

AMPHIBIANS AND REPTILES

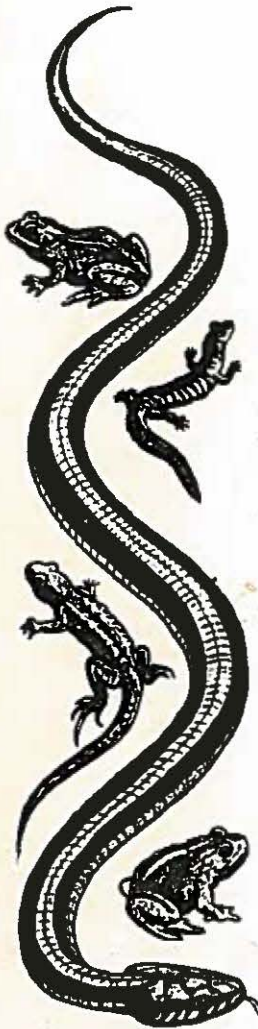
OF

LASSEN VOLCANIC NATIONAL PARK

By

ROBERT BADARACCO

Published in cooperation
with the National Park Service



LASSEN VOLCANIC NATIONAL PARK

Mineral, California

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*Lassen Volcanic National Park
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Nature Is The Art of God.

—Dante

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PREFACE

This book was written with a particular group of people in mind: those who find snakes, lizards, frogs, toads, and salamanders interesting forms of life and subjects worthy of their observation and study. Amphibians and reptiles constitute an integral part of the natural history of Lassen Volcanic National Park, as important—at least to the interested person—as land-forms, mammals, and wild-flowers. Interpretive literature concerning these obscure creatures is often scarce, and this lack of popular knowndge is frequently a source of frustration to the individual who delights in observing these animals in their native habitats and learning more of their interesting ways. I hope that this book will answer such a need for the Lassen visitor.

Common names used in this book are those approved by the American Society of Ichthyologists and Herpetologists. Scientific names are given in parentheses at the beginning of each species account. In most instances I have purposely refrained from referring to or making distinctions between sub species; sub-specific characteristics are subtle, technical, and would serve no purpose in a publication of this scope. Identification of specimens can be readily made from the use of the full-page illustrations, descriptions in the text, and the key at the end of the book.

All drawings in this book have been made by Mr. Donald Hovie.

It cannot be stressed too strongly that Lassen is a National Park, and as such is an area where all wild forms of life are protected. One should not construe any comments in this book to be approval, tacit or otherwise, for the collection of specimens within park boundaries. The interested visitor is encouraged to observe and study these animals, but he is cautioned not to molest or harm them in any manner, or remove them from their natural surroundings.

Much of the information contained within the species accounts is based upon my own field research and observation, but I do not presume to present any essentially new herpetological knowledge in this book. I have consulted the biological literature and other publications written by experts in the field of herpetology, and I have drawn heavily from these rich sources.

Under the heading, "Suggested Readings", the reader will find a number of selected references which will be of invaluable assistance in further amphibian-reptile study. If the reader has been somehow stimulated to read on, then this book will have served a fruitful purpose.

To those who have assisted and encouraged me both in my field study and in the preparation of this manuscript, I offer my sincere thanks.
L.V.N.P.

ROBERT BADARACCO

Spring 1961

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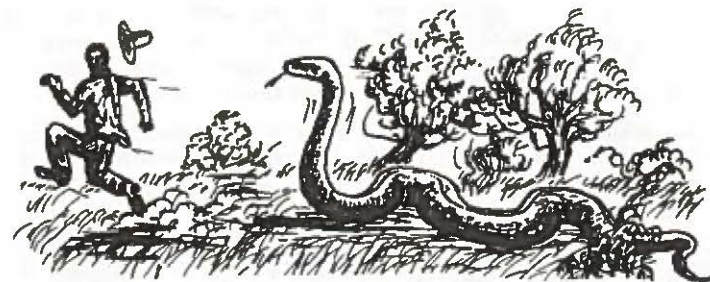
CHAPTER I

FOLKLORE, FANTASY, AND FACT

An Old Story

The naturalist on duty at the museum information desk glanced down across the sales counter at a small eight-year-old chinning himself on the counter's edge and eagerly scanning the natural history publications for sale. The boy's mother, close beside, promised the lad a book, and he had but to select the one of his choice. His eyes moved up and down the columns of books dealing with a variety of topics—geology, birds, trees, stars, and others—then suddenly stopped as they caught sight of a colorful book with illustrations of frogs, salamanders, snakes, and lizards on its cover. "Mom," the little fellow beamed enthusiastically, "I want that book, the one with the snakes and frogs on the cover." A disgruntled look crossed the mother's face as she disgustedly retorted, "Now Billy, why in heaven's name do you want to go and buy that book on all those slimy things? Here," she said, pointing first to a book on wildflowers and then to one on birds, "Why don't you let mother get you one of these books on wildflowers or birds, something nice instead of all those poisonous creatures?"

Is it any wonder that many of us have come to regard reptiles and, to a lesser extent, amphibians, with apprehension? When this sort of indoctrination begins at so early an age, we have little choice but to accept the words of our parents; after all, parents know best. Thus the acquisition of phobias and fallacious ideas begins as we inherit them from our elders, and it is no wonder that we jump at the mere sight of a harmless garter snake 20 years later. We might have brought that garter snake home as a child, but mother would have screamed, and father would have fumbled for the first weapon at hand to bludgeon the helpless creature to insensibility. Mother wasn't acting, and father wasn't intentionally cruel; each was merely acting or, better yet, reacting in the way that previous generations had reacted, and they were unknowingly handing down the same fears, misconceptions, and phobias that have been with us for ages.



Individuals with long experience behind museum desks have found that children invariably possess a natural curiosity for reptiles and amphibians. People are not born with these fears; they acquire them. We can thank our forbears for beliefs that snakes are slimy, that handling toads produces warts, that many lizards are poisonous, that reptiles are always cold, and that salamanders live in fire. Folklore and fantasy have so pervaded our thought regarding these creatures that the average person's knowledge of them is more fallacy than fact.

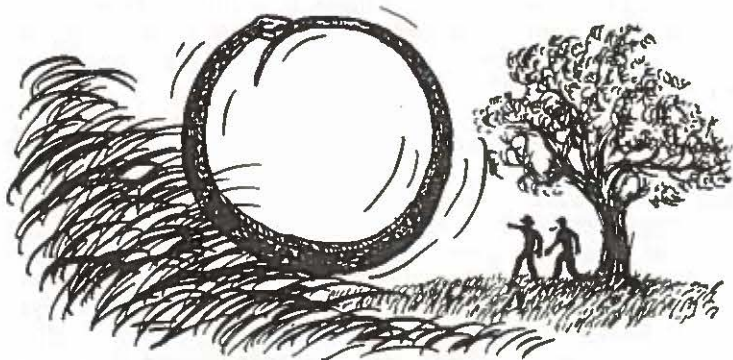
From Hoop-Snakes to Fire Spirits

It is commonly believed that snakes are cold and slimy. Snakes and other reptiles are, in fact, quite dry to the touch, and how cold they are is often a matter of interpretation. Oddly enough, the power of suggestion must be very strong, as

this belief continues to prevail among some individuals who have actually handled the creatures; hence, the common rebuttal, "I know they're slimy, I've felt them myself." The mucous secreting glands that do produce the slime upon the skins of salamanders and frogs are absent in reptiles; their scales are thus free of any slime secretion. But when we consider the abundance of glands present upon the bodies of mammals, the group of animals to which we claim affinity, we find that they perhaps deserve title to the term "slimy-skinned." Did you ever notice the window pane that little Johnny rubbed his nose against?

As to the claim that reptiles are cold, it must be said that they are at times cold, just as they are at times warm. The temperature of reptiles varies directly with the temperature of the environment. Oftentimes, they are warmer than some mammals.

A common snake myth is the belief in the hoop-snake, a clever and acrobatic individual which sticks its tail in its mouth, assumes the shape of a hoop, and then proceeds to revolve until the moment is right to stab its victim; this it accomplishes by means of a stinger on its tail.



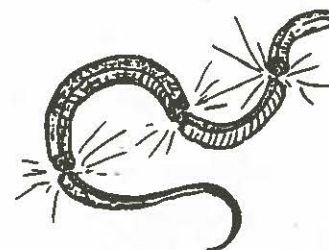
Equally as widespread is the tale of the milk snake which purportedly arouses the ire of many a farmer because of the volume of milk it consumes, directly from the cows. No snake has ever been known to revolve as a living hoop, nor does any snake possess a stinger on its tail, though there are snakes with sharp tails. As for the milk snake, picture if you can a cow remaining still long enough for a snake with needle-sharp teeth to consume a meal, on the hoof!

One of the more ridiculous fantasies concerning snakes is the alleged existence of the glass snake, a creature that breaks into fragments when hit with a stick, and then, when danger has passed, adroitly reassembles itself. This bit of 20th century mythology is undoubtedly based upon the habits of a certain legless lizard which, like many lizards, has the ability to release its tail when slight pressure is brought to bear upon it. While the would-be captor is momentarily distracted by the wiggling tail, the lizard hastily makes its escape.

It is firmly contended by some that certain snakes, namely the garter snake, swallow their young or hide them in their mouths when danger threatens. The contention is pure fiction, in all probability based upon the fact that certain snakes, including garter snakes, are live bearers, and that gravid females have been found with unborn young inside, the finder simply mistaking uterus for stomach.

It has been said that snakes cannot tolerate crawling over soil formed from volcanic rocks having a glassy texture. This is supposed to cause them great discomfort when the small, glassy particles lodge themselves between the ventral scales. This assumption has even been offered in evidence by some pseudo-scientists for the fact that rattlesnakes are not present in the park. However, supporters of

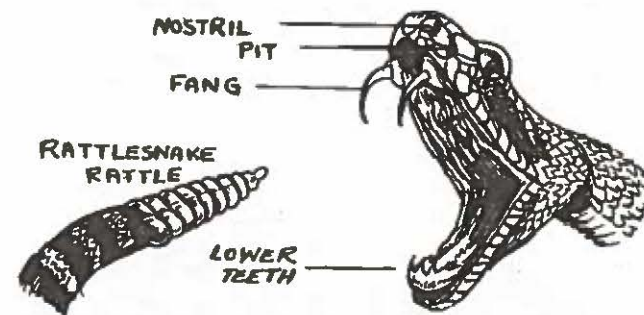
this theory fail to recognize the more obvious facts that there are present within the park other species of snakes. Moreover, rattlesnakes are so common in certain volcanic regions of the Southwest as to constitute a source of apprehension on the part of local inhabitants.



GLASS SNAKE

The rattlesnake is undeniably clothed in mystery and surrounded with folklore far in excess of its actual importance. The rattler has been both the object of man's fear and fascination for generations. Witness the number of "snake pits" along our highways which still, despite their reputations, attract thousands of curious people annually, and make money doing it.

Rattlesnake folklore has prospered on the curiosity of the public, and its dissemination has been rapid, especially with the widespread media of communication, not the least of which is the popular periodical. Beliefs that the rattlesnake's age may be determined by counting the number of rattles on the tail, that it stings with its tail or even its tongue, or that it will not tread over a horsehair rope because the rope pricks its underside, are all pure fiction. Yet subscribers to these misconceptions are many. Rattlesnakes bite with a pair of specialized teeth in the upper jaw; through these two hollow fangs the deadly venom is injected. Rattlesnakes add a segment to the rattle on the tail each time they shed their skin, which may occur a number of times in a year.



The claim that a rattlesnake will commit suicide if it bites itself is completely unfounded, as rattlesnakes are immune to their own venom. In fact most snakes are resistant to the venom of other snakes. Because the kingsnake possesses this immunity coupled with voracious feeding habits, it is a formidable enemy of the rattlesnake. But the idea that the kingsnake seeks out its archenemy is equally unfounded. The kingsnake is an indiscriminate feeder which takes on all comers, provided they are not too large to swallow.

Lizards have not been as abused or maligned as their snake cousins. It seems that the presence of legs on a very similar body has tended to reduce their sinister aspect in the eyes of man. (Most people are unable to differentiate between a legless lizard and a snake.)

Lizards have not been tagged with the so-called evils and treacherous habits of snakes. Nevertheless, many people cling to the belief that lizards are poisonous and are therefore a constant hazard. Suffice it to say that there is only one poisonous lizard in the United States, the gila monster, a large, lumbering individual that inhabits the arid Southwest. A reticent and shy creature by nature, it avoids humans and bites only upon provocation or under unusual circumstances. The only other poisonous lizard in the world is the Mexican beaded lizard, a very close relative of the gila monster.

HORNED TOAD & GILA MONSTER



Lizards are generally regarded as animals that can tolerate fantastic amounts of sun and heat because they are mostly commonly found in warm, arid regions. Generally they are seen sunning themselves upon a rock and though they bask only for short periods at a time, they are most commonly thought of in this attitude. Actually, they are constantly shifting back and forth between sun and shade, thus maintaining a fairly stable temperature. Because they lack the internal heat regulatory mechanism that mammals possess, they are dependent upon their environment for their body temperature.

Studies have demonstrated that some reptiles are killed at temperatures of 98° F., less than the normal temperature of man, and that no reptiles can survive temperatures in excess of 118° F. for any length of time. When it is realized that the desert floor often exceeds 160° F. under the intense rays of the sun, it is understood that no reptile could exist thereon for longer than momentary periods. Mammals, certainly not thought of as heat-loving creatures in the sense of lizards, are able to outlast reptiles by far in prolonged exposure to solar radiation. They owe this ability to their "built-in thermostats." Lizards are not sun worshippers; place one in a jar in the direct rays of a strong sun, and its minutes are numbered.

Certain beliefs concerning the horned toad of the Southwest are quite prevalent. The chief fallacy is in its very name. The pudgy, little insect eater of the arid lands is, indeed, not a toad but a lizard. Its name is a misnomer, undoubtedly derived from the fact that it possesses a rough, warty-like skin reminiscent of the toad. The dissimilarities are greater, however, for the horned toad lays claim to a tail, scales, claws, and horns, all of which do not make up the attire of a true toad. This interesting reptile should properly be called the horned lizard.

Folklore and fantasy is much less prevalent regarding amphibians. Little is known about this relatively obscure group, and they are seldom encountered, with the exception perhaps of the ubiquitous frogs and toads. Furthermore there are no venomous species among them, and folklore thrives upon venomous creatures. The average person knows little about amphibians, and the herpetologist is often surprised—alarmed—that many people cannot identify a salamander. Upon being confronted with one for the first time, many think it is a lizard. Likewise to many, a frog is a toad or a toad is a frog, though the differences are certainly not difficult to observe.

Neither frogs nor toads cause warts on humans. The bit of mythology that states that the handler of a frog or toad may receive warts on his hand as a result is deeply rooted in folklore. The warty-like skin of frogs and especially toads is probably responsible for this fiction. Interestingly enough, toads do possess a toxic alkaloid in the numerous glands of their skin and though it does not produce warts, it may cause severe reactions when it is contacted by a would-be adversary. Many dogs and other animals have learned the hard way that toads are not to be mouthed. Results have been great discomfort, and in some cases severe illness. The delicate mucous membrane of the mouth and eyes are particularly susceptible to the poison, and pronounced irritation results.

It has been claimed that toads and frogs have demonstrated the amazing ability to remain imprisoned underground in chambers of limestone or porous rock for years upon end. Now and then an "eye-witness" account or popular article substantiates this viewpoint. Investigation invariably proves that these accounts are exaggerations or misinterpretations of the actual facts. Occasionally a frog or toad, estivating or hibernating beneath the ground to escape unfavorable environmental conditions, is unearthed, and upon such occurrences the rude assumptions are based. Frogs and toads do so retreat at times of drought or cold, but protracted periods of dormancy are unknown, as experiments have demonstrated. Toads enclosed in limestone boxes and placed underground died before the expiration of two years.

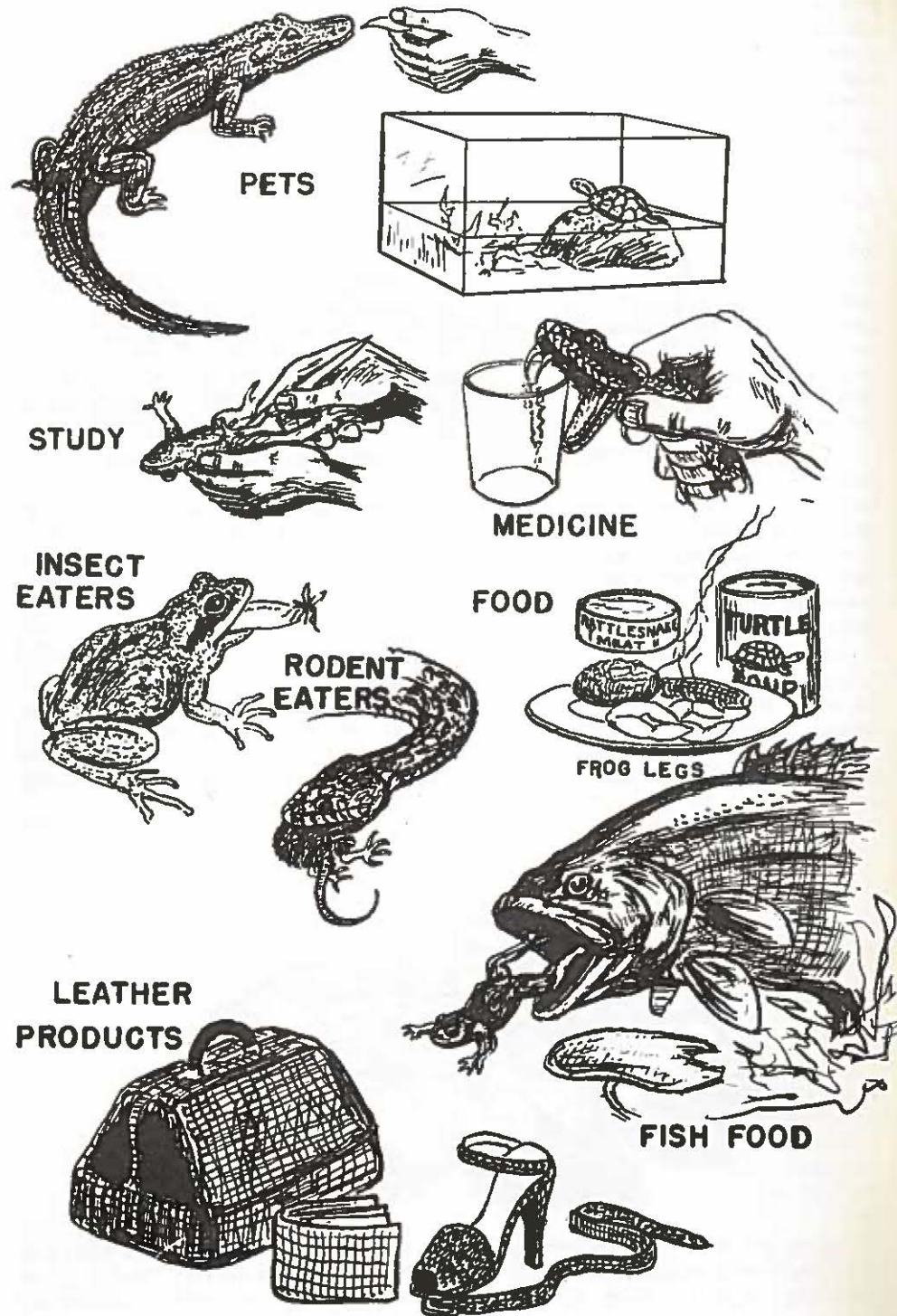
In considering the other major group of amphibians, the salamanders, we find that these creatures have been attributed with the ability to live in fire. Indeed, for centuries man has associated fire with these animals of moist skin which, in fact, perish with excessive heat more readily than most other vertebrates. Collectors of salamanders have even had certain of these delicate creatures die in their hands from body heat alone when held too long. Nevertheless, one accepted definition for the term, salamander, states "any person or thing that can stand great heat."

As far back as the 16th century, Paracelsus referred to the salamander as the "elemental fire spirit." This fiction has persisted since, and today the unskeptical are awed at the sight of a salamander leaving a raging fire in the hearth. Were they to investigate the log that they had just put on the fire, they might find that the salamander had been cozily nestled within the rotten wood, a common niche for this creature. Of course, the heat of the fire immediately drove it out, fleeing for its life.



Only a few of the more common fables, myths, fantasies—call them what you like—have been mentioned that, in this 20th century, continue to cloud popular knowledge regarding these animals. It seems incredible that while scientists are

IMPORTANCE OF AMPHIBIANS & REPTILES



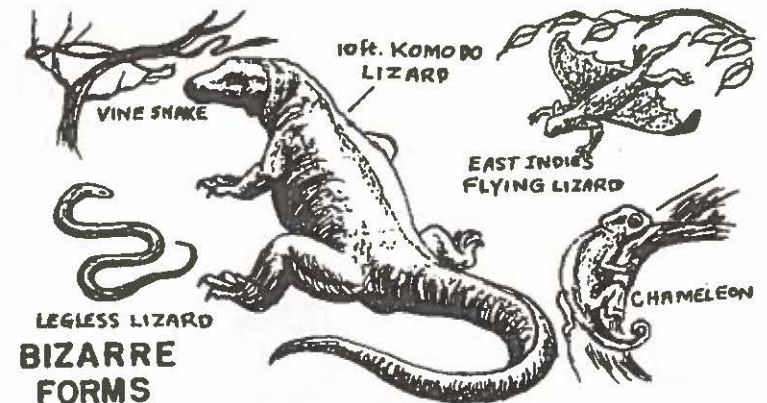
at this moment laying the groundwork for man's conquest of the moon, other men of the same society cling tenaciously to beliefs that are medieval. The power of word of mouth and hearsay is potent indeed, and science must wage a constant battle to endeavor to bring truth to people. The public has come to accept too easily what it reads in popular periodicals, and certain writers untrained in biological science, themselves victims of folklore and fantasy, have been set up as so-called experts. Beware of "experts"! Many of them haven't even seen the creatures about which they write.

Stranger than Fiction

Amphibians and reptiles are fascinating creatures, and their life histories are among the most interesting in the animal kingdom. It is unfortunate that the real aspects of their natural history have not been publicized instead of the purely fictional accounts. Those who would seek out the bizarre and the incredible in these animals need only look to their actual lives. Here may be found a wealth of the unusual, stranger indeed than fiction.

Species of amphibians and reptiles are represented the world over, residents of every continent except Antarctica. They occupy niches from the tropics to the Arctic Circle where only the wood frog represents these two classes of creatures—2,500 species of amphibians and 6,000 of reptiles. Their forms are as diverse as the regions they inhabit, and their habits as complex as the specializations and adaptations they possess.

In size these creatures range from frogs, a fraction of an inch in length to the giant salamander of eastern China and Japan, a brook-dwelling form that approaches a length of six feet; from snakes smaller than a pencil to the anaconda of South America, a water boa which has been said to reach a length of 46 feet, but which certainly reaches 30 feet; from turtles scarcely the size of one's hand to the great leatherneck turtle, the Pacific form of which attains a length of eight feet and tips the scales at one ton; and from lizards smaller than a cigarette to crocodiles which reach the fearsome length of 30 feet.



The form and structure of amphibians and reptiles may be bizarre or even grotesque. In coloration, some snakes rival even the birds. Nature has conceived methods beyond man's wildest dreams to enable these creatures to carry out their life processes. For example, the Surinam toad of South America has the eggs deposited in pockets on the back of the mother, each egg in a separate pouch protected with a flap of skin. Here the eggs develop, and the toads emerge as diminutive adults. Horned lizards possess the ability to squirt blood out of the corners of their eyes, thus confusing their pursuers while they make their flight to safety.

One lizard, a native of Indonesia, has developed large, membranous, winglike structures on the sides of the body, and it is able to glide with great proficiency through the air. Another lizard, in taking up a subterranean habit, has lost its legs, since they would be a hindrance rather than an asset in that mode of life. The marine iguana, a large lizard of the Galapagos Islands, has the distinction of being the only lizard in the world that has not only taken to the sea, but has forsaken a terrestrial diet for one of seaweed.

Not to be outdone by the lizards, the salamanders boast a few species that remain immature or juvenile throughout life and furthermore, these individuals are fully virile, and reproduce in the manner of the adult forms. The cobra, an Asiatic snake, reaches a length of 18 feet; it can spit its toxic venom with reasonable accuracy for a distance of six or seven feet. Poison reaching a person's eyes in this manner causes considerable discomfort, even temporary blindness. But the cobra must actually sink its fangs into its prey to inject venom and thus cause fatal poisoning.

Salamanders are found beneath the ground in caverns, poisonous snakes in the ocean, tortoises in the deserts, and frogs along the crestline of the windswept Sierra Nevada. Their pageant of life is an endless procession on nature's ingenuity and imagination.

CHAPTER II

WHO CARES ABOUT AMPHIBIANS AND REPTILES?

The Aesthetics of Frogs, Toads, and Lizards

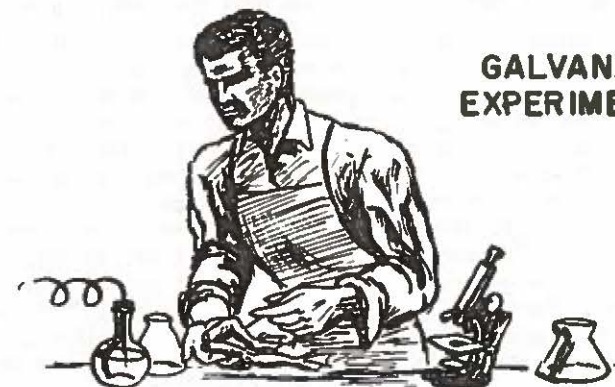
An oldtimer in the Lassen country has related the following incident which occurred recently. "I was going fishing and had my gear and my lunch on my back. As I approached the barbed wire fence that lay between the meadow and the stream, I saw three young boys throwing rocks at a fence post. When I got closer I could see that there was a medium-sized lizard perched atop the fence post apparently unaware of what was going on. The boys were taking great delight in the sport and seemed especially enthused when one of them would come close with a good shot. Finally a rock hit the poor lizard and knocked it to the ground, a bloody mess. The boy who made the kill was congratulated by his playmates, and they started to run off. It was at this point that I called to them. I asked the boys just why they wanted to kill the lizard; one replied, 'I don't know.' There must be a reason, I insisted. He said, 'Well, just for fun.' Just for fun! I said, 'Do you have fun in simply killing harmless creatures?' The boy explained, 'But I'm not hurting anything; anyway those lizards ain't good for nothin'."

The boy was reflecting an attitude prevalent among many Americans today, the feeling that something is "good for nothing" unless it can be measured in terms of dollars and cents, unless some economic value can be attached to it. As a matter of fact, these humble creatures do possess certain economic values. Amphibians and reptiles have provided a food source for man throughout his development, and today gourmets still relish the taste of turtle soup and frog legs; rattlesnake meat is even sold in cans. The skins of certain reptiles have long been used



for the manufacture of wearing apparel, and the alligator leather industry is big business. Many reptiles and amphibians have long been appreciated by agriculturists because of the number of insects and rodent pests which they consume. These creatures, especially frogs, now serve man in still another way. As "guinea pigs" in the laboratories of schools, clinics and universities, they are important in furthering science and medical knowledge. Finally, what little boy, at one time or another, has not owned—or at least wished to own—a baby turtle, alligator, newt, or chameleon, all of which are available in pet shops and which constitute a business operation of major proportions. Yes, these creatures can be shown to have economic value, but should we consider them important only for that reason? What if they were of no value in terms of dollars and cents? Would their existence be less important?

GALVANI'S EXPERIMENT



Each little tree frog that lends its voice to an evening chorus on a crisp spring night is indeed a part of that spring night. What is the eve of spring without the trill of a cricket or the fragrance of blossoms, without the croak of the distant frog? How many a city boy spending a day in the country has thrilled to the sight of a lizard basking on a rock in the sun or to frogs in the nearby stream? To such a boy the lizards and frogs are a part of the country.



Picture the person who finds a quiet pond in a shaded glade. Everything is still except for the breeze blowing across the yellow pond lilies atop the water, still, that is, except for the sudden break in the water's surface as a salamander shoots upward for a quick gulp of air. Then, just as suddenly, he is gone, back down to the dark bottom of the pond, leaving in the mind of the observer the knowledge that it is there and the thrill of having discovered a wild creature in its own habitat.

Many seek the wilderness for all that it offers, its trees, its lakes and streams, and its life. Each living creature contributes to that wilderness, even the snake that quickly darts like a flash across your path is a part of that wilderness, a part of the natural scene.

For Future Generations

The National Parks of this Nation have been established "... to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." This is the creed of the National Park Service, and by this basic statement it guides its course.

Occasionally, visitors to Lassen question our policy regarding plants and wildlife. A woman may want to pick a few wildflowers, a boy may want to collect a few frogs and take them home; these people contend that what flowers or frogs they take will not hurt anything or anybody. Why can't they have them? First of all, these people have made an incorrect assumption. Taking a few flowers or a few frogs will hurt somebody; it affects all the American people who come to Lassen hoping and expecting to see and enjoy these same things. For every flower picked, for every frog caught, there is that much less for others to see and enjoy. Even though one person's collecting is just a drop in the bucket, just imagine what would happen if everyone did the same, all of the 500,000 visitors that come to Lassen each year! Then you say, "Well, all those people don't do that, so what harm can I cause if I just take a few?" The reply is simply that no one person has special privileges in the National Parks. Everyone is expected to appreciate

and preserve them just as everyone is expected to enjoy them. Isn't it a bit ridiculous and, indeed, selfish to expect everyone to obey the law except you?

But let us not think of the National Parks as places where we cannot do things. The parks are places where there is much to do and see. Thirty National Parks represent the most superlative scenic areas within the United States, outdoor sanctuaries where nature is being preserved for all Americans to enjoy. These are your National Parks; treat them as you would your home. Preserve them unspoiled so that future generations of Americans may enjoy their rightful heritage. In a day of missiles and technology, cities and smog, commerce and industry, concrete and steel, these jewels of the wilderness are priceless treasures, heirlooms of peace and inspiration for harried people in a troubled world.



CHAPTER III

THE LASSEN ENVIRONMENT

An animal that makes its home in a given place does not do so by accident. It remains because it possesses the abilities to live and survive there, because it has the makeup that will tolerate a given climate, a certain community of plants, other species of animals, a particular type of landscape, and a host of other conditions peculiar to a particular place. These things in total constitute the environment, and survival requires that the animal meet every demand of the environment; thus an animal does not accidentally select its habitat—not twice anyway.

Location

Lassen Volcanic National Park is in northeastern California, and occupies the southernmost part of the Cascade Mountain range. To the north of the park the Cascade mountains continue through California into Oregon and Washington. West of the park lies the great Central Valley of California. On the east is the Great Basin, a rugged desert land of broad plains sporadically interrupted by mountains and ranges. South of Lassen the Cascade Mountains merge almost imperceptibly with the higher Sierra Nevada which trends southward for 400 miles before terminating in the Tehachapi Mountains.

Climate

Probably no physical factor so governs the lives of animals as does climate. At Lassen, climate appears to play a particularly important role because of the severity of winter conditions. No area in the park is below 5,000 feet, and most of it is well above this elevation. Consequently winters at Lassen are long and hard, and the park is mantled in snow seven months of the year. Depths of snow at Lake Helen in the high country has been measured in excess of 30 feet. It is no wonder that amphibians and reptiles, "cold-blooded" creatures, are unable to withstand the rigors of such winter extremes. They are all forced into a state of hibernation or winter sleep.

Prior to the onset of the first winter snows, they retreat beneath the ground where they may remain at temperatures just above freezing. Here they remain until melting snows and warm days of spring make possible a restoration of activity. These creatures are, so to speak, born again and "live" for the next five months. It is during this shorter portion of the year that they must reproduce their kind. In most cases, mating occurs sometime after emergence, and the young are born during the summer or fall. With the first inactivating weather of fall the juveniles go into hibernation, as do the adults, and they resume their growth the following year.

Summer temperatures are in marked contrast with those of winter. Many days are quite warm, and temperatures above 85° F. are not unusual at Manzanita Lake. Nights are almost always cool even during July and August, when nighttime temperatures may drop to 40° F. There is a considerable altitudinal range within the park, from slightly over 5,200 ft. at Warner Valley to 10,457 ft. atop Lassen Peak. Temperatures vary directly with the elevation, becoming colder with greater height. On a given day it may be 75° F. at Warner Valley and 50° F. atop Lassen Peak. The reptile-amphibian fauna therefore varies altitudinally.

Lassen's Landscape

Lassen Volcanic National Park is, as its name implies, a region of volcanic activity. Present-day activity is negligible when compared with the dramatic past. There are a number of active hydrothermal areas within the park, and occasional puffs of steam are seen issuing from Lassen Peak. But the entire park is composed

of volcanic rocks—basalts, andesites, dacites, thus indicating mass outpourings of molten lava in bygone days.

The park is best visualized as an expansive and irregular lava plain dotted with, and prevailed over by, a number of volcanoes, some large and others quite insignificant by comparison. The western part of the park is high country, very little of it below 7,000 ft. Lassen Peak, Chaos Crags, Brokeoff Mountain, Mt. Diller, Loomis Peak, and Mr. Conrad dominate this section. To the east of the high country, the park levels out into a plateau which is overlaid by cinder cones, lava flows, and shield volcanoes.

There is a profusion of lakes within the park. It is difficult to make an actual count because of the ephemeral nature of so many of the smaller ones, but over 60 lakes are named, and most of these are permanent bodies of water. There are hundreds of ephemeral lakes and small ponds. With few exceptions the basins of all the lakes are the result of glacial activity, and the majority are situated in the park's central section. The numerous lakes provide excellent breeding grounds and habitats for amphibians, and for reptiles which have taken up a semi-aquatic existence. Eight major streams drain Lassen and provide another habitat for many amphibians.

Life Zones

Perhaps you have a favorite spot somewhere in the country, a place where you have spent some time and feel you know pretty well. When you think of it, a picture of everything in it comes to mind. You can visualize the trees, certain shrubs that grow beneath them, a few wildflowers, some of the mammals, birds, and possibly a few reptiles and amphibians that live there. They all fit together, and when you think of one you have the tendency to think of others, for somehow you have made this association in your mind. The association is a valid one because this is a community of living things, and you could undoubtedly find a similar community elsewhere. Biologists have made use of this association and have formed the *life zone* concept.

Life zones are not clearly divided bands, but blend into one another imperceptibly along the slopes of a mountain. As you pass from one zone to another, you will observe the increased presence of the plants typical of the higher zone. If you are circling the mountain, you will find that the lower life zones extend further up the slope on the warm southern side. This is particularly so if that side is less exposed to prevailing storms.

You should learn the names of the zones and some of the plant and animal species that characterize them. Thus a system of ready communication is set up, and when one person says, "Transition zone," another gets a reasonably accurate mental picture of the dominant forms of life there. Plants are best employed as indicators of life zones because they are not mobile, and are less apt to appear out of their zones. Vegetation varies with climate and, all things being equal, climate varies with altitude. Therefore, life zones follow altitudinal lines to a large extent, and it is upon this basis that they are usually described.

Starting from the lowest elevation, the life zones are as follows: Lower Sonoran, Upper Sonoran, Transition, Canadian, Hudsonian, Arctic-Alpine. If we were to start at Red Bluff and walk to Lassen Peak, we would walk from Lower Sonoran to Arctic-Alpine. Lassen Peak encompasses only four zones, and they are described in the accompanying table.

It should be pointed out that elevations for zones vary in different parts of the country and those given here apply to Lassen Volcanic National Park; furthermore, the elevations given are approximate.

Interrelationship of Living Things

A living thing cannot exist of or by itself alone. There exists in nature complex interrelationships among plants and animals. They are mutually dependent,

AMPHIBIANS AND REPTILES FOUND IN LASSEN'S LIFE ZONES

LIFE-ZONE	ELEVATION	PLANT INDICATORS	REPTILES OF LASSEN	AMPHIBIANS OF LASSEN
TRANSITION	To 6,000 ft.	Yellow pine Douglas-fir Incense-cedar Jeffrey pine	Sagebrush lizard Northern alligator lizard Rubber boa Common garter snake Western skink	Pacific treefrog Western toad Red-legged frog Ensatina salamander Long-toed salamander Rough-skinned newt
CANADIAN	6,000 ft. to 7,500 ft.	Red fir Pine mat manzanita Western white pine	Rubber boa Common garter snake	Long-toed salamander Pacific treefrog Cascades frog Western toad
HUDSONIAN	7,500 ft. to 9,000 ft.	Whitebark pine Mountain hemlock	Species found in Canadian life zone may occasionally be found here.	Species found in Canadian life zone may occasionally be found here.
ARCTIC- ALPINE	9,000 ft. and above	No trees; grasses and herbaceous plants, such as polemonium and buckwheat	None	None

and the presence of one species in a community of living things will affect the others, directly or indirectly. Living forms constitute one part of the environment just as climate and landforms make up another. Therefore an animal or a plant must adapt itself to its biological surroundings as well as its physical world.

Amphibians and reptiles, like all other creatures, play a definite role in the food chain of life. Plants are at the base of life's food chain, and every creature ultimately owes its existence to plants. Certain animals feed directly upon plant material. These plantfeeders are eaten by other creatures which, in turn, may be eaten by still others. Thus a food chain is set up; any break in it may disrupt the total community of living things.

Few amphibians and reptiles are directly dependent upon plants as a direct food source. Their place is further along the food chain where they feed primarily upon other living things. Tadpoles, the larval forms of frogs and toads, subsist upon plants. They eat algae and small bits of vegetation they find in the water. Without sufficient plant material in the water, tadpoles perish, and with them succumbs a potential frog or toad population. Without tadpoles, frogs, and toads, the common garter snake of Lassen would eke out a meager existence; it is doubtful if it could even survive without this basic food source. The snake may itself serve as a meal for a predatory bird inhabiting the area, such as a hawk or a heron. This is a very simple food chain; many of nature's food chains are more complicated and because they are so frequently misunderstood, they are often weakened or broken by man.

As a source of habitat and shelter, plantlife plays an important part in the daily lives of Lassen's amphibians and reptiles. Many make their homes directly within vegetation, such as treefrogs and garter snakes. Some make their homes in or under rotting logs, such as the ensatina salamander and the rubber boa. Lizards use vegetation to great advantage as a means of survival, though their homes may be made in the ground. Next time a lizard scurries across your path, watch where it goes. It will either seek refuge beneath a rock or in a clump of vegetation.

Often there is a favorite bush nearby to which the lizard retreats. You will realize the value of such a bush after numerous and fruitless attempts to capture a lizard from the impenetrable tangle of twigs and foliage. As a retreat alone, plants are of great importance to these creatures. Added to this is the fact that plants are equally important as food sources. None of Lassen's lizards feed upon vegetation, but insects which are attracted to the plants provide their all-important food supply. Alligator lizards are particularly fond of dense vegetation, and are seldom found far from it.

Food and shelter for man and animal are the basic necessities of life. With amphibians and reptiles it is, in large measure, food that shapes the choice of a shelter or home. A common garter snake might find excellent shelter within the vegetation surrounding a pond, but if the pond provided no food, a new home would soon be needed. Likewise lizards prosper in suitable shelter only if there is enough insect life present to sustain them.

The world of amphibians and reptiles has a variation of the food chain. It seems that everyone eats everyone else. Perhaps this is an exaggeration, but the interdependence of these creatures is great. As previously mentioned, garter snakes feed upon tadpoles. They also feed upon salamanders, toads, and frogs. Here is a reptile that is a potential feeder upon every amphibian group in the park. Garter snakes feed upon other reptiles too, with lizards the apparent favorites. The rough-skinned newt, one of the park's salamanders, may eat the eggs of other salamanders, and the rubber boa feeds upon alligator lizards and swifts.

The park's amphibians and reptiles are preyed upon by other vertebrates—fish, birds, and mammals. Undoubtedly, many frogs, toads, tadpoles, and salamanders fall prey to the voracious appetites of the park's larger trout. Birds of lakes and ponds, such as grebes, herons, egrets, bittern, mergansers, and ducks are

all known to feed upon amphibians, and they undoubtedly take a large toll, as all of these birds have been seen within the park. These birds are also effective in preying upon the park's reptile population, since most of them eat an occasional snake or lizard. In addition, hawks, owls, and kingfishers, also present in the park, consume variable amounts of snakes and lizards.

Lassen's mammals offer little respite to these preyed-upon creatures, for minks, martens, weasels, and badgers, all ravenous predators of the hardy weasel family, seldom refuse the opportunity to partake of a meal whether it be mammal, reptile, or amphibian. It would seem that the amphibians and reptiles of Lassen must be ever vigilant since they are attacked in water, from the sky, and on land. Nowhere have they any certain assurance of safety.

But it is the individual whose existence is perilous, not the species; individuals come and go, but the species lives on. This is the way of nature, seemingly a bit ruthless at times, but exceedingly effective. Creatures have been preyed upon by other creatures since the beginning of life on earth; nature has imposed an intricate system of natural checks and balances, and they operate with astounding precision and efficiency, unless disturbed by man, or by some natural cataclysm.



Man—His Role and Impact

Because Lassen is a National Park and as such receives the protection of the National Park Service, it has remained little changed and little affected by man and his often ruthless ways. Consequently, we find nature in Lassen in a relatively primitive state. This is not the case in other areas where man has so disrupted the biological balance that there remains hardly a semblance of the original flora and fauna. Unfortunately, such regions are all too common. Forests have been denuded, grasslands laid bare, and bird and mammal species wiped out. Through all this most of the amphibians and reptiles have come unscathed, although certain species commercially valuable, such as the alligator, have felt the impact of the all-important dollar.

Arizona has done a noteworthy thing in passing legislation which protects horned lizards and gila monsters. Imagine the vigorous contention that must have accompanied the proposal to protect a poisonous lizard like the gila monster. Yet Arizonans realized that horned lizards and gila monsters are part of the natural scene—a part of Arizona. No threat to human life is incurred by the protection of these species, testimonials notwithstanding, and the life and color of the desert is being preserved for future generations.

Fur-bearing and game mammals are protected by law in California because of their economic importance. Songbirds are protected only because of the noble efforts of bird lovers who derive great pleasure from these colorful creatures. Amphibians and reptiles are still fair game, but fortunately they are of only moderate economic value to man, and so are left alone to lead their obscure lives—far better for them that they are obscure!

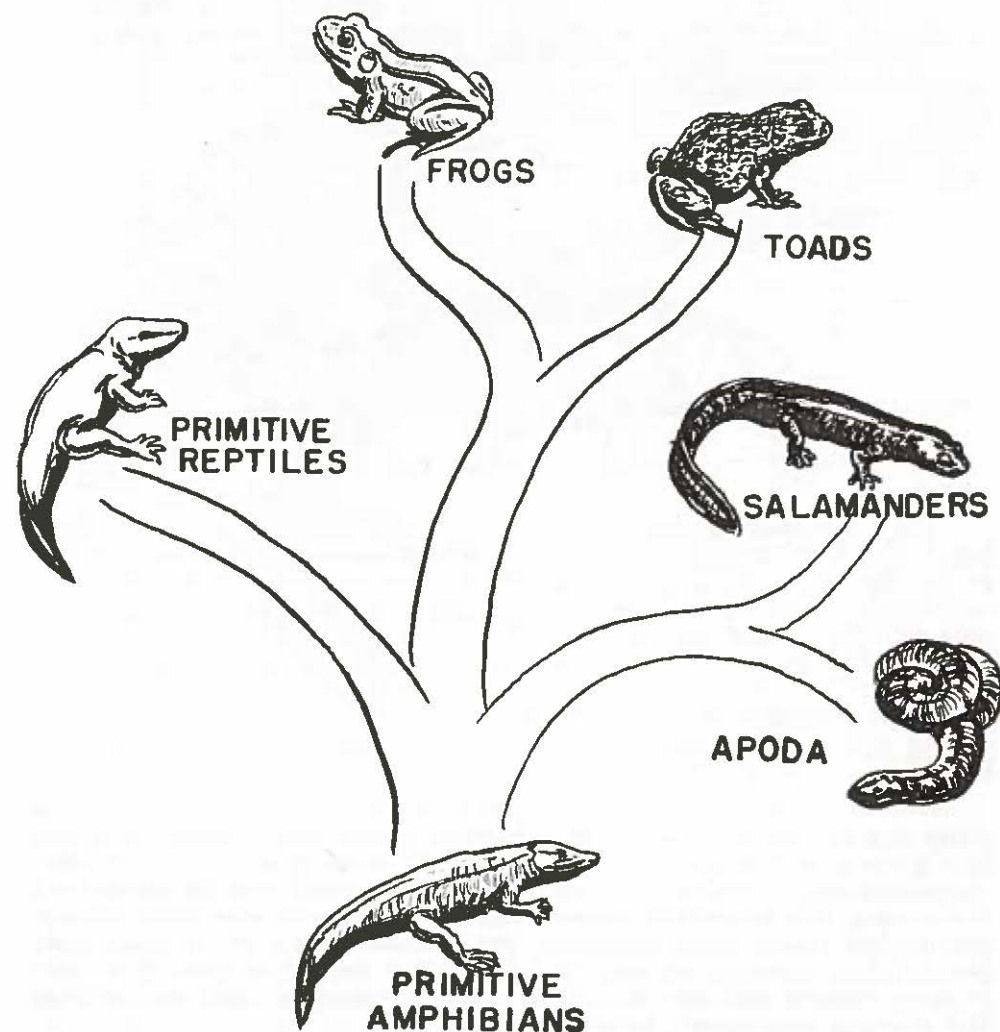
CHAPTER IV

AMPHIBIANS—A DUAL LIFE, LAND AND WATER

Origin of the Amphibians

One day over 300 million years ago, a fish with thick, lobe-like fins used these peculiar appendages to crawl out of a stagnant, rapidly-drying pool of water which had been the home of its progenitors for countless years. Somewhat laboriously it made its way to another body of fresh water not far distant. In that space of time, the group that we call Amphibia started to evolve, and the earth, devoid of vertebrate life since its beginning two and one-half billion years previously, felt for the first time the tread of a backboneed creature. In days to come

AMPHIBIAN FAMILY TREE

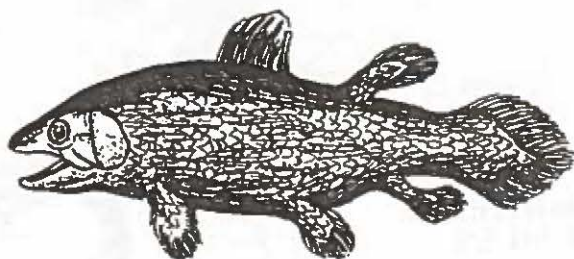


the earth would become populated with vertebrate animals of higher classes—the reptiles, the birds, and the mammals. With the birth of the amphibians a new era was born in the pageant of life, and the amphibians were to become—for the next 100 million years—masters of the earth.

It is somewhat difficult to realize, as we look at the obscure and innocuous salamanders, frogs, and toads about us, that their ancestors did at one time dominate our planet. If these creatures occupied such a high place in ancient life, why or how did they lose it? What indeed proved to be fatal for the amphibians? And why did they leave the water in the first place? For the answers to these questions, we must turn our attention far back into geologic time, back to that day when a lobe-finned fish left its pond, and made its momentous overland trek. We look to the fossil record for evidence of these distant evolutionary events.

During Devonian time, the geological period in which the amphibians were born, the earth's climate was changing, becoming drier than it had previously been. Many lakes and ponds began to dry up slowly but steadily. Some that did not disappear completely became stagnant, deficient in oxygen, and incapable of supporting much life. Competition between living things in such ponds was rigorous. Meanwhile, certain cumbersome fishes inhabiting these lakes, known by the equally cumbersome name of "Crossopterygii," had developed lungs, and also fins which were lobed and thick, as you might expect of a rudimentary appendage. Both these developments were evolutionary adaptations which were to be of indispensable benefit to these fish in meeting the demands of their changing environment.

COELACANTH



The lungs came first, enabling the fish to breathe air when the pond became fouled or depleted in oxygen. The next logical step was the addition of appendages so that these fish could make their way to other pools with more hospitable living conditions. For thousands of generations those with the thickest, strongest fins were naturally selected since they were the best adapted to the changing environment. At first, these fins enabled the fish to crawl only a little way beyond the water's edge for air and food. Eventually these Crossopterygians (crossopterygians) succeeded in attaining a development of fins or appendages which, coupled with their air-breathing lungs made land migrations possible. Thus the fish could leave an inhospitable pond for a better one.

It is most important to remember that these changes were not effected in a matter of a generation or two, or even a hundred. Evolutionary changes encompass time spans of thousands and millions of years. Thus we speak figuratively when we say that amphibians were born one day when one lobe-finned fish crawled out of the water. The process took place in small and slow degrees over many millenia, and involved thousands of individuals. But what about those fish in those ponds that failed to develop lungs and lobed fins? What became of them? They, like so many creatures that have existed and failed to meet and conquer the challenge of a changing environment, became extinct.

LABYRINTHODONT Primitive Amphibian



It is important that we clearly understand the reason for the invasion of the land by the Crossopterygians. They did not acquire lungs and lobed fins so that they might take up a terrestrial existence; quite the contrary, they developed these structural modifications so that they could continue life in water. In order to continue life in water, these animals had to make an overland journey, necessitating these morphological changes. However, in the process of migration and utilization of these new-found adaptations, some of these fishes must have found life along the edges of the ponds much more pleasant; food may have been more plentiful,

competition for it less keen. Some may have begun wandering even farther afield for the same reasons. Eventually a terrestrial—or rather amphibious—form was developed, one that was equally suited to life in land and water. The word amphibious derives from two Greek words—the prefix “amphi” meaning double, and “bios” meaning life—hence a double-lived animal, in water and on land.

The first true amphibian possessed legs capable of locomotion on land, a tremendous improvement over the awkward and inefficient stubby appendages of its ancestors. It, of course, possessed lungs like its predecessors, and was not restricted in its movements for want of oxygen. However, it required a moist and humid environment just as today’s amphibians do; furthermore, it had to return to water to lay its eggs where they would develop in the manner of their fish ancestors.

In the years that followed—and we are again measuring them in millions—many forms developed from this primitive ancestral amphibian which we call the Labyrinthodont (Lab-er-rinth-oh-dont). The world became populated with a variety of forms of amphibians, and they must have enjoyed life in a noncompetitive world. But they were lumbering, awkward, unintelligent creatures; some scientists have referred to them as fish with legs. Their greatest shortcoming, however, was in their conservatism. These creatures had dramatically begun the road to a terrestrial existence, but they had missed an important turn, and headed up a blind alley. They were unable to make the break with water, and each year those primitive amphibians would return to water to deposit their eggs, which would develop into aquatic, larval forms. Before they could live on land, they had to serve time in their ancestral home.

The amphibians were so dependent on water that their potentialities were immediately and severely limited, as were their habitats and their food. Further, these creatures of moist skin were at the mercy of an ever-changing climate. Is it any real wonder that these onetime masters of the earth did not forever reign supreme? They were overthrown, so to speak, by a group of animals much more progressive than they and descended from them—the reptiles. The amphibians have existed for about 300 million years, yet present-day forms do not differ markedly from the original ones. We need have no reservations in saying that the amphibians are a conservative lot, leaders of a dual life, but in fact nurtured in water.

What Is An Amphibian?

Having traced the ancestry and evolution of the amphibians, we logically come to a need for a definition. Just what is an amphibian? We know that they are vertebrate creatures, animals with a backbone. They are “cold-blooded” animals, unable to regulate their temperature internally. The majority of amphibians possess moist or slimy skin which is no accident since it may serve as a primary or accessory breathing organ. Others have a rough or horny skin, such as the toads. With but a few exceptions, amphibians possess functional limbs, and never do they possess paired fins. None of these factors is definitive in itself, but when all are considered, they apply only to the amphibians. Thus we may define an amphibian as a cold-blooded vertebrate with a slimy, rough, or horny skin, generally possessed of functional limbs, and never having paired fins. Too often the layman attempts to define an amphibian as a creature that lives partly on land and partly in water. This is a logical mistake since the term amphibian means precisely that. Unfortunately, the definition holds true for many other creatures not related to the amphibians. Seals, polar bears, sea otters, alligators, water snakes, pelicans, and ducks, to mention a few, all spend time on land and in water, but they are not amphibians.

The present-day amphibians consist of three distinct groups, all somewhat diverse in body structure. One order called the Apoda (“without limbs”) is a small and obscure group even for the amphibians. They are primarily tropical forms with small, wormlike bodies, devoid of any legs. They are an evolutionary degenerate lot, and exhibit only a distant relationship to other amphibians.

Frogs, toads, and treefrogs comprise a second order in the class of amphibians. They are characterized by a streamlined body with a short trunk and disproportionately long, hind legs. This order, called Salientia, constitutes the most highly developed and specialized of the amphibians. Cosmopolitan by nature, they are found throughout most of the world. The Anurans (“tailless ones”), as they are called to differentiate them from the salamanders, are a highly successful group with a variety of forms, some quite bizarre. Toads are distinguished from frogs generally by their stockier build, shorter hind legs, and rough and warty skin. The treefrogs are similar in body build and skin texture to frogs, but they possess enlarged adhesive pads on the tips of their toes. Actually, they are more closely related to the toads.

The tailed amphibians or salamanders make up a third order of amphibians called the Caudata (“tailed ones”). Salamanders and newts, which are included in this group, typically have elongated bodies with four limbs of almost equal size. They possess tails either rounded for terrestrial life or somewhat flattened from side to side for an aquatic habitat. Mudpuppy, waterdog, water pups, are some of the common terms used to refer to salamanders. Salamanders, unlike their Anuran relatives, are not as cosmopolitan, and are found chiefly in the more humid zones of the temperate regions of the world. Very few species are found in the tropics where most salamanders are seemingly unadapted for survival.

Reproduction

At one time or another, everyone has heard a chorus of frogs croaking on a warm, spring evening. Such vocalizing is courtship behavior of these Anurans. The pond frog’s courtship is entirely vocal, and the familiar spring choruses are the males calling to the females. Shortly before breeding time, the male frogs migrate to suitable bodies of water: creeks, ponds, lakes, irrigation ditches, etc. Here they congregate and commence their croaking, stimulated by the sound of the others which are, of course, active competitors. Some frog choruses are surprisingly loud, and you would think that there are frogs everywhere. Frogs are quite noisy for their size, and these choruses can be heard for great distances both by man and frog. Toads have a courtship routine similar to that of frogs.

The courtship of salamanders is quite different from that of frogs and toads. Since most salamanders are mute and deaf to airborne sounds, they have evolved a courtship of gestures. The ensatina salamander of Lassen, for example, has a very complex courtship of movement by the courting pair. Smell is often well developed in salamanders, and many species emit a secretion during courtship.

The eggs of frogs and toads are laid in the water, generally attached to aquatic vegetation. Frog’s eggs are laid in masses or clusters containing a few eggs or a prodigious number. The Pacific treefrog may lay between 500 and 1,500 eggs. One toad outrivals all the frogs in its ability to lay an astounding number of eggs—25,000 at a time! Toad eggs can be distinguished from those of frogs in that they are deposited in the form of long, gelatinous ribbons. All amphibian eggs that are deposited in water are covered by a layer of soft, clear, jelly-like material, which swells when the eggs are laid. Within the protective gelatin envelope is the egg itself, a small round, black dot, from which the young frog or toad will develop.

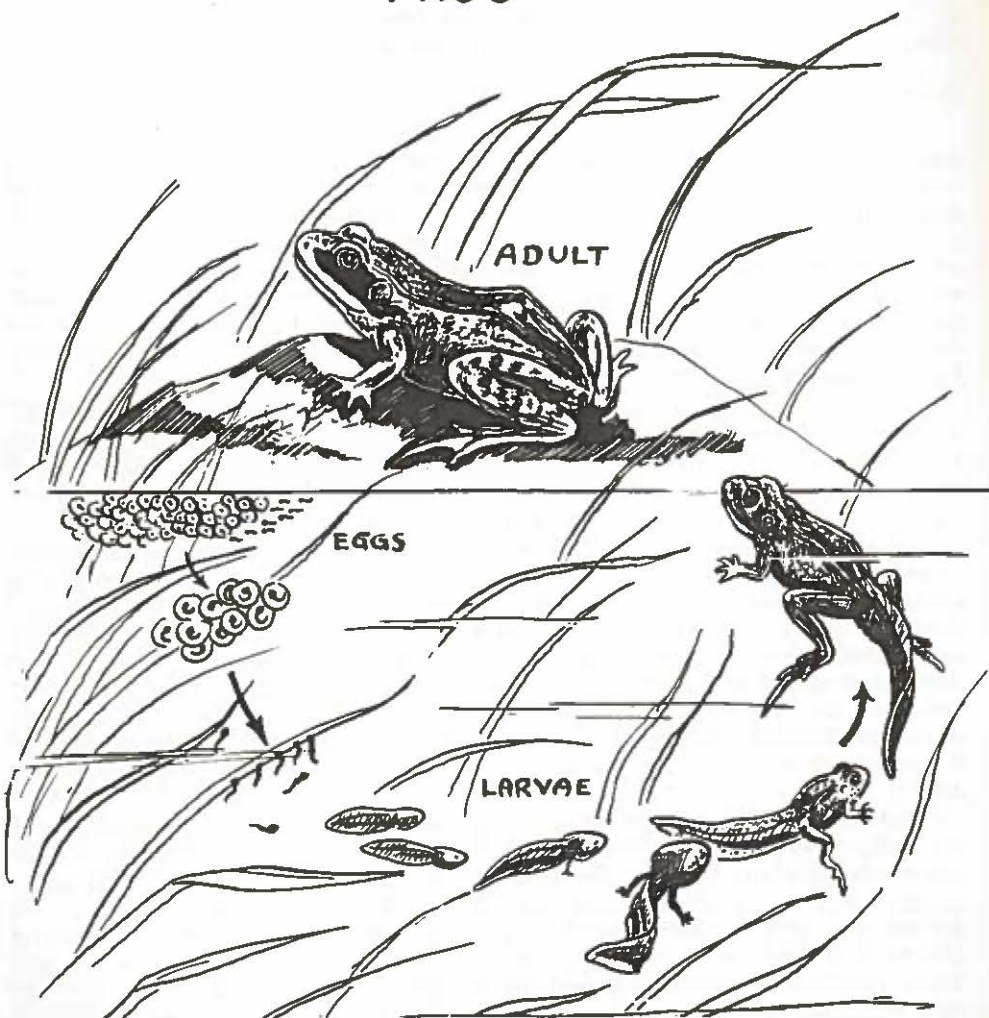
Salamanders deposit their eggs in clusters or singly attached to vegetation in the water or to the sides or bottoms of rocks. They are similar to the eggs of frogs and toads, and the two are easily and often confused. Generally, salamander clutches are of much smaller mass and number. Some salamanders no longer need deposit their eggs in the water; most notable among these are the Plethodontid (Pleth-oh-don-tid) salamanders, a family including Lassen’s ensatina salamander. These salamanders, which interestingly enough are lungless and breathe through their skins, deposit their eggs on land in cool, moist, sheltered locations, under logs and rocks. Here the mother broods the eggs until they hatch, then loses interest.

(Brooding is quite unusual among amphibians.) Though these animals do not lay their eggs in the water, they are nevertheless obliged to deposit them in moist locations, else the eggs will dry out and die.

Growth and Development

In mammals, when a young is born, it is a miniature adult; its various stages of embryonic development have been completed within the womb of the mother. This is not the case with most amphibians. When they hatch they must undergo a period of life in a larval form which is a subadult stage. We are all familiar with tadpoles or pollywogs, the larval form of the frog and toad. Amphibian eggs gen-

LIFE HISTORY of the FROG



erally hatch quite rapidly; some frogs' eggs hatch in as short a period as three days, and one toad hatches from its egg in a day and a half. Salamanders take a considerably longer time to hatch.

Larval frogs and toads are quite unlike the adult form both in aspect and in their habits and were you to see a tadpole for the first time, you would have little reason to suppose it to be the young of a frog or toad. Salamanders, on the other hand, are virtual miniatures of the adults from the time of hatching. They possess four legs in the larval stage, but unlike adult form, have gills for breathing in the water. Tadpoles possess gills for breathing too, but they are concealed beneath the skin. Tadpoles are vegetarians from birth until they metamorphose into adults. They feed upon algae and other plant food. Salamanders are carnivorous from birth.

The length of time that a frog, toad, or salamander spends in the larval stage varies considerably with different species. One spadefoot toad completes its development from egg to adult in less than two weeks. There is good reason for this since it lives in arid regions, and its development must be completed within the short time that standing water is available. The bullfrog, which undergoes the longest larval period of any amphibian in this country, may spend two years or more in the tadpole stage.

Generally, northern species require a longer period of development, since they are active for only three to seven months during the year. Hibernation puts an end to growth which is resumed upon emergence the following spring. Weather and other environmental factors may directly influence the development of the amphibian larva. Warm weather favors rapid development, whereas a prolonged cold spell may retard development and even forestall metamorphosis until the following spring.

The transformation of a frog or toad tadpole to an adult is accompanied first by the appearance of hind legs. Front legs subsequently appear attended by reduction in the size of the tail, and metamorphosis is complete when the last of the tail is lost. By then, the young have become amphibious and are equally at home on land or in water.

Salamanders become adults with the loss of their external gills. At that time internal lungs have fully developed, and the young adults are capable of breathing on land. However, some salamanders undergo no larval stage, and others fail to change into adults. So in a manner of speaking, some salamanders are never immature, while others never grow up. The axolotl and some of the tiger salamanders retain their gills throughout life, and never assume the adult form common to other groups of salamanders. These perennibranchiates ("perennial gills") as they are called, are fully capable of reproduction, and bear young in the same manner as other salamanders.

Mammals and birds have a limited period of growth. Beginning at birth, growth continues until the adult form is reached; this is generally indicated by the ability to reproduce. At this point or soon after, growth ceases. Thus mammals and birds have definite limits to the maximum size that may be attained by any individual. Of course, larger than average individuals are produced occasionally just as smaller ones are, but most often they reach a definite size within a period of time consistent for the species.

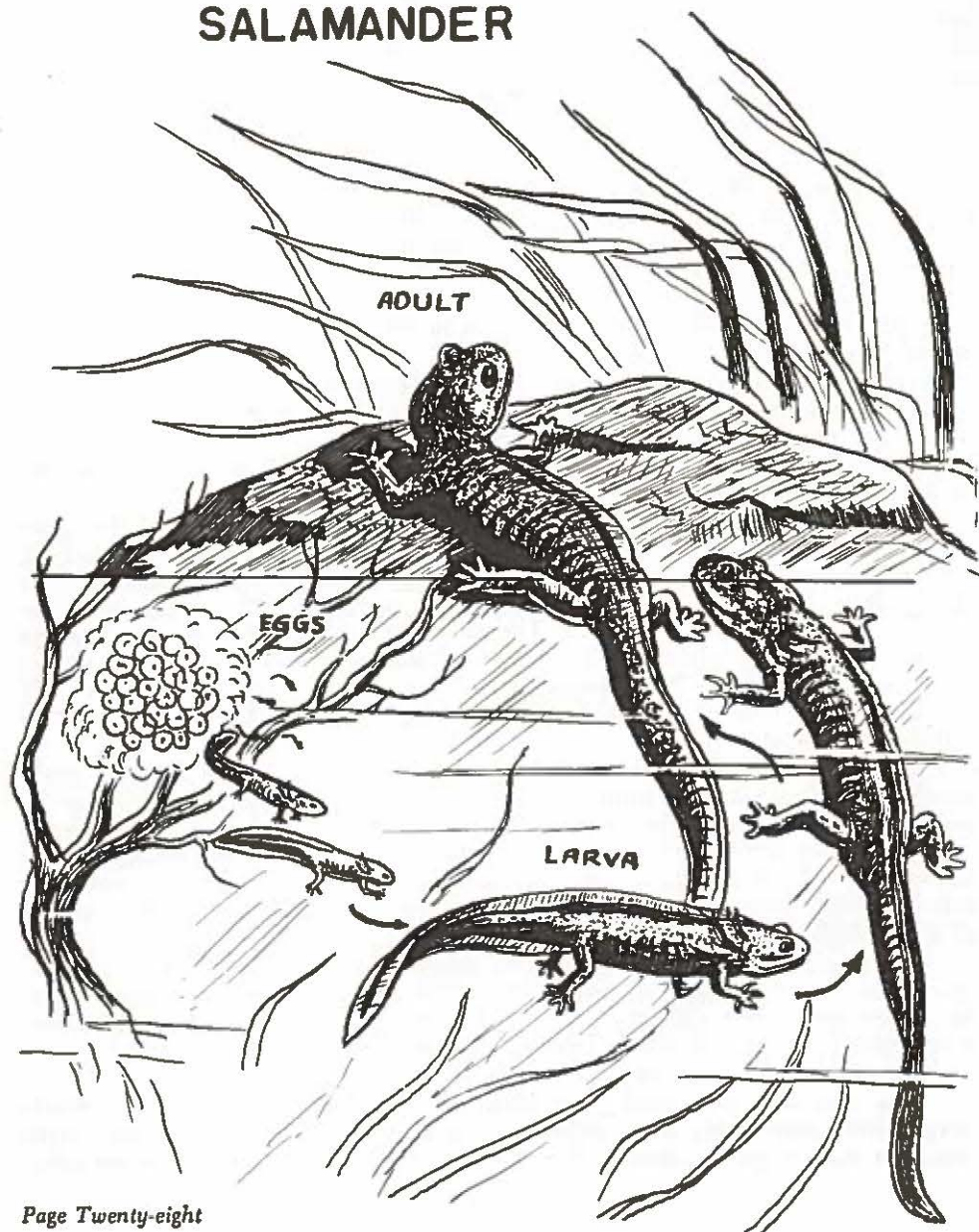
Most amphibians and reptiles, on the other hand, have no set limits on maximum size. They grow throughout their lifetimes and should an individual be fortunate enough to live a particularly long life and get plenty to eat, it may attain a prodigious size for its species. Thus we may usually expect the largest individuals to be the oldest.

The ages of reptiles and amphibians have been in many instances grossly exaggerated, particularly with regard to the reptiles. Tales of great sea turtles centuries old are quite common. For obvious reasons it is difficult to obtain infor-

mation regarding the age spans of these creatures. Some turtles in zoos are known to outlive human beings, and a few long-lived individuals are authentically known to have passed the century mark.

Many amphibians live for periods which are longer than most of us would suspect. Would you think a frog would live for 16 years, a salamander for 25 years? Individuals of certain species have survived as long, and *Bufo*, the American toad, has ripped the pages of the calendar for 31 years! These are unusually long records of life for these creatures, but they point out effectively our tendency to underestimate the age of amphibians, just as we overestimate the age of the reptiles.

LIFE HISTORY of the SALAMANDER



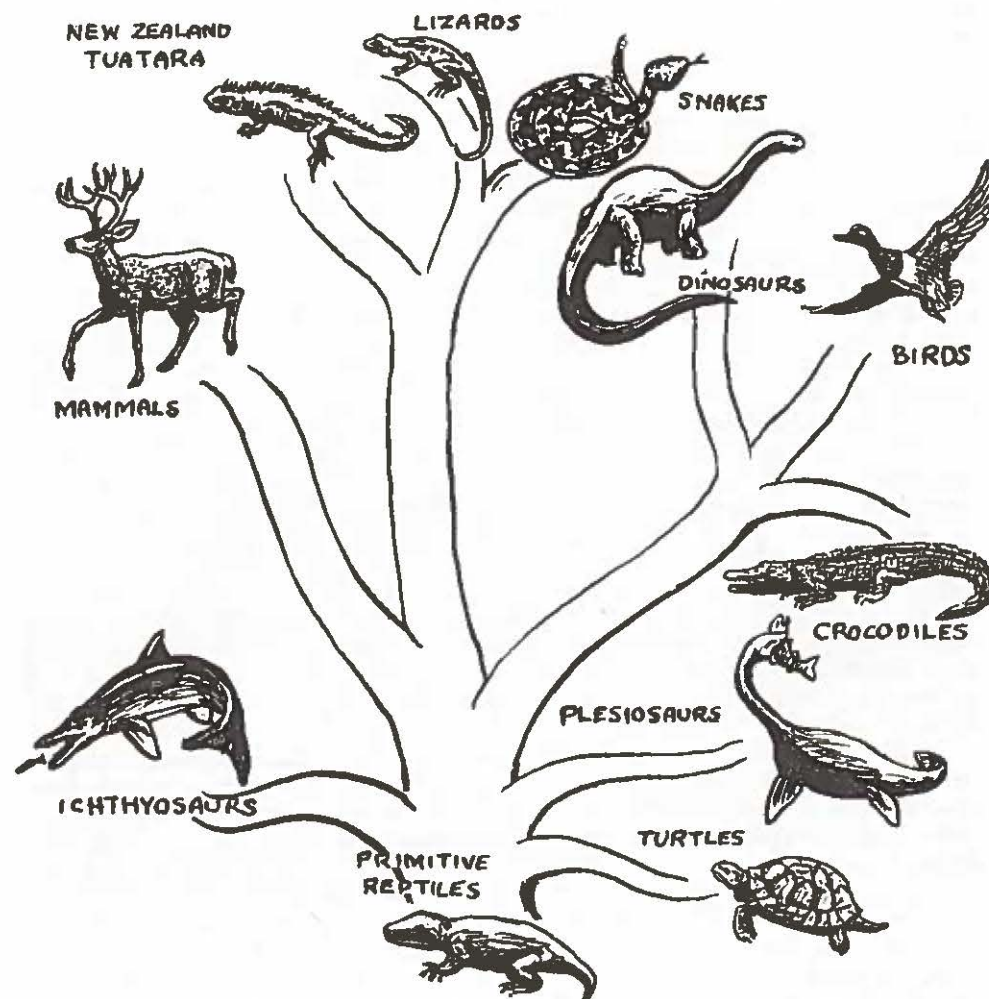
CHAPTER V

REPTILES—CONQUERORS OF THE LAND

Origin of the Reptiles

In the previous chapter you read that the amphibians were unable to effect a complete break with their ancestral home, the water, and have thus failed to adopt an entirely terrestrial existence. The reptiles, however, took up where the amphibians left off, and succeeded in making the transition to land. How then did the reptiles succeed, and through what avenues did they overcome the obstacles

REPTILE FAMILY TREE



that thwarted the amphibians? The answer lies in the very origin of the reptiles, and it demonstrated vividly the continuous change that has attended the development of vertebrate life. The reptiles were a more progressive group of animals and

once they had overcome a key obstacle to assuming a terrestrial mode of life, their conquest of the land was dramatic and inevitable.

You will recall that amphibians are, with a few exceptions, creatures which are obliged to return to water to deposit their eggs. It is in this liquid medium that the eggs hatch and the larvae develop. Only upon reaching the adult stage are amphibians free to leave the pond or stream, and even then they must unfailingly return when the breeding urge is upon them. Since the adult amphibian is capable of life upon land, the key link in the chain that binds them to the water is their type of egg, which is subject to rapid drying out if removed from water.

The earliest known reptiles were a clumsy looking group of amphibian-like creatures known as Cotylosaurs (cot-till-oh-sahrs). These Cotylosaurs were descended from the Labyrinthodonts, the first amphibians; so both amphibians and reptiles had a common ancestor. The Cotylosaurs were able to lay eggs out of water. At first these eggs must have been similar to those of today's ensatina salamander in that they required a moist location to prevent drying. Remember always that the process of evolution is slow and gradual; nature is seldom in a hurry. But as geologic time rolled by, the reptiles evolved the typical reptile egg of the present day. This egg is amply protected from drying by a horny or leathery shell. Within the egg the embryo young undergoes its larval development while nourished by a plentiful supply of yolk. A membrane surrounds the developing creature which is bathed in and further protected by a watery fluid. This fluid in which the young develops simulates the ancestral home of all vertebrates.

When the reptiles had developed the land-type egg, the road to terrestrial existence was open to them, and it was abundantly intersected by side roads all of which the reptiles have taken in their subsequent diversification, for they are, indeed, a versatile group. So diverse were reptile forms and so important did they become that the reptiles for a long time ruled the earth. Geologists have appropriately called this period "The Age of Reptiles." For well over 100 million years these creatures enjoyed an undisputed reign, and they produced the largest and most formidable looking land animals the world has even seen. One of these giants reached a length of almost 90 feet while another attained the ponderous weight of over 50 tons. Only the larger whales of today exceed them in size and in bulk.

These prehistoric reptilian monsters, as they are popularly called, proved an impressive lot, and were widely distributed over the earth. Dinosaurs roamed the land, flying reptiles soared in the skies, and fishlike reptiles made their homes in the oceans. But for all their might, their large sizes, their numbers, they have perished from the face of the earth. Why? What caused their extinction? Scientists can only speculate. Perhaps it was a change in the climate of the earth that occurred during the reign of these creatures. It may have been the building of new mountain ranges that destroyed many of the lowlands and swamps which had been their homes. Maybe food was the limiting factor when plant life so changed as to be unsuitable to these great beasts. Maybe even the primitive mammals, furtively lurking in the shadows of these beasts, were competitors and predators.

All these factors may have contributed in greater or lesser degrees to the destruction of the great saurians, but one thing can be said with certainty—these great reptiles were unable to adapt to a changing environment, and failing to adapt, they chose the only other course, the inevitable road to extinction. Only their dwarfed and obscure relatives lived on, the ancestors of the reptiles of today.

What Is a Reptile?

Just what are these creatures which we call reptiles? The word is derived from the Latin term, "reperere" meaning "to creep." The creeping of reptiles is not an identifying trait, since many other animals share the creeping habit and for that matter, all reptiles do not creep. Like the amphibians, the reptiles are "cold-blooded," and they possess a backbone. They differ, however, from the amphibians in the possession of scales or horny plates which cover a body nearly devoid of

AGE OF REPTILES



glands. Furthermore, the reptiles always breathe by means of lungs once they have reached the adult stage.

Thus we may define a reptile as a "cold-blooded" vertebrate possessing scales or horny plates on a nonglandular body, and breathing by means of lungs. It is well to remember that other groups of animals may possess one or more of these characteristics, but not all of them. Thus a bird is a lunged vertebrate with scales (on its feet), but it is not "cold-blooded" and thus not a reptile.

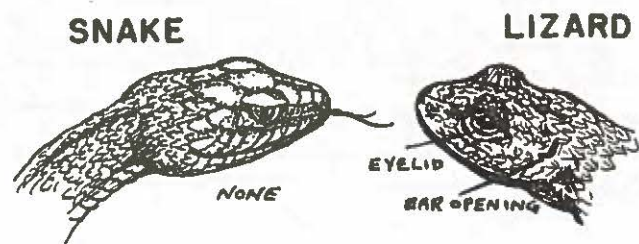
Modern reptiles consist of five distinct groups displaying a great diversity in form and habit: the turtles, crocodilians, rynchocephalians, lizards, and snakes. Turtles are an ancient group of reptiles that have demonstrated little tendency to modify their form. For well over 200 million years the turtles have been going about with a horny, protective shell upon their backs, and this means of self-protection has apparently served him admirably.

The crocodilians are also an old group of reptiles, though not quite as ancient as their turtle relatives. All the crocodilians are quite similar in form and habit; again they seem to be a fairly conservative group. Alligators, crocodiles, gavials, and caimans, are all families of the order, Crocodilia.

The least known group of reptiles is the one represented by a single living species. The group is known by the term, Rynchocephalia, and it is represented by the tuatara of New Zealand. The tuatara is surprisingly like a typical lizard in external structure, but the resemblance is only skindeep. Skeletal features distinguish the tuatara as a survivor of an ancient order of reptiles. We may thus think of the tuatara as a reptilian "missing link." The most highly developed reptile groups in existence are the lizards and snakes; they represent the two orders that are found in Lassen Volcanic National Park.

Lizards are an interesting group, as every young boy who has spent hours stalking them will attest. Typically, they possess four functional limbs, a somewhat elongated body, and a long, slender tail. Most lizards have eyelids and external ear openings. Thus they are able to close their eyes, and some of them can hear airborne sounds. There are about 2,000 known species of lizards inhabiting all continents and many oceanic islands. One species of lizard lives within the Arctic Circle, but this animal is an exception; most are inhabitants of warm regions.

"How can I tell a lizard from a snake?" This is a frequently asked question, and the answers are often debated. Of course, there is the temptation to say that lizards have legs and snakes do not. This distinction would undoubtedly satisfy the average person in most of his encounters with these creatures, but technically he would be incorrect. As a matter of fact, there are snakes with legs and lizards without legs. Certain snakes, such as the boas possess vestiges of legs; true, they are minute and nonfunctional, but they are present. Snakes have evolved from a lizard-like ancestor, and have lost their legs. There are some present-day lizards which have likewise lost their legs, and they are appropriately called, "legless lizards."



There is really no single character upon which we may differentiate at a glance a lizard from a snake. But when several characters are taken together, we arrive at a satisfactory means of distinction. A snake might be best defined as a

reptile having an elongate body, devoid of any functional limbs, with no external ear openings, and with no eyelids. Thus a snake travels in the familiar, sinuous manner of the serpent, is deaf to airborne sounds, and "sleeps" with its eyes open. Were you to find a creature with all these characteristics, you could safely assume that it was a snake and not a lizard. Like the lizards, snakes are distributed throughout the world, but they are most abundant in tropical regions.

Reproduction

Like the amphibians, the reptiles must employ some method of bringing the sexes together at the breeding period. Of first importance is sex recognition; once the sexes are brought together, courtship behavior may commence. The ultimate end of all courtship behavior is reproduction and the continuation of the species.

Voice plays but a small part in the sex life of most reptiles, since most of them are mute. A sound well known to inhabitants of the Gulf States is the roaring or bellowing of the bull alligators during the breeding season. At this time, their deep-toned calls may serve to bring the sexes together. Smell may serve a much more important purpose in bringing the sexes together, especially with snakes. Sight may play an important role in sex recognition of many snakes and lizards.

Unlike the amphibians which depend upon the more primitive method of external fertilization, reptiles fertilize their eggs internally; thus fertilization is assured. Subsequently, reptiles either lay the eggs or give birth to the young, depending upon the species. Live-bearers retain the eggs within the female, completely protected until embryonic development is complete, and then the young are born.

The advantages of live-birth are readily apparent when you consider the numerous environmental hazards to which eggs are subjected when they are simply laid and left to the mercy of predators, parasites, and the elements. Reptile young are born in a relatively precocious state, ready to fend for themselves. The mother does not take care of the young.

Growth and Development

Upon hatching, the young snake or lizard must begin to feed. The rich food source in the egg yolk is no longer available, and the tiny individual must become a hunter. Most snakes and lizards are predators, feeding upon other living creatures; some feed upon eggs, and others are vegetarians. The typical North American lizard is a relatively small creature that feeds primarily upon insects. It captures these by means of an extensible tongue or by simply grabbing with its jaws.

The common chuckwalla of the Southwestern deserts is one lizard that is a vegetarian. Some lizards eat mammals and birds, and the giant monitor lizard of the East Indies, reported to reach a length of 10 feet, is reputed to attack deer and wild pigs. Most lizards do not chew their food even though they are supplied with numerous spikelike teeth. After a few cursory chomps, they swallow their food whole.

Snakes are perhaps most unique of all animals in their unusual method of feeding. They are capable of swallowing things greater than their own diameter. Just how is this seemingly impossible feat accomplished? Most of the elements in the skull of the snake are movable. The lower jaw is loosely hinged to the back of the skull, and the two halves of the lower jaw are hinged in front by means of a flexible ligament. Thus the gape of the snake's mouth may be enlarged far beyond what one would expect from the size of the head alone. Since the snake's jaws can thus be enlarged, this fellow can swallow animals larger than itself. The snake, lacking any limbs with which to grasp its food and tear it apart, swallows its meal whole; it is aided by its many, sharp, backward-curving teeth which prevent the meal from slipping out of the mouth once engulfment has begun. The bodies of snakes can stretch to accommodate prey twice the snake's diameter because of overlapping scales and loose skin, which allow for great distension.

Snakes feed entirely upon animals (including eggs); there are no vegetarians in their ranks. Insects, lizards, other snakes, eggs, birds, frogs, toads, salamanders, fish, and mammals are all on the snake's menu, although each species is somewhat specific in its own food habits. Many snakes consume large numbers of rodents, and are helpful to man. The farmer who finds a gopher snake in his grainfield and quickly dispatches it with his hoe is in reality doing himself a great disservice. That gopher snake was probably there only to eat rodents which were devouring a part of the farmer's crop.



SNAKE SKULL

A characteristic feature in the growth of snakes and lizards is the periodic shedding of their skin. They do this because they outgrow their scaly skin, and because it may have become worn or damaged in the weeks or months of use since the last shedding. So the old skin is shed, exposing a bright new one beneath. Snakes characteristically shed their skins in one piece. The old skin is loosened in the head region usually about the lips. The snake then catches it on some sharp object, a stone or twig, and crawls out of its skin, turning it inside out in the process. Lizards, on the other hand, shed their skin in small patches or flakes. There are exceptions, such as the northern alligator lizard of Lassen which sheds its skin much in the manner of snakes.

Poisonous Species

More curiosity and interest center about poisonous snakes and lizards than any other group of reptiles. This has been found to be true at Lassen where naturalists on duty in the museum have frequently been asked: "Are there any rattlesnakes or poisonous snakes in the park?" People seem to be more curious about the things they fear, and poisonous reptiles are no exception. As you will see, most of the fears that people have regarding poisonous reptiles are unjustified, and they are either the result of outright misinformation or exaggerations which are beyond the realm of probability.

There is but one poisonous lizard in the United States, and this creature is known by the formidable title of gila monster. Certainly, the name is a misnomer, for the lizard is no monster at all. It lives only in the American Southwest deserts—nowhere near Lassen Volcanic National Park.

The rattlesnake is the only poisonous reptile in California, but has not been observed within Lassen Volcanic National Park. All sorts of suggestions for identifying a rattlesnake are freely doled out by would-be snake experts. Triangular heads, vertical eye pupils, diamonds on the back, bodies which are short and stubby, and many other characteristics are offered as guides in the detection of these venomous vipers. However, many harmless snakes possess certain of these characteristics. How then can you tell a rattlesnake immediately? By its rattle, of course! (It is always possible that a rattlesnake may have lost its rattle through accident, and remember further that there are other poisonous snakes in other States.)

CHAPTER VI

THE AMPHIBIANS OF LASSEN VOLCANIC NATIONAL PARK

Pacific treefrog (Hyla regilla)

The little Pacific treefrog is a good vocalist. Its voice, far out of proportion to its diminutive size, is a hearty and melodic "kreck-eck" uttered in frequent sequence, each second or so. When many hundreds of these noisy anurans congregate during the breeding season, a symphony of croaks pervades the stillness of the early summer night. A chorus of Pacific treefrogs is an operatic performance one will not easily forget, as the males seemingly do their best to outsing their numerous rivals to solicit the affections of the less vocally inclined females.

By far the smallest of the frogs and toads of Lassen, the Pacific treefrog seldom exceeds one and one-half inches in body length. This frog may be immediately distinguished from other species in the park by the presence of enlarged pads or discs on the tips of the toes. A prominent stripe of blackish color crosses the face from well behind the eye to the tip of the nose. The color of these frogs is extremely variable since they do possess the ability of color change. Generally, their coloration is somewhat in harmony with their environment. Color may vary from light green through shades of brown and gray to almost black. Males may be distinguished from females by the presence of a brownish colored throat.

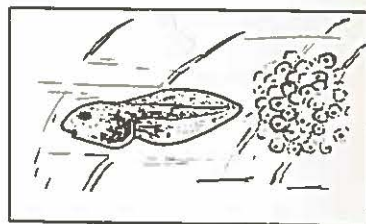
The Pacific treefrog is found throughout Lassen Volcanic National Park from the lowest elevations to the fringe of the Hudsonian Life Zone. There is no record of this cosmopolitan individual on the tops of the park's highest peaks but realizing the adaptability of this species, it would not be altogether surprising if one were picked up on the slopes of Lassen Peak.

Outside the park, this amphibian ranges as far down as the Lower Sonoran life zone. Within Lassen the frog occupies a wide variety of habitats. It may be found in springfed and snowfed meadows, along the edges of the park's numerous ponds or lakes, in pine and fir forests, high upon relatively barren slopes, and even within the desolate Devastated Area where it frequents tiny ponds resulting from the melting of large snowbanks. However, they are most commonly found in areas of sufficient moisture, though they have been found far from any standing water. One of the best places to see and hear the treefrogs is in Kings Creek Meadow in late June or early July when the spawning activity is at its height in that region of the park.

The female lays the eggs in shallow bodies of water. In Kings Creek Meadow the eggs are deposited in small pools or puddles which fill the numerous depressions in the floor of the meadow. These ponds are fed from melting snow on ridges not far above. However, they are rapidly warmed by the sun and become tepid during the day. Hence development of the eggs and tadpoles may be completed before the pools dry up in midsummer, since the rapidity of development is directly related to the temperature of the water in which the eggs are laid. The metamorphosed individuals are tiny creatures less than $\frac{3}{4}$ " in length but perfect miniatures of the mature adult and fully capable of carrying out the daily routines of a treefrog.

The term "treefrog" is certainly a misnomer for although this animal does occasionally climb trees and bushes, it spends more time on the ground than it does aloft. It seeks retreat in dense grass, within rock crevices, and under logs and surface litter. It climbs with great agility obtaining secure hold by means of the adhesive pads on the tips of its toes. These frogs can cling tenaciously to smooth, vertical surfaces, as is aptly demonstrated when one is placed in a glass terrarium. They are primarily nocturnal, engaging in most of their chorusing at night, but are also active during the day. Insects make up the largest part of the treefrog's menu.

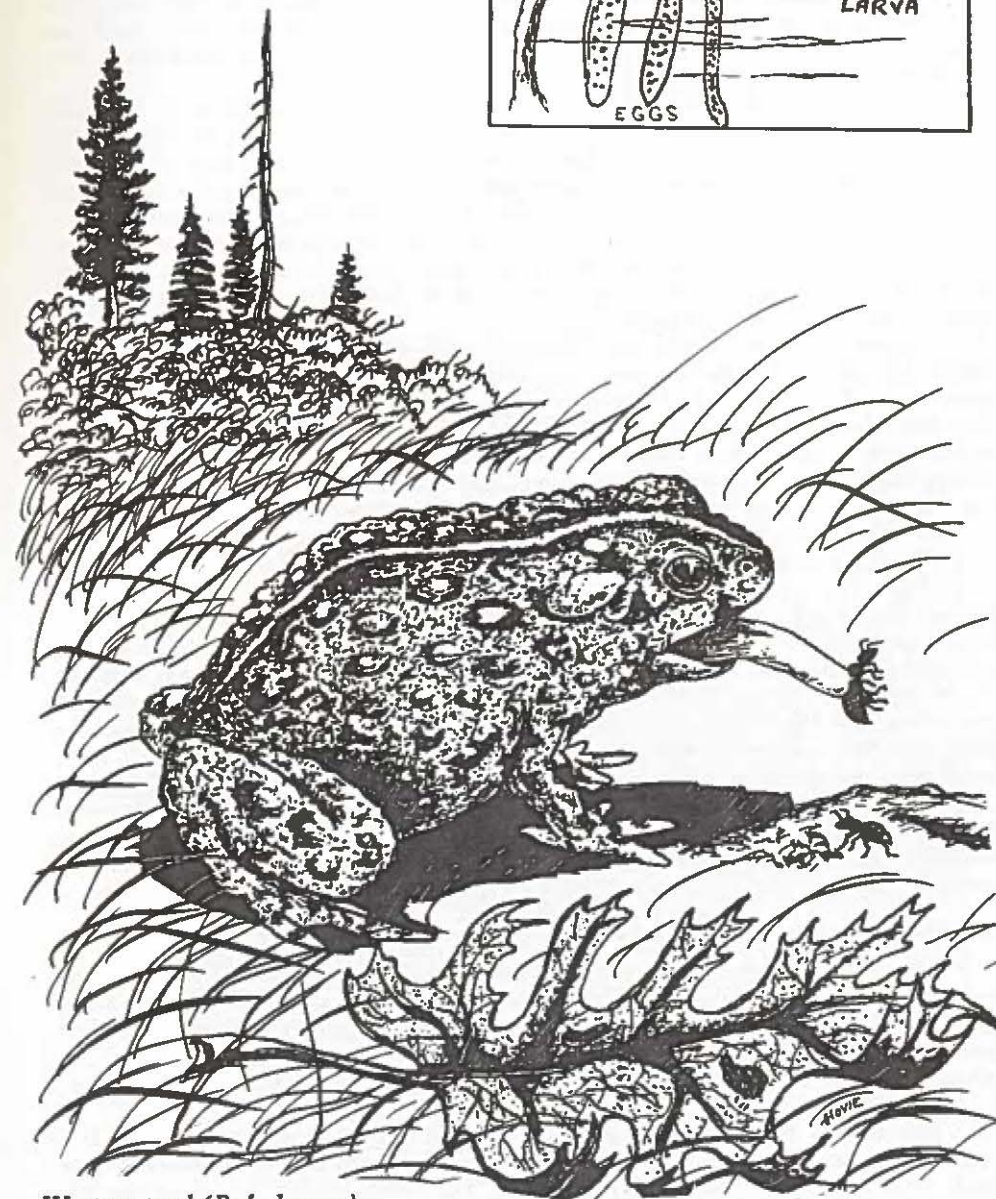
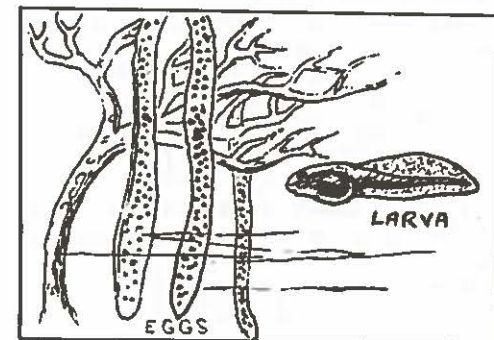
PACIFIC TREE FROG



LARVA AND EGGS



WESTERN TOAD



Western toad (*Bufo boreas*)

A tiny insect looking up into the face of the western toad must behold a predaceous monster of formidable proportions. In a sense he is, insofar as insects and

other such small creatures are concerned, for *Bufo* is a true gormand, and his voracious feeding habits result in the consumption of a prodigious number of insects.

Apparently, the western toad will eat anything that is small enough for it to swallow and that moves sufficiently to attract its attention. These toads have been known to eat bees, ants, moths, beetles, grasshoppers, flies, spiders, crustaceans, and numerous other items. They may prove a source of anxiety to beekeepers, for toads will take up residence in the apiary and consume great numbers of bees. However, because of the numbers of insects they eat, toads are an important means of control in maintaining the balance of insect populations. One toad caught at Hot Rock in Lassen Park had among its stomach contents numerous carpenter ants, beetles of various sorts, a number of insect grubs, a sphinx moth, and two rocks, each about the size of a pea. Toads, then, seem not to be particularly discriminating in their feeding habits.

The western toad is not easily confused with any other amphibian in the park. The adult is a squat, chunky creature, about three to four inches in body length with legs proportionately shorter than those of most frogs. The skin of the body is liberally dotted with warts, and there are a pair of very large and conspicuous, wartlike glands back of the head, one behind each eye. Down the middle of the back, running from the nose to the end of the body, is a prominent cream-colored stripe. Coloration varies considerably from a light gray or buffish color to almost black. If there is still doubt in your mind as to the identity of a western toad, open its mouth; it is toothless.

Western toads are widely distributed throughout the park, like the ubiquitous Pacific treefrogs. Outside the park they range down the western slope of the Cascades to the Lower Sonoran life zone of the central valley of California. In Lassen they have been found as high as 7,500 feet, and they undoubtedly occur at even higher elevations. Seldom are they actually found in the water except, of course, during the breeding season. More often, they wander far afield; a number have been found a mile or two from the nearest standing water and they have been seen in areas of relative dryness where one would certainly not expect to find amphibians. They are occasionally active during the day, but they are primarily nocturnal.

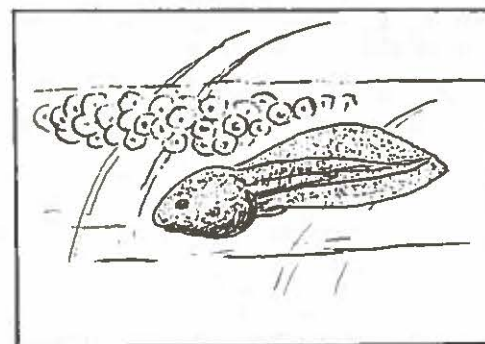
In late spring and early summer when the western toads are breeding in Lassen, their egg masses may be found in suitable bodies of water, generally shallow lakes and ponds that are well warmed by the sun. The egg masses are distinctive, being laid in the form of long strings or ribbons. Observers have counted well over 15,000 eggs in a single clutch. Needless to say, the mortality rate is by necessity enormous, else the earth would be overrun with toads in just a few generations. Because of parasitism, predation, desiccation, and other factors many eggs never hatch and of those that do, the tiny, black tadpoles themselves are the subjects of nature's dangers. The metamorphosed larvae, no larger than jellybeans, provide succulent repasts for various predators. However, through the agency of sheer numbers the western toads manage to surmount the myriad of obstacles and the species lives on.

Cascades frog (Rana aurora cascadae)

Hikers in the Lassen back-country, where there are permanent bodies of water, have often come across the Cascades frog. Quite often all they see is a flash alongside the hiking trail followed by a sudden splash in the water. A quick and sharp look will reveal the well camouflaged frog motionless on the bottom not far from where it dived. If it is not observed, a moment's patient waiting will see it come to the surface for air.

This frog is highly aquatic and seldom ventures more than a few feet from standing water. It makes its home in lakes, small ponds, and along streams especially where there are relatively quiet pools. The Cascades frog is a swimmer with no equal among the park's amphibians. With long and powerful hind legs and broad, webbed hind feet, it swims in a series of forceful jerks, breaking the surface with a pattern of rippling and expanding V's. This creature is a powerful jumper,

RED-LEGGED FROG



EGGS & LARVA



and can hop two and even three feet in a bound. Its slipperiness combined with its jumping abilities make it a difficult animal to capture, as many a young boy will attest. This is just as well, however, since Lassen is a National Park, and is thus a sanctuary for all native creatures.

The Cascades frog has a pale reddish-yellow coloring on the undersurface of the hind legs, but there is much variation amongst individuals in this respect. Adults are about two and one-half to three inches in body length, but they attain larger sizes in other areas. The skin is fairly smooth, though some warts may be present, and two conspicuous folds of skin run along the back, one extending down each side of the back from just behind the eye to the region of the groin. The ground color of the frog is olive interrupted with patches of a darker brown, and the back has a number of black, inky spots. The underside of this frog is a creamy yellow. The Cascades frog in Lassen Volcanic National Park bears a striking similarity to the red-legged frog and to the spotted frog (*Rana pretiosa*), a species found farther north.

Within the park this frog occupies the Transition and Canadian life zones and reaches the edge of the Hudsonian zone. It inhabits the Lassen high country, and is thus found in some of the most beautiful and wild areas of the park. Blue Lake in Blue Lake Canyon is one of the many places that serves as a summer congregation area. They have been observed throughout the park from the lowest elevations to Kings Creek Meadow at 7,500 feet.

A characteristic of the Cascade frog is its odor which is a faint musky smell somewhat medicinal and pungent. Insects are the most important item in the diet of adults. The tadpoles, like all frog larvae, feed upon algae and other plant material in the water. The eggs are deposited in water during the spring or summer. With the onset of cold, autumn weather, these frogs bury themselves in lake mud and enter into a long period of hibernation which in Lassen may last seven months. Emergence from hibernation in springtime is induced by temperature increases and thawing of the lakes.

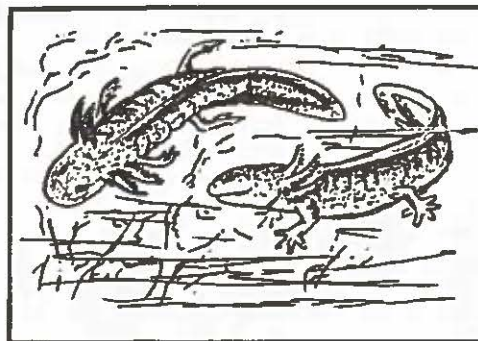
Long-toed salamander (Ambystoma macrodactylum)

If you were looking for amphibians in Lassen, you would hardly expect to find salamanders at elevations above 8,000 feet, and least of all within the icy and relatively sterile waters of Lake Helen. Yet each summer, as surely as the heavy winter snowpack melts from the surface of the lake, the long-toed salamanders make their overland trek to resplendent Lake Helen to start a new generation of species. This beautiful glacial lake, situated at 8,164 feet and well within the Hudsonian life zone, is one of the many in the park which serves as a breeding ground for these contrastingly marked salamanders. Seldom does Lake Helen become devoid of ice and snow before mid-July. Soon afterward the salamanders enter the water, mate, and deposit their gelatinous eggs. The females attach their eggs to rocks or to the bottom, there being no aquatic vegetation to use for this purpose. The eggs are laid singly or in small clusters.

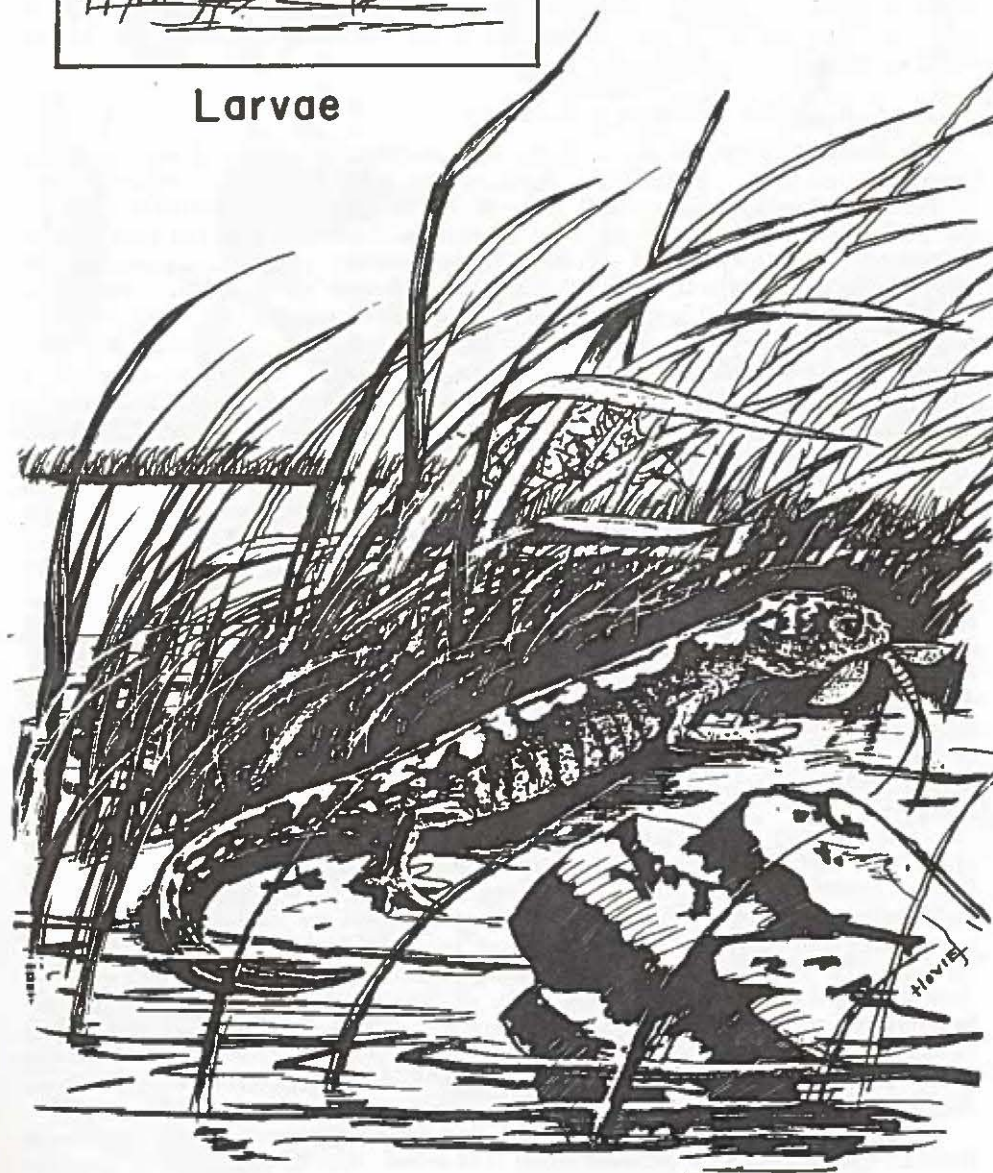
The long-toed salamander is not easily confused with other park salamanders. Its distinctive ground color of black with bright yellow splotching down the midline of the back, should readily serve to identify it. Adults reach a length of six to seven inches. As both the common name and scientific name imply the toes are long and slender, but they are not so long as to be conspicuous—not unless one is accustomed to comparing the relative lengths of salamanders' toes. These are handsome amphibians, and their coloring may serve them usefully as camouflage in certain situations.

Long-toed salamanders are found in a variety of places in the park from the Upper Transition to the Canadian life zone. They occur within or near permanent bodies of water during the breeding season, but at other times they may be some distance from standing water. Individuals have been occasionally observed in water boxes within the Manzanita Lake area. These small, earthen cubicles, housing water valves and covered with wooden lids, are havens of moisture for these sala-

LONG-TOED SALAMANDER



Larvae



manders during the prolonged dry spell of the Lassen summer. Numerous insects are also encountered within these water boxes. Long-toed salamanders have been seen at Table Mountain, and the larval forms are often found in the temporary lake which occupies the summit of the mountain in early summer.

The adults are, to a large extent, scavengers but they also feed upon live, terrestrial insects and on aquatic insect larvae. The larval salamanders are voracious individuals which consume aquatic insect larvae and perhaps crustaceans. Two individuals confined in a jar of water would begin nipping ferociously at one another when they were not fed for some time; the two were separated when it was found that one had torn off half of the external gill structure of the other. Many of Lassen's lakes abound with aquatic life that provides ample food for the larval forms therein. The immature salamanders probably do not metamorphose into adults until the second summer. Metamorphosis is attended by the loss of external gills, reduction in the lateral compression of the tail, and the assumption of the adult coloration.

Ensatina salamander (Ensatina eschscholtzi)

Probably the least abundant of all the Lassen amphibians and reptiles is the ensatina salamander. At least this creature has been the most infrequently encountered, and unfortunately little is known of its habits and distribution within the park. However, the scarcity of individuals at Lassen should not lead one to believe that ensatina is a rare species. On the contrary, ensatina salamanders are quite common throughout much of the West, and they are found in a variety of environments. It is, in fact, their wide range which accounts for their presence within Lassen. A few individuals have come into the park even though environmental conditions seem not to be ideal.

These salamanders range from southern British Columbia to the Mexican border along the western half of the Pacific States, and they occupy much of the Sierra-Cascade mountain chain. Ensatinas prefer the Upper Sonoran and Transition life zones, but a few individuals live in the Canadian life zone. It is doubtful if they occur above 7,000 feet in Lassen. The few recorded specimens within the park have been seen at Summit Creek and in the Manzanita Lake area.

The ensatina salamander is a colorful amphibian, subject to the extremes of racial variability. There are seven sub-species, and each has distinct markings and coloration. If you were to compare a specimen from Lassen with one found, for example, in Los Angeles, you would not believe them to be of the same species. Adults attain a length of four or five inches. This salamander may be immediately distinguished from all other western salamanders by the presence of a well-defined constriction at the base of the tail. The Lassen form is brown above with blotches of orange atop the body, tail, and legs. The amount, distribution, and intensity of blotching is variable, but there is no other similarly marked salamander within the park.

The ensatina salamander is a member of the family Plethodontidae, a group of salamanders which have lost their lungs. Consequently they must breathe through their skins; such respiration is assisted by a moist skin where oxygen/carbon dioxide transfer may rapidly occur. The ensatinas have also forsaken the water, and this attested to by the shape of the tail which is rounded rather than vertically flat for a swimming organ. They spend their lives upon the land; here they deposit their eggs, but only in moist environments where they are protected from drying out. The young hatch as miniature adults, having completed their larval development within the egg. The female of this species is somewhat unique in her habit of brooding the eggs, but this solicitous care does not extend beyond the egg stage; once hatched the young are on their own.

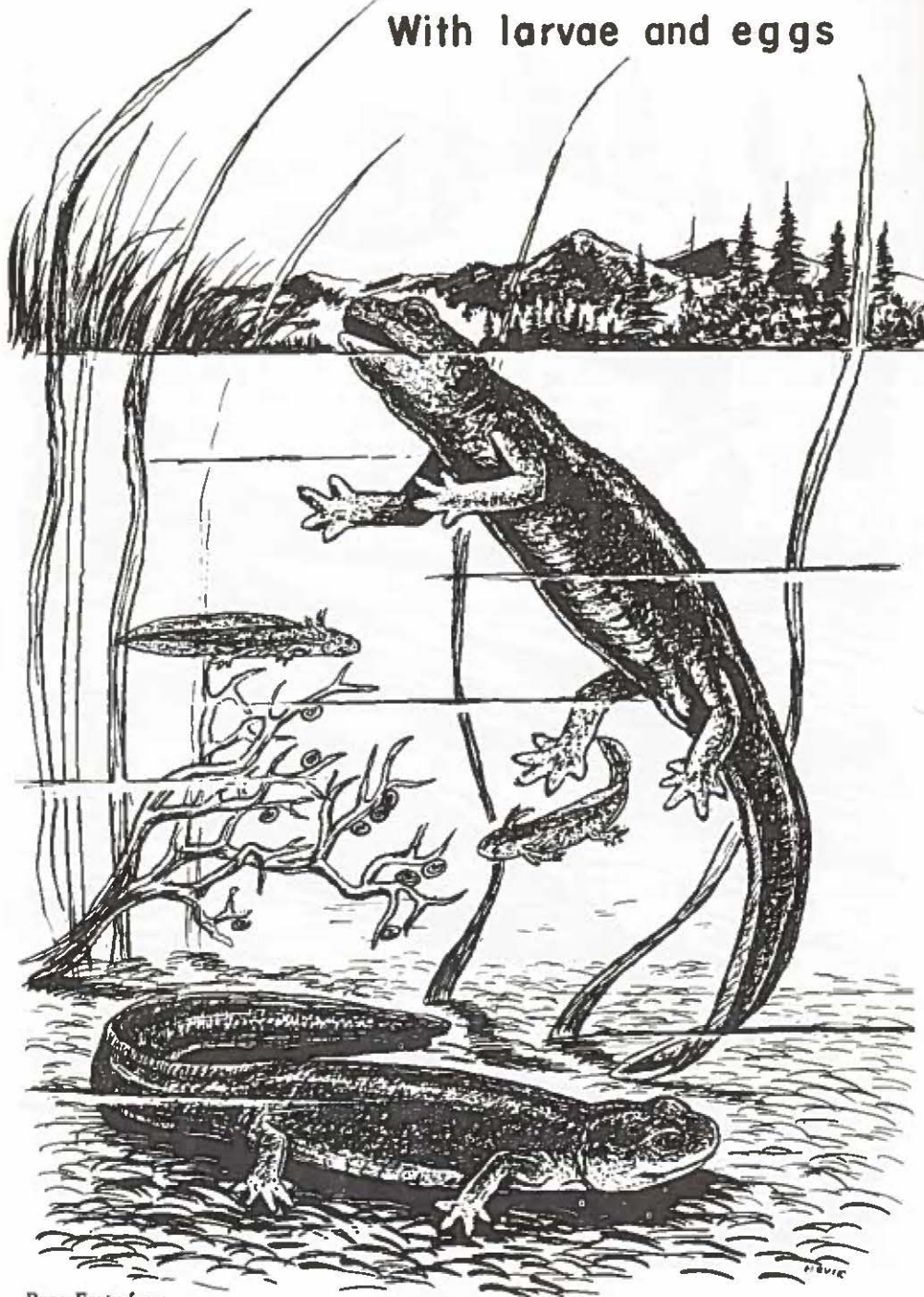
These salamanders are capable of losing their tails much in the manner of lizards. The tail may be released when it is seized, thus allowing the salamander to escape a pursuer while the enemy's attention is diverted by a wiggling tail.

ENSATINA SALAMANDER



When molested this salamander has been known to secrete a milky fluid from its skin; this substance may be repulsive to enemies, and may thus serve as an additional survival mechanism.

ROUGH-SKINNED NEWT With larvae and eggs



Rough-skinned newt (Taricha granulosa)

Quite often we look directly at something and fail to see it, and only notice it after we have taken a second and more careful look. Many Lassen visitors have undoubtedly looked squarely at the rough-skinned newt in the water, but have failed to notice the salamander resting quietly on the bottom or, more often, floating motionless beneath the surface, its chocolate brown color rendering it difficult to see against a similar background. After a moment or so, the newt suddenly shoots upward with a jerk, breaks the placid surface of the water with its snout, gulps a mouthful of air, and dives again toward the bottom where it again becomes motionless.

The rough-skinned newt of Lassen attains a total length of six to seven inches. Its back is a rich chocolate brown which contrasts rather sharply with a bright reddish-orange undersurface; for this reason they are commonly called "red-bellied newts." When they are seen in the water, the tail is generally flattened laterally into an efficient swimming organ. Also at this time the males develop a smooth-textured skin which contrasts with the usual rough or granular skin which has given this newt both its common and scientific names. The rough-skinned phase corresponds with a land habitat, and this replaced by the smooth skin only when the newts return to water to breed.

At Lassen these colorful salamanders live only in the Transition life zone which is apparently the upper limit of their distribution in the park. They have been observed in the Manzanita Lake area where they frequent the numerous ponds in the vicinity of Reflection Lake. Quiet ponds that are relatively shallow seem to offer preferred sites. Though these newts spend some time in the water during the breeding period, they are mainly land-dwellers. They seek the shelter of logs, rocks, and other ground cover when on land, keeping in shady and relatively moist places.

The rough-skinned newt has been observed breeding as early as April 13 in ponds near Reflection Lake; at this time of year the days are cool and brisk, and the winter snowpack has just left the ground. The males generally come to the ponds first; they are in smooth-skinned condition. The females arrive later at the ponds. After a prolonged courtship involving a series of gesticulations, mating and fertilization take place. The female deposits her eggs singly, attaching them to bits of aquatic vegetation in the water. The eggs hatch into the larval form which probably does not metamorphose into the adult until the following year at the earliest.

THE REPTILES OF LASSEN VOLCANIC NATIONAL PARK

Sagebrush lizard (Sceloporus graciosus)

When you observe a sagebrush lizard busily intent in executing a series of "push-ups," you might wonder if that lizard is inclined to body-building exercises like an ever-increasing part of our population. Why else would the lizard be so involved?

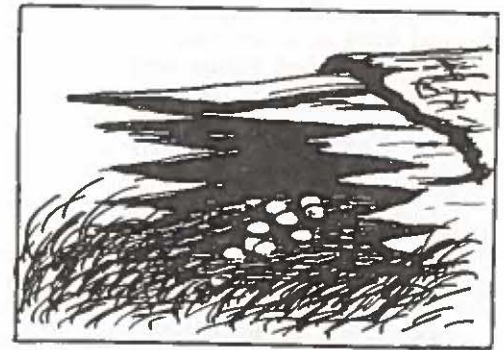
Actually the agile sagebrush lizard is protecting its territory, and is not the least bit concerned with calisthenics. These lizards are very territorial in behavior, and the males, having established residence within a small plot of ground, will protect their territory from encroachment by other males. The males possess bright blue markings on their undersides, and the "push-ups," executed by flexing the elbows and thus raising and lowering the body, allow the males to advertise their ownership. A trespassing male must make a hasty retreat at the sight of the blue underside of the exercising landlord or be prepared to fight; most often it retreats.

The adult sagebrush lizard is about six inches in length. Diamond shaped scales on top the body overlap like shingles on a roof. External ear openings are present, the anterior margins bearing toothlike projections. The toes are long for the size of the animal, particularly those of the hind feet. The upper side is brownish gray with blotches of a blackish color arranged in longitudinal rows along the back. The armpits are rusty colored. Males have a blue throat and conspicuous blue patches on each side of the belly, hence the often-applied name, "blue-belly." Females either lack the bluish areas, or these are only a pale blue.

These lizards are widely distributed throughout much of the West; they occupy areas from the Upper Sonoran to the Canadian life zones. They are principally concentrated within the Great Basin in regions of sagebrush flats, thus their common name. However, their range extends throughout a considerable part of the Sierra-Cascade mountain chain of California. Though they are found in a diversity of environments, they seem to prefer relatively open and well illuminated areas. Within the park their distribution is spotty, the heaviest concentration of individuals perhaps being in the Manzanita Lake area. Here they inhabit the sparsely forested Chaos Jumbles, a mass of avalanche rock where they find excellent shelter and get considerable sunlight. In Lassen they are principally found in the Transition life zone where it merges with the Canadian life zone.

The sagebrush lizard is a member of a large and well-distributed genus whose members are sometimes referred to as swifts, fence-lizards, and blue-bellies. They are frequently seen along the western shore of Manzanita Lake and along the Lily Pond trail. There they make their homes in the numerous rock crevices in hummocks composed of angular blocks of lava. They are often seen basking in the sun, but they cannot tolerate the mid-day heat at which time they retreat to their cooler burrows. Forenoon and late afternoon are the hours of greatest activity at which time the patient observer may see these swift reptiles dart about gobbling insects one by one. Often they may be seen jumping up into bushes, picking off insects attracted to the foliage. Carpenter ants are the staple diet, because these abundant ants make their colonies in the same areas inhabited by the lizards.

Eggs are laid in midsummer, and there may be between two and seven eggs in a clutch. The tiny young, about one and one-half inches long, hatch in the autumn. Soon afterwards the young must begin a long period of hibernation which will last for six months or more. Growth, of course, is not resumed until emergence from hibernation, usually in May.

SAGEBRUSH
LIZARDEGG
CLUTCH

UNDER VIEW



HOBBS

Northern alligator lizard (Gerrhonotus coeruleus)

You see a long, snakelike lizard slowly and stealthily making its way through the leaf litter or underbrush; you carefully approach the lizard taking care not to alarm it and when within arm's length of the furtive reptile, you lunge forward grasping the lizard by the tail before it can get away. But in another instant the lizard has gotten away, much to your amazement and you are left with a writhing, wiggling lizard's tail in your hand while the now tailless lizard frantically scurries to safety, later to grow a new tail. The northern alligator lizard, like many lizards, possesses this power of autotomy, that is, the ability to lose its tail when seized by an adversary. However, the alligator lizards are particularly adept in this regard; and their tails are lost with little hesitation. Bleeding is retarded by special sphincters which close the severed blood vessels. A texture and color slightly different from the rest of the body is characteristic of a regrown tail.

The northern alligator lizard is somewhat snakelike in appearance; the body is elongated and streamlined, and the limbs are small in proportion to the size of the animal. Adults attain a length of 11 inches or more. The scales are almost rectangular, and they are arranged in rows along the body. Ear openings are conspicuous, bearing no toothlike processes. The lizard is grayish above and across this ground color run irregular bands of brownish black, imparting somewhat of a checkered appearance. As the lizard moves along the ground, its body is occasionally thrown into sinuous motion reminding of a snake. The forked tongue is frequently thrust out and is employed as a sense organ of smell.

The northern alligator lizard has a wide range extending from British Columbia to southern California. It is found from the Lower Sonoran to the Canadian life zone. Within the park, it is mainly confined to the Transition life zone in areas that are densely wooded or abundant in ground cover. It travels within the underbrush and leaf litter quietly stalking its prey which consists principally of a variety of insects. The lizards have been seen in aspen groves and within coniferous forests. Rotting logs and other sources of surface litter offer suitable retreat for these secretive creatures.

An alligator lizard is a wary creature that will seek the refuge of its burrow when the first sign of danger threatens. A patient wait of a few moments' duration will find the lizard cautiously emerging from its retreat ready to resume its previous activity. They are pugnacious individuals when first picked up, and will defend themselves by biting (which can scarcely do much harm) and by releasing a foul smelling excrement which must certainly discourage a predator.

During the breeding season the male grasps the female's head in its jaws while mating. The behavior of the mating pair is in other ways so rough that you might mistakingly assume the two are involved in combat. Eggs are laid in the summer, and the young hatch very soon afterward. The tiny individual within the egg has completed development at the time of laying, and is ready to emerge by merely breaking through a thin membrane. This is an evolutionary intermediate stage between reptiles that lay hard-shelled eggs and those that bear their young.

Western skink (Eumeces skiltonianus)

The western skink effectively exemplifies the fact that man may inhabit a particular area for years and still be completely unaware of the presence of certain wild creatures. Many wild animals live within the shadow of man but because of secretive habits and innate wariness, they are seldom or never encountered.

The western skink was not discovered and identified as a Lassen inhabitant until this book had been all but completed; fortunately, the skink made its debut in time to go to press. A year before work had begun on this book a young boy related an observation he made of a lizard with a "bright blue tail." Only one lizard could answer this description—the western skink—and the long search began. The first summer's search was fruitless but during the second summer, when doubt

NORTHERN ALLIGATOR LIZARD



had all but dimmed enthusiasm, a rock was overturned, and a slender, striped lizard with a bright blue tail scurried away in alarm, its secret uncovered at last.

The western skink attains a maximum adult size of approximately nine inches in length. The tail may be twice as long as the body. These lizards are brownish above with four, lengthwise stripes, two atop the back and one running along each side of the body. The scales are exceptionally smooth, imparting a luster or glassy aspect to the long, slender body. In juveniles, the tail is a conspicuous blue which even the most casual observer cannot help noticing. The tail is readily lost and the bright blue wriggling member may divert an adversary's attention while the terrified lizard makes a getaway.

The range of the western skink extends from southern British Columbia to northern Baja California, and it comprises parts of seven Western States. This skink is found in northern and coastal California from the upper Sonoran to the Lower Canadian life zones. Within Lassen Park only one specimen has been found to date; it was procured on the lower slopes of Table Mountain in the Manzanita Lake area. This site is covered with trees and brush growing on a rocky mantle of boulders which make up the mountain's lower slopes. Crevices in the rocks and abundant surface litter both serve to make an ideal habitat for these furtive creatures.

Little is known of the feeding habits of the shy skink, but it probably feeds upon a variety of insects. The one skink found in the park had two spiders and one grub about an inch long among its stomach contents. These lizards are known to stalk their prey. Catching sight of a likely looking insect a skink stealthily creeps up on its prospective meal, thrusts out its head suddenly, and grasps the helpless insect within its jaws.

These lizards are most difficult to observe owing to their retiring habits, and rarely do they venture forth into the open where there is the slightest indication that an intruder is about. Instead they remain quietly secure beneath ground litter, until it is again safe to resume foraging. It is difficult to pick up a western skink for observation; they dart away immediately in sinuous, snakelike fashion once they have been exposed. They almost always attempt to bite when picked up, but can do little harm. These skinks are most active in late afternoon. If you are aware of an area inhabited by a skink, a long and perfectly quiet wait at the proper time of day may be rewarded by a glimpse of this lizard. Seven to ten eggs are laid some time during the summer.

Rubber boa (Charina bottae)

If you were told that there are boa constrictors in Lassen Volcanic National Park, you would undoubtedly look askance at your informant. However, your incredulity would not be warranted, for there are, indeed, boas in Lassen. The rubber boa, a true member of the boa family and a constrictor like other boas, is native to the park. In characteristic boa constrictor fashion, this snake subdues its prey with coils thrown around the victim's body. The life of the prey is literally squeezed out by the snake which subsequently swallows its limp meal.

Of course, the rubber boa does not attain the extraordinary size with which we generally associate the term, boa. It is a small snake seldom exceeding two feet in length, but proportionately it is as formidable as its larger relatives, at least in the eyes of its victims. Its unusual name results from its smooth and supple body.

The rubber boa is not easily confused with most other snakes, and it is readily distinguished from the only other snake present in the park, the common garter snake. This midget constrictor is uniformly colored a tannish brown above. Its very smooth scalation imparts a satin-like texture to the body. Its eyes are small, and the pupil is vertically elliptical. There is not much of a constriction in the neck region so that the head is not as distinct from the body as in most snakes. Furthermore, the tail is quite rounded and blunt and because of its superficial

WESTERN SKINK



resemblance to the head, the popular name, "two-headed snake," has been sometimes applied. When endangered the snake has been known to move its tail about in a manner simulating the head while its head is safely protected beneath a ring of coils.

Though the rubber boa is primarily a resident of the Transition life zone, it has also been found within Lassen's Canadian life zone above 7,000 feet. It is not a common reptile within the park, but is occasionally seen over a widespread area. The snake is principally an inhabitant of the coniferous forest. Individuals have been found under rocks, surface litter, and within rotting logs.

The rubber boa is nocturnal and it begins its nightly forays only when the alpine glow has long left the upper reaches of Lassen Peak. Visitors occasionally see the snake along the park road where it is conspicuous in the headlight beam against the dark pavement. Unfortunately, little is known about the boa owing to its nocturnal and secretive habits. Most of its hunting is probably confined to the duff of the forest floor where it is known to feed upon lizards and small mammals. The boas are not egg-layers; they bear their young. One female rubber boa found in Lassen gave birth to three young snakes while it was under observation in captivity.

This snake is an extremely docile creature; it may be picked up in the wild with little fear of its biting. If one wraps itself about your wrist, it may quietly remain so entwined for some time, especially in the evening. Apparently, during the coolness of the night the snake enjoys the feeling of warmth from the human's body, and clings tightly to its warm-blooded friend. They are very fond of burrowing and when kept in a terrarium under observation, they will nose themselves under pine needles and soil until they are well hidden from view.

Western rattlesnake (Crotalus viridis)

No snake in Western North America elicits such fear and apprehension from so many people as the rattlesnake, and throughout much of the West the western rattlesnake has been given the title of most formidable serpent. Campfire tales relate in lurid detail—often with surprising lack of authenticity—encounters with these "death-dealing" reptiles. Not to be outdone by one spinner of tall yarns, another exaggerates his story until a modicum of original truth is lost in a haze of wild imaginings.

It is no wonder that the authentic natural history of this interesting snake is obscured in a sea of untruth. By far the majority of snakes brought into museums for identification by people who supposed them to be rattlers or some other poisonous snake were really quite harmless species.

The western rattlesnake is not an inhabitant of Lassen Volcanic National Park; at least, it has never been observed. It is included in this book because it ranges near the park and because of the popular interest and misconceptions regarding rattlers. These snakes are present along Hat Creek on Highway 89, and it is not known just how close to the park boundaries they range. Probably very few extend above 5,000 feet on the western slope, but it is possible—though improbable—that one could be found within the park's boundary. Outside the park this snake ranges from the Lower Sonoran through the Transition life zones. It occurs over much of Western North America.

This highly adapted creature is readily identified, that is, as a rattlesnake. It seems unnecessary to say that rattlesnakes may be identified by the presence of a rattle, yet many people persist in basing their identification upon such subtle and inaccurate characteristics as shape of the head, thickness of the body, type of eye, et cetera. This snake is one of the largest rattlesnakes in the West; an unusually large specimen may attain a length of five feet or more. Most people tend to exaggerate rattlesnake lengths by significant amounts, often by 50 per cent or more. The body is stout for its length, and the head is somewhat triangular.

RUBBER BOA



In addition to the nostrils which appear prominently on the face there are present a pair of small pits which immediately distinguish this snake as one of the pit vipers. There is considerable variation in markings and coloration among these snakes, but the above characters will suffice to identify it from other snakes in this region.

The western rattlesnake eats a variety of animals: mice, rats, gophers, small rabbits, squirrels, chipmunks, birds, lizards, and amphibians. Its victims may be located partly by means of its facial pits which are known to be sensitive to hot and cold. Since these snakes often hunt at night, their warm-blooded prey may be sensed, when close enough, by means of the pits—the prey being warmer than the night air. The prey is subdued by means of venom which is injected through an elaborate mechanism, culminating in a pair of fangs on the forepart of the upper jaw. The venom affects the blood and causes internal hemorrhage.

The effect on man of rattlesnake bite has been grossly exaggerated on the one hand and contemptuously regarded on the other. The chances of getting bitten in rattlesnake terrain are slim and almost negligible if you take the proper precautions. High boots should be worn as protection for the lower legs. You should not blindly thrust a hand into brush or rock crevices. You should be on guard for a warning rattle, but should also realize that rattlesnakes do not necessarily rattle before they strike.

Snakebite can result in death particularly if neglected or improperly treated. Needless to say, you should not even entertain ideas of walking in rattlesnake terrain unless you have considered just how you would handle an emergency. No method of snakebite first aid is outlined here, since there seems to be disagreement among experts regarding the best procedure. Certain agencies still propose the method followed with a snakebite kit, namely tourniquet, incision, and suction. The use of cryotherapy (lowering the temperature of the part of the body bitten) is a procedure very successfully employed in certain areas. Proponents of cryotherapy state that considerable tissue damage—a serious problem attending snakebite—is considerably reduced compared with the tourniquet, incision, and suction method, which they further claim is virtually ineffectual and promotes tissue damage.

You should consult your physician for instructions if you plan a trip in rattlesnake terrain. One word of advice, however: if you are bitten, try to keep calm! Do not run about frantically. Remember, the faster your heart beats, the faster you are pumping toxic venom throughout your tissues.

Common garter snake (Thamnophis sirtalis)

Almost everyone has seen the handsome common garter snake at one time or another, and accordingly, many Lassen visitors find this old acquaintance crossing their path as they hike park trails along streams and ponds. Occasionally the snake stops suddenly after it has slithered away a few feet; in this motionless attitude it may remain for a moment, affording the hikers ample opportunity to observe its colorful markings. More often, however, it quickly darts across your path and abruptly disappears amidst the tall grasses and aquatic vegetation which surround the pond or stream of its residence. It frequently will dive beneath the water's surface and swim underwater to some safe refuge, for this reptile is an adept swimmer and spends much of its time in the water.

The common garter snake may attain a length of four feet, but most adult individuals found in Lassen are between two and three feet long. This snake may be readily distinguished from the rubber boa, the only other snake within the park, by the presence of longitudinal stripes running the length of the body. This garter snake has three prominent stripes on a background of black which

WESTERN RATTLESNAKE



extend down the back from just behind its head to the end of its tail. One is situated along the midline of the back, and the other two are lateral in position; they are all yellowish, the top stripe being the brightest. Reddish splotches dot the sides of the body just above the side stripes. The eyes are relatively large, and the head is distinct from the body by a conspicuous constriction about the neck region.

The garter snakes exhibit considerable variation in physical characteristics, and students of snakes often encounter difficulty in distinguishing between certain species.

Garter snakes are one of the most widespread and abundant genera of snakes in North America, and they have adapted themselves to a variety of environments and biological conditions. The common garter found at Lassen ranges from the Transition to the Canadian life zones. The park's numerous lakes, ponds, and streams afford excellent habitats. Their food is likewise directly related to their habitat, for they feed primarily upon frogs, toads, and tadpoles. Insects and worms may also constitute an important part of the diet, especially for the smaller young.

One snake was observed active in the Manzanita Lake area as early as the first week of April; at that time the snow had just left the ground, and the snake was sunning itself in 50° weather. The females bear the young during the summer, and a single snake may give birth to as many as 50 young. The young are quite precocious at birth, but the mortality rate is high.

These snakes are pugnacious individuals, and will often attempt to bite when picked up. They will further resort to the release of a substance from anal glands at the base of the tail; it is foul smelling, and is in itself good enough reason to leave these snakes alone, as the odor is lingering and difficult to remove from the hands. This habit must undoubtedly be of certain survival value, although small boys seem not repulsed in this regard. They perhaps constitute the common garter snake's greatest hazard, and it is only the most elusive of these snakes that can escape the thoughtless onslaught of a barrage of stones and swinging sticks.

COMMON GARTER SNAKE



APPENDIX

A SIMPLIFIED KEY TO THE AMPHIBIANS AND REPTILES OF LASSEN VOLCANIC NATIONAL PARK

1a	Body covered with scales skin not slimy or moist	2
1b	Body without scales; skin slimy or moist	7
2a	Limbs, eyelids, and external ear openings present	3
2b	Limbs, eyelids, and external ear openings absent	5
3a	Skin fold along each side of body	NORTHERN ALLIGATOR LIZARD pg. 48
3b	Skin folds absent	4
4a	Body with four, light, lengthwise stripes	WESTERN SKINK pg. 48
4b	Body without stripes	SAGEBRUSH LIZARD pg. 46
5a	Tail with rattle	WESTERN RATTLESNAKE* pg. 52
5b	Tail without rattle	6
6a	Body with three, lengthwise, yellowish stripes	COMMON GARTER SNAKE pg. 54
6b	Body without stripes	RUBBER BOA pg. 50
7a	Long tail; limbs all about the same size	8
7b	No tail present; hind limbs much larger than forelimbs	10
8a	Bright orange beneath; uniformly brownish above	ROUGH-SKINNED NEWT pg. 45
8b	Not orange beneath; not uniformly brownish above	9
9a	Constriction at base of tail	ENSATINA SALAMANDER pg. 42
9b	No constriction at base of tail	LONG-TAILED SALAMANDER pg. 40
10a	Enlarged pads on tips of toes	PACIFIC TREEFROG pg. 35
10b	No enlarged pads on tips of toes	11
11a	Narrow, light stripe along midline of back	WESTERN TOAD pg. 37
11b	No light stripe along midline of back	CASCADES FROG pg. 38

* Rattlesnakes are not known to occur in the park.

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