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Reptile and Amphibian Survey

Dave Merritt

REPTILE AND AMPHIBIAN SURVEY

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Revision By Dave Merritt

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INTRODUCTION

Herpetology is the branch of biology encompassing the study of two classes of vertebrates: amphibians and reptiles. The study of these taxa becomes particularly important when they are acknowledged as indicators of the integrity of various types of habitat. Reptiles and amphibians (herpitiles) have become particularly vulnerable to human-caused extinction and extirpation caused by commercial and residential development, agriculture, mining, deforestation, and other forms of habitat loss.

Amphibians

Amphibians were the first vertebrates known to have emerged from aquatic habitats and to use the terrestrial habitats for a significant portion of their life cycles. The earliest fossils of amphibians date back to the Devonian Period, 350-400 million years ago, and coincide with a period of great extremes in climate and available food sources (Campbell, 1987). The ability to range out of the water enabled amphibians and reptiles to utilize a wider variety of food sources than water-bound vertebrates. These rapid changes necessitated adaptations which eventually led to the emergence of new terrestrial vertebrate biota.

Amphibian reproduction usually occurs in water. Most amphibian eggs lack a protective shell and are sensitive to surrounding environmental conditions. Amphibians carry out much of their respiration across their moist skin. Since amphibian skin is permeable to water, this group of animals is particularly sensitive to environmental changes and environmental contamination (Duellman and Trueb, 1986). Amphibians are accordingly susceptible to changes in the quality and the quantity of water resources.

There are about 3200 amphibian species alive today worldwide. About 80 of these live in the United States. There are 17 species of amphibians known to inhabit Colorado (Hammerson, 1986). The amphibians of Boulder's Open Space include salamanders, frogs and toads.

Table 1: Approximate numbers of living species of the various orders of the Class Amphibia (data from Hammerson, 1986)

Order	Worldwide	United States	Colorado
Caecilians	154	0	0
Salamanders	336	120	1
Anurans	2770	80	17

Reptiles

It is theorized that reptiles evolved from Devonian amphibians about 300 million years ago. The fossil record indicates that reptiles became the dominant terrestrial vertebrates for more than 200 million years. Reptiles produce shelled amniotic eggs which are commonly laid on land. Reptile skin is scaled and impermeable to water, preventing desiccation and enabling reptiles to inhabit a wide range of habitats. Unlike amphibians, reptilian respiration occurs exclusively via the lungs. Lizards are the most diverse and numerous of extant reptiles. Snakes, turtles, alligators, and crocodiles are among the members of the class Reptilia (Campbell, 1987). There are an estimated 5959 species of living reptiles throughout the world. The table below gives some general information about the numbers of various orders of reptiles.

Table 2: Approximate numbers of living species of selected orders of the Class Reptilia (data from Hammerson, 1986)

Order	Worldwide	United States	Colorado
Tuatara	1	0	0
Amphisbaenians	135	1	0
Turtles	222	48	5
Lizards	3310	98	16
Snakes	2270	120	25

Present Condition

With the rise of commercial and residential development and other changes leading to the loss of suitable habitat, amphibian and reptile populations are declining. Thirteen percent of all animal species listed since the Endangered Species Act became effective in 1973, have been herptiles (Jeffreys, 1992). The drainage of wetlands for agriculture, decline in water quality and quantity (through diversions and impoundments), and competition from introduced exotic species are just a few of the threats to herpitile populations.

Some of Colorado's high altitude lakes are experiencing the effects of acid precipitation. The U.S. Forest Service has begun monitoring visibility, atmospheric deposition, and lake chemistry in the Mount Zirkel Wilderness Area. The Forest Service has determined that high levels of sulfates and nitrates may be impairing aquatic ecosystems (Baird, 1992). Decreasing pH in these lakes may be the result of deposition of acids that pollute the air. The aquatic community is affected not only by lowered pH, but by the mobilizing of heavy metals and other toxins which are detrimental to aquatic communities (Goudie, 1990).

Another area of concern is the effect of acid mine drainage upon amphibian populations. The Colorado Division of Wildlife has requested $1.25 million dollars from the federal government to study the effects of acidification and increased concentrations of heavy metals in mine drainage upon native aquatic communities. Preliminary findings have indicated that bio-accumulation of heavy metals in some fish inhibit growth and reproduction (Colorado Division of Wildlife, 1992).

With the rapid development of the natural landscape along Colorado's front range, the City of Boulder Open Space land system is becoming an increasingly important benchmark of relatively undisturbed conditions. The Open Space Department has begun to inventory native amphibian and reptile populations. The results of this baseline study will provide land managers with information about how amphibians and reptiles should be considered in management plans. It will also provide a basis for future monitoring, and research into other aspects of the ecology of amphibian and reptile populations on City of Boulder Open Space.

ACKNOWLEDGEMENTS

Thanks are due to Dr. Hobart Smith and Dr. David Chiszar of the University of Colorado who provided a great deal of advice and guidance for this study. They provided the investigators with access to the amphibian and reptile collections of the University Museum. They assisted in all aspects of the project design and made recommendations on locations for *targeting* and ways to avoid the need for destructive sampling. Dr. Smith and Dr. Chiszar equipped the investigator with knowledge and advice crucial to the successful completion of this project. Although no new records were found for Boulder county during this field season, we will keep looking.

METHODS

Methods for this survey were generally non-invasive. Animals were not trapped and only captured when necessary for identification.

Transects

The transects were walked to locate and identify amphibians and reptiles and their sign. Sign of reptiles includes snake skins, egg shells, turtle shells, and bones. Once a reptile or amphibian was located, capture was attempted if necessary for identification. All animals recorded were identified to species. Other data such as time, number of individuals, sex, age, habitat description, proximity to water, proximity to cover, activity/behavior observed, humidity, temperature, cloud cover, and length of observation were recorded (see Appendix A-Data Sheet). Transects usually walked by a lone investigator except in some cases when two people walked the transects together.

Transect locations were selected to cover a range of habitats and areas of special interest throughout the City of Boulder Open Space system. A 3000 foot transect was established at each location.

The habitat types surveyed are shown with the property name (Figure 1 shows the location of the transects with respect to the Open Space land system):

Habitat Type	Open Space Property (ies)
Tall grass prairie	Thomas-Hogan-Parish (THP)
Ponderosa pine forest	Wittemyer North
Riparian forest	Kaufman
Sand stone cliffs	Ertl/Whiterocks
Short grass prairie	Boulder Valley Ranch, Tracy Collins-Flatirons Vista

Four of the sixtransects used had previously been designated for ongoing monitoring as part of the Department's "wildlife transect" system. The previously existing transects are marked by six poles evenly spaced throughout the transect. The two newly designed transects for the herpetology survey were located on Ertl and Tracy Collins. Each transect was walked 12 times throughout the summer; four times in the morning (730-1000), four times in the afternoon (1130-1400), and four times in the evening (1830-2100). Each survey took approximately one hour to complete.

Targeting

In addition to the pre-existing transects, other favorable amphibian and reptile habitats were also selected for survey. Areas which were considered potentially rich in species, or likely habitat for species not collected in Boulder County or habitat for species not encountered on transect routes were identified and visited. Habitats such as ponds, creeks, gravel pits, rocky cliffs, rock slides, and marshes were included in such "targeting." Targeting at ponds involved the use of a seine and a dip net to sample.

Results

The survey period began June 15, 1992[1] and ended on August 14, 1992. Over that period the six transects were each walked 12 times. Nineteen areas were targeted. Field time totalled 92 hours. Over the course of the survey 531 individual animals were encountered and 8 snake skins were identified. A total of 12 species were recorded (see table 3).

[1] Frog and toad choruses had ceased by time the survey was begun. Listening for such vocalizations is recognized as an effective means of surveying for the presence of leopard frogs, chorus frogs and toads.

Table 3: Species of Amphibians and Reptiles Encountered in 1992 Herpitile Survey

SCIENTIFIC NAME	COMMON NAME	FREQ.
Rana pipiens	Northern Leopard Frog	408
Pseudacris triseriata maculata	Western Chorus Frog	56
Cnemidophorus sexlineatus viridis	Six-lined Racerunner	18
Ambystoma tigrinum mavortium	Barred Tiger Salamander	12
Chrysemys picta bellii	Western Painted Turtle	11
Bufo woodhousii woodhousii	Woodhouse's Toad	10
Coluber constrictor flaviventris	Racer Snake	8/2*
Thamnophis radix haydenii	Plains Garter Snake	3/1*
Sceloporus undulatus erythrocheilus	Eastern Fence Lizard	2
Chelydra serpentina serpentina	Common Snapping Turtle	1
Nerodia sipedon sipedon	Northern Water Snake	1
Pituophis melanoleucus sayi	Bullsnake	1/5*

*reptile skins found

Transect Data

Species

Of the total 92 hours, 67 (72.8%) represented time at the transects. Ninety-four (17.7%) of the 531 individuals were observed during transect surveys. While the relative percentage of observed individuals was small, two-thirds (n=8) of the 12 species were encountered along the transects.

Of the 94 individuals seen during the transect survey, 66 (70%) were identified as northern leopard fogs, and 18 (19%) as six-lined racerunners. The remaining 11% comprised 7 species (Figure 2). These species were northern water snake (n=1), Woodhouse's toad (n=2), western painted turtle (n=3), plains garter snake (n=1), racer snake (n=2), and the common snapping turtle (n=1).

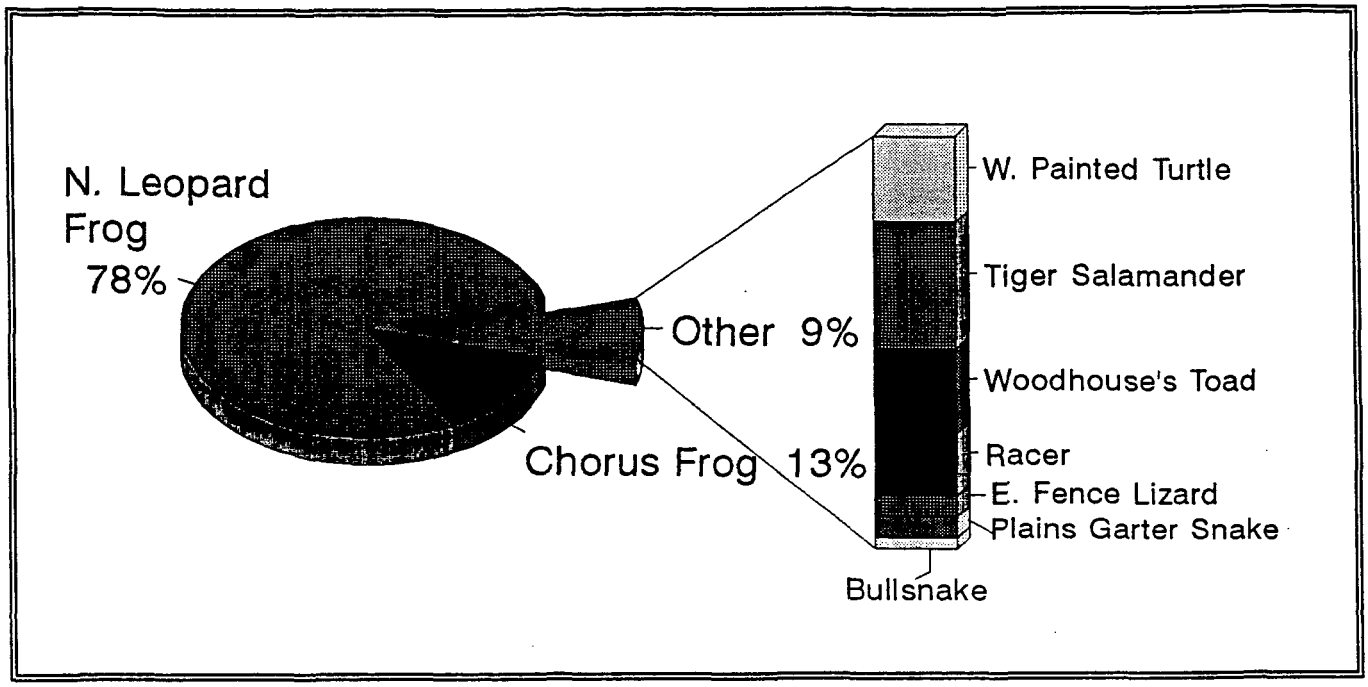

Figure 2: Transects-Species Observed
Total Number of Observations = 94

Properties

Herptiles were found on four of the six properties that were periodically walked.

Property name	Habitat Type	Species Sighted
Ertl	dry sandy shrubby cliffs	18 six-lined racerunners 2 bullsnake skins 2 racer snake skins
Kaufman	riparian forest/floodplain	8 northern leopard frogs 1 common snapping turtle 1 plains garter snake.
Tracy Collins Flatirons Vista	shrublands, ponds and short grasses	59 northern leopard frogs 4 Woodhouse's toads, 1 racer
OSOC	tall grass prairie w/ditches	1 northern water snake, 1 Woodhouse's Toad
Wittemyer North BVR	ponderosa pine forest short grass prairie	no sightings no sightings

Time of Day

Seven individuals (7.3%) were seen during the morning transect walk. The individuals included: four northern leopard frogs, one racer snake, and two six-lined racerunners. Twenty-eight (29%) individuals were observed in the afternoon (16 six-lined racerunners, 1 snapping turtle, seven northern leopard frogs, five Woodhouse's toads and one northern water snake). During the evening transects, 59 individuals (62.7%) were identified. These included 56 northern leopard frogs, two western painted turtles, and one plains garter snake (figures 3 and 4).

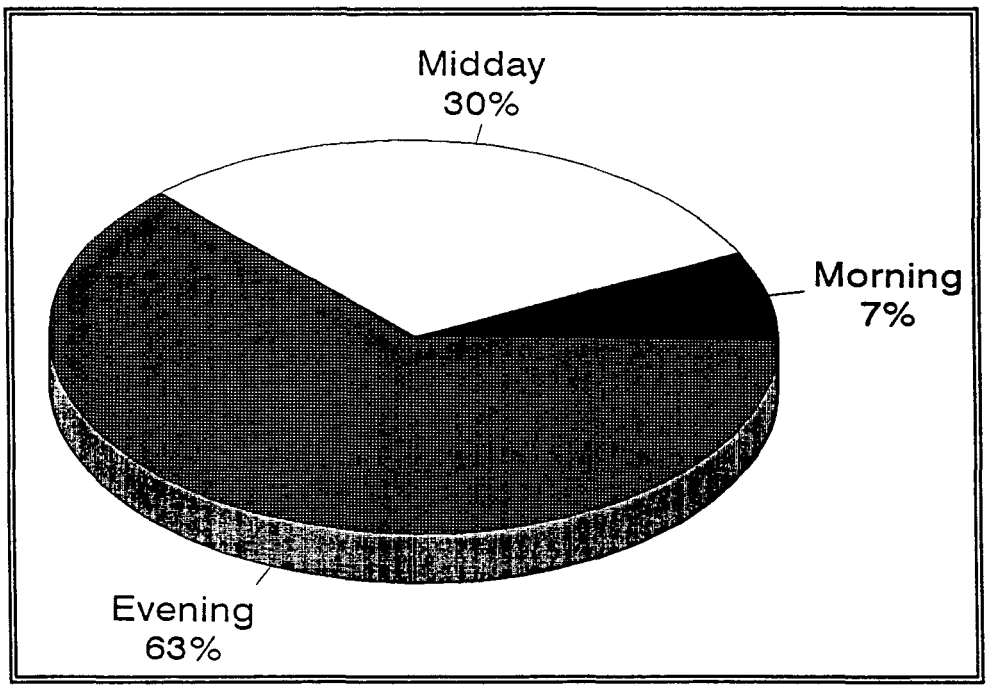

Figure 3: Overall observations by time of day.
Total numuber of observations=94.

Targeting

The majority (n=437;83.2%) of animals were observed at specially selected sites. Of the 12 species observed overall 9 (75%) were observed at specially chosen sites. Targeting involved 25 hours of observation or 27% of the total survey time. The northern leopard frogs were the most commonly observed species representing 342 (78.3%) of the individuals seen. Chorus frogs represented 56 (12.8%) of the individuals observed during targeting.

Seven other species represented the remaining 39 (8.9%) individuals (Figure 5).

Several species recorded for Boulder below 6500' were not encountered either through transects or targeting. These species are *Tantilla nigriceps*, *Scaphiopus bombifrons*, and *Tropidoclonion lineatum*.

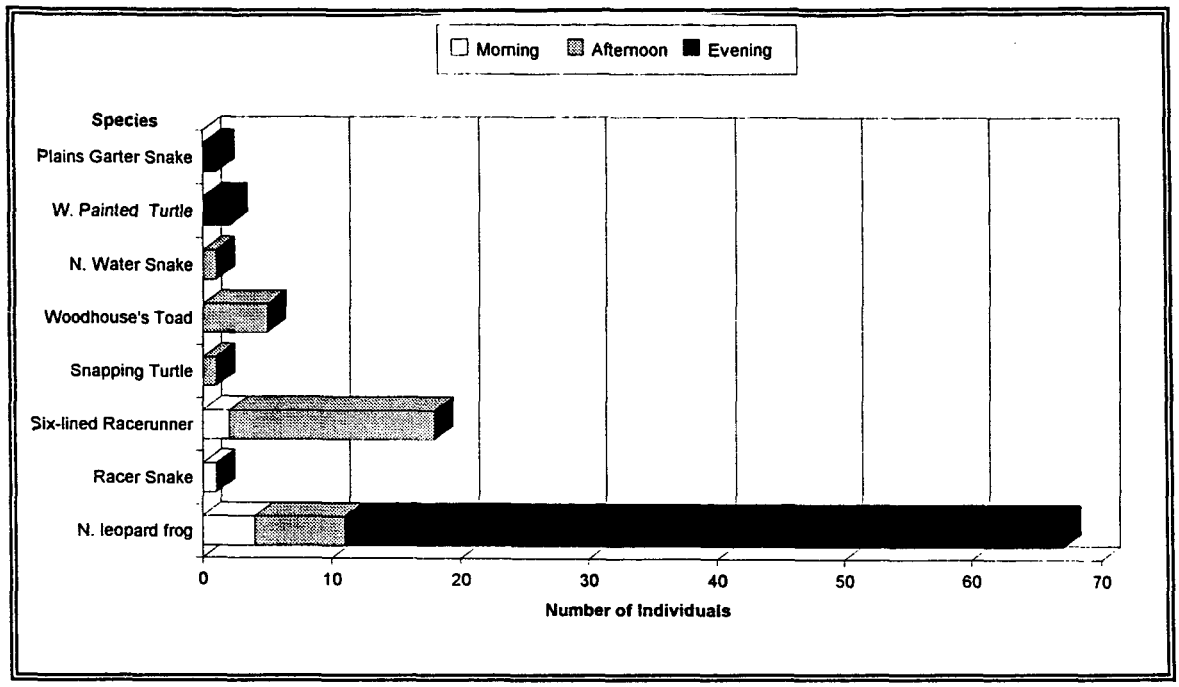

Figure 4: Transects, species observations according to time of day.
Total numuber of observations=94.

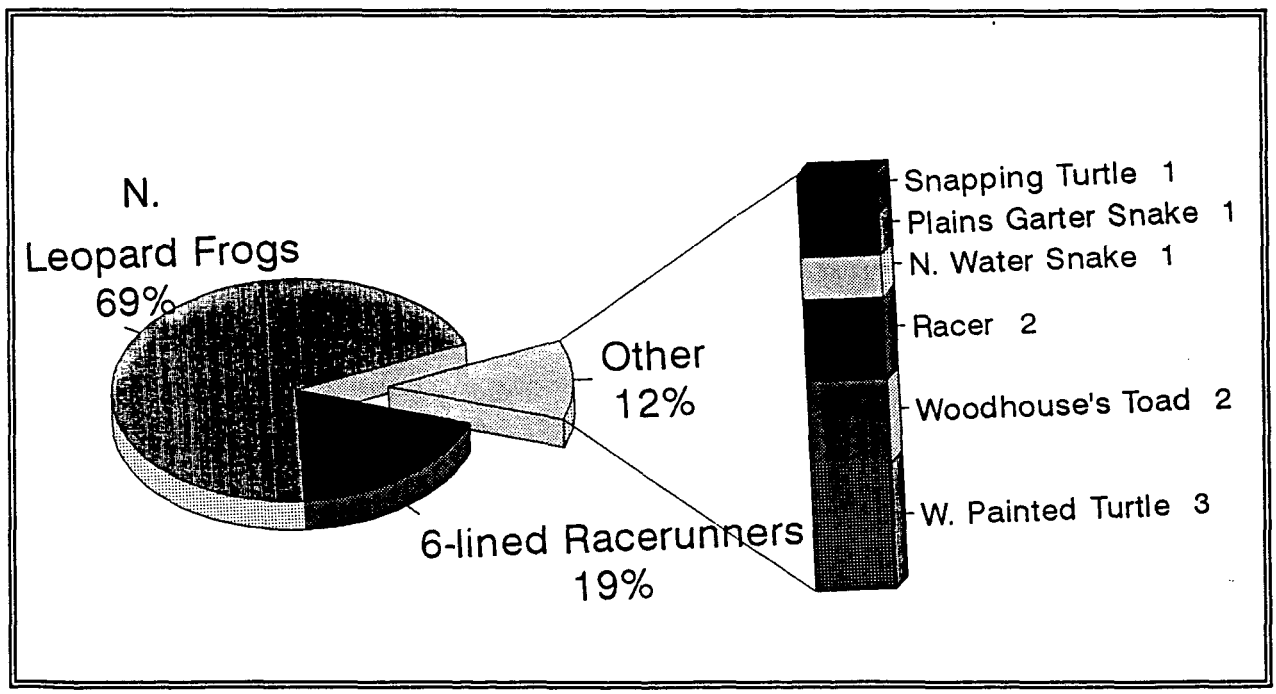

Figure 5: Targeting, species observed
Total numuber of observations=437.

DISCUSSION

This study provides a foundation of data for the monitoring of amphibian and reptile populations on City of Boulder Open Space properties. This "base line" of data may be useful for future studies and impact evaluations, such as habitat requirements of certain species; relation of amphibian populations to water chemistry and proximity to agricultural or mining runoff; the relationship of exotic species to native populations. Data on herpetile populations, range, habitat, and variety is an essential part of the effective evaluation and management of local wildlife habitats.

The importance of wetland and aquatic habitats to amphibians and certain turtles is fairly intuitive and follows from the biology of these organisms. That relationship is supported by the results of this study. All northern leopard frogs, western chorus frogs, Woodhouse's toads, tiger salamanders, western painted turtles and common snapping turtles were observed wither in or very close to a pond, creek or wetland. One might also infer the importance of aquatic habitats for the northern water snake. The results of the survey indicate a use of wetlands by racers and plains garter snakes. In fact all observations of these species were in creeks or stream-side wetlands. The use of these wetland habitats by these species is consistent with descriptions in the herpetological literature.

Six-lined racerunners, bullsnakes and eastern fence lizards were only observed in upland habitats. The racerunners were observed on the sandy ledges below the cliffs at Whiterocks, bullsnakes in upland shortgrass prairie, and eastern fence lizards among mountain boulders.

Amphibians serve as ecological indicators for the health of aquatic communities. In this study the northern leopard frog and the western chorus frog represented the largest amphibian populations of all recorded species. This is significant in that the northern leopard frog and the western chorus frog have become scarce in much of their historical range in Colorado (Hammerson, 1986). This is a possible indication that City of Boulder Open Space properties contain relatively healthy aquatic communities.

RECOMMENDATIONS

This survey should be periodically repeated in order to gain a better understanding of the full range of reptile and amphibian species which inhabit Open Space lands. Repeating the survey on an annual or semi-annual basis would be an efficient method for long-term monitoring of reptile and amphibian populations.

Targeting should be continued for several reasons:

→ It may be possible to collect records for species previously unrecorded for the Boulder Valley (such as *Sceloporus undulatus garmani*, *Eumeces multivirgatus*, and *Heterodon nasicus*)

→ It may be possible to locate species known from Boulder County below 6500' which were not recorded during this years study (such as *Tantilla nigriceps*, *Scaphiopus bombifrons*, and *Tropidoclonion lineatum* and see table 4.)

→ It is a useful tool for locating important herpetile habitat on newly acquired properties.

The survey should be expanded to include spring and summer vocalization surveys. Some frog and toad species are much more vocal than they are visible. By listen at night after heavy rains large populations can be located, and visited during daylight hours for census work.

Table 4: Species of Amphibians and Reptiles Reported by Maslin (1964) for the Boulder, Colorado Region (* indicates species recorded as part of this study) († nomenclature of Maslin, recent nomenclature from Hammerson, 1986).

SCIENTIFIC NAME	COMMON NAME
**Ambystoma tigrinum mavoritum*	Tiger salamander
Scaphiophus (=Spea)† bombifrons	Plains spadefoot toad
Bufo boreas boreas	Western (Boreal)† toad
Bufo cognatus	Great plains toad
**Bufo woodhousei woodhousei*	Rocky mountain (Woodhouse's)† Toad
**Psuedacris triseriata maculata*	Striped (Boreal)† Chorus frog
Rana catesbeiana	Bullfrog
**Rana pipiens (brachycephala)†*	Western leopard frog
**Chelydra serpentina serpentina*	Common snapping turtle
**Chrysemys picta belli*	Western painted turtle
Terrapene ornata ornata	Ornate box turtle
Trionyx spiniferus hartwegi	Western spiny softshell turtle
Holbrookia maculata maculata	Lesser earless lizard
Phrynosoma douglassii	Short-horned lizard
**Scleroporus undulatus erythrocheilus*	Eastern fence lizard (Red-lipped rock lizard)†
Scleroporus undulatus garmani	Eastern fence lizard (Northern prairie lizard)†
**Cnemidophorus sexlineatus*	Six-lined racerunner
Eumeces multivairgatus multivirgatus	Many-lined skink
**Nerodia (=Natrix)† sipedon*	Northern water snake
Thamnophis elegans vagrans	Western terrestrial (Wandering)† garter snake
**Thamnophis radix haydeni*	Plains (Western plains)† garter snake
Thamnophis sirtalis parietalis	Common (Red-sided)† garter snake
Tropidoclonion lineatum lineatum	Lined (Northern lined)† snake

SCIENTIFIC NAME	COMMON NAME
Heterodon nasicus nasicus	Western hognose snake
**Coluber constrictor flaviventris*	Racer (Eastern yellow-bellied racer)†
Opheodrys vernails blachardi	Smooth green snake
**Pituophis melanoleucus sayi*	Bullsnake
Lampropeltis triangulum gentilis	Western milk snake
Tantilla nigriceps nigriceps	Plains blackhead (black-headed)† snake
Crotalus viridis viridis	Western (Plains)† rattlesnake

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