AMERICAN BURYING BEETLE *(Nicrophorus americanus)*

Physical Description

Photo by D. Backlund

The American burying beetle (*Nicrophorus americanus)* is North America's largest carnivorous beetle belonging to the *Nicrophorus* genus, measuring 2.5 to 3.6 centimeters long. American burying beetle can be easily identified by their distinctive orange red on shiny black coloration. This beetle has distinct orange markings on each elytra (wing covers) and on its pronotum (shield-like structure behind the head). Additionally, each large antennae tip and portions of the head may have orange markings. Sexual dimorphism is present within sexes of this species, with male beetles having a large rectangular orange-red facial mark below the frons (a mustache like feature), while females have a smaller triangular mark.

Life History

American burying beetle is an annual species, typically completing its life-cycle in one calendar year. They are most active from late April through September. Adults are nocturnal and active when temperatures exceed 15 C (60 F). Most reproductive activity occurs in June and July and is dependent upon carrion. American burying beetles select carcasses in which to deposit their young. The carrion chosen by the beetle is larger than carrion chosen by other burying beetles with optimum weights between 80 and 200 grams (Holloway and Schnell, 1997). Carcass weight is a critical component to successful reproduction; with larger carrion (>100 g) being positively related to the number of young produced.

Males find carcasses at night, soon after it is dark. They then emit pheromones (sex attractants) to attract females. Males and females compete amongst themselves for a carcass, with size generally determining who claims the carrion. Carcasses are buried on the spot or rolled into a ball, carried elsewhere (up to 1 m), then buried, usually before dawn. Carcasses weigh up to 200 times a beetle's own weight. The beetles move a carcass by lying on their backs and balancing the carcass above them, then walking their legs to move the load forward as if on a conveyor belt.

A brood chamber is constructed adjacent to the carcass while it is being buried. About two days after burying the carcass, the female lays her eggs in an escape tunnel leading off the brood chamber. One parent, usually the female, stays with the eggs. Larvae hatch in approximately four days and are cared for and fed by the adult. This level of parental care is quite rare for a non-social insect. Development of larvae is usually completed in 6-12 days, at which time the brood disperses to pupate in the soil nearby. They emerge as adults 48-60 days later in July and August, and then disperse with their parents. The young, now adults, reproduce the following June or July. They overwinter, probably singly, in the soil. The parents die off after reproduction or during the subsequent winter.

Distribution and Habitat

The American burying beetle has been recorded historically from at least 150 counties in 35 states in the eastern and central United States, as well as along the southern fringes of Ontario, Quebec and Nova Scotia in Canada (Lomolino et al., 1995). In the United States, the American burying beetle still has extant populations in Nebraska, Rhode Island, Massachusetts, Oklahoma, Arkansas, Kansas, Texas, and South Dakota (Anderson and Peck, 1985; Lomolino et al., 1995). However, in most states distribution is localized and patchy (Ratcliffe, 1996).

Specific habitat conditions for American burying beetle are unknown due to the broad geographic range formerly occupied by the species. Because of the large distribution it is unlikely that vegetation or soil type were historically limiting. However, recent habitat suitability models indicate the importance of specific soil types in Nebraska (Jurzenski et al., 2011). This result emphasizes the importance of soil characteristics needed for the excavation and deposition of carrion for the completion of the reproductive cycle. Today, the American burying beetle seems to be largely restricted to areas most undisturbed by human influence.

Carrion availability (appropriate in size as well as numbers) may be the more important factor of where beetles occur than the type of vegetation or soil structure. Habitats in Nebraska where these beetles have been recently found consist of grassland prairie, forest edge and scrubland.

The USFWS Species Status Assessment for American burying beetle (Service 2019) defines suitable habitat as "areas where suitable soils contain the appropriate abiotic elements (e.g., soil temperature, soil moisture, particle size, etc.) that are favorable for excavation and formation of brood chambers and where appropriate carrion for reproduction is available. Suitable habitat accounts for breeding, feeding, overwintering, and dispersal needs".

Additionally, the SSA Report (Service, 2019) defines unfavorable habitat as "areas that are regularly tilled, vegetation maintained at less than 8 inches through regular mowing, wetland areas with standing water or saturated soils, or urban areas with paved surfaces".

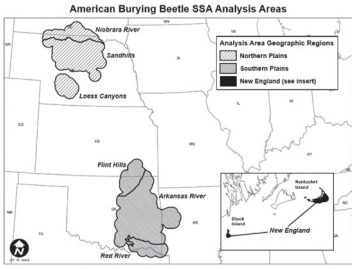
Status and Limiting Factors

Federal: Threatened with a 4(d) Rule
State: Threatened

A direct cause for the reduction in number and geographical range of the American burying beetle is unknown. However, several plausible reasons acting in concert provide valid explanations for the species decline (USFWS, 1991). Among these reasons, habitat loss and fragmentation most

likely contribute more so than other explanations because they lead to a reduction in carrion resources. This reduction in amount and quality (<50 grams) of carrion has been shown to reduce American burying populations at the local level.

The 4(d) Rule and Species Status Assessment identified regulatory boundaries, titled "Analysis Areas," to assist in conservation and recovery of the species. These areas have specific actions that may allow otherwise prohibited "take" of the species.



Management and Recovery

Strategies for the conservation of American burying beetle consist of both research and further understanding of the species ecology and management designed around the protection and continued existence of populations. Research so far has primarily been focused on population surveys and estimates, while management practices include carrion feeding, reintroductions, and habitat conservation.

A second component to the conservation and recovery of American burying beetle has been the continued maintenance of captive populations (USFWS, 1991). Several organizations currently facilitate rearing programs for reintroduction and educational purposes.

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AMERICAN GINSENG (*Panax quinquefolium*)

Physical Description

Photo: Nebraskaland Magazine

Ginseng is an aromatic, perennial, herbaceous plant. It has a fleshy, fusiform root and solitary stem that grows 4-20 inches tall. Plants have 3 to 5 palmately compound leaves each with 3 to 5 leaflets with serrated edges. The greenish-white flowers are in solitary terminal umbels. Fruits are bright red drupes. (Nebraska Game and Parks Commission, 1999, 2010).

Life History

Sexual and asexual reproduction can be found in the species. In Nebraska, plants come up in early spring. They produce small greenish-white flowers that bloom in May through July and green fruit in mid-summer (July), which mature to bright red (August) (Nebraska Game and Parks 2010). Pollinators include halictids (brightly colored bees) and syrhids (hoverflies or "flower flies") (Schessman 1985). Fruit set can be high 80-89% but dry conditions can reduce fruit set to 47% (Lewis and Zenger 1982). These fruits can have 1-2 seeds or, less frequently 3-4 seeds (Lewis and Zenger 1982). Plants die back, and seed dispersal occurs in the autumn (September or October). Seedlings have been found to be clustered within a meter or less of the maternal plant and fruits dispersed less than 20 feet from the maternal plant (Anderson et. al., 1984). Seeds can exhibit variable dormancy periods, but most seeds germinate in the second spring following dispersal (McGraw et al., 2005; Mooney & McGraw, 2007). These life history traits such as low seedling recruitment, slow individual growth and long pre-reproductive periods make the species especially vulnerable to disturbance (Lewis and Zenger 1982, Charron and Gagnon, 1991, and Nantel et al, 1996).

Distribution and Habitat

Photo: *Gulf South Research Corp*

Ginseng grows in deciduous woods throughout much of the eastern United States and Canada. It has been documented in 33 states and 2 Canadian provinces. Collecting ginseng is not permitted on most national forests at the edge of ginseng's range where populations are few and scattered. The ginseng populations in Nebraska are on the western edge of the species' range. In Nebraska it is limited to deciduous forests along the Missouri River and is presently known from only five sites ranging from Richardson County in far southeast Nebraska to Dixon County in northeast Nebraska. In 1999, fewer than 20 plants occurred in each known population (Nebraska Game and Parks Commission, 1999). Other populations of ginseng likely occur within Missouri River bluff forests in Nebraska. Populations that occur on the edge of a species' range often contain genetic variation that is not found in other populations of the species, and this variation may be important to the overall survival of the species (Nebraska Game and Parks Commission, 1999).

Ginseng grows only in rich, cool, moist, possibly older-growth, deciduous forest, such as those found along the Missouri River in eastern Nebraska. Within the Missouri River bluff forests, the plant is found especially on the mid and lower slopes. Overstory trees present within these forests include bur oak (*Quercus macrocarpa*), basswood (*Tilia americana*), hickories (*Carya* spp.), and black walnut (*Juglans nigra*). Soils at the sites are typically loamy and formed in loess. The plant is typically associated with high quality, relatively undisturbed forest habitat.

Status and Limiting Factors

Federal: not listed
State: Threatened

American ginseng (Panax quinquefolius) is on Appendix II of the Convention on International Trade's Endangered Species (CITES) list of Wild Fauna and Flora in 1977, because the large quantity of wild-collected plants sold internationally threatens to deplete the species.

Harvesting of ginseng is a primary threat to the species throughout its range. While collection of ginseng is known to occur in Nebraska, it is not known to what extent ginseng is currently collected. However, given the small population sizes in the state, any collecting could be detrimental to those populations. These small, isolated populations are also vulnerable to being eliminated by chance human-induced or natural catastrophic events. The other primary cause of the ginseng's decline is the loss, degradation, and alteration of habitat (Nebraska Game and Parks Commission, 1999, 2010). Many of Nebraska's native forests have been logged and the sites converted to cropland or pastures. Logging continues to be a moderate threat to eastern Nebraska forests. Residential development in forests is a primary threat, especially near the Omaha metropolitan area. Grazing is known to be detrimental to ginseng populations. Most of Nebraska's native forests are currently grazed by cattle or have been grazed in the past (Nebraska Game and Parks Commission, 1999). The invasion of forest habitats by exotic plant species such as garlic mustard is an additional threat. Exotic plants like garlic mustard are displacing native plants and invading forests along the Missouri River. (Nebraska Game and Parks Commission, 1999).

Management and Recovery

The identification of the plant and careful management of the area in which it is found is extremely important to conserve this species. Proper management and protection of high quality mature Northeastern and Southeastern Upland Forests from conversion to cropland or pastureland is probably the most important management practice currently

available for this species. Partnerships that encourage good stewardship practices that also work towards sustainable harvesting are important for the species (USFWS 2005).

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BLACK-FOOTED FERRET (*Mustela nigripes*)

Physical Description

Photo: Nebraskaland Magazine

The black-footed ferret is a medium-sized carnivore and the only ferret native to North America. It is yellow buff in color with whitish under parts and face, and a distinctive black facial mask, feet, and legs. The fur is short and fine textured, and the ears are conspicuous and rounded. These weasel-like animals are about the size of a mink ranging from 18-24 inches in length with a 4-6-inch tail and have black feet and face mast (Clark and Stomberg, 1987). Females are usually 10% smaller than males, as is typical of mustelids (Fitzgerald et al, 1992).

Life History

The species is primarily nocturnal with the most daytime activity limited to the first few morning hours (USFWS, 1988, and Nebraska Game and Parks 1992). They spend the majority of time in underground burrows and occur in areas with low human densities. The black-tail prairie dog (Cynomys ludovicianus) is the black-footed ferrets primary prey and the burrows of prairie dog towns are utilized for maintaining its livelihood. Ferrets do not hibernate but limit activity during the winter months. They have been found to remain underground in the same burrow system for a week at a time in the winter. However, they have been observed to travel more than 4 miles in one night in September (male travel distances tend to be about double that of females (Forest et. al, 1988, and Nebraska Game and Parks 1992). Behavior of ferrets has been observed to be playful, especially in juveniles. Vocalizations are used for various purposes including a hiss for an alarm call and female whimpers to encourage young to follow (Nebraska Game and Parks 1992).

Black-footed ferrets lead solitary lives except during the breeding season. Breeding activity generally occurs in March and April, and after a gestation period of 41 to 45 days, a litter (typically of three or four) are born generally in May or June. Young are born blind and helpless, but development is fairly rapid. Young do not come above ground until they are 6 weeks old, and females will remain with young until about mid-August (USFWS 1995).

Distribution and Habitat

Ferrets were once found throughout the Great Plains, from Texas to southern Saskatchewan, Canada (Nature Serve 2009). Their range extended from the Rocky Mountains eastward through the Dakotas and south through Nebraska, Kansas, Oklahoma, and Texas (USFWS 1995). The current range exists in portions of Nebraska, South Dakota, Montana, and Wyoming, although small populations might exist in other states. Efforts to reintroduce the species into the wild focus on ecosystems such as the one near Wind Cave National Park in South Dakota.

In Nebraska, the ferret probably occurred in the western three-quarters of the state, coinciding with the range of the prairie dog. The last known museum specimen from Nebraska is an animal killed on a road near Overton in Dawson County in 1949 (Nebraska Game and Parks 1992). Many reports have been received since but there have been no confirmed reports of the black-footed ferret in Nebraska. It is believed that existing prairie dog colonies are either too small or isolated from one another to support the species. However, larger prairie dog colonies such as those once observed in the southern portions and the Panhandle of Nebraska may still provide habitat for the species. Few surveys have been completed. New sites for reintroduction that are relatively plague-free are currently being considered by the USFWS. Nebraska may have some potential sites in the southern and Panhandle portions of the state.

Status and Limiting Factors

Federal: Endangered
State: Endangered

Range-wide efforts to exterminate prairie dogs have critically reduced the size of prairie dog towns and their ability to support viable populations of black-footed ferrets. This combined with the contamination of their prey and effect of diseases, such as canine distemper and plague, led to the removal from the wild of the last known naturally occurring population in 1985. Captive raised animals have been reintroduced into the wild in Wyoming, Colorado, Utah, Arizona, South Dakota, and Montana. Most reintroductions appear to be highly successful and promising. More reintroductions are scheduled at a number of sites in the future.

This species is limited to open habitat, the same habitat used by prairie dogs: grasslands, steppe, and shrub steppe. Resting and birthing sites are in underground burrows, generally made by prairie dogs. It has been estimated that about 40-60 hectares of prairie dog colony are needed to support one ferret. See Oldemeyer et al., 1993 and Biggins et al., 1998 for information on evaluating areas as potential ferret habitat; factors include size of prairie dog complex, prairie dog population density, spatial arrangement of prairie dog colonies, potential for disease in prairie dogs and ferrets, potential for prairie dog expansion, abundance of predators, future resource conflicts and ownership stability, and public and landowner attitudes (Nature Serve 2009).

Management and Recovery

The principal management of the black-footed ferret is through proper management and conservation of prairie dog towns. When possible, prairie dog towns should be left uncontrolled. If prairie dogs are controlled by the use of toxicants, the town should be first surveyed to ensure that ferrets are not using it. It is critical to protect ferrets from human or other disturbances after reintroduction.

Recovery efforts in Nebraska have concentrated on investigating ferret reports in the wild and monitoring prairie dog colonies. Prairie dogs have been surveyed to identify where ferrets might still occur in the wild and to determine potential ferret reintroduction sites. For a site to be

considered, a complex of prairie dog colonies must occur that includes at least 1,000 acres of prairie dogs. Additionally, prairie dogs can occur in one or more colonies, but colonies cannot be separated by more than 4.3 miles, the maximum distance ferrets were found to travel (Nebraska Game and Parks 1992).

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BLACKNOSE SHINER (*Notropis heterolepis*)

Physical Description

Photo: Nebraskaland Magazine

The blacknose shiner is a slender, silvery or brassy minnow with large eyes and a small, nearly horizontal, mouth. The lateral band is a series of crescent-shaped marks forming a black strip that extends through the eye to the snout but not the lips or chin (Pflieger, 1997). Breeding males are without special colors but have very small tubercles on upper surface of head and along pectoral fin rays (1997). Adults are commonly 1.8-2.5 inches in length to a maximum of about 2.8 inches.

Life History

The blacknose shiner lives in schools in midwater and often is associated with the sand shiner, bigeye shiner, redfin shiner, bluntnose minnow, and brook silverside (Pflieger, 1997). Blacknose shiners is a bottom-feeder that feeds in the morning and at night and their diet consists mostly of vegetation, insects, crustaceans, and other small invertebrates that it finds (Becker, 1983, Nebraska Game and Parks, 2010). Little information is available about their reproduction. In Nebraska, the blacknose shiner is likely to spawn during May through June over sandy substrate (Nebraska Game and Parks, 2010). This fish is found only in clear, well-oxygenated portions of streams that are relative undisturbed by humans.

Distribution and Habitat

Historically, the blacknose shiner was widely distributed in cool, clear streams across northeastern and north-central United States and southeastern Canada (Nature Serve 2009). It has experienced a severe population decline and has been collected infrequently in the past twenty years in Nebraska. Its range in Nebraska is in the North Central portion of the state. It is still considered common and widespread in Ontario, Minnesota, and Wisconsin (Nebraskaland 1992).

The blacknose shiner is found with greatest frequency in small, moderately clear Prairie Streams, in quiet pools having considerable amounts of vegetation and bottoms of muck and organic debris, often overlaying sand, gravel or rock (Pflieger 1997). In Nebraska they are found in clear, cool streams often associated with aquatic vegetation such as Potomogeton, Chara, and various forms of algae (Nebraskaland 1992). This species is extremely intolerant of continuously turbid water.

Status and Limiting Factors

Federal: not listed
State: Endangered

This minnow is declining rapidly due to decreased water quality such as depleted oxygen, increased siltation, and increased runoff containing chemicals and livestock waste, and untreated urban sewage (Nebraskaland 1992). Soil erosion and the tendency of smaller streams to dry up as the result of intensive cultivation and cattle grazing seem to be the most important factors (Nebraskaland 1992). The introduction of non-native, competitive or predaceous species has also contributed to its displacement. Decline in the south is due to increased turbidity, siltation of stream bottoms, and resulting disappearance of aquatic vegetation (Nature Serve 2009). Land disturbance activities that include clearing, logging, overgrazing and the subsequent siltation and loss of vegetated backwaters are causes for the decline in the Ozarks of Missouri (Pflieger, 1997).

Management and Recovery

Proper grazing management, avoiding introduction of non-native fish into habitat occupied by blacknose shiner, stream bank erosion control, and careful management of pesticide and nutrient application will improve and maintain water quality and, therefore, habitat quality of the streams.

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BLOWOUT PENSTEMON (*Penstemon haydenii*)

Physical Description

Photo: Nebraskaland Magazine

Also known as, Hayden's penstemon, blowout beardtongue, or blowout bluebell, blowout penstemon is a hairless perennial forb 1-2 foot tall characterized by very leafy stems with leaves being entire, sessile, and clasping. The leaves are 3-5 inches long by 1-3 inches wide. The flowers appear in clusters with 4-6 pale to dark lavender flowers each. The flowers, themselves, are long and tubular, flaring into a two lobed upper lip and a three lobed lower lip. The flowers also have dark nectar lines and a sterile stamen with golden hairs near the tip. Each flower is opposite the axil of a spoon shaped sharp tipped leaf-like bract. The species flowers from mid-May to late June and has a strong persistent fragrance that lures pollinators.

Life History

Growth begins in late March or early April from buds on the lower stems formed the previous year. Some stems near the soil surface can remain green through the winter. By early May, flowering shoots can be distinguished from vegetative shoots by the developing broad bracts of the inflorescence. The plants bloom from late May to late June. Though it is uncommon, a few plants sometimes bloom in August or September. Individual flowers bloom for five to nine days.

Distribution and Habitat

The blowout penstemon is a regional endemic species of the Sand Hills of west-central Nebraska and the northeastern Great Divide Basin in Carbon County, Wyoming (Fertig 2001a, Fertig 2001b). This species is known from three occurrences in Wyoming. It was initially discovered in Wyoming by Frank Blomquist in 1996 (Fertig 2001a). Wyoming populations are found northwest of Bradley Peak in the western Seminole Mountains, on the south slope of Bear Mountain, and on the north side of Junk Hill at the eastern side of the Ferris Mountains (Fertig 2001b). Wyoming populations of blowout penstemon occur on lands managed by the State of Wyoming and on BLM surface lands within Carbon County under the jurisdiction of the Rawlins FO (Fertig 2001b). The known populations are subdivided into at least eight subpopulations that occupy about 80 acres within five square miles (Fertig 2001b). There is no critical habitat designated for the blowout penstemon (USFWS 1987). However, there is a recovery plan in place (USFWS 1992). At the time of the recovery plan's publication (USFWS 1992), there were no known occurrences of blowout penstemon in Wyoming. Therefore, the recovery plan focuses on habitat protection in Nebraska.

The blowout penstemon's habitat consists of sparsely vegetated, early successional, shifting sand dunes and blowout depressions created by wind (Fertig 2001a, Fertig 2001b). In Wyoming, it is often found on the lower half of steep, sandy slopes, deposited at the bases of sedimentary or granite mountains or ridges. Blowout penstemon is found most frequently in microsites that are zones of sand accumulation. The plant is a primary invader that does not persist when a blowout becomes completely vegetated (USFWS 1987). Wyoming populations occur at an elevation between 2035 and 2270 meters (Fertig 2001a, Fertig 2001b). On unstable, windward slopes, blowout penstemon is typically found with communities of blowout grass (Redfieldia flexuosa), lemon scurf-pea (Psoralidium lanceolatum), and thickspike wheatgrass (Elymus lanceolatus var. lanceolatus) with less than five percent vegetative cover. Populations on more stable, lee slopes occur in similar communities with vegetative cover between 15 and 40 percent. Some populations may also be found on choppy dunes associated with silver sagebrush (Artemisia cana) and thickspike wheatgrass, or on barren slopes above stands of chokecherry (Prunus virginiana) and stinging nettle (Urtica dioica) associated with seeps (Fertig 2001a, Fertig 2001b).

Status and Limiting Factors

Federal: Endangered
State: Endangered

Better range management by ranchers for livestock production as well as more wildfire control has resulted in fewer habitats available. Blowouts typically form over winter to early spring when snow cover is sparse.

No long-term trend data is available on the Wyoming population. The cause of the sharp decline in the Nebraska population is also unknown, although wildfire control, severe drought, improvements in range management, leveling of sand dunes, and outbreaks of pyralid moths have all been identified as causes (Fertig, 2000). Threats to the viability of the species include changes in habitat quality, livestock trampling and grazing, over-collection, off-road vehicles (ORV), pesticides, construction activities, and natural threats (Heidel 2004, Fertig 2001b, USFWS 1992).

Changes in habitat quality occur because of vegetative succession in the absence of periodic disturbances. Historically, fire and grazing helped maintain suitable habitats by removing sand-stabilizing vegetation. Implementation of fire-control policies, elimination of bison, initiation of soil conservation programs, and increased use of rotational grazing practices have reduced the incidents of wind erosion, resulting in a loss of blowout penstemon habitat (Heidel 2004, Fertig 2001).

Blowout penstemon is edible to cattle and horses but is not preferred forage if other vegetation is available. Some evidence indicated drought might be the primary threat to the existence of

the species. In years with lower-than-normal precipitation or in the end period of intensive grazing, livestock have been observed to closely graze almost every available plant when more favorable forage is limited. Livestock trampling damage is typically not significant because of the plant's sparse distribution and shifting substrate. Fertig (2001b) observed stem damage from deer or elk trampling on 10 percent of the population at Bear Mountain and on 60 to 80 percent of the stems at Bradley Peak.

Blowout penstemon is vulnerable to over-collection for seed and garden stock. Penstemon, in general are a desirable landscape plant, but most of the known locations of blowout penstemon in Wyoming and Nebraska are remote and inaccessible (Heidel 2004, Fertig 2001b, USFWS 1992).

Blowout penstemon habitat (sand dunes) is popular terrain for off-road vehicles (ORVs), especially on state and public lands. Hill climbing and associated ORV activities may benefit blowout penstemon habitat by ensuring continued disturbance and erosion. However, driving directly over plants may cause a severe negative impact to populations (USFWS 1992). The known blowout penstemon populations in Wyoming are sufficiently remote to offer some protection from high ORV use (Heidel 2004, Fertig 2001b).

Invasive and noxious weeds have the potential to threaten habitat and populations of blowout penstemon due to over-competition by weeds. Impacts of herbicides on blowout penstemon are unknown; however, it is likely that broadleaf weed killers would negatively impact populations of this species. Because of the sparse vegetation cover within blowout penstemon habitat, herbicide application is minimal in Nebraska and Wyoming. The use of insecticides for range pests may negatively impact the pollinators of this species (Heidel 2004, Fertig 2001b, USFWS 1992).

Construction of permanent roads or ranch trails within suitable blowout penstemon habitat is unlikely because of the unsuitability of shifting sand as a road surface or trail. Home construction on blowout penstemon habitat is also unlikely based on the instability of the substrate. Power lines and pipeline construction may have short-term negative impacts during the construction phases of the projects (Heidel 2004, Fertig 2001b).

Oil and gas exploration and development have the potential to negatively impact the plants habitat. However, leasing and development activities within blowout penstemon habitats would be avoided and activities would be required to move pads to adjacent areas and drill diagonally.

Sand mining near the Ferris Mountains occurs adjacent to the recreational area near Seminole Road. Sand removed from the area is used for golf courses. Mining in habitats of known blowout penstemon populations is not feasible due to isolated and rugged terrain.

Natural succession, which involves the vegetative stabilization of shifting dunes and blowouts, is a threat to existing populations of blowout penstemon. Insects, such as spider mites, grasshoppers, and penstemon aphids, also pose a threat to blowout penstemon populations. The most serious pest problem may result from the larvae of Pyralid moths, which bore into the stems and root crowns of blowout penstemon to pupate. This frequently results in individual plant death (Heidel 2004, Fertig 2001b).

Management and Recovery

Recovery potential is high. "Disturbed" habitat (overgrazed or otherwise degraded) is actually preferred for colonization efforts. However, very little habitat is considered "protected" where the species exists and a requirement for the species to actually recover under the present USFWS Recovery Plan.

There are indications that artificial propagation and transplanting can be used to reintroduce populations in suitable areas. The identification of the plant and careful management of the area in which it is found is extremely important to rejuvenate this species. Active management of the site, including heavy grazing during periods when the penstemon is not growing may help to keep blowouts open. Establishment of new populations with greenhouse grown plants has become an integral part of blowout penstemon management.

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COLORADO BUTTERFLY PLANT (*Gaura neomexicana coloradensis*)

Physical Description

Photo: Nebraskaland Magazine

The Colorado Butterfly Plant (CBP) is a short-lived perennial herb with one or more reddish, pubescent stems 20 to 32-inches tall. The lance-shaped leaves average 2 to 4-inches long and have smooth or wavy margins. The inflorescence is located above the leaves and consists of numerous branches that continue to grow throughout the flowering season. Flowers have four white petals, approximately one-quarter to one-half inch wide, that turn pink or reddish with age. There are eight stamens that curve downward, giving the flowers an asymmetrical appearance. The hard nut-like fruits are four-angled and sessile (Fertig 2000). Non-flowering plants consist of a rosette of oblong, mostly glabrous, entire or toothed leaves 1.5 to 8-inches long (Clark and Dorn 1979, Marriott 1987, Fertig, 1994, 2000).

Life History

CBP begins to flower in late June or early July and continues until the first hard frost of fall (usually late September to early October). Fruits begin to mature in late July and will continue to develop through September (Fertig 1994). The species reproduces entirely by seed. It is believed that the seeds lie dormant for 9 months (over the winter period) before germinating due to moist soil conditions in the spring. The plant will live as a stemless, vegetative rosette for 1-5 years before flowering once and then dying (Fertig 2000). Flowers open at dusk and are likely pollinated by moths. The species grows in clumped patterns within a limited range suggesting that seed dispersal distances are relatively short (Fertig 1994). Seed dispersal mechanisms of CBP are believed to include transport by water or muddy animals (e.g., livestock, ungulates, and waterfowl) (Brown 1999).

Distribution and Habitat

CBP is a regional endemic, restricted to approximately 1,700 acres of habitat in western Kimball County, Nebraska, Laramie County, Wyoming, and Weld County, Colorado. Extant populations are restricted to Bow, Crow, Horse, Lodgepole, and Spring Creeks, all within the North and South Platte River watershed (Fertig 2000, USFWS 2010). Historically, native populations were also known from Boulder, Douglas, and Larimer counties in Colorado, but these populations are believed to be extirpated (Fertig, 1994). The range-wide population of the CBP has been estimated to be around 82,300 to 97,000 plants (USFWS 2010). The two known Nebraska populations (with about 8 subpopulations) are located in the floodplain of Lodgepole Creek in Kimball County. In 1992, approximately 600 plants were counted at these 2 sites. A small population of CBP was also located on the Oliver Reservoir State Recreation Area owned by the Nebraska Game and Parks Commission. All other Nebraska populations are located on private owned property.

The species typically occurs on sub irrigated, alluvial soils on level or slightly sloping floodplains and drainage bottoms at elevations 5000-6400-feet. Colonies are often found in low depressions or along bends in wide, meandering stream channels. Most populations are found a short distance from the actual channel and may even occur at the base of low, alluvial ridges at the interface between riparian meadows and drier grasslands. CBP occurs on soils derived from sandstones, conglomerates, mudstones and siltstones of the Ogallala, Tertiary White River, and Arikaree formations (Love and Christiansen 1985, Fertig 1998). Average annual precipitation for CBP habitat ranges from 13 to 16-inches. Most precipitation is in the form of rain, which peaks in May at the western edge of the range, and in July at the eastern edge (Martner 1986, Fertig 1998).

In Nebraska, CBP grows at elevations of 4800-5000-feet within native sub irrigated meadows on floodplain and lower stream terraces of Lodgepole Creek. Soils at these sites are formed in alluvium. The plants typically grow in lower depressions or along bends in the wide meandering stream channel. CBP is an early successional species and requires some form of disturbance (e.g., fire, grazing, or flooding) to become established and maintain itself at a site. In the absence of disturbance, habitats become overgrown with exotic plants or dense, brushy, late successional vegetation. These conditions are not suitable for the CBP. On wetter sites CBP often is associated with redtop (Agrostis stolonifera) and Kentucky bluegrass (Poa pratensis). In somewhat drier sites it may occur in stands of wild licorice (Glycyrrhiza lepidota), Flodmans' thistle (Cirsium flodmanii), and horsetail (Equisetum laevigatum) (Fertig 1994, 1998).

Status and Limiting Factors

Federal: not listed
State: Endangered

The CBP was listed as a federally-threatened species rangewide on October 18, 2000 (USFWS 2000). CBP has also been state-listed as threatened. Critical habitat was federally designated along 113 stream miles within Laramie and Platte Counties in Wyoming, on January 11, 2005 (USFWS 2005). No habitat federally designated in Nebraska.

Loss, degradation, and alteration of habitat have been the primary cause of the CBP's decline and currently the greatest threat to the species. CBP occurs primarily in habitats created and maintained by streams active within their floodplains, with vegetation that is relatively open and not overly dense or overgrown.

Indiscriminate spraying of broadleaf herbicides to control invasive species and the disturbance of riparian areas that contain native grasses due to agricultural conversion, water diversions, channelization and urban development are continual threats to the species. Some agricultural practices

that also impact riparian habitats, such as mowing, haying, and construction of stock ponds also pose a threat to the species due to the timing.

Declines in the CBP populations have been caused by drainage and conversion of its habitats to agricultural production, channelization, siltation, road and bridge construction, grazing, haying, development, and the application of herbicides.

Management and Recovery

Studies have shown that Colorado butterfly plants can thrive in pastures that are winter grazed or managed on a short-term grazing rotation cycle (Nebraska Game and Parks Commission, 1999). Thus, haying in mid-summer and overgrazing will damage plants (Nebraska Game and Parks Commission, 2010). It is critical that pesticides not be used in close proximity to known populations. Long-term field surveys strongly suggest that periodic disturbances are necessary to create and maintain suitable habitat for the establishment of seedling Colorado butterfly plants.

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EASTERN BLACK RAIL (*Laterallus jamaicensis jamaicensis*)

Physical Description

Photo: Birds of North America Online

The Black Rail is the smallest North American rail, measuring only about the size of a sparrow. Adult black rails are dark gray or nearly black overall with a variable amount of scattered white spotting on the back that may also extend onto the wing. The nape and upper back are deep chestnut colored. The dark gray feathers under the tail and flanks are streaked with white or light gray color. The tail is short and grayish brown. The bill is short and black, and the legs and feet are grayish brown. Sexual dimorphism in plumage exists between males and females, with males more vividly colored. Eye color changes with age. It is red in adults and may range from brown to orange in juveniles. Juveniles have an appearance similar to adults, but the plumage is duller with fewer white spots and streaking. Black Rail are approximately 3 to 6 inches (10-15 cm) tall with an 8 to 11-inch (22-28 cm) wingspan.

Life History

Black Rails fly little during the breeding and wintering seasons—they prefer to remain on the ground, running quickly through dense vegetation—and are considered secretive because of this behavior.

Black Rails prefer areas of moist soil interspersed with scattered small pools of shallow water surrounded by fine-stemmed rushes, grasses, and sedges for use during migratory stopover and nesting. They feed primarily on small aquatic invertebrates, terrestrial invertebrates, and seeds. The generalized bill shape suggests that this rail gleans or pecks at individual items and thus feeds by sight.

Nest site is usually a couple of inches above ground or shallow water in a clump of vegetation, often at a spot slightly higher than surrounding marsh. Nest is a well-constructed cup of marsh plant material, usually with a domed top woven over it.

Distribution and Habitat

Coastal birds breed from Connecticut south to Florida and along the Gulf Coast to southern Alabama, with a disjunct population in southeastern Texas. There are also birds breeding in inland North American from Colorado, Kansas, and Oklahoma, north to Minnesota and east (possibly) as far as Connecticut. However, the distribution of the inland individuals is not well understood. Along the west coast, this species can be found on the central California coast, concentrated in the northern San Francisco Bay. There are some individuals in the Lower Colorado River Valley and a recently discovered population in the Sierra Nevada foothills.

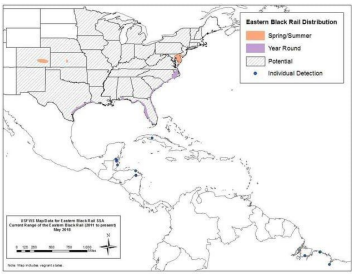

Figure: *USFWS Map/Data for SSA, May 2018*

The status of the Black Rail in Nebraska is poorly known. It is currently considered to be a is a rare casual spring and summer visitor statewide; however, there are only two reports supported by documentation. It may occur more frequently than the limited number of records indicate. The best available data indicate the bird is a vagrant through most of the interior states with small populations in both Kansas and Colorado.

Status and Limiting Factors

Federal: Threatened with 4(d) rule
State: Threatened

Management and Recovery

Black Rail populations are difficult to estimate, but well-studied populations along the Atlantic coast north of South Carolina are in steep decline, and many historical populations in the United States have declined or disappeared. Habitat loss due to wetland degradation and destruction is the primary cause for the decline of this species' population. Effects from climate change may also pose serious threats.

The Eastern Black Rail was listed as a threatened species with a 4(d) rule under the Endangered Species Act on October 8, 2020.

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ESKIMO CURLEW (Numenius borealis)

Physical Description

Photo: Birdlife International

This small, mostly brown, or mottled brown shore bird has a slightly decurved bill, and closely resembles its slightly larger relative the Whimbrel. The Eskimo curlew is approximately 12 inches (30 cm) tall, has short bluish-gray legs, and a rich cinnamon color on its belly and wing linings. It also has dark brown head stripes and an indistinct crown stripe. Its breast and flanks have rows of Y-shaped markings. Eskimo curlews eat grasshoppers and their eggs, grubs, cutworms, ants, small snails, seeds, and berries.

Life History

We have little information about the Eskimo Curlew's life history and breeding biology (Gill et al., 1998). There are reports of four-egg clutch size (four eggs in one brood), but others have observed broods of two or three eggs. No information is available about nest construction, pair formation, courtship, and incubation.

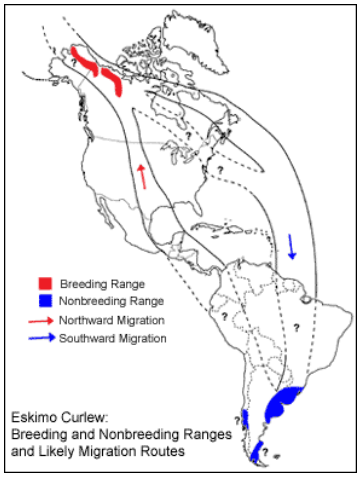
The curlew's young are precocial (highly independent). They're thought to depart the nest within hours after hatching and are assumed to forage (search for food) independently from adults.

There is no information about the longevity of the Eskimo Curlew, but most other species like this are very long-lived, surviving from 10 to 29 years.

Distribution and Habitat

Historically, during the spring migration northward, huge numbers of curlews reached the tall grass and mixed grass prairies of the Great Plains (including Nebraska) by March and April. During these migrations, curlews liked to hang out in of the parts of the prairies burned from fires caused by lightning or indigenous peoples. They also favored disturbed areas along river and lake banks where bison herds had been romping and roaming previously.

The historic Eastern Rainwater Basin landscape provided resources and habitat needed by these species during their migration. Eskimo Curlews apparently liked to feed on grasshopper larvae. In Nebraska, in 1915, Myron H. Swank noted that, "In the latter 1870's these birds would congregate on pieces of land which had not been plowed and where the grasshopper eggs were laid, reach down into the soil with their long bills, and drag out the egg capsules, which they would then devour with their contents of eggs or young 'hoppers until the land had been cleared of the pests."



Status and Limiting Factors

Federal: Endangered
State: Endangered

Best estimates for historic population size suggest the Eskimo Curlew once numbered in the hundreds of thousands. However, historic population numbers are often over-exaggerated because of the tendency of the species to concentrate in migration areas in spring. The numbers were also overestimated because curlews are highly gregarious – they like to hang out in large flocks together – and they tend to return to the same sites in autumn. One person described their occurrence in Nebraska as a "dense mass of birds extending for a quarter to half a mile in length and a hundred yards or more in width" and said that "upon landing (the birds) would cover 40 to 50 acres of ground."

There are also accounts of many birds being shot in Nebraska – so many that one observer said they would "fill wagons to the sideboards with curlews shot during northward migration." As you might expect, the Eskimo Curlew population declined rapidly between 1870 and 1890. By 1890, large numbers of curlews were still being killed in Nebraska and shipped to Boston markets, by the "barrels full" according one account.

The Eskimo Curlew was placed on the U.S. list of threatened and endangered species in 1967 and is listed as a state endangered species in Nebraska. Today, the Eskimo Curlew is presumed to be extinct.

Management and Recovery

Scientists believe that the rapid downfall of the Eskimo Curlew was brought about by three human-caused factors that took place mainly in the Great Plains. First, fire was suppressed, and wide areas of grassland were converted to agriculture. Second, at the same time prairie fires ceased and agriculture was expanding, the Rocky Mountain grasshopper, a potential primary food source, became extinct. Third, there was intense pressure from unregulated market hunting (hunting birds and animals to sell). There were no limits on the number of birds a hunter could kill.

Certain life history characteristics of the curlew kept it from increasing its population. It has a low reproductive rate. It's a long-lived species. And it evolved with one of the longest and most demanding migrations while relying on few traditional stopover sites.

In the prairie biome (a geographical area of distinctive climate, plant life, and animal life), the curlew lost its entire series of northward migration stopover sites, as the prairies vanished from Nebraska and other states. These rapid changes took place over such a short period of time there was very little chance for this shorebird to adapt.

A coordinated search for the curlew's wintering, migratory, and breeding grounds are still being conducted today.

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FINESCALE DACE (*Chrosomus neogaeus*)

Physical Description

Photo: *Nebraskaland Magazine*

Finescale dace are minnows that are commonly 3-5 inches in length. They are stout-bodied with a single horizontal dark band along their side and a metallic silver-gold stripe above (Nebraskaland 1992). The white belly becomes yellow to red on breeding males.

Life History

Finescale dace do not use vegetation for reproduction. Rather, numerous adults – both male and female – gather near a covered depression in the sand. When a single pair is ready to mate, they dart into the depression where the female lays 30-40 eggs. The single male fertilizes the eggs. Eggs mature in four days and receive no parental care. Spawning periods are dependent on water temperature. For finescale dace, spawning occurs from April to June. Young mature in 1-2 years.

Most eggs and young of either species do not survive into adulthood. Most eggs and larval fish are eaten by predators. The few predators that do exist for finescale dace include sunfish such as bluegill. When predators are present, dace will most likely not inhabit the area or will occur in low numbers.

Finescale dace primarily eat aquatic invertebrates (small insects and clams). The finescale does not have teeth in its mouth, but rather has large teeth in its throat that aide in crushing and shredding larger insects and other aquatic invertebrates. The finescale may also eat plankton and algae

Distribution and Habitat

Historically, the finescale dace was found throughout much of the central portion of the state as well as the northern panhandle. Current distribution has been reduced primarily to the Sandhills and several small tributaries of the North Platte River and South Loup River. Survey work in Cherry, Brown, and Keya Paha counties in 1995-97 in Sandhill streams recorded the species in streams within the drainages of the Niobrara, North Loup, and Snake Rivers.

The finescale dace is most commonly found in small, Sandhills streams. They are usually found at sites high in the drainage near the headwaters of the stream. Inhabited streams are usually relatively narrow, one to several yards wide, and shallow, several inches to a foot deep, with deeper pools. During the late summer or during dry periods, if flows are greatly reduced or stop, the fish find refuge in remaining pools. High water quality, fine sand substrate, some in-stream floating vegetation, and bank vegetation of grasses, forbs, some willows, and shrubs characterize these streams.

Status and Limiting Factors

Federal: not listed
State: Threatened

Decreased water quality such as depleted oxygen levels, increased siltation, and runoff containing chemicals and livestock waste will cause this minnow to disappear. Recent survey work has shown that the finescale dace has a limited distribution in the Sandhills, which is the primary portion of its range.

Management and Recovery

Finescale dace are greatly impacted by any changes to the spring-fed streams they inhabit. One of the greatest threats is the depletion of water from these streams through pumping of groundwater. Also contributing to the alteration of stream hydrology is the creation of dams for flood control and irrigation. Additionally, any increase in water turbidity has a negative effect on these sight-feeding species. When normally clear waters become murky, dace cannot find food.

Proper grazing management, stream bank erosion control, cautious and conservative use of pesticides near streams, as well as protecting the streams from runoff containing sediment, agricultural chemicals, and livestock waste will improve and maintain the habitat quality of the streams.

Ditching and channel maintenance/cleaning can have a highly disruptive and negative impact on in-stream habitat and direct physical impact on fish. Whenever possible such activities should be avoided in stream segments with this species. If undertaken, it is recommended that ditching and channel maintenance / cleaning are limited to a quarter-mile section per year to allow for areas of escape and provide for necessary habitat.

The stocking of predatory and competitive game species in stream segments or drainages to streams with the finescale dace should be prevented. These introduced species create pressure through competition, predation, and potential introduction of parasites and diseases.

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GRAY WOLF (*Canis lupus*)

Physical Description

Photo: U.S. Fish and Wildlife Service

Gray wolves (*Canis lupus*) are the largest wild members of Canidae, or dog family, which includes coyotes, red fox, swift fox, and domesticated dogs. Gray wolves typically range from 5 – 6.6 feet (nose to tail) for males, and 4.5 – 6 feet for females. Adult gray wolves typically weigh between 70 – 115 pounds for males and 60 -100 pounds for females. Wolves in the northern part of their range tend to be larger than those in the southern part of the range.

Gray wolves can range in color from gray, white, black, or brown. Often their fur is tipped in black and or gray. Their tail is longer than 18 inches and is tipped in black. Their ears are erect and triangular in shape. Their track is large, often reaching 4 inches with claws visible.

Gray wolves have long legs that are well adapted to running, allowing them to move fast and travel far in search of food, and large skulls and jaws that are well suited to catching and feeding on large mammals. Wolves also have keen senses of smell, hearing, and vision, which they use to detect prey and one another.

Life History

In North America, gray wolves are primarily predators of medium and large hooved mammals, such as moose, elk, white-tailed deer, mule deer, caribou, muskox, and bison. They will also take insects, small mammals, berries, and nuts. They may not eat for several days but can eat up to 20 pounds of food in a single meal. Wolves often prey upon the young, old, and weak individuals.

Wolves are extremely vocal and have a distinctive howl. Howling helps both pairs and the pack bond. Additionally, howling may be a way for wolves to indicate the beginning or end of a hunt or to warn other wolves to stay out of their range. Howling may also be used as an alarm or to locate members of their pack.

Although the wolf pack includes several adult members, it is only the alpha pair that breed. Breeding occurs from late January to March with a gestation period of 63 days. Litters of 4-6 pups are born from late March to May in a den. Dens can include burrows in the ground, a hollow log, or a cave. Pups are born covered in fuzzy fur and weigh about a pound. They are deaf and blind at birth with their eyes at two weeks of age and can hear at three weeks. They are weaned from their mother's milk at about six weeks when they begin to eat meat brought to them by adults. The entire pack help care for the pups.
By September, pups are nearly fully grown and are regularly traveling with the adults.

At about 3 years old, wolves often leave the pack to look for a mate. During this search, wolves may travel hundreds of miles. If a wolf chooses to stay in its original pack, it will help raise the young of the alpha pair and wait for its turn (if ever) to rise to the alpha position. Wolves can live in the wild up to 13 years and remain reproductively active until approximately 10 years old.

Distribution and Habitat

Historically, the Gray Wolf was found across the United States from the Pacific Ocean to the Atlantic and from Alaska into Mexico. They were not present in the southeast due to the presence of Red Wolves.
Although Gray Wolves typically are not found in Nebraska, the state was part of the species historic range. The wide range of habitats in which wolves can thrive reflects their adaptability as a species and includes temperate forests, mountains, tundra, taiga, grasslands, and deserts. Additionally, the habitat in Nebraska could support wolves.

Status and Limiting Factors

Federal: Endangered
State: Endangered

There are currently four distinct populations of Gray Wolves: Western Great Lakes, Northern Rocky Mountains, Southwest Recovery Area, and Alaska. The total population of Gray Wolves is approximately 13,380-16,880 individuals.

Management and Recovery

During the early 1900s, predator-control programs resulted in the elimination of wolves throughout most of the conterminous United States, with the exception of northeast Minnesota. Gray wolves were originally listed as subspecies or as regional populations of subspecies in the contiguous United States and Mexico. In 1978, USFWS reclassified the gray wolf as endangered at the species level (C. lupus) throughout the contiguous United States and Mexico, except for gray wolves in Minnesota which were classified as threatened. The Northern Rocky Mountains population was delisted due to recovery in 2011, except for Wyoming which was delisted in 2017. Remaining wolf populations in the contiguous United States were delisted due to recovery in 2021. Following a court order on February 10, 2022, the gray wolf was reinstated as endangered.

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INTERIOR LEAST TERN (*Sterna antillarum athalassos*)

Physical Description

Photo: Nebraskaland Magazine

Least terns are the smallest members of the subfamily Sterninae and family Laridae of the order Charadriiformes. The interior least tern is a swallow-like bird 20 to 23 centimeters long with a wingspan of 51 inches. It was once called sea swallow for its delicate, graceful, and buoyant flight. In breeding plumage, it is distinguishable from other terns by its glossy black crown, white forehead and undersurface, pale gray back and wings, and the black-tipped yellow-orange bill. The short legs and webbed feet of the male are orange, while those of the female are pale yellow. The long, black outermost primary feathers and the short, deeply forked tail are conspicuous in flight. The plumage of immature terns is darker gray than the adults. Immature birds have a dark bill, a dark gray eye stripe, a white forehead, and a dusky brown cap.

Life History

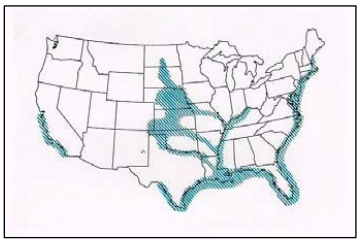
Interior Least Terns arrive at breeding areas from late April to early June (USFWS, 1990). Courtship occurs at the nest site or at some distance from the nest site. It includes the fish flight, an aerial display involving pursuit and maneuvers culminating in a fish transfer on the ground between the two displaying birds. Other courtship behaviors include nest scraping, copulation, and a variety of postures and vocalizations (USFWS, 1990). Courtship feeding is one of the most significant parts of the courtship process and is continued through the incubation period. Least terns nest in colonies as small as a single pair of birds to 100-plus pairs, and nests can be as close as just a few feet apart or widely scattered up to hundreds of feet (USFWS 1990).

Although several scrapes might be built by each pair, only one is used for nesting. Nest scrapes are sometimes located near small pieces of wood or debris or near clusters of small stones (Burger and Gochfeld, 1990: Kirsch, 1992). After the female selects a suitable scrape, two or three eggs are laid on consecutive days. Both sexes share the role of incubation, which generally lasts 20-25 days, but has ranged from 17 to 28 days (USFWS 1990). Eggs in the same clutch hatch within one day of each other. If a first clutch of eggs is lost, least terns will renest up to two times, each renesting attempt taking place at a new site.

After breeding season, least terns gather in small flocks along rivers to feed and prepare for migration. In fall, they probably follow the same migration routes that they use in spring, but their movements are less regular and more casual. In Nebraska, fall migration usually takes place from mid- or late July to early September.

Distribution and Habitat

The interior population historically nested along the Mississippi, Red, Ohio, and Rio Grande river systems and rivers of central Texas (Sidle et al., 1988). The breeding range extended from Texas to Montana and from eastern Colorado and New Mexico to southern Indiana.



Today, least terns occupy scattered remnants of their former range where they nest on sparsely vegetated riverine sandbars, sand, and gravel spoil piles.

In Nebraska, the Least Tern breeds along the Platte River from its mouth, west to North Platte, along the lower reaches of the Niobrara River, portions of the Loup and Elkhorn Rivers, and on the un-channelized section of the Missouri River below the Fort Randall and Gavin's Point dams. Least Terns also nest on the shoreline of Lake McConaughy when low lake levels expose wide sandy beaches.

Status and Limiting Factors

Federal: not listed
State: Endangered

Habitat alteration and degradation have been the primary cause of decline for the Interior least tern. Particularly, human development and use of tern nesting beaches for housing and recreation lead to rapid population decline. However, in the interior United States, river channelization, irrigation diversions and the construction of dams contributed to the destruction of much of the terns' sandbar nesting habitat. By the mid-1970s, least tern populations had decreased by more than 80 percent from the 1940s.

Management and Recovery

In 1990, the USFWS published the *Interior Population of the Least Tern Recovery Plan* (USFWS 1990; Tern Recovery Plan). That plan includes recovery goals for the least tern along major river systems throughout the species range. Major recovery steps outlined in the plan include a) determine population trend and habitat requirement; b) protect, enhance, and increase populations during breeding; c) manage reservoir and river water levels to the benefit of the species; d) develop public awareness and implement educational programs about the least tern, and e) implement law enforcement actions at nesting areas where there are conflicts with high public use.

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LAKE STURGEON (*Acipenser fulvescens*)

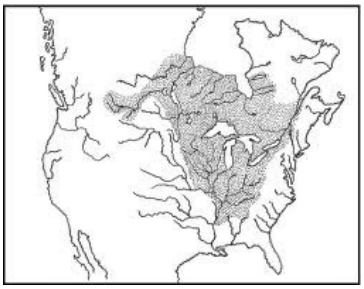
Physical Description

Photo: Nebraskaland Magazine

The lake sturgeon is a primitive fish with a cartilaginous skeleton. It has 5 rows of large, prominent bony plates or scutes on its body. A small aperture, the spiracle, is present between the eye and upper corner of the gill cover. The region from the anus to the tail fin is thick and not entirely covered with bony plates. Lake sturgeon has a flattened snout with large, fleshy barbels and a protractile mouth located under the head. The lower lip has 2 slightly papillose lobes. The lake sturgeon is one of Nebraska's largest fish and can reach a total length of 2 m (78 in.) and weigh over 45 kg (99 lbs.).

Life History

Lake sturgeon travel widely in loose aggregations within their range. They require extensive areas of shallow water to find food, lightly dragging their barbels along the bottom in search of prey. Their diet includes insect larvae and other invertebrates, snails, leeches, small mussels, and small fish. Spawning occurs between April and early June, and aggregations can be seen in shallow water (0.3-4.6 m; 1-15 ft.) near shorelines (Becker 1983). Little is known about exact spawning timeframes of lake sturgeon in the Missouri River; however, in other portions of this species range, spawning occurs in late spring in water temperatures between 55-64 F (MODoC 2000). Based on 20 years of average temperatures recorded in the Missouri River at the Decatur, IA USGS Stream Gauge, this correlates to mid-March to early-May. Lake sturgeon is thought to return to natal areas to spawn and individuals migrate long distances (as far as 201 km (125 miles)) upstream to spawning grounds. Males arrive at spawning sites before females, often cruising the shallows in groups of 8 or more. Spawning begins as soon as a ripe female enters the group, and several males attend 1 female. Fertilized eggs are adhesive and attach to gravel or rocks until hatching. Females may spawn for 5-8 hours over one or more days. Lake sturgeon is slow-growing and late-maturing, and they only spawn intermittently. Females spawn once every 4-6 years and typically reach sexual maturity at 24-26 years old, when they are about 140 cm (55 in.) long (Becker 1983). Males spawn every 2 to 3 years and typically reach sexual maturity at 8-17 years, when they are around 114 cm (44 in.) long. Only 10-20% of adults within a population is sexually active and spawn during a given season (U.S. Fish and Wildlife Service 2008). The largest lake sturgeon specimen documented in Minnesota's official angling records was caught in the Kettle River and weighed 42.7 kg (94 lbs. 4 oz.). It measured 178 cm (70 in.) long and 67 cm (26.5 in.) in girth. The largest historical record was from 1903 and measured 457.2 cm (180 in.) long and weighed 181.4 kg (400 lbs.). The maximum life span of lake sturgeon is typically 55 years for males and may be more than 150 years for females.



Distribution and Habitat

The lake sturgeon occupies the United States and Canadian waters of the Great Lakes and the St. Lawrence River basin; Lake Champlain (Vermont-New York); the Lake Winnebago-Fox River complex (Wisconsin); Canada's Hudson and James Bay watersheds; the Saskatchewan River (Alberta, Saskatchewan, and Manitoba); and the Mississippi River basin area from the headwaters in Minnesota to the northern portion of the state of Louisiana and up the Missouri River into southern South Dakota. Well-regulated sport fisheries occur throughout the northern part of the range and Canada manages modest commercial fisheries in Ontario and Quebec provinces. Lake sturgeon is the only *Acipenser* species in the Missouri River. They are a fluvial dependent species, meaning they are found in a variety of habitats, but require flowing water at some point in their life cycle (Galat et al. 2005). In riverine habitats, lake sturgeon is primarily a benthic species that inhabits the main channel, over sand and gravel substrate (Setffensen et al. 2014).

Status and Limiting Factors

Federal: not listed
State: Threatened

Although lake sturgeon populations in the Great Lakes were greatly reduced due to overfishing during the last several decades of the nineteenth century they appear to be on the rebound throughout the Great Lakes and St. Lawrence basins with spawning populations being documented from 63 locations and spawning size estimates calculated for 17 of these sites. The current status of lake sturgeon populations in most of the Great Lakes Basin, the St. Lawrence River and in Wisconsin's Lake Winnebago system is stable or increasing.

Lake sturgeon was generally considered to be rare or uncommon in most waters of the Mississippi River basin since the late 1800s. In 1989, this species was declared as threatened by the American Fisheries Society in all Mississippi River states except Louisiana where they are believed to be extirpated (Williams et al. 1989). The Department of Natural Resources in Iowa and Illinois and the Missouri Department of Conservation list the lake sturgeon as endangered in their respective states, and in Minnesota, the lake sturgeon is listed as a species of special concern. In Nebraska the species is listed as a state threatened species. The species appears to be extirpated from its former range in Alabama and Arkansas.

The current status of lake sturgeon throughout the Mississippi basin is considered to be severely depressed from historical abundance levels. However, modern population assessment studies are lacking, and rate of stock decline or growth is unknown. Native stocks were extremely depressed prior to the stocking program undertaken by the Missouri Department of Conservation. Following the first releases into Mark Twain Lake (Salt River, a Pool 24 tributary) in 1984, then at Louisiana on Pool 24 of the Mississippi River and at several Missouri River locations in 1988, increasing

reports of incidental catch in commercial gear and by recreational anglers has been occurring.

Management and Recovery

The life history characteristics of slow growth, late maturation, and irregular spawning periodicity make lake sturgeon subpopulations particularly vulnerable to over-exploitation. Anthropogenic effects such as industrial and municipal pollution, blockage of access to habitats by dikes and dams, channelization, and elimination of backwater areas, dewatering and water level fluctuations, physical destruction of spawning habitat, and inundation of habitat by reservoirs are known to threaten sturgeon subpopulations. Direct mortality of lake sturgeon due to impacts with commercial and/or recreational navigation vessels has been documented.

Dams may be the greatest impediment to lake sturgeon rehabilitation in the Great Lakes. Although there are numerous recorded instances of tagged sturgeon passing through navigation locks, many fish are precluded or delayed from reaching spawning or preferred feeding waters. Dams without locks completely block sturgeon passage and serve as severe impediments to lake sturgeon recovery in the Mississippi basin. Spawning and nursery areas are further degraded from land use problems such as erosion, sedimentation, and adverse discharges from point and non-point sources.

Construction of spawning habitats using coarse stone riprapping has been undertaken in some states (particularly Wisconsin) and appears to be highly successful. Artificial culture and restocking of lake sturgeon is under development in Minnesota using wild brood stock. In New York, sturgeon eggs are taken from wild stocks in the St. Lawrence River and cultured fingerlings have been reared and released in several locations since 1995. Survival has been high, and populations appear to be recovering. In Missouri over 210,000 lake sturgeon fingerlings have been stocked in the upper Mississippi and lower Missouri rivers since 1986. Survival of stocked fish is considered excellent as tagged lake sturgeon have been recaptured in the Mississippi, Missouri, Gasconade and Osage rivers and commercial fishermen have reported incidental catches reaching nuisance proportions (Hesse and Carreiro 1997). Artificial culture and restocking of lake sturgeon is also under development in Minnesota using wild brood stock. Wisconsin DNR propagates some lake sturgeon for restocking purposes with cultured fish only being placed into the same basins from which brood stock were taken. The Tennessee Valley Authority has stocked thousands of young lake sturgeon within the Ohio River Basin. Recent captures of lake sturgeon from the Missouri River along Nebraska's eastern border are primarily hatchery-reared fish, based on the presence of tags. As the stocking program continues, the abundance of lake sturgeon in the channelized reach of the Missouri River along Nebraska's border will likely increase, and reproductively mature fish will make spawning migrations up the Missouri River and potentially into tributaries in search of spawning habitats. These tributaries may also provide the necessary nursery areas for age-0 lake sturgeon (Steffensen et al. 2014).

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MOUNTAIN PLOVER (*Charadrius* montanus)

Physical Description

Photo: NebraskaLand Magazine

The mountain plover is a small/medium-sized bird with long legs that is most often observed on the ground in shortgrass prairie habitat. It is light brown on the back, with a dark cap, a dark line from the bill to the eye, and white under parts. It closely resembles a killdeer but lacks any dark banding around the neck and breast. The mountain plover rarely flies, relying instead on its running ability. Its diet includes insects, especially grasshoppers, crickets, beetles, and flies. The mountain plover builds its nest in a shallow scrap in the ground, lines it with plant material and lays up to three, brown speckled eggs. The young are able to run as soon as they hatch and often move from the immediate nesting area once all eggs have hatched.

Life History

Mountain plovers are shorebirds, having brown upperparts; mainly white underwings; white throat, breast, and belly, with buffy tinge (more extensive in winter) on breast. Their breeding plumage includes a white forehead and line over the eye, contrasting with the dark crown (NGS 1983, Peterson 1990). In winter, plumage differs from winter Golden-Plovers by having a grayer unmottled back, paler legs, a light wing stripe, white (vs. grayish) underwings, and a dark tail band (NGS 1983, Peterson 1990; Nature Serve, 2009).

The mountain plover is a Great Plains native that breeds on the arid shortgrass prairie from northern Montana to southern New Mexico and winters in California, Texas, and Mexico. Current distribution maps are misleading, showing plovers occurring over a large range. In reality, habitat within this range is limited. Breeding strongholds are confined to small areas of native prairie in Montana and Colorado. Most of the birds winter in California, principally in the San Joaquin Valley, an area experiencing high rates of human population growth (NGPC website).

This opportunistic bird feeds primarily on insects (grasshoppers, crickets, beetles, flies, ants). It takes prey from the ground and selects different food items at different locales (Knopf, in prep). These birds are generally crepuscular foragers, spending much of midday relatively inactive (Nature Serve, 2009).

Mountain plovers are gregarious birds, outside breeding season. They forage and roost in loose flocks of changing composition. Flock size may exceed 1000 on southern Great Plains in late summer (Knopf and Rupert 1995; Nature Serve, 2009).

Breeding begins in late April in the south, mid-May in the north. Nesting begins in April in Colorado (Knopf 1996). Full clutches occur mid-May to late June in north. Both sexes incubate three, sometimes two or four, eggs for 29 days, but not at the same nest. The female may lay second clutch while the male incubates the first clutch (Graul 1975). This behavior may be more the rule than the exception (Knopf, pers. obs.). Nestlings are precocial and fledge in about 33-34 days. Adults nest alone or in loosely associated groups.

Excessive rain and storms may destroy nests and result in taller vegetation that precludes birds from renesting in the vicinity as on the Pawnee National Grasslands in 1995 and 1997 (Knopf, unpub. data). The brood usually moves one to two km from the nest site in the first two to three days (Knopf and Rupert 1996). More than half of the clutches are lost to predators, mainly coyote (Canis latrans) and swift fox (*Vulpes* velox), and chicks also experience high rates of predation (Knopf 1996; Nature Serve, 2009).

Nesting habitat includes high plains/shortgrass prairie and desert tablelands, commonly prairie dog towns in some areas, such as sagebrush/blue grama habitats in central Montana. In central and southwestern Montana, southeastern Wyoming, and northeastern Colorado, nesting often occurs in shortgrass prairie with a history of heavy grazing or in low shrub semideserts. Nesting areas are characterized by very short vegetation, significant areas of bare ground (typically >30%, which may be the minimum requirement), and flat or gentle slopes (<5%) (Graul 1975, Graul and Webster 1976, Knowles et al. 1982, Olson 1984, Olson and Edge 1985, Olson-Edge and Edge 1987, Knopf and Miller 1994, Knopf 1996). Commonly, nesting takes place in barren fields that subsequently are planted with millet or sunflowers, resulting in losses of eggs and chicks (Knopf 1996). Nests are on the ground in shallow depressions that may be lined with plant material and/or adjacent to dried cattle dung (Knopf and Miller 1994). Adults often take chicks to windmill/water tank areas to forage (Knopf 1996), but site around tank must be dry. This bird generally avoids moist soils (Nature Serve, 2009).

Preferred winter habitat consists of short-grass plains and fields, plowed fields, and sandy deserts (AOU 1983), and commercial sod farms (New Mexico, Knopf 1996). In southern California, wintering birds preferred heavily grazed native rangelands; they used burned fields primarily for night roosting. Alkali flats were the most favored habitat, where available; the use of cultivated land may be a result of loss of native habitats; native habitats may be critical in fall before freshly cultivated fields become available (Knopf and Rupert 1995; Nature Serve, 2009).

Distribution and Habitat

The mountain plover occurs in Nebraska as a spring migrant, as a spring nester, and as a summer resident. Historically, the species was a resident throughout the panhandle. Today, it is a rare but regular resident in the southern panhandle of Nebraska. Recent records of the mountain plover have primarily been in Kimball and southwest Cheyenne counties during the spring migration/nesting period. There is one summer record of the mountain plover from Box Butte County. They usually arrive in their nesting areas in mid-

March to mid-May.

The mountain plover is a species associated with the high plains and shortgrass prairie. They prefer sites with very short vegetation, and very little or no cover or litter. Traditional habitat includes highly overgrazed pastures, burned areas, and sandy/gravelly sites. The mountain plover is one of a group of species often associated with prairie dog towns. They will also utilize tilled cropland, mowed areas, and disturbed sites.

Status and Limiting Factors

Federal: not listed
State: Threatened

Breeding populations exceed 10,000 individuals; breeding range has contracted over time, but the population has not greatly declined in recent years and threats are not as great as previously believed. Conversion of native grassland to wheat and irrigated cropland, the elimination of prairie dog towns, and implementation of grazing regimes that maintain higher vegetation have greatly reduced suitable mountain plover habitat. The loss of optimum habitat has been exacerbated by the use of alternative habitat by the mountain plover. As an alternative to the low vegetation native grassland preferred by the species, the mountain plover will nest in fallow or disked cropland. This makes the birds and nests vulnerable to agricultural practices of disking, spraying, etc.

Management and Recovery

There is no chance of restoration to historical levels; the best hope is the stabilization of declining populations. The conversion of grasslands to cropland, land development, and prairie dog control, continue to erode and fragment the small areas of remaining suitable habitat. Prevent conversion of suitable habitat to cropland. Implement management regimes that will provide very short vegetative cover during the spring migration/nesting period and summer brood rearing. If nesting occurs on cropland, work with the landowner to avoid nest destruction and detrimental impacts. Off-road vehicle access should be restricted between 1 April and 1 August in areas identified as plover habitat.

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NORTHERN LONG-EARED BAT (*Myotis septentrionalis*)

Physical Description

Photo: USFWS

The northern long-eared bat is a medium sized bat with a body length of 3 to 3.7 inches but a wingspan of 9 to 10 inches. Their fur color can be medium to dark brown on the back and tawny to pale- brown on the underside. As the name suggests, this bat is distinguished by its long ears.

Life History

In Nebraska, the estimated timing of the northern long-eared bat's behavior occurs from April to September 30, which mostly includes the spring staging period (March 15 to May 1), the summer roosting, and fall swarming period (August 15 to October 31). The Inactive season occurs from October 1 to March 30, which mostly includes the hibernation period.

Winter Habitat: Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible.

Summer Habitat: During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats seem to be flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found rarely roosting in structures, like barns and sheds.

Reproduction: Breeding begins in late summer or early fall when males begin to swarm near hibernacula. After copulation, females store sperm during hibernation until spring. In spring, they emerge from their hibernacula, ovulate and the stored sperm fertilizes an egg. This strategy is called delayed fertilization.

After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies of females and young generally have 30 to 60 bats at the beginning of the summer, although larger maternity colonies have also been seen. Numbers of individuals in roosts, typically decreases from pregnancy to post- lactation. Most bats within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending on where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Maximum lifespan for the northern long-eared bat is estimated to be up to 18.5 years.

Feeding Habits: Like most bats, the northern long-eared bat emerges at dusk to feed. They primarily fly through the understory of forested areas feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation or by gleaning motionless insects from vegetation.

Distribution and Habitat

The northern long-eared bat's range includes much of the eastern and north central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and Eastern British Columbia. The species' range includes the following 37 States and the District of Columbia: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and

Wyoming.

Figure: *https://www.fws.gov/Midwest/endangered/mammals/nle b/nlebRangeMap.html*

Within Nebraska, the suspected range of the bat includes 64 counties. The range generally follows areas within deciduous forests such as the Niobrara River in the northern portion of the state, and the Missouri River and its tributaries in the east (USFWS 2014). Counties that contain the Loup and Elkhorn River headwaters (i.e., riparian corridors) and southern counties bordering Kansas, except for Dundy and Hitchcock, are also thought to contain the species (USFWS 2014).

Status and Limiting Factors

Federal: Endangered
State: Endangered

Management and Recovery

White-nose Syndrome: No other threat is as severe and immediate as the disease, white-nose syndrome. If this disease had not emerged, it is unlikely the northern long-eared bat would be experiencing such a dramatic population decline. Since symptoms were first observed in New York in 2006, white-nose syndrome has spread rapidly from the Northeast to the Midwest and Southeast; an area that includes the core of the northern long-eared bat's range where it was most common before this disease. Numbers of northern long- eared bats (from hibernacula counts) have declined by up to 99 percent in the Northeast. Although there is uncertainty about the rate that white-nose syndrome will spread throughout the species' range, it is expected to spread throughout the United States in the foreseeable future.

Other Sources of Mortality: Although no significant population declines have been observed due to the sources of mortality listed below, they may now be important factors affecting this bat's viability until we find ways to address white-nose syndrome.

Impacts to Hibernacula: Gates or other structures intended to exclude people from caves and mines not only restrict bat flight and movement, but also change airflow and internal cave and mine microclimates. A change of even a few degrees can make a cave unsuitable for hibernating bats. Also, cave-dwelling bats are vulnerable to human disturbance while hibernating. Arousal during hibernation causes bats to use up their already reduced energy stores, which may lead to individuals not surviving the winter.

Loss or Degradation of Summer Habitat: Highway construction, commercial development, surface mining, and wind facility construction permanently remove habitat and are activities prevalent in many areas of this bat's range. Forest management benefits northern long-eared bats by keeping areas forested rather than converted to other uses. But, depending on type and timing, forest management activities can cause mortality and temporarily remove or degrade roosting and foraging habitat.

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NORTHERN REDBELLY DACE (*Chrosomus eos*)

Physical Description

Photo: Fishbase.org

The northern redbelly dace is a small minnow approximately 2-3 inches in length. They have dark stripes surrounding a light band on the side. Breeding males have brilliant crimson and/or yellow flanks below the thick black band.

Life History

Northern redbelly dace typically spawn from early May to July in Nebraska. These fish have the unusual habit of spawning in masses of filamentous algae (Stasiak, 2006). One to eight males will pursue a female into an algal mass. There the female will vibrate laying 5-30 eggs that are fertilized by the males). The female then leaves to another algal mass and lays more eggs. A single female may lay 2,000-6,500 eggs in a season depending on her size. There is no parental care, and the embryos hatch in 8-10 days when water temperatures are 21-27° C (69-80° F).

Often the northern redbelly dace and the finescale dace frequently form hybrids, which can make identification of the species difficult. Northern redbelly dace are omnivorous, primarily eating diatoms and filamentous algae, but also consuming zooplankton and aquatic insects.

Distribution and Habitat

Historically, the northern redbelly dace was found throughout much of the central portion of Nebraska, as well as the northern panhandle. Current distribution has been reduced primarily to the Sandhills and several small tributaries of the North Platte River and South Loup River. Survey work in Cherry, Brown, and Keya Paha counties in 1995-97 in Sandhill streams recorded the species from streams in the drainages of the Niobrara, North Loup, and Snake Rivers.

The northern redbelly dace is most commonly found in small, Sandhills streams. They are usually found at sites high in the drainage near the headwaters of the stream. Inhabited streams are usually relatively narrow, one to several yards wide, and shallow, several inches to a foot deep, with deeper pools. During the late summer and dry periods, the flows in these streams may stop and the fish find refuge in the remaining pools. High water quality, fine sand substrate, some in-stream floating vegetation, and bank vegetation of grasses, forbs, some willows, and shrubs characterize these streams.

Status and Limiting Factors

Federal: not listed
State: Threatened

Recent survey work has shown that the northern redbelly dace has a limited distribution in the Sandhills, which is the primary portion of its distribution (Stasiak, 2006). Decreased water quality such as depleted oxygen levels, increased siltation, and runoff containing chemicals and livestock waste will cause this minnow to disappear. Southern-most population in Colorado has been reduced by stream channelization, reductions in discharge, and changes in water quality; now threatened by continued urban development.

Management and Recovery

Proper grazing management, stream bank erosion control, cautious and conservative use of pesticides near streams, as well as protecting the streams from runoff containing sediment, agricultural chemicals, and livestock waste will improve and maintain the habitat quality of the streams. Ditching and channel maintenance/cleaning can have a highly disruptive and negative impact on in-stream habitat and direct physical impact on fish. Whenever possible such activities should be avoided in stream segments with this species. If undertaken, it is recommended that ditching and channel maintenance are limited to a quarter-mile section per year to allow for areas of escape and provide for necessary habitat. The stocking of predatory and competitive game species in stream segments or drainages to streams with the northern redbelly dace should be prevented.

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PALLID STURGEON (*Scaphirhynchus albus*)

Physical Description

Photo: Nebraskaland Magazine

The pallid sturgeon is a large fish (to 186 centimeters) with a heterocercal tail, a long slender caudal peduncle, a flat shovel-shaped snout, four fringed barbels on the snout, a ventral mouth, and large bony scutes on the head, back, and sides; 37 to 43 dorsal rays; 24 to 28 anal rays (Page and Burr 1991). The pallid sturgeon is similar to the shovelnose sturgeon but has no scale-like scutes on the belly, the bases of the outer barbels usually are posterior to the bases of the inner barbels, the inner barbels are shorter, the head is larger, the mouth is wider, the eye is smaller, and the color is usually paler (gray-white above and on sides) (Page and Burr 1991).

Life History

Pallid sturgeon is a migratory species with annual home ranges in Montana between 12.4 to 331.2 kilometers with a median of 52 kilometers; seasonal home ranges were smaller in fall and winter than in spring and summer (Bramblett 2001). Currently, there is little evidence of natural reproduction in pallid sturgeon in the last fifty years. It is believed that this lack of reproductive success is due to both a lack of spring river pulses that cue spawning and the existences of dams that cut off access to spawning grounds. Pallid sturgeon populations are currently augmented by artificial propagation. Development includes a planktonic larval stage. After the larval stage growth is rapid during the first four years then slows. Pallid sturgeon do not reach sexual maturity until 7 to 20 years of age. Once reaching maturity, individuals may require several years between spawning.

Distribution and Habitat

The pallid sturgeon's historical range spanned the entire Missouri and into the Mississippi Rivers. Historically, the species was rare to nonexistent in the upper Mississippi, probably due to a lack of proper habitat. Currently, the species is considered imperiled throughout its entire range. As of 2008, pallid sturgeon can still be found throughout their original range, but their population numbers have severely declined from the mid-20th century. The Missouri and Mississippi Rivers from Montana to Louisiana, as well as the Atchafalaya River in Louisiana, continue to harbor an aging population of pallid sturgeon. Pallid sturgeon have never been very common; as early as 1905 when the species was first identified, they represented only 1 in 5 of all sturgeon in the lower Missouri River and as few as 1 in 500 where the Illinois River meets the Mississippi. Recently, between 1985 and 2000, the ratio of pallid sturgeon to all sturgeon netted declined from 1 in about 400 to 1 in nearly 650. A 1996 study concluded that between 6,000 and 21,000 pallid sturgeons remained in their natural habitat at that time.

Pallid sturgeon is generally bottom feeders, skimming the sandy reaches of the various rivers and streams in their habitat. Though little is known about the precise eating habits of the species, they are thought to be opportunistic feeders. One study which examined the contents from the stomachs of juvenile pallid sturgeon revealed that their diets were seasonally dependent. Various insects were consumed during some seasons and various fish species during others. These results support the description of the pallid sturgeon's eating habits as opportunistic.[32] Fish is a more important dietary staple for pallid sturgeon than it is for shovelnose sturgeon. In one study comparing dietary tendencies between adult shovelnose sturgeon and immature pallid sturgeon, the pallid sturgeon was found to consume far greater numbers of small fish such as Cyprinids (minnows). In another study conducted in the upper Missouri River region, an examination of the stomach contents of hatchery reared pallid sturgeon showed that 82% of the wet weight was small fish and the balance was mosquito-like insects, mayflies and caddis flies and small amounts of detritus and plant material.[34]

Status and Limiting Factors

Federal: Endangered
State: Endangered

The route and the environmental characteristics of Missouri River in the northern Great Plains states of North and South Dakota, Nebraska, and Montana, have been significantly altered. The resultant changes to the Missouri River in the upper Great Plains from channelization and impoundment prevent upstream migration. The reduced water flow rates and sediment loads and has brought an end to the seasonal flooding of the flood plains in the region. Since the construction of the Fort Peck Dam in Montana in 1937, and subsequent damming and channelization, the Missouri river has lost over 90 percent of its wetland and sandbar ecosystems. More than 2,000 miles (3,200 km) of the Missouri River has been altered and only that stretch of the river above Fort Peck Reservoir in Montana remains relatively unchanged. These alterations of the river have had a detrimental impact on a number of native fish species. In the 13 U.S. states that the pallid sturgeon is found, only a few other fish species are listed as endangered. Although substantial efforts are being implemented to ensure the survival of this species, the rarity of self-sustaining populations of pallid sturgeon ensures that it will remain federally protected for many decades.

Management and Recovery

Beginning in 1996, research efforts were primarily focused on pallid sturgeon population increases and the preservation of the pallid sturgeon genetic pool through stocking. The main purpose of the stocking program is to preserve the genetic pool and reconstruct an optimal population size within the habitat's carrying capacity (Krentz 1997). One of the most obvious detrimental changes in the pallid sturgeon environment was the

damming of the Missouri River and several other important tributaries.

Efforts are now being directed at restoring the river to a more normal condition. In 2000, the U.S. Fish and Wildlife Service completed an Endangered Species Act consultation with the U.S. Army Corps of Engineers regarding operation of Missouri River dams. Through an informal agreement the U.S. Bureau of Reclamation has agreed to provide a dominant discharge spring pulse out of Tiber Reservoir every 4 to 5 years for Missouri River fish migrations which could help the Upper Missouri River pallid sturgeon population. To address pallid sturgeon passage and entrainment on the Yellowstone River, the USFWS has begun consultation with BOR regarding problems at Intake Diversion Dam. The future for pallid sturgeon recovery may continue to be uncertain even after positive changes have been implemented because pallid sturgeon populations are so depleted, and the newly stocked fish will take at least 15 years before the females first reach sexual maturity and begin to spawn.

Therefore, it is important to realize that immediate evaluations are impractical, and recovery will take a dedicated, long-term commitment. Implementing the pallid sturgeon recovery program in this area is a multi-state and agency task. To facilitate this, the Montana/Dakota Pallid Sturgeon workgroup was organized in 1993. The group is comprised of representatives from MFWP, NDGF, USFWS, USBOR, WAPA and PPL-MT, and acts in an advisory role identifying research needs and funding sources, developing workplans and providing an opportunity for communication between biologists and agency personnel.

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PIPING PLOVER (Charadrius melodus)

Physical Description

Photo: Nebraskaland Magazine

The piping plover is a migratory shorebird of the order Charadriiformes. Adult birds weigh between 43 and 63 grams, are 17-18 centimeters (cm) long, and have a wingspan 11.0-12.7 cm long. Both sexes are sand-colored with white undersides, and the legs are orange. During the breeding season, adults develop an orange bill, and a single black forehead band and breast band. Nonbreeding birds lose the dark bands. Immature plumage resembles adult nonbreeding plumage; juveniles acquire adult plumage the spring after they fledge.

Life History

The breeding season begins when the adults reach the breeding grounds in mid- to late-April in Nebraska. The adult males arrive earliest, select beach habitats, and defend established territories against other males. When adult females arrive at the breeding grounds, the males conduct elaborate courtship rituals including aerial displays of circles and figure eights, whistling song, posturing with spread tail and wings, and rapid drumming of feet.

Piping plovers often return to the same nesting area year after year (but few return to natal sites). Piping plovers are generally monogamous during a single breeding season. Adults tend to pick new mates each year (Wilcox 1959). Nest sites are simple depression, scrape or bowl in the sand. The average nest is about 6 to 8 cm in diameter, and is often lined with pebbles, shells, or driftwood to enhance the camouflage effect. Occupied nests are generally 50 to 100 meters apart (Wilcox 1959, Cuthbert and Wiens 1982).

Piping plover chicks are precocial, leave the nest almost immediately, and are able to feed themselves within a few hours. Adults will accompany the chicks and lead them to and from foraging locations. Adults also brood chicks to protect them from predators and inclement weather. Most adults raise only one brood of up to four chicks per nesting season. Broods remain on nesting territories but can expand range or movements depending on age and disturbance factors.

Distribution and Habitat

Piping plovers are territorial shorebirds that spend only three to four months on northern United States and southern Canada breeding sites. Piping plovers historically bred in three areas of North America: Atlantic coastal beaches from Newfoundland to South Carolina, beaches of the Great Lakes, and the northern Great Plains/Prairie region from Alberta to Ontario and south to Nebraska. The piping plover winters along Gulf Coast beaches and sand/mudflats from Florida into northern Mexico (Laguna Madre). Large numbers of piping plovers winter along the Texas coast.

In addition to the Missouri River, Piping Plovers in Nebraska nest on the Platte, Elkhorn, Loup, and Niobrara Rivers. Habitat conditions on these systems fluctuate widely depending on flows (Brown and Jorgensen 2008). Plovers in Nebraska also nest on sandy beaches around lakes created by the sand and gravel mining industry, or by lakes created for housing development. Although this habitat is short-lived, it has supported from 0 to 200 adult plovers since monitoring began in 1987. Lake McConaughy, a large reservoir in southwestern Nebraska has been monitored for plover nesting since 1992. In recent years, due to drought conditions, the lake has supported a high of 236 plovers, although birds and habitat can be affected by flooding and disturbance from recreational uses.

Piping plovers nest on sparsely vegetated sandbars, aggregate mining spoil piles, and reservoir shorelines. Nesting habitats on the Platte, Niobrara, and Missouri rivers typically are dry sandbars located midstream in wide, open channels, with less than 25 percent vegetative cover (Schwalbach 1988, Ziewitz et al. 1992). The optimum range for vegetative cover on nesting habitat has been estimated at 0 to 10 percent. Schwalbach (1988) and Ziewitz et al. (1992) suggest that birds select higher nest sites when available and sites away from the water's edge. This suite of habitat conditions provides wide, horizontal visibility; protection from terrestrial predators; isolation from human disturbance; greater distance from avian predator perch sites; and sufficient protection from rises in river levels and flooding when sandbars are of sufficient height. The absence of any or all of these conditions can negatively impact reproduction. Ziewitz et al. (1992) measured characteristics of nesting habitat of least terns and piping plovers in the central and lower reaches of the Platte River. At the time of this study, most nesting birds were in the lower Platte River. They found that birds nested in areas where the channel was wider with a greater area of sandbars.

Status and Limiting Factors

Federal: Threatened
State: Threatened

Since the early 1900s, habitat alteration and destruction from channelization, irrigation, and the construction of reservoirs on our nation's large river systems constitute the primary reason for the species' decline and current status (USFWS 1988). Bank stabilization via rock armoring, revetment and hard points and levee construction have also altered the river form and corresponding function. Disruption of riverine ecosystem processes by these human activities has resulted in significant piping plover habitat loss. Alterations to the historic hydrograph have subdued the lower Platte River's capacity to build high sandbars and scour existing sandbars which is necessary for successful nesting.

Sediment and sediment transport in association with variable discharges are key components of sandbar habitat creation. In much of the piping plover's range, sediment had been reduced from flowing water as it settles out in reservoirs. In addition, historical high flows, which are now tempered, are important to introduce and transport organic material from the floodplain to the river system. These over bank flows and resulting input of organic material support the system's productivity.

Management and Recovery

Efforts underway to help the piping plover include: (1) timing spring to mirror the behavior of a natural river more closely (i.e., reduced flows during the nesting period); (2) reducing human, dog, and vehicle disturbance during nesting; (3) informing the public about plover biology and life requirements; and (4) minimizing predation (especially from gulls) by installing temporary, large-mesh cages over the nests. Additionally, an international piping plover survey involving 26 states, three Canadian provinces, seven countries, and more than 1,000 volunteers was undertaken in 1991. The survey is scheduled to be repeated and expanded in 1996 and every five years thereafter. The 1996 survey will include a two-week count in June and another two-week count in winter.

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RUFA RED KNOT (*Calidris canutus rufa*)

Physical Description

Photo: *Birds of North America Online*

This medium sized shorebird has a short neck, straight and slightly tapering black bill that is not longer than its head, and short dark legs. During the breeding season, Red Knots have a rusty-red face, throat, and breast and greyish brown wings. During the nonbreeding season, they become uniformly dull grey with white bellies. Red Knots are approximately 9 to 10 inches (23 to 25 cm) tall with a 20-to-22-inch (52 to 56 cm) wingspan.

Life History

Red Knots nest in the dry arctic tundra in areas of sparse vegetation. During the nonbreeding season Red Knots are found primarily in intertidal marine habitat, but during migration birds can be found at wetlands and lake shorelines in the interior United States. Red Knots feed primarily on invertebrates including bivalves, small snails, crustaceans, and terrestrial invertebrates. They nest on the ground and lay an average clutch size of four eggs. Young are precocial (highly independent).

Distribution and Habitat

Red Knots make one of the longest yearly migrations of any bird, traveling more than 9,300 miles (15,000 km) between their breeding grounds and wintering habitats. The *rufa* Red Knot breeds throughout the central Arctic Islands of Canada and winters from the U.S. southern Atlantic and Gulf coasts to the southern tip of South America.
In Nebraska, Red Knots are a rare casual spring and fall migrant statewide. This species occupies mudflats and shorelines.

Figure: *Birds of North America Online*

Status and Limiting Factors

Federal: Threatened
State: Threatened

Management and Recovery

Red Knots were once one of the most numerous shorebirds in North America. Numbers declined in the 1800s and early 1900s due to severe hunting pressure. Today the primary threat to the *rufa* Red Knot is a reduction of food availability in Delaware Bay, an important migratory stopover site, due to the over harvesting of Horseshoe Crabs (*Limulus polyphemus*). Effects of climate change may also pose serious threats.

The *rufa* subspecies of Red Knot was listed as a threatened species under the Endangered Species Act on December 11, 2014.

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Document prepared by Lauren R. Dinan, Nongame Bird Program at the Nebraska Game and Parks Commission, 3 March 2015.

SALT CREEK TIGER BEETLE (*Cicindela nevadica lincolniana*)

Physical Description

Photo: Nebraskaland Magazine

The Salt Creek tiger beetle (*Cicindela nevadica lincolniana*) is a member of the tiger beetle family Cicindelidae. Tiger beetles are metallic colored, ground-dwelling, predaceous insects. The Salt Creek tiger beetle is one of thirty-two species and subspecies of tiger beetles that have been recorded in Nebraska. It is a small-to-medium size beetle approximately one-half inch in length. It can be distinguished from other tiger beetles by its distinctive form and color pattern. Wing covers are metallic brown or dark olive green and the pronotum (body segment behind head) is dark brown, tending to green. Ventral surfaces are dark green and reflective.

Life History

The burrow dwelling larvae of the Salt Creek tiger beetle have three instars (developmental stages) prior to pupation and emergence as adults. They are approximately three-quarters of an inch long and one-sixteenth of an inch in diameter. They have 3 hooks on the dorsum of the 5th abdominal segment which act as anchors to keep them from being pulled out of their burrows by larger prey.

Distribution and Habitat

The Salt Creek tiger beetle has one of the most restricted ranges of any insect in the United States. This sub-species is endemic to Lancaster County, Nebraska, being found only in the northern third of the county. The Salt Creek tiger beetle occupies an extremely limited habitat type, eastern Nebraska saline wetlands and their associated streams.

The Salt Creek tiger beetle is often associated with three other tiger beetles that inhabit saline environments, C. fulgida, C. togata, and C. circumpicta. However, these three species have much broader ranges, being found elsewhere in Nebraska and the Great Plains.

The entire life cycle of the Salt Creek tiger beetle is linked to exposed mud flats of saline wetlands and mud banks of streams that drain these wetland complexes. The species is adapted to periods of high water and highly saline conditions. Adults are confined to the wetter muddy areas within a few yards of wetland and stream edges. Larval burrows occur within a few inches of the water's edge. Larvae will plug their burrows and retreat inside during periods of high water, very hot weather, or very dry conditions. For the most part larvae remain active until cold weather, when they plug their burrows and hibernate. Both the adult and larvae of the Salt Creek tiger beetle are voracious predators. They will eat almost any other insect of similar or smaller size.

Status and Limiting Factors

Federal: Endangered
State: Endangered

The Salt Creek tiger beetle is one of the rarest insects in the world. The earliest collections of the Salt Creek tiger beetle date back to 1900. Although there is no documentation regarding the size of early populations of the beetle, the large number of museum specimens indicates that this beetle was once abundant in the Lincoln vicinity. Annual monitoring has shown that the population of the Salt Creek tiger beetle fluctuates on a yearly basis. The 1991 survey observed 229 individuals while in 1992 only 114 were found. The highest total population numbers observed was 623 individuals counted in 1996. The number declined to fewer than 565 in 1997 and only 311 were found in 1998. The Capitol Beach area, once a haven for the beetle, had a high population count of 12 in 1992, but only 1 in 1996 and 4 in 1998. At one site, beetles have not been observed for over three years.

The eastern Nebraska saline wetlands are the most restricted and imperiled plant community types in the state. The estimated original acreage of eastern saline wetlands was about 16,000 acres. An inventory of saline wetlands in 1990 found that over 90% of these wetlands have been destroyed since European settlement of the region through commercial, residential, and agricultural development. Most remaining eastern Nebraska saline wetlands have undergone extensive degradation through drainage, disking, filling, farming, overgrazing, stream channelization, and head cutting of Salt Creek and its tributaries.

Commercial and residential development pressure on the wetlands and streams continue to increase as the city of Lincoln expands to the north and west. A 1992 stream bank stabilization project on Little Salt Creek destroyed approximately one-half of the then remaining prime Salt Creek tiger beetle habitat. The population of the Salt Creek tiger beetle at this location was down from 115 individuals in 1991 to 54 individuals in 1992. One potential catastrophic event is the spraying of insecticides in areas occupied by the beetle. This could result in the loss of local populations or the entire subspecies by contact directly with the spray or through insecticide carried by runoff. Insecticides may also impact the Salt Creek tiger beetle indirectly. Since Tiger beetles are predaceous, the use of insecticides may reduce the prey base needed to support viable populations of the beetle. In addition, insects that have been sprayed with an insecticide may be consumed by the beetle resulting in the death of the Salt Creek tiger beetle. Pollution could also impact this beetle. Incidents of pollution impacts in other areas of the country have proven highly detrimental to insect populations within the impacted area.

Management and Recovery

Protection and restoration of eastern saline wetlands are perhaps one of the most important practices for conserving the beetle. Maintaining and establishing croplands within the watershed to grassland, especial those adjacent to wetlands and streams may reduce excessive sedimentation and flooding. Although stream bank stabilization and stream channelization activities have harmed populations, stabilization of down cutting streams in northern Lancaster County and southern Saunders County can protect, and in some cases restore habitat. Maintaining adequate butters around wetlands and streams coupled with proper use of pesticides should minimize pesticide risk.

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SALTWORT (*Salicornia rubra*)

Physical Description

Photo: *Nebraskaland Magazine*

Saltwort is a salt-tolerant, herbaceous, annual pant that grows 3 to 6-inches tall. The stems are freely branched, succulent, and jointed. They are also glabrous (hairless) and often reddish at maturity. The leaves are small, scale-like and opposite on the stem. The small, inconspicuous flowers are borne in groups of three and are sunken in the joints of the fleshy inflorescence. (Nebraska Game and Parks Commission, 1999).

Life History

Saltwort is an annual herb. It competes favorably on saline and alkaline soils. As a wetland dries or water levels recede, the seeds of this species will germinate in the exposed salt or alkali-encrusted silt (Dodd and Coupland 1966). It is not known how long seeds can lie dormant in the soil. Saltwort is distinguished by its pale-green color, succulent jointed stem, and skeleton-like appearance. Flowering begins in late June and occurs throughout July. Fruiting spikes occur in the upper joints and form slender cylinders that turn read at maturity.

There are 3 flowers in a triangular arrangement at each joint of the fruiting spike. Flowers are minute and enclosed within the fleshy calyx that is sunk into a hollow of the fleshy stem (Larsen 1993). Scales are broadly triangular, blunt, or subacute; the middle one is the highest and usually reaches the tip of the joint. Leaves are dark reddish-green, triangular, scale-like, opposite, and attached at each stem node. The fruit is a small, flattened seed covered with minute hairs and enclosed in the spongy calyx (Vance et al., 1984, Nelson 1992). The best time to search for saltwort is when the plants have matured, and seeds have ripened in late summer into the fall (Minnesota DNR 2010).

Distribution and Habitat

Saltwort ranges from western Minnesota to Saskatchewan and western Kansas to Nevada (Nebraska Game and Parks, 1999). It is restricted to moist saline or alkaline soils. It has been observed rarely in some naturalized saline areas along highways in Minnesota where high amounts of salts have been added for snow/ice removal (Minnesota DNR 2010). In Nebraska, saltwort grows only in the saline wetlands of Lancaster County and southern Saunders County (Nebraska Game and Parks Commission, 2010). Presently, saltwort is known from an isolated Platte River wet meadow site in Phelps County, and seven saline wetlands all within the floodplains of Salt Creek and Little Salt Creek (Gersib, R.A. and G. Steinauer 1991). There are no historical records of collections elsewhere in the state. The exact numbers of individuals are not known, though several thousand plants likely exist within the Lancaster County populations (Nebraska Game and Parks, 1999). Because the saltwort is an annual, population levels can fluctuate widely from year to year, depending on how suitable the climatic conditions are for seed germination.

Saltwort grows within a narrow range of habitat within the saline wetlands of Eastern Nebraska. It is found growing primarily on moist, saturated clay mudflats. Saltgrass (Distichlis spicata) and sea blite (Suaeda calceoliformis) are generally the only 2 species that grow in association with saltwort (Steinauer and Rolfsmeier 2010). Saltwort generally grows in heavy soils with about 25% clay, 30% sand, and 40% silt, with salinity levels ranging from 2.6% to 4.7%. The water table is generally within 3 feet of the surface and at any time of the year, standing water may be present. The high salinity levels and lack of soil aeration due to the heavy clay and water content, inhibits other plants from growing in this wetland type.

Status and Limiting Factors

Federal: not listed
State: Endangered

Loss and degradation of habitat is the primary cause of the decline of saltwort and currently is the greatest threat to the species. The species occupies one of the most imperiled and restricted plant community types in Nebraska: Eastern Saline Wetlands. Of the remaining 1,600 acres of eastern saline wetlands, only a limited number (<400 acres) provide soil conditions suitable for the saltwort ((Schneider et. al, 2005).

Most remaining eastern Nebraska saline wetlands have undergone extensive degradation through drainage, disking, filling, farming, overgrazing, stream channelization and head cutting of Salt Creek and its tributaries. Commercial and residential development pressure on the remaining wetlands continues to increase as the city of Lincoln expands to the north and west. The small size of the remaining populations increases the possibility of loss of the remaining populations as a result of any accidental or natural catastrophe.

In Nebraska, the Saltwort's habitat consists of the saline wetlands of Lancaster County, an area that has been severely degraded over the last century. The Nebraska Game and Parks Commission estimates that up to 90% of these wetlands have been destroyed or degraded by draining and conversion to cropland, urban development, dilution with freshwater, and down cutting of local streams which influences the wetland hydrology and other factors (Gersib and Steinauer 1991). The saltwort has a very restricted range in Nebraska and its saline meadow habitats are highly threatened by development, invasive species, and loss of soil salinity (Nebraska Game and Parks, 2010).

Management and Recovery

Protection and restoration of saline wetlands are the primary management and conservation needs of this species. Control against invasive plant species and the prevention of wetland draining activities are needed for the species (Nebraska Game and Parks, 2010). Research is also needed on the habitat, life history, population trends, beneficial management practices, reproductive biology, ecology, and population demographics of this species (Minnesota DNR, 2010).

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SCALESHELL MUSSEL (*Leptodea leptodon*)

Physical Description

Photo: Nebraskaland Magazine

The Scaleshell muscle is a relatively small (3 inches) freshwater mussel with a thin, fragile, elongated, compressed, shell. The outer shell is smooth, has faint greenish yellow rays that becomes darker brown to black in older shells. The inner shell is pinkish white or light purple and a highly iridescent posterior. The umbos are small and low and about even with the hinge line. The beak has 4-5 double looped ridges that are sometimes eroded and difficult to distinguish.

Life History

Relatively little is known about the species life history. Its general biology is believed to be similar to other mollusks belonging to the family Unionidae.

Adults are suspension feeders, using their gills to remove suspended particles in the water column (Nature Serve 2009). The diet is believed to include detritus, phytoplankton, zooplankton, diatoms, bacteria, and other microorganisms (Fuller 1974). Scaleshell muscles have an unusual and complex reproductive cycle. Their eggs develop into microscopic larvae (glochidia) within the gills of the female mussel. These glochidia must attach to the gills or fins of a fish to continue developing. Glochidia can only develop on certain species of fish hosts. One such host is known to be the freshwater drum (Aplodinotus grunniens).

Glochidia continue growing on the fish and transform into juveniles, then they drop off the fish, and land on the river bottom where they mature into adults. Formal studies are needed to better define the Scaleshell breeding season (USFWS 2010). However, based on recent observations in Missouri, the Scaleshell spawns and begins brooding in early August, and the glochidia are released the following June (Gordon 1991, Barnhart 1998, and Barnhart 2001).

Distribution and Habitat

The Scaleshell historically occurred in 56 rivers in 13 states within the Mississippi River Drainage. Currently, the species can only be consistently found (rare) in three Missouri streams including the Meramec, Bourbeuse, and Gascondade Rivers. It has been reported from 15 additional streams in the last 25 years, but only has been represented by a small number or single specimen (live or dead) collected during one or more extensive mussel surveys of those rivers (Big, Big Piney, Osage and Missouri River in Missouri; Missouri River in South Dakota; Myatta Creek, St. Francis, White, Spring, South Fork Spring, Strawberry, South Forche LaFave, Cossatot, Saline (tributary of the Little River), and the Little Missouri rivers in Arkansas; and Kiamichi River in Oklahoma (USFWS 2010).

In Nebraska, there are natural heritage records in Cedar and Knox counties of Nebraska from the Missouri River. The Scaleshell mussel occurs in medium to large rivers with low to medium gradients and is typically associated with riffles, relatively strong currents, and substrate of mud, sand, or assemblages of gravel, cobble, and boulder (USFWS 2010). The species is restricted to streams that have maintained relatively good water quality and usually where a diversity of other mussels is concentrated, but more specific habitat requirements are unknown (USFWS 2010).

Status and Limiting Factors

Federal: Endangered
State: Endangered

This species is severely impacted by alteration and inundation of channels, siltation from agriculture and clear- cutting, chemical and organic pollution. The decline of Scaleshell is primarily due to threats that cause habitat loss and degradation from construction activities and intensive land use. The spread of the non-native zebra mussel (Dreissena polymorpha) may threaten Scaleshell populations in the near future (USFWS 2010). The sedentary nature of the species and the low density of remaining populations exacerbate threats to its survival posed by natural and manmade factors. Further the relatively short life span of the Scaleshell may render it less able to tolerate periods of poor recruitment. The species is believed to be extirpated from 9 of the 13 states it historically occurred in. In the streams (approximately 18), only three or four populations are thought to be stable, and most occurrences are widely disjunct.

Management and Recovery

This species was listed as federally endangered in the U.S. in 2001 and a recovery plan has been finalized in 2010 (USFWS, 2010). It is necessary to determine habitat preferences and environmental tolerances, tolerance to various pollutants and siltation, and reproductive biology/glochidial hosts.

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SMALL WHITE LADY'S SLIPPER ORCHID (*Cypripedium candidum*)

Physical Description

Photo: *Nebraskaland Magazine*

The stems of *C. candidum* are 10-35 cm (3.9-13.8 in.) tall, with up to 50 or more arising from a single branching rhizome. The leaves number 2-4 and are mostly in the upper half of the stem. They are narrowly ovate to lance-elliptical or elliptical, 5-15 cm (2.0-5.9 in.) long, and 2-6 cm (0.8-2.4 in.) wide. The inflorescence is a single flower subtended by a leaflike bract 3.3-11 cm (1.3-4.3 in.) long. The dorsal sepal is ovate to elliptical, greenish yellow, and 1.7-2.5 cm (0.7-1.0 in.) long. The lateral sepals are fused to form a single synsepal located directly below the pouch. The apex of the synsepal is split; otherwise, it is similar to the dorsal sepal. The petals are lance-linear, similar in color to the sepals, and 2.1-4.1 cm (0.8-1.6 in.) long. The floral lip is an inflated pouch, white in color, occasionally with faint purple veins or spots, obovoid in shape, and 1.7-2.5 cm (0.7-1.0 in.) long (Smith 1993). The flowers resemble a small porcelain slipper (Nebraska Game and Parks 1999).

Life History

Like most members of the genus Cypripedium (the lady's-slippers), C. candidum is a slow growing, long-lived plant that requires an estimated 12 years or more to reach maturity (Curtis 1943). The maximum age can only be guessed but probably exceeds 50 years. The flowers are reported to be pollinated by small andrenid and halictine bees (Catling and Knerer 1980). The seeds are very small, not much larger than dust, and can be carried on the wind for considerable distances. Germination of the seeds requires ideal moisture conditions and the presence a specific mycorrhizal soil fungus. As in all terrestrial orchids, the seeds of C. candidum contain no nutrients and receive organic compounds from fungal hyphae that have penetrated the seed coat. It is unknown if this fungal relationship continues after C. candidum has developed roots and photosynthetic leaves. In Nebraska, the orchid blooms in mid-May to mid-June (Nebraska Game and Parks, 2010).

Distribution and Habitat

The small white lady's-slipper is a plant of the northeastern United States. It ranges from New York westward to central Nebraska, south to Missouri and north to southern Manitoba (Nebraska Game and Parks Commission, 1999, Nature Serve, 2009). Historically the orchid was likely found throughout eastern Nebraska and much of central Nebraska. There are collection records for the orchid from 17 Nebraska counties. In the past 15 years, the orchid has been collected from only four Nebraska counties: Howard, Pierce, Platte, and Sherman. There are only 7 known extant populations. Two populations are thought to have been destroyed in recent years by road construction projects (From 2005). In 1999, all of the known populations had less than 200 plants (Nebraska Game and Parks Commission 1999).

The habitat of C. candidum is primarily deep-soil mesic prairies. Wet prairies, certain types of sedge meadows, and calcareous fens (in the south) can also support this species. It does not occur in habitats with a history of livestock grazing or crop production (Sheviak, 1974, Nebraska Game and Parks, 1999). The soils are primarily calcareous till or lacustrine clays, or occasionally fibric, sedge-derived peat.

All of Nebraska's known populations occur in native, sub-irrigated wet meadows. These sites have sandy loam soils and are dominated by typical wet meadow species including big bluestem (Andropogon gerardii) and sedges (Carex spp.). The majority of sites where the orchid occurs are relatively undisturbed hay meadows. The orchid appears to be intolerant of cattle grazing and has not been found in grazed pastures. Two populations of orchids near Columbus occurred in road ditches adjacent to native meadows.

The small white lady's-slipper rarely occurs in such early successional habitats, but when they do, they are usually adjacent to naturally occurring seed sources. The populations in Nebraska are on the western edge of the species' range. Populations that occur on the edge of a species' range often contain genetic variation that is not found in other populations of the species, and this variation may be important to the overall survival of the species (Nebraska Game and Parks Commission, 1999).

Status and Limiting Factors

Federal: not listed
State: Threatened

The conversion of wet meadows to cropland and urban development are primary threats to remaining populations of the small white lady's-slipper. Another primary threat is the alteration of natural groundwater levels in meadows where the orchid occurs. Direct pumping of groundwater from irrigation wells can reduce groundwater levels in meadows. Reduced flows in streams adjacent to meadows can also reduce groundwater levels in the meadows. Exotic species invasion and annual haying of wet meadows are also known threats (Nebraska Game and Parks Commission, 2010).

The small white lady's-slipper has not been found in grazed pastures, and it appears that cattle grazing has likely impacted the orchid's abundance (Nebraska Game and Parks Commission, 1999). The orchid is also susceptible to herbicides and both their direct herbicide application as well as herbicide drift from adjacent croplands has likely impacted the species. The original habitat of small white lady's-slipper has been highly fragmented, resulting in small, isolated populations of the species. These small populations are vulnerable to being eliminated by chance human-induced or natural catastrophic events.

Management and Recovery

The identification of the plant and careful management of the area in which it is found is extremely important to conserve this species. Protection and restoration of herbaceous wet meadows is an important step toward protecting it. Managed haying, protection from livestock grazing, and protection from herbicide damage are also priority activities.

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SOUTHERN FLYING SQUIRREL (*Glaucomys volans*)

Physical Description

Photo: *Nebraskaland Magazine*

The southern flying squirrel has gray to brown fur on its back with blackish under fur. The underside is white. Its broad flattened tail is brownish gray on top and paler gray underneath. It is distinguished from other squirrels by its nocturnal nature and a loose fold of skin that extends from the outside of the wrist on the front leg to the ankle on the hind leg. When the legs are outstretched, this skin is used to glide from a high perch to a lower tree or the ground. It has long tactile whiskers, prominent ears, and large black eyes. Its total length is 7 to 10 inches, and they weigh between 2-4 ounces (Nebraska Game and Parks Commission, 1992, 2010).

Life History

These squirrels cannot fly. Rather, they glide from a higher perch to a lower one. In doing so, they spread their legs, thus drawing taut the loose skin running along each side of the body. The membranes support the squirrel as it glides in somewhat the same fashion as a parachute. The tail acts as a rudder. By varying the tension on their membranes and by altering the position of their tail, flying squirrels can control their direction and speed to some extent. They always land in a head-up position on the trunk of a tree.

Flying squirrels are similar to many other sciurids, or members of the squirrel family, by being granivorous and arboreal, but the two species of Glaucomys are unique among squirrels in two notable ways. First, these squirrels glide, allowing them a form of locomotion beyond climbing, an excellent adaptation for their arboreal lifestyle. Second, flying squirrels are nocturnal. Their large eyes indicate the importance of vision as they navigate and forage at night. Because of their small size and elusive behavior, flying squirrels are difficult to observe, and oftentimes their presence at night is indicated only by their high-pitched chirps. Unlike some sciurids, flying squirrels do not hibernate. Instead, they congregate in nests when resting to conserve energy during the winter months.

Most flying squirrels probably breed for the first time when they are about a year old. The breeding season varies with latitude, occurring from spring to fall in the north and from late summer to winter in the south. In Nebraska, there are two periods of breeding activity. The first is in February and March, and the other is sometimes late May through July (Nebraska Game and Parks Commission, 1992, 2010). Litters are usually of 3 or 4 but can be up to 7 and are born after a 40-day gestation period (Nebraska Game and Parks Commission, 1992, 2010). The southern flying squirrel is the most "carnivorous" of the squirrels eating plant and animal foods. Throughout the rest of the year, it also feeds on insects in spring, and nuts, seeds, and fruits.

Distribution and Habitat

The southern flying squirrel inhabits most of the eastern United States. The species prefer deciduous and mixed forests and may also occur in old orchards. Southern flying squirrels inhabit heavy, deciduous forested areas that contain mast-producing trees. Often, they prefer an area with an abundance of dead standing timber and oak, walnut, and hickory trees. In New Hampshire, preferentially used areas with large shagbark hickories and beeches; males tended to use areas with large oaks, females tended to use areas with abundant snags (Fridell and Litvaitis 1991). Favors small, abandoned woodpecker holes for den sites; also uses nest boxes and abandoned bird and squirrel nests outside tree cavities. In Nebraska, it is found only in the extreme eastern and southeastern parts of the state where there are a variety of mast-producing trees in Nemaha and Richardson Counties.

Status and Limiting Factors

Federal: not listed
State: Threatened

Little is known about these squirrels. They are difficult to study because of their nocturnal habits. Threats include loss of habitat and loss of cavity-bearing and mast-producing trees. The species is negatively impacted by habitat fragmentation and human land-use activities, and it has demonstrated an inability to traverse non habitat (Nupp and Swihart 2000, Swihart et al 2003). In Arkansas, a seed- tree harvest regime, particularly without retained over story hardwoods, produced a level of disturbance and resource depletion that was too severe for flying squirrel persistence (Taulman et al 1998).

Management and Recovery

As of 1991, there were 100 nest boxes at 5 locations in southeastern Nebraska in an attempt to determine status and distribution. The Nebraska Game and Parks Commission plans to do more research on southern flying squirrel habitat availability, movements, home range, and mortality.

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STURGEON CHUB (*Macrhybopsis* gelida)

Physical Description

Photo: *D. Ostendorf*

Sturgeon chub are adapted to bottom dwelling by having a streamlined body and depressed heads, which minimize resistance to flow. The snout is distinctive for being long and flat, extending well beyond the horizontal mouth. Sturgeon chub are adapted to turbid water by having small eyes, but taste buds in the fins and large barbell. Their back is brownish to blueish, and the sides and underparts are silvery to white. The overhanging snout on their ventral mouth is the classic characteristic and there is a conspicuous barbel at each corner of the mouth.

Life History

The biology of sturgeon chub is not well known. Based on collections of ripe fish, this species spawns from June through July (Stewart 1981; Werdon 1992; Gould 1994). Ripe fish have been found in waters of about 18-25 C (Werdon 1992; Gould 1994). Sexual maturity is obtained by age 2 at sizes of about 76 mm total length (Stewart 1981; Werdon 1992). Average lengths at ages 1 through 3 were calculated to be 48, 69 and 80 mm respectively (Werdon 1992). Apparently, few fish reach age 4 (Stewart 1981).

Distribution and Habitat

Sturgeon chubs occur in the mainstem of the Yellowstone, Missouri, and Mississippi rivers in the central portion of the United States, primarily in the states of Montana, Wyoming, North Dakota, South Dakota, Nebraska, Iowa, Kansas, Illinois, Kentucky, and Missouri. In addition, sturgeon chubs are found in a number of tributaries of the Yellowstone and Missouri rivers. In Nebraska, sturgeon chub are primarily found in the Platte and Missouri rivers, though appearances in the tributaries of these rivers would not be unexpected.

Sturgeon chub are found in the open channels of large rivers. They prefer continuous highly turbid water with moderate to strong current over bottoms ranging from rocks and gravel to coarse sand (Werdon, 1993). An affinity for gravel substrate has been continuously noted (Plieger 1997). In the Powder River, sturgeon chub were taken most frequently at sites with depths less than 51 centimeters and depth velocities of less than 90 centimeters per second at 0.6 depth (Stewart 1981, Werdon 1992, Gould unpublished data) (AFS website 2003).

Status and Limiting Factors

Federal: not listed
State: Endangered

Major threats to the sturgeon chub and other large river fishes are habitat and flow alterations from dams, diversions, irrigation operations and riparian development (Rinne et al. 2005). Sturgeon chubs need gravel riffles and runs in turbid shallow and deeper running waters for their life history requirements (Werdon 1993), thus decreased flows and excessive siltation of gravels are threats facing all lithophilic spawning fish species.

Reservoirs created behind dams inundate riverine habitats and replace the river with lentic conditions, which is unsuitable habitat for sturgeon chubs. Dams also create unsuitable habitat for sturgeon chubs downstream by reducing turbidities and/or altering temperature and flow regimes.

Fortunately for this species, it appears unlikely that any new dams will be built on the Powder, Yellowstone, or Missouri rivers in Montana in the foreseeable future. However, water regulation at Fort Peck Dam and several other tributary dams (Intake on the Yellowstone) continue to limit the distribution and abundance of some fish populations in Montana by fragmenting populations and restricting spawning and migration patterns (Rinne et al. 2005).

Management and Recovery

The management of this species should involve routine monitoring (once every 2 to 3 years) of existing populations. The monitoring program should be designed to evaluate population trends, range expansion or losses and collect additional information on life history and ecology. This could be conducted while sampling for other species. Recommendations for operating reservoir and irrigation projects should be developed for improving and maintaining sturgeon chub populations and habitats in Montana. Reintroduction of sturgeon chub should be considered for the lower Teton, Milk and Tongue rivers (AFS website 2010).

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SWIFT FOX (*Vulpes velox*)

Physical Description

Photo: *Nebraskaland Magazine*

The swift fox averages 5 pounds and measures about 3 feet from head to tail. It is about the size of a large domestic cat and about one-half the size of the more common red fox. Its fur is buff yellow or tan, with reddish and gray overtones. The tail is black tipped, and there are also areas of black found on each side of the snout. Winter pelage is dark buffy gray above, orange-tan on the sides, legs, and lower surface of the tail, and buff to white on the chest and belly; in summer, the coat is shorter, harsher, and more reddish. Compared to kit fox, swift fox have smaller ears, broader snout, and shorter tail.

Life History

Swift fox are primarily nocturnal, vocal, and non-territorial. They spend more time underground than any other canid. Although social animals, they keep one mate throughout their lifetime. They received their name because of their speediness (up to 25 mph). Coyotes, eagles, and hawks have been reported as predators of swift fox. Swift fox breed when they are 1 to 2 years old. Breeding generally occurs in December and early March, with the gestation period being 50 to 60 days. (Nebraska Game and Parks Commission, 2010).

The average litter size ranges from 2 to 6. The young emerge from dens at 3 to 4 weeks and are weaned 6 to 7 weeks. The young will stay with adults for about 4 to 5 months. Swift fox have a lifespan of 3 to 6 years. Dens are used on a daily basis all year round. Dens may be excavated by the swift fox, or they may use old badger holes or prairie dog burrows. Diet includes mammals (prairie dogs, jackrabbits, cottontails, ground squirrels, and mice), birds, invertebrates, and vegetable matter (grasses and berries). Swift fox also readily feed on carrion.

Distribution and Habitat

Historically, the swift fox was widely distributed from southern Canada to the panhandle of Texas, and from the northwest of Montana to western Minnesota. They have been reduced to about 60% of their former range. The historic geographic range of the swift fox extended over most of Nebraska. At present, they are found in a few areas in the western Panhandle and in the southwestern part of the state.

The swift fox prefers open semi-arid, shortgrass and mixed grass prairie, including areas intermixed with winter wheat fields, generally away from intensively cultivated or irrigated cropland (with little or no shrubs). They also inhabit areas of mixed agricultural use, but in these areas the population densities are lower. Prairie dog towns are a preferred habitat of the Swift Fox (Kahl et al). Principle foods are cottontails, jackrabbits, small birds, insects, and small mammals, including mice and ground squirrels.

Status and Limiting Factors

Federal: not listed
State: Endangered

They are easily trapped and readily eat poison baits used to kill coyotes. Conversion of grassland to cropland has had an adverse effect on swift fox populations. The swift fox has disappeared from about 40% of its former range. It is still widespread in the central United States and relatively common in some areas, but declining/scarce in other areas. Some reintroduction efforts have been successful, and increases have been noted in states such as Montana.

Threats include habitat loss and degradation to agriculture and mineral extraction, interspecific competition with red fox and coyote, vehicle collisions, and others; more information on population trends and threats is needed (Stephens and Anderson, 2005).

The swift fox has declined as a consequence of the increase in agriculture and the disappearance of the native prairies. Widespread shooting, trapping, and poisoning campaigns aimed at wolves, coyotes and red fox also reduced swift fox populations Swift fox are very easy to trap and very susceptible to poisoned bait. They also get hit by cars when foraging along roadsides (Kahn, et. al).

Management and Recovery

Protection of open native grasslands is the single most important thing needed to help insure the survival of the swift fox. Activities that fragment blocks of grassland within swift fox concentration areas and that create visual barriers, such as tree plantings or conversion of grasslands to irrigated row crops, are generally detrimental. Reducing mortality caused by humans may be essential to the expansion of the population. Hunters, trappers, and motorists in areas known to have concentrations should take precautions to avoid harming swift foxes.

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THICK-BILLED LONGSPUR (*Rhynchophanes mccownii*)

Physical Description

Photo by Shawn Billerman

Thick-Billed Longspurs are medium-sized birds in the Order Passeriformes, Family Calcariidae. The average size of Thick-Billed Longspur is 15 cm (6 in) long with wing spans of 28 cm (11 in), and body mass of 23 g (0.8 oz). Both male and female longspurs have white outer tail feathers with dark central feathers forming an inverted T-shape. The plumage of breeding males is streaked above, with black crown, whitish face, black whisker markings below the eye, gray rump, chestnut wing bar, and black band across the upper breast. The females and winter males are duller in color and more streaked; males may maintain a vestige of the black breast band. This species has a large conical bill which is stouter than other longspurs.

Life History

Thick-Billed Longspurs are migratory; the species' breeding and wintering range is entirely within North America. In Nebraska, Thick-Billed Longspurs occur in the wide expanses of high-plains shortgrass prairie located west of the Sandhills in the Panhandle (Sharpe et al. 2001). Spring migrants arrive typically in April but sometimes as early as March (Sharpe et al. 2001). Fall departure occurs normally in late October, sometimes November (Sharpe et al. 2001). The southern limit of the breeding range is in east-central Colorado (Colorado Bird Atlas Partnership 2016), and the northern limit extends into the Canadian provinces of Saskatchewan and Alberta (With 2010). Thick-Billed Longspurs winter in the southwestern U.S., primarily west Texas, Oklahoma, and New Mexico, and northwestern Mexico (Mickey 1943, Krause 1968), ranging into the grasslands of the Chihuahuan Desert (Partners in Flight 2016).

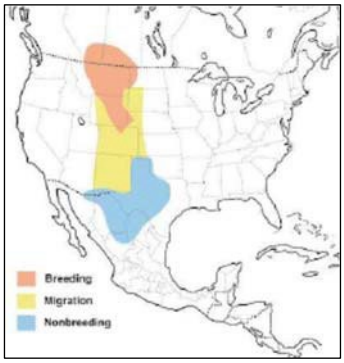
Thick-Billed Longspurs are a common spring and fall migrant in the western Panhandle and breeds locally within two areas, the southwestern Panhandle including most of Kimball, southern Banner, and western Cheyenne counties and the prairies of central and southern Sioux County (Rosche 1982, Sharpe et al. 2001, Johnsgard 2013). Territory size requirements vary by region and habitat quality, with a range of 0.5–1.5 ha (Dechant et al. 2002). Thick-Billed Longspurs feed primarily on insects (e.g., grasshoppers, beetles, and moths) and other arthropods in the summer and seeds from grasses and forbs in fall and winter (With 2010).

Reproduction: Thick-Billed Longspurs likely begin breeding at 1 year of age (With 2010). Breeding occurs mid-March to mid-August (With 2010), but individuals may remain on breeding grounds as late as October to November (Johnsgard 1980). Nests are most often located on top of hills and buttes where males sing and perform courtship displays (With 2010, Mollhoff 2016).

The female lays 2–5 pale green eggs with dark brown and black spots in a grass-lined hollow or scrape on open ground (With 2010). Breeding habitat is generally dry, shortgrass plains. Rosche (1982) reported that longspurs nest in light to moderately grazed native shortgrass prairie, frequently at prairie dog colonies. Nests are usually associated with bunch grasses, some shrubs, or cacti (With 2010). The female incubates 12 days (DuBois 1937, Mickey 1943); she alone is responsible for all the incubation (With 2010). Both parents then tend young that leave the nest after 10 days and can fly 12 days after hatching (DuBois 1923). Thick-Billed Longspurs frequently produce two broods in a single nesting season, but this may be limited by the energy reserves of the female (Felske 1971, With 2010). Subsequent or replacement nests within individual territories may be located an average of 30.4 m from the first nest (With 2010).

In Nebraska, Snyder and Bly (2009) observed nesting Thick-Billed Longspurs in fallow agricultural fields in Kimball County in 2007 when 21 nests were located during surveys for Mountain Plovers. These observations suggest that Thick-Billed Longspurs are more flexible in their habitat use than previously believed. However, it is unknown if nesting in agricultural fields occurs regularly, if the observations in 2007 are unique, or if agricultural habitats can serve as a suitable substitute to natural grassland habitats. It seems that Thick-Billed Longspurs are attempting to accommodate the changes in their grassland nesting habitat, which has been greatly reduced.

Distribution and Habitat



Range-wide distribution of the Thick-Billed Longspur 2010

Thick-Billed Longspurs are a species of the western Great Plains of North America. In Nebraska, Thick-Billed Longspurs occur in the wide expanses of high-plains shortgrass prairie located west of the Sandhills in the Panhandle (Sharpe et al. 2001). They are typically found in sparse shortgrass prairies, plowed and stubble agricultural fields, and other areas with little vegetative litter or bare ground (Felske 1971, Sharpe et al. 2001, Dechant et al. 2002).

Thick-Billed Longspurs have always been part of the ornithological landscape with records since the time of settlement by Europeans. Bruner et al. (1904) considered the species to be an uncommon migrant and noted its breeding occurred in Sioux County. Thick-Billed Longspur's distribution within Nebraska is limited currently to the westernmost parts of the state. Within Nebraska, as in nearby Wyoming (Faulkner 2010), Thick-Billed Longspurs nest in localized areas likely because of the patchy distribution of suitable habitat (Rosche 1982, Sharpe et al. 2001). Rosche (1982) noted the eastern edge of the breeding range expands eastward during dry years and retreats westward during wet years.

Status and Limiting Factors

Federal: Not Listed
State: Threatened

Populations of Thick-Billed Longspurs have exhibited drastic declines in northern and migratory parts of their range (NatureServe 2016). Their breeding habitat has become fragmented as the landscape has been converted from grassland to other uses (Schneider et al. 2011). Loss of native shortgrass prairie has been detrimental to the wintering range of Thick-Billed Longspur as well (Sedgwick 2004). Management practices that maintain higher vegetation structure create conditions unsuitable for Thick-Billed Longspurs (Schneider et al. 2011). The elimination of colonies of black-tailed prairie dogs (Cynomys ludovicianus) negatively impacts habitat for Thick-Billed Longspurs (Schneider et al. 2011).

Management and Recovery

Preservation and restoration of native grasslands that supply potential nesting sites will likely benefit this species. Prescribed burning is also important in maintaining habitat health to prevent encroachment of undesirable trees and shrubs. Restoration and mitigation methods should be developed.

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TIMBER RATTLESNAKE (*Crotalus horridus*)

Physical Description

Photo by John Farrar, NEBRASKAland

Timber rattlesnake is a large, venomous snake which can be identified by dark chevron bands, a rusty brown dorsal stripe, a triangular head, and a golden colored stripe that extends along the cheeks. Their long tail is black with a lighter colored rattle. These are the largest of Nebraska's rattlesnakes and grow to an average size of 44–50 in (111-127cm).

Life History

Winter Habitat: During the winter, Timber Rattlesnakes hibernate in rocky outcrops called hibernacula. These communal dens may be used by other snake species as well.

Summer Habitat: Timber Rattlesnakes become active around the beginning of April and stay active until the beginning of November. The Timber Rattlesnake prefers mature forests with non-forested fringes. During the active period, Timber Rattlesnakes can be found basking, foraging for food, and searching for mates.

Reproduction: Mating occurs from Mid-July to late October. Timber rattlesnakes are ovoviviparous and give birth during the warmest months of the year. Females produce litters in 2-4-year intervals.

Distribution and Habitat

Timber rattlesnakes have a wide distribution throughout the eastern U.S. Approximately half the states in the U.S. consider the Timber Rattlesnake to be a species of greatest conservation need. Timber Rattlesnakes are listed as threatened in TX, MN, IL, and NY and endangered in IN, OH, NJ, VT, MA, CT, and NH. This species is considered extirpated from ME and RI, and extinct in Canada.

Fogell (2010) documents Timber Rattlesnakes using deciduous and riparian woodlands in conjunction with rock outcrops or talus slopes that provide winter denning hibernacula. Woodlands are often associated with prairie uplands. Grasslands, and agricultural fields, provide the snakes with a migratory corridor between woodlots.

Map illustrating the complete distributional range of the Timber Rattlesnake (Map prepared by NatureServe).

In Nebraska, this species is found in the far southeast portion of the state in the southern parts of Jefferson, Gage, and Pawnee counties and along the Missouri River corridor in Richardson and Nemaha Counties. They are found in the Sandstone Prairies, Southeast Prairies, Missouri River, Indian Cave Bluffs, and Rulo Bluffs Biologically Unique Landscapes, although records are scarce. Nebraska's population is at the western periphery of the species' range.

Status and Limiting Factors

Federal: Not Listed
State: Threatened

Mature woodland areas are rare in Nebraska and even rarer are woodlands with rocky outcroppings. Habitat loss and fragmentation due to development and agricultural practices are the major factors for the Timber Rattlesnakes decline. Fragmentation of populations causes connectivity issues leading to a reduction in genetic diversity within the species. The destruction of dens during hibernation can cause high mortality rates and kill entire populations. The destruction of dens during the active months can also lead to high mortality since individuals may not be able to find a new site. Eastern red cedar (Juniperus virginiana) encroachment of suitable hibernacula leads to a "shading over" effect that prevents winter sun from warming the dens. In the species' range, rock outcroppings in some locations are being quarried for rock. Some old quarries with denning sites are once again being mined, thus destroying denning sites. Because Timber Rattlesnakes in Nebraska also frequently occupy grasslands such as pastures and hay fields, several are killed annually during hay cutting and baling activities.

Management and Recovery

Preservation of mature woodlands, restoration of forested areas and preservation of rocky outcrops that supply potential den sites will likely benefit this species. Prescribed burning is also important in maintaining habitat health to prevent encroachment of undesirable trees and shrubs. Restoration and mitigation methods should be developed, and major mortality factors should be identified throughout the range.

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TOPEKA SHINER (*Notropis topeka*)

Physical Description

Photo: *G. Senegal*

The Topeka shiner is a small, stout minnow up to 3 inches in length. A dark lateral line extends from behind the eye to the base of the tail and ends with a distinguishing dark chevron (>) at the base of the tail. However, this chevron can be indistinct, making identification difficult. The Topeka shiner is olive-green to gold colored above the lateral line and silvery-white below. During mating season, the cheeks and fins of males turn reddish-orange. (Pflieger 1997, USFWS 1998, Nature Serve 2009, Nebraska Game and Parks 2010).

Life History

The Topeka shiner occurs in schools in midwater or near the surface and is most often found with redfin, sand, common and red shiners, and the bluntnose minnow (Pflieger 1997).

Males establish and defend territories, and spawning occurs in late spring and early summer (May to summer in Nebraska) (Nebraska Game and Parks 2010). There are 150-800 eggs in a clutch. The eggs hatch after 5 days. The lifespan of the shiner does not generally exceed 3 years (Nature Serve 2009, NGPC 2010).

Distribution and Habitat

There are 9 records of the Topeka shiner in Nebraska of which only two are considered extant with the remaining seven records being historic. The historic distribution of the species was the eastern third of the state from Knox County in the north to Adams County and Saline counties in the south. The two recent records are from Taylor Creek in Madison County and Brush Creek in Cherry County. A stable population occurs in the Blue River drainage just south of the Nebraska/Kansas state line. This indicates the species distribution may extend into the Blue River basin in the southeast portions of Nebraska. The potential distribution of the species is considered to be the eastern half of the state.

Characteristic Topeka shiner habitat is small, including areas of quiet, open headwater prairie streams with cool temperatures and good water quality. Typically, the substrate is clean cobble, gravel, or sand; in some areas it is bedrock or clay hardpan overlain with fine silt. The streams are usually perennial although they may approach intermittency in the summer. In pools of intermittent streams, cool water temperatures are maintained by groundwater seepage or spring flows. The Topeka shiner is usually found in the pools and runs of streams as opposed to riffles or along the banks. The Topeka shiner has also been found in old oxbows and sloughs that are normally isolated from the main stream but receive flow-through during high water events.

Status and Limiting Factors

Federal: Endangered
State: Endangered

There is a small range in six states in the Great Plains region; remaining populations were becoming increasingly fragmented and threatened, but the species is now receiving much more conservation attention in states where previously it was not receiving any attention, so more populations have been discovered or rediscovered; some threats have been reduced. The major threats are land and water practices that alter characteristics of streams. The fish is fairly resistant to natural, short-term stress but sensitive to permanent changes such as reduced water quality and increased water temperature.

Management and Recovery

Consider conducting surveys to determine presence of species on streams having characteristic shiner habitat within the historic range and especially within and adjacent to 8-digit Hydrologic Unit Areas (HUA) having known populations. Preclude the construction of tributary dams and stock ponds on perennial or intermittent portions of streams with populations of the Topeka shiner. Prevent/eliminate dewatering of streams. Prevent and reduce siltation and pesticide runoff into streams by establishing adequate buffer strips and agricultural practices to reduce erosion and runoff. Prevent conversion of grassland to cropland and initiate grazing practices to improve grassland condition. Prevent threats from introduced piscivorous (fish-eating) fish. The streams should not be altered in any way.

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UTE LADIES' TRESSES (*Spiranthes diluvialis*)

Physical Description

Photo: *Native Ecosystems Organization*

Ute-ladies'-tresses orchid is a perennial, terrestrial orchid with stems 20 to 50 centimeters (8 to 20 inches) tall, arising from tuberous thickened roots. Its narrow leaves can reach 28 cm (11 inches) long. Basal leaves are the longest and become reduced in size up the stem. The flowering stalk consists of few too many small white or ivory flowers clustered into a spike arrangement at the top of the stem. The species is characterized by whitish, stout, ringent (gaping at the mouth) flowers. (USFWS 1992, Nature Serve 2009).

Life History

Ute-ladies'-tresses generally blooms from late July through August; however it does not necessarily flower every year (Fertig et al 2005). Flowering is dependent upon temperature and moisture. (Fertig et al 2005). The species is thought to have adapted to early-to mid-seral, moist to wet conditions, where competition for light, space, water, and other resources is normally kept low by periodic or recent disturbance events (Nature Serve 2009).

Distribution and Habitat

The orchid is an endemic orchid that occurs primarily in seasonally moist peat, sand, silt, or gravel soils near wet meadows, springs, lakes, ponds, or perennial streams. The orchid establishes in open grass and forb dominated riparian areas that are not particularly dense or overgrown (Coyner 1989, 1990; Jennings 1989, 1990). The orchid seems generally intolerant of shade, though a few populations in eastern Utah and Colorado occur in riparian woodlands. Most populations occur as small, scattered groups occupying relatively small areas within the riparian system. Populations occur in mesic or wet meadows near riparian edges, gravel bars, and old oxbows along perennial streams at elevations ranging from 4,000 to 7,000 feet. Most sites are sub-irrigated and seasonally flooded, remaining moist into the summer.

The species range spans the states of Wyoming, Montana, Nebraska, Idaho, Washington and recently (2008) in British Columbia (Nature Serve 2009). Utah and Colorado have the most plants and occurrences. Populations of the species are known from three broad general areas of the Interior western states—near the base of the eastern slope of the Rocky Mountains in Southwestern Wyoming and adjacent Nebraska and north-central and central Colorado; in the upper Colorado Basin, particularly in the Uinta Basin; and the Bonneville Basin along the Wasatch Front and westward in the eastern Great Basin; in north central and western Utah, extreme eastern Nevada, and southeastern Idaho. The orchid has also been discovered in southwestern Montana and in the Okanogan area and along the Columbia River in north-central Washington (USFWS 2004).

In Nebraska the species was first discovered in 1996 and exists in low, sub-irrigated somewhat alkaline wet meadows. It is presently known only from the Niobrara River in Sioux County (Niobrara headwaters watershed) (Fertig et al 2005).

Status and Limiting Factors

Federal: Threatened
State: Threatened

The Ute ladies' tresses orchid (Spiranthes diluvialis) is a Federally listed threatened species. The Natural Heritage rank is G2 and S1, meaning that the species is imperiled because of rarity on the global level (often known from six to 20 locations) and critically imperiled because of extreme rarity on the state level (known from five or fewer occurrences). WYNDD lists the orchid as sparse and a High Conservation Priority (Fertig et al 2005).

Orchids, in general, are not common plants. Most are rare in their distribution. This makes it difficult to assess the stability of any given population. Furthermore, the naturally occurring low population numbers make the species susceptible to localized extinction caused by natural or man-made disasters. Historical accounts typically help realize the population trends, but populations in Wyoming were not discovered until 1993 and in 1996 in Nebraska. Although no trend data are available, populations in Wyoming are considered stable (Fertig 2005). Continued presence/absence surveys and population studies will provide data necessary to quantify statewide trends in distribution and populations for Wyoming.

Changes in large ungulate populations have probably affected the distribution of the orchid. This species likely evolved according to the seasonal presence of large herbivores such as American bison, elk, deer, and bighorn sheep. Changes in these species' distribution could have negatively impacted the orchid populations by removing them during late winter and early spring, possibly leading to a buildup of live and dead vegetation. Additionally, cattle grazing may alter both plant communities and stream ecology. Depending on when a site is grazed, there is the possibility of removing flowering or fruiting stalks. With cattle introduction there runs the risk of noxious weed invasion. Canada thistle, reed canary grass, and leafy spurge pose threats as they compete vigorously with the orchid.

Herbicides applied to control noxious weeds and fertilizers from agricultural fields possibly affect the orchid. Both direct applications to nearby agricultural fields and runoff from sites upstream have potentially harmful effects on orchids. Pesticides applied to nearby sites could affect bumblebee populations, which are the orchid's primary pollinators.

Development in or near wetlands certainly has had an effect on the distribution of the orchid. Water

diversion, channelization, and irrigation have all impacted the species. All of these factors decrease the input of water into riparian systems or completely destroy habitat, thus eliminating potential habitat for this species. Conversely, some irrigated plots have proven to create habitat for the orchid.

In Nebraska, this species is considered a facultative wetlands plant that inhabits sub-irrigated wet meadows, early successional riparian wetlands, and floodplains. Populations are known to occur along the Niobrara River in Sioux County, Nebraska; however, smaller populations may occur at other sites in western Nebraska, especially areas that contain slightly alkaline wetlands. Alteration of surface and groundwater hydrology is a threat to Ute ladies'-tresses.

Management and Recovery

The orchid is well-adapted to periodic disturbances from stream movement and grazing (USFWS 1992). Annual mid-summer haying of meadows prevents the orchid from flowering and seeding. Overgrazing is a concern. More diversified management would benefit the species and control of exotic cool-season grasses.

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WESTERN MASSASAUGA (*Sistrusus tergeminus*)

Physical Description

Photo: Nebraskaland Magazine

Medium-size pit viper that is one of the smallest rattlesnakes occurring in the Great Plains, normally ranging in size from 18 to 39 inches. Identifying characteristics include nine, enlarged scales on the top of the head, a small pit on each side of the head between the nostril and the eye, and a stocky tail with a moderately developed rattle (Ernst and Ernst 2003, Nebraska Game and Parks 2010). The massasauga is typically dark gray in color but may vary to light brown. Dark brown saddles or blotches extending down the length of the back become bands as they approach the tail. A light-bordered dark bar extends from eye to rear of the jaw. Dark bars on the top of head also extend onto the neck. The belly is dark mottled or light with blotches and mottling.

Life History

In Nebraska, massasaugas emerge from hibernation in mid-to-late March. Often observed basking adjacent to crayfish burrows in which they hibernated and shared with other snake species including Garter snakes, Brown snakes, and Lined snakes. Massasaugas are often encountered basking on mild days but become crepuscular or nocturnal during the hot summer months (Nebraska Game and Parks, 2010). By mid-spring they migrate to more upland habitat and start to use vegetation and mammal burrows for cover as they search for food (Fogell, 2010). Breeding occurs in early spring upon emergence into mid-summer, generally from April to May (Nebraska Game and Parks, 2010). Young are born alive a year later generally from July to early September (Fogell, 2010). The species may live up to 14 years or more. Females are sexually mature in 3 years (Behler and King 1979). Massasauga feeds on rodents, frogs, and other small snakes. Lizards, small mammals, and centipedes are important foods in the western part of the range, whereas small mammals (voles, mice, shrews) dominate the diet in the east, with snakes and birds of lesser importance. Young feed often feed on small shrews and other snakes (Fogell, 2010). The snake's twitching of the tail tip can attract prey (Nebraska Game and Parks, 2010).

Distribution and Habitat

The distribution range extends discontinuously in a northeast to southwest fashion from New York, Ontario, and Pennsylvania down through southwestern Texas, New Mexico, and extreme southeastern Arizona (Nature Serve through the central and southern Great Plains region to southeastern Arizona, Texas Gulf Coast, and northeastern Mexico (Nature Serve 2009).

In Nebraska the massasauga is native to the tallgrass prairie ecosystem and found primarily in the southeastern portion of the state. It is most closely associated with wet meadow sites within the prairie landscape but is also found in drier, upland prairie sites. There is evidence that snakes move from wet to dry sites on a seasonal basis.

In Lancaster County the massasauga was often associated with the saline wetlands around Lincoln. In Colfax County it has been found in a wet meadow in the Platte River floodplain. In Pawnee County it is found on two state wildlife management areas associated with wetlands around ponds and lakes. Most snake species, including the massasauga, hibernate in large numbers at ancestral den sites.

Status and Limiting Factors

Federal: not listed
State: Threatened.

NOTE: Eastern massasauga (*Sistrurus catenatus catenatus*) is federally listed as a Candidate in Region 3.

Loss and alteration of habitat is believed to be the primary cause of the decline of the massasauga and currently is the greatest threat to the species. In Nebraska, the species is dependent upon intact tallgrass prairie ecosystems, which have been drastically diminished and altered since pre-settlement times due to conversion to cropland and other developments. Such habitat fragmentation reduces movement of individuals between populations, thus reducing the exchange of genetic material and increasing the probability of negative genetic effects (e.g., inbreeding). Reduced movement also decreases the probability that a suitable site will be re-colonized should the existing population be lost due to chance events. Remaining tallgrass prairie tracts are typically too small to maintain viable populations of the massasauga. A number of the tracts that are otherwise large enough to support a population may no longer have suitable habitat due practices such as overgrazing and fire suppression.

Remaining tallgrass prairie tracts are susceptible to conversion to other uses and this potential habitat loss remains a threat to the viability of the species in the state. The destruction dens during the hibernation period can kill large numbers of snakes and eliminate whole local populations. The loss of a den site during non-hibernating periods can also result in high mortality rates since individuals may not be able to find suitable new den sites. Road mortality can also contribute to decline of small populations and reduce movement among populations (Bernardino, F.S. and Dalrymple 1992, Rosen and Lowe 1994, Rudolph et al 1998).

Management and Recovery

Preservation and restoration of sizeable tracts of tallgrass prairie and wetlands and herbaceous riparian areas will likely benefit this species. Prescribed moderate and light livestock grazing and prescribed burning are also important to maintain the quality of eastern grasslands and prevent tree and shrub encroachment. Extensive research on monitoring methods is needed. Restoration methods should be developed, as should mitigation methods for fragmentation effects. Major mortality factors should be identified throughout the range.

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WESTERN PRAIRIE FRINGED ORCHID (*Platanthera praeclara*)

Physical Description

Photo: *Nebraskaland Magazine*

The western prairie fringed orchid (*Platanthera praeclara)* is a native perennial forb with a single stout stem growing 1-3 feet tall. It has long smooth leaves with parallel venation, 4-8 inches long and 1 inch wide at the base, tapering toward the tip. Up to 40 single flowers are arranged in a spike at the top of the stalk. The individual flowers are creamy to greenish white and about one inch long. Like other orchids, they have 3 colored sepals and 3 petals, the three sepals forming the upper part of the flower. The two lateral petals look alike and are about 1/4 inch long. The lower petal forms a lip that is divided into three sections; the middle one is the longest (up to 3/4 inch) and forms a landing pad for the hawkmoth that pollinate it. All three sections of the middle petal are deeply lobed, giving it the fringed look from which its name comes. The orchid flowers from mid-June through mid-July and has a faint sweet scent. It forms a fruit that is a three-angled capsule with many spindle-shaped seeds.

Life History

Western prairie fringed orchid sprouts between late April and early May in southwestern Minnesota and from early May to mid-June in the northwestern part of the state. It senesces in late September, or earlier if soil moisture is abnormally low. In late summer, a single bud is produced on the fleshy rhizome. That bud will remain dormant until the following spring when it will develop into the aerial stem. If the bud is damaged in the interim or fails to develop, no stem will be produced that year. Even without the stem, the rhizome may survive and produce another bud in late summer, which will develop into a stem the following year.

In Nebraska, the orchid's bloom period begins around June 15th in the southeast and extends to around July 15th in the north. Orchid surveys can only be conducted during the dates of the flowering period as non-flowering plants are extremely difficult to find among other vegetation.

Distribution and Habitat

The western prairie fringed orchid is a species of the North American tallgrass prairie community. Nationally, its range spans from northern Oklahoma, Nebraska, Missouri, Iowa, eastern South Dakota, eastern North Dakota, Minnesota, and northward to Manitoba. As of 2008, populations were known from 175 sites in six States and Canada. In eastern Nebraska, it occurs in wet-mesic prairies and sedge meadows in alluvial soils of river floodplains. In the Sandhills of central and western Nebraska, the species occurs in the sandy soils of sub irrigated meadows and prairie swales. While specific site types vary, all sites are typified by the tallgrass prairie habitat and a high soil moisture profile (Nebraska Game and Parks 1992, Steinauer and Rolfsmeier 2003).

In Nebraska, the species is known to occur at 64 sites in 15 counties in eastern Nebraska, the central Platte Valley and the Sandhills. In eastern Nebraska, it occurs in several southeast counties; however, these populations are small in size. More substantial populations exist in the eastern and central Sandhills and outlying sand dune complexes of northeast Nebraska.

Status and Limiting Factors

Federal: Threatened
State: Threatened

All populations in Kansas, Missouri, and Oklahoma have fewer than 50 individuals. The species may have been extirpated in South Dakota. Conversion of habitat for crop production, grazing, intensive haying, drainage, and indiscriminate herbicide use, fire protection and the general decline of native prairie areas have contributed to the decline of the western prairie fringed orchid.
Declines in the western prairie fringed orchid populations have been caused by drainage and conversion of its habitats to agricultural production, channelization, siltation, road and bridge construction, grazing, haying, and the application of herbicides.
Populations are known to occur in Boone, Cherry, Dodge, Garfield, Grant, Greeley, Hall, Holt, Lancaster, Loup, Madison, Otoe, Pierce, Rock, Saline, Sarpy, Seward, and Wheeler counties, and may occur at other sites in Nebraska.

In Nebraska, declines in the population have been caused by drainage and conversion of its habitats to agricultural production, channelization, siltation, road and bridge construction, grazing, haying, and the application of herbicides. Additionally, one of the most pervasive threats to the species has become exotic plants. Smooth brome (Bromus inermis), reed canary grass (Phalaris arundinacea), and Garrison creeping foxtail (Alopecurus arundinaceus) invade orchid meadow habitats.

The most significant threats to P. praeclara are habitat destruction/loss and habitat degradation and alteration, particularly in the USA. Improper management of the intact habitat is also a significant threat to the species. Large tracts of prairie habitat ideal for the orchids have been lost due to conversion of land for agricultural purposes especially row-cropping which results in ploughing (Sharma et al. 2002, Lenz 1996, Fauske and Rider 1996, USFWS 1996). In addition, habitat is increasingly lost under pressure of development as both remnant prairie and grazing lands are converted for housing and commercial uses. Although some habitat conversion has been documented in Canada in recent years, historical trends are not available.

The orchids are also at risk from habitat alteration and degradation, which is induced by anthropogenic factors. Inappropriate land management practices can damage individual plants or create ecological changes that disadvantage entire orchid populations. For example, cattle can damage individual plants by grazing and trampling them (Self and Anthonisen 2005; Alexander 2000, 2001; Fauske and Rider 1996). More problematic are

management practices and other alterations to associated ecological systems that disadvantage P. praeclara. For instance, non-application or misapplication of prescribed fire, grazing, or mowing could have a detrimental impact on plant survival, growth, and reproduction (USFWS 1996, Self and Anthonisen 2005, Environment Canada 2006).

Similarly, a loss of prairie habitat within the landscape matrix can lead to a decline in pollinators and change local hydrology, thereby altering the surrounding vegetative communities (Sharma et al. 2002, USFWS 1996). With more dry conditions, for example, Leafy Spurge (Euphorbia esula) an invasive exotic plant species, commonly invades P. praeclara habitat, often out-competing the orchids (Challey 1992, Crummy 1993, Kirby et al. 2003)Other exotic species that are observed in the habitat and could potentially out-compete P. praeclara are St. Johns Wort (Hyperiucum perforatum), Smooth Brome (Bromus inermis), Kentucky Bluegrass (Poa pratensis), Reed Canary Grass (Phalaris arundinacea) and clover species (Trifolium sp.) (Environment Canada 2006).

Drought lasting more than one year is known to severely increase mortality and reduce flowering of surviving western prairie fringed orchid. It is also known that plants do not persist when flooded for extended periods during the growing season. Annual mowing of wild hay presents another problem as it removes the seed capsules of P. praeclara before the seeds are ripe. Because this species reproduces entirely by seed, annual mowing could lead to reproductive failure, and eventually, population collapse.

The effects of fire must also be considered. Before settlement, the prairie habitats of P. praeclara were exposed to wildfire at intervals of perhaps 2-4 years. While fire was necessary for the proper function of the prairie ecosystem, native prairie has now been reduced to tiny, isolated fragments that no longer function as an ecosystem. In an effort to restore ecological function to these isolated fragments, fire is often reintroduced on a prescription basis. Prescribed fire can be very useful in managing P. praeclara habitats, but timing is absolutely critical. If the growing tips of P. praeclara are even 5-7 cm (2-3 in.) above ground, they may be damaged or killed by a fire. The species has a very limited ability to resprout if the growing tip is killed, and often mortality ensues.

Management and Recovery

Conservation measures for this species include recognition of the species, acquisition of land on which the orchid grows, and the management of populations on private land. On both public and private land, care should be taken to reduce disturbances to the plants' habitat. Livestock overgrazing, intensive hay mowing, herbicide use near populations, and other practices detrimental to native prairie should be avoided. Ditching of wet meadows and the introduction of exotic forage plants would also be detrimental to the western prairie fringed orchid.

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WHOOPING CRANE (*Grus americana*)

Physical Description

Photo: *Nebraskaland Magazine*

The Whooping crane is a tall, mainly white bird with a long neck, long legs, and red facial skin; black primaries are evident in flight; immature individuals are mainly white but have pale reddish-brown head and neck and similar color scattered elsewhere on the body. Whooping cranes are slightly larger than Sandhill cranes; approximately 4.5 feet tall with a wingspan of 7 feet.

Life History

The Whooping crane is one of the rarest birds in North America and also one of the largest. Whooping cranes are vulnerable to accidents during migration. Each spring they travel north from their wintering grounds around Aransas National Wildlife Refuge in Texas to their breeding grounds in Wood Buffalo National Park in central Canada (2,400 miles). Each fall this route is reversed. Their journey traverses eastern Montana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma and Texas. In Nebraska, they stop to rest and feed on the Platte, North and Middle Loup and Niobrara Rivers. (Information taken from the USFWS Draft Revised International Whooping Crane Recovery Plan Jan 2005)

During the summer it feeds on insects, crustaceans, and berries, while the winter diet includes grains, acorns, wolfberry fruit, and aquatic species.

Distribution and Habitat

Wild birds are nesting in Florida. Presently whooping cranes in the Wood Buffalo-Aransas population only nest in Wood Buffalo National Park, Northwest Territories, Canada. Whooping cranes migrate through Nebraska from late March through early May during the spring migration and from October to mid-November during the fall migration. The primary migration corridor is through central Nebraska from Grand Island to North Platte. However, they have been documented from York County in the east. High use areas include the Rainwater Basin wetlands, the central portion of the Platte River, wetlands in Custer County west of Broken Bow, the Loup River around Taylor, wetlands in Cherry, Brown, and Keya Paha counties, and the Niobrara River.

Whooping cranes roost in wide river channels, wetlands, and farm ponds. They feed in nearby grassland and cropland. Wetlands used include permanent wetland as well as shallow, temporary wetland occurring in cropland. Major prerequisites of suitable stopover locations appear to be resting areas with shallow water (standing or flowing), good horizontal and overhead visibility, proximity to feeding sites, and reasonable isolation from human developments and/or disturbances. Critical habitat for whooping cranes has been designated as a strip of river bottom south of I-80 with a north south width of three miles, extending from about Lexington to the Interstate 80 interchange for Shelton and Denman.

Status and Limiting Factors

Federal: Endangered
State: Endangered

Habitat destruction and indiscriminate shooting in the late 1800's and early 1900's were the primary factors that caused the drastic reduction in numbers. Another contributing factor to their continuing small numbers is their low rate of reproduction. There are rarely more than two eggs per breeding pair and often only one chick survives.

In the spring of 2000, there were about 188 whooping cranes in the wild. One self-sustaining population nest in Canada, winters primarily along the Texas coast; two additional reintroduced populations, one group migrates from Wisconsin to Florida, and the other is nonmigratory and resides in Florida.

Management and Recovery

Recovery strategies involve protection and enhancement of the breeding, migration, and wintering habitat. Maintenance of a captive breeding flock to protect against extinction; with the offspring of captive breeding released into the wild is necessary; as well as maintaining water flows, maintaining, and restoring open river channels and wet meadows, reducing woody vegetation, and limiting encroachment by development. The protection, restoration, and management of wetlands and wet meadows throughout the corridor are also very important in maintaining and protecting whooping crane habitat.

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