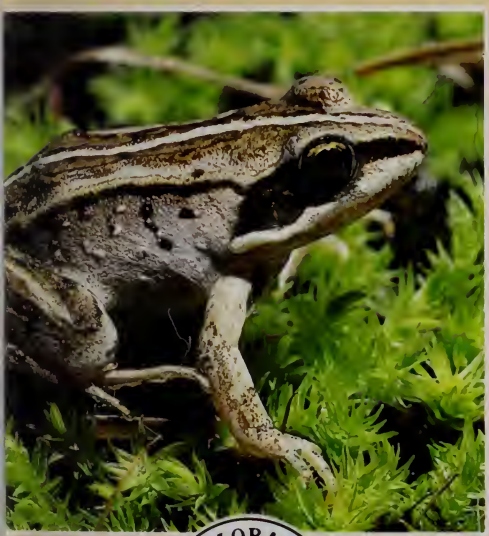
Amphibians and Reptiles in Colorado

By
GEOFFREY A. HAMMERSON



COLORADO DIVISION OF WILDLIFE
Department of Natural Resources
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The first printing of "Amphibians and Reptiles in Colorado" regretfully contains the following potentially misleading errata or omissions.

p.19 Maximum total length should read "13½ inches"
pp.28,31,64 In "Recognition" section:units of maximum length should read "mm"
p.34 Right column, lines 9-10:text after comma should read "which usually follows warm, heavy rains."
p.51 Third line in "Recognition" section:"projecting", not "protecting"
p.72 Left column, line 11:"1981 m" not "1081 m"
p.78 Wrong map was printed; substitute map below
p.82 Right column, line 8:add "7500 ft. (2286 m)".
p.118 Right column, line 7, should read "mid-1800s".
p.118 Right column, 4th line from bottom:correct dates are 1890-1976
p.126 Lines 37-41 in left column should be inserted after line 28 in right column

ADD TO LITERATURE CITED:

Brattstrom, B. H. 1962. Thermal control of aggregation behavior in tadpoles. Herpetologica 18:38-46.

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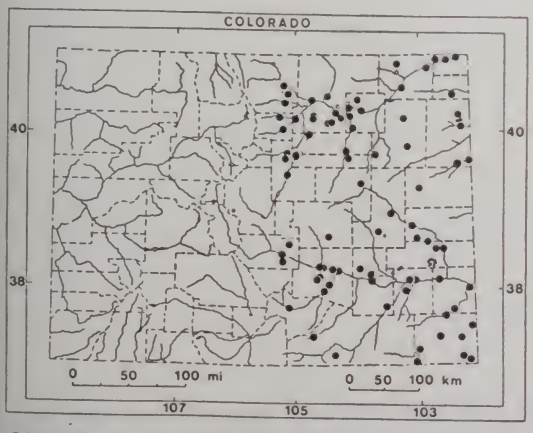
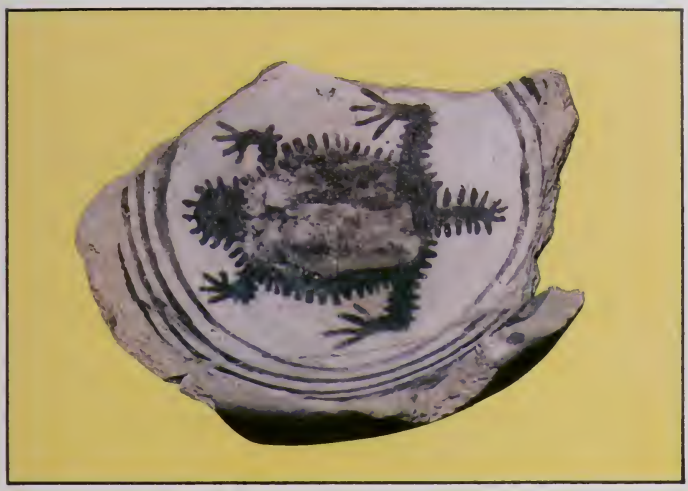


Distribution of the Six-lined Racerunner in Colorado

m egg.



Horned lizard on 700-year-old pottery
from Mesa Verde in southwestern Colorado.

Cover photographs are (clockwise from left): wood frog, desert spiny lizard, racer hatching from egg. Wood frog and racer by G. Hammerson, desert spiny lizard by L. Livo and S. Wilcox.

Amphibians and Reptiles in Colorado

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Edited by Jim Bennett and Jim Hekkers
Design by Russ Bromby

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Dedicated to all Coloradans who
have donated part of their income tax refund
to support nongame wildlife

Foreword

The famous entomologist Thomas Say ited what is now Colorado in 1820 and was : first scientist to record observations of lorado's amphibians and reptiles. Nearly e hundred years later, Ellis and Henderson)13, 1915) published the first state-of-the- treatment of Colorado's amphibian and)tilian fauna, listing 57 species then known thought to inhabit Colorado. More recently, aslin (1959), Smith, Maslin, and Brown)65), and Hammerson and Langlois (1981),)vided useful summaries of the distribu- ns of Colorado's herptiles.

This book, originally envisioned by the thor as a short pamphlet, gradually evolved :o the first comprehensive, fully illustrated blication to provide information on the :ntification, distribution, habitat, and nat- al history of the 64 species of amphibians d reptiles now known to inhabit Colorado. ne Colorado Division of Wildlife Nongame ogram was quick to realize the potential benefits of such an effort and provided the clerical and financial support needed to produce *Amphibians and Reptiles in Colorado.*

In response to the tremendous increase of interest in nonconsumptive use of Colorado's wildlife resources, the Nongame Program took advantage of this obvious opportunity to enhance "user" understanding and appreciation of these special Colorado residents. Our goal was to produce a comprehensive and current book about the state's herptiles that was readable by students, herpetologists, and laymen alike. This production was financed by monies donated by Coloradans through the nongame check-off option on their state income tax forms.

Jim Bennett
Aquatic Wildlife Specialist
Nongame Section
Colorado Division of Wildlife

Contents

Introduction

This book contains information on the identification, distribution, habitat, and life history of each amphibian and reptile species known to inhabit Colorado. It is intended to serve a variety of purposes. The color photographs and species descriptions should facilitate the identification of amphibians and reptiles for the non-biologist who is interested in these odd-looking creatures. Students and teachers should find the text to be a useful introduction to amphibian and reptilian biology. The up-to-date distribution maps and habitat information should be valuable to resource managers and field biologists. Both amateurs and professionals should find this a convenient compilation of life history information heretofore either widely scattered throughout the literature or unavailable.

Amphibians and reptiles comprise two very different groups of animals, as different from each other as birds are from mammals. Nevertheless, they often are studied together for historical and practical reasons. Early naturalists did not consider the differences between amphibians and reptiles very important and treated them as one group. Biologists today recognize that amphibians and reptiles represent two distinctive classes of vertebrates (animals with backbones) but continue the tradition of studying them together because the methods for studying them are so similar. The study of amphibians and reptile is called herpetology, which comes from th Greek words "herpes" (a creeping or craw ing thing) and "logos" (a discourse). Fo simplicity amphibians and reptiles often ar collectively called "herptiles" or "herps. See *Quick Guide to Colorado's Amphibian and Reptiles* for distinguishing characteristic of the major groups of amphibians and rep tiles in Colorado.

Research for the book began in 1977 an continued until April of 1982. I made an e fort to compile and evaluate all available in formation on Colorado's amphibians and rep tiles, examining all pertinent literature an many unpublished theses and reports. Biol gists throughout the state provided me wit much useful information. An examination o the collections of 16 museums and a surve and evaluation of the records of 13 addition museums yielded a wealth of distribution data. Intensive field surveys yielded much needed additional information on distribu tion, habitat preferences, and life histories This book is an up-to-date, comprehensiv summary of what is known about the amph bians and reptiles of Colorado. Unfortun ately, there is a great deal that is not known. hope that this book will encourage furthe study of these fascinating animals.

Acknowledgments

This book would not have been possible thout the help of many friends and colgues. John Torres, Nongame Program anager, Colorado Division of Wildlife, arnged funding to cover writing, secretarial, d publication expenses. Support for field d museum research was provided by the alker Van Riper Fund, University of Colodo Museum, and the Kathy Lichty Memor Fund, Department of Environmental, opulation, and Organismic Biology, niversity of Colorado, Boulder. The Colodo Natural Heritage Inventory, funded by he Nature Conservancy, supported part of y museum research.

I was fortunate to have David M. Armrong, George T. Baxter, Joseph T. Collins, m Hekkers, Beth P. Lapin, and Hobart M. nith review the entire manuscript. They ade many useful suggestions but, of course, ny errors or idiosyncrasies that remain are y responsibility. Editorial and production sponsibilities for this project were effiently handled by James Bennett, Jim Hekers, and Russ Bromby.

Robert L. Bezy and John Wright (Los ngeles County Museum of Natural listory), Charles C. Carpenter (University of klahoma), Ronald Crombie (National Museum of Natural History), William G. Degenhardt (University of New Mexico), ames R. Dixon and Michael J. McCoid Texas A & M University), William E. Duellman (University of Kansas), Harry W. Greene and Steve Busack (University of California), Donald Hoffmeister (University f Illinois), Crawford G. Jackson and Mark Dodero (San Diego Natural History Museum), Arnold Kluge and Elizabeth McGhee (University of Michigan), John M. Legler (University of Utah), Alan E. Leviton nd John Simmons (California Academy of Sciences), John Lynch (University of Nebraska), Hyman Marx (Field Museum of Natural History), C.J. McCoy (Carnegie Museum of Natural History), Peter Meylan University of Florida), Robert F. Martin and Doyle Mosier (University of Texas), Charles Myers and Richard G. Zweifel (American Museum of Natural History), David Pettus (Colorado State University), Andrew H. Price (New Mexico State University), Felix Revello (Colorado National Monument), Jose Rosado (Harvard University), Douglas A. Rossman and Randy H. Vaeth (Louisiana State University), Cecil Schwalbe (University of Arizona), Wilmer Tanner (Brigham Young University), Robert G. Webb (University of Texas, El Paso), and Shi-Kuei Wu and Peter LaRochelle (University of Colorado) contributed to the accuracy and completeness of my distribution maps by allowing me to examine specimens in their care or by providing information on the herpetological collections at their respective institutions.

Karölis Bagdonas, J.E. Gillis, Donald E. Hahn, John B. Hess, Garry Knopf, Lauren J. Livo, C.J. McCoy, Terry C. Matthews, Paul Miller, Douglas D. Post, Robert W. Reese, John Scott, Albert W. Spencer, and W. Thomas Turner generously allowed me to use their unpublished theses and dissertations, which in many cases contain the best available information on particular species of amphibians and reptiles in Colorado.

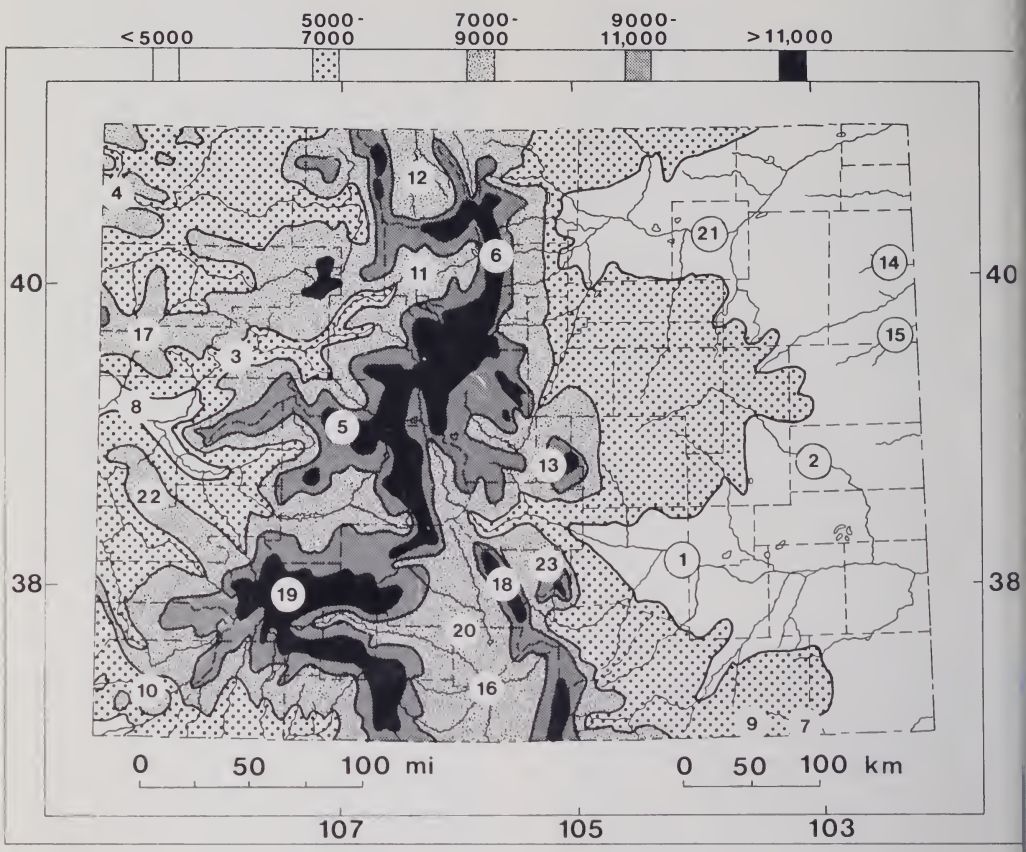
The drawings in this book were done by the skillful hand of my wife, Beth P. Lapin. Several color photographs were contributed by Lauren Livo and Steve Wilcox.

I regret that I cannot adequately acknowledge all of those who facilitated this project in so many other ways. I am especially grateful to Steve Aird, Eldon Brown, Robert Cohen, Steve Corn, Max Dutton, Robin Knox, David Langlois, Beth Lapin, Lauren Livo, Chuck Loeffler, Willard Louden, Mark Ludlow, Tom Lytle, Gary Packard, Steve Petersburg, Robert Sanz, Hobart Smith, Kenneth Soltesz, and Walter Tordoff. I would like to express my appreciation to all the ranchers and landowners throughout Colorado who permitted me to search for amphibians and reptiles on their property.

Last, but certainly not least, I thank the people of Colorado, who have so strongly demonstrated their support for nongame wildlife by their income tax checkoff donations, thereby making this book possible.

Topographic Map of Colorado

Numbers indicate physiographic features and streams mentioned in this book.
Elevation (feet) indicated at top of map.



1. Arkansas River
2. Big Sandy Creek
3. Colorado River
4. Echo Park, Dinosaur National Monument
5. Elk Mountains
6. Front Range
7. Furnish Canyon
8. Grand Valley
9. Mesa de Maya
10. Mesa Verde
11. Middle Park
12. North Park
13. Pikes Peak
14. Republican River, N. Fork
15. Republican River, S. Fork
16. Rio Grande
17. Roan Plateau
18. Sangre de Cristo Range
19. San Juan Mountains
20. San Luis Valley
21. South Platte River
22. Uncompahgre Plateau
23. Wet Mountains.

Environmental Relationships

Colorado is somewhat south and west of the nter of North America. The state straddles e Continental Divide, the high mountain est that separates the Atlantic and Pacific ainage systems, and perhaps is best known r its mountains. However, an even greater ea of gently sloping plains and a nearly ual area of plateaus, canyons, and basins oc- ipy the eastern and western parts of Colo- do, respectively.

The varied topography and unique geographic position of Colorado interact to create an unusually diverse array of environments. One can descend 8,000 ft. (2438 m) from a glacier to an oppressively hot river valley in only 20 airline miles (32 km). These environmental variations profoundly affect the distributions and lives of amphibians and reptiles.

Habitats of Amphibians and Reptiles in Colorado

The habitat of a species is the place where it ves (in an ecological, not geographic, sense). cologists often use characteristics of the ve- etation, topography, and substrate to dis- nguish terrestrial habitats. Aquatic habitats ommonly are distinguished using criteria ich as depth, rate of flow, clarity, tempera- ire, extent, and permanency of the water. he major habitat types of Colorado and eir typical amphibian and reptilian inhabi- nts are summarized on the following pages.

Alpine tundra: Alpine tundra, dominated y long-lived, low-growing perennial plants,

igh mountains of Boulder County with alpine tundra, ubalpine forest, mountain riparian, and aquatic habitats.

ccurs above the upper limit of tree growth usually 11,500-12,000 ft., 3305-3657 m) on he highest mountains in Colorado. It is a old, wind-swept environment that typically s devoid of amphibians and reptiles.

Subalpine forest: Extensive subalpine orests of densely spaced, spire-topped con- fers dominate the high mountains of Colo- ado below the alpine tundra. Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), and lodgepole pine (*Pinus contorta*) are the common subalpine conifers. Stands of aspen (*Populus tremuloides*), a broad-leafed, deciduous tree, also occur throughout the subalpine forest. Elevation at the lower extent of this forest-type varies considerably but usually falls between 8200-9500 ft. (2499-2896 m). Subalpine forest does not provide favorable habitat for many amphibians or reptiles. A few species such as the tiger salamander, western toad, and wood frog, which are most closely associated with the mountain riparian habitat type (see below), may forage in the forest or hibernate there, but no species is a characteristic inhabitant of the forest.

Montane forest: The lower mountains of Colorado are forested by broad-crowned conifers of which ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*) are most common. Aspen and lodgepole pine transgress the arbitrary boundary between the montane and subalpine forest-types. Montane forest is inhabitated by a relatively small number of amphibians and reptiles, especially in northern Colorado where the typical species include only the eastern fence lizard (in rocky areas) and the milk snake. Several other species, including the many-lined skink, short-horned lizard, bullsnake, and western rattlesnake, occur in this habitat in southern Colorado.

Mountain grassland: The grasslands that occur throughout the montane and subalpine forest zones typically are uninhabited by amphibians and reptiles unless associated with a body of water (see riparian and aquatic habitats). Some of the montane forest species occasionally range into the mountain grasslands.

Mountain shrubland: Shrublands dominated by deciduous oaks and other shrubs occur throughout the foothills and lower mountains of Colorado. These shrublands are most extensive in western Colorado where they generally are interposed between coniferous forest and piñon-juniper woodland or sagebrush shrubland. Mountain shrubland also occurs as a narrow foothills belt between montane forest and plains grassland along the eastern base of the mountains. Among the common reptilian inhabitants of this habitat-type are the eastern fence lizard and western rattlesnake, which favor exposures of broken rock.

Sagebrush shrubland: Shrublands dominated by big sagebrush (*Artemisia tridentata*) occupy extensive areas in northwestern Colorado, North and Middle parks, portions of the San Luis Valley, the Gunnison Basin, and basins in southwestern Colorado. Sagebrush exhibits a wide elevational range, occurring below 5000 ft. (1525 m) in western Colorado and above 10,000 ft. (3050 m) on warm slopes in the mountains. Well-developed stands often occur on deep, well-drained alluvium. Amphibians and reptiles generally are absent or rare in high elevation stands of sagebrush. Species present at low elevations generally are the same as those inhabitating semidesert shrublands (see below).

Semidesert shrubland: These shrublands occupy deep soils of lowland areas generally below 7000 ft. (2130 m) in western Colorado and extensive areas of the San Luis Valley at about 7500-8500 ft. (2285-2590 m). Saline soils with a high water table are dominated by greasewood (*Sarcobatus vermiculatus*). Saltbush (*Atriplex* spp.) is common on drier, less alkaline soils. Shrubs often are rather openly spaced. Reptiles are among the most conspicuous animals of this habitat-type. Common inhabitants include the sagebrush lizard, side-blotched lizard, western whiptail, striped whipsnake, Great Basin gopher snake, and bullsnake. Where exposures of rock occur, the collared lizard, eastern fence lizard, and tree lizard are usually common.

Piñon-juniper woodland: Relatively open stands of small, shrubby conifers cover extensive areas of western and southern Colorado. Piñon pine (*Pinus edulis*) dominates at higher elevations while junipers (*Juniperus* spp.) are most common at lower elevations

Canyon country in Mesa County with piñon-junip woodland.

and north of the Colorado River in wester Colorado. These woodlands typically occu on shallow soils of rocky canyons or escar ments. Reptiles, especially lizards, are co spicuous residents of these rocky woodland Among the more common species are the co lared lizard, sagebrush lizard, eastern fenc lizard, tree lizard, side-blotched lizard, platea striped whiptail, striped whipsnake, Gre Basin gopher snake, and western rattlesnake

Plains grassland: The gently slopin plains of eastern Colorado are dominated b sod-forming short-grasses of which blu grama (*Bouteloua gracilis*) and buffalo gra (*Buchloë dactyloides*) are most common. Yucc (*Yucca glauca*) and, south of the Platt

Plains grassland at Pawnee Buttes in Weld County.

Arkansas Divide, cane cactus (*Opuntia imbr cata*), often are conspicuous elements of th vegetation. The grasslands of Colorado sup port a diverse amphibian and reptilian faun Some of the more common species are th tiger salamander, plains spadefoot toac Woodhouse's toad, short-horned lizarc lesser earless lizard, western box turtl coachwhip, bullsnake, and prairie rattl

nake. Rocky areas commonly are inhabited y the eastern fence lizard.

Sandhills: Sand sagebrush (*Artemisia ilifolia*) and a variety of grasses are the domiant vegetation on the low rolling sandhills of astern Colorado. Common sandhill species nclude the plains spadefoot, western box turle, lesser earless lizard, eastern fence lizard subspecies *garmani*), six-lined racerunner, nany-lined skink, bullsnake, milk snake, and rairie rattlesnake.

Mountain riparian habitats: The moist nd relatively lush vegetation characteristially bordering high mountain streams, onds, lakes, marshes and reservoirs, or ocurring in wet meadows, is widely inhabited y a few common species, including the western toad, striped chorus frog, northern eopard frog, western terrestrial garter snake, nd smooth green snake.

Lowland riparian habitats: This habitat ype includes the banks and borders of bodies of water in lowland areas below 6000 ft. (1828 m). Vegetation may range from dense belts of cottonwood trees hundreds of meters wide to only a low sparse cover of grasses and forbs. A great number and variety of amphibians and reptiles occur in this habitat type. Commonly observed species include the tiger salamander, Woodhouse's toad, striped chorus frog, plains and northern leopard frogs, painted turtle, six-lined racerunner, northern water snake, and various garter snakes.

Permanent water—littoral zone: Marshes and the shallow portions of lakes, ponds, reservoirs, or slow streams where rooted aquatic plants grow harbor a wide variety of amphibians and reptiles. At all elevations this is an important breeding habitat for amphibians and feeding habitat for turtles and garter snakes.

Permanent water—open water zone: The open water of streams, lakes, ponds, and reservoirs are used for feeding and breeding activities by relatively few species, the most typical of which are the aquatic turtles.

Temporary pools: Temporary pools of water resulting from heavy rains or flooding, and pools along intermittent streams, are important breeding sites for many amphibians, including the tiger salamander, spadefoot toads, Great Plains toad, red-spotted toad, and plains leopard frog.

Elevational Relationships

In mountainous areas such as Colorado the maximum elevation reached by plants or animals often is of interest. About 70 percent of the amphibian species in Colorado do not range above 8000 ft. (2438 m). Over 50 percent of the reptile species do not occur above 6000 ft. (1828 m) and more than 80 percent are not found above 8000 ft. (2438 m). Amphibians and reptiles that range across the latitudinal breadth of Colorado reach distinctly higher elevations in the southern part of the state. North-south differences in the upper elevational limits may be 2000-3000 ft. (609-914 m) or more.

Climatic Correlations

Elevation exerts its influence on amphibian and reptile distribution indirectly through differences in climate (highland areas generally are colder than lowland areas). Most amphibians and reptiles cannot live in a cold environment. They require moderately warm body temperatures for feeding and reproduction but are unable to produce their own body heat. Unless there is an adequate external source of heat, they languish and ultimately die. Predictably, cooler areas in Colorado are inhabited by fewer species of amphibians and reptiles than are warmer areas.

Geographic Patterns

The environmental relationships discussed above result in a bold geographic pattern of distribution: the southwestern and southeastern portions of Colorado are inhabited by far more species of amphibians and reptiles than are the more northern and central parts of the state. For example, in a well-chosen area of a few square kilometers in the mountains of northcentral Colorado one might find five species of amphibians and one snake, but no lizards or turtles. In contrast, an area of equal size in southeastern Colorado could yield nine amphibian species, four kinds of turtles, eight species of lizards, and 19 kinds of snakes.

Relationship to Humans

Human activities often have devastating consequences for native wildlife. In Colorado human communities have replaced native biotic communities in extensive areas along the eastern base of the mountains. The few amphibians and reptiles that are able to survive in undeveloped remnants of native habitat usually lose when they encounter any of the hordes of humans who now claim the land for their sole use. For example, thousands of amphibians and reptiles are killed each year as they attempt to cross roads linking the ever growing urbanized and residential areas.

Intensive agriculture, especially "clean farming" in which no native vegetation is allowed to remain, has exterminated amphibians and reptiles over large expanses of eastern Colorado. In many areas individuals survive only in undisturbed refugia along streams or topographic breaks. Heavy pesticide use on croplands and rangelands may reduce the food supply for insectivorous species and may contaminate amphibian breeding ponds. On the other hand, rodent-infested fields and ranch buildings, and water retention and diversion structures in irrigated areas, provide favorable habitat for mammal-eating snakes and aquatic or amphibious species, respectively. Bullsnakes are notable for their persistence in agricultural areas despite massive habitat disruption. Throughout the rangelands and agricultural areas of Colorado, snakes, lizards, and toads devour enormous numbers of rodents and insects each year. The wise farmer or rancher protects amphibians and reptiles and their habitats and reaps the economic benefits of these natural "pesticides."

Mining has altered large areas in some parts of Colorado (for example, visit the Climax molybdenum mine). However, the greatest threat to amphibians and reptiles is not posed by the direct effects of digging but rather by toxic concentrations of minerals draining from mines and mine tailings into streams and lakes. Porter and Hakanson (1976) found that mine drainage in Clear Creek County had concentrations of hydrogen ion, copper, and zinc all individually much greater than the tolerance levels of tadpoles of the western toad, a common mountain species. Only after the water was diluted approximately one thousand times could the tadpoles survive in it.

Amphibian reproduction is adversely affected when eggs are covered by sediments resulting from excessive erosion. Hence, mining, logging, over-grazing, road-building, and other activities that destroy soil-holding vegetation often are detrimental to amphibian populations.

Introductions of non-native game species have provided valuable sport for the fisherman but often have been harmful to native amphibians. Predatory fishes such as trout and bass devastate salamander and frog populations by eating the vulnerable eggs and larvae. Amphibians survive only where shallow, vegetation choked areas provide protection from the fishes. Unfortunately these important shallow areas sometimes are eliminated, along with the amphibians, when pools are deepened prior to stocking them with trout. The introduction and subsequent expansion of the bullfrog, which is hunted for its edible flesh, apparently is having a detrimental effect on native amphibians. Tiger salamanders rarely are found in ponds inhabited by bullfrogs even if other conditions are favorable. Bullfrogs also appear to be replacing or to have replaced native leopard frogs in some areas of eastern Colorado. (Bullfrogs not only eat many of the same foods eaten by leopard frogs but also eat the leopard frogs as well.) Tiger salamanders seem to get a poor deal in relation to sport fishing—larvae that are lucky enough to escape the predatory fishes may be harvested by the fisherman for use as bait.

Future human threats to amphibians and reptiles in Colorado are ominous but uncertain. Massive disruption of the landscape by energy development, population growth and urban-suburban sprawl, and acidification of bodies of water due to increasing air pollution will create a rather bleak future for amphibians, reptiles, and other wildlife in Colorado unless a balanced approach to growth and development is adopted.

In general, amphibians and reptiles are innocuous creatures which rarely cause any harm to humans or their property. They sometimes prey on species that are hunted by humans: snapping turtles may kill ducklings in ponds; bullsnakes may eat duck eggs; garter snakes, water snakes, and turtles may

ccasionally capture a sportfish (probably an njured or sick one). However, only the rattlenakes (two species in Colorado) pose any eason for concern. Rattlesnakes are indeed angerous creatures but are not as deadly as nany would believe. In the U.S., more than en times as many people die each year from ee stings or from being struck by lightning han die from rattlesnake bites (less than one ercent of those bitten die). Most bites result rom careless handling of the snakes by perons intent on capturing or killing them. Only very rarely is someone bitten during an unexpected encounter with a rattlesnake. Cattle, sheep, or horses that have been bitten may experience swelling and become sick, but they rarely die.

The esthetic values of amphibians and reptiles should not be overlooked. Observation of frog or lizard behavior in the field is no less rewarding than bird or mammal study. Few experiences in nature study are as thrilling as a nighttime visit to a pond in which several kinds of frogs are singing simultaneously.

How to Observe Amphibians and Reptiles

Amphibians and reptiles often are secretive creatures. Only a relatively few species are observed regularly. Several techniques can greatly increase one's chances of finding these animals if the constraints of season and weather are considered. Late spring and early summer (May-June) usually are the best times to observe amphibians and reptiles in Colorado, although the active season of various species generally extends from late March through late October. Amphibians and reptiles are most active on warm, sunny days and warm evenings, especially after heavy summer rains. Cold weather and wind usually inhibit their activities.

During daylight hours a visit to a pond, lake, or reservoir having shallow, weedy margins can be a productive method of finding amphibians and reptiles. Various frogs, turtles, and snakes usually can be observed by walking slowly along the edge of the water. Once an animal is located a great deal can be learned of its habits if one has the patience to sit quietly and watch, rather than immediately pounce on the creature in an effort to catch it. Steep-sided ponds with little shoreline vegetation also may harbor amphibians and reptiles unless predatory fishes are present.

Another productive, although tiring, daytime technique is to search under rocks, logs, boards, and other debris on the ground. This is one of the best ways to find species that are especially rare or secretive. Objects that have been overturned always should be carefully returned to their original position so that the hiding place is preserved for future use. Thoughtless destruction of these hiding places, which protect the animal from predators and unfavorable weather, may deplete or eliminate local populations. Animals found under surface objects, after being examined or photographed, should be released at the edge of the repositioned rock or log so that they may crawl beneath it without danger of being crushed.

Conspicuous exposures of rock are good places to find several kinds of lizards, especially during late morning or late afternoon. Feeding, courtship, and territorial behavior can be watched easily from a distance through binoculars.

One of the best ways to find frogs and toads is to listen for their calls at night after heavy summer rains. Once a chorus is heard, a cross-country hike with flashlight in hand often leads to one of the most enjoyable spectacles in the animal world. The beam of the flashlight usually causes little disturbance as the males sing and joust with one another in an effort to win the attention of a female. When several species are calling simultaneously the result is truly a sight and sound extravaganza.

Amphibians and reptiles often can be found by driving slowly (15-20 mph) on little-traveled blacktop roads on warm summer nights. As the air cools, the animals tend to linger on the warm road surface where they can be seen in the beam of a car's headlights. Unfortunately thousands of animals (especially snakes) are killed by cars each year because of the habit. Road-hunting is also

productive during or immediately after heavy summer rains, which stimulate many amphibians and reptiles to roam.

Road-hunting is an effective way of finding amphibians and reptiles but can be quite dangerous if done carelessly. When an animal is found the driver should pull onto the shoulder of the road and park. The doors on the road side of the car should not be left op when retrieving the animal. An animal fou on the road should be released in the a where found but far enough away from t road to ensure that it does not become "road-kill." Road hunting should not be tempted on roads traveled by more than o car every few minutes.

Photographing Amphibians and Reptiles

The equipment and procedures I used in taking the photographs in this book are relatively simple. Other equipment and methods may work as well or better, but those summarized below are effective, relatively inexpensive, and simple enough for field use.

Equipment: My basic equipment consisted of a standard 35 mm single lens reflex camera equipped with a 50 mm macro lens and an inexpensive electronic flash unit.

Film: For most photos, I used slow (ASA 64) color slide film.

Capture of animals: In most cases I captured the animal by hand prior to photographing it. I captured some lizards with the aid of a small noose tied to the end of a hand-held stick. I photographed rattlesnakes as found in the field.

Getting a good pose: The fundamental dilemma in photographing reptiles and amphibians is that the animal, which the photographer hopes will pose with regal demeanor, is intent only on escape. Sometimes careful stalking allows one to get close enough for a photo of an undisturbed animal, but usually they hop, run, or crawl away from the camera lens; they must be captured and recaptured before one can focus and shoot. Some calm down if held for a few minutes. Then they can be photographed if placed down gently. Others seem reluctant to sit still for even a single photograph. One way to coax these "hyperactive" animals to slow down is to let them crawl beneath some object such as a hat or one's hand. Thus hidden, the animal generally becomes immobile and can be photographed after the cover is lifted. Another way to calm animals for photography is to chill them in the shade. This makes them lethargic and easier to photograph but also often changes or dulls their colors and prevents them from maintaining a normal posture.

Background: Where possible and prac cal, elements of the natural habitat are i cluded in the background of the photograp in this book, but the primary purpose of t photographs is to provide a large, unobscur illustration of each amphibian and reptil Ideally, photographs should clearly illustra an animal engaged in normal activity in i natural habitat, a goal that is superb challenging.

Flash photography: Closeup photogr phy using only natural light usually results i photos that lack sharpness or in which a sul stantial portion of the subject is out of focu This is because either the shutter speed mu be too slow or the aperture too large (or bot in order to compensate for inadequate ligh The high-speed color films (ASA 400) no available alleviate the problem somewhat bu only through the use of a flash unit can max mum sharpness, richness of color, and dept of focus be achieved.

I took most of the photos in this book at a aperture setting of f/22 (which maximize depth of focus) with the camera held in th right hand and the flash in the left. Flash-t subject distance, which depends on the mag nification of the photo and the light output o the flash unit (as well as on the film speed an aperture setting), was determined using th calculations and tables provided by Blake (1976: 310-322). This method, although awk ward at first, yields excellent results and i convenient for use under field conditions.

Natural light: When high magnification are not required (i.e., when the subject i fairly large) excellent photographs can b made with natural light. For sharp prints shutter speeds should not be less than 1/25 second.

Explanation of Species Accounts

Most of this book consists of species accounts containing information on the identification, distribution, and life history of Colorado's amphibians and reptiles. The content of each species account is explained below.

Names: Most people using this book will prefer to use common rather than scientific names. However, the fact that a species may be known by several different common names results in confusion. For this reason, zoologists often use the scientific name, which is unique for each species and eliminates any doubt about what amphibian or reptile is being discussed. The scientific name consists of two or three words always underlined in written or typed form and italicized in printed form—for example, *Sceloporus undulatus* or *Sceloporus undulatus garmani*. The first word, *Sceloporus*, the generic name, always begins with a capital letter. Several different but closely related kinds of animals may have the same generic name. The second word, *undulatus*, the specific name, never begins with a capital letter. The generic and specific names together denote a specific kind of animal, or "species." Different species normally do not interbreed with one another. Sometimes a third word, the subspecific name, is included in the scientific name. Subspecies are discussed below. With a few exceptions, the common and scientific names used in this book are from Collins et al. (1978). Derivations of scientific names are listed at the end of this book.

Photographs: Each species is illustrated by at least one color photograph. Differences between sexes, ages, or individuals from different areas are illustrated in some cases. All photographs were taken by me unless otherwise credited.

Recognition: Characteristics which together distinguish adults of each species from any other species in Colorado are listed in this section. Major differences between sexes, ages, and individuals from different areas are described if appropriate. Maximum sizes of species are mostly based on Stebbins (1966) and Conant (1975). "Keys" to the identification of species are often included in a book of this nature, but I have omitted them from this book for several reasons. First, most species in Colorado can be identified rapidly using only the color photographs and distribution maps. Second, keys are seldom used. Third, keys are tricky and persons most in need of an identification aid often come to erroneous conclusions when using them. I recommend the following procedure for identifying an unknown amphibian or reptile: (1) consult "Quick Guide to Colorado's Amphibians and Reptiles" to determine if it is a salamander, frog, turtle, lizard, or snake; (2) scan the appropriate photographs until a tentative identification can be made; (3) verify the identification by checking the recognition characteristics listed for the species. The distribution maps should be consulted to determine if the species is likely to occur where it was found.

Distribution: The total range of each species is briefly stated, followed by a description of the distribution in Colorado.

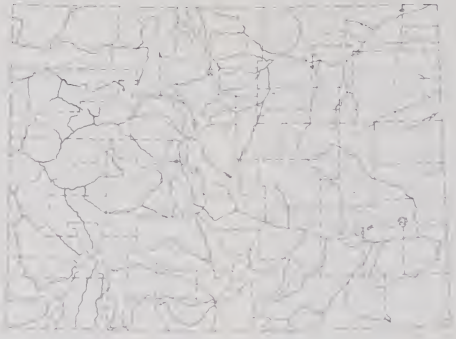
Maps: Detailed maps show the distribution of each species in Colorado. Black spots indicate places where the species is known to occur. I carefully evaluated the authenticity of each "spot record" before accepting it as valid. Doubtful records are not included on the maps. Any occurrences of a species outside the indicated range should be brought to the attention of the Division of Wildlife.

Habitat and Habits, Breeding, Food: These sections describe what is known of the lives of Colorado's amphibians and reptiles. My major references were studies conducted in Colorado. Lacking local sources, I included information from other areas only if thought pertinent to Colorado. This supplementary material was obtained from Stebbins (1951, 1954), Fitch (1970), Ernst and Barbour (1972), and other references cited in the text.

Subspecies in Colorado: Subspecies are geographic races (or subdivisions) of species. Subspecies usually differ from one another in color, scalation, and/or body proportions, but they nevertheless interbreed with other subspecies of their species. Where two subspecies meet and interbreed they are said to "intergrade." Intergrading populations may be intermediate in appearance between the two subspecies or may have some individuals that look like one subspecies, some that look like the other, and some that are intermediate. When the area of intergradation is large, boundaries between subspecies become hard

to define and subspecific names become rather meaningless. Subspecies should not be taken too seriously in any case because they are distinguished only by arbitrary criteria and have no biological significance *per se*. Biological differences between different populations of a species are related to differences in the environments they inhabit and do not necessarily correlate with the subspecific designations of taxonomists. have not emphasized subspecies in this book Usually I simply state the subspecies found i Colorado. If more than one subspecies occur in the state, their distinguishing characteris tics are listed.

Remarks: Any information not covered i one of the other categories is included in thi section.



Quick Guide to Colorado's Amphibians and Reptiles

I. AMPHIBIANS: slimy or warty skin; usually in or near water.

A. Salamanders

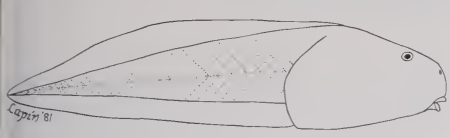
1. Adults: 4 limbs, 4 toes on forefoot; no claws; large tail (compare with lizard).

2. Larvae: 4 limbs; bushy gills; large tail fin.

B. Frogs and toads

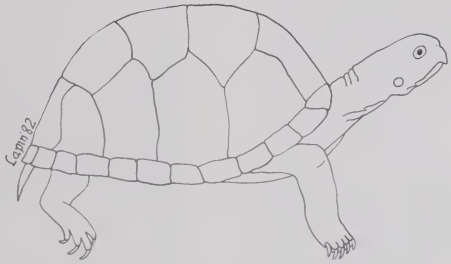
1. Adults: no tail; long hindlimbs.

2. Larvae: no visible gills; large tail fin but no paired fins; no limbs at first, small legs appear later.



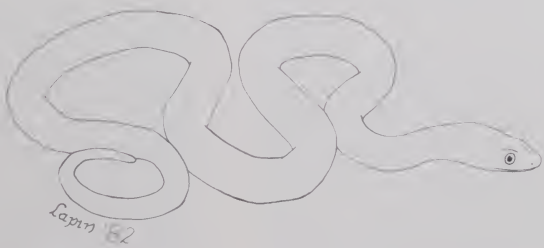
I. **REPTILES:** scaly skin (may be smooth or prickly); hatchlings resemble adults; found in, near, or away from water.

A. Turtles: body enclosed in a hard or soft shell.



B. Lizards: 4 limbs; 5 clawed toes on forefoot; long tail (compare with salamander).

C. Snakes: no limbs, no movable eyelids.



AMPHIBIANS

The amphibians first appeared during the late Devonian period some 400 million years ago. The first amphibians were much larger than those alive today, but all of these ancient species are now extinct; in fact, most of the amphibian species that have ever lived are now extinct.

The amphibians alive today number some 3260 species in three groups—the caecilians (154 species), the salamanders (336 species), and the frogs and toads (about 2770 species). The caecilians (Order Gymnophiona) are worm-like burrowing or aquatic creatures restricted to tropical regions. Only one fossil caecilian, dating from the Paleocene epoch about 55 million years ago, has been found. The salamanders (Order Caudata) are four-legged, long-tailed amphibians which inhabit much of the Northern Hemisphere and the New World tropics. The earliest fossil salamander comes from late Jurassic deposits over 120 million years old. About 100 species of salamanders occur in the United States, but only one is known to occur in Colorado. The frogs and toads (Order Anura) are tailless amphibians (as adults) with greatly elongated hind legs. There is no technical distinction between frogs and toads; warty anurans usually are called toads, smooth-skinned anurans are called frogs. Fossil frogs are known from early Triassic deposits perhaps 180 million years old. Anurans have an essentially world-wide distribution, being absent only from the extreme northern part of the globe, Antarctica, and some isolated islands. They are most diverse in the tropics. About 80 species occur in the United States; 17 of these inhabit Colorado.

Amphibians are distinguished by a skin that is moist, glandular, and naked. Unlike that of fishes, reptiles, birds, and mammals, amphibian skin has no covering of scales, feathers, or hair. Numerous glands of two major kinds, mucous and poison, are contained in the skin. Secretions of the mucous glands keep the skin moist and sometimes make it quite slippery, facilitating escape from predators. In some species the mucus is toxic and functions as a dual anti-predator device. Poison glands also serve a protective function. They produce an alkaloid substance that is distasteful or toxic if ingested. These glands often are aggregated in the skin, forming warts or glandular ridges. The large lumps (parotoid glands) behind the eyes of a toad (*Bufo* spp.) are aggregations of poison glands. A bite on the neck of a toad causes the white, sticky poison to squirt into the mouth of the would-be predator. Handling toads does not cause warts in humans.

Many amphibians can readily change the color of their skin. Color change is caused by change in the distribution of pigment within special cells called melanophores or by concealment or exposure of other kinds of color cells. A change in color occurs when a stimulus, such as a change in body temperature, causes the pituitary gland in the brain to release a hormone called MSH (melanophore stimulating hormone). The hormone circulates in the blood and, upon reaching the skin, causes a dispersal of pigment in the melanophores, producing a dark color. Another hormone, melatonin, causes pigment concentration, resulting in a light color.

Since amphibian skin is moist and relatively well supplied with blood, it can be used as a respiratory surface. Probably all amphibians obtain at least some of their oxygen through the skin. The lungs, the lining of the mouth, and the gills of larval stages also are respiratory tissues. Some salamanders (family Plethodontidae) rely solely on the skin and mouth lining for oxygen exchange; they have no lungs.

Amphibians shed the outer layer of the skin every 1-3 days. In many frogs, the skin comes off in irregular pieces. In other species, such as the toads, it is shed in one piece. Many amphibians eat the shed skin.

The activities of amphibians are greatly influenced by weather, a phenomenon that is easily explained by two basic aspects of amphibian physiology and anatomy. First, they are ectothermic (derive their body heat from the external environment) but are not especially tolerant of very hot or cold conditions. They are unable to compensate for cold wea

:r by producing their own body heat. Sec-
d, the thick layer of dead, keratinized cells
it acts as a water-repellent outer covering in
ıer land-dwelling vertebrates is very thin in
ıphibians. Consequently, amphibians con-
ntly lose water from the portion of the skin
ıt is exposed to air. The rate of water loss is
ughly inversely proportional to the humid-
, and amphibians dehydrate rapidly when
posed to dry conditions.

Amphibians in Colorado avoid the long
ld winters and dry midday heat of summer
taking refuge in buffered microenviron-
ents such as underground burrows and
›dies of water. The period of inactivity may
st only several hours each day in the sum-
er, but during winter the animals may be
›nfined to their hibernacula for five succes-
ve months or more. For some Colorado am-
ıibians, especially the spadefoot toads
caphiopus), summer rainfall is the primary
imulus for activity. Even when temperature
›nditions are favorable these toads may pass
:veral weeks of dry summer weather in un-
erground burrows before a thunderstorm
rings the soaking rains that stimulate their
:tivity.

Amphibians regain the water lost during
ıeir terrestrial excursions by absorbing it
ırough the skin while sitting in a pool of
ater or on damp soil. Water also is obtained
om food. Amphibians do not drink in the
sual sense. When in water, amphibians
xperience a problem opposite to that they
xperience on land. Water constantly is ab-
orbed through the skin and must be elimi-
ıated by producing large volumes of dilute
ırine.

The melting ice and warming days of early
pring hail the onset of the amphibian breed-
ng season in Colorado. Beginning with the
ıorthern leopard frog and chorus frog in
March, breeding of various species may ex-
end through August. Generally, the breed-
ng season of each species is restricted to a
ather short portion of the spring and summer
ıonths.

Breeding begins with the formation of ag-
gregations of individuals in ponds, lakes, or
›ther bodies of water. The males usually ar-
rive first at the breeding site and, in many
frogs and toads, mark their arrival with loud
vocalizations. The calls are amplified by in-
flatable vocal sacs which lie under the skin of
the throat or neck. The sacs are inflated with
air from the lungs which passes into the sacs
through two tiny holes in the floor of the
mouth. Calls are made with the mouth closed.
Each species gives a distinctive call which at-
tracts females of the same species and, in
some species, repels other males. Often sev-
eral species may call simultaneously from one
pond and the resulting chorus can be deafen-
ing. The ears of the females are tuned to the

Male red-spotted toad chorusing at the edge of a breeding pool in Baca County.

calls of their own species and they probably
do not hear the other calls very well. Salaman-
ders do not produce breeding calls. They lack
external ear openings and cannot hear air-
borne sounds very well, if at all. Their breed-
ing activities go on in silence.

In frogs and toads, mating begins when a
female that is ready to breed approaches a
male. Immediately the male pounces on her
and clasps his front legs around her waist
(spadefoots) or chest (other Coloradan frogs
and toads). The pair is then said to be in
amplexus, which may last several hours.
Sometimes a male clasps another male who
comes too close. He realizes his mistake by
the relatively slender (not egg-laden) body
and distinctive protest calls of the clasped
male, which is soon released. During the
breeding season male frogs and toads usually
develop rough pads on their forefeet which
help them grip the slippery female. The male
often has a dark throat and is smaller than the
female.

As the female deposits the eggs (up to
20,000 or more in some toads) in the water,
the male sheds sperm over them. Then the
male and female go their separate ways. The
fertilized eggs are left to develop on their
own. None of the amphibians in Colorado are
known to care for their eggs or offspring.

Fertilization of the eggs occurs differently

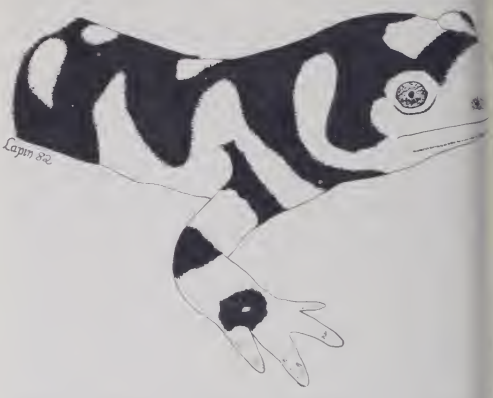
in Colorado's lone salamander species. Following a period of courtship activity that consists of nuzzling and butting, the male deposits a spermatophore, a cone of jelly with a small packet of sperm at its tip. The spermatophore is attached to some object in the water. The female picks up the sperm with the lips of the cloacal opening. Fertilization occurs within the female's body before the eggs are laid. The female, unaccompanied by the male, attaches the eggs to vegetation or other objects in the water.

The fertilized eggs of amphibians at first develop in a small chamber within a string, sphere, or mass of jelly. The shell that envelops the eggs of reptiles and birds is absent. After a few days or weeks, a tiny amphibian emerges from its capsule and assumes a free-living existence in the water. At this point the amphibian is called a larva (plural, larvae). Salamander larvae can be distinguished easily from the larvae of frogs and toads. Salamander larvae have three pairs of bushy gills attached to the sides of the neck and possess four legs soon after hatching. The larvae of frogs and toads, popularly called tadpoles or pollywogs, also have gills, but soon after hatching they become enclosed in a chamber and cannot be seen. Tadpoles do not possess legs until late in the larval stage.

The larva lives in the water for a period which may last weeks, months, or even a year or more, then undergoes a remarkable change called metamorphosis. During metamorphosis of the tiger salamander, the gills are resorbed, eyelids develop, and the tail fin becomes smaller. Eventually the animal leaves the water and assumes a primarily terrestrial existence. Anuran metamorphosis is even more drastic. The tail and gills are completely resorbed, legs appear and grow rapidly, and the small, beak-like mouth of the larva is replaced by a typical gaping frog mouth. Some anurans then leave the water and live mostly on land. Other species remain at the water's edge.

Metamorphosed amphibians are carnivorous and tend to eat a wide variety of small animals. Vegetation is ingested only by accident. Movement of the prey often is an important stimulus for the feeding response of amphibians, many of which depend on sight for the detection and capture of food. However, at least some amphibians can detect food by smell alone.

The mouth parts of metamorphosed amphibians are adapted for grasping prey but not for chewing. The food is swallowed whole. The tiger salamander has small teeth along the upper and lower jaws and across the roof of the mouth. The tongue is broad and fleshy but does not play an important role in obtaining food. Food items held in the jaws of



the salamander are maneuvered down the throat by jerky motions of the head, by pushing the projecting end of the prey against some object, and by actions of the tongue.

The tongue of metamorphosed anurans, especially toads in the genus *Bufo*, often is highly adapted for capturing prey. It is attached in the front of the mouth but the free, rear portion can be flipped rapidly forward. The tip of the tongue is coated with a sticky substance derived from the intermaxillary gland in the roof of the mouth. A quick flip of the sticky-tipped tongue secures the prey. Some species use the forelimbs to help push food into the throat. When swallowing, anurans often depress their eyeballs into the sockets. This causes the eyeballs to bulge into the mouth cavity and helps push the food down the throat.

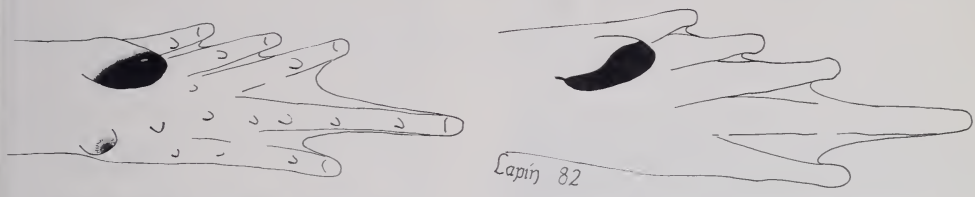
Teeth are present in the upper jaw of many anurans, but true toads (*Bufo*) have no teeth.

The feeding apparatus of larval anurans differs greatly from that of the adult. Tadpoles have horny, beak-like mouthparts which generally are used for scraping minute food items off the surface of rocks, vegetation, or other objects in the water. Sometimes large dead animals are fed upon. The larvae of spadefoots (*Scaphiopus*) occasionally are cannibalistic.

Aquatic larvae of the tiger salamander snap at their food and hold it with the teeth in their upper and lower jaws until it can be swallowed. The larvae are carnivorous and are not averse to biting a baited fishing line.

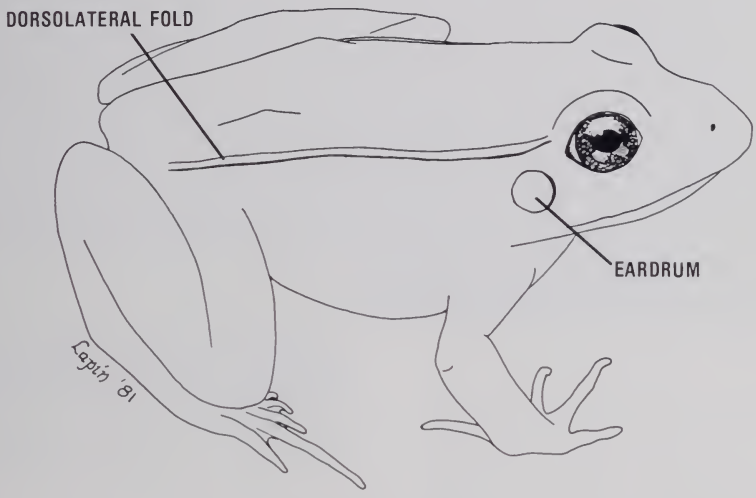
AMPHIBIAN TERMINOLOGY

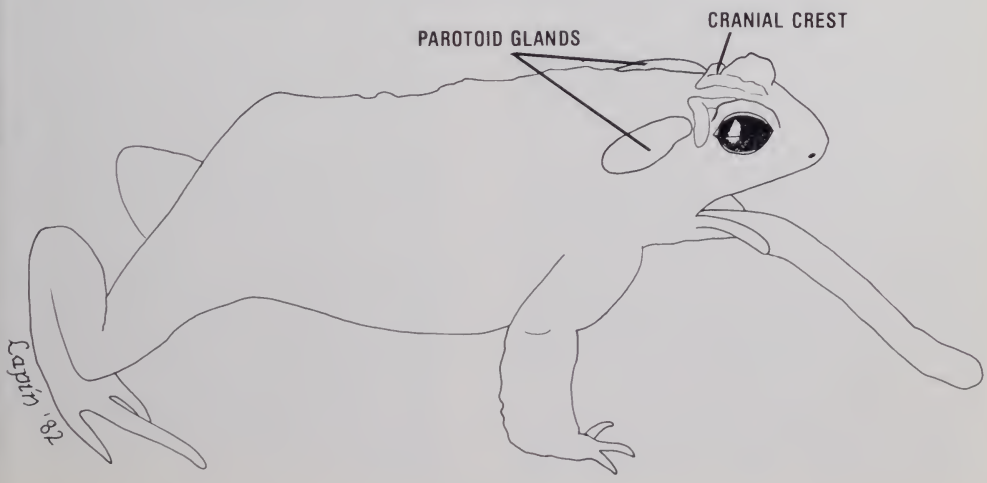
UNDERSIDE OF HIND FOOT



"SPADE" WITH ADDITIONAL TUBERCULE (WOODHOUSE'S TOAD)

SINGLE "SPADE" (COUCH'S SPADEFOOT)





Salamanders

Mole Salamanders—Family Ambystomatidae

Mole salamanders are a North American group, comprising some 33 species. Many of these broad-headed, stout-bodied salamanders occur in the eastern U.S. The largest species is the tiger salamander, sole representative of this family in Colorado.

Tiger Salamander

Ambystoma tigrinum

Adult and larval (insert) tiger salamanders from eastern Colorado.

Recognition: (1) slimy skin; (2) long tail; (3) four toes on each forefoot; (4) maximum total length about 12½ inches (346 mm). Tiger salamanders from eastern Colorado have yellowish bars or spots on a dark background. Salamanders from western and central Colorado typically have dark spots or mottling on a lighter background or are uniformly dark. Mature males have swollen flaps (cloacal glands) between the hind legs. Aquatic larvae have three conspicuous pairs of gills on the neck.

Distribution: Ranges throughout much of North America. Occurs throughout Colorado at elevations up to 12,000 ft. (3658 m) in the southwest.

Habitat and Habits: Reese (1969) studied the tiger salamander in Colorado and most of the information in this account, unless otherwise credited, is based on his work.

Tiger salamanders occur in virtually any habitat, provided there is a body of non-flowing water nearby for breeding. However, they do not regularly occupy alpine tundra. Occasionally they are found in caves. These salamanders inhabit ponds, lakes, and reservoirs ranging in size from 10 ft. (3 m) across to several acres. They are equally at home in clear waters of lakes, glacial kettle ponds, and beaver ponds in the mountains, and in turbid ponds badly polluted with cow manure in the plains (Smith et al. 1965). Sunny, mud bottomed ponds at least 18-24 inches (46-61 cm) deep with a shallow beach-like shore seem to be preferred. Vegetation may or may not be present in the water. Tiger salamanders usually are absent from waters inhabited by predatory fishes, bullfrogs, turtles, and crayfish.

Metamorphosed salamanders usually spend e winter underground in rodent burrows. eastern Colorado, winter retreats often are n gentle north slopes south of the breeding nds. Vaughan (1961) reported numerous stances of tiger salamanders using burrows ill occupied by pocket gophers. Salaman-ers sometimes dig their own burrows in ose soil but do not over-winter in them.

Terrestrial activity occurs primarily at ight, but salamanders may be abroad during aylight hours in wet weather. Aquatic larvae ppear to be mainly diurnal, moving about in allow, sunny areas. When startled they uickly swim for deep water or into thick egetation.

Breeding: In spring, tiger salamanders ave the winter retreats and migrate to the reeding ponds. Migrations in the plains egion often occur after rains once daytime emperatures have warmed to 50°F (10°C). Migrations may be interrupted by dry, windy eather. In the mountains salamanders move o the ponds anytime from April to July, de-ending on when the winter ice melts. Males enerally arrive in the ponds before the emales.

After being fertilized eggs are laid singly or n rows or small clusters on vegetation or lebris 2-10 inches (5-25 cm) below the sur-ace of the water. In the plains, eggs may be

Distribution of the Tiger Salamander in Colorado

laid from mid-March to mid-August. In the mountains, eggs are laid from April (Hamilton 1949) through early August, generally later at higher elevations. Egg-laying occurs from mid-April to mid-June in western Colorado. In a given pond, the period of egg-laying is more restricted than the range of dates listed above. Norris (1973) found that females from a pond in Boulder County contained an average of 414 eggs.

Metamorphosed salamanders in the mountains usually leave the ponds after breeding and return to land. Plains salamanders commonly spend most of the summer in the water.

Eggs hatch 2-5 weeks after being laid, taking longer at higher elevations (Sexton and

Adult tiger salamander from western Colorado. Photo by D. Langlois.

Bizer 1978). Hatchlings are about one-half inch (11-14 mm) long.

The length of the aquatic larval period varies greatly. Sexually immature larvae may metamorphose before their first winter, 2-5 months after hatching. This occurs commonly at low elevations and in warmer mountain ponds. Mass migrations of the newly metamorphosed salamanders from plains breeding ponds commonly occur on rainy nights in August but may extend through November if conditions are favorable. Salamanders sometimes leave the ponds before metamorphosis is complete, especially when drying of the ponds stimulates the animals to begin metamorphosis earlier than usual. These salamanders often have short gill stubs and open branchial slits on the neck. Metamorphosis generally occurs when the salamanders are about 5 inches (131 mm) long.

Tiger salamanders sometimes do not metamorphose until they are one or two years old. This occurs in cool mountain ponds, in plains ponds where salamanders have laid eggs late in summer, and in ponds adjacent to those in which salamanders metamorphose before their first winter (DeBoer 1973; Rodda 1975). Larvae over-winter in the ponds below the ice. They metamorphose and leave the ponds from late July to early September in the mountains.

Aquatic larvae sometimes become sexually mature before metamorphosis and begin breeding when 1-2 years old, never having left the water. This phenomenon, called paedomorphosis or neoteny, seemingly occurs rather haphazardly. Paedomorphic larvae may occur at both high and low elevations and in the same ponds as, or in ponds adjacent to, those containing non-paedomorphic larvae. Paedomorphosis has been attributed to low pond temperature (Bizer 1978) and to the nature of the bottom of the pond (DeBoer 1973), but much work remains to be done before we will be able to fully explain this intriguing phenomenon.

Food: When they are in water metamorphosed salamanders eat snails, bugs, beetles, larval mayflies, dragonflies, caddis flies, and midges. The stomachs of terrestrial adults usually are empty. Dodson and Dodson (1971) found that small aquatic larvae in Gunnison County prefer phantom midge pupae and large zooplankton such as water fleas (*Daphnia*), copepods, and larval midges (Chironomidae). Large larvae eat just about any animal they can catch and swallow, including snails, large zooplankton, fairy shrimp, amphipods, aquatic insect larvae, leeches, tadpoles of the leopard frog and western toad, amphibian eggs, and smaller salamander larvae.

Cannibalism occurs frequently among the larvae, especially where hatchlings coexist with older larvae. Occasionally, cannibalistic larvae undergo pronounced morphological changes. The body increases in bulk and length, and the head may double in width to 2½ inches (64 mm). These hideous-looking cannibals may be either male or female, but females may have enlarged cloacal glands and resemble males externally. Broad-headed cannibals usually are found in paedomorphic populations which provide a continual supply of food. If the food supply should run out, they metamorphose and eventually become rather ordinary-looking salamanders.

Subspecies in Colorado: According to Reese (1973), three subspecies occur in Colorado. *Ambystoma t. mavortium* occupies the plains of eastern Colorado; *A. t. melanostictum* inhabits North and Middle parks and northwestern Colorado; and *A. t. nebulosi* occurs throughout the remainder of cent and western Colorado. The subspecies *m ortium* and *nebulosum* intergrade widely alo the eastern edge of the mountains, in the S Luis Valley, and in South Park. Reese (19 distinguished adults of the three subspecies follows.

mavortium: yellow blotches or bars on a bla background.

melanostictum: black spots or irregu blotches on a dark gray to dark cream (usua dark olive) background.

nebulosum: uniformly dark gray or da brown, or with a reticulation of black spots an intermingling of different shades of bro on a dark background, or with evenly disp sed round black spots on a plain gold or oli background.

Subspecies occasionally are found outsi their normal range after being transport around the state as fish bait. Smith and Ree (1970) reported that tiger salamanders some parts of northeastern Colorado ha unusual color patterns consisting of dar light-centered spots on a light background small light spots on a dark background.

Remarks: Known predators on the tig salamander in Colorado include the weste terrestrial garter snake, plains garter snak bullfrog, aquatic turtles, fishes such as tro and bass, ring-billed gull, green heron, duck crayfish, giant water bug, raccoon, a coyote.

The jelly of salamander eggs from cle mountain pools sometimes contains symbi tic green algae which may help supply t developing embryo with oxygen.

The largest known tiger salamander fro Colorado is a cannibal measuring 13.6 inch (346 mm) in total length. The largest in bu is another cannibal reported by Snow (197 as weighing nearly one pound (434 g).

Tiger salamander larvae sometimes are i correctly called "water dogs" or "mud pu pies"—names that are properly applied certain amphibians of the eastern U.S. that not occur in Colorado.

Frogs and Toads

Archaic Toads—Family Pelobatidae

his family includes 49 species distributed throughout the Northern Hemisphere and In- esia. Most species inhabit southeastern Asia and Indonesia and bear little resemblance to e occurring in Colorado. All members of the family are terrestrial. Four of the six North erican species inhabit Colorado.

lains Spadefoot

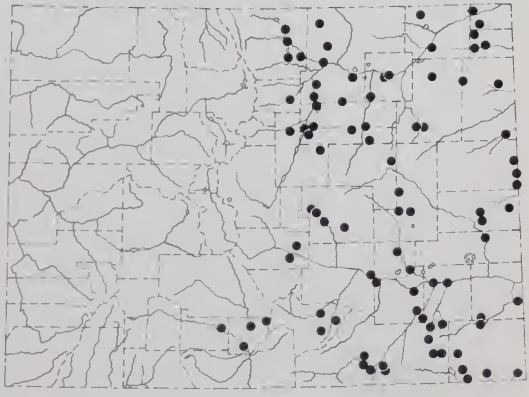
Scaphiopus bombifrons

Recognition: (1) pupil vertical in bright ht; (2) a single hard, black, wedge-shaped pade" on each hind foot; (3) hard lump be- een eyes; (4) maximum snout-vent length inches (57 mm).

Distribution: Ranges throughout most of e Great Plains from southern Canada to rthern Mexico. Occurs throughout the ains of eastern Colorado generally below 00 ft. (1828 m) but up to 6250 ft. (1908 m) in emont County (Banta and Kimmel 1965). so occurs disjunctly in the San Luis Valley elevations of about 7500-8000 ft. (2286- 38 m).

Habitat and Habits: This is a character- ic toad of the grasslands and sandhills of stern Colorado. It inhabits semidesert rublands in the San Luis Valley. Unlike any amphibians, the plains spadefoot toad oes not require permanent water. In fact, it avoids permanent bodies of water unless they fluctuate greatly in size. These toads enter water only to breed.

Spadefoot toads spend most of their time



Distribution of the Plains Spadefoot in Colorado

underground in rodent burrows or in burrows dug with shuffling movements of the hind legs. The hard "spades" on the hind feet aid in digging burrows into which the toads sink rear end first. Rodents do not always welcome toads into their burrows; in Baca County, Smith et al. (1965) observed a spotted ground squirrel (*Spermophilus spilosoma*) attacking a spadefoot, apparently evicting the toad from a burrow. Vaughn (1961) found a spadefoot in the soil plug of a pocket gopher burrow in Weld County. Smith et al. (1965) occasionally found spadefoot toads in daytime under tin and boards. This species generally is active from May to September in Colorado.

Breeding: Reproduction of the plains spadefoot has been studied in El Paso County by Gilmore (1924) and Goldsmith (1926) and in Yuma County by Woody and Thomas (1966, 1968). My information is based largely on these studies.

The plains spadefoot breeds in flooded areas and temporary pools formed by heavy rains. Rains of 0.7 inches (18 mm) or more and temperatures of at least 50°F (10°C) are necessary to initiate breeding, which in Colorado may occur anytime from May to August. Breeding pools may be muddy or clear and vary in depth from a few inches to a few feet.

Once spadefoot toads emerge, breeding proceeds rapidly. Males give their snore-like call from the edges of the pools or while floating in the water. Large choruses can be heard for well over half a mile (0.8 km). Mating and egg laying may be completed in a particular pool in only 2-3 days. Calling, mating, and egg-laying may occur both day and night. Elliptical masses of 10-250 eggs are attached to submerged vegetation or other objects in the water. Each female may lay several egg masses. Adults usually leave the water immediately after the eggs are laid bu may linger for several days if rains continu Adults may move 200-500 ft. (60-150 m) du ing each of one or two nights as they leave th breeding pools.

Eggs hatch in 2-3 days. Larvae develo rapidly and commonly complete metamo phosis in 36-40 days. In some ponds met morphosis may not begin until 75 days c more after hatching. Rapid development advantageous because of the danger of ponc drying up before metamorphosis is complet

Tadpoles sometimes depart from their usu herbivorous diet and become carnivorou eating not only small invertebrates but othe spadefoot tadpoles as well. The carnivorou tadpoles have large beaked jaws powered b greatly enlarged muscles. They develop mor rapidly than the herbivorous tadpoles, an ac vantage in the ephemeral breeding pool Both herbivorous and carnivorous tadpole may be in the same pond.

Rains occurring after those initiating th first breeding event of a given year may resul in another emergence of breeding toads, pre sumably those not breeding during previou rains. Thus several breeding events may oc cur at a given pool each year.

Food: Whitaker et al. (1977) found that th major foods of plains spadefoot toads i Yuma County were adult moths, caterpillars carabid beetles, and various other smal arthropods.

Remarks: Stabler (1948) found a plain spadefoot in the stomach of a prairie rattle snake near Colorado Springs. Sexton an Marion (1974) watched several Swainson' hawks catching spadefoots as the toads swar in ponds in Lincoln County. I found a west ern terrestrial garter snake in Las Anima County that had eaten three plains spadefoo tadpoles.

Couch's Spadefoot

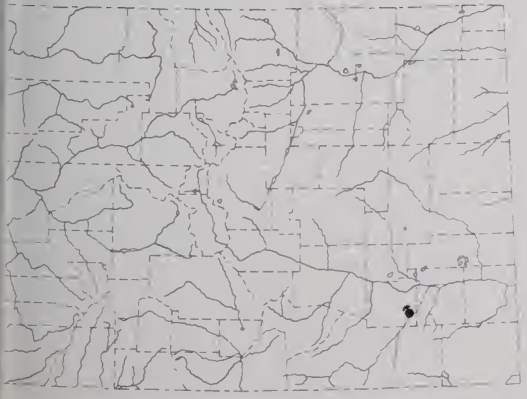
Scaphiopus couchii

Female (top) and male (above) Couch's spadefoot toads. Male is chorusing in a breeding pool.

Recognition: (1) pupil vertical in bright light; (2) a single hard, black, sickle-shaped "spade" on each hind foot; (3) snout-vent length may exceed 2½ inches (64 mm). Males are greenish-yellow with scattered dark spots or blotches. Females have more extensive dark mottling.

Distribution: Ranges from southwestern U.S. through much of northern Mexico. Known to occur in Colorado only in southeastern Otero County at elevations below 4500 ft. (1372 m).

Habitat and Habits: Couch's spadefoot inhabits plains grasslands in Colorado. This toad spends most of its life buried in the soil, emerging at night only after spring and summer rains. Dimmitt and Ruibal (1980*b*) found that the primary cue for emergence is the sound or vibration caused by falling rain; soil moisture and temperature seem to be of secondary importance. Most activity probably occurs from May to September.



Distribution of the Couch's Spadefoot in Colorado

Like other spadefoot toads, these toads are well-adapted to arid conditions. When buried in the soil for long periods they develop a body cover of dead, dry skin which reduces water loss. If necessary, they can tolerate dehydration up to about 50 percent of their standard body weight.

Breeding: Couch's spadefoot breeds only after heavy rains fill depressions and small reservoirs with water. Breeding aggregations have been observed in Colorado in May (Livo 1981) and June (personal observation). Toads

emerge from the ground and move quickly to the pools. Males that I observed in Otero County began giving their croaking "yeow" call vigorously about an hour after a heavy evening rain began. Calling continued all night long, finally subsiding at about 10:00 a.m. the next morning.

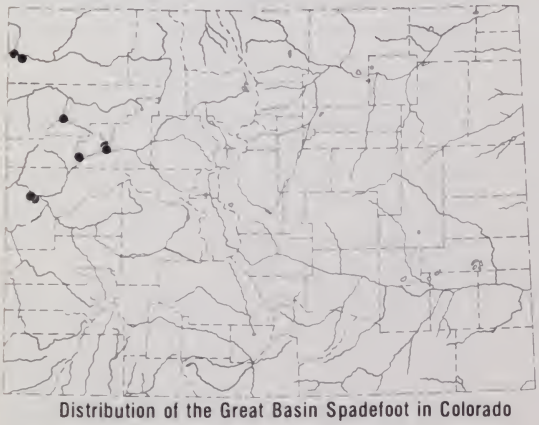
Breeding of this spadefoot has not been studied in detail in Colorado. Elsewhere, females lay clusters of 6-145 eggs on vegetation in water usually less than 6 inches (15 cm) deep. Each female may lay a total of 350-500 eggs which hatch after 1-2 days. The larval stage is passed rapidly; individuals m metamorphose and leave the pool as few as days after hatching! Thus, this species is ab to breed successfully in small pools that d up quickly.

Food: Foods eaten in Colorado are n known, but elsewhere this toad eats termit ground and scarab beetles, ants, grassho pers, crickets, caterpillars, spiders, seed bu and other small arthropods (Whitaker et 1977). Dimmitt and Ruibal (1980*a*) det mined that this toad is capable of eati enough food in one meal to last it a year.

Great Basin Spadefoot

Scaphiopus intermontanus

Photo by L. Livo and S. Wilcox



Distribution of the Great Basin Spadefoot in Colorado

Recognition: (1) pupil vertical in brig light; (2) a single hard, black, wedge-shap "spade" on each hind foot; (3) pliable lur between eyes; (4) maximum snout-ve length less than 2½ inches (64 mm).

Distribution: Ranges throughout t Great Basin in western North America, fr northern Arizona to southern British Colu bia. Occurs north of the Uncompahgre P teau in western Colorado at elevations bel 7000 ft. (2133 m). Records from sou western Colorado (Secoy and Brown 19 are based on *S. multiplicatus* (Hammerson, press).

Habitat and Habits: The Great Basin defoot inhabits piñon-juniper woodland, ebrush, and semidesert shrublands in lorado. It usually is found in or near dry ky slopes or canyons but Cary (1911) nd this spadefoot among beds of prickly r cactus on a sandy knoll in Garfield unty.

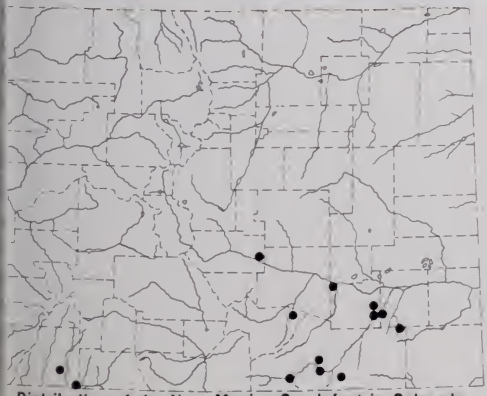
Like other spadefoot toads, this species is inly nocturnal and emerges from its under- und retreat only after heavy spring or nmer rains. Great Basin spadefoots have n found in Colorado from June through tember.

Breeding: The Great Basin spadefoot breeds in springs and temporary pools resulting from heavy rains, but little is known of the reproduction of this toad in Colorado. Presumably, it resembles other spadefoot toads in progressing rapidly from egg to metamorphosis. Spadefoot toads in various stages of metamorphosis have been observed in Moffat County on June 25. Stebbins (1966) describes the call of this toad as a hoarse, rapid "wa-wa-wa."

Food: No information is available from Colorado. Tanner (1931) found that the stomachs of a few individuals from Utah contained ants, beetles, a grasshopper, a wasp, and a cricket.

New Mexico Spadefoot

Scaphiopus multiplicatus



Distribution of the New Mexico Spadefoot in Colorado

Recognition: (1) pupil vertical in bright light; (2) a single hard, black, wedge-shaped "spade" on each hind foot; (3) no lump between eyes; (4) maximum snout-vent length about 2½ inches (64 mm).

Distribution: Ranges from southwestern U.S. through central Mexico. Occurs chiefly south of the Arkansas River in southeastern Colorado at elevations generally below 6000 ft. (1828 m). Occurs south of the Uncompahgre Plateau at elevations below 6500 ft. (1981 m) in southwestern Colorado.

Habitat and Habits: The New Mexico spadefoot inhabits plains grassland in south-

eastern Colorado. It occurs in sagebrush and semidesert shrublands in basins and flood plains of streams in western Colorado. Typical of the spadefoot toads, it enters water only to breed and spends much of its time buried in the soil. Burnett (1926) found one of these toads in the entrance of a prairie dog burrow in Montezuma County. Emergence from the soil is stimulated by heavy rainfall. Most activity occurs at night. This toad has been found in Colorado from May through September.

Breeding: Temporary ponds and muddy rainpools are used for breeding, which in Colorado occurs primarily after heavy rains in June and July. Females are attracted to the stuttering croak of the male, given as he floats in the water. Breeding activities may occur both day and night immediately after heavy rains. No details are available from Colorado but elsewhere this spadefoot attaches clusters of 10-42 eggs to vegetation or rocks in the water. Each female may lay 300-500 eg Adults leave the water soon after breedir Eggs hatch in about 2 days. Metamorpho may occur about a month after the eggs a laid. Metamorphosing New Mexico spac foot toads have been found in Colorado mid-August. The New Mexico spadefo may breed simultaneously in the same pon with the plains spadefoot and Couch's spac foot in southeastern Colorado.

Food: Food habits in Colorado a unknown, but this toad undoubtedly eats wide variety of small arthropods.

Remarks: This toad formerly was knov as *Scaphiopus hammondii.* That name is nc restricted to populations in California a Baja California (Brown 1976).

The New Mexico spadefoot produces skin secretion that smells like roast peanuts. Handling this toad sometim results in watery eyes, runny nose, and snee ing in humans.

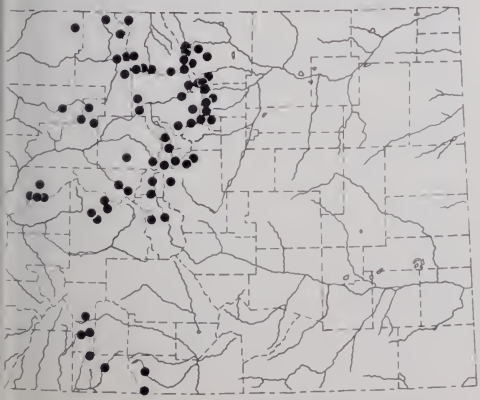
True Toads—Family Bufonidae

e toad family includes some 280 species occurring nearly worldwide, excluding Australia marine toad, *Bufo marinus*, has been introduced there). True toads generally are robust, ter- al creatures with thick glandular skin. Compared to most frogs, toads have short legs and ed jumping ability. The largest member of the family is the marine toad, which sometimes s a snout-vent length of 9½ inches (238 mm). Five of the 18 species of true toads in the U.S. r in Colorado.

Western Toad

Bufo boreas

Recognition: (1) warty skin; (2) oval otoid glands; (3) no cranial crests; (4) light pe along middle of back; (5) dark spots on st; (6) tubercles on hind foot without a l-developed cutting edge; (7) snout-vent length usually less than 3½ inches (89 mm).



Distribution of the Western Toad in Colorado

Distribution: Ranges throughout much of western North America except arid Southwest. Occurs throughout most of the mountainous portion of Colorado but apparently is absent from the Sangre de Cristo Range, Wet Mountains, and Pikes Peak region. These toads are most common between 8500-11,000 ft. (2615-3385 m) but Campbell (1976) found them as high as 11,860 ft. (3615 m). Rarely they have been found as low as about 7000 ft. (2134 m).

Habitat and Habits: The western toad inhabits marshes, wet meadows, and the margins of streams, beaver ponds, lakes, and glacial kettle ponds in subalpine areas of Colorado. It is commonly found in shallow water or among sedges and shrubby willows where the soil is damp or wet. Campbell (1976) reported that females tend to move to drier areas after the breeding season. Ellis and

Henderson (1915) found large numbers of these toads under street lights and along irrigation ditches at Buena Vista, Chaffee Co. They also observed western toads in the warm waters of Hortense Hot Springs, Chaffee Co., but the hot springs acted as death traps for some toads.

Western toads may be active both day and night in Colorado. Nocturnal activity occurs primarily on warm summer evenings. They hide beneath rocks or logs or in rodent burrows when inactive. Campbell (1970) reported that toads spent the winter in a natural, rock-bounded chamber that opened next to a creek in a small opening in subalpine forest in Boulder County. Toads emerged from the snow-covered chamber during May and began to move back to the hibernaculum during late August and early September. By October, most toads had entered hibernation.

Campbell (1976) reported that western toads maintain home ranges that vary greatly in size. He found that toads sometimes stayed in the same spot for several days but occasionally moved more than 165 ft. (50 m) from one day to the next.

Breeding: Burger and Bragg (1047) observed that western toads in the Elk Mountains, Gunnison Co., may breed in any body of water lacking a strong current and with gradually descending banks at some point along the margin. They found tadpoles both in large lakes and in small puddles. Beaver ponds and glacial kettle ponds are typical breeding habitat. These toads have rather soft voices. Breeding males emit a soft chirping call to attract females.

Campbell (1972) provided the following information on the reproduction of the western toad in Boulder County. Breeding begins late in spring as the winter snowpack begins to melt. Strings of eggs usually are deposited in shallow pools or along lake margins in May or early June. Tadpoles metamorp during their first summer at elevations b 9000 ft. (2743 m). At higher elevations, r morphosis does not occur until the se summer; tadpoles overwinter beneath th

Burger and Bragg (1974) and Blair (1 found that metamorphosis occurs in late and early August in the Elk Mountains. I white and Wassersug (1974) reported more than 50 newly metamorphosed t formed an aggregation several indivic deep on the mud bank on a pond in the Mountains in mid-August. Hahn (1 observed metamorphosing toads in August in the San Juan Mountains. E strom (1962) observed aggregations of poles in the warm shallow portions of po Rabbit Ears Pass in early August. Toad not breed successfully every year at eleva above 11,000 ft. (3385 m) (Campbell 19

Food: Campbell (1970) found that wes toads in Boulder County feed both day night on a wide variety of invertebrates cluding ants, planorbid snails, car beetles, lycosid spiders, and culicid quitos.

Subspecies in Colorado: Burger Bragg (1947) and Hubbard (1972) descr several morphological, biochemical, vocal differences between *Bufo boreas* po tions in the Southern Rocky Mountains those in the Pacific Northwest. Howe toads from both regions currently are assi to the subspecies *Bufo b. boreas*.

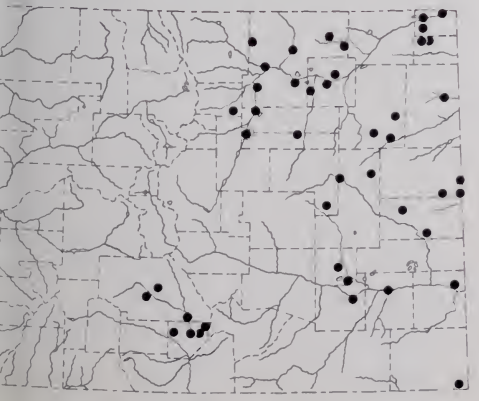
Remarks: As is true of most amphibi larval and juvenile western toads experi rather severe mortality, but toads that r adult size tend to live long lives. Camp (1976) reported that western toads in C rado may live 9 years or more. Gray sometimes eat the larvae of this species.

reat Plains Toad
Bufo cognatus

ecognition: (1) skin with numerous ıll warts; (2) prominent cranial crests; (3) l parotoid glands; (4) large, somewhat ımetrical pattern of light-edged dark spots back; (5) maximum snout-vent length 4½ nes (114 m).

Distribution: Ranges throughout the eat Plains, southwestern U.S., and much the northern half of Mexico. Occurs oughout most of eastern Colorado generally ow 6000 ft. (1828 m) and in the San Luis lley at 7500-8000 ft. (2286-2438 m).

Habitat and Habits: The Great Plains d inhabits plains grassland, sandhills, and icultural areas in eastern Colorado, ecially along the flood plains of streams where soils are relatively soft. It inhabits semidesert shrublands in the San Luis Valley. Most activity occurs at night after heavy rains from May to September. At other times this toad is usually underground in self-dug burrows.



Distribution of the Great Plains Toad in Colorado

Breeding: Areas temporarily flooded by heavy rains and reservoirs that fluctuate greatly in size are the primary breeding habitat in Colorado. The breeding season corresponds with the occurrence of warm rains, rather than with a particular date. In Colorado, I have heard these toads calling when air temperature was as low as 55°F (13°C) but usually at temperatures of 60°F (16°C) or more. The male's breeding call, which may be heard anytime from May to July, is an ear-splitting trill which sounds almost like a jackhammer. Other amphibians known to breed in pools with the Great Plains toad include the plains spadefoot, plains leopard frog, Woodhouse's toad, and chorus frog.

Breeding of this toad has not been studied in detail in Colorado. Elsewhere, eggs are laid in tubes of jelly which look something like a string of beads, the jelly being slightly constricted between the eggs. Each female may lay up to 20,000 eggs which hatch in 2-3 days. Tadpoles usually start to metamorphose about 1½ months after hatching. However, Hahn (1968) reported that he found metamorphosed toads in a pool in the San Luis

Valley only 17 days after the eggs were laid. Estimates of the age at which these toads begin to breed range from 2-5 years.

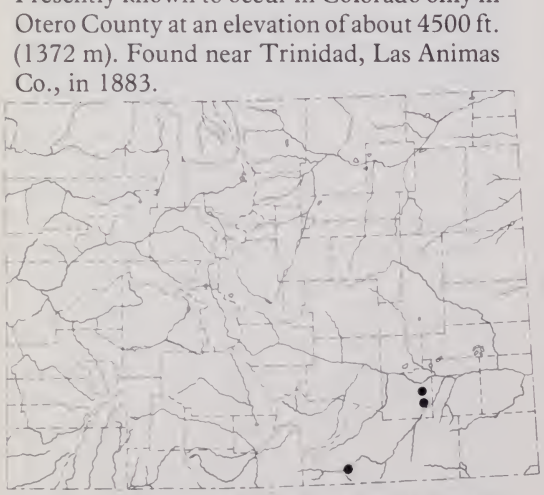
Food: No details are available from Colorado, but elsewhere the Great Plains toad eats moths, caterpillars, cutworms, flies, beetles, and other small arthropods. This toad is an effective enemy of many agricultural pests.

Remarks: Breeding individuals in th Luis Valley are much smaller than th eastern Colorado. Average snout-vent l of males: San Luis Valley, 1.8 inches mm); eastern Colorado, 2.9 inches mm). Average snout-vent length of fe San Luis Valley, 2.1 inches (52.4 eastern Colorado, 3.4 inches (86.8 mm

Green Toad
Bufo debilis

Recognition: (1) upper surface green with scattered black spots; (2) parotoid glands large and roughly triangular; (3) warty skin; (4) inconspicuous cranial crests; (5) head rather flat; (6) snout-vent length 2 inches (51 mm) or less.

Distribution: Ranges from northern Mexico through southcentral U.S., reaching its northern limit in Colorado and Kansas. Presently known to occur in Colorado only in Otero County at an elevation of about 4500 ft. (1372 m). Found near Trinidad, Las Animas Co., in 1883.



Distribution of the Green Toad in Colorado

Habitat and Habits: The green toa habits plains grassland in Colorado. It is s cretive toad, emerging from rodent burr ant nests, and other underground retreats after summer rains. Most activity occu night. Green toads have been found in C rado in June and August.

Breeding: The green toad breeds heavy summer rains in temporary ponds in pools along intermittent streams. Bree pools usually contain muddy water and have a rock or mud bottom. The breedin is a flat buzz lasting several seconds. M call from the edge of the pools, usually v hidden in vegetation. Calling is most v ous at night but may continue until morning immediately after heavy r Breeding pools in Colorado may be sh with the New Mexico spadefoot and Co spadefoot. Few details are known abou eggs and larvae of the green toad. Zw (1970) stated that the eggs probably are laid in long continuous strings.

Food: The green toad probably e variety of small arthropods.

Subspecies in Colorado: *Bufo d sidior.*

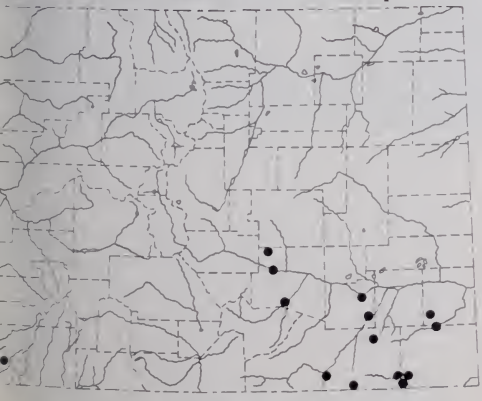
ed-spotted Toad

Bufo punctatus

Recognition: (1) upper surface gray or own with orange or red warts; (2) flat head d body; (3) circular or somewhat oval paro- d glands; (4) inconspicuous cranial crests; snout-vent length 3 inches (76 mm) or less. venile Woodhouse's toads have red spots d sometimes are mistaken for this species.

Distribution: Ranges from southwestern d southcentral U.S. through central Mex- . Occurs in southeastern Colorado princi- lly south of the Arkansas River at elevations nerally below 6000 ft. (1828 m). Also occurs uth of the Colorado River in western Colo- do at elevations below 7000 ft. (2134 m).

Habitat and Habits: The red-spotted toad usually is associated with rocky canyons in Colorado, but in some places it occurs along streams and in canyon bottoms that are devoid of large rocks. Junipers usually are scattered over the slopes of the canyons where these toads occur.



Distribution of the Red-Spotted Toad in Colorado

Male (on top) and female red-spotted toads in amplexus near a breeding pool in Mesa County.

Most activity occurs at night, but it is not unusual to find these toads hopping along canyon-bottom streams in the morning or late afternoon. Active toads have been found in Colorado from May through October. During the hot part of the day and the cold season, these toads hide in crevices, rodent burrows, or under rocks. Burnett (1926) found one in a prairie dog burrow in Montezuma County. I found six adults under a rock 50 ft. (15 m)

from a temporary rain pool in the same county.

Like many residents of dry habitats, red-spotted toads have physiological adaptations for obtaining and conserving water. They are particularly efficient in absorbing water from damp soil through the "seat patch." Water stored in the urinary bladder is used to replace water lost from the body fluids during dry periods. When handled roughly, toads often release the fluid in the bladder.

Breeding: Temporary rainpools, spring-fed pools, and other pools along intermittent streams are the primary breeding habitat in Colorado. Breeding pools often are bounded by large rocks, have a layer of sand or silt on the bottom, and usually contain clear or only slightly turbid water.

Breeding occurs anytime from about mid-May through August in Colorado. The breeding call, a high, ringing trill lasting sev seconds, is given by the male as he sits shallow water or at the edge of a pool. M sometimes call during daylight hours wl hidden in rock crevices near the breed pools.

Eggs are laid singly or in short string small clusters on the bottoms of the po Newly metamorphosed toads have been served in Colorado as early as July Luepschen (1981) found tadpoles (albir that had not yet metamorphosed as late as tober 7 in Mesa County.

Food: Like other toads, this species ea variety of small invertebrates including bu beetles, ants, and bees.

Remarks: The red-spotted toad is kno to hybridize with Woodhouse's toad in M County (McCoy et al. 1967).

Woodhouse's Toad

Bufo woodhousii

Recognition: (1) rough, warty skin; (2) light stripe along middle of back; (3) conspicuous cranial crests; (4) parotoid glands about twice as long as wide; (5) maximum snout-vent length 5 inches (127 m). Juveniles have red spots and sometimes are misidentified as red-spotted toads.

Distribution: Ranges throughout most of the central and eastern U.S. Occurs throughout Colorado at elevations below 7000 (2134 m). Reaches 7900 ft. (2408 m) in Wet Mountains. A disjunct population curs in the San Luis Valley at elevation about 7500-8000 ft. (2286-2438 m).

Habitat and Habits: Woodhouse's toa associated primarily with deep friable soil n river valleys and flood plains. It commo inhabits irrigated agricultural areas.

oodhouse's toads emerge from their sub-
nean winter retreats in April or early
and remain active throughout spring
summer. They generally disappear into
vinter hibernacula in September. Most
ity occurs at night but these toads
:times forage during late morning or
mid-afternoon. Temperatures of
36°F (20-30°C) are most favorable for
urnal activity. These toads spend hot
lay periods buried in the soil, under
s or other cover, or on damp soil in partial
at the waters' edge.

ke many other toads, Woodhouse's toad
gulps air and "puffs up" when handled.
umably this makes it more difficult for a
ator to swallow the toad.

reeding: Woodhouse's toad breeds in
shes, rain pools, ponds, lakes, reservoirs,
ded areas, and other bodies of water lack-
a strong current. Breeding pools may be
ldy or clear, sometimes contain extensive
vths of algae or other vegetation, and may
in size from a meter or so across to sev-
hectares. Breeding usually occurs in
il, May, or June, often after rains when
emperature is 54°F (12°C) or higher. The
onged "waaaaah" call is given as the male
at the edge of the water. Calling seems to
nost vigorous during the first few hours
r sunset.

ggs are laid in long cylindrical strings of
which usually become tangled in vegeta-
at the bottom of the breeding pool. Each
ale may lay up to 25,000 eggs which hatch
r a few days.

arge numbers of newly metamorphosed
odhouse's toads often are observed in July
metamorphosis commonly does not occur
il August. I have found metamorphosing
llets as early as mid-June in Yuma County.

Distribution of the Woodhouse's Toad in Colorado

Food: Food habits in Colorado are not known, but elsewhere Woodhouse's toad eats a variety of small invertebrates including sowbugs, scorpions, centipedes, grasshoppers, crickets, moths, caterpillars, flies, bugs, beetles, ants, and bees.

Male Woodhouse's toad chorusing in a breeding pool in Weld County.

Subspecies in Colorado: Toads from throughout Colorado usually have been assigned to *Bufo w. woodhousii*. Conant (1975) indicated that specimens from the San Luis Valley and part of southwestern Colorado are intergrades between the subspecies *woodhousii* and *australis*. Compared to populations elsewhere in Colorado, the San Luis Valley population has a less distinct dorsal color pattern, a greater proportion of individuals with dark ventral pigmentation, and a more pronounced tendency toward hypertrophy of the cranial crests and development of a raised interorbital boss (hard lump between the eyes).

Remarks: Irrigation in the Grand Valley has allowed Woodhouse's toad to spread into semidesert areas formerly occupied only by the red-spotted toad (McCoy et al. 1967). These two toads sometimes hybridize where their ranges overlap in Mesa County.

The western toad and Woodhouse's toad occupy complementary areas in Colorado. The only place where they have been found together is in northern Archuleta County (Harris 1963).

The blackneck garter snake sometimes preys on this toad in Colorado. I found the head of an adult Woodhouse's toad that had been decapitated by some predator at the edge of a reservoir in Washington County.

Treefrogs—Family Hylidae

Treefrogs are a Holarctic, Neotropical, and Australian group. Most of the 560 species inh South America. Most treefrogs are arboreal, with enlarged toe-tips that aid in climbing. Of th species of treefrogs in the U.S., three inhabit Colorado. Only one of these—the can treefrog—is an adept climber.

Northern Cricket Frog

Acris crepitans

Recognition: (1) dark triangle between eyes; (2) large webs between hind toes; (3) white marks on upper lip; (4) upper surface usually grayish with small irregular dark marks; (5) snout-vent length 1½ inches (38 mm) or less.

Distribution: Ranges throughout most of eastern and central U.S. Occurs in the Republican River and South Platte River drainage areas in northeastern Colorado. Appears to be most abundant along the North For the Republican River in Yuma County (3 ft., 1074 m). The distribution of the cric frog in the South Platte River drainage a needs further study.

Distribution of the Northern Cricket Frog in Colorado

Habitat and Habits: The cricket frog habits sunny, muddy or marshy edges ponds, reservoirs, streams, and irrigat ditches in pastureland and sandhill countr Colorado. Although cricket frogs ususally found near water in Colorado, Burnett (19 found one in the opening of a prairie dog b row in Weld County.

This frog is active during daylight ho and on warm evenings. The seasonal per of activity is known to extend from May October, but cricket frogs probably eme from the winter retreats at least as early April. When frightened on the banks o pool, cricket frogs leap into the water soon swim back to shore if left undisturb

Breeding: Little is known of the reproc tion of this frog in Colorado. Males give th repeated "gick-gick-gick" call on warm d and nights from the edge of the water or wh

ched on mats of algae or other vegetation he water. Calling may begin in April and ntinues through July. Eggs are deposited gly or in small clusters. Each female may 224-350 eggs which hatch after a few days. wly metamorphosed cricket frogs have been observed in Colorado in early July.

Food: Cricket frogs probably eat a variety of small invertebrates obtained at the water's edge.

Subspecies in Colorado: *Acris c. blanchardi.*

Canyon Treefrog

Hyla arenicolor

Recognition: (1) expanded, paddle-like e tips; (2) upper surface light-brown or ay, often closely matching rocks upon nich the frogs perch; (3) snout-vent length ¼ inches (57 mm) or less.

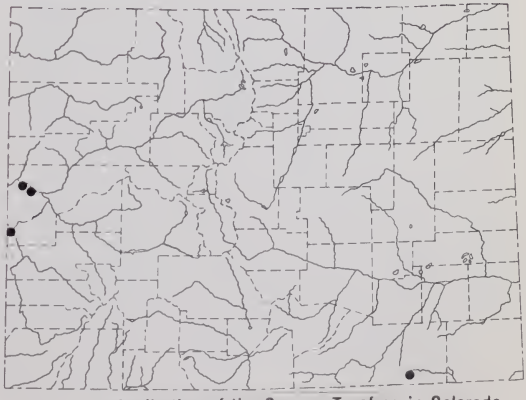
Distribution: Ranges from southwestern .S. through central Mexico. Known to oc- ır in western Colorado along the south rim the Colorado River valley west of Grand ınction and in John Brown Canyon, Mesa o. (Finley 1953). Not found since 1886 at lesa de Maya, Las Animas Co.

Habitats and Habits: The canyon tree- og occurs along intermittent streams in ep rocky canyons. Scattered cottonwood ees often occur along inhabited stream urses. Piñon-juniper woodland usually oc- ırs on the canyon slopes.

These frogs are most active at night but fre- uently can be found during the day resting ı small depressions in solid rock near pools f water. Despite their name, canyon tree- ogs in Colorado do not climb trees. They treat to rock crevices in hot weather and uring the cold season. Most activity occurs om May to September.

Breeding: The canyon treefrog breeds in anyon bottom pools which often are bounded by solid rock. The nasal "ah-ah-ah-ah" calls of the males resonate through the canyons during the breeding season, which seems to peak in May and early June. The call has been likened to the "bleat of a goat" or a "hoarse sheep." Few details are known of the larval development of this frog. Metamorphosing canyon treefrogs have been observed in Colorado in late July and early August.

Food: Food habits in Colorado are unknown. Elsewhere they are known to eat beetles, ants, caterpillars, bugs, centipedes, and spiders.



Distribution of the Canyon Treefrog in Colorado

Striped Chorus Frog

Pseudacris triseriata

Recognition: (1) stripe through eye from snout to groin; (2) hind toes not distinctly webbed; (3) snout-vent length 1½ inches (38 mm) or less. Average body size increases with increasing elevation. The largest male frogs from elevations below 6000 ft. (1828 m) seldom reach 1⅛ inches (30 mm) in snout-vent length, which is the average size of adult male frogs from elevations above 6000 ft. The upper surface of the frog may exhibit any of eight color combinations; background color may be green, red, or brown, while spot or stripe color may be green or brown (Matthews and Pettus 1966). The dorsal pattern may consist of three solid stripes (most common pattern), three rows of spots, small spots lacking a definite arrangement, or anythir between.

Distribution of the Striped Chorus Frog in Colorado

Distribution: Ranges throughout muc of eastern and central North America. Occu throughout most of Colorado, ranging fro below 3500 ft. (1066 m) in eastern Colorac to above 12,000 ft. (3670 m) in Hinsda County (Spencer 1971). Rare or absent in e treme western and southeastern Colorado.

Habitat and Habits: Chorus frogs lowland areas of Colorado usually remain or very near a nonflowing body of water, suc as a marshy pond, for most of the spring ar summer. In the mountains, chorus frogs al can be found in or near pools of water, b they spend most of the summer in wet me dows, sometimes as much as ⅓ mile (0.5 kn from the breeding pools (Spencer 1964).

Chorus frogs emerge from their wint retreats in March in lowland areas. The usually remain active until September ar October, but some individuals remain acti into November even after cold spells. Sprir emergence in the mountains may not occ until May. Spencer (1964) found that chor frogs at high elevations sometimes remain a tive even after September snowstorms, but other times they disappear by mid-Septemb even if warm weather continues.

Spencer (1964) found that chorus frogs 9700 ft. (2956 m) are most active betwee 10:00 A.M. and 3:00 P.M. except during th

eeding season when they may call until late night. Chorus frogs in lowland areas tend be diurnal in early spring and fall, and noc- nal or crepuscular during warm spring and mmer months. When inactive, they hide in ter, thick vegetation, under objects on the ound, or in rodent burrows.

Breeding: Chorus frogs breed in marshes, n pools, bog ponds, lakes, reservoirs, flooded eas, and other bodies of water lacking a nificant current. Spencer (1964) observed at chorus frogs usually do not breed in ountain pools kept cool by large influxes of ater. Both permament and temporary pools e used, but the latter sometimes dry up fore the tadpoles have metamorphosed. eeding pools usually contain aquatic plants d/or submerged terrestrial vegetation.

In lowland areas, males usually begin giv- g their stuttering call in March or April. horusing continues through spring and early mmer. By late June calling comes to a tem- orary halt, only to begin again in July or en August (Burt 1933) after heavy rains or hen fields are flooded with irrigation water. is not known if eggs are laid during these id-summer choruses. Corn (1980) reported at egg-laying females were present in a ond in the foothills of Larimer County from pril 24 to June 4. Miller (1977) found that reeding populations of chorus frogs at low evations are composed only of frogs that atched the previous year.

Hahn (1968) observed breeding chorus ogs at moderate elevations in the San Luis alley from late April to early July.

At high elevations (above 9000 ft., 2896 m) reeding begins immediately after the spring aw in late May or early June (Matthews and ettus 1966). Nonbreeding yearlings emerge om their winter retreats a week or two after reeding has begun. Spencer (1964) observed reeding from June 10 to June 20 and from May 14 to June 4 in two different years in the nountains of Larimer County. Spencer 1971) observed breeding chorus frogs in July t elevations above 11,800 ft. (3597 m). Spencer (1964) and Matthews (1971) deter- nined that mountain males do not breed until bout 2 years old, females not until 3 years old.

Chorus frogs lay loose, irregular clusters of eggs which usually are attached to vegetation in shallow water. Each female may lay several egg clusters. Pettus and Angleton (1967) found that females from mountain and low- land areas in Colorado lay an average of about 450 eggs (range 137-793) which develop best at temperatures of 68-75°F (20-24°C). Eggs of mountain females are darker and larger than eggs of lowland females.

Chorus frogs metamorphose as early as June in lowland areas and during July and August in the mountains (Blair 1951; Stebbins 1951; Harris 1963; Spencer 1964, 1971; pers. obs.). Spencer (1964) estimated that the breeding of each mountain female results in 12-20 frogs that survive through metamor- phosis. In a lowland population Miller (1977) estimated about 30 percent survival from egg to metamorphosis; frogs reached average adult size about 78 days after metamorphosis.

Populations of chorus frogs often consist of separate, nearly isolated colonies (Spencer 1964) and vary tremendously in size. Tordoff (1980) found mountain populations that in- cluded as few as 37 adults. The largest popu- lation studied by Hess (1969) totaled about 36,000 individuals.

Food: Chorus frogs eat a wide variety of in- vertebrates. Christian (1976) found that low- land frogs frequently eat flies, springtails, mites, bugs, spiders, beetles, and ants.

Subspecies of Colorado: Chorus frogs in Colorado usually have been assigned to the subspecies *maculata* based primarily on their relatively short hind legs. However, current subspecific designations in this species have little biological significance because many other variable characteristics (see "Recogni- tion" above) have not been taken into account.

Remarks: Robins, gray jays, garter snakes, and smallmouth bass are known predators on chorus frogs in Colorado (Mat- thews and Pettus 1966, Badgonas 1968, Miller 1977). Mortality is most severe in the younger stages. Matthews (1968) estimated the annual death rate in a mountain pop- ulation to be 31 percent in adults, 45 percent in yearlings, and 90-94 percent in juveniles. Only about 1 percent of the eggs laid result in an adult frog. However, at least some moun- tain frogs live 5 years or more (Spencer 1964).

For unknown reasons, chorus frogs have become scarce in some areas of Colorado where they formerly were abundant.

True Frogs—Family Ranidae

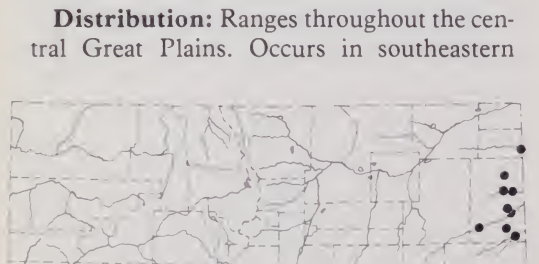
True frogs generally have smooth skin, long legs, and webbed toes. The largest species, *raua goliath* of Africa, sometimes grows to a snout-vent length of nearly one foot (300 mm). true frogs, which comprise some 600 species, occur nearly worldwide. They are the domi anurans in Africa and Eurasia. Four of the 21 species in the U.S. inhabit Colorado.

Plains Leopard Frog

Rana blairi

Recognition: (1) large dark spots on back; (2) background color always brown; (3) usually a well-defined light spot on eardrum; (4) dorsolateral folds usually broken and inset toward midline on rump; (5) hind toes webbed, (6) maximum snout-vent length about 4⅜ inches (111 mm).

Distribution: Ranges throughout the central Great Plains. Occurs in southeastern Colorado and in the Republican R drainage area in northeastern Colorad elevations below 6000 ft. (1828 m).



Distribution of the Plains Leopard Frog in Colorado

Habitat and Habits: The plains leo frog inhabits the margins of streams, po creek pools, reservoirs, irrigation ditches, other bodies of water in areas dominate plains grassland and sandhills, and in r canyon bottoms.

The annual activity period of this frog erally extends from March or April to tober in Colorado. In late September or e October large numbers of frogs often ga at certain ponds favored as over-winte sites.

Breeding: Plains leopard frogs bree permanent and temporary pools lacking a nificant current. They often inhabit the ec of flowing streams but do not breed in th

The breeding season varies greatly f place to place and from year to year. Sout the Arkansas River breeding occurs in M June, or July. North of the Arkansas al Big Sandy Creek, breeding may occur fi early April (Post 1972) to late August (G

75). Gillis (1975) reported that breeding en coincides with heavy rains along Big ndy Creek. More than one breeding event y occur each year at a given pool; freshly l eggs and large tadpoles are sometimes nd together.

The breeding call consists of a series of ort "clucks" followed by a few low chuck- g sounds. Large clusters of eggs are attached vegetation in shallow water. Larvae may tamorphose anytime during summer, the te depending on when the eggs were laid. llis (1975) found that tadpoles hatched m eggs laid in late August over-winter in ponds and metamorphose the following ring.

Food: These frogs probably eat a variety of invertebrates. The stomach of a plains leopard frog from Prowers County was full of grasshoppers.

Remarks: On two occasions I have been alerted to predation on these frogs by their distress screams. In both cases a western terrestrial garter snake had captured the frog.

This leopard frog sometimes hybridizes with the northern leopard frog (see account of latter species).

Gillis (1979) described various physiological and behavioral adaptations that allow the plains leopard frog to exploit more ephemeral aquatic habitats than does the northern leopard frog.

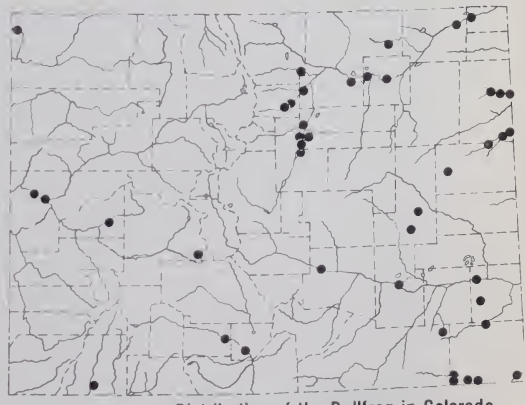
Bullfrog

Rana catesbeiana

Recognition: (1) fold of skin across top nd rear of eardrum; (2) fully webbed hind oes; (3) snout-vent length may exceed 7 inches 180 mm). Eardrum is wider than eye in nales, about same width as eye in females.

Distribution: Native range includes most of eastern and central U.S. Introduced in Colorado and other western states. The bullfrog is most widespread in eastern Colorado but is extending its range in the state through continued introductions and subsequent expansion.

Habitat and Habits: Bullfrogs usually inhabit permanent ponds, quiet stream pools,



Distribution of the Bullfrog in Colorado

reservoirs, and marshes, but they also inhabit flowing streams and irrigation ditches if the current is not too swift. Only rarely are bullfrogs found more than a leap or two from water, but they do leave the water occasionally and colonize temporary or newly created bodies of water hundreds of meters from permanent streams or pools. Bullfrogs often coexist with warmwater game fishes which apparently are averse to eating bullfrog larvae.

The annual activity period extends from about March to October. Bullfrogs spend the winter at the bottom of a body of water. Bullfrogs are active both day and night for most of the summer. They often sit in the sun at the edge of the water or in thick mats of algae. Startled bullfrogs usually squawk as they leap into the water.

Breeding: Bullfrogs breed in permanent bodies of water which typically contain thick growths of algae and rooted aquatic plants such as cattails. Breeding pools usually are rich in aquatic animal life and have a soft mud bottom. Bullfrogs typically are lowland creatures because they require relatively warm water for breeding. However, they thrive in the mountains of Gunnison County at 9000 ft. (2743 m) where the warm spring waters of Hot Spring Creek enable bullfrogs to reproduce in an area that otherwise is much cold.

Actual dates of breeding in Colorado not well known. The bellowing, "m-ru calls of the male can be heard from late M through August, but calling seems to be n vigorous in June and July. Most mat males defend territories in which they r mate with several females (usually at nig Eggs are laid in large jelly masses that flo the surface of the water. Each female may up to 20,000 eggs which hatch after sev days. The length of the larval period in C rado is not definitely known but at least so larvae over-winter in the ponds and proba metamorphose during the second sumn Tadpoles in various stages of metamorph have been observed in Colorado from Ma to September.

Food: Bullfrogs will eat any animal t can be captured and swallowed, includ each other.

Remarks: Bullfrogs have eliminated are eliminating native leopard frogs fr some areas of eastern Colorado, proba through competition and predation.

Bullfrogs have edible flesh and are cla fied as "sport amphibians" by the Divisio Wildlife.

Northern Leopard Frog

Rana pipiens

Recognition: (1) large dark spots on back; dorsolateral folds not inset toward midline rump; (4) webbed hind toes; (5) maximum out-vent length about 4⅜ inches (111 mm).

Distribution: Ranges across much of rthern U.S. and southern Canada. Occurs roughout Colorado except in Republican ver drainage area and southeastern Colorado uth of the Arkansas River. Ranges to above ,000 ft. (3353 m) in southern Colorado.

Habitats and Habits: The northern leo- ard frog typically inhabits the banks and allow portions of marshes, ponds, lakes, servoirs, beaver ponds, streams, and other odies of permanent water, especially those aving rooted aquatic vegetation. It also in- abits irrigation ditches and wet meadows.

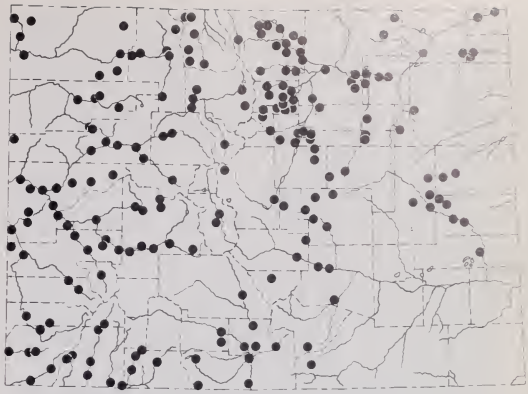
In the plains region, northern leopard frogs pically emerge from their winter retreats in ie bottoms of ponds in March. They usually main active until October and November

Inusual blue variant of the northern leopard frog from Veld County.

when cold weather forces them into dormancy. However, Hahn (1968) found "active" leopard frogs in January and February in pools formed by warm artesian wells in the San Luis Valley. Activity may occur day or night. Northern leopard frogs are most frequently observed at the edge of the water but sometimes roam far from water on rainy nights.

Breeding: The northern leopard frog breeds in the shallow, non-flowing portions of permanent bodies of water and in seasonally flooded areas adjacent to or contiguous with permanent pools. Breeding pools typically contain vegetation, mats of algae, and fairly clear water.

Most of my information on leopard frog reproduction is based on studies done at elevations below 5500 ft. (1676 m). Males begin calling on warm, sunny days in March or



Distribution of the Northern Leopard Frog in Colorado

April. The typical call, given while the male floats at the surface, is a prolonged snore lasting 2-3 seconds followed by 2-3 series of stuttering croaks each lasting no more than a second. Sometimes the croaks are given without the introductory snore. Frogs frequently wrestle with one another between calls. Calling usually wanes in April but lowland frogs sometimes call during May or early June. I have heard leopard frogs calling vigorously after a heavy rain in late May at 5000 ft. (1524 m) but whether egg laying occurred is unknown.

Females begin laying eggs a few days after calling begins. Most females in the plains region of Boulder County lay their eggs by mid-April. Post and Pettus (1967) found that the breeding season may extend through May and early June in Pueblo County. Egg masses about 2-5 inches (5-13 cm) in diameter are attached to vegetation in water typically 5-7 inches (13-18 cm) deep. Livo (1981) found that egg masses in Boulder County (1524 m) average 3116 eggs (645-6271), with larger females laying larger numbers of eggs. She found that eggs hatch 4-15 days after being laid. Metamorphosis occurs several weeks after hatching, probably in July or August. Frogs do not begin breeding before their second spring.

Corn (1981) studied leopard frog reproduction at 6680-7760 ft. (2036-2365 m) in Larimer County. Eggs were laid in late May and early June. Metamorphosis occurred from mid-July through mid-September after a larval period of 58-105 days. Hahn (1968) observed metamorphosed leopard frogs in the San Luis Valley (7500 ft., 2286 m) on July 24.

Information on reproduction at high elevations is sketchy. Blair (1951) reported that leopard frogs in the Elk Mountains (9500 ft.,

2896 m) did not metamorphose before August 12. Stebbins (1951) found tadpoles in North Park (9000 ft., 2743 m) on August 23. Hahn (1968) observed metamorphosing leopard frogs on August 2 at 10,500 ft. (3200 m) in southern Colorado.

Food: Food habits in Colorado are not definitely known, but these frogs undoubtedly eat a wide variety of invertebrates.

Remarks: Known predators on leopard frogs in Colorado include garter snakes, tiger salamanders, and various fishes (Cockerell 1910, Bagdonas 1968, Corn 1981).

The ranges of the northern leopard frog and plains leopard frog are largely complementary in Colorado. They are known to overlap along portions of Big Sandy Creek, the Arkansas River near Pueblo, the Huerfano River in southern Pueblo County, and along Fountain Creek in southern El Paso County. The two species hybridize along Big Sandy Creek (Gillis and Pettus 1974). In Pueblo County they breed at different tir (northern breeds earlier) and in different h itats (northern breeds in permanent wa plains in ephemeral pools) and are not kno to hybridize (Post 1972, Post and Pet 1967). Gillis and Pettus (1974) conclu that hybridization along Big Sandy Creek fairly recent phenomenon resulting in p from the creation of numerous ponds throu sand and gravel excavations. The north leopard frog has colonized these ponds wh provide suitable habitat in an area forme inhabited only by the plains leopard fr The two species now breed together in ponds and frequently hybridize.

The formerly abundant northern leop frog has become scarce in many areas of Co rado. Part of the decline seems to be due to p dation by the increasingly abundant bullfr but the leopard frog is also becoming unco mon in areas where bullfrogs are absent. T cause(s) of the decline should be investigat

Wood Frog

Rana sylvatica

Recognition: (1) dark "mask" across eyes; (2) light stripe along middle of back; (3) webbed hind toes; (4) dorsolateral folds on back; (5) maximum snout-vent length about 3¼ inches (83 mm).

Distribution: Ranges across northern and eastern North America, occurring north the Arctic Circle. Disjunct populations occ in the Rocky Mountains. Occurs in Colora around the margins of North Park, along t upper tributaries of the Colorado River, a in the upper Laramie River drainage. Elev

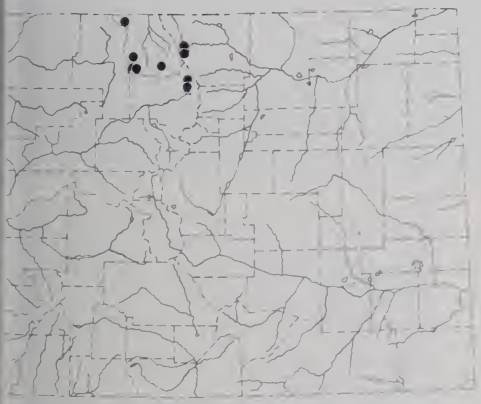
al range in Colorado is about 8300-9800 2529-2987 m).

abitat and Habits: Wood frogs inhabit shes, bogs, pothole ponds, beaver ponds, s, stream borders, wet meadows, willow kets, and subalpine forests bordering e mesic habitats. Willow thickets and st stream courses are inhabited primarily r frogs have dispersed from the breeding ds.

Vood frogs are diurnal in spring and may ıctive day and night during warmer sum- months. They usually emerge from their ter retreats in holes under logs or rocks in forest (Bagdonas 1968) in May and are ac- until September. Wood frogs have rela- ly short hind legs and are poor leapers ıpared to leopard frogs.

Breeding: Bagdonas (1968) and Haynes . Aird (1981) summarized information on od frog reproduction in Colorado and st of my information is based on their k.

Vood frogs usually breed in small natural ıds that lack a permanent inlet and outlet. ctive beaver ponds and man-made ponds ıetimes are used. Breeding ponds typically



Distribution of the Wood Frog in Colorado

ıve a shallow, sunny, north edge with an ex- nsive growth of sedges in the water. Frogs ually do not breed successfully in ponds in- ıbited by trout.

Males begin calling in May before the last ıow fall and when ice still forms at the pond surface at night. The call is a rapid series of 1-8 (usually 3-5) snoring notes that barely can be heard at 100 ft. (30 m). Males typically call from the shallow north shore of the pond, frequently changing position between calls. As in many other frogs, wood frog males attempt to clasp any frog that swims by, including males and other species. Only the female wood frog does not resist the male's clasp. Male wood frogs probably first breed in their second spring, females in their third spring.

Eggs are laid at night and often are attached to sedges in water 4-6 inches (10-15 cm) deep at the north side of the pond. The breeding season is short; most eggs are laid from late May to early June. Each female lays 750-1250 eggs divided among 1-4 masses. Many egg masses often are laid in a small area. Most adults leave the breeding ponds soon after the eggs are laid.

Eggs hatch from late May to late July, 4-20 days after being laid. Larvae metamorphose from mid-July to late August, usually 70-85 days after hatching. Apparently larvae occasionally over-winter in the pond and metamorphose the next spring but this needs to be investigated further. Newly metamorphosed frogs spend several days feeding near the breeding pools. Later they migrate at night to willow thickets and meadows where they spend the rest of the summer.

Food: Bagdonas (1968) reported that wood frogs eat small insects, worms, and spiders.

Remarks: Known predators on wood frog larvae include diving beetle larvae, trout, smallmouth bass, and the western terrestrial garter snake, which also eats young frogs (Bagdonas 1968).

Porter (1969) named the disjunct population of wood frogs in the Southern Rocky Mountains *Rana maslini*, based on his inability to successfully hybridize the frogs with *Rana sylvatica* from Canada. Bagdonas and Pettus (1976) showed that wood frogs from Colorado and Canada are genetically compatible despite the fact that they have been geographically separated for several thousand years. Thus the basis for Porter's new species is not valid. Smith (1978) retained *maslini* as a subspecific name.

Microhylids—Family Microhylidae

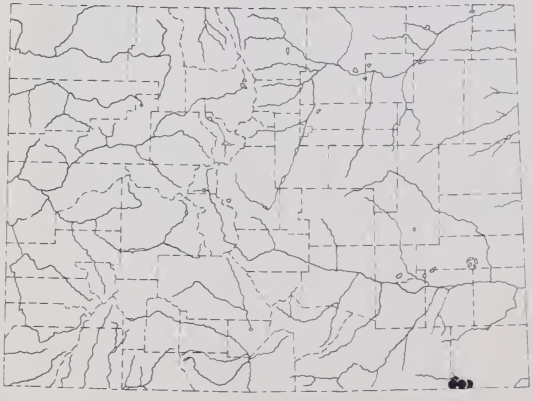
Microhylids occur in southeastern Asia, Indonesia, Africa, and the Americas; most of the species inhabit the Southern Hemisphere. Some members of this family are toad-like, others resemble treefrogs. North American representatives are small-headed and stout-bodied. Only the three species in the United States inhabits Colorado.

Great Plains Narrowmouth Toad

Gastrophryne olivacea

Recognition: (1) fold of skin across back of head; (2) pointed snout; (3) flattened body; (4) unwebbed toes; (5) maximum snout-vent length about 1½ inches (38 mm).

Distribution: Ranges from central U.S. through central Mexico. Occurs below 5000 ft. (1524 m) in extreme southeastern Colorado.



Distribution of the Great Plains Narrowmouth Toad in Colorado

Habitat and Habits: The narrowmouth toad inhabits areas dominated by low grasses and forbs in the bottoms of rock-rimmed canyons and on slopes having numerous flat rocks imbedded in the soil.

These toads are most active after spring or summer rains have moistened the soil. At such times they can be found day or night under rocks and at the edge of rainpools and stock ponds. Narrowmouth toads have been found in Colorado from May to August.

Breeding: Narrowmouth toads breed after heavy summer rains in small temporary rain pools and in larger ponds that dry up in some years. Breeding pools may have muck or rock bottoms, and contain muddy or oily somewhat turbid water; characteristically, they are ringed with sunflowers.

Males call from shallow water at the edge of

he pond. The call is a nasal buzz lasting 1-3 econds. Several toads calling vigorously ound like a squadron of toy airplanes. I have eard narrowmouth toad choruses in July and ugust (Hammerson 1980) and found a newly id raft of eggs floating in a small pool on July 8. Special glands on the belly of the male ecrete a sticky substance which helps him ling to the female during amplexus. The ength of the larval period and dates of netamorphosis in Colorado are unknown.

Food: Narrowmouth toads from Baca County defecated the remains of ants, which is their usual diet in other areas.

Remarks: Hunt (1980) found up to five narrowmouth toads in tarantula burrows in Texas. Toads hid beneath the spider when disturbed. Hunt suggested that the spider may protect toads from foraging snakes while the toads reciprocate by keeping marauding ants from bothering the spider and its eggs and offspring. It would be interesting to know if a toad-tarantula association occurs in Colorado.

REPTILES

The reptiles first appeared in the early portion of the Pennsylvanian period, about 250 million years ago. The most famous of all reptiles, the dinosaurs, lumbered across Colorado during the Mesozoic era but became extinct about 65 million years ago.

The reptiles that survive today are scaly creatures comprising four major groups—the turtles (222 species); the crocodiles (21 species); the lizards, snakes, and amphisbaenians (3310, 2270, and 135 species, respectively); and the tuatara (1 species). Each of these groups made its first appearance during the Triassic period, about 155 to 190 million years ago.

The tuatara (Order Rhynchocephalia) is a lizard-like reptile now found only on a few islands off the coast of New Zealand. It is the only survivor of a formerly widespread group of reptiles.

The crocodilians (Order Crocodylia) are the only surviving members of the subclass Archosauria, which includes the now-extinct dinosaurs and pterosaurs (flying reptiles). Crocodilians are sprawling, amphibious creatures primarily found in tropical areas throughout the world. Crocodiles inhabited the swamps of Colorado until at least late Oligocene time some 25 million years ago. They disappeared as the formerly subtropical climate became cooler and drier.

The lizards, snakes, and amphisbaenians comprise the Order Squamata. Lizards generally have four legs and a long tail, but several species lack legs and resemble snakes. Many of these legless lizards can be identified as such by their movable eyelids and/or external ear openings, which snakes never have. No legless lizards occur in Colorado. Lizards occur throughout most of the world, being absent only from cold regions near the poles and from some isolated islands. Many species inhabit desert regions. Of the 98 lizard species that occur in the U.S., 16 are found in Colorado.

Snakes are long-bodied, legless reptiles with unblinking eyes. Snakes are unable to close their eyes because they lack movable eyelids. The eyes are protected by a clear, spectacle-like shield. Snakes are associate primarily with the warmer regions of th world. A few species range north of the Arcti Circle. About 120 species of snakes occur i the U.S., 25 of which inhabit Colorado.

Amphisbaenians are worm-like, burrowin creatures found in tropical, subtropical, an warm temperate regions. All but a few specie lack legs. The eyes are poorly developed Members of the Long Expedition claimed t have found an amphisbaenid in Colorad (James 1823), as have several other peopl (see Smith and Holland 1981), but no spec men has ever been presented as proof.

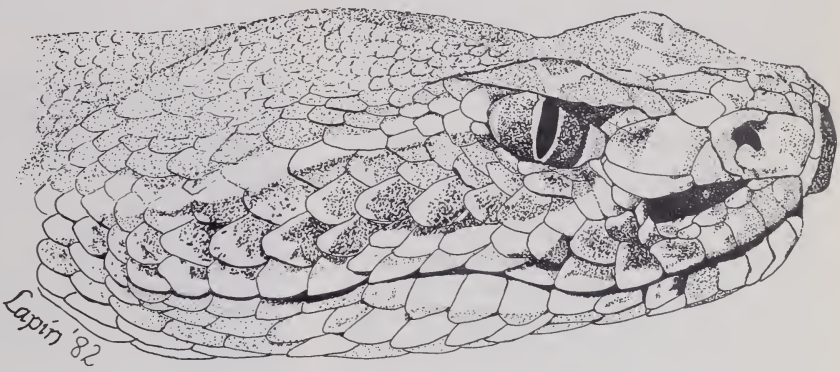
Turtles (Order Testudines), with their dis tinctive protective shells, are familiar t almost everyone. The shell is a bony, box- o cage-like structure usually covered wit horny plates. The name "turtle" is a gener term which can be applied to species popularl known as tortoises or terrapins. Turtles oc cupy the warmer regions of the world, incluc ing the oceans. About 48 species occur in th U.S., five of these in Colorado.

Reptiles typically have dry scaly skin. A superficial layer of dead cells (stratum cor neum), scale-forming deposits of keratin, an a virtual absence of secretory glands make th skin of a reptile drier and more impervious t water than that of an amphibian. Reptile ski is also more resistant to abrasion.

Like amphibians, reptiles have special colo cells (chromatophores) in the skin that enabl them to change color rather quickly. Colo changes result from changes in position of th pigment within certain chromatophore (melanophores). Movement of the pigmer may result from nervous or hormonal stimu or may be caused directly by changes i temperature or light intensity. Among th reptiles, lizards are capable of the greate changes in skin color. By changing color t match its background, a lizard can becom quite cryptic and may be overlooked by potential predator. Color changes, whic alter the rate of heat gain from the sun, als function in the regulation of body temper ture. Many lizards also undergo more gra

l, seasonal color changes. These usually are sociated with breeding activities.

Reptiles periodically shed the dead outer yer of the skin as new layers form beneath. snakes, the eyes become clouded, then rn to a normal appearance shortly before e skin is shed. The skin first becomes loos- ed about the s, then from e rest of the ad. The ini- al loosening the skin in any reptiles curs as the ead becomes gorged with lood and no- ceably swells. The snake rawls slowly long, rubbing gainst rocks, vegetation or other objects nd eventually slips out of the old skin, often rning it inside-out in the process. Snakes sually shed the skin in one piece, but other eptiles may shed it in many pieces. Rep- les generally shed several times each year.



Reptiles usually have a fairly long tail, which in many lizards is rather easily detached. Among Coloradan lizards, the skinks (*Eumeces*) have notoriously fragile tails. A slight ug or bump is all that is necessary to break it. The tail usually thrashes vigorously for a few minutes after being detached. The easily lost ail is an adaptation that allows the lizard to scape from a tail-biting predator. Even if the predator does not bite the tail, the lizard may scape if the predator is distracted by a hrashing tail detached during the lizard's struggles. For most lizards, a broken tail does no great harm. The tail bones have a predetermined fracture zone that minimizes damage to the skeletal system. The tail muscles separate smoothly and constrict quickly at the break, closing off the blood vessels. The tail is regrown, but the regenerated portion is shorter, duller, and is supported by a rod of cartilage; the bones do not regenerate. The scale covering on the new tail also differs from the original. The major problem incurred by a tailless lizard is in maintaining balance; movements of tailless lizards are rather clumsy.

Not all lizards give up their tails so readily. Notable among Colorado lizards is the sturdy tail of the collared lizard. The tails of snakes and turtles break only when extreme force is applied, which greatly injures the animal.

Except in burrowing species, vision is one of the dominant senses by which reptiles perceive their environment. Diurnal reptiles generally have good visual acuity and color vision, although some of them are nearly blind at night. Nocturnal species tend to be color blind.

Many lizards, including most of those found in Colorado, have a tiny structure called the "parietal eye" on top of the head. It resembles an eye in fine structure (it has a lens and retina), but it cannot register an image. It seems to function as a light meter, controlling in part the amount of time the lizard exposes itself to the sun. An associated structure, the pineal gland, produces melatonin, a hormone that aggregates pigment (melanin) in melanophores, lightening the general color tone of the skin.

Lizards and snakes have an excellent sense of smell due primarily to the chemical-sensitive vomeronasal (Jacobson's) organs, paired sac-like structures that open into the roof of the mouth. Airborne odors or chemical substances on the substrate or on other individuals are picked up on the tip of the protrusible tongue, then are transferred to the vomeronasal organ inside the mouth. Snakes frequently use their long, forked tongue in this way. Many lizards frequently lick objects but rarely appear to use the tongue to sample airborne odors.

The hearing ability of reptiles varies widely. Most Colorado lizards have an externally visible eardrum and the usual structures of the middle ear to transmit sounds to the inner ear. Presumably, these lizards can hear well.

The eardrums of the lesser earless lizard and some of the horned lizards are covered with scaly skin, which probably decreases their hearing sensitivity.

Snakes show no external evidence of having ears (the eardrum and middle ear cavity are missing), but, contrary to popular belief, they are able to perceive airborne sound waves. In fact, at least some snakes can hear low frequency sounds better than can a domestic cat. In general, however, snakes hear rather poorly. The hearing ability of turtles is about the same as that of snakes.

Like amphibians, reptiles are ectothermic. By shuttling between sun and shade many reptiles maintain fairly stable body temperatures that equal or exceed human body temperature. At night, however, their temperatures approximate those of the soil or air. Secretive reptiles, such as those usually found in the daytime under rocks, obtain most of their body heat from the soil or from warm rocks. They characteristically maintain lower body temperatures than do those that bask in the sun.

In spite of their thermophilic (heat-loving) habits, most reptiles cannot tolerate excessive heat. Diurnal reptiles retreat to underground burrows or crevices during the midday heat of summer. Most activity takes place in the morning and late afternoon. Other reptiles, particularly snakes, confine their activities to twilight or nighttime hours. Some snakes shift their activity patterns seasonally, becoming more nocturnal as the weather gets hotter.

Cold weather severely reduces the capacity for activity of most reptiles. In Colorado, many reptiles spend the cold winter months deep in the ground where they can avoid freezing. Some aquatic turtles retreat to the deep, unfrozen bottoms of lakes and ponds. Oxygen is obtained from the water through the walls of the mouth cavity and/or cloaca. The winter period of reptilian inactivity in Colorado generally extends from November through March. Although a few individuals may venture out during unseasonably warm weather, reptiles generally cannot be found during the cold season.

In the temperate environment of Colorado, reptilian reproduction is distinctly seasonal. Breeding activities are at their height during spring and early summer. Soon after emerging from their winter hibernacula males begin to seek females. Aquatic turtles a lizards seldom need to make any special eff to locate females because their relatively hi population densities result in frequent ma female encounters. Population densities snakes often are relatively low, and males m have to actively search for females. It thought that male snakes find mates by f lowing scent trails left on the ground females. Reproduction in at least some sna is induced by the increase in body tempe ture experienced by snakes as they eme from the hibernation, not by increas photoperiod (length of day) as in many bir

Breeding often begins with a period courtship, which precedes actual mati Males play the more active role in the cou ship behavior of most reptiles. Male turt may bob the head repeatedly or bite, bun or stroke the female in an effort to entice l to mate. Lizard courtship often includes d tinctive head-bobbing or "push-up" behav during which brightly colored areas of body are displayed. Males of some liz species bite or nip at the female during cou ship. Male snakes often court females crawling over them and rubbing the be over the female's back. Tongue-flicking a intertwining of the tails often accompan the body undulations.

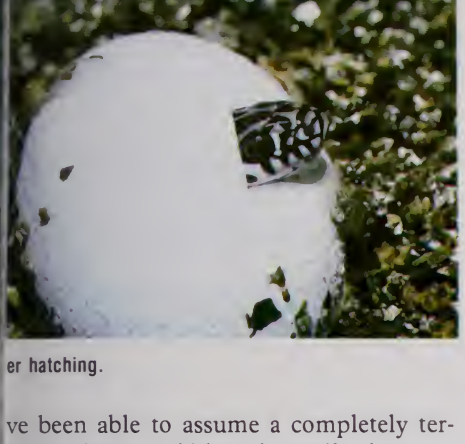
Reptiles reveal their sex and species to e another by these distinctive courtship beh iors and by their reactions to the behavio others. The sense of smell also may be imp tant in species and sexual recognition, p ticularly in snakes. Outward appearance, the absence of any behavioral or chemi cues, often is not enough to allow recogniti

Courtship usually leads to copulation. F tilization is internal (occurs within the bo of the female) in all reptiles. Male lizar snakes, and turtles release sperm into e cloaca of the female by way of a grooved int mittent organ (penis). Turtles have a sin erectile penis which is inserted from the re When not in use the penis is withdrawn i the cloaca. Mating is facilitated by the c cave shape of the male's lower shell (plastr which conforms well with the convex r portion of the female's upper shell (carapa

Male lizards and snakes have dual copu tory organs, each of which is called a he penis. Copulation takes place as a hemipe everts through the vent (cloacal opening) the male and pushes into the cloaca of e

ale. Only one hemipenis is used during
n mating. Mating may last minutes or
rs during which time the males of some
ies grasp the head, neck, or shoulders of
female with the jaws. When not in use the
ipenes lie hidden in the base of the tail,
behind the vent.

ll turtles and most lizards and snakes lay
s encased in a shell. Because the egg can
leed, must) be laid on land, many reptiles



er hatching.

ve been able to assume a completely ter-
strial existence. Although reptiles lay eggs
d reproduce successfully even in the driest
deserts, a humid micro-environment is
cessary to prevent desiccation of the
veloping egg. Thus, reptiles bury their
gs in the soil or lay them under rocks or in
bterranean burrows.

Most lizards and snakes lay elliptical or
ongate eggs with flexible leathery shells.
urtle eggs may be either flexible, as in the
apping turtle, or hard like birds' eggs, as,
onically, in the soft-shelled turtle. Turtle
gs tend to be rather spherical. Not all rep-
es lay eggs. Some lizards and snakes give
rth to their young. One Colorado lizard
hort-horned lizard) and several of the snakes
arter snakes, lined snake, water snake, and
ttlesnake), give birth.

The reptilian life cycle does not include the
ee-living larval stage so typical of the amphi-
ans. The newly born or hatched reptile be-
ns its life as a miniature but sexually imma-
ure version of the adult.

Most reptiles abandon their eggs soon after
ying. Females of some skinks (*Eumeces*) may
are for their eggs and young until several
ays after hatching, but in general reptiles ex-
ibit little, if any, parental care beyond the preparation of a suitable nest site. The young are able to fend for themselves.

As a group, turtles are omnivorous, eating a wide variety of plant and animal matter. Most Colorado turtles appear to be more carnivorous than herbivorous. Food is detected by sight or, especially in aquatic species, by smell. Turtles procure food by biting with the sharp-edged, toothless beak. Small food items may be crushed in the jaws and swallowed. Large prey generally are torn apart, sometimes with the aid of the forefeet, and swallowed.

All Colorado lizards are carnivorous, eating mainly small arthropods. Some of the larger lizards eat small vertebrates, particularly other lizards, as well. Food is detected by sight in most lizards; movement of the prey alerts the lizard to a potential meal. Some lizards, especially whiptails (*Cnemidophorus*), appear to use the sense of smell to detect small animals buried in the soil. Lizards are equipped with small teeth generally attached in single rows along the edges of both the upper and lower jaws and in patches in the roof of the mouth. Food items are crushed in the jaws and swallowed.

All snakes are carnivorous and swallow the food whole, but species differ greatly in the kinds of food eaten and in the method by which it is dispatched. In Colorado, the smallest snakes eat invertebrates which they simply grasp with the jaws and swallow. Larger snakes eat small vertebrates and large invertebrates. Some of these snakes catch their prey with a quick, open-mouthed lunge and swallow it alive (if it has not been killed by the bite). Other snakes, called constrictors, grasp the prey in the jaws and immediately wrap coils of the body around it. As the coils tighten, the prey suffocates. The snake then loosens the coils and swallows its meal.

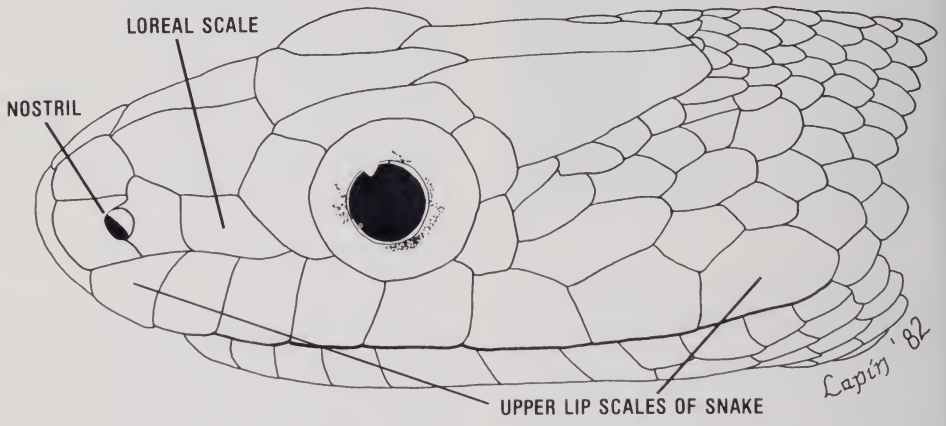
Rattlesnakes also usually kill their prey before attempting to swallow it. A quick bite is all that is necessary to kill the prey, often a small rodent. When striking, two hollow fangs in the front of the mouth swing downward and forward to deliver the venom. The snake-bit rodent usually staggers away and quickly dies. The rattlesnake, flicking its tongue frequently, eventually finds the rodent by following it scent trail, then swallows it.

Most snakes use both vision and the acute sense of smell to locate food. Rattlesnakes have special heat-sensing organs located in a

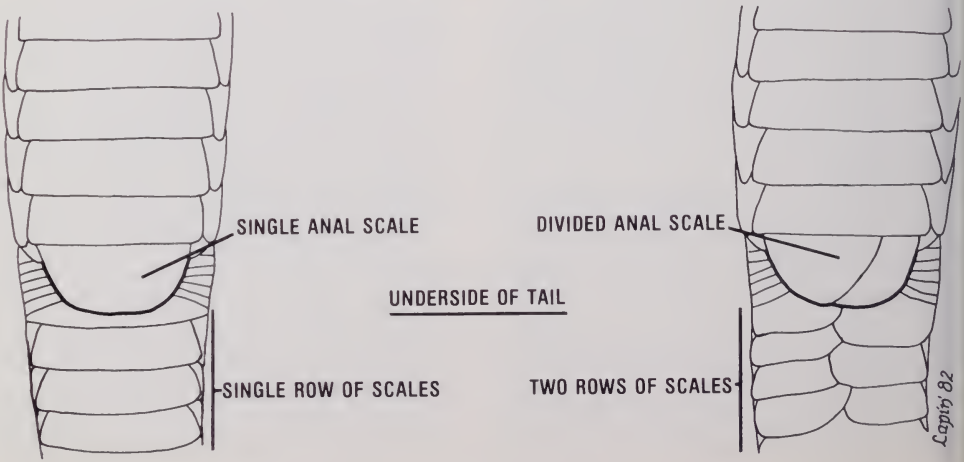
pit on each side of the head that are used to detect and locate warm-blooded prey. An accurately directed strike, based solely on information received through the heat-sensing organs, can be made in total darkness.

The jaws of snakes are remarkably adapted for manipulating and swallowing large prey. The upper jaw is loosely attached to the skull and both sides, each with two rows of teeth, can be moved independently. The two sides of the lower jaw are attached in the middle a loose ligament and also move independent Each side bears a single row of teeth. Fo items are positioned (usually head-end fir and pulled into the throat by independent b coordinated forward-backward movements the jaws. The skin of the neck can expa greatly to allow the passage of large pre Snakes digest bones, but the fur of mamm passes through and appears in the feces.

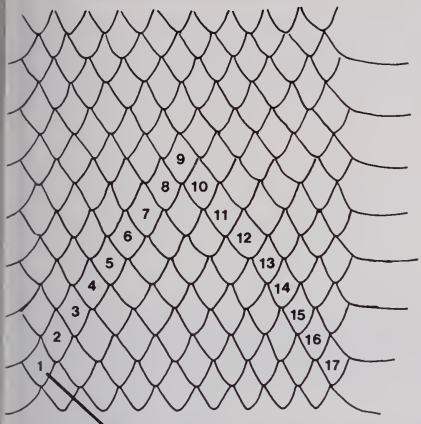
REPTILE TERMINOLOGY



ANAL REGION OF SNAKE

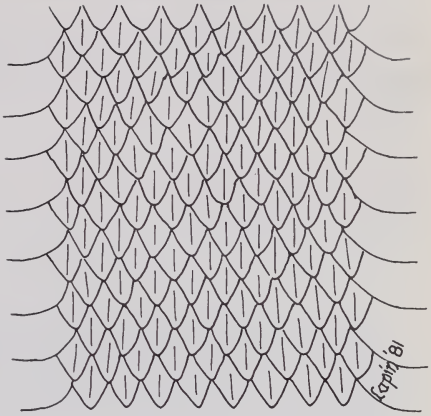


SMOOTH SCALES OF SNAKE



METHOD OF COUNTING SCALE ROWS

KEELED SCALES OF SNAKE



Turtles

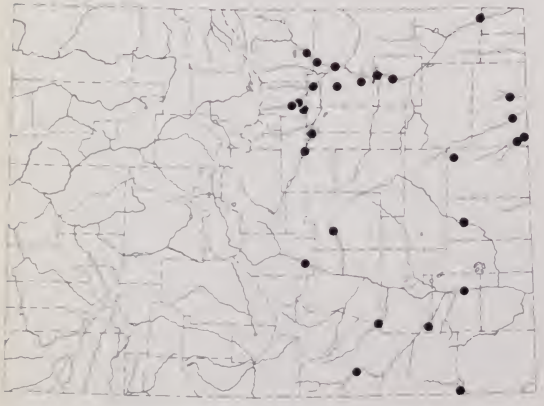
Snapping Turtles—Family Chelydridae

These turtles are characterized by their large size, massive head with hooked jaws, and long ta The alligator snapper of the southeastern U.S. may weigh over 200 pounds (91 kg). This family restricted to the Americas and includes only two species, represented in Colorado by the snappi turtle.

Snapping Turtle

Chelydra serpentina

Recognition: (1) hard shell; (2) rear edge of shell saw-toothed; (3) long tail with a row of enlarged, protecting, bony scales along mid-line of upper side; (4) large head with hool i jaws, (5) maximum shell length about 18 inc s (46 cm). Juveniles have three ridges on te top shell.



Distribution of the Snapping Turtle in Colorado

Distribution: Ranges from eastern a i central U.S. to northern South America. C - curs throughout eastern Colorado at ele - tions below about 5500 ft. (1676 m).

Habitat and Habits: The snapping tu e inhabits permanent, flowing or non-flow g bodies of water in the plains region. t sometimes inhabits ponds that dry up oc - sionally and may colonize permanent po s along intermittent streams.

Snapping turtles spend most of their ti e in the water. Occasionally they are observ d basking on a log in the sun or floating at e surface of the water, but most activity occ s on the bottom. These turtles usually are -

e from March or April to October in Colo-
lo. Most snappers probably over-winter in
ıd or debris at the bottom of a body of
ter.

Snapping turtles defend themselves by
apping vigorously with their sharp jaws
ıich are capable of lacerating human skin.
ırge turtles can be handled safely by grasp-
g the hind limbs, keeping the head away
)m one's legs. Large turtles can be injured if
ted by the tail.

Breeding: Throughout its range, the
apping turtle may mate anytime during the
arm season. Mating occurs in the water as
e male clasps the shell of the female with his
aws. The sperm from a single mating may
st several years. Eggs are laid in a muskrat
dge or in a burrow dug with the hind feet in
ft soil by the female. Packard et al. (1981*a*)
)served snapping turtles constructing nests
ı June 7 and 16 in Logan County. Usually
)out 20-30 eggs are laid in the nest which may be far from water. Hatching occurs from late August to early October but the young turtles sometimes do not emerge from the nest until spring. Amazingly, the sex of hatchling turtles is determined by the temperature of the nest during development. Snapping turtles begin breeding when the shell is about 8 inches (20 cm) long.

Food: Snapping turtles are not very particular about their diet. They eat plant material, decaying animal carcasses, and just about any kind of live animal that can be captured, including many kinds of invertebrates, amphibians, snakes, small mammals, and birds (especially ducklings which they pull under water and drown.)

Subspecies in Colorado: *Chelydra s. serpentina*.

Remarks: The flesh of this turtle is delicious and, as a result, humans are the chief predators of adults. Eggs and hatchlings are eaten by a variety of predators.

Musk and Mud Turtles—Family Kinosternidae

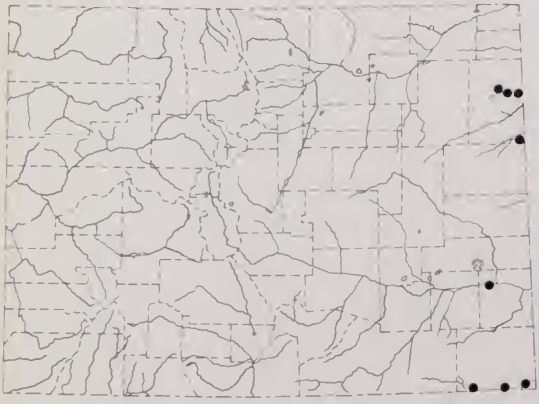
These odoriferous turtles have two pairs of musk glands on the sides of the oval-shaped she The family comprises 23 species restricted to the Americas. Only one of the nine species in t U.S. occurs in Colorado.

Yellow Mud Turtle

Kinosternon flavescens

Photo by L. Livo and S. Wilcox

Recognition: (1) a hard shell; (2) yellow chin and throat, (3) upper shell smooth; (4) five pairs of plates and one unpaired plate on bottom shell; (5) maximum shell length abo 6⅜ inches (162 mm). Males have a spi tipped tail and conspicuous patches of sca on the inner surface of each hind leg.



Distribution of the Yellow Mud Turtle in Colorado

Distribution: Ranges throughout sou central U.S. and northern Mexico. Occurs extreme eastern Colorado at elevations bel 4500 ft. (1372 m).

Habitat and Habits: The yellow m turtle inhabits permanent and intermitt streams, ponds, rain pools, irrigation ditch and soggy fields in areas dominated by gra lands and sandhills. It sometimes is observ traveling overland between bodies of wate

This turtle may be active day or night. sometimes basks in the sun at the edge of t water, but extensive growths of algae on t shell of some individuals indicate that a gr deal of time is spent in the water. The ann

riod of activity usually extends from April October. Winter is spent at the bottom of ols or in underground burrows on land.
Yellow mud turtles emit a foul-smelling usk from glands at the junction of the upper d lower shells when harassed. Otherwise y are mild-mannered and seldom attempt bite.

Breeding: Males become sexually mature hen 4-7 years old, females when 5-8 years old. Courtship and mating usually occur in the water. Females lay 2-4 eggs sometime during summer. Nest sites and hatching dates in Colorado are unknown.

Food: These turtles eat insects, crustaceans, mollusks, amphibians, animal carcasses, and plant material. They usually feed in water but sometimes feed on land.

Subspecies in Colorado: *Kinosternon f. flavescens*.

Pond and Box Turtles—Family Emydidae

This is the largest turtle family, with 80 species occurring nearly worldwide (absent fr Australia and sub-Saharan Africa). Most species are semi-aquatic and have somewhat flatten shells, but a few are terrestrial with high domed shells. Most of the 26 species in the U.S. a found in the eastern part of the country. Only two species inhabit Colorado.

Painted Turtle
Chrysemys picta

Recognition: (1) hard, somewhat flattened shell; (2) pattern of narrow yellow lines on upper shell; (3) yellow streaks on head, neck, and legs; (4) maximum shell length about 9⅞ inches (251 mm). The lower shell of juveni is strongly tinted red or orange. Males a much smaller than females and have lo fingernails.

Distribution of the Painted Turtle in Colorado

Distribution: Occurs throughout most eastern and northern U.S., ranging from treme southern Canada to extreme northe Mexico. Occurs at elevations mostly bel 6000 ft. (1828 m) in eastern Colorado. A occurs in southwestern Colorado at ele tions up to about 7300 ft. (2225 m).

Habitat and Habits: The painted tur typically inhabits permanent ponds, res voirs, marshes, and the slow-moving portic of streams. It seems to be most abundant bodies of water with soft bottoms, aqua plants, and partially submerged logs. seldom wanders far from water but may c onize temporary pools and seasonally flood areas near permanent bodies of water.

This turtle usually emerges from its winter reat in the bottom mud of a pond in March April in Colorado. Activity may continue rough at least mid-November if the weather nains mild. Painted turtles sleep in water at ght. In the morning they crawl onto a log or ore and bask in the sun before feeding. riods of basking may interrupt other activi- s throughout the day.

The home range of a painted turtle may in- ıde several adjacent ponds and turtles metimes are seen crawling on land between nds. Large numbers of turtles often inhabit ingle pond. It is not unusual to see dozens these turtles crowded together on favored ısking logs.

Breeding: Several years are required for ıinted turtles to reach sexual maturity. Males stroke the head and neck of the female with their long fingernails prior to mating. Courtship and mating usually occur in spring but may be observed in summer and fall as well. Females lay 4-20 eggs in a nest dug in soft soil in a sunny area. Nesting in Colorado probably occurs in late June or early July.

Hatchling painted turtles usually are first observed in spring, suggesting that after hatching in late summer (probably August) they spend the winter in the nest before emerging. Perhaps they do not hatch until spring.

Food: The painted turtle feeds in water on a wide variety of living and dead plants and animals.

Subspecies in Colorado: *Chrysemys p. bellii.*

Western Box Turtle

Terrapene ornata

Distribution of the Western Box Turtle in Colorado

Recognition: (1) hard shell; (2) hinged bottom shell; (3) domed top shell usually with yellowish radiating lines; (4) maximum shell length about 5¾ inches (146 mm). The iris and foreleg spots are reddish in males, yellowish in females.

Distribution: Ranges throughout central U.S., from South Dakota to extreme northern Mexico. Occurs throughout most of eastern Colorado, mostly at elevations below 5500 ft. (1676 m). Escaped or released pets often are found in cities or parks where box turtles do not naturally occur.

Habitat and Habits: The western box

turtle inhabits grasslands and sandhills. It is a terrestrial species, but it sometimes enters shallow, slow-flowing streams (Rodeck 1949) or creek pools (pers. obs.) to drink or swim.

Legler (1960) studied this turtle in Kansas. Most of the following information is based on his work. The western box turtle is diurnal in spring and fall. Most activity occurs in early morning and late afternoon during hot summer months. Activity is stimulated by summer rains. The annual activity period usually extends from April to October. Winter is spent underground in burrows dug by the turtles or by other animals.

Box turtles move an average of about 200-300 ft. (60-90 m) per day in summer over a home range of about 5 acres (2 ha). Favorable habitat may harbor 3-6 turtles per acre (1.2-2.4/ha).

Breeding: Most males become sexually mature when 8-9 years old, females when 10-11 years old. The mating season is long; I observed a pair mating on June 8 in Baca County while Smith et al. (1965) observed mating in the same county on August 17. The male mounts the female from the rear and grips her shell with his hind feet. Usually
eggs are laid in May, June, or July in a r
dug in the evening by the female in soft, w
drained soil. Early nesting females may la
second batch of eggs. Eggs hatch abou
months after being laid. Newly hatch
turtles, which are more vulnerable to pre
tion than are the adults, apparently spe
most of their time underground and rarely
observed.

Food: The diet of the western box tu
consists almost entirely of insects, especia
beetles, caterpillars, and grasshoppers.
sometimes searches for insects beneath ca
dung. I have observed box turtles biting d
Texas horned lizards and box turtles
roads, but whether the turtles were attrac
to the decaying flesh or to the insects on
carcasses is unknown.

Subspecies in Colorado: *Terrapene*
ornata.

Remarks: Hundreds of box turtles
killed by automobiles in Colorado each y
Turtles that can avoid humans may live
years.

Softshell Turtles—Family Trionychidae

These are distinctive aquatic turtles generally characterized by a tubular snout and a flattened shell covered by soft, leathery skin. The family includes 23 species occurring in North America, Africa, southern and eastern Asia, and Indonesia. One of the three North American species inhabits Colorado.

Spiny Softshell
Trionyx spiniferus

Recognition: (1) flat, soft, flexible shell; (2) long, tubular snout; (3) maximum shell length about 18 inches (457 mm). Males are much smaller than females.

Distribution: Ranges throughout much of central and eastern U.S. (absent in Northeast). Also inhabits rivers in arid Southwest. Occurs in eastern Colorado at elevations below 5500 ft. (1676 m).

Distribution of the Spiny Softshell in Colorado

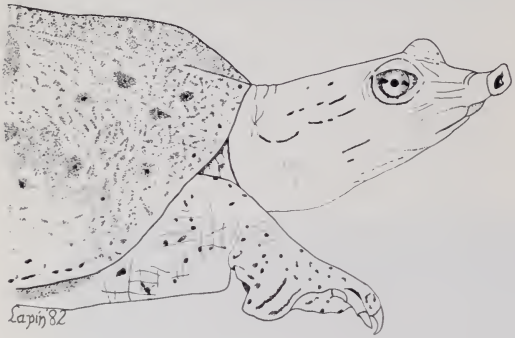
Habitat and Habits: The spiny softshell inhabits large rivers, river impoundments, and pools along intermittent streams. It sometimes colonizes ponds near flowing streams. Bodies of water with sunny, sand or mud banks and soft bottoms are preferred.

This turtle is diurnal and possibly also nocturnal. It is seen most often basking in the sun on a sandy bank or partially submerged log, or swimming slowly at the surface. Softshells often bury themselves in sand or mud in shallow water, occasionally extending the long neck to get a breath of air. The annual activity period usually extends from April to October. Winter is spent in the soft bottom of a pool.

The spiny softshell can extend its long, snake-like neck a surprising distance and may

strike vigorously with its sharp jaws when handled.

Breeding: Packard et al. (1979, 1981*b*) reported that this turtle digs its nest in coarse sand or fine gravel on high sandbars along the South Platte River in Logan County. N ts that had been constructed not more tha a few days earlier were found on June 2 id June 22 in two successive years. Three n ts contained 15, 26, and 33 eggs. Eggs f m these nests began to hatch in the labora y 51-53 days later; hatching under natural c - ditions in Colorado probably occurs August.



Food: Softshells forage in the wa Crayfish and insects are the major foods, mollusks, worms, fishes, amphibians vegetation also are eaten.

Subspecies in Colorado: *Triony hartwegi.*

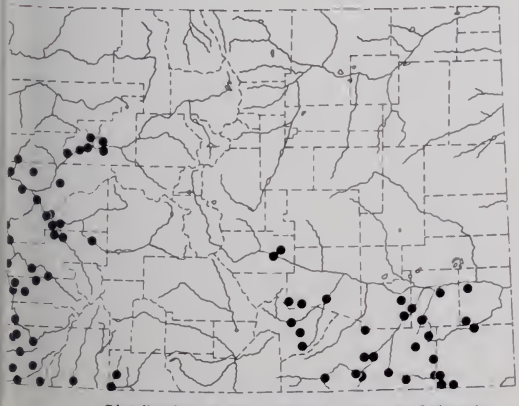
LIZARDS

Iguanids—Family Iguanidae

The iguanids are primarily a New World group, but a few species occur in Madagascar and Fiji. A diverse array of about 610 species is included in this family. Many species are small, but the iguana (*Iguana iguana*) sometimes reaches 72 inches (almost 2 m) in length. Iguanids generally are conspicuous arboreal lizards, but the family also includes many terrestrial species. Of the 44 native iguanids in the U.S., 10 occur in Colorado.

Collared Lizard

Crotaphytus collaris



Distribution of the Collared Lizard in Colorado

Recognition: (1) large head; (2) long tail; (3) two black collars around neck; (4) smooth granular scales on back; (5) upper surface usually with numerous small light dots on a darker background; (6) maximum total length about 14 inches (356 mm). The sides of breeding females are marked with orange spots or bars which fade after the eggs are laid. The head of the male is exceptionally large.

Distribution: Ranges from southwestern and southcentral U.S. to northern Mexico. Occurs mainly south of the Arkansas River in southeastern Colorado and south of the Roan

Plateau in western Colorado. Reaches 7000 ft. (2134 m) in southeast and 8000 ft. (2438 m) in west but is most common below 6000 ft. (1828 m).

Habitat and Habits: The collared lizard inhabits rocky canyons, slopes, gullies, exposures of bedrock, and other rocky areas. It commonly ventures away from its usual habitat into rockless gullies, flat canyon bottoms, and mesa tops where soils are firm. This lizard prefers areas with sparse vegetation. Piñon-juniper woodland, sagebrush, semidesert shrubland, and plains grassland frequently occur in inhabited areas.

Collared lizards emerge from their underground winter retreats in late March or April and are active throughout summer. By September, most of the lizards still active are hatchlings, which may not hibernate until October.

The collared lizard is diurnal. It often can be seen basking on a rocky perch from which it dashes after its food. When running, this lizard sometimes uses only its hind legs. The collared lizard is active throughout the day in spring, but during summer it spends the hot midday period in the shade under a rock or in a crevice.

This lizard is territorial. Males aggressively threaten male intruders with bobbing displays and, if necessary, will attack and chase trespassers from the area.

Breeding: Little is known of the reproduction of this lizard in Colorado. Mating probably occurs in May and June. In Kansas females lay one or two clutches of 1-12 (ave. = 5 or 6) eggs in June and July. Hatchli first appear in August in Colorado. Colla lizards in our area apparently do not br until they are about 22 months old, but needs to be verified.

Food: The diet includes arthropods small lizards. Werth (1972) found that primary foods in western Kansas are gr hoppers and beetles.

Subspecies in Colorado: Some herpe

Head of adult male collared lizard from Baca County

ogists recognize two subspecies in Colora *Crotaphytus c. auriceps*, identified prima by the bright yellow head of the adult m occurs in western Colorado. *Crotaphytu collaris* occurs in eastern Colorado and usu lacks the bright yellow head color.

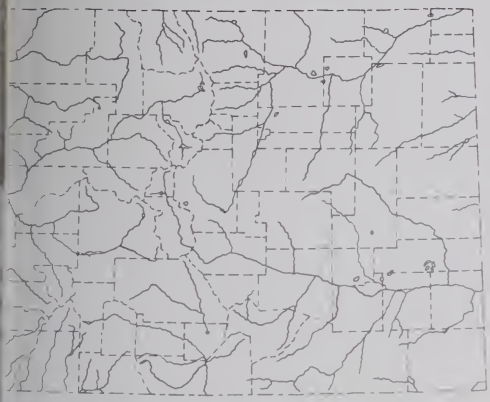
Remarks: A female night snake found Baca County had eaten an adult colla lizard.

Longnose Leopard Lizard

Gambelia wislizenii

Recognition: (1) smooth scales on back; upper surface with numerous small round own spots on light brownish-gray back- ound; light lines across back fade with age; maximum total length about 15⅛ inches 34 mm). Breeding females are brilliantly arked with orange-red on the underside of e tail and on the sides and back; the color des after the eggs are laid. Hatchlings have veral light crossbands and red spots on the ck; the head is boldly marked with alternat- g black and white bars.

Distribution: Ranges throughout south- estern U.S. and northern Mexico. Occurs



istribution of the Longnose Leopard Lizard in Colorado

elow 5000 ft. (1524 m) in extreme south- vestern and westcentral Colorado.

Habitat and Habits: McCoy (1967) tudied this lizard in Mesa County; informa- on in the sections below is based on his bservations.

Leopard lizards inhabit stands of grease- vood and sagebrush on deep sandy soils and road outwash plains in or near the mouths of anyons on the south side of the Grand Valley. On the north side of the valley, eopard lizards occur on clay soils in saltbush- agebrush shrublands and among fairly dense tands of saltbush, greasewood, rabbitbrush, nd cheatgrass near arroyos and in the flood lains of semi-permanent streams. They eem to occur only where soil mounded at the ase of shrubs is riddled with rodent burrows.

This lizard emerges from its winter retreat n late May, long after other lizards have emerged. Adults are active through June and July then disappear underground by early

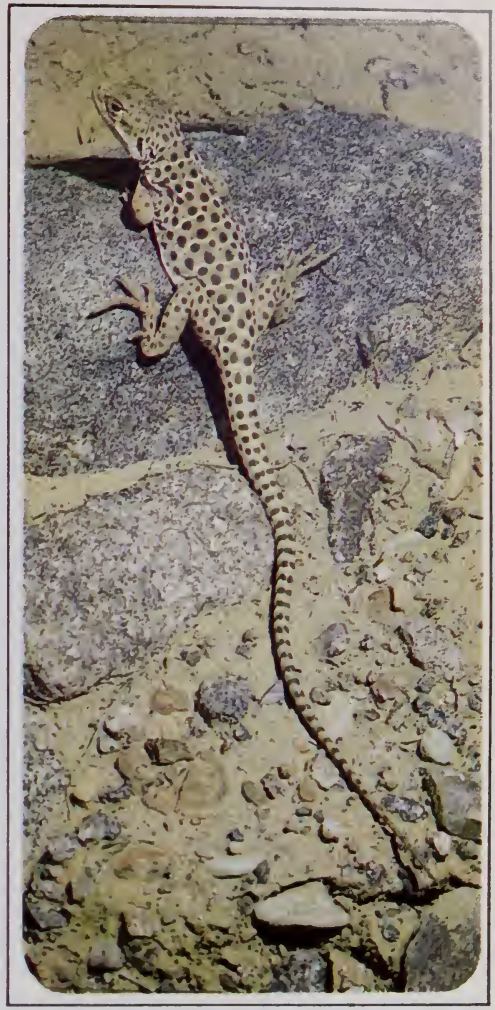


Photo by L. Livo and S. Wilcox

August. Hatchlings may remain active through early September.

Leopard lizards sometimes emerge from their nighttime retreats (often rodent burrows) before 7:30 A.M. After basking in the sun, they actively hunt for food until about 12:30 or 1:00 P.M. when air temperatures approach 95°F (35°C). Activity seems to peak between 10:00 and 11:00 A.M. They spend the hottest part of the day in the shade or underground. About 4:30 or 5:00 P.M. lizards re-emerge for another period of basking or casual feeding, then retreat to a burrow which may be used on several successive nights.

Breeding: Mating occurs in late May and

early June. About 6-10 eggs are laid underground in late June or early July. Hatchlings first appear in early August, 5-7 weeks after the eggs are laid. Young lizards grow rapidly and begin breeding during their second spring at an age of about 22 months (snout-vent length 3⅛-3½ inches; 80-90 mm).

Food: Leopard lizards eat grasshoppers, beetles, lycosid spiders, sphecoid wasps, ant lions, caterpillars, and lizards, including the western whiptail, side-blotched lizard, and eastern fence lizard. Hatchling leopard lizards sometimes eat hatchling fence lizards. McCoy found a leopard lizard that appeared to choked to death while trying to swallow a western whiptail.

Subspecies in Colorado: *Gambelia punctatus*.

Remarks: The leopard lizard formerly was included in the genus *Crotaphytus*.

Lesser Earless Lizard

Holbrookia maculata

Recognition: (1) smooth granular scales on back; (2) no external ear openings; (3) two black marks on each side of belly; (4) maximum total length about 5⅛ inches (130 mm). Females are tinted with orange during and shortly after the breeding season.

Distribution: Ranges from central and southwestern U.S. through central Mexico. Occurs throughout eastern Colorado and in the southwestern corner of the state. Reaches about 5300 ft. (1615 m) in northeastern Colorado and 6000 ft. (1828 m) in the southern part of the state.

Distribution of the Lesser Earless Lizard in Colorado

Habitat and Habits: Lesser earless lizards inhabit sandhills, sandy or gravelly areas along streams, and relatively flat plains having a sparse cover of grass and low shrubs. The lizards generally emerge from their underground winter retreats in March or April. They are diurnal and remain active through October if temperatures are mild. They seek shade during the hottest part of the day in summer. Werth (1972) found that peaks in activity occur between 11 A.M. and noon and between 4 P.M. and 5 P.M. in western Kansas. Vaughan (1961) reported that earless lizards sometimes hide in pocket gopher burrows but seem to prefer the smaller burrows of pocket mice. Sometimes they bury themselves by plunging headfirst into the soil and wriggling the body until hidden.

Breeding: Cuellar and Fawcett (1971) found that the sex organs of males are filled with sperm by early May. Females containing 3-6 large eggs have been found in Colo-

o from early June through mid-July. tchlings have been observed as early as July ut most first appear in August.

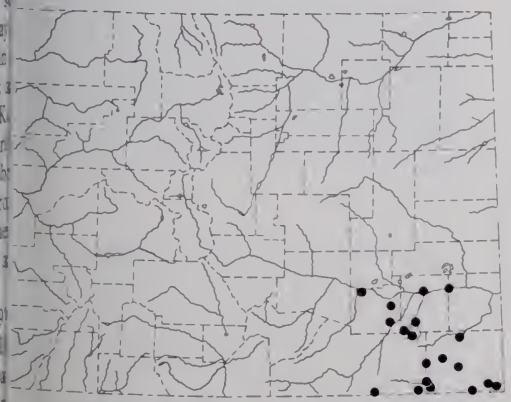
Food: Earless lizards eat a variety of small ertebrates. Bugs, ants, and beetles are the st important foods in western Kansas erth 1972).

Subspecies in Colorado: *Holbrookia m. maculata* occurs in eastern Colorado. According to some herpetologists, another subspecies (*H. m. approximans*), which lacks pale stripes along the back and has a strongly speckled back, is represented in southwestern Colorado.

exas Horned Lizard
Phrynosoma cornutum

Recognition: (1) large spines on back of ead; (2) side of body fringed with two rows of ointed scales; (3) dark bars radiating from eye;) maximum total length 7⅛ inches (181 m).

Distribution: Ranges from southcentral .S. to northern Mexico. Occurs chiefly uth of the Arkansas River at elevations elow 6000 ft. (1828 m) in southeastern Colorado. The Texas horned lizard and short-horned lizard have complementary ranges in Colorado; they are not known to coexist anywhere in the state.



Distribution of the Texas Horned Lizard in Colorado

Habitat and Habits: The Texas horned lizard inhabits plains grassland, especially where there are large patches of bare soil. The lower limit of juniper growth often marks the upper limit of this lizard's habitat in canyons and at the foot of mesas.

These lizards emerge from their underground winter retreats by early May. The annual period of activity generally ends in September. Daily activity may begin as early as 7:30 A.M. They may be active throughout the day, and it is not unusual to see them on asphalt roads even on hot summer afternoons. Activity generally ceases in early evening, but on several occasions I have found Texas horned lizards crouched on warm asphalt roads at dusk or well after dark. The lizards ran quickly off the road when approached on foot.

Horned lizards are well camouflaged and

usually are not seen until they move. They tend to "freeze" until nearly stepped on, then run for cover. They can run rather quickly but are not difficult to capture by hand. Lizards that I have caught have shown their annoyance by arching the neck and jabbing the spines into my hand, by spurting blood onto my shirt from a sinus at the corner of the eye, or (rarely) by biting. Horned lizards may look ferocious, but they are harmless.

Breeding: Virtually nothing is kno about the reproduction of this lizard in Co rado. Mating probably occurs in May June, egg-laying in June or July. Clutch s usually exceeds 20 eggs throughout the ra of this lizard. Hatching probably occurs August.

Food: Ants are the favorite food of t lizard, but other small invertebrates also n be eaten.

Short-Horned Lizard

Phrynosoma douglassii

Recognition: (1) short spines on back of head; (2) sides of body fringed with one row of enlarged scales; (3) maximum total length about 5⅞ inches (149 mm).

Distribution of the Short-horned Lizard in Colorado

Short-horned lizards from Weld (top) and Rio Bla (above) counties.

Distribution: Ranges throughout mu of western U.S. Occurs throughout most western, southern, and eastern Colorado; sent from the high mountains in the cen part of the state and possibly from extre eastern Colorado. Occurs at elevations bel

0 ft. (1737 m) in northeastern Colorado ranges into the mountains to at least 8000 2438 m) elsewhere in the state. Reaches)00 ft. (3353 m) in La Plata County (A. ncer).

abitat and Habits: The short-horned d occurs in a wide variety of habitats in orado, ranging from grasslands and semi- rt shrublands in the lowlands to open ifer forests in the mountains. Sparse vege- on at ground level seems to be common to t areas inhabited by this species. Soil tex- may vary from sandy to rocky. In Colo- the short-horned lizard usually is active ing warm daylight hours from April to ober. When inactive, short-horned lizards y themselves in the soil or hide in rodent rows.

his lizard often closely matches the color he soil in its habitat and usually is not seen il it moves. Like other horned lizards it netimes spurts blood from the corner of eye when disturbed.

Breeding: Unlike other lizards in Colo- o, the short-horned lizard does not lay s; it gives birth to its young. The eggs elop inside the female during spring and y summer, and the young are born in late y or August. Litter sizes of 12 females n Colorado ranged from 13 to 24 (ave. = . Sexual maturity is attained at an age of ut 22 months.

Food: The stomach of a short-horned rd found dead on a road at Mesa Verde, Montezuma Co., by Douglas (1966) contained ants, the favorite food of this species. Beetles, grasshoppers, and bugs also are eaten.

Subspecies in Colorado: Popular field guides indicate that up to three subspecies occur in Colorado. However, my studies (Hammerson 1981) indicate that subspecies of short-horned lizards in Colorado cannot be distinguished adequately using the standard criteria (dorsal color pattern, relative length of the head spines, head proportions). Dorsal coloration and spine length correlate better with local soil characteristics and body size, respectively, than they do with the broad geographic areas supposedly inhabited by the subspecies. I do not recognize any subspecies in this species.

Remarks: A dwarfed population of short-horned lizards inhabits the San Luis Valley (Hahn 1968, Hammerson 1981). The largest individual (an adult female) from the valley measures only 2⅝ inches (66 mm) in snout-vent length. In remarkable contrast, short-horned lizards reach their maximum size in North America only 70 miles (113 km) east of the valley. Kerfoot (1962) found a female in Las Animas County that measured over 4 inches (104 mm) in snout-vent length. Females from southeastern Colorado *average* more than 8 mm longer than the *largest* individual from the San Luis Valley.

Douglas (1966) found a young short-horned lizard in the stomach of a striped whipsnake at Mesa Verde.

Sagebrush Lizard

Sceloporus graciosus

Recognition: (1) small spiny scales on back; (2) tiny (sometimes unkeeled) scales on rear of thigh; (3) no distinct blue patches on sides of throat (throat may be mottled with blue); (4) usually a light strip along each side of back; (5) maximum total length about 5⅞ inches (149 mm). Males have a blue-mottled throat (paler or absent in females) and bright blue patches on each side of the belly.

Distribution: Ranges throughout much of western U.S. Occurs throughout western Colorado at elevations primarily below 7500 ft. (2286 m) in the northwest but up to 8500 ft. (2590 m) in the southwest.

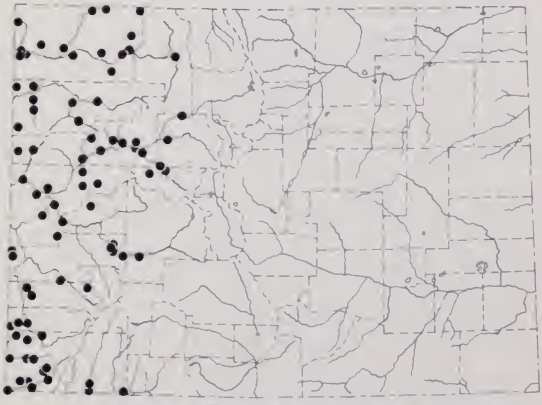
Habitat and Habits: The sagebrush lizard inhabits piñon-juniper woodlands, semidesert shrublands, sagebrush, open montane forests, and mountain shrubland can be found at the base of rocky ledges, exposures of bedrock, and on fine-grai soils far from any rocks. The sagebrush liz often coexists with the eastern fence liz but is less inclined to perch on rocks.

Douglas (1966) and Turner (1974) stuc this lizard in Montezuma and Garfield co ties, respectively, and the information in remainder of this account is based on th observations.

Sagebrush lizards emerge in large numb from their winter retreats in April; mos the early-emerging lizards are males. Ad are active through summer but become sc in September. By the end of September c hatchlings are still active. Activity occ during daylight hours, with peaks at ab 10:00 A.M. and 4:30-5:30 P.M.

Breeding: The sagebrush lizard lays clutches of eggs each year in Garfield Cou and probably also in Montezuma County. first clutch, laid in early June, averages ab five eggs. The second clutch, averaging ab four eggs, is laid in early July. Eggs in the clutch hatch in early to mid-August. The ond clutch hatches in mid-September.

Food: Ants seem to be the most impor food for the sagebrush lizard. Other food clude termites, leaf bugs, leafhoppers, v ous kinds of beetles, butterflies and mo flies, spiders, and pseudoscorpions.



Distribution of the Sagebrush Lizard in Colorado

ubspecies in Colorado: *Sceloporus g. iosus.*

emarks: Douglas found a sagebrush d in the stomach of a striped whipsnake that had been hit by a car at Mesa Verde, Montezuma Co. Turner (1974) reported that a hatchling sagebrush lizard was eaten by an eastern fence lizard in Garfield County.

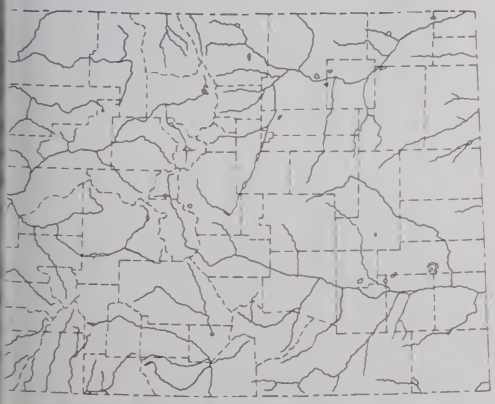
esert Spiny Lizard

Sceloporus magister

Photo by L. Livo and S. Wilcox

Recognition: (1) very large spiny scales on ck; (2) black mark on each side of neck; (3) of head dull orange or yellow in adult; (4) ximum total length about 13 inches (330 n). Males have vivid blue patches on each le of the belly and on the throat. The blue as are faint or absent in females. Juveniles ve distinct crossbands on the back.

Distribution: Ranges throughout much southwestern U.S. and northwestern Mexico. Occurs in extreme southwestern Colorado at elevations below about 5100 ft. (1554 m).



Distribution of the Desert Spiny Lizard in Colorado

Habitat and Habits: The large, colorful desert spiny lizard inhabits shrub-covered dirt banks and sparsely vegetated rocky areas near flowing streams and arroyos. It occurs on soft soils beneath stands of greasewood and rabbitbrush but also frequently perches on large rocks or in vegetation.

The annual period of activity in Colorado is not well known but extends from at least May through September. The desert spiny lizard is diurnal and usually is seen as it basks on a favorite perch, which males aggressively defend against other males. When approached it may do a bobbing "push-up" display or immediately run for cover. Lizards in trees either hide in the pile of woody debris that usually is present at the base of favorite perch trees or climb high into the upper branches.

Tinkle (1976) determined that there were 3 adults and 3 yearlings per acre (7.4/ha) at a site in southern Utah. About 17 percent of the hatchlings, 23 percent of the yearlings,

and 42 percent of the adults survived from one year to the next.

Breeding: Not much is known about the reproduction of this lizard in Colorado. Mating probably occurs in May or June. I found a female carrying six eggs about ready for laying in mid-July. The number of clutches per year and hatching dates in Colorado are unknown. In southern Utah, Tinkle (1976) found that desert spiny lizards annually produce two clutches of about six eggs each. Hatc n begins in early August. Lizards reach s maturity at an age of 22 to 23 months.

Food: Johnson (1966) found that d e spiny lizards in Montezuma County mainly ants and beetles. Other foods inc bugs, grasshoppers, termites, moths and terflies, spiders, and centipedes.

Subspecies in Colorado: *Sceloporu cephaloflavus*.

Eastern Fence Lizard

Sceloporus undulatus

Eastern fence lizards from Weld (top) and Do la (above) counties.

Recognition: (1) spiny scales on back; (2) keeled scales on rear of thigh; (3) maximum total length about 7¼ inches (184 mm). Coloration is extremely variable (see "Subspecies in Colorado").

Distribution: Ranges across most of southern U.S. and northcentral Mexico. Occurs throughout most of Colorado; absent from high mountains in central part of state. Ranges to about 9200 ft. (2804 m) on warm slopes. (See "Subspecies in Colorado" for explanation of symbols on map.)

Habitat and Habits: The eastern fence lizard inhabits sunny, rocky terrain throughout most of Colorado. Vegetation adjacent to and among the rocks may range from coniferous trees in the mountains to semidesert shrublands or grassland in lowland areas. This lizard sometimes is found on buildings, logs, or along steep dirt banks away rocky areas.

The habitat and habits of this lizar northeastern and extreme southeastern C lo rado are entirely different; it is a gro dweller occurring only in areas with o sandy soil. Sand sagebrush is a typica dicator of suitable habitat.

Eastern fence lizards emerge from their

anean winter retreats in March and April. st adults are active for about 5 months, n begin to disappear underground in Sep- ıber and October. Newly hatched lizards nmonly are active through October. Most ivity occurs during mid-to late morning

ern fence lizards from Archuleta (above) and Montezuma nt) counties.

l late afternoon. In summer, the hottest t of the day is spent in the shade.

Ferner (1974) found that the home range of les in the foothills of Boulder County aver- s about 0.2 acres (826 m^2) in spring, over ice that of a typical female. The home ıge of the male shrinks greatly after the eding season. Home ranges often overlap. nkle and Ballinger (1972) estimated the pulation density to be about six adult and arling lizards per acre (15/ha) at a site in esa County. Ferner (1976) found that the mber of juveniles in the foothills of ulder County varied from year to year, but the number of adults remained fairly constant at about 10-14 adults/acre (25-35/ha). No information is available on population densities in the sandhills of eastern Colorado, but they apparently greatly exceed those of rock-dwelling populations.

Breeding: Ferner (1974, 1976) reported information on breeding in the foothills of Boulder County. Bobbing courtship displays occur from May through early July but copulation occurs mostly in early June. A male

may mate with several females who live in his territory. Females lay one clutch of about 8-12 (ave. = 9.4) eggs, usually in late June or early July. Eggs hatch in August.

Tinkle and Ballinger (1972) found that this lizard lays two clutches in May and June in Mesa County. Each clutch averages about eight eggs. Egg-laden females sometimes are observed in July or early August. Eggs hatch from mid-July through early September.

In both Mesa and Boulder counties, eastern

Subspecies of the Eastern Fence Lizard in Colorado

- *Sceloporus u. elongatus*
- *Sceloporus u. erythrocheilus*
- *Sceloporus u. garmani*
- *Sceloporus u. tristichus*
- intergradation between *elongatus* and *tristichus*
- intergradation between *tristichus* and *erythrocheilus*

fence lizards first breed in their second spring at an age of almost 2 years. Some lizards survive and breed again in subsequent years, but very few individuals live beyond an age of 4 years.

Little is known of the reproduction of the sandhill populations in eastern Colorado. Newly hatched lizards have been observed from early July through at least mid-August, suggesting that two clutches of eggs are laid each year. Ballinger et al. (1981) reported that females in sandhill populations in western Nebraska produce two clutches averaging about 5-6 eggs each in June and July. Females begin breeding at an age of 9-10 months.

Food: In rocky areas this lizard usually waits on a perch until it sees a small insect, then dashes after it. I have seen these lizards leap into the air to catch low-flying insects.

Common food items in Boulder County include flies, grasshoppers, beetles, insect larvae, spiders, and ticks (Ferner 1976). Douglas (1966) reported that leafhoppers, beetles, butterflies, moths, wasps, flies, and ants are eaten at Mesa Verde, Montezuma Co. Ladybird beetles, snout beetles, and ants are favorite foods at a lower elevation in Montezuma County (Johnson 1966). Turner (1974) reported that an eastern fence lizard ate a hatchling sagebrush lizard in Garfield County. Werth (1972) found that ants are the most important food in western Kansas.

Subspecies in Colorado: Four subspecies inhabit Colorado. They can be distinguished using the following key.

1A Usually 45 or more scales along middle of back from posterior-most large scale on head to level of rear edge of thigh; light stripes along sides of back crossed by dark wavy crossbands, or stripes absent 2

1B Usually 44 or fewer scales along middle of back; light stripes along sides of back usually distinct and not crossed by ar crossbands . . . . . .

2A Blue patches on throat meet at midli adult male; lips and chin of adults o or red during breeding season; dark crossbands on back . . *S. u. erythroc*

2B Blue patches on sides of throat d meet at midline; lips and chin orange or red; dark crossbands on often faint, discontinuous, or absent . . . . . *S. u. elon*

3A Blue patches on sides of throat . . . . . *S. u. trist*

3B Usually no blue patches on sides of throat . . . . . *S. u. gar*

Sceloporus u. elongatus (■) occurs i western border counties of Colorado, us in rocky areas. Subspecies *erythrocheili* occurs in rocky areas along the eastern m tain front, throughout most of the San Valley and in canyons and on volcanic in southeastern Colorado. *Sceloporus u. mani* (▲) inhabits sandy areas in northea and extreme southeastern Colorado. species *tristichus* (◆) occurs on rocks an in Archuleta County. Intergradation bet *elongatus* and *tristichus* occurs in La County (◐); *tristichus* and *erythrocheilus* i grade in the southwestern corner of th Luis Valley (◑). Subspecies *garmani* an *throcheilus* occupy mutually exclusive ar eastern Colorado and do not intergrade

Remarks: Douglas (1966) found a st whipsnake at Mesa Verde, Montezuma that had eaten an eastern fence lizard. F (1976) saw a racer make an unsuccessf tempt to capture one of these lizards. Lapin (pers. comm.) found an eastern lizard in Weld County that had been im on a pointed branch of a dead herba plant, probably by a loggerhead shri bird).

Tree Lizard
Urosaurus ornatus

Recognition: (1) scales of irregular sizes along middle of back; (2) fold of skin across throat; (3) dark crossbars on back; (4) maximum total length about 5⅜ inches (137 mm). Males have a blue throat and blue patches on the sides of the belly. Belly patches are absent in females.

Distribution: Ranges from southwestern U.S. through northern Mexico. Occurs throughout much of western Colorado at elevations up to at least 6500 ft. (1081 m) in the north and 8000 ft. (2438 m) in the south.

Distribution of the Tree Lizard in Colorado

Habitat and Habits: Tree lizards inhabit cliffs, rocky canyon slopes, and other areas strewn with large boulders. Piñon-juniper woodland and various shrubs typically are scattered through the habitat. Tree lizards characteristically perch on steep rock surfaces, but they often perch in trees (usually junipers) as well. They are agile creatures capable of running up or down a vertical surface. These diurnal lizards generally are active from April through October.

Breeding: Douglas (1966) provided the only information on the reproduction of this lizard in Colorado. He found females containing 3-5 large eggs in mid-May and in late June and early July. Females observed in late May and early June contained only small eggs. These observations suggest that females produce two clutches each year. Newly hatched tree lizards were first observed in late August.

Food: Douglas (1966) reported that tree lizards at Mesa Verde eat a wide variety of small invertebrates, including thrips, bugs, aphids, beetles, caddisflies, butterflies, moths, flies, wasps, ants, and spiders.

Subspecies in Colorado: *Urosaurus o. wrighti.*

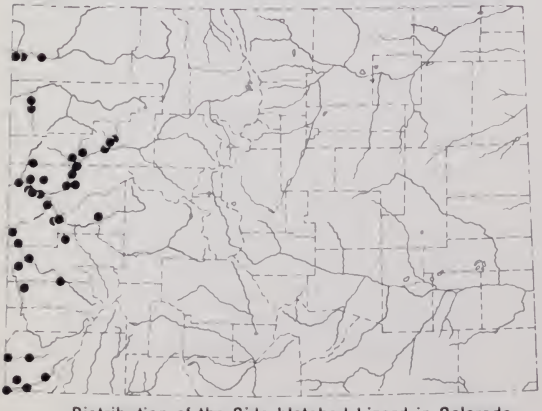
Side-blotched Lizard

Uta stansburiana

Recognition: (1) dark spot on each side of chest; (2) fold of skin across throat; (3) small, unpointed scales on back; (4) upper surface uniformly colored or with numerous small light and dark dots; (5) maximum total length about 5½ inches (140 mm). Breeding males have a blue throat rimmed with orange.

Distribution: Ranges throughout the Great Basin, southwestern U.S., and northern Mexico. Occurs throughout western Colorado at elevations generally below 6000 ft. (1828 m).

Habitat and Habits: The side-blotched lizard typically inhabits washes, rocky canyon slopes, and boulder-strewn ravines, b also occupies flat, shrubby areas in car bottoms where soils are soft and deep. characteristically found in piñon-jun woodlands, semidesert shrublands, and s brush.



Distribution of the Side-blotched Lizard in Colorado

These diurnal lizards emerge in large n bers from their winter retreats in April are active through at least October. Ti (1967) reported that side-blotched lizard Mesa County usually emerge from t nighttime retreats between 8:00-9:00 A.M May and June.

Tinkle (1967) provided information c population of side-blotched lizards in M County. He found that individuals usu move over an area of 0.02-0.07 acres (0 0.03 ha) during their daily activities. H ranges of side-blotched lizards usually o lap; they do not defend territories. Inst there is a dominance hierarchy someth like a "peck-order" in chickens. In diffe years, population density may range fr 10-18 adult lizards per acre (25-44/ha), males and females about equally abund About ⅓ of the adult population consist lizards 2 or more years old.

Breeding: Tinkle (1967) reported following information on reproduction

lesa County. Bobbing courtship displays of ıe male can be observed in April. Prior to)pulation, which lasts a minute or longer, ıe male frequently licks and nips the female. 'nreceptive females reject a male by a shud- ering, bobbing motion that resembles the ıale's courtship bob. Females that are at least years old lay as many as three clutches of)out three eggs each, starting as early as mid- .pril and ending in July. Females breeding)r the first time may lay only two clutches. Hatching begins as early as late July and con- nues through August. Lizards attain sexual maturity during the middle of the breeding season in the year after hatching.

Food: Food habits in Colorado are not definitely known, but these lizards undoubtedly eat a variety of small arthropods such as grasshoppers, beetles, crickets, and ants.

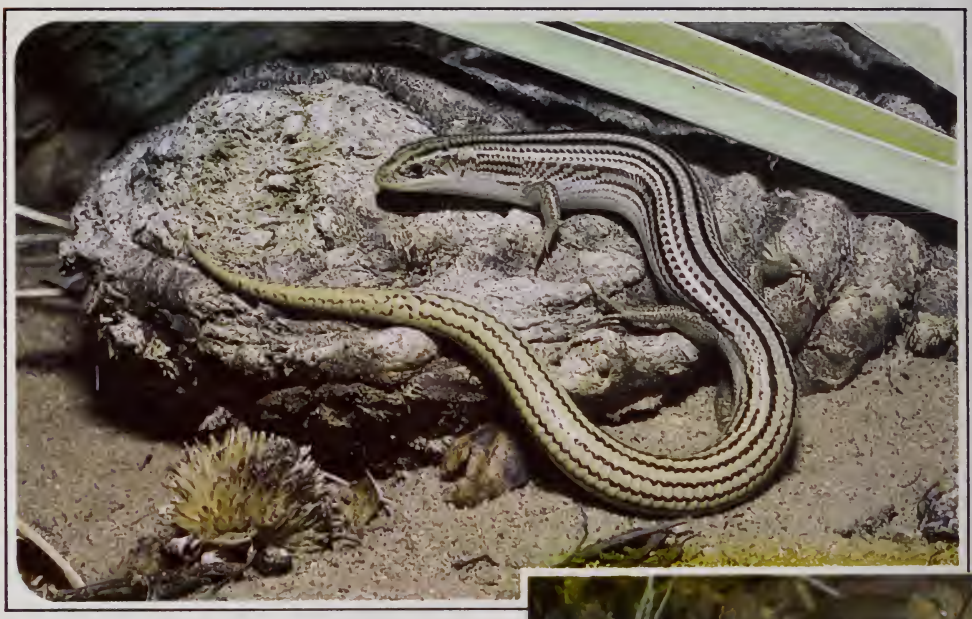
Subspecies in Colorado: *Uta s. uniformis.*

Remarks: Known predators in Colorado include the leopard lizard and striped whipsnake (McCoy 1967, Tinkle 1967). Only about 20 percent of the hatchlings live as long as a year; most die during winter (Tinkle 1967).

Skinks—Family Scincidae

Skinks generally are small lizards with smooth, shiny, overlapping scales and an elongated bod with short legs. Some 1030 species occur throughout the temperate and tropical regions of th world; the center of diversity is in southeast Asia and Indonesia. Two of the 15 species of skinks i the U.S. inhabit Colorado.

Many-lined Skink
Eumeces multivirgatus



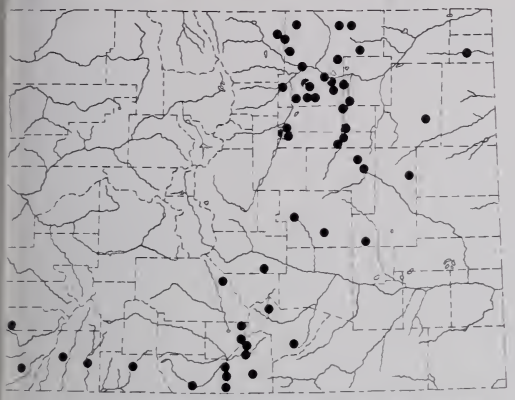
Adult many-lined skinks from Weld (top) and La Pl (above) counties. Lower photo by L. Livo and S. Wilc

Recognition: (1) long slender body; (2) scales on back smooth, shiny, and with rounded rear edge; (3) tail (if unbroken) 1.5-2.0 times as long as head and body, (4) scales on sides of body arranged in horizontal rows, (5) maximum total length about 7⅞ inches (194 mm). Color pattern is variable (see "Subspecies in Colorado").

Distribution: Ranges from Nebraska to Arizona and Texas; isolated populations occur in northern Mexico. Occurs in northeastern, southcentral, and southwestern Colorado at elevations principally below 5500 ft. (1676 m) in the north but up to 8500 ft. (2590 m) in the south.

Habitats and Habits: The many-lined skink inhabits areas of loose sandy soil in eastern Colorado, but it usually occurs in rocky, mountainous areas in the southern part of the state. Maslin (1957) reported that this skink was found "under partially buried, rounded boulders on a steep, open, gras slope in a forested area above a stream-water valley" in Archuleta County. Hahn (196 usually found this skink at the edges of roc canyons in the San Luis Valley but also fou it in a dry, sandy greasewood-rabbitbru association. Hahn observed many-lin skinks in piñon-juniper woodland and und

a log along a stream in the mountains surrounding the valley. Douglas (1966) saw a skink at the edge of an oak thicket at Mesa Verde, Montezuma Co. Many-lined skinks sometimes inhabit vacant lots in cities and residential areas.



Distribution of the Many-lined Skink in Colorado

The many-lined skink is active from April (or late March) to September or October. It is seldom seen away from cover. Usually it is found under objects such as rocks, logs, trash, and cattle dung. Many-lined skinks go underground and are difficult to find during hot, dry weather.

Breeding: Evidence presented by Maslin (1957) indicates that females at an elevation of 8000 ft. (2438 m) in Archuleta County lay 5-7 eggs in late June. Breeding occurs earlier at lower elevations—hatchlings have been observed as early as mid-July at about 5000 ft. (1524 m) in Weld County. Nothing else has been reported on the reproduction of this species in Colorado.

Food: This skink probably eats a variety of small invertebrates. Barry (*in* Taylor 1935) found them "under cow dung in a prairie dog town, feeding on ant larvae."

Subspecies in Colorado: *Eumeces m. multivirgatus* occurs in sandy areas of eastern Colorado. *Eumeces m. gaigeae* occurs in the mountains of southern Colorado. The two subspecies are distinguished as follows:

multivirgatus: adult pale with many dark stripes; juveniles dark with light spots arranged in rows on back, resulting in a basically 2-striped appearance.

gaigeae: adult olive brown with 2 dark-edged light stripes along sides of back; juveniles are dark with 3 light stripes on back.

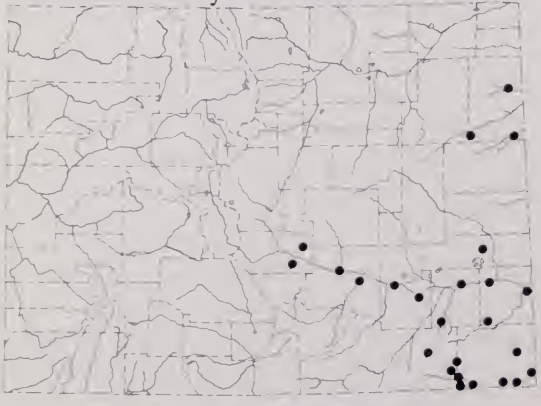
Remarks: The American Kestrel (sparrow hawk) occasionally preys on this lizard in Colorado (Barry, *in* Taylor 1935).

Great Plains Skink

Eumeces obsoletus

Recognition: (1) smooth, shiny scales with rounded edges; (2) scales along sides of body in oblique rows; (3) upper surface pale with numerous dark marks sometimes forming stripes; (4) maximum total length about 13¾ inches (349 mm). Hatchlings are black with white spots on the lips; the tail is blue.

Distribution: Ranges from southern Nebraska through northern Mexico. Occurs mainly south of the Arkansas River at elevations below 7200 ft. (1890 m) in southeastern Colorado and in the Republican River drainage area in northeastern Colorado at elevation below 4500 ft. (1372 m). Reports of this lizard from Weld and Larimer counties are based on the many-lined skink.



Distribution of the Great Plains Skink in Colorado

Adult (top) and juvenile (above) Great Plains skinks fr
Baca County.

Habitat and Habits: The Great Plair skink inhabits rocky slopes and outcrops, ca yon bottoms, and floodplains of streams i southeastern Colorado. It inhabits sandhil in northeastern Colorado.

This skink is most active during warm we ther from April to September. It is seldo seen crawling in the open; usually it is four beneath rocks, logs, wood, or other debris c the ground.

Breeding: Few details are available fro Colorado. In Kansas this skink lays 7-17 (av = 11) eggs under rocks in June or Jul Females remain with the eggs until th hatch. In Colorado, newly hatched skin begin to appear in early August.

Food: The diet includes a variety of sm invertebrates and occasionally small lizard

Whiptails—Family Teiidae

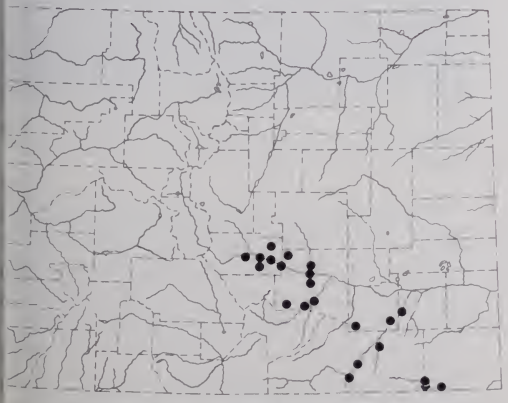
This New World family of some 200 species is most diverse in South America. For the most art, these are long slender lizards with small granular scales on the back and large rectangular ales on the belly. The tongue is long and forked at the tip. Sixteen species of one genus (*Cnemi-phorus*) are native to the U.S.; four of these inhabit Colorado.

Six-lined Racerunner

Cnemidophorus sexlineatus

Recognition: (1) long slender body and ail; (2) small granular scales on back, larger ectangular scales on belly; (3) seven (occa-ionally six) light stripes along back and sides, o light spots in dark areas between stripes; 4) neck, shoulders, and sides of chest often right green in adults; (5) maximum total ength 10½ inches (267 mm). The belly of the nale is pale blue. Juveniles have a blue tail.

Distribution: Ranges throughout south-entral and southeastern U.S. Occurs throughout eastern Colorado at elevations below 6500 ft. (1981 m) in the north and 7500 ft. (2286 m) in the south.



Distribution of the Six-lined Racerunner in Colorado

Habitat and Habits: Six-lined racerunners inhabit plains grassland, sandhills, sandy or gravelly banks and floodplains of streams, and sparsely vegetated areas among rocks at the base of the mountains. They are active during warm, daylight hours from April to October. Most racerunners still active in September and October are hatchlings. Werth (1972) found that racerunners in western Kansas emerge from their burrows each morning when soil temperatures reach about 84-88°F (29-31°C). A peak in activity occurs between 1:00 P.M. and 4:00 P.M. At night and during the cold season racerunners remain underground. Vaughan (1961) reported that abandoned pocket gopher burrows are the favored retreat in sandhill areas.

Racerunners are almost always on the move when out of their burrows. They walk in a somewhat jerky manner, often flicking the tongue. When approached, they head for cover with a quick burst of speed. I have seen these lizards skitter across shallow pools of

water while fleeing from me. Racerunners do not always avoid humans; lizards that I watched foraging on a sandy beach at a lake in Bent County seemed unconcerned by the sunbathers nearby.

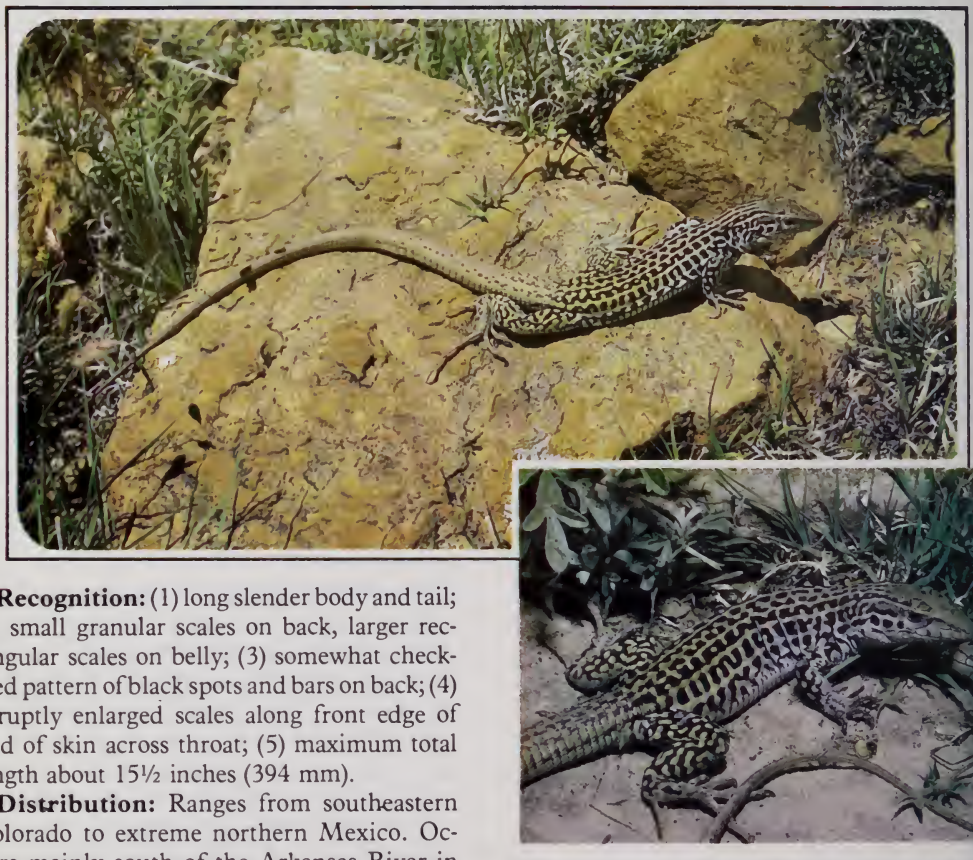
Breeding: Racerunners mate in spring and probably lay their eggs in June or July. Throughout the range of this species clutch size average three eggs, and females may lay more than one clutch each summer. Hatchlings first appear in mid-August in Colorado.

Food: Racerunners eat a variety of small arthropods. The stomach of a racerunner from Boulder County was filled with grasshoppers. The most important items in the diet of racerunners from western Kansas are grasshoppers, caterpillars, spiders, and bugs (Werth 1972).

Subspecies in Colorado: *Cnemidophorus s. viridis*.

Colorado Checkered Whiptail

Cnemidophorus tesselatus



Recognition: (1) long slender body and tail; (2) small granular scales on back, larger rectangular scales on belly; (3) somewhat checkered pattern of black spots and bars on back; (4) abruptly enlarged scales along front edge of fold of skin across throat; (5) maximum total length about 15½ inches (394 mm).

Distribution: Ranges from southeastern Colorado to extreme northern Mexico. Occurs mainly south of the Arkansas River in Colorado, ranging to 6900 ft. (2103 m) in Fremont County (Banta and Kimmel 1965).

Habitat and Habits: The Colorado checkered whiptail inhabits sparsely vegetated canyon slopes, bluffs, and gullies. It can be found in rocky areas and in shrubby areas devoid of rocks. Knopf (1966) studied this lizard in Pueblo County and unless otherwise noted the information in the remainder of this account is based on his observations.

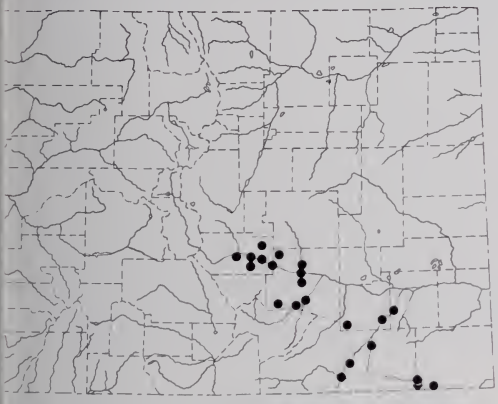
Colorado checkered whiptails (top and bottom) from Ba County.

Checkered whiptails usually emerge fro their subterranean winter retreats in Apri Large adults end the spring-summer activi period in late August but younger lizards ma remain active through mid-October. Daily a tivity in summer usually begins between 8:0 10:00 A.M. and peaks between 10:00 A.M and 1:00 P.M. Checkered whiptails sper

)out 70 percent of the active period search-
ıg for food. They usually are not active after
30 P.M., spending the night in self-dug
ırrows which are defended against other
ıeckered whiptails.

The home range of an adult checkered
hiptail usually is about ⅛ to ¼ acre (0.07-0.1
a). Home ranges are not defended and
:oadly overlap. Population densities of 40
zards per acre (99/ha), not including hatch-
ngs, may be attained in ideal habitat.

Breeding: Although a few males have
:en reported (Taylor et al. 1967), this
)ecies is essentially all female. Maslin (1971)
ıowed that males are not necessary for repro-
uction. Lizards kept in total isolation from
ıe egg stage through sexual maturity pro-
uce eggs that yield fertile female offspring.



Distribution of the Colorado Checkered Whiptail in Colorado

The eggs develop without being fertilized by
nale sperm, a process called parthenogenesis.

Egg laying occurs from mid-June through
ate July. Apparently a single clutch of 1-4
ave. = 2.7) eggs is laid in some years and two
:lutches in other years. Egg laying is not
ıighly synchronized within a population;
)lder lizards often lay their eggs before
younger lizards do. Eggs are laid 7-9 inches (18-23 cm) below the soil surface in burrows dug with the forefeet in soft, well-drained soil. About 2 hours are required to dig the nest, which is typically in a sunny area devoid of vegetation. Several lizards may dig nest burrows in a small area. Checkered whiptails plug the burrow entrance and spend 1-2 days underground when laying. Nest sites are defended during and immediately after laying. Eggs from early nesting lizards hatch from late August to mid-September. Hatching in other nests may continue through early October. Hatchlings dig their way out of the nest burrow and sometimes return to it at night. Some hatchlings overwinter in the nest burrow. Checkered whiptails first breed in their second spring at a minimum snout-vent length of 2¾ inches (70 mm).

Food: Checkered whiptails eat a variety of small arthropods.

Remarks: Both adult and hatchling coachwhips are known to eat these lizards. Probably 80 percent of the checkered whiptail population survives from one year to the next. Some individuals live 5 years or more.

This remarkable species is thought to have arisen through hybridization between other species of whiptails not more than a couple of hundred years ago. Studies of chromosomes by Wright and Lowe (1967) indicate that some populations originated as a result of hybridization between *Cnemidophorus tigris* and *C. gularis*; these checkered whiptails possess two copies of each chromosome, one from each parent species. Other populations originated when one of these hybridized with *C. sexlineatus*; lizards in these "double hybrid" populations each possess three copies of each chromosome, one from each of the three parent species. Populations of the new species, *C. tesselatus*, are maintained through parthenogenesis (see above), not through continued hybridization between the parent species.

Western Whiptail

Cnemidophorus tigris

Recognition: (1) long slender body and tail; (2) small granular scales on back, larger rectangular scales on belly; (3) dark marks on back and sides with yellowish background; (4) scales immediately anterior to fold of skin across throat not abruptly enlarged; (5) maximum total length about 12 inches (305 mm).

Distribution: Ranges throughout the Great Basin, southwestern U.S., and parts of northern Mexico. Occurs throughout most of western Colorado at elevations below 6000 ft. (1828 m).

Habitat and Habits: McCoy (1965, 1974) studied this lizard in Mesa County and most of the information in this account is based on his observations. The western whiptail inhabits nearly all lowland habitats occurring in the arid river valleys of western Colorado. Openly spaced stands of greasewood or piñon-juniper on friable soils seem to comprise ic habitat.

Western whiptails emerge from their wi retreats, which may be used by more than lizard, about the first of May. Activity stea diminishes after May, and by mid-Septem all adults have gone underground. Ha lings may be active through mid-Octo Daily activity begins at about 8:00 A. when the soil temperature is 95°F (35°C). tivity peaks between 10:30-11:00 A When the soil temperature reaches 12 (52°C) in early afternoon, lizards retrea underground burrows (dug by the lizard by rodents). The burrows are plugged w occupied. A few lizards may emerge agai late afternoon, but in general little acti occurs then.

The home range of a male western whi averages about ⅓ acre (0.13 ha), that of female about ¼ acre (0.10 ha). Home ra are not defended and broadly overlap. Po lation density is relatively low; one are Mesa County supported only seven liz per acre (17/ha).

Breeding: Courtship and mating occu early to mid-June. During this time m often closely follow females. A single cl of eggs is laid underground in mid- to June. Females breeding for the first t usually lay three eggs, older females lay f Eggs hatch in early August about 50 after being laid. Western whiptails first b in their second spring at an age of abou months.

Distribution of the Western Whiptail in Colorado

Food: Western whiptails are able to detect moving prey at distances up to at least 18 ft. (6 m). Important foods in Mesa County include caterpillars, carabid and curculionid beetles, grasshoppers, and spiders. Scorpions and side-blotched lizards are sometimes eaten. Johnson (1966) reported a similar diet for this species in Montezuma County.

Subspecies in Colorado: *Cnemidophorus t. septentrionalis.*

Remarks: The western whiptail is eaten by leopard lizards in Colorado. About 80 percent of the adults survive from one year to the next. Few lizards live more than 6 years.

Plateau Striped Whiptail

Cnemidophorus velox

Recognition: (1) long slender body and tail; (2) small granular scales on back, larger rectangular scales on belly; (3) six or seven light stripes on back and sides; (4) no light spots in dark areas on back; (5) maximum total length about 10¾ inches (273 mm). Young lizards have a bright blue tail.

Distribution: Restricted to the Colorado Plateau in Utah, Colorado, Arizona, and New Mexico. Occurs south of the Roan Plateau in western Colorado at elevations below

Distribution of the Plateau Striped Whiptail in Colorado

Habitat and Habits: The plateau striped whiptail inhabits piñon-juniper woodland, sagebrush, semidesert and mountain shrublands, and lowland riparian habitats. It occurs on rocky slopes and on deep sandy soils in flat areas. This lizard often occurs in areas inhabited by the western whiptail, but it also ranges into more upland habitats where the western whiptail is absent. The annual activity period of this diurnal lizard usually extends from May to September, but hatchlings may be active through at least mid-October.

Breeding: This species is essentially all female and reproduces by parthenogenesis (see account of Colorado checkered whiptail). My observations and those of Douglas (1966) suggest that 3-5 eggs are laid in late June or early July. I have seen newly hatched lizards in early August in Mesa County. Douglas (1966) first observed hatchlings in late August at a higher elevation in Montezuma County.

Food: This lizard probably eats a variety of small arthropods.

SNAKES

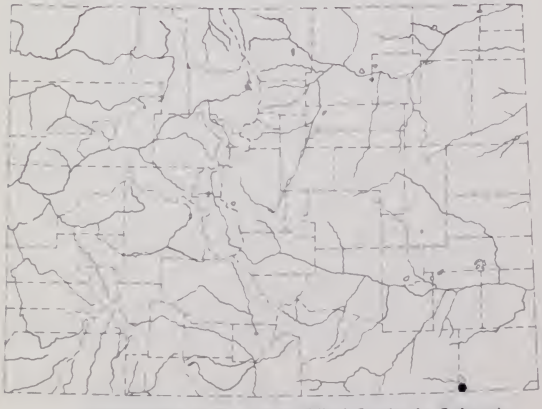
Slender Blind Snakes—Family Leptotyphlopidae

The 64 species in this family occur in Africa, southwestern Asia, southern North America, and much of South America. Slender blind snakes are worm-like, burrowing creatures that have a cylindrical body, short tail, vestigial eyes, and teeth present only in the lower jaw. One of the two species in the United States inhabits Colorado.

Texas Blind Snake

Leptotyphlops dulcis

Recognition: (1) slender worm-like body; (2) scales on belly the same size as those on the upper surface; (3) vestigial eyes, apparent only as a dark spot on each side of the head; (4) maximum total length 10¾ inches (273 mm



Distribution of the Texas Blind Snake in Colorado

Distribution: Ranges from southcentr U.S. through northern Mexico. Definite known to occur in Colorado only in extrer southwestern Baca County at an elevation about 4500 ft. (1372 m). Willard Loud found what was probably a blind snake sou of the Mesa de Maya, Las Animas Coun but was unable to save the specimen as doc mentation of its occurrence there.

Habitat and Habits: The only doc mented occurrence of the Texas blind sna in Colorado was at the base of a rocky, sou facing slope of a flat-bottomed canyon. Piñ pine, junipers, and various shrubs were sc tered over the slope, and grasses, yucca, a cane cactus covered the canyon floor. This cretive snake spends most of its time in dan loose soil between and under rocks. It prov

he open on warm summer nights. The as blind snake probably is active from ut May to September in Colorado.

reeding: Nothing is known about the re-duction of this snake in Colorado. Else-re, females lay 2-7 eggs in underground ties in late June or July, often remaining the eggs after laying them. Several ales may nest in a small area.

ood: Texas blind snakes eat termites, ants, and the eggs, larvae, and pupae of ants. They find ant nests by following the scented trails left by the ants. When raiding ant nests, blind snakes defend themselves against attacking ants by coiling and smearing cloacal fluid over the body. Ants are repulsed by the fluid, and the snake is temporarily protected from their attacks.

Subspecies in Colorado: *Leptotyphlops d. dissectus.*

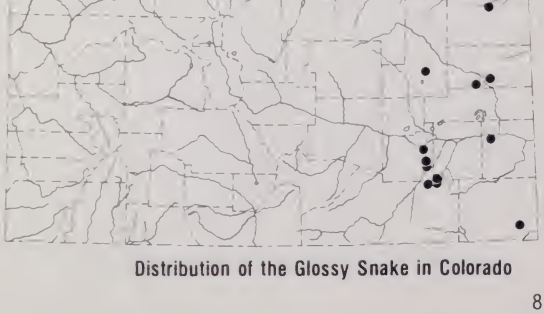
Colubrids—Family Colubridae

About 1550 species are included in this "catch-all" family. Colubrids typically have large scal on top of the head, well-developed eyes, unspecialized teeth, and wide belly scales. These snak are essentially worldwide in distribution. Of the 115 species in the U.S., 22 inhabit Colorad

Glossy Snake

Arizona elegans

Recognition: (1) upper surface with numerous blotches on a pale background; (2) no dark marks on pale belly; (3) single anal scale; (4) smooth scales on back; (5) lower jaw inset; (6) maximum total length about 56 inches (142 cm).



Distribution of the Glossy Snake in Colorado

Distribution: Ranges from southweste and southcentral U.S. to Mexico. Occu below 5000 ft. (1524 m) in eastern Colorac

Habitat and Habits: The glossy snake habits plains grassland and sandhills. It see to be most active at dusk and at night fr June to August, usually when air temperatu is above 68°F (20°C). When inactive, t glossy snake hides underground.

Breeding: Throughout its range t glossy snake lays 3-23 eggs, the average bei a single clutch of about eight eggs. Eggs pr ably are laid in a rodent burrow in June or Ju in Colorado. Hatching probably occurs August or September.

Food: The glossy snake often kills its fo by constriction. Its usual diet includes liza s and small rodents.

Subspecies in Colorado: *Arizona elegans*.

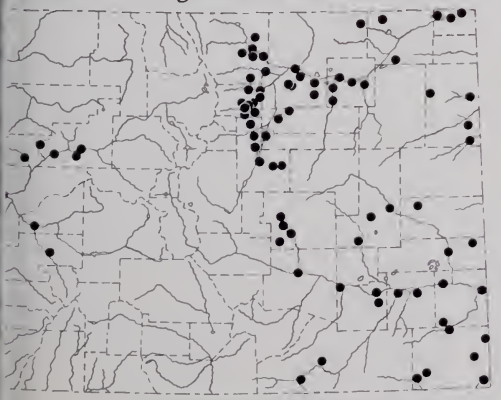
Racer
Coluber constrictor

Adult (top) and hatchling (above) racers from Sedgwick County.

Recognition: (1) slender body; (2) smooth ales on back; (3) no dark marks on cream or llow belly; (4) divided anal scale; (5) nostril rdered by two separate scales; (6) large es; (7) maximum total length usually less an 60 inches (152 cm). The upper surface of e adult is plain brown or olive. Juveniles ve numerous blotches on the back, and the es seem especially large. The blotched pat-rn may be retained for more than a year.

Distribution: Ranges throughout most of .S. Occurs at elevations generally below)00 ft. (1828 m) in eastern Colorado and low about 5500 ft. (1677 m) in western olorado.

Habitat and Habits: The racer is primar- a snake of the grasslands and sandhills in eastern Colorado, but it also commonly occurs in open riparian woodlands and shrubby foothill canyons. The racer inhabits semidesert shrublands, agricultural areas, and lowland riparian habitats in western Colorado.



Distribution of the Racer in Colorado

Racers usually emerge from their winter retreats in April. They remain active until the weather turns cold in fall. Most of the racers seen in September and October are hatchlings. At the western edge of the plains, they spend the winter deep in rock crevices in the Dakota hogback and other sedimentary outcrops. These fast-moving, warmth-loving snakes are active only during warm daylight hours. They are active during mid-morning and late afternoon in hot weather. Racers tend to be rather pugnacious, a trait which sometimes causes the blotched juveniles to be mistaken for rattlesnakes.

Breeding: Racers probably mate in May.

Egg-laden females seem to be most common during mid-June; eggs probably are laid in late June or July. A 42-inch racer from Sedgwick County laid 16 eggs, but no other clutch sizes for this common snake have been reported from Colorado. (see "Subspecies" below).

Swain and Smith (1979) described a communal nest in Boulder County that contained 89 eggs and 29 empty shells from eggs laid in previous years. Evidently several females had laid their eggs in the same nest since the largest clutch ever reported for this species included only 26 eggs; a dozen is more typical. The nest was 18 inches (45 cm) deep beneath a large rock. Eggs began hatching immediately after the nest was discovered in mid-August. All eggs that hatched (82) had done so by August 24.

Food: The racer dashes after small animals and swallows them immediately after capture. Food may be crushed and killed in the jaws or swallowed alive. Despite its scientific name, this snake is not a constrictor (it may pin the prey to the ground under a loop of the body). The diet typically includes small mammals, birds, reptiles, amphibians, and large insects. Known prey in Colorado includes grasshoppers, plains garter snake, and newborn western rattlesnakes. Ferner (1976) saw a racer attack an eastern fence lizard in Boulder County.

Subspecies in Colorado: *Coluber c.* or *mormon* occurs in western Colorado; *C.c. f* or *ventris* occurs in eastern Colorado. The distinguished as follows:

mormon: usually eight upper lip s (labials) on each side of head; row of 8 more scales on underside of tail; ave clutch size 6-7 eggs; maximum snout- length about 29 inches (74 cm).

flaviventris: usually seven upper lip scal each side of head; row of 84 or fewer scal underside of tail; average clutch size 1 eggs; maximum snout-vent length abou inches (121 cm).

Fitch et al. (1981) proposed that *morm* a distinct species, basing their conclusio several morphological, meristic, and eco cal differences between *mormon* and *j ventris* and on the apparent absence of i gradation between these two taxa. How they did not examine any specimens fro area where intergradation might be exp to occur (Wyoming and Montana, an which is as yet inadequately explored h tologically). The one specimen from this for which they presented data conforms cl with *mormon* but was collected withi presumed range of *flaviventris*. Until a tional specimens allow a more defin analysis of the relationship between *flav tris* and *mormon*, I prefer to retain the lat a subspecies.

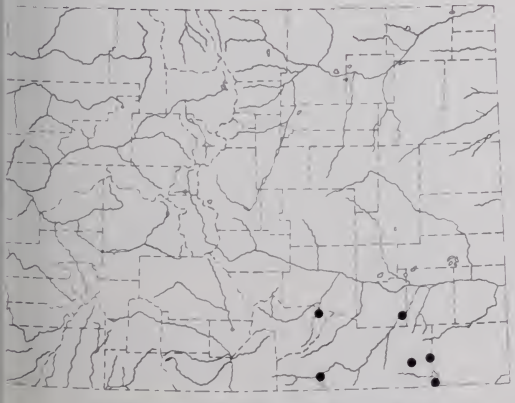
Ringneck Snake

Diadophis punctatus

Recognition: (1) orange ring around neck; (2) belly yellow-orange to red with numerous black spots; (3) maximum total length about 16½ inches (419 mm).

Distribution: Ranges throughout eastern and southcentral U.S. and much of northern and central Mexico. Spotty distribution in western U.S. Occurs below 6000 ft. (1828 m) in southeastern Colorado.

Habitat and Habits: The secretive but locally abundant ringneck snake inhabits plains grassland and canyon bottoms in Colorado, especially near streams. I have observed this snake under flat rocks beneath cottonwood trees, under boards in an open grassy area, and in and under damp rotting wood, all in the flat bottom of a canyon with rocky, juniper- and shrub-covered slopes. Sometimes more than one snake hides under a single rock or log.



Distribution of the Ringneck Snake in Colorado

Ringneck snakes have been found in Colorado from May to September. They seem to be most abundant on the soil surface when conditions are warm and damp. When disturbed these snakes coil the tail, displaying the bright red underside, and emit a smelly substance from the cloacal opening.

Breeding: Gravid females have been observed in Colorado in late May. Eggs probably are laid in late June or early July. In Baca County I found a single ringneck snake egg under a heavy log in a field near a stream in mid-July; near it was the empty shell of an egg probably laid the year before. Five eggs laid in mid-July by a captive ringneck snake from Baca County hatched in early September, but the incubation period and hatching dates under natural conditions in Colorado are unknown.

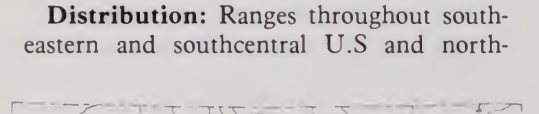
Food: Food habits in Colorado are unknown. Elsewhere this snake eats worms and other invertebrates.

Subspecies in Colorado: *Diadophis p. arnyi.*

Corn Snake
Elaphe guttata

Recognition: (1) upper surface light gray with numerous dark-edged blotches; (2) weakly keeled scales on back; (3) divided anal scale; (4) numerous square-cornered dark marks on belly; (5) dark stripes on underside of tail, (6) maximum total length about 5 ft. (153 cm).

Distribution: Ranges throughout southeastern and southcentral U.S and northeastern Mexico. Occurs below 6000 ft. (3 m) in southeastern Colorado. A disjunct o ulation occurs in the river valleys of e central Colorado and eastern Utah.



Distribution of the Corn Snake in Colorado

Habitat and Habits: The corn sna closely associated with river valleys and a yon bottoms in Colorado. It inhabits a v of vegetation types, including grass n shrubland, and woodland, but usually o not venture far from a permanent or inte tent stream or arroyo. This snake some is seen in rodent-infested ranch outbuil

The corn snake prowls primarily on nights from May to September. Someti can be found under objects on the g during the day.

Breeding: A female found in Otero C in early July was laden with nine large g about ready for laying. Nothing else is k about the reproduction of this snake in C rado.

Food: The corn snake preys most rodents, which are killed by constrictio

Subspecies in Colorado: *Elap emoryi.*

Western Hognose Snake

Heterodon nasicus

Recognition: (1) prominent, up-turned, ade-like snout; (2) belly and underside of l with extensive black areas; (3) maximum al length about 35 inches (90 cm).

Distribution: Ranges throughout central orth America from southern Canada to exico. Occurs in eastern Colorado at eleva-ns below 6000 ft. (1828 m).

Habitat and Habits: The western hog-se snake characteristically inhabits plains assland and sandhills in Colorado. Some-nes it is seen prowling the margins of eams or irrigation ditches. Most activity curs in the morning and late afternoon om April to October.

istribution of the Western Hognose Snake in Colorado

Head of western hognose snake from Yuma County. Note shovel-like snout.

This snake spreads and flattens its head and neck and may strike and hiss vigorously when disturbed. It seldom actually bites. Sometimes it hides its head beneath the coiled body and strikes with the tail when touched. If these ploys fail to put off an attacker, the hognose snake may roll onto its back, regurgitate, defecate, and hang its tongue out of the open mouth. When turned right side up the snake immediately twists onto its back again. If left alone for a few minutes, it turns over and crawls away. This unusual "death feigning" behavior presumably repulses at least some types of predators, but its function under natural conditions has not been documented.

Breeding: The following information obtained by Platt (1969) in southcentral Kansas may apply to Colorado as well. Females first breed in their second spring after which they may breed in alternate years. Eggs are laid in July. Young adults average about five eggs per clutch, large females about 14. Eggs hatch after about 2 months. Hatchling hognose snakes have been observed in Colorado in early September.

Food: Hognose snakes are thought to u their shovel-like snout to dig their food, mai toads and lizards, out of the soil. Buried p is detected by smell. Enlarged teeth at the r of the snake's mouth may be used to defl toads that fill their lungs with air when c tured. The deflated toad is much easier swallow.

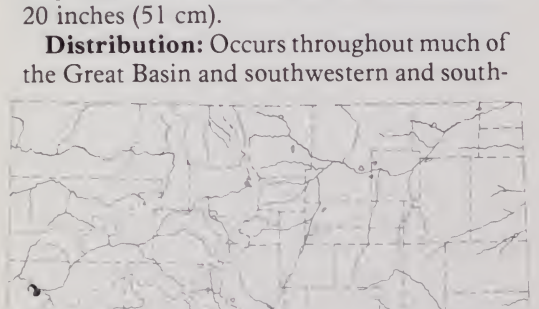
Subspecies in Colorado: *Heterodon nasicus.*

Night Snake

Hypsiglena torquata

Recognition: (1) smooth scales on back; (2) divided anal scale; (3) vertical pupils in bright light; (4) maximum total length about 20 inches (51 cm).

Distribution: Occurs throughout much of the Great Basin and southwestern and south-central U.S., ranging south through Me to Central America. Occurs in southeast Colorado at elevations below 6000 ft. (1 8 m). Known to occur in Colorado Natio Monument (4500-6600 ft., 1372-2012 m) at Mesa Verde (7900 ft., 2408 m) in west Colorado.



Distribution of the Night Snake in Colorado

Habitat and Habits: The night sn usually is associated with rocky slopes canyons sparsely vegetated with pi juniper woodland and/or various shrubs grasses. Occasionally it is found in flat pl grassland miles from the nearest rocks.

Night snakes have been observed in C rado from May to October. They are activ night, hiding under rocks or in crevices (ing the day.

Breeding: Copulating night snakes h been observed in Baca County in late M The snakes were found under a flat roc mid-morning. The meager information a

ble on reproduction indicates that this snake may lay a single clutch of 2-6 eggs in June or July. Hatching probably occurs in August and September.

Food: Night snakes prey primarily on lizards, which are captured beneath rocks or crevices during their nocturnal period of activity. When a night snake encounters a lizard, it bites and holds on. A pair of enlarged teeth at the rear of the snake's mouth pierce the lizard, allowing the saliva, which is toxic to the lizard, to seep in and subdue the struggling prey. The "venom" and the snake's habit of hunting when lizards are most lethargic allow the little night snake to prey on relatively large, powerful lizards; the female of the pair of copulating snakes mentioned above regurgitated a partially digested adult collared lizard. Barry (1933) reported that a night snake found dead on a road at Mesa Verde had eaten a sagebrush lizard.

Subspecies in Colorado: *Hysiglena t. loreala* ocurs in western Colorado *H. t. janii* occurs in southeastern Colorado. They are distinguished as follows:

loreala: two or more loreal scales on each side of head.

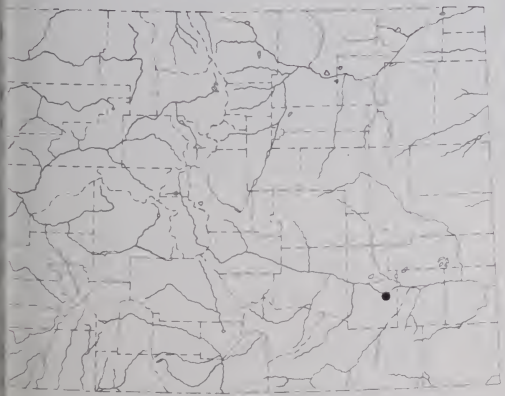
janii: one loreal scale on each side of head.

Common Kingsnake

Lampropeltis getulus

Common kingsnake of southwestern Colorado subspecies (top) and a hatchling from Otero County (above).

Recognition: (1) smooth scales on back; (2) single anal scale; (3) usually two rows of scales on underside of tail; (4) upper surface black or dark brown with either yellowish speckling or broad white or yellowish bands around the body (see "Subspecies in Colorado"); (5) maximum total length about 72 inches (183 cm).



Distribution of the Common Kingsnake in Colorado

Distribution: Ranges throughout southern U.S. and northern Mexico. Known to occur in Colorado only in McElmo Canyon, Montezuma Co., at about 5200 ft. (1585 m) and in the vicinity of La Junta, Otero Co., at

about 4000 ft. (1219 m) (Spencer 1974, Kappel 1977).

Habitat and Habits: Spencer (1974) found this snake in the broad bottom of a canyon through which a permanent stream flows in Montezuma County. Much of the canyon bottom, formerly covered by semidesert shrubland, has been converted to hay fields. Residents of the canyon report that this snake is seen most frequently near human habitations. The common kingsnake has been found near irrigated fields on the floodplain of the Arkansas River and in a rural residential area near an intermittent stream in southeastern Colorado.

This snake may be active either day or night. Nocturnal activity occurs during hot weather. The annual period of activity in Colorado probably extends from April to October.

Breeding: A 37-inch (94 cm) female captured in mid-June in Otero County laid eight eggs in late July. Nothing else is known ab the reproduction of this snake in Colorad

Food: The common kingsnake usu kills its prey by constriction before eating Throughout its range it eats small mamm birds, lizards, birds and reptile eggs, amp bians, and snakes, including rattlesnak Like most snakes, it is immune to rattlesn venom.

Subspecies in Colorado: *Lampropelt californiae*, recognized by the alternat black and white bands encircling the bo occurs in southwestern Colorado. Ki snakes from southeastern Colorado are in grades between the subspecies *holbrooki* a *splendida*; the sides are dotted with yell the middle of the back is black with yellow crossbars, and the cream-colored belly sparsely or heavily marked with black. T yellowish bars across the back are accentua in juveniles.

Milk Snake

Lampropeltis triangulum

Recognition: (1) black, whitish, and red or orange bands around body; (2) smooth scales on back; (3) single anal scale; (4) two rows of scales on underside of tail; (5) maximum total length about 36 inches (91 cm).

Distribution: Ranges from extreme southern Canada to northern South America, possibly the widest distribution of any living snake species. Occurs throughout most eastern and southern Colorado at elevatic below about 8000 ft. (2438 m) and in we central Colorado below about 6000 (1828 m).

Habitat and Habits: The milk snake curs in a wide variety of habitats in Colorac including grasslands, sandhills, canyons a

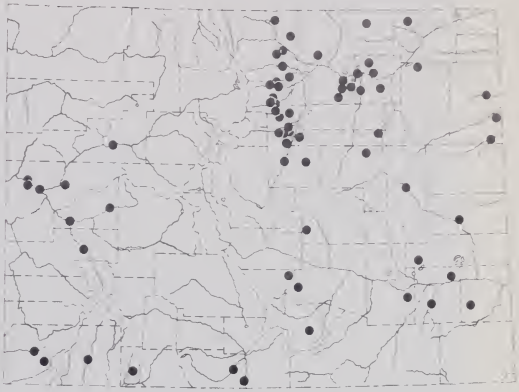
ɔen stands of ponderosa pine in the foothills, ñon-juniper woodland, and arid river lleys. Harris (1963) found this species ıder a rotting log near the mouth of a canyon ɔoded with ponderosa pine and Gambel oak Archuleta County. Hahn (1968) found a ilk snake under debris on the floor of an ›andoned mine in the San Luis Valley.

Milk snakes usually emerge from their subrranean winter retreats in April in eastern ɔlorado. Hahn (1968) observed milk snakes nerging from a den in a rock crevice along e Rio Grande in early June in the San Luis alley. After emergence, milk snakes remain tive until September or October. They may : active day or night depending on the wea-er; activity at dusk and at night occurs more equently in hot weather.

Breeding: A 26-inch (65 cm) female found ı July 4 in a foothill canyon in Boulder ɔunty laid four eggs on July 15 (Smith ›77). Newly hatched milk snakes appear ıring August and September in Colorado.

Food: This snake is a constrictor and eats a riety of small vertebrates, including small ammals, birds, lizards, snakes, and bird and ptile eggs. A milk snake found in the San ıis Valley by Hahn (1968) disgorged seven gs of some unknown reptile.

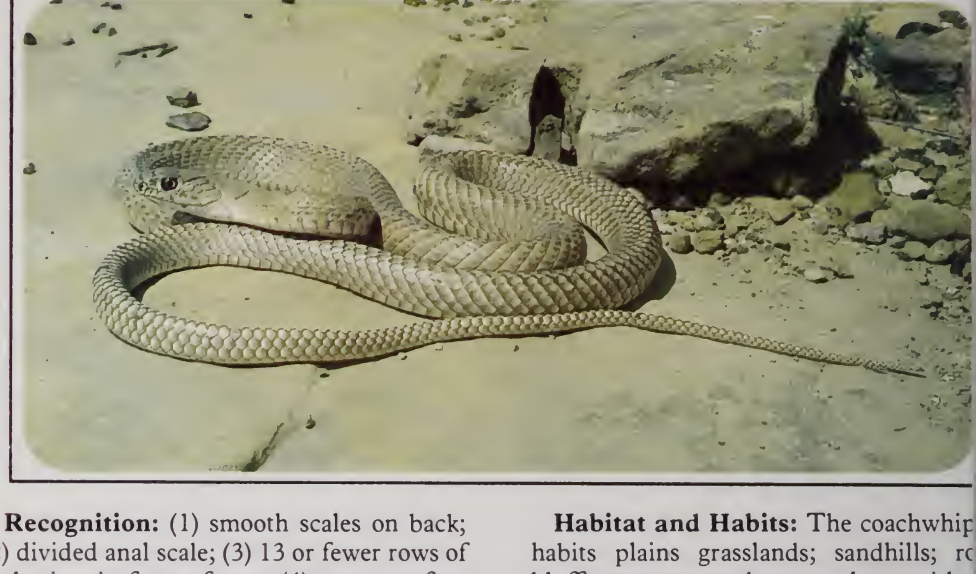
Subspecies in Colorado: According to Williams (1978), *Lampropeltis t. taylori* occurs in westcentral Colorado; intergrades between the subspecies *taylori* and *celaenops* occur in southwestern and southcentral Colorado; intergrades between the subspecies *gentilis* and *multistrata* occur in northeastern Colorado; and the subspecies *gentilis* occurs throughout the remainder of eastern Colorado. Because of the extensive areas of intergradation in Colorado, a detailed description of the ranges and distinguishing characteristics of these subspecies would be pointless.



Distribution of the Milk Snake in Colorado

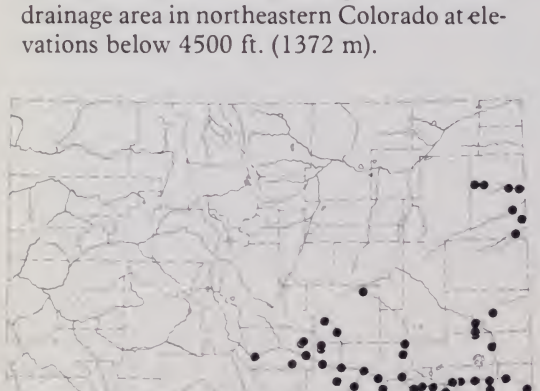
Coachwhip

Masticophis flagellum



Recognition: (1) smooth scales on back; (2) divided anal scale; (3) 13 or fewer rows of scales just in front of vent; (4) upper surface tan, pink, or red, sometimes with dark crossbars on neck; (5) rear portion of body resembles a braided whip; (6) maximum total length about 80 inches (203 cm). Juveniles have dark crossbars that are most prominent on the anterior part of the body.

Distribution: Ranges throughout southern U.S. and northern and central Mexico. Occurs in southeastern Colorado usually below 6000 ft. (1828 m) but has been found at 7700 ft. (2346 m) on the northwestern slope of the Wet Mountains, Custer Co. (Banta 1968). Also occurs in the Republican River drainage area in northeastern Colorado at elevations below 4500 ft. (1372 m).



Distribution of the Coachwhip in Colorado

Habitat and Habits: The coachwhip habits plains grasslands; sandhills; rocky bluffs, outcrops, and canyon slopes with scattered piñon and juniper; open riparian woodlands; and agricultural areas (if not "clean farmed").

Coachwhips usually emerge from their underground winter retreats in April and remain active through September or October. These warmth-loving diurnal snakes have the unfortunate habit of basking on warm roads and often become "road-kills." In a sample of 30 coachwhips observed by me in Colorado over the last few years, 21 had been killed on roads.

Coachwhips are among the fastest snakes and when fully warmed are difficult to catch. When pursued and cornered these snakes usually turn and strike repeatedly. Large snakes may rear up and strike nearly waist high. The bite of a coachwhip may lacerate the skin but poses no more danger than any other small cut. This agile snake sometimes climbs into vegetation to bask in the sun or search for prey.

Breeding: A 59-inch (150 cm) female found dead on a road in Crowley County on June 24 was laden with 15 large eggs almost ready for laying. Hatching dates in Colorado are unknown.

Food: Throughout its range the coachwhip eats small mammals, birds and their eggs, lizards, snakes, and insects. An adult coachwhip found in Baca County had eaten

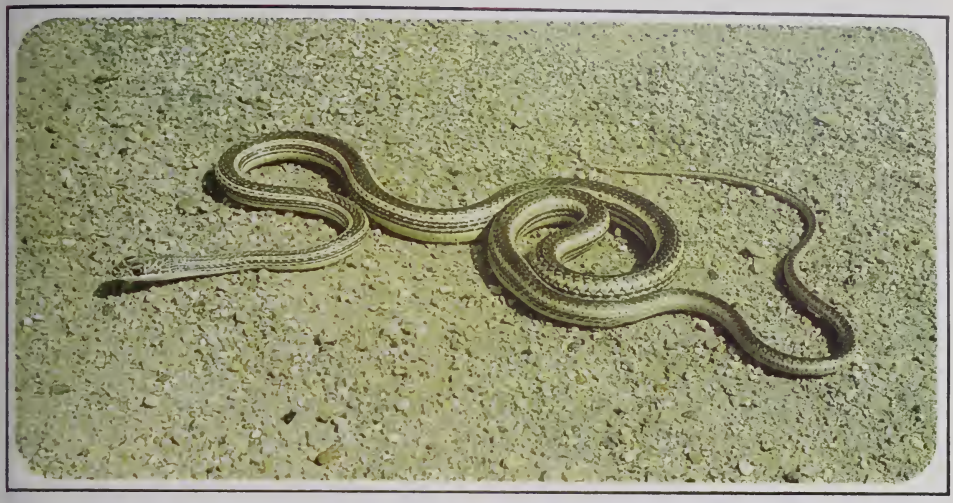
rge grasshoppers. Knopf (1966) reported iat hatchling and adult coachwhips prey on ie Colorado checkered whiptail.

Subspecies in Colorado: *Masticophis f. staceus*. Subspecies *piceus* may possibly occur in extreme southwestern Colorado (Maslin 1959).

Remarks: Chuck Loeffler (pers. comm.) observed a red-tailed hawk carrying an adult coachwhip in its talons in Pueblo County.

Striped Whipsnake

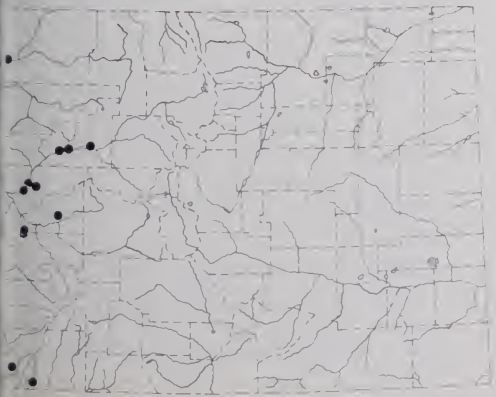
Masticophis taeniatus



Recognition: (1) long slender body; (2) nooth scales on back; (3) divided anal scale; 4) 15 rows of scales at midbody; (5) black and hite stripes along sides of body; (6) maxiium total length about 72 inches (183 cm).

Distribution: Ranges from Great Basin irough extreme southcentral U.S. to central lexico. Occurs throughout western Coloido at elevations below about 7000 ft. (2134) in the north and 8100 ft. (2468 m) in the outh.

Habitat and Habits: Habitats of the striped whipsnake in Colorado include semidesert shrublands in broad basins, piñon-juniper woodlands on mesa tops and rocky slopes, and intermittent stream courses in the bottoms of canyons. This diurnal snake is most active from April to October in Colorado. Like the racer and coachwhip, it depends on its great speed to escape from predators and capture prey.



Distribution of the Striped Whipsnake in Colorado

Breeding: Breeding activities begin in late April or May. During this time males defend small mating territories around females and may "wrestle" with or bite intruding males. Maslin (1947) found two females each carrying four large eggs about ready for laying on June 20 in Moffat County. A 51-inch (130 cm) whipsnake captured on May 29 in Montezuma County later laid five eggs. Newly hatched whipsnakes have been observed in late August in Colorado.

Food: The stomachs of three whipsnakes that had been run over by cars at Mesa Verde contained an adult sagebrush lizard, a young short-horned lizard, and white-footed mouse (*Peromyscus*) fur (Douglas 1966).

Subspecies in Colorado: *Masticophis t. taeniatus*.

Northern Water Snake

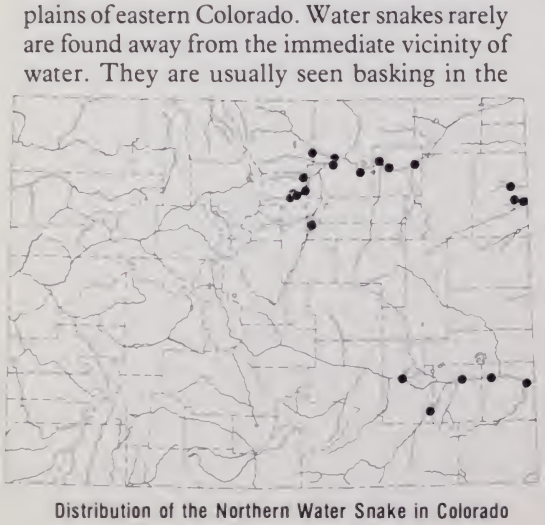
Nerodia sipedon

Photo by L. Livo and S. Wilcox

Recognition: (1) keeled scales on back; (2) divided anal scale; (3) front part of body crossbanded, rear part crossbanded or blotched; (4) bold black, reddish, and yellowish marks on belly; (5) maximum total length about 53 inches (135 cm).

Distribution: Ranges throughout much of eastern and central U.S. Occurs in eastern Colorado at elevations below about 5500 ft. (1676 m).

Habitat and Habits: The northern water snake inhabits streams, reservoirs, marshes, and canals along the major drainages in the plains of eastern Colorado. Water snakes rarely are found away from the immediate vicinity of water. They are usually seen basking in the sun on a log jam in a stream or swimm along the edge of a cattail marsh. Sometir they can be found under rocks or wood at edge of the water. When captured, wa snakes usually attempt to bite and emit a fc smelling liquid from the vent.



Distribution of the Northern Water Snake in Colorado

Water snakes are most active from Apri October in Colorado but sometimes are served in March and November. They n be active day or night; nocturnal activity curs during hot weather.

Breeding: The northern water snake d not lay eggs; it gives birth to its young. Ba water snakes are enclosed in a membran sac from which they emerge during or shor after birth. This snake is a prolific breed giving birth to 8-99 young in a single litt Litter sizes of 14-30 are typical. Birth occ from August to October in Colorado.

Food: The northern water snake usua hunts in shallow water where it feeds fishes, adult and larval amphibians, crayfi and other small animals.

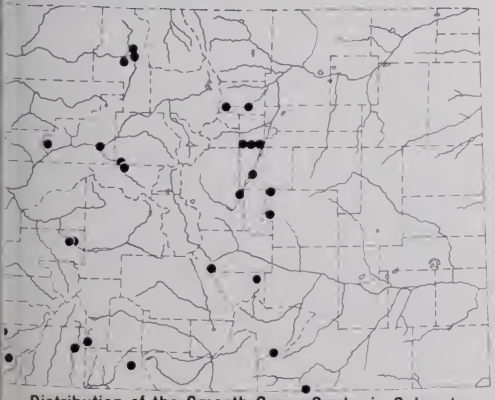
Subspecies in Colorado: *Nerodia sipedon.*

Remarks: This snake formerly was cluded in the genus *Natrix*. That name is n restricted to Eurasian and north Afric water snakes. All North American wa snakes are now included in the ger *Nerodia*.

Smooth Green Snake
Opheodrys vernalis

Recognition: (1) smooth scales on back;) upper surface plain green, belly whitish;) divided anal scale; (4) nostril centered in a ngle scale; (5) maximum total length about 5 inches (66 cm).

Distribution: Ranges across northeastern .S. and extreme southeastern Canada. Isolad populations occur in western and southntral U.S. Occurs between 5500-9000 ft. 676-2743 m) on both sides of the Continenl Divide in Colorado.



Distribution of the Smooth Green Snake in Colorado

Habitat and Habits: The smooth green snake typically inhabits lush growths of herbaceous vegetation along mountain and foothill streams on the east side of the Continental Divide. It occasionally wanders into drier habitats adjacent to riparian vegetation. It occurs in similar habitats west of the Divide but also commonly inhabits mountain shrublands far from water. Most activity of this diurnal snake occurs from May to September. When inactive it hides underground, under rocks or wood, or in rotting logs.

Food: Terrestrial insects and spiders are the primary foods. I found an adult in Custer County which regurgitated two moths and a one-inch-long (2.5 cm) crayfish, suggesting that this snake may occasionally enter water when foraging.

Breeding: Nothing is known about the reproduction of this snake in Colorado. Elsewhere it typically lays six or seven eggs which may hatch as soon as 4 days after laying.

Subspecies in Colorado: *Opheodrys v. blanchardi.*

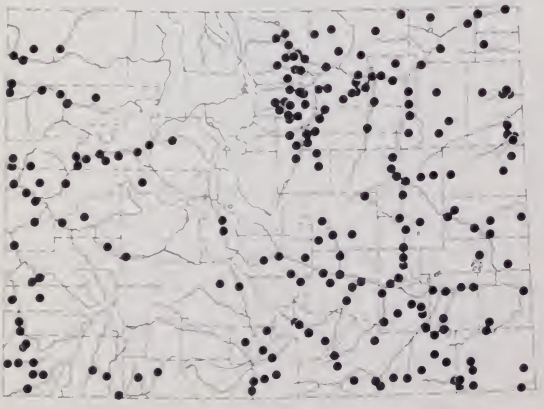
Bullsnake

Pituophis melanoleucus

Bullsnakes from Otero (top) and Garfield (above) co ties. Note triangular head in lower photo (see text).

Recognition: (1) keeled scales on back; (2) single anal scale; (3) row of four large scales across top of head in front of eyes; (4) upper surface yellowish or cream-colored with numerous dark blotches; (5) maximum total length about 100 inches (254 cm).

Distribution: Occurs throughout most of western, central, and southeastern U.S., ranging south to southern Mexico. Occurs at elevations below about 8500 ft. (2590 m) throughout most of Colorado.



Distribution of the Bullsnake in Colorado

Habitat and Habits: The bullsnake c curs in a wide variety of habitats in Colorad including plains grasslands, sandhills, rip ian vegetation, marshes, rocky canyons, sen desert and mountain shrublands, sagebrus piñon-juniper woodlands, open forests ponderosa pine, rodent-infested agricultu lands and ranch buildings, and suburb residential areas.

Bullsnakes emerge from their undergrou winter retreats in April and May. After t spring-summer period of activity, m bullsnakes disappear underground in Se tember and October. Hahn (1968) report

at this snake hibernates deep in volcanic ck crevices in the San Luis Valley, sharing e dens with rattlesnakes, western terrestrial rter snakes, and milk snakes. Yarrow (1875) ated that hundreds of bullsnakes occupied ns in lime concretions formed by spring ater at Pagosa Springs, Archuleta Co. ullsnakes seem to be most active during ylight hours, at dusk, and during the first w hours of darkness; nocturnal activity oc- rs during hot summer weather.

This snake is remarkably variable in its havior. Some individuals lie motionless hen approached, remaining passive even hen handled. Other individuals coil and rike repeatedly, hissing loudly and vibrat- g the tail. The jaws may be spread, giving e head the triangular shape typical of rattle- akes. In dry vegetation the vibrating tail ay produce a sound resembling that made a rattlesnake's rattle. Some individuals oduce a rattling hiss. Unfortunately, many these beneficial snakes lose their lives at the nds of humans because they are such con- ncing "mimics" of rattlesnakes.

Vaughan (1961) found that bullsnakes in stern Colorado usually crawl into aban- oned pocket gopher burrows when pursued. lthough heavy-bodied, bullsnakes are cap- ble climbers and sometimes are found in ees.

Breeding: Information on reproduction in olorado is sketchy. Bauerle (1972) found opulating bullsnakes on May 27 in Weld ounty. A female found on June 12 in oulder County contained 16 eggs large ough to be felt through the belly. A female ptured on July 8 at 7100 ft. (2164 m) in oulder County laid an unknown number of gs a week later. Another female captured on ne 13 in Logan County laid 13 eggs on July 6. Swenson and Rodeck (1948) stated that a male found at 6700 ft. (2063 m) in Boulder ounty laid 20 eggs. Newly hatched bull- akes first appear in September.

Food: The food consists primarily of odents, a diet that should make these snakes elcome in agricultural areas, ranchlands, nd near human habitations. Bullsnakes also at birds and their eggs and lizards. A bull- nake found by Douglas (1966) at Mesa Verde egurgitated a juvenile white-throated wood- rat when captured. Vaughan (1961) twice found bullsnakes swallowing pocket gophers that had been caught in traps. Dartt (1879) reported that a snake found 10 feet (3 m) up in a cottonwood tree along the South Platte River disgorged five young flickers (a kind of woodpecker). Other known foods in Colorado include nestling songbirds and duck (mallard, pintail) eggs.

The bullsnake is a constrictor, suffocating large prey in its powerful coils before swallowing. Small animals may be swallowed alive. Bullsnakes kill rodents in their narrow underground burrows by pinning them to the burrow wall with a loop of the body.

Subspecies in Colorado: *Pituophis m. sayi* (bullsnake) occurs in eastern Colorado; *P. m. deserticola* (Great Basin gopher snake) occurs throughout western Colorado. These two subspecies intergrade in southern Colorado. They are distinguished as follows:

sayi: scale on tip of snout usually narrow and raised well above adjacent scales; black or brown blotches on neck usually not connected to form a dark band on the side of the neck.

deserticola: scale on tip of snout not narrow or raised above adjacent scales; black blotches on neck connected to one another, forming a dark band on the side of the neck.

Some herpetologists have reported that a third subspecies, *P. m. affinis*, occurs in Colorado, but my research (Hammerson 1981) indicates that specimens assigned to *affinis* by Maslin (1959) and Smith et al. (1965) probably should be considered intergrades between *sayi* and *deserticola*. At most, *affinis* might intergrade with either or both of the other subspecies in southern Colorado. The subspecific identity of these snakes is a nomenclatural problem yet to be clarified.

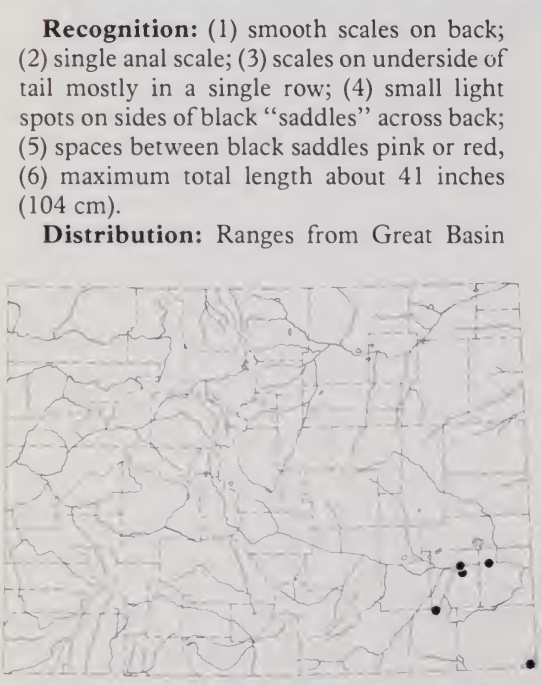
Remarks: An appalling number of these beneficial snakes are killed on roads in Colorado each year. In a sample of 109 bullsnakes observed by me in Colorado over the past few years, 81 (74 percent) had been run over by automobiles, most of them in agricultural areas where they should be ardently protected. One unfortunate snake had been beheaded by an ignorant fisherman. Several bullsnakes found alive on roads had to be rescued from on-coming cars.

Longnose Snake

Rhinocheilus lecontei

Recognition: (1) smooth scales on back; (2) single anal scale; (3) scales on underside of tail mostly in a single row; (4) small light spots on sides of black "saddles" across back; (5) spaces between black saddles pink or red, (6) maximum total length about 41 inches (104 cm).

Distribution: Ranges from Great Basin and southcentral U.S. to central Mexico. O curs below 5000 ft. (1524 m) in southeaste Colorado, ranging north to the Arkans River.



Distribution of the Longnose Snake in Colorado

Habitat and Habits: The longnose snak inhabits plains grasslands and sandhills i Colorado. The annual period of activity is n well known but probably extends from least May to September. This secretive snak usually is active at night. Daylight hours a spent under rocks or in underground bu rows. It sometimes emits a smelly, blood fluid from the vent when disturbed.

Breeding: A female captured on June 1 in Bent County laid eight eggs on July Nothing else is known about the reprodu tion of this snake in Colorado.

Food: The diet of the longnose snak typically includes lizards and their egg rodents, small snakes, and sometimes insect Large prey is killed by constriction befo being swallowed.

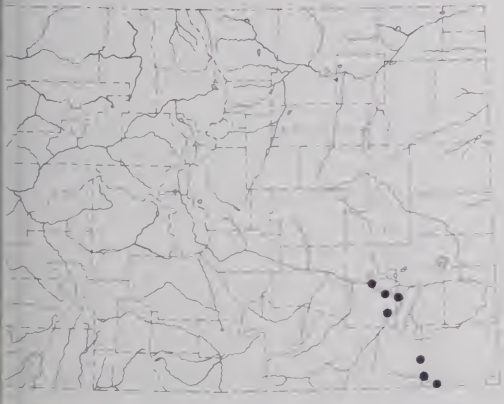
Subspecies in Colorado: *Rhinocheilus tessellatus.*

Ground Snake

Sonora semiannulata

Recognition: (1) 15 rows of smooth scales n back; (2) divided anal scale; (3) upper sur- ıce light brown, gray, or reddish, usually ith dark crossbands (some individuals lack rossbands or have only a collar band); (4) max- num total length about 15 inches (38 cm).

Distribution: Ranges throughout most of outhwestern and southcentral U.S. and orthern Mexico. Occurs in southeastern Colorado at elevations below 5500 ft. (1676 m).



Distribution of the Ground Snake in Colorado

Habitat and Habits: The ground snake occurs in a variety of habitats in areas dominated by plains grassland—sand blows, shale outcroppings, hillsides with flat rocks partially imbedded in the soil, and canyon bottoms. Most activity occurs on warm nights from April to October in Colorado. Ground snakes can be found under rocks and other objects on the ground during daylight hours.

Breeding: Nothing is known about the reproduction of this secretive snake in Colorado. Studies elsewhere suggest that about 4-6 eggs are laid in late June or early July. Eggs probably hatch in late August or September about 2 months after being laid. Mating may occur in both spring and fall.

Food: Throughout its range, the diet of the ground snake is known to include insects, spiders, centipedes, and small scorpions.

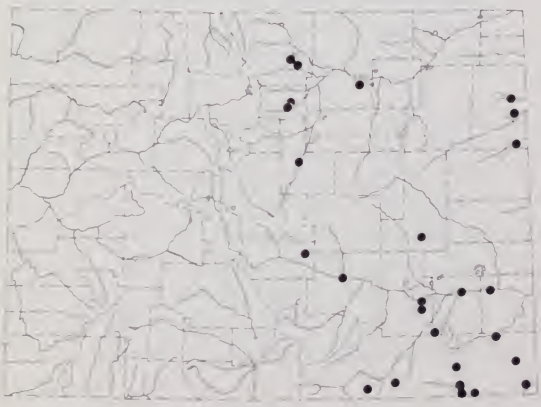
Remarks: Ground snakes in Colorado formerly were known as *Sonora episcopa* (see Frost and Van Devender 1979).

Plains Blackhead Snake

Tantilla nigriceps

Recognition: (1) smooth scales on back; (2) black cap on top of head extends 3-5 scales beyond rear-most large scales on head; (3) upper surface uniformly light brown, belly pink; (4) maximum total length about 15 inches (38 cm).

Distribution: Ranges from southcentral U.S. to northern Mexico. Occurs throughout southeastern Colorado, in the Republican River drainage area in northeastern Colorado, and along the eastern base of the Front Range where it may range to above 7000 (2134 m).



Distribution of the Plains Blackhead Snake in Colorado

Habitat and Habits: The plains bla head snake inhabits flat plains grassland, r ing sandhills, and rocky canyons. It sometimes found in old rubbish dumps. T snake is most active in Colorado from April September. Winter is spent undergrou Blackhead snakes crawl in the open at nig usually when air temperature is above 6 (20°C). During daylight hours they can found beneath rocks, wood, or other deb and in rotting logs near streams.

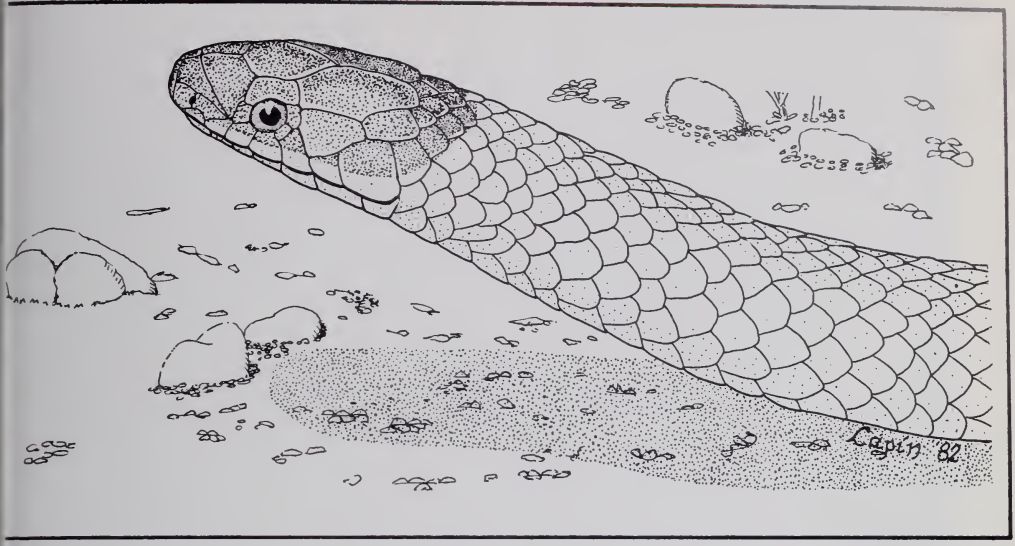
Breeding: Reproduction of this snake h not been studied in Colorado or elsewhe Like other blackhead snakes it probably lay clutch of 1-3 eggs.

Food: Blackhead snakes eat milliped centipedes; spiders; insect larvae, pupae, a adults; and other small soft-bodied inver brates. Enlarged and grooved teeth at the r of the jaw may help introduce the presumat toxic saliva into the prey. The "venom" is n dangerous to humans.

Subspecies in Colorado: *Tantilla nigriceps*.

Western Blackhead Snake

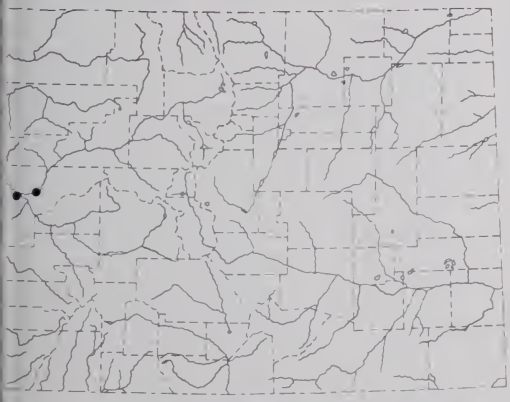
Tantilla planiceps



No photo available.

Recognition: (1) smooth scales on back; 2) dark cap on head usually extends two or fewer scale lengths beyond rear-most large scales on head; (3) upper surface uniformly brownish; (4) maximum total length about 15 inches (38 cm).

Distribution: Ranges from southwestern U.S. to central Mexico. Known to occur along the edge of the Grand Valley in west-central Colorado at elevations of 4750-5058 ft. (1447-1542 m).



Distribution of the Western Blackhead Snake in Colorado

Habitat and Habits: McCoy et al. (1964) found the western blackhead snake in the mouths of large canyons in areas dominated by sandy, rock-laden soils and xerophytic shrubs (greasewood, sagebrush, saltbush). This secretive snake prowls at night, spending daylight hours beneath rocks, in crevices, or in underground burrows. Most activity probably occurs from late April to October.

Breeding: The limited information available for this snake indicates that a typical clutch consists of only one egg. Egg laying and hatching dates in Colorado are unknown.

Food: The diet probably includes a variety of small invertebrates.

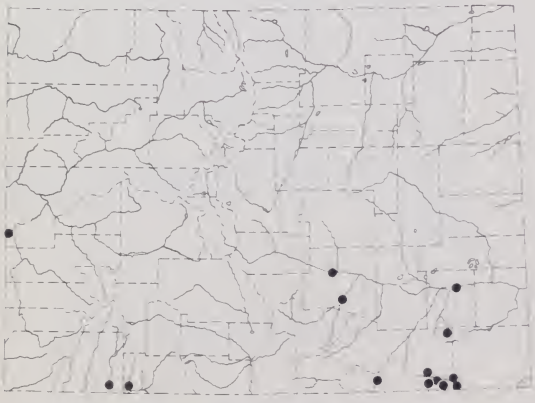
Remarks: Blackhead snakes in western Colorado formerly were known as *Tantilla utahensis*.

Blackneck Garter Snake

Thamnophis cyrtopsis

Recognition: (1) keeled scales on back; (2) single anal scale; (3) two large black blotches on neck; (4) top of head gray; (5) yellowish stripe along middle of back; (6) white stripes on sides (on 2nd and 3rd scale rows above lateral edges of belly scales); (7) heavy black marks on sutures between upper lip scales; (8) maximum total length about 42 inches (107 cm). The western terrestrial garter snake often is mistaken for this species.

Distribution: Ranges from southwestern U.S. through Mexico to Guatemala. Known to occur as far north as the Arkansas River in southeastern Colorado; in John Brown Canyon, Mesa Co., in westcentral Colorado; and in southern La Plata and Archuleta counties in southwestern Colorado. Occurs below 6000 ft. (1828 m) in southeast, below 6500 ft. (1981 m) in west.



Distribution of the Blackneck Garter Snake in Colorado

Habitat and Habits: The blackneck garter snake lives along permanent and intermittent streams, often in the bottom of canyons with rocky, juniper- and/or oak-covered slopes. These snakes frequently wander away from water and sometimes are observed in open grassland, especially near dry washes.

Blackneck garter snakes may be active day or night. Nocturnal activity occurs on warm summer evenings. The annual period of activity usually extends from April to October.

Breeding: Garter snakes give birth to their young; they do not lay eggs. The meager information on reproduction of the blackneck garter snake indicates that litter size usually is less than 10 (but up to 25). Recently born blackneck garter snakes have been found in Pueblo County on August 11.

Food: The diet of this snake includes larval and metamorphosed amphibians. A blackneck garter snake from Las Animas County regurgitated a juvenile Woodhouse's toad when captured.

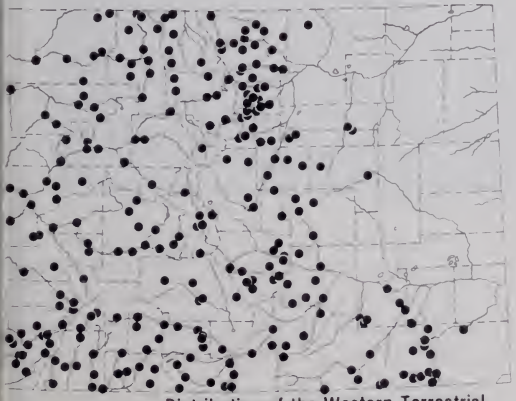
Subspecies in Colorado: *Thamnophis c. cyrtopsis.*

Western Terrestrial Garter Snake

Thamnophis elegans

Western terrestrial garter snakes from Larimer (top) and Las Animas (above) counties.

Recognition: (1) keeled scales on back; (2) ingle anal scale; (3) usually eight upper lip cales on each side of head; (4) often irregular lack marks on belly; (5) often two large black narks on neck; (6) pale (but not white) stripes n sides of body (on 2nd and 3rd scale rows bove lateral edges of belly scales); (7) narrow lark marks (if any) on upper lips confined to ront edge of vertical suture between lip cales; (8) maximum total length about 42 nches (107 cm). Stripe along middle of back s bright, broad, and extends the length of the body in snakes from southeastern Colorado, some parts of northwestern Colorado, and the San Luis Valley; elsewhere the stripe usually fades at mid-body. This snake is often mistaken for the blackneck garter snake, common garter snake, or the checkered garter snake (not known to inhabit Colorado).



Distribution of the Western Terrestrial Garter Snake in Colorado

Distribution: Ranges from southwestern Canada through western U.S. to northern Mexico. Occurs throughout most of Colorado but is absent from most of the plains region in the northeastern quarter of the state. Usually occurs below 11,000 ft. (3353 m) but has been found at 13,100 ft. (3992 m) in San Miguel County.

Habitat and Habits: This garter snake can be found in the vicinity of virtually any

flowing or non-flowing body of water within its broad geographic and elevational range in Colorado. However it is not restricted to riparian situations and frequently wanders far from water into whatever terrestrial habitat happens to be nearby.

Western terrestrial garter snakes emerge from their winter retreats as early as March in lowland areas and remain active through October. The annual period of activity is more restricted in the mountains. Scott (1978) found that this species usually is active from mid-May to mid-September at 8530 ft. (2600 m) in Larimer County. Winter is spent in small mammal burrows beneath rocks near ponds. Hahn (1968) reported that this garter snake hibernates in fissures in volcanic rocks in the San Luis Valley; the dens are shared with bullsnakes, milk snakes, and rattlesnakes.

Like most garter snakes, this snake usually expels a foul-smelling liquid from its anal scent glands when first captured.

Breeding: Despite the abundance of this snake, little is known about its breedin habits in Colorado. Two females fron Boulder and Mesa counties each gave birth t 11 young. A female found dead on a road i Bent County on June 9 contained seven de veloping young. Birth usually occurs i August or September.

Food: The western terrestrial garter snak is known to eat the following foods in Colo rado: leeches, snails, slugs, earthworms, vari ous fishes (including the entrails of "cleaned' fishes), larval and metamorphosed tiger sala manders, larval and metamorphosed frog (leopard frogs, chorus frogs) and toads (spade foot toads, Woodhouse's toad), eastern fenc lizards, small birds, voles, and other rodent (Ruthven 1908, Cockerell 1910, Ellis an Henderson 1913, Blair 1951, Pennock 1960 Hahn 1968, Scott 1978, pers. obs.). Meta morphosing and newly metamorphosed frog and toads seem to be the primary food in lat summer.

Subspecies in Colorado: *Thamnophis e vagrans.*

Plains Garter Snake

Thamnophis radix

Recognition: (1) keeled scales on back; (2) single anal scale; (3) pale stripe on 3rd and 4th scale rows above lateral edge of belly scales; (4) black vertical bars on upper lips; (5) bold yellow or orange stripe along middle of back; (6) maximum total length about 42 inches (107 cm).

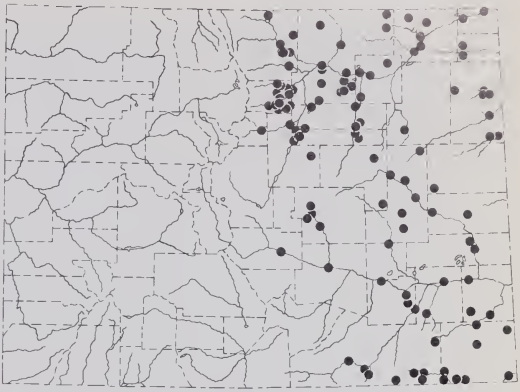
Distribution: Ranges throughout th plains of central North America. Occur throughout eastern Colorado primarily at ele vations below 6000 ft. (1828 m) but ranges t 7000-7500 ft. (2134-2286 m) in some foothil canyons.

Habitat and Habits: The plains garte

ıake can be found in the vicinity of nearly ıy permanent or semipermanent, flowing or ɔn-flowing body of water in the plains of ıstern Colorado. Typically, it inhabits the ıores and shallow waters of marshes but ten strays far from water, appearing in sidential areas, dry grasslands, and sand-lls.

Most plains garter snakes emerge from ıeir winter retreats in April, but a few indi-duals usually can be observed as early as ıid-March. However, Bauerle (1972) re-ɔrted that these snakes hibernate until May ı the Pawnee National Grassland in Weld ounty. Plains garter snakes are diurnal dur-ıg mild spring or fall weather but may be ac-ve day or night during hot summer months. hey often attempt to bite and emit an foul-nelling liquid from the anal scent glands hen handled.

Breeding: I observed courtship activities f a pair of plains garter snakes on May 21 in tero County; the snakes were wrapped ound a clump of cattails a few inches above ater. Bauerle (1972) observed mating in late ıay and early June in Weld County. Females ıat are noticeably pregnant can be observed s early as mid-May, suggesting that mating so occurs in April or possibly in fall. New-orn plains garter snakes usually first appear in late July or early August in Colorado. Different females continue to give birth through September. Litter sizes of seven plains garter snakes from Colorado ranged from 9 to 21 (ave. = 16).



Distribution of the Plains Garter Snake in Colorado

Food: Plains garter snakes in Colorado are known to eat earthworms, grasshoppers, chorus frogs, adult plains leopard frogs, and larval and metamorphosing bullfrogs. Fishes and other amphibians, including larvae, undoubtedly are eaten as well.

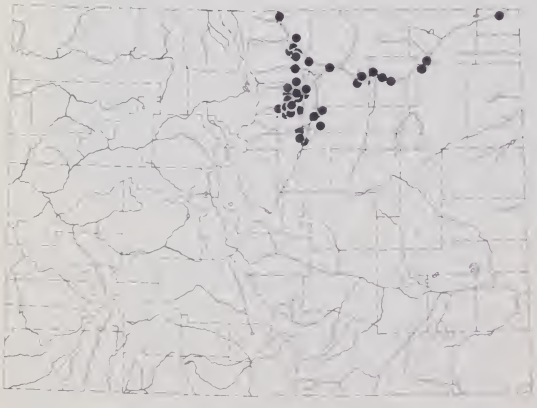
Subspecies in Colorado: *Thamnophis r. haydenii.*

Common Garter Snake

Thamnophis sirtalis

Recognition: (1) keeled scales on back; (2) single anal scale; (3) seven upper lip scales on each side of head; (4) pale stripe on side of body on 2nd and 3rd scale rows above lateral edge of belly scales; (5) red blotches between stripes on back; (6) maximum total length about 49 inches (124 cm).

Distribution: Ranges throughout most of U.S. and southern Canada; absent from most of Great Basin and arid Southwest. Occurs only along the South Platte River and its tributaries at elevations below 6000 ft. (1828 m) in northeastern Colorado. Reports of this species from the San Luis Valley (Yarrow 1875, Fitch and Maslin 1961) and from outside the South Platte drainage in eastern Colorado (Secoy and Brown 1968) are based on *T. elegans* (Hahn 1968; Hammerson 1981 in press).



Distribution of the Common Garter Snake in Colorado

Habitat and Habits: The common garter snake inhabits marshes, ponds, and the edges of streams. For the most part it is restricted to aquatic and riparian habitats along the flood plains of streams. Unlike the plains garter snake, this species is seldom found away from water or at isolated ponds.

Common garter snakes emerge from hibernation in March and April. The annual period of activity generally ends in September or October. These snakes seem to be most active on sunny days, but they probably are also active at night during hot weather.

Breeding: Young are born in late July, August, or September. Litter sizes of three females from Boulder County ranged from 19 to 24.

Food: The diet in Colorado includes various fishes, small metamorphosed bullfrogs, and other larval and adult amphibians. On numerous occasions I have observed common garter snakes capturing and devouring fishes that had been carried through a culvert draining into the shallow edge of a marsh in Boulder County. The snakes wait at the outflow of the culvert and catch the disoriented fishes as they flounder in a shallow pool.

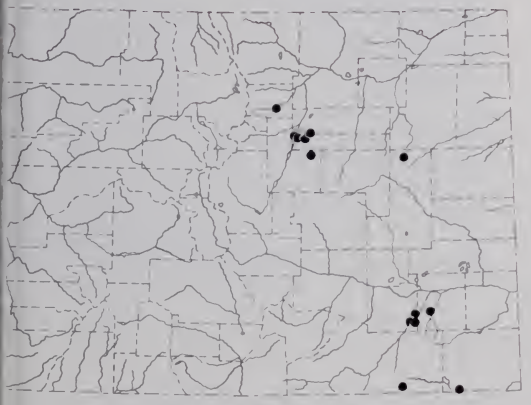
Subspecies in Colorado: *Thamnophis s. parietalis.*

Lined Snake

Tropidoclonion lineatum

Recognition: (1) keeled scales on back; (2) single anal scale; (3) belly whitish, with a symmetrical pattern of black, half-moon-shaped spots; (4) five or six upper lip scales on each side of head; (5) maximum total length about 21 inches (53 cm).

Distribution: Ranges throughout much of central U.S. Probably occurs throughout most of eastern Colorado below 6000 ft. (1828 m).



Distribution of the Lined Snake in Colorado

Habitat and Habits: Lined snakes inhabit flat plains grasslands, canyon bottom grasslands, and grassy vacant lots and gullies in cities. They usually emerge from their underground winter retreats in April and remain active through September or October, prowling at dusk and at night. During daylight hours they hide under rocks, wood, or debris on the ground. Lined snakes are most active after spring and summer rains. When disturbed they void a muddy, smelly substance from the vent and often hide the head beneath the body.

Breeding: Courtship and mating occur in spring or fall. Females give birth to their young in August. Litter sizes of six females from eastern Colorado ranged from 3-10 (ave. = 7).

Food: The lined snake feeds almost exclusively on earthworms.

Subspecies in Colorado: *Tropidoclonion l. lineatum.*

Vipers—Family Viperidae

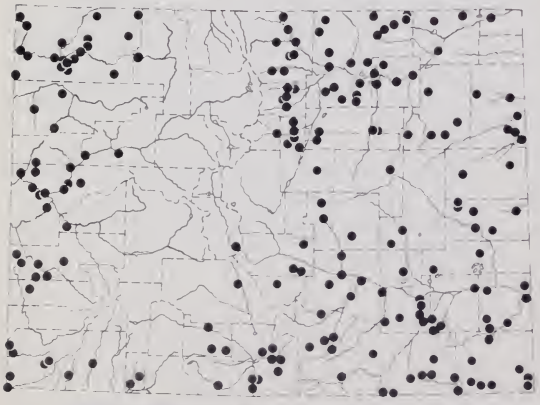
Vipers are dangerously poisonous snakes with hollow, movable fangs at the front of the upper jaw. About 182 species of these broad-headed, narrow-necked snakes occur worldwide, excluding Australia. Pit vipers (subfamily Crotalinae), represented in the U.S. by the rattlesnakes, cottonmouth, and copperhead, have a heat-sensitive pit on each side of the head. The pit is used to locate warm-blooded prey. The largest member of this family is the bushmaster (*Lachesis muta*) of South America, which sometimes approaches 12 feet (360 cm) in length. Two of the 17 species of vipers in the U.S. occur in Colorado.

Western Rattlesnake

Crotalus viridis

Recognition: (1) rattle on end of tail; (2) numerous small scales on top of head; (3) keeled scales on back; (4) wide head, narrow neck; (5) maximum total length about 48 inches (146 cm) in Colorado.

Distribution: Occurs throughout most of western U.S., ranging from southern Canada to northern Mexico. Occurs throughout most of Colorado, reaching an upper elevational limit of 7500-9500 ft. (2286-2896 m) in different areas of the state.



Distribution of the Western Rattlesnake in Colorado

Western rattlesnakes from Otero (top) and Mesa (above) counties. Lower photo by L. Livo and S. Wilcox.

Habitat and Habits: The western rattlesnake occurs in virtually every terrestrial

habitat within its broad geographic and elevational range in Colorado. Typical habitats include plains grasslands, sandhills, mountain and semidesert shrublands, sagebrush, riparian vegetation, piñon-juniper woodlands, and open coniferous forests. Soils in inhabited areas vary from rocky to sandy. Only perennially wet areas seem to be avoided.

Rattlesnakes usually begin to disperse from their winter retreats in prairie dog burrows or crevices in rock outcrops in eastern Colorado in April (Klauber 1937, Ludlow 1981). After the spring-summer period of activity the snakes begin to return to the dens in mid-September. Most snakes are in the dens by early November. Large numbers of rattlesnakes sometimes can be seen at the dens in spring and, especially, fall. At prairie dog towns in Weld County, Perkins found the largest concentrations of rattlesnakes in mid-October and mid-April.

The annual activity period is more restricted at higher elevations. Hahn (1968) reported that rattlesnakes at 7500-8300 ft. (2286-2530 m) in the San Luis Valley usually leave their rock crevice dens in early June and return by early September.

Hill (1943) stated that rattlesnakes in northwestern Colorado leave their dens in rocky, south-or east-facing ridges in early May and return by October or November.

Rattlesnakes are diurnal during the mild weather of spring and fall. During hot summer weather they usually prowl at dusk and at night. When inactve, rattlesnakes retreat to rock crevices, wood piles, or the burrows of small mammals such as prairie dogs, pocket gophers (Vaughan 1961), or kangaroo rats (Smith et al. 1965).

Rattlesnakes are not aggressive. When approached, they usually rattle and assume a coiled, defensive posture. If left alone, rattlesnakes eventually crawl away and seek a hiding place. If cornered or harassed, they will defend themselves vigorously by striking.

Breeding: Smith et al. (1965) reported that during summer months rattlesnakes found under cover often are in pairs, one of each sex. Presumably these are mated pairs. Females in Weld County begin breeding in their second spring and give birth to their first brood when three years old (Klauber 1936). Young adult females average only about six young per brood while older females often give birth to 15-16 young. Overall, females produce a single litter of 4-21 young (ave. = 12) which may be born in late August, September, or early October. Hill (1943) reported that rattlesnakes in northwestern Colorado give birth to an average of 15 young in late August or September. Hahn (1968) observed a female giving birth on September 3 in the San Luis Valley.

Food: The western rattlesnake is known to eat the following prey in Colorado: plains spadefoot, side-blotched lizard, lesser earless lizard, short-horned lizard, a juvenile pheasant, nestling songbirds, pocket mice, prairie dogs, ground squirrels, chipmunks, kangaroo rats, voles, white-footed mice, and cottontails (Klauber 1937, 1972; Hill 1943; Stabler 1943; Smith et al. 1965; Ludlow 1981). See "Reptiles" for information on rattlesnake feeding behavior.

Subspecies in Colorado: Two subspecies occur in Colorado:

Crotalus v. viridis (prairie rattlesnake) occurs throughout eastern Colorado and across most of southern Colorado; *C. v. concolor* (midget faded rattlesnake) occurs in westcentral Colorado. The two subspecies intergrade in southwestern and northwestern Colorado. Subspecies are distinguished as follows:

viridis: usually 25 or 27 dorsal scale rows at mid-body; usually 13 or more scale rows at mid-tail; upper surface green or brown; maximum total length exceeds 33½ inches (850 mm).

concolor: usually 23 or 25 dorsal scale rows at mid-body; usually 12 or fewer scale rows at mid-tail; upper surface cream-colored or yellowish; maximum total length rarely exceeds 26 inches (650 mm).

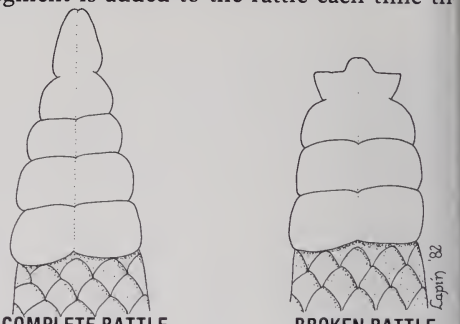
McCoy (1962) allocated rattlesnakes from Montezuma County to the subspecies *nuntius*, but subsequent studies based on additional specimens indicate that rattlesnakes from southwestern Colorado probably should be considered *viridis/concolor* intergrades (Douglas 1966, Hammerson 1981). Intergrades in northwestern and southwestern Colorado may possess various combinations of the two subspecies' characteristics. Some intergrade populations include individuals that look like typical *viridis*, some that resemble *concolor*, and others that are intermediate.

Remarks: Racers and golden eagles (Klauber 1972:1081) are known to prey on rattlesnakes in Colorado, but humans are the most important "predators." Some rattlesnakes are killed because of a legitimate con-

cern for the safety of one's family, but many die at the hands of sadistic individuals in the name of "fun."

Rattlesnakes are indeed dangerous to humans, but during the period 1957 to 1978 only two persons (both children) died from rattlesnake bites in Colorado. Cattle, horses, and sheep sometimes are bitten but rarely die as a result. Contrary to popular belief, large rattlesnakes are potentially more dangerous than small rattlers. In growing from 16 to 31 inches (40 to 80 cm) in total length, the volume of venom that the snake is capable of injecting increases five times (Klauber 1972:812). The venom of baby rattlers is no more potent than that of an adult. There are, however, significant differences in the potency of the venom of the two subspecies in Colorado. Glenn and Straight (1977) found that drop for drop the venom of the subspecies *concolor* is 10 to 30 times more lethal than that of any other subspecies of *C. viridis*. The venom-conducting fangs of rattlesnakes are not as large as one might imagine. Klauber (1939) measured the fangs of hundreds of rattlesnakes from Weld County and found that they vary in length from 0.08 to 0.33 inches (2.0-8.4 mm), larger snakes hav ing larger fangs.

The rattle of a rattlesnake consists of series of horny, interlocking segments. A nev segment is added to the rattle each time th



COMPLETE RATTLE BROKEN RATTLE

snake sheds its skin, which may occur 2- times each year. Captive rattlesnakes ofte develop long rattles, but under natural condi tions the rattle is kept relatively short due t breakage. Klauber (1940) found that mos adult rattlesnakes in Weld County possess 4- rattle segments; only one of 621 snakes had a many as 10 segments in the rattle. Rattle snakes usually enter their second hibernatio with five rattle segments (Klauber 1972:333)

Massasauga

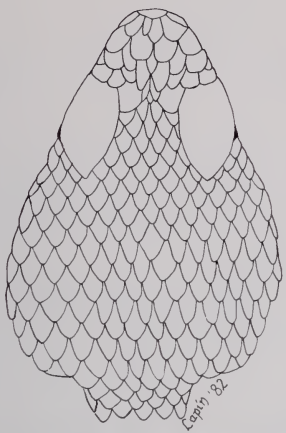
Sistrurus catenatus

Photo by L. Livo and S. Wilcox

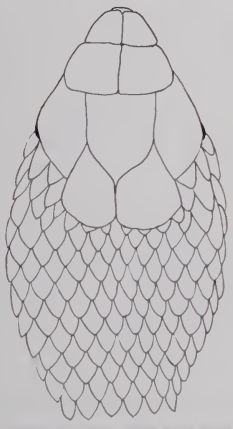
Recognition: (1) rattle on end of tail; (2) nine large scales on top of head; (3) pupil vertical in bright light; (4) wide head, narrow neck; (5) keeled scales on back; (6) total lengt usually less than 24 inches (61 cm) in Colo rado. This rattlesnake closely resembles th

rairie rattlesnake; check head scales for positive identification.

TOP OF HEAD



HEAD SCALES OF WESTERN RATTLESNAKE



HEAD SCALES OF MASSASAUGA

Distribution: Ranges from Great Lakes to northern Mexico. Occurs at elevations below 5500 ft. (1676 m) in southeastern Colorado.

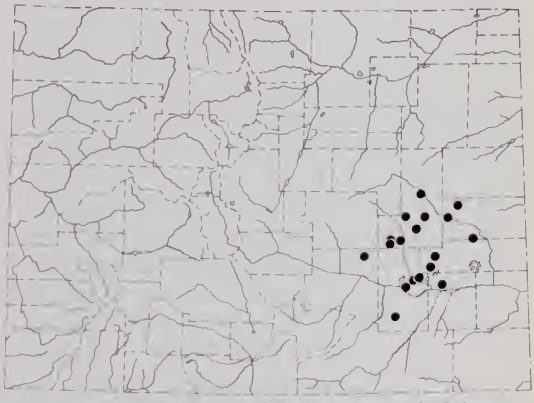
Habitat and Habits: The massasauga inhabits dry plains grasslands in Colorado. The annual period of activity usually extends from April to October. This snake sometimes is active during daylight hours, especially in spring and fall, but prowls mostly in the early evening and at night in summer.

Breeding: Limited information from throughout the range of the massasauga indicates that it mates in fall and probably also in spring. Litter size ranges from 2-19 (ave. = 8).

Food: The primary food in Colorado probably is rodents and lizards. Smith et al. (1965) reported that a massasauga from Crowley County had eaten two white-footed mice (*Peromyscus*). See "Reptiles" for information on rattlesnake feeding behavior.

Subspecies in Colorado: Massasaugas in Colorado are intergrades between the subspecies *edwardsii* and *tergeminus* (Maslin 1965).

Remarks: The massasauga is venomous and the bite is dangerous to humans. However, it is a small, unaggressive species and the bite is rarely fatal.



Distribution of the Massasauga in Colorado

Species of Possible Occurrence in Colorado

Amphisbaenid (*Bipes sp.*). James's (1823) account of the Long Expedition mentions a two-legged amphisbaenid supposedly found near Julesburg in northeastern Colorado. Most herpetologists have dismissed this record as erroneous for two major reasons. First, James claimed that the creature was difficult to capture because it was so swift, impossible behavior for the slow-moving, fossorial *Bipes*. Second, the nearest known occurrence of *Bipes*, a subtropical genus, is thousands of miles to the south in Mexico. Nevertheless, several persons (not herpetologists) have claimed to have seen animals resembling *Bipes* in Colorado and Nebraska and the validity of James' record recently has become a point of debate (see Maslin 1959, Campbell 1980, Gans and Papenfuss 1980, Dundee 1980, Smith and Holland 1981). I cannot seriously consider *Bipes* to be an inhabitant of Colorado until firm documentation of its occurrence is obtained.

Rubber Boa (*Charina bottae*). Bernard and Brown (1978) and Simon (1979) indicated that the rubber boa occurs in Colorado but did not document their reports with specimens. The observational records of Dinosaur National Monument contain a report of a juvenal rubber boa seen in 1979 at Echo Park in Moffat County. Inasmuch as the rubber boa occurs in the Uinta Mountains in northeastern Utah, there is no reason to doubt the record from Echo Park. However, documentation of its occurrence must be obtained before the rubber boa can be added to the state list of amphibians and reptiles.

Eastern Hognose Snake (*Heterodon platyrhinos*). A large specimen (Univ. Colorado Mus. 1006) was collected nine miles west of Lamar, Bent Co., in 1943. Although no others have been found in Colorado, this specimen and others from extreme western Kansas (Collins 1974) suggest the possible natural occurrence of the eastern hognose snake in the Arkansas River Valley in southeastern Colorado.

Brown Snake (*Storeria dekayi*). Ellis and Henderson (1913) listed a specimen (no longer in existence) collected in Las Animas County by A.E. Beardsley in 1883 (Hammerson 1982). The nearest occurrence of the brown snake is in southwestern Kansas. Because several of Beardsley's seemingly doubtful records have proven reliable (Hammerson 1982), I cannot deny the possibility that this snake occurs in Colorado.

Western Ribbon Snake (*Thamnophis proximus*). Fourteen ribbon snakes were collected in Furnish Canyon, Baca Co., in 1931 (Barry 1932); five of these are in the University of Colorado Museum (UCM 11669-11673). These specimens document the only record of the ribbon snake in Colorado. I have searched for this species in Furnish Canyon several times but have found only other *Thamnophis* species. Perhaps the highly amphibious ribbon snake was extirpated from Colorado during the drought years of the 1930s.

Legal Status

Recognizing that amphibians and reptiles are important components of ecosystems, the Colorado Division of Wildlife has enacted laws designed to protect them from overexploitation. Regulations enforced in 1982 are summarized below.

1. **Tiger salamander:** Aquatic larvae: persons possessing a valid fishing license may harvest or possess not more than 120 for use as bait. Open season all year.
2. **Bullfrog:** daily bag and possession limit is 10 frogs. Valid fishing license required. Open season August 15 through September 30.
3. **Snapping Turtle:** classified as a "varmint." May be killed if creating a nuisance or causing damage to property.
4. **Rattlesnakes:** may be killed within municipalities if creating a nuisance or causing damage to property.
5. **Wood frog:** classified as "threatened" in Colorado. Unlawful to collect or possess.

All other species are classified as nongame wildlife and are therefore protected by state law. Contact the Division of Wildlife for current regulations.

Glossary

amphibious: inhabiting both land and water.

amplexus: the sexual embrace of frogs and toads; the male grasps a female from above with his forelimbs while fertilizing the eggs.

anal scale: in snakes, the large scale covering the vent, immediately anterior to the base of the tail on the underside of the body; see "Reptile Terminology."

anal scent glands: glands that open on each side of the vent in some lizards and snakes; secrete a foul-smelling liquid.

anterior: before, or toward the front.

anuran: a frog or toad.

aquatic: water-dwelling.

arboreal: inhabiting trees, or climbing.

arroyo: dry gulch.

arthropod: a joint-legged animal lacking a backbone, especially insects, spiders, and crustaceans.

branchial slit: an opening on the side of the neck of a larval amphibian.

boss: a glandular or bony lump between the eyes of certain toads.

calcareous: containing calcium carbonate, as in the egg shells of reptiles.

carnivorous: feeding on animals.

cloaca: the chamber into which the intestinal, excretory, and reproductive tracts discharge; empties to the outside through the vent.

Colorado Plateau: an elevated area of horizontal sedimentary strata deeply dissected by canyons, encompassing parts of Colorado, Utah, Arizona, and New Mexico.

constriction: in certain snakes called constrictors, a method of killing prey by suffocating it in tight coils of the body; the prey is unable to expand its chest to breathe.

Continental Divide: the high mountain crest that separates streams draining into the Pacific Ocean from those draining into the Atlantic Ocean.

copulation: sexual intercourse.

cranial crests: ridges that border the medial and posterior portions of the eyes in certain toads; see "Amphibian Terminology."

diurnal: active during daylight hours.

dorsal: pertaining to, or situated on or near, the upper side.

dorsolateral folds: ridges of skin along the sides of the back in certain frogs; see "Amphibian Terminology."

ectothermic: deriving body heat from the external environment.

fang: a long, sharp tooth, especially a hollow one modified for the conduction of venom in poisonous snakes.

feces: excrement.

fossorial: adapted for digging; living underground.

gills: feathery organs through which certain aquatic amphibians (especially larvae) obtain oxygen from the water.

granular scales: tiny, rounded, smooth scales characteristic of certain lizards.

gravid: egg-laden; term analagous to pregnant that is applied to egg-laying species.

Great Basin: roughly the area of internal drainage between the Rocky Mountains and Sierra Nevada-Cascade Range, north and west of Colorado Plateau.

habitat: the natural abode of a plant or animal; the place where it is commonly found.

herps: collective, colloquial term for amphibians and reptiles.

herptiles: amphibians and reptiles.

hibernaculum (plural, **hibernacula**): the place where an animal spends the winter or cold season.

hibernate: to spend the winter in a lethargic, inactive state (a term not used in the restricted physiological sense in this book).

Holarctic: inhabiting the Northern Hemisphere.

home range: the area in which the normal daily activities of an individual occur.

hormone: a chemical that is released into the blood at one point and produces an effect at another point.

invertebrates: animals without a backbone.

keeled scales: scales with a straight longitudinal ridge; see "Reptile Terminology."

kettle pond: a water-filled basin in a glacial deposit.

larva (plural, **larvae**): a gill-bearing, water-dwelling amphibian that has not metamorphosed.

ligament: a tough band of tissue connecting two bones.

littoral zone: the shallow area near the shore of a body of water.

medial: toward or in the middle.
metamorphosis: the morphological change from the gill-bearing, water-dwelling larval stage to the gill-less, land-dwelling stage characteristic of most amphibians.
musk: a smelly substance secreted by glands at the sides of the shell of certain turtles.
Neotropical: inhabiting the tropical region of the Americas.
New World: the Western Hemisphere.
nocturnal: active at night.
omnivorous: eating both plants and animals.
territory: portion of the home range that is defended against other individuals of the same species.
total length: the distance from the tip of th snout to the tip of the tail.
type specimen: specimen upon which th name of a species or subspecies is based.
upper lip scales: scales on the upper lip, n including the scale at the tip of the snou see "Reptile Terminology."
venom: poisonous fluid secreted by glanc in the mouth of certain snakes.
vent: anus; the external opening of th cloaca.
vertebrate: animal with a flexible column cartilage or bone along the back, includin fishes, amphibians, reptiles, birds, an mammals.
warts: glandular bumps in the skin of toad

Derivations of Scientific Names

Scientific names usually are derived from Greek or Latin words but sometimes commemorate mous naturalists or denote geographic areas. The formal rules of zoological nomenclature re- iire that all scientific names be latinized, regardless of their derivation. Thus a name honoring homas Say becomes *sayi* and a species first found in Utah might be given the specific name *ahensis*. Usually the names indicate characteristics of the species (e.g. *olivacea*, *punctatus*, *iniferus*). Taxonomists sometimes give a species an inappropriate name in their haste to name a :wly discovered amphibian or reptile; Linnaeus gave the racer the specific name *constrictor* but this ake is not a constrictor. However a name cannot be changed simply because it is inappropriate. For many persons, scientific names are nothing more than an unprounounceable jumble of let- rs. This list of translations and derivations will make the names more meaningful.

cris: locust.
ffinis: related.
mbystoma: *Amby-*, rounded; *-stoma*, mouth.
pproximans: proximate to, similar; probably referring to a similarity to subspecies *maculata*.
renicolor: *areni-*, sand; *-color*, colored.
rizona: pertaining to Arizona, from a Papago Indian word meaning "place of little springs."
rnyi: for S. Arny, who collected the type specimen in Kansas in mid-1800s.
uriceps: *auri-*, golden; *-ceps*, head.
ustralis: southern.
ellii: for T. Bell (1792-1880), English student of turtles.
lairi: for W.F. Blair, modern-day herpetologist at the University of Texas.
lanchardi: for F.N. Blanchard (1888-1937), herpetologist at the University of Michigan.
ombifrons: *bombi-*, lump; *-frons*, forehead.
oreas: northern.
ufo: toad.
alifornіae: pertaining to California, where the type specimen was collected.
atenatus: chained.
atesbeiana: for M. Catesby (1679-1749), English naturalist in southeastern U.S.
elaenops: *celaen-*, dark; *-ops*, face.
ephaloflavus: *cephalo-*, head; *-flavus*, yellow.
helydra: water serpent, turtle.
hrysemys: *chrys-*, golden; *-emys*, freshwater turtle.
nemidophorus: *cnemido-*, leg armor; *-phorus*, bearer.
ognatus: related.
ollaris: with a collar.
Coluber: serpent.
concolor: *con-*, uniform; *-color*, colored.
constrictor: constrictor.
cornutum: horned.
couchii: for D.N. Couch (1822-1897), who collected the type specimen in Mexico in the mid-1980s.
crepitans: rattling.
Crotalus: pertaining to a rattle.
Crotaphytus: pertaining to the side of the head.
cyrtopsis: *cyrt-*, curved; *-opsis*, appearance.
debilis: disabled, feeble.
deserticola: *desert-*, desert; *-icola*, inhabitant.
Diadophis: *diad-*, crown, headband; *-ophis*, snake.
dissectus: referring to the divided labial scale.
douglassii: for D. Douglass (1798-1834), who collected the type specimen near the Columbia River in the early 1800s.
dulcis: sweet.
edwardsii: for L.A. Edwards, who collected the type specimen in Mexico in the mid-1800s.
Elaphe: deer or elk.
elegans: elegant.
elongatus: elongate.
emoryi: for W.H. Emory (1811-1887), Director of U.S. and Mexican Boundary Survey.
episcopa: overseer.
erythrocheilus: *erythro-*, red; *-cheilus*, lip.
Eumeces: *eu-*, good; *-meces*, length.
flagellum: whip.
flavescens: yellow.
flaviventris: *flavi-*, yellow; *-ventris*, belly.
gaigeae: for H. Gaige (1890-1849), herpetologist at the University of Michigan.
Gambelia: for W. Gambel (1819-1849), California ornithologist.

garmani: for S. Garman (1843-1927), herpetologist at Harvard University.
Gastrophyryne: *gastro-*, belly; *-phryne*, toad.
gentilis: belonging to the same stock or race.
getulus: a barbarism.
graciosus: prone to slenderness, graceful.
guttata: spotted.
hammondii: for J.F. Hammond, who collected the type specimen in California in the early 1800s.
hartwegi: for N.E. Hartweg, herpetologist at the University of Michigan.
haydenii: for F.V. Hayden (1829-1887), geological explorer of the American West.
Heterodon: *hetero-*, different; *-don*, tooth.
holbrooki: for J.E. Holbrook (1794-1871), author of *North American Herpetology*.
Holbrookia: as above.
Hyla: a wood or forest.
Hypsiglena: *hypsi-*, high; *-glena*, eye.
insidior: seated or cunning.
intermontanus: *inter-*, between; *-montanus*, pertaining to mountains.
janii: for G. Jan (1791-1866), Italian herpetologist.
Kinosternon: *Kino-*, movable; *-sternon*, chest.
Lampropeltis: *lampro-*, shining: *-peltis*, shield.
lecontei: for J.L. LeConte (1825-1882), who collected the type specimen in California in the mid-1800s.
Leptotyphlops: *Lepto-*, slender; *-typhlops*, blind.
lineatum: lined.
loreala: pertaining to the loreal scale.
maculata: spotted.
magister: chief.
maslini: for T.P. Maslin, curator emeritus in herpetology at the University of Colorado.
Masticophis: *mastic-*, whip; *-ophis*, snake.
mavortium: war-like.
melanoleucus: *melano-*, black; *-leucus*, white.
melanostictum: *melano-*, black; *-stictum*, dotted.
mormon: pertaining to the religious sect inhabiting the area where the type specimen was collected.
multiplicatus: *multi-*, many; *-plicatus*, folded.
multistrata: *multi-*, many; *-strata*, layer.
multivirgatus: *multi-*, many; *-virgatus*, lined.
nasicus: with a pointed nose.
Natrix: water-snake.
nebulosum: clouded dark.
Nerodia: fluid swimmer.
nigriceps: *nigri-*, black; *-ceps*, head.
nuntius: messenger; in Hopi Snake Ceremonial, these snakes are used as messengers to the gods of the underworld (Klauber).
obsoletus: without clear markings.
olivacea: olive-colored.
Opheodrys: *opheo-*, snake; *-drys*, tree.
ornata: decorated.
ornatus: decorated.
parietalis: pertaining to side of body.
Phrynosoma: *phryno-*, toad; *-soma*, body.
picta: painted.
pipiens: peeping.
Pituophis: *pitu-*, pine; *-ophis*, snake.
planiceps: *plani-*, flat; *-ceps*, head.
Pseudacris: *pseud-*, false; *-acris*, locust.
punctatus: spotted.
radix: root.
Rana: frog.
Rhinocheilus: *rhino-*, nose; *-cheilus*, lip.
sayi: for T. Say (1787-1834), entomologist and first biologist to record observations of Coloradan amphibians and reptiles.
Scaphiopus: *scaphio-*, shovel; *-pus*, foot.
Sceloporus: *scelo-*, leg; *-porus*, pore.
semiannulata: *semi-*, half; *-annulata*, ringed
septentrionalis: northern.
serpentina: like a snake.
sipedon: a siren, decoy.
sirtalis: like a garter.
Sistrurus: rattling.
Sonora: pertaining to Sonora.
spiniferus: spiny.
splendida: glittering.
stansburiana: for H. Stansbury (1806-1863), army captain who collected the type specimen in Utah in 1849.
sylvatica: living in the woods.
taeniatus: striped.
Tantilla: small.
taylori: for E.H. Taylor (1889-1978), herpetologist at the University of Kansas.
tergeminus: *ter-*, thrice; *-geminus*, twin, referring to the number of rows of blotches on the back and belly, respectively.
Terrapene: terrapin.
tesselatus or ***tessellatus:*** checkered.
texana: pertaining to Texas.
Thamnophis: *thamn-*, bush; *-ophis*, snake.
tigrinum: tiger-like.
tigris: tiger.
torquata: adorned with a necklace; collared
triangulum: *tri-*, three; *-angulum*, cornered
Trionyx: *tri-*, three; *-onyx*, claw.

triseriata: *tri-*, three; *-seriata*, in rows.
tristichus: *tri-*, three; *-stichus*, in rows.
Tropidoclonion: *tropido-*, keel; *-clonion*, twig.
undulatus: undulated, wavy.
Uta: pertaining to Utah, where the type specimen was collected in 1849.
uniformis: uniform.
Urosaurus: *uro-*, tail; *saurus*, lizard.
utahensis: from Utah.
velox: swift.
vernalis: of spring.
viridis: green.
wislizenii: for F.A. Wislizenus (1810-1889), army surgeon who collected the type specimen in Utah in 1849.
woodhousii: for S.W. Woodhouse (1821-1904), surgeon-naturalist in western U.S.
wrighti: for A.H. Wright (1879-1970), herpetologist at Cornell University.

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Index to Common Names

Index to Scientific Names

About the Author

Geoffrey Hammerson was born and grew up in northern California, where he developed an intense interest in, and appreciation for, wildlife and field biology. He earned a B.S. at the University of California, Berkeley and a M.A. at California State University, Hayward. While in California, he worked with the U.S. Fish and Wildlife Service on bird and mammal censuses and studied the behavior and ecology of snakes using homemade radio transmitters.

Hammerson was awarded a Ph.D. from the University of Colorado, where his studies of Colodo amphibians and reptiles centered for the past several years. He is presently a research sociate and instructor at the University of Colorado and has taught ecology and ornithology. He is traveled widely in pursuit of his naturalistic interests.

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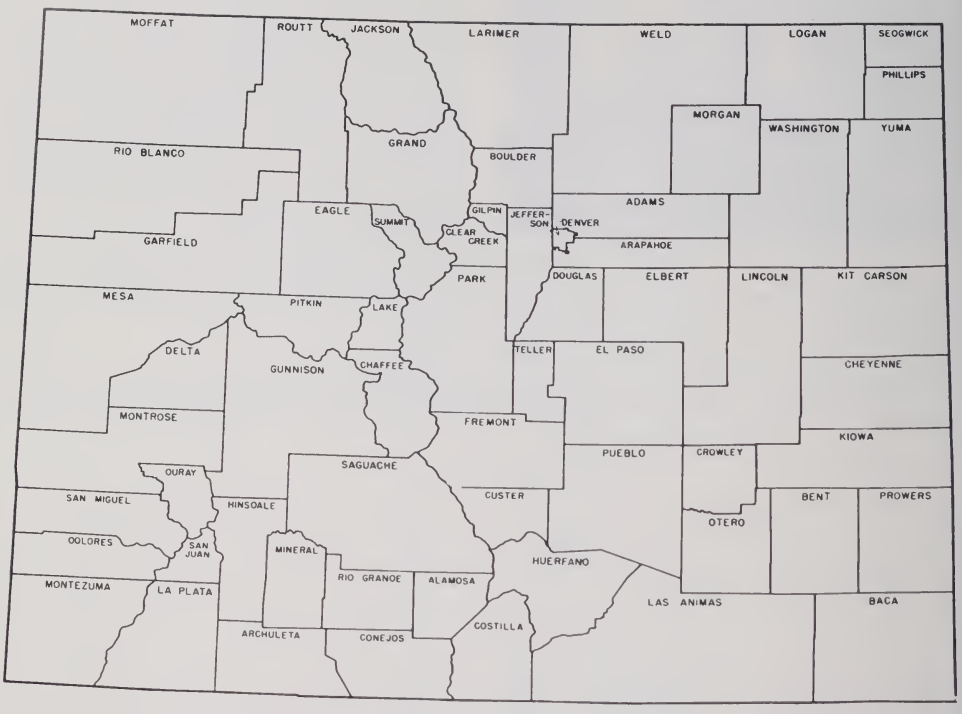
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