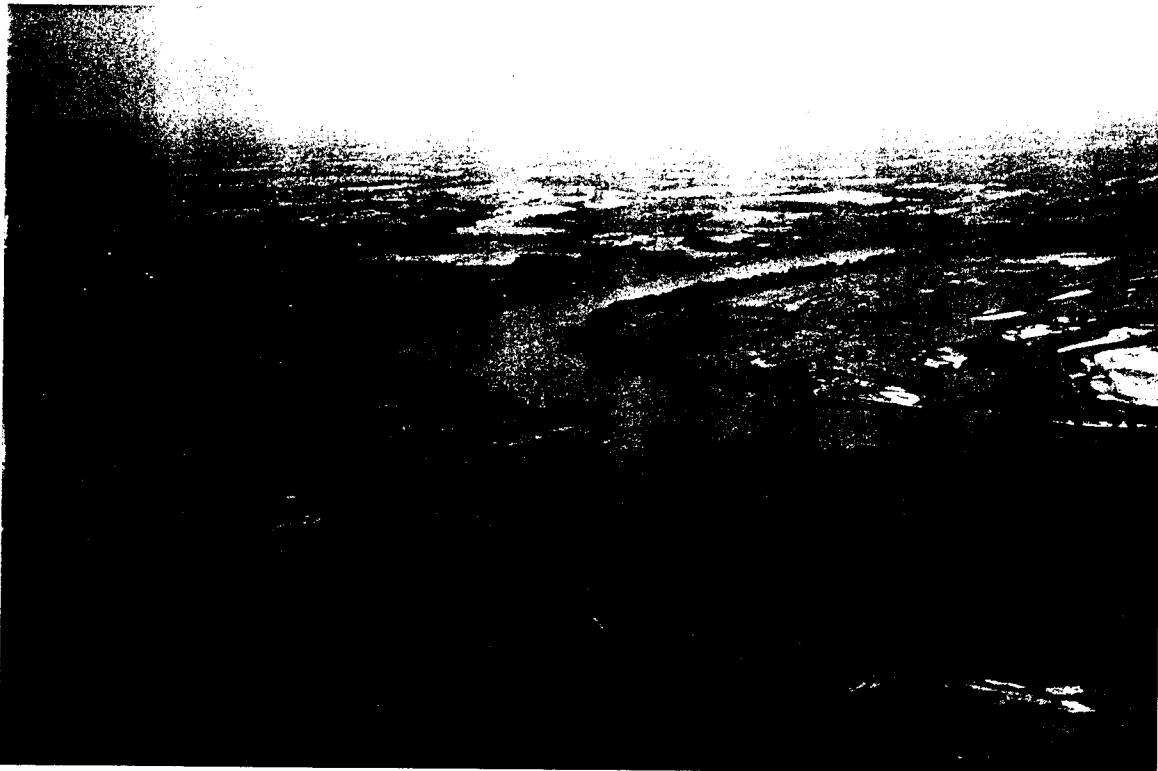


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Lower Missouri River Rare and Endangered Fishes Distribution,  
Relative Abundance and Community Association

Big Muddy National Fish and Wildlife Refuge Proposed  
Acquisition Sites and Other Biologically Significant  
Focus Areas (River Mile 338 to the mouth)



U.S. Fish and Wildlife Service  
Fishery Resources Office  
Columbia, Missouri  
Joanne Grady, Fishery Biologist  
July 1996  
Revised January 1998

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## **Chapter 1**

### **A Brief History of the Missouri River and its Fishery**

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## The River

The Missouri River basin was purchased by the United States in 1803 as part of the “Louisiana Purchase” (Keenlyne 1988). The Lewis and Clark expedition of 1804-1806 failed to find the waterway to the Pacific Ocean that Thomas Jefferson had hoped for, but it did find a wealth of natural resources. This wealth brought the first people into the Missouri River Basin; fur trappers and traders. Fur was the major commercial product of the basin until the 1830s.

The first steamboat moved up the Missouri River in 1819 (Keenlyne 1988). Steamboating, although treacherous due to sand bars and channel snags, was a very profitable venture. Steamboats carried the bulk of the freight in the new territory for the next 50 to 60 years. When the steamboat era ended in the 1880s, river banks in Montana and North Dakota were almost barren due to the vast tree cutting required to fuel the steamboats (Jackson and Stucky 1988).

Snagging operations to ease steamboat travel on the Missouri River began in 1832 and were sanctioned by an Act of Congress in 1838 (Funk and Robinson 1974). Major Stephen H. Long, Superintendent of Western Waters, supervised the removal of 60,000 channel snags from 1843 to 1846 (Jackson and Stucky 1988).

Lt. Col. C.R. Suter wrote the first report on the Missouri River in 1881. His recommendations to protect the banks and contract the river to maintain a navigation channel led to his becoming the first president of the Missouri River Commission in 1884 (Funk and Robinson 1974). The Missouri River Commission developed the techniques for revetments, pile dikes, and bankheads still used to this day. Congress appropriated money for work in scattered locations only instead of the systematic development which the Commission hoped for. Due in part to the railroad’s increasing freight capabilities, river commerce dropped and the Missouri River Commission was abolished in 1901 (Funk and Robinson 1974).

Congress gave responsibility for the Missouri River to the Corps of Engineers in the Act of 1902. No maintenance was provided by the Corps to the Missouri River Commission’s structures which largely washed away in flood waters. Congress authorized a 6 foot channel from Kansas City to the mouth of the Missouri River in 1912. Although a lot of engineering work was done from 1912 to 1917, Congress appropriated little to no money to the Corps for construction from 1917 to 1922. Most work completed from 1922 to 1927 was directed at flood protection (Funk and Robinson 1974). In 1927, the extension of the 6-foot channel to Sioux City was authorized (Funk and Robinson 1974). The Rivers and Harbors Act of 1945 provided for an even deeper 9-foot deep and 300-foot wide channel from Sioux City, Iowa to the mouth of the Missouri River (Funk and Robinson 1974).

The Fish and Wildlife Coordination Act of 1934 mandated that the value of wildlife as a public good had to be recognized and given equal consideration in federal project planning (Keenlyne 1988). This act was passed while the Bureau of Reclamation and the Corps of Engineers were

both independently developing comprehensive plans for development of the Missouri River. The plans of both Colonel Pick of the Corps of Engineers and Glenn Sloan, representing the Bureau of Reclamation, along with a subsequent compromise resolution were all “authorized” in the 1944 Flood Control Act (Keenlyne 1988). This was a nationwide act which authorized flood control projects in about 50 basins.

In 1935, the U.S. Army Corps of Engineers built the first big dam on the Missouri River near Fort Peck, Montana in order “to provide 20,000 cfs for navigation” (Keenlyne 1988). The comprehensive Pick-Sloan Plan called for the construction of additional dams in the upper basin of the Missouri River to provide flood control, irrigation, and hydropower. The completion of Big Bend Dam in 1964 brought the total to six large dams on the Upper Missouri River.

Although mainstem flood control and hydropower dams were not constructed within the state of Missouri, the operation of these facilities determines the hydrograph for the Lower Missouri River in Missouri. Tributary dams on the Osage River Basin in Kansas and Missouri, the Kansas River Basin, and the Platte River Basin also influence the hydrograph. This hydrograph is a subject of current debate as the Corps of Engineers is rewriting their Master Water Control Manual. Historic river flows included a spring rise that peaked in late June, then declined throughout the summer and fall reaching a low point in late December. Fall rains caused a slight rise in the lowermost reach in Missouri. The spring rise provided essential cues in the spawning behavior of fish species which evolved with the Missouri River. Flows have been modified to meet flood control, navigation, and hydropower objectives. Spring high flows have been suppressed while low summer and fall flows have been augmented. Downstream of Kansas City, the effect of mainstem dams is moderated by large tributary flows (Mike LeValley, personal communication).

The dams and the change in the flow regimen dramatically reduced the turbidity of the Missouri River. Turbidity of the river was exceptionally high in 1945 with readings at most stations near 3,000 parts per million (Fisher 1962). Mean annual turbidity from daily measurements at a Saint Louis water-treatment facility have been less than 1000 ppm in the post impoundment era. Many native river fishes evolved with the river’s high turbidity levels and are now vulnerable to predation and competition from sight-feeding fishes.

The Missouri River levee system was authorized by the Flood Control Act of 1941 and expanded by the Flood Control Act of 1944 as part of the Missouri River Basin Comprehensive Plan. The project provided for a series of levees along both sides of the river from Sioux City, Iowa to the mouth for the protection of agricultural lands and communities against flooding (Missouri Basin States Association 1983). These levees have fostered the conversion of riparian and wetland habitats to agriculture and prevented floodplain spawning fish species from accessing and using floodplain habitats.

The Missouri River Bank Stabilization and Navigation Project was 98% complete by 1967 (Funk and Robinson 1974). This project was devastating to the natural resources of the Missouri River Basin. Between 1879 and 1972, the water surface area of the Missouri River between Rulo, Nebraska and the mouth was reduced by 50% of the original surface area of the river (Funk and Robinson 1974). This loss in Missouri River surface area was accomplished through sediment accumulation behind dikes and the removal of river meanders. The Corps of Engineers principally used revetments and permeable pile dikes until 1960 when it turned to rock dikes (Funk and Robinson 1974). Rock dikes increased the siltation rates in backwaters and reduced fish habitat even further. The Missouri River was shortened considerably. In 1879, Rulo, Nebraska was located at river mile 544; it is now located at river mile 498.1 (Funk and Robinson 1974). This is a loss of 45.9 miles. One hundred forty-three unconnected islands were also systematically “removed” from the Missouri River channel between 1879 and 1954. This resulted in a loss of 98% of the island surface area in the Missouri River. Most of the islands are now accreted land which have been claimed by adjacent landowners and converted to agricultural production.

The rainfall that deluged the Missouri and Mississippi river basins in the spring and summer of 1993 caused the largest flood ever measured at St. Louis. Flooding in the Missouri River Basin has become a common event in the 1990s, due in part to unusual weather patterns and in part to the constriction of the floodplain caused by levee construction, channelization of the river and its tributaries, and changes in runoff rates due to land use. Flooding events of this magnitude and duration have caused public concern over regulation and management of the Missouri River Basin and may lead to enlightened floodplain management and restoration efforts.

### **The Fishery**

The descriptions of the early Missouri River fishery sketch a picture of limitless unexploited bounty. Very little information on Missouri River fish stocks before 1905 is available. Twenty-eight fish species were recorded in the river near Saint Joseph, Missouri and Sioux City, Iowa (Jordan and Meek 1885; Meek, 1892). The most distinctive fish species collected by Meek were adapted for life in an environment with persistently high turbidity, wide seasonal fluctuations in flow and temperature, and an unstable river bed (Pflieger and Grace 1987). These species included pallid sturgeon, western silvery minnow, plains minnow, flathead chub, sturgeon chub, and sicklefin chub.

Earliest commercial fish reports are based primarily on the part of fishermen’s catch that went to markets. Smith (1898) reported that 143 fishermen collected 569,710 pounds of fish in 1894. Townsend (1902) reported a 34% increase in the number of commercial fishermen (334) caught 711,687 pound of fish in 1899. Seines and trotlines were popular fishing gears due to the prevalence of sand bars.

The 1890s were the peak period of commercial fishing for sturgeon. These fish were desired for their roe, which was made into caviar, and their flesh, which was smoked (Pflieger 1975). Due in part to this fishing pressure, lake sturgeon, the largest sturgeon species in the Missouri River declined from 2% of the total catch in 1894 to 0.3% in 1899. Sturgeon continued to decline through the early 1900s. Shovelnose sturgeon had dropped from 11% of the catch in 1899 to 1.8% of the catch in 1931 (Funk and Robinson 1974). No lake sturgeon were reported caught by 1931 (Funk and Robinson 1974). Ed Little, of the National Biological Service's Midwest Science Center, began tracking sonar tagged pallid sturgeon in the Missouri River in 1995. This project will attempt to determine pallid sturgeon habitat preferences and movements to aid in habitat conservation and restoration.

Paddlefish harvest increased in the 1890s when lake sturgeon harvest declined. Paddlefish made up 8% of the catch in both 1894 and 1899 (Funk and Robinson 1974). The paddlefish declined markedly in the early 1900s, comprising 0.4% of the total commercial catch by 1931 (Funk and Robinson 1974). The Mississippi Interstate Cooperative Resource Association, and its member state and federal agencies initiated a long-term, multi-state paddlefish study to assess status, distribution, and movement of paddlefish stocks throughout the Mississippi River Basin. The study has microtagged and released 27,011 hatchery-reared juvenile and 158 adult paddlefish in the state of Missouri. Data will be evaluated to determine paddlefish habitat preferences and movements to aid in habitat conservation and restoration.

Catfish were also an important component of the early Missouri River commercial fishery comprising 30% of the catch in 1894 and 24% in 1899 (Funk and Robinson 1974). Catfish harvest remained relatively stable until 1922 and then declined to 9% during the Great Depression in 1931. In 1992 South Dakota, Nebraska, Iowa, Kansas, and Missouri closed the Missouri River to commercial harvest of channel, blue, and flathead catfish because the population was dominated by small, young fish. Commercial fishing was thought to be the major cause of overharvest. The elimination of commercial harvest should allow catfish population levels and size distribution to recover.

Carp were not collected by Meek at St. Joseph in 1884 but had become prevalent by 1894. The Missouri Fish Commission had opened a hatchery in St. Louis in 1880 and stocked carp throughout Missouri for several years. Carp were 12.1% of the reported commercial fish catch in 1894 but were not individually reported in 1899 (Funk and Robinson 1974). The continued decline of the native big-river fish species and the alterations in fish habitat provided plenty of opportunity for the common carp. Carp dominated the commercial fishery in 1908 at 53% of the total catch (Funk and Robinson 1974). Carp continued to increase and was 60 to 64% of the commercial catch from 1945 to 1965 (Funk and Robinson 1974) but carp declined to 39% in 1970 (Funk and Robinson 1974). Funk and Robinson (1974) believed the decrease in carp was due to increased proportions of buffaloes (29%) and catfishes (22%). Pflieger and Grace (1987) postulated that it may be due to the increase of intensive wastewater treatment and improved water quality as carp are tolerant of pollution and have been found concentrated at sewage entry



points.

The state of Missouri did not require commercial fishermen to hold a license or to report their catch prior to 1940. In 1945, H.J. Fisher, a fish biologist with the Missouri Conservation Commission began reviewing the data collected from the monthly reports of Missouri River commercial fishermen. The estimated commercial harvest of Missouri River fish in Missouri in 1945 was:

<u>Species</u>	<u>Pounds</u>	<u>Percentage of Catch</u>
Buffalo	240,112	16.7
Drum	58,950	4.1
Carp & other scalefish	878,493	61.1
Catfish	191,227	13.3
Bullhead	4,313	0.3
Hackleback and sturgeon	17,254	1.2
Paddlefish	17,254	1.2
Eel	1,438	0.1
Total	1,437,895	

Commercial fishermen reported declines of sturgeon, paddlefish, and Missouri suckers in the mid-1940's. Some fishermen were of the opinion that navigation dike construction had eliminated suitable habitat (Fisher 1945).

Reporting of harvest by commercial fishermen was not strictly enforced until 1970. Fishery biologists were able to estimate the total commercial harvest based on the percentage of fishermen reporting their catches. Although estimates before and after 1940 cannot be compared, biologists were able to determine that commercial harvest declined by 80% between 1947 and 1963 (Funk and Robinson 1974). Although many factors effect the success of commercial fishing, the one consistent trend in the Missouri River was the loss of fish habitat to the Bank Stabilization and Navigation Project.

Funk (1969) reported the catch of sport fishermen creeled between 1946 and 1958. Their catch consisted of 45% carp, 21% channel catfish and blue catfish, 7% crappies, 7% bullheads, 6% flathead catfish, 6% sturgeons, 6% flathead catfish, and 2% buffaloes.

H.J. Fisher also completed the first extensive scientific sampling of fish in the Missouri River in Missouri in 1945. Devastating floods had impacted farming in the Missouri River Basin in the early 1940's. The establishment of the Missouri Valley Authority and the construction of several dams on the Missouri River and its tributaries had been proposed. The Conservation Commission needed information on fish stocks to assess the impacts of dam construction. Fisher collected 60

species of fish between the Iowa line and the river mouth. Seventy percent of the fish collected were minnows and other forage-size fishes. Thirty-nine percent of the collected fish were plains minnows while 21% were flathead chubs (Fisher 1962). Fisher collected 5,115 flathead chubs, 9,556 plains minnows, 23 sturgeon chubs, and 66 sicklefin chubs at 16 sampling sites (Fisher 1962). Of the harvestable size fish; carp were 35%, carpsuckers 19%, channel catfish 19%, gizzard shad 9%, buffaloes 6%, bullheads 5%, freshwater drum 5%, mooneyes 4%, centrarchids 3%, and flathead catfish 2% (Fisher 1962).

Carlson et al. (1985) collected 1,806 river sturgeons from the Missouri River in 1978 and 1979. Only five (0.3%) of these fish were pallid sturgeon. Four fish were hybrids of the pallid and shovelnose sturgeon. This ratio of pallid sturgeon to shovelnose sturgeon was much lower than the 36% recorded by Fisher in 1945 (Fisher 1962). The apparent increasing frequency of hybridization between the pallid and shovelnose sturgeons suggests competition between them. Reduced habitat diversity and abundance caused by channelization and reductions in turbidity and sediment load favor the shovelnose sturgeon. Altered hydrology and habitat changes have increased hybridization by changing the two species reproductive chronology and habitat utilization (Carlson et al. 1985).

Bill Pflieger of the Missouri Department of Conservation collected fish in late summer and early fall of 1962-1963 and 1982-1983 from the same stations used by Fisher (1962). Collections were compared chronologically as well as by river stretch (Pflieger and Grace 1987).

Sixty-seven species of fish were collected by Pflieger and Grace (1987) in the 1960s. Skipjack herring, grass carp, and white bass were added to the Missouri River fish fauna after 1945. There were changes in the relative abundance of several large fish species. The gizzard shad and potentially five other fish species (goldeye, bluegill, white crappie, sauger, and freshwater drum) increased from the 1940s to the 1960s. The common carp and bigmouth buffalo declined. Substantial increases for several shiner species including the emerald shiner, river shiner, red shiner, and sand shiner occurred between the 1940s and the 1960s. The speckled chub, sturgeon chub, sicklefin chub, and silver chub showed slight to substantial increases while the plains minnow and flathead chub declined. Olund and Cross (1961) determined the flathead chub feeds primarily on terrestrial insects obtained from the surface by sight feeding. Sight feeding would place the flathead chub higher in the water column than the other chub species making it more susceptible to predation and forcing it to compete with increasing numbers of shiner species (Pflieger and Grace 1987).

Sixty-five fish species were collected by Pflieger and Grace in their 1982-1983 surveys. Many of the trends witnessed from the 1940s to the 1960s continued into the 1980s. Carp and bigmouth buffalo continued to decline, while gizzard shad, bluegill, and freshwater drum continued to increase. Shiners comprised 47.9% of all small fishes collected in the 1980s, compared to 39.5% in the 1960s. Sicklefin chub, speckled chub, and sturgeon chub continued to increase in the 1980s, but the silver chub declined from the 1960s numbers. The flathead chub and western

silvery minnow continued to decline.

Hesse (1994a) reported alarming trends for several chub and minnow species in the Missouri River in Nebraska. Sicklefin, sturgeon, and flathead chubs were not collected from 1983-1993 in either the river upstream from Lewis and Clark Lake or from the unchannelized portion of the river below Gavins Point Dam. Sicklefin and sturgeon chubs have declined in abundance to an extent in the Upper Missouri River that they may be or are likely to become extirpated in some sections (Hesse 1994a). Plains minnows and western silvery minnows were collected in 2 of 10 years above Lewis and Clark Lake, and 4 of 10 years below Gavins Point Dam. In all cases they comprised less than one percent of the total catch. The relative abundance of plains and western silvery minnows in the unchannelized portion of the Missouri River in Nebraska has decreased by 96% (Hesse 1994a). Flathead chubs in that stretch have decreased by 98% (Hesse 1994a). The loss of these fishes in the upper and middle reaches of the Missouri River lends unparalleled importance to maintaining these big river species in the lower river.

Gelwicks et. al. (1996) seined fish in thirteen Missouri River sites in early November 1994. These sites were historically sampled by Pflieger in the 1960s and 1980s. The results of the study did not suggest a decline in the distribution of the sicklefin and sturgeon chubs in the Missouri River in Missouri and suggested a general upstream extension of the range of sicklefin and sturgeon chubs reported by Grace and Pflieger (1985). However, there were declines in the distribution and abundance of the flathead chub, plains minnow, and western silvery minnow. Gelwicks collected one flathead chub at the head of a small channel bar. When compared to the 5,115 flathead chubs collected by Fisher (1962) this represents a drastic reduction in this species.

Kubisiak (1996) and Hooker (1996) collected fish in several Missouri River scour holes created by the 1993 Flood. The scour holes were categorized by their degree of connectivity to the river. Kubisiak found both higher catch rates and higher species richness in sites with a higher degree of connectivity to the river. Fish adapted to riverine conditions such as goldeye, smallmouth buffalo, freshwater drum and several species of chub, preferred sites which were seasonally or continuously connected to the river (Kubisiak 1996). Gizzard shad, red shiner, bigmouth buffalo, carp, mosquitofish, and bluegill appeared to be habitat generalists with no preference for sites either connected to or isolated from the river (Kubisiak 1996). Likewise, Hooker found differences in catch according to habitat use guilds. Floodplain-spawning floodplain-using fish dominated the catch in all sites and categories of connectivity (Hooker 1996). Channel-spawning channel-using fish were only captured in connected or seasonally connected scour holes (Hooker 1996). Hooker also found differences in larval fish densities and diversities. Larval fish densities peaked in connected, seasonal and ditch connected scours from June 20 to July 3, 1995 while densities in isolated scours didn't peak until after August 11, 1995 (Hooker 1996). Isolated scours tended to be dominated by larval sunfish while connected scours were dominated by larval minnows. Information such as that provided by Kubisiak (1996) and Hooker (1996) supports the critical importance of diverse backwater, side channel and floodplain habitats for native big river fishes.

## **Chapter 2**

### **Fish Species Found in Association with Potential Big Muddy National Fish and Wildlife Refuge Areas with Approved Environmental Assessments**

### Jackass Bend Vicinity (RM 336-338L) in Clay, Jackson, and Ray Counties

No historical records are available and no recent surveys have been conducted on this site.

### Bakers Bend/Cranberry Chute Vicinity (RM 278-292R) in Saline and Lafayette Counties

Two lake sturgeon were collected by Bill Pflieger on COE owned property in the vicinity in 1988.

Kubisiak (1996) examined a ditch connected scour hole left by the 1993 Flood at river mile 273.2L with a seine and standard half-circle hauls. Hooker (1996) sampled the same scour hole with gill nets.

bighead carp<sup>H</sup>  
bigmouth buffalo<sup>K, H</sup>  
black crappie<sup>K</sup>  
bluegill<sup>K</sup>  
channel catfish<sup>H</sup>  
common carp<sup>K, H</sup>  
emerald shiner<sup>K</sup>  
gizzard shad<sup>K, H</sup>  
goldeye<sup>H</sup>  
green sunfish<sup>K</sup>  
largemouth bass<sup>K</sup>

longnose gar<sup>H</sup>  
mosquitofish  
northern pike<sup>H</sup>  
quillback<sup>H</sup>  
red shiner<sup>K</sup>  
shortnose gar<sup>K, H</sup>  
smallmouth buffalo<sup>H</sup>  
walleye<sup>H</sup>  
white bass<sup>H</sup>  
white crappie<sup>K</sup>  
white perch<sup>K</sup>



### Little Missouri Bend (rm 237-241R) in Saline County

No historical records are available for this site.

Kubisiak and Hooker both examined a continuously connected scour hole left by the 1993 Flood at river mile 240.5R. Kubisiak<sup>K</sup> (1996) sampled with a seine and standard half-circle hauls while Hooker<sup>H</sup> (1996) sampled with gill nets.

bigmouth buffalo<sup>K</sup>  
 black crappie<sup>K</sup>  
 blue catfish<sup>H</sup>  
 bluegill<sup>K</sup>  
 channel catfish<sup>K, H</sup>  
 common carp<sup>K, H</sup>  
 emerald shiner<sup>K</sup>  
 freshwater drum<sup>K</sup>  
 ghost shiner<sup>K</sup>  
 gizzard shad<sup>K, H</sup>  
 goldeye<sup>K</sup>  
 grass carp<sup>H</sup>  
 green sunfish<sup>K</sup>  
 largemouth bass<sup>K</sup>  
 longnose gar<sup>K, H</sup>  
 mosquitofish<sup>K</sup>

plains minnow<sup>K</sup>  
 quillback<sup>K</sup>  
 rainbow smelt<sup>K</sup>  
 red shiner<sup>K</sup>  
 river carpsucker<sup>K, H</sup>  
 sand shiner<sup>K, H</sup>  
 sauger<sup>K, H</sup>  
 shortnose gar<sup>K, H</sup>  
 shovelnose sturgeon<sup>H</sup>  
 silver chub<sup>K</sup>  
 smallmouth buffalo<sup>K, H</sup>  
 speckled chub<sup>K</sup>  
 suckermouth minnow<sup>K</sup>  
 white bass<sup>K, H</sup>  
 white crappie<sup>K, H</sup>



## Lisbon Bottoms/Jameson Island Vicinity (RM 213-220L/210-216R) in Howard and Saline Counties

Plains killifish were collected in nearby Salt Creek during several sampling trips from 1961 to 1986.

Kubisiak and Hooker examined two continuously connected scour holes left by the 1993 Flood at river miles 214.8R<sup>K1, H1</sup> and 218.2L<sup>K2, H2</sup>. Kubisiak (1996) sampled with a seine and standard half-circle hauls while Hooker (1996) sampled with gill nets.

bighead carp <sup>H1</sup>	johnny darter <sup>K1</sup>
bigmouth buffalo <sup>K1, K2, H1</sup>	largemouth bass <sup>K1, K2</sup>
black crappie <sup>K2</sup>	longnose gar <sup>H2</sup>
bluegill <sup>K1, K2</sup>	mosquitofish <sup>K1, K2</sup>
blue sucker <sup>K1</sup>	plains minnow <sup>K1, K2</sup>
bluntnose minnow <sup>K2</sup>	quillback <sup>K2</sup>
bullhead minnow <sup>K1, K2</sup>	red shiner <sup>K1, K2</sup>
channel catfish <sup>K1, K2, H1, H2</sup>	river carpsucker <sup>K1, K2, H1, H2</sup>
common carp <sup>K1, K2, H1, H2</sup>	sand shiner <sup>K1, K2</sup>
emerald shiner <sup>K1, K2</sup>	sauger <sup>K1, K2, H1, H2</sup>
flathead catfish <sup>K2</sup>	shorthead redhorse <sup>H1</sup>
freshwater drum <sup>K1, K2, H2</sup>	shortnose gar <sup>K1, K2, H1, H2</sup>
ghost shiner <sup>K2</sup>	silver chub <sup>K1, K2</sup>
gizzard shad <sup>K1, K2, H1, H2</sup>	smallmouth buffalo <sup>K1, K2, H2</sup>
goldeye <sup>K1, K2, H1, H2</sup>	speckled chub <sup>K1, K2</sup>
goldfish <sup>K2</sup>	suckermouth minnow <sup>K1, K2</sup>
grass carp <sup>H1, H2</sup>	white bass <sup>K1, K2, H2</sup>
green sunfish <sup>K1, K2</sup>	white crappie <sup>K1, K2, H1</sup>

### Diana Bends Vicinity (RM 187-193R) in Cooper County

Herbert J. Fisher, a fishery biologist with the Missouri Conservation Commission completed the first comprehensive scientific sampling of Missouri River miles 181 to 187.5 in 1945. He used an assortment of gears including hoop nets, trammel nets, and seines to collect the following fish species:

bigmouth buffalo	creek chub	plains minnow
bigmouth shiner	fathead minnow	orangethroat darter
black buffalo	flathead catfish	red shiner
black bullhead	flathead chub	sand shiner
bluegill	freshwater drum	shovelnose sturgeon
bowfin	gizzard shad	sicklefin chub
brown bullhead	golden shiner	silver chub
carpsuckers	green sunfish	smallmouth buffalo
channel catfish	largemouth bass	speckled chub
central stoneroller	mimic shiner	suckermouth minnow
common carp	mooneye	white crappie
common shiner	plains killifish	white sucker

Kubisiak (1996) and Hooker (1996) examined one seasonally connected scour hole left by the 1993 Flood at river mile 187.9R<sup>K1, H1</sup> and one isolated scour hole at rm 190.0L<sup>K2, H2</sup>. Kubisiak sampled with a seine and standard half-circle hauls while Hooker sampled with gill nets.

bighead carp <sup>H2</sup>	ghost shiner <sup>K1</sup>	river carpsucker <sup>K1, H1</sup>
bigmouth buffalo <sup>K1, K2, H1, H2</sup>	gizzard shad <sup>K1, K2, H1, H2</sup>	sand shiner <sup>K1, K2</sup>
black crappie <sup>K2, H2</sup>	goldeye <sup>K1, H1, H2</sup>	sauger <sup>K1, H1, H2</sup>
blue catfish <sup>H1</sup>	green sunfish <sup>K1, K2</sup>	shortnose gar <sup>K1, K2, H1, H2</sup>
bluegill <sup>K1, K2</sup>	hybrid striped bass <sup>H2</sup>	silver carp <sup>H1</sup>
bluntnose minnow <sup>K1</sup>	lake sturgeon <sup>H1</sup>	silver chub <sup>K1</sup>
central stoneroller <sup>K1</sup>	largemouth bass <sup>K1</sup>	smallmouth buffalo <sup>K1, H1</sup>
channel catfish <sup>K1, H1, H2</sup>	longnose gar <sup>K1, H1, H2</sup>	speckled chub <sup>K1</sup>
common carp <sup>K1, K2</sup>	mosquitofish <sup>K1, K2</sup>	suckermouth minnow <sup>K1</sup>
creek chub <sup>K1</sup>	paddlefish <sup>H2</sup>	white bass <sup>K1, K2</sup>
emerald shiner <sup>K1</sup>	plains minnow <sup>K1, K2</sup>	white crappie <sup>K1, K2, H1</sup>
flathead catfish <sup>K1, H1</sup>	quillback <sup>K1</sup>	unidentified Cyprinidae <sup>K1</sup>
freshwater drum <sup>K1, H1, H2</sup>	red shiner <sup>K1, K2</sup>	unidentified larval fish <sup>K1</sup>



### St. Aubert Island Vicinity (RM 118-127R) in Osage County

Bill Pflieger collected three sturgeon chubs in St. Aubert Chute in 1978.

Tim Grace and Bill Pflieger sampled river miles 124-130 in 1982. Sampling included shoreline seining<sup>S</sup> in August and boom-mounted electrofishing<sup>E</sup> in September. They collected the following fish species (Grace and Pflieger 1985):

chestnut lamprey <sup>SE</sup>	sand shiner <sup>S</sup>	spotted bass <sup>E</sup>
shortnose gar <sup>E</sup>	ghost shiner <sup>S</sup>	largemouth bass <sup>F</sup>
American eel <sup>E</sup>	Western silvery minnow <sup>S</sup>	green sunfish <sup>E</sup>
gizzard shad <sup>SE</sup>	plains minnow <sup>S</sup>	orangespotted sunfish <sup>S</sup>
goldeye <sup>SE</sup>	bluntnose minnow <sup>E</sup>	bluegill <sup>SE</sup>
common carp <sup>S</sup>	bigmouth buffalo <sup>E</sup>	white crappie <sup>E</sup>
silver chub <sup>S</sup>	smallmouth buffalo <sup>E</sup>	sauger <sup>E</sup>
speckled chub <sup>S</sup>	river carpsucker <sup>SE</sup>	Ozark logperch <sup>S</sup>
flathead chub <sup>S</sup>	quillback <sup>E</sup>	freshwater drum <sup>SE</sup>
sturgeon chub <sup>S</sup>	shorthead redhorse <sup>E</sup>	
sicklefin chub <sup>S</sup>	channel catfish <sup>SE</sup>	
emerald shiner <sup>S</sup>	mosquitofish <sup>S</sup>	
river shiner <sup>S</sup>	white bass <sup>E</sup>	

Gelwicks collected fish by seine at three locations at this site in 1995: the channel side of a connected bar near the mouth of the Osage River at rms 129.8L, 129.7L, and 129.1L (Gelwicks 1996).

blue catfish	gizzard shad	sicklefin chub
bluegill	red shiner	silver chub
bluntnose minnow	river carpsucker	speckled chub
channel catfish	rosyface shiner	sturgeon chub
emerald shiner	shorthead redhorse	white x striped bass

### **Chapter 3**

## **Fish Species Found in Association with Lower Missouri River Biologically Significant Areas**

### Sunshine Lake Vicinity (RM 318-328L) in Lafayette and Ray Counties

Herbert J. Fisher, a fishery biologist with the Missouri Conservation Commission completed the first comprehensive scientific sampling of Missouri River miles 323 to 325 in 1945. He used an assortment of gears including hoop nets, trammel nets, and seines to collect the following fish species:

bigmouth buffalo	flathead catfish	mimic shiner	shortnose gar
carpsuckers	flathead chub	pallid sturgeon	sicklefin chub
channel catfish	freshwater drum	plains minnow	silver chub
common carp	goldeye	red shiner	smallmouth buffalo
fathead minnow			

Bill Pflieger, MDC fish biologist, collected eleven sicklefin chubs and two sturgeon chubs in the vicinity in 1963.

Tim Grace and Bill Pflieger sampled river miles 313.6-324.1 in 1982. Sampling included shoreline seining<sup>S</sup> in August and boom-mounted electrofishing<sup>E</sup> in September. They collected the following fish species (Grace and Pflieger 1985):

shortnose gar <sup>SE</sup>	emerald shiner <sup>S</sup>	bigmouth buffalo <sup>E</sup>	largemouth bass <sup>E</sup>
longnose gar <sup>E</sup>	river shiner <sup>S</sup>	smallmouth buffalo <sup>E</sup>	green sunfish <sup>E</sup>
gizzard shad <sup>SE</sup>	red shiner <sup>S</sup>	river carpsucker <sup>E</sup>	bluegill <sup>SE</sup>
goldeye <sup>S</sup>	sand shiner <sup>S</sup>	channel catfish <sup>SE</sup>	white crappie <sup>SE</sup>
common carp <sup>SE</sup>	Western silvery minnow <sup>S</sup>	blue catfish <sup>S</sup>	black crappie <sup>S</sup>
silver chub <sup>S</sup>	plains minnow <sup>S</sup>	flathead catfish <sup>S</sup>	sauger <sup>SE</sup>
speckled chub <sup>S</sup>	fathead minnow <sup>S</sup>	white bass <sup>SE</sup>	freshwater drum <sup>SE</sup>
suckermouth minnow <sup>S</sup>	minnow species <sup>S</sup>	striped bass <sup>E</sup>	

The Sunshine Lake vicinity was studied by both Gelwicks in 1994 and by Kubisiak and Hooker in 1995. Gelwicks<sup>G</sup> collected fish by seine at eleven locations at this site: channel bar head and channel side at rm 324.2R, a connected bar head and channel side at rm 322.2L, a channel margin at rm 323.2L, a connected bar head and channel side at rm 321.5L, a channel margin upstream of a wing dike at rm 321.6L, and the channel and bank sides of a channel bar at rm 319.7R. Kubisiak and Hooker both examined two isolated scour holes left by the 1993 Flood at river miles 318.6L<sup>K1, H1</sup> and 328.5L<sup>K2, H2</sup>. Kubisiak (1996) sampled with a seine and standard half-circle hauls. Hooker (1996) sampled with gill nets.

bighead carp <sup>H1</sup>	black crappie <sup>K2</sup>	common carp <sup>G, K1, K2, H1, H2</sup>
bigmouth buffalo <sup>K1, K2, H2</sup>	blue catfish <sup>H2</sup>	emerald shiner <sup>G, K2</sup>
bigmouth shiner <sup>G</sup>	bluegill <sup>H2</sup>	flathead catfish <sup>G</sup>
black bullhead <sup>K1, H2</sup>	channel catfish <sup>G, H1, H2</sup>	freshwater drum <sup>K2, H2</sup>

gizzard shad <sup>G, K1, K2, H2</sup>	plains minnow <sup>G</sup>	smallmouth buffalo <sup>K2, H1, H2</sup>
goldeye <sup>H2</sup>	quillback <sup>K2</sup>	speckled chub <sup>G</sup>
goldfish <sup>K2</sup>	rainbow smelt <sup>G</sup>	speckled x sturgeon chub <sup>G</sup>
grass carp <sup>H2</sup>	red shiner <sup>G, K1, K2</sup>	striped bass <sup>H1, H2</sup>
green sunfish <sup>K1</sup>	river carpsucker <sup>G, K2, H2</sup>	sturgeon chub <sup>G</sup>
hybrid striped bass <sup>H2</sup>	river shiner <sup>G</sup>	western silvery minnow <sup>G</sup>
largemouth bass <sup>K1, K2</sup>	sand shiner <sup>G</sup>	white bass <sup>K1, K2, H1, H2</sup>
longnose gar <sup>H1, H2</sup>	shortnose gar <sup>H1, H2</sup>	white crappie <sup>K1, K2, H2</sup>
mosquitofish <sup>K1, K2</sup>	sicklefin chub <sup>G</sup>	
orange-spotted sunfish <sup>K2</sup>	silver chub <sup>G</sup>	

### **Crooked River Cutoff/Hicklin Lake (RM 309-312L,R) in Lafayette and Ray Counties**

No historical records are available and no recent surveys have been conducted on this site.

### **Wakanda Creek/Chute Vicinity (RM 257-265L) in Carroll County**

Herbert J. Fisher, a fishery biologist with the Missouri Conservation Commission completed the first comprehensive scientific sampling of Missouri River miles 262 to 269.2 in 1945. He used an assortment of gears including hoop nets, trammel nets, and seines to collect the following fish species:

bigmouth buffalo	carpsuckers	mimic shiner	shovelnose sturgeon	sturgeon chub
black buffalo	emerald shiner	mooneye	silver chub	white crappie
black crappie	flathead catfish	paddlefish	smallmouth buffalo	
bluegill	flathead chub	plains minnow	speckled chub	
bowfin	freshwater drum	red shiner		

Bill Pflieger collected two sicklefin chubs in 1982 within the vicinity.

Tim Grace and Bill Pflieger sampled river miles 262-271 in 1982. Sampling included shoreline seining<sup>S</sup> in September and boom-mounted electrofishing<sup>E</sup> in October. They collected the following fish species (Grace and Pflieger 1985):

chestnut lamprey <sup>E</sup>	flathead chub <sup>S</sup>	plains minnow <sup>S</sup>	mosquitofish <sup>S</sup>
shortnose gar <sup>E</sup>	sicklefin chub <sup>S</sup>	fathead minnow <sup>S</sup>	white bass <sup>SE</sup>
longnose gar <sup>E</sup>	emerald shiner <sup>S</sup>	river carpsucker <sup>SE</sup>	green sunfish <sup>S</sup>
gizzard shad <sup>SE</sup>	river shiner <sup>S</sup>	shorthead redhorse <sup>E</sup>	bluegill <sup>S</sup>
goldeye <sup>SE</sup>	red shiner <sup>S</sup>	channel catfish <sup>SE</sup>	white crappie <sup>E</sup>
common carp <sup>SE</sup>	sand shiner <sup>S</sup>	blue catfish <sup>S</sup>	sauger <sup>S</sup>
silver chub <sup>S</sup>	Western silvery minnow <sup>S</sup>	flathead catfish <sup>S</sup>	freshwater drum <sup>SE</sup>
speckled chub <sup>S</sup>			

The Wakanda Creek vicinity was studied by both Gelwicks in 1994 and by Kubisiak and Hooker in 1995. Gelwicks<sup>G</sup> collected fish by seine at thirteen locations at this site: channel margins upstream of wing dikes at rm 269.2L and 266.6L, a channel bar head at rm 267.4R, a channel margin between wing dikes at rm 266.0L, the channel and bank sides of channel bars at rms 265.8L and 262.9L, and the channel margins upstream and downstream of the chute at rms 262.0L and 262.2L, respectively. Kubisiak and Hooker examined a ditch connected scour hole left by the 1993 Flood at river mile 261.2R. Kubisiak<sup>K</sup> (1996) sampled with a seine and standard half-circle hauls. Hooker<sup>H</sup> (1996) sampled with gill nets.

bighead carp <sup>H</sup>	paddlefish <sup>H</sup>	sicklefin chub <sup>G,K</sup>
bigmouth buffalo <sup>K, H</sup>	plains minnow <sup>K</sup>	silver chub <sup>G,K</sup>
black crappie <sup>K</sup>	quillback <sup>K</sup>	smallmouth buffalo <sup>K, H</sup>
bluegill <sup>G,K</sup>	rainbow smelt <sup>G</sup>	speckled chub <sup>G</sup>
central stoneroller <sup>K</sup>	red shiner <sup>G,K</sup>	speckled x sturgeon chub <sup>G</sup>
channel catfish <sup>G</sup>	river carpsucker <sup>G, K, H</sup>	sturgeon chub <sup>G</sup>
common carp <sup>K, H</sup>	river shiner <sup>K</sup>	suckermouth minnow <sup>K</sup>
emerald shiner <sup>G, K</sup>	sand shiner <sup>G</sup>	white bass <sup>G,K</sup>
gizzard shad <sup>G, K, H</sup>	sauger <sup>G, K</sup>	white crappie <sup>K</sup>
goldeye <sup>G, K, H</sup>	shortnose gar <sup>K, H</sup>	unidentified Cyprinidae <sup>K</sup>
largemouth bass <sup>K, H</sup>	shovelnose sturgeon <sup>G, H</sup>	unidentified Notropis sp. <sup>K</sup>
mosquitofish <sup>K</sup>		

### **Little Chariton River (Old Channel Chariton River) Vicinity (RM 227-240L) in Chariton County**

Herbert J. Fisher, a fishery biologist with the Missouri Conservation Commission completed the first comprehensive scientific sampling of Missouri River miles 225 to 232 in 1945. He used an assortment of gears including hoop nets, trammel nets, and seines to collect the following fish:

bigmouth buffalo	flathead catfish	mooneye	sicklefin chub
bigmouth shiner	flathead chub	pallid sturgeon	smallmouth buffalo
blue catfish	freshwater drum	plains minnow	suckermouth minnow
bluntnose minnow	gizzard shad	red shiner	Topeka shiner
carpsuckers	mimic shiner	shortnose gar	walleye
central stoneroller	Mississippi silvery	shovelnose sturgeon	
creek chub	minnow		

Bill Pflieger reported the collection of one pallid sturgeon at the mouth of the Little Chariton River in 1944.

Tim Grace and Bill Pflieger sampled river miles 221.5-231.5 in 1982. Sampling included shoreline seining<sup>S</sup> in September and boom-mounted electrofishing<sup>E</sup> in October. They collected the following fish species (Grace and Pflieger 1985):

shortnose gar <sup>E</sup>	sturgeon chub <sup>S</sup>	plains minnow <sup>S</sup>	blue catfish <sup>S</sup>
longnose gar <sup>E</sup>	sicklefin chub <sup>S</sup>	bluntnose minnow <sup>S</sup>	flathead catfish <sup>SE</sup>
gizzard shad <sup>SE</sup>	emerald shiner <sup>S</sup>	fathead minnow <sup>S</sup>	white bass <sup>E</sup>
goldeye <sup>S</sup>	river shiner <sup>S</sup>	blue sucker <sup>S</sup>	green sunfish <sup>SE</sup>
rainbow smelt <sup>S</sup>	bigmouth shiner <sup>S</sup>	bigmouth buffalo <sup>E</sup>	bluegill <sup>SE</sup>
common carp <sup>E</sup>	red shiner <sup>S</sup>	black buffalo <sup>E</sup>	white crappie <sup>SE</sup>
silver chub <sup>S</sup>	sand shiner <sup>S</sup>	river carpsucker <sup>SE</sup>	sauger <sup>S</sup>
speckled chub <sup>S</sup>	Western silvery	sucker species <sup>S</sup>	freshwater drum <sup>SE</sup>
flathead chub <sup>S</sup>	minnow <sup>S</sup>	channel catfish <sup>S</sup>	

The Little Chariton River vicinity was studied by both Gelwicks in 1994 and by Kubisiak and Hooker in 1995. Gelwicks<sup>G</sup> (1996) collected fish by seine at seven locations at this site: the channel and head sides of a connected bar at rm 231.9L, a channel margin downstream of a wing dike at rm 230.1L, a channel margin between wing dikes at rm 229.1L, and the channel, backwater, and head sides of a channel bar at rm 227.0R. Kubisiak and Hooker examined a continuously connected scour hole left by the 1993 Flood at river mile 247.1L. Kubisiak<sup>K</sup> (1996) sampled with a seine and standard half-circle hauls. Hooker<sup>H</sup> (1996) sampled with gill nets.

bighead carp <sup>H</sup>	freshwater drum <sup>K</sup>	plains minnow <sup>K</sup>	sicklefin chub <sup>G</sup>
bigmouth buffalo <sup>K, H</sup>	ghost shiner <sup>K</sup>	quillback <sup>K</sup>	silver chub <sup>G, K</sup>
bigmouth shiner <sup>G</sup>	gizzard shad <sup>G, K, H</sup>	rainbow smelt <sup>G, K</sup>	smallmouth buffalo <sup>K, H</sup>
black bullhead <sup>K</sup>	goldeye <sup>K</sup>	red shiner <sup>G, K</sup>	speckled chub <sup>G, K</sup>
black crappie <sup>K</sup>	goldfish <sup>K</sup>	redfin shiner <sup>K</sup>	speckled x sturgeon chub <sup>G</sup>
blue catfish <sup>H</sup>	grass carp <sup>H</sup>	river carpsucker <sup>G, K</sup>	sturgeon chub <sup>G</sup>
bluegill <sup>K</sup>	green sunfish <sup>K</sup>	river shiner <sup>K</sup>	suckermouth minnow <sup>K</sup>
bluntnose minnow <sup>K</sup>	hybrid striped bass <sup>H</sup>	sand shiner <sup>G, K</sup>	white bass <sup>K</sup>
central stoneroller <sup>K</sup>	largemouth bass <sup>K</sup>	sauger <sup>K, H</sup>	white crappie <sup>K, H</sup>
channel catfish <sup>G, K, H</sup>	logperch <sup>K</sup>	shortnose gar <sup>K, H</sup>	
common carp <sup>K, H</sup>	longnose gar <sup>K, H</sup>	shovelnose	
emerald shiner <sup>G, K</sup>	mosquitofish <sup>K</sup>	sturgeon <sup>G</sup>	

### Wallace Island Vicinity (RM 203-209L) in Howard County

No historical records are available for this site.

Kubisiak (1996) and Hooker (1996) examined a ditch connected scour hole left by the 1993 Flood at river mile 204.0L. Kubisiak<sup>K</sup> sampled with a seine and standard half-circle hauls while Hooker<sup>H</sup> sampled with gill nets.

bighead carp <sup>H</sup>	freshwater drum <sup>H</sup>	mosquitofish <sup>K</sup>	white bass <sup>H</sup>
bigmouth buffalo <sup>K</sup>	ghost shiner <sup>K</sup>	paddlefish <sup>H</sup>	white crappie <sup>K</sup>
black crappie <sup>K</sup>	gizzard shad <sup>K, H</sup>	red shiner <sup>K</sup>	white perch <sup>K</sup>
bluegill <sup>K</sup>	grass carp <sup>H</sup>	river carpsucker <sup>H</sup>	unidentified Cyprinidae <sup>K</sup>
channel catfish <sup>H</sup>	green sunfish <sup>K</sup>	sand shiner <sup>K</sup>	
common carp <sup>K, H</sup>	largemouth bass <sup>K</sup>	shortnose gar <sup>H</sup>	
emerald shiner <sup>K</sup>	longnose gar <sup>H</sup>	smallmouth buffalo <sup>H</sup>	

### Morrison Bend/Big Tavern Creek (RM 110-113L) in Callaway and Montgomery Counties

Topeka shiner, plains topminnow and blacknose shiner have all been found in a tributary stream within the vicinity of this area. These species are unlikely to be found in the Missouri River unless washed into the river in a high flow event. No recent surveys have been conducted on this site.

### Berger Bend (Bates Island Complex) Vicinity (RM 90-94L,R) in Franklin and Warren Counties

Herbert J. Fisher, a fishery biologist with the Missouri Conservation Commission completed the first comprehensive scientific sampling of Missouri River miles 93.5 to 100 in 1945. He used an assortment of gears including hoop nets, trammel nets, and seines to collect the following fish species:

bigmouth buffalo	bluntnose minnow	freshwater drum	redfin shiner
black bullhead	carpsuckers	gizzard shad	shovelnose sturgeon
black crappie	channel catfish	green sunfish	smallmouth buffalo
blue catfish	chestnut lamprey	longear sunfish	Topeka shiner
blue sucker	creek chub	mooneye	white crappie
bluegill	flathead catfish	red shiner	yellow bullhead

One lake sturgeon was located in 1988 by Missouri Department of Conservation biologists in the vicinity.

Gelwicks collected fish by seine at three locations at this site in 1995: the bank side of a channel bar at rm 99.5L, a channel margin upstream of a wing dike at rm 100.1R, and a channel margin upstream of a small tributary at rm 100.8R (Gelwicks 1996).

bluegill	emerald shiner	largemouth bass	river carpsucker	speckled chub
channel catfish	freshwater drum	longear sunfish	sicklefin chub	striped shiner
channel shiner	gizzard shad	red shiner	silver chub	

### **Pickney Bend Vicinity (RM 83-85R) in Franklin County**

No historical records are available and no recent surveys have been conducted on this site.

### **Goose Island Vicinity (RM 74-81L) in Warren County**

Herbert J. Fisher, a fishery biologist with the Missouri Conservation Commission completed the first comprehensive scientific sampling of Missouri River miles 80 to 82.4 in 1945. He used an assortment of gears including hoop nets, trammel nets, and seines to collect the following fish species:

bigmouth buffalo	common carp	green sunfish	red shiner	suckermouth
black bullhead	fathead minnow	largemouth bass	shortnose gar	minnow
bluegill	flathead catfish	mimic shiner	sicklefin chub	walleye
blue catfish	flathead chub	paddlefish	silver chub	white crappie
carpsuckers	freshwater drum	plains killifish	smallmouth buffalo	
channel catfish	gizzard shad	plains minnow		

MDC fish biologists collected one lake sturgeon, twenty-six sicklefin chubs, and five plains killifish within the vicinity in 1945.

Tim Grace and Bill Pflieger sampled river miles 77.8-69.5 in 1982. Sampling included shoreline seining<sup>S</sup> in September and boom-mounted electrofishing<sup>E</sup> in October. They collected the following fish species (Grace and Pflieger 1985):

chestnut lamprey <sup>E</sup>	Alabama shad <sup>S</sup>	speckled chub <sup>S</sup>	river shiner <sup>S</sup>
shovelnose sturgeon <sup>S</sup>	gizzard shad <sup>SE</sup>	flathead chub <sup>S</sup>	bigeye shiner <sup>S</sup>
shortnose gar <sup>SE</sup>	goldeye <sup>S</sup>	sturgeon chub <sup>S</sup>	red shiner <sup>S</sup>
longnose gar <sup>E</sup>	common carp <sup>E</sup>	sicklefin chub <sup>S</sup>	sand shiner <sup>S</sup>
skipjack herring <sup>E</sup>	silver chub <sup>S</sup>	emerald shiner <sup>S</sup>	channel mimic shiner <sup>S</sup>



ghost shiner <sup>S</sup>	bigmouth buffalo <sup>E</sup>	flathead catfish <sup>S</sup>	white crappie <sup>E</sup>
Western silvery minnow <sup>S</sup>	smallmouth buffalo <sup>E</sup>	white bass <sup>SE</sup>	sauger <sup>S</sup>
plains minnow <sup>S</sup>	river carpsucker <sup>SE</sup>	largemouth bass <sup>E</sup>	freshwater drum <sup>SE</sup>
bluntnose minnow <sup>S</sup>	shorthead redhorse <sup>S</sup>	bluegill <sup>SE</sup>	
	channel catfish <sup>SE</sup>		

Gelwicks collected fish by seine at four locations at this site in 1995: a channel margin downstream of a small tributary at rm 77.6R, a channel margin downstream of a small tributary at rm 76.5R, a channel margin over a flooded channel bar at rm 76.4L, and a channel margin upstream of a wing dike at rm 75.1L (Gelwicks 1996).

bluegill	common carp	rainbow smelt	shorthead redhorse	striped shiner
bluntnose minnow	emerald shiner	red shiner	sicklefin chub	
channel catfish	freshwater drum	river carpsucker	silver chub	
channel shiner	gizzard shad	sand shiner	speckled chub	

### **Marthasville Bend/St. John's Island Vicinity (RM 67-73L,R) in Franklin and Warren Counties**

Sicklefin and sturgeon chubs were found in seine samples collected by Bill Pflieger, MDC in 1963.

Tim Grace and Bill Pflieger sampled river miles 77.8-69.5 in 1982. Sampling included shoreline seining<sup>S</sup> in September and boom-mounted electrofishing<sup>E</sup> in October. They collected the following fish species (Grace and Pflieger 1985):

chestnut lamprey <sup>E</sup>	sturgeon chub <sup>S</sup>	bigmouth buffalo <sup>E</sup>
shovelnose sturgeon <sup>S</sup>	sicklefin chub <sup>S</sup>	smallmouth buffalo <sup>E</sup>
shortnose gar <sup>SE</sup>	emerald shiner <sup>S</sup>	river carpsucker <sup>SE</sup>
longnose gar <sup>E</sup>	river shiner <sup>S</sup>	shorthead redhorse <sup>S</sup>
skipjack herring <sup>E</sup>	bigeye shiner <sup>S</sup>	channel catfish <sup>SE</sup>
Alabama shad <sup>S</sup>	red shiner <sup>S</sup>	flathead catfish <sup>S</sup>
gizzard shad <sup>SE</sup>	sand shiner <sup>S</sup>	white bass <sup>SE</sup>
goldeye <sup>S</sup>	channel mimic shiner <sup>S</sup>	largemouth bass <sup>E</sup>
common carp <sup>E</sup>	ghost shiner <sup>S</sup>	bluegill <sup>SE</sup>
silver chub <sup>S</sup>	Western silvery minnow <sup>S</sup>	white crappie <sup>E</sup>
speckled chub <sup>S</sup>	plains minnow <sup>S</sup>	sauger <sup>S</sup>
flathead chub <sup>S</sup>	bluntnose minnow <sup>S</sup>	freshwater drum <sup>SE</sup>

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**Dubois Creek Vicinity (RM 65-67R) in Franklin County**

No historical records are available and no recent surveys have been conducted on this site.

**Boles Bend/Dunn Spring Creek/Volkerding Island Vicinity (RM 59-65L,R) in Franklin and St. Charles Counties**

No historical records are available and no recent surveys have been conducted on this site.

**Hinkles Bend Vicinity (57-59L) in Franklin and St. Charles Counties**

One blue sucker was located within the vicinity by Bill Pflieger on COE owned property in 1986. No recent surveys have been conducted on this site.

**St. Albans Island Vicinity (RM 53-54R) in Franklin and St. Charles Counties**

One blue sucker was located on COE property within the vicinity by Danny Brown in 1994. No recent surveys have been conducted on this site.

**Johnson Island/Bonhomme Island (Chute) Vicinity (RM 40-44R/38-42L) in St. Charles and St. Louis Counties**

Bill Pflieger collected nine sicklefin chubs and 3 sturgeon chubs within the vicinity in 1963. No recent surveys have been conducted on this site.

**Catfish Island Vicinity (RM 35-37L) in St. Charles County**

No historical records are available and no recent surveys have been conducted on this site.

### **Jane Downing Island Vicinity (RM 32-34R) in St. Louis County**

Twenty-six sicklefin chubs were collected in seine samples by Bill Pflieger of the Missouri Department of Conservation in 1982.

Gelwicks (1996) collected fish by seine at three locations at this site in 1995: a channel margin downstream of a dry chute at rm 31.1L, and the channel and bank sides of a channel bar at rm 34.9L.

black crappie	emerald shiner	red shiner	silver chub
bluegill	freshwater drum	river carpsucker	speckled chub
channel catfish	gizzard shad	sand shiner	sturgeon chub
channel shiner	rainbow smelt	sicklefin chub	

### **Bryan Island (Cowmire Creek) Vicinity (RM 22-27R) in St. Louis County**

Herbert J. Fisher, a fishery biologist with the Missouri Conservation Commission completed the first comprehensive scientific sampling of Missouri River miles 16.7 to 28.5 in 1945. He used an assortment of gears including hoop nets, trammel nets, and seines to collect the following fish species:

bigmouth buffalo	central stoneroller	longnose gar	sauger
black buffalo	channel catfish	mimic shiner	shortnose gar
black bullhead	chestnut lamprey	Mississippi silvery	shovelnose sturgeon
black crappie	common carp	minnow	sicklefin chub
bluegill	flathead catfish	mooneye	silver chub
blue catfish	flathead chub	mosquitofish	smallmouth buffalo
blue sucker	freshwater drum	orangespotted sunfish	walleye
bluntnose minnow	gizzard shad	paddlefish	white crappie
bowfin	green sunfish	plains minnow	white sucker
carpsuckers	largemouth bass	red shiner	

Three sicklefin chubs were collected by Missouri Department of Conservation fisheries biologists in 1946.

Gelwicks collected fish by seine at eight locations at this site in 1995: channel bar head between channel bars, and between bank and bar at upstream end of Car of Commerce chute at rm 16.3R, a connected bar at upper end of Car of Commerce chute and channel side of Car of Commerce chute at rm 16.2R, a connected bar at upper end of Car of Commerce chute and channel side along mainstem at rm 16.2R (Gelwicks 1996).

bluegill	ghost shiner	river shiner	speckled x sturgeon
channel catfish	gizzard shad	sicklefin chub	chub
channel shiner	grass carp	silver chub	sturgeon chub
emerald shiner	red shiner	silverband shiner	white bass
freckled madtom	river carpsucker	speckled chub	white x striped bass
freshwater drum			

### **Brickhouse Bend (Littles Island) Vicinity (RM 8-11L) in St. Charles County**

Bill Pflieger collected 101 sicklefin chubs within the vicinity in 1963. No recent surveys have been conducted on this site.

### **Cora Island/Chute Vicinity (RM 2-8L) in St. Charles County**

No historical records are available and no recent surveys have been conducted on this site.



## **Chapter 4**

### **Life History Accounts of Selected Lower Missouri River Fishes**

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## Federally listed fish species

### **Pallid Sturgeon** (*Scaphirhynchus albus*) Endangered Species



The pallid sturgeon was not recognized as a species until 1905, so little is known concerning its early abundance and distribution. It has probably always been rare. In the early 1900's pallid sturgeon comprised only 1 in 500 river sturgeon captured in the Mississippi River at Grafton, Illinois (Forbes and Richardson 1905). The pallid sturgeon was listed as an endangered species throughout its entire range in October 1990.

The pallid sturgeon occurs in large rivers of central North America in the Missouri and Mississippi River drainages (Bailey and Cross 1954). Pallid sturgeon prefer to live in turbid waters with rapid current over sand, gravel, or rock bottoms (Forbes and Richardson 1905, Carlson et al. 1985). Carlson et al (1985) captured pallid sturgeon in the main channels of the Missouri River along sandbars at the inside of river bends and behind wing dikes with deeply scoured trenches. The largest remaining population in Missouri occurs in the Mississippi River below St. Louis (National Paddlefish and Sturgeon Steering Committee 1993).

Carlson et al (1985) found that aquatic invertebrates comprised most of the diet for river sturgeons in the state of Missouri. Pallid sturgeon, however, had a greater proportion of fish in the diet than did shovelnose sturgeon.

The pallid sturgeon looks similar to the shovelnose sturgeon but is usually paler in color, and has less prominent bony plates, with none occurring on the belly. The two longer outer barbels of the pallid sturgeon are slightly farther back than the two shorter inner barbels.

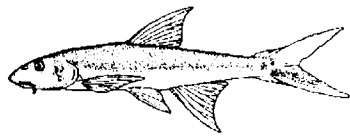
Pallid sturgeon are known to hybridize with the smaller shovelnose sturgeon. Hybrids were first identified in the Mississippi River below St. Louis, Missouri in the late 1970's (Carlson et al. 1985). Hybrids may constitute a serious threat to the survival of pallid sturgeon through competition and the potential for genetic swapping.

The pallid sturgeon matures very slowly. Males reach sexual maturity at ages 5-7. Females begin egg development at ages 9-12 and first spawn at ages 15-20 (Keenlyne and Jenkins 1993). Observations of pectoral fin rays by Keenlyne and Jenkins (1993) indicate that females wait for several years before spawning again. Pallid sturgeon may spawn in late April or early May in the lower Missouri and middle Mississippi Rivers.

Pallid sturgeon were first artificially spawned by the Missouri Department of Conservation in 1992. Pallid sturgeon marked with floy-type tags were released by the Missouri Department of Conservation in 1994.

Kallemeyn (1983) stated that management of pallid sturgeon is hindered by lack of detailed information about its life history and habitat use. Williams et al. (1989) indicated that pallid sturgeon declines were due to: 1) present or threatened destruction, modification, or curtailment of its habitat or range; and 2) other natural or man-made factors affecting its continued existence (hybridization, introduction of exotic or transplanted species, predation, and competition).

**Sicklefin Chub** (*Macrhybopsis meeki* Jordan and Evermann) Candidate species



This small silvery minnow has long sickle-shaped pectoral fins. It is a pale yellowish-brown with silvery white sides and belly. Adults are typically 2.4 to 3.7 inches long to a maximum of 4 inches (Pflieger 1975).

The original description of the sicklefin chub is based on specimens collected in the Missouri River near St. Joseph in 1884. Sicklefin chub were historically collected infrequently, and their abundance in relation to other species in historic collections was usually not reported.

The sicklefin chub occurs in the Missouri River and the lower Mississippi River at least as far downstream as the mouth of the Ohio. The sicklefin chub is strictly confined to the main channels of large, turbid rivers where it lives in a strong current over a bottom of sand or fine gravel (Pflieger 1975). Water quality requirements are unknown, but this species is specialized for life in the turbid Missouri River. The eyes are reduced in size and are partly covered by skin. External taste buds are less well developed than in the sturgeon chub, but are better developed than in chubs that live in clear water (Pflieger 1975). Feeding habits haven't been extensively studied. Reigh and Elsen (1979) examined stomach contents of three sicklefin chubs and found insects and other unidentifiable material.

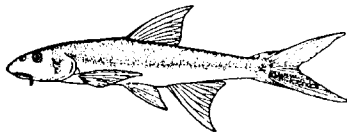
Spawning requirements are not well known. Lopinot and Smith (1973) reported that sicklefin chub reproduce at 1 year of age and spawn annually. Spawning is believed to occur in spring as young-of-the-year have been collected in July from the Missouri River (Pflieger 1975). Etnier (unpub. data) collected young-of-the-year sicklefin chub from the Missouri River in Missouri in 1990. Eighteen sicklefin chubs collected by the LTRMP Station in Cape Girardeau, MO in 1992 were young-of-the-year or juvenile fish. However, Pflieger and Hrabik (unpub. data) considered they might be waifs from the lower Missouri River and there may not be a self-sustaining population in the Mississippi River.

Pflieger and Grace (1987) reported sicklefin chub species composition for three time periods: 0.7 percent (1940-1945); 2.1 percent (1962-1972); and 2.8 percent (1978-1983). When analyzed by river reach, sicklefin chub were nearly absent from the Missouri River between Kansas City and

the Iowa border. This includes the type locality. Abundance was greater downstream of Kansas City and greatest between St. Joseph and St. Louis, Missouri. These increases in abundance were likely due to effects of major tributaries such as the Kansas and Osage Rivers on physical and chemical characteristics of the Missouri River. Increases in abundance may also be related to increases in gravel substrate as a result of the upstream reservoirs trapping fine sediments (Pflieger unpub. data). Pflieger (unpub. data) collected 6 specimens in 1992 near Marion, Missouri.

Cross (1967) suggested that this species is so specialized for life in the large, silt-laden Missouri and lower Mississippi Rivers that their survival might be threatened by impoundments and other habitat modifications. Aquatic habitat restoration on the Missouri and Mississippi Rivers via flow regime changes and/or physical habitat restoration should be pursued (Werdon 1993a). The Big Muddy National Fish and Wildlife Refuge is a specific opportunity to recover the sicklefin chub.

#### **Sturgeon Chub** (*Macrhybopsis gelida* Girard) Candidate species



This small member of the minnow family seldom exceed 3 inches in length. It is light brown to light green above with many fine dark specks. The sturgeon chub has a sucker-like mouth with barbels at the corners.

The sturgeon chub was first collected from the Milk River in Montana during the Pacific Railroad Surveys of 1853-1855 (Girard 1856). Sturgeon chub were historically collected infrequently, and their abundance in relation to other species in historic collections was usually not reported.

The sturgeon chub occurs in the Missouri River and the lower Mississippi River at least as far downstream as the mouth of the Ohio. It does not enter tributary streams and does not ascend the Mississippi River above the mouth of the Missouri. This fish inhabits the open channels of large, silty rivers and occurs in swift current over a bottom of rock, sand or fine gravel (Pflieger 1975). It is mostly carnivorous, consuming aquatic insect larvae. Like the sicklefin chub, this species is specialized for life in the turbid Missouri River. Its eyes are reduced in size, and external taste buds are abundantly developed over the head, body, and fins (Pflieger 1975). Stewart (1981) observed that if turbidity declined, sturgeon chub were eliminated, both from a competitive standpoint and based upon physiological and morphological characteristics.

Sturgeon chubs are short-lived (4 years) and both sexes mature at 2 years (Stewart 1981, Werdon 1992). Mature males are 78-79 mm total length, while mature females are 76-81 mm total length (Werdon 1992). Breeding males have tubercles along the edges of the pectoral fins (Pflieger



1975). Spawning is likely influenced by water temperature and increasing flows due to snowmelt or precipitation events. Ripe males were collected at 23 C in Kansas (Cross 1967). Although eggs and larval fish have not been collected, reproduction was documented on the Missouri River in Missouri in 1990 by the collection of 40 young-of-the-year (Etnier, unpublished data).

Pflieger and Grace (1987) reported sturgeon chub species composition for three time periods: 0.1 percent (1940-1945); 0.2 percent (1962-1972); and 0.8 percent (1978-1983). When analyzed by river reach, sturgeon chub were nearly absent from the Missouri River between Kansas City and the Iowa border. Abundance was greater downstream of Kansas City and greatest between St. Joseph and St. Louis, Missouri.

Aquatic habitat restoration on the Missouri and Mississippi Rivers via flow regime changes and/or physical habitat restoration should be pursued (Werdon 1993b). The Big Muddy National Fish and Wildlife Refuge is a specific opportunity to recover the sturgeon chub.

### **Topeka Shiner** (*Notropis topeka*) Candidate species

The Topeka shiner is a pelagic species. It prefers pools in small, prairie streams with high water quality, cool temperatures and bottoms composed mostly of sand, gravel or rubble (Pflieger 1975). It occurs in schools in midwater or near the surface often with the redbfin, sand, common, and red shiners (Pflieger 1975). Increased siltation due to intensive agriculture may have reduced the Topeka shiner's preferred habitat in Missouri. It is restricted to direct tributaries of the Missouri River with sufficient gradient to prevent silt deposition (Pflieger 1975). Recent surveys in Iowa, Kansas, and Missouri indicated the Topeka shiner has declined throughout its historic range. In a study recently completed by the Missouri Department of Conservation Topeka shiners are restricted to three of the 14 drainage basins from which they were historically collected (Gelwicks and Bruenderman 1996).

## **State listed fish species**

### **Paddlefish** (*Polyodon spathula*) State Watch List



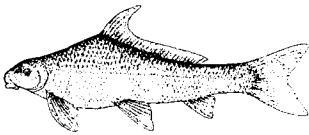
Paddlefish inhabit the large, free-flowing rivers of the Mississippi Valley. Prior to dam construction and channelization, these systems provided the braided channels, oxbow lakes, and back water areas preferred by the paddlefish. Adult paddlefish were usually found in slower moving river and backwater areas. They moved into bayous and river-lakes during spring rises to spawn (Russell 1986).

The distinctive feature of the paddlefish is the long, paddle-shaped snout whose function is still unknown. Paddlefish are bluish-gray to nearly black on the dorsal side, grading to white on the belly. They are largely cartilaginous and have been reported to reach 160 pounds in weight. Paddlefish caught in Missouri commonly exceed 60 pounds (Pfleiger 1975). Paddlefish feed in slow-moving water rich in zooplankton, its main food source. It filters water through its large, toothless mouth extracting microscopic plants and animals with its gill rakers.

Paddlefish mature very slowly. Males reach sexual maturity at ages 8-10; females at ages 10-12 (Russell 1986). A precise timing of events is necessary to stimulate reproduction. Their spawning needs include a water temperature near 60 F, clean gravel substrate for egg attachment, and increased flow to trigger spawning (Russell 1986). One of the primary reasons for the decline in paddlefish populations since the turn of the century is the loss of spawning and rearing habitat due to environmental alteration. Dam construction has eliminated spawning sites, interrupted natural spawning migrations, altered water flow, and eliminated backwaters which are used as nursery and feeding areas (National Paddlefish and Sturgeon Steering Committee 1993).

The paddlefish was formerly abundant over much of the Mississippi Valley but has undergone a drastic decline since 1900. For a time near the turn of the century the paddlefish ranked as the most important commercial fish in the Mississippi Valley. Full utilization of this fish did not begin until about 1895 after a decline of the sturgeon fishery. In 1899 the total harvest was nearly 2,500,000 pounds (190,000 pounds in Missouri). It was valued for its flesh, and for caviar. Population peaked about 1900. Overharvest was responsible for the decline. In the early 1970s the harvest was less than 5,000 pounds annually (Pfleiger 1975).

### **Blue Sucker** (*Cyprinus elongatus*) State Watch List



The blue sucker is rare but widespread in the Missouri and Mississippi Rivers and the lower sections of their tributaries. It is said to be the best food fish of all the suckers and was formally of some commercial importance along the Missouri and Mississippi Rivers. In 1894 and 1899 alone, nearly 2 million pounds of blue suckers were collected on a 21-mile section of the Mississippi River between Keokuk, Iowa and Canton, Missouri (U.S. Fish and Wildlife Service 1995). By 1910, after construction of a series of locks and dams, the blue sucker catch declined to 700,000 pounds on the same river section. This fish species inhabits the deep, swift channels of large rivers over a bottom of sand, gravel, or rock. It is tolerant of high turbidity if there is sufficient current to prevent deposition of silt (Pfleiger 1975). Juveniles occupy shallower habitat with less current. Adults winter in deep pools and move upstream in spring to rocky spawning areas. Blue suckers feed off the bottom and don't need to see to locate food. It seems to have declined in abundance since 1900 (Pfleiger 1975). It is still taken in small numbers by commercial fishermen, most often by drifting trammel nets with the current.

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**Lake Sturgeon (*Acipenser fulvescens*) State Endangered**

Lake sturgeon are widely distributed in North America and are found in three major drainages: the Mississippi River, the Great Lakes, and the Hudson Bay. Most of its range in the United States is in the Mississippi River Basin from the upper Mississippi River and its major tributaries to the southern border of Arkansas. Lake sturgeon is most often found over firm sandy, gravelly, or rocky bottoms. They are shallow water fish, seldom found in water deeper than 6 m. Benthic invertebrates, especially insect larvae, are the primary diet of lake sturgeon (National Paddlefish and Sturgeon Steering Committee 1993). Growth of the lake sturgeon is very slow. Females usually reach sexual maturity in 20-24 years while males mature in 15-17 years.

Lake sturgeon were an important commercial fish in the upper Mississippi River and the Great Lakes region during the late 1800's (National Paddlefish and Sturgeon Steering Committee 1993). Statistics compiled by the U.S. Fish Commission show that Missouri fishermen harvested 50,000 pounds of lake sturgeon from the Missouri and Mississippi Rivers in 1894 (Pflieger 1975). Most lake sturgeon were processed as smoked sturgeon, caviar, isinglass, and fish oil. Lake sturgeon were soon overexploited in the large market for sturgeon flesh. More recently, pollution and alteration of large rivers, including dam construction, channelization, and dredging have adversely affected lake sturgeon populations. The Missouri Department of Conservation is currently rearing and stocking lake sturgeon fingerlings in an attempt to recover once thriving populations.

**Alabama Shad (*Alosa alabamae*) State Rare**

A member of the herring family, this shad is characterized by a saw-toothed edge on the belly and very flat sides. It is bluish or greenish with silvery reflections, silver sides and belly. It grows to a length of 18 inches and a weight of 3 pounds (Pflieger 1975).

The Alabama shad is anadromous, spending most of its life at sea. It enters the fresh waters of the Mississippi River system to spawn in swift water in late spring or early summer. It has undergone a marked decline in abundance in the Mississippi River system; it was said to be common enough in the early 1900s to support a limited commercial fishery. Adults do not feed in fresh waters, but the young feed on small fishes and aquatic insects (Pflieger 1975). From 1950 to 1975 the Alabama shad has been taken in Missouri on at least 8 occasions from the Meramec, Gasconade, and Osage Rivers.

**Blacknose Shiner** (*Notropis heterolepis*) State Rare

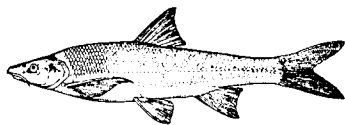
This rare minnow is found in schools in small, moderately clear prairie streams. The blacknose shiner does not seem to tolerate continuous turbidity (Pflieger 1975). It lives in the midwater region of quiet pools with considerable amounts of aquatic vegetation (Pflieger 1975). Pool bottoms consist of muck and organic debris over sand, gravel or rock. Increased siltation and dewatering of prairie streams due to intensive agriculture may be important factors in the shiner's decline (Pflieger 1975).

**Plains Killifish** (*Fundulus zebrinus*) State Rare

The plains killifish resides in alkaline or saline streams with few other fish. In Missouri, the plains killifish occurs in Salt Creek below Boone's Lick Spring, where it is the most common fish, and in Clear Creek in Clay County (Pflieger 1975). Boone's Lick Spring has a high salt concentration, 31% that of sea water (Pflieger 1975). This has an effect on the chemistry of downstream Salt Creek. The plains killifish is the only fish species occurring near the spring during low stream flows. It occurs in small, loosely organized schools in various habitats. It lies buried in sand up to its head during inactive periods (Pflieger 1975). This species occurs incidentally in the Missouri River. Fisher collected the plains killifish in the Missouri River in Franklin County in 1945 (Fisher 1962).

**Plains Topminnow** (*Fundulus sciaticus*) State Status Undetermined

The plains topminnow inhabits quiet pools of small streams and the backwaters of larger streams (Pflieger 1975). It prefers clear water with little current. It is found singly or in small groups near the water surface in or adjacent to beds of submergent vegetation (Pflieger 1975).

**Species of Special Concern****Flathead Chub** (*Platygobio gracilis* Richardson)

The flathead chub is a slender, silvery minnow with long pointed pectoral fins and a small barbel in the corner of its mouth. Adult fish are commonly 3.7 to 7.5 inches long. Maximum fish length is 9 inches (Pflieger 1975). Flathead chubs are light brown with silvery white sides and belly. Breeding males are covered with small tubercles on the upper surface of their heads and bodies. Flathead chubs are thought to spawn in Missouri in mid-July through mid-August, as this is when they spawn in Perry Creek, Iowa and Montana (Martyn and

Schmulbach 1978, Gould 1985). Specimens less than an inch long were collected in the Missouri River in Boone County in late May. The flathead chub is a long-lived cyprinid, maturing at 2-4 years of age, and surviving to 10 years (Bishop 1975).

The historical range of the flathead chub extends from Tennessee and Arkansas to Montana and Wyoming. Like the sicklefin and sturgeon chubs, it is not found in the Mississippi River above the Missouri River confluence. The flathead chub enters tributaries only in extreme northwest Missouri. This minnow inhabits a diverse range of habitats. In the Missouri and Mississippi Rivers it is found in turbid waters with a swift current and a sand and fine gravel bottom (Pflieger 1975). Flathead chubs are active fish, moving constantly, often in mixed schools with other big-river minnows. It is frequently found in association with sturgeon chubs. Flathead chubs rely on external taste buds to locate food in turbid water. The flathead chub lives off the bottom more frequently than other native chubs (Pflieger 1975). Its large, powerful body and highly depressed head allow it to deflect current efficiently (Hesse 1994a). Their diet consists mostly of terrestrial insects that fall into the water (Pflieger 1975).

Pflieger and Grace (1987) noted that flathead chubs and plains minnow were most numerous in the Missouri River in Missouri during 1940-1945. Unfortunately, it has since declined dramatically (Pflieger and Grace 1987, Gelwicks et al. 1996).

### **Western Silvery Minnow (*Hybognathus argyritis*)**

The historic range of western silvery minnow extended from Montana to Ohio and southward to the Gulf States. Western silvery minnows inhabit larger prairie streams with silt or sand bottoms, backwaters and pools of large streams, and the quiet reaches of their tributaries. This minnow is often found in association with the plains minnow and silver and flathead chubs. It occupies a different niche than the plains minnow in that it is more commonly found in the backwaters where current is low and the bottom is silty (Hesse 1994a). It is typically found in water less than one foot deep and heavily vegetated with emergent grasses and reeds. Detailed food studies have not been conducted but bottom ooze and algae have been reported and probably are the main food items (Pfleiger 1975).

Pfleiger (1975) noted the western silvery minnow was decidedly less abundant than the plains minnow in the Missouri River. Pflieger and Grace (1987) showed a decline in abundance of western silvery minnows between the 1940-1945 and the 1978-1983 sampling periods in the Missouri River in Missouri. The western silvery minnow has continued to decline in the 1990s (Gelwicks et al. 1996).

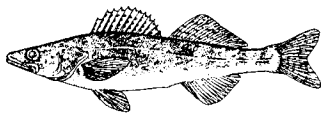
### **Plains Minnow** (*Hybognathus placitus*)

The plains minnow is found from Louisiana to North Dakota. Plains minnows live in schools near the bottom of large prairie streams, often in association with western silvery minnows. Plains minnows colonize the margins of the main channel, where the current eddies and organic debris accumulates (Hesse 1994a). Detailed food studies have not been conducted but the food typically consists of microscopic plant and animal material found on stream bottoms. Plains minnows usually live less than two years. Taylor and Miller (1990) found the short life spans were related to post-spawning mortality. Similar to other river-adapted species, changes in water flow, photoperiod, and water temperature trigger spawning. The plains minnow constitutes an important forage for the young of game species inhabiting the same habitat.

Pfleiger and Grace (1987) showed a decline in abundance of plains minnows between the 1940-1945 and the 1978-1983 sampling periods in the Missouri River in Missouri. The plains minnow was less abundant in the lower reaches of the Missouri River in Missouri in 1978-1983 than in the upper reaches. The plains minnow has continued to decline in the 1990s (Gelwicks et al. 1996).

### **Important Sport Fishes Which May Have Declined from Historical Abundance**

#### **Sauger** (*Stizostedion canadense*)



The sauger is often associated with strong current and high turbidity and is somewhat restricted to large, free-flowing rivers (Pfleiger 1975). The sauger comprised 10 to 65% of the main channel, big-river fishes before channelization and impoundment of the Missouri River (Hesse 1994b). Although the main channel was important for breeding, sauger used side channels and backwaters for feeding, resting, and maturing. Hesse (1994b) noted that the CPUE of sauger by electrofishing from the channelized Missouri River in Nebraska dropped from 19 fish per hour in 1963 to 0 to 2 fish per hour in the late 1980s.

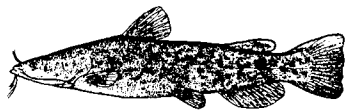
The life history of the sauger is very similar to that of its cousin, the walleye. Spawning may occur in Missouri in April, since females that had not spawned have been taken from the Mississippi River in March (Pfleiger 1975). It has been reported to spawn at night in early spring over gravel or rubble shoals at depths of 2 to 12 feet. Sauger do not construct a nest; the scattered eggs adhere to the substrate until hatching occurs (Robinson and Buchanan 1992). The sauger grows more slowly and does not attain as large a size as the walleye, seldom exceeding a length of 18 inches in Missouri. Adult sauger feed exclusively on fish, while young sauger feed on invertebrates and small fish (Robinson and Buchanan 1992).

**Blue Catfish** (*Ictalurus furcatus*)

The blue catfish is a big river fish occurring only in the Missouri and Mississippi rivers and their major tributaries. The blue catfish is principally an inhabitant of swift chutes and of pools having noticeable current (Pflieger 1975). The sensitive barbels of the blue catfish are probably more important than site in locating food. Blue catfish feed mostly on or near the bottom and to a lesser extent in midwater. It eats a variety of animal life including fishes, aquatic insects, and freshwater mussels (Pflieger 1975). Spawning occurs in the Mississippi River near Keokuk, Iowa in June (Pflieger 1975). Natural cavities about piles of drift, logs, or undercut banks are favored nest sites. Semidarkness and seclusion are major factors in the choice of nest sites. Females do not participate in the selection of nest sites or in care of young.

Most early reports of large catfish from the Missouri and Mississippi Rivers were blue catfish. Before 1900, specimens weighing over 100 pounds were common. Blue catfish comprised 30 percent of the commercial catch in 1894 (Funk and Robinson 1974). Reported commercial harvest of blue catfish in the Missouri section of the Missouri River remained somewhat stable as a percentage of the total catfish catch (16 %) from 1949 to 1971. However, total numbers in catch declined by nearly 80 percent.

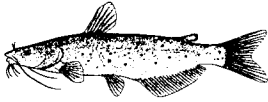
Blue catfish moved seasonally in response to water temperature, returning to southern regions where water is warmest (Pflieger 1975). Large dams prevented this migration and contributed to its demise. Unfortunately the catfish fishery in the Missouri River currently consists primarily of small young fish. The blue catfish, along with all other large catfish species, was removed from commercial fishing lists in the Missouri River states of Kansas, Nebraska, Missouri, and Iowa in 1992 in the hope that catfish population levels and size distribution would recover.

**Flathead Catfish** (*Pylodictis olivaris*)

The flathead catfish is a scaleless, heavy-bodied fish with a flat head, sharp heavy pectoral and dorsal spines and long, slender barbels near the mouth. It is a yellowish brown above, pale grey below and often mottled with brown or black. A popular game and food fish, the species can weigh over 100 pounds. A nocturnal, opportunistic feeder that eats mostly fish, the catfish has many external taste buds especially on the barbels. After eggs are laid in a nest prepared by the male under logs, stumps or brush piles in quiet water, the male guards the nest until the young hatch. The flathead inhabits large sluggish rivers and large low-gradient tributaries of the entire Mississippi River drainage and was introduced into the lower Colorado River where they are now common. Unfortunately the catfish fishery in the Missouri River currently consists primarily of small young fish. The flathead catfish, along with all other large catfish species, was removed from commercial fishing lists in the Missouri River states of Kansas, Nebraska, Missouri, and Iowa in 1992 in the hope that catfish population levels and size

distribution would recover.

### **Channel Catfish** (*Ictalurus punctatus*)



The channel catfish is the most abundant and widely distributed large catfish in Missouri (Pflieger 1975). This catfish species inhabits a wide variety of habitats, but prefers large streams with low or moderate gradients. Adults occupy deep water near submerged logs during the day and move into the shallows at night to feed. The channel catfish is a bottom feeder which locates most of its food by taste. This catfish spawns from late May through mid-July in Missouri. The male prepares and defends the nest and fry until they leave the nest. The channel catfish is one of the most popular sport and food fishes in Missouri. It figures prominently in the creel in Missouri's streams and reservoirs (Pflieger 1975). Unfortunately the catfish fishery in the Missouri River currently consists primarily of small young fish. The channel catfish, along with all other large catfish species, was removed from commercial fishing lists in the Missouri River states of Kansas, Nebraska, Missouri, and Iowa in 1992 in the hope that catfish population levels and size distribution would recover.



Fish of the Lower Missouri River Floodplain  
(Gelwicks 1996, Grace and Pfeleger 1985, Hooker 1996, Kubisiak 1996, Funk and Robinson 1974)

Chestnut Lamprey	<i>Ichthyomyzon castaneus</i>	Central Silvery Minnow	<i>Hybognathus nuchalis</i>
Lake Sturgeon	<i>Acipenser fulvescens</i>	Western Silvery Minnow	<i>Hybognathus argyritis</i>
Shovelnose Sturgeon	<i>Scaphirhynchus platyrhynchus</i>	Plains Minnow	<i>Hybognathus placitus</i>
Pallid Sturgeon <sup>E</sup>	<i>Scaphirhynchus alba</i>	Brassy Minnow	<i>Hybognathus hankinsoni</i>
Paddlefish <sup>C</sup>	<i>Polyodon spathula</i>	Bluntnose Minnow	<i>Pimephales notatus</i>
Shortnose Gar	<i>Lepisosteus platostomus</i>	Fathead Minnow	<i>Pimephales promelas</i>
Longnose Gar	<i>Lepisosteus osseus</i>	Central Stoneroller	<i>Campostoma anomalum</i>
Bowfin	<i>Amia calva</i>	Blue Sucker	<i>Cycleptus elongatus</i>
American Eel	<i>Anguilla rostrata</i>	Bigmouth Buffalo	<i>Ictiobus cyprinellus</i>
Rainbow Smelt	<i>Osmerus mordax</i>	Black Buffalo	<i>Ictiobus niger</i>
Skipjack Herring	<i>Alosa chrysochloris</i>	Smallmouth Buffalo	<i>Ictiobus bubalus</i>
Alabama Shad	<i>Alosa alabamiae</i>	River Carpsucker	<i>Carpionodes carpio</i>
Gizzard Shad	<i>Dorosoma cepedianum</i>	Quillback	<i>Carpionodes cyprinus</i>
Goldeye	<i>Hiodon alosoides</i>	White Sucker	<i>Catostomus commersoni</i>
Mooneye	<i>Hiodon tergisus</i>	Golden Redhorse	<i>Moxostoma erythrurum</i>
Northern Pike	<i>Esox lucius</i>	Shorthead Redhorse	<i>Moxostoma macrolepidotum</i>
Carp	<i>Cyprinus carpio</i>	Black Bullhead	<i>Ictalurus melas</i>
Goldfish	<i>Carassius auratus</i>	Yellow Bullhead	<i>Ictalurus natalis</i>
Grass Carp	<i>Ctenopharyngodon idella</i>	Channel Catfish	<i>Ictalurus punctatus</i>
Bighead Carp	<i>Hypophthalmichthys nobilis</i>	Blue Catfish	<i>Ictalurus furcatus</i>
Silver Carp	<i>Hypophthalmichthys molitrix</i>	Freckled Madtom	<i>Noturus nocturnus</i>
Golden Shiner	<i>Notemigonus crysoleucas</i>	Flathead Catfish	<i>Pylodictus olivaris</i>
Creek Chub	<i>Semotilus atromaculatus</i>	Stonecat	<i>Noturus flavus</i>
Silver Chub	<i>Hybopsis storeriana</i>	Burbot	<i>Lota lota</i>
Gravel Chub	<i>Hybopsis x-punctata</i>	Plains killifish	<i>Fundulus kansae</i>
Speckled Chub	<i>Hybopsis aestivalis</i>	Mosquitofish	<i>Gambusia affinis</i>
Flathead Chub	<i>Hybopsis gracilis</i>	Brook Silverside	<i>Labidesthes sicculus</i>
Sicklefin Chub <sup>C</sup>	<i>Macrhybopsis meeki</i>	White Bass	<i>Morone chrysops</i>
Sturgeon Chub <sup>C</sup>	<i>Macrhybopsis gelida</i>	Striped Bass	<i>Morone saxatilis</i>
Suckermouth Minnow	<i>Phenacobius mirabilis</i>	Hybrid Striped Bass	<i>Morone chrysops * saxatilis</i>
Emerald Shiner	<i>Notropis atherinoides</i>	Largemouth Bass	<i>Micropterus salmoides</i>
Silverband Shiner	<i>Notropis shumardi</i>	Spotted Bass	<i>Micropterus punctulatus</i>
Redfin Shiner	<i>Notropis umbratilis</i>	Green Sunfish	<i>Lepomis cyanellus</i>
Common Shiner	<i>Notropis cornutus</i>	Orangespotted Sunfish	<i>Lepomis humilis</i>
Striped Shiner	<i>Notropis chrysocephalus</i>	Longear Sunfish	<i>Lepomis megalotis</i>
River Shiner	<i>Notropis blennioides</i>	Bluegill	<i>Lepomis macrochirus</i>
Bigmouth Shiner	<i>Notropis dorsalis</i>	Rock Bass	<i>Ambloplites rupestris</i>
Bigeye Shiner	<i>Notropis boops</i>	White Crappie	<i>Pomoxis annularis</i>
Spotfin Shiner	<i>Notropis spilopterus</i>	Black Crappie	<i>Pomoxis nigromaculatus</i>
Red Shiner	<i>Notropis lutrensis</i>	Walleye	<i>Stizostedion vitreum</i>
Sand Shiner	<i>Notropis stramineus</i>	Sauger	<i>Stizostedion canadense</i>
Mimic Shiner	<i>Notropis volucellus</i>	Slenderhead Darter	<i>Percina phoxocephala</i>
Ghost Shiner	<i>Notropis buechanani</i>	Logperch	<i>Percina caprodes</i>
Rosyface Shiner	<i>Notropis rubellus</i>	Johnny Darter	<i>Etheostoma nigrum</i>
Channel Shiner	<i>Notropis wickliffi</i>	Orangethroat Darter	<i>Etheostoma spectabile</i>
		Freshwater Drum	<i>Aplodinotus grunniens</i>

## **Chapter 5**

### **Federal and State Listed Plant and Animal Species Which Inhabit the Lower Missouri River Floodplain**

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The following list of plant and animal species was derived from records in the Natural Heritage Database maintained by the Missouri Department of Conservation. These species are reported to have been found on proposed acquisition areas or on areas with similar habitat located near acquisition areas. This list does not contain all species of federal and state concern which may or can reside on the proposed acquisition areas.

## PLANTS

### **Oval Ladies' Tresses** (*Spiranthes ovalis* var. *Erostella*) State Rare

This species was located near Cora Island in 1845. It was found in shady grassy woods in the floodplain where the Missouri and Mississippi Rivers converge.

### **Decurrent False Aster** (*Boltonia decurrens*) Federal Threatened Species

The decurrent false aster is a perennial plant that occurs in open wetland habitats along the shores of lakes and banks of streams. It is most common in disturbed lowland areas. Habitat destruction and modification seem to be related to the decline of this species. This plant has been reported in several areas in the floodplain where the Missouri and Mississippi Rivers converge. The closest acquisition area is Cora Island.

### **Amethyst Shooting Star** (*Dodecatheon amethystinum*) State Rare

This plant has been found on north facing wooded slopes along the Missouri River near the St. Aubert Chute acquisition area.

### **Bushy Cinquefoil** (*Potentilla nicoletti*) State Extirpated

This plant had been found in sands along the Missouri River flats just upstream of the Bakers Bend/Cranberry Bend acquisition area in Carroll County. It has not been located in recent years due to destruction of habitat by channelization.

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**A Bugseed** (*Corispermum hyssopifolium*) State Watch List

This plant occurs on sand dunes and flats along the Missouri River. Collections are recorded in Clay, Jackson, Ray, and St. Louis counties. This plant has been located one mile downstream of the Sunshine Lake acquisition area. Steyermark (1975) felt this species could be found in sandy situations in all counties bordering the Missouri River.

**Clasping Leaved Coneflower** (*Dracopis amplexicaulis*) State Status Undetermined

This species occurs in prairies, chert barrens along streams, waste ground, and along roadsides in western Missouri (Steyermark 1975). This plant was located in several shallow roadside ditches near the vicinity of Jackass Bend in the mid-1980's.

**Willow Herb** (*Epilobium leptophyllum*) State Endangered

Willow herb occurs in wet ground along streams and in bogs (Steyermark 1975). It was found in a fen in Jackson County upstream of the Jackass Bend acquisition area.

**Tufted Loosestrife** (*Lysimachia thyrsiflora*) State Endangered

This plant occurs in swamps, boggy ground, and wet river bottom prairies and swales (Steyermark 1975). It was found in a fen in Jackson County upstream of the Jackass Bend acquisition area.

**Wild Rye** (*Elymus diversiglumis*) State Endangered

This plant was identified in woody rocky hills along the Missouri River downstream of the Crooked River Cutoff/Hicklin Lake acquisition area in 1953.

**Bergia** (*Bergia texana*) State Endangered

This waterwort family member is historically uncommon along the Missouri River (Steyermark 1975). It was identified in a mud flat in the vicinity of Sunshine Lake in the mid-1980's.

## INVERTS

### **Tadpole Shrimp** (*Triops longicaudus*) state Status Undetermined

The tadpole shrimp is a non-cladoceran branchiopod. It has more pairs of legs than cladocerans and compound eyes. It begins life as a nauplii or metanauplii and experiences a dozen or so molts before reaching maturity. They typically occur in the absence of fish and have one generation each time their habitat appears. Their major reproductive strategy is to make as many small resistant eggs in the shortest amount of time. These eggs then hatch when the pond fills again. Tadpole shrimp and their resistant eggs are an important part of the diet of many waterfowl, especially dabbling ducks (Dodson and Frey 1991). Proctor (1964) raised *Triops*, and several other non-cladoceran branchiopods from feces of mallard ducks. The tadpole shrimp was identified on the Jackass Bend acquisition area in the late 1970's and early 1980's.

### **A Shore Bug** (*Pentacora signoretti*) State Endangered

This bug was found at the Booneslick State Historic Site, near the Lisbon Bottoms/Jameson Island acquisition area in the late 1970's.

## REPTILES

### **Eastern Massasauga** (*Sistrurus catenatus catenatus*) State Endangered

The eastern massasauga is reported to have once been found in the vicinity of the Wakanda Creek/Chute area in Saline County. Massasaugas are restricted to marshes or moist prairie areas in proximity to large river floodplains (Johnson 1987). Adult massasaugas feed primarily on voles and deer mice. A remnant population exists in nearby Van Meter State Park.

## BIRDS

### **Bald Eagle** (*Haliaeetus leucocephalus*) Federal Threatened species



This large fish-eating bird can be found along coasts, rivers, and lakes. Bald eagles are thought to have historically nested in all of the lower 48 states. It's estimated that there were 50,000 breeding pairs of bald eagles in pre-colonial

times. Due to human activities including the use of DDT, loss of habitat, shooting, and trapping. The population in the lower 48 states reached a low of 400 breeding pairs in the early 1960s. Major wintering areas for the bald eagle are along stretches of the Mississippi, Missouri, and Illinois River systems.

Adults mate for life and tend to use the same nest year after year. The majority of nest sites are within ½ mile of water. They nest in platforms of sticks in tall trees and cliffs. Nests can become enormous, weighing more than a ton. Unfortunately, the large cottonwood trees it prefers to roost in are gradually dying out in many riverine areas.

As buffer areas of 1 mile from an active nest are often recommended, tracts of floodplain habitat removed from agricultural development may provide nesting and overwintering habitat for bald eagles in the future (U.S. Fish and Wildlife Service 1995). The bald eagle nests or overwinters in several areas along the Missouri River including St. Aubert Chute, Howell Island Conservation Area downstream of Diana Bend, and near Bowdry Drain.

#### **American Bittern** (*Botaurus lentiginosus*) State Endangered

The American Bittern resides in bogs and swamps. It is less gregarious and less conspicuous than other herons. The bittern is not an active bird. It spends most of its time hiding in vegetation, watching and waiting for prey. The bittern's movements are stealthy and noiseless. It catches frogs and small fish by spearing them with its sharp beak. It also eats meadow mice, small snakes, crayfish, various molluscs, dragonflies, grasshoppers, and other insects (Beck 1963b). The American bittern was recently located in MDC-owned Grand Pass Conservation Area, five miles downstream of the Cranberry Chute acquisition area and 2 miles upstream of the Wakanda Creek acquisition area.

#### **King Rail** (*Rallus elegans*) State Endangered

This large freshwater rail inhabits freshwater and brackish swamps and marshes with dense growth of reeds and water plants. It is hard to see but can be heard at dusk and dawn (National Geographic Society 1987). The king rail feeds predominantly on seeds, with some insects, slugs, tadpoles, and small crayfish (Beck 1963b). The king rail was recently located in MDC-owned Grand Pass Conservation Area, five miles downstream of the Cranberry Chute acquisition area and 2 miles upstream of the Wakanda Creek acquisition area.

**Sora** (*Porzana carolina*) State Status Undetermined

The sora inhabits freshwater and brackish marshes, rice fields and grainfields. It is the most widely distributed and best known rail. The preferred food of sora is wild rice seeds. They will also eat small molluscs, dragonflies, and tadpoles (Beck 1963b). The sora was recently located in MDC-owned Grand Pass Conservation Area, five miles downstream of the Cranberry Chute acquisition area and 2 miles upstream of the Wakanda Creek acquisition area.

**Yellow-headed Blackbird** (*Xanthocephalus xanthocephalus*) State Rare

Yellow-headed blackbirds prefer freshwater marshes or reedy lakes. They are often seen foraging in open farmlands (National Geographic Society 1987). They prefer to nest over water that is from 2-4 feet deep, or deeper with a thick growth of vegetation to protect young from predators (Beck 1965). They feed primarily on vegetable matter, but also consume beetles, caterpillars, and grasshoppers. The yellow-headed black bird was recently located in MDC-owned Grand Pass Conservation Area, five miles downstream of the Cranberry Chute acquisition area and 2 miles upstream of the Wakanda Creek acquisition area.

**Pied-billed Grebe** (*Podilymbus podiceps*) State Rare

The pied-billed grebe is a year-round Missouri resident which nests around marshy ponds and sloughs. The pied-billed grebe feeds largely on animal matter such as small fish, snails, small frogs, tadpoles, aquatic worms and insects; it also eats the seeds and soft parts of aquatic plants to some extent (Beck 1963a). The pied-billed grebe was identified in bird surveys conducted in several areas including: Grand Pass Conservation Area, Baltimore Bend Conservation Area, and the Sunshine Lake proposed acquisition area.

**Great Egret** (*Casmerodius albus*) State Rare

The great egret is found in marshes, mangrove swamps, and mud flats. It is partial to open habitats for feeding. The egret stalks prey slowly and methodically. The great egret population was greatly reduce by plum hunters at the turn of the century. It is now mostly recovered and is still expanding in some parts of its range (National Geographic Society 1987). The great egret has been located within the vicinity of the Sunshine Lake acquisition area.

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## MAMMALS

There are several caves in Boone County which provide either maternity or hibernation habitat to the Indiana and gray bats. The closest acquisition area is Diana Bends in Cooper County.

### **Indiana Bat** (*Myotis sodalis*) Federal Endangered Species

Indiana bats spend the winter hibernating in caves in the Ozarks. They hibernate in large dense clusters from October to April (Harvey 1992). During April and May, females migrate north and establish small maternity colonies in suitable sites within wooded riparian areas, floodplain forests, or upland woodlots. Maternity roost sites tend to be in dead or dying trees greater than 9 inches in diameter at breast height and with loose or exfoliating bark. Trees most likely to have loose or exfoliating bark are dead oaks, hickories, elms, green and white ash, silver maple, and eastern cottonwood, or living shagbark hickory. Preferred roost sites are located in forest openings, at the forest edge, or where tree canopy is sparse, and within 1 km (0.6 mi.) of water. Females raise a single offspring under this loose bark usually along wooded riparian habitat. Bats primarily feed on emerged aquatic insects along riparian corridors.

### **Gray Bat** (*Myotis grisescens*) Federal Endangered Species

Gray bats are year-round cave residents. They hibernate in deep vertical caves with large rooms. Female gray bats form maternity colonies in summer in large caves with streams which trap and hold their body heat. They occupy a wide variety of caves during the spring and fall transition periods. Gray bats forage over water, feeding primarily on mayflies. The gray bat population is estimated to have declined 72 to 81 percent in Missouri (Harvey 1992).



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 Plant and Animal Species Which Inhabit the Missouri River Floodplain

<b>Trees</b>		<b>Shrubs</b>	
(Wylie and Gass 1993)		(Wylie and Gass 1993)	
Green Ash	<i>Fraxinus pennsylvanicus</i>	Persimmon	<i>Diospyros virginiana</i>
Black Walnut	<i>Juglans nigra</i>	Spicebush	<i>Lindera benzoin</i>
Eastern Red Cedar	<i>Juniperus virginiana</i>	Hawthorns	<i>Crataegus</i> spp.
Cottonwood	<i>Populus deltoides</i>	Flowering Dogwood	<i>Cornus florida</i>
Pecan	<i>Carya illinoensis</i>	False Indigo	<i>Amorpha fruticosa</i>
Shagbark Hickory	<i>Carya ovata</i>	Buttonbush	<i>Cephalanthus occidentalis</i>
Bitternut Hickory	<i>Carya cordiformis</i>	Grapes	<i>Vitis</i> spp.
Shellbark Hickory	<i>Carya laciniosa</i>	Water-elm	<i>Planera aquatica</i>
White Oak	<i>Quercus alba</i>	Swamp dogwood	<i>Cornus ammomum</i>
Pin Oak	<i>Quercus palustris</i>	Gray Dogwood	<i>Cornus foemina</i>
Bur Oak	<i>Quercus macrocarpa</i>		
Chinkapin Oak	<i>Quercus muehlenbergii</i>	<b>Aquatic and Floating Vegetation</b>	
Shumard Oak	<i>Quercus shumardii</i>	Duckweeds	<i>Lemna</i> spp.
Shingle Oak	<i>Quercus imbricaria</i>		<i>Spirodela polyrhiza</i>
Wild Plum	<i>Prunus americana</i>	Water Milfoils	<i>Myriophyllum</i> spp.
Black Locust	<i>Robinia pseudoacacia</i>	Water-meal	<i>Wolffia</i> spp.
River Birch	<i>Salix nigra</i>	Mosquito fern	<i>Azolla mexicana</i>
Sumac	<i>Rhus</i> spp.	Pondweeds	<i>Potamogeton</i> spp.
Sycamore	<i>Platanus occidentalis</i>	White water lily	<i>Nymphaea adorata</i>
Black Willow	<i>Salix nigra</i>	Yellow cow lily	<i>Nuphar luteum</i>
Slippery Elm	<i>Ulmus rubra</i>	American lotus	<i>Nelumbo lutea</i>
American Elm	<i>Ulmus americana</i>	Slough grass	<i>Spartina pectinata</i>
Box Elder	<i>Acer negundo</i>		
Silver Maple	<i>Acer saccharinum</i>		
Hackberry	<i>Celtis occidentalis</i>		

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**Herbaceous Plants** (Combs and Drobney, Steyermark 1975)

Foxtails	<i>Alopecurus</i> spp.	Spikerushes	<i>Eleocharis</i> spp.
Slough Grass	<i>Spartina pectinata</i>	Terrestrial Water-Starwort	<i>Callitriche terrestris</i>
Muhly	<i>Muhlenbergia</i> spp.	Water-Primroses	<i>Ludwigia</i> spp.
Reed Canary Grass	<i>Phalaris arundinaca</i>	Bitter Cresses	<i>Cardamine</i> spp.
Cutgrasses	<i>Leersia</i> spp.	Butter-cups	<i>Ranunculus</i> spp.
Panic Grasses	<i>Panicum</i> spp.	Butterweed	<i>Senecio glabellus</i>
Sprangle Top	<i>Leptochioa filiformis</i>	Cut-leaf Coneflower	<i>Rudbeckia laciniata</i>
Lovegrasses	<i>Eragrostis</i> spp.	Cardinal Flower	<i>Lobelia cardinalis</i>
Spikegrass	<i>Chasmanthium latifolium</i>	Great Blue Lobelia	<i>Lobelia siphilitica</i>

Asters	<i>Aster</i> spp.	Marshmallow	<i>Hibiscus laevis</i>
Rushes	<i>Juncus</i> spp.	Ditch Stonecrop	<i>Penthorum sedoides</i>
Boltonias	<i>Boltonia</i> spp.	Blue Skullcap	<i>Scutellaria lateriflora</i>
Indian Heliotrope	<i>Heliotropium indicum</i>	Bugleweeds	<i>Lycopus</i> spp.
Pigweeds	<i>Amaranthus</i> spp.	Mints	<i>Mentha</i> spp.
Groundnut	<i>Apios americana</i>	False Nettle	<i>Boehmeria cylindrica</i>
Toothcup	<i>Ammania coccinea</i>	Hedgenettles	<i>Stachys</i> spp.
Water-willows	<i>Justica</i> spp.	False Dragon-heads	<i>Physostegia</i> spp.
Swamp Milkweeds	<i>Asclepias</i> spp.	Germander	<i>Teucrium canadens</i>
St. John's Worts	<i>Hypericum</i> spp.	Frog-Fruit	<i>Phyla lanceolata</i>
Hedgehyssops	<i>Gratiola</i> spp.	Eclipta	<i>Eclipta alba</i>
Blackberry	<i>Rubus</i> spp.	Boneset	<i>Eupatorium perfoliatum</i>
Bullrushes	<i>Bolboschoenus</i> spp.; <i>Schoenoplectus</i> spp.	Water-Hemlock	<i>Cicuta maculata</i>
Carex Sedges	<i>Carex</i> spp.	Water-Parsnip	<i>Sium suave</i>
Giant Ragweed	<i>Ambrosia trifida</i>	Cinquefoils	<i>Potentilla</i> spp.
Goldenrods	<i>Solidago</i> spp.	Yellow-Cress	<i>Rorippa</i> spp.
Greenbriars	<i>Smilax</i> spp.	Dwarf Bulrush	<i>Lipocarpa micrantha</i>
Pokeberry	<i>Phytolacca</i> spp.	Burreeds	<i>Sparganium</i> spp.
Umbrella Sedges	<i>Cyperus</i> spp.; <i>Kyllinga</i> spp.	Cattails	<i>Typha</i> spp.
Water Plantain	<i>Alisma subcordatum</i>	Irises	<i>Iris</i> spp.
Smartweeds	<i>Polygonum</i> spp.	Violets	<i>Viola</i> spp.
Arrowheads	<i>Sagittaria latifolia</i>	Burheads	<i>Echinodorus</i> spp.
Horsetails	<i>Equisetum</i> spp.	Arrow Arum <sup>1</sup>	<i>Peltandra virginica</i>
Poison Ivy	<i>Rhus radicans</i>	Bedstraws	<i>Galium</i> spp.
Clearweed	<i>Pilea pumila</i>	Loosestrifes	<i>Lysimachia</i> spp.
Beggarstick	<i>Bidens frondosa</i>	False Pimpernels	<i>Lindernia</i> spp.
Docks	<i>Rumex</i> spp.	Water Hyssop	<i>Bacopa rotundifolia</i>
Neckweed	<i>Veronica peregrina</i>	Spurges	<i>Euphorbia</i> spp. & <i>Chamaesyce</i> spp.
Monkey Flowers	<i>Mimulus</i> spp.	Toothcup	<i>Rotala ramosieor</i>

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**Freshwater Mussels (Oesch 1984) (all located in Lower Missouri River)**

Fragile Paper Shell	<i>Leptodea fragilis</i>	Pink Paper Shell	<i>Potamilus ohioensis</i>
Pink Heel Splitter	<i>Potamilus alatus</i>	Asiatic Clam	<i>Corbicula leana</i>

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<sup>1</sup> Only on Missouri River near St. Louis

**Amphibians** (Johnson 1987, Conant 1975)

Smallmouth Salamander	<i>Ambystoma texanum</i>	Northern Spring Peeper	<i>Hyla crucifer crucifer</i>
Eastern Tiger Salamander	<i>Ambystoma tigrinum</i>	Gray Treefrog	<i>Hyla versicolor</i>
Mudpuppy	<i>Necturus maculosus</i>	Northern Crawfish Frog	<i>Rana areolata circulosa</i>
Plains Spadefoot	<i>Scaphiopus bombifrons</i>	Bullfrog	<i>Rana catesbeiana</i>
Great Plains Toad	<i>Bufo cognatus</i>	Green Frog	<i>Rana clamitans</i>
Woodhouse's Toad	<i>Bufo woodhousei woodhousei</i>	Pickerel Frog	<i>Rana palustris</i>
Fowler's Toad	<i>Bufo woodhousei fowleri</i>	Southern Leopard Frog	<i>Rana sphenoecephala</i>
Blanchard's Cricket Frog	<i>Acris crepitans blanchardi</i>		

**Reptiles** (Johnson 1987, Conant 1975)

Common Snapping Turtle	<i>Chelydra serpentina serpentina</i>	Western Fox Snake	<i>Elaphe vulpina vulpina</i>
Stinkpot	<i>Sternotherus odoratus</i>	Eastern Hognose Snake	<i>Heterodon platyrhinus</i>
Western Painted Turtle	<i>Chrysemys picta bellii</i>	Speckled Kingsnake	<i>Lampropeltis getulus holbrooki</i>
Map Turtle	<i>Graptemys geographica</i>	Yellow-bellied Water Snake	<i>Nerodia erythrogaster flavigaster</i>
Mississippi Map Turtle	<i>Graptemys kohnii</i>	Diamondback Water Snake	<i>Nerodia rhombifer rhombifer</i>
False Map Turtle	<i>Graptemys pseudogeographica</i>	Northern Water Snake	<i>Nerodia sipedon sipedon</i>
Missouri River Cooter	<i>Pseudemys concinna metteri</i>	Rough Green Snake	<i>Opheodrys aestivus</i>
Red-eared Slider	<i>Trachemys scripta elegans</i>	Graham's Crayfish Snake	<i>Regina grayhamii</i>
Midland Smooth Softshell	<i>Trionyx muticus muticus</i>	Midland Brown Snake	<i>Storeria dekayi wrightorum</i>
Western Spiny Softshell	<i>Trionyx spinifer hartwegi</i>	Western Ribbon Snake	<i>Thamnophis proximus proximus</i>
Southern Coal Skink	<i>Eumeces anthracinus pluvialis</i>	Eastern Plains Garter Snake	<i>Thamnophis radix radix</i>
Five-lined Skink	<i>Eumeces fasciatus</i>	Eastern Garter Snake	<i>Thamnophis sirtalis sirtalis</i>
Broadhead Skink	<i>Eumeces laticeps</i>	Osage Copperhead	<i>Agkistrodon contortrix phaeogaster</i>
Ground Skink	<i>Scincella lateralis</i>		
Six-lined Racerunner	<i>Cnemidophorus sexlineatus</i>		
Black Rat Snake	<i>Elaphe obsoleta obsoleta</i>		

## Birds (National Geographic Society 1987)

Horned Grebe	<i>Podiceps auritus</i>	Lesser Yellowlegs	<i>Tringa flavipes</i>
Pied-billed Grebe	<i>Podilymbus podiceps</i>	Solitary Sandpiper	<i>Tringa solitaria</i>
American White Pelican	<i>Pelecanus erythrorhynchus</i>	Spotted Sandpiper	<i>Actitis macularia</i>
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Common Snipe	<i>Capella gallinago</i>
Least Bittern	<i>Ixobrychus exilis</i>	Hudsonian Godwit	<i>Limosa haemastica</i>
American Bittern	<i>Botaurus lentiginosus</i>	Marbled Godwit	<i>Limosa fedoa</i>
Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	Ruddy Turnstone	<i>Arenaria interpes</i>
Yellow-crowned Night Heron	<i>Nycticorax violaceus</i>	Sanderling	<i>Calidris alba</i>
Green Heron	<i>Butorides virescens</i>	Semi-palmated Sandpiper	<i>Calidris pusilla</i>
Cattle Egret	<i>Bubulcus ibis</i>	Western Sandpiper	<i>Calidris mauri</i>
Great Egret	<i>Casmerodius albus</i>	Least Sandpiper	<i>Calidris minutilla</i>
Great Blue Heron	<i>Ardea herodias</i>	White-rumped Sandpiper	<i>Calidris fuscicollis</i>
Little Blue Heron	<i>Egretta caerulea</i>	Baird's Sandpiper	<i>Calidris bairdii</i>
White-faced Ibis	<i>Plegadis falcinellus</i>	Pectoral Sandpiper	<i>Calidris melanotos</i>
Snow Goose	<i>Chen caerulescens</i>	Dunlin	<i>Calidris alpina</i>
Canada Goose	<i>Branta canadensis</i>	Stilt Sandpiper	<i>Calidris himantopus</i>
Mallard	<i>Anas platyrhynchos</i>	Short-billed Dowitcher	<i>Limnodromus griseus</i>
American Black Duck	<i>Anas rubripes</i>	Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>
Pintail	<i>Anas acuta</i>	American Woodcock	<i>Scolopax minor</i>
Gadwall	<i>Anas strepera</i>	Wilson's Phalarope	<i>Phalaropus tricolor</i>
American Wigeon	<i>Mareca americana</i>	Franklin's Gull	<i>Larus pipixcan</i>
Northern Shoveler	<i>Anas clypeata</i>	Bonaparte's Gull	<i>Larus philadelphia</i>
Blue-winged Teal	<i>Anas discors</i>	Ring-billed Gull	<i>Larus delawarensis</i>
Green-winged Teal	<i>Anas carolinensis</i>	Herring Gull	<i>Larus argentatus</i>
Ruddy Duck	<i>Oxyura jamaicensis</i>	Caspian Tern	<i>Sterna caspia</i>
Wood Duck	<i>Aix sponsa</i>	Common Tern	<i>Sterna hirundo</i>
Redhead	<i>Aythya americana</i>	Forster's Tern	<i>Sterna fosteri</i>
Canvasback	<i>Aythya valisineria</i>	Black Tern	<i>Chlidonias niger</i>
Ring-necked Duck	<i>Aythya collaris</i>	Turkey Vulture	<i>Cathartes aura</i>
Greater Scaup	<i>Aythya marila</i>	Bald Eagle <sup>E</sup>	<i>Haliaeetus leucocephalus</i>
Lesser Scaup	<i>Aythya affinis</i>	Sharp-shinned Hawk	<i>Accipiter striatus</i>
Common Goldeneye	<i>Bucephala clangula</i>	Cooper's Hawk	<i>Accipiter cooperii</i>
Bufflehead	<i>Bucephala albeola</i>	Northern Harrier	<i>Circus cyaneus</i>
Common Merganser	<i>Mergus merganser</i>	Red-shouldered Hawk	<i>Buteo lineatus</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>	Broad-winged Hawk	<i>Buteo platypterus</i>
King Rail	<i>Rallus elegans</i>	Red-tailed Hawk	<i>Buteo jamaicensis</i>
Virginia Rail	<i>Rallus limicola</i>	Rough-legged Hawk	<i>Buteo lagopus</i>
Common Moorhen	<i>Gallinula chloropus</i>	Osprey	<i>Pandion haliaetus</i>
Sora	<i>Porzana carolina</i>	American Kestrel	<i>Falco sparverius</i>
American Coot	<i>Fulica americana</i>	Peregrine Falcon	<i>Falco peregrinus</i>
Black-bellied Plover	<i>Pluvialis squatarola</i>	Wild Turkey	<i>Meleagris gallopavo</i>
Lesser Golden-Plover	<i>Pluvialis dominica</i>	Ring-necked Pheasant	<i>Phasianus colchicus</i>
Semipalmated Plover	<i>Charadrius semipalmatus</i>	Northern Bobwhite	<i>Colinus virginianus</i>
Killdeer	<i>Charadrius vociferus</i>	Rock Dove	<i>Columba livia</i>
Greater Yellowlegs	<i>Tringa melanoleuca</i>	Mourning Dove	<i>Zenaida macroura</i>
		Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
		Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>

Great Horned Owl	<i>Bubo virginianus</i>	Blue-gray Gnatcatcher	<i>Poliophtilla caerulea</i>
Barred Owl	<i>Strix varia</i>	Eastern Bluebird	<i>Sialia sialis</i>
Eastern Screech Owl	<i>Otus asio</i>	Gray-cheeked Thrush	<i>Catharus minimus</i>
Short-eared Owl	<i>Asio flammeus</i>	Swainson's Thrush	<i>Catharus ustulatus</i>
Common Nighthawk	<i>Chordeiles minor</i>	Hermit Thrush	<i>Catharus guttatus</i>
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>	Wood Thrush	<i>Hylocichla mustelina</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>	American Robin	<i>Turdus migratorius</i>
Chimney Swift	<i>Chaetura pelagica</i>	Gray Catbird	<i>Dumetella carolinensis</i>
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	Northern Mockingbird	<i>Mimus polyglottos</i>
Belted Kingfisher	<i>Megacerle alcyon</i>	Brown Thrasher	<i>Toxostoma rufum</i>
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	Water Pipit	<i>Anthus spinoletta</i>
Northern Flicker	<i>Colaptes auratus</i>	Cedar Waxwing	<i>Bombycilla cedrorum</i>
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	Loggerhead Shrike	<i>Lanius ludovicianus</i>
Downy Woodpecker	<i>Picoides pubescens</i>	European Starling	<i>Sturnus vulgaris</i>
Hairy Woodpecker	<i>Picoides villosus</i>	White-eyed Vireo	<i>Vireo griseus</i>
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>	Bell's Vireo	<i>Vireo bellii</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Solitary Vireo	<i>Vireo solitarius</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Yellow-throated Vireo	<i>Vireo flavifrons</i>
Great-crested Flycatcher	<i>Myriarchus crinitus</i>	Warbling Vireo	<i>Vireo gilvus</i>
Acadian Flycatcher	<i>Empidonax virescens</i>	Philadelphia Vireo	<i>Vireo philadelphia</i>
Alder Flycatcher	<i>Empidonax alnorum</i>	Red-eyed Vireo	<i>Vireo olivaceus</i>
Willow Flycatcher	<i>Empidonax trailii</i>	Blue-winged Warbler	<i>Vermivora pinus</i>
Least Flycatcher	<i>Empidonax minimus</i>	Golden-winged Warbler	<i>Vermivora ehrysoptera</i>
Eastern Wood Pewee	<i>Cantopus virens</i>	Tennessee Warbler	<i>Vermivora peregrina</i>
Horned Lark	<i>Eremophila alpestris</i>	Orange-crowned Warbler	<i>Vermivora celata</i>
Purple Martin	<i>Progne subis</i>	Nashville Warbler	<i>Vermivora ruficapilla</i>
Tree Swallow	<i>Tachycineta bicolor</i>	Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>
Bank Swallow	<i>Riparia riparia</i>	Prothonotary Warbler	<i>Protonotaria citrea</i>
Rough-winged Swallow	<i>Stelgidopteryx ruficollis</i>	Northern Parula	<i>Parula americana</i>
Barn Swallow	<i>Hirundo rustica</i>	Magnolia Warbler	<i>Dendroica magnolia</i>
Cliff Swallow	<i>Hirundo pyrrhonota</i>	Yellow-rumped Warbler	<i>Dendroica coronata</i>
Blue Jay	<i>Cyanocitta cristata</i>	Black-throated Warbler	<i>Dendroica caerulescens</i>
American Crow	<i>Corvus brachyrhynchos</i>	Blackburnian Warbler	<i>Dendroica fusca</i>
Tufted Titmouse	<i>Parus bicolor</i>	Yellow-throated Warbler	<i>Dendroica dominica</i>
Carolina Chickadee	<i>Parus carolinensis</i>	Palm Warbler	<i>Dendroica palmarum</i>
Black-capped Chickadee	<i>Parus atricapillus</i>	Blackpoll Warbler	<i>Dendroica striata</i>
Eastern Phoebe	<i>Sayornis phoebe</i>	Cerulean Warbler	<i>Dendroica cerulea</i>
House Wren	<i>Troglodytes aldou</i>	Black-and-white Warbler	<i>Mniotilta varia</i>
Carolina Wren	<i>Thryothorus ludovicianus</i>	American Redstart	<i>Setophaga ruticilla</i>
Winter Wren	<i>Troglodytes troglodytes</i>	Yellow Warbler	<i>Dendroica petechia</i>
Sedge Wren	<i>Cistothorus platensis</i>	Kentucky Warbler	<i>Oporornis formosus</i>
Marsh Wren	<i>Cistothorus palustris</i>	Hooded Warbler	<i>Wilsonia citrina</i>
Golden-crowned Kinglet	<i>Regulus satrapa</i>	Common Yellowthroat	<i>Geothlypis trichas</i>
Ruby-crowned Kinglet	<i>Regulus calendula</i>	Yellow-breasted Chat	<i>Icteria virens</i>
		Northern Waterthrush	<i>Seiurus noveboracensis</i>

Louisiana Waterthrush	<i>Seiurus motacilla</i>	Harris' Sparrow	<i>Zonotrichia querula</i>
Mourning Warbler	<i>Oporornis philadelphia</i>	Dark-eyed Junco	<i>Junco hyemalis</i>
Wilson's Warbler	<i>Wilsonia pusilla</i>	Lapland Larkspur	<i>Calcarius lapponicus</i>
Canada Warbler	<i>Wilsonia canadensis</i>	Bobolink	<i>Dolichonyx oryzivorus</i>
Summer Tanager	<i>Piranga rubra</i>	Brown Creeper	<i>Certhia americana</i>
Scarlet Tanager	<i>Piranga olivacea</i>	White-breasted Nuthatch	<i>Sitta carolinensis</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Dickcissel	<i>Spiza americana</i>
Northern Cardinal	<i>Cardinalis cardinalis</i>	Eastern Meadowlark	<i>Sturnella magna</i>
Blue Grosbeak	<i>Guiraca caerulea</i>	Western Meadowlark	<i>Sturnella neglecta</i>
Indigo Bunting	<i>Passerina cyanea</i>	Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	Rusty Blackbird	<i>Euphagus carolinus</i>
Clay-colored Sparrow	<i>Spizella pallida</i>	Brown-headed Cowbird	<i>Molothrus ater</i>
Field Sparrow	<i>Spizella pusilla</i>	Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>
Vesper Sparrow	<i>Poocetes gramineus</i>	Common Grackle	<i>Quiscalus quiscula</i>
Lark Sparrow	<i>Chondestes grammacus</i>	Orchard Oriole	<i>Icterus spurius</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Baltimore Oriole	<i>Icterus galbula</i>
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	Pine Siskin	<i>Carduelis pinus</i>
Fox Sparrow	<i>Passerella iliaca</i>	House Sparrow	<i>Passer domesticus</i>
Lincoln's Sparrow	<i>Melospiza lincolni</i>	American Goldfinch	<i>Carduelis tristis</i>
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	Purple Finch	<i>Carpodacus purpureus</i>
Song Sparrow	<i>Melospiza melodia</i>	Evening Grosbeak	<i>Coccothraustes vespertinus</i>
American Tree Sparrow	<i>Spizella arborea</i>	American Avocet	<i>Recurvirostra americana</i>
Chipping Sparrow	<i>Spizella passerina</i>	Piping Plover	<i>Charadrius alexandrinus</i>
White-throated Sparrow	<i>Zonotrichia albicollis</i>		
Swamp Sparrow	<i>Melospiza georgiana</i>		

### Mammals (Harvey 1992, Schwartz and Schwartz 1981)

Opossum	<i>Didelphis virginiana</i>	Fox Squirrel	<i>Sciurus niger</i>
Southeastern Shrew	<i>Sorex longirostris</i>	Beaver	<i>Castor canadensis</i>
Short-tailed Shrew	<i>Blarina brevicauda</i>	Western Harvest Mouse	<i>Reithrodontomys megalotis</i>
Eastern Mole	<i>Scalopus aquaticus</i>	Deer Mouse	<i>Peromyscus maniculatus</i>
Indiana Bat <sup>E</sup>	<i>Myotis sodalis</i>	Golden Mouse	<i>Ochrotomys notteli</i>
Gray Bat <sup>E</sup>	<i>Myotis grisescens</i>	Southern Bog Lemming	<i>Synaptomys cooperi</i>
Eastern Pipistrelle	<i>Pipistrellus subflavus</i>	Meadow Vole	<i>Microtus pennsylvanicus</i>
Little Brown Bat	<i>Myotis lucifugus</i>	Muskrat	<i>Ondatra zibethicus</i>
Big Brown Bat	<i>Eptesicus fuscus</i>	Meadow Jumping Mouse	<i>Zapus hudsonius</i>
Silver-haired Bat	<i>Laionycteris noctivagans</i>	Coyote	<i>Canis latrans</i>
Red Bat	<i>Lasiurus borealis</i>	Gray Fox	<i>Urocyon cinereoargenteus</i>
Evening Bat	<i>Nycticeius humeralis</i>	Raccoon	<i>Procyon lotor</i>
Hoary Bat	<i>Lasiurus cinereus</i>	Mink	<i>Mustela vison</i>
Eastern Cottontail	<i>Sylvilagus floridanus</i>	Striped Skunk	<i>Mephitis mephitis</i>
Eastern Gray Squirrel	<i>Sciurus carolinensis</i>	White-tailed Deer	<i>Odocoileus virginianus</i>

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