AMPHIBIAN AND REPTILE INVENTORY SURVEY TRAINING FOR LITTLE BIGHORN BATTLEFIELD NATIONAL MONUMENT

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I. Background and Purpose

The Little Bighorn Battlefield National Monument (LIBI) currently has limited information on occurrence and distribution of amphibian and reptile species. The following inventory and survey methods and field guide, as well as an on-site training, were designed to help park personnel determine (1) which species of amphibian and reptile are present at LIBI, (2) how widely distributed each known species is across the monument, and (3) for amphibian species in particular, if LIBI supports a breeding population.

LIBI lies along the banks of the Little Bighorn River and is comprised of the Custer and Reno-Benteen battlefields, separated by the five-mile Tour Road. The monument is largely covered in northern mixed grass prairie and sagebrush shrub-steppe vegetation. The southwest boundary of the Custer battlefield borders the river and contains riparian habitats with sedge and cottonwood stands. Within this habitat, there is one pond that may contain water year-round. The upland areas provide habitat for most snake and lizard species, as well as some terrestrial amphibians, while riparian areas may support pond-breeding amphibians, garter snakes, and turtle species.

To date, several amphibian and reptile species have been documented, either formally or informally, at LIBI. The following resources will help park staff target appropriate habitats (under appropriate environmental conditions) for species whose presence is not known in the park. Additionally, the procedures and data forms will help park staff formalize the process of both surveying and documenting presence of species in the park.

II. Field Guide

Two field guide resources were provided to park personnel. The first is the book Amphibians and Reptiles of Montana, by J. Kirwin Werner, Bryce A. Maxell, Paul Hendricks, and Dennis L. Flath (Mountain Press Company, Missoula, MT, 2004). Currently, this is the only field guide for amphibians and reptiles in Montana. It provides descriptions of all the species of reptile and amphibians that could be found at LIBI, as well as detailed descriptions of egg and tadpole identification, and how to identify similar looking species.

The second is a digital field guide for all the species of amphibian and reptile that have been found in Big Horn County. It can be found in Appendix 1 of this report. Species that have been seen to date at LIBI are marked with an asterisk, as noted in the guide. The digital guide contains pictures of each species, range maps, and physical descriptions and identifying characteristics for each species. It also contains relevant habitat, behavior and management information.

III. On-site Training

Rebecca McCaffery, from the University of Montana, conducted a brief training session on species identification and data recording on June 3, 2009 at Little Bighorn Battlefield National Monument. Two park rangers, a seasonal biotech, biotech Melana Stichman, and Cassity Bromley, BICA Resources Manager, were in attendance. Over the course of an hour, all the amphibians and reptiles present in Bighorn County were described, and identifying features of each species were discussed. Also discussed were the habitat types in which each species is found and what data should be collected when a species is observed by visitors or park staff.

During the field portion of the training Melana Stichman and Rebecca McCaffery visited several locations in the monument. Locations for future targeted surveys were identified, like the pond near the southwest boundary of the Custer battlefield, the gravel service road to the river, Weir point, and the south-facing, rocky slopes within the Reno-Benteen battlefield. Two northern leopard frogs (*Rana pipiens*) were observed at the pond, which had not been seen or documented on the monument previously. Visual-encounter survey methods were discussed, including wetland survey methods, road-based surveys, and targeted habitat surveys. These methods are detailed in Appendix 2 (Amphibian and Reptile Inventory Survey Methods for the Little Bighorn Battlefield National Monument), which contains habitat and species-specific methods for both opportunistic and targeted surveys.

IV. Resources and Data Forms

Appendix 2 includes contact information for the senior zoologist at the Montana Natural Heritage program (MTNHP) and research zoologist at the United States Geological Survey, both of whom can help with additional questions regarding species identification and data reporting. Currently, the MTNHP houses most of the state's data on amphibian and reptile locations.

Two data forms will help park personnel in recording data on amphibian and reptile sightings at LIBI. Appendix 2 includes a descriptive form suitable for keeping park records using the survey methods described there. Appendix 3 (Incidental Observation Form for Amphibians and Reptiles) is a MTNHP form, which contains the data requested for submitting formal records to the Heritage Program, as well as instructions for filling out the form.

V. Appendices

APPENDIX 1—SPECIES LIST AND DIGITAL FIELD GUIDE

List of species confirmed or possibly present at LIBI

Amphibians:

1. Tiger salamander (*Ambystoma tigrinum*)*
2. Plains spadefoot toad (*Spea bombifrons*)
3. Great Plains Toad (*Bufo cognatus*)
4. Woodhouse's Toad (*Bufo woodhousii*)
5. Boreal Chorus Frog (*Pseudacris maculata*)
6. Northern Leopard Frog (*Rana pipiens*)*

Reptiles:

7. Eastern Racer (*Coluber constrictor*)*
8. Western Hog-Nosed Snake (*Heterodon nasicus*)
9. Milksnake (*Lampropeltis triangulum*)
10. Bull or Gopher Snake (*Pituophis catenifer*)*
11. Terrestrial Gartersnake (*Thamnophis elegans*)+
12. Plains Gartersnake (*Thamnophis radix*)+
13. Common Gartersnake (*Thamnophis sirtalis*)+
14. Prairie Rattlesnake (*Crotalus viridis*)*
15. Greater Short-horned Lizard (*Phrynosoma hernandesi*)*
16. Common Sagebrush Lizard (*Sceloporus graciosus*)
17. Snapping Turtle (*Chelydra serpentine*)**
18. Painted Turtle (*Chrysemys picta*)**
19. Spiny Softshell Turtle (*Apalone spinifera*)**

*Currently known to be present at Little Bighorn Battlefield National Monument, along with at least one species of unidentified toad.

+Garter snakes are often found near water. Terrestrial and common garter snakes may be found near the pond or in the riparian area, but are unlikely to be found in upland habitats. Plains garter snakes are more likely to be seen in upland habitats, and may be present on the monument

**Unlikely to be present at LIBI due to their constant association with water. It is possible that painted turtles use the pond on the southern end of the monument.

Unstarred amphibian and reptile species are cryptic, and may be present on the monument.

Digital Field Guide: Amphibians and Reptiles of Big Horn County, Montana

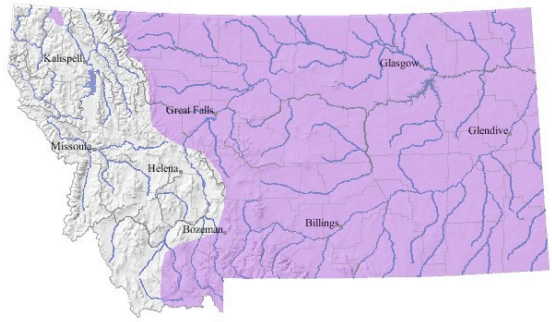
The following information was compiled from the Montana Natural Heritage Program's Montana Field Guide (http://fieldguide.mt.gov/).

Amphibians:

Tiger salamander (*Ambystoma tigrinum*)

General Description
Adults vary in color pattern, but background color is usually dark, with lighter blotches of yellow, tan, or green. Adults are large and heavy-bodied with a body length of 3 to 6 inches. Eggs and Larvae: Eggs are typically laid in small clusters of 5 to 120, but may be laid singly. Larvae are typically pale green or brown. They have external gills and are relatively large and heavy-bodied (0.75 to 4 inches) (FWP). Coloration geographically variable to an extreme, often mottled, blotched, or spotted; adults are stocky, with 11-14 (usually 12-13) costal grooves, a broad head, small eyes, and tubercles on the soles of the feet; pond-type larva (but lacks balancers), with three large pairs of gills, vomerine teeth in U-shaped pattern, and dorsal fin extending to region of axilla; adults usually are about 15-22 cm in total length (to about 34 cm) (Stebbins 1951, 1985; Behler and King 1979; Conant and Collins 1991).

Montana Range



Habitat

Tiger salamanders in Montana are primarily associated with prairie or agricultural habitats. They breed in ponds, lakes, springs, intermittent streams, and stock ponds, usually those without fish present. Adults go to the breeding ponds soon after snowmelt; after breeding, adults may remain in the ponds or move to upland areas and live in burrows. Eggs hatch in 2 to 5 weeks and metamorphosis takes 2 to 24 months. In some locations larval salamanders never transform, but rather become sexually mature and breed while retaining external gills (referred to as neoteny). These salamanders are often called "axolotls" or "water dogs" (FWP). Are benthic in ponds but may enter upper water column at night. At high elevation, tend to select warmest water in ponds (rarely >25 C) - shallows during day, deep water at night.

Ecology

Late metamorphosis is probably caused by temperature rather than food abundance. Paedomorphic populations tend to occur at higher elevations. High elevation populations use behavioral thermoregulation (Heath 1975).

Reproductive Characteristics

Breeds in May on prairie; June-mid August at 7780 ft. in SW MT. Eggs hatch in ca. 15 days, Jun-Aug. Metamorphosis occurs in August of 1st year on prairie; not until year 2-3 at high elevation.

Plains spadefoot toad (*Spea bombifrons*)



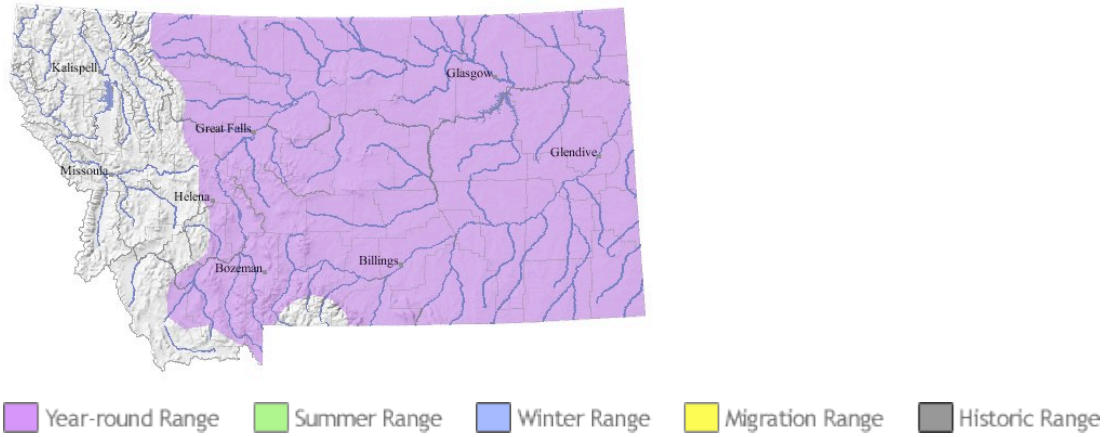
General Description

Adult plains spadefoot are gray or brown with darker mottling on the back and white on the belly. The back may be covered with smallish tubercles tipped in yellow or orange, and often present as a rough hourglass-shaped marking. Some individuals have indistinct longitudinal streaking. In adults the pupils are vertically elongate in bright light; there is a hard lump or "boss" between the eyes, slightly anterior of an imaginary midline connecting the eyes. Prominent parotoid glands posterior to the eyes are absent. A single hard and dark wedge-shaped spade is present on each hind foot. Maximum snout-vent length (SVL) is about 6.0 centimeters. Males have dark patches on the inner 2-3 digits of the forelimbs during breeding, and have an expanded bi-lobed vocal sac. The male breeding call is a brief snore.

Tadpoles may be brown or green to whitish on the back, or mottled gray to dull olive-yellow, sometimes with a bluish iridescence. The belly is an iridescent golden color; the gut coil is not visible through the body wall. The dorsal fin is clear or with sparse yellowish flecking; the anus is at the base of the tail on the midline. The body shape is globular, with the eyes positioned dorsally, and total length is usually up to 7.0 centimeters. The mandibles are frequently cusped; labial tooth rows are 0/0 to 6/6, but most often 3/4 or 4/4. Oral papillae completely encircle the mouth. Eggs are black above and white below, about 1.5 to 1.6 millimeters in diameter and surrounded by two jelly layers, and deposited in elliptical masses of 10 to 250 eggs.

Diagnostic Characteristics
No other adult frog or toad in Montana has a combination of vertical pupils, bony "boss" between the eyes, large black tubercles or spades on the hind feet, and lack of prominent parotoid glands. No other tadpoles have a combination of a normal (not sucker-like) mouth completely surrounded by oral papillae, and a midline anal vent at the base of the tail. No other Montana amphibian has small (less than 4.0 millimeters) pigmented eggs surrounded in two jelly layers that are laid singly or in short linear or globular clusters.

Montana Range



Migration
No information specific to Montana plains spadefoot is available. Elsewhere adults are known to migrate up to several hundred meters between breeding pools and nonbreeding terrestrial habitats. During breeding, they may move 60 to 150 meters during each night as they leave the breeding ponds and move inland (Hammerson 1999).

Habitat
Little specific habitat information is available. This species is usually found in areas with soft sandy/gravelly soils near permanent or temporary bodies of water. For much of each year it lives largely inactively in burrows of its own construction or occupies rodent burrows, and enters water only to breed. Following heavy rains, adults have been reported in water up to 30 centimeters deep in flooded wagon wheel ruts, temporary rain pools formed in wide flat-bottom coulees, water tanks, and badland seep ponds, and tadpoles and toadlets have been observed in stock ponds and small ephemeral reservoirs, usually in sagebrush-grassland habitats (Cope 1879, Mosimann and Rabb 1952, Dood 1980, Reichel 1995, Hendricks 1999, Hossack et al. 2003).

Ecology
Plains spadefoots are mostly active as adults at dusk and night when air temperatures are between 12 and 26 degrees C. Adults in Alberta, Wyoming, and Colorado may be active anytime during May through August and less frequently later (Baxter and Stone 1985, Russell and Bauer 1993, Klassen 1998, Hammerson 1999), depending on rains and the presence of standing water. In Montana, adults have been observed during May to August (Mosimann and Rabb 1952, Hendricks 1999, Hossack et al. 2003). When conditions are such that adults retreat underground, the spades on the hind feet are used to dig backwards into the soil until pockets of moist soil are encountered, sometimes at depths of almost a meter. Tadpoles may be able to tolerate brief periods of almost total evaporation of their pools (Russell and Bauer 1993).

Reproductive Characteristics

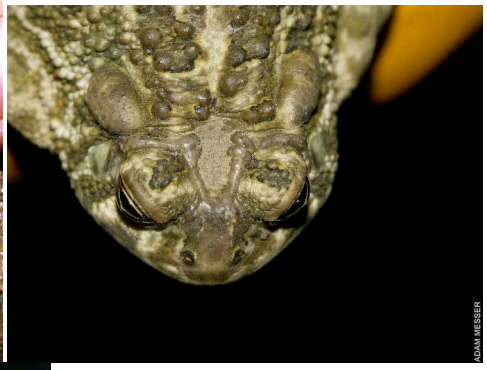
Little specific information is available. Adult choruses have been heard from late May through early August. Tadpoles from legless to 4-legged stages have been reported during late June of the same year in Carbon County (Hendricks 1999), and fully transformed juveniles have been found in the same area during a different year in late August (P. Hendricks personal observation, Maxell et al. 2003). Recently transformed juveniles have been reported along the Missouri River in late August (Cope 1879).

Breeding occurs in Colorado after heavy rains of 1.8 centimeters or more at air temperatures greater than 10 degrees C. (Hammerson 1999). Breeding choruses usually last about 2 or 3 days, with adults calling from edges of the pools or while floating; large choruses can be heard from a distance of 3 kilometers or more. Females lay up to 2700 eggs during a single breeding event, often in several egg masses each attached to submerged vegetation or other objects. Adults usually leave the water once breeding and egg-laying are finished, but may remain nearby for several days if rain continues. Rains occurring after the first round of breeding may stimulate more breeding, presumably from individuals that did not breed the first time. Adults probably reach maturity when 2 to 3 years old. Eggs hatch in 2 to 3 days. Tadpoles develop rapidly, and complete metamorphosis in 21 to 60 days (Klassen 1998). Transforming toadlets emerged from water may still have tails.

Management

No special management needs are currently recognized. However, at permanent and semi-permanent water bodies (reservoirs and stock ponds) where breeding has been observed, portions of the shoreline where emergent vegetation might develop could be fenced to create exclosures that protect breeding adults, eggs and tadpoles from trampling and the removal of emergent cover by livestock; trampled juveniles have been found at some stock ponds (P. Hendricks personal observation). Another option would be the creation of ponds designed for use by prairie amphibians as breeding sites, with the perimeter surrounded by fencing to prevent access by livestock. Game fish should not be introduced to any of these ponds.

Great Plains Toad (*Bufo cognatus*)



General Description

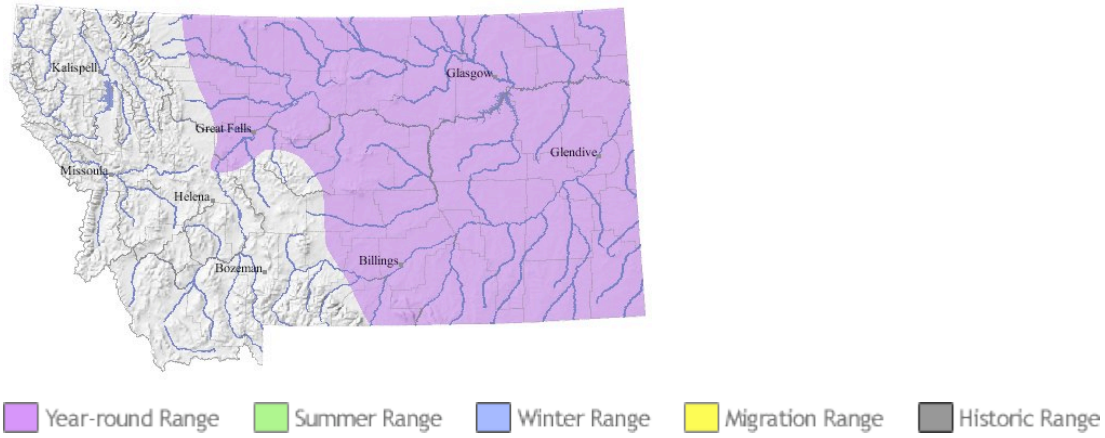
The skin of adult Great Plains toads is covered with numerous small warts; cranial crests are prominent, and diverge posteriorly from a hard lump (boss) on top of the snout. The parotoid glands posterior to the eyes are elongate. The back exhibits a somewhat symmetrical pattern of large, light-edged dark spots or patches. The underside of the hind foot often has a sharp-edged tubercle and a smaller dark-tipped tubercle. Females can reach 11.4 centimeters snout-vent length (SVL); males are usually less than 9.5 centimeters SVL. Males have dark, loose throat skin and a dark patch on the inner surface of the innermost digit of the forefeet during breeding; the vocal sac when inflated may extend beyond the front of the face. The breeding call is a long continuous trill or pulsating ringing sound.

Juveniles have reddish warts. Tadpoles are initially blackish on the dorsum with light or gold flecking, then become paler and mottled brown; the dorsal pattern of large, paired blotches appears before metamorphosis is complete. The eyes are dorsal, and the dorsal fin is highly arched with some black dentritic lines. The upper mandible is highly arched, and labial tooth rows are usually 2/3, with oral papillae restricted to the sides of the mouth. Total length ranges from 25 to 35 millimeters. Eggs are black above, white below, and about 1.2 to 1.3 millimeters in diameter, usually in a single row in long strings of two-layered jelly that is constricted between individual eggs.

Diagnostic Characteristics

On Woodhouse's toad (*Bufo woodhousii*), the cranial crests are parallel between the eyes, forming two back-to-back L shapes (not convergent between the eyes in a V), and do not merge on the snout in a bony lump or boss. Woodhouse's toads lack on the back and sides the symmetrical black-green spots with light halos. Woodhouse's toad tadpoles lack the strongly arched tail fin. Woodhouse's toad eggs are enclosed in a single jelly layer.

Montana Range



Migration

No information is available specific to Montana. Elsewhere the species is known to migrate up to several hundred meters between breeding pools and nonbreeding terrestrial habitats.

Habitat

Little specific information on the habitat of Great Plains toad is available. It has been reported from sagebrush-grassland, rainwater pools in road ruts, in stream valleys, at small reservoirs and stock ponds, and around rural farms; breeding has been documented in small reservoirs and backwater sites along streams (Mosimann and Rabb 1952, Dood 1980, Hendricks 1999, Hossack et al. 2003, P. Hendricks personal communication).

Information gathered from other locations indicates that when inactive, the Great Plains toad is found in burrows, and under rocks or wood. During the active season, it occupies burrows during the day that are quite shallow. This species enters water only to breed. It breeds in rain pools, flooded areas, and ponds and reservoirs that fluctuate in size, and appears to prefer stock tanks and roadside ponds rather than floodplains (Baxter and Stone 1985). Eggs and larvae develop in shallow water, usually clear or slightly turbid, but not muddy.

Ecology

Great Plains toads are uncommon near human habitation (Black 1970). They are mainly nocturnal (Bragg 1940, Black 1970). Postmetamorphic young may form aggregations (Graves 1993).

Reproductive Characteristics

Great Plains toads breed only after rain in clear, shallow, temporary pools of flooded grasslands, probably May to July in Montana (Bragg 1940, Black 1970). Two of three females collected in north-central Montana on July 20 had well developed eggs (Mosimann 1952).

From information gathered in Oklahoma, breeding choruses usually last a few days but are of variable duration. They lasted up to 14 days in March but only 1 to 2 days in June (Krupa 1994). Clutch size was usually several thousand eggs that hatch in a few days. The larval period was short (as few as 18 days) in June, long (up to 49 days) in early spring; pools rarely held water long enough for larvae to reach metamorphosis (Krupa 1994). Great Plains toads are sexually mature in 2 to 5 years. The species commonly exhibited communal egg deposition (Krupa 1994).

Management

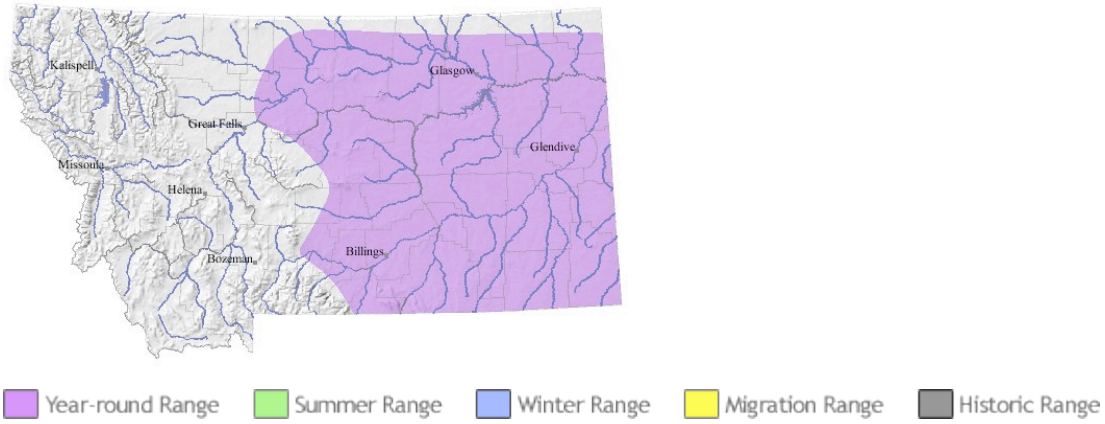
No special management needs are currently recognized. However, at permanent and semi-permanent water bodies (reservoirs and stock ponds) where breeding has been observed, portions of the shoreline with emergent vegetation could be fenced to create exclosures that protect breeding adults, eggs and tadpoles from trampling and the removal of emergent cover by livestock. Another option would be the creation of ponds designed for use by prairie amphibians as breeding sites, with the perimeter surrounded by fencing to prevent access by livestock. Game fish should not be introduced to any of these ponds.

Woodhouse's Toad (*Bufo woodhousii*)

General Description
Adults have dry skin with small warts, and are gray, brown, or olive green with paler mottling or spots. A prominent white or yellowish line runs down the center of the back (very young transformed toads typically lack the dorsal line and often have reddish brown warts). Adult body length is 2.5 to 5 inches. Parallel cranial crests are present between the eyes and the post-orbital crests connect them at a right angle behind the eyes; the post-orbital crests typically touch the parotoid glands. If a lump is present on the snout it does not extend back between the eyes. Adults have two black tubercles on each hind foot. Eggs and Tadpoles: Similar to the western toad.

Diagnostic Characteristics
The Great Plains toad has large, white-bordered, dark dorsal blotches. See description for Great Plains toad. Note: it is difficult to distinguish among the four Montana toad species in recently transformed toadlets.

Montana Range



Habitat
Adults are partially terrestrial but usually found near water; they typically breed in permanent lakes, ponds, reservoirs, and slow streams, where they prefer shallow areas with mud bottoms. They are usually found in irrigated agricultural areas and floodplains. Breeding and egg laying is spread out over spring and early summer (FWP). Most records are from non-forested E MT, but some occur in transition veg. in

P. pine and savannah forests (Black 1970). Found in floodplains and moist grass areas around water (Black 1970, Baxter and Stone 1980).

Ecology

Probably most versatile and wide-ranging toads in regard to distribution (Black 1970). Temps of 20-30 C most favorable for nocturnal activity. During day remain under cover of rocks, or burrowed in soil or damp cover near water (Hammerson 1982). May live over 20 years in the wild (Engeman and Engeman 1996).

Reproductive Characteristics

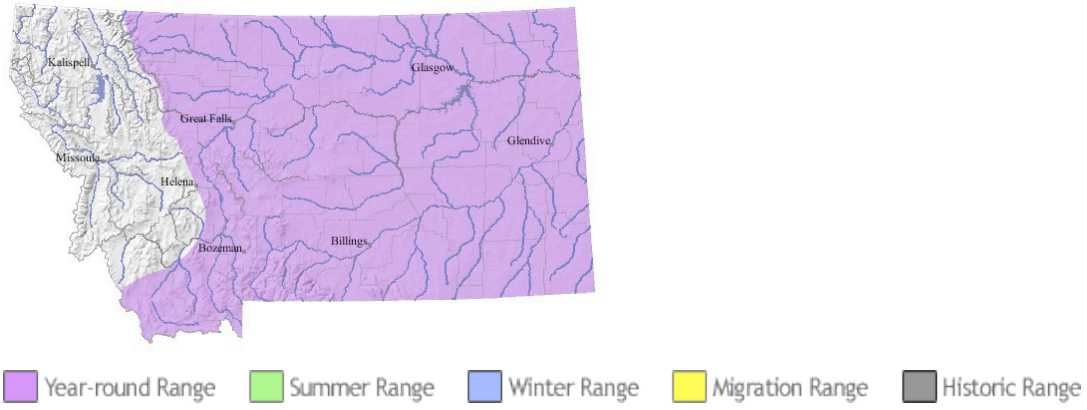
Breed late Apr-Jul dependent on spring/summer rains. Breed in streams, rivers, irrigation ditches, in shallow water w/o strong current (Black 1970).

Boreal Chorus Frog (*Pseudacris maculata*)

General Description
Adults have a tiny, almost unnoticeable toe pads; a dark line extends from the snout through the eye to the groin. Basic coloration varies, with background color green, brown, gray, or reddish. Typically three to five dark longitudinal stripes are present on the head and back; in some individuals the stripes may be broken into spots. Adult body length is .75 to 1.5 inches. Eggs and Tadpoles: Eggs are laid in clusters of 20 to 100; clusters are usually less than 1 inch across and attached to submerged vegetation. Tadpoles are brown/bronze with eyes located on the sides of the head.

Diagnostic Characteristics
Pacific tree frogs have obvious toe pads and an eye stripe ending at the shoulder.

Montana Range



Habitat
Boreal chorus frogs are regularly found in the water only during the breeding period in spring. They announce their presence this time of year by calling frequently at night and sporadically during the day. Following breeding, they move into adjacent uplands and are rarely seen. In eastern Montana, they breed in temporary ponds and small lakes surrounded by prairie (or occasionally open forest) habitats. Eggs hatch in about 2 weeks and tadpoles take 8 weeks to metamorphose (FWP). When not breeding, they are generally found in damp grassy/marshy areas or damp forests near water, but have been found up to 0.5km from water (Nussbaum et al. 1983, Hammerson 1982).

Ecology
Most common amphibian noted in NC MT. In high mountains males may not breed until 2nd year, and females until the 3rd year. Survival to adulthood may be only around 1% in mountain populations (Hammerson 1982).

Reproductive Characteristics
Breed late Mar-early Jun in WY (Hammerson 1982). Noted singing in early Apr in SW ID and as late as early July (Nussbaum et al. 1983). Eggs hatch in 10-14 days; metamorphosis in ca. 2 months (Nussbaum et al. 1983). Metamorphosis observed late Jul-Aug in north central MT (Mosimann and Rabb 1952).

Northern Leopard Frog (*Rana pipiens*)

General Description

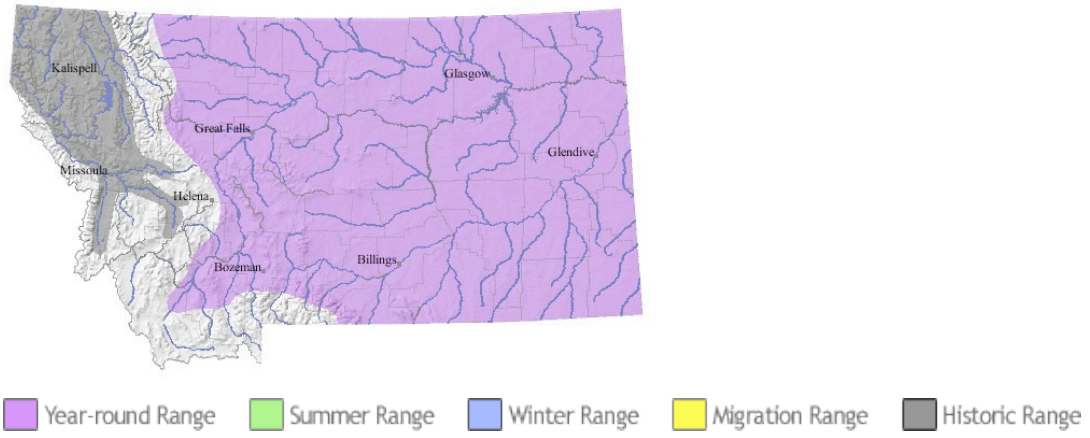
The backs of adult northern leopard frogs and juveniles are a green or brown base color (rarely light bluish) covered with large, oval dark spots, regular in outline, each of which is surrounded by a lighter halo or border. Ventral color is white to cream, with some pinkish patches on the feet. The skin is smooth, the dorsolateral folds are not inset toward the midline on the rump, the tympanum (eardrum) usually lacks a distinct light spot, and the hind toes have extensive webbing. Snout-vent length is 1.8 to 11.0 centimeters. The breeding call of males is a snoring sound lasting 2 to 3 seconds followed by a series of 2 to 3 stuttering croaks or chuckles.

Larvae (tadpoles) are dark brown to olive or gray on the back with a flecking of light gold and black, more concentrated on the sides, and then merging with a silvery-white or transparent belly. Tail length is less than 1.5 times the body length, the dorsal tail fin begins anterior to the tail musculature when viewed from the side. The anus is on the right side in front of the fin, not on the midline. The eyes fall within the outline of the head when viewed from above. The eggs are black above and white below, and are laid in large (orange- to grapefruit-sized) somewhat flattened globular masses; total diameter of individual eggs (including the two jelly layers) is less than 6.0 millimeters. Masses are usually attached to submerged vegetation.

Diagnostic Characteristics

This is the only ranid frog species in Eastern Montana.

Montana Range



Migration

No northern leopard frog information is available for Montana. In other locations, leopard frogs usually remain in relatively small seasonal home ranges, but may range several hundred meters or more between seasons in the upper Midwest. In Michigan, average nightly movement during rain was 36 meters, and as much as 800 meters. Individuals in Colorado have been documented moving at least 3 kilometers between years, and 8 kilometers between-year movements have been reported in the Cypress Hills, Alberta; young-of-the-year moved 2.1 kilometers between natal and breeding ponds in the Cypress Hills (Wagner 1997, Hammerson 1999).

Habitat

Habitats used by northern leopard frog in Montana are similar to those reported for other regions, and include low elevation and valley bottom ponds, spillway ponds, beaver ponds, stock reservoirs, lakes, creeks, pools in intermittent streams, warm water springs, potholes, and marshes (Brunson and Demaree 1951, Mosimann and Rabb 1952, Black 1969, Miller 1978, Dood 1980, Reichel 1995, Hendricks and Reichel 1996, Hendricks 1999). There is no evidence that this species in Montana has ever occupied high elevation wetlands, in contrast to Wyoming and Colorado (Baxter and Stone 1985, Hammerson 1999).

More specifically, northern leopard frogs require a mosaic of habitats to meet annual requirements of all life stages. Generally separate sites are used for breeding and overwintering, but this may occur in the same pond in some cases. They occupy a variety of wetland habitats of relatively fresh water with moderate salinity, including springs, slow streams, marshes, bogs, ponds, canals, flood plains, beaver ponds, reservoirs, and lakes, usually in permanent water with rooted aquatic vegetation. Habitats are often with few or no trees, but in Alberta and Colorado forested areas may be used. In summer, adults and juveniles commonly feed in open or semi-open wet meadows and fields with shorter vegetation, usually near the margins of waterbodies, and seek cover underwater; taller, denser vegetation seems to be avoided.

Eggs are laid and larvae usually develop in shallow warm and still water, generally in areas well exposed to sunlight. Generally eggs are attached to vegetation just below the surface of the water. In northern Minnesota, successful reproduction in acidic bog water either does not occur or is a rare event (Karns 1992). During winter, northern leopard frogs usually are found inactive underwater on the bottom of deeper streams and ponds or springs that do not freeze to the bottom and are well oxygenated, sometimes under bottom rubble and debris, in water as deep as 85 centimeters (Baxter and Stone 1982, Nussbaum et al. 1983, Russell and Bauer 1993, Wagner 1997, Hammerson 1999).

Ecology

Northern leopard frogs are active during the day and night. The active period extends from March to November in Colorado (Hammerson 1999). In Wyoming and the Pacific Northwest, adults emerge in March or April (Nussbaum et al. 1983, Baxter and Stone 1985, Russell and Bauer 1993) when water temperatures exceed 10 degrees C. In Montana, the active period of adults is reported to extend from mid-March to early October (Brunson and Demaree 1951, Roedel and Hendricks 1998, Hendricks 1999). In all cases, activity begins when ice melts. Predators of adults and juveniles include Great Blue Heron, Burrowing Owl, snakes (including garter snakes), some mammalian carnivores, and game fish. Tadpole predators include Pied-billed Grebe, tiger salamander, garter snakes, and bullfrog tadpoles (Nussbaum et al. 1983, Russell and Bauer 1993, Hammerson 1999). Predators in Montana have not been reported.

Reproductive Characteristics

Information on reproduction in Montana is limited, and no detailed studies of the reproductive biology of any population have been conducted. Timing appears variable, and depends on the year and location. Calling males have been reported in April and May. Near Tiber Reservoir, in Toole and Liberty counties, females have been collected with relatively undeveloped eggs in mid-June and moderately developed to fully developed eggs in early and late July; recently transformed juveniles also were noted in late July (Mosimann and Rabb 1952). Eggs and tadpoles have been reported at breeding sites across eastern

Montana during early April to late July, with a peak in May and June; sometimes tadpoles are observed in August and September (Reichel 1995, Hendricks and Reichel 1996, Hendricks 1999, Hossack et al. 2003). Recently metamorphosed juveniles with small tail stubs measured 2.6 to 3.4 centimeters snout-vent length.

In general, males gather at breeding sites of shallow, quiet water in spring and vocalize on warm sunny days (water temperatures of 14 to 23 degrees C.) while floating at the surface of the water. In favorable habitat, 20 to 25 or more males may gather in a 20 square meter area. Females begin laying eggs a few days after calling begins. The time of egg deposition varies with latitude and elevation. Egg deposition occurs typically in April in southern Quebec, New York, and the Great Lakes region, late April to late May farther north in Manitoba and Nova Scotia (Gilbert et al. 1994). In Colorado, eggs are laid mainly in late March or by mid-April at low elevations, and in May in the mountains (Corn and Livo 1989, Hammerson 1999). Breeding often peaks when water temperatures reach about 10 C. At a particular site, egg deposition generally occurs within a span of about 10 days. Egg masses include several hundred to several thousand ova; the clutch size of 68 Colorado egg masses was 645 to 6272 eggs (Corn and Livo 1989). The density of egg masses often reaches a few hundred per hectare in favorable habitat, sometimes more than 1000 per hectare, but is usually less than 100 in Colorado.

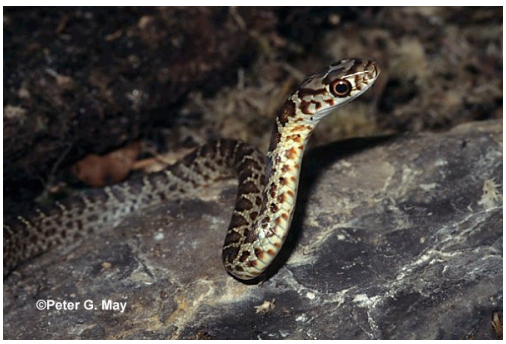
Eggs hatch in about 1 to 2 weeks; the larval (tadpole) period is about 10 to 12 weeks (58 to 105 days). Hatching may occur over several weeks at a single site. Recently metamorphosed juveniles appear in late June and early July at lower elevations, and in mid-July to September at higher elevations (Hammerson 1999). Size at metamorphosis is 2.1 to 3.6 centimeters snout-vent length. Aquatic larvae usually metamorphose in summer, but they may overwinter as tadpoles in some areas (Baxter and Stone 1985). Females are sexually mature usually in two years in most areas, three years in high elevation populations. Breeding males in Colorado are usually more than 5.0 centimeters snout-vent length, and breeding females more than 6.0 centimeters.

Management

No special management needs are currently recognized for populations in eastern Montana. However, at permanent and semi-permanent water bodies (reservoirs and stock ponds) where breeding has been observed, portions of shorelines where emergent vegetation is present or might develop could be fenced to exclude access by livestock and thereby protect breeding adults, eggs and tadpoles from trampling and the removal of emergent cover by livestock. Another option would be the creation of ponds designed for use by prairie amphibians as breeding sites, with the perimeter surrounded by fencing to prevent access by livestock. Game fish should not be introduced to any of these ponds, nor should chemical fertilizers, pesticides and herbicides be used within 100 meters of the shoreline. All breeding sites west of the Continental Divide should be protected from livestock, and organic and chemical (pesticide and herbicide) contamination. Game fish and bullfrogs should not be introduced to these sites. Care should be taken to avoid introducing parasites and fungal, bacterial, and viral pathogens when monitoring these sites (see suggestions in Maxell 2000, Maxell et al. 2003). Any populations discovered in the western region should be reported to the Native Species Biologist of the Montana Department of Fish, Wildlife & Parks or the Program Zoologist of the Montana Natural Heritage Program.

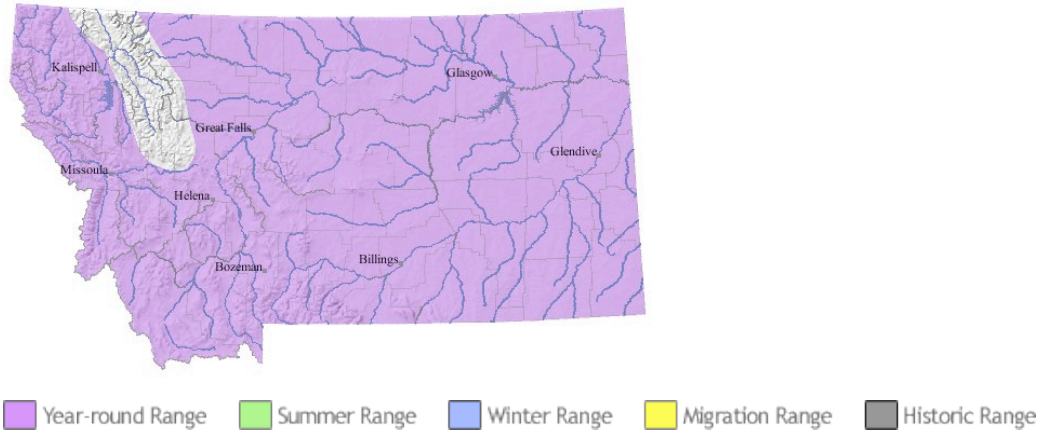
Reptiles:

Eastern Racer (*Coluber constrictor*)



General Description
A slender, moderately long snake, the racer ranges from 20 to 65 inches in length. In adults, color of the back can vary from uniform greenish gray to brown or blue. The belly is whitish to pale yellow, the latter extending onto scales of the upper lips and nasal region of the head. The eyes are relatively large, and the scales are smooth. Young snakes (up to about 20 inches) have a much different coloration than adults. On the back, a series of brown blotches edged with black runs the length of the snake; a row of blotches on each side also extends onto the belly.

Montana Range



Habitat
Racers are associated with relatively open habitats either in shortgrass prairie or forested areas. Very fast and active, they prey on insects and small vertebrates such as mice and frogs. They are generally diurnal and will climb vegetation. Females lay a clutch of three to seven eggs in summer (FWP). In WY, primary habitats are scarp woodlands of plains and foothills often near water (Baxter and Stone 1980). Some cover seems especially important on shortgrass prairie (Fitch 1963). In the NW racers generally absent from dense forest/high mountains (Nussbaum 1983)

Ecology
Home range of about 1 ha in KA & UT; travel as far as 4000' between hibernacula and summer range (KA) (Fitch 1963), or 1.6 km (UT) (Brown and Parker 1976).

Reproductive Characteristics
In NE KA: mate May-early Jun; oviposit Jun-early Aug; incubate average of 51 days; clutch size average 11.6 (flaviventris), 5.8 (mormon) (increases with size/age). Also KA: 13% of 2 yr old females fecund; 80% of old ones (Fitch 1963, Fitch 1970).

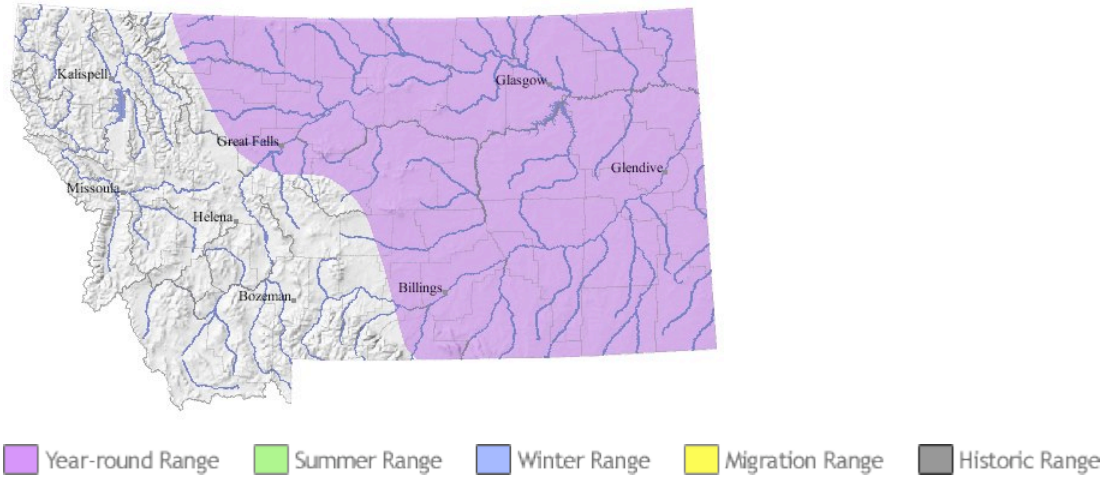
Western Hog-Nosed Snake (*Heterodon nasicus*)



General Description
This is a heavy-bodied snake with a broad neck and dark blotches on the back extending from the back of the head onto the tail. There is much black pigmentation on the underside of the body, with contrasting patches of white, yellow, and orange, and the anal scale is divided. The snout is upturned, with an enlarged rostral scale that is spade-like and keeled. The dorsal scales are also keeled. There are enlarged ungrooved teeth near the rear of the upper jaws. The maximum total length is about 90 centimeters, but most individuals are less than 65 centimeters. Hatchlings are similar to adults in appearance and about 17 to 20 centimeters total length. Eggs are smooth and elongate (usually 26 to 38 millimeters x 14 to 23 millimeters in length and breadth).

Diagnostic Characteristics
The presence of an upturned snout that is spade-like and keeled, in combination with keeled dorsal scales, a dark-patterned belly, a divided anal scale, and the absence of tail rattles and facial pit, distinguishes the western hognose snake from all other snakes native to Montana. The color pattern is described as similar to both the gopher snake and the western rattlesnake, but neither of these, nor any other snake in Montana, has an upturned nose like the western hognose snake.

Montana Range



Habitat

Little specific information for the state is available. They have been reported in areas of sagebrush-grassland habitat (Dood 1980) and near pine savannah in grassland underlain by sandy soil (Reichel 1995, Hendricks 1999). In other locations, their apparent preference for arid areas, farmlands, and floodplains, particularly those with gravelly or sandy soil, has been noted. They occupy burrows or dig into soil, and less often are found under rocks or debris, during periods of inactivity (Baxter and Stone 1985, Hammerson 1999, Stebbins 2003).

Ecology

Little information is available specific to Montana. However, western hognose snakes are known to be diurnal. Their active period extends primarily from late April to mid-October in Colorado (Hammerson 1999). The active period in Montana is poorly documented, with records from mid-May to the end of September, and mostly from early June to early August (Mosimann and Rabb 1952, Reichel 1995, Hendricks and Reichel 1998, Hendricks 1999). Population density was estimated at about 4 to 6 per hectares in Kansas pasture, about half of this was in an ungrazed area (Platt 1969).

The few confirmed predators include hawks (*Buteo* spp.), American Crows, and coyotes (Platt 1969, Hammerson 1999). Predators of the western hognose snake in Montana have not been reported. When disturbed, western hognose snakes may flatten their heads and vigorously strike and hiss. If these methods fail to deter a threat, individuals may exhibit death-feigning behavior that includes writhing, rolling over on the back, letting the tongue hang from the mouth, and remaining limp. If turned right side up, individuals will immediately roll over on their backs again (Hammerson 1999). Montana individuals also show this death-feigning behavior (Mosimann and Rabb 1952).

Reproductive Characteristics

There is almost no information specific to Montana. A female collected in Toole County on July 20, 1950 contained seven eggs ready for laying (Mosimann and Rabb 1952).

Information from other locations indicate that western hognose snakes lay clutches of 3 to 23 eggs in shallow burrows or nests a few inches below the surface (Platt 1969). The eggs of a female obtained June 11 measured 13 by 27 millimeters (Stebbins 1954). Eggs are laid in May through August, depending on locality, but mainly during June and July. Females may oviposit in alternate years, and only half of the females in a population may lay eggs in any year. Eggs hatch in about two months; hatchling emergence peaks in late July and early August in Colorado (Hammerson 1999). They reach sexual maturity in the second year (Platt 1969). In a Kansas study, only about 30% of the population was as old as 4 years. Maximum longevity in natural conditions is about 8 years, but captive animals have lived two decades.

Management

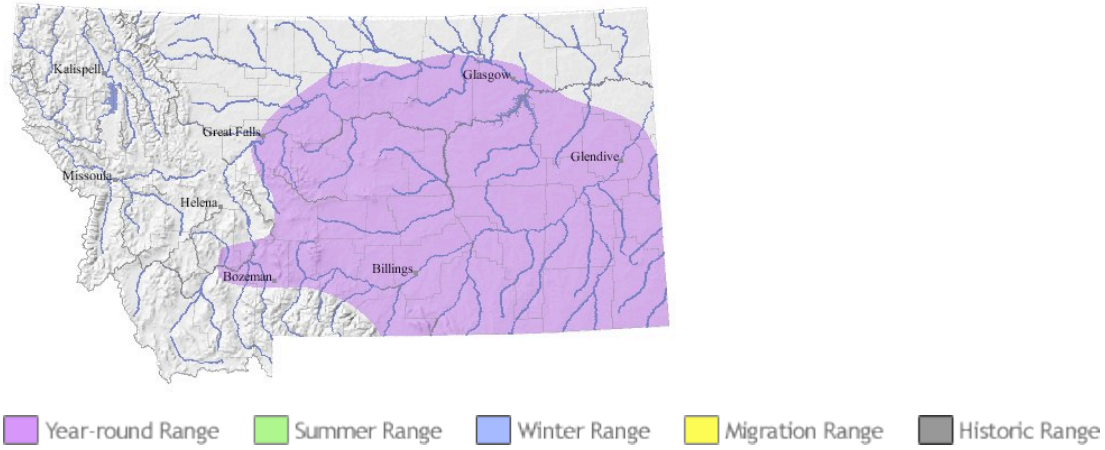
Apparently the western hognose snake was relatively abundant in Montana during the late 19th Century, at least in some regions; in 1876 it was the third most common reptile (after the western rattlesnake and short-horned lizard) along the Missouri River between Fort Benton and the mouth of the Judith River (Cope 1879). This is no longer the case (Maxell et al. 2003); the few recent records suggest that the species is uncommon throughout Montana, although its status is largely unknown. Even though this snake is still encountered across its historical range, it is less abundant than in the 19th Century probably due to extensive habitat loss associated with conversion of prairie to agricultural landscapes. As in other regions, an unknown percentage of local populations experiences road mortality, as many specimen and observation records are of road-killed individuals. Draining of prairie wetlands may have negative impacts on the prey (toads and frogs particularly, and perhaps turtle eggs) this snake prefers. Management in Montana for this species is hampered by a lack of basic information on abundance, food habits, and habitat associations, but is probably best effected for the long-term by protecting suitable prairie habitats from conversion to agricultural uses. No specific management activities are suggested at this time, but any nests and dens should be protected and left undisturbed.

Milksnake (*Lampropeltis triangulum*)

General Description
The back and sides of the body of the milk snake are marked with whitish, black, and reddish or orange bands, with the reddish-orange bands bordered by the black; the snout is blackish and sometimes with whitish flecking. The bands often extend across the belly, but sometimes may be incomplete or absent, in which case the belly is whitish. Dorsal scales are smooth (unkeeled). The anal scale is not divided, as are most of the scales on the ventral surface of the tail. The neck is relatively short and thick. Total length of adults in the western Great Plains is usually 39 to 85 centimeters. Hatchlings are similar in appearance to adults, and 16 to 29 centimeters in total length. Eggs are slightly granular and range from 29 to 44 millimeters x 13 to 16 millimeters in length and breadth, depending on locality.

Diagnostic Characteristics
The whitish, black, and reddish to orange banding or rings around the body, an undivided anal scale, and smooth (unkeeled) dorsal scales distinguish the milk snake from all other snakes native to Montana.

Montana Range



Migration
No information on the movement or migration of milk snakes is available for Montana. The species is believed to be non-migratory. Little information is available on movements of milk snakes throughout the species' range. They may migrate between hibernacula and summer ranges in some areas (Vogt 1981, Fitch and Fleet 1970, Hammerson 1999), and home ranges are about 20 hectares in northeastern Kansas.

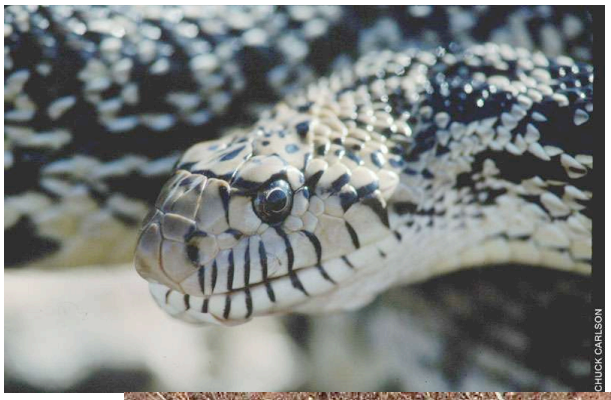
Habitat
Little specific information is available. Milk snakes have been reported in areas of open sagebrush-grassland habitat (Dood 1980) and ponderosa pine savannah with sandy soils (Hendricks 1999, B. Maxell personal communication, L. Vitt personal communication), most often in or near areas of rocky outcrops and hillsides or badland scarps, sometimes within city limits.

Ecology
Milk snakes are mostly crepuscular and nocturnal, although they may on occasion be active during the day, particularly during moist surface conditions. In Colorado, milk snakes emerge from dens in April and re-enter hibernacula in mid-October (Hammerson 1999), although they have been seen as late as mid-November. The active period in Montana is poorly documented; records extend from late May to October (B. Maxell personal communication). Predators are largely unknown, including in Montana, but milk snakes exhibit predator defense behavior, and rear up and strike, or vibrate the tail, when disturbed, although they are usually docile when handled.

Reproductive Characteristics
No information specific to the reproductive habits of the milk snakes is known for Montana. Based upon information from other states, courtship and mating are believed to occur in spring, generally in May. Milk snakes lay clutches of 2 to 17 eggs; typical clutches in Colorado and adjacent areas are 4 to 6 eggs (Hammerson 1999). Eggs are laid usually in mid-June to mid-July. Eggs hatch in about 6 to 9 weeks, beginning in late August and most often in September. Some females reach sexual maturity in their 3rd or 4th year (45 to 50 centimeters snout-vent length) in Kansas (Fitch and Fleet 1970), and evidence indicates this is also the case in Colorado (Hammerson 1999). Longevity in wild populations is unreported, but captive individuals have lived more than 20 years.

Management
So few recent milk snake records exist for Montana (Maxell et al. 2003) that it is difficult to determine if management activity is needed. Nevertheless, the widely scattered recent records indicate that milk snakes continue to occupy a large part of the known range in the state, and some sites near a large urban center have remained occupied for the last 40 to 45 years (L. Vitt personal communication). Management for this species is hampered by a lack of basic information on abundance, food habits, and habitat associations. No specific management activities are suggested at this time, other than to protect dens and regulate or restrict commercial harvest for the pet trade.

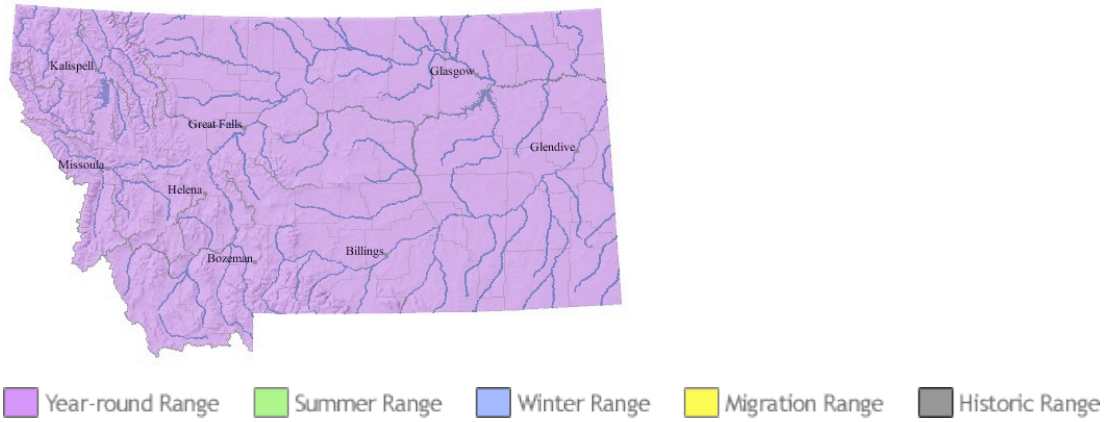
Bull or Gopher Snake (*Pituophis catenifer*)


General Description

The gopher or bull snake can reach a length of 7 feet (it is Montana's largest snake), but most range from 3 to 5 feet. It can be readily identified by a series of large black to brown blotches that run down the back, and another series along the sides. The blotches, which are set on a yellow background, become more widely spaced toward the tail. The dorsal scales are keeled (have a ridge running down the center). A black band can usually be seen on the head in front of and extending below the eyes. The belly is yellow to white, often spotted with black (FWP). Dorsal coloration varies geographically, but in most areas has numerous dark blotches on a cream or yellowish background; 4 prefrontal scales; dorsal scales keeled; anal undivided; adults usually 90-183 cm in total length (Conant and Collins 1992, Stebbins 1985).

Montana Range



Habitat
Gopher snakes are associated with dry habitats, including open pine forests. They feed on rodents, rabbits, ground-dwelling birds, and to a lesser extent lizards. They sometimes hiss and vibrate their tail when alarmed, producing a sound similar to that of rattlesnakes. They occasionally climb trees. They are largely crepuscular. Females lay 2 to 24 eggs in summer (FWP). N central MT: of 12 records, 9 in river valley, 1 in coulee, 2 on prairie (Mosimann and Rabb 1952). One found in rocky sagebrush area N of Arlee, MT (Franz 1971). Common in SE Alberta in brushy coulees, sage flats, & along roads (Lewin 1963).

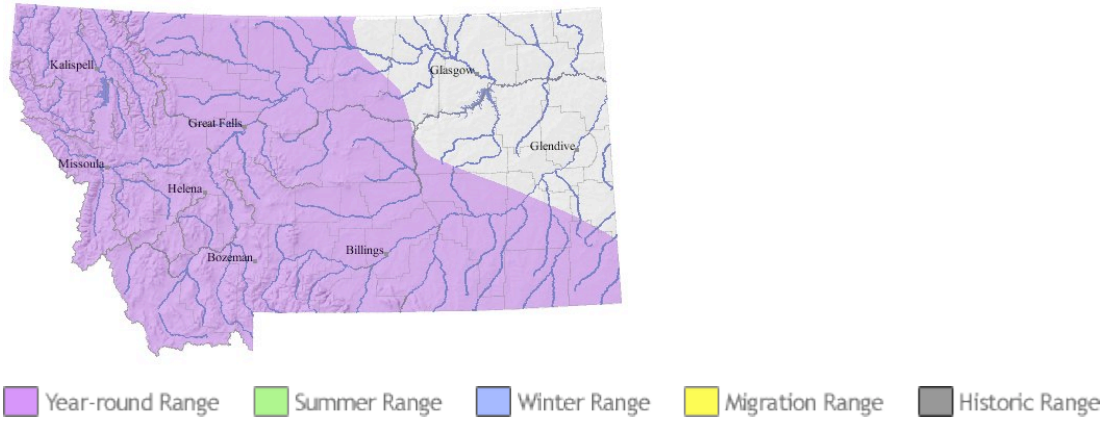
Ecology
Overwinter survival in N UT > 88% (adults), 25% (juv.) (Parker and Brown 1980). Densities of 1.3 snakes/ha reported for ID (Nussbaum 1983).

Reproductive Characteristics
Mate in late May-Jun; lay eggs late Jun-Jul; hatch late Aug- Sep (Hammerson 1982). Clutch size (P.C. SAYI) ave. 12.4 (Fitch 1970). Hatching success in N UT was 92% (Parker and Brown 1980).

Terrestrial Gartersnake (*Thamnophis elegans*)


General Description
Adults vary from 16 to 43 inches in length. This snake is distinguished by three yellow stripes (one dorsal, two lateral) running the length of the body and a series of black spots situated between, and somewhat on, the stripes. The background color between the stripes is brownish or greenish. All-black individuals are occasionally found. A series of dark black/brown blotches covers most of the belly. There are normally eight scales on the upper lip.

Montana Range



Habitat
Garter snakes are found in nearly all habitats, but most commonly at lower elevations around water. They are diurnally active. Females give birth to 6 to 18 live young during summer. They eat a variety of vertebrates and invertebrates (FWP). Common near water but also found away from water. At high elev. common on rocky cliffs/ brushy talus (Brunson and Demaree 1971, Franz 1971). On prairie may be more common along brushy bottomland (Mosimann and Rabb 1952, Lewin 1963).

Reproductive Characteristics
Birth usually occurs in Aug-Sep (CO) (Hammerson 1982), late Jul-early Aug (Pacific NW) (Nussbaum 1983).

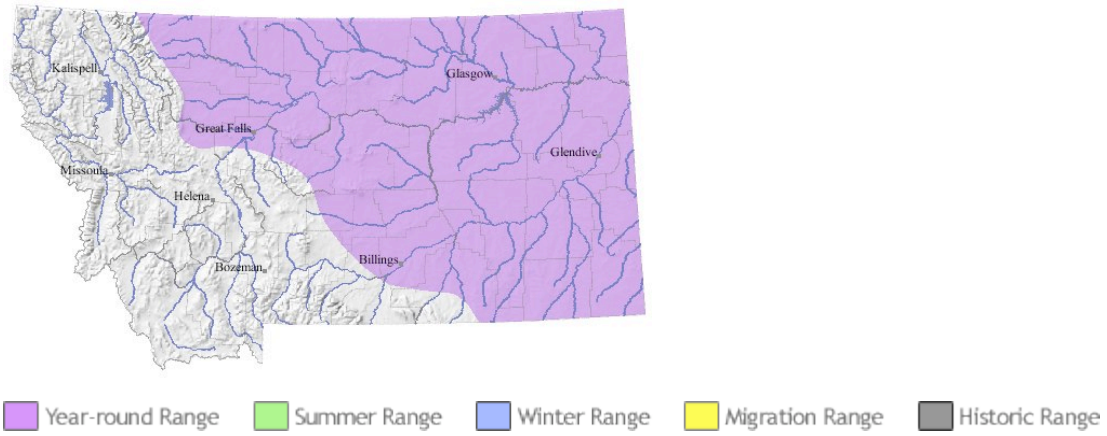
Plains Gartersnake (Thamnophis radix)



General Description
Adults range from 16 to 42 inches in length. Background color above is olive, brown, or black. This snake has an orange or yellow dorsal stripe and two greenish-yellow stripes on each side (the latter located on the third and fourth scale rows above the belly scales). It typically has black vertical bars on the upper lips.

Diagnostic Characteristics
Other garter snakes in Montana have the lateral yellow lines on the second and third scale rows above the belly scales.

Montana Range



Habitat
Garter snakes are found in nearly all habitats, but most commonly at lower elevations around water. Females give birth to 6 to 18 live young during summer. They eat a variety of vertebrates and invertebrates (FWP). Widely distributed over shortgrass prairie, but may be esp. common near ponds/coulees.

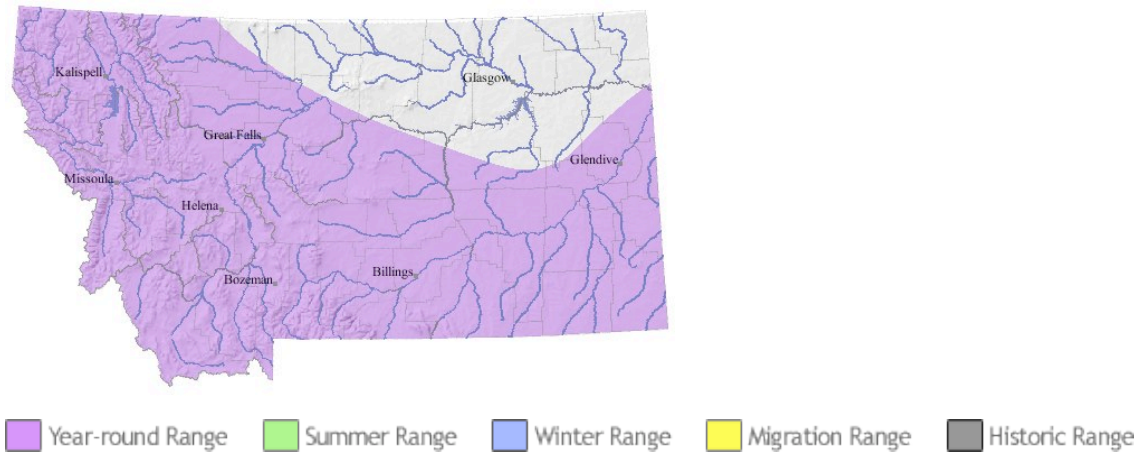
Reproductive Characteristics
In CO, mate May-early Jun; parturition late Jul-Sep. Litter sizes 16 (2-21). In Saskatchewan may have >1yr long reproductive cycle.

Common Garter Snake (*Thamnophis sirtalis*)

General Description
Adult common garter snakes range from 16 to 42 inches in length. This snake has two color variations in Montana. The first has three yellow longitudinal stripes (one dorsal and two lateral) and a black stripe broken by red spots between the yellow stripes. The lateral stripes are located on the second and third scale rows above the belly scales. The second color variation has the same striping pattern but lacks the red dots. In both variations, the background color between stripes is black to dark olive. The belly color ranges from yellow to bluish, and some individuals of the red-sided color variation have small black spots on the edge of the belly scales. The dorsal scales are keeled, and normally there are seven scales on the upper lip (FWP). Coloration varies geographically. There are 19 dorsal scale rows at mid-body and lateral stripes on the 2nd and 3rd scale rows (also on row 4 in subspecies annectens). There are 7 upper labials, 1 preocular, and 3 postoculars. The scales are keeled, and the anal undivided. The total length of adults is usually 41 to 66 centimeters (up to 131 centimeters). Common garter snakes are around 12 to 23 centimeters at birth (Conant and Collins 1991, Smith and Brodie 1982).

Diagnostic Characteristics
The western terrestrial garter snake has black spots overlapping the dorsal yellow stripe, and the background color between stripes tends to be brownish. The plains garter snake has its lateral yellow stripes on the third and fourth scale rows above the belly scales, and the dorsal stripe is often orange or red (FWP). It differs from other sympatric garter snakes by the following combination of characteristics: lateral stripe confined to the 2nd and 3rd scale rows (except in subspecies annectens), seven upper labials, tail less than 27% of total length, and 19 scale rows at mid-body.

Montana Range



Habitat

Garter snakes are found in nearly all habitats, but most commonly at lower elevations around water. They are diurnal. Females give birth to 6 to 18 live young during summer. They eat a variety of vertebrates and invertebrates (FWP). They prefer moist habitats and are found most often along the borders of streams, ponds and lakes (Franz 1971, Brunson and Demaree 1951, Anderson 1977). They may travel long distances (4 to 17 kilometers) from hibernacula to forage in preferred habitat (Gregory and Stewart 1975).

Food Habits

Common garter snakes prey extensively on amphibians, especially during metamorphosis (Gregory 1984, Fitch 1965, Gregory and Stewart 1975). The western Montana diet varied little with the season and consisted of (% by number) Anura 46 (mostly Bufo boreas 23, Abystoma macrodactylum 13), Hirudo 41, and Oligochaeta 7. Slugs, birds and small mammals are also taken (Anderson 1977).

Reproductive Characteristics

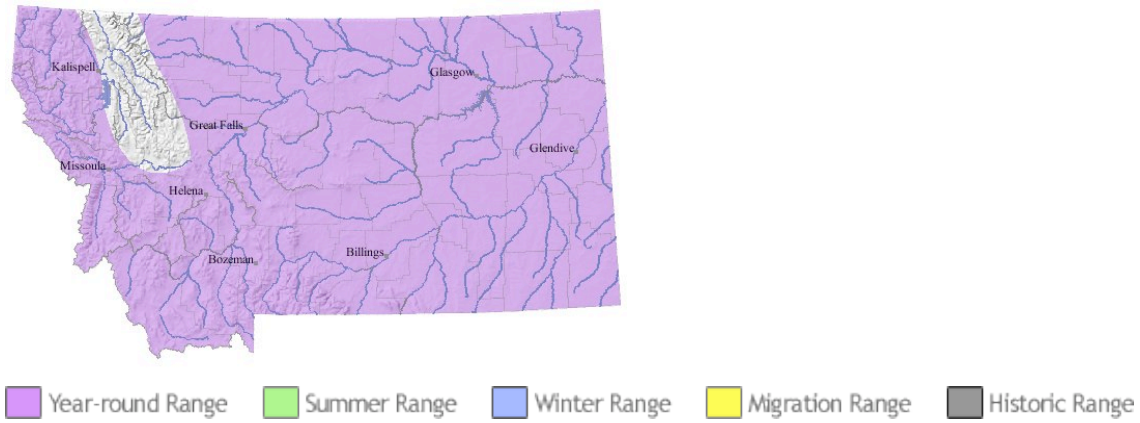
Common garter snakes may mate in fall but most mate soon after emergence (late April to early June). Air temperature may trigger spring mating; mating is most intense at temperatures more than 15 degrees C. (Aleksink and Gregory 1974). Parturition is in late July to August in Kansas.

Prairie Rattlesnake (*Crotalus viridis*)

General Description
Adults have a triangular head, blunt nose, narrow neck, and stout body; they range in length from 15 to 60 inches. The background color above varies from pale green to brown; a series of brown or black blotches edged with a dark and then a light line extends the length of the body. The blotches often merge into rings on the tail. There are also blotches on the sides. The belly is pale yellow to white and lacks blotches. All rattlesnakes have a heat-sensing pit located between the nostril and the eye. The fangs are hollow and hinged, allowing them to be folded back against the roof of the mouth. The tail ends in a rattle that helps warn potential predators of the snake's presence.

Diagnostic Characteristics
No other snake in Montana has rattles (see gopher snake and western hognose snake)

Montana Range



Habitat

Western rattlesnakes favor open and arid country but are also found in ponderosa pine stands and mixed grass-coniferous forests. They are more likely to be encountered on south-facing slopes and in areas with rock outcrops. Rattlesnakes den communally, but range up to 7 miles from the dens during the summer. Females give birth to 4 to 21 young in late summer; the young are marked similarly to adults, but colors are brighter. They are mainly crepuscular, but can be active at other times of the day or night if conditions are suitable. Rattlesnakes prey on a variety of animals, including mice, ground squirrels, and rabbits (FWP). Gravid females may aggregate at basking sites (rookeries) (Gannon and Secoy 1985). May be most common near broken country and breaks. Land use changes from range to irrigated farmland may adversely affect population (Pendlebury 1977).

Ecology

In SW Saskatchewan, one hibernaculum contained an estimated 150 ad., plus juv. and YOY in same den. Overwinter weight loss greater for N pop than for S pop; overwinter mortality of YOY may be significant for N population (Gannon and Secoy 1984).

Reproductive Characteristics

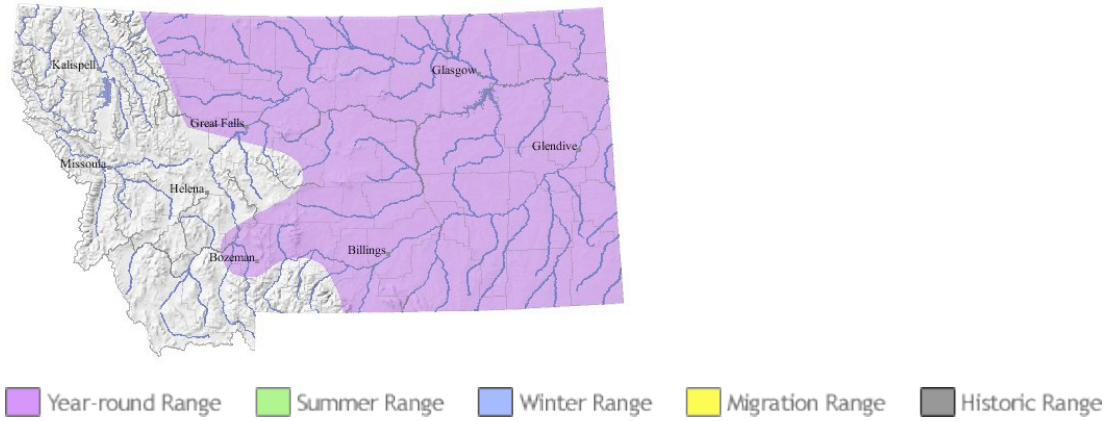
Female probably has 2 yr repro cycle (Gannon and Secoy 1984). Mate late Jul-early Sep (Klauber 1972). Sperm presumed to stay viable overwinter. Parturition late Aug-Sep - ave. yng = 9-10 in S Saskatchewan (Gannon and Secoy 1984).

Greater Short-horned Lizard (*Phrynosoma hernandesi*)

General Description
The short-horned lizard body is broad and flattened. The back is spiny, with an especially noticeable single row of scales fringing each side of the body. The spines at the back of the head are about as long as wide at the base. The coloration of the back usually blends cryptically with the soil and can vary somewhat from region to region and at single localities. The maximum total length is about 15 centimeters. In males, there is a swelling at the base of the tail, and the tail is proportionally longer than in females. Newborn young have the broad and flattened body shape, and are about 2.0 to 2.5 centimeters snout-vent length and up to 3.8 centimeters by the time of first hibernation.

Diagnostic Characteristics
The broad, flattened body separates this lizard from the other three lizard species regularly documented in Montana, and the range overlaps only with the sagebrush lizard. The pigmy short-horned lizard has been reported from extreme southwestern Montana, in the Centennial Valley, Beaverhead County (Maxell et al. 2003), but adults of this species are much smaller than short-horned lizards, the small horns on the back of the head project almost vertically rather than horizontally, and they lack the wide notch between the horns on the back of the head that gives the head of short-horned lizards a "heart-shaped" appearance when viewed from above (St. John 2002).

Montana Range



Habitat

Habitat use in Montana is poorly described, but appears to be similar to other regions. Reports mention individuals on ridge crests between coulees, and in sparse, short grass and sagebrush with sun-baked soil (Mosimann and Rabb 1952, Dood 1980). On the southern exposures of the Pryor Mountains, Carbon County, individuals occur among limestone outcrops in canyon bottoms of sandy soil with an open canopy of limber pine-Utah juniper, and are also present on flats of relatively pebbly or stony soil with sparse grass and sagebrush cover (P. Hendricks personal observation).

Ecology

Adult short-horned lizards are diurnal and active during the warmer daylight hours. Specific information for Montana is limited, but information from other areas within their range indicates they may appear as early as late March (Hammerson 1999), with most surface activity in the northern parts of the range occuring from mid-April to mid-September. Extreme records in Alberta extend from April 1 to November 10 (Powell and Russell 1998), but most have disappeared by the mean date of the first fall frost. Young-of-the-year are generally not active during mid-day hours, and small lizards appear more dependent on air temperatures than on substrate temperatures, while large ones are more dependent on substrate temperature. Predators of this species are mostly unknown, but striped whipsnake (*Masticophis taeniatus*) and Burrowing Owls (*Speotyto cunicularia*) have been reported (Hammerson 1999), and birds have been identified as the primary predatory group (Russell and Bauer 1993). The annual period of activity in Montana in poorly defined, and no predators have been reported.

Reproductive Characteristics

No studies of the life history and reproduction of this species have been conducted in the state. In extreme southern Montana, young about 3.0 to 3.5 centimeters snout-vent length have been observed in early August and early September (Hendricks 1999, P. Hendricks personal observation).

Based upon information gathered from other areas within the species' range, adult short-horned lizards mate shortly after emerging from hibernation in late March to early June, depending on location, and young are born about two or three months after eggs are fertilized. The short-horned lizard is viviparous, giving live birth to 5 to 36 young (3 to 15 in the Pacific Northwest) during July to September (Nussbaum et al. 1983, Stebbins 1985). The size of 8 litters from Alberta, born in late July to early August, ranged from 6 to 13 young (Laird and Leech 1980, Powell and Russell 1998) and 5 litters in Colorado ranged from 14 to 18 young (Hammerson 1999). A litter of 13 young was born in southern Wyoming in early August (2.3 to 2.4 centimeters snout-vent length at birth) and consisted of two color morphs (Ashton and Ashton 1998); 4 young were stillborn. Sexual maturity is reached in at least two years (Nussbaum et al. 1983, Hammerson 1999).

Management

Threats to this species in Montana are speculative, due to lack of study and poor survey coverage. The short-horned lizard was considered the most abundant reptile along the Missouri River in Montana in the late 19th Century (Cope 1879), second only to the western rattlesnake, but it is no longer thought common anywhere in the state, with the possible exception of southern Carbon County (Maxell et al. 2003). The relatively few records in recent years parallel the pattern for Colorado (Hammerson 1999), but inadequate survey coverage makes conclusions regarding trends in Montana tenuous. Habitat loss due to the conversion of prairie to cropland has undoubtedly contributed to the apparent decline, but livestock grazing is probably not a serious threat to any population, judging from reports in other regions. However, clearing of sagebrush to increase grass production for livestock could have detrimental impacts on local populations of short-horned lizards. Indiscriminant use of insecticides to control some insect species could also affect the food supply of this lizard. No management activity for this species in Montana is currently underway, nor is any proposed at this time, but the conversion of native prairie to cropland or other use will contribute to the decline of this species in the state. Within the range of the short-horned lizard in Montana where sagebrush control is planned, some sage should be left in a network of patches to insure population persistence of these lizards. Given the small home range size of the species, thinning of sagebrush or removal in small patches is probably a better management guideline than removing sagebrush entirely or in large patches.

Common Sagebrush Lizard (*Sceloporus graciosus*)

Male ventral Female ventral

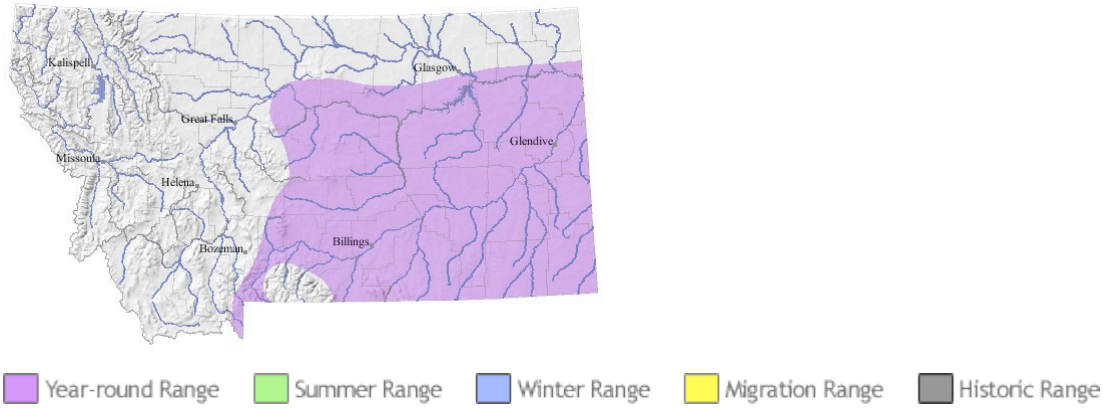
General Description

The body of the sagebrush lizard is small and narrow. The back is covered with small spiny, keeled scales, and usually has a pale dorsolateral stripe on each side; scales on the rear of the thigh are very small and often granular. Dorsal coloration is brown, olive or gray with a bluish or greenish tinge. Ventral surfaces of females are white or yellow; males have blue lateral abdominal patches and blue mottling on the throat. Maximum snout-vent length (SVL) is about 6.5 centimeters; maximum total length is about 15 centimeters, with the tail length about 1.5 times the snout-vent length. Mature males have enlarged postanal scales with two enlarged hemipenal swellings on the underside at the base of the tail. Gravid females may develop a reddish-orange color along the sides. Hatchlings are 2.3 to 2.8 centimeters SVL; eggs are white and leathery, and 12 to 14 millimeters in length by 6 to 8 millimeters in breadth.

Diagnostic Characteristics

The sagebrush lizard lacks the broad flattened body and the fringe of prominent spines on each side of the body that is present in the greater short-horned lizard, the only other Montana lizard with which it overlaps in range. The northern alligator lizard has a prominent skin fold on the side of the body; the western skink has smooth and shiny rounded scales.

Montana Range



Habitat

Habitat use in Montana has not been the subject of detailed studies. However, occupied habitats appear similar to other parts of the range (P. Hendricks personal observation). This species occurs in sage-steppe habitats, sometimes in the presence of sedimentary rock outcrops (limestone and sandstone), and in areas with open stands of limber pine and Utah juniper (Hendricks and Hendricks 2002) or ponderosa pine. In many places, open bare ground is abundant, grass cover is less than 10%, and height of shrub cover may be as low as 0.25 meters.

In Yellowstone National Park, Wyoming it is found at higher elevations in geothermal areas (Koch and Peterson 1995). Favored areas tend to have a high percentage of open bare ground and a component of low to tall bushes, such as sagebrush and rabbitbrush (Stebbins 1985, Green et al. 2001). Although a ground dweller, this lizard will perch up to 1 to 2 meters above ground in low shrubs and trees (Hammerson 1999). It uses rodent burrows, shrubs, logs, and rocks for cover.

Ecology

Sagebrush lizards are active during the day in the warmer hours from early May through mid-September in Yellowstone National Park (Koch and Peterson 1995), but emerging in March or April and remaining active into October in other parts of the range (Nussbaum et al. 1983, Hammerson 1999). Timing of spring emergence has not been determined for Montana populations, but numerous animals of all size classes have been observed in the last week of September in southern Carbon County (Hendricks 1999).

In southern Utah and west-central California, the annual survival rate averaged roughly 50 to 60% in adults, but less than 30% in juveniles and eggs (Tinkle et al. 1993). The southern Utah population appeared to be substantially resource limited. Home range size averaged about 400 to 600 square meters in Utah. Areas experimentally depopulated of this species were quickly recolonized from surrounding areas (M'Closkey et al. 1997).

Use of rodent burrows for overnight refuge, escape, and winter hibernation has been documented. In southeastern Idaho, activity was determined to be unimodal with a peak at 1100 to 1500 hours (Guyer 1978). Preferred body temperature was 30.9 C. in Yellowstone National Park (Mueller 1969).

The sagebrush lizard is probably food for a wide variety of reptiles, birds, and mammals, but documented predators are surprisingly few. Predators include striped whipsnake (*Masticophis taeniatus*), night snake (*Hypsiglena torguata*), desert collared lizard (*Crotaphytus bicinctores*), eastern fence lizard (*Sceloporus undulatus*), and a variety of birds including American Kestrel (*Falco sparverius*), Red-tailed Hawk (*Buteo jamaicensis*), Loggerhead Shrike (*Lanius ludovicianus*), and Ash-throated Flycatcher (*Myiarchus cinerascens*) (Knowlton and Stanford 1942, Tinkle et al. 1993, Hammerson 1999). In Montana the Green-tailed Towhee (*Pipilo chlorurus*) is the only predator so far reported (Hendricks and Hendricks 2002).

Reproductive Characteristics

There is essentially no information about the reproductive biology of this species in Montana. Juveniles (2.8 centimeters snout-vent length, 5.8 centimeters total length) have been collected in southern Carbon County in early September (P. Hendricks personal observation).

In southern Utah, reproduction occurred between mid-May and early July (Tinkle et al. 1993). Eggs are laid in June to July in Colorado, and May to July in west-central California. Extremes in clutch size are 1 and 8 eggs, but throughout the range clutch size averages between 3 and 5 eggs (Tinkle et al. 1993). Eggs hatch in 45 to 75 days (beginning in early to mid-August in Colorado and Utah, mid- to late August in west-central California). In Colorado and Utah, most adult females produce 2 clutches annually. Sexual maturity is attained in the first (south) or second (north) year (10 to 11 months in west-central California). In southern Utah, most females produce their first clutch at an age of about 22 to 24 months (some matured in about one year under uncommon optimal conditions). Males and females in southern Utah can live for at least six years (Tinkle et al. 1993).

Management

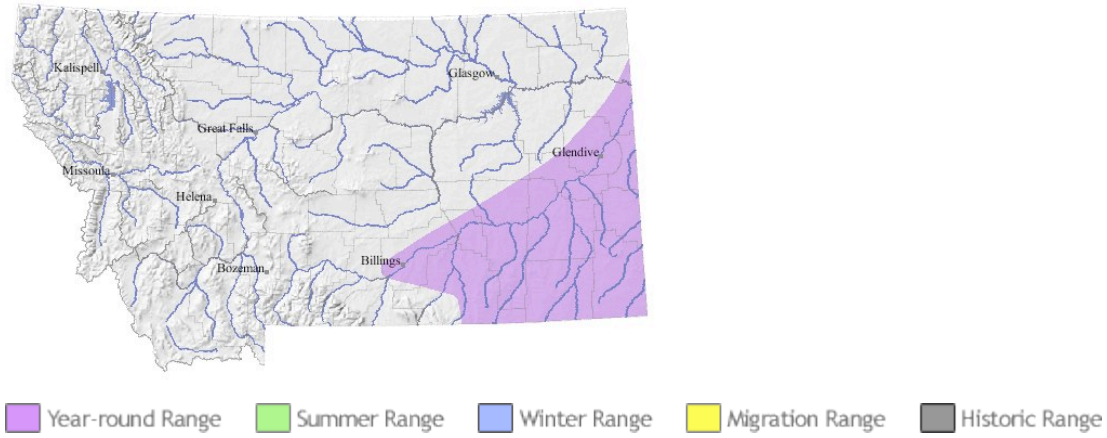
This species is of concern in Montana due to few reports in recent years and its seemingly restricted and disjunct distribution within the state (Maxell et al. 2003), although it appears populations are robust in a few areas, such as the southern slopes of the Pryor Mountains (P. Hendricks personal observation). Reduction of sagebrush cover to promote grass growth for livestock should be avoided or carefully assessed in areas occupied by this species. When clearing of sagebrush is deemed desirable, it should be conducted in a way to retain a mosaic of cover conditions, including the presence of moderately tall shrubs (sagebrush and rabbitbrush in particular) at a relatively fine scale to accommodate habitat requirements in home ranges that are fairly small (about 400 to 600 square meters).

Snapping Turtle (*Chelydra serpentine*)

General Description
The snapping turtle shell is hard and very serrated ("saw-toothed") on the rear edge of the carapace; the plastron is relatively small. The tail is as long or longer than the carapace, with a crest of large, bony scales. The head is large, with a hooked upper jaw and two barbels on the chin. The limbs are strong, with webbed toes and robust claws. Skin and shell color is black to tan. Maximum carapace length is 50 centimeters, but usually is less than 36 centimeters; average weight of wild individuals is 16 kilograms. In mature males, the anal opening extends farther beyond the base of the tail than in females, and is usually beyond the rear margin of the carapace (under the rear edge in females). In adults, the carapace is relatively smooth, and the longitudinal ridges are not prominent. In juveniles, there are three longitudinal ridges on the carapace; in hatchlings the carapace is rough with conspicuous ridges. Eggs are moderately pliable, somewhat brittle, and average 28 x 27 millimeters.

Diagnostic Characteristics
The snapping turtle differs from other Montana turtles by the presence of a plastron (ventral shell) that is reduced to a cross-like structure, covering perhaps only half of the ventral surface; the presence of keeled scutes or scales on the carapace (dorsal shell); and the presence of a tail at least as long as the carapace. The shell is hard, not soft and leathery, nor is it flattened or pancake-like, as is the case with the spiny softshell.

Montana Range



Movement

Research from other locations indicates that the snapping turtle may migrate up to several miles between the permanent water of usual residence and nesting areas. Some may travel up to a few kilometers between summer range and winter hibernation sites; others hibernate within summer range (Brown and Brooks 1994).

Habitat

Habitat use by snapping turtles in Montana is probably similar to elsewhere in the range, but studies are lacking and there is little qualitative information available. They have been captured or observed in backwaters along major rivers, at smaller reservoirs, and in smaller streams and creeks with permanent flowing water and sandy or muddy bottoms (Reichel 1995, Hendricks and Reichel 1996, P. Hendricks personal observation). Nesting habitat and nest sites have not been described.

Elsewhere, snapping turtles occur in all types of shallow freshwater habitats, such as streams, rivers, reservoirs, and ponds, especially those with a soft mud bottom and abundant aquatic vegetation or submerged brush and logs (Hammerson 1999), and in brackish water in some areas. Although found most often in shallower water, they have been reported on the bottom of lakes in water up to 10 meters deep. Temporary ponds may also be occupied. Hatchlings and juveniles tend to occupy shallower sites than mature individuals in the same water bodies. They are mostly bottom dwellers, where they spend much of their time. Although highly aquatic, they may make long movements overland if their pond or marsh dries (Baxter and Stone 1985, Ernest et al. 1994, Hammerson 1999). Nests are built in soft sand, loam, vegetation debris, or even sawdust piles, most often in open areas and often a hundred meters or more from water (Congdon et al. 1987, Ernst et al. 1994, Hammerson 1999); they also nest in beaver and muskrat lodges.

Ecology

Snapping turtles are most active at night in the southern parts of the range, but this is not so at northern locations, where activity is more pronounced in the morning (Ernest et al. 1994). They may be active year round in the southern United States, but cold weather there will drive them into dormancy. Most snapping turtles in more northern populations do not emerge until April, and enter hibernation by late October. In Colorado, snapping turtles emerge from hibernation in March and remain active through October (Hammerson 1999); there they are active day or night. The period of activity in Montana is poorly documented, with records mostly from early July through September (Reichel 1995, Hendricks and Reichel 1996); active individuals have been seen during mid-day in small streams (P. Hendricks personal observation).

Reproductive Characteristics

The youngest mature female known from Michigan was 12 years. In Ontario the average age of first nesting ranged from 17-19 years. Virtually no reproductive data exists specific to Montana; however, Montana populations likely exhibit traits similar to those elsewhere. Warming temperatures trigger nesting behavior in females. Obbard and Brooks (1987) developed a model to predict the onset of nesting activity from temperature data in Ontario. Females may travel several kilometers to locate a suitable nest site. Obbard and Brooks (1980) reported a round trip distance of 16 km to a nest site and back (Ernst et al. 1994). Nests are usually built in open areas a hundred meters or more from water; excavated in soft sand, loam, vegetation debris, sawdust piles, and beaver and muskrat lodges. Females generally dig nests from 7-18 cm (Congdon et al. 1987, Ernst et al. 1994, Hammerson 1999). In northern regions, eggs are generally deposited in late May to early June. Recorded clutch sizes range from 6 to 104, but typically 20-40 eggs are laid.

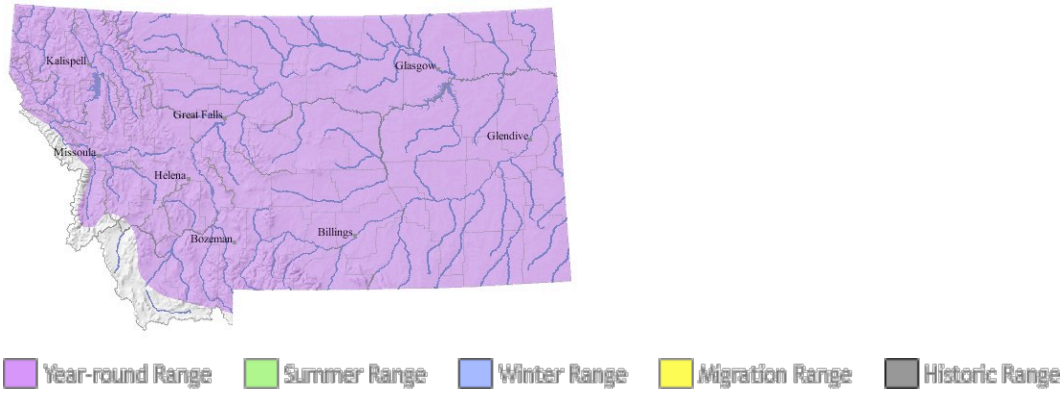
Management

Montana populations of the snapping turtle are poorly understood, making management of them more difficult. It is likely that dams and large reservoirs on rivers (e.g. Fort Peck Dam and Reservoir) are detrimental to population continuity to some degree, judging by the apparent lack of viable populations on the Missouri River in Montana (Maxell et al. 2003), although this species can travel overland and may be able to bypass some dams. Impacts of other habitat disturbances are not clear, but this species occupies man-made water bodies throughout its range that provide necessary resources and habitat characteristics. Routine surveys for snapping turtles in appropriate habitats could be made a standard part of the field duties of agency fishery biologists. Identified nesting sites should be monitored and protected from disturbance by humans.

Painted Turtle (*Chrysemys picta*)

General Description
The upper shell is olive to black, with the edges of shields (plates making up the shell) bordered with yellow. The head, neck, and legs are marked with yellow lines, and a red spot appears behind the eye. The lower shell is brightly colored with red and yellow. Females may reach 9 inches in upper shell length, but males seldom reach 7 inches. Males have much longer front claws than females, and the vent is situated farther from the edge of the shell.

Montana Range



Habitat
Painted turtles are found in lakes, ponds, reservoirs, and sloughs that contain some shallow water areas and a soft bottom; also river backwaters and oxbows with little current. They often use logs and rocks for basking. Painted turtles hibernate in bottom mud from early October to mid- or late April. They reproduce at 4 to 8 years of age, depending on climate (later in northern latitudes). Six to 20 leathery eggs are laid in nests excavated in gravel or sand. Food items include aquatic vegetation, frogs, tadpoles, small fish, and a variety of invertebrates (FWP). Found in wide variety of waterbodies, incl. glacial lakes (Franz 1971); but not found in oligotropic mtn lakes above 3363 ft. in Mission Mtns (Brunson and Demaree 1951). Nest on S facing grassy slopes in S Canada (MacCracken et al. 1983).

Food Habits
Ease of capture and size are major influences on what prey is taken. In S Saskatchewan, turtles preferred animal food (>87% by vol.) over abundant vegetation. Decapoda greatly preferred, then amphipod, gastropod, insect larvae. Plant material was a significant food item (21-61%) in some turtles that had stopped growing. Food quality (animal vs. plant) and quantity may influence reproductive potential (MacCracken et al. 1983).

Ecology
In SW Canada: density 11.1/ha. Hatchling survival 19.7 (0- 52%). A 1995 mortality study (Fowle 1996) reported most DOR turtles occurring from late May to mid July and consisting of 43% adult males, 26% adult females, and 31% of unknown sex, including juveniles. Densities of adult turtles were positively correlated with pond distance from the highway, and proportionally more juveniles and fewer adults were found at ponds closest to the highway, implying that roadkill mortality may be killing proportionally more adults (Fowle 1996).

Reproductive Characteristics
A 1995 Mission Valley, MT, study (Fowle 1996) reported gravid females ranging from 7 to 17 in age, with smallest gravid female plastron lengths/widths of 166 and 82 mm for 11- and 9-year olds, respectively. The youngest males with secondary sex characteristics were 2 years old, with minimum plastron lengths/widths of 33 and 49 mm for 4- and 3-year olds, respectively (Fowle 1996). Males sexually mature at plastron length 100 mm (4-5 years); females at 140-150 mm (5-6 years). Clutch size is 20 (in southern Canada) to 10 (in Wisconsin & Minnesota) (Christiansen and Moll 1973). In Wisconsin, 50% of females laid two clutches and nested from June to mid-July. Eggs may overwinter (Ernst 1972).

Spiny Softshell Turtle (*Apalone spinifera*)

General Description

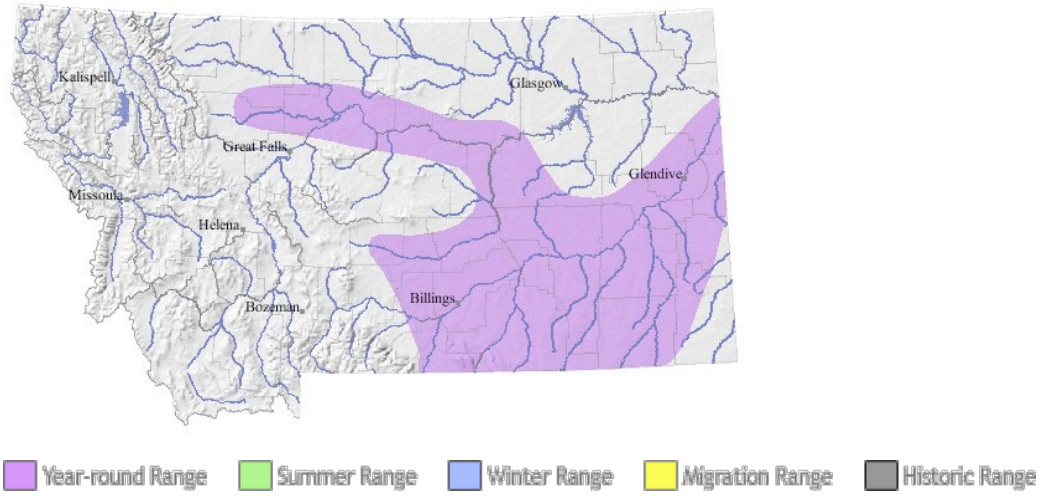
In the spiny softshell the shell is flattened (pancake-like), with flexible edges and covered with leathery skin; small conical tubercles or "spines" are present on the front edge of the carapace above the neck. The snout is tubular, with a ridge along the inner margin of each nostril, which allows this turtle to remain beneath the surface with just the snout exposed. In mature males, the carapace is like sandpaper, and marked with small dark spots or circles. The tail is thick and long, with the vent well beyond the rear edge of the carapace. In mature females, the carapace is not notably like sandpaper, is more generally mottled or marked with blotches, the tubercles at the front edge of the carapace are more prominent than in males, and the tail is relatively short.

Juveniles have characteristics that are female-like, except the carapace coloration, which is male-like. In hatchlings, the carapace is olive to tan, with small dark circles, spots, or dashes, and a yellowish margin bordered by a black line. The eggs are hard and white, smooth, thick-shelled, and about 24 to 32 millimeters in diameter. Adult females can reach 52 centimeters in carapace length, but much less in adult males (which average about 10 centimeters shorter); hatchlings are about 3 to 4 centimeters in carapace length.

Diagnostic Characteristics

The spiny softshell differs from other Montana turtles by having a flattened and leathery shell that is soft and lacks horny plates, and a pointed snout with tubular nostrils.

Montana Range



Migration

No specific information is available for Montana. In Vermont, softshells migrated about 3 kilometers between riverine wintering sites and river mouth nesting sites near Lake Champlain; migratory movements were most extensive in spring and late summer (Graham and Graham 1997). Annual home range size in Arkansas was 784 to 2,310 meters of stream length for males and 683 to 2,145 meters for females (see Hammerson 1999).

Habitat

Habitat use by spiny softshells in Montana is probably similar to elsewhere in the range, but studies are lacking and there is little qualitative information available. They occupy larger rivers and tributaries. Both sexes have been observed basking together on partially submerged logs in backwater sites of slow-moving water, and on sandy or muddy riverbanks (P. Hendricks personal observation).

Generally, the spiny softshell is primarily a riverine species, occupying large rivers and river impoundments, but also occurs in lakes, ponds along rivers, pools along intermittent streams, bayous, irrigation canals, and oxbows. It usually is found in areas with open sandy or mud banks, a soft bottom, and submerged brush and other debris. Spiny softshells bask on shores or on partially submerged logs. They burrow into the bottoms of permanent water bodies, either shallow or relatively deep (0.5 to 7.0 meters), where they spend winter. Eggs are laid in nests dug in open areas in sand, gravel, or soft soil near water (Baxter and Stone 1985, Ernst et al. 1994, Hammerson 1999, Stebbins 2003).

Generally, spiny softshells forage in the water, often in shallows with vegetation. They are considered to be generalist carnivores, and usually feed on the bottom. Major foods are crayfish, aquatic insects (of at least seven orders), and fishes, but mollusks, worms, isopods, amphibians, carrion, and vegetation also are eaten (Ernst et al. 1994, Hammerson 1999). The diet in an Iowa study was about 25% insects, 36.5% fish as carrion, 5.8% small fish as live prey, and 55% crayfish, with plant material in 61% of the stomachs sampled; this breakdown of categories appears representative for other states (Ernst et al. 1995). Prey may be chased, ambushed, or flushed and pursued.

Ecology

Animals are active from April to October (usually May to September) in Kentucky and Colorado (Ernst et al. 1994, Hammerson 1999). Water temperatures of 12 degrees C. appear to determine when animals enter or emerge from hibernation in Vermont (Graham and Graham 1997). Adults emerge earlier from hibernation, and remain active longer into the fall, than juveniles. The period of activity in Montana is poorly documented, with records from early June to late July (Hendricks and Reichel 1996, Hendricks 1999).

Reproductive Characteristics

No specific information is available for Montana, but data from other locations indicate that eggs are laid mostly in the second half of May and in June (most areas), mainly in the first half of June in southern Ontario and mid-June to early July in the far north. In Colorado evidence indicates nesting is from late May to early July, with June as the norm. In the more arid Great Plains and Rocky Mountain states, nesting activities may be stimulated by spring and early summer rains (Ernst et al. 1994, Hammerson 1999); most nesting occurs in either the morning or evening. Nests are bowl-shaped, with a narrower opening descending to a larger egg chamber; depths are usually from 7 to 18 centimeters, but may be up to 26 centimeters or more.

Clutch size averages 20 to 40 eggs, but may be as few as 6 or as high as 109 (Ernst et al. 1994, Hammerson 1999). A single clutch is produced, with most mature females nesting each year, although some may skip a year. Hatchlings emerge in 55 to 125 days in late August to early October (mainly September).

Management

Montana populations of the spiny softshell are poorly understood, making management of them more difficult. It is apparent that the construction of dams and large reservoirs on rivers (e.g. Fort Peck Dam and Reservoir) is detrimental to population continuity, effectively creating smaller isolated populations. Impacts of other habitat disturbances are not clear. Studies of nesting success, population structure, dispersal, and population size need to be conducted throughout the range of both Montana sub-populations (Missouri River and Yellowstone River). Routine surveys for softshells in appropriate habitats could be made a standard part of the field duties of agency fishery biologists. Nesting sites need to be identified and protected from disturbance by human activities.

APPENDIX 2: INVENTORY SURVEY METHODS AND DATASHEET

AMPHIBIAN AND REPTILE INVENTORY SURVEY METHODS FOR LITTLE BIGHORN BATTLEFIELD NATIONAL MONUMENT

The following protocol provides guidelines for two types of surveys most appropriate for the monument given the current staffing. The first is for opportunistic encounters with amphibians and reptiles on the monument (e.g. by interpretive staff, seasonal workers, and visitors encountering individual amphibians or reptiles during daily activities). The second is for taxa-specific visual encounter surveys, which are targeted visual surveys of suitable habitat for individual species during certain environmental conditions/seasons. These can be conducted by the monument biologist or trained seasonal technicians.

Following the protocol are some general cautions and caveats about these methods and information for additional resources. Also included is a form to record survey observations. All data on species observations should be compiled and stored at the monument annually.

Opportunistic encounters with amphibians and reptiles

Amphibians and reptiles can be very cryptic, and sometimes they are most often seen by chance encounters with people who are out walking around, rather than via systematic surveys. Observations made by staff and visitors at LIBI can help with compiling a more accurate species inventory, as well as help determine the distribution of species across the monument.

Methods: Staff and visitors will routinely see amphibians and reptiles along trails, on the road, or out in the grasslands. The key is to record these observations at the time they occur. The following data should be recorded:

a. What species was seen (a photograph of the animal is highly recommended to confirm questionable sightings)

b. The location of the sighting (the more specific the better; ideally, get coordinates for the location using GPS)

c. General description of where/when the species was found (including surrounding vegetation and time of day, whether it was found on a road/trail or in other habitat)

These data can be recorded on NPS observation forms, and/or the attached data form and compiled into the monument's species observation database.

Visual encounter survey methods

Description of technique

Visual encounter surveys are a common and effective technique for documenting the presence of amphibians and reptiles, and are effective in most habitats. In fact, the most direct way (without trapping) to determine the number of species of amphibians and reptiles present in a specific area

is to systematically survey the natural habitat cover and appropriate microhabitats when the weather conditions are warm and dry (reptiles) or warm and wet (amphibians).Visual encounter surveys are conducted by observers walking through a designated area, visually searching (in a systematic way, e.g. transects or roads), for animals. This is more complicated than it appears, as many species are cryptic in color and secretive in nature, making them difficult to find even under the best conditions. The number of animals encountered are noted along with time elapsed during the survey. Data collected yields information on the presence of a species but does not establish absence, nor does it give reliable estimates of abundance. Therefore, not finding a particular species at a site, even after extensive searching, does not necessarily mean that the species is absent from that site. However, if the appropriate microhabitats are searched when the weather conditions are favorable and searches are done several times in a season, as the cumulative number of unproductive searches increases, it becomes more unlikely that the species is present. I have outlined specific guidelines for various species and different habitats around LIBI.

For each survey type, the following data should be recorded:

a. What species was seen (a photograph of the animal is highly recommended to confirm questionable sightings)

b. The location of the sighting (the more specific the better; ideally, get coordinates for the location using GPS)

c. General description of where/when the species was found (including surrounding vegetation and time of day, whether it was found on a road/trail or in other habitat)

d. The date, time, and location of the search

e. The total search time (in person-hours: the number of people multiplied by the amount of time searched. Time spent recording data does not count towards search time)

Pond-based surveys for amphibians, garter snakes, and turtles

Pond-breeding amphibians will congregate at ponds in early spring (for LIBI species, April to late June, depending on weather conditions) to chorus and breed. Individuals may chorus during both the day and nighttime, though it is more likely that they will chorus at night. In general, breeding amphibians are more visible and vocal at night. Leopard frogs may be present at the pond throughout the summer and will be visible during the day, but all other amphibians species that may be found at LIBI will likely only show up at the pond/ephemeral breeding site around breeding time. If there are garter snakes at LIBI, they will probably be found in ponds and associated riparian areas rather than upland sites.

For daytime surveys, carefully walk around the pond/standing water body and search for signs of adult frogs, eggs, tadpoles, or snakes. Egg strings (most toads) or egg masses will typically be found in shallower water around vegetation. See *Amphibians and Reptiles of Montana* for species specific descriptions and pictures of eggs. If you see tadpoles, it is useful to catch some in a small net (aquarium net or dipnet) to properly identify them. Again, the field guide has guidelines for identifying tadpoles. Snakes may be found swimming in the water or in the vegetation around the pond. Turtles will be out basking on logs/rocks or swimming (if there are

any turtles on the monument, they will be found in the main pond—otherwise, they will be in the river). Dusk/nighttime surveys are useful for looking for adults, which can be located by their choruses and with spotlights.

Amphibians will likely be breeding/active when daytime temperatures are reaching at least 60 degrees F and there has been a recent rainstorm. Therefore, I suggest surveying ponds/depressions during/after these conditions annually. During the breeding season, surveying the main pond on the monument every week to 10 days should allow you to determine if the leopard frog or any other amphibian is breeding there. If you have enough rain in the spring to create standing water elsewhere on the monument for 2-3 consecutive weeks, survey these areas as well. Surveying the pond a couple times later in the summer will help determine if garter snakes or turtles inhabit that area. Mid-morning or late afternoon surveys may be best for locating garter snakes and turtles that are out basking.

Road-based surveys for amphibians and reptiles (can also be used for trails)

Snakes:

Road surveys have been used in many studies to sample snake populations. By travelling stretches of roads (by car, bicycle, or on foot), it is possible to record at least the presence of particular species. Road-cruising for snakes may be quite biased as a sampling technique as some studies report that some snakes avoid crossing roads. Because of this, the absence of snakes on roads does not mean that they are not present in the surrounding habitat.

Despite the biases, many snakes can be found along roads, basking at the edges during the day (e.g. garter snakes) or on the road itself in the early evening (e.g. gopher snakes, rattlesnakes). When searching roads, it is important to keep in mind the reason why snakes are apparently attracted to the road. The presence of snakes on roads is likely associated with reptilian thermoregulation. Because of this, it is unlikely to find snakes sitting on a road on a hot sunny day, as the road surface will be much too hot. However, pavement generally heats up quickly in the morning, making it potentially attractive to snakes as a basking spot until they reach their optimal temperature. The same is true in the evening as the pavement retains heat relatively well and can provide a warm surface for basking. It should be noted that this circadian pattern may vary depending on whether a species is diurnal or nocturnal; sampling for a particular species must be conducted at an appropriate time.

For these surveys, I suggest picking out a few roads or trails that you would like to monitor, and walking/driving them once every 2-4 weeks (depending on personnel availability) throughout the summer, including both morning and evening surveys to capture snake use of the roads. Roads with less vehicle use are best, though most roads on the monument could be surveyed pretty easily. Record the distance you travel and the temperature at the time of your surveys. Then drive slowly (or walk) the road length and scan the road for snakes. Note that snakes may be partially hidden under vegetation on the side of the road. Stop to identify and take pictures of any animals you see.

Amphibians:

You will use the same methods as described above, except that amphibians are most likely to be found on the road on warm, wet nights. This is when they will move to breeding sites or come

out to feed on insects. These amphibian road surveys should be conducted opportunistically during warm and wet conditions on the monument. Drive the road slowly at dusk/night while scanning for movement/amphibian presence on the road in front of you. If you are driving it is useful to have a passenger with a spotlight/flashlight also looking. If you are walking, a spotlight will be useful for picking up amphibian eyeshine. Stop to identify and take pictures of any animals you see.

Targeted surveys for lizards

The two lizard species potentially present at LIBI may be seen opportunistically, but may also be found through visual surveys of suitable habitat. These surveys can be conducted 2-4+ times throughout the summer to determine the presence and extent of these species at LIBI. As with snakes, they are most likely to be out and active in the morning and late afternoon on clear days when weather conditions are warm.

The greater short-horned lizard is active from April to October, but is hard to see because of cryptic coloration and its secretive nature. It is most likely to be found on south-facing slopes and rocky outcrops. These areas should be surveyed by slowly walking back and forth across the area and looking for lizards. The common sagebrush lizard is found in sagebrush and short-grass prairie habitat, but are easiest seen on bare rock or crossing open areas of sand or gravel. Therefore, areas where short-horned lizards may be found could also contain sagebrush lizards.

Things that could bias your surveys (amphibian and reptile):

Knowing when and how to conduct surveys for amphibians and reptiles can increase your success. You cannot control for all of the factors below, but keep them in mind as you determine how and when you will conduct surveys. In general, try to survey during similar weather conditions annually, survey each site or location at LEAST twice during the season, survey at suggested times of day for each species, and note alterations in habitat that could cause you to change your survey methods. The information below comes from the USGS Managers' Monitoring Manual, which is found at: www.pwrc.usgs.gov/monmanual/techniques/ves.htm.

Detectability

A number of variables influence detectability, and detectability can, in turn, bias VES. These include, but are not limited to: reproductive cycle, unpredictable seasonal events (e.g. drought or blizzard), animal activity patterns, air, water and substrate temperatures, relative humidity, soil moisture, rainfall, barometric pressure, cloud cover, moon phase, prey (food) availability, and predator activity.

Effort

Small numbers of sites visited and / or low number of visits per site can affect presence estimates. In general, the greater the number of sites and visits, the more robust the probability of finding an amphibian or reptile on at least one visit will be. Effort expended on surveys is often a function of human resource availability. Credible decisions on species or population management cannot be made in the absence of survey data, and that when in doubt one should always err on the side of conservatism, as if the species is present. Initial goals of surveys should

be to determine whether or not the species is present at a site in detectable numbers. These data can form the basis of site recovery and management evaluations.

Weather

Weather can compromise detectability during VES as well as affect amphibian and reptile behavior. For example, rain can affect the ability of the observer to see animals both in and out of the water. Weather may also influence amphibians to be more active and therefore more detectable in the case of warm spring rain, or less detectable in the case of sleet or snow. Reptiles will be out basking when it is warm but not when it is too hot. In general, most protocols strive to minimize the effects of weather by determining a priori what the guidelines are for conducting surveys. For example, don't do a VES if it snows.

Time of year/time of day

Breeding season is the optimal time for conducting VES for most amphibians (pond dwelling, stream dwelling), because they are more visible during this time. Visits that occur before the breeding season has started or after it has concluded may bias results. This potential source of bias should be considered carefully. Often, breeding or activity seasons can vary by several weeks with elevation even though the sites are in the same general area, (Corn and Muths 2002). Reptiles can be found throughout the spring and summer, but may be more visible during spring emergence from hibernacula. Time of day can also bias results and can be linked to temperature factors, sunlight and activity cycles of particular amphibians and reptiles.

Habitat change

Changes in habitat over the years may provide a subtle bias in the results if those changes increase or decrease the relative detectability of the amphibians or reptiles. For example, if over time a site's habitat shifted from dense and nearly complete grass cover to brush with an open understory and lots of downed wood, counts would be biased for some species as they would be easier to find and spot in the now more open and accessible environment. In most circumstances, however, vegetation and habitat changes will have a minor influence on detectability, even though they may have major changes in population size and status.

Observer effects

These are biases brought to the project by the observers who participate. Changes in personnel doing the survey from one visit to the next, particularly the visual acuity and "search image" of a particular observer can influence the results. Errors in identification, both by visual inspection and by sound can occur. In Eastern Montana, the amphibian and reptile fauna is relatively depauperate, making identification fairly simple.

Resources

The Montana Natural Heritage Program (MTNHP) houses all amphibian and reptile records for public lands in the state. Data on amphibians and reptiles located at LIBI should be communicated to MTNHP. Pictures to confirm identification, GPS locations, and habitat/weather information are all useful data for the MTNHP database (please see data form below for more information). MTNHP can also help with species identification. Questions and data can be directed to:

Dr. Bryce A. Maxell, Senior Zoologist
Montana Natural Heritage Program
P.O. Box 201800
Helena, MT 59620-1800
(406) 444-3655 (office)
(406) 444-0581 (fax)
bmaxell@mt.gov

The United States Geological Survey conducts extensive amphibian surveys on National Parks System lands in Montana, and can provide assistance with species identification for both amphibians and reptiles:

Dr. P. Stephen Corn, Research Zoologist
US Geological Survey
Northern Rocky Mountains Science Center
Aldo Leopold Wilderness Research Institute
790 E. Beckwith Ave.
Missoula, MT 59801
(406) 542-4191 (office)
(406) 542-4196 (fax)
scorn@usgs.gov

Amphibian and Reptile Observation Form:

Year:

Location:

Date/Time	Species Observed (if unknown describe features)	Number of animals seen	Location Description (GPS coordinates, or describe common landmarks)	Photo taken? (Y/N)	Habitat Description (include temperature, vegetation, etc.)	Observer name

APPENDIX 3

Incidental Observation Form for Amphibians and Reptiles

Contact Information for Individual Reporting Observations: Name_____; Phone Number_____; *Indicate Datum Here_____;

1. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						
2. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						
3. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						
4. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						
5. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						
6. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						
7. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						
8. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						
9. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						
10. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						
11. Species	Locality		County	Township Range Section ¼ ¼ Section		UTM Zone	UTM North	UTM East	Date	Elevation Ft / M
Observer	Life History Stage (Circle Most Appropriate) Egg Larvae Metamorph Juvenile Adult	Number _____ 100-1000 1000-10000	10-100 >10000	Comments						

Instructions and Definitions of Variables on Incidental Observation Form for Amphibians and Reptiles

Instructions

Use this sheet to report incidental observations of all amphibian and reptile species, especially those with limited distribution data or of management concern. DO NOT report observations unless you are absolutely certain of the identification of the species. This information is highly important for most amphibian and reptile species. Documentation with photographs or collection of individual animals is necessary for records outside the documented range of species and for all of the following species, which are undocumented, but possibly present, in Montana: Idaho giant salamander (western edge of state), Canadian toad (NE corner of state), wood frog (NW corner of state or Bighorn Mountains), and pigmy short-horned lizards (SW Montana). Individuals reporting incidental observations should send this data sheet to the Montana Natural Heritage Program, 1515 East 6th Avenue, P.O. Box 201800, Helena, Montana 59620-1800, or enter the data on their website. Employees of federal or state agencies should enter this observational data in a database with data fields that correspond to those in the statewide point observation database at the Montana Natural Heritage Program and then forward a digital copy of this database to the Heritage Program. A template of this database can be obtained by contacting the Montana Heritage Program or Bryce A. Maxell.

Data Definitions

Species: For each species record the first two letters of the genus and species names for all amphibian and reptile species found at the site. (e.g., BUBO for *Bufo boreas*).

Locality: Describe the specific geographic location of the site so that the type of site is described and the straight-line distance from one or more permanent features on a 7.5 minute (1:24,000 scale) topographic map records the position of the site (e.g., Beaver pond, 1.5 miles south of Elephant Peak and 1.3 miles east of Engle Peak).

County: Use the full county name.

Township Range Section ¼ ¼ Section: Describe the location of the site in reference to a 1:24,000 or 1:100,000 scale map by recording the Township number and whether it is north or south, the Range number and whether it is east or west, the Section number, and at the location with the section at the ¼ of ¼ level (e.g., SENE indicates SE corner of NE corner).

UTM Zone: Universal Transverse Mercator zone recorded on the topographic map. Note: It is important to report this information in addition to Township, Range, Section information because UTMs are more precise, are easier to map in a GIS, and provide double confirmation of the site locality.

UTM North: Universal Transverse Mercator northing coordinate in meters as recorded on a 1:24,000 scale topographic map or GPS receiver (it is best to compare the GPS coordinates with map coordinates to check for agreement). Note: It is important to report this information in addition to Township, Range, Section information because UTMs are more precise, are easier to map in a GIS, and provide double confirmation of the site locality.

UTM East: Universal Transverse Mercator easting coordinate in meters as recorded on a 1:24,000 scale topographic or GPS receiver (it is best to compare the GPS coordinates with map coordinates to check for agreement). Note: It is important to report this information in addition to Township, Range, Section information because UTMs are more precise, are easier to map in a GIS, and provide double confirmation of the site locality.

Date: Use MM-DD-YY format (e.g. 05/12/00 for May, 12 of 2000).

Map Elevation: The elevation of the site as indicated by the topographic map in feet (GPS elevations are often inaccurate).

Observer: Record the full name or names of individuals who made the observation.

Life History Stage: Circle the appropriate life history stage of the amphibian or reptile. If multiple life history stages are present circle all that apply.

Number: Enter the number of individuals or circle the most appropriate category of numbers of individuals for each life history stage present. If multiple life history stages are present enter the first letter of the life history stage by the number or number category (e.g., E 50 for 50 eggs, L 1000-10000 for 1000-10000 larvae, etc.).

Comments: Include method of observation (i.e., heard individuals calling or incidental visual observation), measurements of the snout-to-vent length, total length, or the length and width of the carapace and plastron, habitat observed in, and how specimen was identified if a rare species. If tissue samples are collected record the tissue number or range of tissue sample numbers. If a museum voucher specimen was collected record the preliminary museum voucher specimen number assigned to the animal. Attach additional pages if necessary.