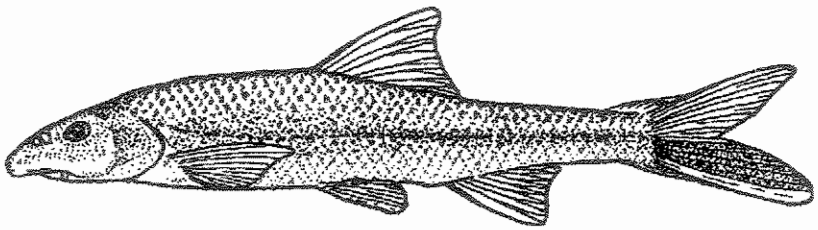
Status Report on Sturgeon Chub (Macrhybopsis gelida), a Candidate Endangered Species



U.S. Fish and Wildlife Service
Ecological Services
North Dakota State Office
1500 East Capitol Avenue
Bismarck, North Dakota 58501

August 1993

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APPENDICES

Taxon name: *Macrhybopsis gelida* (Girard).

Common name: Sturgeon chub

Family: Cyprinidae

States/Nation where taxon occurs: Arkansas, Iowa, Illinois, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Montana, Nebraska, North Dakota, South Dakota, Tennessee, and Wyoming, USA.

Current Federal status: Category 2 (U.S. Department of the Interior, 1991).

Recommended Federal status: Under review.

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Original date of report: August 1993

Date of most recent revision: Not applicable

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I. Species Information.

1. Classification and nomenclature.

A. Species or intraspecific taxon.

1. Scientific Name.

a. Binomial. *Macrhybopsis gelida* (Girard) (American Fisheries Society 1991).

b. Full bibliographic citation. *Gobio gelidus*

Girard, C.F. 1856. Researches upon the cyprinoid fishes inhabiting the fresh waters of the United States west of the Mississippi Valley, from specimens in the museum of the Smithsonian Institution. Proceedings of the Philadelphia Academy of Natural Sciences 8:165-213.

Jordan and Gilbert (1882) listed the species as *Ceratichthys gelidus*. Jordan and Evermann (1896) consolidated the genus *Ceratichthys* into the genus *Hybopsis* and placed sturgeon chub in the subgenus *Erimystax* as *H. gelidus*. Cockerell and Allison (1909) moved *H. gelidus* into the subgenus *Macrhybopsis*. Jordan (1920) gave *Macrhybopsis* generic status and this remained unchanged through 1929. Jordan et al. (1930) changed *H. gelidus* to *gelida* so that the specific name matched the gender of the generic name. Bailey (1951) returned the species to *Hybopsis*. Mayden (1989) reclassified it into the genus *Macrhybopsis*. Coburn and Cavender (in press) followed Mayden's (1989) classification.

c. Type specimens. Sturgeon chub were first collected from the Milk River in Montana, during the Pacific Railroad Surveys of 1853-1855 by Dr. George Suckley, under Governor Isaac I. Stevens (Girard 1856). The 10 type specimens are located in the United States National Museum at the Smithsonian Institution (USNM 59137).

Additional specimens.

California Academy of Sciences (CAS): 1337

Cornell University (CU): 65811

Florida State Museum (FSU): 5 specimens

Illinois Natural History Survey (INHS): 10 specimens

Oklahoma State University (OSU): 11601, 12473, 23361

South Dakota State University (SDSU): 155 specimens

Southern Illinois University - Carbondale (SIUC): 6222, 6266, 8284, 12825

United States National Museum at the Smithsonian Institution (USNM): 59137, 76049, 76050, 125133, 174889, 174890

University of Kansas Museum of Natural History (KU): 1852, 1888, 1963, 2171, 2225, 2446, 2449, 3847, 3857, 4488, 4654, 6862, 8111, 8124, 9687, 9902, 10154, 13985, 17360, 17361, 19775, 19882, 22101

University of Michigan Museum of Zoology (UMMZ): 92262, 94170, 94171, 94759, 97832-97834, 105473, 106366, 111576, 120360-120369, 134682, 134796, 135055, 135099, 135661, 135772, 135810-135815, 135821, 147043, 161905-161917, 162937, 163831-163834, 164819, 164849, 166828-166852, 166957-166991, 167109-167115, 205287

University of Minnesota James Ford Bell Museum of Natural History (JFBMNH): 16734, 18144, 22495, 22496

University of Nebraska - Omaha (UNO): 3935, 13983

University of Nebraska State Museum (UNSM): 506, 1612, 3656, 5601, 5602, 5549, 15602

University of North Dakota (UND): F947, F955, F1395-F1402, F1584-F1602

University of Tennessee (UT): 57+ specimens

University of Washington (UW): 2 specimens

U.S. Fish & Wildlife Service (Bismarck, ND) (USFWS): 4 specimens

2. **Pertinent synonym.** None.

3. **Common names.** Sturgeon chub, keel-scaled minnow (Schrenkeisen 1938), sturgeon dace (Johnson 1942; Baxter and Simon 1970), roughscale chub (Morris 1960).

4. **Taxon codes.** Not applicable.

5. **Size of genus.** Four species; occurs with the speckled chub (*M. aestivalis*), sicklefin chub (*M. meeki*), and silver chub (*M. storeriana*).

B. **Family classification.**

1. **Family name.** Cyprinidae.

2. **Pertinent synonyms.** None.

3. **Common name for family.** Carps and minnows.

C. **Major fish group.** Order Cypriniformes, Suborder Cyprinoidei.

D. **History of knowledge of taxon.** The original collection was made in the Milk River, a Missouri River tributary in Montana (Girard 1856). The exact location where the specimens were taken is unreported. The collection was made in association with the Pacific Railroad Surveys of 1853-1855.

E. **Comments on current alternative taxonomic treatment.** Coburn and Cavender (in press) followed Mayden's (1989) classification renaming *H. gelida* as *M. gelida*.

2. **Present legal or other formal status.**

A. **International.**

1. **Present designated or proposed legal protection or regulation.** None.

2. **Other current formal status recommendations.** None.

3. **Review of past status.** None.

B. **National.**

1. **United States.**

a. **Present designated or proposed legal protection or regulation.** The taxon has Federal category 2 status, but does not receive legal protection. The designation suggests that Federal agencies and other organizations consider the taxon in environmental planning.

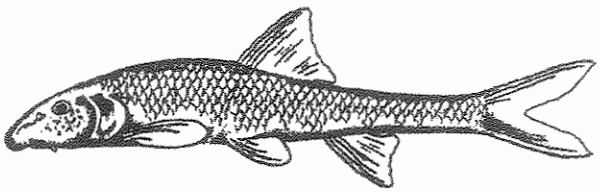
b. **Other current formal status recommendation.** None.

c. **Review of past status.** Not applicable.

C. **State.** State designated or proposed legal/protective status of sturgeon chub.

State	Classification	Citation
AR	Undetermined	Robison and Buchanan (1988)
IA	None	IA Dept. Natural Res. (1988)
IL	None	IL Natural Heritage Program (1990)
KS	Threatened	KS Dept. Wildlife & Parks (1992)
KY	Special concern	KY Dept. Fish & Wildlife Resources (1991)
LA	Accidental in state	LA Natural Heritage Program (1990)
MO	Rare	MO Dept. Conservation (1986)
MS	None	MS Dept. Wildlife, Fisheries & Parks (1992)
MT	Special concern	Holton (1980)
NE	Special concern	Lock (pers. comm.)
ND	Watch	ND Chapter Wildlife Society (1986)
SD	Threatened	Ashton and Dowd (1991)
WY	Imperiled in state	The Nature Conservancy (1991)
TN	In need of management	TN Wildlife Resources Commission (1991)

3. **Description.**



Sturgeon chub
[Reprinted from Pflieger (1975) by permission]

A. **General nontechnical description.** Sturgeon chub are usually tan to pale green on the back, and cream to white on the belly. Juveniles have a mottled appearance. A few black speckles are occasionally present on the sides and back. Sturgeon chub have a long, fleshy snout and the mouth is located on the underside of the head. They have small eyes, streamlined bodies, and deeply-forked tails. Scales on the back and sides have ridges of skin arranged in rows. Taste buds are abundant on the underside of the head, and on the belly and fins. Maximum length is approximately 10 cm and weight of a mature adult can exceed 5 g.

B. **Technical description.** Sturgeon chub have exceptionally dense concentrations of sensory papillae on the ventral surface, fins, and gular region. A single barbel is located at the corners of the mouth. They also exhibit longitudinally-arranged, epidermal keels on most scales. Lateral line

neuromasts are abundant and protected. The head is depressed and a long, fleshy snout overhangs the subterminal mouth. The eyes are reduced. The caudal fin is deeply forked and the caudal peduncle is narrow. Maximum recorded total length is 96.5 mm (Stewart 1981). Morphological features used to distinguish the species have been determined on adult fish; no work has been conducted on larval specimens. Sturgeon chub meristic characteristics include 37-46 lateral line scales, 8 or 9 dorsal and anal fin rays and a pharyngeal tooth structure of 1,4-4,1 (Cross 1967; Eddy and Underhill 1978; Robison & Buchanan 1988).

C. **Local field characters.** Sturgeon chub resemble speckled chub and sicklefin chub. The primary distinguishing feature of sturgeon chub is the epidermal keels. In comparison with speckled chub, sturgeon chub have scattered pigmentation versus organized spots on the dorsal surface, smaller eyes, shorter maxillary barbels, and the lower lobe of their caudal fin is darker than the upper lobe. The pectoral fins of sturgeon chub are shorter than on sicklefin chub and the dorsal fin is not falcate.

D. **Identifying characteristics of material which is in interstate or international commerce or trade.** Not applicable.

E. **Photographs and/or line drawings.**

Ashton and Dowd (1991) - color photograph: adult.
Baxter and Simon (1970) - black and white photograph: adult.
Branson (1963) - line drawings: olfactory apparatus.
Branson (1966) - line drawings: head.
Cross (1967) - line drawing (shaded): adult.
Eddy and Underhill (1978) - line drawing: adult.
Jenkins (1980) - line drawing: adult.
Lopinot and Smith (1973) - line drawing: adult.
Moore (1950) - line drawings: head, pectoral fin.
Pflieger (1975) - line drawings: adult.
Reigh and Elsen (1979) - line drawing: adult.
Reno (1969) - line drawings: cephalic lateral line system.
Robison and Buchanan (1988) - color photograph: adult.
Scalet (1979) - line drawing: adult.
Smith (1979) - line drawing: adult.
Stewart (1980) - color photograph: adult.
Stewart (1981) - black and white photographs: scale, keels.
U.S. Fish and Wildlife Service (Bismarck, ND) - 35 mm color slides and color photographs: adult fish from various angles, scales, sectioned gonads.

4. **Significance.**

A. **Natural.**

Peculiar adaptations or structures. The turbidity of streams in the Great Plains region has required adaptive changes in fish inhabitants. Heavy silt loads can eliminate over 90 percent of the incident light in the upper 25 mm of water (Moore 1950). The eyes and optic lobes of sturgeon chub are reduced and further limit vision. The species exhibits a greater development of sensory structures to compensate for diminished visual acuity. Sturgeon chub have a single pair of maxillary barbels. However, sensory papillae are abundant over the entire ventral surface and within the buccal cavity (Branson 1963, 1966; Davis and Miller 1967). Additional sensory structures are located on the pectoral fins. Lateral line neuromasts are abundant and canal pores are specialized to prevent suspended particulates from entering (Reno 1969). Scales on the dorsal and lateral surfaces have unique, longitudinally-arranged epidermal keels. These keels may improve hydrodynamic efficiency (Blake 1983; Fish and Hui 1991) and may also have a sensory function (Cross 1967).

Disjunction or endemism in range. Sturgeon chub are endemic to the Missouri and lower Mississippi Rivers and many Missouri River tributaries. Dams constructed on the Missouri River and numerous tributaries have caused habitat disjunction and restricted fish movements.

Taxonomic uniqueness. The sturgeon chub is unique among cyprinids in having keeled scales.

Obligate relationships with other species. There are no known obligate relationships with other species.

B. **Human.** Sturgeon chub have scientific interest because of their physical adaptations to turbid riverine environments.

5. **Geographical distribution.**

A. **Geographical range.** Sturgeon chub have been found in 14 states within the United States.

▩ Historic range

B. **Precise occurrences.** Occurrences are broken down into six categories based upon: how recently collections were made, whether collection sites were revisited since 1989, and the specificity of reported site locale. Several collections appearing in separate categories (1-5) were made at sites within short distances of each other. There is no basis for

assuming that these collections represent discrete, localized populations, and continued existence of the species at nearby sites should be considered.

1. **Populations currently or recently known extant.** Occurrence at these sites was verified by field visits.

Current range

Missouri:

Missouri River, Andrew Co., boat ramp near Nodaway; 9/27/90 (Etnier, unpubl. data)

Missouri River, Cooper Co., Taylor's Landing at I-70 bridge; 9/25/90 (Etnier, unpubl. data)

Missouri River, Buchanan Co., second dike below Hwy 92 bridge; 7/2/92 (Wenke, unpubl. data)

Missouri River, Cole Co., Marion, RM 159; 4/19/90, 5/1/92 (Pflieger, unpubl. data)

Montana:

Yellowstone River, Dawson Co., T. 13 N., R. 54 E., Secs. 4 & 5; 6/8/89 (Werdon, unpubl. data)

Powder River, Custer Co., T. 6 N., R. 52 E., Sec. 30; 6/7/89 (Werdon, unpubl. data)

Powder River, Custer Co., T. 9 N., R. 50 E., Sec. 8; 6/7/89 (Werdon, unpubl. data)

Powder River, Powder River Co., T. 9 S., R. 48 E., Secs. 17 & 18; 6/11/90 (Werdon, unpubl. data)

Powder River, Powder River Co., T. 1 S., R. 54 E., Sec. 17; 6/11/90 (Werdon, unpubl. data)

Powder River, Custer Co., T. 9 N., R. 51/52 E., Sec. 8; 6/11/90 (Werdon, unpubl. data)

Nebraska:

Platte River, Dodge Co., T. 17 N., R. 7 E., Sec. 13 & 24; T. 17 N., R. 8 E., Sec. 20, RM 60; 7/9/87 (Peters et al. 1989)

Nebraska (Cont.):

Platte River, Sarpy Co., T. 12 N., R. 10 E., Sec. 12, 0.5 mile east of Schramm State Park; 9/10/91 (UNSM 1992)

Platte River, Sarpy Co., Schramm State Park; 9/17/91 (UNSM 1992)

Missouri River, Richardson Co., wing dam near Rulo boat ramp; 4/4/88 (Hesse and Mestl, unpubl. data)

North Dakota:

Yellowstone River, McKenzie Co., T. 151 N., R. 104 W., Sec. 35; 7/21/92 (USFWS 1992)

Wyoming:

Powder River, Johnson Co., T. 44 N., R. 78 W., Sec. 5; 5/31/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 44 N., R. 78 W., Sec. 17; 6/1/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 45 N., R. 78 W., Sec. 27; 6/1/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 44 N., R. 78 W., Sec. 20; 6/1/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 46 N., R. 77 W., Sec. 18; 6/2/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 47 N., R. 78 W., Sec. 25; 6/2/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 46 N., R. 77 W., Sec. 18; 6/4/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 47 N., R. 78 W., Sec. 36; 6/4/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 47 N., R. 78 W., Sec. 24; 6/4/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 47 N., R. 77 W., Sec. 20, NW 1/4; 6/4/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 48 N., R. 77 W., Sec. 20, SW 1/4; 6/5/90 (Werdon, unpubl. data)

Wyoming (Cont.):

Powder River, Johnson Co., T. 48 N., R. 77 W., Sec. 31; 6/5/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 47 N., R. 78 W., Sec. 13; 6/5/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 48 N., R. 77 W., Sec. 8; 6/5/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 51 N., R. 77 W., Sec. 8; 6/7/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 52 N., R. 77 W., Sec. 3; 6/7/90 (Werdon, unpubl. data)

Powder River, Johnson Co., T. 52 N., R. 77 W., Sec. 32; 6/7/90 (Werdon, unpubl. data)

Powder River, Sheridan Co., T. 50 N., R. 77 W., Sec. 28; 6/8/90 (Werdon, unpubl. data)

Powder River, Sheridan Co., T. 54 N., R. 77 W., Sec. 27; 6/8/90 (Werdon, unpubl. data)

Powder River, Sheridan Co., T. 56 N., R. 77 W., Sec. 23; 6/9/90 (Werdon, unpubl. data)

Powder River, Sheridan Co., T. 57 N., R. 76 W., Sec. 29; 6/10/90 (Werdon, unpubl. data)

Powder River, Campbell Co., T. 58 N., R. 76 W., Sec. 12; 6/10/90 (Werdon, unpubl. data)

Powder River, Campbell Co., T. 58 N., R. 75 W., Sec. 31; 6/10/90 (Werdon, unpubl. data)

Powder River, Campbell Co., T. 58 N., R. 75 W., Sec. 29; 6/10/90 (Werdon, unpubl. data)

2. **Populations known or assumed extirpated.** Collections at these sites in 1989 and 1990 failed to locate sturgeon chub (Werdon 1992).

Iowa:

Missouri River, Woodbury Co., islands by Big Sioux River mouth, Sioux City; (Meek 1892)

Kansas:

Smoky Hill River, Geary Co., T. 12 S., R. 5 E., Sec. 14, Hwy 77 bridge south of Junction City; 5/9/64 - KU 8124 (Metcalf 1966; Cross 1967)

Kansas River, Douglas Co., T. 12 S., R. 20 E., Sec. 30, Lawrence; 10/24/51-KU 1852, 11/10/51-KU 1888, 6/2/52-KU 2446, 6/12/52-KU 2449, 6/6/69-KU 13985, (Cross 1953; Metcalf 1966; KU 1992)

Kansas River, Leavenworth/Douglas Co., Eudora; 3/14/59-KU 4488, 4/20/62-KU 9902

Kansas River, Leavenworth Co., T. 125 S., R. 20 E., Sec. 27; 4/5/52-KU 2171

Missouri River, Atchinson Co., T. 6 S., R. 21 E., Sec. 17; 8/24/57-KU 3857 (KU 1992)

Missouri River, Atchinson Co. near Oak Mills, T. 75 S., R. 21 E., Sec. 12; 8/24/57-KU 3847.

Missouri:

Missouri River, Boone Co., Rocheport; 3/9/46 (Bailey & Allum 1962)

Missouri River, Cole Co., Jefferson City, RM 142-153; 8/29-9/6/45 (Fisher 1962)

Missouri River, Saline Co., Miami, RM 262-269.2; 5/8-17/45 (Fisher 1962)

Missouri River, Lafayette Co., Lexington, RM 323-325; 8/14-23/45 (Fisher 1962)

Montana:

Tongue River, Custer Co., Miles City; 6/11/26 (Bailey & Allum 1962)

Tongue River, Custer Co., T. 7 N., R. 47 E., Sec. 14 & 15; (Elser et al. 1980)

Box Elder Creek, Carter and Fallon Cos., T. 18 N., R. 57 E., Sec. 31; (Elser et al. 1980)

Box Elder Creek, Carter Co., T. 5 S., R. 58 E., Sec. 19; (Haddix & Estes 1976)

Montana (Cont.):

Powder River, Prairie Co., T. 11 N., R. 50 E., Sec. 3; 6/10/26 (Elser et al. 1980; UMMZ 1992)

Powder River, Custer Co., T. 6 N., R. 52 E., Sec. 30; (Elser et al. 1980)

Powder River, Powder River Co., T. 9 S., R. 47 E., Sec. 36; (Elser et al. 1980)

Powder River, Powder River Co., T. 5 S., R. 51 E., Sec. 3; (Elser et al. 1980)

Nebraska:

Bazile Creek, Knox Co., east of Niobrara; (Evermann & Cox 1896)

Republican River, Nuckolls Co., Superior; 6/51-KU 2225 (Bailey & Allum 1962)

Republican River, Webster Co., 2 miles east of Inavale; 7/15/40 (Bailey & Allum 1962)

Republican River, Red Willow Co., 1 mile south of Indianola; 7/17/40 (Bailey & Allum 1962)

Missouri River, Thurston Co., NE of Macy; 8/29/41 (Bailey & Allum 1962)

Missouri River, Dixon Co., NW of Newcastle; 8/28/41 (Bailey & Allum 1962)

Platte River, Merrick Co., T. 11 N., R. 8 W., Sec. 31, Grand Island; (Evermann & Cox 1896)

Platte River, Butler Co., T. 17 N., R. 1 E., Sec. 34, NW of Bellwood; 6/11/40 (Bailey & Allum 1962)

Loup River, Platte Co., 1 mile south of Monroe; 8/21/41 (Bailey & Allum 1962)

Elkhorn River, Dodge Co., T. 19 N., R. 8 E., Sec. 15, 1 mile north of Winslow; 8/27/41 (Bailey & Allum 1962)

North Dakota:

White Earth Creek, Mountrail Co., at mouth; 7/24/53 (Reigh & Elsen 1979)

North Dakota (Cont.):

Little Missouri River, Slope Co., Marmarth; 6/9/26 (Hankinson 1929; Bailey & Allum 1962)

Little Missouri River, Dunn Co., T. 148 N., R. 95 W., Sec. 34; 7/29/77 (Reigh & Owen 1979)

Little Missouri River, McKenzie Co., T. 148 N., R. 99 W., Sec. 35; 6/1/76 (Reigh & Owen 1979)

Little Missouri River, McKenzie Co., T. 148 N., R. 99 W., Sec. 31; 6/2/76 (Reigh & Owen 1979)

Little Missouri River, McKenzie Co., T. 147 N., R. 101 W., Sec. 22; 7/18/77 (Reigh & Owen 1979)

Little Missouri River, McKenzie Co., T. 146 N., R. 102 W., Sec. 2; 6/3/76 (Reigh & Owen 1979)

Little Missouri River, Billings Co., T. 143 N., R. 102 W., Sec. 4; 7/15/77 (Reigh & Owen 1979)

Little Missouri River, Billings Co., T. 143 N., R. 102 W., Sec. 26; 7/12/76 (Reigh & Owen 1979)

Little Missouri River, Billings Co., T. 142 N., R. 102 W., Sec. 12; 7/13/76, 7/15/77 (Reigh & Owen 1979)

Little Missouri River, Billings Co., T. 142 N., R. 102 W., Sec. 23; 7/13/76 (Reigh & Owen 1979)

Little Missouri River, Billings Co., T. 141 N., R. 101 W., Sec. 5; 7/13/76 (Reigh & Owen 1979)

Little Missouri River, Billings Co., T. 141 N., R. 101 W., Sec. 33; 7/14/76 (Reigh & Owen 1979)

Little Missouri River, Billings Co., T. 140 N., R. 102 W., Sec. 10; 7/14/76 (Reigh & Owen 1979)

Little Missouri River, Billings Co., T. 140 N., R. 102 W., Sec. 34; 6/24/65 (KU 10154)

Little Missouri River, Billings Co., T. 137 N., R. 101 W., Sec. 31; 7/15/76, 7/14/77 (Reigh & Owen 1979)

Little Missouri River, Billings Co., T. 137 N., R. 102 W., Sec. 4; 7/14/77 (Reigh & Owen 1979)

Little Missouri River, Slope Co., T. 136 N., R. 103 W., Sec. 6; 7/16/76 (Reigh & Owen 1979)

North Dakota (Cont.):

Little Missouri River, Slope Co., T. 136 N., R. 103 W., Sec. 3; 7/16/76, 7/10/77 (Reigh & Owen 1979)

Little Missouri River, Slope Co., T. 136 N., R. 102 W., Secs. 9, 16 & 17; 1979 (Stewart, pers. comm.)

Little Missouri River, Billings Co., T. 139 N., R. 102 W., Sec. 10; 7/20/76 (Reigh & Owen 1979)

Little Missouri River, Billings Co., T. 138 N., R. 102 W., Sec. 19; 7/20/76 (Reigh & Owen 1979)

Little Missouri River, Slope Co., T. 136 N., R. 104 W., Sec. 30; 7/21/76, 7/10/77 (Reigh & Owen 1979)

Little Missouri River, Slope Co., T. 135 N., R. 105 W., Sec. 15; 7/9/77 (Reigh & Owen 1979)

Little Missouri River, Slope Co., T. 135 N., R. 105 W., Sec. 33; 7/9/77 (Reigh & Owen 1979)

Little Missouri River, Slope Co., T. 134 N., R. 105 W., Sec. 30; 7/22/76 (Reigh & Owen 1979)

Little Missouri River, Bowman Co., T. 132 N., R. 106 W., Sec. 15; 7/22/76 (Reigh & Owen 1979)

Little Missouri River, Slope Co., T. 133 N., R. 105 W., Sec. 30; 7/22/76 (Reigh & Owen 1979)

Little Missouri River, Slope Co., T. 133 N., R. 105 W., Sec. 7; 7/23/76 (Reigh & Owen 1979)

Little Missouri River, Golden Valley Co., T. 137 N., R. 103 W., Sec. 32; 7/23/76 (Reigh & Owen 1979)

Little Missouri River, Slope Co., T. 136 N., R. 104 W., Sec. 9; 7/26/76 (Reigh & Owen 1979)

Little Missouri River, Bowman Co., T. 131 N., R. 106 W., Sec. 13; 7/27/76 (Reigh & Owen 1979)

Little Missouri River, Bowman Co., T. 131 N., R. 106 W., Sec. 2; 7/27/76 (Reigh & Owen 1979)

Little Missouri River, Bowman Co., T. 131 N., R. 105 W., Sec. 31; 7/27/76 (Reigh & Owen 1979)

North Dakota (Cont.):

Little Missouri River, Bowman Co., T. 130 N., R. 106 W., Sec. 10; 7/27/76, 7/8/77 (Reigh & Owen 1979)

Little Missouri River, Bowman Co., T. 130 N., R. 106 W., Sec. 29; 7/27/76, 7/8/77 (Reigh & Owen 1979)

Little Missouri River, Bowman Co., T. 129 N., R. 106 W., Sec. 4; 7/28/76 (Reigh & Owen 1979)

Little Missouri River, Bowman Co., T. 129 N., R. 106 W., Sec. 21; 7/28/76, 7/8/77 (Reigh & Owen 1979)

Little Missouri River, Bowman Co., T. 129 N., R. 106 W., Sec. 28; 7/28/76 (Reigh & Owen 1979)

Little Missouri River, McKenzie Co., T. 145 N., R. 101 W., Sec. 18; 7/18/77 (Reigh & Owen 1979)

Box Elder Creek, Bowman Co., T. 129 N., R. 106 W., Sec. 32; 7/28/76 (Reigh & Owen 1979)

Beaver Creek, Golden Valley Co., T. 142 N., R. 105 W., Sec. 6; 7/21/77 (Reigh & Owen 1979)

Beaver Creek, Golden Valley Co., T. 144 N., R. 103 W., Sec. 22; 6/18/76 (Reigh & Owen 1979)

Yellowstone River, McKenzie Co., T. 150 N., R. 104 W., Sec. 16; 7/26/77 (Reigh & Owen 1979)

Yellowstone River, McKenzie Co., T. 151 N., R. 104 W., Sec. 26; 7/27/77 (Reigh & Owen 1979)

Yellowstone River, McKenzie Co., T. 151 N., R. 104 W., Sec. 14; 7/26/77 (Reigh & Owen 1979)

South Dakota:

Little Missouri River, Harding Co., T. 22 N., R. 2 E., Sec. 33 NW 1/4; 7/7/76 (Bich & Scalet 1977)

Little Missouri River, Harding Co., T. 22 N., R. 2 E., Sec. 28 SW 1/4; 7/8/76 (Bich & Scalet 1977)

Little Missouri River, Harding Co., T. 22 N., R. 2 E., Sec. 28 SW 1/4, 30 m downstream; 7/8/76 (Bich & Scalet 1977)

Little Missouri River, Harding Co., T. 22 N., R. 2 E., Sec. 8 NW 1/4; 7/9/76 (Bich & Scalet 1977)

South Dakota (Cont.):

Little Missouri River, Harding Co., T. 21 N., R. 2 E., Sec. 21 NW 1/4, SE of Hwy 988; 7/15/76 (Bich & Scalet 1977)

White River, near mouth; (Evermann & Cox 1896)

White River, Jackson Co., T. 3 S., R. 22 E., Sec. 31; 7/20/34 (Bailey & Allum 1962)

White River, Jackson Co., T. 3 S., R. 24 E., Sec. 17; 8/10/31 (Bailey & Allum 1962)

Grand River, Corson & Walworth Cos., T. 19 N., R. 30 E., Sec. 31; 8/24/52 (Bailey & Allum 1962)

Grand River, Corson Co., T. 20 N., R. 28 E., Sec. 26; 8/24/52 (Bailey & Allum 1962)

Cheyenne River, Pennington Co., T. 1 N., R. 14 E., Sec. 2; 7/14/50 (Bailey & Allum 1962)

Missouri River, Charles Mix & Gregory Cos., 1-2 miles below Ft. Randall Dam, T. 95 N., R. 65 W.; 8/29/52 (Bailey & Allum 1962)

Missouri River, Yankton Co., 5 mile reach below Yankton; 8/30/52 (Bailey & Allum 1962)

Wyoming:

North Platte River, Converse Co., Douglas; (Evermann & Cox 1896)

Big Horn River, 1 mile upstream of Yellowtail Reservoir; 4/81 (WYGFD, unpubl. data)

Powder River, Sheridan Co., Arvada, 6/24/61-KU 6862.

Powder River, Johnson Co., T. 43 N., R. 79 W., Sec. 13; (Stewart 1981)

Powder River, Johnson Co., T. 43 N., R. 79 W., Sec. 14; (Stewart 1981)

Powder River, Johnson Co., T. 44 N., R. 78 W., Sec. 20; (Stewart 1981)

Powder River, Johnson Co., T. 46 N., R. 78 W., Sec. 36; (Stewart 1981)

Wyoming (Cont.):

Powder River, Johnson Co., T. 46 N., R. 77 W., Sec. 19; (Stewart 1981)

Powder River, Johnson Co., T. 49 N., R. 77 W., Sec. 5 & 8; (Stewart 1981)

Powder River, Johnson Co., T. 50 N., R. 77 W., Sec. 17; (Stewart 1981)

Powder River, Johnson Co., T. 52 N., R. 77 W., Sec. 32 & 33; (Stewart 1981)

Powder River, Johnson Co., T. 51 N., R. 77 W., Sec. 20; (Stewart 1981)

Powder River, Sheridan Co., T. 52 N., R. 77 W., Sec. 2 & 11; (Stewart 1981)

Powder River, Sheridan Co., T. 55 N., R. 77 W., Sec. 34 & 35; (Stewart 1981)

Powder River, Johnson Co., T. 50 N., R. 77 W., Sec. 22; (Stewart 1981)

Powder River, Sheridan Co., T. 54 N., R. 77 W., Sec. 26; (Stewart 1981)

Powder River, Johnson Co., T. 53 N., R. 77 W., Sec. 35; (Stewart 1981)

Powder River, Sheridan Co., T. 55 N., R. 77 W., Sec. 23; (Stewart 1981)

Powder River, Sheridan Co., T. 56 N., R. 77 W., Sec. 12; (Stewart 1981)

3. **Historically known populations where current status not known.** No field collections have been at these sites to verify the presence or absence of sturgeon chub.

Arkansas:

Mississippi River, across from Mississippi Co.; (Robison & Buchanan 1988)

Iowa:

Missouri River, Mills Co., 3.5 miles west of Pacific Junction; (Bailey 1951)

Illinois:

Mississippi River, Jackson Co., Bar 76 near Chester; 8/23/40 (Bailey & Allum 1962)

Mississippi River, Chester; 2/30 (O'Donnell 1935)

Mississippi River, Jackson Co., Grand Tower; 8/24/38 (Bailey & Allum 1962)

Mississippi River, Jackson Co., Grand Tower; 11/12/81, 3/3/82 (Burr, pers. comm.)

Mississippi River, Jackson Co., Sandy Island, Grand Tower; 5/13/36 (UMMZ 1988)

Mississippi River, Jackson Co., Grand Tower Island; 5/2/81, 10/24/85 (Burr, pers. comm.)

Mississippi River, Alexander Co., Cairo; 5/18/44 (Bailey & Allum 1962)

Kansas:

Kansas River, Shawnee Co., Willard; 5/9/64-KU 8111 (Metcalf 1966)

Kansas River, Wyandotte Co., T. 11 S., R. 24 E., Sec. 28; 8/9/79 (KU 1992)

Missouri River, Atchison Co.near Oak Mills, T. 7 S., R. 21 E., Sec. 12; 8/24/57 (Bailey & Allum 1962; KU 3847)

Wakarusa River, Douglas Co., T. 135 N., R. 20 E., Sec. 20; 8/24/51-KU 1963

Louisiana:

Mississippi River, west side of Fancy Pt. Towhead below St. Francisville; (Guillory 1979)

Missouri:

Missouri River, Cooper, Boone, and Moniteaus Cos., 1 mile E of Wooldridge; 5/25/79 (Etnier, unpubl. data)

Montana:

Sears Creek, Richland Co., T. 21 N., R. 58 E., Sec. 27; 1979 or 1980 (Morris et al. 1981)

Montana (Cont.):

Sunday Creek, Custer Co., T. 9 N., R. 47 E., Sec. 36; 9/12/74 (Haddix & Estes 1976)

Yellowstone River, Dawson Co., T. 18 N., R. 57 E., Sec. 30; (Elser et al. 1980)

Yellowstone River, Dawson Co., T. 18 N., R. 56 E., Sec. 36, Intake; 8/21/75, 9/18/75, 10/3/75 (Haddix & Estes 1976)

Yellowstone River, Richland Co., Sidney; 10/3/75, 10/30/75 (Haddix & Estes 1976)

Teton River, Chouteau Co., Chester Bridge; 9/11/79 (Holton 1980)

Nebraska:

Missouri River, Cass Co., 3 miles SE of Plattsmouth; 6/19/40 (Bailey 1951; Bailey & Allum 1962)

Missouri River, Ft. Calhoun intake screen, RM 645.8; 2/77 (UNSM 1992)

Missouri River, Nemaha Co., near Brownville, RM 575.85; 10/25/77-KU 19775

Missouri River, RM 646; 11/21/78 (UNSM 1992)

Platte River, Dawson Co., 1 mile south of Gothenburg; 6/25/31, 9/8/31 (UMMZ 1988)

North Dakota:

Little Missouri River, Dunn Co., T. 148 N., R. 95 W., Sec. 34; 7/29/77 (Reigh 1978)

South Dakota:

Cheyenne River, Pennington Co., T. 1 N., R. 14 E., Sec. 9; 11/29/51 (UMMZ 19)

Tennessee:

Mississippi River, Tipton Co., Randolph, 4.5 miles SW of Gilt Edge; 1/31/81 (Etnier, unpubl. data)

Wyoming:

Big Horn River, Big Horn Co., 3 miles below Shoshone River mouth; 9/3/38 (Simon 1951)

4. Locations not yet investigated believed likely to support additional natural populations. Unknown.

5. Reports having ambiguous or incomplete locality information.

Iowa:

Missouri River; (Harlan & Speaker 1956)

Illinois:

Mississippi River, Madison Co.; (Smith 1979)

Mississippi River, Union Co.; (Smith 1979)

Kansas:

Kansas River, Douglas Co.; (Davis & Miller 1967; KU 2447

Missouri:

Missouri River, 22 km reach above St. Joseph; 1977 or 1978 (Cross & Moss 1987)

Missouri River, St. Charles Co. at mouth of river; 9/24/63-KU 1992

Missouri River, Holt Co., RM 465.2; 10/9/77-KU 19882

Montana:

Milk River; (Girard 1856)

Yellowstone River, Station #225; 1977 (Etnier, unpubl. data)

Yellowstone River, Custer Co., above and below mouth of Tongue River; (Elser et al. 1980)

Yellowstone River, Prairie Co., above and below mouth of Powder River; (Elser et al. 1980)

Powder River, Prairie Co., near mouth; (Bailey & Allum 1962)

Montana (Cont.)

Box Elder Creek, Dawson Co.; 1977 (Elser et al. 1978)

Nebraska:

Republican River, Dundy Co.; (Reno 1969)

Missouri River, Nemaha Co., near Cooper Nuclear Station; 10/25/77 (Hesse et al. 1982;-KU 19775)

Platte River, Hall Co.; (Jenkins & Lachner 1971)

North Dakota:

Little Missouri River; (Personius & Eddy 1955; Van Eeckout 1974; Duerre 1975b)

Little Missouri River; Slope and Bowman Co., 7/22-28/76-KU 17360

Green River; (Duerre 1975a)

Yellowstone River; McKenzie Co., 7/26/76-KU 17361

Wyoming:

Powder River; (Simon 1951; Baxter & Simon 1970)

6. **Locations known or suspected to be erroneous reports.**

Kansas:

Missouri River, Leavenworth Co.; (Gilbert 1886) Specimens collected were actually sicklefin chub.

C. **Biogeographical and phylogenetic history.** Unknown.

6. **General environment and habitat description.**

A. **Concise statement of general environment and habitat.** Sturgeon chub require turbid, free-flowing riverine habitat with a combination of rock, gravel, and/or sand substrate. They are found in greatest abundance in gravel riffles (Stewart 1981; Werdon 1992). Stewart (pers. comm.) observed that if turbidity declined, sturgeon chub were eliminated, both from a competitive standpoint and based upon physiological and morphological characteristics.

B. Physical characteristics

1. Climate.

a. Koppen climate classification. BSk, Cfa.

b. Regional macroclimate. The Missouri River Basin is primarily located in prairie and steppe ecoregions. These are characterized by variable temperatures, low to adequate rainfall, grass and shrub vegetation, and Mollisols and Aridisols. The lower Mississippi River is located in the subtropical ecoregion. This area is characterized by moderate temperatures, adequate rainfall, mixed coniferous-deciduous forests, and Ultisols. Bailey (1980) provides more detailed regional climatology information.

2. Water quality requirements. Water quality requirements of sturgeon chub are unknown, but they are adapted to highly-turbid riverine habitat (Moore 1950; Branson 1963, 1966; Davis and Miller 1967; Reno 1969).

3. Physiographic province. Not applicable.

4. Physiographic and topographic characteristics. Not applicable.

C. Biological characteristics.

1. Frequently associated species. Species with similar habitat utilization and distribution include the sicklefin chub (*Macrhybopsis meeki*) (Jenkins 1980), flathead chub (*Platygobio gracilis*) (Olund and Cross 1961), and longnose dace (*Rhinichthys cataractae*) (Stewart 1981). The sicklefin chub has Federal category 2 status; the flathead chub is declining in portions of its range (Pflieger & Grace 1987), but currently has no Federal category status; longnose dace populations remain abundant and the species has no Federal category status.

2. Dominance and frequency. Sturgeon chub were historically collected infrequently and their abundance in relation to other species in historic collections was usually not reported. The best available data on dominance and frequency is from Pflieger and Grace (1987), but only pertains to the Missouri River in Missouri. Pflieger and Grace (1987) reported sturgeon chub percent species composition (by number) in historic collections for three time periods: 0.1 percent (1940-45); 0.2 percent (1962-72); 0.8 percent (1978-83). They also broke down collections by river section and showed that sturgeon chub were nearly absent from the Missouri River between Kansas

City and the Iowa border (1978-83). Abundance of sturgeon chub during this same time period was greater downstream of Kansas City and was greatest between St. Joseph and St. Louis. Cross and Randall (1987) reported they found three sturgeon chub (1979-81) out of 97,766 specimens taken out of the lower Kansas River. Cross and Randall (1987) made 96 collections (1977-78) at eight sites in a 22-km reach of the Missouri River upstream from St. Joseph, Missouri. The samples contained 13,512 fish of 44 species, but only one sturgeon chub. Hesse et al. (1982) reported similar results based on samples from the Missouri main stem in Nebraska in 1971-77. Of the 57 species recorded, only one sturgeon chub was captured. Dominance appears to vary with habitat type. Stewart (1981) reported that sturgeon chub comprised an average of 28 percent of the species (by number) in gravel riffles, but only 5 percent in mixed riffle/non-riffle areas.

3. **Other endangered, threatened, rare, or vulnerable species occurring in habitat(s) of this taxon.** Pallid sturgeon (*Scaphirhynchus albus*) - endangered; blue sucker (*Cycleptus elongatus*) - category 2; sicklefin chub (*Macrhybopsis meeki*) - category 2; paddlefish (*Polyodon spathula*) - category 2. The population status of category 2 species is uncertain. Reported abundance of these species varies greatly throughout the range of the sturgeon chub.

7. **Population biology.**

A. **General summary.** Sturgeon chub are short-lived (four years) and both sexes mature at 2 years of age (Stewart 1981; Werdon 1992). Spawning is believed to occur in June and July, based upon collections of ripe fish (Lee et al. 1980; Stewart 1981; Werdon 1992).

B. **Demography.**

1. **Known populations.** The range of sturgeon chub extends from the upper Missouri River in Montana nearly to the mouth of the Mississippi River in Louisiana. Construction of the Missouri River main stem dams fragmented sturgeon chub populations. No population estimates have been made, as sturgeon chub are typically collected incidental to other species. Populations currently or recently known to exist are on the lower Yellowstone, Powder, Platte, and Missouri Rivers.

2. **Demographic details.** Sturgeon chub collection reports were subdivided by river. The majority of all sturgeon chub collections have been made on the Missouri and Mississippi Rivers. With the exception of the Yellowstone River, many

tributary collections may have consisted of transitory or displaced specimens.

a. **Milk River (MT).**

1. **Number of fish.** Ten specimens were cataloged from the original collections by Suckley (Girard 1856).

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** There are no published reports of sturgeon chub being collected in the Milk River since Suckley's original collection.

b. **Lower Yellowstone River (MT, ND).**

1. **Number of fish.** Reigh (1978) collected sturgeon chub in 1976 at four locations on the Lower Yellowstone River and deposited two specimens at the University of Kansas (KU 17361). He also recommended threatened status for the species. Elser et al. (1980) made three collections of an unknown number of specimens. Werdon (1992) collected one sturgeon chub on the Yellowstone River in Montana in 1989. The U.S. Fish and Wildlife Service (USFWS) (1992) collected three specimens in McKenzie County, North Dakota in 1992 and 10 specimens in 1993 (USFWS 1993). The North Dakota Game and Fish Department also collected 10 specimens in McKenzie County, North Dakota, in 1993 (NDGF, unpubl. data).

2. **Density.** Unknown.

3. **Evidence of reproduction.** Reigh and Elsen (1979) reported collecting young-of-the-year in July. The USFWS (1992) collected two young-of-the-year in late September 1992.

4. **Evidence of expansion/contraction.** The McKenzie County collections were at a new collection site for the species, but within their historic range.

c. **Big Horn River (WY, MT).**

1. **Number of fish.** Simon (1951) collected five specimens in 1938. The Wyoming Game and Fish Department (unpubl. data) collected a single

sturgeon chub upstream of Yellowtail Reservoir in 1980 or 1981.

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Baxter and Simon (1970) reported that Yellowtail Reservoir eliminated the majority of sturgeon chub habitat in the lower Big Horn River. Werdon (1992) sampled the upstream collection site in 1990 and no sturgeon chub were collected.

d. **Tongue River (WY, MT).**

1. **Number of fish.** Hubbs and Schultz collected 16 specimens in 1926 (UMMZ 1988). Elser et al. (1980) collected an unknown number of specimens.

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Werdon (1992) resampled historic collection sites in 1989-90 and no sturgeon chub were collected.

e. **Box Elder Creek (MT, ND).**

1. **Number of fish.** Unknown.

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** There are no reports of sturgeon chub collections on Box Elder Creek since the late 1970's (Haddix and Estes 1976; Reigh and Owen 1979; Elser et al. 1980).

f. **Teton River (MT).**

1. **Number of fish.** Gardner collected one specimen in 1979 (UMMZ 1988).

2. **Density.** Gardner and Berg (1982) stated that sturgeon chub were uncommon in seine hauls during 1979 and not collected during electrofishing surveys.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Five irrigation reservoirs impound the Teton River (combined storage capacity of 131.7 million m^3) and during the irrigation season portions of the lower river are dewatered.

g. **Powder River (WY, MT).**

1. **Number of fish.** In 1893, Cox collected four sturgeon chub near Arvada, Wyoming (USNM 1992). Other collections in the late 1800's yielded a total of 17 specimens (USNM 1992). Hubbs and Schultz collected 13 specimens in 1926 (UMMZ 1988). Two specimens were collected in 1961 (KU 6862). Stewart (1981) collected approximately 100 sturgeon chub from "ideal habitat" during 1979-80. Werdon (1992) collected 158 sturgeon chub from 1989-90.

2. **Density.** Percent species composition of sturgeon chub in the Powder River appears variable.

Reference	Percent Composition
Rehwinkel (1978)	1.7 - 8.6%
Wichers (1980)	1.3 - 2.0%
Stewart (1981)	5.0 - 28.0%
Werdon (1992)	1.2 - 3.0%

3. **Evidence of reproduction.** Stewart (1981) collected ripe sturgeon chub in June and July 1979, and collected young-of-the-year in November. Werdon (1992) collected six ripe sturgeon chub in June 1990 and collected three separate year-classes.

4. **Evidence of expansion/contraction.** Werdon (1992) resampled collection sites of Evermann and Cox (1896), Jordan and Evermann (1896), Elser et al. (1980), and Stewart (1981), and collected sturgeon chub at 33 of 48 historic sites.

h. **North Platte River (WY, NE).**

1. **Number of fish.** A collection in the late 1800's provided one museum specimen (USNM 1992).

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Werdon (1992) sampled at historic collection sites on the North Platte in 1990 and no sturgeon chub were collected.

i. **Little Missouri River** (MT, SD, ND).

1. **Number of fish.** Hankinson (1929) reported four sturgeon chub collected in 1926. Duerre (1975a) considered sturgeon chub abundant (10+ specimens taken at more than one sampling station) in the main stem Little Missouri River and common (1-10 specimens taken at more than one sampling station) on tributaries to the Little Missouri River. Other collectors (Personius and Eddy 1955; Bailey and Allum 1962; Reigh and Elsen 1979; Reigh and Owen 1979) did not report numbers. One specimen was collected in 1965 (KU 10154); six specimens were collected in 1976 (JFBMNH 1992); and four specimens (KU 17360) by R. Reigh. Stewart (pers. comm.) collected approximately 12 specimens in 1979.

2. **Density.** Unknown.

3. **Evidence of reproduction.** Reigh and Elsen (1979) reported collecting young-of-the-year in late July.

4. **Evidence of expansion/contraction.** Werdon (1992) resampled historic collection sites in 1989-90 and no sturgeon chub were collected.

j. **Beaver Creek** (MT, ND).

1. **Number of fish.** Unknown.

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Werdon (1992) sampled Beaver Creek in 1990 and no sturgeon chub were collected.

k. **White Earth Creek** (ND).

1. **Number of fish.** One specimen was deposited in a museum collection (JFBMNH 1992).

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Werdon (1992)

sampled the historic site at the mouth in 1990 and no sturgeon chub were collected.

l. **Green River** (ND).

1. **Number of fish.** Duerre (1975b) reported 78 sturgeon chub collected at four stations.

2. **Density.** Percent species composition of sturgeon chub at the four sites ranged from 6.5 to 13.6 percent (Duerre 1975b).

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** None.

m. **Grand River** (ND, SD).

1. **Number of fish.** Bailey collected one specimen upstream and three specimens at the mouth (UMMZ 1988).

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** The historic collection sites were inundated by the creation of Lake Oahe and the substrate in the former Grand River channel is heavily silted. Werdon (1992) sampled the area in 1990 and no sturgeon chub were collected.

n. **Cheyenne River** (SD).

1. **Number of fish.** Bailey and Allum (1962) collected 21 sturgeon chub from the Cheyenne River.

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Sturgeon chub were originally collected on the Cheyenne River in 1950 and 1951 (Bailey and Allum 1962). Scalet (pers. comm.) collected sturgeon chub at Bailey and Allum's sites in the late 1970's. No sturgeon chub were collected at one historic Cheyenne River site in 1989 (Werdon 1992).

o. White River (SD, NE).

1. **Number of fish.** Burt, Stewart, and Young collected a total of four sturgeon chub (UMMZ 1988).

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Sturgeon chub were collected on the White River in 1896, 1931, and 1934. Werdon (1992) did not collect any sturgeon chub during extensive sampling on the White River in 1989-90.

p. Bazile Creek (NE).

1. **Number of fish.** Unknown.

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Since the collections of Evermann and Cox (1896), no sturgeon chub have been reported from Bazile Creek.

q. Platte River (NE).

1. **Number of fish.** Evermann and Cox (1896) did not report numbers, however, five specimens collected in 1893 were deposited in the United States National Museum, along with eight other specimens whose collection date is unknown (USNM 1992). Schultz and DeLacy collected 33 specimens in 1931; Johnson and Romberg collected four in 1940 (UMMZ 1988). One sturgeon chub was collected near Fremont, Nebraska, in 1987 (Peters et al. 1989). Four specimens were collected near Schramm State Park, Nebraska in 1991 (UNSM 1992).

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** No sturgeon chub were collected at historic sites in 1990, including the Fremont area (Werdon 1992).

r. Loup River (NE).

1. **Number of fish.** Johnson collected six specimens in 1941 (UMMZ 1988).

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** The single historic collection site was sampled in 1990 and no sturgeon chub were found (Werdon 1992).

s. Elkhorn River (NE).

1. **Number of fish.** Johnson collected six sturgeon chub in 1941 (UMMZ 1988).

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** The one historic collection site was sampled in 1990 and no sturgeon chub were collected (Werdon 1992).

t. Republican River (NE, KS).

1. **Number of fish.** Johnson and Romberg collected 47 specimens near Indianola, Nebraska, in 1940 (UMMZ 1988). Johnson (1942) reported that sturgeon chub were common in the Republican River proper. Bailey and Allum (1962) reported 54 specimens collected near Indianola in 1940. One specimen was collected in 1951 at Superior (KU 2225).

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Werdon (1992) did not collect sturgeon chub near Indianola or at two other historic collection sites on the Republican River.

u. Kansas River (KS).

1. **Number of fish.** Cross (1953) collected a total of 47 specimens during six collections in/at Lawrence, Kansas. Cross (1967) reported that sturgeon chub were widely distributed in the Kansas River. Branson (1963) discussed morphological data from

eight sturgeon chub collected near Linwood, Kansas. Metcalf (1966) reported one near Willard, Kansas. Davis and Miller (1967) utilized four previously-collected museum specimens from an unspecified location on the Kansas River. Cross et al. (1982) three reported sturgeon chub from the lower Kansas River in 1979.

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Cross and Moss (1987) reported that abundance of sturgeon chub below Lawrence clearly decreased from 1950 to 1980. The two sites where sturgeon chub were collected in 1979 were dredged in 1980 and that habitat was lost. Werdon (1992) sampled at other historic collection sites in 1990, but no sturgeon chub were collected. However, high water levels may have decreased sampling efficiency.

v. **Wakarusa River** (KS).

1. **Number of fish.** The University of Kansas Museum of Natural History has a single specimen which was collected in 1951.

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** None.

w. **Smoky Hill River** (KS).

1. **Number of fish.** Metcalf (1966) reported three sturgeon chub south of Junction City, Kansas, collected by F.B. Cross and KU Ichthyology class (KU 8124). Summerfelt (1967) believed the species was rare in the Smoky Hill River.

2. **Density.** Unknown.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Werdon (1992) sampled south of Junction City in 1990 and no sturgeon chub were found.

x. **Missouri River** (MT, ND, SD, NE, IA, IL, KS, MO).

1. **Number of fish.** Meek (1892) reported sturgeon chub as abundant at Sioux City, Iowa. Evermann collected five in the upper Missouri during the late 1800's (CAS 1992). Johnson and Romberg collected two in 1940; Johnson collected six in 1941; and Hudson collected one in 1946 (UMMZ 1988). Bailey and Allum collected a total of 19 during 1952 (UMMZ 1988). Seven specimens were collected in 1957, KU 3847 (2), KU 3857 (5) by Minckley and Metcalf. In Missouri, Fisher (1962) collected one specimen at Jefferson City; one at Miami; and 21 at Lexington. Two specimens were collected in 1963. Cross (1967) reported that sturgeon chub were widely distributed in the Missouri River. Cross and Moss (1987) collected one specimen in 1977, KU 19882. One sturgeon chub was collected in Nebraska from the Ft. Calhoun intake screen in 1977 and another was collected nearby in 1978 (UNSM 1992). Pflieger (unpubl. data) has documented 447 specimens collected from 1945-1983. Hesse et al. (1982) collected one specimen in 1977, KU 19775. Hesse and Mestl (unpubl. data) collected one specimen at Rulo, Nebraska, in 1988. Etnier (unpubl. data) collected a total of 40 sturgeon chub in 1990 from two locations in Missouri. Wenke (unpubl. data) collected three sturgeon chub across from Atchison, Kansas, and one at Leavenworth, Kansas, in 1992.

2. **Density.** Pflieger (unpubl. data) documented percent species compositions of 2.5 to 100 percent per site for sturgeon chub collected on the Missouri River from 1945-83. Pflieger and Grace (1987) examined three time periods and reported average percent species compositions of 0.1 (1940-45), 0.2 (1962-72), and 0.8 (1975-83). Cross and Moss (1987) collected only one sturgeon chub out of 13,512 specimens collected in 1977 and 1978. Hesse et al. (1982) collected one sturgeon chub out of 90,379 specimens. One specimen was collected between 1986-1990 from the channelized Missouri River of Nebraska out of 6,217 small fish (Hesse, et al., 1993). No sturgeon chub were collected among 32,448 small fish seined between Fort Randall and Gavins Point Dams during 1983-1990. Stasiak (1990) failed to collect sturgeon chub among 3,801 specimens. Werdon (1992) also did not collect any sturgeon chub out of over 4,000 specimens seined from the Missouri River. Gardner (pers. comm.) concluded that sturgeon chub are rare in occurrence

on the wild and scenic Missouri River in Montana due to the near absence of specimens in collections.

3. **Evidence of reproduction.** Etnier (unpubl. data) collected young-of-the-year sturgeon chub on the Missouri River in Missouri during 1990.

4. **Evidence of expansion/contraction.** Sturgeon chub have been documented at only three sites on the Missouri River in nearly 10 years.

y. **Mississippi River** (IL, MO, KY, TN, AR, MS, LA).

1. **Number of fish.** Trautman and Thompson collected 24 specimens in 1936; Moore collected one specimen during 1938; Bauman collected four in 1940; and Barnickol collected two in 1944 (UMMZ 1988). Guillory (1979) reported two sturgeon chub taken near St. Francisville, Louisiana. Etnier (unpubl. data) collected five specimens at Randolph, Tennessee, in 1981. During 1981-1982, three specimens were collected at Grand Tower, Illinois (Burr, pers. comm.). A single specimen was collected at Grand Tower Island in 1981 and 1985 (Burr, pers. comm.).

2. **Density.** Pflieger (unpubl. data) reported percent species composition of sturgeon chub as 3.2 percent at one 1963 collection site.

3. **Evidence of reproduction.** None.

4. **Evidence of expansion/contraction.** Hrabik (unpubl. data) reported that no sturgeon chub were collected between RM 28-80 during either 1991 or 1992. Hrabik stated that there is no evidence to suggest that populations of sturgeon chub are sustained in this portion of the Mississippi River. Pflieger (unpubl. data) and Hrabik (unpubl. data) considered that sturgeon chub found in the middle Mississippi River might be waifs from the lower Missouri River.

C. **Phenology.**

1. **Patterns.** Sturgeon chub are ripe from mid-June until late July in Wyoming (Jenkins 1980; Stewart 1981; Werdon 1992) and in mid-July in South Dakota (Lee et al. 1980). Tuberculate male sturgeon chub have been collected in the Kansas River in May and June (Cross 1967). However, tubercles disappear by July and August (Cross 1967).

2. **Relation to climate.** Spawning is likely influenced by water temperature. Sturgeon chub in the Powder River, Wyoming, were ripe at water temperatures of 18.3 to 22.2°C (Werdon 1992). Ripe males were collected at 23°C in Kansas (Cross 1967). Spawning may also be regulated by increasing flows due to snowmelt or precipitation events.

D. **Reproductive ecology.**

1. **Types of reproduction.** The reproductive biology of sturgeon chub is unknown, but is likely similar to that of speckled chub, with which it has been reported to hybridize. Speckled chub spawn at midday, in deep water where the current is fast (Botrell et al. 1964). Fertilized speckled chub eggs drift downstream and hatch in about a day (Botrell et al. 1964). Ripe female sturgeon chub contain approximately 5,000 previtellogenic, vitellogenic, and mature oocytes (Werdon 1992).

   Breeding male sturgeon chub have tubercles along the edges of the pectoral fins (Pflieger 1975). However, there are no other secondary sex characteristics and the sexes are similar in color and size. Sturgeon chub mature at 2 years of age and annual growth slows as the fish mature (Stewart 1981; Werdon 1992). Mature females are approximately 76-81 mm total length; mature males are approximately 78-79 mm total length (Werdon 1992).

2. **Dispersal.** Eggs and larval sturgeon chub may be carried downstream. Movement patterns of adults and juveniles are unknown. They are likely forced to migrate as water levels decline in the late summer and fall.

3. **Survival and nature of mortality.** The survival rate of sturgeon chub to Age-I is unknown. However, on the Powder River in Wyoming and Montana, 23.9 percent of 158 sturgeon chub were Age-I, 72.3 percent were Age-II, and 3.8 percent were Age-III (Werdon 1992). This data indicates that survival of sturgeon chub past Age-II is poor. Natural causes may account for some mortality as the maximum recorded age for sturgeon chub is 4 years (Stewart 1981).

4. **Overall assessment of reproductive success.** Reproduction has been documented for sturgeon chub in the Powder River from 1975-79 (Stewart 1981) and 1987-89 (Werdon 1992). Reproduction also was documented on the Missouri River in Missouri in 1990 by the collection of 40 young-of-the-year (YOY) (Etnier, unpubl. data) and on the Yellowstone River in North Dakota during 1992 by the collection of two YOY (USFWS 1992). Overall reproductive success outside the Powder River and limited sites on the Missouri River is

likely low due to low population densities, population isolation, and potential hybridization with speckled chub.

8. **Population ecology of species.**

A. **General summary.** Sturgeon chub are found in the main stem Missouri River, lower Mississippi River, and in many large, turbid tributaries to the Missouri River. Populations in tributaries may have been extirpated.

B. **Positive and neutral interactions.** Unknown.

C. **Negative interactions.**

1. **Predators, parasites, and diseases.** Increased predation of sturgeon chub may result from piscivorous fish stocked in the Missouri River Basin. A related, sympatric species, the sicklefin chub, is heavily preyed upon by sauger (*Stizostedion canadense*) in the Missouri River, Montana (Gardner, pers. comm.). Parasites and diseases of sturgeon chub have not been studied. However, Werdon (unpubl. data) collected one sturgeon chub on the Powder River, Wyoming, with an unidentified leech attached to the pectoral fin and a few other sturgeon chub exhibited black-spot disease (*Uvulifer* sp.).

2. **Competition.**

a. **Intraspecific.** Remaining sturgeon chub populations are isolated and densities are low, thus intraspecific competition is unlikely.

b. **Interspecific.** Stewart (1981) attributed the longnose dace and the sturgeon chub the same niche in riffle areas of streams. Sturgeon chub and speckled chub may compete for spawning habitat in some areas resulting in hybridization. Where habitat exists for both species, competition for food between sturgeon chub and sicklefin chub is likely reduced by different feeding mechanisms (Davis and Miller 1967).

D. **Hybridization.**

1. **Naturally occurring.** The family Cyprinidae is the largest family of freshwater fishes in North America (Eddy and Underhill 1978) and has the greatest number of hybrids (Hubbs 1955). Sturgeon chub and speckled chub are reported to hybridize in the wild (Johnson 1942; Morris et al. 1974).

2. **Artificially induced.** Unknown.

3. Potential for spontaneous occurrence in cultivation. No attempt has been made to culture sturgeon chub and requirements for spawning and rearing are unknown. It is unlikely sturgeon chub and speckled chub would be cultured together.

E. Other factors of population ecology. Unknown.

9. Current land ownership and management responsibility.

A. General nature of ownership and management. Upland adjacent to the Missouri River, middle and lower Mississippi River and their tributaries is a mixture of private, state, tribal, local government and Federal land, most of which is privately owned. Ownership and management of the river bottom and water also varies, usually between states and waterways. Reservoir elevations and discharge from Missouri River main stem dams are the management responsibility of the Army Corps of Engineers (Corps) and the Bureau of Reclamation (Reclamation) on some tributaries. The Corps manages locks and dams on the Mississippi River.

B. Specific landowner(s). Unknown.

10. Management practices and experience.

A. Habitat management.

1. Review of past management. The Flood Control Act of 1944 and the Pick-Sloan Plan directly impacted Missouri River Basin fish populations. The Act authorized construction of 105 reservoirs on the Missouri River main stem and its tributaries, to control and utilize the waters of the Missouri River Basin. Six main stem dams were constructed between 1937 and 1963. Together, the six reservoirs flooded over 1,300 km of the Missouri River, impounded 92.4 billion m^3 of water at normal full pool, and created an extensive lentic environment. Channelization impacted almost 1,183 km of the Missouri River by 1982 and additional impacts have resulted from small-scale impoundments, levees, and diversion projects throughout the Basin. Presently, only one-third of the Missouri River remains in a free-flowing state.

2. Performance under changed conditions. Reproduction of sturgeon chub within the Missouri River main stem has not been documented by collections of eggs or larval fish. However, young-of-the-year sturgeon chub were collected on the lower Missouri River in 1990 (Etnier, unpubl. data).

3. **Current management policies and actions.** The agency operating the Missouri River main stem dams is the U.S. Army Corps of Engineers (Corps). However, the U.S. Bureau of Reclamation is responsible for some consumptive usage of reservoir and riverine water (i.e., irrigation diversions). Reclamation also manages flow releases from reservoirs located on Missouri River tributaries in the upper basin. The multipurpose nature of the riverine system creates varied seasonal demands for water. Annual operating plans are formulated by the Corps to best meet the demands of water users under current and predicted water conditions.

4. **Future river use.** The Corps' Missouri River Master Water Control Manual guiding operations of the main stem dams is undergoing review and any revisions will influence future use of the Missouri River.

B. **Cultivation.**

1. **Controlled propagation techniques.** Eggs were easily hand-stripped from gravid sturgeon chub collected on the Powder River (Werdon, unpubl. data). However, no attempt at cultivation has been made.

2. **Ease of transplanting.** Stewart (1981) reported that sturgeon chub appeared disoriented when transported and held in aquaria with no current. The USFWS (Bismarck, ND) held a sturgeon chub in an aquarium for nearly five months before it died of unknown causes.

3. **Pertinent knowledge concerning ecologically similar taxa.** Unknown.

4. **Status and location of presently cultivated material.** Not applicable.

II. **Evidence of threats to survival.**

A. **Present or threatened destruction, modification, or curtailment of habitat or range.**

1. **Past threats.** Water development projects on the Missouri and lower Mississippi Rivers and Missouri River tributaries likely impacted sturgeon chub populations. Reservoirs flooded riffle habitat, altered temperature and flow regimes, and reduced turbidity. Channelization straightened and narrowed the river, reduced habitat diversity, and reduced overbank flooding. Additional pressure on the species likely resulted from stocking high densities of piscivorous fish into the reservoirs and remaining riverine sections. Pollution from industry and agriculture may have also altered water quality. Sand and

gravel extraction operations have removed habitat and restricted fish movements.

2. **Existing threats.** Water manipulation through dams and irrigation diversions continues to threaten the species. Threats from water depletion are greatest for tributary populations. Average annual sediment loading in the lower Missouri River decreased by 81 percent after closure of the main stem dams (Slizeski et al. 1982). The seasonal hydroperiod and water temperature have also been disrupted. Sedimentation occurring under continued low flow conditions may be threatening the species' riffle habitat. Sturgeon chub forced into pool habitat on the smaller tributaries or into main stem reservoirs are likely especially vulnerable to walleye (*S. vitreum*), sauger, and other predators. Pollution from industry and agriculture may continue to be a threat.

3. **Potential threats.** Water depletion, water manipulation, habitat loss, and possibly predation are the greatest threats facing sturgeon chub populations. Future water depletions are likely to result from energy development (coal mining) in the upper Missouri River Basin. Other water losses may result from inter-basin diversions and increased municipal, industrial, and irrigation usage. Also, power plant and water supply intakes may entrain and impinge sturgeon chub. Further fragmentation of sturgeon chub populations due to dam construction and channelization are a potential threat to the species, reducing genetic variability and preventing repopulation of tributaries after severe drought conditions. Dredging for channel maintenance and sand/gravel extraction may be an obstacle to fish movement. As sturgeon chub populations are isolated and numbers decline, the potential for hybridization with speckled chub will increase. Water pollution associated with nutrient enrichment and chemical contaminants may be especially detrimental to populations in small tributaries and under low water conditions where pollutants would be concentrated. Future introductions of exotic fish and other organisms may threaten sturgeon chub through predation or competition.

B. **Overutilization for commercial, sporting, scientific, or educational purposes.** None known. However, difficulties with field identification of young-of-the-year sturgeon chub could result in removal of specimens from the wild.

C. **Disease or predation.** No diseases are currently known to threaten the species. Predation has likely increased over historic levels due to stockings of piscivorous fish.

D. **Inadequacy of existing regulatory mechanisms.** Federal category 2 status provides no legal protection for the species.

E. **Other natural or manmade factors.** More than three consecutive years of severe drought may have eliminated sturgeon chub from some small Missouri River tributaries and may reoccur and impact additional tributary populations. Sturgeon chub populations in the main stem Missouri may be too small and too wide-spread to naturally recolonize these tributaries even though suitable habitat may still exist in the tributaries.

II. **Assessment and Recommendations.**

12. **General assessment of vigor, trends, and status.** Documentation indicates that sturgeon chub were locally abundant at some historic collection sites. Sturgeon chub are currently extremely uncommon or absent from 23 of 27 streams within their historic range. Recruitment is occurring in the Powder River of Wyoming and Montana, the Yellowstone River in North Dakota, and in the lower Missouri River in Missouri, however, the viability of these populations is unknown. It is unlikely populations in other tributaries still persist. Federal category 2 status indicates that the U.S. Fish and Wildlife Service is concerned about the declining abundance of the species and 11 states have designated special status for the species. With the exception of the Powder River, documented catches of sturgeon chub have been so rare over the past decade that sturgeon chub may be endanger of extinction from throughout a significant portion of its range.

13. **Recommendations for listing or status change.**

Under review.

14. **Recommended critical habitat.**

Under review.

15. **Conservation/recovery recommendations.**

A. **General conservation recommendations.**

1. **Recommendations suggesting changes in present or anticipated activities in habitat area.**

a. **Energy Development.** Coal mining in the Powder River Basin of Wyoming and Montana may eventually threaten sturgeon chub through water depletion. The responsible Federal agency should restrict leasing of mineral rights on Federal lands within a buffer zone adjacent to the Powder River. The States of Wyoming and Montana

and/or the Federal government should obtain instream flow water rights on the Powder River to protect sturgeon chub. On other rivers, operations of existing hydroelectric dams causing substantial flow fluctuations in sturgeon chub habitat areas should be changed so flows more closely resemble natural hydrologic conditions.

b. **Agriculture.** Irrigation water withdrawals may threaten sturgeon chub in the Powder River and other small Missouri River tributaries through water depletion. An instream flow right should be established on these tributaries to protect the species. Ranchers should be encouraged to protect riparian areas by fencing them. Any feed lots should be moved a suitable distance away from the river to reduce nutrient enrichment. A buffer zone should be established for pesticide usage near streams with sturgeon chub populations.

c. **Recreational.** Consider modifying Federal and State fish management programs, including stockings of piscivorous fish, within designated sturgeon chub conservation areas. States should prohibit commercial and recreational bait minnow collections in these areas as well.

2. **Specific area(s) recommended for natural area designation, easement, land acquisition, or other protection.** The Powder River and other remaining free-flowing rivers within the range of sturgeon chub should be protected from development and impoundment.

3. **Management and recovery alternatives recommended to reduce or mitigate threats to taxon.** Propagation of sturgeon chub populations should be investigated. Once cultured specimens are available, they can supplement remaining natural populations and be reintroduced into important habitat areas still capable of supporting sturgeon chub, but incapable of recolonization because of reduced populations in main stem rivers.

4. **Anticipated consequences of publicity.** Critical habitat areas on large rivers such as the Missouri and lower Mississippi Rivers are not likely to be placed in jeopardy from publicity concerning this taxon. Critical habitat on smaller tributaries would be more vulnerable. However, there are no current recreational or commercial utilizations of sturgeon chub.

5. Other recommendations. The U.S. Fish and Wildlife Service should also curtail habitat loss and degradation, initiate efforts to increase sturgeon chub population levels, and evaluate areas for potential reintroduction. It should be possible to obtain broodstock from the Powder River population. However, obtaining sufficient broodstock from other rivers may be difficult. Aquatic habitat restoration on the Missouri and Mississippi Rivers via flow regime changes and/or physical habitat restoration should be pursued. The Missouri River Mitigation Project, Missouri Chutes Refuge Project, dike modifications under the Missouri and Mississippi River navigation projects, proposals for National Fish or Fish and Wildlife Refuges on the Lower Missouri and Middle Mississippi Rivers, and main stem Missouri River reservoir operational changes (via the Missouri River Master Water Control Manual or Annual Operating Plans) are specific opportunities to recover sturgeon chub.

B. Monitoring activities and further studies or research recommended.

1. Further field studies are needed to determine abundance and distribution of sturgeon chub in the wild and scenic portion of the Missouri River in Montana, the Missouri River in Missouri, and the Yellowstone and Mississippi Rivers.

2. Important habitat areas and critical components need to be determined, especially regarding spawning and rearing needs.

3. Specimens from suspected populations should undergo genetic analyses to determine the degree of genetic differentiation and incidence of hybridization.

4. Broodstocks need to be established and culture techniques need to be developed.

5. Establish monitoring studies and monitor population trends.

16. Interested Parties.

Federal

U.S. Fish and Wildlife Service, Ecological Services Offices in Montana, North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Missouri, Kansas, Kentucky, Tennessee, Louisiana, Arkansas, and Illinois.

U.S. Fish and Wildlife Service, Fisheries Division Offices in Montana, North Dakota, Missouri, and Louisiana.

Federal (Cont.)

U.S. Fish and Wildlife Service, Ecological Services and Fisheries Divisions in Regional Offices for Regions 3, 4, and 6.

U.S. Fish and Wildlife Service, Regional Directors for Regions 3, 4, and 6.

U.S. Bureau of Land Management Offices with lands adjacent to the Missouri and Mississippi Rivers.

U.S. Environmental Protection Agency, Regional Offices for Regions 4, 5, 6, 7, and 8.

U.S. Army Corps of Engineers, District and Division Offices on the Missouri and Mississippi Rivers.

Western Area Power Administration, Area Office, P.O. Box 35800, Billings, Montana 59107-5800.

U.S. Bureau of Reclamation, Regional Office, P.O. Box 36900, Billings, Montana 59103.

U.S. Bureau of Reclamation, Project Office, P.O. Box 30137, Billings, Montana 59107.

U.S. Fish and Wildlife Service, Large Rivers Fishery Coordination Office, 608 E. Cherry Street, Columbia, Missouri 65201.

State

Natural resource and/or water development state offices in Montana, North Dakota, South Dakota, Nebraska, Minnesota, Iowa, Missouri, Kansas, Kentucky, Tennessee, Louisiana, Arkansas, and Illinois.

Kansas Biological Survey, 2041 Constant Avenue, Foley Hall, Lawrence, Kansas 66047-2906.

Non-Government Organization

Missouri River Public Water Supplies Association, St. Louis Co. Water Co., 535 North New Ballas Rd., St. Louis, Missouri 63141.

National Wildlife Federation, (Attn: Rudolph A. Rosen), 1412 16th Street, NW, Washington, D.C. 20036-2266.

Missouri Basin Tribes, Plains Water Resource Coordinator, 2421 River Oakes Dr., Billings, Montana 59105.

Riparian Association, RR 2, Box 298, Nebraska City, Nebraska 68410.

Non-Government Organization (Cont.)

American Fisheries Society, 5410 Grosvenor Lane, Suite 110, Bethesda, Maryland 20814-2199.

Missouri Basin States Association, P.O. Box 9193, Missoula, Montana 59807.

Chairman, Mississippi Interstate Cooperative Resource Agreement, c/o Large Rivers Fishery Coordination Office, 608 E. Cherry St., Columbia, Missouri 65201.

Chairman, Missouri River Natural Resources Committee, Nebraska Game and Parks Commission, Lincoln, Nebraska 68503.

III. **Information Sources.**

17. **Sources of information.**

A. **Publications.**

1. **References cited in report.** Appendix A.

2. **Other pertinent publications.** Appendix B.

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C. **Fieldwork.** Fieldwork conducted in support of this status report is discussed in Werdon (1992).

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18. **Summary of materials on file.** All referenced materials except Coburn and Cavender (in press) are available from the author.

IV. Authorship.

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20. **Maintenance of status report.** The U.S. Fish and Wildlife Service (Ecological Services, Bismarck, ND) is taking responsibility for receiving new information, making revisions and corrections to this status report, and distributing revisions to interested parties.

V. New Information

21. **Record of revisions.** Not applicable.

APPENDIX A - References Cited

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