

Herpetofaunal Inventory of the Missouri National Recreational River and the Niobrara National Scenic River

Final Report

By:

Daniel D. Fogell and George R. Cunningham



Woodhouse's toad from James River Island, Missouri National Recreational River

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Northern Great Plains Inventory & Monitoring Coordinator
National Park Service
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Keystone, South Dakota 57751**

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Executive Summary

During 2003 and 2004 we inventoried the amphibian and reptile species of the Missouri National Recreational River (MNRR) in South Dakota and Nebraska and the Niobrara National Scenic River (NIOB) in Nebraska. Since prior surveys at NIOB had concentrated on the western portion of the park and surveys there were fairly adequate, this survey concentrated on the portion east of the Niobrara Valley Preserve, at the request of NPS. Also at NIOB, due to a complete absence of private landowner cooperation, surveys were limited to bridge crossings, adjacent roads, and one large property owned and managed by the Kansas Audubon Society. For MNRR, several large islands were included in the survey also at the request of NPS. Several inventory techniques we employed, including visual encounter surveys, frog and toad call surveys, turtle trapping, road surveys on roads that border the parks, seining for amphibian larvae, and the use of artificial cover objects as well as drift fences and pitfall traps. Since National Park Service (NPS) boundaries for these parks rarely extend beyond the banks of the rivers, much of the inventory work was accomplished using either motorized or non-motorized watercraft. All accessible public properties (State Parks, National Wildlife Refuges, etc.) that are adjacent to MNRR and NIOB were also surveyed.

The primary objective, as stated by the National Park Service, was to determine the presence or absence of amphibian and reptile species within the boundaries of each park. We were to identify the presence of at least 90% of the species expected to occur in the parks as well as offer sound explanations as to why absent species were not found. In addition, management and conservation issues were to be noted and reported appropriately. We conducted searches on 60 individual days during 2003 and 2004 with a minimum of 8 search hours per person, per day. Most survey days included at least two surveyors, which accounts for a minimum of 960 search and/or set up hours for both parks. We encountered a total of at least 1,840 individual amphibians and reptiles, and our success rates were mixed. For MNRR, 26 species were encountered out of an expected 29 species, for an encounter rate of 89.7% (Table 1). For NIOB, however, our success rate was only 71% (22 out of 31 species) (Table 2). Many of the species that were not found on NIOB, however, have already been documented by other survey activities or on the western portion of the park. The expected species list for MNRR was modified to include the prairie rattlesnake (*Crotalus viridis*) and the ornate box turtle (*Terrapene ornata*), which were not originally included on the expected species list provided by NPS.

Visual encounter surveys (VES) provided the greatest abundance of species encounters, mostly because of the large number of amphibians and turtles encountered at MNRR. The importance of employing other survey techniques is evident, however, due to the fact that each additional technique provided an encounter with at least one species that would not have been encountered using a VES. For example milk snakes (*Lampropeltis triangulum*) are rarely seen above ground and during this survey were ONLY captured using artificial cover objects. Additionally, northern prairie skinks (*Eumeces septentrionalis*) were found only under artificial cover objects. At MNRR, plains spadefoot toads (*Spea bombifrons*) were not encountered but were only identified via call surveys.

In most cases, species were found only within specific habitat features of each park, and with few exceptions it is doubtful that any species occupies the entire area of any park. The false map turtle was ubiquitous at MNRR, however it preferred to occupy specific habitat features while basking. Softshell turtles (*Apalone* spp.) were also found along nearly the entire length of MNRR but again had preferred habitat features they

would occupy. Amphibians, especially toads, were found on the banks of both rivers but were more common in backwater areas. Non-chelonian reptiles (snakes and lizards) were only rarely found on riverbanks but rather were more common in terrestrial habitats away from the rivers. In fact the majority of all snake encounters were accomplished using road surveys. All of the islands at MNRR harbored herpetofauna of some variety, with amphibians and turtles being most common. Snakes and lizards were present on some islands but not all of them.

Management issues for each park are addressed within the individual park summaries. The most important management issues for MNRR involve flow regime and recreational use of sandbars and islands. Flow regime is an ongoing discussion between multiple agencies and is only discussed in this report to address turtle nesting locations and backwater sloughs, oxbows, etc. Recreational use of sandbars and small islands is addressed for the same reason – turtle nesting success. Few management issues need to be addressed for NIOB.

There is no need for more intensive survey activities at either of these parks, since most species were uncovered during this survey. Since NPS is actively involved in monitoring Least Tern and Piping Plover nesting areas along NIOB, we recommend that while floating the river they take note of any turtle species encountered. This may help identify some of the species not found during this study – specifically softshell turtles (*Apalone* spp.). Monitoring efforts should include the techniques used in this survey. Anuran amphibians can easily be monitored via call surveys, and park personnel should be trained to recognize frog and toad calls. Since most snake species were not found directly on the rivers but were found on roads adjacent to them, road surveys should be included in any monitoring efforts. These can also be accomplished passively as park personnel travel from one location to another and take note of dead or living snakes on roads. The utility of artificial cover objects (cover boards) can only be realized if boards are left in place over long periods of time. Standing transects of strategically placed cover boards should be placed in areas that are easily accessible, such as state parks and national wildlife areas. Employees at these parks can easily be trained to identify snake species and can check cover boards two to three times each year. Drift fences have no utility in long-term monitoring efforts unless they are checked two to three times each week to prevent trapped animals from dying. The same holds true for turtle traps, although turtle trapping is recommended to more easily differentiate between smooth and spiny softshell turtles, as well as to monitor the ratio of one species compared to the other.

Introduction and Basic Design of the Study

Amphibian and reptile surveys were conducted at two National Parks: The Missouri National Recreational River (MNRR) and the Niobrara National Scenic River (NIOB). Both of these parks are composed of sections of rivers with very little associated terrestrial habitat. Given this unique design, survey methodology had to be modified from standard search techniques. Between both parks, a total of 35 different species were expected.

At MNRR, survey locations along the banks of the river as well as island locations were accessed via motorized watercraft. Terrestrial public access areas were also surveyed. These areas included:

- Karl Mundt National Wildlife Refuge (South Dakota and Nebraska)
- Niobrara State Park (Nebraska)
- Elk Point Game Production Area (South Dakota)
- Mulberry Bend Wildlife Management Area (Nebraska)
- Redbird State Wildlife Management Area (Nebraska)
- Bazille Creek State Wildlife Management Area (Nebraska)

At NIOB, nearly all properties along the length of river to be surveyed were privately owned, therefore survey activities were conducted primarily at bridge crossings and along public (and some private) access roads adjacent to the river. We were given access to one fairly large property near the eastern border of NIOB that was owned and managed by the Kansas Audubon Society. We had unlimited access to this land and were able to place a sizeable number of artificial cover objects in several different habitat types. We were also able to set turtle traps and visit small wetlands at this property to survey aquatic turtles and amphibian larvae.

The following survey techniques were employed at either MNRR, NIOB, or both, and each will be addressed individually in the paragraphs that follow:

- Visual Encounter Surveys
- Amphibian Call Surveys (including the use of automated recording devices)
- Road Surveys
- Turtle Trapping
- Seining (for amphibian larvae)
- Minnow trapping (for salamander larvae)
- Artificial Cover Objects
- Drift Fences with Pitfall Traps

Visual Encounter Surveys: The most effective method of surveying turtles on MNRR was using binoculars to identify species basking in various riverine habitats. Visual encounter surveys were also employed at both parks to search for amphibians along backwater wetlands, and to survey xeric habitats for diurnal, non-fossorial lizards. Occasionally, diurnal snakes (mostly garter snakes, genus *Thamnophis*) were encountered using this technique – especially on Goat Island and in the marshy flats along the Niobrara River portion of MNRR. Visual encounter surveys were conducted in riverine, wetland, grassland, bluffs, and riparian woodland habitats, however the most successful results were from riverine and wetland habitats. Lizards were often found using rocky bluffs, and occasionally diurnal snakes would be found in grassland habitats.

Riparian woodlands, however, were apparently devoid of herpetofauna, as there were no encounters in this habitat using any of the survey techniques. Twenty-two species of amphibians and reptiles were encountered using this technique, making it the most effective survey method (Figure 1).

Amphibian Call Surveys: Without exception, all nine species of expected anuran amphibians found within the two parks were heard calling at least one time during the survey period. This is an excellent way to determine the presence of frogs and toads, however two species – the Great Plains toad (*Bufo cognatus*) and the plains spadefoot toad (*Spea bombifrons*) rely on more specific climatic conditions before they begin to call. Two other species – the western chorus frog (*Pseudacris triseriata*) and Cope's gray treefrog (*Hyla chrysoscelis*) are rarely seen but are easily identified via call surveys. Call surveys were responsible for extending the known distributional range of *Hyla chrysoscelis* more than 160 miles. In addition to manual calling surveys, automated recording systems (a.k.a. "Frog Loggers") were placed at Karl Mundt NWR, Ponca State Park, on the Kansas Audubon Society property, and along the MNRR portion of the Niobrara River.

Road Surveys: Road surveys were absolutely necessary for identifying the presence of many snake species expected to be found in the parks. Large snakes such as bullsnakes (*Pituophis catenifer*) and fox snakes (*Elaphe vulpina*) have fairly large home ranges and also have a tendency to bask on roads to thermoregulate. Additionally, larger snakes are migratory and may use riverine habitat during the summer but will hibernate in areas that are quite a distance from the river – usually crossing over roads to get to hibernacula. With only one exception each, road cruising is the only way these species were encountered. Box turtles (*Terrapene ornata*) and eastern hognose snakes (*Heterodon platyrhinos*) were only encountered via road surveys. Other amphibians and reptiles were found by "road cruising" as well, in fact this technique accounted for 16 different species. Roads that are directly adjacent to the parks were surveyed most often, however any herpetofaunal species encountered on all roads while traveling between sites were recorded. Road surveys were conducted during times of the year and times of the day when amphibians and reptiles were most likely to be encountered. Spring and fall surveys were conducted during daytime hours while night road cruising was performed during warmer summer months.

Turtle Trapping: Turtle trapping was not absolutely necessary at MNRR, since all expected species of turtles were identified using other survey methods, however the technique was still used on several occasions. Turtle traps were also used along NIOB as well as in stock ponds on the Kansas Audubon Society property. All expected species at MNRR were trapped. At NIOB, however, only snapping turtles (*Chelydra serpentina*) and painted turtles (*Chrysemys picta*) were trapped. These were also the only turtle species encountered at NIOB. Turtle trapping would be an efficient way of monitoring the numbers of spiny softshell turtles (*Apalone spinifera*) in comparison to smooth softshell turtles (*A. mutica*) at MNRR.

Seining: Whenever ponds or other non-riverine aquatic habitats were encountered, they were either seined or swept with a hand-held fine-mesh net to capture amphibian larvae. With the exception of true toads (*Bufo* spp.), most amphibian larvae can be identified to species. Leopard frogs (*Rana blairi* and *R. pipiens*) are also nearly impossible to identify to species. Only two species were positively identified via this technique.

Minnow Trapping: Small, fine-mesh collapsible minnow traps were set in several ponds at both parks for the sole purpose of encountering salamander larvae. None were captured, however one trap successfully captured three adult western chorus frogs

(*Pseudacris triseriata*) including a pair in amplexus at MNRR. No other amphibian species were encountered using this survey method.

Artificial Cover Objects: Several transects of artificial cover boards (2 ft. x 2 ft. minimum in dimension) were placed in bluffs, grassland, and riparian woodland habitats on both riverbank and island locations. During the first season of surveys, encounters under the boards were nearly non-existent. After a year of seasoning, however, many boards started to produce reptiles. None of the riparian woodlands boards ever attracted a single amphibian or reptile species, however the bluffs and grasslands boards had fairly decent success rates. Six species of snakes and one species of lizard were encountered using this technique. Milk snakes (*Lampropeltis triangulum*) and northern prairie skinks (*Eumeces septentrionalis*) were only encountered using artificial cover objects. In some cases, snakes were found beneath artificial cover objects that already existed as discarded "trash" in MNRR.

Drift Fences/Pitfall Traps: Drift fences were erected only on the James River Island and a parcel of property adjacent to Bow Creek that was recently acquired by NPS. They were set up strictly to capture adult salamanders as well as lizards. Unfortunately, the pitfall traps associated with the drift fences did not successfully capture any reptiles or amphibians. While this is usually an excellent technique for capturing herpetofauna, our zero results are probably due to the short duration that the fences were in place (approx. 6 weeks) as well as the time of year (fall, since cooler temperatures reduce the risk of loss of life for animals captured in traps).

INDIVIDUAL PARK SURVEY RESULTS

Missouri National Recreational River

Abstract

Encounter rates at MNRR (89.7%) were very close to the results desired by NPS (90%). Only three species were not encountered: tiger salamanders (*Ambystoma tigrinum*), milk snakes (*Lampropeltis triangulum*) and northern water snakes (*Nerodia sipedon*). Herpetofaunal species with close ties to aquatic habitats (turtles and amphibians) were the most common species encountered. All five expected species of aquatic turtles were encountered as well as all nine expected species of anuran amphibians. Amphibians and reptiles were found in all habitats except woodlands. Larger islands had representatives of turtles, snakes, frogs, toads, and lizards. The use of bank stabilization materials appears to be reducing available aquatic turtle habitat. Additionally, turtles seem to rely on large, semi-permanent sandbars and small islands with low vegetation densities for nesting sites. The high recreational use of these features may also ultimately reduce turtle nesting success, as would the ecological succession of these islands towards fully forested, heavy canopy woodlands.

Introduction and Methods

The Missouri National Recreation River is composed of two units (39-mile and 59-mile) of unchannelized segments of the Missouri River, ranging from the Fort Randall Dam in South Dakota to Ponca State Park in northeast Nebraska. The upper (39-mile) unit also includes the eastern-most portion of the Niobrara River as well as the northern-most section of Verdigre Creek. The lower (59-mile) unit ranges from the Gavins Point Dam to Ponca State Park.

Habitat within MNRR can be broadly divided into four types: riverine/wetland, bluffs, grassland, and riparian woodland. Riverine/wetland habitat consists of riverbanks, riverine habitat structures (i.e. emergent logs), and any associated backwater wetlands, such as oxbow lakes, sloughs, and temporary wetlands formed by river flood activity. Bluffs are sparsely-vegetated rocky hillsides and ledges. Many, but not all of the bluffs were directly adjacent to the river and made up the bulk of some riverbanks. Grasslands are areas adjacent to the river that were virtually devoid of trees and ranged from savanna-like habitat to true grasslands. Riparian woodlands are forested habitats with a direct association with the river. A fifth "habitat" type – agricultural field – was observed on many occasions but was not surveyed.

MNRR is also composed of numerous islands, ranging from completely barren sandbars to large, fully-forested, well-established fluvial islands. Larger islands often harbored three of the four major habitat types – the exception being bluffs. Smaller islands were found in various stages of ecological succession. Larger islands, such as Goat Island and James River Island, were surveyed as intensely as riverbanks and associated habitats were surveyed.

Searches at MNRR were primarily conducted using visual encounter surveys (VES). Most survey locations were accessed via motorized watercraft, although some state and national areas were accessed by way of automobile. In addition to VES, arrays of artificial cover objects were employed in all four major habitat types as well as on larger

fluvial islands. Call surveys and seining were conducted in areas where backwater sloughs and stock ponds were present. Roads adjacent to MNRR were searched repeatedly throughout 2003 and 2004 for living or dead amphibians and reptiles. Drift fences with pitfall traps were erected at two locations – including James River Island.

Results and Discussion

Out of 29 species expected to occur at MNRR, 26 were encountered at least once throughout the two years of survey activity for a success rate of 89.7%. The total number of encounters was 1,489. Amphibians and aquatic turtles comprised the majority of encounters with 929 and 461 encounters respectively. Snakes accounted for 91 encounters, while terrestrial (box) turtles and lizards accounted for only 4 encounters each.

The amphibian that was most widely distributed on the Missouri River proper was Woodhouse's toad (*B. woodhousii*). It was encountered on nearly every riverbank we approached, and was found on nearly every island and sandbar that had any form of established vegetation. Other amphibians were found directly on the river, however most were found either in wetlands on large islands or in backwater areas. The greatest diversity of amphibian species occurs in the flood plain where Verdigre Creek, the Niobrara River, and the Missouri River all converge. The only frog or toad species not encountered in this area was the Great Plains toad (*B. cognatus*). Oddly, the only northern cricket frogs (*A. crepitans*) encountered were found on the Nebraska banks of the river, where they were actually quite common. Even though extensive searches were performed on the South Dakota banks and backwater areas as well as tributaries to the Missouri River, none could be found using either call surveys or VES. This species is considered endangered by South Dakota Game, Fish, and Parks, and its absence on the South Dakota banks is not understood. Further survey activities may uncover populations in South Dakota, and we recommend tracking this species on the Nebraska side of the park to monitor potential population declines. Cricket frog populations have been declining substantially from the northern portion of their range and are believed to now be extinct in Minnesota. They are ranked as critically imperiled in Minnesota and South Dakota, and vulnerable in Iowa (NatureServe 2005), however they appear to be stable in Nebraska. Given the north-to-south pattern of decline, if their populations begin to decline in Nebraska, the first and most noticeable locations will be along MNRR.

One species of amphibian has apparently extended its range along the Missouri River and, as a result of this survey, was found for the first time along the Verdigre Creek and Niobrara River portions of MNRR. This species is Cope's gray treefrog (*Hyla chrysoscelis*). Prior to this survey, the known range of *H. chrysoscelis* extended along the Elkhorn River to the northern extreme of Dodge County (Lynch 1985). Previous surveys had been conducted at Niobrara State Park however this species was neither heard calling nor otherwise encountered. This implies that it is a relatively recent resident of MNRR. Cope's gray treefrogs inhabit woodlands and woodland edges that have aquatic associations, and while the Missouri River has probably always had some riparian woody vegetation associated with it, changes in land management adjacent to MNRR have encouraged more extensive growth of woody vegetation. These actions likely produced favorable conditions for *H. chrysoscelis*, however the possibility that they were haphazardly introduced to the park cannot be discounted. Given the high numbers of boaters using MNRR, treefrogs could have easily been "rafted" to MNRR on boats, trailers, and other structures. Since breeding choruses of *H. chrysoscelis* were found at

multiple locations from Ponca State Park through Sanctuary Island, the majority of populations probably exist as a result of natural migration and colonization. This species was not found upstream of Sanctuary Island, although call surveys and frog loggers were used to search for them at Karl Mundt NWR. The only other upstream location they have been found is below the dam at Lake Oahe, where a small chorusing population is heard each year (Doug Backlund, South Dakota GFP, personal communication).

The single amphibian species that was not encountered is the tiger salamander (*Ambystoma tigrinum*). Multiple techniques can be used to uncover this species, and all of these were employed at one time or another during this survey. The most logical explanation for the tiger salamander's absence from MNRR is the fact that it absolutely requires a breeding environment that is devoid of predatory fish. We did not find any bodies of water that fit this description along MNRR. Even the small temporary ponds that formed along the Niobrara River in early summer were found to harbor small grass pickerel (*Esox americanus vermiculatus*) when they were seined. We seined and placed baited minnow traps in a deep, fishless pond near the residence at Karl Mundt NWR, however we found no tadpoles or adult salamanders at this pond. More than likely the tiger salamander occurs within some of the grasslands along MNRR, however unless climatic conditions are optimal or the salamanders are concentrated in a single area (i.e. a prairie dog town), chance encounters with adult salamanders will be rare. Seining and/or trapping for larvae in suitable wetlands (including livestock ponds that have not been stocked with fish) are the most efficient methods of determining their presence as well as monitoring their status in the future.

Another species whose range was extended significantly as a result of this survey is the western fox snake (*Elaphe vulpina*). In Nebraska this species is known from as far west as the eastern border of Boyd County, between the Niobrara and Missouri Rivers (Lynch 1985). In South Dakota, the western extreme of the fox snake's range ends just north of the confluence of the Niobrara and Missouri Rivers in Bon Homme County (Ballinger et al. 2000). We have extended this range in South Dakota by two counties to the west, with the westernmost specimen now represented by a road-killed individual found just west of Karl Mundt NWR in Gregory County. This new location represents the westernmost occurrence for the entire species.

Several other encounters have some significance and should be addressed here. First is the occurrence of ornate box turtles (*Terrapene ornata*) at MNRR. The known range of *T. ornata* in both Nebraska and South Dakota excluded MNRR and in fact excluded the Missouri River completely. Four box turtles were encountered in the area just south and west of the confluence of the Niobrara River and Verdigre Creek. This area is a northeastern extension of the Nebraska Sandhills, which is a habitat that supports box turtles as well as other sand-dwelling animals. Ord's kangaroo rats (*Dipodomys ordii*) were also found along the same roads that box turtles were found on. Searches were conducted for lizards here, but none were found. A fifth box turtle was found about six miles south of the Niobrara River in Holt County but was not included in the results. The individual prairie rattlesnake (*Crotalus viridis*) that was found on the banks of the river represents some significance. Prairie rattlesnakes are known from Knox County but have not been seen there in more than 30 years. Finding this individual provides evidence that at least a small population still exists in the bluffs along the Missouri River in Knox and probably Boyd Counties. The DOR individuals found west of Karl Mundt NWR were expected from that region. The remaining significant discoveries involved reptiles other than turtles existing on islands. Common garter snakes (*Thamnophis sirtalis*) were captured along the edges of wetlands on Goat Island. This was the only snake we encountered there, however students conducting mammal

and herpetofaunal surveys on Goat Island reported a single encounter with a western fox snake. Artificial cover boards were placed in woodland, grassland, and wetland habitat types on Goat Island but only common garter snakes were encountered. Similarly, cover boards were placed at James River Island, but no snake species were encountered there. Instead, however, a lizard species was encountered. The northern prairie skink (*Eumeces septentrionalis*) was present in a patch of open grassland on the southeast side of the island. This represents somewhat of a range extension for Nebraska but not so for South Dakota. The significance lies in the fact that a small, predominantly fossorial lizard was able to establish itself on a fluvial island. In addition to the skinks, this habitat was home to literally dozens of orchids (*Spiranthes lacera*), which were found blooming in mid- to late August 2004.

The remaining two species that were not found are the milk snake (*L. triangulum*) and the northern water snake (*N. sipedon*). Milk snakes are fairly ubiquitous in grassland habitats however they are rarely ever seen due to their preference for a subterranean lifestyle. The best way to uncover them is to search beneath objects on the ground – such as rocks, logs, or discarded sheets of wood or tin. Although nearly 200 artificial cover boards were placed at various locations throughout MNRR, the milk snake could not be found. It probably occurs in several areas, including Karl Mundt NWR where an extensive tract of grassland exists. From prior experience, we have discovered that artificial cover boards should be in place for two to three years before they start to produce results, therefore a permanent array of cover boards should eventually uncover milk snakes. Given the known ranges of various milk snake subspecies, the subspecies expected to occur at MNRR is the pale milk snake (*L. t. multistriata*), although the red milk snake (*L. t. sypila*) may hybridize with it along the eastern border of the park. Northern water snakes are known to occur in significantly high numbers at Lewis and Clark Lake. In South Dakota, this is the only known location for *N. sipedon*, while in Nebraska it is also known from the confluence of the Niobrara and Missouri Rivers. We concentrated our efforts on uncovering this species at other areas along MNRR – specifically backwater areas and sloughs. Several areas that appeared promising were investigated, including a backwater wetland at Ponca State Park that appeared to be perfect *N. sipedon* habitat. Other snake species (*T. sirtalis*) were present, however northern water snakes were never encountered. In fact boaters that regularly travel sections of MNRR were questioned about snakes but none have ever reported seeing a water “moccasin” or water snake other than within the borders of Lewis and Clark Lake. We have encountered this species along portions of the channelized Missouri River in eastern Nebraska, therefore water flow rate should not be a factor in determining its absence or presence in MNRR. The best possible explanation that might explain its absence is a lack of suitable hibernacula. Water snakes often hibernate in burrows along the banks of streams and ponds, where they will often get below the frost line to avoid freezing to death during the winter. Water in these burrows provides a microclimate that helps maintain temperatures above the freezing point. Fluctuations in water flow and water levels may hinder the abilities of northern water snakes to successfully colonize areas along the banks of the river. Additionally, it is possible (and quite likely) that populations in Lewis and Clark Lake are the result of inadvertently introduced northern water snakes that have “hitchhiked” their way there in boats. This statement can be supported by the fact that there are no other populations in South Dakota, and that the nearest known populations of northern water snakes on the Missouri River do not occur until the mouth of the Platte River in Cass County. Away from the Missouri River, there are a few locations along the Niobrara and Elkhorn Rivers, but there are no known records of *N. sipedon* anywhere else in northern or northeastern Nebraska.

Based on known distribution records and the habitat at MNRR, two additional species may eventually be found there. The American toad (*Bufo americanus*) has been found in South Dakota not far from the Missouri River across from Ponca State Park (Fogell 2003a). While analyzing recordings from frog loggers, we thought we might have heard distant calls from *B. americanus*, however subsequent call surveys never produced any encounters. The American toad is extremely rare in Nebraska, presently existing in only a few isolated locations. However given the fact that many privately owned parcels of land in northeast Nebraska have suitable habitat, it is not unlikely that additional populations exist – including at and near Ponca State Park. The other species that may occur there is the five-lined skink (*Eumeces fasciatus*). Unsubstantiated historic accounts of this species exist for areas along the Missouri River in Washington County, Nebraska, and specimens exist in the University of Nebraska Museum from the Yankton region of South Dakota. Fitch (1954) suggested that there may be locally abundant populations in areas along the Missouri River, especially on the South Dakota side. The preferred habitat of *E. fasciatus* is deciduous woodlands with scattered open spaces and rocky bluffs and hillsides. There are several locations between Lewis and Clark Lake and Ponca State Park that fit this description. We have found them in southeastern Nebraska by using artificial cover objects to attract them, however they were never found beneath cover objects anywhere along MNRR. Ponca State Park is a site where they would most likely occur if they exist at MNRR.

Finally, there is one concern regarding the survey results that must be addressed. Given that the Missouri River is a large river and that, of the two softshell turtle species, the smooth softshell turtle (*Apalone mutica*) is predominantly a large river species, we are concerned that it was not encountered as often as the spiny softshell turtle (*A. spinifera*) was. One possible reason may have to do with the bias of selecting our search locations. We chose areas that were adjacent to backwater locations, where species richness was expected to be highest. This is also where we predominantly set turtle traps. Since *A. mutica* prefers clean, flat, sandy shores with no vegetation (Goldsmith 1944), it is understandable that they were not encountered more frequently when we surveyed backwater areas. Vandewalle and Christiansen (1996) noted that an increased presence of erosion control structures such as riprap reduced the numbers of *A. mutica* encounters on rivers in Iowa. Erosion control structures are becoming increasingly common along the banks of MNRR (see Recommendations for Park Management below) and may have contributed to the reduced sightings of smooth softshell turtles during this survey.

Recommendations for Park Management and Monitoring

Given the high diversity of herpetofaunal species found at MNRR, it is clear that current management activities are somewhat successful. There are some concerns, however, that may affect aquatic turtles as well as anuran amphibians. The most obvious concern has to do with the flow regime of the river. Currently there are ample sandbars and semipermanent small islands that afford suitable nesting areas for turtles. It is important that these islands remain exposed during the warmer months when turtles are laying eggs. It is equally important that they remain relatively free of vegetation – especially large, woody species such as cottonwood trees (*Populus deltoides*) that provide the foundation for potential forested, permanent islands. While nesting turtle tracks were observed within patches of short vegetation, none were ever encountered between large trees. The scouring of fluvial islands to prevent vegetative growth is an issue that concerns other species – namely the least tern (*Sterna antillarum* *athallasos*)

and piping plover (*Charadrius melodus*) – and is presently being addressed. As long as the flow regime incorporates concerns for these species, turtles on MNRR will continue to have abundant nesting sites. The recreational use of these islands can also negatively affect turtle nesting success, although it is not known to what extent at this time.

Another concern regarding turtles is the use of erosion control structures along the banks of the river (Figure 2). Turtles – especially false map turtles (*Graptemys pseudogeographica*) – rely on fallen trees for basking and resting sites along the river. Erosion control will prevent these trees from falling, thus reducing the amount of habitat available to riverine turtles. Additionally, turtles rarely use the erosion control structures themselves – such as rocks and large slabs of concrete. Only one or two instances of turtles using these riverbank features were recorded during this survey. False map turtles are listed as endangered species by South Dakota GFP, and all species of the genus *Graptemys* are being considered for protection under CITES regulations due to their decline across their range. Given these facts, serious consideration should be given when allowing the use of erosion control measures along the length of MNRR.

The last recommendation is regarding amphibians. It is widely known that amphibian species are in decline throughout the planet. We have already mentioned the north-to-south decline of *Acris crepitans* and its probable extirpation from Minnesota. Therefore a strong recommendation will be presented here to maintain any known seasonal and other backwater wetlands as pristinely as possible, and if opportunities arise to modify habitat areas, to consider how those modifications will affect amphibians. One case in point involves a recent habitat modification project at Ponca State Park with the objective of producing shallow water wetlands. In completing this project, several natural, fish-less wetlands were destroyed. The resulting wetlands may be adequate for amphibian reproduction, however recruitment rates will drop significantly from prior years because predatory fish will feed on amphibian larvae. Some species, such as the western chorus frog (*P. triseriata*) will likely abandon the location as a breeding site altogether if fish maintain a presence there. We encountered several choice amphibian breeding areas along MNRR that are maintained because of seasonal detachments from the main channel of the river (Figure 3), and there are probably dozens more that we did not investigate. These areas are crucial to the continued existence of all amphibians at MNRR, and they also provide slow water refugia for hatchling turtles. Their importance cannot and should not be overlooked.

Although MNRR is a “recreational” park, it is also a park of biological significance and should be maintained as such. Recreational activities should be monitored, and violations of recreational rules should be strongly enforced. The biological integrity of MNRR should be considered whenever major management decisions are presented. We recommend continued monitoring of amphibians and reptiles at MNRR, especially calling frogs and toads and basking turtles. These species particularly rely on the riverine habitat in order to flourish and survive. Their continued existence will be indicators of successful management of the biological component of the Missouri National Recreational River.

Niobrara National Scenic River

Abstract

Twenty-two of the 31 expected species were encountered at the Niobrara National Scenic River, resulting in an encounter success rate of 71%. Of the nine species that were not encountered, seven have been previously documented at the western section of the park, leaving only two undocumented species. The remaining two are the western fox snake (*Elaphe vulpina*) and the smooth softshell turtle (*Apalone mutica*). Species that are normally associated with the Nebraska Sandhills were commonly encountered, including several terrestrial reptile species. Turtle species were especially difficult to encounter given the shallow water depth in the Niobrara River during most dates of survey activities. Snake and lizard species were encountered fairly frequently using road surveys and visual encounter surveys. Anuran amphibian species comprised the majority of encounters. Due to a lack of cooperation from private landowners, survey activities were restricted to public bridge crossings and a preserve owned and managed by Audubon of Kansas. Very few management issues were encountered, however, and the park appears to be rich with herpetofaunal life.

Introduction and Methods

The Niobrara National Scenic River (NIOB) spans from Valentine, Nebraska to the east a distance of approximately 76 miles. The western half of the park has been previously surveyed for amphibians and reptiles and a fairly complete species list has already been compiled. The eastern half has not been surveyed, therefore the scope of this survey includes that portion of the Niobrara River that extends east from Norden, Nebraska to Mariaville, Nebraska.

Most of the property along this stretch of the river is privately owned, and requests to access several private properties were repeatedly denied. As a result, survey activities were predominantly restricted to several bridge crossings as well as adjacent roads. In addition, we were provided full access to a 208-acre preserve controlled and managed by Audubon of Kansas (permission granted by Ron Klataske, Audubon of Kansas).

Habitat at NIOB differs between the north and south banks. The north banks are dominated by a mix of deciduous and coniferous trees scattered among steep, somewhat rocky hillsides. The south bank is less rocky and composed primarily of grasses and herbaceous plants with some riparian vegetation along the river. A fairly extensive flood plain made up of marshes and meadows separates the river from the sandy-soiled grasslands. Additionally, at some locations there are small pockets of sandhills habitat.

Several inventory techniques were employed at NIOB. Visual encounter surveys were conducted at all accessible bridge crossings, rock outcrops along roads that are adjacent to NIOB, and the Audubon site. VES were conducted during daylight hours when temperatures were appropriate for herpetofaunal activity. The best results occurred on rocky and sandy sparsely-vegetated hillsides where snakes and lizards could easily be observed. Additionally, VES were very effective along the banks of the Audubon preserve, where several species of anuran amphibians were fairly abundant as larvae, metamorphs, and adults.

Anuran call surveys, which included the use of frog loggers, were also conducted at the Audubon preserve. Additional call surveys were conducted at bridge crossings and

along roads, where we would stop during road surveys and record frog and toad calls whenever they were heard.

In order to compensate for the lack of accessibility to private properties, road surveys were extensive at NIOB. Several excellent sand and gravel roads are present on both the north and south banks of the river – many of which are less than a few hundred meters from the river. Road surveys accounted for several snake species that were not encountered at the Audubon preserve as well as physical encounters with frogs and toads that were otherwise only encountered via call surveys.

Artificial cover boards were placed at strategic locations on the Audubon preserve as well as alongside certain roads. None of the boards produced any results until the second year of the study, however at least two species would not have been encountered without them, including one species that was expected but had not been encountered during previous surveys (*Diadophis punctatus*).

Seining for larvae was performed at bridge crossings and at the Audubon preserve. Also, a permanent pond formed by a natural spring on the Audubon preserve was sampled for salamanders, salamander larvae, and anuran amphibians. Several minnow traps were set over a period of two months to attempt to trap salamander larvae.

Results and Discussion

Out of 31 expected species, 22 were encountered during the survey period, providing a successful encounter rate of 71%. The total number of encounters was 351 at a minimum, with frogs and toads accounting for the majority of the encounters with 245. Lizard encounters were the second highest in number with 54, and snakes closely followed with 46 encounters. Turtles represented the lowest number of encounters, with only six accounts of both aquatic and terrestrial turtles. According to NPS records, of the nine species that were not encountered, seven have been previously documented. The remaining two species are the western fox snake (*Elaphe vulpina*) and the smooth softshell turtle (*Apalone mutica*), both of which only occur well outside the range of NIOB. The species that were not encountered are discussed in further detail later in this section.

None of the results we observed were unexpected. All of the species encountered were species that are very common in that particular region of Nebraska. It was somewhat concerning that more aquatic turtles were not encountered, especially at the bridge crossings. It is likely that snapping turtles (*Chelydra serpentina*) and painted turtles (*Chrysemys picta*) are more common in some of the wetlands and stock ponds on properties along the banks of NIOB, however the softshell turtle species are probably much more rare. During mid- and late summer survey activities, water levels were low enough that we were able to walk completely from one bank to the other. Additionally the braided channels along this stretch of the river are not very wide. These conditions are not favorable for *Apalone* species. While softshell turtles will likely migrate through this section of the river, they probably do not spend a substantial amount of time here. In addition to the water conditions and the channel sizes, sandbars are neither large enough nor permanent enough to support nesting habitat. The other two aquatic turtle species (snapping turtles and painted turtles) will often use more upland locations for nesting. Turtle traps were set along the south bank of NIOB at the Audubon preserve, however only snapping and painted turtles were captured. According to Lynch (1985), *A. mutica* is not known from the Niobrara River. Current museum records indicate a single record from Keya Paha County from 1987 (deposited after Lynch's 1985 publication), but the precise location is not indicated. All other accounts of this species

are restricted to larger rivers or larger channels. Additionally, an impoundment along the eastern Niobrara River near Lynch, Nebraska (Spencer Dam) may reduce the smooth softshell turtle's capacity to migrate upstream.

Other species that were expected but not encountered include Blanding's turtle (*Emydoidea blandingii*), the eastern hognose snake (*Heterodon platyrhinos*), western fox snake (*Elaphe vulpina*), many-lined skink (*Eumeces multivirgatus*), northern water snake (*Nerodia sipedon*), smooth green snake (*Liochlorophis vernalis*), and the tiger salamander (*Ambystoma tigrinum*). Blanding's turtle is a common species in the Nebraska sandhills proper and has also been found in numerous locations throughout east-central Nebraska. Museum records exist for areas very close to the survey location, yet they were not encountered during this survey. Although they are primarily pond-dwelling species, we have found them in other locations in small, sandy-bottomed, slow-moving streams. Four ponds exist on the Audubon preserve, but *E. blandingii* was not trapped or observed in any of them. This species is much more common along the western portion of NIOB where we have seen them on numerous occasions prior to this survey, therefore their absence along the eastern section during this survey is of little concern.

Eastern hognose snakes reach the northwestern limits of their range in northeast Cherry County, Nebraska, and are considered fairly rare along the Niobrara River. Museum specimens exist from Cherry, Brown, and Keya Paha Counties, all of which were found along or very near the Niobrara River. As the banks of the Niobrara River become more forested, *H. platyrhinos* will probably become more common. There is likely a fair amount of interspecific competition with *H. nasicus*, since they both prefer the same kind of soil and are both frog and toad specialty feeders, however the habitat differences should be enough to allow them both to continue to exist. Herpetologists from Fort Hays State University in Fort Hays, Kansas encountered a DOR *H. platyrhinos* near Valentine, Nebraska while conducting road surveys in the sandhills during 2004 (Chad Whitney, personal communication), indicating that they still exist along the western portion of NIOB. Also, they have been previously documented at NIOB.

Although the western fox snake (*E. vulpina*) was included on the list of expected species, its occurrence along the Niobrara River west of the confluence with the Missouri River is presently unlikely. In Nebraska, fox snakes are commonly found in riparian areas of the northeast corner of the state and are especially common along the Missouri River. If the banks of the Niobrara River continue to become heavily wooded, then like the eastern hognose snake, the fox snake will probably eventually migrate and colonize habitats to the west and become more common. They are moderately large snakes that are commonly encountered as road kills, and if they existed in this region, we surely would have found living or dead specimens on roads around NIOB.

We have found many-lined skinks to be common in some areas of western Nebraska, including long the Niobrara River in Sioux County, but successfully finding them required searching beneath rocks and other cover objects. Habitat similar to this exists on the bluffs of the north bank, yet the species still was not found. Our artificial cover boards also did not provide us with any skink encounters, however we believe that permanent transects of cover boards will eventually uncover this species. It also has been previously documented at NIOB and can be verified with museum records.

While the Niobrara River seems to be excellent habitat for the northern water snake, there are very few records from there. Museum records indicate that *N. sipedon* has been in Cherry County since at least 1933, and the most obvious means of migration would have been via the Niobrara River. The Audubon preserve has excellent habitat for water snakes, with three large exposed ponds very close to the river and a fourth one quite a distance away, we should have encountered them there, either in turtle traps or

during VES around the ponds (since they are primarily diurnal snakes). The only explanation for their absence is that there may not be adequate hibernacula in the area. Winter hibernation sites are the limiting factor for ectotherms in temperate climates, and the sandy substrate may not provide the preferred form of winter habitat for water snakes. Since there are already records of their existence at NIOB, it is likely that they are just not common in the areas that we surveyed.

Tiger salamanders (*Ambystoma tigrinum*) are widespread throughout Nebraska however records from the north-central portion of the state are scant (Lynch 1985). The only records are from Brown and Cherry Counties, and they are all from areas along the Niobrara River. Tiger salamanders doubtlessly still exist along NIOB but are difficult to encounter without seining fishless ponds for larvae. We have found them to use cattle tanks in other areas of the sandhills, as well as temporary and permanent fishless ponds. Of the four ponds on the Audubon preserve, only one is fishless. We attempted to trap larvae using minnow traps – a technique that has been successful in other surveys – however we were unsuccessful. Seining was also unsuccessful because the pond was extremely deep. Another technique we used was to drive sandy roads either during or after a rain event. Other amphibians were encountered, however salamanders were not. The lack of records from this area is interesting because there is also a void of records for quite a continuous distance north into South Dakota (Ballinger et al. 2000). Tiger salamanders may just be rare in this region, or they may be suffering from reductions due to grazing, prairie dog town eradication, irrigation, or the stocking of ponds with game fish.

The last species we were unable to locate here was the smooth green snake (*Liochlorophis vernalis*). This snake is generally an inhabitant of wet meadows and marshes, of which there are plenty along the south bank of NIOB. However, this species is one of the rarest snakes in Nebraska and only a few records exist from 5-6 locations throughout the state. Perfect green snake habitat exists at the Audubon preserve, and extensive searches were conducted to find it, however the meadow on the property is hayed annually, which may negatively affect the species status at the site. None of the verified museum records of *L. vernalis* indicate that it exists anywhere near NIOB, however NPS has listed it as a species that has already been observed there. One of us (DDF) has found them to use cover boards in the eastern US as well as in Nebraska along the Platte River, therefore an array of artificial cover objects in meadow habitat may eventually help determine their presence. If NPS or other official personnel encounter this species in the future, we strongly recommend that a photograph (slide preferably) be taken as well as a voucher specimen.

One species that was encountered at NIOB, included on the NPS expected list, but which we did not expect to find at the park was the plains leopard frog (*Rana blairi*). This species has historically been limited in distribution to areas in southern and eastern Nebraska. However it has been successfully extending its range in recent years and has been found in several locations along the unchannelized portion of the Missouri River along the Nebraska-South Dakota border (see MNRR account, this report). It is not unlikely then that this species would migrate west along the Niobrara River. No data currently exist as to whether *R. blairi* is competing for resources with, or even outcompeting, the northern leopard frog (*R. pipiens*), however it is a very real possibility that should be investigated in the future.

By taking into account the species previously documented at NIOB and those found during this survey, 29 of the 31 expected species, or 93.5%, have been verified to occur on or near the park. The two remaining species are either absent from the park (*Elaphe vulpina*) or are not expected in most areas of the park due to unsuitable habitat (*Apalone mutica*). Three additional species may eventually be found to occur at NIOB, based on

either their current distributions and habitat preferences, or anecdotal evidence of their current occurrence. Two turtle species – the yellow mud turtle (*Kinosternon flavescens*) to the west and the false map turtle (*Graptemys pseudogeographica*) to the east have the potential to extend their ranges and inhabit the scenic river portion of the Niobrara River. The yellow mud turtle is predominantly a pond inhabitant in Cherry County and throughout the sandhills, however it is also known to occur in streams and is fairly common in the Republican River in southwest Nebraska. We would not be surprised to find it in the western portion of NIOB – especially around the Valentine area. The false map turtle normally occupies large rivers and is common along the Missouri River (MNRR, this report), however it has also been found in smaller to moderately-sized rivers such as Platte River in Nebraska (Fogell 2003b) and the James and Big Sioux Rivers in South Dakota (Ballinger 2000). During years of high water flow in the Niobrara River, false map turtles might easily and preferably migrate upstream and colonize areas farther west along the river, however as with the smooth softshell turtle, the Spencer Dam may be a potential barrier to upstream migration. A third species that may eventually be encountered is based on anecdotal reports from a herpetologist/student at Fort Hays State University in Fort Hays, Kansas. Chad Whitney (personal communication) reported encountering a living specimen of a western ribbon snake (*Thamnophis proximus*) along a sandy road that parallels the Niobrara River just south and west of Springview, Nebraska (approximately N: 42.77070° W: -99.92259°). The specimen was not collected nor was it photographed, however the individual that found it is an accomplished herpetologist. This location is well outside the current known range of western ribbon snakes in Nebraska. We traveled this road extensively during this survey but found only garter snakes. We report this species as a potential species but with some skepticism. Since garter snakes and ribbon snakes are morphologically similar, we do not accept the account as valid without a photograph or a specimen, however we suggest that any “garter snakes” encountered in this region by NPS or other personnel be more closely examined to ascertain whether it is a ribbon snake or not. The most obvious identifying feature of ribbon snakes is the ABSENCE of black bars between the labial (“lip”) scales. It will also be a more slender-bodied snake than garter snakes, but since male garter snakes remain small and slender in build, this characteristic is not always reliable.

Recommendations for Park Management and Monitoring

Because the channels are smaller and more braided and the water levels are shallow, the eastern portion of NIOB does not receive as much recreational traffic as the western portion does. As a result, damage to habitat by recreational use is not a major issue here. Erosion control structures also appear to be virtually non-existent on the Niobrara River along the NIOB stretch, and there are no impoundments or major flood control structures along NIOB, so the threat of habitat changes due to anthropogenic sources is probably minimal. Therefore, it seems that current management practices appear to be sufficient. One potential threat to amphibians and turtles, however, is the stocking of ponds with sport fish. This activity will reduce amphibian and turtle recruitment from larvae and hatchlings substantially and may result in local extirpations. Overgrazing of cattle, annual haying, and fire suppression by private landowners will alter habitat adjacent to the river – possibly to the point that species compositions will be affected. Given the natural state of the Niobrara River – not just at NIOB but along its entire length, habitat modifications and conversions should be prevented or minimized whenever possible. Recommendations include:

- Avoiding the installation of any additional impoundments.
- Encouraging landowners to participate in conservation incentive programs to maintain land in a pristine state.
- Discouraging the practice of stocking ponds with non-indigenous fish that may reduce herpetofaunal populations as well as potentially escape into the main channel of the river.
- Controlling the amount of recreational activity so that it does not ultimately become a management issue in the future.

Additionally, we recommend that annual to semi-annual surveys of herpetofauna be conducted in order to look for potential trends in frequencies of species occurrences at the park (see “MONITORING RECOMMENDATIONS” below).

CONCLUSION

Based on our results presented here and the lists of previously encountered species provided by NPS, both MNRR and NIOB appear to be very near or above the desired 90% expected species occurrence rate. Many species at both parks were encountered with very little effort, however there are several species that required more specialized inventory techniques to ascertain their presence at the parks. Those four species that were not encountered either previously or during these surveys are either secretive (*Ambystoma tigrinum* – both parks, *Lampropeltis triangulum* at MNRR) or potentially well outside the range of the parks (*Apalone mutica* and *Elaphe vulpina* at NIOB). Additionally, there is the potential that additional species may ultimately be encountered at both parks.

Given the linear distances that each of the parks encompasses, there are probably very few locations where all, or at least a majority of the species that occur within the parks can be encountered at any given time. Habitats are extremely variable along the lengths of the parks, and they change – sometimes radically (MNRR) – from the western extremes to the eastern portions of the parks. This accounts for the vast diversity of herpetofaunal species at MNRR and NIOB as well as the difficulty in encountering some of them.

Public use differs between the two parks, basically because of their designations. MNRR experiences heavy recreational use by people who are often unsympathetic to herpetofauna. Also, since the use of motorized watercraft is authorized there, almost any location along MNRR is accessible to humans. This potentially represents a major habitat management issue, especially in backwater areas – which is where the greatest species diversity seems to occur. This is less of a problem at NIOB because the use of motorized watercraft is not allowed, and much of the river is not easily accessed. The pristine character of NIOB, however, is dependent on the management actions of private landowners, who may unpredictably choose to change management practices at anytime. As a result, even though both parks appear to be rich with herpetofaunal diversity, that status is not secure and both parks are vulnerable to population and/or species losses due to human activity.

On a more positive note, both parks harbor an impressive number of amphibians and reptiles. Given the size and shape of the parks, it is unlikely that any species will completely disappear from either park. Continued proper management and a monitoring program are the key to maintaining this diversity.

RECOMMENDATIONS FOR MONITORING

Now that baseline surveys have been completed, the task of monitoring should begin. The greatest benefits of monitoring amphibian and reptile populations will be to identify trends in abundance or even occurrence at the parks, and the potential identification of species that were not encountered or that may eventually be discovered at the parks. The size and linear distances of the parks has already been addressed as contributors to the vast diversity of the parks. These characteristics will also be a hindrance when conducting future monitoring surveys. Also, since many species are not easily encountered using visual encounter surveys, additional methods will have to be employed to ensure that all taxa are represented during monitoring activities.

In order to monitor the greatest number of species, we recommend the following monitoring activities:

1. *Visual encounter surveys for turtles while conducting other activities on the rivers:* Since NPS and other partners actively monitor tern and plover nesting activities on both rivers, surveys for turtle species can easily be accomplished. Even if they are simply notes that state the occurrence of certain species along certain stretches of the rivers, it is better than not recording any observations at all.
2. *Setting up permanent cover board arrays on public land:* Several species found during these surveys would not have been found without the use of artificial cover boards. While the initial investment in time and money may be significant, the efforts to check them in subsequent years are nominal. Rather than placing them in random locations, we recommend choosing sites that will more than likely produce animals. These include areas near permanent or temporary water sources, ecotones between woodland and grassland habitats, and grassland locations characterized by high small mammal activity (numerous small burrows). At MNRR, sites that would work well are Karl Mundt NWR, Ponca State Park, Niobrara State Park, Mulberry Bend WMA, Elk Point GPA, and a property adjacent to Bow Creek which was recently acquired by NPS. At NIOB, we would recommend the Niobrara Valley Preserve as well as locations along appropriate roads adjacent to the river. Also, we recommend forming a relationship with Audubon of Kansas to obtain access to their preserve for cover board surveys as well as other monitoring activities.
3. *Amphibian call surveys:* Monitoring amphibian populations using call surveys is a technique that is used globally. Several points that have a strong diversity of amphibians can be selected based on data provided from this survey. Since different species often call at different times of the spring, sites should be visited at least three times each year – from April through June – to ensure proper coverage of all species.
4. *Road surveys:* Road surveys can either be purposeful, where specific roads are selected for the sole reason of surveying for animals, or incidental, where living or dead individuals are recorded each time they are encountered during normal work travel. If surveys are to be purposeful, sand or gravel roads should be selected, and surveys should be conducted during nighttime hours in the heat of summer or during morning and/or evening hours during spring

and fall. At a very minimum, incidental surveys should be conducted anytime travel is required throughout either of the park regions.

5. *Using seasonal employees to conduct monitoring activities:* Most of the species in both parks are easily identifiable, and even seasonal or student employees can easily be trained to both conduct surveys and identify species. Not all survey activities would have to be performed annually, however all should be conducted every 3-4 years if possible.
6. *Communicating with partner organizations:* Biologists from other organizations – such as the US Fish and Wildlife Service, US Geological Survey, US Army Corps of Engineers, The Nature Conservancy, and the Nebraska Game and Parks Commission – among others, are often performing tasks in these parks. They should be requested or even directed to report the presence of any species they encounter – amphibians, reptiles, or otherwise – during the tenure of their activities on the rivers.

By employing some or all of these activities, the status of amphibians and reptiles along MNRR and NIOB can be monitored for long-term changes. The data harnessed from monitoring may eventually provide insight into ways to better manage the parks for biological diversity.

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FIGURES AND TABLES

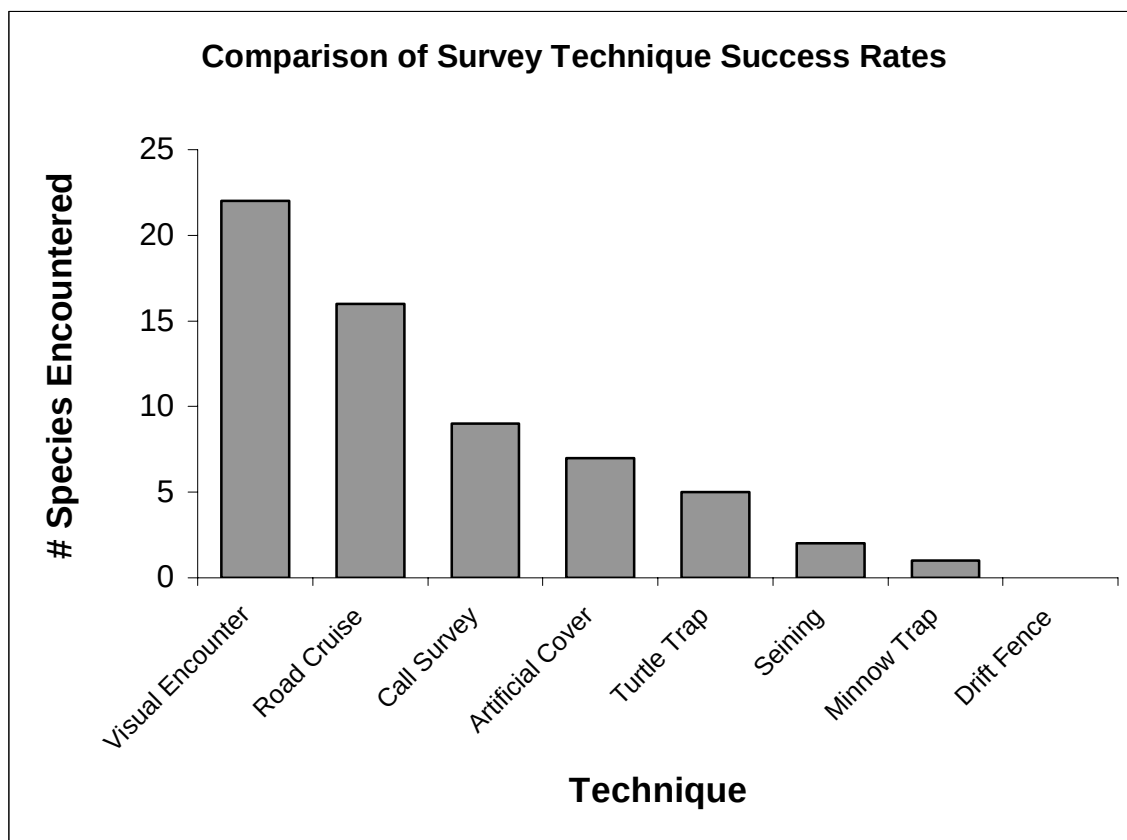


Figure 1. Comparison of survey techniques and success rates for NIOB and MNRR amphibian and reptile surveys.



Figure 2. Example of common erosion control techniques employed at MNRR that may reduce basking and nesting habitat for aquatic turtles.



Figure 3. Example of backwater habitat at MNRR that is rich with amphibian species as well as immature aquatic turtles.

Table 1. Expected, encountered, and previously documented species at the Missouri National Recreational River.

Common Name	Scientific Name	Expected	Found	Previously Documented
Bullfrog	<i>Rana catesbeiana</i>	Y	Y	N
Bullsnake	<i>Pituophis catenifer</i>	Y	Y	N
Common Garter Snake	<i>Thamnophis sirtalis</i>	Y	Y	N
Common Snapping Turtle	<i>Chelydra serpentina</i>	Y	Y	N
Cope's Gray Treefrog	<i>Hyla chrysoscelis</i>	Y	Y	N
Eastern Hognose Snake	<i>Heterodon platyrhinos</i>	Y	Y	N
False Map Turtle	<i>Graptemys pseudogeographica</i>	Y	Y	N
Great Plains Toad	<i>Bufo cognatus</i>	Y	Y	N
Milk Snake	<i>Lampropeltis triangulum</i>	Y	N	N
Northern Cricket Frog	<i>Acris crepitans</i>	Y	Y	N
Northern Leopard Frog	<i>Rana pipiens</i>	Y	Y	N
Northern Prairie Skink	<i>Eumeces septentrionalis</i>	Y	Y	N
Northern Water Snake	<i>Nerodia sipedon</i>	Y	N	N
Ornate Box Turtle*	<i>Terrapene ornata</i>	N	Y	N
Painted Turtle	<i>Chrysemys picta</i>	Y	Y	N
Plains Garter Snake	<i>Thamnophis radix</i>	Y	Y	N
Plains Leopard Frog	<i>Rana blairi</i>	Y	Y	N
Plains Spadefoot Toad	<i>Spea bombifrons</i>	Y	Y	N
Racer	<i>Coluber constrictor</i>	Y	Y	N
Ringneck Snake	<i>Diadophis punctatus</i>	Y	Y	N
Six-lined Racerunner	<i>Cnemidophorus sexlineatus</i>	Y	Y	N
Smooth Softshell Turtle	<i>Apalone mutica</i>	Y	Y	N
Spiny Softshell Turtle	<i>Apalone spinifera</i>	Y	Y	N
Tiger Salamander	<i>Ambystoma tigrinum</i>	Y	N	N
Western Hognose Snake	<i>Heterodon nasicus</i>	Y	Y	N
Western Chorus Frog	<i>Pseudacris triseriata</i>	Y	Y	N
Western Fox Snake	<i>Elaphe vulpina</i>	Y	Y	N
Woodhouse's Toad	<i>Bufo woodhousii</i>	Y	Y	N
Prairie Rattlesnake*	<i>Crotalus viridis</i>	N	Y	N

Total Found / Expected** = 26/29 (89.7%)

* = not on original expected list

** = includes two additional species

Table 2. Expected, encountered, and previously documented species at the Niobrara National Scenic River.

Common Name	Scientific Name	Expected	Found	Previously Documented
Blanding's Turtle	<i>Emydoidea blandingii</i>	Y	N	Y
Bullfrog	<i>Rana catesbeiana</i>	Y	Y	Y
Bullsnake	<i>Pituophis catenifer</i>	Y	Y	Y
Common Garter Snake	<i>Thamnophis sirtalis</i>	Y	Y	Y
Common Snapping Turtle	<i>Chelydra serpentina</i>	Y	Y	Y
Eastern Fence Lizard	<i>Sceloporus consobrinus</i>	Y	Y	Y
Eastern Hognose Snake	<i>Heterodon platyrhinos</i>	Y	N	Y
Great Plains Toad	<i>Bufo cognatus</i>	Y	Y	Y
Lesser Earless Lizard	<i>Holbrookia maculata</i>	Y	Y	Y
Many-lined Skink	<i>Eumeces multivirgatus</i>	Y	N	Y
Milk Snake	<i>Lampropeltis triangulum</i>	Y	Y	Y
Northern Cricket Frog	<i>Acris crepitans</i>	Y	Y	Y
Northern Leopard Frog	<i>Rana pipiens</i>	Y	Y	Y
Northern Water Snake	<i>Nerodia sipedon</i>	Y	N	Y
Ornate Box Turtle	<i>Terrapene ornata</i>	Y	Y	Y
Painted Turtle	<i>Chrysemys picta</i>	Y	Y	Y
Plains Garter Snake	<i>Thamnophis radix</i>	Y	Y	Y
Plains Leopard Frog	<i>Rana blairi</i>	Y	Y	N
Plains Spadefoot Toad	<i>Spea bombifrons</i>	Y	Y	Y
Prairie Rattlesnake	<i>Crotalus viridis</i>	Y	Y	Y
Racer	<i>Coluber constrictor</i>	Y	Y	Y
Ringneck Snake	<i>Diadophis punctatus</i>	Y	Y	N
	<i>Cnemidophorus</i>			
Six-lined Racerunner	<i>sexlineatus</i>	Y	Y	Y
Smooth Green Snake	<i>Liochlorophis vernalis</i>	Y	N	Y
Smooth Softshell Turtle	<i>Apalone mutica</i>	Y	N	N
Spiny Softshell Turtle	<i>Apalone spinifera</i>	Y	N	Y
Tiger Salamander	<i>Ambystoma tigrinum</i>	Y	N	Y
Western Chorus Frog	<i>Pseudacris triseriata</i>	Y	Y	Y
Western Fox Snake	<i>Elaphe vulpina</i>	Y	N	N
Western Hognose Snake	<i>Heterodon nasicus</i>	Y	Y	Y
Woodhouse's Toad	<i>Bufo woodhousii</i>	Y	Y	Y
Total Found / Expected = 22/31 (71%)				

APPENDIX
**Voucher Photographs for the Missouri National Recreational
River and the Niobrara National Scenic River**

MISSOURI NATIONAL RECREATIONAL RIVER VOUCHER PHOTOGRAPHS



Northern Cricket Frog – *Acris crepitans*



Smooth Softshell Turtle – *Apalone mutica*



Spiny Softshell Turtle – *Apalone spinifera*



Great Plains Toad – *Bufo cognatus*



Woodhouse's Toad – *Bufo woodhousii*

Common Snapping Turtle –
Chelydra serpentina



Painted Turtle – *Chrysemys picta*



Six-lined Racerunner –
Cnemidophorus sexlineatus



Racer – *Coluber constrictor*



Prairie Rattlesnake – *Crotalus viridis*



Prairie Rattlesnake – DOR



Ringneck Snake – *Diadophis punctatus*



Western Fox Snake – *Elaphe vulpina*



False Map Turtle –
Graptemys pseudogeographica

Northern Prairie Skink –
Eumeces septentrionalis



Western Hognose Snake –
Heterodon nasicus



Eastern Hognose Snake –
Heterodon platyrhinos



Cope's Gray Treefrog – *Hyla chrysoscelis*



Bullsnake – *Pituophis catenifer*



Western Chorus Frog – *Pseudacris triseriata*



Plains Leopard Frog – *Rana blairi*



Bullfrog – *Rana catesbeiana*

Northern Leopard Frog – *Rana pipiens*



Ornate Box Turtle – *Terrapene ornata*



Plains Garter Snake – *Thamnophis radix*



Plains Garter Snake – CLOSE UP



Common Garter Snake –
Thamnophis sirtalis

Voucher photographs do not exist for:

Plains Spadefoot Toad (*Spea bombifrons*) – only encountered via call surveys.

Tiger Salamander (*Ambystoma tigrinum*) – Not encountered

Northern Water Snake (*Nerodia sipedon*) – Not encountered

Milk Snake (*Lampropeltis triangulum*) – Not encountered

NIOBRARA NATIONAL SCENIC RIVER VOUCHER PHOTOGRAPHS



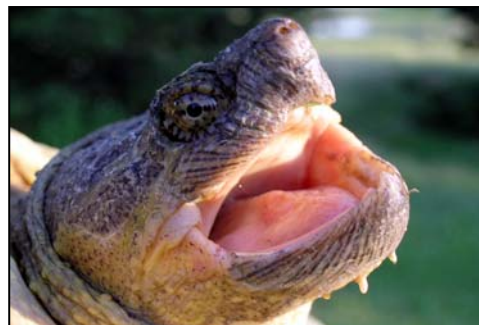
Northern Cricket Frog – *Acris crepitans*



Great Plains Toad – *Bufo cognatus*



Woodhouse's Toad – *Bufo woodhousii*



Common Snapping Turtle –
Chelydra serpentina



Painted Turtle – *Chrysemys picta*



Six-lined Racerunner –
Cnemidophorus sexlineatus



Racer (juvenile) – *Coluber constrictor*



Ringneck Snake – *Diadophis punctatus*



Lesser Earless Lizard – *Holbrookia maculata*



Bullsnake – *Pituophis catenifer*



Prairie Rattlesnake – *Crotalus viridis*



Western Hognose Snake – *Heterodon nasicus*



Milk Snake – *Lampropeltis triangulum*



Plains Leopard Frog – *Rana blairi*



Bullfrog – *Rana catesbeiana*



Western Fence Lizard –
Sceloporus consobrinus



Ornate Box Turtle – *Terrapene ornata*



Common Garter Snake –
Thamnophis sirtalis

Northern Leopard Frog – *Rana pipiens*



Plains Spadefoot Toad – *Spea bombifrons*



Plains Garter Snake – *Thamnophis radix*

Voucher photographs do not exist for:

Tiger Salamander (*Ambystoma tigrinum*) – Not encountered
Smooth Softshell Turtle (*Apalone mutica*) – Not encountered
Spiny Softshell Turtle (*Apalone spinifera*) – Not encountered
Western Fox Snake (*Elaphe vulpina*) – Not encountered

Blanding's Turtle (*Emydoidea blandingii*) – Not encountered
Many-lined Skink (*Eumeces multivirgata*) – Not encountered
Eastern Hognose Snake (*Heterodon platyrhinos*) – Not encountered
Smooth Green Snake (*Liochlorophis vernalis*) – Not encountered
Northern Water Snake (*Nerodia sipedon*) – Not encountered
Western Chorus Frog (*Pseudacris triseriata*) – Not photographed