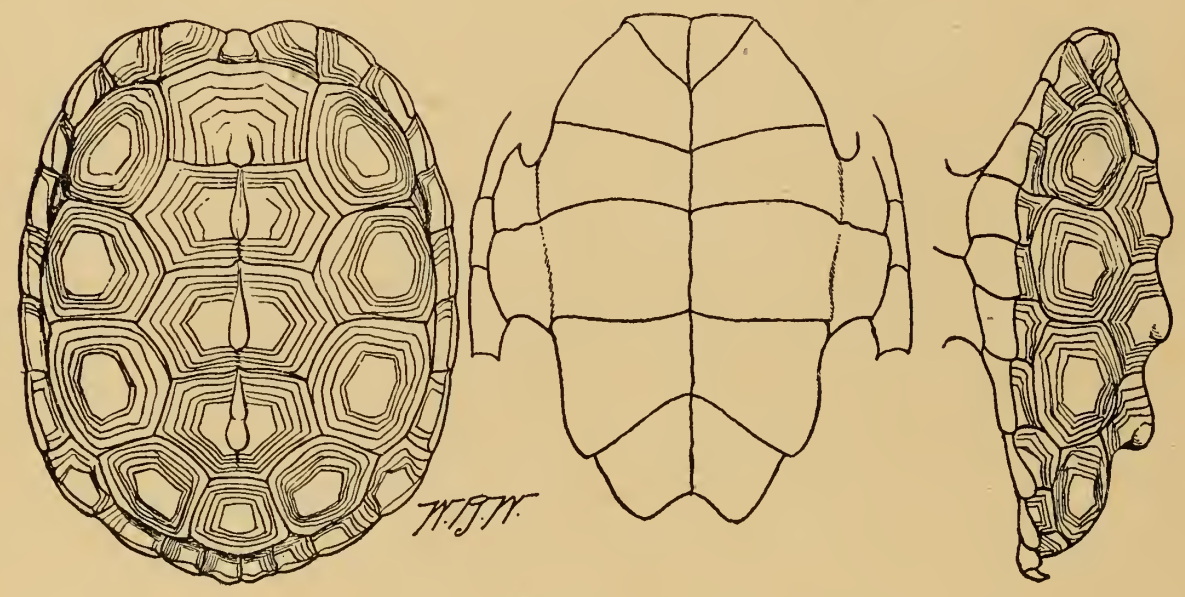

Fig. 7. Diamond-back Turtle. Figures showing dorsal, ventral and left side views of shell. (One-half size of original.) Drawn by W. R. Walton, in office of H. A. Surface, State Zoologist.

Holbrook says, "It lives in salt water and in salt marshes, where it hibernates; far from these it is never seen. It is timid, easily disturbed, and hides on least alarm. Swims with great rapidity and moves quickly even on land. Is easily taken at time of egg-laying. Flesh is excellent at all times, but most popular during hibernation period."—Holbrook, p. 90.

It is said that this trutle is systematically reared for market, although it is doubtful if such business would become profitable on account of their slow growth and multiplication, as this species lays only 6 or 7 eggs at a time.

"It is found in the salt marshes of New Jersey, scarce and rather difficult to procure. They crawl out of the creeks on the advent of frost and seek winter-quarters by hibernating in the black mud

along the banks. This is generally a short distance from the water's edge. They bury a foot or so in the mud and remain there all winter. When spring approaches they revive and move out. Sometimes they continue for quite a distance up a stream or inlet, till a favored locality is found. By means of the disturbance they have caused in the mud where they have attempted to burrow they may be successfully trailed. They are eagerly sought on account of their high market value. Six inches is a common size, and eight inches unusual."—Fowler, pp. 231-232.

The female deposits her eggs in loose soil in the spring or early summer, leaving the water for this purpose. They lay only five to seven eggs at a time and thus their multiplication is not rapid. This is the one turtle that regularly frequents salt marshes, and excepting the Sea Turtles is the only one that lives in salt water.

Ditmars says that the Diamond-Back in captivity eats chopped clams and oysters, some fish and raw meat, and it is also fond of small periwinkle snails. He has observed one eating a small crab on the seashore. In captivity it has been known to nibble lettuce leaves and will probably eat sea weed when wild.

Having had none to examine we cannot report the food from personal observations.

Species 10. Pseudemys rubriventris (Lec.). Red Bellied Terrapin.

The Red Bellied Terrapin has been referred to in literature not only by its common name, but also as Potter, Red Bellied Turtle, Skill Pot, and Slider. The first common name is, of course, taken from the color of the under side, while it is sometimes called the "Slider" from the habit of sliding from banks, rocks or logs into the water when alarmed. This turtle is found from New Jersey to Virginia, and has been reported as being common in the Delaware river near Trenton. It is also reported as being found in the eastern part of Ohio, Pennsylvania, New Jersey, Delaware, Maryland, the two Virginias and North Carolina.

Holbrook says "It is frequently brought to the Philadelphia market from both the Delaware and Susquehanna river systems" and LeConte says "it is common in the Delaware river near Trenton."

This species has the general character of *geographicus*, but with alveolar surface of upper jaw divided by a longitudinal ridge parallel to margin; upper jaw notched in front; head with thin hard skin; carapace without median keel but with two medio-lateral short ridges. Loose skin between legs without scales, ridge in alveolar surface of jaw tuberculate. Young marked with confluent, lozenge-shaped figures. Jaws coarsely serrated; point of upper jaw with a

prominent hook. Dusky, with irregular markings above; marginal plates with much red; plastron red or partly yellowish; head and neck brown, with numerous parallel stripes all of which are yellow; variable. Length about twelve inches. Shell serrated at rear margin.

Holbrook says this turtle is met with in "running water, preferably with a rocky bed." This differs materially from some of the other turtles which prefer decidedly quite, muddy water. Eugene Smith says "The Slider is much used as a substitute for the real Diamond Back Terrapin now that the latter is becoming scarce." We have no specimens of this species, and would ask for both specimens and notes on observations of its habits.

Species 11. Pseudemys hieroglyphica (Holbrook). The Hieroglyphic Turtle.

This turtle has no distinctive common name other than that which refers to the specific name given it by Holbrook. This refers to the hieroglyphics or peculiar markings on its back. It is a turtle about which comparatively little is known, and comparatively few specimens have been seen in this State. It occurs from New York to Wisconsin and southward. It is decidedly limited in its distribution, having only isolated regions here and there in which it appears.

The Hieroglyphic Turtle differs from P. rubriventris in lacking the serrations of the jaw and in having the carapace smooth, olive-brown, variously marked with reticulated or concentric yellowish lines, plastron yellowish, and a dark blotch on the border of each marginal shield. Shell, when twelve inches long, only three inches high.

"Nothing is known about its habits. It is undoubtedly entirely aquatic."—Hay.

As we have had no opportunity to examine specimens of this turtle we cannot give any personal observations nor can we find any definite statement published concerning its haunts and habits, eggs, young, food or economic features.

Species 12. Chrysemys picta (Hermann). Painted Turtle.

The Painted Turtle has been variously called Mud Turtle, Pond Turtle, Chequered Tortoise, Painted Terrapin, Yellow-belly, Yellow-bellied Terrapin, Painted Tortoise, and Chequered Terrapin. While it is a mud turtle, this name is applied to several species and it would be better to set it aside for only one species and thus avoid confusion. It is best known as the "Painted Turtle", not only on account of its bright colors, but also because the specific name "picta" means "painted" and refers to this feature.

It is found in the Eastern United States from New Brunswick to the Gulf of Mexico and westward to Louisiana. The Allegheny Mountains form almost a sharp boundary line between this and the next species, which is no doubt its western form. Whether they should be recorded as distinct species or not is left for others to determine.

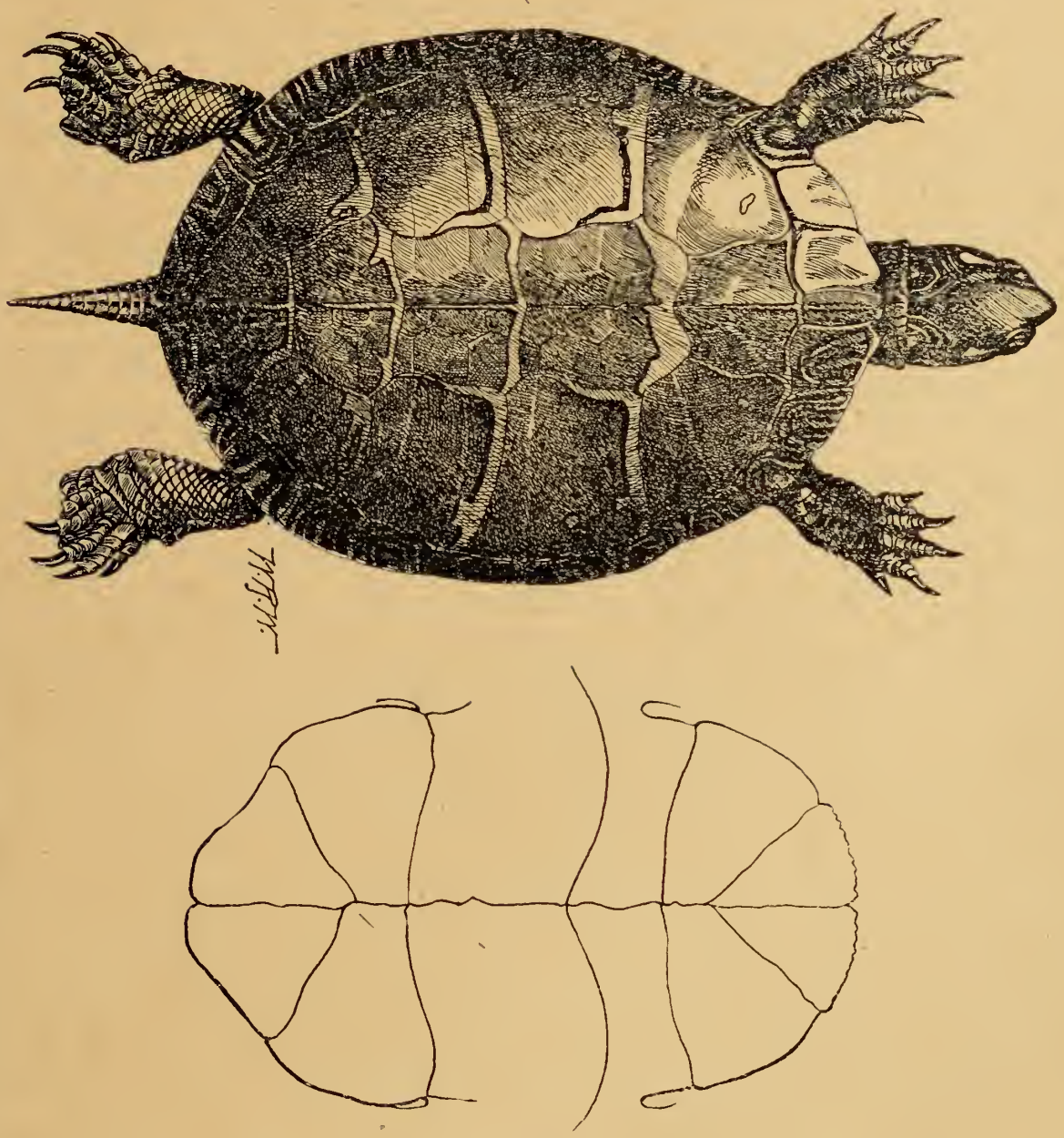

Fig. 8. Painted Turtle, showing complete dorsal view and outline of plastron. (One-half nat. size.) Drawn by W. R. Walton, in Laboratory of Pa. State Zoologist.

The Painted Turtle has the carapace ovate, depressed, without keel, smooth, margin flaring slightly, never serrated posteriorly and but slightly notched. Plastron immovable. Alveolar surface of jaw narrow, well marked except in front; upper jaw notched in front. Olive or greenish black, plates margined with paler, opposite, slightly imbricated; marginal plates marked with bright red; plastron yellow, often blotched with brown. Length of shell occasionally six inches.

This is one of the common turtles seen in ponds, ditches, and shallow streams, in rows on stones, logs and banks, and which upon the slighest alarm slide into the water and hide in mud, swim away, or stir up the mud and thus cloud the water so as to be concealed.

Holbrook says of the Painted Turtle that it "frequents ditches, ponds and pools, is abundant in rivers where the water is sluggish; spends almost the whole day basking in the sun on the banks of rivers, or on fallen trees or logs. Is very timid and escapes rapidly when disturbed. Hibernates early and is first to be seen in the spring. It takes the angler's hook readily. Its flesh is sometimes eaten but not much esteemed."

It hibernates in the deeper water of quiet ponds, especially where there is an accumulation of submerged leaves. In seining for fishes in the fall of the year, we have frequently caught the net full of turtles of this species in such place.

There is no good rule for distinguishing the sexes in this species. The usual rule of males having concavity in plastron does not hold here. There is a difference in body proportions. This was determined by measuring a known number of males and females and working out the ratios of length to width and height. The following is a tabulated statement of the results of measurements of 29 males and 19 females.

	Males.	Females.
Length greater than height,	$\frac{L}{H} = 2.64$	$\frac{L}{H} = 2.82$
Length greater than width,	$\frac{L}{W} = 1.21$	$\frac{L}{W} = 1.47$

This condensed table means that in the males the length is 2.64 times the height and 1.21 times the width, while in the females the length is 2.82 times the height and 1.47 times the width. It is thus shown that the females are proportionately higher and broader than the males, while they become not only proportionately but actually larger in all dimensions.

Our Pennsylvania collections of this species have been as follows:

Berks county, Boyertown High School, Boyertown.
Berks county, Gruber, C. L., Kutztown.
Bucks county, Atkinson, Mrs. J. W., Buckingham.
Centre county, Cook, C. M., Bellefonte.

Columbia county, Baldy, S., Catawissa.
Cumberland county, Zoological Division, Camp Hill.
Dauphin county, Zoological Division, Harrisburg.
Dauphin county, Fisher, Boyd, Harrisburg.
Dauphin county, Zoological Division, Highspire.
Dauphin county, Keboch, F. D., Williamstown.
Dauphin county, Attaches of Zoological Division, Rockville.
Dauphin county, Sober, Miss M. G., Dauphin.
Fulton county, Palmer, G. A., Warfordsburg.
Fulton county, Jackson, R. L., McConnellsburg.
Lancaster county, Wislar, J. J., Columbia.
Luzerne county, Campbell, E. W., Pittston.
Lycoming county, Koch, Aug., Williamsport.
Lycoming county, Rothrock, B. P., Williamsport.
Monroe county, Roberts, G. C., Stroudsburg.
Northampton county, Kinney, I. L., Portland.
Perry county, Stewart, Wm., Landisburg.
Schuylkill county, Ramberger, James, Blackwood.
Wayne county, Bullock, W. H., Honesdale.

W. H. Smith says this species "emits a piping note" and if so it must be regarded as one of the numerous species of creatures whose piping or "peeping" is heard in swamps in the spring.

Professor Smith also adds that, "after the eleventh year the female on a June evening, digs a vertical hole in which she deposits her elliptical eggs." Report of Ohio, pg. 664.

Prof. Louis Agassiz in his contribution on Embryonic Turtles, published in 1857, says, "The process of reproduction by laying is not commenced before the 11th year. * * * * Enough has been seen to warrant the assumption that from the eleventh to the fourteenth year is about the age at which most, if not all our native fresh water turtles lay their eggs for the first time." He also adds "Not one of our turtles makes more than a single nest. They deposit all their eggs at once. The Painted Turtle has an almost identical period of incubation with the Snapping Turtle, namely from the 11th to the 25th of June."

The Painted Turtle is known to lay only from five to seven eggs a year although more may be found within the body at any time. These do not all come to maturity during the same year.

Of the eighty-six specimens of Painted Turtles dissected in our laboratory, the stomach contents were found to be as follows:

	No.	Per Cent.
Vegetation,	63	73.2
Cryptogams, (Flowerless Plants),	32	37.4
Algæ,	30	35.1

	No.	Per Cent.
Bryophyta,	2	2.3
Liverwort, (Marchantia polymorpha),	1	1.1
Sphagnum moss,	1	1.1
Phanerogams, (Flowering Plants),	65	75.1
Undetermined, (Flowering Plants),	11	12.8
Undetermined leaves,	36	41.8
Undetermined stems of plants,	5	5.8
Undetermined seeds,	4	4.6
Lepidium virginicum (Pepper Grass) seeds and pods,	1	1.1
Sambucus canadensis, Berries of Elder,	1	1.1
Polygonum sp. seed, (Smartweed),	1	1.1
Rumex sp. seed, (Dock),	1	1.1
Peltandra virginica leaves, (Arum),	1	1.1
Lemna sp. leaves, (Duck Weed),	1	1.1
Grass,	3	3.5
Animal matter,	69	80.2
Mollusca, (Mollusks),	23	26.7
Bivalves, (Clams, etc.),	5	5.8
Snails,	17	19.8
Pond Snails,	3	3.5
Slugs,	1	1.1
Crustacea,	3	3.5
Insects,	61	70.9
Undetermined fragments,	22	25.6
Larvæ of insects,	3	3.5
Aquatic nymphs,	1	1.1
Odonata, (Dragon flies),	11	12.8
Undetermined Nymphs of Dragon flies,	9	10.5
Agrionidæ, nymphs,	2	2.3
Libellulidæ, nymphs,	1	1.1
Orthoptera, (Grasshoppers, etc.),	1	1.1
Gryllidæ, Gryllotalpa sp., Mole Cricket,	1	1.1
Hemiptera, (Bugs),	4	4.6
Belostomidæ—Zaitha sp.,	1	1.1
Hydrobatidæ, (Water Striders),	2	2.3
Jassidæ, (Leaf Hoppers),	3	3.5
Neuroptera, larva,	1	1.1
Lepidoptera, Moth larvæ,	2	2.3
Coleoptera, (Beetles),	37	43
Undetermined fragments,	24	27.9
Larvæ,	1	1.1
Carabidæ, (Ground Beetles),	3	3.5
Dytiscidæ, (Diving Beetles) larvæ,	1	1.1

	No.	Per Cent.
Scarabaeidæ, Macrodactylus subspinosus, (Rose Bug),	10	11.6
Chrysomelidæ—Donacia sp., (Leaf Beetle),	4	4.6
Rhynchophorous beetle, (Snout Beetle),	1	1.1
Diptera, (Flies),	19	22.1
Undetermined,	4	4.6
Undetermined larva, (Flies),	5	5.8
Undetermined pupae, (Flies),	3	3.5
Tipulidæ, larvæ, (Crane Flies),	1	1.1
Syrphidæ, (Syrphus Flies),	3	3.5
Larvæ, undet.,	1	1.1
Pupæ, undet.,	2	2.3
Hymenoptera, (Ants, etc.),	3	3.5
Undetermined pupa,	1	1.1
Undetermined ants,	2	2.3
Vertebrata, (Vertebrate Animals),	8	9.3
Undetermined vertebrates, (Flesh),	2	2.3
Pisces undetermined, (Fishes),	4	4.6
Mammalia undetermined, (Mammals),	1	1.1

Fortunately we were able to obtain enough specimens of the Painted Turtle to make a fairly exhaustive study of its actual food in the way of stomach contents. We are consequently prepared to point out some interesting facts in this regard. As shown above, eighty-six specimens of the Painted Turtle were found to contain food, of which sixty-three contained vegetable matter. Thirty of these had eaten Algæ or the so-called frog spawn, green slime or "green maiden hair," sometimes found in quiet water. Eleven contained undeterminable fragments of higher plant life, and thirty-six contained leaves of the flowering plants. This shows that the Painted Turtle is decidedly herbivorous, as it feeds to a great extent upon vegetation. Four had eaten seeds of plants, and three contained blades of grass. One had eaten the floating plant, Lemna, or duck weed, and one had eaten the seed of the dock plant, another smart weed, another the seeds and pods of the pepper grass and another the berries of the Common Elder (Sambucus canadensis). While the berries of this plant are considered decidedly useful by mankind, they will not be appreciably reduced by depredations of turtles, even though two species were found to have eaten them.

Sixty-nine Painted Turtles were found to contain animal matter of some kind of the low as well as the higher forms of animal life, including insects. In comparison with the sixty-three containing plant food we find a balance which shows that the Painted Turtle is omniverous, and almost equally herbivorous and carnivorous.

Twenty-three specimens were found to contain mollusks, of which one had eaten a slug and seventeen had devoured dry land slails or the snail covered with a shell, and living on the land. This shows the Painted Turtle is a destroyer of this creature which feeds so extensively on the foliage of plants in damp places. Three had eaten pond snails and five had devoured bivalves or mussels. Of course, the last named were taken from the water as they are only aquatic in their living.

Sixty-one of the eighty-six had eaten insects, of which twenty-two contained undeterminable fragments of immature insects, and three contained undetermined insect larvæ. Eleven had fed on dragon flies in the immature stage. As the nymphs of the dragon flies live entirely in the water it is plainly seen that the Painted Turtle seeks much of the food in the mud at the bottom of streams and ponds. Of course, some of them could be captured at the time they come from the water and cling to objects in the air and transform to the winged stage.

It is interesting to entomologists to know that one specimen of Painted Turtle was found to contain a mole cricket in good condition. This insect is rare in most portions of the State, but its proclivity to live in damp regions accounts for the greater chance of its being found and eaten by a semi-aquatic animal like the Painted Turtle.

Among the Hemiptera it was found that one Painted Turtle had eaten a small giant water bug (Zaitha), two devoured water striders or "skaters" and three had fed upon leaf hoppers. Two Painted Turtles should be given credit for eating the larvæ of moths, commonly called caterpillars, while nineteen were found to have fed on flies, mostly in the immature stages as larvæ or pupæ. Most of these were flies of the species that live in or near the mud and water.

Thirty-seven Painted Turtles were found to contain beetles, of which twenty-four contained fragments of species which could not be determined. Three had eaten ground beetles, and one an aquatic Diving Beetle, while ten had shown their decidedly beneficial results by feeding on the very objectionable Rose Bug. While it is possible these turtles had taken the insects from the surface of the water where they were floating, nevertheless credit must be given them as certainly being an enemy of one of the most obnoxious pests of this State, and for which there is no satisfactory remedy. Eight Painted Turtles had eaten vertebrates, four of which contained fishes and one a mammal. Others contained only bones or fragments of flesh and could not be recorded with certainty.

In the review of the food of the Painted Turtle it becomes evident that it eats vegetation to a great extent, but is not necessarily objectionable by so doing, as the plants are mostly of aquatic species. It is beneficial in feeding upon such insects as snails, leaf

hoppers, moth larvæ, rose bugs and other species. While it occasionally feeds upon fishes this may not be a serious objection as they are not generally such desirable species as game fishes.

Other authors have made statements concerning their food as follows:

"Fish" (Ditmars); "Insects" (Holbrook, DeKay, and Ditmars); "Tadpoles" (Holbrook, Ditmars); "Frogs" (Holbrook); "Ducklings etc." (Shaw); "Earthworms" (Holbrook); "Aquatic reptiles" (DeKay); "Aquatic plants" (Ditmars, Eug. Smith); "Water Plantain leaves" (DeKay).

It will be seen from the above that this species is reported to feed to a considerable extent upon vertebrate material, whereas we have found less than 10 per cent. of those dissected containing Vertebrates. Further, it has been the common belief that turtles feed on fish, while out of the 86 stomachs examined less than 5 per cent. were found to have eaten fish. By far the greatest amount of food for the Painted Turtles was furnished by the group of animal organisms known as Insects, although a large per cent. of their food was plant material. In fact, 73 per cent. of those containing food had eaten more or less of vegetable matter, while over 80 per cent. had eaten animal material.

Among the insects some are recognized as very destructive species, and a careful study of our food charts shows that these turtles must be regarded as beneficial rather than obnoxious.

Special attention should be called to some of the stomach contents of some individuals of this species. For example, specimen No. 6391a[2] contained eleven damsel fly nymphs of one species, one of another species, one true dragon fly, one damsel fly, one beetle larva, one flat spiral shell (Planorbis) and one crustacean. In the intestines were found many fragments pointing to a preponderence of damsel flies as food. Specimen 9932a[1] contained considerable food, and of this 99 per cent. was vegetable matter, mostly algæ and fragments of water lily or arrow head leaves. Specimen 5951a[2] contained considerable food, of which 75 per cent. was the remains of aquatic snails or mollusks and 25 per cent. was plant leaves. In the seventy-nine specimens examined the greater portion of the food contents of twenty-eight individuals was of animal origin, while forty-four contained vegetable matter as their major portion, and seven contained about equal amounts of animal and vegetable tissue. It is remarkable to know that some specimens contained specimens of Macrodactylus subspinosus, the Rose Chafer, which is also known as the injurious Rose Bug. There can be no doubt of the economic features of these insectivorous creatures.

Shaw goes so far as to say, "This species is a voracious eater of ducklings, etc." It is our opinion that such a statement is misleading. Various writers report that the Painted Turtle is eaten by man but is not much esteemed.

Species 13. Chrysemys marginata (Agassiz). The Margined Turtle.

The specific name of this turtle refers to the red marks upon the margin of the plates. It could properly be called "The Western Painted Turtle," in accordance with the expression used by Dr. Hay, but no better name could be given in accordance with its scientific name and coloration than "The Margined Turtle," from its specific name. It is also sometimes called Agassis's Turtle. Hay called it

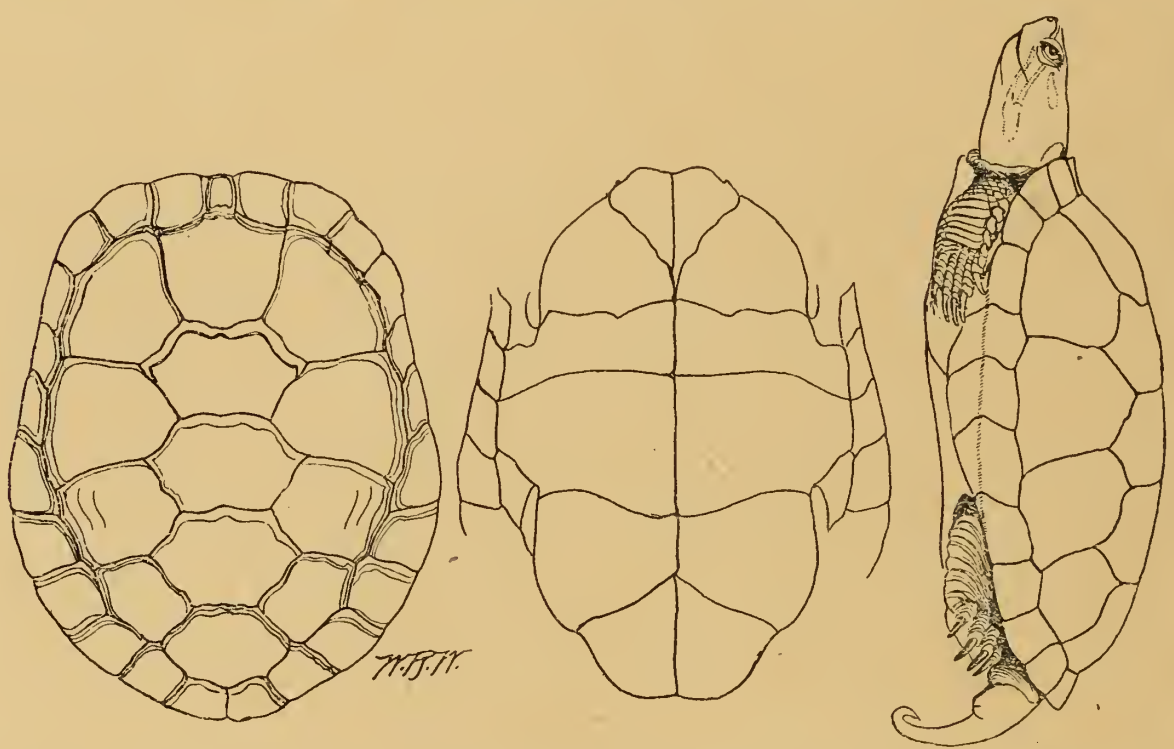

Fig. 9. Margined Turtle. Outline of carapace and plastron and left side view of complete specimen. (One-third nat. size.) Drawn by W. R. Walton, in office of H. A. Surface, State Zoologist.

the Western Painted Turtle, because it is really the Western form of the Painted Turtle. Prof. Agassiz pointed out the fact that this form has the plates in the longitudinal rows over the back alternating, the rows across the shell being broken, while in the Eastern form the plates are arranged in regular straight rows in each direction, both lengthwise and across the shell.

Of the Marginal Turtle, the carapace is ovate, depressed, without keel, smooth, margin flaring slightly, never serrated posteriorly, and but slightly notched. Plastron immovable. Jaws as in *C. picta* Plates of carapace alternating, the lateral series with strong, concentric striae. Length of shell six inches. Color as in *picta*, except that a dark spot usually marks the central area of plastron of *marginata*.

The Margined Turtle occurs from Western New York to Iowa and perhaps southward to Louisiana. W. H. Smith says, than in Ohio this species is abundant. It is certain that in the eastern part of Pennsylvania the Painted Turtle is found while in the western part the Margined Turtle much predominates.

Our collections in Pennsylvania have been from Erie county, by Prof. E. M. Mixer, Waterford, and Tioga county, Mr. D. C. Manley, Stokesdale.

Hay says of the Margined Turtle, "It is at once our most beautiful and most common tortoise (Indiana). Is strictly aquatic and excessively timid. It prefers ponds, pools, and the sluggish parts of our streams. May be often seen lying on some fallen tree trunk or on some projecting stone basking in the sun. The sense of sight and hearing appear to be acute, for it easily takes alarm and tumbles into the water and disappears. It is then often to be found buried in the mud, close to where it entered the water. Is entirely harmless, and can hardly be provoked to bite."

A comparison of the two species reveals some points of interest. Among these are such as follows:

C. picta is regarded as a species in the process of formation from *C. marginata*. It seems to have "freed itself" pretty well, as Hay says, yet not completely. Intergarding forms are rather common. In other words, the imitation period has not come to a close. It is impossible to distinguish with any degree of certainty the young of the two species. Agassiz's figures of their shells and plates do not show the true condition of affairs, although applicable to the majority of cases after they have made some growth.

A series of specimens has been arranged, and photographed, and is here published as our Plate VIII, showing gradations from the marginata type to the picta type. These, from their geographical range, and from their adult contemporaries in the same pond in certain cases, are undoubtably *C. picta.* The youngest one shown in this series is certainly like *marginata* in every respect.

In general, the two species may be distinguished when adult by the following characters:

1. Geographical range. This is not infallible, as both species may occur in Western Pennsylvania and in Ohio, although the Allegheny Mountains must be regarded as dividing their general respective regions.

2. Arrangement of plates on carapace. In *marginata* the side (costal) and middle (vertebral) plates are arranged alternately as is common in turtles; in *picta* these are arranged opposite each other so that they form transverse rows across the back.

3. The yellow (red in life) border to the anterior margins of the costal and vertebral scutes or plates is wider in picta than in marginata. (Authority of Dr. Hay.) Of course in *marginata*, these borders do not form straight transverse stripes as in typical *picta*.

4. The plates of the carapace in *marginata* show concentric striae or ridges (in our specimens) while in *picta* the scutes are smooth, except in occasional specimens.

Variations in scale arrangement. Our specimen No. 8785g[1] has six vertebral plates in a row and five costals in regular arrangement. No. 8785g[2] has an extra trinangular plate between the fourth and fifth vertebrals, on the left side, not in the middle.

No. 8785g[4] has the third costal of the left side divided transversely into two quadrilateral plates. The fourth costal in the left side is triangular instead of quadrilateral.

In No. 1073 there is a fifth costal on each side, triangular in shape. The last vertebral plate is correspondingly modified to an octagonal shape.

The greater number of adults have rather sharp serrations or points on the anterior margins of the carapace. There are also serrations usually on the anterior and posterior borders of the plastron.

The vertebral line of red (yellow in formalin) is present in every case. It may be dim or present only on the posterior part of the carapace, but part of it at least is always present.

The Margined Turtle is found in places or situations similar to those frequented by the Painted Turtles, and the food and economic features are similar. It has been reported that this turtle is found out of its winter quarters as late as December 22nd and in the spring has been moving as early as the 31st of March.

It is common in the swamps and ponds of the north-eastern portion of Mississippi Valley where we have seen them in great numbers on logs and stones disporting themselves with just such habits as are seen in the Painted Turtles in the eastern part of Pennsylvania.

Unfortunately we have had examined in our laboratory only two stomachs of the Margined Turtle collected in Pennsylvania, but we have little doubt that the food of these turtles is practically the same as that of the closely related Painted Turtle. Dr. Hay reports that the food is probably insects, tadpoles and feeble and small animals.

Species 14. Clemmys muhlenbergi (Schweigger). Muhlenberg's Turtle.

This is know as Muhlenberg's Turtle from the fact that Schweigger chose to name this reptile in honor of one of the early writers on such subjects. It has also been called Muhlenberg's Tortoise, and Terrapin and the Mud Turtle. While it lives in the mud, as do

most turtles, and is consequently in a general sence a "mud" turtle, if we wish to avoid confusion it should not be called "The Mud Turtle."

In this species the carapace is ovate, considerably arched, smooth or but slightly keeled, margin flaring, not notched in rear. Upper jaw deeply notched, and arched downward. Head not notably narrower below than above. Plates of carapace showing fine, concentric grooves. Each of the large plates with dull yellowish or

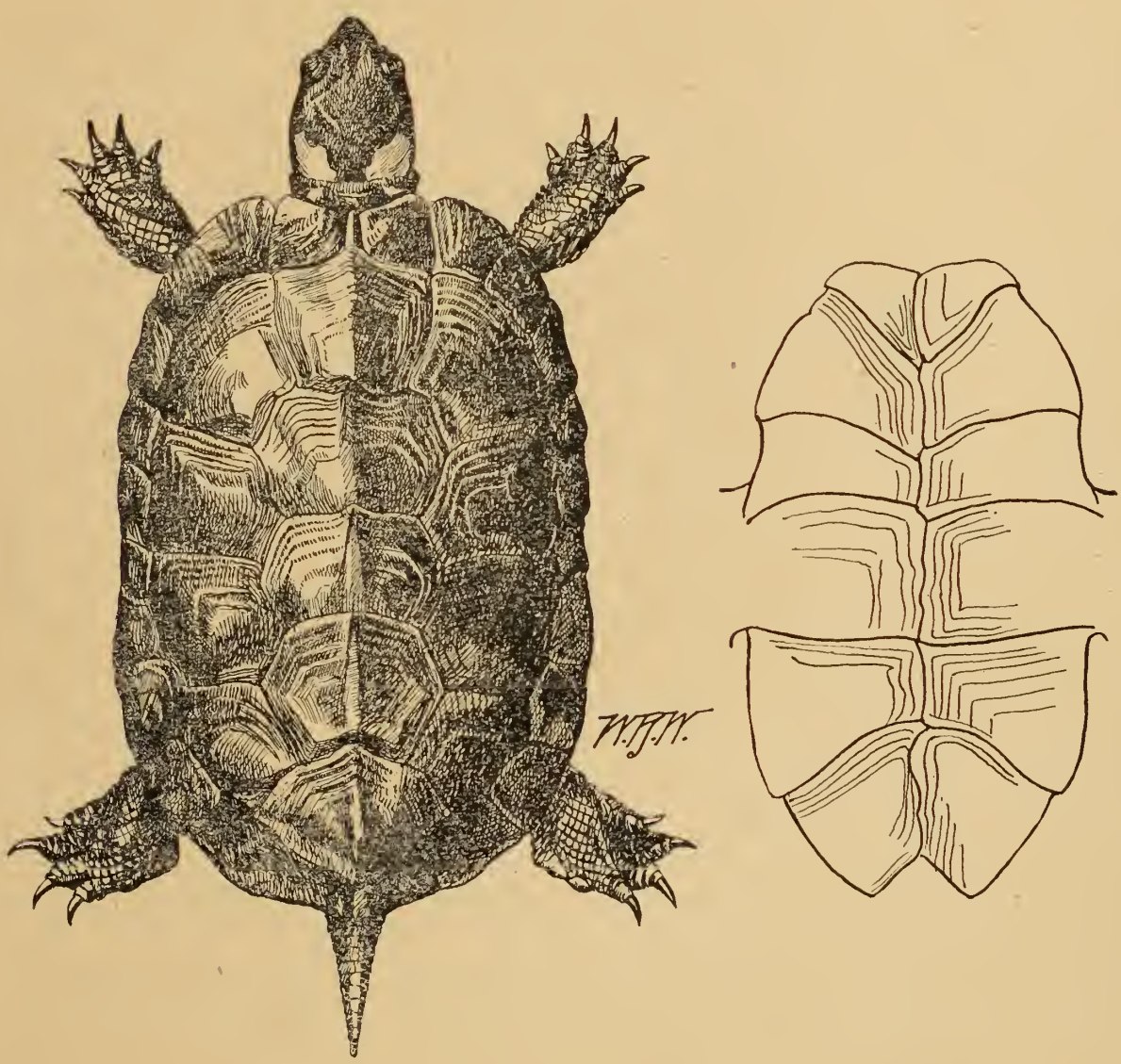

Fig. 10. Muhlenberg's Turtle, showing complete dorsal view and outline of plastron. (Slightly reduced.) Drawn by W. R. Walton, in office of H. A. Surface, State Zoologist of Pa.

reddish markings in the center, (sometimes obsolete). Plastron black with yellowish blotches. The head is black with a large patch of brilliant orange-yellow on each temple. Skin dusky, paler in the more protected parts.

"Is decidedly terrestial in its habits; preferring, however, moist places, and the neighborhood of running streams. Their movements are very sluggish, and in captivity they attempt to burrow."—DeKay, 18.

"In fresh water, as early as April 15. Is rather abundant and colonial near Trenton. Is aquatic in habits and similar to *C. guttata.*"—Fowler, 242.

This turtle is found in Eastern Pennsylvania, New Jersey and Southern New York. It is thus decidedly limited in its distribution, and even in this region it is found only in select or limited locations. In our collection we have two specimens, both coming from Delaware county, one having been contributed by Mr. S. M. Lehman, of Essington, and the other by Mr. S. Omensetter, of Media.

Our study of the stomach contents revealed that only one contained food, and this consisted of undetermined berries, 20 per cent., and undetermined insects fragments 80 per cent. This shows that it feeds out of water and is accustomed to find fallen berries and other material on the ground beneath bushes. Ditmars says this species feeds readily out of the water, eating tender green leaves, insects and worms. He reports that in captivity it will take chopped meat, earthworms, meal worms, lettuce and berries. We invite further observations and collections of this particular species, concerning which so very little has been published.

Species 15. Clemmys insculptus (Le Conte). The Wood Turtle.

The Wood Turtle has been variously designated as Sculptured Tortoise, Fresh Water Terrapin, Wood Terrapin, Red Bellied and Rough Back Turtle, Rough Back and Water Terrapin and Wood Tortoise. It takes its common name from the fact that it is abundant in woods, living sometimes in such places all the year around and hibernating only beneath leaf mold and fallen leaves. The specific term "insculptus" means engraved, and refers to the markings, or lines and grooves, on the back. From these marks it has also been given the name of Sculptured Tortoise, and Rough Back Turtle.

This species has the carapace ovate, keeled, margin flaring, serrate or toothed in rear. Upper jaw deeply notched and arched downwards. Head decidedly narrower below than above. Plates or carapace with concentric and radiating grooves and radiating black lines; reddish brown; plastron with a black blotch on each plate, posterior margin deeply notched. Length 8 inches. The entire carapace has a rough chiseled aspect, hence the specific name—"insculptus". The fleshy parts, with the exception of the top of the head and limbs, are bright brick-red.

The number of marginal plates varies somewhat. Our specimen No. 1536a has twenty-four marginal plates, and No. 9467f[1] has twenty-seven.

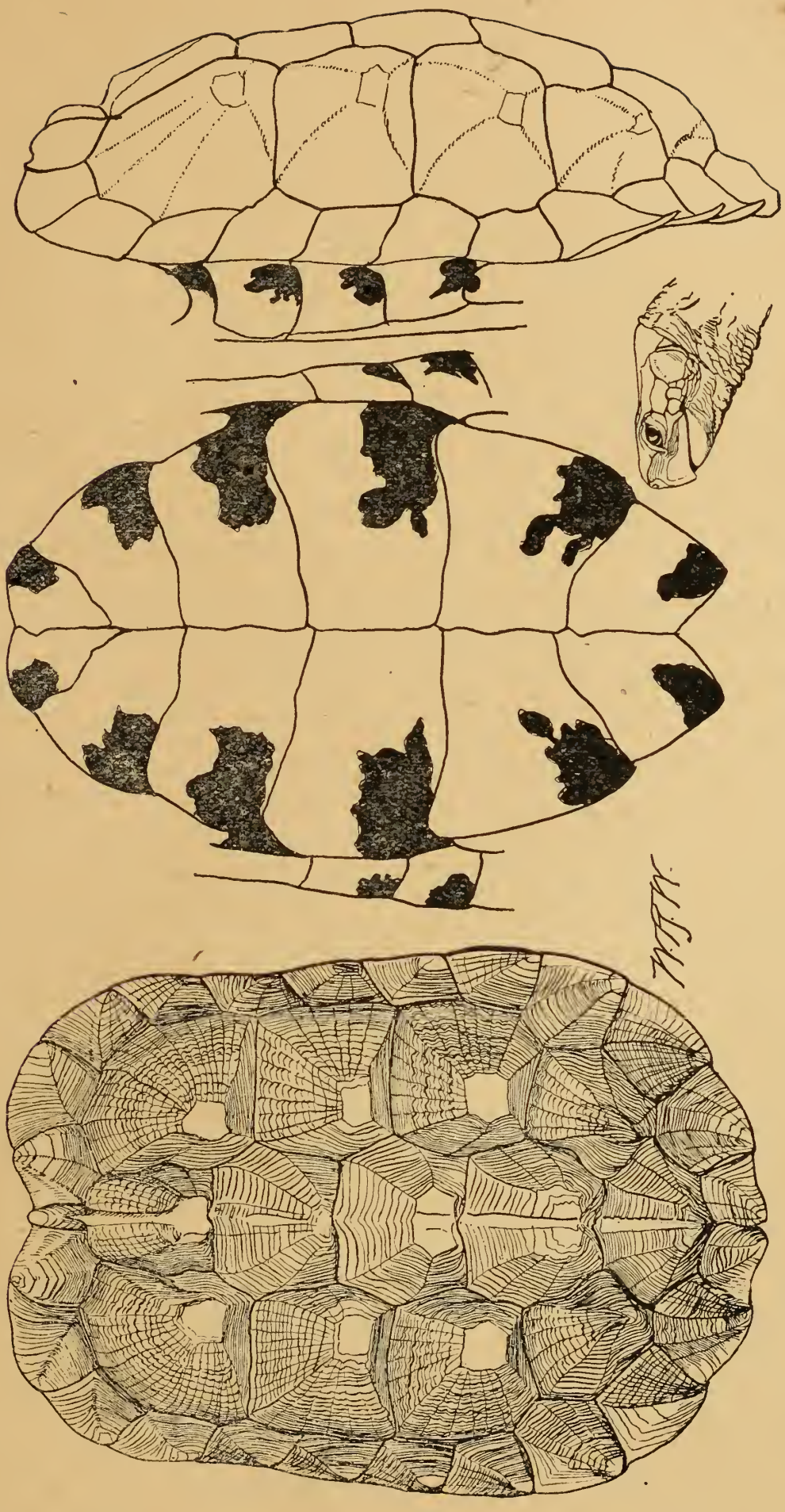

Fig. 11. Wood Turtle, showing outlines of carapace, plastron and left side view of shell, with side view of head. (One-half nat. size.) Drawn by W. R. Walton, from life, in Laboratory of State Zoologist, Harrisburg, Pa.

Our No. 6593c has an extra plate between the third and fourth vertebral scutes on the left side. This plate occupies part of the space of the fourth vertebral and has shoved forward the left half of both the second and third vetebral scutes.

In the adults the male has a marked concavity in the plastron. In the female the plastron is convex or practically flat in half grown specimens.

The Wood Turtle is found in the northeastern United States and Ontario, extending from Maine to Pennsylvania and westward to Ohio. Even then it is very limited in its distribution. We have received speciments from Ulster county, N. Y., from Mr. A. A. Northrup, Browns Station; Warren county, N. J., from Paul S. Tooker, Phillipsburg, while from Pennsylvania, our specimens have been mostly from the central and northwestern portions of the State as the following acknowledgments indicate:

Bedford county, Zoological Division, Bedford.
Bedford county, Zoological Division, Bedford.
Bradford county, Smith, A. C., Burlington.
Bradford county, Biles, W. L., Wyalusing.
Cambria county, Seaman, A. F., Wilmore.
Cambria county, Brubaker, F. M., Johnstown.
Center county, Kuhn, C. F., State College.
Clearfield county, Hurd, W. E., La Jose.
Clinton county, Allabach, Lulu F., Lock Haven.
Cumberland county, Zoological Division, Camp Hill.
Dauphin county, Zoological Division, Harrisburg.
Dauphin county, Meredith, H. L., Harrisburg.
Dauphin county, Fegley, Carl, Harrisburg.
Dauphin county, Anderson, Stephen, Harrisburg.
Dauphin county, Keboch, F. D., Williamstown.
Dauphin county, Sober, Miss M. G., Dauphin.
Franklin county, Lehman, A. B., Fayetteville.
Huntingdon county, Swoope, J. P., Huntingdon.
Huntingdon county, Blatt, W. J., Huntingdon.
Indiana county, Wehrle, R. W., Indiana.
Indiana county, Hasinger, L. C., Indiana.
Luzerne county, Angus, Wm., Stoddartsville.
Luzerne county, Good, Jacob, Wapwallopen.
Luzerne county, Campbell, E. W., Wilkes-Barre.
Lycoming county, Myers, C. E., Hughesville.
Monroe county, Allegar, I. L., Shawnee.
Northampton county, Bedford, G. H., Nazareth.
Perry county, Showalter, C. E., Landisburg.
Potter county, Lehman, J. P., Coudersport.
Tioga county, Barns, O. J., Mansfield.

Venango county, Lavelle Bean, Emlenton.
Wayne county, Stevens, F. Wm., Sterling.
Wayne county, Bullock, W. H., Honesdale.
Wyoming county, Baker, Gerdon, Noxen.

"Occurs usually in dry fields, though also in meadows and along orders of streams in spring. Less aquatic than any of the other embers of the family. In numerous cases the author found leeches nd Helicidae adhering to their legs or flanks, which shows a means f distribution for the latter forms. They repair in autumn to reams and ponds and prepare to hibernate by burying themselves mud. Timid and retiring, but when excessively irritated, will nap. They emit a piping note."—W. H. Smith, p. 659.

"An upland species and scarce. Is in demand as food. Sometimes lives in dry woods though mostly are found along banks of reams."—Fowler, p. 243.

"This, though given as living mostly in ponds, appears to be the ost terrestial of our turtles, next to the Common Box Turtle, and is uite a good walker, raising itself well from the ground. It appears nstantly on guard, ready to defend itself." —Eug. Smith, 30.

The Wood Turtle is liable to be found in any habitat or haunt roughout its range where the conditions are suitable, or where here are damp leaves in rather secluded woods. In fact it is seen ore out of the water than within this element and this no doubt counts for the large number of specimens which we have received om contributors. Where it is found on dry land it is easily collected, whereas those species which live in water easily escape and e not so often sent in by voluntary contributors.

We have seen this turtle hibernating in comparatively dry woods Centre county, and recollect distinctly that one of the situations as on a knoll or sloping hillock where there was considerable caying vegetation and many fallen leaves, with a temporary pool ly a few yards away. It makes a nest by digging a hole and turng around, adjusting the burrow to the size and shape of its body. here it remains with only two or three inches of earth and leaves er it the entire winter. Under the decaying vegetation and with e warm earth helping to contribute heat, it remains there during e winter. It is well known that in such places the earth does not nerally freeze deeply, while the snow melts readily.

From our study of this species we find that 76 per cent. of those ntaining food had eaten vegetable matter, nearly half of which uld not be determined because so badly broken, while 80 per cent. d eaten animal matter. This means of course that some had ten both vegetable and animal tissue as food.

Among those that had eaten animal tissue the number that had ten mollusks was rather large, considering that more than one-

fourth of all examined was found to contain them, while the number that had eaten insects was still larger, being about 53 per cent. of all those that contained food.

Two had eaten birds but they were not in condition to be determined. It is of course possible that the birds were found dead as it is known that turtles are valuable and important scavengers. It is scarcely to be thought that such slow creatures as turtles could capture and kill the birds.

Special records of our examinations of specimens are as follows:

Our No. 6593c contained thirteen sawfly larvæ, two species of moth larvæ, one millipede, fragments of several beetles, two slugs, and possibly hundreds of rudimentary "plates" of slugs.

Of twenty-one specimens examined and showing comparison in the records, sixteen had the major part of stomach contents vegetable, five animal.

Of course those that live in water are reported to readily take water fowls, especially young ducks and goslings. However this charge is not yet proven against the Wood Turtle, the Snapper being the chief culprit in this regard.

Mr. Vincent, of White Marsh, Md., reported to us in the early part of December, 1906, that turtles ate off the flower buds of his water-lilies in ponds. The species doing this work he called the "Shovel or Slider Turtle," which would no doubt be the Wood Turtle.

Following is the food chart from our laboratory dissections of *Clemmys insculptus* (No. with food 26).

	No.	Per Cent.
Vegetation,	20	76.9
Cryptogams, (Flowerless Plants),	1	.....
Fungi—		
Basidiomycetes,	1	3.8
Toadstools,	1	3.8
Bryophyta, (Mosses),	1	3.8
Jungermannia,	1	3.8
Phanerogams, (Flowering Plants).		
Undetermined flowering plants,	13	49.9
Seeds,	9	34.8
Asinina triloba, (Papaw fruit),	1	3.8
Ilex verticillata seeds, (Holly),	2	7.6
Vitis labrusca, (Fox Grape),	1	3.8
Clover,	1	3.8
Fragaria sp., (Strawberry, fruit and seeds),	1	3.8
Rubus sp., (Blackberry) seeds,	1	3.8
Pyrus sp., (Apple) fruit,	1	3.8
Hedera hirsuta, seeds,	1	3.8
Sambucus canadensis fruit, (Elder),	1	3.8

	No.	Per Cent.
Mitchella repens, (Partridge Berry),	1	3.8
Solanum sp., (Nightshade berries),	1	3.8
Chelone glabra seeds, (Turtle Head),	1	3.8
Plantago major, (Plantain),	2	7.6
Betula sp., (Birch),	1	3.8
Gramineæ, grass,	9	34.8
Animal matter,	21	80.7
Annulata, Earthworms,	1	3.8
Mollusca,	7	26.8
Snails,	6	23
Slugs,	1	3.8
Crustacea,	3	11.6
Oniscidae, (Sow Bugs),	1	3.8
Cambarus sp., (Crayfish),	1	3.8
Gammarus sp., (Fresh Water Shrimp),	1	3.8
Myriapoda, (Millipedes, etc.),	4	15.4
Insects,	14	53.7
Undetermined fragments,	4	15.4
Hemiptera, Pentatomidæ, (Stink Bugs),	1	3.8
Lepidoptera, (Moths and Butterflies),	2	7.6
Noctuidæ, (Cutworms),	1	3.8
Heterocerous Macrolepidoptera, (Moth),	1	3.8
Coleoptera, (Beetles).		
Undetermined beetles,	5	19.2
Carabidæ, (Ground Beetles),	1	3.8
Harpalus caliginosus,	1	3.8
Chrysomelidæ, (Leaf Beetles),	2	7.6
Undetermined Leaf Beetles,	1	3.8
Chrysomela suturalis,	1	3.8
Scarabaeidæ,	2	7.6
Tenebrionidæ,	1	3.8
Diptera, (Flies),	1	3.8
Hymenoptera, (Ants, etc.),	2	7.6
Tenthredinidæ, (Sawflies),	1	3.8
Ant,	1	3.8
Vertebrata,	2	7.6
Undetermined birds,	2	7.6

Concerning the food of this species, other authors state as follows:

W. H. Smith says it "feeds on low field-blackberries and other vegetables." Ditmars says it "feeds on tender vegetation, berries and insects."

There appears to be but little known concerning the life history and nesting habits, of the Wood Turtle, as the only statement in literature which we have found is by W. H. Smith who says "In the early spring the males and females seem to be together in damp localities. Later I was able to find only the females and they were uniformly filled with eggs."

Further careful observations are greatly needed in this regard.

Species 16. Clemmys guttatus (Schneider). Speckled Tortoise.

The Speckled Tortoise has been cited in literature by the various names of Speckled Turtle, Speckled Terrapin, Spotted Tortoise, Spotted Turtle, Pond Turtle, Spotted Terrapin, Speckled Terrapin, Yellow-spotted Terrapin and Speckled Back.

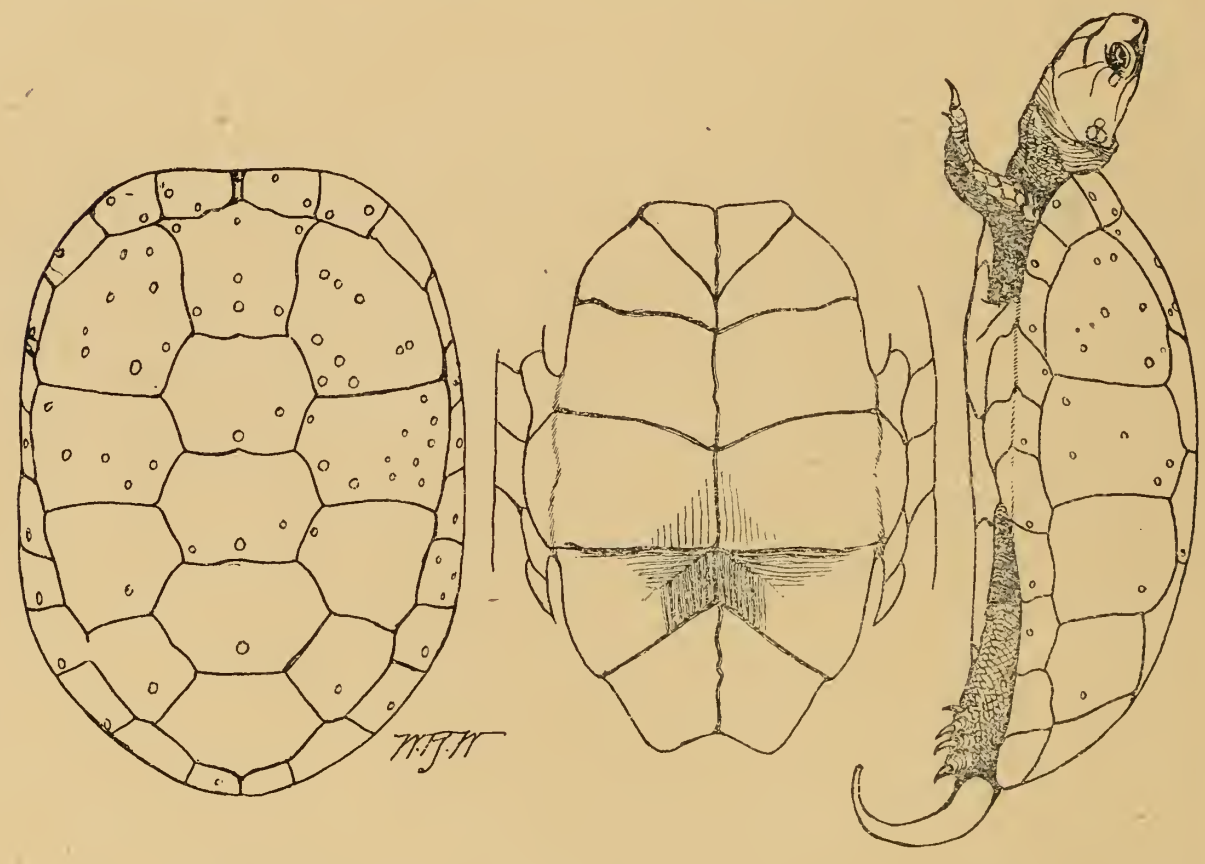

Fig. 12. Speckled Turtle, showing outline of carapace and plastron and left side view of complete specimen. (One-half nat. size.) Drawn by W. R. Walton, from life, in office of State Zoologist, Harrisburg, Pa.

The specific name "guttatus" means spotted and refers to the orange-yellow specks or spots to be seen on the back.

The Speckled Turtle has carapace ovate, depressed, smooth, not keeled, margin flaring, not serrate in the rear. Upper jaw deeply notched, the edges nearly straight. Carapace black with round orange spots, these spots rarely obsolete; plastron yellow, blotched with black or black with faded patches of yellow. Above, the head is black with a few yellow spots in front, and a larger spot of orange over the region of the ear. Lower surface of the limbs and the fleshy parts, pale salmon. Length four and one-half inches.

Our No. 9059a[2] has two extra triangular plates one on each side, between the first vertebrals and first costals.

The spots of yellow on this species are subject to quite a varied arrangement. In many cases the arrangement is irregular. There seems to be a tendency for each marginal plate to have one yellow spot, each vertebral plate one and each costal plate two, one outside and in front of the larger one. With this goes one or two pairs of round yellow spots on the head between the eyes, and a pair of elongated yellow spots further back. One of our specimens has a single yellow spot between the eyes.

This species is found in the Eastern United States, westward to Indiana; it is also common in southwestern Ontario and is found as far south as North Carolina. In our own State it appears to be decidedly eastern and southern in distribution, as most specimens which we have received are from the Eastern and Southeastern portions of Pennsylvania.

"Frequents sluggish streams, ponds and ditches with muddy bottom, but I have not seen them where the water itself was muddy. Observed with *picta* in N. Y., in about equal numbers. Strictly aquatic. Frequently observed on edges of ponds and on logs, from which they plunge quickly when approached. Bury in mud in the fall to winter over."—Smith, p. 661.

"Less exclusively aquatic than most species of turtles. It seems to delight in being in the neighborhood of swamps and sluggish streams, and it probably spends the greater part of its time in the water. Nevertheless it often leaves the water. It is very harmless and deserves protection. When at freedom they collect in numbers on objects above the water and enjoy the sunshine; but if any fancied enemy is seen approaching they slide off rapidly into the water and soon bury themselves in the mud."—Hay, 577.

"S. E. Pennsylvania and S. N. J., even in pine barrens, but probably not in the higher mountains."—Stone, p. 170.

Our collections of this species are as follows:

Berks county, Becker, Wm. D., Fleetwood.
Berks county, Boyertown High School, Boyertown.
Berks county, Gruber, C. L., Kutztown.
Berks county, Grim, Wm. H., Hamburg.
Bucks county, Atkinson, Mrs. J. Willis, Buckingham.
Chester county, Snyder, Dr. W. P., Spring City.
Dauphin county, Zoological Division, Harrisburg.
Dauphin county, Zoological Division, Rockville.
Dauphin county, Zoological Division, Dauphin.
Dauphin county, Schick, Harris, Harrisburg.
Dauphin county, Pritchard, Geo. R., Harrisburg.

Dauphin county, Keboch, F. D., Williamstown.
Delaware county, Dickson, Wallace C., Wayne.
Luzerne county, Campbell, E. W., Pittston.
Luzerne county, James, Wayne T., Wilkes-Barre.
Luzerne county, Campbell, E. W., Wilkes-Barre.
Lycoming county, Koch, Aug., Williamsport.
Northampton county, Bedford, G. H., Nazareth.
York county, Donleay, LeRoy, Etters.

Shaw says of this species that "It inhabits rivers and lakes in North America. The young are scarcely larger than pigeons' eggs and are very black, beautifully spotted with gold color."

Its eggs are few in number according to Agassiz, never being more than three or four. These are an inch and a quarter in length and three-fourths of an inch in width.

About the 20th of June it is said the female digs a vertical hole by the use of her hind legs and after laying the eggs pushes the dirt back over the opening so as to conceal it entirely. It is in the more quite pools of remote woods that the young or smaller specimens of this species are found and this indicates the vicinity in which the eggs are laid and the young live.

The following chart shows the results of study of the stomach contents of twenty-seven specimens of the Speckled Turtle:

	No.	Per Cent.
Vegetation,	3	11.1
Undetermined leaves,	1	3.7
Undetermined seeds,	1	3.7
Gramineæ—Grass,	2	7.4
Animal matter,	27	100
Annulata, (Worms),	1	3.7
Mollusca,	3	11.1
Snails,	2	7.4
Slugs,	1	3.7
Crustacea,	8	29.6
Undetermined spp.,	6	22.2
Gammarus sp., (Fresh Water Shrimps),	1	3.7
Cambarus sp., (Crayfish),	1	3.7
Myriapoda, (Millipedes, etc.),	1	3.7
Arachnida, (Spiders),	2	7.4
Insecta, (Insects),	27	100
Undetermined fragments,	11	40.8
Ephemerida, (Mayflies),	2	7.4
Plecoptera—Perlidae, (Stone Flies),	3	11.1

	No.	Per Cent.
Odonata, (Dragon Flies),	9	33.3
Nymphs,	8	29.6
Agrionidæ, (Damsel Flies),	1	3.7
Hemiptera, (Bugs),	3	11.1
Capsidæ, (Water Bugs),	1	3.7
Notonectidæ, (Back Swimmers),	1	3.7
Belostomidæ,	1	3.7
Zaitha fluminea,	1	3.7
Neuroptera—Sialidæ,	2	7.4
Lepidoptera,	3	11.1
Undetermined Moth larvæ,	2	7.4
Noctuidæ, (Cutworms),	1	3.7
Coleoptera,	20	74.0
Undetermined Beetle fragments,	13	48.1
Carabidæ, (Ground Beetles),	2	7.4
Dytiscidæ, (Diving Beetles),	2	7.4
Chrysomelidæ, (Leaf Beetles),	3	11.1
Undetermined,	2	7.4
Donacia sp.,	1	3.7
Scarabaeidæ.		
Lachnosterna, (June Bugs),	1	3.7
Euphoria inda, (Flower Beetles),	1	3.7
Macrodactylus subspinosus, (Rose Bugs),	2	7.4
Rhynchophora, (Snout Beetles),	1	3.7
Diptera, (Flies).		
Undetermined flies,	10	37
Tipulidæ, (Crane Flies),	2	7.4
Chironomidæ, (Midges),	1	3.7
Scatophagidæ,	1	3.7
Hymenoptera, (Ants, etc.).		
Tenthredinidæ,	1	3.7
Ichneumonidæ,	1	3.7
Brachondiæ,	1	3.7
Ants,	1	3.7

From the above chart it is to be seen that only one-ninth of the dividual specimens examined had eaten vegetable matter, and in ct there was very little plant tissue found in the stomachs, while of them contained animal matter, thus showing that they differ nspicuously from the Wood turtles in preferring animal matter to getable food. Not only is it remakable that all the specimens ntained animal tissue, but also that all of them had eaten insects. While many of these food materials were fragmentary and un- ermined it was plainly shown that most of them were aquatic ects, such as would be found living in water or such as may have

dropped into the water or could be found in wet regions. Again the destructive and obnoxious Rose Bug had found as its enemy more than one individual of this species of turtle. Nearly half of the turtles of this species had eaten beetles of some kind, and over one-third had fed upon flies in some stage.

Special records of our examinations of specimens are as follows: 5951b contained a very rich collection of aquatic larvæ; many Diptera larvæ and pupæ, probably Chironomid or Tipulid; two or more robust Coleoptera or Mayfly, aquatic insect larvæ, heads of Coleoptera larvæ, one perfect shrimp like Crustacean, one snail.

No. 5951c[1] contained a choice collection of Chironomid and other aquatic larvæ or nymphs. Parts of Euphoria inda, wing of Braconid and many other insect fragments.

No. 5951c[2], c[3] and c[4] likewise contained insects, vegetable matter being absent in the above five specimens.

No. 6391b[2] contained about three dozen Notonectid nymphs; Mayfly nymphs; maggot-like fly larvæ; Tipulid (?) larva; three Odonata nymphs; Elytra of water beetle; two species of aquatic Crustacea, several of each.

No. 6593 b contained fifty-three sawfly larvæ and several other insects.

No. 9626 b contained a vertebrate, probably a frog. Fragments of insects and of crayfish may be originally from frog. Only five out of twenty-seven contained vegetable matter, and these all contained far more animal matter than vegetable matter. The species therefore is to be considered carnivorous, or more narrowly insectivorous, rarely feeding on vertebrated animals.

In speaking of the food of this turtle, Ditmars says, in his report, page 5, "These feed largely on dead fish and the larvæ of aquatic insects. In captivity it will eat lettuce leaves, but seems unable to swallow when the head is not covered with water." Hay reports its food as consisting of "tadpoles, young frogs and other weak animals." It is our belief that he had heard a wrong report. He further adds that he learned "they devoured crickets, grasshoppers and earthworms." This is, of course, accurate.

DeKay published that the food consists of insects, frogs and worms. It is to be doubted if these turtles feed much if at all upon frogs.

Holbrook says its food consists of "such animals as it can seize, as tadpoles, young frogs, etc." He also published that "it takes to land frequently in search of food, devouring earthworms, crickets, grasshoppers, etc."

From the above chart it is proven for the first time that the Speckled Turtle is particularly insectivorous and is beneficial rather than obnoxious. In the interest and economy of mankind the Speckled Turtle is worthy of preservation.

It is unfortunate that some of our predecessors have been guessing at the food of this and some other species of turtles, and the comparatively recent writers have accepted without question, and quoted without quotation marks, the statements made by previous writers on this subject.

Species 17. Emydoidea blandingi (Holbr.). Blanding's Turtle.

Blanding's Turtle is so named in honor of an early writer on herpetology. It is variously known as Blanding's Tortoise, Blanding's Terrapin, Blanding's Cistuda and the Semi-Box Turtle. The last term refers to the fact that it can partially close its shell although not wholly.

In Blanding's Turtle the carapace is elongated and globular, margin flaring. Plastron with transverse hinge and cartilaginous union between carapace and plastron. Feet fully webbed. Black, usually with numerous yellow dots. Plastron yellowish with black blotches; head with yellow spots. Young nearly circular, black. Chin and throat are bright, immaculate yellow. Rear lobe of plastron bluntly notched. The head is cylindrical, upper mandible is sharply notched, the neck is very long. Length eight inches.

This turtle is found from New York to Wisconsin, being most abundant in Indiana. Nash reports its occurrence in Ontario and Ditmars says it is to be found in the Allegheny region, the Northeastern part of Pennsylvania and New York into Massachussetts, Rhode Island and New Hampshire. It occurs chiefly from Pennsylvania westward and on the shores of the Great Lakes in Canada. It is not common even in that region. It is a land animal, living in damp fields near water. We have not been so fortunate as to have a Pennsylvania specimen of this species.

Agassiz reports that it lays from seven to nine eggs together each year and the eggs are oval, measuring one and three-eights by almost an inch in size. Hay, page 579, calls attention to the fact that, "according to Agassiz's figures, there are no yellow nor orange dots on the shell of the very young, thus being in contrast with the young of the Speckled Turtle. This makes it not difficult to distinguish between the two species. Holbrook who originally described the species says, "The type was a female from which we took 60 eggs of different stages of development" (page 42). It is to be seen that these sixty eggs would not be laid all at one time but would be carried and laid as Agassiz has reported, a few during each year. It is known that turtles carry their eggs while they are developing, during a period of several years.

There is but little literature concerning this rare turtle. Hay says that the food is probably animal matter and Ditmars says it lives

in or near the water and will take tender shoots, berries and insect larvæ. "In captivity it will feed voraciously upon earth worms, small fishes, tadpoles, and young frogs, giving vigorous chase, and is very fond of lettuce."

Species 18. Terrapene carolina (L.). Common Box Turtle.

The Common Box Turtle has been given more common names than any other species of this entire Order. It has been called The Tortoise, The Turtle, Land Tortoise, Box Turtle, Common Box Turtle, Common Box Tortoise, Chequered Tortoise, Land Turtle, Closed Turtle, Chequered Turtle, Locked Turtle, Land Tortoise, Box Tortoise and Carolina Box Turtle, Terrapin, Land Terrapin, etc. The simple name of Box Turtle is not applicable for the reason that there are several species of Box Turtle and consequently a distinguishing term must be added.

The Common Box Turtle has the carapace ovate, high arched, globular, keeled, keel especially prominent in young, margin, flaring, notched slightly behind, but not serrate. Plastron transversely hinged before and back of the point of connection with carapace, enabling the animal to close itself completely. Toes not, or scarcely webbed. Colors very variable, chiefly blackish and yellowish; no two alike in pattern; iris carmine red in male, hind feet with four toes. Head bright ochre, neck duller ochre. Plates of carapace with concentric grooves. Skin within cavities of shell dull chrome to brownish, scales on and between limbs mostly dull orange to brown, tail darker; eyelids brownish. The keeled plates each bear a spot of pale yellow, in the young. All the plates of the carapace in the young are granularly rough.

"S. E. Pennsylvania and S. W. New Jersey, especially common in Chester and Greene counties, Pennsylvania. No record of it in Pine Barrens. Species seems restricted to a Carolinian fauna." —Stone, p. 170.

"Can accurately close all parts of shell under load of 500 or 600 pounds. Is found chiefly in marshy situations, but occurs also in driest and hottest places. Chiefly sought for its eggs which are reckoned a delicacy."—Shaw, p. 37.

"Is a very gentle and timid animal. I have seen (May 1), a specimen, measuring 6 inches, in which the coriaceous laminæ covering the plates were gradually falling off or shed; leaving the new epidermis completely smooth beneath, with colors of renewed brilliancy, while the old laminæ were dull and strongly corrugated. How often does this desquamation occur? Is it the effect of disease, or is it an annual or periodical process?" Common everywhere (N. Y.) on dry land, although also occasionally met with in swamps and

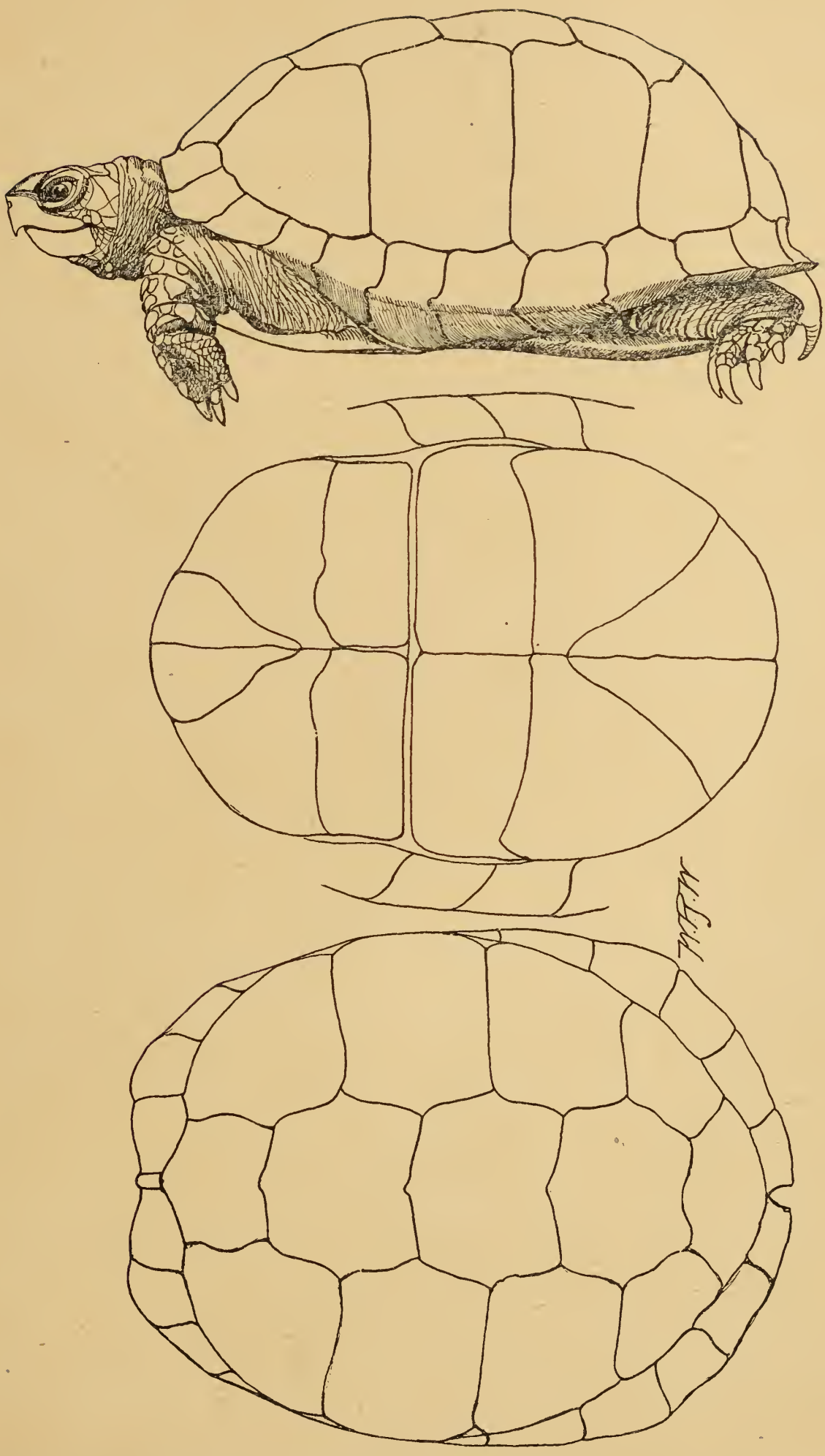

Fig. 13. Common Box Turtle, showing outline of carapace and plastron, with side view of complete specimen. (One-half nat. size.)

moist places. It never takes to the water from choice and indeed would be drowned if retained there. It is frequently kept in cellars, under the notion that it drives away or destroys rats and other domestic vermin. One which I kept in my cellar was found in the spring eaten up by the rats. It usually (N. Y.) goes into winter quarters in the latter part of September." DeKay, p. 25.

"A thoroughly terrestrial animal, though not helpless in water. The statement that they never go near the water and cannot endure rain is untrue. Their shells are too heavy for them to swim readily. Entirely harmless, and when disturbed, retire with the shell and submit passively to their captor."—Hay, 58.

This turtle is found from New York to Missouri and southward and in fact from Maine to South Carolina and westward.

Our collection from Pennsylvania is as follows:

Allegheny county, Reed, Chester, Bridgeville.
Beaver county, Kirchgessner, C., Darlington.
Berks county, Boyertown High School, Boyertown.
Berks county, Brunner, S. A., Krumsville.
Berks county, Schraum, L. G., Womelsdorf.
Bucks county, Atkinson, Mrs. J. W., Buckingham.
Carbon county, Solt, N. E., Weissport.
Chester county, Baldwin, C. V. M., Parkesburg.
Chester county, Lowell, E. P., Avondale.
Chester county, Lawrence, John, Coatesville.
Clarion county, Brown, T. R., Hawthorne.
Clinton county, Allabach, Lulu F., Lock Haven.
Columbia county, Young, A. P., Millville.
Columbia county, Baldy, S., Catawissa.
Cumberland county, Zoological Division, Bowmansdale.
Cumberland county, Zoological Division, New Cumberland.
Cumberland county, Zoological Division, Enola.
Dauphin county, Zoological Division, Dauphin.
Dauphin county, Sober, Miss. M. G., Dauphin.
Dauphin county, Keboch, F. D., Williamstown.
Dauphin county, Clouser, Clarence, Williamstown.
Dauphin county, Adams, S. R., Williamstown.
Dauphin county, Kirchoff, Elizabeth, Williamstown.
Dauphin county, Warlow, Tessie T., Williamstown.
Dauphin county, Good, Donald, Williamstown.
Dauphin county, Adams, Clayton, Williamstown.
Dauphin county, Drum, William, Williamstown.
Dauphin county, Wiest, Harry, Williamstown.
Dauphin county, Carl, L. C., Williamstown.
Dauphin county, Zoological Division, Rockville.

Dauphin county, Zoological Division, Linglestown.
Dauphin county, Buffington, H. E., Lykens.
Dauphin county, Zoological Division, Harrisburg.
Dauphin county, Ellenberger, R., Harrisburg.
Delaware county, Lehman, G. M., Essington.
Franklin county, Mayers, G. W., Mont Alto.
Franklin county, DeLong and Atkinson, Mont Alto.
Franklin county, Lehman, A. B., Fayetteville.
Fulton county, Schenck, J. M., Enid.
Huntingdon county, Swoope, J. P., Huntingdon.
Indiana county, Wherle, R. W., Indiana.
Juniata county, Stoner, H. L., Mifflintown.
Lancaster county, Good, M. R., Marvon.
Lancaster county, Eby, D. H., Mount Joy.
Lancaster county, Wanner, A. G., Ephrata.
Lebanon county, Zoological Division, Lebanon.
Mifflin county, Naginey, M. M., Milroy.
Monroe county, Allegar, I. L., N. Water Gap.
Monroe county, Allegar, I. L., Shawnee.
Montgomery county, Brunner, M. M., Trappe.
Montgomery county, Benner, W. M., Telford.
Montgomery county, Weber, F. C., Ambler.
Montgomery county, Nesley, C. H., Pottstown.
Montgomery county, Zeigler, J. H., Red Hill.
Montgomery county, Brunner, M. M., Iron Bridge.
Montgomery county, Weber, J. D., West Point.
Montgomery county, Gettshalk, O. S., Iron Bridge.
Montour county, West, Mrs. G. P., Danville.
Northampton county, Shea, A. L., Easton.
Northampton county, Tooker, P. S., Easton.
Northumberland county, Derr, J. R., Arters.
Perry county, Brightbill, Mrs. M. C., Marsh Run.
Perry county, Zoological Division, Newport.
Perry county, Kane, S. S., Landisburg.
Snyder county, Bingaman, C. F., Beavertown.
Union county, Foster, T. C., Winfield.
Washington county, Couch, Joseph; Canonsburg.
Washington county, Couch, Merle, Canonsburg.
York county, Frageser, Wm., York.

It is one of the most common turtles of the State, frequently seen in unexpected places, especially cultivated hillsides. It is often found in plowed fields, and in fact one of its chief enemies is the spike-tooth harrow and cultivator. It is one of the few turtles which appears to care very little for damp situations or an aquatic

habitat, depending for drink on the water which rests on the leaves as dew or may fall as rain. They occur in adundance in Pennsylvania and throughout one particular ridge which we have had opportunity to inspect closely there must be fully as many as one for each ten acres of land. We have had opportunity to observe them in their winter retreats, which consist merely of holes in the ground under leaf mold and beneath the leaves, as with the Wood Turtle, whose wintering habits it imitates. We have also been so fortunate as to find their nests with eggs, and we know that they live for many years in one circumscribed or limited area, oftentimes going only far enough from a certain knoll or hillside to find water, when such can be found within convenient distance.

These turtles become very old, reaching, in common with some other species of the Order, the age of at least a century, and doubtless more.

Variations of the Common Box Turtle and Special Notes.

Two specimens show only a rudimentary fifth digit, or toe. These are our numbers 4110c and 5822c. One showed a zigzag curvature of the dorsal keel, due to the alternate twisting of vertebral scutes.

Several differences:—In a series of forty-two specimens, seventeen males and twenty-five females, the following differences were observed. All males had a marked concavity in the posterior half of the plastron, in fact, the two sexes were separated using this character as a basis, and the accuracy of this division was subsequently confirmed by dissections. The carapace of the male has more or less of a flare at the posterior corners. The nuchal or neck notch is not quite so well marked in the females. The plastron of the females is very convex. The relation of both height and width is greater in the females. In the males the carapace is usually somewhat flattened. In other words, the carapace of the female approaches more nearly a spherical shape than does that of the male.

Striations on the shell appears to be more marked in the young than in the old. Of course, the very young show none. Up to a certain size the ridges increased in size and number. After that it would appear that they become shallower or wear away and finally disappear.

There is great variation in the coloration. The original color pattern seems to be, for each vertebral scute to have a dark center with yellow keel, and a circle of white spots, for each costal scute a black center with a yellow surrounding ring, which becomes broken up into yellow spots. These, as the turtle grows, elongate, and finally become very irregular in arrangement. This elongation of yellow spots is greatest in an outward direction toward the margin,

and toward the anterior border, which are the directions of greatest radial growth of scales.

It is strange that as common as is the mature Common Box Turtle, the very young are rarely seen. These are indeed so rare that it is a question as to how and where they live.

The female of this species makes her nest among loose pebbles and earth, on rather dry hillside ground, and covers the eggs only a very few inches. We remember distinctly having seen a nest accidentally opened by a hoe which uncovered and cut out three white, rather hard eggs, which resembled the eggs of a snake and would have been pronounced such by the uninitiated, had it not been for the hard shell and the fact that two of the eggs were cut open and contained small embryonic animals, which indeed looked as much like young mice as anything else. It was seen at once that they were Box Turtle eggs, of which only three had been laid in the nest. These were left on the hillside to hatch, and later the young were to care for themselves. Whither the very young go after they are hatched, and how they live, is hard to say, but it is to be presumed that they find their way into the midst of the dense vegetation, especially beneath bushes in the small valleys or ravines which are usually to be found in the vicinity where the eggs are laid.

Shaw says that the eggs of this species are about as large as a pigeon egg, while Hay more accurately says they are oval, one and one-half by three-fourths inch in measurement and number from four to six in number. He further states they have a rather thin shell and are laid the latter part of June or later. Ditmars says that the eggs are ovoidal with thin, hard shell, buried in the soft ground or secreted in the leaves.

The following tabulations show the results of our study of the stomach contents of forty specimens of the Common Box Turtle:

	No.	Per Cent.
Vegetation,	25	62.5
Cryptogams, (Flowerless Plants),	7	17.5
Fungi.		
Undetermined fungi,	1	2.5
Basidiomycetes,	1	2.5
Mushrooms,	4	10
Bryophyta, Moss,	1	2.5
Phanerogams, (Flowering Plants).		
Undet.,	4	10
Roots,	2	5
Buds,	1	2.5
Leaves,	5	12.5
Berries,	3	7.5

	No.	Per Cent.
Seeds,	1	2.5
Podophyllum petatum (May Apple),	1	2.5
Vitis labrusca (Grapes),	1	2.5
Prunus sp. (Cherry) seeds,	1	2.5
Rubus sp. (Blackberry),	3	7.5
Pyrus sp. (Apple),	2	5
Osmorhiza sp.,	1	2.5
Pyrola rotundifolia,	1	2.5
Physalis sp. (Ground Cherry),	3	7.5
Gramineæ, grass,	8	20
Bird's Wheat Moss,	1	2.5
Animal matter,	32	80
Annulata (Earthworms),	2	5
Mollusca (Mollusks),	15	37.5
Snails,	14	35
Slugs,	2	5
Crustacea (Cambarus sp.),	1	2.5
Myriapoda (Millipedes),	8	20
Insecta (Insects),	24	60
Undetermined insects,	7	17.5
Orthoptera (Grasshoppers, etc.),	7	17.5
Acrididæ,	1	2.5
Melanoplus femur-rubrum (Red-legged G),	2	5
Gryllidae (Crickets),	1	2.5
Gryllus pennsylvanicus (Cricket),	2	5
Locustidæ (Long Horned Grasshoppers),	1	2.5
Hemiptera Pentatomidæ (Stink Bugs),	1	2.5
Lepidoptera (Moths),	9	22.5
Larvæ (Caterpillars),	7	17.5
Pupæ (Chrysalids),	1	2.5
Notodontidæ—Datana ministra,	1	2.5
Noctuidæ, larvæ (Cut worms),	3	7.5
Diptera (Flies),	1	2.5
Coleoptera (Beetles, etc.),	10	25
Undetermined beetles,	7	17.5
Larvæ of Beetles,	2	5
Carabidæ (Ground Beetles).		
Undetermined ground beetles,	2	5
Carabus limbatus,	1	2.5
Pterostichus lucublandus,	1	2.5
Harpalus caliginosus,	1	2.5
Hymenoptera (Ants, etc.),	1	2.5
Vertebrata (Back-boned Animals).		
Mammalia, Muridæ (Mice),	1	2.5

The study of the above shows that 62 per cent. of the specimens containing food contained vegetable matter of which berries and seeds were rather conspicuous. Eighty (80) per cent. of those containing food contained animal tissue which means that several individuals contained both animal and vegetable tissue. Among the organisms to be found were snails, slugs, millipedes or thousand legged worms, and insects.

Among the insects the Orthoptera (the grasshoppers and crickets) were conspicuously taken as food as were the Lepidoptera (moths and butterflies) in the worm or larval stage. The Coleoptera or beetles also received a good share of attention.

It is remarkable that only one out of the forty specimens containing food had eaten the flesh or tissue of vertebrate animals and this had eaten a mouse. However, in this regard it was decidedly beneficial in its economic influence.

Of course, the berries that had been eaten were those which had become over ripe and had dropped from the bushes and consequently would not be gathered by mankind. The chief thing that can be laid against them is that of destroying cantaloupes on their vines, but it is our belief that they more than repay this by their conspicuous and evident destruction of insect pests.

Let the Common Land Turtles be preserved and they will help take care of the pests destroying the farm produce.

Special records of our examinations of specimens are as follows:

No. 5822c[2] contained entirely animal matter; two snails and fragments of snail shell. No. 5822c[3] contained an earth worm, three or more snails, one millipede and no vegetable matter.

Of forty-four stomach contents, twenty-one showed more animal than vegetable matter; thirteen more vegetable than animal, and ten with both animal and vegetable, but no record showing one in excess of the other.

It is interesting to note the statements of authors concerning the food of the Common Box Turtle. For example, Shaw says "It feeds on various kinds of small animals, such as mice, and even serpents, which it seizes by the middle and draws into the shell and thus crushes them to death; it also eats various vegetable substances." We are not of the opinion that this turtle makes a trap of its shell.

LeConte says its food consists of "fruit, insects and edible fungi. Many persons are in the habit of keeping them in their cellars where they destroy snails, crickets and other obnoxious insects but it is a question whether they ever devour rats and mice and it is also a ridiculous idea of their destroying snakes." We consider his questions justifiable.

Holbrook says they "feed on insects, crickets, etc., and eat readily whatever food is offered them in confinement, such as bread, pota-

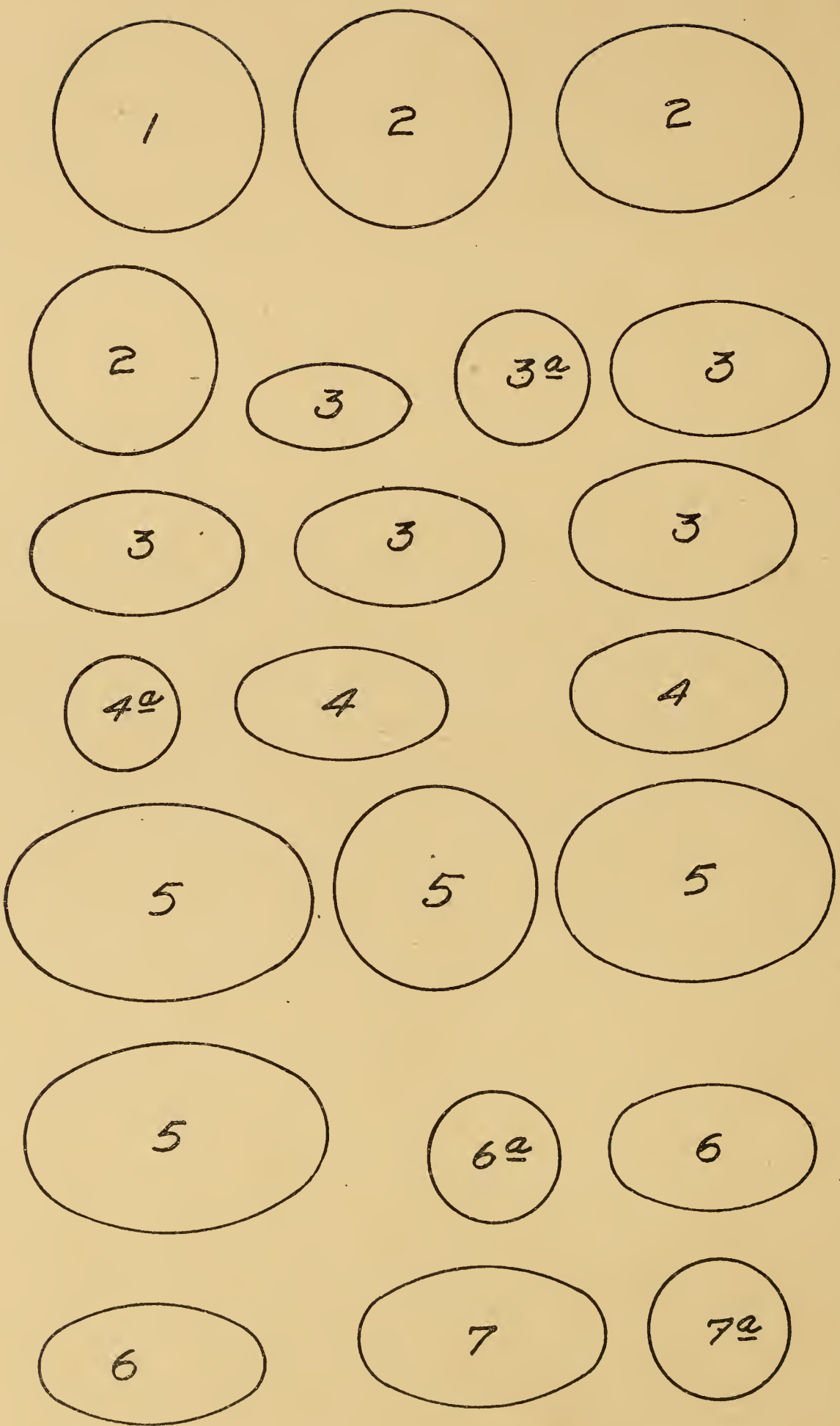

Fig. 14. Turtle eggs: (1) A. spinifer; (2) C. serpentina; (3) K. pennsylvanicum; (4) A. adoratus; (5) G. geographicus; (6) C. picta; (7) C. marginata.

toes, apples, etc." He doubts whether they destroy mice or snakes as was believed by Bosc, Muhlenberg and Shaw.

DeKay says it is fond of insects, fruits and edible mushrooms. In this he is correct.

Eugene Smith reports that one killed and ate a Brown Snake in captivity.

Hay reports that this species "loves cucumbers and lettuce, working injury to them."

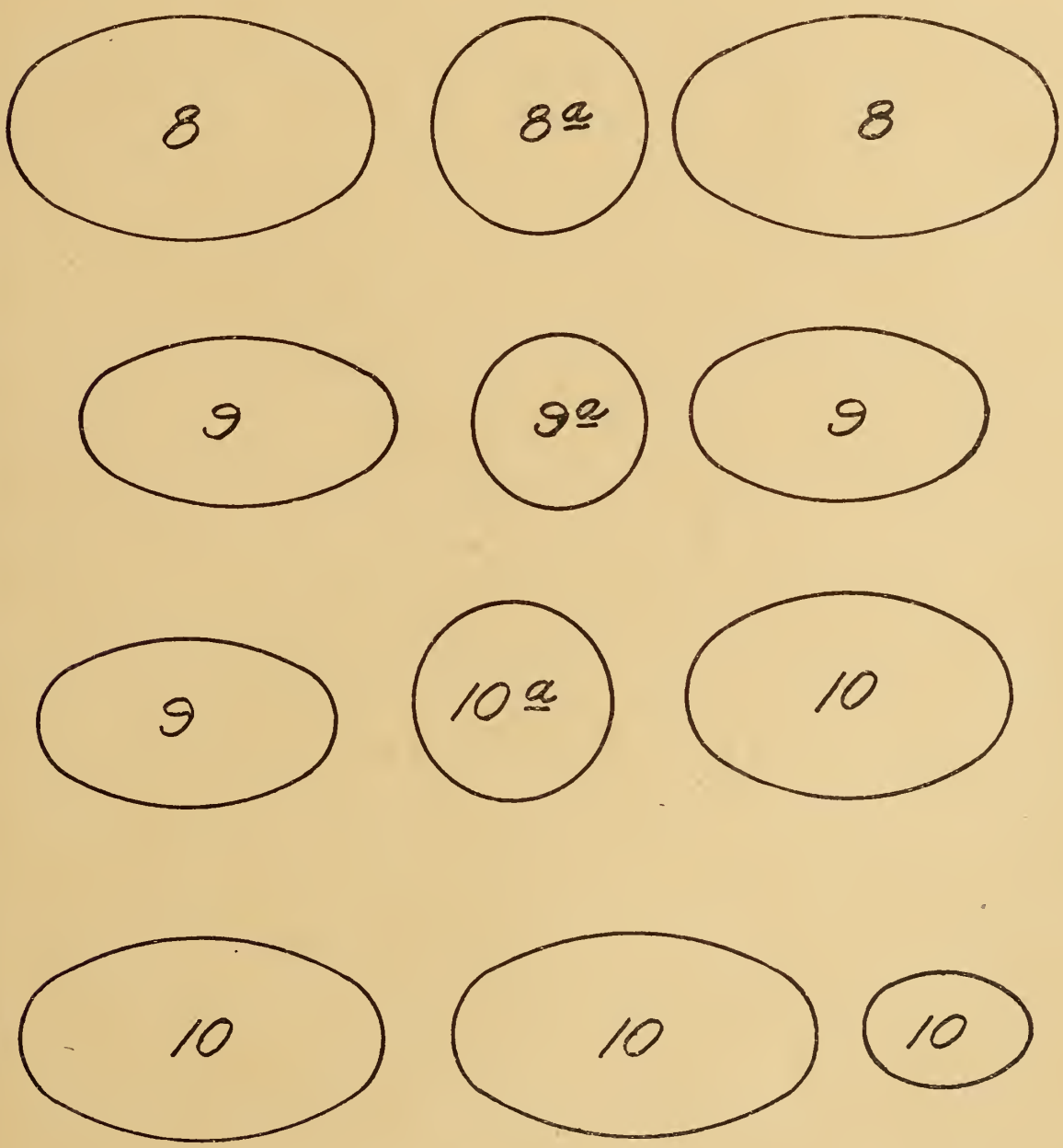

Fig. 15. Turtle eggs: (8) C. insculptus; (9) C. guttatus; (10) T. carolina. All numbers marked *a* are end views. Natural size, after Agassiz.

Food of Young Turtles.

It is interesting to note the food of very young or small individuals of different species because it is evident in many cases these must be quite different from that of the adult or full grown creatures. We have been fortunate enough to examine several specimens of young of five species of our native turtles.

These were not more than 5 centimeters or two inches in length. The stomach contents were carefully examined and tabulated as below.

	Snapping turtles. Two examined.	Musk turtles. One examined.	Painted turtles. Five examined.	Speckled turtles. Three examined.	Common box turtles. One examined.
Fresh water worms,	.....	.....	.....	1	.....
Insects,	2	1	5	3	1
Insect fragments,	.....	.....	4	3	1
Odonata nymphs,	.....	.....	1	1	.....
Damsel nymphs,	.....	.....	.....	1	.....
Perlid nymphs,	.....	.....	.....	1	.....
Hemiptera (bugs),	.....	.....	1	.....	.....
Zaitha,	.....	.....	1	.....	.....
Neuroptera larvæ,	.....	.....	1	.....	.....
Sialid larvæ,	.....	.....	.....	1	.....
Coleoptera (beetles),	2	1	2	.....	1
Dytiscid larvæ,	.....	.....	1	.....	.....
Diptera larvæ,	.....	.....	1	.....	.....
Adults (flies),	.....	.....	.....	.....	1
Pisces (fishes).					
Catostomid (sucker),	1	.....	.....	.....	.....
Crayfish,	1	.....	.....	.....	.....
Snails,	1	.....	.....	.....	.....
Vegetation,	.....	.....	1	.....	.....
Leaves,	.....	.....	1	.....	.....
Grass,	.....	.....	.....	.....	1
Tender stems,	.....	.....	.....	.....	1

It is to be observed that the young Snapping Turtles have all eaten insects to some extent, and fed upon fishes and crayfish as well, while the young Painted Turtles and the Common Box Turtles had fed upon some vegetable matter.

The very young Speckled Turtles maintained their good record as insectivorous creatures.

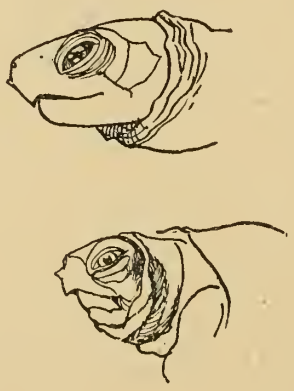

Fig. 16. Egg-tooth, as found on hatching specimens of (upper figure) the Common Snapping Turtle and of (lower figure) the Common Box Turtle. This "tooth" is specially provided for cutting the shell and is lost soon after hatching.

Economic Features of Food Items of Turtles.

In considering the economic features of any creature in regard to the kinds of food it takes, it is decidedly necessary to bear in mind

the economic features of each item of food taken, and weigh in the balance of thought the evidence adduced, in order to be able to arrive at something like a fair decision as to the beneficial or obnoxious results of the creature which may have been found feeding upon various substances. In such a study as this considerable attention must be given to the entire subject of Economic Botany as well as Economic Zoology, because many plants or parts of plants were found in the stomachs of turtles examined, and various kinds of animals besides insects were also found eaten by Turtles.

A review of the economic relationships of the food items discussed in the Food Table of Turtles may aid readers in arriving at conclusions concerning the total economic results of the feeding habits of the creatures mentioned. It must be remembered that it is very difficult to discuss a strictly scientific subject upon a purely popular basis and be accurate in every detail, for the reason that it is really impossible to divest such sciences as botany and zoology of the technical terms, which naturalists find necessary to use in expressing their meanings, and at the same time give correct expressions in popular words to show the meaning of such terms.

*Plant Material Eaten by Turtles.

The Vegetable Kingdom contains plants belonging to the two great groups, the Cryptogamia or Flowerless Plants, and the Phanerogamia or the Flowering Plants. The three groups of Cryptogams mentioned in our table are Algæ, Fungi and Bryophyta.

The Algæ:—Algæ are Cryptogams with Chlorophyl, or the green colored substance commonly seen in plants. Belonging to this group are the water slimes, often called "frog spawn," and looking like tresses of green hair floating on the water. Of course, there are many other Algæ than these, but these are the Algæ which were found eaten by both of the aquatic species of turtles, and while they may have some beneficial effects in aerating or purifying water, they are much more objectionable by filling ponds and ditches, especially reservoirs, and becoming offensive by contaminating the water by their decaying. Any creature that removes Algæ from reservoirs or other drinking waters is decidedly beneficial in its economic results.

The Fungi:—The Fungi are the flowerless plants which have no Chlorophyl or green-coloring substance. These grow mostly out of the water, but prefer damp places for their existence. Many are parasitic upon other plants in the forms of mildew, moulds, rusts, smuts, etc., and all these are decidedly injurious to cultivated plants as producers of plant diseases. The parasitic fungi are, of course,

*We here discuss only the actual food of our native Pennsylvanian Turtles as shown by their stomach contents in our laboratory dissections.

not intentionally eaten by Turtles, although these animals might eat the infected leaves of most plants. Other species of fungi are the familiar Mushrooms and Toadstools, which were found eaten by the Wood Turtle and the Common Box Turtle. The latter is known to feed extensively upon this form of vegetation.

The Mosses:—The Bryophata, or Mosses and Liverworts, contributed their quota to the food of at least three species of Turtles, as shown by the table. These are the Painted Turtle, the Wood Turtle and the Common Box Turtle.

Many of the portions of flowering plants eaten were, of course, only fragments that could not be determined. In many cases the miscroscope showed vegetable fibre only, but in other cases it was possible to determine what part of the plant had been eaten. It is to be observed that the Painted Turtle, the Wood Turtle and the Common Box Turtle were among the most extensive feeders on vegetation. Two specimens of the Common Box Turtle were found to contain the roots of some kind of plant, and five Painted Turtles had fed upon plant stems, while two Snapping Turtles, thirty-six Painted Turtles, one Speckled Turtle and five Box Turtles had fed upon the leaves of flowering plants. One Box Turtle contained undetermined bugs, and three contained unrecognizable berries. The single specimen of Muhlenberg's Turtle that was examined contained only berries that were beyond recognition. Undetermined seeds were found in the stomachs of the Snapping Turtle, the Painted Turtle, the Wood Turtle, Speckled Turtle and the Common Box Turtle. Grasses were found to have been eaten by Turtles as follows: Three Snappers, three Painted Turtles, nine Wood Turtles, two Speckled Turtles and eight Common Box Turtles. These contained the blades or leaves of undetermined species of grasses.

The little flowering plant known as the Duck Weed, which is one of the smallest of flowering plants and often taken as food of ducks or other herbivorous aquatic birds and Water Arum leaves, were found in the stomach of the Painted Turtle, while the Skunk Cabbage was eaten by the Snapper, and birch leaves by the Wood Turtle. The seeds of Dock and Smart-Weed were found in the stomach of the Painted Turtle, while the fruit of the Papaw was found eaten by the Wood Turtle, and the fruit of the May Apple was devoured by the Common Box Turtle. The seeds and buds of Pepper Grass (Lapidium) were found to have been eaten by the Painted Turtle and the fruit of the blackberry was found in the stomach of a Wood Turtle and also three Common Box Turtles, while one Wood Turtle had eaten strawberries.

Apple seeds were found in the stomach of the Snapping Turtle, the Wood Turtle and two Box Turtles. This shows the tendency of such species to feed upon whatever fruits may be available for them.

Cherries were eaten by one Box Turtle and clover leaves were found devoured by the Wood Tortoise. The seeds of the black alder (Ilex) were discovered in the stomachs of two Wood Turtles, while another specimen of the same species had fed extensively upon fox grapes. One Common Box Turtle had regaled itself upon the fragrant plant commonly known as the Sweet Cicely, while another had likewise indulged in the spicy foliage of the common Wintergreen.

Three Common Box Turtles were found to have fed on Ground Cherries, or the low herb bearing fruits enclosed in paper-like capsules and sometimes called "paper cherries" or "Erdcache" (Physalis), while one Wood Turtle had actually fed upon the berries of the Nightshade, and another contained the seeds of a plant known as Turtlehead (Chelone glabra). Two other Wood Turtles had fed on the common Plantain, and another had eaten the fruit of the Partridge Berry (Mitchella), while another had fed on the berries of the Common Elder (Sambucus), as had also a Painted Turtle.

In reviewing the food of Turtles from the standpoint of the plants, it will be seen that the Flowering plants were most attacked, of which the grasses received a fair share of attention and berries were also among the favorites. There appeared, however, no concentration upon any one kind of plant for food by any species of turtle, such as is shown by some of the carnivorous turtles, showing preference for certain kinds of animal organisms. Perhaps further examinations, with complete determination of fragments, might reveal a more definite vegetable choice for some species of turtles.

It should here be recorded that melons, especially cantaloupes, are favorite articles of food of at least one species of turtle. The Common Box Turtle has come into considerable disrepute with our melon growers owing to its tendency to feed extensively upon this fruit. We know a careful and thoughtful grower of melons who makes a practice of killing the Common Box Turtles in his premises, owing to the loss suffered by these animals biting out pieces of the melons as they lie on the vines in the fields.

We also received a report from a botanist in Washington, D. C., to the effect that by eating the leaves aquatic turtles had severely injured his lilies growing in a pond. This is an unusual record, but it is quite possible for such species as the Mud Turtle, the Wood Turtle and the Terrapin to do such damage.

The few fruits which are eaten by turtles are, of course, in most cases those which have dropped on the ground and consequently are almost or entirely worthless, excepting the melons. It is quite evident that the destruction of obnoxious insects more than balances the slight injury they may inflict to vegetation.

Animal Material Eaten by Turtles.

The Annulata or Worms, of which the earthworms are good representatives, have no hard parts, and consequently would not exist long in a determinable condition in the stomach of any creature eating them. However, such organisms were found contributing to the food elements of one specimen of Wood Turtle, one Speckled Turtle and two Common Box Turtles. In the destruction of the earthworm the turtle may be regarded as somewhat objectionable, because of the beneficial effects of this worm upon the soil which it inhabits. However, the earthworm is responsible for the destruction of some young plants, especially in gardens in the early spring, and therefore may be obnoxious.

Mollusks, or the slugs, snails, mussels, and other so-called Shell-bearing Invertebrates, were eaten extensively by the turtles, showing that these animals to a great extent feed on all manner of animal material in wet or damp places inhabited by molluscan life. In feeding upon the mollusks, the turtles are generally destroying creatures which are almost wholly objectionable in their economic effects. The terrestrial mollusks or snails are remarkably destructive to vegetation, and many complaints are made by gardeners concerning injury by snails or slugs. Any creature feeding extensively upon these snails or slugs should be regarded as a friend of gardeners and should be preserved. From the fact that nearly half of the Common Box Turtles examined were found to contain snails we see that this reptile is valuable to mankind in a garden by aiding to suppress these pests which are so difficult to meet and destroy by other practical means.

Pond snails, or the spiral univalve mollusks living in water (genera Physa and Melantho), were eaten by Snapping Turtles and by the Painted Turtles. It is not surprising that these two types of aquatic turtles should feed on aquatic animals of any kind obtainable. Bivalves, commonly called "Mussels," were eaten by five Painted Turtles. As these mollusks live only in the water, and mostly upon the mud at the bottom of streams and ponds, we have an indication of the feeding habits of this species of reptile.

The Arthropods were discussed in one of our previous Bulletins, and it is now enough for us to say that this large branch contains four Orders: The Crustaceans, the Myriapods, the Arachnids or Spiders, and the Insects. Belonging to the Crustaceans are the crayfish and shrimps, which always live in water and have beneficial effects, because they feed upon organic material which may be dead and decomposed. They thus act as scavengers in helping to purify the water in which they live; also by making holes in the ground extending down to the water beneath, the crayfish have afforded

drink to thirsty travelers on the plains or prairies. It is said that from the custom of thirsty travelers sucking water through hollow reeds from the crayfish holes the State of Illinois received the name of the "Sucker State." The crayfish and shrimp are also decidedly beneficial in becoming the food of certain carnivorous fishes, such as the bass, pike, pickerel, sunfish, trout and others. Therefore, the creature that would feed upon the crayfish or the fresh-water shrimp and reduce the number of these in a stream would be reducing the further supply for some of our valuable game and food fishes. In this slight regard the Turtles feeding extensively upon these invertebrates have not proven as beneficial in their feeding habits as have other species that confine their diet mostly to insects. It is important to note that eight different species of Turtles were found eating the crayfish and fresh-water shrimps. Among these were two specimens of the Common Soft-shelled Turtle, twelve of the Snapper, one Map Turtle, three Painted Turtles, three Wood Turtles, eight Speckled Turtles and one Common Box Turtle.

The Pill-Bug, which is a common insect-like creature belonging to the Sow-Bug family, living under boards and in damp places, and feeding mostly upon decaying vegetable matter, was eaten by a specimen of Wood Turtle. Millipedes or thousand-legged worms, which feed mostly upon decaying vegetable matter, were eaten by four Wood Turtles, one Speckled Turtle and eight Box Turtles. Spiders were devoured by two Speckled Turtles.

Insects formed the most important and interesting element in the food of many species of Turtles and Lizards. Of each kind of these Reptiles of which specimens were examined some representatives were found to have eaten insects, excepting the Map Turtle, of which only one was examined, and which contained only a crayfish, no insects. In many stomachs there were considerable quantities of fragments which were so broken as to be unrecognizable. This is illustrated in the twenty-two specimens of turtles containing undetermined fragments of mature insects.

The Ephemerids, or Mayflies, are interesting insects, which in the young stage are nymphs, living active lives in water, and when mature have a short or ephemeral existence as winged creatures. They have no objectionable traits or effects, and may be considered beneficial from the fact that they form an important element in the food of fishes. Two specimens of the Speckled Turtle were found to have fed upon Mayflies.

The Odonata or Dragon Flies are the insects that are commonly called Snake Doctors, Snake Dragons, Winged Darning Needles, Snake Feeders, etc. In the immature stage they live as active

nymphs in water, and when mature or adult are among the most active of flying creatures. Of course, it would be practically impossible for a Turtle to capture a winged Dragon Fly, but it would not be surprising for these insects to die and their remains be picked up by such reptiles. This may have been the explanation of the occurrence of Dragon Flies in the winged stage in the stomachs of two specimens of the Painted Turtle. The nymphs or young of dragon flies were found in the stomach of ten Painted Turtles and eight Speckled Turtles. Most of these were fragmentary and undeterminable as to species, but it was found that one Painted Turtle and one Speckled Turtle had eaten young of the group called Damsel Flies.

The Odonata or Dragon Flies are decidedly beneficial insects, especially as they are proven to be among the chief enemies of mosquitoes, which in turn carry to mankind certain diseases, such as malarial and yellow fever. Thus in the destruction of dragon flies mankind loses friends and benefactors. These and the crayfish are among the few beneficial creatures eaten by Turtles, and but few Dragon Flies in either the adult or young stage, are destroyed by Turtles.

The Plecoptera, or Stone Flies, also live in water when young, and their economic value is similar to that of the May Flies in being taken frequently as the food of insectivorous fishes. Three specimens of Speckled Turtles were found to have eaten these insects.

The Orthoptera, or Straight-winged insects, to which belong the grass-hoppers, crickets and katydids, were scarcely noticed as the food of Turtles, excepting of the Common Box Turtle, of which seven individuals were found to contain insects of this order. Common Black Crickets were found eaten by one Musk Turtle and two Common Box Turtles, and the Mole Cricket was devoured by the Painted Turtle. The Common Box Turtle fed upon the Short-horned Grasshoppers, two specimens of this reptile having eaten the common and destructive Red-Legged Grasshopper; one also was found to have fed on a Long-horned Grasshopper.

It is very interesting to compare the food of the Common Lizard (Pa. Zool. Bul. Vol. V. p. 257) and the Common Box Turtle and see how closely these two widely different creatures agree in regard to food items. This is no doubt due to the similarity of haunts or regions occupied by them. It is notable that the aquatic turtles were not found to have fed upon the Orthoptera or Jumping Insects. As these creatures are decidedly known to be pests, an animal like the Common Box Turtle feeding upon them extensively, as it does, is of practical benefit to mankind.

The Bugs, or Hemipterous insects (Vol. IV, No. 2, June, 1906) were likewise avoided by Turtles to a conspicuous extent. Representatives of the Stink Bug Family (Pentatomidæ) (Vol. IV, p. 71), were found in the stomach of one Snapping Turtle, one Wood Turtle and one Common Box Turtle; while the Water Boatman (Vol. IV, p. 51), was found eaten by a Snapper and the Speckled Turtle, and the Back-swimmer (Vol. IV, p. 52), was also eaten by the last-named. Zaitha, an ally of the Giant Water Bug (Vol. IV, p. 56) was devoured by a Painted Turtle and by a Speckled Turtle, while Water Striders (Vol. IV, p. 58), or so-called "skaters" were eaten by two Painted Turtles. These Water-striders are beneficial in their habits, acting as scavengers, as described in our Bulletin on the Hemiptera.

Leaf Hoppers (Vol. V, No. 3, July, 1907), were found in the stomachs of three Painted Turtles, having doubtless been obtained from the surface of the water on which they had fallen.

The Neuroptera or "Nerve-winged Insects" are represented by both land and water species. They are not pests to mankind. Of those of which the young or nymphs live in water, some were eaten by the Painted Turtle and others by the Speckled Turtle.

The butterflies and moths fly so readily that it would scarcely be expected that they would be taken as the food of Turtles, and we truly find that they are not important elements in this consideration. Those that were eaten were mostly in the larval or caterpillar stage. Two Speckled Turtles had eaten winged moths, but these may have been taken from the water into which they had dropped. Moth larvæ in a stage of digestion prohibiting determination were eaten by two Musk Turtles, two Painted Turtles and seven Common Box Turtles. The chrysalis of a species of moth was also found in the stomach of the Common Box Turtle, and a Yellow-necked Prominent was found eaten by the same reptile. Cutworms were eaten by the Wood Turtle, the Speckled Turtle and three Common Box Turtles. This shows a good influence toward destroying one of the worst insect pests. The larvæ of moths or butterflies are practically all destructive in their influence on vegetation, and all creatures that feed upon them are consequently beneficial in their economic effects in this regard.

Flies in their adult or winged stage are not readily captured, and, as would be expected, Turtles did not feed readily upon them in this stage; but it is to be seen that undetermined stages of flies were found in the stomachs of four Painted Turtles, one Wood Turtle, ten Speckled Turtles and one Common Box Turtle. Adults of two families of flies were contained as food in the Speckled Turtle. It is possible that these may have been taken from the surface of

water or may have been found dead. Fly larvæ were found in the stomachs of three Snappers, seven Painted Turtles and two Speckled Turtles, while the pupæ or chrysalids of flies were found in the stomachs of five Painted Turtles. It will be noted from the table that the flies eaten by Turtles are chiefly those species which in the larval stage live in mud or in damp places. The similarity of the haunt or habitat of the Turtle accounts for these aquatic insects as elements of their food. It is remarkably interesting to the student of ecology, or the relationship of organisms in Nature, to compare our table for the Orthoptera, which live away from water when young, and which were almost entirely avoided by the aquatic Turtles, but eaten extensively by Lizards and Common Box Turtles, with the table for the Diptera or flies, representing species the young of which live in water, but none of which were taken by the last named Reptiles, yet having entered plainly into the food of the aquatic species of Turtles.

The Coleoptera, or Beetles, present a very wide range of food, structure, and economy. Many insects belonging to this order were eaten by Turtles. Undeterminable fragments of beetles were found in the stomachs of all species of Turtles, excepting two, while undetermined beetles recognized to be in the larval stage were found in only two. Nothing can be said of the economic effect or value of insects which are so fragmentary as to be unrecognizable.

The ground beetles are beneficial insects, in general, because they are predaceous in habits and feed upon other insects. This family was found represented in the stomachs of the Musk Turtle, three specimens of Painted Turtle, the Wood Turtle, two Speckled Turtles and some Box Turtles.

The lower families of beetles are mostly aquatic, living on or in the water. Some feed upon other insects and small aquatic organisms, and all act as scavengers. Among these are the Diving Beetles which are obnoxious because they may feed upon small fishes. These predaceous insects or diving beetles were devoured by one Snapper, one Painted Turtle and two Speckled Turtles. The Whirligig Beetles are the little dark insects which gyrate or whirl around rapidly on the surface of the water and are scavengers. These were found represented in the stomach of only one Snapper. The Water Scavengers are large dark beetles living in the water, and according to their name are beneficial in cleaning up dead material found in their realm. They were found eaten by only one Snapper.

June Bugs and Rose Bugs are among the most serious enemies of vegetation, in both their larval and adult stages. The young of the June Bug, and also of the Flower Beetle, are known as white grubs and feed upon the roots of plants in the ground. These insects were

eaten by the Speckled Turtle, while as many as ten Painted Turtles were found to have eaten rose bugs, and two Speckled Turtles had devoured the same pest. Leaf Beetles, which are quite destructive to the foliage of plants, were eaten by four Painted Turtles, the Wood Turtle and some Speckled Turtles. Snout Beetles or weevils, which are serious plant pests, were eaten by the Painted Turtle and the Speckled Turtle.

The Hymenopterous insects, represented by the ants, wasps, and bees, were not extensively devoured by Turtles. Sawflies were found in the stomachs of the Wood and the Speckled Turtle. Ants were found eaten by a Painted Turtle and the Wood Tortoise, and a few other insects of that order were taken by these reptiles.

It is in the study of the vertebrate food that remarkably interesting results are obtained. For example, vertebrates were not found eaten by the Common Soft-shelled Turtles, although it is our opinion that this reptile will feed upon flesh when it has an opportunity. Undetermined fragments of vertebrates were found in the stomachs of two Snappers, two Painted Turtles and two Wood Turtles, and fish were found eaten by two Snappers and four Painted Turtles. One of the fishes was determined as a Sucker (Catostoma). A frog was found in the stomach of a Snapper, and two snakes were found eaten by this reptile. Birds had been devoured by a Snapping Turtle and by two Wood Turtles. An undetermined portion of a mammal was found in the stomach of a Snapper, while a rabbit was found to have been eaten by another Snapper, and mice had been swallowed by two Snappers and a Common Box Turtle. It is probable that any small animal that drops in the water and drowns or becomes helpless may be captured and eaten by Turtles. We know that the aquatic species of these reptiles are often very injurious to fishes in fish ponds. Their presence frequently can be determined by the presence of the air bladders of fishes floating on the water. When the fish is caught by the Turtle the cutting edge of the mouth often opens the body of the fish in such a way that the air bladder escapes and rises to the surface. The Turtle is the only creature feeding under water that cuts the fish to pieces in such a way as to permit the air bladder to escape and come to the surface of the water, and thus tell the story of a combat and feast.

The positive determination of a rabbit having been eaten by a Snapping Turtle is remarkable. If we could dare, in a serious scientific report, to insert a facetious remark, it would be to the effect that in the proverbial race between the Tortoise and the Hare it is not so wonderful that history should record the winning by the former, since scientific research now definitely shows it may have swallowed its competitor.

FOOD TABLE OF TURTLES.

The vertical columns refer to species by our number, as follows:

2. Aspidonectes spinifer (Le Sueur). The common Soft-shelled Turtle.
4. Chelydra serpentina (L.). The common Snapping Turtle.
6. Aromochelys odoratus (Latreille). The Musk Turtle.
7. Graptemys geographicus (Le Sueur). The Map Turtle.
12. Chrysemys picta (Hermann). The Painted Turtle.
14. Clemmys muhlenbergi (Schweigger). Muhlenberg's Turtle.
15. Clemmys insculptus (Le Conte). The Wood Tortoise.
16. Clemmys guttatus (Schneider). The Spreckled Tortoise.
18. Terrapene carolina (L.). The common Box Turtle.

	Spinifer.	Serpentina.	Odoratus.	Geographicus.	Picta.	Muhlenbergi.	Insculptus.	Guttatus.	Carolina.
	2	4	6	7	12	14	15	16	18
Number containing food,	2	19	4	1	86	1	26	27	40
Number containing vegetable matter,	0	5	0	0	63	1	20	3	25
Cryptogamia (Flowerless Plants).									
Algae (Plants with Chlorophyl),	.....	2	.....	.....	30	.....	.....	.....	.....
Fungi (Plants without Chlorophyl).									
Undetermined,	.....	.....	.....	.....	.....	.....	1	.....	1
Basidiomycetes,	.....	.....	.....	.....	.....	.....	.....	.....	1
Mushrooms,	.....	.....	.....	.....	.....	.....	1	.....	4
Bryophyta (Mosses and Liverworts).									
Hepaticæ (Liverworts).									
Marchantia polymorpha,	.....	.....	.....	.....	1	.....	.....	.....	.....
Jungermannia sp.,	.....	.....	.....	.....	.....	.....	1	.....	.....
Musci (Mosses):									
Sphagnum sp. (Sphagnum Moss),	.....	.....	.....	.....	1	.....	.....	.....	.....
Undetermined Moss,	.....	.....	.....	.....	.....	.....	.....	.....	1
Phanerogamia (Flowering Plants):									
Undetermined Fragments,	.....	.....	.....	.....	11	.....	13	.....	4
Roots,	.....	.....	.....	.....	.....	.....	.....	.....	2
Stems,	.....	.....	.....	.....	5	.....	.....	.....	.....
Leaves,	.....	2	.....	.....	36	.....	.....	1	5
Buds,	.....	.....	.....	.....	.....	.....	.....	.....	1
Berries,	.....	.....	.....	.....	.....	1	.....	.....	3
Seeds,	.....	1	.....	.....	4	.....	9	1	1
Gramineæ (Grass),	.....	3	.....	.....	3	.....	9	2	8
Lemna sp. (Duckweed), leaves,	.....	.....	.....	.....	1	.....	.....	.....	.....
Peltandra virginica, leaves (Water Arum),	.....	.....	.....	.....	1	.....	.....	.....	.....
Spathyema fœtida (Skunk Cabbage), leaves,	.....	1	.....	.....	.....	.....	.....	.....	.....
Betula sp. (Birch), leaf,	.....	.....	.....	.....	.....	.....	1	.....	.....
Rumex sp. (Dock), seed,	.....	.....	.....	.....	1	.....	.....	.....	.....
Polygonum sp. (Smartweed), seed,	.....	.....	.....	.....	1	.....	.....	.....	.....
Asimina triloba (Papaw), fruit,	.....	.....	.....	.....	.....	.....	1	.....	.....
Podophyllum peltatum (Mayapple), seed,	.....	.....	.....	.....	.....	.....	.....	.....	1
Lepidium virginicum (Pepper Grass), seeds and pods,	.....	.....	.....	.....	1	.....	.....	.....	.....
Rubus sp. (Blackberry), seeds,	.....	.....	.....	.....	.....	.....	1	.....	3
Fragaria sp. (Strawberry), fruit and seeds,	.....	.....	.....	.....	.....	.....	1	.....	.....
Malus sp. (Apple), seeds,	.....	1	.....	.....	.....	.....	1	.....	2
Drupaceæ. Prunus sp. (Cherry), seeds,	.....	.....	.....	.....	.....	.....	.....	.....	1
Clover,	.....	.....	.....	.....	.....	.....	1	.....	.....
Ilex verticillata (Black Alder), seeds,	.....	.....	.....	.....	.....	.....	2	.....	.....
Vitis labrusca (Fox Grapes),	.....	.....	.....	.....	.....	.....	1	.....	.....
Washingtona sp. (Sweet Cicely),	.....	.....	.....	.....	.....	.....	.....	.....	1
Pyrola rotundifolia (Wintergreen),	.....	.....	.....	.....	.....	.....	.....	.....	1
Physalis sp. (Ground Cherry),	.....	.....	.....	.....	.....	.....	.....	.....	3
Solanum sp. (Nightshade), berries,	.....	.....	.....	.....	.....	.....	1	.....	.....
Chelone glabra (Turtle-head), seeds,	.....	.....	.....	.....	.....	.....	1	.....	.....
Plantago major (Plantain),	.....	.....	.....	.....	.....	.....	2	.....	.....
Mitchella repens (Partridge Berry), fruit,	.....	.....	.....	.....	.....	.....	1	.....	.....
Sambucus canadensis (Common Elder), berries,	.....	.....	.....	.....	1	.....	1	.....	.....
Bird's Wheat Moss,	.....	.....	.....	.....	.....	.....	.....	.....	1
Number containing animal matter,	2	19	4	1	69	1	21	27	32

FOOD TABLE OF TURTLES—Continued.

	Spinifer.	Serpentina.	Odoratus.	Geographicus.	Picta.	Muhlenbergi.	Insculptus.	Guttatus.	Carolina.
	2	4	6	7	12	14	15	16	18
Annulata (Ringed Worms):									
Undetermined,	.....	.....	.....	.....	.....	.....	.....	1	.....
Lumbricus sp. (Earth-worm),	.....	.....	.....	.....	.....	.....	1	.....	2
Mollusca (Mollusks, Slugs and Snails),	0	7	2	0	23	0	8	3	15
Univalves (Slugs and Snails):									
Slugs,	.. ..	1	.....	.....	1	.....	1	1	2
Snails,	.....	4	2	.....	17	.....	6	2	14
Helix hirsuta (Land Snail),	.....	.....	.....	.....	.....	.....	1	.....	.....
Pond Snails,	.....	2	.....	.....	3	.....	.....	.....	.....
Bivalves (Mussels),	.....	.....	.....	.....	5	.....	.....	.....	.....
Arthropoda:									
Crustacea,	2	12	0	1	3	0	3	8	1
Undetermined,	.....	.....	.....	.....	3	.....	.....	6	.....
Cambarus sp. (Crayfish),	2	12	.....	1	.....	.....	1	1	1
Gammarus,	.....	.....	.....	.....	.....	.....	1	1	.....
Oniscidæ (Sow-bug Family),	.....	.....	.....	.....	.....	.....	1	.....	.....
Myriapoda (Millipedes),	.....	.....	.....	.....	.....	.....	4	1	8
Arachnida (Spiders),	.....	.....	.....	.....	.....	.....	.....	2	.....
Insecta (Insects),	1	9	3	0	61	1	14	27	24
Undetermined, fragments,	.....	2	.....	.....	24	1	4	10	7
Undetermined, adults,	.....	.....	.....	.....	1	.....	.....	0	.....
Undetermined, larvæ,	.....	.....	.....	.....	6	.....	.....	5	.....
Undetermined, aquatic nymphs.	.....	.....	.....	.....	1	.....	.....	3	.....
Ephemerida (May-flies), nymphs,	.....	.....	.....	.....	.....	.....	.....	2	.....
Odonata (Dragon-flies),	0	0	0	0	11	0	0	9	0
Undetermined nymphs,	.....	.....	.....	.....	10	.....	.....	8	.....
Agrionidæ (Damsel-flies). adults,	.....	.....	.....	.....	2	.....	.....	.....	.....
Agrionidæ (Damsel-flies), nymphs,	.....	.....	.....	.....	1	.....	.....	1	.....
Plecoptera (Stone-flies), nymph,	.....	.....	.....	.....	.....	.....	.....	3	.....
Orthoptera (Straight Winged Insects),	0	0	1	0	1	0	0	0	7
Acrididæ (Short-horned Grasshoppers):									
Undetermined,	.....	.....	.....	.....	.....	.....	.....	.....	1
Melanoplus femur-rubrum, Red-leg Grasshopper,	.....	.....	.....	.....	.....	.....	.....	.....	2
Locustidæ (Long-horned Grasshoppers):									
Undetermined,	.....	.....	.....	.....	.....	.....	.....	.....	1
Gryllidæ (Crickets):									
Undetermined,	.....	.....	.....	.....	.....	.....	.....	.....	1
Gryllus pennsylvanicus,	.....	.....	1	.....	.....	.....	.....	.....	2
Gryllotalpa sp. (Mole-Cricket),	.....	.....	.....	.....	1	.....	.....	.....	.....
Hemiptera, Bugs,	0	1	0	0	4	0	1	3	1
Pentatomidæ (Stink-bugs),	.....	1	.....	.....	.....	.....	1	.....	1
Corisidæ (Water Boatman),	.....	1	.....	.....	.....	.....	.....	1	.....
Notonectidæ (Back Swimmers),	.....	.....	.....	.....	.....	.....	.....	1	.....
Belostomidæ (Giant Water-bugs):									
Zaitha fluminea,	.....	.....	.....	.....	1	.....	.....	1	.....
Hydrobatidæ (Water-striders),	.....	.....	.....	.....	2	.....	.....	.....	.....
Jassidæ (Leaf-hoppers),	.....	.....	.....	.....	3	.....	.....	.....	.....
Neuroptera (Nerve-winged Insects):									
Undetermined larvæ,	.....	.....	.....	.....	1	.....	.....	.....	.....
Sialidæ (Dobson-fly Family),	.....	.....	.....	.....	.....	.....	.....	2	.....
Lepidoptera (Butterflies and Moths),	0	0	2	0	2	0	2	1	9
Undetermined, adults,	.....	.....	.....	.....	.....	.....	.....	2	.....
Undetermined, larvæ,	.....	.....	2	.....	2	.....	.....	.....	7
Undetermined, pupæ,	.....	.....	.....	.....	.....	.....	.....	.....	1
Notodontidæ (The Prominents):									
Datana ministra (Yellow Necked),	.....	.....	.....	.....	.....	.....	.....	.....	1
Noctuidæ,	.....	.....	.....	.....	.....	.....	1	1	.....
Undetermined larvæ,	.....	.....	.....	.....	.....	.....	.....	.....	3
Moth,	.....	.....	.....	.....	.....	.....	1	.....	.....
Diptera (Flies),	0	3	0	0	16	0	1	14	1
Undetermined adult flies,	.....	.....	.....	.....	4	.....	1	10	1
Undetermined larvæ,	.....	2	.....	.....	5	.....	.....	.....	.....
Undetermined pupæ.	.....	.....	.....	.....	3	.....	.....	.....	.....
Tipulidæ (Crane-flies). larvæ,	.....	.....	.....	.....	1	.....	.....	2	.....
Chironomidæ (Midges).	.....	.....	.....	.....	.....	.....	.....	1	.....
Stratiomyiidæ larva.	.....	1	.....	.....	.....	.....	.....	.....	.....
Syrphidæ, Syrphus Flies:									
Undetermined larvae,	.....	.....	.....	.....	1	.....	.....	.....	.....
Undetermined pupæ,	.....	.....	.....	.....	2	.....	.....	.....	.....
Scatophagidæ,	.....	.....	.....	.....	.....	.....	.....	1	.....

FOOD TABLE OF TURTLES—Continued.

	Spinifer.	Serpentina.	Odoratus.	Geographicus.	Picta.	Muhlenbergi.	Insculptus.	Guttatus.	Carolina.
	2	4	6	7	12	14	15	16	18
Coleoptera (Beetles),	1	7	2	0	37	0	13	20	10
Undetermined beetles, adults,	1	5	1	.....	24	.....	5	13	7
Undetermined larvæ,	.....	.....	.....	.....	1	.....	.....	.....	2
Carabidæ (Ground Beetles),	.....	.....	1	.....	3	.....	.....	2	.....
Undetermined ground beetles,	.....	.....	.....	.....	.....	.....	1	.....	2
Carabus limbatus,	.....	.....	.....	.....	.....	.....	.....	.....	1
Harpalus caliginosus,	.....	.....	.....	.....	.....	.....	1	.....	1
Pterostichus lucublandus,	.....	.....	.....	.....	.....	.....	.....	.....	1
Dytiscidæ (Predaceous Diving-beetles),	.....	1	.....	.....	1	.....	.....	2	.....
Gyrinidæ (Whirligig Beetles),	.....	1	.....	.....	.....	.....	.....	.....	.....
Hydrophilidæ (Water Scavengers),	.....	1	.....	.....	.....	.....	.....	.....	.....
Water-beetle larvæ,	.....	1	.....	.....	.....	.....	.....	.....	.....
Scarabæidæ (Scarabæids),	.....	.....	.....	.....	.....	.....	.....	.....	.....
Undetermined,	.....	.....	.....	.....	.....	.....	2	.....	.....
Lachnosterna sp. (June Bugs),	.....	.....	.....	.....	.....	.....	.....	1	.....
Macrodactylus subspinosus (Rose-bug),	.....	.....	.....	.....	10	.....	.....	2	.....
Euphoria inda (Bumble Flower-beetle),	.....	.....	.....	.....	.....	.....	.....	1	.....
Chrysomelidæ (Leaf-beetles),	.....	.....	.....	.....	.....	.....	.....	.....	.....
Undetermined, Leaf-beetles,	.....	.....	.....	.....	.....	.....	1	2	.....
Donacia sp. (Long-horned Leaf-beetles),	.....	.....	.....	.....	4	.....	.....	1	.....
Chrysomela suturalis,	.....	.....	.....	.....	.....	.....	1	.....	.....
Tenebrionidæ (Darkling Beetles),	.....	.....	.....	.....	.....	.....	1	.....	.....
Rhynchophora (Snout-beetles),	.....	.....	.....	.....	1	.....	.....	1	.....
Hymenoptera (Ants, Wasps, etc.),	0	0	0	0	3	0	2	3	1
Undetermined Hymenoptera, adults,	.....	.....	.....	.....	.....	.....	.....	.....	1
Undetermined pupæ,	.....	.....	.....	.....	1	.....	.....	.....	.....
Tenthredinidæ (Saw-flies),	.....	.....	.....	.....	.....	.....	1	1	.....
Ichneumonidæ,	.....	.....	.....	.....	.....	.....	.....	1	.....
Braconidæ,	.....	.....	.....	.....	.....	.....	.....	1	.....
Myrmicidæ (Ants),	.....	.....	.....	.....	2	.....	1	.....	.....
Vertebrata (Vertebrates),	0	7	0	0	8	0	4	0	1
Undetermined,	.....	2	.....	.....	2	.....	2	.....	.....
Pisces (Fishes),	0	2	0	0	4	0	0	0	0
Undetermined,	.....	1	.....	.....	4	.....	.....	.....	.....
Catostomidæ (The Suckers),	.....	1	.....	.....	.....	.....	.....	.....	.....
Batrachia. Rana sp. (Frog),	.....	1	.....	.....	.....	.....	.....	.....	.....
Ophidia (Snakes),	.....	2	.....	.....	.....	.....	.....	.....	.....
Aves (Birds),	.....	1	.....	.....	.....	.....	2	.....	.....
Mammalia (The Mammals),	0	4	0	0	1	0	0	0	0
Undetermined Mammals,	.....	1	.....	.....	.....	.....	.....	.....	.....
Leporidæ. Lepus sp. (Rabbit),	.....	1	.....	.....	.....	.....	.....	.....	.....
Muridæ (Mice),	.....	2	.....	.....	.....	.....	.....	.....	1

Glossary of Scientific Terms Used in Turtle Bulletin.

Adult, mature.
Anterior, front.
Carapace, the upper shell.
Class, a major group of organisms, such as Reptilia, composed of orders.
Concentric, a series of more or less circular markings each within another.
Costal, belonging to the ribs.
Depressed, flattened vertically.
Dilation, enlargement.
Dorsal, belonging to the back.
Family, the first group smaller than order, composed of genera.
Iris, colored portion of the eye.
Keel, a ridge, a raised line.
Lateral, along the side.
Lobe, a flap or lid.
Longitudinal, lengthwise.
Marginal, pertaining to the edge.
Order, first group division of a class, composed of families.
Osseous, bony.
Plastron, the lower shell.
Posterior, rear or hinder.
Proboscis, snout.
Scute, any external bony or horny plate.
Serration, edged like saw teeth.
Species, the lowest recognized natural grouping, composing genera.
Spine, a sharp pointed projection.
Striae, stripes, streaks or scratches.
Striations, fine grooves or scratches.
Transverse, across.
Tubercles, small fleshy projections.
Ventral, belonging to the under side.
Vertebral, pertaining to the backbone.

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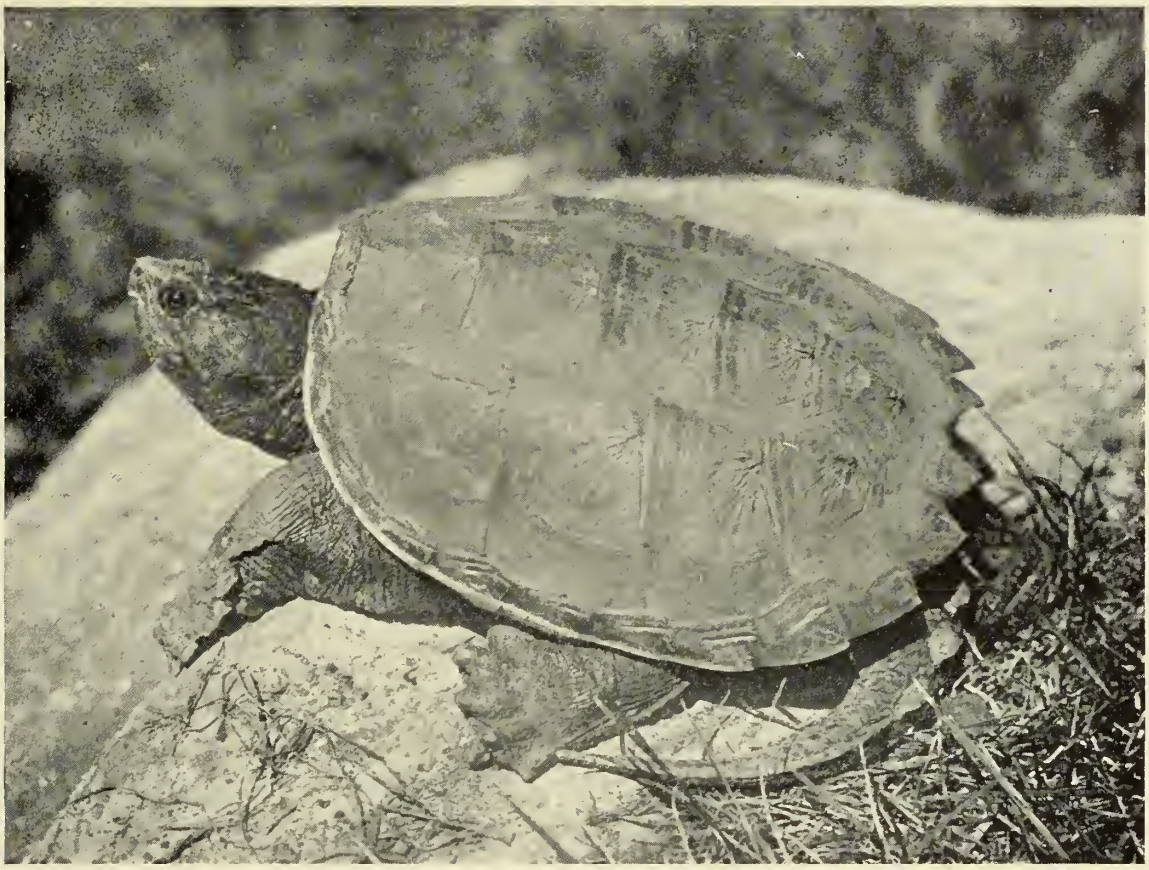


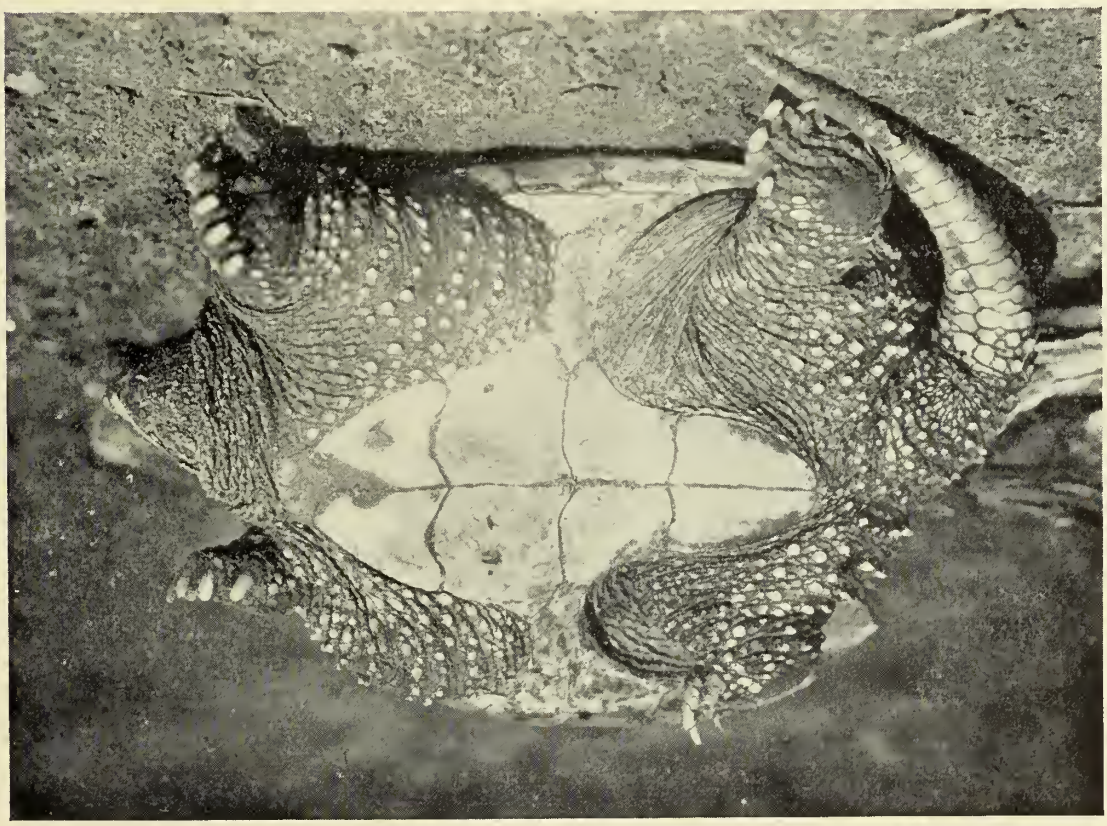
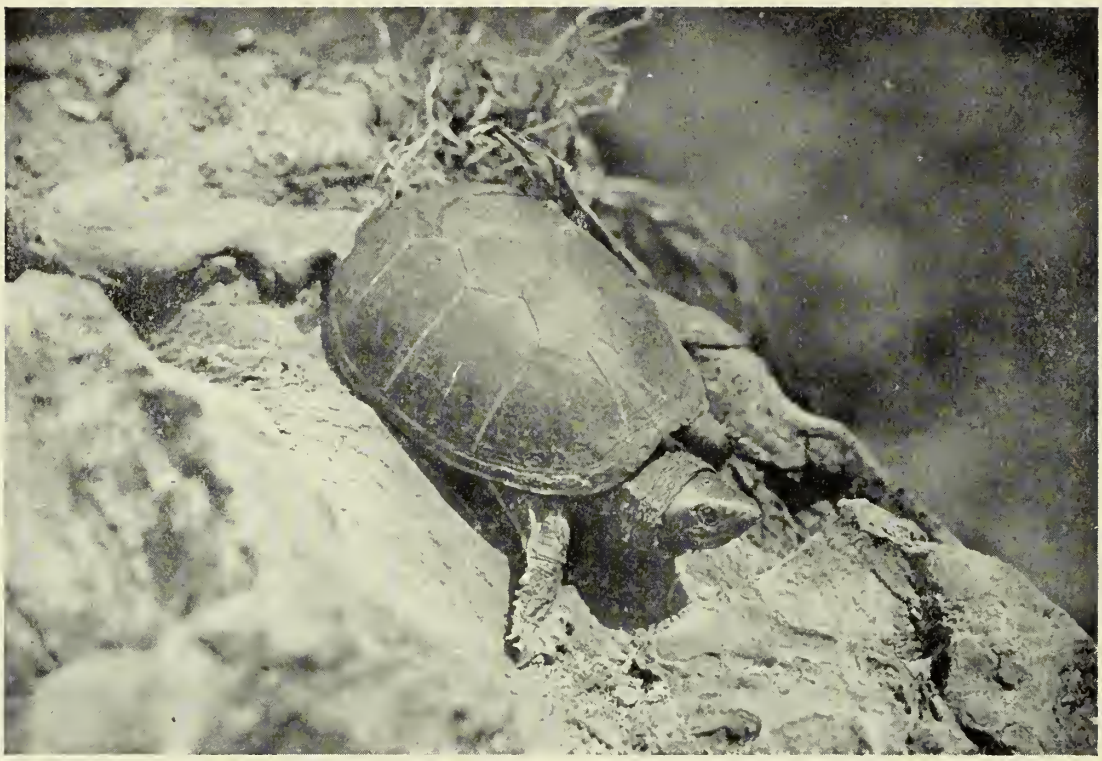


Plate IV. (a) Common Snapping Turtle. (b) Common Snapping Turtle; on its back. (From American Museum Journal Vol. V, No. 3, July 1905.)



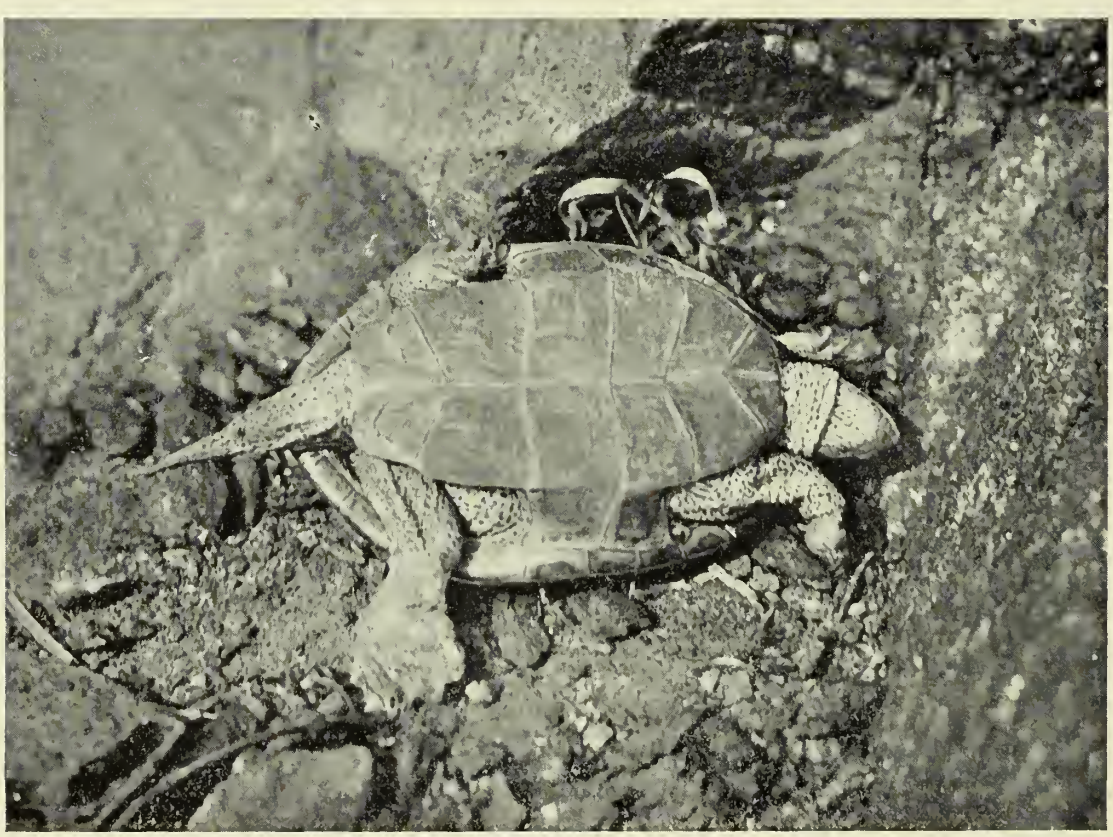


Plate V. (a) Musk Turtle. (b) Diamond Back, on its back. (From Am. Mus. Journ. Vol. V, No. 3.)

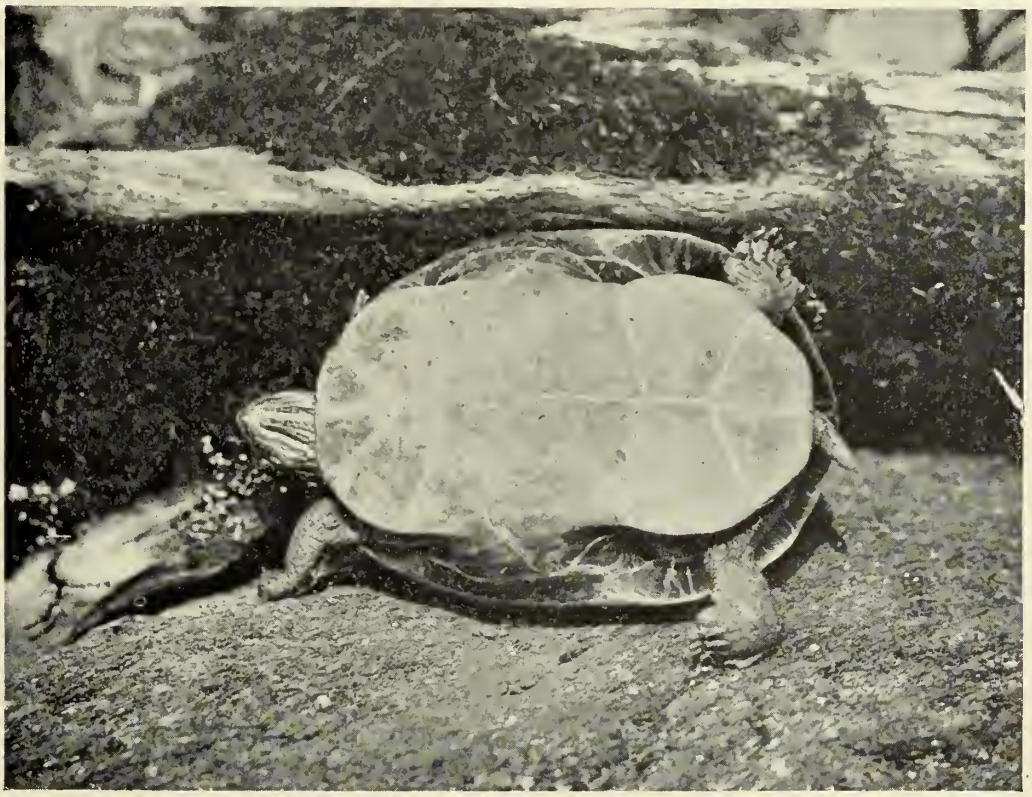


Plate VI. (a) Painted Turtle. (b) Painted Turtle, on its back. (From Am. Mus. Journ. Vol. V, No. 3.)

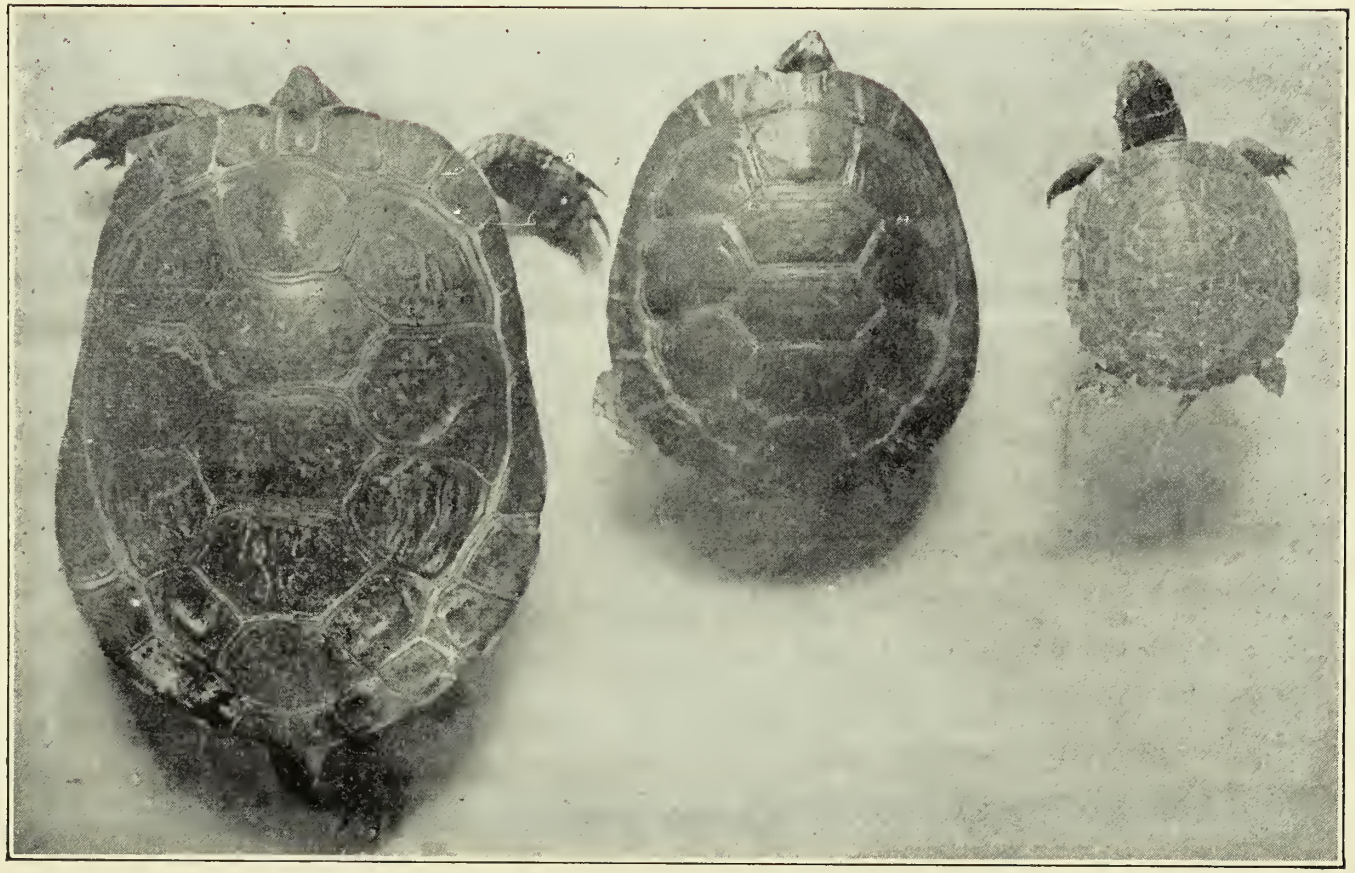


Plate VII. Margined Turtle, specimens of different ages. (Original.) Photographed from life by W. R. Walton, in Laboratory of State Zoologist, Harrisburg, Pa.

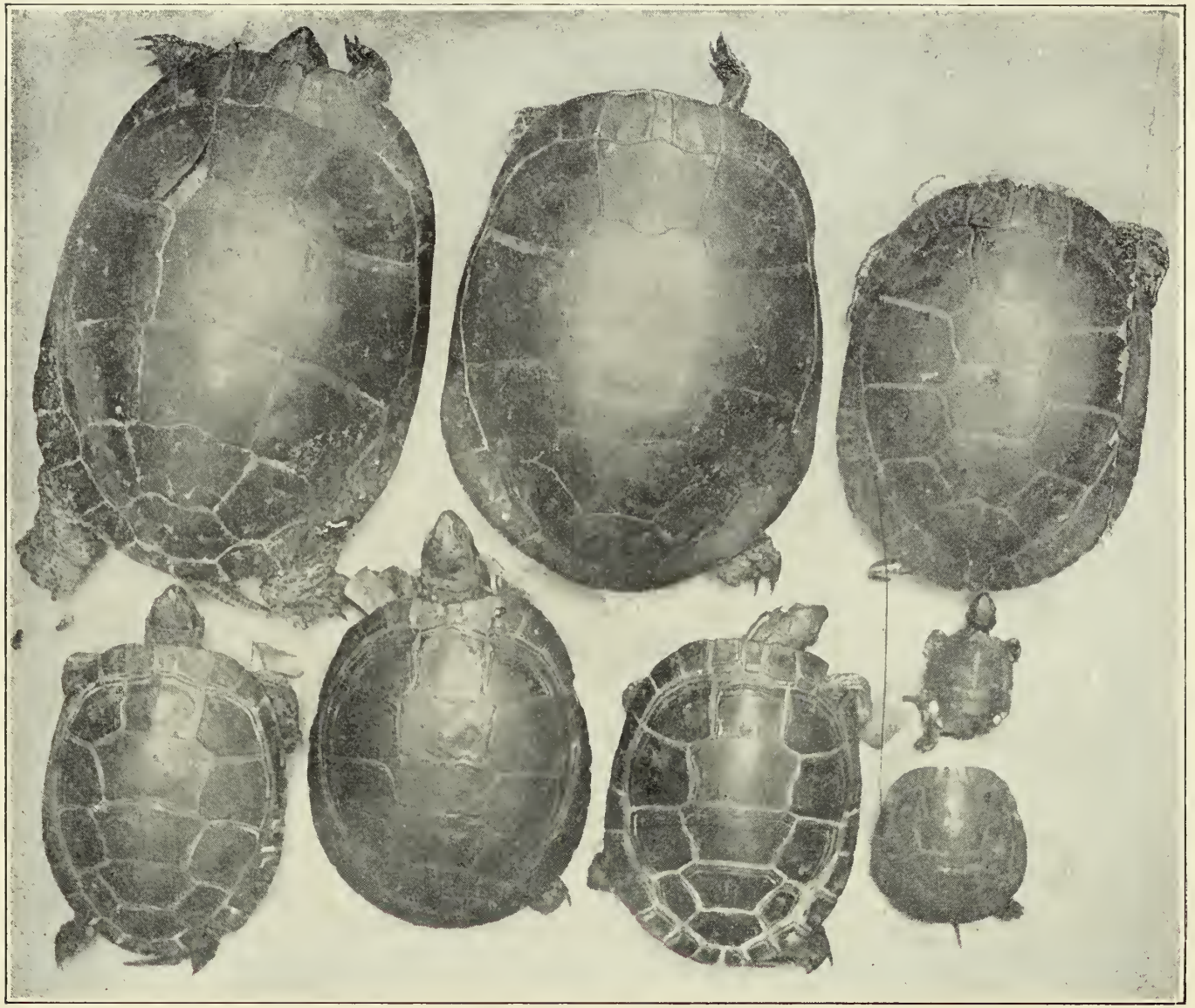


Plate VIII. Painted Turtle, showing its graded approach to scale arrangement of the Margined Turtle. (Original.) Photographed from life by W. R. Walton, in Laboratory of State Zoologist, Harrisburg, Pa.

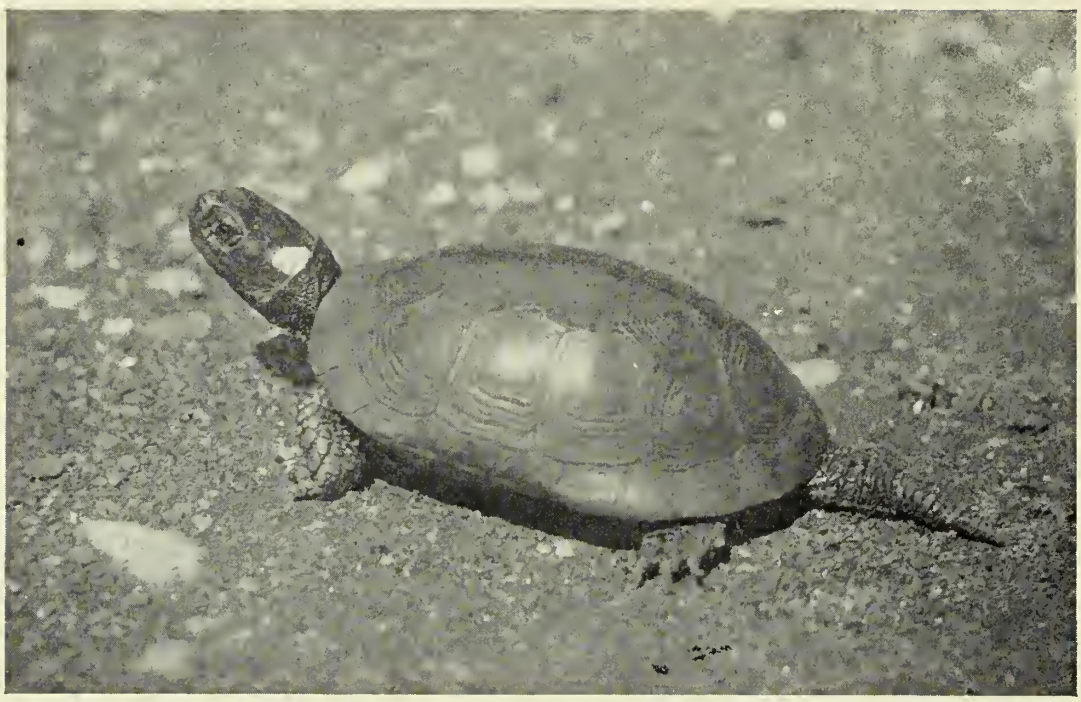
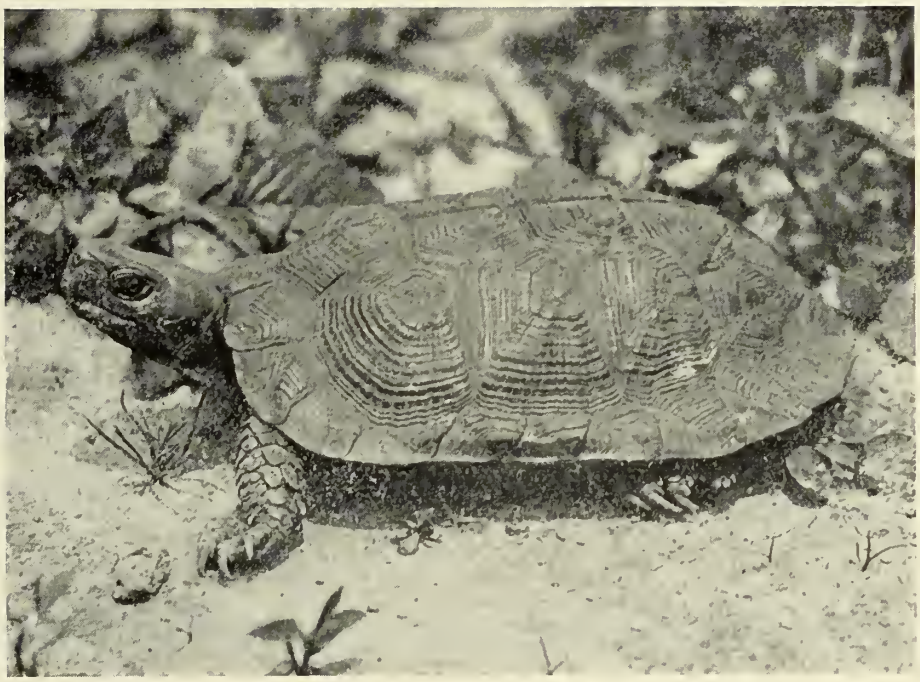


Plate IX. Muhlenberg's Turtle.(a) Lacking color pattern; (b) color pattern present. (From Am. Mus. Journ. Vol. 5, No. 3.)



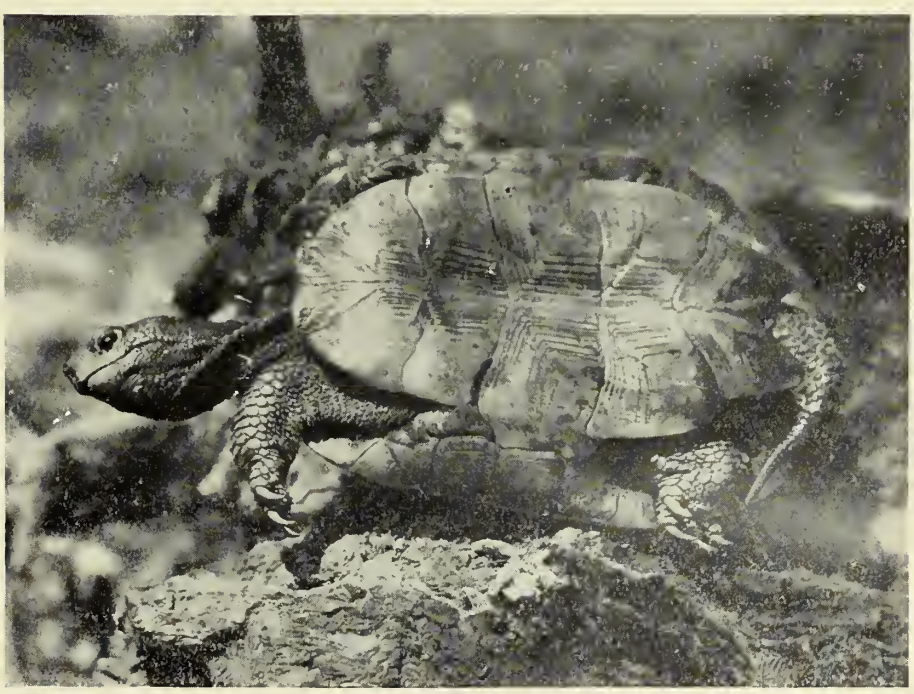


Plate X. (a) Wood Turtle. (b) Wood Turtle, on its back. (From Am. Mus. Journ. Vol. 5, No. 3.)

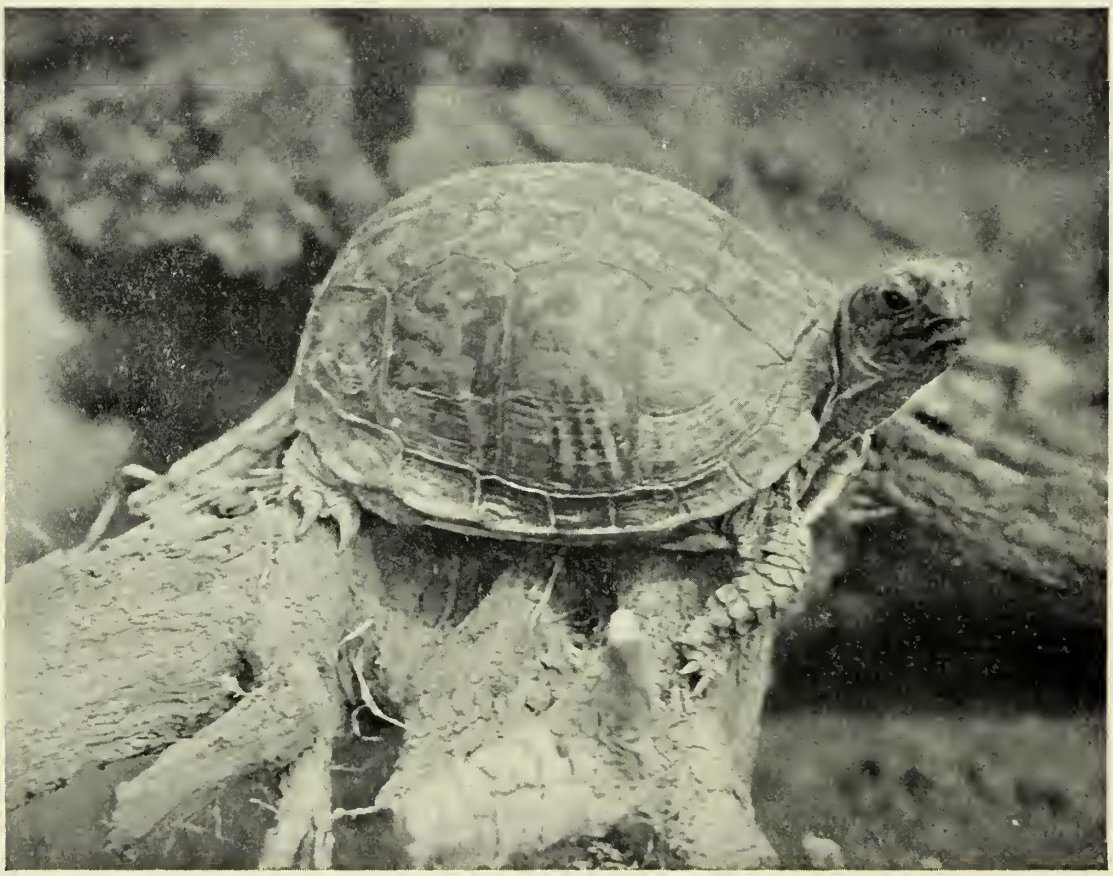


Plate XI. (a) Speckled Turtle. (b) Common Box Turtle. (From Am. Mus. Journ., Vol. V, No. 3.)

Plate XII. Common Box Turtle. (Nearly life size.) Adult, male. (Photo from life by Dr. R. W. Shufeldt, New York City).