


AMPHIBIANS *and* Reptiles *of* TENNESSEE





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Why Study Reptiles and Amphibians?

The average American citizen lives out his life with very little direct contact with either reptiles or amphibians. When man and reptile accidentally meet on a woodland path there is usually a moment of shock and the startled parties take off in opposite directions. It is no wonder that the citizen knows little of these animals and is thankful for the lack of association.

Even a Game and Fish Commission is not much concerned with reptiles and amphibians directly, nor are we bent on making snake handlers of Tennessee's housewives and automobile mechanics. Reptiles and amphibians are relatively uncommon and unessential to life amid the brick cliffs and asphalt fields of a modern city. But beef cattle are not common here either, and they certainly play a significant role in our lives.

Frog legs and turtle soup do not have the economic importance of beef, to be sure, but they are a positive contribution to man's welfare. There are many other products, most of which are more important in other parts of the world than in the United States: Alligator skin shoes and luggage; snake and lizard skins; tortoise-shell combs and ornaments; turtle eggs and meat for food; frogs, salamanders and turtle meat for fish bait; and rattlesnake steaks, a gourmet's dish. In general, it is the low in-

come group around the world which makes widest use of these animals for food. In a few areas they are a major part of the diet. However, the potential is great, particularly if men should decide someday to exploit fully the resources of the sea. The big green turtle could become a staple food.

Nevertheless, these uses of reptiles and amphibians are not the main basis of our interest in them. Even our extensive medical and school laboratory use of them doesn't tell the story, although salamanders have been one of the favorite subjects for genetic research. The *Ambystoma* is generally used because of its hereditary make-up and interesting reactions to environment. Cancer research and many other basic problems are begun with amphibian experiments. And few are the zoology students who haven't waded squeamishly through a *Necturus* and a bullfrog. But, as we have said, this is a small part of the story. Much of our knowledge of embryology is based on study of amphibians.

The real significance of these two groups lies in their INDIRECT relations to man. Like insects and earthworms and crayfish and bacteria they are the out-of-sight, out-of-mind creatures that make nature work. Were they eliminated few people would miss them as such, but as the indirect effects began

to pile up, man would find himself in a very different kind of world. Frogs make scarcely a ripple in our civilization, but fish do, and tadpoles and eggs of frogs are important items in the food of many fish. They are a link in many food chains. The word "chain" implies that all are tied together, and this is a basic truth of nature.

In every area where they live, amphibians and reptiles influence the plant-animal community. For, if it takes ten pounds of frogs to produce a pound of bass in a pond, it takes a HUNDRED pounds of insect larvae and worms to produce that ten pounds of frogs. Food chains are, of course, more complicated than this. We do not know much about them. We do know that many times when someone innocently tampers with one link in the chain dramatic changes take place. They are usually bad, sometimes catastrophic. The point is that biologists have a great respect for the delicate balance and, with our present knowledge, proceed cautiously in all of their experimentation. Reptiles and amphibians, then, are an integral part of an outdoors which we like. The better we understand them, the better we will understand the whole picture.

What Are Reptiles and Amphibians?

Reptiles and amphibians are creatures of hot and temperate climates. The reason is simple. Since they are cold-blooded, their body temperature is the same as their surroundings. Like mammals, they have a heart, arteries, and veins in order to circulate blood. However, they have no mechanism for keeping the body temperature constant, as does a person, who moves from the chilly December air outside into an overheated room and maintains a 98.6 degree internal temperature in both places.

Reptiles and amphibians become less active as the temperature drops. However, they can survive at temperatures close to freezing, and there are many places that animals can go during periods of cold. For example, the ground seldom freezes more than a few inches deep in most of the United States. A snake in a hole beneath the frost line will become stiff and helpless, but if unmolested it can remain alive until the warming air of spring heats up the ground. Those dug up in winter and even those which get surprised by late spring or early fall cold spells can be easily caught and handled. Of course these are often victims of hawks and 'coons.

Amphibians are less subject to the whims of weather than reptiles, for water is a more staple environment. Water temperature changes slowly and finally becomes really chilled only after long periods of cold weather. Even then, life can continue in the pool. Since ice floats, the first real freezing weather puts a protective layer across the water and only the shallowest puddles freeze solid. A frog in the mud at the bottom of a pond is relatively warm, while temperatures in the air above may be below zero. In Tennessee it is possible to find amphibian eggs during any month of the year.

The animals which people know best are mammals. Cats, dogs, cows, pigs, horses and other domestic animals are fairly familiar to most folks, even in this day of city slickers. We are familiar with the way mammals (and people) act, eat, sleep, have young, respond to injury and react to stimuli. Amphibians and reptiles are not so well known, and are therefore considered "strange." As a result many falsehoods have grown up around them.

This misunderstanding has slowed down the study of amphibians and reptiles and led to actual persecution of

them. Luckily there is now more widespread appreciation of their place in nature, as discussed under "Economic Value", and fear of them is vanishing along with the old superstitions.

These animals have played an important part in the history of our earth. "Amphibians", whose name comes from two Greek words meaning "both kinds of life," represent an experiment at life both on land and in the water. So successful was their life on land that many groups of animals eventually became entirely terrestrial. Among these were the reptiles, and there was a time, a hundred million years ago, when reptiles dominated the world. In hundreds of shapes and sizes they filled every niche in Nature, but changing climate brought an end to the fierce Tyrannosaurus and the plodding reptile giants which nibbled vegetation.

In the modern world both reptiles and amphibians have reconciled themselves to roles which are not spectacular, but which are beneficial to man and significant in nature's scheme.

Amphibians

Most amphibians, although theoretically suited for land life, reside uneasily out of water. They seek out moist places which will allow them to respire through the skin as well as by lungs. The toad, of course, is an exception but even it, lays its eggs in water.

Amphibians differ from reptiles in several important ways. Their skin is smooth, not scaled. They do not have claws like reptiles. Their jelly-coated

eggs, layed in water, hatch into gilled larvae.

There are two groups of amphibians in Tennessee and both are common. Frogs and toads make up one of these groups. This includes true toads, tree frogs, true frogs, the spadefoot toad and the narrow-mouthed frog.

Salamanders are an almost equally common group. Some of these verge on being true land animals when they ma-

ture. Although they do not make particularly attractive pets, salamanders are fascinating subjects for study. They still pose some scientific enigmas and are the subjects of many laboratory experiments.

In Tennessee the group includes mud-puppies, hellbenders and sirens, as well as the variable collection of more commonly seen salamanders of springs, creeks and other moist places.



CRICKET, TREE, AND CHORUS

FROGS

OF TENNESSEE

By RALPH SINCLAIR

Congress is now in session. No, we don't mean the United States Congress, currently in session in Washington, D.C., but the literally thousands of congresses that are in session from the Mississippi to the Smokies. Every pond, lake, swamp, and even temporary ditches and pools have come to life with myriads of tiny chorus frogs. This is an important congress, for it is a "breeding congress", and as such will insure the perpetuation of the species. Males arrive first at this congress, and their calls attract other males and females. Here the eggs will be laid, tadpoles hatched, and another generation is on the way.

What are these frogs, and where do they come from?

The latter part worried the ancients. Of course we know now that they have been hibernating in the mud at the bottom of the pond.

There are three groups of this particular family in Tennessee. All have in common a rough granular skin on the belly, terminal toe discs, and males have discolored throats. This is the Hylidae or treefrog family. The ones with the more pronounced terminal discs are treefrogs or the genus *Hyla*. With less pronounced discs are the chorus frogs, genus *Pseudacris*; and the cricket frogs, genus *Acris*.

Practically all members of this unique family in Tennessee engage in these breeding congresses. Frogs from two or even three of the three groups may hold forth in the same pond. This combined effort often makes an ear-splitting din.

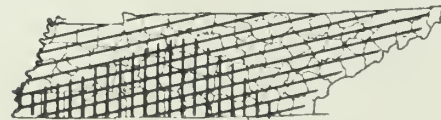
The males do the calling, and it is thought that the calls serve to attract distant males to the congress as well as the females.

All species of frogs have a distinct call, which may be learned by an observer rather easily. An excellent record for this purpose is put out by the Comstock Publishing Company in Ithaca, New York. It can often be found at your local library. Appropriately, it is called "Voices in the Night." Tree frogs, however, call in the daytime as well as at night. Right now the chorus frog can be heard calling in many damp places where water is standing in the countryside, and even in towns.

Cricket Frogs

The cricket frogs *Acris gryllus* are miniature tree frogs though they do not live in trees nor seldom climb. It gets its common name as well as its specific name from the similarity of its call to the cricket. Scarcely larger than a good sized cricket, it ranges from three-fifths to one and one-third inches in length. Coloration is extremely variable with all shades of green, gray, and brown. Note

the characteristic triangle behind the eyes, in the drawing. *Acris* can be told from its near relatives by the alternating light and dark bands on the back of the thighs. Cricket frogs are found around ponds, lakes, and streams; usually permanent. They stay fairly close to the water, not actually living in it. Usually one tremendous leap (as much as three feet) lands them in the water. The bullfrog, champion leaper, is a piker compared to this frog. Using a size-to-leap ratio the "cricket" far outstrips the bullfrog. Once in the water they seem in a hurry to be back out of it. Their call can be compared to the sound made by striking two marbles sharply together. Two subspecies of this frog are found in Tennessee; *Acris gryllus gryllus* and *Acris gryllus crepitans*. The former is essentially southern and shown on the



accompanying map by vertical lines. The latter is found statewide, except in the higher mountains of East Tennessee, and its range is shown by transverse lines. Both forms are quite similar and their ranges overlap.

CRICKET, TREE, AND
CHORUS FROGS (FAMILY HYLIDAE)



CRICKET FROG
Acris gryllus



GREEN TREE FROG
Hyla cinerea



BIRD-VOICED
TREE FROG
Hyla phaeocrypta



GRAY TREE FROG
Hyla versicolor



SPRING PEEPER
Hyla crucifer



MOUNTAIN CHORUS FROG
Psuedacris brachyphona



SQUIRREL TREE FROG
Hyla squirella

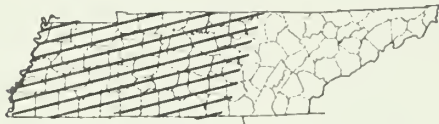


WESTERN CHORUS FROG
Psuedacris nigrita

Chorus Frogs

Chorus frogs (or *Pseudacris*) are slightly larger than the cricket frogs, and have four (sometimes five) rows of stripes, broken sometimes, or spots on the back and sides. There are four forms of chorus frogs found in Tennessee.

The western chorus frog, *Pseudacris nigrita triseriata*, is found in Western



and Middle Tennessee; the upland chorus frog, *Pseudacris nigrita feriarum*, in



East Tennessee and the mountain chorus frog, *Pseudacris brachyphona*, in the

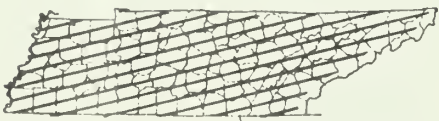


Cumberland Mountains and Plateau. The first two have five rows of stripes often broken or with spots. The latter has only four rows. Chorus frogs may be found around ponds and lakes in Spring during the breeding season. In Summer and Fall their calls are seldom or never heard, and they are rarely seen.

Tree Frogs

The genus *Hyla* or tree frogs (in the restricted sense) is represented in Tennessee by five forms. They are, on the average, somewhat larger than the other two groups, the green treefrog reaching a length of two and one-half inches. As the name implies, these frogs, excepting the spring peeper, spend a good part of their active time in trees.

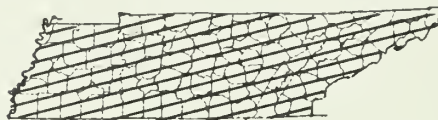
The spring peeper, *Hyla crucifer*, is the best known member of this family. It is smaller than our other *Hylas* ranging in size from three-fourths of an inch to one and one-fourth inch. This peeper is brown



with a dark mark resembling an X or St. Andrew's cross on its back. Another dark mark between the eyes is in the shape of a V. An observer in Florida noted that a chorus of these frogs is composed of many trios, with each trio having members singing in a different key. The member with the lowest note begins the calls, the second with a higher note calls, and finally the third with the highest note calls. They continue their chorus in this "call order", even after being disturbed. The same trios do this at least for the evening. They do not

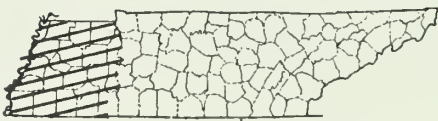
necessarily have to be close to each other. It has been suggested that cricket frogs have a "call order." Observations on this are much needed.

Sometimes confused with the spring peeper is the eastern gray treefrog, *Hyla v. versicolor*. It does not have the cruciform markings, and is more distinctly grayish or greenish rather than brown.



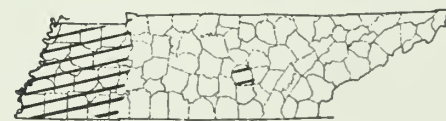
The gray treefrog sometimes has a suggestion of an X mark on its back, but this mark is not distinct and narrower than the peeper's.

One of the more puzzling treefrogs, at least in times past, to the biologist is the western birdvoiced treefrog, *Hyla phaeocrypta phaeocrypta*. It was first named this, then described as *avivoca*, meaning birdvoiced. Now it is back to *phaeocrypta*. All of these armchair nomenclatorial gymnastics have left this small edition of the gray treefrog unimpressed. It may be told from its larger relative by pale yellow markings on the back of its thighs rather than orange. It is restricted to the western part of the state,



whereas the gray is found statewide, even to above 2,500 feet altitude in the Smokies.

The squirrel treefrog, *Hyla squirella*, is a smaller treefrog ranging from seven-eighths to one and one-half inches in length. There are no records for it in Tennessee. It is found in the Jackson Purchase of Kentucky, in Mississippi, and other southeastern states. No doubt it will eventually be collected in West Tennessee. Easily confused with this frog is the green treefrog, *Hyla c. cinerea*. The former is smaller (seven-eighths to one and one-half inches), green or brown, and with an indistinct whitish line along the jaw and down each side of the body. The latter is considerably larger (one and one-half inch to two and one-half inch to two and one-half in length); green or brown, and with a sharply defined white line down the upper jaw and along the sides of the body. The green treefrog is the largest of the family in Tennessee. It is found



mainly in West Tennessee. Dr. Glenn Gentry, Chief of Fish Management in the State Game and Fish Commission, has also found it in Warren County.

Here is an opportunity for high school biology students, teachers, and others to add a real contribution to a knowledge of our Tennessee frogs by making studies on this group.

Famous Frogs

Frogs, unlike dogs, don't get named and immortalized in fact and fiction. After all, they can't wag their tails like Rin-Tin-Tin and Lassie. But frogs have played a significant role in history.

The galvanometer which electricians use is named after Luigi Galvani, who discovered electric current and always gave a frog much of the credit. In fact, it was his wife who first noticed that a frog's leg in a frying pan will jump when touched with a piece of metal, thus starting her husband off on a series of important experiments in the eighteenth century.

Probably the most famous individual is Mark Twain's celebrated jumping frog—but he said afterwards that the animal was entirely imaginary, though frog-jumping contests have at times been popular in this country.

Frogs usually make the headlines en masse rather than individually. Currently they are staging an invasion of England, following William the Conqueror's

route across the Channel from France. Things could be worse, for these tasty intruders are more desirable gastronomically than the skinny English species which they are rapidly replacing.

Ancient customs have strange ways of lingering with us. Take the case of France's emblem. In 500 A.D. Clovis thought so much of frogs that he had three placed on his coat of arms. Over the centuries artistic license and/or poor redrawing of the shield led, by 1200 A.D., to the simple and familiar fleur-de-lis.

And lest you think man foolish to magnify the importance of so lowly a creature, consider this fact. Scientists say that one of the chief reasons for the superiority of the human species is the thumb opposite the fingers. Any frog you pick up in a scummy pond has the same arrangement—and frogs had it millions of years before man appeared on the earth.

True Frogs of Tennessee

By RALPH SINCLAIR

Illustrations by WILL HON

Little introduction is needed for the Ranidae frog family. The bullfrog is perhaps the leading representative of this group often called the "true frogs". All of our "true frogs" belong to the genus *Rana*. In between the "true toads" or *Bufo*, and this group are other frog families called "toads" by some and "frogs", by others. In the unrestricted usage of the word all "toads" and "frogs" are known as frogs.

This group is probably the most important economically to man. The bullfrog, leopard frog, and green frog furnish much sport for frog hunters. Their legs bring close to two dollars a pound on the retail market. Besides furnishing meat for the table and sport, these frogs have aided man in his search for new knowledge in the field of biology and medicine.

The bullfrog is the standard subject for study and dissection in the laboratory for college freshmen. The smaller leopard frog furnishes its leg muscles for routine experiments in physiology, as well as its toe webbing for studies of blood movement under the microscope. The leopard frog has also been widely used in tests for pregnancy. The eggs of these frogs have proven invaluable for routine study and experimentation in the field of embryology.

Frogs of this genus are much used for fish bait. As yet no "frog farm" has ever been commercially successful. Practically all frogs sold commercially for food are harvested in the wild by "froggers". Farm ponds sometimes furnish many "eating size" frogs. It is easy to see that the big drawback to frog farming is the relatively slow growth rate.

In New York State it took a female bullfrog seven years to attain a size of six inches, and five years to reach five inches. On the average then it would take one year to put an inch of growth on a bullfrog. The growth rate probably is somewhat more rapid in the south. One year, sometimes two, is required for a bullfrog to change from a tadpole into a young frog. In the north it often takes three years for this frog to transform.

The bullfrog *Rana catesbeiana* is the largest member of this group and reaches a length of eight inches. Though celebrated as a jumper, it fails to live up to its reputation. A study of the jumping ability of this frog, the green frog, and the leopard frog reveal it to be last on

the list. Average leaps of the three in order named are as follows; twenty-six and three-fourth inches, thirty-two and one-half, and thirty-six and three-fourth. Ratio of leap to size was eight and nine-tenths, eleven and five-tenths, and twelve and nine-tenths. The tiny cricket frog made an average leap of thirty-three and three-fourths inches with the ratio of thirty-six and two-tenths.

No frog in Tennessee can rival the bullfrog when it comes to eating. This giant with a giant's appetite will eat anything that moves, and that it can get in its mouth. As if to revenge itself of the toll on young frogs taken by snakes, it will eat snakes. Looking much like an old man wrestling with a long piece of spaghetti it seizes the head and rolls the rest of it into a "ball" with its two front feet. Even small birds have fallen prey to this frog. It is not likely to lose its title as the deepest (and loudest) bass voice in the frog family. The bullfrog is a native to the east, and ranges to the Great Plains.

It has been introduced in the far West. This introduction has been harmful inasmuch as several native West Coast frogs are reduced in population, and even one species has been feared exterminated due to the cannibalistic habits of this frog. It has been reported that the majority of the aquatic snakes of the Pacific Coast find its odors repugnant. Our eastern aquatic snakes are unaware of its repulsive odor evidently. A case such as this shows that it is wise to consider with much thought the wisdom of introducing exotics (or non-native species) into new areas.

The green frog *Rana clamitans* resembles the bullfrog, but it is smaller (two to four inches), and has dorso-lateral folds on each side. Both of these frogs are found statewide.

The leopard frog *Rana pipiens* and the pickerel frog *Rana palustris* are much alike in size (two to four and one-fourth inches) and pattern. The former has rounded spots on its back and the latter has "squarish" spots more or less arranged in rows. The pickerel also has an orange color on the concealed portions of its thighs and groin. Both are found statewide. The pickerel is less abundant, and is found near springs and along small mouth bass streams. This frog has a skin secretion that is highly poisonous if ingested by members of its own group or man.

The leopard frog is represented by the southern form *Rana pipiens sphenocapla* in the western half of the state (transverse lines on the map); and the north-



ern form *Rana pipiens pipiens* in the eastern half (vertical lines). The former has a white spot in the center of its tympanum (ear drum), the latter does not.

The eastern wood frog *Rana sylvatica sylvatica* is brown above with a distinctive brown patch on its "shoulder", just behind the eye and covering the tym-



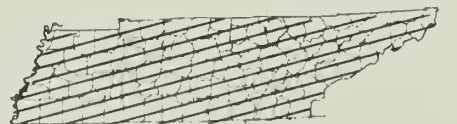
panum. It ranges in size from two and one-half to three and one-third inches.

The northern crayfish frog *Rana areolata circulosa* is the only Ranid in Tennessee that is not solitary. Breeding congresses begin as early as March. These congresses are held in low flooded land adjacent to their permanent habitat, crayfish holes. They can often be found by looking for a crayfish burrow lacking the "chimney", and with a smooth platform at one side of the lip. At night



the frogs sit on this smooth spot and catch insects which chance by. A limber stick with a small fish hook on the end can be probed into the hole to extricate them.

Last and least of all is the narrow-mouth frog *Gastrophryne carolinensis* which belongs to the family Microhylidae, and is this family's sole representative in Tennessee. It is from four-fifths to one and two-fifths inches in size. Because of its small size it is seldom seen. It breeds in congresses in the spring, and its call has been likened to the bleating of a sheep. It is found most abundantly during the breeding season. At other times it can be found beneath rocks and boards around ponds and in damp places.





BULLFROG
Rana catesbeiana



GREEN FROG
Rana clamitans



NARROW-MOUTHED FROG
Microhyla carolinensis



LEOPARD FROG
Rana pipiens



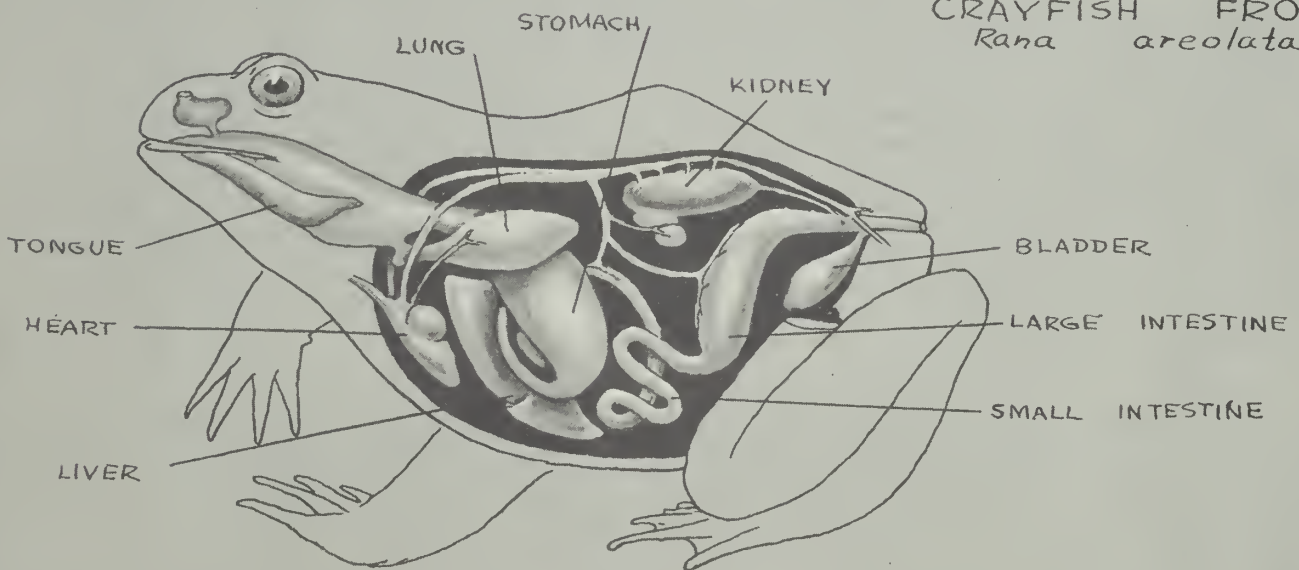
PICKEREL FROG
Rana palustris



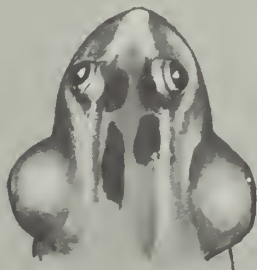
WOOD FROG
Rana sylvatica



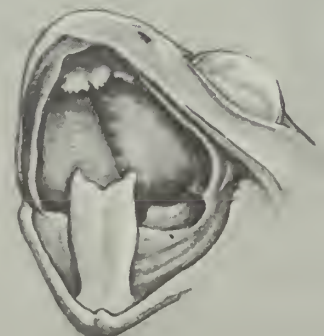
CRAYFISH FROG
Rana areolata



BULLFROG ANATOMY



MALE LEOPARD FROG SINGING.



MOUTH OF BULLFROG

Toads of Tennessee

By
WILL HON

As if the ugliness of the toad were not enough of a burden for the animal to bear, folklore has built up around it an awesome set of superstitions.

It is generally believed that handling toads causes warts. This is not true and it is difficult to see how such an idea can become so widespread when there is no evidence to support it. The explanation probably lies in the glandular excretion of the skin of toads which can cause irritation if it gets in the eyes or mouth. Dogs and cats often become violently sick from mouthing toads, so there is no doubt that this alkaloid, which is for the toad's defense, is quite toxic. However, it does not hurt the skin and does not produce warts.

Even more obscure is the basis of the belief that there is a "precious jewel" in its head. This ancient superstition taught that the jewel could be worn as a talisman to ward off evil, but it is not known today which part of the toad's head was used.

Stories often arise of toads being imprisoned for years in rocks, concrete, or tree trunks and reviving when released dozens of years later. These accounts are usually based on inaccurate and incomplete observations. The truth is that toads do burrow into the ground during dry periods and spadefoot toads

apparently spend most of their adult lives buried beneath the surface. A few individuals have been known to remain buried for nearly two years under certain conditions. Stories which go beyond these facts have some other explanation and a little careful investigation will often turn up a logical reason why such things arise as newspaper accounts of live toads imprisoned in the cornerstones of buildings for half a century.

Then, of course, there are the rather commonplace accounts of rains of toads and frogs—and large areas covered with toads which have changed from tadpoles and hopped out of the water during a summer thundershower certainly give that appearance. Strong winds can pick up almost anything and drop it miles away, so the possibility of the thing actually happening leads to many accounts of its occurrence even when no wind has been present.

Pest control is the forte of toads, and they probably contribute substantially in ridding us of many harmful insects among cultivated plants. Examination of the stomachs of numbers of toads discloses that all but one per cent of the diet is made up of insects, spiders, sow bugs, snails, and earthworms. For this reason they have occasionally been taken

by man to new areas to aid in insect control.

The word "toad" is not too meaningful, for there is no sharp line between those animals we call "toads" and those we call "frogs". Frogs which live in drier areas and have warty skins, even though they are not closely related, are usually lumped together and referred to as toads in the popular vernacular.

Toads are plump and less streamlined than frogs. They move slower, jumping not nearly as well as most frogs. The average hop for a toad on a leisurely tour of a garden is less than six inches, but when really pressed one may cover nearly two feet in a single leap. This obviously is not in the same class with "Leaping Lena", the pride of South African frog fanciers, who averages over ten feet per leap on her better days.

Mass movements of toads are sometimes conspicuous, as when adults move toward breeding ponds. And, since many young often become transformed from tadpoles to adults at the same time, their movement away from their birthplace, usually at night or on cloudy days, may be spectacular. One observer reports standing by a gravel road and counting a hundred frogs a minute passing by him during the time he was there.



FOWLER'S TOAD
IN TYPICAL SINGING POSITION

EGGS OF TOADS

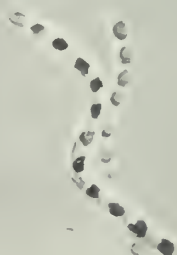
SPADEFOOT



AMERICAN



FOWLER'S



TOADS of TENNESSEE

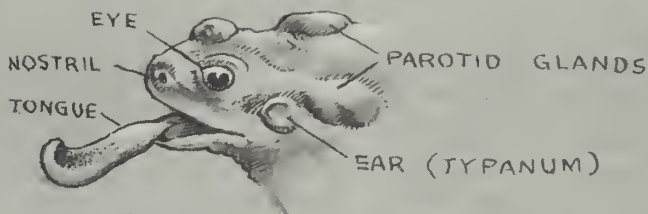


SPADEFEET TOAD

Scaphiopus holbrookii holbrookii



HIND FOOT OF SPADEFEET

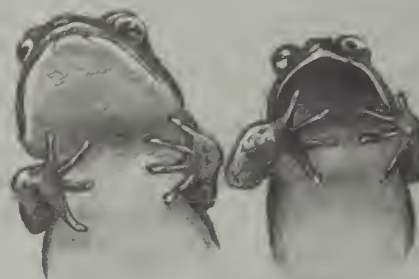


BUFO

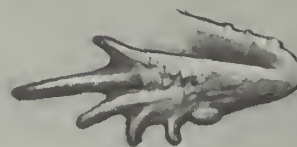


AMERICAN TOAD

Bufo terrestris americanus



FEMALE MALE
AMERICAN TOAD



HIND FOOT OF AMERICAN TOAD



FOWLER'S TOAD

Bufo woodhousii fowleri



FOWLER'S TOAD SINGING,
as seen by flashlight

The intelligence of toads is not great, but the fact that they use memory and acquired habits is demonstrated by experiments in mazes and in their "home" areas. Toads can be taught to follow a certain route through a maze and will retain that memory for some time. Toads moved by man out of their "home" areas often find their way back from many hundreds of feet away and have been known to come back a mile.

Toads generally hibernate in the fall, probably as a reaction to decreasing temperature. Since amphibians have no built-in heat regulating mechanism, they are very dependent on climatic conditions and must seek protected places during cold weather. Since this place must also be moist, toads find the ideal location by burrowing well beneath the surface. As the upper layers of soil become frozen in severe winters, they burrow even deeper. Bodily processes are drastically slowed down in hibernation, so that no food is required for long periods, breathing and heartbeat are much slower, and activity is almost eliminated. In general, toads are not active when the temperature is below 59°.

The sense organs of toads are hard to compare to those of human beings. In addition to eyes, ears, nose and tongue, amphibians have special glands and cells in the skin which are sensitive to equilibrium, vibration, light, heat, pain, hunger, and moisture. For example, the skin of a toad's foot is quite sensitive to moisture differences in the soil. The ears are well developed and voice plays an important part in reproduction. The eyes are fairly good, but smell is probably not very significant.

There are only three species of "toads" known to occur in Tennessee, representing two genera.

EASTERN SPADEFOOT TOAD (*Scahiopus holbrookii holbrookii*). The hind feet of these secretive toads have small, sharp "spades" which make it possible for them to dig backward into the soil amazingly fast. The detailed sketch on the facing page shows this inconspicuous tool. Unlike other toads, which can also dig, spadefoots actually live much of the year in subterranean burrows. The spadefoot is small, always under three inches. As can be seen in the painting, the skin is relatively smooth and the eyes are large. The vertical pupils are distinctive and indicate a nocturnal animal. It is found throughout Tennessee, moving out of its underground quarters when the temperature rises above 55 or 60 degrees to lay its eggs, almost always choosing a warm thundershower as the time for emerging. Eggs may be laid at any time during the summer months that these conditions prevail.

So nocturnal is the spadefoot that few Tennesseans have ever examined one,

though many hear its distinctive hoarse call, which has been compared to that of a young crow and an irritable human baby. A real congress of spadefoots at a breeding pool formed by summer showers can be impressive.

AMERICAN TOAD (*Bufo terrestris americanus*) The American toad and Fowler's toad are so similar in appearance that a rather careful examination must be made. As shown in the illustrations the American has large warts, the Fowler's more and smaller warts. The easiest check of this is to look at the dark spots on the back. The former has usually only one wart in each, whereas the latter has several. Fowler's toad is also smaller and more greenish, and normally has a decided light streak down the center of the back. As indicated in the sketches, the throat is different in the sexes of the American toad, that of the male being dark and leathery.

Eggs are laid in early March in the average Tennessee situation and, after a rapid incubation period, are transformed into toads in a little less than two months.

The song of the American toad is a high trill of nearly half a minute, as compared to the low trill of the Fowler's toad which lasts only a few seconds.

FOWLER'S TOAD (*Bufo woodhousii fowleri*). Often known as the "garden toad" this toad can, like the American toad, be found throughout the state. However, it may not be in the higher mountains and the American toad is uncommon in the low-lands of West Tennessee. Therefore, Fowler's toad has a western emphasis in distribution and the American toad a western one. In Middle Tennessee they are both very common.

Fowler's toad waits for warmer weather, beginning to sing at about 75° and laying its eggs a month or so later (April) than the American toad. As in the American toad, the throat of the male Fowler's toad is darker than that of the female. Also true of both species is the fact that the males average noticeably smaller.

Fowler's toad will sometimes feign death when handled and may even remain rigid when laid down on its back.

The development of amphibian eggs is very variable in time elapsed, since it depends on water temperature. While the minimum hatching time of toad eggs is under two days, the process may be stretched out for more than two weeks without any harm to the tadpoles which develop. As shown in the lifeseize strands and the enlarged detailed sketches, the eggs are surrounded by a protective mass of transparent jelly. This jelly increases in volume as it remains in the water and absorbs more liquid. Egg development and tadpoles will be discussed in a later article on frogs.

SALAMANDERS

Salamanders have the same general appearance as lizards, with tails and well-developed legs. They are very different, however, in a multitude of ways, for lizards are closely related to snakes and salamanders to frogs.

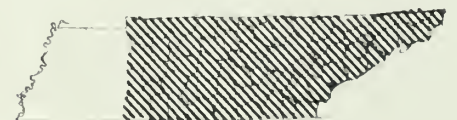
Salamanders are creatures of moist situations, some entirely aquatic. They have no scales on their skin. They do not have claws on their toes, which are only four in number on the front feet as compared to five for lizards. Young salamanders have gills for breathing and many retain these into adulthood. Many others, however, lose their gills, move on to the land and can survive in moist crannies even in dry areas. It is breathing which requires that the skin be moist, for oxygen is taken in through the wet, slimy surface.

Tennessee has a fine, varied assortment of salamanders, with the Smoky mountains offering one of America's most interesting and fruitful areas of search. The developmental stages through which salamanders go and the color variations within some species often make identification difficult. Therefore the illustrations, particularly since they are black and white only, are not diagnostic. Many of the rarer salamanders are not pictured.

Since salamanders are not well known to the general public, many do not have common names, others are confused. Therefore scientific names offer the surest way to "pin a label" on a salamander. Unless you are interested in a serious taxonomic study of salamanders, take them alive, keep them only as long as you need them, and return them to their habitat. Actually the most fascinating way to study any animal is under natural conditions. Study its habits and its life history. This information is only scantily known for many species.

Information on distribution is taken from Dr. Glen Gentry's checklist, originally published in the Journal of the Tennessee Academy of Science, April, 1955:

WATER DOG: HELLBENDER (*Cryptobranchus alleganiensis*) 16 to 20 inches. The water dog, common in the Cumberland and Tennessee River systems, is broad and short, with wrinkled skin. They prefer the small tributaries



with rocky bottoms and are seldom found in lakes. They are quite harmless, NOT poisonous as some fishermen think.

MUDPUPPY; WATER DOG (*Necturus maculosus*) (12 inches) *Necturus*, so well known as a subject for laboratory dissection in college zoology, is similar to the hellbender. However, it has bushy red gills throughout its life. Its distribution is the reverse of the hellbender, for



it is common in the large rivers and impoundments but rare in smaller tributaries.

SIREN (*Siren intermedia*) 10 inches. Sirens are typical of southern swamps, ponds and ditches but they are seldom seen except when water is drained for construction work. Having prominent gills and only one pair of legs, it is distinctive in appearance. In Tennessee it



is western in distribution.

JEFFERSON SALAMANDER (*Ambystoma jeffersonianum*) 6½ inches. This salamander is apparently quite rare in Tennessee. Records of its occurrence would be valuable. It is not illustrated here, but is similar in shape to the other members of the genus, has brown skin with pale blue markings. It is found in woods near streams and swamps. Reported in Hardeman County.

SPOTTED SALAMANDER (*Ambystoma maculatum*) 7 inches. In Tennessee the members of the Genus *Ambystoma* are called "ground puppies". This species is common in suitable habitats



everywhere but the sandy flats of West Tennessee. Black and yellow.

MARbled SALAMANDER (*Ambystoma opacum*) 4 inches. This small black and white salamander is more



common in West Tennessee than in the east. Young are mottled brown.

MOLE SALAMANDER (*Ambystoma talpoideum*) 3½ inches. This is a species seldom collected, and further specimens



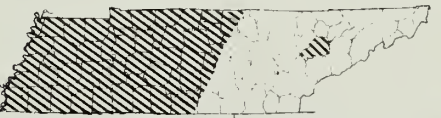
would be welcome. It is small, stout and flatheaded. The back is brown with small bluish spots clustered like lichens. The underside are bluish-gray.

TEXAS SALAMANDER (*Ambystoma texanum*) 5½ inches. Fairly common in West Tennessee, this salamander is sel-



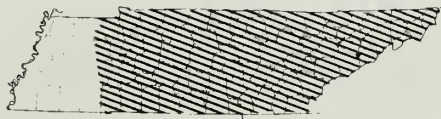
dom recognized, for it is rather nondescript. It is a blotched gray or brown, lighter beneath. Found under logs and rocks in a variety of wooded areas.

TIGER SALAMANDER (*Ambystoma tigrinum*) 8 inches. The tiger salamander is strikingly marked, black and yellow, and big. It is common in Middle



and West Tennessee. As an adult it is a burrowing animal and spends much of its life beneath the surface of the ground.

NEWT: SPRING LIZARD (*Diemictylus viridescens*) 3 inches. Newts are pretty, common, and interesting. Particularly is the larvae stage known as "red eft". This land form, red-orange with dark spots, remains away from the



pool of its birth for a year or more. It then returns to water to become a strictly aquatic creature in the form illustrated. If kept as pets they may be fed earthworms and larval insects. Of course the adults should be kept in an aquarium, red efts in a terrarium.

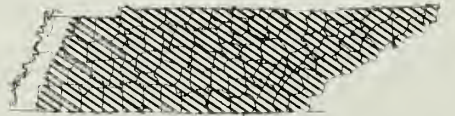
CONGO EEL: LAMPERS EEL (*Amphiuma means*) 20 to 40 inches. This is a salamander commonly mistaken for



the true eel, which is a fish and has long narrow fins and no legs. The legs of *Amphiuma* are very small and poorly developed.

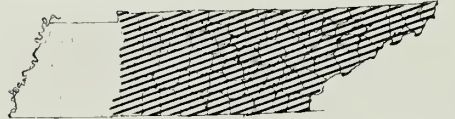
DUSKY SALAMANDERS: SPRING LIZARD (*Desmognathus fuscus*) 3½ inches. The spring lizard is found throughout Tennessee except high altitudes in the Smoky Mountains and in the Mississippi River bottoms. As the name implies they are dark and have mottled backs. They are at home in springs, where they live beneath rocks along the margin but do not swim about in the water. Thus, they are terrestrial and may be found in many other habi-

tats: along stream borders, under moss, and beneath the bark of rotten logs.



In the genus *Desmognathus* there are five other salamanders similar to this species in appearance in Tennessee. In the genus *Leuognathus* there are two similar species. All seven of these salamanders are typical of the higher altitudes of the Smokies and are found nowhere else in the state. Their identification is difficult and anyone interested should consult scientific publications. For the serious herpetologist this area offers fine opportunity for study and a chance to add to our knowledge.

RED-BACKED SALAMANDER (*Plethodon cinereus*) 3 inches. This is an eastern species of a large genus. Con-

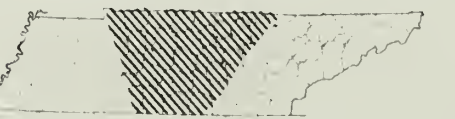


fusion can easily result from the fact that adults occur in two color phases and at intermediate stages between the two. The red-backed form, which is illustrated, is distinctive. However, the other phase is uniformly dark brown or gray above, mottled below. Both phases can be confused with the similar *Plethodon dorsalis*. The latter is not found in the Smokies, but is common from the foothills through Middle Tennessee.

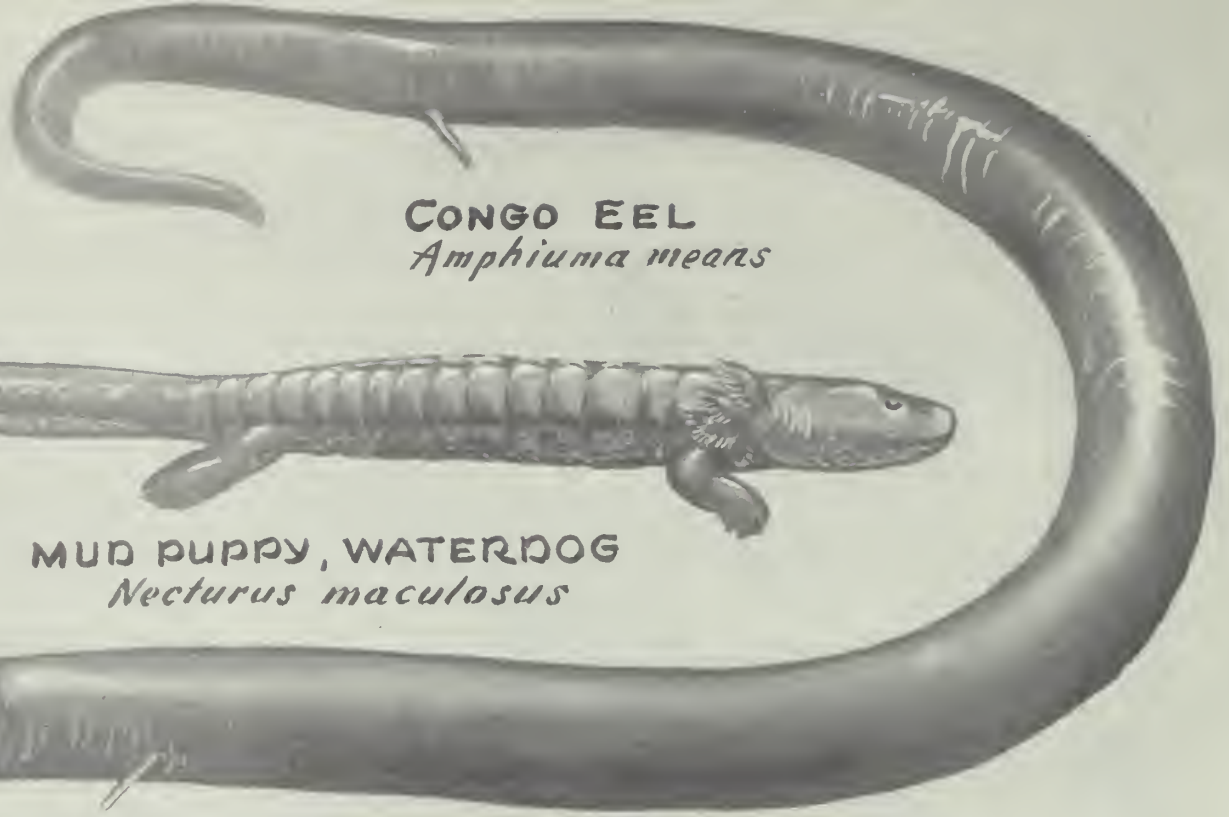
SLIMY SALAMANDERS (*Plethodon glutinosus*) 6 inches. This large salamander is one of the most widely distributed. It occurs throughout Tennessee. It is typical of wooded areas, found under rocks and logs. The skin is blue-black with light gray spots. In dry periods it may burrow well beneath the surface.

The genus *Plethodon*, like the genus *Desmognathus*, has a group of salamanders restricted to the moist slopes of the Smoky Mountains. Four such species have been identified, but their description is beyond the scope of this pamphlet.

FOUR-TOED SALAMANDER (*Hemidactylium scutatum*) 2½ inches. This small salamander has a limited distribution in the state, but occurs to some extent between the two segments of the Tennessee River . . . that is, in Middle

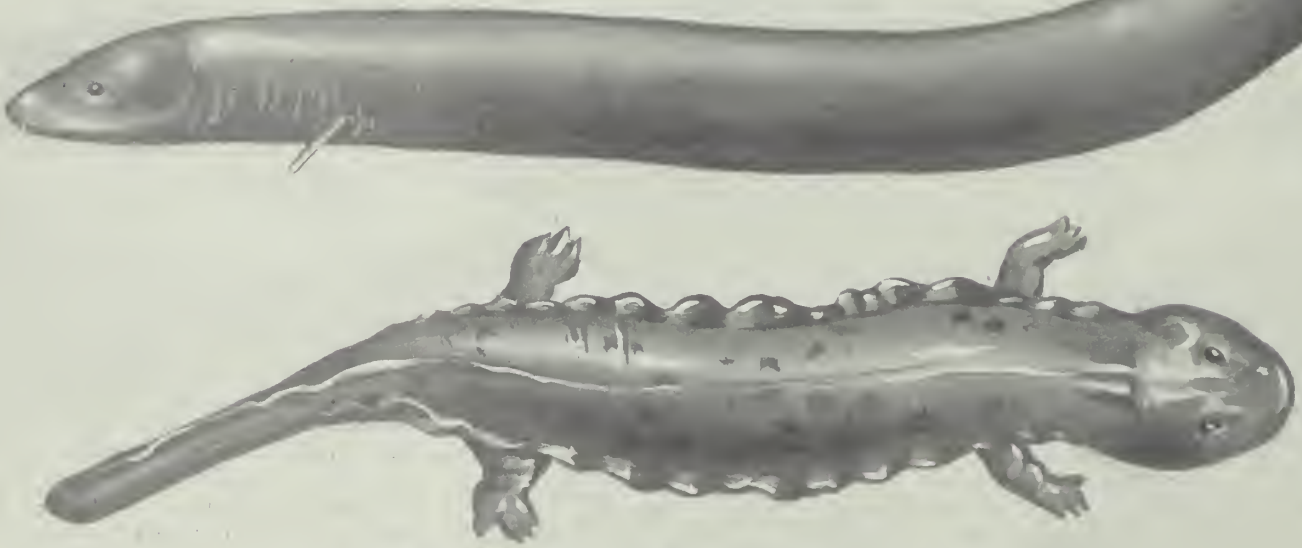


Tennessee and on the Plateau. It has four toes on both front and hind feet. It is red-brown above and the light belly is marked with dark spots.



CONGO EEL
Amphiuma means

MUD PUPPY, WATERDOG
Necturus maculosus



WATERDOG, HELLBENDER
Cryptobranchus alleganiensis



SIREN
Siren intermedia



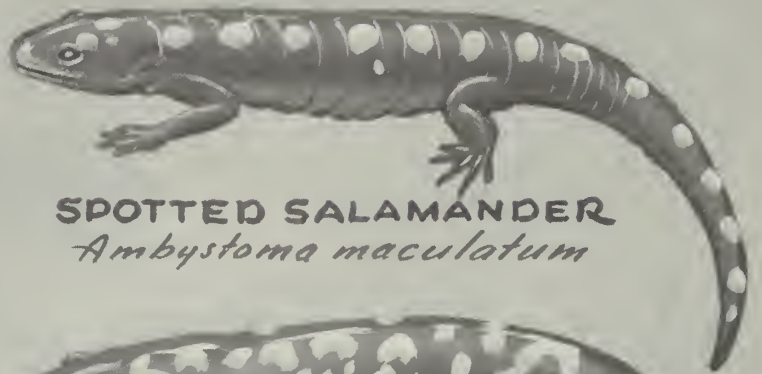
NEWT, SPRING LIZARD
Diemictylus viridescens



DUSKY SALAMANDER
Desmognathus fuscus



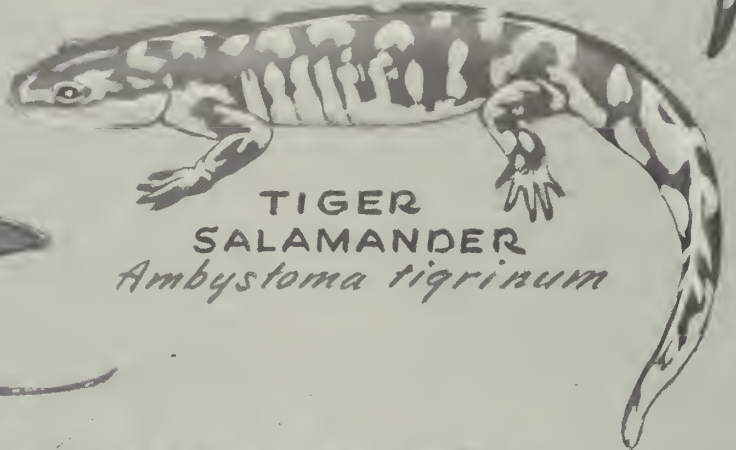
RED SALAMANDER
Pseudotriton ruber



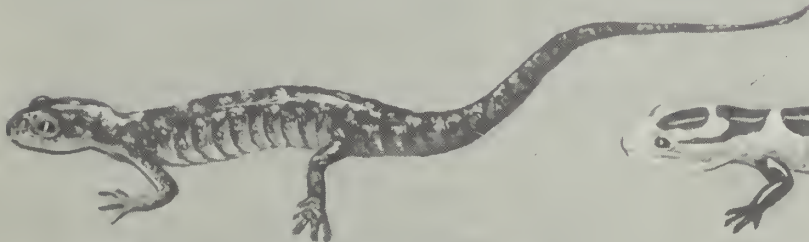
SPOTTED SALAMANDER
Ambystoma maculatum



PURPLE SALAMANDER
Grinophilus porphyriticus



TIGER SALAMANDER
Ambystoma tigrinum



GREEN SALAMANDER
Aneides aeneus



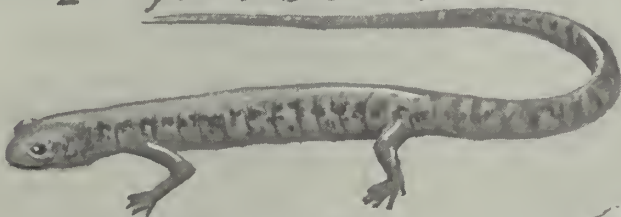
MARBLED SALAMANDER
Ambystoma opacum



TWO-LINED SALAMANDER
Eurycea bislineata



TEXAS SALAMANDER
Ambystoma texanum



LONG-TAILED SALAMANDER
Eurycea longicauda



RED-BACKED SALAMANDER
Plethodon cinereus



CAVE SALAMANDER
Eurycea lucifuga



SLIMY SALAMANDER
Plethodon glutinosus

PURPLE SALAMANDER (*Gyrinophilus porphyriticus*) 5 inches. The young of this species and the next are bright red with dark spots. The adults are drabber. This one is reddish-brown. It is fairly common on the Cumberland Pla-



teau and has been found westward to Hamblen and Johnson counties.

This genus also includes two species found only in the Smokies.

RED SALAMANDER (*Pseudotriton ruber* and *P. montanum*) 5 inches. The adult red salamander is dark brown above, lighter below, and heavily mottled with very dark spots. These two species each have a subspecies which is



fairly common, but there are also three other forms found only in the Smoky mountains.

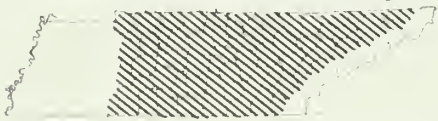
GREEN SALAMANDER (*Aneides aeneus*) 4 inches. The back is blackish with a camouflaging pattern of light green which resembles little patches of lichens.

The green salamander has a distribution which closely follows its chosen habitat: crevices in cliffs of Pennsyl-



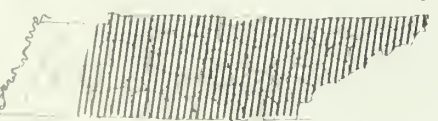
vania sandstone. In Tennessee this limits the salamander to the Cumberland Plateau.

TWO-LINED SALAMANDER (*Eurycea bislineata*) 3 inches. As the name implies, the yellowish color is marked with two distinct lines of dark spots.



There are actually four subspecies involved and one or other of them may be found in any part of the state. However, the species is uncommon in West Tennessee.

LONG-TAILED SALAMANDER (*Eurycea longicauda*) 3 inches. Although the species is state-wide, there are actually



three subspecies in Tennessee. The color is yellowish orange, generously sprinkled with dark spots. Gentry has noted that most specimens were found under un-

decayed wood, whereas most terrestrial salamanders prefer decaying timber.

CAVE SALAMANDER (*Eurycea lucifuga*) 5 inches. Limestone rock formations are the ideal locale for this species and determines its distribution. It is



particularly common where caves are found. A careful search of most limestone caves will reveal a few specimens.

Lizards

By RALPH SINCLAIR

There is a wide gap between the King's Palace and a dusty roadside, a gap which few beggars can cross. Yet the ubiquitous lizard is found in both and virtually all places between. The wise man Solomon mentions in Proverbs that the lizard takes hold and is found even in palaces. Such a place is a bit pretentious even for a lizard, but regardless, lizards many times take up abode near man and even in his home. Needless to say, housewives as well as kings do not welcome the intrusion.

Lizards are found in large cities, in vacant lots, gardens, railroad rights-of-way, and many other places including of course woods and fields. They are rather well fitted for their environment even if at first it seems out of place for them. The brick wall of a modern home substitutes very well for a limestone cliff. In the tropics lizards are quite often found in homes. Most of these are the nocturnal Geckos which have pads on their feet enabling them to cling to smooth surfaces, even upside down. Geckos are native to parts of the Southwest and Florida. Tropical Geckos have accidentally found their way into this country and have become well established in a few coastal cities in the South.

Tennessee has only ten lizard species whereas California has over fifty.

Contrary to popular belief none of our native lizards are poisonous. In fact the only poisonous lizard found in this country is the Gila Monster which is found in the deserts of the Southwest.

Tennessee lizards are mostly terrestrial. Some spend much of their time in trees, and some like the Ground Skink, as its name implies, lives in the leaf litter of the forest floor. Although nearly all lizards are good swimmers none in the United States are aquatic. An occasional lizard is caught by a bass when taking to water. Other enemies, besides man, include cats, hawks, owls, snakes, and even larger lizards.

Their best defense against enemies is their blending coloration and speed and agility. The "Chameleon", hereafter called Anole, can change in color from brown to green. However, the Anole does not always match a brown or green background. Other factors such as temperature and excitement enter into color changes. Probably the most interesting defense mechanism is "tail dropping." Most lizards are able to sever the tail voluntarily or at least to part with it when the tail is touched. The break occurs at the middle of the vertebra and a sphincter automatically cuts off flow of blood from the caudal artery. The tail bounds and wiggles about as if "alive." While the enemy is attracted to the tail the owner has escaped. Many a lizard owes its long life to this ability to distract an enemy. Curiously enough some lizards have been known to drop their own tail and then eat it. The tail soon begins to regenerate, though it will not grow to be as long nor will it be covered with the same size and color scales as the original.

Generally speaking our lizards are insectivorous. Some western lizards eat flowers as well as other vegetable matter. Small insects and millipedes are chewed momentarily and then swallowed entirely. If the prey is too large to be swallowed entirely, the lizard may shake it vigorously or tear it into small pieces. Because of the tremendous number of insects eaten, lizards should be considered beneficial.

Lizards accept food readily in captivity, and are hardy. They do need a variety of insect food, an artificial light source, water, and a place to hide. Some dry out easily, and for this reason a damp hiding place should be provided. The entire cage should not be damp.

All Tennessee lizards lay eggs. The Horned Lizard bears its young alive. Several lizards stay with their eggs coiling about them and even keeping them together. The eggs are usually laid under logs or stones. Most lay one clutch of eggs a year during the summer, and they hatch out by fall.

THE IGUANA FAMILY

The Anole (*Anolis carolinensis*) is found only in the southern part of the



State. This is the lizard sold in pet shops and carnivals by the name "Chameleon." Actually the Anole is not a true Chameleon. The true Chameleon is found in parts of the Old World. The latter is a peculiar beast. Besides changing color it has a prehensile tail which it wraps around its perch. It also can rotate each

eyeball independently of the other. The foot is a grasping organ and shaped somewhat like a pair of pliers divided into two toes on one side and three on the other. Captive Anoles should be given a varied diet of insects such as crickets, mealworms, and flies. Water should be sprinkled on plants in the cage. Anoles should not be given a diet of sugar and water.

The Fence Swift (*Sceleporus undulatus hyacinthinus*) is found in all parts of the state. It is easily identified by the



rough scales covering it, and belongs to a group of lizards called rough-scaled lizards. Fence Swifts are by no means confined to rail fences, but are found on trees and stone walls as well as on the ground. They are found in wooded areas and also in open situations. No other Tennessee lizards have such pronounced sexual dimorphism (males and females colored differently). Both are brown or gray above, but the male has intense blue and black markings below. The female is white underneath with small black flecks. During the mating season the male stakes out a particular territory. Upon the approach of another male he inflates himself and raises one side to show the blue color. The males are quite aggressive fighting with one another when one comes into the others territory. When the male's color is painted over to resemble a female other males accept it as a female.

The Horned Lizard (*Phrynosoma cornutum*) is not native to Tennessee, but has been reported from scattered localities. This is to be expected due to the number imported with accidental or deliberate releases. It is a matter of conjecture whether any could adapt to our climate. The release of exotic (not native) animals is to be discouraged. Horned lizards are generally called "Horned Toads," a name which is quite misleading. They will do well in captivity if provided with water, an artificial light source, and a varied insect diet. Despite popular belief and news stories they cannot remain sealed in concrete for years. Like other reptiles they must have food, exercise, sunshine, and water to sustain them. Horned lizards can forcibly eject a small stream of blood from the eye.

THE SKINK FAMILY

The skinks are the largest group (species wise) of lizards found within the State. This group may be distinguished from all others by the presence of absolutely smooth, polished scales; not granular or rough as in the other

legged-lizards of Tennessee.

The Ground Lizard (*Scincella laterale*) is found state-wide in a variety of habitats, generally in leaf litter on the



forest floor. It is a small (under 4 inches) brown lizard which rarely comes to the attention of any but a person familiar with their habits. They are sometimes found under stones, but are best found by walking carefully through the woods listening intently. When startled from cover they make a rustling sound through the leaf litter. It is surprising sometimes to hear the noise that one of these diminutive lizards can make. If the eye is sharp and the hand quick, they may be easily located and caught. This lizard has been found active in December, January, and early March.

As with most other lizards the Ground Skink makes an attractive terrarium animal. It accepts food quickly (small insects, such as young grasshoppers). A distinguishing feature of this lizard is the presence of a large single window-like scale in the lower eyelid.

The Coal Skink (*Eumeces anthracinus*) is rare in Tennessee, being found so far only in the eastern mountainous

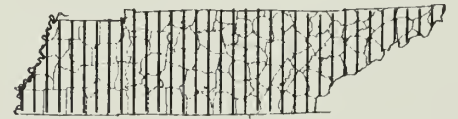


area. It should be found in parts of Middle Tennessee. Damp habitats seem to be preferred, and it readily takes to water to escape capture. It may be distinguished from other small skinks by the light mid-dorsal line which if present does not reach onto the head.

The Blue-tailed Skinks (*Eumeces fasciatus*, *laticeps*, and *inexpectatus*) are difficult to tell apart by the beginner. This difficulty arises due to the fact that all go through much the same color pattern from young to adult. The young are generally black above with five yellow stripes (the middle one forking on the head), and the tail is a bright blue. As they mature they lose the bright colors and the stripes are lost. The males have a bright orange color on the sides of their head. Since color is of little help in telling these three apart, scale characters must be relied upon.

The Broad-headed Skink (*Eumeces laticeps*) is the larger of the three reaching nearly a foot in length. It is considered to be more of a tree dweller than the other two. This skink is found on stone walls, trees, and even house walls. It is occasionally found with its

head sticking out of an old woodpecker hole. Because of its size and shape and color of the head, many believe it to be poisonous. In fact a common name for it by local people is the name "Scorpion."



Scorpions are poisonous, but they happen to be a close kin of spiders and mites. This is another example of a misleading name. The Broad-headed Skink can bite and clamp down with their strong jaws. The skin is rarely broken by the bite. The Blue-tailed Skinks are our most vicious lizards, if they could be termed that. They appear to be highly nervous and irritable, and bite vigorously when held. A finger so much as pointed at one elicits an open mouth ready to clamp down. Even the young resent being handled. In captivity they soon tame down, and will accept choice insect morsels from the hand.

The Five-lined Skink (*Eumeces fasciatus*) like the Broad-headed Skink is found state-wide. It does not reach the



size of the former. This skink is found upon logs, stones, and on the ground. It is not as arboreal as the preceding skink though it is also found on trees.

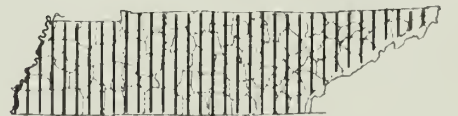
The Southeastern Five-lined Skink (*Eumeces inexpectatus*) has been found in East Tennessee, and will most likely be found in West Tennessee. It may be



distinguished from other five-lined skinks by the character of the scales on the underneath of the tail toward the base. These are not or scarcely wider than long.

THE RACERUNNER FAMILY

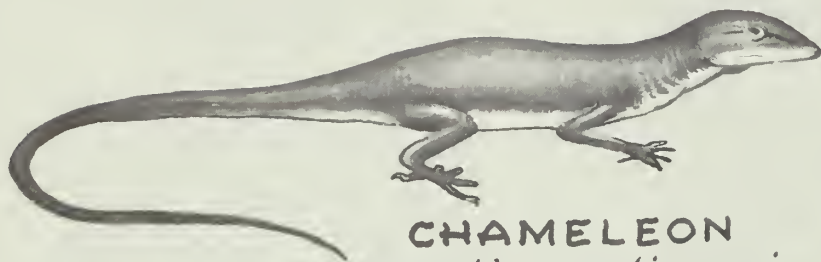
The Racerunner (*Cnemidophorus sexlineatus*) is found in many habitats from the river bottoms of West Tennessee to an altitude of 1200 feet in the Smoky Mountains. It seems to prefer a



well drained environment, and is quite common in the cedar glades of Middle Tennessee. It is an associate in the glades with the rear-fanged snake (*Tantilla coronata*). This association has also been noted in Alabama. Racerunners



GROUND LIZARD
Lygosoma laterale



CHAMELEON
Anolis carolinensis



FIVE-LINED SKINK
Eumeces fasciatus



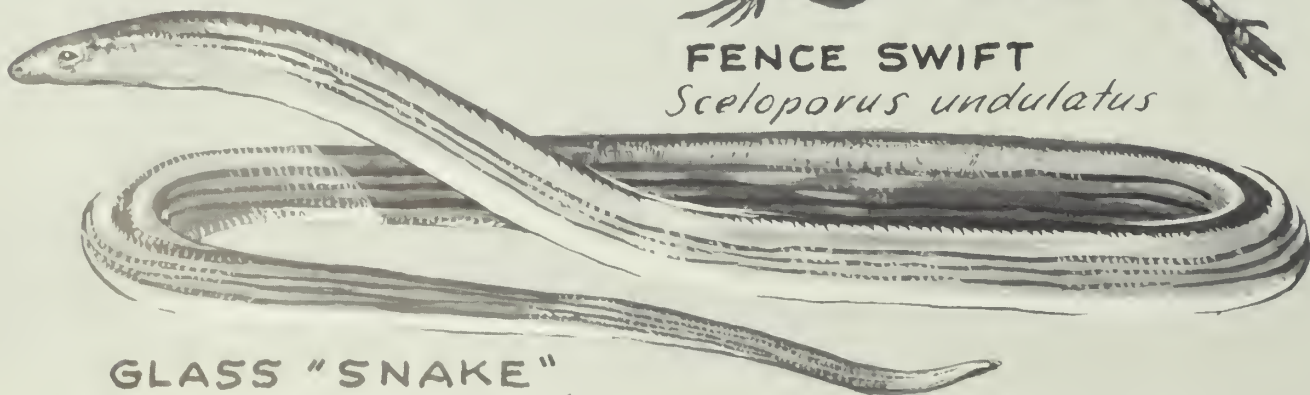
HORNED "TOAD"
Phrynosoma cornutum



SIX-LINED RACERUNNER
Cnemidophorus sexlineatus



FENCE SWIFT
Sceloporus undulatus

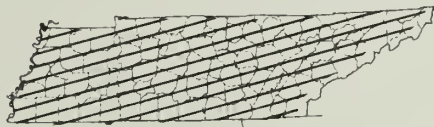


GLASS "SNAKE"
Ophisaurus ventralis

have been clocked at an unofficial speed of 18 m.p.h. As its scientific name implies it has six stripes. It may be easily distinguished from our other lizards which have stripes by its granular uniform dorsal scales and large ventral scales, which are many times the size of the dorsals.

THE LATERAL FOLD LIZARD FAMILY

The Glass Lizard (*Ophisaurus*) sometimes called "glass-snake" is actually a legless lizard. Upon close examination its movable eyelids and external ear opening reveal it to be a lizard and not a snake. It is fairly fragile, the long tail breaking off easily. Popular legend has it that "the joint-snake" upon being hit by a stick will break into pieces. Afterwards the pieces will seek each other out and join together again. As much as half of the lizard's length can be tail. Like all lizards it will regenerate a new tail, which may have something to do with the origin of this tale. Glass lizards are seldom found. This is probably due to their secretive nature and not to their being rare. They occasionally are found in the city in parks and yards. These lizards are peculiar in having a lateral fold down the side. Their close relatives belonging to the same family are found in the western United States. These are the alligator lizards. Alligator lizards have this same peculiar fold down each side. However, they have four legs. Glass lizards appear to be much like snakes. The illusion stops there for snakes have movable ribs which enable them to move their ventral plates (belly scales) in a well coordinated fashion. Glass lizards do not have this arrangement, and must depend on moving from side to side in a snake-like fashion. From this standpoint they are rather clumsy. They are mostly insectivorous but also eat small snakes and lizards. Two species of glass-lizards are found in the state, *ventralis* and *atten-*



uatus. Their range in this section is little known since several races have been considered as one in the past. *Ventralis* does not have dark stripes on the belly nor a distinctive mid-dorsal stripe. *Attenuatus* generally has both.

The natural history of any of these ten native lizards can be investigated with profit, for much remains to be recorded about their distribution, ecology, and habits.

Reptiles

Tennessee has three types of reptiles, all common but seldom seen by the average city dweller. Snakes are best known, yet few people have any idea that almost any yard will yield a few specimens if carefully searched. This is fortunate, for too many otherwise sensible folks grab a stick and begin beating frantically at the sight of the most harmless little snake. There is in man (and more particularly in women) a creepy horror of snakes which almost no amount of logic can overcome. Still there is progress, and as more and more children have an opportunity to study Nature first-hand in school, camps and through the many fine new elementary textbooks, each new generation will have less fear, more understanding.

There are poisonous snakes, in a ratio of about one in twenty in Tennessee. These are easily recognized after a little study. If caution and discretion are used in the field there is very slight danger

and the non-poisonous snakes can be studied to good advantage. They are interesting and some even make good pets.

Lizards make up a group very similar to snakes. There are no poisonous lizards in this state, in spite of the fact that the common skink is generally called "scorpion". The skink is a resident of dead trees, an avid insect hunter which could be considered dangerous only by a beetle or an ant. Tennessee has seven fairly common species of lizards, all beneficial to man.

Turtles are very different in appearance. Most of our turtles are aquatic, like amphibians. However, amphibians breathe through the skin, and, in the early stages of life, through gills. Turtles breathe only by lungs and therefore, in general, must come up for air more frequently. They also show their bond to the land by returning ashore to lay their eggs.

Turtles

In a world as fast-moving and chaotic as ours, it's pretty comforting to know that some things don't change much in 200 million years. Turtles have managed to maintain their own inimitable way of life for at least that long. The age of mighty dinosaurs has come—and gone—and still, these peculiar reptiles which drag their homes about with them thrive throughout the world.

Nature constructed the turtle from a remarkable set of blue prints. No other animal ever known to exist has been even similar to it. The skeleton has been transformed into a bony box, with the backbone and ribs firmly fused within. The top part, covered with horny scales, we call the carapace. The underside is the plastron, which is made in sections in some species, like the box turtle, so that the animal can draw in its head and legs and become an impregnable little fortress.

Turtles have no teeth in their horny beaks, but many tear and eat meat easily with these sharp hook-tipped tools. They do not have a keen sense of hearing or probably of smell or sight either, but an armor-plated gladiator can afford to be a little disdainful toward the problems which bother ordinary folks. Certainly turtles have no great intelligence, but their way of life requires but little—and after all, remember the 200 million years. If time is as true a test as proverb declares it be, turtles are champions.

Conservatism is their watchword. Passive resistance has proven so effective

in their defense, that few changes have occurred in compromise with the coming and going of the eras. The aquatic life of most of our turtles today is merely an invention mothered by necessity, for all reptiles are truly land animals. Through the eons they have become so divorced from the water that even the most aquatic turtles return to high ground to scratch a hole for their eggs.

Amphibians, on the other hand, however terrestrial they may be (the toad, for example) feel an inexorable pull back to the water when mating time stirs their cold blood. Turtles and toads, then, are just the reverse of each other in way of life and show how Nature tries many experiments and gives each group of animals a chance to explore every way of life.

Longevity as a group is not the only distinction of turtles. Individually they have the longest life span of any animal. Box turtles are known to have lived 138 years. The age of big sea turtles can only be guessed at. However, this does not mean that most of the specimens encountered in the field are reptilian Methuselahs. Certainly a covering of moss on a pond turtle's back does not mark it as an octagernarian. It has been proven that such an ancient looking cloak can be acquired in one year in some ponds. In Nature, few animals survive to realize their potential old age, for even armored creatures are subject to disease, surprise attack, and a thousand unsuspected enemies as they grow older and weaker.

ALLIGATOR SNAPPER
Macrochelys temmincki



SNAPPING TURTLE
Chelydra serpentina



SOFT-SHELLED TURTLES



SPINELESS
Trionyx muticus



SPINY
Trionyx ferox

Awkward Knights In Armor:

The Turtles of Tennessee

by WILL HON

ALLIGATOR SNAPPING TURTLE (*Macrochelys temmincki*)

Although this monster of our larger rivers is known in some areas as the loggerhead turtle and in others as the alligator snapper, it is recognized everywhere as a formidable critter. In fact there has been much exaggeration of its prowess. For example, it is often stated, even in printed matter, that it can bite through two-by-fours and broom-sticks with impunity. This is stretching to ridiculous lengths the fact that it can mangle a man's fingers in short order.

This is an animal so large and so well armored that when it becomes adult it has no enemies in the river—but man. Specimens of over two hundred pounds have been reported, but not from Tennessee. The largest verified records from this state are somewhat less than



one hundred pounds, and many of these whoppers have come from the western portion of the Tennessee River.

The common snapping turtle is similar when specimens of the same size are compared, but the loggerhead has a more massive head which cannot be drawn entirely into the shell. The knobs on the plates are more exaggerated than in the common snapper, though in old specimens they become less so. The alligator snapper has large plates covering the head, unlike the common snapper.

One of the strangest adaptations among turtles is the bright red ribbon-like tongue of this species. With its body motionless and its mouth wide open, the alligator snapper sets the tongue into serpentine motion and offers an "earthworm" lure to passing fish. This ruse must work consistently, for the diet is also entirely fish.

COMMON SNAPPING TURTLE (*Chelydra serpentina*)

This turtle cannot match an adult alligator snapper in size, but a fifty pound, or even a fifteen pound, specimen has a wicked enough temper and a sharp enough beak to warrant cautious handling. At Reelfoot Lake and in many other sections snappers are taken for food, being nearly as much of a delicacy

as the diamond back terrapin of coastal areas.

The common snapper can be distinguished from its larger relative, the alligator snapper, by the soft skin on top of the head, the plates on the back which are rough but not prominently knobbed, and the row of high, dinosaur-like plates on the upper edge of the tail.

Snappers have small plastrons, a fact which makes movement easier but offers less protection. However, they are easily able to take care of themselves against any enemies they may encounter except a man wanting turtle soup. A fair sized industry is dependent on the canning of turtle soup made from this species. In addition the eggs are edible when fried (but will not solidify when boiled).

Except in the higher mountains, the common snapper occupies most streams and ponds throughout the state. In June, the female crawls from the water and prepares a hole in sand or dirt about six inches deep. Here she deposits two to three dozen round, white eggs and covers them. After ninety days the young break out of their shell by using a horny "tooth" on the tip of their beak.

The food is varied, first choice probably being live fish and other animals. However, carrion and some plants are taken. The snapper has been accused of doing serious damage to game fish. What little research has been done so far indicates that this cannot be true to any appreciable extent under ordinary circumstances. Though snappers can be pests around fish-rearing ponds, they usually eat only a small percentage of game fishes and help by eating a much greater number of non-game species.

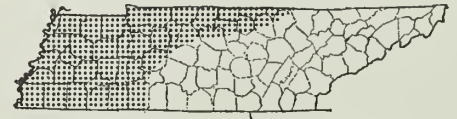
SMOOTH SOFT-SHELLED TURTLE (*Trionyx muticus*)

The shells of this and the next species are leathery—not really soft throughout, but soft enough at the edges to be bent easily with the fingers. The smooth soft-shell can be told from the spiny by looking at the front edge of the carapace. In the latter, a row of small but distinct projections give a toothed appearance, while in the former, the border is smooth.

In adults the shell is uniformly brown above, but immature specimens are flecked with black and have a yellowish margin around the back half of the carapace. The maximum size is about eleven inches long (shell only).

The tail seems to be the only safe handle for holding soft-shelled turtles for they are as vicious as snappers. The snakelike neck moves quickly, the jaws are powerful, and the beak is sharp.

Rivers and streams are the preferred home of this species, which is seldom seen but should occur throughout the



western portions of the Tennessee and Cumberland River basins.

The diet is mostly animal. They are reputed to swim well enough to catch even the wariest of fish; they also add insects and worms, crustaceans and mollusks, frogs and roots to their variable menu.

Eggs are laid quite close to water, in contrast to the snapper which may go half a mile inland. Ten to thirty eggs are a clutch, and hatch in about ten weeks.

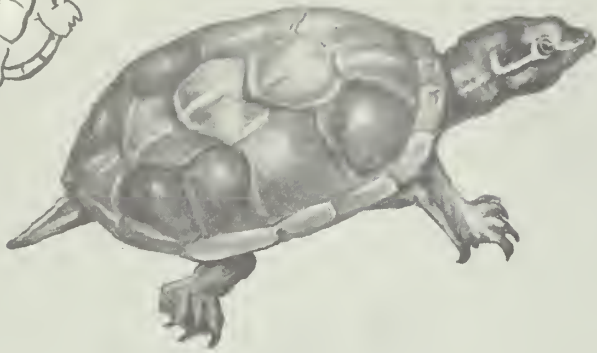
SPINY SOFT-SHELLED TURTLE (*Trionyx ferox*)

This species, the more common of the soft-shelled turtle is found throughout the state. Like the preceding, it has an excellent flavor and is therefore taken for food. The extent to which it is used is limited by the difficulty of finding and capturing it.

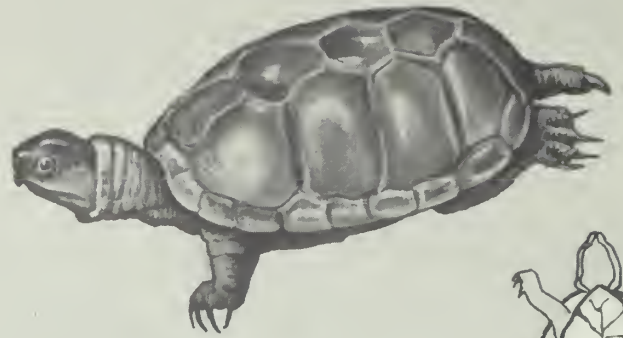
The adult, with its toothed front edge of the carapace, is solid brown; however, immatures carry the rings shown in the drawing until they are quite large. Sexual maturity is reached at about ten inches, and of course adults grow much larger, the maximum being around fifteen inches.

The spiny soft-shelled turtle is partial to rivers and the larger streams. It is rarely encountered out of sight of water, though it moves easily and rapidly on land. Activity may be expected from March until early winter, when hibernation begins. Unlike snapping turtles which dig deeply into muskrat dens or similar holes, soft-shelled turtles hibernate under a thin layer of mud or sand in much the same manner that they spend many of their summer days, only in deeper water. Soft-shells like to bask for hours in the summer sun.

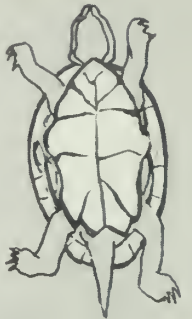
Eggs are laid in June, within sight of the water, numbering one or two dozen,



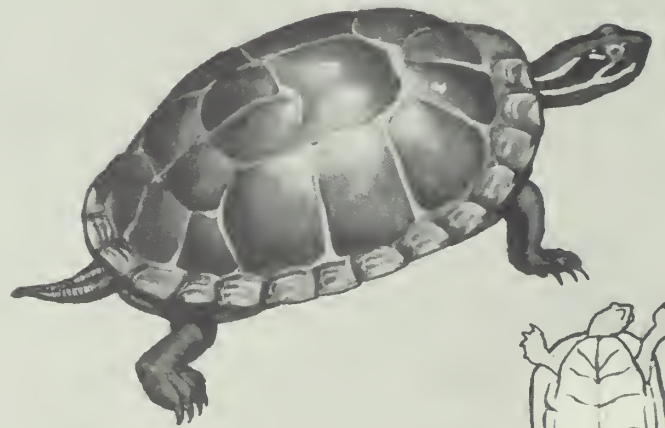
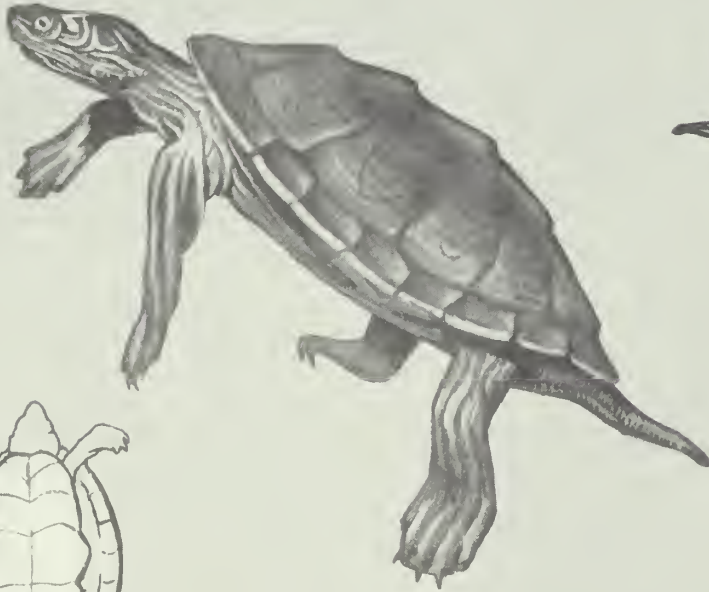
MUSK TURTLE
Sternotherus odoratus



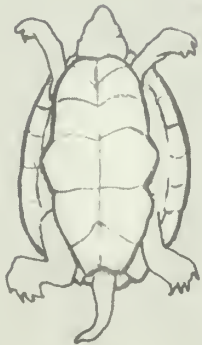
MUD TURTLE
Kinosternon subrubrum



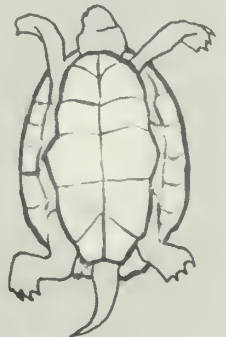
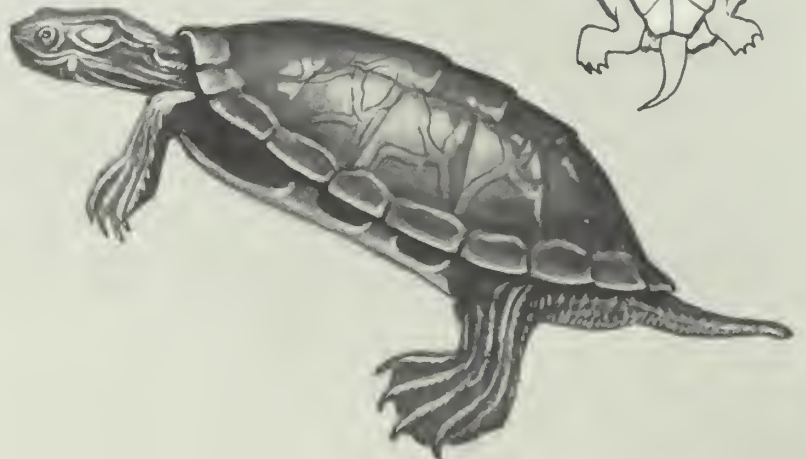
FALSE MAP TURTLE
Graptemys pseudogeographica



PAINTED TURTLE
Chrysemys picta



MAP TURTLE
Graptemys geographica



TOPS of HEADS



FALSE MAP and MAP

and hatch in the fall, though some nests may not be hatched until the following spring.

Crayfish are a staple of the diet, but a number of other animals as well as fruits are taken when available.

MUSK TURTLE

(*Sternotherus odoratus*)

Another aquatic turtle, but built on much less heroic proportions than the four preceding species, the musk turtle is common throughout Tennessee in sluggish streams and backwaters. The shell is only about four inches long, the carapace smooth, brown, and high-arched; and two distinctive yellow marks (see illustration) border the head and neck.

The name is no misnomer, for the glands at the base of the legs emit a penetrating musk odor. That is not the only way in which it is unpleasant, for its disposition is as nasty as that of a snapping or soft-shelled turtle. It moves its neck slowly, as it does in capturing prey, but then snaps viciously in spite of its small size.

The musk turtle is a poor swimmer, usually crawling along the muddy bottoms which it matches so well in color. Consequently, its food is mostly worms, aquatic insect larvae, snails, and crayfish. This turtle is almost never seen up sunning itself in exposed positions.

Only three to five eggs are laid in early summer in a hole the female digs near a log or stump. The eggs are a little over an inch long and half that thick at the center. The young hatch in less than ninety days and are immediately able to fend for themselves.

Musk turtles leave hibernation in the mud in March and are active by either day or night. Now and then they will take the hook of a fisherman and thus be brought up to human view.

MUD TURTLE

(*Kinosternum subrubrum*)

In size and appearance this turtle is much like the musk turtle, but occupies forest pools and old ponds rather than streams. The simplest way to tell them apart is by the plastron. In the musk, the front pair of plates doesn't come within a quarter of an inch of the hinge, whereas, in the mud, the rear edge of this pair touches the hinges (or very nearly so).

The musk and mud turtles have their plastron hinged in two places, making front and rear flaps which can be partially closed against the edges of the carapace. They are therefore known as "box turtles", though the species most commonly known as box turtle or terrapin is the land turtle discussed later (*Terrapene carolina*).

Like the musk turtle, the mud turtle is called "stinkpot" in some areas, due to

the disagreeable odor given off by its musk glands. The diet and manner of feeding are also similar to that species, but the mud is not so addicted to water. It often basks for long periods in the sun and may be found on pond banks with some frequency.

Hibernation is in a burrow near water or a marshy area and ends about March in this climate. Like other turtles it comes from its winter sleep a pretty sad-looking specimen . . . emaciated, mud-coated, and grouchy. Ordinarily, however, a mud turtle has a relatively sunny disposition and makes an interesting pet. It is fairly common throughout the state.

PAINTED TURTLE

(*Chrysemys picta*)

This is a beautiful turtle, with its dark olive carapace bordered in red crescents above and irregular markings below. In East Tennessee specimens these markings will be blood-red and the plastron bright yellow, but in the West Tennessee subspecies these colors are less striking, becoming brown and buff.

Sun-loving turtles, they may often be seen, particularly in the summer, up on floating logs or stumps. Their smooth shells glistening in the sun, they seem frozen in position with their heads raised. As a person draws nearer they slide one or two at a time into the water and swim a few yards away to watch with only the tops of their heads above the surface. Thus they are easy to see but difficult to capture. This is unfortunate, for they make excellent and attractive pets.

Painted turtles are found throughout Tennessee in both ponds and streams. They occasionally move about on land, especially in the spring, but their diet is strictly aquatic and the ease with which they swim marks them as water inhabitants. Under water they will eat almost anything from algae to mollusks (including carrion), but seem unable to swallow out of water—a good point to remember when keeping them as pets.

The plastron has no hinges as the preceding two species do. It is not likely to be confused with other turtles because of its red markings, the yellow pattern on the head (see illustration), and the ridgeless carapace with a smooth rear edge. The map turtles and sliders to be discussed later have a keel down the center of the carapace and a toothed back border.

Egg-laying occurs in June in Tennessee within sight of the water, and the the process of nest-building which the female goes through is typical of all turtles, including even the big oceanic species. The hole is dug entirely with the hind feet, which are larger than the

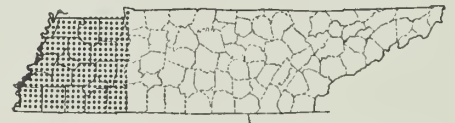
front and form a sizeable scoop. In soft soil the feet alternately push the dirt back into a pile on each side and the rear end of the turtle gradually drops into the deepening hole. The female does not look back at her work, even when she lays four to eight pinkish eggs and pushes them down into the recess, which has become six or eight inches deep and flask-shaped. This species and a number of others use water from the bladder to soften the dirt for digging and to make it pack down better when the female pulls the two piles of loose dirt over the eggs. In hard-packed dirt the digging and covering may take two hours, but usually requires less time.

Eggs normally hatch in about two and a half months, but in cold climates often hold over until spring. This may be true in East Tennessee, and there are also cases in which late-hatching turtles remain in the nest in hibernation until spring. Adult painted turtles hibernate in mud at the bottom of their home pond or stream in October or November and remain until March or April.

FALSE MAP TURTLE

(*Graptemys pseudogeographica*)

Only in West Tennessee is this turtle common, but it has been found even in the eastern part of the state. Where



found, they are often locally abundant, but they are more timid even than painted turtles. They sun themselves in the same manner but disappear at the least disturbance. Their meat is edible and they make good pets, though of course they are not easily captured.

This species can be distinguished from the true map turtle most easily by the head pattern (see illustration) and the fact that the rear of the carapace is more deeply notched. This last, of course, is a character useful only after experience with the two species.

The food and habitat of the map turtles are so similar that they will be discussed together.

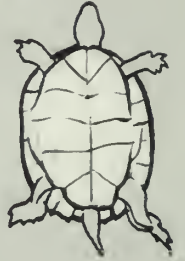
MAP TURTLE

(*Graptemys geographica*)

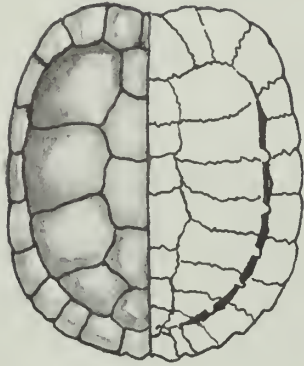
The entire state has large, permanent bodies of water with much vegetation and a muddy bottom which are suitable for this species, but Gentry has found them consistently only in Middle Tennessee.

Apparently the map and false map turtles feed largely on snails and clams, which they can crush with their strong jaws. Insects and crayfish are taken at some seasons of the year. In captivity

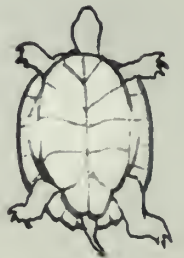
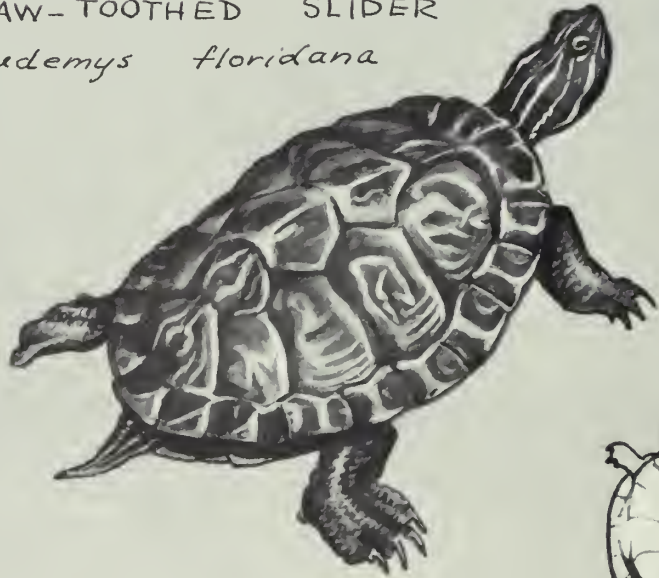
ELEGANT SLIDER
Pseudemys scripta



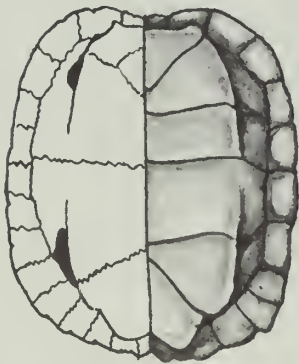
CARAPACE



SAW-TOOTHED SLIDER
Pseudemys floridana



PLASTRON



BOX TERRAPIN
Terrapene carolina



they will eat chopped fish or meat, grubs, and earthworms, which they take below water to eat.

These two species grow to a foot in length, the false map sometimes a little larger. They get their name from the pale yellowish pattern on their carapace which looks somewhat like trails or streams marked on a map. On the fleshy parts these yellow stripes are much brighter and more regular.

The eggs are laid in May, June, and early July, with those laid late sometimes hatching the following spring. Map turtles are so aquatic that egg-laying is the only occasion which tempts them onto land. Ten to sixteen eggs make up a clutch.

In Tennessee these two species probably pass warm winters by remaining sluggishly active, but will, if the situation demands, burrow into the muddy pond bottom and hibernate.

ELEGANT SLIDER (*Pseudemys scripta*)

There is an excellent chance that the green, prettily-marked turtle you buy your children in the ten-cent store is a slider. It will have a bright red check patch and yellow trim around the carapace. As an adult it will become a drab brown turtle nearly a foot long, whose only claim to elegance will be the red cheek stripe.

The sliders are a southern group of turtles, typical of quiet ponds and rivers. This species occurs from the upper watershed of the Tennessee and Cumberland rivers to Middle and West Tennessee, where it becomes more common.

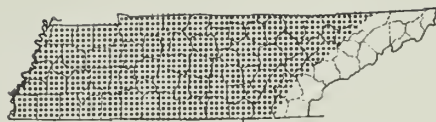
Animal matter makes up most of the diet, but plants are sometimes eaten along with the insects, snails, crayfish, tadpoles, and carrion. Our species of sliders not only feed underwater but are almost never seen away from it. They sun themselves for hours on exposed logs.

The claws on the front foot of male (see illustration) are twice as long as those of the female. These are used during courtship in gently stroking the neck of the female. Two weeks after mating (June or July) about ten eggs are laid in a nest much like other turtles.

SAW-TOOTHED SLIDER (*Pseudemys floridana*)

At Reelfoot Lake this species is abundant and a number of them can be seen basking on logs on any sunny, summer day. In bayous and sloughs of the western part of the state they are common and even appear in the Cumberland River occasionally. In some areas it is known as the "hieroglyphic turtle" because of the strange yellow markings on the blackish-brown carapace.

The habitat and habits are similar to those of the elegant slider. They both



like muddy bottoms with much plant life.

BOX TURTLE (*Terrapene carolina*)

This is the only strictly terrestrial species in Tennessee, though to the west and south gophers are common in arid regions and in New England the wood turtle is common in moist woodlands. Others are semi-aquatic. The box turtle swims well but is seldom found by the water, for it much prefers moist, open woods or swamps.

When molested its hinged plastron closes tightly to form an impregnable box, which is tight enough to protect it from almost any harm. The base color of the shell and body is black, with attractive yellow markings. The carapace is four or five inches long and highly arched in comparison to other turtles.

The food is variable, depending largely on seasonal availability. At any rate, it

includes both plants and animals, primarily insects, worms, slugs, myriapods, carrion and fruit.

Two to seven eggs are laid in June or early July. The depression which holds the eggs is shallow but the nesting process may take five hours due to the clumsiness of the animal. Eggs hatch in about ninety days and the young hibernate immediately.

In this species hibernation is a continuing process, for as temperatures drop the box turtles burrow farther down to keep below the frost line. They do not ordinarily go more than two feet down.

The territoriality of box turtles has been studied rather extensively and indicates that they are "home bodies." They rarely wander more than a few hundred yards from the center of their home area and will remain in the same vicinity for decades. If taken away, their homing instinct often makes it possible to return.

"Terrapins", as they are sometimes called, are docile and make good pets. They are quite common throughout Tennessee.

Turtle Reference Books

Two excellent inexpensive reference books are available which will be of great value to a beginning herpetologist (which is what you become when you study amphibians and reptiles).

The first, beautifully and accurately illustrated with paintings, obtainable in any book store, is:

Reptiles and Amphibians, by Herbert S. Zim and Hobart M. Smith. It is part of Simon and Schuster's pocket-size Nature series. The paperback edition, which sells for one dollar, will last through hundreds of field trips if you will border the cover with scotch tape.

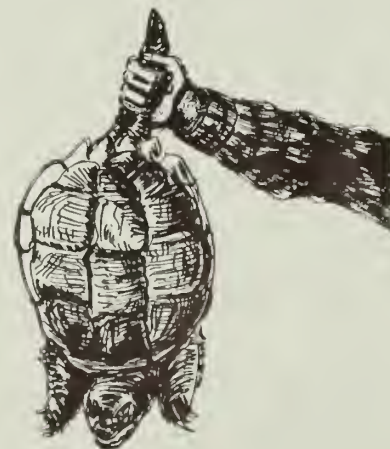
The second, though it covers a slightly different fauna (group of animal life), is very useful and has good photographs and accounts of the species:

Handbook of Amphibians and Reptiles of Kansas, by Hobart M. Smith. This may be obtained from the Museum of Natural History, University of Kansas, Lawrence, Kansas, for one dollar and a half (postpaid).

Much field work has been done in Tennessee by Dr. Glenn Gentry of the State Game and Fish Commission. He has published a statewide checklist, which was used in determining distribution of all species in the above article. It appeared in two parts in the *Journal of the Tennessee Academy of Science*. Section one, in the April, 1955, issue covered

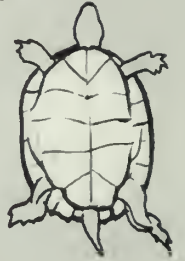
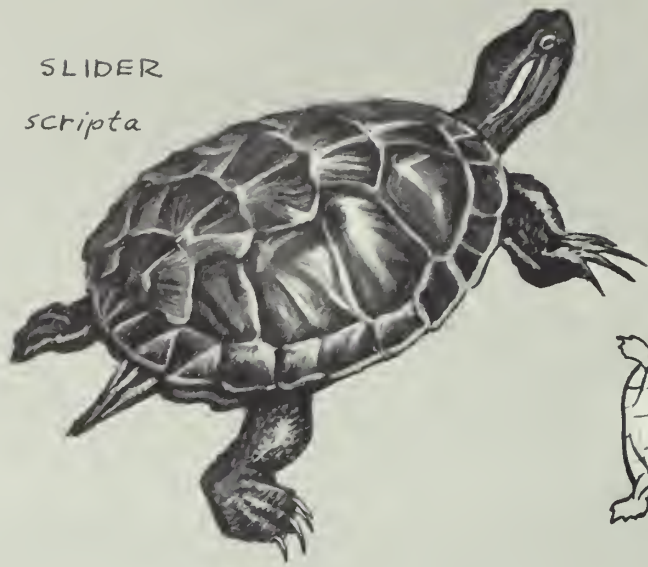
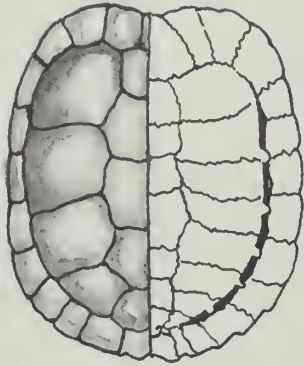
amphibians; section two, July, 1956, concluded with the reptiles.

Amateurs have made many of the most important contributions to all sciences. If you are seriously interested in herpetology, you may wish to get from the library or buy all or part of the Comstock (Ithaca, N.Y.) handbook series. Individual volumes cover salamanders, lizards, turtles, frogs and toads, and snakes (two). The turtle book is seven and a half dollars, the others, six or six and a half apiece. These are the ultimate in compiling scientific knowledge between two covers, yet maintaining readability and interest.



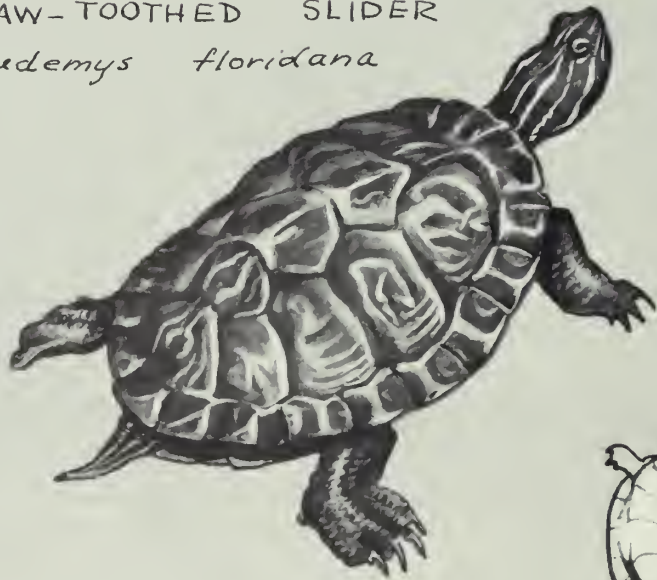
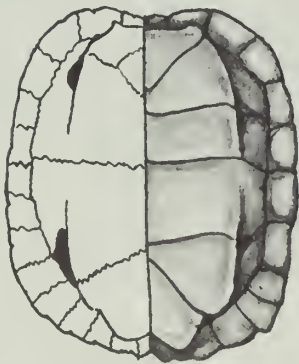
ELEGANT SLIDER
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CARAPACE



SAW-TOOTHED SLIDER
Pseudemys floridana

PLASTRON



BOX TERRAPIN
Terrapene carolina



they will eat chopped fish or meat, grubs, and earthworms, which they take below water to eat.

These two species grow to a foot in length, the false map sometimes a little larger. They get their name from the pale yellowish pattern on their carapace which looks somewhat like trails or streams marked on a map. On the fleshy parts these yellow stripes are much brighter and more regular.

The eggs are laid in May, June, and early July, with those laid late sometimes hatching the following spring. Map turtles are so aquatic that egg-laying is the only occasion which tempts them onto land. Ten to sixteen eggs make up a clutch.

In Tennessee these two species probably pass warm winters by remaining sluggishly active, but will, if the situation demands, burrow into the muddy pond bottom and hibernate.

ELEGANT SLIDER (*Pseudemys scripta*)

There is an excellent chance that the green, prettily-marked turtle you buy your children in the ten-cent store is a slider. It will have a bright red check patch and yellow trim around the carapace. As an adult it will become a drab brown turtle nearly a foot long, whose only claim to elegance will be the red cheek stripe.

The sliders are a southern group of turtles, typical of quiet ponds and rivers. This species occurs from the upper watershed of the Tennessee and Cumberland rivers to Middle and West Tennessee, where it becomes more common.

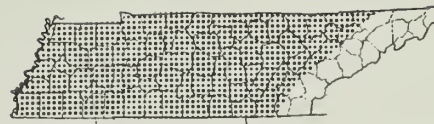
Animal matter makes up most of the diet, but plants are sometimes eaten along with the insects, snails, crayfish, tadpoles, and carrion. Our species of sliders not only feed underwater but are almost never seen away from it. They sun themselves for hours on exposed logs.

The claws on the front foot of male (see illustration) are twice as long as those of the female. These are used during courtship in gently stroking the neck of the female. Two weeks after mating (June or July) about ten eggs are laid in a nest much like other turtles.

SAW-TOOTHED SLIDER (*Pseudemys floridana*)

At Reelfoot Lake this species is abundant and a number of them can be seen basking on logs on any sunny, summer day. In bayous and sloughs of the western part of the state they are common and even appear in the Cumberland River occasionally. In some areas it is known as the "hieroglyphic turtle" because of the strange yellow markings on the blackish-brown carapace.

The habitat and habits are similar to those of the elegant slider. They both



like muddy bottoms with much plant life.

BOX TURTLE (*Terrapene carolina*)

This is the only strictly terrestrial species in Tennessee, though to the west and south gophers are common in arid regions and in New England the wood turtle is common in moist woodlands. Others are semi-aquatic. The box turtle swims well but is seldom found by the water, for it much prefers moist, open woods or swamps.

When molested its hinged plastron closes tightly to form an impregnable box, which is tight enough to protect it from almost any harm. The base color of the shell and body is black, with attractive yellow markings. The carapace is four or five inches long and highly arched in comparison to other turtles.

The food is variable, depending largely on seasonal availability. At any rate, it

includes both plants and animals, primarily insects, worms, slugs, myriapods, carrion and fruit.

Two to seven eggs are laid in June or early July. The depression which holds the eggs is shallow but the nesting process may take five hours due to the clumsiness of the animal. Eggs hatch in about ninety days and the young hibernate immediately.

In this species hibernation is a continuing process, for as temperatures drop the box turtles burrow farther down to keep below the frost line. They do not ordinarily go more than two feet down.

The territoriality of box turtles has been studied rather extensively and indicates that they are "home bodies." They rarely wander more than a few hundred yards from the center of their home area and will remain in the same vicinity for decades. If taken away, their homing instinct often makes it possible to return.

"Terrapins", as they are sometimes called, are docile and make good pets. They are quite common throughout Tennessee.

Turtle Reference Books

Two excellent inexpensive reference books are available which will be of great value to a beginning herpetologist (which is what you become when you study amphibians and reptiles).

The first, beautifully and accurately illustrated with paintings, obtainable in any book store, is:

Reptiles and Amphibians, by Herbert S. Zim and Hobart M. Smith. It is part of Simon and Schuster's pocket-size Nature series. The paperback edition, which sells for one dollar, will last through hundreds of field trips if you will border the cover with scotch tape.

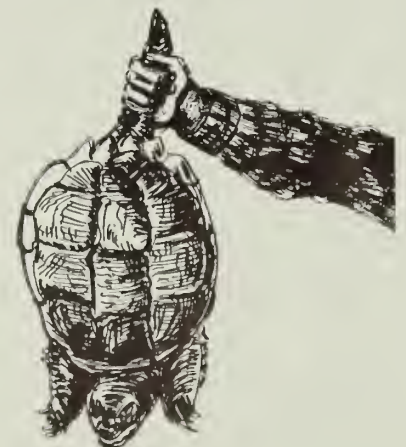
The second, though it covers a slightly different fauna (group of animal life), is very useful and has good photographs and accounts of the species:

Handbook of Amphibians and Reptiles of Kansas, by Hobart M. Smith. This may be obtained from the Museum of Natural History, University of Kansas, Lawrence, Kansas, for one dollar and a half (postpaid).

Much field work has been done in Tennessee by Dr. Glenn Gentry of the State Game and Fish Commission. He has published a statewide checklist, which was used in determining distribution of all species in the above article. It appeared in two parts in the *Journal of the Tennessee Academy of Science*. Section one, in the April, 1955, issue covered

amphibians; section two, July, 1956, concluded with the reptiles.

Amateurs have made many of the most important contributions to all sciences. If you are seriously interested in herpetology, you may wish to get from the library or buy all or part of the Comstock (Ithaca, N.Y.) handbook series. Individual volumes cover salamanders, lizards, turtles, frogs and toads, and snakes (two). The turtle book is seven and a half dollars, the others, six or six and a half apiece. These are the ultimate in compiling scientific knowledge between two covers, yet maintaining readability and interest.



Snake Bite!

by
BOB FERGUSON
and
WILL HON



"The Lord God said to the serpent, ' . . . cursed are you above all cattle, and above all wild animals; upon your belly you shall go, and dust you shall eat all the days of your life. I will put enmity between you and the woman, and between your seed and her seed; he shall bruise your head, and you shall bruise his heel.'"

Thus, according to the Old Testament, did the serpent come to share a tripartite curse with man and woman. Man was to eke his living from the soil, woman was to bear pain in childbirth, and the serpent was to become the enemy of mankind.

Significant is the fact that at this early point in our literature we find a reference to snakes. Nor has there been any let up in the ages since. Snakes have continued to be the subject of many a story and the object of almost universal dislike or downright hatred. An abundance of superstition has been nourished about the creature which proves extremely difficult to dispel. Such false beliefs result in the death of great numbers of harmless snakes each year. A bit of knowledge prepares us for a more sensible approach to the snake problem and can prevent the slaughter of many types of snakes which fill a beneficial niche in the pyramid of life.

The snakes which are considered to be dangerous are not many. We should learn to know them and should not hesitate to slay them when they are found for they hold the power of death. They

are admirably equipped to ". . . bruise the heel".

We have four kinds of venomous snakes: rattlers, cottonmouths, copperheads, and corals. Each has a rather distinctive pattern of markings by which it may be known (as shown in the illustrations).

The source of poison is any venomous snake is its mouth: never its tail. The cottonmouth, copperhead and rattler are pit vipers and are armed with sharp, hollow fangs in the forepart of the upper jaw. Venom is forced into a wound by muscular action on poison glands located at the base of the fangs. When at rest the fangs are folded against the roof of the mouth; when the snake strikes they are thrown forward for the bite and the ejection of venom.

The venom itself is a complex agent containing a large number of toxic components. Some act locally on tissues around the wound and others act on the vital organs after absorption. Blood cells are destroyed, higher nerve centers are poisoned, and the heart action is weakened. The severity of the wound depends in a large part upon the amount of poison injected—rather than upon the size of the snake. Venom from the tiny pygmy rattler (*Sistrurus miliaris*) is considered of higher toxicity than the poison of some larger rattlesnakes. All rattlers are believed to carry enough poison in their sacs to kill a man.

Rattlesnakes, even the pygmy, often sound a warning. The buzz of the

pygmy is scarcely distinguishable from the sound made by many insects. Insects, however, cease their buzz as a person draws near; With the pygmy the buzz continues and may even become more insistent.

No warning is sounded by the copperhead, cottonmouth or coral. A rattlesnake may fail to buzz. While shedding their skin, snakes are particularly irritable and may strike at the slightest disturbance. All of which means, of course, that even the most cautious and discerning outdoorsman may become a victim of snake bite.

It is believed that over 75 per cent of the snake bites in this country would not cause death even if given no especial care. This is because the snakes rarely inject a full toxic dose in one bite. Or it may be because protective clothing prevented deep penetration of the fangs. Such cases have led some people to believe that snake bites are not very serious. "No worse than a bee sting", we sometimes hear.

The truth of the matter is that if you get a genuine full-strength snake bite you will suffer terribly and will be deathly sick for at least three days. This is true even with good treatment.

FIRST AID

In case of suspected venomous snake bite, send for a doctor if possible. Kill and identify the snake (if you can without exertion) as soon as you have applied



Of the few poisonous snakes in this state, the COPPERHEAD is the most common in populated areas and therefore the one most likely to be dangerous.



The COTTONMOUTH is a water snake, a close relative of the copperhead, and equally venomous. It often stands its ground with its white mouth open, apparently as a warning.



Tennessee has two large RATTLESNAKES, the yellowish timber rattlesnake and the reddish cone-broke rattlesnake. Both can be known by their rattles and are therefore given a wide berth.

a tourniquet. Apply the tourniquet immediately upon being bitten, keeping it loose enough to squeeze one finger beneath it. If you can reach a doctor within a few minutes, use only the tourniquet. Do not run! Walk if you must, but be carried if possible.

Correct use of the tourniquet is the most important first aid measure. Use a handkerchief, necktie, belt or a strip torn from clothing. Do not use narrow rubber bands. They become buried in the swelling, are forgotten, and cause gangrene. Apply the tourniquet a few inches above the bite, between bite and heart. The pulse should not be stopped. Beware that the afflicted part does not become bluish or cold. If it does, the tourniquet is too tight and should be reapplied less tightly. Too tight a tourniquet will certainly cause death if left on longer than 8 or 9 hours and then released.

If you are alone, fasten the tourniquet securely as soon as possible. You may faint within a few minutes after the bite. With the tourniquet in place, you can resume first aid after recovering consciousness.

Calm down, now that the tourniquet is on. There is no great rush about the rest of the treatment. Drink all the water you want. If you can get to a doctor within a few minutes, this completes the first aid. If not, continue as follows:

Sterilize the area at and around the bite with an antiseptic if available. Sterilize a clean, sharp blade with antiseptic or flame. Be certain from pain and swelling that the bite was from a venomous snake and that venom was delivered. On bony parts wait until swelling has developed before making the incisions. Then, cutting only into the swelling, make a few cross-shaped cuts about $\frac{1}{8}$ -inch long and $\frac{1}{8}$ -inch deep at and around bite. Avoid cutting nerves, tendons or blood vessels. Do not cut down to bone.

Apply suction to these cuts for at least 30 minutes and for 20 minutes of each hour following. Suck the wounds by mouth if necessary as long as no pain develops in the mouth. Digestive juices in the stomach easily destroy the venom. Suction should be gentle.



The diagram of the poisonous snake bite on the left shows marks of teeth and two large fangs. The fang marks are absent in the bite of a harmless snake (right). Actual bites rarely show the patterns so completely.

Keep comfortably warm. A cup of hot tea or coffee may be drunk.

Move tourniquet up as swelling spreads, making new incisions as required. Wounds that are not being sucked should be wrapped with cloths soaked in a strong, hot table salt or epsom salts solution. Do not release the tourniquet more often than necessary. The sudden release of more venom into the system may produce serious shock.

New methods for treating snake bite are being developed. Among these are the administration by a physician of ACTH. In one case it seemed to produce rapid and complete recovery.

A radical new treatment called the "L-C treatment" was developed in 1953 by Herbert L. Stahnke, Ph.D. It involves the use of ice-water and a tourniquet. The ice water is used to slow the absorption of venom by the system. It is said that incisions are seldom necessary when this treatment is used. The method is new and we are awaiting further reports of actual cases where the L-C treatment has been used.

Antivenin is of great value in treating serious snake bite if the patient is not sensitive to horse serum. Follow directions of the manufacturer to determine sensitivity. Antivenin can cause the immediate death of persons sensitive to it.

So far, we have been dealing with the bites of the pit vipers (see accompanying illustrations). The bite of the coral snake is something different. Being

closely related to the cobra, its venom is strongly neurotoxic and may paralyze or destroy nerves—especially those governing breathing and heart action. When a coral snake bites it may hang on, chewing several times, working in more venom. Although there is no local swelling for some time, the bitten limb often pains agonizingly within a few minutes.

Apply a tight tourniquet—loosening it for a few seconds every ten minutes. Make criss-cross cuts $\frac{1}{8}$ -inch deep and $\frac{1}{4}$ -inch wide through the fang punctures at once and begin suction, by mouth if no other means is available.

Do not exercise. Get the patient to a doctor. Use artificial respiration and stimulants if necessary. Keep up the suction and keep the wound draining (oozing, not flowing) with hot cloths soaked in epsom salts solution.

In any snake bite, a great danger lies in under-treatment. Be thorough throughout and keep up suction and drainage of the afflicted part. Sudden relapses are not uncommon. Drainage of a snake bite is kept up for weeks in hospitals. Watch a patient carefully for any signs of faintness or sudden weakness and resume treatment at the slightest indication of relapse. Remember that shock is the companion to any such wound and must be treated.

To guard against snakebite yourself, watch where you walk. Wear protective clothing. Don't put your hands where you can't see. And avoid handling venomous snakes—most persons who work with them are bitten sooner or later.

Heavy leather boots with loose tops afford fine protection. Trousers worn outside the boots may cause the snake to strike short. Trousers with well-padded legs protect against thorns as well as snakes.

Further information on snake-bite may be found in the following sources for this article: Wildlife Leaflet 339, By William H. Stickel, Fish & Wildlife Service, Washington 25, D. C. And a pamphlet prepared by Wyeth Incorporated, Philadelphia 3, Penna., manufacturers of Antivenin, Wyeth.

Further information on the ACTH treatment and the L-C treatment will be released when available.



The small PIGMY RATTLESNAKE has only a tiny rattle and is less dangerous than the large poisonous species. It is slate-colored with black blotches.



The head of any of our poisonous snakes has a distinct hole between the eye and the nostril, which gives them the name pit viper.



The non-poisonous species lack this and have round eye pupils in contrast to the vertical slits of the venomous kinds.

STATE GAME AND FISH COMMISSION
Cordell Hull Building
6th Avenue, North
Nashville 3, Tennessee