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Distribution and Natural History of Amphibians and Reptiles in Western Nebraska with Ecological Notes on the Herpetiles of Arapaho Prairie

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INTRODUCTION

The distribution and natural history of amphibians and reptiles have been little studied in the northern states of the great plains. Relative to other vertebrate groups, the herpetofauna of grasslands is depauperate particularly at higher latitudes where temperature becomes a limiting factor to poikilotherms. Nevertheless, certain species of amphibians and reptiles are common in specific habitats and thus form a conspicuous component of the prairie fauna. The purposes of the present study were to document the distributions of herpetiles in a specified region of western Nebraska and to describe general aspects of their natural history. We hope such information will stimulate additional work as well as provide a baseline reference for future studies on the herpetofauna of the northern great plains. Previous work on herpetiles in western Nebraska are either in need of updating (e.g. Hudson, 1942) or are anecdotal or not comprehensive (Heyl and Smith, 1957; Gehlbach and Collette, 1959; Iverson, 1975; Lynch, 1978).

MATERIALS AND METHODS

The area of study included western Nebraska counties of Arthur, Deuel, Garden, Keith, Lincoln, McPherson, and Perkins. These counties were chosen for extensive study because of their proximity to Cedar Point Biological Station of the University of Nebraska-Lincoln and because they display a broad diversity of habitats in western Nebraska including sandhills prairie, short grass prairie, riparian communities along a major river system, juniper canyons and extensive marshlands.

Observations presented in this report were collected from 1975 through 1978. A total of 654 specimens deposited in the University of Nebraska State Museum (UNSM) is reported which involve over 300 new locality records including 82 new county records. General localities are given in the accounts of species and specific localities of specimens cited may be obtained from the authors. Some specific localities are given for the rarer species.

One area receiving special attention was Arapaho Prairie owned by the Nature Conservancy in Arthur County which is managed by the School of Life Sciences of the University of Nebraska-Lincoln as a controlled-access research site and nature preserve. Arapaho Prairie consists of approximately 1300 acres of typical sandhills prairie. This prairie was established as a research site and nature preserve in January, 1977. It had previously been used for grazing cattle which were removed at that time.

Major Habitat Types

General descriptions of major vegetation types in the area of study may be found in Weaver (1965) and Kaul (1975). Principal physiographic features include the Platte Rivers, sandhill region north of the Platte, Lake McConaughy, an extensive area of lakes and associated wetlands in the northwest, the dissected loess plains in the southeast and the tablelands of the western plains in Perkins and Deuel counties. Average precipitation varies from 17 inches/year in the west to 21 inches/year in southeastern Lincoln county. May and June are the months with the greatest rainfall. Seven reasonably distinct habitat types can be identified. The first three listed below roughly correspond to major vegetation types whereas the other four are habitats with special vegetation or structural features.

Sandhills Prairie Habitat. This habitat is part of an extensive unique grassland in north central Nebraska consisting of deep sands which form hills with considerable relief (up to 200 feet). In the region of our study it encompasses most of the area north of the North Platte River Valley including Arthur and McPherson counties, the northern two-thirds of Garden County, and the northern one-third of Keith and Lincoln counties. There are similar isolated sandhills in southern Perkins and Lincoln counties, although the vegetation is slightly different. The dominant vegetation of the sandhills prairie includes grasses (*Andropogon, Calamovilfa* and *Stipa*) and *Yucca* with scattered forbs. Abundance of *Yucca* appears to increase with overgrazing by cattle which is the predominant land use practice in the area. Keeler and Harrison (in mss.) divide the sandhills vegetation of Arapaho Prairie into four distinct associations which generally coincide with topographic features including dune tops, dune slopes, rolling swales, and flat valley bottoms. Vegetational associations appear less important to herpetile distributions than physical features. Microhabitats of blowouts, ponds, dense native grass and disturbed areas (fence rows, etc.) offer variable environments and affect distribution and abundance of amphibians and reptiles.

Mixed Prairie Habitat. This habitat includes the western edges of the mixed prairie of south central Nebraska interspersed with the sandsage prairie extending from the southwest corner of the state (Kaul, 1975). The region includes the southeastern half of Perkins County and Lincoln County south of the Platte River Valley. Dominant vegetation includes grasses (*Andropogon, Bouteloua, Buchloë,* and *Calamovilfa*) and sandsage (*Artemesia*) and *Yucca*. Much of the area is now under cultivation.

Shortgrass Plains Habitat. This habitat represents an extension of the plains of eastern Colorado and Wyoming in the form of the Cheyenne Table in Deuel and

southwestern Garden Counties and the Perkins Table in that county. The vegetation consists primairly of short grasses (*Bouteloua gracilis* and *Buchloë dactyloides*). According to Kaul (1975) there are fewer forbs than in other prairies. The area is now used extensively for cultivation and grazing.

Cedar Bluffs Habitat. Bluffs associated with the Platte Rivers possess a habitat distinct from surrounding grasslands. The dominant and conspicuous plant is *Juniperus virginianum*. Other common plants include hackberry (*Celtis*) in the draws as well as *Yucca* and scattered grasses (particularly *Bouteloua*). The soil is thin and well drained and the terrain is dissected by many washes and canyons with exposed rock ridges and cliffs.

Marshland Habitat. The western sandhills particularly in Garden and Arthur counties contain numerous natural lakes, ponds and associated marshes. Some of these bodies of water are quite extensive and vary in their degree of permanence but most support a dominant vegetation of cattail (*Typha*) and bulrush (*Scirpus*). These habitats support good populations of turtles, frogs and snakes.

Floodplain Forest Habitat. A gallery forest of cottonwood trees (*Populus*) and willows (*Salix*) extends along the sides of the Platte Rivers for most of their length. This forest with associated fallen trees and shrubs provides habitat for a number of herpetiles. The gravel and sand substrate extending from the river is often open with little forb or grass cover providing ideal habitat for lizards.

Man-Disturbed Habitat. Utilization and disturbance of natural areas by man often have a detrimental effect on the native fauna. The southern and eastern regions (Perkins, Lincoln, and Keith counties) of the area studied are those most heavily disturbed primarily because of the extensive practice of agriculture. However, amphibians and reptiles are sometimes less affected by man's activities than larger wildlife. In some cases, such as construction of farm ponds, man's activities may be beneficial to certain herpetiles. Roadsides provide remnant relatively stable habitats for smaller species particularly lizards. Piles of junk and debris as well as abandoned or little used farm buildings may be used extensively as hiding places by amphibians and reptiles. Reduction of dense grass cover by overgrazing may increase the habitat for heliothermic lizards as well as promote growth of *Yucca* which is used extensively by *Sceloporus undulatus* (Jones and Droge, in press)

Annotated Species Accounts

AMPHIBIA

Caudata - Salamanders

Ambystoma tigrinum (Tiger salamander). In spite of the relative aridity of the prairie this species occurs throughout the area except the shortgrass plains of Deuel and Perkins counties. It is infrequently observed except by seining ponds and roadside ditches which often contain numerous larvae and metamorphosing individuals. Temporary ponds typically have larvae whereas permanent ponds may have neotenic forms. Adults are occasionally observed in the sandhills far from water after heavy rains or in mammal burrows. Larval forms have been ob-

served to be preyed upon by the Plains Garter Snake. Large neotenic forms, metamorphosed adults, and numerous larvae were secured in Hackberry Lake, Garden County.

Anura - Frogs and Toads

Scaphiopus bombifrons (Plains Spadefoot Toad). This species has been recorded in all seven counties of the study, but it is infrequently encountered except as tadpoles in temporary and ephemeral ponds following rains in late spring and early summer. Adults have been observed calling following rains, crossing highways, and foraging for insects at night.

Bufo cognatus (Great Plains Toad). Of the toads, *B. cognatus* appears to be the least abundant. Evidence of reproduction (larvae) was obtained from Arapaho Prairie and near Grant in Perkins County and toadlets were observed around Diamond Bar Lake in McPherson County. It has not been collected in Keith and Deuel counties and may be absent from the Platte River valleys. Occasional toadlets are found in association with those of *Bufo woodhousii* but never in as great abundance. Breeding probably occurred in late May in 1977. Records include one (UNSM 7555) from Arapaho Prairie, Arthur County; three (UNSM 402-4; from near Oshkosh, Garden County) one (UNSM 120) at North Platte, Lincoln County) two (UNSM 7558-59) west of Tryon, McPherson County; and four (UNSM 7560-63) from near Grant and Elsie, Perkins County.

Bufo woodhousii (Rocky Mountain Toad). This toad has been observed in all seven counties but voucher specimens from Perkins County were not saved. It is the most frequently encountered amphibian as large numbers of newly emerged toads are found migrating from most bodies of water by mid-June. Specimens are even observed in the relatively arid sand dunes and in sparsely wooded areas of the floodplains forest along the Platte. *Heterodon nasicus* was observed eating a young *B. woodhousii* at Diamond Bar Lake, McPherson County. Gehlbach and Collette (1959) recorded this species in Deuel County and we have observed it in Perkins County.

Acris crepitans (Cricket Frog). This normally abundant frog reaches its western limit in Nebraska near North Platte (UNSM 3264) where it has been collected along the Platte River. In spite of considerable field work in 1975-1979 along the river we failed to find the species further west. Sandy soils may prevent overwinter survivorship.

Pseudacris triseriata (Striped Chorus Frog). This frog is found throughout the area and is abundant following spring rains. It breeds in May when water temperatures are cold. After the brief reproductive activity these frogs move into the prairie where they are occasionally found beneath debris. The striped chorus frog may also be found to call for longer periods in the marshes along Lakes Ogallala and Keystone below Lake McConaughy. This extended mating behavior presumably occurs because of the cold water continuously discharged from the bottom of Lake McConaughy. We do not know if breeding is extended but calling males may be observed throughout the summer. Following heavy July rains, males were heard calling in grass, well away from standing water. These males appeared to move down the slopes to standing water.

Rana catesbeiana (Bullfrog). The bullfrog is known only from specimens collected in the Platte Valley where permanent bodies of water associated with the river provide habitat necessary for the two year larval stage. Its occurrence here may be the result of efforts by game commission personnel to stock this species. It may not be associated with permanent water in the sandhills because of lack of stocking, dispersal distance or akaline water conditions. We have an unconfirmed sighting of a bullfrog near Diamond Bar Lake in McPherson County so it may be found in some of the sandhills lakes. Records of specimens include two (UNSM 6562-63) near Big Springs, Deuel Co.; two (UNSM 3512, 6561) near Lisco and Lewellen, Garden Co.; seven (UNSM 4747, 6270, 7592-95, 7811) in the vicinity of Keystone, Keith County and one (UNSM 120) from North Platte, Lincoln County.

Rana blairi (Plains Leopard Frog). This species appears to be restricted to loess soils (Lynch, 1978) and occurs primarily in this region in the mixed prairie habitats of Perkins County in headwaters of the Republican River drainage. It is found on loess soils at the upper end of Lake McConaughy and along Lonergran Creek on the north side of Lake McConaughy near Lemoyne. Museum records include nine (UNSM 3579-82, 5151-53,7087-88) from near Lewellen, Garden County) two (UNSM 7332, 7334) near Lemoyne, Keith Co.; 24 (UNSM 131, 4490, 6394-6415) in vicinity of North Platte, Lincoln Co.; and five (UNSM 7587-91) from near Elsie, Perkins County.

Rana pipiens (Northern Leopard Frog). This is the most common leopard frog in the area. It is abundant in marshland habitats in the sandhills as well as in floodplain habitats along the Platte River. It is sympatric with *R. blairi* only at the upper end of Lake McConaughy and in lower Lonergran Creek near Lemoyne. It is not found south of the Platte Valley (Lynch, 1978). Gehlbach and Collette (1959) recorded this species from near Sutherland, Lincoln County.

REPTILIA

Chelonia - Turtles

Kinosternon flavescens (Yellow Mud Turtle). This species is found only in the sandhills lakes. Repeated searches of comparable marshes in the Platte Valley have failed to yield specimens. The populations in Arthur and Garden counties are probably disjunct from those further south in the Republican River drainage. The species may be expected in southern Lincoln County, but we have no records to confirm this expectation. Records include one (UNSM 7860) at Swan Lake, northeast of Arthur, Arthur Co. and three in the lakes north of Oshkosh, Garden Co.

Chelydra serpentina (Common Snapping Turtle). The snapping turtle is found throughout the area in marshland habitats. It also occurs in large lakes of the sandhills and the Platte River. These turtles are actively breeding in June.

Emydoidea blandingii (Blanding's Turtle). This species reaches the southwestern limit of its range at Swan Lake in Arthur County. In Nebraska these sluggish turtles are apparently restricted to sandhills lakes and marshes but are not known to occur west into Garden County.

Terrapene ornata (Ornate Box Turtle). This is the most conspicuous if not the most common turtle of the area. It occurs throughout the seven counties but appears less common south of the Platte Valley. The box turtle is very active in late spring and early summer, particularly after rain showers, but becomes increasingly inactive in the drier mid-summer. It is commonly observed in the sandhills prairie as well as crossing roads, an activity to which it is particularly vulnerable. Of 19 dead herps observed on the highway in late June of 1977, 13 (68%) were box turtles.

Chrysemys picta (Painted Turtle). This turtle occurs throughout the region principally in permanent bodies of water, but it is occasionally observed in irrigation and roadside ditches in the summer. It is abundant in oxbows and sandpits adjacent to the Platte River as well as in isolated sandhills lakes. Reproduction and egg laying are conspicuous in June.

Trionyx spiniferus (Spiny Soft-shelled Turtle). This species has been found only in the South and North Platte Rivers in this area. It is not encountered in the smaller tributaries except within a hundred meters of the Platte River. Specimens are located either during seining or less frequently when they bask on sand bars.

Squamata (Sauria) - Lizards

Holbrookia maculata (Lesser Earless Lizard). This species is distributed throughout the seven county area, but it appears to be more abundant in the sandhills prairie. It prefers relatively open rather than densely vegetated areas of the prairie although Jones and Droge (in press) found it to be associated less with blowout areas than was *Sceloporus undulatus*. They also reported home ranges of approximately 3800 square meters in males and 1800 square meters in females.

Sceloporus undulatus (Fence Lizard). This lizard is found commonly throughout the area. Although we have no records from Perkins nor Deuel Counties it is probably to be found there. The fence lizard occurs abundantly in the sandhills with the earless lizard, but is also associated with more woody habitats such as the floodplain forests along the Platte River. At Arapaho Prairie it is more commonly associated with blowouts and *Yucca* plants than is *Holbrookia*. Jones and Droge (in press) found that home range sizes approximating 700-800 square meters were similar in both sexes. The species breeds in May and early June and more than one clutch may be laid by July.

Cnemidophorus sexlineatus (Six-lined Racerunner). This lizard also occurs throughout the area, but appears more abundant in the Platte Valley. It is often locally common along roadside and in man-disturbed habitats. On Arapaho Prairie it is less common than the fence and earless lizards. It is commonly observed because of its habits of actively foraging for food in early morning hours. Although it is probably the most thermophilic of the lizard species, it will become inactive in the middle of the day during hot summer temperature. An analysis of the stomach contents of 27 individuals collected along the North Platte River below Lake Keystone revealed its insectivorous nature. Approximately 31% of the diet by volume consisted of grasshoppers. Insect larva comprised 14% of the diet whereas insects in six varied orders (Lepidoptera, Hemiptera, Coleoptera,

Hymenoptera, Homoptera and Diptera) comprised approximately 29% of the diet. Spiders represented about 19% of the diet and snails were occasionally (3%) eaten. The common racer is a conspicuous predator of *Cnemidophorus* near Keystone.

Eumeces multivirgatus (Many-lined skink). This is the least common lizard although its secretive habits may make it less conspicuous than it is. Our records indicate it to be restricted to the sandhills prairie, although it may be found in the sagebrush plains as well. On Arapaho Prairie and at two localities in northern Keith County, we have observed unicolor specimens as described by Heyl and Smith (1957). Specimens are most common in the same microhabitat as the lesser earless lizard.

Squamata (Serpentes) - Snakes

Heterodon nasicus (Western Hog-nosed Snake). This is probably the third most abundant snake in the area. It occurs throughout the region and is particularly common in the sand dunes bordering Lake McConaughy. It has been observed eating small *Bufo woodhousii* at Diamond Bar Lake and is also commonly observed on Arapaho Prairie. One individual was collected while it was in the process of eating a clutch of racer eggs.

Opheodrys vernalis (Smooth Green Snake). This species enters the area as a relict population at North Platte. The status of this population is not known. We have not observed it in the past ten years. In Nebraska, the smooth green snake is known only from three widely separated localities where they were collected between the late 1890's and 1960. The only museum record from the area of this study is UNSM 2356 from North Platte, Lincoln Co.

Coluber constrictor (Common Racer). This is probably the most abundant snake in the Platte Valley and is also common in the sandhills prairie. Common racers have been observed to eat six-lined racerunners. In 1976 they were seen to feed on moths (*Sphynx*) which were extremely abundant on the introduced Russian Olive tree.

Pituophis catenifer (Bullsnake). The bullsnake occurs widely throughout the area and except perhaps in the Platte Valley it is probably the most abundant snake. It is commonly observed crossing roads and has been seen eating rodents as well as cliff swallows. Specimens have been taken from all seven counties in the area. Our use of *Pituophis catenifer* for the bullsnake instead of the more generally applied *P. melanoleucas* is based on two points. Auffenberg (1963) pointed out the distinctions in vertebral shape between bull and pine snakes. The case for a single species of *Pituophis* in the United States rests on precious little evidence. Smith and Kennedy (1951), Fugler (1955), and Conant (1956) have examined the situation in the only critical area (eastern Texas), but in the absence of intergradation we are unwilling to assume that distinctive, allopatric populations (*viz., sayi, ruthveni,* and *lodingi*) must be viewed in a polytypic species paradigm. A growing body of evidence involving other "widespread" taxa (e.g., leopard frogs, ribbon snakes, banded water snakes) suggests that many of the species combinations generated in the 1950's are subject to reinterpretation.

Lampropeltis triangulum (Milk snake). This secretive snake probably occurs throughout the area but we have encountered it only twice. One specimen collected on Arapaho Prairie escaped before it was preserved. A second specimen (UNSM 2282) was obtained by a rancher northwest of Keystone, Keith Co.

Nerodia sipedon (Common Water Snake). This species is relatively abundant along the Platte River Valley at least as far west as the upper end of Lake McConaughy. These snakes are encountered in the wet meadows, at the mouths of streams entering the Platte River as well as along the main channel. They do not venture far from the river and thus appear restricted to the floodplain forest and interspersed wet meadows. Records include six (UNSM 7347-49, 7435-36, 7440) near Keystone, Paxton and Lemoyne, Keith Co. Gehlbach and Collette (1959) recorded it from Sutherland, Lincoln Co.

Thamnophis radix (Plains Garter Snake). The plains garter snake occurs throughout the area but appears more abundant in the sandhills than in the Platte Valley. This observation is consonant with Hudson's (1942) belief that this species is better adapted to dry conditions than is the red-sided garter snake. The plains garter snake has been observed foraging on larvae of the tiger salamander, spadefoot toad, striped chorus frog, and northern leopard frog. On one occasion, 30-40 adults were actively diving and capturing salamander larvae. Once a salamander was caught it was carried to shore and eaten, after which the snake would return to the pond.

Thamnophis sirtalis (Red-sided Garter Snake). This species occurs throughout the area and is abundant in the Platte Valley in the marshes adjacent to the river. It is also common in the very large marshes in the sandhills but appears much less common in smaller marshes.

Tantilla nigriceps (Black-headed Snake). This burrowing and secretive snake is near its northern distributional limit in this area. We have only a single record (UNSM 1291) from Sutherland, Lincoln Co. but it may also be expected in Perkins and southern Keith counties.

Crotalus viridis (Prairie Rattlesnake). Eradication by ranchers may be largely responsible for the relative scarcity of this poisonous species. It can be found in the Cedar Bluffs habitat and is often found associated with prairie dog towns which have been virtually eliminated from the area. Ranchers report that rattlesnakes are also common in hay meadows, but we have not collected them there.

Ecology of Herpetiles of Arapaho Prairie

Because of the interest in developing the Arapaho Prairie as a research site for long term controlled access studies we make special reference to the herpetofauna of this 1300 acre prairie. Thirteen species of herps have been recorded on the prairie including one salamander (*Ambystoma tigrinum*) three anurans (*Bufo woodhousii, Bufo cognatus* and *Scaphiopus bombifrons*), one turtle (*Terrapene ornata*), four lizards (*Sceloporus undulatus, Holbrookia maculata, Cnemidophorus sexlineatus* and *Eumeces multivirgatus*), and four snakes

(*Heterodon nasicus, Lampropeltis triangulum, Pituophis catenifer* and *Coluber constrictor*).

Amphibians and reptiles may be observed from early April to mid-October. The most conspicuous amphibian is *Bufo woodhousii* which is extremely common as small toads emerge from the two ponds where amphibians breed following spring rains. Emerging toads of *Bufo cognatus* have also been observed so both *Bufo* species breed at this location, but *B. cognatus* is much less abundant. Adult *Ambystoma* have been observed on the slopes of the sandhills and they may also breed in the ponds but we have no evidence of this.

The most conspicuous reptiles include *Sceloporus undulatus, Holbrookia maculata* and *Terrapene ornata*. The box turtle is commonly observed in May and June. The fence lizard and lesser earless lizard prefer the open areas on the slopes of the hills and are less common in swales and bottomlands. *Sceloporus* is particularly abundant in blowouts and in *Yucca* stands (Jones and Droge, in press).

Of the snakes, *Heterodon* and *Pituophis* appear to be the most abundant. *Heterodon* is observed on the slopes of the sandhills where it feeds on young *Bufo*. *Pituophis* is seen in areas with greater grass cover.

In the summer of 1977 we constructed three 600 m transects to count individual herpetiles active during the day. One of the transects was located in the lowland, a second transcended the slope of the central sandhill and a third traversed to the top of the hill. Too few records were obtained to analyze habitat perferences but some indication of relative abundance of species was obtained. Of 103 specimens sighted in late June, 47% were *Bufo woodhousii* and 28% were *Holbrookia*. Seven species represented the remaining observations and no other species represented more than 10% of the sightings. *Sceloporus* was seen at a 7% rate although mark-recapture studies indicate it to be as abundant as *Holbrookia* (Jones and Droge, in press).

Summary of Herpetofaunal Distributions

The herpetofauna of the seven county study area in western Nebraska may be characterized in general by a preponderance of organisms exhibiting both wide geographical and wide ecological distributions and tolerances. Species exhibiting little microhabitat specificity and which are found widely throughout the region include the tiger salamander, spadefoot toad, rocky mountain toad, striped chorus frog, lesser earless lizard, fence lizard, racerunner, common racer, bullsnake, red-sided garter snake, plains garter snake, snapping turtle and painted turtle. Those ecologically restricted species that enter the area include the plains leopard frog, common water snake, black-headed snake, yellow mud turtle, Blanding's turtle, and spiny soft-shelled turtle.

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