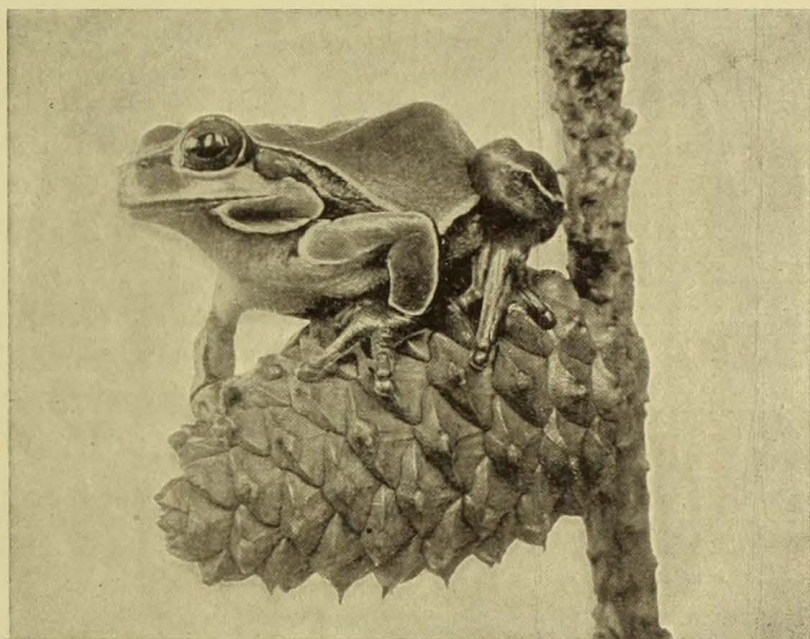


AMERICAN MUSEUM OF NATURAL HISTORY

The Batrachians of the Vicinity of New York City



By Raymond L. Ditmars

Curator of Reptiles, New York Zoölogical Park

With illustrations from photographs from life by Herbert Lang, American Museum of Natural History

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FIG. 1. BULL FROG. NEARLY NATURAL SIZE
From specimen in New York Zoölogical Park

The
Batrachians of the Vicinity
of
New York City

With Reference to the Collection in the
American Museum of Natural History

By

RAYMOND L. DITMARS

CURATOR OF REPTILES, NEW YORK ZOÖLOGICAL PARK

With Illustrations from Photographs taken from Life

BY

HERBERT LANG

AMERICAN MUSEUM OF NATURAL HISTORY

GUIDE LEAFLET No. 20.

REPRINTED FROM THE AMERICAN MUSEUM JOURNAL,

VOLUME V, No. 4, OCTOBER, 1905.

New York. Published by the Museum.

PREFATORY NOTE

The Museum gratefully acknowledges the coöperation of the New York Zoölogical Society in the preparation of the Guide. The author is Mr. Raymond L. Ditmars, Curator of Reptiles in the New York Zoölogical Park, Bronx Park, who also prepared the leaflet upon the local reptiles which was issued with the preceding number of the JOURNAL. Through Director W. T. Hornaday the abundant living material of the Zoölogical Park was placed at the disposition of the Museum for the purpose of making photographs for the illustrations, and through Director C. H. Townsend similar courtesies were extended at the New York Aquarium, Battery Park. The source of the illustrations is indicated under each figure.

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The collection illustrating the local batrachians may be found at present in the Synoptic Hall, No. 107 of the ground floor of the Museum Building.

THE BATRACHIANS OF THE VICINITY OF NEW YORK CITY.¹

BY RAYMOND L. DITMARS,

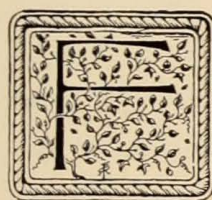
Curator of Reptiles, New York Zoölogical Park.

With Illustrations from Photographs Taken from Life

BY HERBERT LANG,

American Museum of Natural History.

INTRODUCTION.



FOLLOWING the reptiles in zoölogical classification come the batrachians, creatures which may be said to constitute a connecting link between the reptiles and the fishes. Unlike the former, the great majority of batrachians begin life as strictly aquatic, fish-like forms, provided with gills, which with many species are elaborately developed in the shape of external, fringed processes. From this aquatic form, with gills (the tadpole or larval stage), the average batrachian ultimately matures into a creature constituted to breathe atmospheric air.

Swamps and bogs and the borders of streams and ponds are usually the homes of the batrachians, which thrive in such damp situations. Some species, like the toad, are quite terrestrial, and many are subterranean, but with few exceptions they frequent the immediate vicinity of water or damp and shaded places. There are species that remain aquatic throughout life, like the Mud Puppy (*Necturus*) and the Hellbender (*Cryptobranchus*), both North American species. In the Old World is found the *Proteus*, a blind and translucent species, that passes its entire existence in underground rivers or in the dark lakes of European caverns.

¹ Reprinted from *The American Museum Journal*, Vol. V, pp. 161-206, Oct., 1905.

With but few exceptions the mature batrachians differ from the reptiles in the total absence of scales. Their naked, usually slimy skin at once defines them to the novice. The few scaled species indicate their scalation only upon close examination, and beneath the shining skin may be discerned a fine dermal texture. No species among the local batrachians possesses scales.

In our local fauna, two orders of the Batrachia are represented. These are the *Urodela*, comprising Salamanders and Newts, and the *Salientia*, or Tailless Batrachians (the Toads and Frogs).

SALAMANDERS.

Order *Urodela*.

The salamanders and the newts may be easily recognized by their lizard-like form, but even the novice may at once distinguish them from true lizards by their moist or slimy, naked skin, totally devoid of scales. Many of the semi-aquatic species, however, are actually known in the regions they inhabit as water "lizards."

The majority of the local species begin life, like the frogs and toads, as tadpoles, hatching from opaque eggs which are deposited in streams and ponds. Unlike the frog larva however, the tadpole of the salamander retains throughout the larval state external gills, arranged in three tufts on each side of the head. These gills are delicately fringed and enable the young creature to lead a fish-like existence. The presence of these organs enables the observer to distinguish at a glance the larvæ of the salamanders and newts from those of the frogs and toads. Apart from the gills, however, the salamander tadpoles differ from the tailless batrachians in the development of the limbs. The front limbs are the first to appear, an external character quite reversed among the frog larvæ. Though the development with the latter is the same as with the salamanders, the growth of the front limbs goes on under cover of the operculum, while the hind limbs are attaining external development. When the front limbs attain their growth, they push their way suddenly through the folds of the operculum and into view.

A few of the local salamanders, represented by the genera

Plethodon and *Hemidactylium*, undergo their metamorphosis in damp places under stones or logs in the woods. The young of these possess branching gills when hatched, but the gills are absorbed within a few days.

In the vivarium, many of the salamanders may be kept for observation by providing them with some three inches of damp *Sphagnum* moss, over which have been placed strips of old bark. The moss should be kept very damp. Ant larvæ, the grubs of the smaller wood-boring beetles and small earthworms serve as food.

If these creatures were provided with scales like the reptiles, the making of a popular key for identification would be simple. There is, however, among most salamanders a peculiar uniformity of external surface and general structure. Technical divisions of the *Urodela* are founded upon the arrangement of the teeth, the anatomical structure of the tongue, the shape of the tail and the development of the toes. In the preparation of the following key, however, the writer has relied upon the few characters that appeal to an observer not versed in technical terms. The characters employed pertain to variation of *outline*, where such exists, *size* and *color-pattern*. In our local fauna four families, comprising twelve species and two varieties, are represented. These are, the AMBLYSTOMIDÆ, represented by *Amblystoma opacum*, *A. tigrinum*, *A. punctatum*; the PLETHODONTIDÆ, *Plethodon glutinosus*, *P. cinereus*, *P. cinereus erythronotus*, *Hemidactylium scutatum*, *Spelerpes ruber*, *S. bilineatus*, *S. longicauda*; the DESMOGNATHIDÆ, *Desmognathus fusca*, *D. ocropheæ*; the PLEURODELIDÆ, *Diemyctylus viridescens*, *D. viridescens miniatus*.

Key to the Salamanders.

a. FORM STOUT, SIZE LARGE.

1. Tail flattened towards the tip.

Black, marbled with grayish

white blotches..... **Marbled Salamander** (*Amblystoma opacum*).

Black, marbled with yellow,

the yellow predominating... **Tiger Salamander** (*Amblystoma tigrinum*).

Black, two rows of yellow

spots, black predominating. **Spotted Salamander** (*Amblystoma punctatum*).

b. BODY CYLINDRICAL, ELONGATED.

1. Tail rounded.

Size moderate; black, with
silvery spots. **Slimy Salamander** (*Plethodon glutinosus*).

Size very small; brown, with
minute white dots. **Gray Salamander** (*Plethodon cinereus*).

Size very small; dark gray, a
reddish band on back. **Red-backed Salamander** (*Plethodon cinereus erythronotus*).

2. Tail bluntly oval.

Size small; snout very blunt;
brown, paler on back. **Four-toed Salamander** (*Hemidactylium scutatum*).

3. Tail flattened towards the tip.

Size moderate; bright red,
spotted with black. **Red Salamander** (*Spelerpes ruber*).

Size small; yellow band on
back, dark bands on the
sides. **Two-lined Salamander** (*Spelerpes bilineatus*).

Size larger; yellow, sides with
many black spots and a
median dorsal series thereof;
tail keeled above, very long. **Long-tailed, or Cave Salamander** (*Spelerpes longicauda*).

Size moderate; gray, minutely
dotted with white; greater
length of tail flat. **Dusky Salamander** (*Desmognathus fusca*).

Size moderate; brown, lighter
on head; basal half of tail
rounded. **Mountain Salamander** (*Desmognathus ocrophea*).

c. OUTLINES WELL PROPORTIONED; SIZE SMALL.

1. Tail flat from base to tip.

Skin smooth; tail fin-like;
olive above, yellow beneath,
a row of red spots on side;
aquatic. **Water Newt** (*Diemyctylus viridescens*).

Skin rough; tail thicker; red-
dish brown to vermilion;
terrestrial. **Red Eft; Mountain "Lizard"** (*Diemyctylus viridescens miniatus*).

DESCRIPTIVE LIST OF THE SALAMANDERS.



FIG. 2. THE MARBLED SALAMANDER
From specimen in New York Aquarium

The Marbled Salamander, *Amblystoma opacum* Gravenhorst (Fig. 2), is of moderate size and stout form, with flattened tail, which is thick at the base. General color slaty-black, with large elongated spots or blotches of grayish-white on the back and head. Some of the spots run together, producing a marbled appearance, a character which occurs on the back of many specimens. The spots are regularly disposed as half-rings on the upper surface of the tail, producing a banded appearance. Beneath, this species is a uniform bluish-black. It may be distinguished from the other local representatives of the genus by its grayish-white markings, the other species possessing yellowish markings. Total length, $4\frac{3}{4}$ inches; length of tail, 2 inches.

Range: The eastern and central portions of North America.

Local Distribution: General in this vicinity, but not common.

The larvæ of the marbled Salamander may be found in shallow ponds in the openings of woods. They grow rapidly and leave the water late in June or early in July. While developing, they present a dull, grayish appearance, thickly dotted with white, which pattern gives way to the markings of the adult a short time prior to their leaving the water. In the adult form this salamander selects dry situations, and may be found under stones in sandy, or dry and hilly country, where it burrows to some depth.



FIG. 3. THE SPOTTED SALAMANDER
From specimen in New York Zoölogical Park

The Spotted Salamander, *Amblystoma punctatum* Linn. (Fig. 3), is a large form with stout body and broad head. The tail is rounded at the base, but bluntly compressed towards the end. Black above, with a row of round brilliant-yellow spots on each side. This row extends to the tip of the tail and is a ready means of identification. There are several of these spots, too, on the upper surface of each limb. The lower sides are slaty-gray, sprinkled with small, bluish-white spots. In form the Spotted Salamander slightly resembles the Tiger Salamander, but may be distinguished therefrom by the

[12]

regularity of its color pattern. Total length, $7\frac{1}{2}$ inches; length of tail, $3\frac{3}{4}$ inches; width of head, $\frac{3}{4}$ inch.

Range: Eastern and central North America.

Local Distribution: Sparing, in damp woods.

The eggs are deposited early in the spring in ponds and small streams. They resemble the spawn of frogs. The adult may be found under logs and stones in thinly timbered sections. Like the other species of this genus, this salamander will live for years in the vivarium.



FIG. 4. THE TIGER SALAMANDER
From specimen in New York Zoölogical Park

The Tiger Salamander, *Amblystoma tigrinum* Green (Fig. 4), is a large species with stout body, flat head and compressed tail. Ground color above, dark brown or gray (sometimes black), thickly covered with large, irregular, yellowish blotches. The blotches predominate and impart a marbled appearance to the animal. On the lower portions of the sides the yellow is present in the form of round spots, or scattered blotches, and the ground color is lighter. The chin is thickly marked with yellow, but little of the color is apparent on the abdomen, which is gray. The intensity of the markings depends much upon the age of the individual. Very old specimens show a faint pattern and in some lights appear to be of a dull, uniform

Tiger
Salamander.

brown. This is the largest of our salamanders. Although in form resembling the Spotted Salamander, its blotched appearance makes identification easy. The limbs are large and well developed. A mature specimen from New Jersey shows a total length of $8\frac{1}{2}$ inches; the tail is $3\frac{3}{4}$ inches long, and the head $\frac{3}{4}$ inch wide. The species is said to attain a length of eleven inches.

Range: The entire United States and southern Canada; northern and central Mexico.

Local Distribution: Rare, but found occasionally on Long Island and in New Jersey.

Although one of the rarest of the local batrachians, the Tiger Salamander is our most interesting species. The metamorphosis from the larval to the adult form depends largely upon light and temperature, and is strongly influenced by surrounding conditions. In the western and southwestern portions of the United States it is abundant, and throughout those areas, for many years, its larval or tadpole stage was thought to constitute a distinct species, the Axolotl. In permanent lakes of some depth, where the water remains moderately cold and there is abundance of food suitable for the larval form, this creature evinces an interesting persistency in retaining the branching gills (branchiæ) and continues its aquatic existence for indefinite periods even attaining the size of the terrestrial form.

More remarkable, however, than tardy metamorphosis is the fact that during this evidently larval state these creatures breed and deposit eggs. In this aquatic form the species has had several different names. In the case of an evaporating pool, slowly drying away under the summer sun, the larva finds an opportunity along the shallow borders frequently to employ its nostrils at the surface of the water, with the result that the gills become degenerated and transformation is hastened.

Adult specimens secrete themselves in burrows, not far from the vicinity of water, although they may be occasionally found hiding under decaying logs, in very moist situations. They prey upon insects and worms, and they even attack larger creatures, when within reach. A specimen in the writer's collection devoured several very young field mice. Hiding by day, they prowl during the hours of darkness or during rains.

The Four-toed Salamander, *Hemidactylium scutatum* Tschudi (Fig. 5), is small, with cylindrical body and very bluntly oval tail. Color above, deep reddish brown; about the head, especially on the snout, there is a lighter shade, approaching bronze. Close examination of most specimens will reveal the presence of numerous dark spots on the upper surfaces. The sides of the body present a mottled ap-

Four-toed
Salamander.

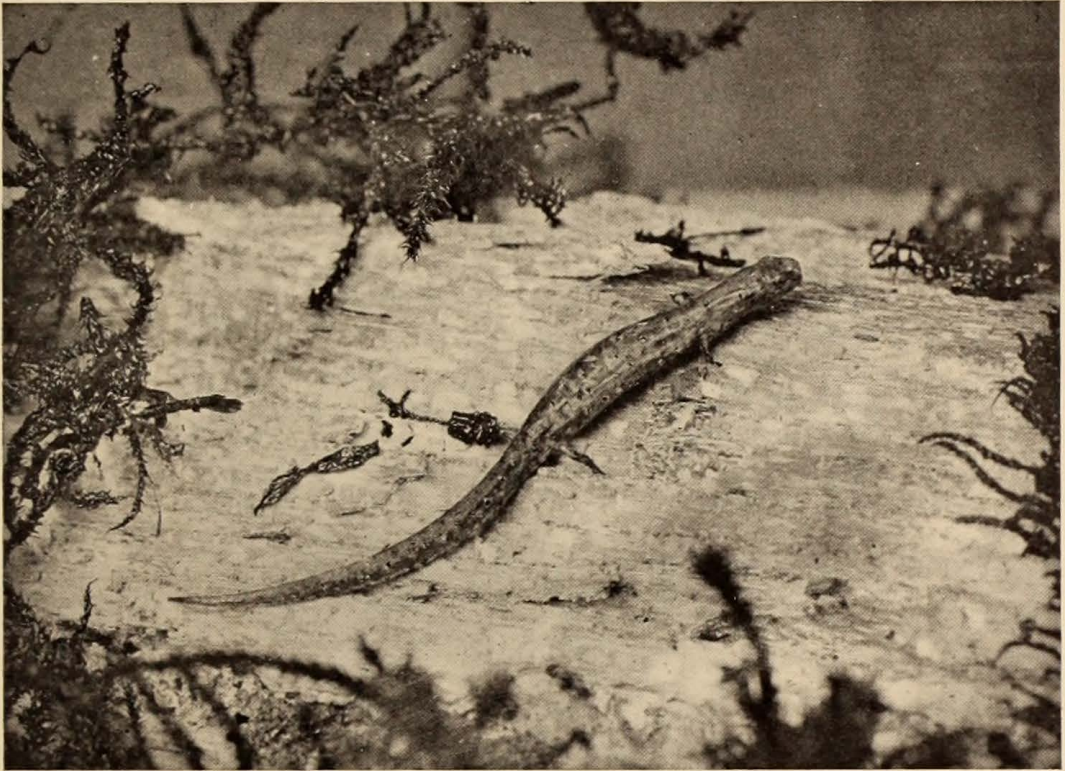


FIG. 5. THE FOUR-TOED SALAMANDER
From specimen in Am. Mus. Nat. Hist.

pearance, and the ground color is much lighter than on the back. The entire under surface is bluish-white, with a few, irregularly placed dark spots, presenting a strong contrast with the principal color.

This small species somewhat approaches the Gray Salamander in appearance, but may be distinguished therefrom by its very blunt snout and proportionately shorter tail. The back and the sides are strongly marked with furrows, a feature in which the species is quite unique. The limbs are small and weak. There are but four toes on the hind foot. Total length, 3 inches; length of tail, $1\frac{1}{2}$ inches.

Range: The entire eastern portion of the United States.

Local Distribution: Mostly along the Palisades of the Hudson River.

The Four-toed Salamander, rather a rare species in this vicinity, is generally found in scattered companies. It is strictly terrestrial, and inhabits timbered regions, where it hides under logs and stones.

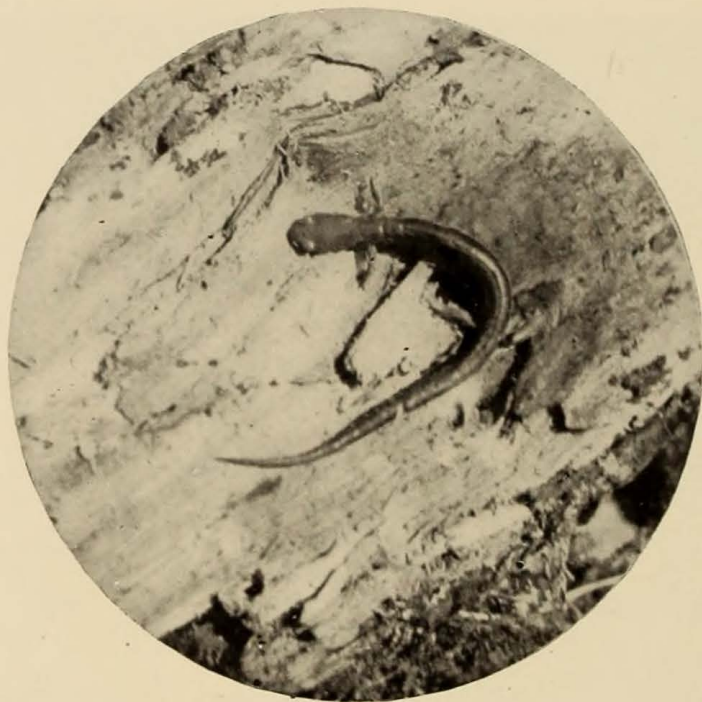


FIG. 6. THE GRAY SALAMANDER
From specimen in New York Zoölogical Park

The Gray Salamander, *Plethodon cinereus* Green (Fig. 6), is a small form, very slender and worm-like; tail round and long.

Gray Salamander. Color above, dark brown, grayish or black, sprinkled with minute silvery spots. Sides of the body lighter and speckled with dark gray. Abdomen pale gray, marbled with a darker shade. Total length, 3 inches. Diameter of body, $\frac{3}{16}$ of an inch.

Range: Southern Canada and the United States generally, east of the Mississippi.

Local Distribution: Particularly abundant on the Palisades of the Hudson River.

This very common little salamander is strictly terrestrial.

It may be found in numbers, hiding under flat stones and logs in damp woods. Although provided with very small and slender limbs, it displays remarkable agility when disturbed, either wriggling its way among fallen leaves, or progressing over them by a series of jumps caused by doubling its worm-like body into a series of lateral undulations and suddenly straightening itself.

The eggs are deposited under damp and decaying logs, in moss or under stones. When the minute larvæ emerge, they possess external gills, but these are absorbed within a few days'

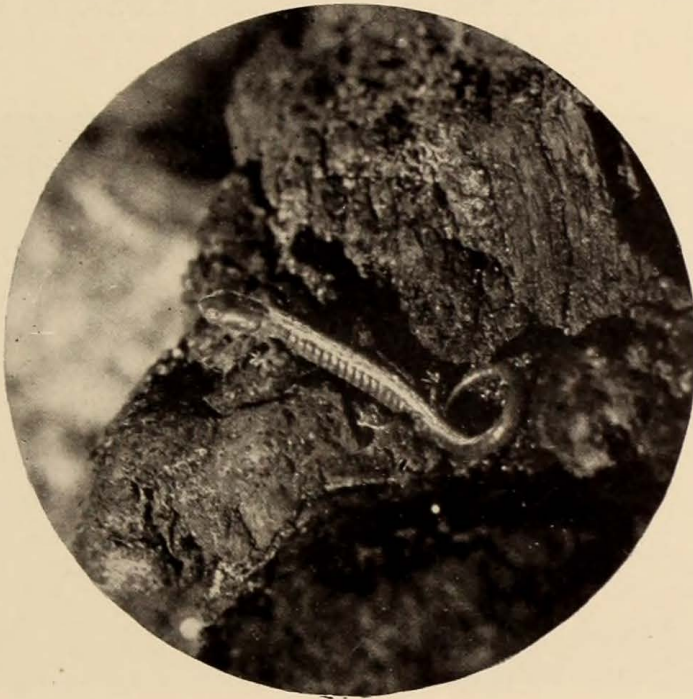


FIG. 7. THE RED-BACKED SALAMANDER
From specimen in New York Zoölogical Park

time. The species is never aquatic at any stage of its life. It is easily distinguished from the other salamanders by its extremely slender body and perfectly round tail.

The Red-backed Salamander *Plethodon cinereus erythronotus* Green (Fig. 7), in size and dimensions is like the preceding form. Grayish on the sides with a bright reddish band on the back.

This band is wide, covering the greater portion of the back and extending towards the end of the tail, where it becomes obscure. The lower portions of the sides present a

Red-backed
Salamander.

thickly dotted appearance; the abdomen is grayish, marbled with darker gray. On some specimens the bright band on the back is sprinkled with small gray dots, but these are so minute that they scarcely produce a dull effect upon the color. On occasional specimens these dots fuse together, forming a dull line down the back, and imparting a resemblance to the markings of many specimens of the Two-lined Salamander. From the latter, however, the present species is at once distinguished by its round tail.

Range: The United States east of the Mississippi and southern Canada.



FIG. 8. THE SLIMY SALAMANDER
From specimen in New York Aquarium

Local Distribution: Generally abundant in damp woods.

This variety is commonly found with the typical form, and occasionally under the same logs and stones with the Slimy Salamander.

The Slimy Salamander, *Plethodon glutinosus* Green (Fig. 8), is of moderate size and rather slender, cylindrical form. The tail is round. Black above, thickly covered with irregular greenish-white, or lichen-gray spots, these often appearing like patches of silvery dust. Different specimens show great variation in the size of the patches, some being blotched with the light color, while others might be said to

Slimy
Salamander.

be finely speckled therewith. Lead color beneath, on which dull surface many specimens show numerous white dots. This species somewhat resembles the Marbled Salamander, but may be distinguished therefrom by its round tail and more numerous spots. It is, moreover, a more slender creature. The neck is much narrower than the head, causing the latter to look broad and flat, as in the larger salamanders (*Amblystoma*). Total length, 5 inches; length of tail, $2\frac{1}{2}$ inches.

Range: From Canada to Florida and westward to Texas.

Local Distribution: General and common. It is particularly abundant on the New Jersey side of the Hudson River, along the Palisades.

When handled, this salamander exudes through the skin a whitish mucus that adheres persistently, hence the technical name, *glutinosus*, and the common one, Slimy Salamander. It is a common species, preferring hilly or mountainous districts, where it leads an entirely terrestrial life, hiding under stones and logs in thickly timbered places, whence it issues at night or in rainy weather.

The Two-lined, or Yellow-backed, Salamander, *Spelerpes bilineatus* Green (Fig. 9), is a small, slender form, with flat tail. Yellowish on the back, which color is bordered on each side with a band of dark gray, brown or black. These bands start from behind the eye and extend down the tail. Beneath the bands the color is pale yellow, profusely sprinkled with dark spots. The broad, yellowish band, covering the back is often spotted with dark gray or brown, and on some specimens the spots run together down the back forming a narrow, dark line. The entire under surface is bright and immaculate yellow. The body is cylindrical; the tail decidedly compressed. Total length, $3\frac{3}{8}$ inches; length of tail, $1\frac{7}{8}$ inches; diameter of body, $\frac{1}{4}$ inch.

Two-lined,
or Yellow-
backed,
Salamander.

Distribution: General, very abundant in the beds of rocky brooks.

Range: From Maine to Florida, and westward to the Missouri River.

The Two-lined Salamander is an extremely active species. It

is usually found hiding under flat stones in the beds of brooks, not actually under water, but where the soil is thoroughly saturated with moisture. When disturbed in its hiding-places, it does not entirely depend upon its diminutive limbs for escaping from danger, but makes surprisingly rapid progress by doubling its body into a series of lateral undulations and suddenly straightening it. The result is a number of bewildering jumps. This performance is varied with a snake-like wriggling. Thus, with a combination of agile motions, the little animal makes like a flash



FIG. 9. THE TWO-LINED OR YELLOW-BACKED SALAMANDER
From specimen in New York Zoölogical Park

for the water and secretes itself among the stones. It is seldom seen except in the immediate vicinity of water, and the larvæ attain nearly the size of the adult before they begin an air-breathing existence.

The Long-tailed, or Cave, Salamander, *Spelerpes longicauda* Green (Fig. 10), resembles in form the Two-lined Salamander, but is a larger species and has a proportionately longer tail. The tail is much compressed and considerably longer than the body. The back is rich yellow, the sides paler. Scattered over the entire upper surface are coarse, black dots, which, on the sides of the tail

Long-tailed,
or Cave,
Salamander.

usually fuse into a series of upright bands. The abdomen is immaculate yellow. Total length, $4\frac{3}{4}$ inches; length of tail, $2\frac{7}{8}$ inches.

Range: The Central States, and inland portions of the Atlantic States.

Local Distribution: Mr. W. D. W. Miller has captured specimens near Plainfield, New Jersey. The writer has not taken it within the limits embraced by this work, but has found it abundant in Pennsylvania.

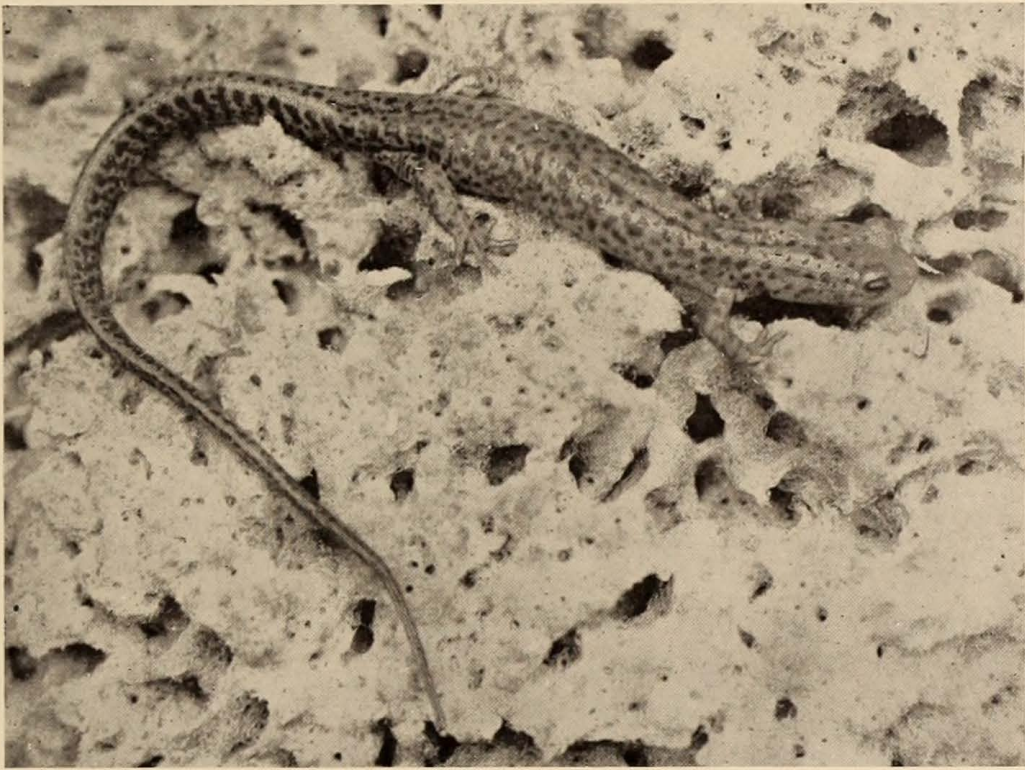


FIG. 10. THE LONG-TAILED, OR CAVE, SALAMANDER
From specimen in Am. Mus. Nat. Hist.

This vividly marked species is at times found at a considerable distance from water, though always in damp situations—in caves or among the fissures of moss-covered rocks. The writer took large numbers of specimens along a mountain stream, at the Delaware Water Gap, Pennsylvania. They were hiding under flat stones in the bed of a nearly dry stream. Their rich coloration was in strong contrast to the damp sand. About a dozen of these specimens lived for a period of more than two years in damp, *sphagnum* moss, placed in an vivarium. During

this period they were supplied with ant-larvæ and white ants, or termites. During the day they always remained hidden, but at night they were frequently observed crawling about the surface of the moss.

The Red Salamander, *Spelerpes ruber* Daudin (Fig. 11), is of moderate size. Its form is cylindrical, — slender when young, becoming stout with an increase in length. Limbs small; tail rounded at base and becoming flattened towards the tip. Rich red or salmon color above, profusely sprinkled with small black spots; paler beneath.



FIG. 11. THE RED SALAMANDER
From specimen in New York Zoölogical Park

Young specimens are frequently of a bright coral-red and not distinctly spotted. Those of medium size are darker red, with intensely black spots, while old specimens are often brownish and spotted with gray. Total length of fully adult specimen, $5\frac{1}{2}$ inches; length of tail, $2\frac{1}{2}$ inches; diameter of body, $\frac{1}{2}$ inch.

Range: Canada to the Gulf of Mexico and westward to the Mississippi River.

Local Distribution: Moderately abundant in the Orange Mountains of New Jersey.

The eggs are deposited early in the spring in the deeper pools of brooks; the adults are semi-aquatic, living in the beds of clear and cold brooks under flat stones or in immediate proximity to the water, into which they quickly make their way when disturbed. They may be sometimes found hiding under the luxuriant moss that covers rocks adjacent to mountain streams, where their brilliant color is in vivid contrast to their surroundings.



FIG. 12. THE MOUNTAIN SALAMANDER
From specimen in New York Zoölogical Park

The Mountain Salamander, *Desmognathus ochrophaea* Cope (Fig. 12), is of moderate size. Body cylindrical; tail rounded for the greater part of its length, flattened near the tip and tapering to a long, sharp point. A wide band of brown extends down the back from behind the head to the base of the tail, where it narrows and becomes indistinct towards the tip. Beneath the brown band the sides are dark gray. From the eye to the angle of the mouth there is a band of light color. The abdomen is dirty white, and generally sprinkled with pure white dots.

Mountain
Salamander.

On occasional specimens the back is sprinkled with a line of black dots, giving the species a very similar pattern to the Two-

lined Salamander, which it also resembles in outlines. The adult Mountain Salamander may be recognized, however, by its rounded tail. Young specimens strongly resemble the Red-backed Salamander, even to the rounded tail. The following characters should be considered in separating them:

<i>Desmognathus ocrophea</i> . ¹	<i>Plethodon cinereus erythronotus</i> .
Form moderately slender.	Form very slender.
Stripe down the back brownish.	Stripe down the back reddish.
A light band from eye to angle of mouth.	No band from eye to angle of mouth.

Total length, $3\frac{1}{2}$ inches; length of tail, $1\frac{5}{8}$ inches; diameter of body, $\frac{5}{16}$ inch.

Range: Common in the Adirondacks and the mountains of northern Pennsylvania, whence it extends southward into the mountain chains of Virginia and North Carolina.

Local Distribution: Very rare, and the species may possibly not occur within the limits given. A single specimen has been taken at Greenwood Lake, N. J.² It has also been found in Allegany County, N. Y. It may occur in the Orange Mountains of New Jersey.

In habits it appears to be quite terrestrial, living under decaying logs or burrowing its way under their bark.

The Dusky Salamander, *Desmognathus fusca* Rafinesque (Fig. 13), is of medium size. The body is cylindrical and moderately slender; tail flat. Color above dark brown or gray, with an obscure, reddish brown tinge on the back. The reddish brown tone is usually distinct on the tail, where it is paler in hue. Numerous black spots show through the brown of the back, which is often bordered with a tinge approaching pink or flesh color, the pink also showing on the tail. Outside this pinkish shade are numerous minute white dots arranged in thick clusters on the sides of the body. The skin of the abdomen is light and translucent and finely marbled with gray. Very old specimens are generally so dark as to

¹ This species is of doubtful or very rare occurrence in this vicinity.

² Taken by Eugene Smith, of Hoboken, N. J.

appear almost uniform black above and show no traces of markings except on the sides and abdomen. The head is about the same width as the body. The front pair of limbs is feeble; the hind pair, larger and stronger. Total length, $4\frac{3}{4}$ inches; length of tail, $2\frac{1}{4}$ inches; diameter of body, $\frac{3}{8}$ inch.

Range: Eastern North America.

Local Distribution: Abundant in the vicinity of small streams. This is the most abundant of our salamanders, but it is not



FIG. 13. THE DUSKY SALAMANDER
From specimen in New York Zoölogical Park

found except in the immediate vicinity of water. It is common in all situations where flat stones, dead leaves or similar objects not actually in the water, but in damp or muddy places in the beds of pools, offer concealment. When discovered in its lairs it runs and wriggles with bewildering agility, often taking to shallow water and secreting itself in the mud in order to escape. According to Cope, the eggs of this species are connected by an albuminous thread, which contracts and hardens after deposition. One of the sexes protects this string of eggs by twisting it about the body and remaining in concealment. The exact duration of the guard over the progeny is not definitely known. The young

salamanders emerge from the eggs with traces of external gills, which are soon absorbed.

The Water Newt, *Diemyctylus viridescens* Rafinesque (Fig. 14), is of medium size. The body is rather stout; the tail very flat and fin-like. Dark olive or green above, on which are scattered numerous small black dots; on each side of the back is a row of small round spots of brilliant vermilion or brick red and bordered with narrow rings of black. The abdomen and lower sides of the body are pale yellow, which

Water
Newt.



FIG. 14. THE WATER NEWT
From specimen in Am. Mus. Nat. Hist.

meets in abrupt contrast the olive of the upper surface; this pale color is thickly covered with small black dots. On the head the line of meeting of the dark and light colors is slightly below the center of the eye.

The tail is very thin and at all times shows traces of fin-like edges, this character being particularly noticeable with the males during the autumn and the spring. Compared with the size of the body the limbs are large and well developed. Male specimens may be distinguished from the females by the large and stocky appearance of the hind limb, the lower joint of which is flattened and very wide, and in appearance quite out of

proportion to the front limb. In female specimens the front and hind limbs are of nearly equal size. During the autumn the males acquire a peculiar series of hard ridges along the inner surface of the hind limbs. This growth is more pronounced during the breeding season when it is clearly discernible as a raised, black process of skin, with a rough surface like the angular edge of a file. Total length, $3\frac{7}{8}$ inches; length of tail, $2\frac{1}{4}$ inches.

Range: Eastern United States and southern Canada.

Local Distribution: General, in ponds and lakes.

In this immediate vicinity, the Water Newt is a strictly aquatic creature, unless, on account of unusual summer heat, the waters of its pond evaporate, when it takes shelter under stones or pieces of bark and in such damp places awaits the refilling of its pond by the fall rains.

The species breeds in the early spring, depositing the eggs singly or in pairs. The eggs are covered with a glutinous envelope and are deposited in such a manner that they adhere to the leaves of aquatic plants. The larvæ possess branching gills like those of the larvæ of the true salamanders. These gills often persist until the animals have reached a length of three inches or more, although absorption usually occurs when the larva is about two inches in length. Thus the transformation appears to be irregular, and not infrequently perfectly developed Water Newts are found that are barely one and one-half inches in length. The metamorphosis is undoubtedly hastened by the warmth of shallow ponds. After the gills have disappeared, the matured individual continues to lead an aquatic life, although if forcibly removed from the water and kept in a damp place, it will live for an indefinite time, breathing with a rapid trembling of the throat, which is the same as the respiratory gulping of the frogs.

The Red Eft, or Mountain "Lizard," *Diemyctylus viridescens miniatus* Raf. (Fig. 15), is a Water Newt which has deserted the ponds in mountainous districts and has taken up life in the damp woods. It is not, however, a distinct variety, since its terrestrial existence is irregular, and it frequently returns to the water to lead an aquatic life. The Red

Red Eft, or
Mountain
"Lizard."

Eft is merely a phase of the common Newt, but it is an interesting case of adaptation to environment.

Few observers who have visited mountainous places in the eastern United States have failed to notice in the damp woods the brilliant red "lizards" slowly making their way over the carpet of fallen leaves. Among residents of the country places they are known as Red Efts, Fire "Lizards" and Rain "Lizards." These are not lizards, but they are batrachians, and they represent a form of the common Newt that has seemingly tired of the water and begun a terrestrial existence. The animals vary in color from dull brown to brilliant vermillion. Rows of red dots

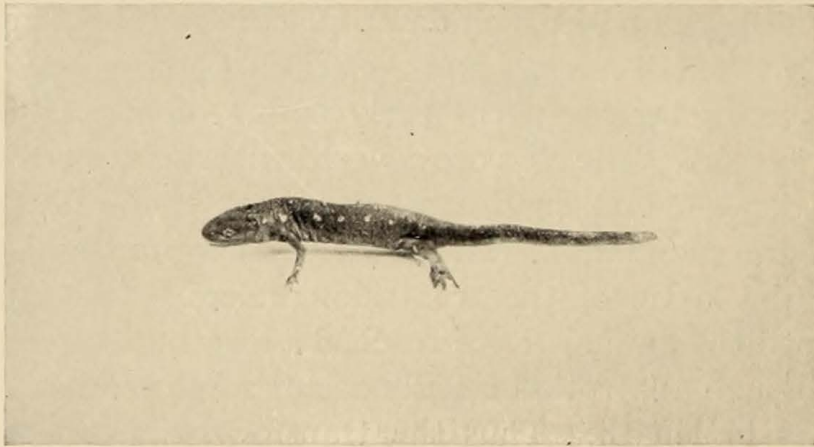


FIG. 15. THE RED EFT, OR MOUNTAIN "LIZARD"

From specimen in New York Zoölogical Park

are very apparent on the brown forms, while on the vermillion forms they are less distinct, but can be discerned as richer red, bordered with narrow circles of black. The brown specimens are forms that have left the water but a short time; those of the brilliant red hues have for some time been leading a terrestrial life. During dry weather the Red Efts hide under leaves and moss; after the summer showers they issue from their hiding-places to swarm through the woods.

In mountain ponds in the heart of districts where the red form is very abundant, the aquatic adults may be found swarming in the water. If the latter are taken from the water and kept in damp moss or among leaves, they lose their greenish tints and the smooth appearance of the skin, becoming dull brown and

rough, an indication of the red hue and rough skin of the terrestrial form. If, on the other hand, specimens found in the woods be placed in an aquarium, they at first show signs of marked distaste for their new quarters. After a time, however, they become reconciled to the water and lose their bright tints, thus beginning to assume the colors of their aquatic associates, while the tail grows broader and better suited for swimming. Very small, bright red forms are often found in the woods, demonstrating that such specimens have left the water immediately after completing the larval stage.

As an explanation of the eccentricities of this species it may be explained that the cool depths of the mountain forests, continuously and heavily shaded, and well saturated with moisture, offer the species an inducement to vary its life history. Close to New York City, where the red form is unknown, the writer has observed an intimation of this terrestrial tendency. In the thick woods of the Palisades of the Hudson, he has found occasional Newts hiding under pieces of bark that rested a few feet from the edge of a pool inhabited by numbers of the kind. Such specimens showed a tinge of brown like the form *miniatus*.

The terrestrial form has been described as possessing a much rougher skin and lacking the fin-folds of the tail of the aquatic form. These characters, however, are caused merely by the drying of the skin.

In the aquarium, the water form is an interesting creature, and may be kept in flourishing condition by feeding it small earthworms or small pieces of raw beef. The red form lives well in a vivarium which has been plentifully supplied with damp moss. It will eat the larvæ of ants and small earthworms. It may be found in the Highlands of the Hudson River. Its range of distribution is much the same as the water form, except that it occurs principally in mountainous districts.

TOADS AND FROGS.

Order *Salientia*.

The Toads and Frogs are the most familiar forms of the batrachians. Eleven species occur in the local fauna, representing four families. All of the local species deposit their eggs in the water and the young pass through a tadpole stage before acquiring the form of the adult. The duration of this larval stage varies considerably with the different species. In some it is limited to a few weeks, others require considerably more than a year to complete their metamorphosis. The growth in the water is much influenced by light and temperature.

For a short time after hatching, the tadpoles of most species are provided on the under surface of the head with two suckers. These organs enable the fragile creatures to cling to the leaves of aquatic plants instead of lying upon the muddy bottom, where they would be exposed to the attacks of many enemies in the shape of the carnivorous larvæ of aquatic insects. At the time of hatching, the young creatures are leech-like in appearance. Development is rapid. Within three days they present the complete form of the tadpole, with fin-like tail. Within a few hours after hatching the mouth-parts begin to develop, and a few days later the little creature feeds upon delicate aquatic vegetation. They then swim readily in search of food, and the suckers become aborted and quickly disappear.

For a few hours after leaving the egg, the frog tadpole possesses branching gills. These soon shrivel and their bases are covered with folds of skin (the "operculum"). Under this fold the fore limbs soon begin their growth. This is the first pair of limbs to acquire full growth, but they are not visible until after the hind pair has appeared. From external appearances the frog tadpole thus seems to acquire the posterior pair of limbs first. Somewhat later the front pair suddenly are thrust through the

folds of the operculum. This is in contrast with the larvæ of the salamanders, in which the operculum is absent and the fore limbs are nearly full grown before the rear pair is visible. Moreover, the tadpoles of the salamanders retain their gill-stalks on each side of the head until after the growth of the limbs is completed.

A popular key to the identification and classification of the Toads and Frogs follows:

Key to the Toads and Frogs.

- I. Tips of toes (digits) expanded in the form of adhesive disks or "suckers"..... **The Tree Toads.**
 - a. SIZE VERY SMALL.
 1. *Disks but slightly developed.*
Brown; a wide green band on the back..... **Cricket Frog** (*Acris gryllus crepitans*).
Gray; three brown bands on the back..... **Swamp Tree Toad** (*Chorophilus triseriatus*).
 2. *Disks well developed.*
Brown to green (varying); a dark, X-shaped mark on the back..... **Pickering's Tree Toad** (*Hyla pickeringi*).
 - b. SIZE SMALL.
Bright green above, which hue is bordered on sides with a band of white. A purplish band from behind nostril.... **Anderson's Tree Toad** (*Hyla andersoni*).
Grayish, with wavy, irregular markings..... **Gray Tree Toad** (*Hyla versicolor*).
- II. No digital disks. Size moderate to large..... **The Toads and Frogs.**
 - a. SIZE MODERATE.
 1. Skin thickly studded with wart-like tubercles; a large gland behind the eye..... **The Toads.**
Pupil of eye horizontal..... **Common Toad** (*Bufo lentiginosus americanus*).
Pupil vertical..... **Spade-foot Toad** (*Scaphiopus holbrookii*).

2. Skin smooth; no gland behind eye **The Frogs.**
- 2a. A vein-like fold of skin from behind eye to the groin.
 Pale brown; a dark-brown blotch behind the eye **Wood Frog** (*Rana sylvatica*).
 Olive, with large, round, black spots, irregularly scattered... **Salt-marsh Frog** (*Rana virescens*).
 Pale brown, with four rows of large black spots **Leopard Frog** (*Rana palustris*).
 Green or olive; head paler..... **Pond Frog** (*Rana clamitans*).
- 2b. No vein-like fold of skin.
- b. SIZE LARGE.
 Olive, irregularly mottled with brown **Bull Frog** (*Rana catesbiana*).

DESCRIPTIVE LIST OF THE TOADS AND FROGS.

The Common Toad, *Bufo lentiginosus americanus* Le Conte (Fig. 16), is of moderate size and stout form. The skin is very rough. A large and prominent gland exists behind the eye. Color above brownish or yellowish brown, with numerous large dark spots, narrowly, though distinctly, edged with pale yellow. Extending down the center of the back is a pale yellowish or whitish band. The abdomen is dirty white. The ground color varies in individuals, some being distinctly reddish, and is influenced by temperature and changes on the individual itself from a lighter to a darker shade or the reverse. The pupil of the eye is horizontal.

The Toad is a familiar creature and is quite characteristic in appearance on account of its very rough glandular skin and the large, swollen glands behind the eyes. The hind feet are but slightly webbed. The blackish hue of the skin under the throat of the male Toad distinguishes it from the female. This skin is capable of great extension as the creature gives voice to the peculiar cry of the breeding season. The females are larger than the males. Length of body of male specimen, $2\frac{3}{8}$ inches; of female, $2\frac{3}{4}$ inches.

Range: Four varieties of this species inhabit North America. One of these appears to occur only in northeastern Massachusetts; another is confined to the Rocky Mountain region; the typical form is found in the southeastern United States, while the variety that occurs locally is distributed over an extensive area, namely: from British America to the Southern States and westward to Arizona.

Local Distribution: Common and abundant.

There is but one species of the local batrachians which



FIG. 16. THE COMMON TOAD
From specimen in Am. Mus. Nat. Hist.

might be confused by the observer with the Common Toad, and that is the Spadefoot Toad. The Spadefoot Toad receives its name from a pronounced spade-like process on the inner edge of the hind foot, a feature which is also slightly developed on the common species. The color of the Spadefoot is, however, quite different from the ordinary toad. Instead of the single light band along the back of the Common Toad, the Spadefoot has two pale bands, which run together and fork at the end of the body.

Many of the reptiles and batrachians have habits which render them of considerable economic value to the agriculturist,

but the Toad ranks first in the list of useful species. Although mainly insectivorous, the depredation on insect life made by the frogs is chiefly confined to the borders of ponds and streams, or to the marshes; in fact, to places not available for agriculture. The Toad, on the contrary, is a terrestrial species, inhabiting the open country and abounding over stretches of farmland. Here at twilight multitudes of toads issue forth to prey upon all forms of insect life, continuing the hunt throughout the night, and retiring at dawn for digestion. The examination of a toad's stomach after a nocturnal excursion will reveal an amazing number of insect forms, among which may always be found species that are destructive to agricultural products.

Among the writings of Shakespeare there are allusions to the venomous character of the Toad which have inspired innumerable scientists to clash in argument. Comparatively recent anatomical investigations have resulted in the discovery that a milky secretion contained in the swollen glands situated behind the eyes and in minute glands scattered over the surface of the skin possesses decidedly poisonous properties. When this fluid is injected into the blood of small mammals, marked symptoms at once develop and speedy death follows. The symptoms produced have been described as similar to those due to the use of *digitalis*, the action being upon the nerve centers and the heart. The effect upon any unwary dog that seizes a toad in its jaws is at once evident. There are immediate signs of distress, and the animal soon foams at the mouth and champs its jaws as if in considerable pain. These symptoms continue for an hour or more.

When the larger glands on the head are compressed, tiny jets of a sticky white fluid are ejected to a distance of three or four inches. Through accident the writer has discovered that this fluid is intensely bitter to the taste. In spite of this poisonous secretion, the Toad is generally harmless when handled. The story of wart-producing powers, furthermore, is purely fallacious. The secretion in the glands which have been mentioned is dangerous only when injected directly into the blood of small animals, but nevertheless Shakespeare's much-combated references have been proved to have abundant foundation in fact.

Most batrachians, particularly those species with a rough skin, secrete a certain amount of this irritant.¹

The Toad is protected by the characters just mentioned from attack by most mammals and birds. The species of snakes, however, that prey upon cold-blooded creatures, appear to prefer toads to frogs.

In its metamorphosis the Toad differs somewhat from the frogs. It leaves its place of hibernation rather late, not until warm weather has become established in the spring, when the weird, drawn-out trill of the males is heard about rain pools and shallow bodies of still water. The eggs are deposited in long strings.² After the strings have absorbed the required amount of water through their transparent covering and lie upon the bottom undergoing development. Each egg measures about a quarter of an inch in diameter. The tadpoles emerge from the eggs after a period of eight to ten days from deposition. They resemble minute leeches and cling for some hours to the leaves of aquatic plants by means of small suckers on the lower surface of the head. Within forty-eight hours they cease the clinging stage and wriggle their way about by means of a rapidly developing, fin-like tail. Four days after hatching they are agile swimmers and feed upon mossy growths of the pool.

The writer has made the following observations upon growth during the tadpole stage:

May	3.	Tadpoles hatched. Clinging stage.....	Length,	$\frac{1}{8}$ inch
"	4.	Body more elongate; swimming feebly at frequent intervals.....	"	$\frac{3}{16}$ "
"	5.	Tail distinctly compressed.....	"	$\frac{1}{4}$ "
"	6.	Tail shows fin-like edges.....	"	$\frac{9}{32}$ "
"	7.	Tail fully developed; feeding.....	"	$\frac{5}{16}$ "
"	12.	Body assuming stout proportions.....	"	$\frac{1}{2}$ "
"	17.	Color above jet black.....	"	$\frac{3}{4}$ "
"	25.	Tadpoles appear fully grown and cluster in masses in very shallow places.....	"	$1\frac{1}{16}$ inches

¹ Among the local frogs the character named is strongly evidenced by the Leopard Frog (*Rana palustris*). When handled, this species gives out a strong odor. Few snakes will eat it.

² The eggs of the frogs are deposited in masses.

- May 26. Rudiments of hind limbs discernible.
 " 30. Hind limbs perfectly formed in miniature and measure $\frac{3}{16}$ inch in length. The tadpoles are now brownish and show traces of spots. Length $1\frac{5}{32}$ inches
 June 4. Hind limbs $\frac{3}{8}$ inch long.
 " 5. " " $\frac{7}{16}$ " "
 " 12. " " fully developed. " $1\frac{1}{4}$ "
 " 14. Front limbs break through operculum.
 " 16. Absorption of tail rapidly taking place.
 " 18. Tail nearly absorbed; young toads leaving the water.
 " 20. Metamorphosis complete; surrounding meadows teeming with perfectly developed toads measuring $\frac{7}{16}$ inch (body).

The full-grown tadpole of the Toad and the perfectly developed creature as it leaves the water, are much smaller than the frog tadpole, which usually attains a length of three and one quarter inches before growth of the hind limbs begins, while the perfect frog generally measures an inch or more when it becomes fitted for semi-aquatic life. The tiny toads fall a prey to many enemies, and but a small proportion of their numbers attains maturity. Full growth is reached in about three years.

The Spadefoot Toad, *Scaphiopus holbrooki* Harlan (Fig. 17), is moderate in size. In form it is very stout, with wide, blunt head. Color, dark brown, or ashy-brown, with two rather indistinct bands of paler shade on the back; these bands begin behind the eyes and extend in wavy or irregular fashion to the end of the body, where they run together.

Although the skin is rough and is covered with numerous raised points, it presents a smoother surface than that of the Common Toad. The parotid gland (behind the eye), though well-developed and very pronounced, is of smaller size in proportion to the individual than that of the Common Toad.

On the inner portion of the under surface of the hind foot there is a hard, spade-like process, tinged at the edge with deep black. From this appendage the creature derives its name. The hind foot is fully webbed. The pupil of the eye is elliptical

(cat-like), a characteristic which is useful in distinguishing this species from the Common Toad, since in the latter the pupil is horizontal.

The species presents some variation in color pattern. Specimens from the northern portions of the United States are sometimes nearly uniform in color, while those from the extreme South possess a very distinct pattern. Length of body, in sitting posture, $2\frac{1}{2}$ inches; total length, hind limbs outstretched, 5 inches; width of head over ear plates $1\frac{1}{8}$ inches.

Range: The entire eastern United States, from New England to Florida and westward to Texas.

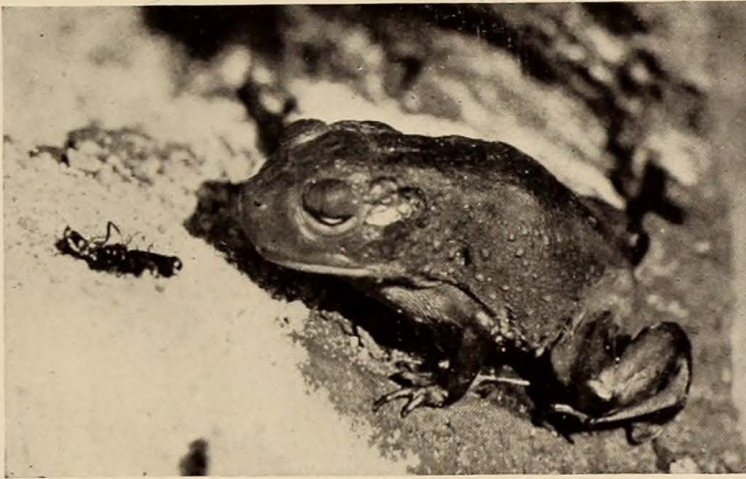


FIG. 17. THE SPADEFOOT TOAD
From specimen in New York Zoölogical Park

Local Distribution: Rare.

The retiring habits of the Spadefoot Toad render it an object seldom seen. The animal employs the sharp scoops of its hind feet to work its way into the soft ground or sand, and there passes the hours of daylight entirely hidden. At night or after heavy showers it ventures abroad for food, sometimes lingering in the vicinity of a rain-pool and uttering its plaintive cry. During the latter part of April and in May this toad congregates in numbers about shallow bodies of water to breed. The voice of the male resembles the tremulous call of the Common Toad, but is slightly louder. The eggs are similar to those of the Toad, and are laid in strings. The metamorphosis is completed within a few weeks from the time of hatching.

The Cricket Frog, *Acris gryllus crepitans* Baird (Fig. 18), is very small. The skin is rough. The body color is brown or grayish brown. Extending from the snout nearly to the end of the body there is a wide band of bright green, which is interrupted between the eyes by a dark triangular blotch, with its point directed backwards. There are three small blotches on the sides, while the hind limbs are banded with dark brown. Beneath, the color is yellowish white. This species is subject to rapid and marked color changes

Cricket
Frog.



FIG. 18. THE CRICKET FROG

From specimen in New York Zoölogical Park

under the influence of varying temperature and the mood of the individual. These changes affect the general color of the body and the bright band down the back. The band, although usually of some shade of green, sometimes fades to yellowish brown. The species is easily distinguished on account of its distinct color pattern. It is the smallest of the local, tailless batrachians. Length of body, $\frac{7}{8}$ inch; total length with hind limbs outstretched, $2\frac{1}{4}$ inches.

Range: The typical form occurs from North Carolina to Florida, and westward to Louisiana. The variety *crepitans*, also, is found from the southern portion of New York State to North Carolina; it extends westward to Kansas, and still farther westward in the extreme northern portion of its range.

Local Distribution: The local form, var. *crepitans*, is common in portions of Long Island and in New Jersey.

The Cricket Frog frequents the borders of shallow pools, where its sharp, trilling cry, resembling in volume the call of the field cricket, may be heard at various times of the year. It is particularly vociferous during the breeding season. The eggs are deposited early in May in small bunches. They usually adhere to grass or reeds.

The animal is very difficult to capture, since it possesses

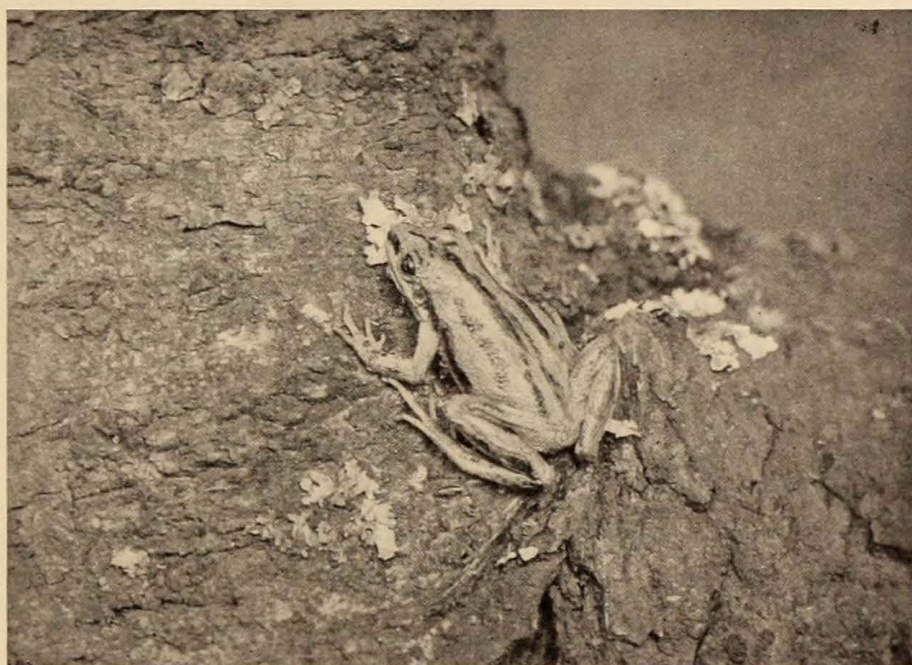


FIG. 19. SWAMP TREE TOAD
From specimen in Am. Mus. Nat. Hist.

great leaping powers and quickness in diving. During periods of heavy dew these frogs may be found in high grass adjacent to marshes. Owing to its smallness and agility, it is rarely observed after the breeding season.

The Swamp Tree Toad, *Chorophilus triseriatus* Wied. (Fig. 19), although a very small species, is larger than the Cricket Frog. It may be readily recognized by the coloration. The ground color is pale gray. On the back are three dark brown stripes or bands, extending the length of the body. On the side is a broader band, extending from the snout

Swamp
Tree Toad.

across the eye and thence along the greater length of the body. The abdomen is whitish, with a few scattered black dots. Length of body, $1\frac{1}{16}$ inches; total length, with hind limbs outstretched, $2\frac{1}{4}$ inches.

Range: This is essentially a western species. It is very abundant in the northwestern portion of the United States, east of the Rocky Mountains, whence it extends southward into Texas. The range extends eastward in the shape of a narrowing band which terminates in central and southern New Jersey. In this apex of its eastern distribution the species is common, especially in the swampy areas of the barrens of the southwestern part of the State.

Local Distribution: Mr. W. D. W. Miller has taken many specimens near Plainfield, N. J.

Like other species of the *Hylidæ*, this creature leaves its winter quarters early and gathers about shallow pools and ditches to breed. It is not an agile swimmer, since the hind feet are not webbed. If alarmed when near the water, it wriggles its way into the marginal vegetation so quickly that it is difficult to capture. Its cry is a sharp trill like that of the Cricket Frog.

Pickering's Tree Toad, or "Peeper," *Hyla pickeringi* Storer (Fig. 20), is a very small animal. The body is pale brown above with distinct, narrow markings on the back which assume the form of an X on the upper portion of the back, behind which is a \wedge -shaped marking. At the end of the body there is another mark, similar to the latter, but of about half the size. A similar mark with the point directed backwards occurs behind the eyes. A band of the same dark color that constitutes the markings on the back extends from the snout across the eye, and thence down the side to a short distance behind the fore limb. The hind limbs are banded. Beneath, the color is yellowish white.

Although the color-pattern is generally pronounced, and the usual colors of the species are as described, this individual varies greatly in color, not only in different individuals but also in the same individual at different times. The writer has observed specimens of normal colors change to pale gray, and

others to a bright tint of green. While the animal was in the green phase, the pattern on the back could not be discerned.

The toes are provided with well-developed adhesive disks, or "suckers," which are particularly distinct on the fore feet. The skin of the abdomen is coarse and granulated; that of the back is smooth.

Male specimens of this species may be distinguished from the females by the loose, dark skin on the throat. This loose skin constitutes the vocal sac, an organ capable of great ex-

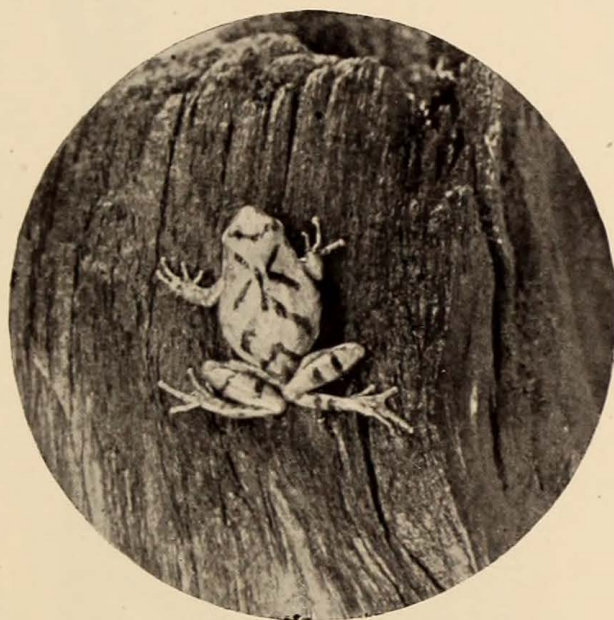


FIG. 20. PICKERING'S TREE TOAD
From specimen in New York Zoölogical Park

pansion while the animal is uttering its shrill mating call. Length of body, $1\frac{1}{8}$ inches; total length, hind limbs outstretched, $2\frac{1}{2}$ inches.

Range: The entire eastern and central portions of the United States, abundant.

Local Distribution: Common, but not easily seen.

Only three representatives of the genus *Hyla* are found in this vicinity.¹ The species are easily distinguished from one another by their characteristic color-patterns, and from other tailless batrachians by their peculiar feet and the disks on the toes.

¹ One species, the *Hyla andersoni*, is of doubtful occurrence, although it is included in this Leaflet.

With the first mild days of spring, the bogs and marshes resound with the cheery, piping notes of the males of this species, the peculiar character of which has given rise to the popular name of "Peeper." Specimens are difficult to find, since they hide among the blades of the coarse grass, and when disturbed take refuge in the water. After the breeding season the animals



Miss Mary Dickerson, Photo.

FIG. 21. ANDERSON'S TREE TOAD

leave the bogs and live among the leaves and low bushes and rank vegetation, and their sharp cries are seldom heard. To produce the piping cry, so intense and penetrating for so small a creature, the male fills his vocal sac with air until it is more than half the size of the body. Then the air is expelled with such energy that the sides of the tiny creature become hollow with the convulsive effort. The eggs of this species are deposited in small masses and hatch quickly. The tadpoles undergo a rapid metamorphosis.

Anderson's Tree Toad, *Hyla andersoni* Baird (Fig. 21), is of moderate size. The disks on the toes are well developed. Bright pea-green above with a narrow, though very distinct, white border on the sides and upper surfaces of the limbs. A narrow, purplish brown band extends from behind each nostril, across the eye and to the base of the fore limb. The lower sides are purplish brown, though of a lighter shade than the band, and are ornamented with irregular spots of a lighter and richer hue. The abdomen is pinkish white, though its edges are suffused with the purple tinge of the sides.

Anderson's
Tree Toad.

This species is of great rarity, and but very few specimens have ever been captured. It is a most attractively colored creature, and on account of the pale green of the upper surface resembles the European Tree Toad. Mature specimens are from an inch and a quarter to an inch and a half in length.

Range: The species is so rare that its range has not yet been determined, but is supposed to extend from southern New York to Florida. The species has been found in South Carolina.

Local Distribution: One specimen has been taken at Jackson, N. J., another at May's Landing and still another (represented in the figure) at Lakehurst, in the same State.

The Gray Tree Toad, *Hyla versicolor* Le Conte (Figs. 22 and 28), is of moderate size and stout form. The ends of the toes are disk-like and adhesive. Color above, usually pale lichen-gray, with large wavy and irregular markings of darker shade. On the hind limbs these darker markings are so disposed that they appear to form two bands when the limbs are folded. Abdomen uniform grayish white; lower portion of hind limbs tinged with bright yellow.

Gray Tree
Toad.

The skin is very rough and is covered with minute, warty points on the back. Male specimens differ from the females in having loose, dark skin under the throat.

The species exhibits great variation in color according to light, temperature and the temperament of the individual. From the pale, ashy gray ordinarily present, the color varies to brown, very dark gray, or to vivid green. With the variation

of color the pattern becomes obscure or more prominent. Length of body, 2 inches; total length with hind limbs outstretched, $4\frac{5}{8}$ inches.

Range: The entire eastern and central portions of the United States, from Maine to Florida, and westward to Texas.

Local Distribution: General and fairly abundant.

The call of the Gray Tree Toad is a loud clattering sound, and resembles the scolding of a frightened chipmunk or red squirrel. It is said that the Tree Toad is particularly vociferous before a coming rain. Like other prognosticators of the weather, however, these creatures are quite unreliable. Their cries are

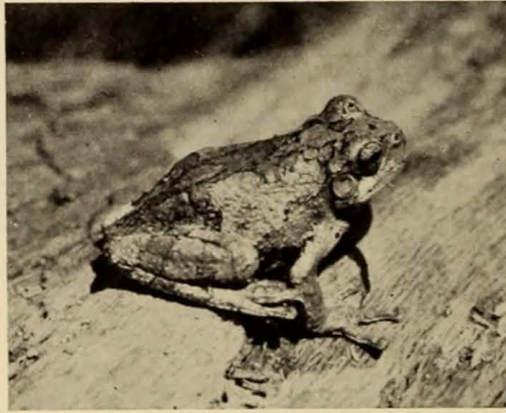


FIG. 22. THE GRAY TREE TOAD

From specimen in New York Zoölogical Park

particularly frequent during the sultry intervals that follow a light summer shower. After the breeding season is over, this Tree Toad frequents trees and usually takes up its abode at some elevation above the ground. It is supposed to deposit its eggs during the latter part of May or early in June. Small weedy ponds are usually selected as breeding-places. The eggs hatch quickly and the transformation from the tadpole stage is rapid.

The Salt-Marsh Frog, *Rana virescens* Kalm (Fig. 23), is of moderate size and rather slender form. Ground color bronze to olive or bright green, but always vividly marked with large and irregularly scattered round spots of dark brown or black; on the back several of these spots are very elongate. The spots are more regularly disposed on the hind limbs, and when the legs are flexed, they have a banded

Salt-Marsh
Frog.

appearance. Over each eye there is a rounded spot, placed slightly inwards towards the center of the head.

A raised, vein-like fold of skin extends from behind each eye to the end of the body and is pale bronze in color. A stripe of similar color extends on each side of the head from the tip of the snout to behind the earplate, where it terminates in a raised skin fold. The under parts are white, indistinctly mottled with gray about the limbs.

When examined from directly above, the arrangement of the spots on the back appears to be irregular. This character may be employed to distinguish the species from the Leopard Frog,



FIG. 23. THE SALT-MARSH FROG
From specimen in New York Zoölogical Park

which it resembles in form and pattern. On the Leopard Frog the spots are rather square in shape and are quite regularly disposed in rows down the back and the sides. Length of body, $3\frac{1}{2}$ inches; total length, hind limbs outstretched, 9 inches. These measurements were taken from a very large specimen. The average length of body is about $2\frac{3}{4}$ inches, and total length more than 7 inches.

Range: Maine to Texas. Several varieties of the species are recognized, some of which occur in the Western States, Mexico and Central America.

Local Distribution: Abundant in swampy situations near the coast.

The Salt-Marsh Frog, sometimes called the Field Frog, inhabits swampy meadows rather than large bodies of water, and is common in many brackish swamps in this vicinity, although it is also found in fresh-water swamps. It is particularly abundant in the Newark meadows. The vocal sacs of the males are

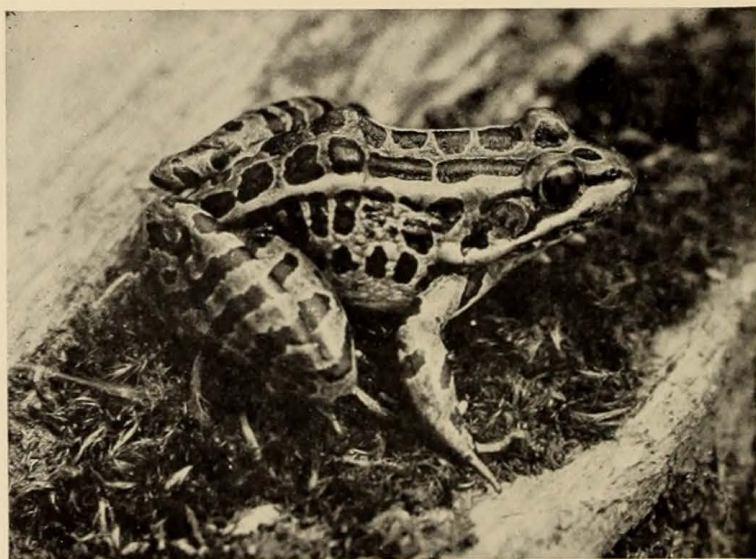


FIG. 24. THE LEOPARD FROG, OR PICKEREL FROG
From specimen in Am. Mus. Nat. Hist.

very prominent externally and become distended as the species gives voice to its sharp, rasping call.

The Leopard Frog, or Pickerel Frog, *Rana palustris* Le Conte (Fig. 24), is of moderate size and rather slender form. Ground color above, pale brown, with four rows of large square spots, two rows down the back and one on each side. These spots are very dark brown or black. The hind limbs are banded with the same color, which is also present in irregular spots on the fore limbs. There is a large spot over each eye, and one directly over the snout. The upper lips are dark brown, and above this color there is a band of pale bronze.

Four ridges or elevated folds of the skin extend down the back, the two outer rows of which are vividly tinged with light bronze; the two inner folds traverse the centers of the rows of dark spots on the back. The abdomen is silvery white. The under surface of the hind limbs is bright yellow, as is also a small area behind each fore limb.

The species may be distinguished from the Salt-Marsh Frog by the regularity of the rows of spots. It is the most showy of our local frogs.

Range: Eastern North America.

Local Distribution: General.

The Leopard Frog is a wanderer, traversing and frequenting stretches of damp meadows and fresh-water swamps. It is sometimes found a considerable distance from the water. Young specimens are most numerous about shallow, slow-running streams bordered with dense vegetation.

When in danger this frog exudes through its skin an acrid secretion which protects the creature from its enemies. Few snakes eat these frogs. They are said, however, to be good bait for pickerel on account of their bright colors; hence one of the popular names, the "Pickerel Frog."

The Pond Frog, or Green Frog, *Rana clamata* Daubin (Fig. 25), is a large species. Form, stout. Dark brown or olive-green above, with an irregular sprinkling of darker spots; head usually bright green. White beneath, with an obscure marbling of gray about the under surface of the limbs; throat of the male generally yellow; of the female, white, marbled with gray.

**Pond, or
Green,
Frog.**

The color of the individual varies with the changes in light and temperature. A common phase displays much vivid green about the head and anterior portion of the body, while the posterior portion is brown or olive. Sometimes the entire body is green, in other instances dull brown. The male may be distinguished from the female by his much larger earplate (tympanum).

This species resembles the Bull Frog, but may be readily distinguished therefrom by a marked anatomical character: on each side, beginning behind the eye and extending nearly the

entire length of the body, there is a vein-like ridge or fold of skin. The Pond Frog is, moreover, considerably smaller. Average length of body, $3\frac{1}{2}$ inches; total length, with limbs outstretched, $7\frac{3}{4}$ inches.

Range: Eastern and central United States and southern Canada.

Local Distribution: General and abundant.

With the possible exception of the Toad, the Pond Frog is the most familiar of our local batrachians. It is found everywhere and abundantly in ponds and streams, where its familiar



FIG. 25. THE POND FROG, OR GREEN FROG
From specimen in Am. Mus. Nat. Hist.

croaking may be heard during the summer months. The eggs are deposited in masses early in the spring. The jelly-like clusters containing the numerous black dots representing the developing embryos are familiar objects. The tadpoles are rather slow in growth, generally consuming two seasons before they complete their metamorphosis, according to the temperature of the water and its exposure to sunlight. In the fall the tadpoles burrow into the mud and hibernate. The average tadpole is three inches in length when the limbs are well advanced in growth, and the young frog, immediately after absorption of the tail, measures slightly more than an inch. Tadpoles

confined in indoor aquaria are much retarded in their growth, and many remain as such for a period of three years or more.

The Bull Frog, *Rana catesbiana* Shaw (Fig. 26), is very large and stout. Limbs short but powerful. Hind feet large and very fully webbed. Head wide. Color above, light olive, irregularly blotched or marbled with dark olive or brown. The intensity of these markings varies with individuals and the disposition of the individuals themselves. Limbs, especially the hind pair, with brown blotches which to-

**Bull
Frog.**



FIG. 26. THE BULL FROG
From specimen in New York Zoölogical Park

ward the extremities assume the form of bands. The under parts are silvery white, with grayish markings, the throat in many individuals assuming a yellowish tinge. The portion of the head between the mouth and the eyes is usually tinged with pale green; the upper surface, however, matches the general color of the body.

Half-grown specimens resemble the adult of the Pond Frog, but may be recognized by the absence of the vein-like fold of

skin which is present on each side of the body in that species. There is, in fact, no trace of this in the Bull Frog. A full-grown specimen will measure $14\frac{1}{2}$ inches from the tip of the snout to the end of the outstretched limbs, and $6\frac{3}{4}$ inches when in a sitting position. Such a specimen would weigh about one pound.

Range: The eastern and central portions of the United States and southern Canada.

Local Distribution: General, but not so abundant as the Pond Frog.

The Bull Frog frequents larger bodies of water than the common Pond Frog, being especially partial to large ponds and slow-running rivers, where the banks are lined with overhanging vegetation in which it can find concealment. The tadpoles grow to a greater size than those of the Common Frog. They may be distinguished by their distinctly yellowish abdomen. During the hours of sunlight they have a habit of lying in shallows around the borders of the pond, but upon the slightest disturbance they scurry for deeper water with startling activity and swim close to the bottom in order to leave a trail of muddy water, agitated by the thrashing of their tails. This maneuver tends to conceal their exact location.

Bull Frogs, particularly young specimens, have a peculiar habit of emitting a sharp cry when disturbed on the bank, and instead of plunging directly into the water, they skim over the surface for a short distance. The Common Frog, on the other hand, when disturbed, jumps into the water and instantly dives to the bottom, where, with a quick kicking of the hind limbs, it stirs up a cloud of mud in which it can conceal itself.

The Bull Frog is a most voracious creature. Mature specimens do not hesitate to swallow any moving object of about their own size that may come within reach of the wide gape of their jaws. They are largely insectivorous, but birds and small rodents are frequently eaten. Captive specimens experience no difficulty in swallowing sparrows or half-grown rats.

The call of a Bull Frog differs from the ordinary "croak" of a Pond Frog. It is a deep, protracted bass, resembling the sound made by drawing a bow for half its length across the string of a bass-viol. The note is repeated four to six times.

The eggs of the Bull Frog are laid in May. During the latter part of July or in August of their second summer the tadpoles acquire limbs and leave the water as perfect frogs.

The Wood Frog, *Rana sylvatica* Le Conte (Fig. 27), is of small size. It is light brown above, with a dark brown spot on each side of the head. This spot extends from the snout through the eye (darkening the lower half of the iris), covers the earplate and adjacent area and terminates in a sharp angular outline with a fold of the skin behind

Wood
Frog.



FIG. 27. THE WOOD FROG
From specimen in New York Zoölogical Park

the base of the fore limb. A whitish line in strong contrast with the dark color on the sides of the snout traverses the upper lip. There is a smaller dark spot near the base of the fore limb. The hind limbs are indistinctly banded on the upper surface. The abdomen is silvery white.

Two well-defined ridges, or vein-like folds, extend down the back of this easily-recognizable species. In different specimens the body color varies somewhat, some are distinctly reddish. The characteristic dark spot on each side of the head is always apparent, however, and facilitates identification. Length of body, $2\frac{1}{4}$ inches; total length, with hind limbs outstretched, $5\frac{3}{4}$ inches.

Range: Like many of the North American frogs, it is gener-

ally distributed over the eastern and central portions of the United States and southern Canada. It does not extend, however, into the sandy portions of the Southern States.

Local Distribution: The Wood Frog appears to be restricted to certain areas, in which it is abundant. The writer has found it common in the woods along the Palisades of the Hudson River and in Westchester County, N. Y.

The Wood Frog, even where it is abundant, is not often seen, on account of its habit of living among the fallen leaves of timbered districts and the fact that its sober colors almost precisely match the dead leaves. It is aquatic only in the spring, when it frequents small bodies of water for the purpose of laying its eggs. At such times the croaking of the many males indicate the first awakening of the cold-blooded creatures from their winter sleep, for the Wood Frog lays its eggs before the ice has entirely left the ponds. The writer has repeatedly observed them as early as March. The eggs are deposited in masses from two to three inches in diameter, and hatch within ten days. The tadpoles grow rapidly and, unless their pool receives the water from cold springs, complete their transformation early in the summer. They are black above and bright golden bronze beneath. Upon leaving the water the young frog is slightly more than half an inch in length.



FIG. 28. THE GRAY TREE TOAD

From specimen in New York Zoölogical Park

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