Return to Chris H.

The Status of Paddlefish, Pallid Sturgeon, Lake Sturgeon, and Shovelnose Sturgeon

A summary of information regarding, status, distribution, and current management strategies within their present range.

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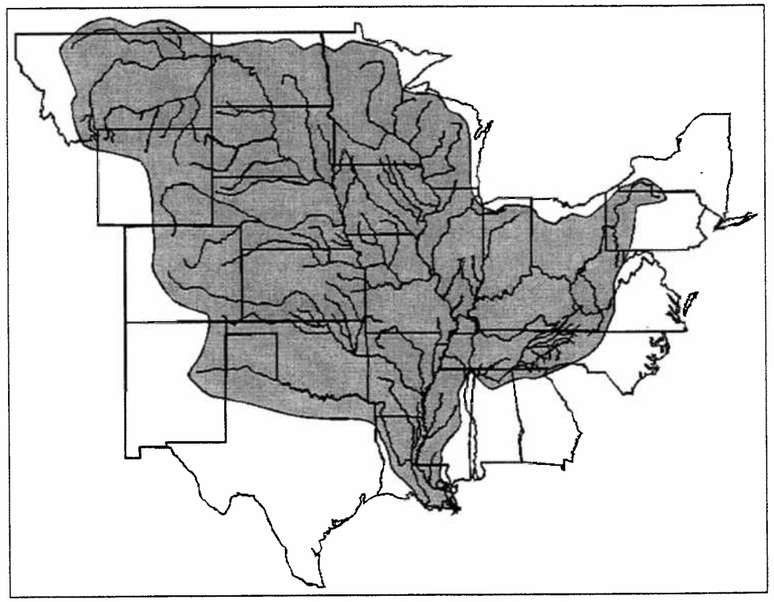
Abstract

Paddlefish, pallid sturgeon, lake sturgeon, and shovelnose sturgeon have been listed as either threatened, endangered, or species of concern in as many as 30 states and provinces in North America. Each species has been extirpated from a portion of its historical range. The Mississippi Interstate Cooperative Resources Association (MICRA) represents fisheries managers responsible for the preservation and enhancement of these unique native fishes in the Mississippi River Basin. MICRA commissioned this current evaluation of the status of these fish.



Map of the Mississippi River Basin and the MICRA project area.

Paddlefish/sturgeon workers, government fisheries administrators, hatchery managers, and federal aid coordinators were surveyed to obtain their assessment of the status, range, and management strategies for these fish. Related literature was obtained to support the results of the surveys. Approximately 31% of the surveys were returned. Respondents provided clear answers to the questions posed when data was available for them to do so. More data was required to realistically evaluate real status; however, it appears that paddlefish have been eliminated from approximately 12.7% of the lakes and streams they were reported to have lived in; pallid sturgeon from 47.6%; lake sturgeon have been eliminated from 29.3%; and shovelnose sturgeon from 25.4%. Over-exploitation, dams, sedimentation, pollution, habitat deterioration, and altered flow regimes were blamed for the reduced abundance. Mixed feelings were expressed regarding the possibility that the plight of these animals could be improved; however, paddlefish seem to have benefitted from intensive management of late, and the results should encourage further work with paddlefish as well as sturgeon species. A more intensive survey may be required to realistically track the changing status and range of paddlefish and sturgeon. The ultimate survey should result in a comprehensive GIS database that can serve as a management benchmark for the first decade of the next century.

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Introduction

"The majority of the worlds' rivers are regulated, and these developments have considerably changed landscape structure and processes, and led to an impoverishment of natural diversity" (Nilsson and Brittain 1996). The Mississippi River Basin drains 31 states and includes more than 90 major river systems. Many or all of these river systems have been altered by dam construction, channelization, pollution, dewatering, and overharvest among other problems, leading to badly mismanaged ecosystems and deteriorating populations of native aquatic flora and fauna (Hesse 1993). The Mississippi Interstate Cooperative Resource Association (MICRA) was formed to coordinate recovery management plan development for this very reason. Specifically, concern for the future of paddlefish was paramount because of their uniqueness, their diminishing status, and the broad realization that protection would require interstate cooperation, and states had been mostly predisposed to manage their fisheries in isolation (Moberly and Sheets 1993).

During this decade paddlefish have been petitioned for federal threatened or endangered (T&E) status and were proposed for inclusion in Appendix I of the Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Spinks 1991), and were eventually included in Appendix II in 1992 (Graham 1993). They have been subjected to excessive overharvest in some sections of their range (Russell 1986, Hesse and Mestl 1993). Pallid sturgeon were listed as a federal endangered species, effective 9 October 1990 (Federal Register 55(173):36641). There is at least some evidence that contaminant accumulations may have reduced pallid sturgeon reproductive capability (Ruelle and Keenlyne 1993). Lake sturgeon have suffered from over-exploitation (Lowe and Krise 1995) and now appear on several state T&E lists (e.g., Nebraska, Minnesota, Iowa, Illinois, Wisconsin, Tennessee, Missouri, Kentucky). Shovelnose sturgeon have been reduced in number as dam construction and channelization progressed early in this century, even when semi-natural riverine conditions remained nearby (Ruelle and Keenlyne 1994), and over-harvest was a factor as well (Keenlyne 1996). Schmulbach (1974) documented very slow growth of < 1 mm per year. All four species have been subjected to habitat loss as hydrosystem function changed in most large rivers throughout their range. These four species are, however, not alone. Moberly and Sheets (1989) pointed out that at least 80 species of fish are of great concern in the Mississippi River basin which represents 41% of the contiguous United States and 12% of North America. Fremling et. al. (1989) listed 62 of 260 freshwater fish species in the Mississippi River ecosystem as species of concern, while Hesse et. al. (1989) listed 33 of 159 from the Missouri River ecosystem.

Essentially, the deterioration of paddlefish and sturgeon populations is a recent event, occurring mostly during or just prior to the turn of this century. The most distressing aspect of this reality is that they are among the most ancient and primitive bony fishes in North America (National Paddlefish and Sturgeon Steering Committee 1993), surviving millennia prior to human interference.

Because these fishes have colonized a wide geographic area their true status is not easily described. Gengerke (1986), Houston (1987), Parker (1988) Graham (1993), Hesse and Mestl (1993), Krentz (1995), Keenlyne (1995, 1996), and Slade (1996) are examples of studies that have attempted to define the status of paddlefish or sturgeon populations, mostly from limited portions of geographic ranges. There is a considerable body of literature dedicated to these fishes as referenced by the bibliographic record (Graham 1986, Georgi

1992, Duffy et al. 1996, and Georgi and Dingerkus 1996). We tried to extract status information from contemporary paddlefish and sturgeon workers which we hoped would be based on the most recent research results. Because all surveys have a certain degree of non-response, we reviewed recently published evidence that would support or add to the understanding of current status. We have presented comments provided to us essentially as they were written. It was not our intention to editorialize or to question the responses provided.

The objectives of this study were: to describe the current status and distribution of paddlefish, pallid, lake, and shovelnose sturgeon; to describe reasons that would explain the status and distribution of paddlefish, pallid, lake, and shovelnose sturgeon; and to describe current management strategies used to maintain or restore populations of paddlefish, pallid, lake, and shovelnose sturgeon.

Methods and Materials

The basis for this report is a series of four questionnaire/surveys distributed to researchers, managers, technicians, administrators, hatchery managers, and federal aid coordinators involved with paddlefish and/or sturgeon species. Our initial mailing list came from the summary list of paddlefish and sturgeon workers (U.S. Fish and Wildlife Service 1994). However, additional surveys were mailed to individuals that were not listed. We feel there were other scientists that would have been able to contribute important information but were not included because we failed to gather these names in a timely manner. We would like to hear from anyone working with the target species that did not receive our surveys.

The primary survey (**Survey Number 1**) was sent to administrators, supervisors, and field biologists, but was an attempt to target individuals responsible for day to day investigation and management of the targeted species. The information gathered from Survey Number 1 provided the bulk of the material for this report. Rivers and lakes that were within the study areas and range of the targeted species were codified and the codes were subsequently used in place of river names throughout this report (See Table 20). Each species will be discussed separately beginning with paddlefish, and followed by pallid sturgeon, lake sturgeon, and shovelnose sturgeon. The first topic addressed for each species is the current status, expressed as a percent in relation to all of the respondents. The second topic addressed is information on the historical and current distribution of each species. The third topic contained a variety of information broken down by individual state, and addressed reasons for current status, methods employed to maintain, stabilize or restore populations, stocking, reproductive success, harvest, and more.

Survey Number 2 was distributed to 36 Fisheries Division Administrators in the United States and Canada. Topics addressed, included: species enhancement potential, commercial versus recreational fishing, preferred management practices, listing and delisting species, and the role of non-anglers, and law enforcement.

Survey Number 3 was sent to 18 hatcheries to investigate the sources of brood stocks for the target species.

Survey Number 4 was distributed to 30 Federal Aid Coordinators in the states to obtain

information regarding planned or ongoing research and management projects funded by Dingell-Johnson/Wallop-Breau. Examples of each survey are included in Appendix I.

Results

Survey Number 1

Two hundred seventy-six surveys were mailed to paddlefish and/or sturgeon biologists in 49 states and provinces (Table 1). Seventy-six (27.54%) responded. Surveys were mailed to all states and provinces within the historical range of the target species, according to range maps in Lee et al. (1980). The *Second Summary of Sturgeon and Paddlefish Researchers and Managers* (U.S. Fish and Wildlife Service 1994) was used as the primary mailing list but the sort procedure used to generate mailing labels resulted in mailings to states outside of the range of the targeted species. When these surveys were removed, 66 (31.13%) of 212 surveys were eventually returned.

Current Status of Paddlefish

Forty percent (40.0%) of the responses from 22 states that returned the paddlefish survey believed paddlefish populations were stable within their study area (Table 2). Three respondents (8.6%) indicated that paddlefish had been extirpated from areas in New York and Pennsylvania. Paddlefish were decreasing in 11.42% of the study areas, while 11.42% felt they were increasing, but an additional 5.7% of the responses listed paddlefish as stable to decreasing. A fairly large portion of the respondents (i.e., 22.86%) did not know what the status of paddlefish was in their study areas. States with a deteriorating population included: Iowa, Minnesota, Arkansas, Mississippi, and South Dakota. States in which populations were stable included: Montana, North Dakota, Kentucky, Louisiana, Missouri, Indiana, Nebraska, Oklahoma, Alabama, and Illinois. Paddlefish populations were increasing in portions of Texas, Kansas, South Dakota, and Oklahoma. The states that indicated status was as yet unknown, at least in a major portion of the state, included: Illinois, Missouri, Mississippi, Montana, Ohio and Wisconsin.

Missouri River paddlefish taken in the 1995 sport fishery below Gavins Point Dam near Yankton, South Dakota.

Field biologists did not report any paddlefish population to be increasing; 52.9% reported paddlefish were stable. Supervisory personnel described paddlefish as increasing (22.2%), and stable (27.8%).

The geographical area where paddlefish occur is large and it was not within the scope of

Table 1. Survey Number 1 mailing statistics.

State or Province	Historical Range * Paddlefish	Pallid sturgeon	Lake sturgeon	Shovelnose sturgeon	Number surveys mailed	Number surveys returned
Alabama	X		X	X	10	1
Arkansas	X	X	X	X	1	1
Illinois	X	X	X	X	10	3
Georgia	?				6	0
Indiana	X		X	X	1	1
Iowa	X	X	X	X	2	2
Kansas	X	X	X	X	6	3
Kentucky	X	X	X	X	3	1
Louisiana	X	X	?	X	5	2
Michigan	?		X		9	4
Minnesota	X		X	X	7	4
Mississippi	X	X	X	X	14	3
Missouri	X	X	X	X	15	4
Montana	X	X		X	9	3
Nebraska	X	X	X	X	3	2
New Mexico				X	0	0
New York	X		X		15	5
North Carolina	X			X	3	0
North Dakota	X	X	?	X	6	3
Ohio	X		X	X	4	1
Oklahoma	X			X	4	2
Pennsylvania	X		X	X	9	3
South Carolina					7	1
South Dakota	X	X		X	7	3
Tennessee	X		X	X	7	0
Texas	X			X	7	2
Vermont			X		2	0
Virginia					3	0
West Virginia	X		X	X	2	1
Wisconsin	X		X	X	21	6
Wyoming				X	0	0
Alberta			X		3	1
Manitoba			X		2	1
Ontario			X		7	2
Quebec			X		1	0
Saskatchewan			X		1	1
Other states and Prov. **					64	10
Totals (confirmed)	24	12	24	25	276	76

* Lee et al. 1980.

** Included: CA, CO, CT, DE, FL, ID, MD, ME, NJ, OR, WA, British Columbia, and Nova Scotia

Table 2. The relative status of paddlefish populations from Survey Number 1.

State	Supervisor	Field biologist
Alabama	-	Stable
Arkansas	Stable to decreasing	
Illinois	Unknown	Stable
Indiana	-	-
Iowa	Decreasing	Stable to decreasing
Kansas	Increasing	
Kentucky	-	Stable
Louisiana	Stable	-
Missouri	Stable	Stable/ Stable/ Stable/ Unknown
Minnesota	Decreasing	-
Mississippi	Unknown	Decreasing/ Unknown
Montana	Stable/ Unknown	Stable
Nebraska	Stable	-
New York	-	Extirpated
North Carolina	-	-
North Dakota	Stable	Stable
Oklahoma	Increasing	Stable
Ohio	-	Unknown
Pennsylvania	Extirpated	Extirpated
South Dakota	Decreasing/ Increasing	-
Texas	Increasing	-
Wisconsin	Stable to unknown	Stable to unknown

this study to create an accurate map of the watersheds that presently have populations. Such an effort would have to be done by incorporating all fish surveys underway within all states. Our respondents represented only 31% of the workers contacted and would not have adequately represented specific areas within all watersheds. However, Table 3 provides a broad overview of the present distribution of paddlefish by state within river systems generally, and subsequently compares present and past range. The time frame represented by the historical and present perspectives was not defined by the respondents. According to respondents, paddlefish have been extirpated from the Tombigbee River, Swan Lake, Big Sioux River, Little Sioux River, Kankakee River, Lake Erie, Namakan River, Shawnee Creek, and Bois d' Arc Creek. They have successfully colonized Smoky Hill River, Wakarusa River, Tuttle Creek Reservoir, John Redmond Reservoir, Des Moines River, Black River, Harry S. Truman Reservoir, Lake of the Ozarks, Salt River, Merimac River, and Current River. In some instances successful colonization of a new body of water might also be described as survival (e.g., Lake of the Ozarks) since paddlefish were known to have colonized riverine reaches prior to impoundment (Osage River). There are numerous examples of this type. Respondents handled individual circumstances differently. For example, reservoirs on the

Table 3. Historical range of paddlefish based on Lee et al. (1980) and comments received from respondents, present range based on comments from respondents, and the changes which have occurred.

State	Historical range	Present range	Change
Alabama	126, 127, 91, 92	126, 127, 91, 92, 217	- 217
Arkansas	01, 18, 78, 86, 88, 87, 89, 120, 95, 121, 05, 122, 123, 124, 125, 97	01, 18, 78, 86, 88, 87, 89, 120, 95, 121, 05, 122, 123, 124, 125, 97	Still found in the same rivers but in less density.
Georgia	Lee et al. (1980) - Maybe present	No response	Undocumented in this survey
Illinois	14	14, 98	- 98
Indiana	52, 60, 34, 152, 153	52, 60, 34, 152, 153	No change
Iowa	22, 37, 39, 15, 01, 11, 13	22, 01, 11, 13	-37, 39, 15
Kansas	22,24, 25, 47, 51, 84, 85, 78	22, 24, 25, 47, 51, 84, 85, 78, 219, 220, 221, 222,	+ 219, 220, 221, 222
Kentucky	Present (Lee et al. 1980)	List was not provided	No change reported
Louisiana	01, 87, 88, 89, 90, 21, 128, 100, 129, 130, 131, 132, 133, 96, 134, 135, 136, 137, 138, 139, 140, 141, 142	01, 87, 88, 89, 90, 21, 128, 100, 129, 130, 131, 132, 133, 96, 134, 135, 136, 137, 138, 139, 140, 141, 142	No change
Michigan	Lee et al. (1980) - Maybe present	Responses inconclusive	Undocumented in this survey
Minnesota	01, 02, 03, 04, 05, 07	01, 02, 03, 04, 05, 07	No change
Mississippi	102, 155	102, 155	No change
Missouri	22, 01, 50, 51	01, 22, 13, 05, 223, 224, 225, 226, 227, 228, 50, 51	+ 13, 05, 223, 224, 226, 227, 228
Montana	22, 24, 25, 26, 29, 30	22, 24, 25, 26, 29, 30	No change
Nebraska	22, 40	22, 40	No change
New York	105	Extirpated	- 105
North Carolina	Present (Lee et al. 1980)	No response	Undocumented in this survey
North Dakota	22, 26	22, 26	No change
Ohio	52, 105	52	- 105
Oklahoma	78, 81, 82, 84, 85, 87, 110, All lakes downstream from Kaw Reservoir, All lakes down from 140 on Neosho River.	78, 81, 82, 84, 85, 87, All lakes on 84 in the mainstem Arkansas River, 156 downstream from Eufala, Red River down from Denison Dam.	- 110, ?
Pennsylvania	52, 53, 105	52, 53	- 105
South Dakota	22, 34, 36	22, 34, 36	No change
Tennessee	Present (Lee et al. 1980)	No Response	Undocumented in this survey
Texas	157, 158, 159, 160, 128, 161, 162, 163, 164, 154	157, 158, 159, 160, 128, 161, 162	- 163, 164, 154
West Virginia	Present (Lee et al. 1980)	Response inconclusive	Undocumented in this survey
Wisconsin	01, 03, 04, 05, 07	01, 03, 04, 05, 07	No change

Missouri River have paddlefish populations but have not been listed as new colonization areas.

Respondents provided information regarding the causes felt to be associated with the current status, and provided comments regarding harvest, reproduction and survival. These data were summarized on a state-by-state basis:

Alabama

Over-exploitation and habitat alterations were blamed for the decline in abundance. Reduced population size resulted in a state-wide moratorium on the harvest of paddlefish, implemented in 1989, which is still in effect, and contributed to the stability in the present population. Stocking has not been used. Eggs are not harvested for caviar. Eggs, larvae and juvenile paddlefish have been collected which indicated that paddlefish were successfully breeding (Table 4). Eggs were observed on gravel in the Tallapoosa River during a scuba survey of suspected spawning grounds. Larvae have been sampled in both the Tallapoosa and Alabama rivers, and juveniles have been captured in two oxbow lakes, the Brickyard and Silver. Poaching was a concern.

Arkansas

The lower White River has a hydrograph and spawning habitat resembling the natural conditions. Seasonal flooding has maintained gravel bars and backwater complexes. Accelerated commercial and sport harvest regulation has reduced pressure on paddlefish. Gravel mining regulations and 404 permit actions have helped to preserve a more natural condition. Mussel refuges have contributed as well. Arkansas has a limited stocking program but habitat restoration projects are priority. The healthiest populations occur where natural habitat and flows predominate, and the poorest populations have been found in areas where habitat has been modified and flows have been impeded. Eggs are harvested for caviar. The current market value for caviar was listed at $30.00. Larval and juvenile paddlefish have been sampled in the White River while juveniles have been sampled in the Arkansas River Basin, Cache, Black, and Little Rivers. The Arkansas River is fairly turbid and has periodic high flows even though it has been fitted with a series of locks and dams. The White River has a somewhat natural hydrology and habitat with oxbows and gravel shoals. The Cache and Black Rivers have a natural hydrograph and natural habitat. The Little River is turbid and retains seasonal high flows and natural habitats, although modified. Arkansas has both a sport and commercial fishing season for paddlefish. There is a statewide daily limit of 5 paddlefish/day, however the limit is reduced to 2 fish/day below Beaver Lake Dam and at Dam 1 at Batesville. Commercial fisherman are not allowed to harvest paddlefish in the White River in a 64 km spawning area during the spawning season. Paddlefish less than 76.2 cm in length from eye to fork cannot be harvested from November through February. Some length-limit violations were noted by commercial fishermen.

Illinois

Swan Lake is an example of the continuing threat to paddlefish populations. It had a natural hydrograph and habitats; however, Swan Lake has been leveed to separate it from the river to facilitate dredging maintenance of the lake. The levee is expected to eliminate paddlefish from Swan Lake. Declining paddlefish populations resulted from habitat

Table 4. Rivers and lakes where eggs, larvae and juvenile paddlefish have been collected in the last three years.

State	Eggs	Larvae	Juveniles
Alabama	91	91, 92	93, 94
Arkansas		86	86, 78, 95, 96, 97.
Illinois	98		
Indiana	52		52, 60
Iowa		22, 01	22, 01
Kansas			45, 47, 51, 84
Kentucky	52	52	52
Louisiana		99	99, 100, 87
Minnesota			01
Mississippi			01
Missouri	102	101, 102, 22, 01, 50	01, 50*, 51*, 22
Montana	22, 26	22, 26, 01	22, 26, 01
Nebraska		22	22
North Dakota	22, 26	22, 26, 01	22, 26, 01
Ohio	52	52	
Oklahoma	84	84	78, 84, 87
South Dakota	22	22	22
Texas			*
Wisconsin			01

*Hatchery fish

degradation due to sedimentation, construction of dams and over-exploitation. A six-month long commercial paddlefish season allowed 6 fishermen into Swan Lake; however, little was known about the annual harvest. Eggs are legal byproducts of the fishery, and they are currently valued at $56.40/kg.

Indiana

Research, regulations, and habitat protection have been used to stabilize populations. Eggs and juveniles have been captured in the Ohio and Wabash rivers. There is both sport and commercial fisheries for paddlefish. The commercial season is open all year, and more than 2,000 fish weighing over 10,000 kg are harvested annually by an average 20 commercial fisherman. The sport season is open for 3.5 months, and the numbers harvested are unknown. Eggs can be legally taken for caviar which is valued at $55/pound. Poaching occurs but it is not a major problem.

Iowa

Loss of habitat caused by the construction of dams, sedimentation, isolation, and

commercial over-harvest were listed as reasons for reduced abundance. Larval and juvenile paddlefish have been sampled in the Missouri River behind wing dikes south of Sioux City, IA. Larval and juveniles have also been collected from the Mississippi River. The Cedar River is believed to support spawning. Attempts were made to stock Pool 14 of the Mississippi River; however, none of the stocked paddlefish have been recovered. A recreational fishery exists in the Iowa portion of the Mississippi River but data on harvest were not provided. The Missouri River commercial paddlefish fishery was terminated in 1986, and from the Mississippi River in 1987. Poaching is a concern.

Kansas

Respondents in Kansas attributed higher numbers of paddlefish in their state to stocking, while areas with reduced populations have resulted from pollution, habitat changes, dams, and possible competition between paddlefish and the non-native, bighead carp. Brood fish for the Kansas River drainage were obtained from Blind Pony Hatchery in Missouri, while brood fish for the Arkansas River drainage were from Grand Lake Oklahoma. Eggs are not legally harvested for human consumption. Juvenile paddlefish have been sampled in the Smoky Hill, Blue, Marais des Cygne and the Neosho rivers. Fish captured in the Smoky Hill and Big Blue rivers were probably escapees from Tuttle Creek Reservoir. Juveniles in the Neosho River were caught by bait seiners upstream from John Redmond Dam. Commercial paddlefish harvest was stopped four years ago but recreational fishing is legal during March through May. A total of 1,430 fisherman participated in the 1995 season, and they harvested 769 fish totaling 11,890 kg. All fish captured must be kept; high-grading is not allowed. Poaching is a concern.

Kentucky

Kentucky paddlefish have been preserved because important habitat remains, water quality has improved, and commercial harvest has remained moderate. Paddlefish are not stocked in Kentucky. Eggs can be legally harvested and caviar is valued at $35 to $45 per pound. Eggs, larvae, and juvenile paddlefish have been collected from the Ohio River in the tailwater of navigation dams, and in the Mississippi River associated with sand bars, islands, and side channels. Juveniles have been found in the Tennessee River and the Cumberland River, upstream and downstream from Kentucky Dam, and upstream from Cumberland Lake. Kentucky has both sport and commercial fishing seasons. Sport harvest is allowed from February through May, statewide, except at Kentucky Dam, where snagging is allowed all year. Statistics related to the sport fishery were not provided. Commercial gillnetting is allowed all year in the Ohio and Mississippi rivers, and a special gillnet season occurs in Barkley and Kentucky lakes. Poaching remains a concern.

Louisiana

Paddlefish populations have remained relatively healthy in Louisiana because more than 90% of the states' rivers are undammed and the natural hydrograph has been retained. Harvest of paddlefish from public water has not been allowed since 1986. Louisiana has a strong research program. Paddlefish are propagated at state and federal hatcheries for use in restoring depleted or extirpated populations. Eggs are not legally harvested for human consumption. Larval and juvenile paddlefish have been sampled in the Mermentau River. Juveniles have been collected in the Calcasieu River and Red River Basin. These river

systems retain natural hydrographs. Poaching is a concern.

Missouri

Populations of paddlefish in reservoirs are maintained by annual stockings of 10,000 hatchery raised fingerlings. Populations in the Missouri and Mississippi rivers have declined because of siltation, pollution, dams, and loss of habitat. Eggs are legally taken for the production of caviar and ranges in value from $25 to $60 per pound. Juvenile paddlefish have been sampled in the Mississippi River over gravel areas following a spring rise. Juveniles have also been found in the Osage and Marais de Cygne rivers over gravel substrates, but these fish were identified as hatchery fish; and there is currently no evidence of natural reproduction in these rivers. Paddlefish larvae were collected in the Lamine River, and near Perche and Auxvasse creeks by a graduate student. Missouri has both a sport and commercial season for paddlefish. The sport fishing season is open for 1.5 months; approximately 20,000 fisherman harvest 5,000 fish annually, totaling 75,000 kg. In the Osage and Marais des Cygnes Rivers the season is open from 15 March through 30 April. There are approximately 8,000 snagging trips made by fisherman who harvest about 2,500 fish per year totaling 50,000 kg. Missouri imposes a 61 cm minimum length (eye to fork), length limit, and a two fish per day bag. Commercial fishing is legal all year only in the Mississippi River and the lower St. Francis River. There are fewer than 200 commercial fisherman, and they harvest 4,140 kg of paddlefish, annually. Poaching is a concern in Missouri. Caviar buyers have reported that eggs have been taken illegally from reservoir areas closed to commercial fishing but open to sportfishing.

Minnesota

Minnesota has developed a long-range plan for sturgeon and paddlefish management, and critical habitats will be identified in an effort to protect and enhance such habitat. Minnesota is working on methods to evaluate sturgeon and paddlefish populations. Minnesota has identified the importance of protecting the genetic identity of Minnesota's sturgeon and paddlefish populations. They are committed to the restoration of extirpated populations and enhancement of existing populations. Paddlefish stocking is not employed in Minnesota. There is no legal harvest of paddlefish in Minnesota. Eggs, larvae and juvenile paddlefish have not been collected in the last three years. Poaching is not a major concern.

Mississippi

Commercial exploitation and habitat degradation have resulted in reduced numbers of paddlefish. Artificial propagation of paddlefish is not a part of Mississippi's management. All harvest of paddlefish or their eggs is illegal in the state. Eggs and larvae have been collected in the Pearl River, while juveniles have been sampled in the Mississippi River. Poaching is a concern.

Montana

Montana respondents attributed healthy paddlefish populations to good rearing conditions in Garrison and Fort Peck reservoirs (Missouri River) with good spawning habitat and a semi-natural hydrograph upstream from Fort Peck, and a natural hydrograph in the Yellowstone River. Montana limits fishermen to two paddlefish in the Missouri River upstream from Fort

Peck Reservoir and one fish in the Yellowstone and Missouri rivers downstream from Fort Peck Reservoir. Hatchery paddlefish are not stocked in Montana. Montana allows only recreational fishing for paddlefish. The season on the Yellowstone River is open for 45 to 60 days, while the Missouri River is open all year. More than 4,800 fishermen are engaged each year; harvest totals approximately 1,500 fish, weighing 27,000 kg from the Yellowstone River fishery. About 600 fish weighing 15,000 kg are harvested from the Missouri River fishery. Eggs are legally harvested for caviar, and the current market value is $120/kg, but eggs are a byproduct of the recreational fishery only. Eggs are donated by anglers to the Glendive, Montana Chamber of Commerce who subsequently sell the eggs for commercial caviar production. Proceeds are used for civic, educational, and cultural projects (60%), and paddlefish research and fishing access improvements (40%). Approximately 2,800 kg of eggs were harvested in 1995. Eggs, larvae, and juveniles have been collected from the Missouri and Yellowstone rivers. There is no evidence of poaching. Montana remains concerned about the long-term viability of their entire riverine fish community because of the altered ecological conditions of the Yellowstone and Missouri rivers.

Nebraska

Paddlefish reproduce, annually, in the Missouri River between Fort Randall and Gavins Point dams, and recruits may make a significant contribution to the population living downstream from Gavins Point Dam. The spawning reach has backwaters, rock-rubble substrate, and is influenced by highly turbid tributary flows during the spawning period especially when reservoir releases are low. Nebraska is working with the U.S. Army Corps of Engineers to restore off-channel habitats along the channelized section of the Missouri River, which will increase spawning, feeding, and nursery areas. Paddlefish, isolated between Fort Randall and Gavins Point dams, are protected from harvest. All commercial paddlefish harvest was stopped in 1986. A sport fishery is managed from the tailwater of Gavins Point Dam to the mouth of the Big Sioux River with a tag quota system and a 35 inch to 45 inch, protected slot, length limit. The recreational fishing season is open for 30 days during an October snagging season (2,250 tags), and 16 days during a July archery season (200 tags). NE and SD join together to issue tags, 200 of which are allocated for non-residents. Individual anglers are limited to no more than two snagging and two archery tags, annually. Between 1989 and 1995, 1,500 to 2,000 fisherman have harvested between 1,000 and 2,000 paddlefish, weighing 13,600 kg on average, annually. Catch and release is practiced but there is a daily bag limit of one fish. Poaching is a concern. Adult paddlefish have been observed and captured in the Platte River (Merrick County) as well as at the Central Nebraska Public Power and Irrigation diversion dam, east of North Platte, NE. Paddlefish are not stocked by Nebraska. Larval and juvenile paddlefish have been sampled in the Missouri River, mainly upstream from Gavins Point Dam, in a remnant, semi-natural section of unchannelized river.

North Dakota

Lake Oahe paddlefish stocks have decreased, while Lake Sakakawea and Yellowstone River stocks seem to be unchanged recently. Reproduction occurs in the Yellowstone River, and Lake Sakakawea provides good nursery habitat. Hatchery paddlefish are stocked in North Dakota. The state does not have a commercial fishery. Eggs are legally harvested for the production of caviar during the recreational fishery. The current market value for #1 and #2 eggs is $58 and $50 per pound, respectively. The sport fishing season is open for 1.5

months. Over 3,200 fisherman harvest 1,350 fish, weighing 30,000 kg. Eggs, larvae, and juveniles have been sampled in the Missouri and Yellowstone rivers. Between 1991 and 1996, more than 60 young-of-the-year paddlefish were dipnetted from Lake Sakakawea. The Yellowstone River has a significant influence on the Missouri River reach from the confluence downstream to Lake Sakakawea. The Yellowstone River remains comparatively unmodified, with natural habitats, discharge, and high turbidity. A limited amount of illegal snagging activity is of concern. North Dakota has a strong and growing research and management program for paddlefish and sturgeon.

Ohio

Ohio funds research on paddlefish through the Ohio State University (OSU) to evaluate movement, habitat use, and to identify critical spawning habitats in the Ohio River. Paddlefish were stocked in 1992; however, no stocking has occurred since. Eggs are not legally taken for the production of caviar. Eggs and larval paddlefish have been sampled in the Ohio River by OSU. Poaching is not considered a problem.

Oklahoma

Paddlefish have increased recently due to habitat protection, restoration and management of the sport fishery. Oklahoma has a sport only season which is open all year. One fish per day is allowed from January 1 through March 14 and from May 16 through December 31. Three fish per day can be harvested from March 15 through May 15. Catch and release is prohibited during the normal snagging seasons. Eggs, larvae, and juveniles have been collected from the Arkansas River Basin. Juveniles have been found in the Neosho River. Poaching is a concern.

Pennsylvania

Paddlefish have been extirpated from portions of the state because of pollution, dams, and dredging. However, paddlefish were stocked in the Pennsylvania portion of the Ohio River (Pools 1-4) and Allegheny River (Pools 1-5) from 1991 to 1995 in an attempt to restore the species to its historic range. Pennsylvania is currently conducting a population assessment to determine the success of these stockings. Paddlefish were supplied by Gavins Point National Fish Hatchery. There is no paddlefish fishery in Pennsylvania and eggs, larvae, and juveniles have not been collected in recent times.

South Dakota

Paddlefish have declined upstream from Gavins Point Dam due to a loss of riverine habitat. Lake Francis Case has a relict population of very old paddlefish. Hatchery raised fish have been used to supplement this population. South Dakota closely controls harvest and stocks paddlefish to maintain populations. South Dakota shares management of a sport fishing season, downstream from Gavins Point Dam, with Nebraska. Regulations are described in the Nebraska section. Eggs are not legally harvested for the commercial production of caviar. Naturally produced eggs, larvae, and juveniles have been collected downstream from Fort Randall Dam. Poaching is a concern.

Texas

Paddlefish abundance has increased recently because of a ten-year stocking program of hatchery reared fish. Paddlefish have been stocked into six river systems, including: Trinity, Neches, Angelina, Sabine, Big Cypress Bayou, and Sulphur. Water quality, zooplankton and habitat surveys have been completed for the Trinity, Neches-Angelina, and Sabine river systems. Salinity toxicity studies have been undertaken. Paddlefish are considered endangered in Texas; sport and/or commercial fishing is prohibited. Juvenile specimens have been captured but thus far all have been determined to be hatchery fish. Poaching is not a concern at this time.

Wisconsin

Wisconsin paddlefish populations are protected by prohibiting all harvest. Paddlefish are not stocked in Wisconsin waters. Juvenile paddlefish have been sampled in the Mississippi River. Poaching is a concern.

Current Status of Pallid Sturgeon

Twenty-one respondents from 12 states supplied information regarding the current status of pallid sturgeon (Table 5). A high percentage (42.9%) of the respondents felt that pallid sturgeon were still decreasing in abundance, and no one felt they were increasing. The remaining 57.1% felt that the actual status of the pallid sturgeon population within their study areas was unknown. States that described the pallid sturgeon as declining included: North Dakota, Iowa, South Dakota, Nebraska, Missouri, Arkansas, and Mississippi. States that classified pallid sturgeon populations as unknown included: Louisiana, Kentucky, Texas, Montana, Kansas, Missouri, and Mississippi.

Table 5. The relative status of pallid sturgeon populations from Survey Number 1.

State	Supervisors	Field biologists
Arkansas	Decreasing	-
Iowa	Decreasing	-
Kansas	Unknown	
Kentucky	-	Unknown
Louisiana	Unknown/ Unknown	-
Mississippi	Unknown	Decreasing
Missouri	-	Decreasing/ Unknown/ Unknown
Montana	Unknown/ Unknown/ Unknown/ Decreasing	-
Nebraska	Decreasing	
North Dakota	Unknown/ Decreasing	Decreasing
South Dakota	Decreasing	-
Texas	Unknown	-

Arkansas reported that pallid sturgeon have disappeared from the St. Francis and White rivers, apparently a recent development (Table 6). Kansas reported the species has been eliminated from the Kansas River. Montana reported collecting pallid sturgeon from Fort Peck Lake.

Table 6. Historical range of pallid sturgeon based on Lee et al. (1980) and comments received from respondents; present range based on comments from respondents, and the changes which have occurred.

State	Historical range	Present range	Change
Arkansas	01, 18, 86	01	- 18, 86
Iowa	22	22	No change
Kansas	22, 45	22	- 45
Kentucky	01	01	No change
Louisiana	01, 87, 130	01, 87, 130	No change
Missouri	01, 22	01, 22	No change
Montana	22, 26	22, 26, 165	+ 165
Nebraska	22, 35, 40,	22, 35, 40	No change
North Dakota	22, 26	22, 26	No change
South Dakota	22, 34	22, 34	No change

Respondents provided new information regarding the causes probably associated with current status, and provided comments regarding, reproduction and survival. These data were summarized on a state-by-state basis:

Arkansas

Pallid sturgeon continue to decline because habitat has not been restored in the St. Francis, Little Missouri, and Mississippi rivers. The hydrograph has been modified by numerous dams and pollution remains a concern. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is not a concern.

Iowa

Reasons listed for declining populations included: loss of the natural hydrograph and habitat, coupled with genetic isolation. Iowa has continued to work with the U.S. Army Corps of Engineers to try to restore a more natural hydrograph. No eggs, larvae, or juveniles have been sampled in the last three years. Poaching was not listed as a concern.

Kansas

The status of pallid sturgeon is a result of the change in the hydrograph, habitat loss, exploitation, and hybridization. Eggs, larvae, and juvenile pallid sturgeon have not been sampled in the last three years. Poaching is not a concern.

Kentucky

Much of the breeding and living habitat has been destroyed to maintain the navigability of the Mississippi River on Kentucky's border. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is not a concern.

Louisiana

Louisiana respondents acknowledged a lack of life history and population studies; however, the density of pallid sturgeon seems to be as great or greater in areas of Louisiana than anywhere in its range. The U.S. Army Corps of Engineers has agreed to operate water diversion structures in a manner that would minimize potential impacts on pallid sturgeon. Juvenile pallid sturgeon have been collected from the Red River basin (Table 7), where a natural hydrograph still exists. Ripe, female pallid sturgeon were observed during surgical implantation of tracking transmitters. Poaching is a concern.

Table 7. Rivers and lakes where eggs, larvae and juvenile pallid sturgeon have been collected in the last three years.

State	Eggs	Larvae	Juveniles
Arkansas			86***
Louisiana			87
Missouri		01*	01**, 22**
North Dakota		26*	

*The larval specimens captured were possibly shovelnose sturgeon.
**Hatchery fish
***Life stage not stated

Mississippi

Habitat degradation was listed as the cause of reduced pallid sturgeon populations in Mississippi. Research has been implemented in the middle Mississippi River to define the best approach for the preservation of this species. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is a concern.

Missouri

Populations are decreasing because of siltation, pollution, loss of the natural hydrograph, and loss of habitat. Missouri stocked 7,200 pallid sturgeon into the lower Missouri and Mississippi rivers in 1994. Since 1994, about 50 of the stocked sturgeon have been recaptured and they seem to be growing well and are in excellent condition. One of the fish traveled 250 miles into the St. Francis River in Arkansas. Juvenile, hatchery raised pallid sturgeon have been collected from the Mississippi River (Table 7). Commercial fisherman have admitted selling pallid sturgeon because they are larger and consequently more valuable. Conservation enforcement agents, along the lower Mississippi, have had difficulty differentiating between shovelnose and pallid sturgeon.

Arkansas reported that pallid sturgeon have disappeared from the St. Francis and White rivers, apparently a recent development (Table 6). Kansas reported the species has been eliminated from the Kansas River. Montana reported collecting pallid sturgeon from Fort Peck Lake.

Table 6. Historical range of pallid sturgeon based on Lee et al. (1980) and comments received from respondents; present range based on comments from respondents, and the changes which have occurred.

State	Historical range	Present range	Change
Arkansas	01, 18, 86	01	- 18, 86
Iowa	22	22	No change
Kansas	22, 45	22	- 45
Kentucky	01	01	No change
Louisiana	01, 87, 130	01, 87, 130	No change
Missouri	01, 22	01, 22	No change
Montana	22, 26	22, 26, 165	+ 165
Nebraska	22, 35, 40,	22, 35, 40	No change
North Dakota	22, 26	22, 26	No change
South Dakota	22, 34	22, 34	No change

Respondents provided new information regarding the causes probably associated with current status, and provided comments regarding, reproduction and survival. These data were summarized on a state-by-state basis:

Arkansas

Pallid sturgeon continue to decline because habitat has not been restored in the St. Francis, Little Missouri, and Mississippi rivers. The hydrograph has been modified by numerous dams and pollution remains a concern. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is not a concern.

Iowa

Reasons listed for declining populations included: loss of the natural hydrograph and habitat, coupled with genetic isolation. Iowa has continued to work with the U.S. Army Corps of Engineers to try to restore a more natural hydrograph. No eggs, larvae, or juveniles have been sampled in the last three years. Poaching was not listed as a concern.

Kansas

The status of pallid sturgeon is a result of the change in the hydrograph, habitat loss, exploitation, and hybridization. Eggs, larvae, and juvenile pallid sturgeon have not been sampled in the last three years. Poaching is not a concern.

Kentucky

Much of the breeding and living habitat has been destroyed to maintain the navigability of the Mississippi River on Kentucky's border. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is not a concern.

Louisiana

Louisiana respondents acknowledged a lack of life history and population studies; however, the density of pallid sturgeon seems to be as great or greater in areas of Louisiana than anywhere in its range. The U.S. Army Corps of Engineers has agreed to operate water diversion structures in a manner that would minimize potential impacts on pallid sturgeon. Juvenile pallid sturgeon have been collected from the Red River basin (Table 7), where a natural hydrograph still exists. Ripe, female pallid sturgeon were observed during surgical implantation of tracking transmitters. Poaching is a concern.

Table 7. Rivers and lakes where eggs, larvae and juvenile pallid sturgeon have been collected in the last three years.

State	Eggs	Larvae	Juveniles
Arkansas			86***
Louisiana			87
Missouri		01*	01**, 22**
North Dakota		26*	

*The larval specimens captured were possibly shovelnose sturgeon.
**Hatchery fish
***Life stage not stated

Mississippi

Habitat degradation was listed as the cause of reduced pallid sturgeon populations in Mississippi. Research has been implemented in the middle Mississippi River to define the best approach for the preservation of this species. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is a concern.

Missouri

Populations are decreasing because of siltation, pollution, loss of the natural hydrograph, and loss of habitat. Missouri stocked 7,200 pallid sturgeon into the lower Missouri and Mississippi rivers in 1994. Since 1994, about 50 of the stocked sturgeon have been recaptured and they seem to be growing well and are in excellent condition. One of the fish traveled 250 miles into the St. Francis River in Arkansas. Juvenile, hatchery raised pallid sturgeon have been collected from the Mississippi River (Table 7). Commercial fisherman have admitted selling pallid sturgeon because they are larger and consequently more valuable. Conservation enforcement agents, along the lower Mississippi, have had difficulty differentiating between shovelnose and pallid sturgeon.

Montana

Pallid sturgeon populations have been reduced due to altered habitat and the inability of the species to successfully reproduce. The short-term recovery objective was intended to prevent extinction by establishing three captive broodstock populations in separate hatcheries that were initially composed of five to seven wild adult males and five to seven wild adult females. The long-term goal of the pallid sturgeon recovery plan was to delist the species through habitat protection and restoration by 2040. Montana adopted a maximum size limit for all sturgeon species; it is illegal to keep any sturgeon over 102 cm, total length. Eggs, larvae, and juveniles have not been sampled in the last three years. Montana does not presently stock pallid sturgeon but will in the future. Poaching is not a concern.

Large Upper Missouri River pallid sturgeon collected by wildlife officials for hatchery spawning.

Nebraska

Pallid sturgeon have been impacted by the lack of reproductive success which may be attributed to migratory interference, a result of dams on the mainstem Missouri River. Nebraska has been working with the U.S. Army Corps of Engineers to restore off-channel habitats to the channelized section of the Missouri River. This habitat may eventually provide spawning, feeding, and nursery areas that were otherwise unavailable. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is not a concern.

North Dakota

Pallid sturgeon are thought to be declining due to a lack of reproduction, habitat alteration, hybridization, changes in temperature and turbidity, and bioaccumulation of toxins. Larval pallid sturgeon (or possibly shovelnose sturgeon) may have been sampled in the Yellowstone River, (Table 7). Based on the capture of a relatively high number of adult pallid sturgeons, compared with other areas within their range, the Yellowstone River is important for the survival of the species. Poaching is not a concern.

South Dakota

Pallid sturgeon have declined due to a reduction in riverine habitat. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is not a concern.

Current Status of Lake Sturgeon

Thirty-five respondents from 23 states and provinces provided information regarding the current status of lake sturgeon (Table 8). There was considerable variation among respondents: 22.9% reported declining populations; 14.3% reported lake sturgeon were

Table 8. The relative status of lake sturgeon from Survey Number 1.

State/Province	Supervisors	Field biologists
Alabama	-	Extirpated
Alberta	Unknown	-
Arkansas	Decreasing	-
Georgia	-	-
Illinois	Unknown	-
Indiana	-	-
Iowa	-	Decreasing
Kansas	Unknown	Unknown
Kentucky	Extirpated	-
Manitoba	Decreasing to extirpated	-
Michigan	Stable	Unknown/ Stable
Minnesota	Increasing/ Stable	Extirpated/ Decreasing
Missouri	-	Increasing/ Unknown/ Unknown
Nebraska	Decreasing	Decreasing
New York	-	Stable to increasing/ Increasing
Pennsylvania	Extirpated	
North Carolina	-	-
Ohio	-	Unknown
Ontario	Increasing/ Decreasing	
Saskatchewan	Decreasing	-
South Dakota	Unknown	-
Vermont	-	-
Wisconsin	Increasing/ Stable/ Stable to increasing/ Decreasing	Unknown/ Unknown

increasing in their area; 14.3% reported stable populations; 11.4% reported lake sturgeon had been extirpated; the remaining 37.1% either did not know the status or found them to be in a state of flux, somewhere between stable and increasing or decreasing.

Populations have been extirpated in North Carolina, Georgia, Arkansas, Pennsylvania, and Alabama. Manitoba has populations that were described as moving toward extirpation. Populations are decreasing in Arkansas, Indiana, Iowa, Manitoba, Minnesota, Nebraska, Wisconsin, Ontario, Saskatchewan, and Vermont. Populations are stable in Indiana, Michigan, Minnesota and Wisconsin. Populations are stable to increasing in portions of New York and Wisconsin while populations are increasing in portions of Wisconsin, New York, Minnesota, and Ontario.

Changes in the historical versus current range were numerous, and mostly negative (Table 9). Systems that once had lake sturgeon that apparently do not support populations at the present time, included: the Coosa, Nelson, White, Little Missouri, Illinois, Ohio, Kansas, Mississippi in Kentucky, Rainy, Winnepeg, Pigeon, South Saskatchewan, Mississippi in Minnesota, Minnesota River, Red River of the North, Missouri in Missouri, Osage, Platte, Elkhorn, Allegheny, North Saskatchewan, Saskatchewan, Churchill, Lake Poygan, St. Louis, Bad, Amnicon, Iron, and Sturgeon rivers. They now occur in Round, Cumberland, Sipinesk, Portuga, Black, Burt, Mullet, Raquette, St. Croix, and Metinak lakes, and in Oswegatchie, and Grasse rivers.

Respondents provided new information regarding the causes probably associated with current status, and provided comments regarding, harvest, reproduction and survival. These data were summarized on a state-by-state basis:

Alabama

Populations of lake sturgeon have been extirpated in Alabama due to over-exploitation and habitat alteration.

Alberta

Lake sturgeon have been impacted by lost riverine habitat, changes in flow rates caused by hydroelectric dams, and poor recruitment. To maintain populations Alberta has developed a comprehensive management plan and have begun to collect baseline life history data. Tagging studies and population estimates have been conducted since 1990, and an overwintering and spawning habitat telemetry study was concluded in 1996. Alberta may also implement catch and release regulations or decrease the harvest to one fish per year for those fish longer than 1.3 m in total length. Stocking has not been used to date. Alberta has a recreational fishery which is open all year. There is no commercial harvest for lake sturgeon eggs or flesh. Presently, Alberta fisherman are required to purchase a special license which allows them to harvest lake sturgeon, including no more than two sturgeon greater than 1 m in fork length. Annually, 25 to 75 fisherman harvest an average of 50 to 100 kg (2 to 4 fish) of lake sturgeon per fishermen. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching remains a concern.

Arkansas

Lake sturgeon habitat has been highly modified in the St. Francis, Little Missouri, and Mississippi rivers. Dams have altered the natural flow regime, and pollution remains a concern. Lake sturgeon are not stocked in Arkansas. Eggs, larvae, and juvenile lake sturgeon have not been sampled in the last three years. Harvest of lake sturgeon or their eggs is prohibited. Poaching is not a concern.

Illinois

Reduced populations of lake sturgeon was reported to be caused by habitat degradation, sedimentation, navigation dams, and over-harvest earlier in this century. Lake sturgeon are not stocked. All harvest is prohibited. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is not a concern.

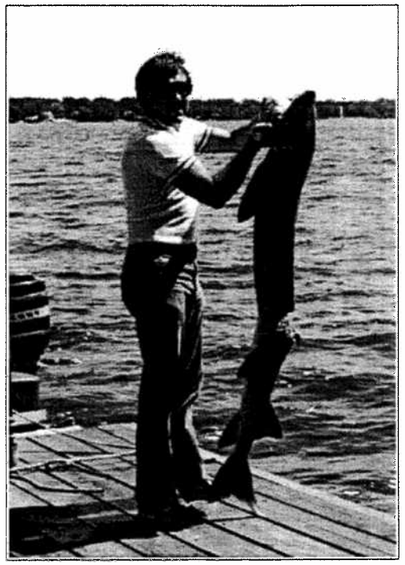
Table 9. Historical range of lake sturgeon based on Lee et al. (1980) and comments received from respondents; present range based on comments from respondents, and the changes which have occurred.

State/Province	Historical range	Present range	Change
Alabama	127		- 127
Alberta	167, 180	167	- 180
Arkansas	01, 86, 120	01	- 86, 120
Illinois	14		- 14
Indiana	152, 106 drainage, 52	152, 106 drainage	- 52
Iowa	01	01	No change
Kansas	22, 45	22	- 45
Kentucky	01, 52	52	- 01
Manitoba	108, 178, 179, 180, 181	182, 183, 184, 185	- 108, 178, 179, 180, 181 + 182, 183, 184, 185
Michigan	103, 104, 105, 106, 116, 185, 186, 187, 188, 189, 174	103, 104, 105, 106, 116, 185, 186, 187, 188, 189, 174, 190, 175, 176, 177	+ 190, 175, 176, 177
Minnesota	113, 103, 169, 170, 01, 02, 03, 168, 171, 108, 172, 173	113, 103, 03, 168, 169, 170, 171, 172	- 01, 02, 108, 173
Missouri	01, 22, 50	01	- 22, 50
Nebraska	22, 40, 229	22	- 40, 229
New York	107, 202	107, 119, 191, 202, 204	+ 119, 191, 204
Ohio	52, 105	105	- 52
Ontario	178, 192, 108, 109, 193, 194, 195, 196, 110, 196, 110, 171, 197, 198, 199, 111	178, 192, 108, 109, 193, 194, 195, 196, 110, 196, 110, 171, 197, 198, 199, 111	No change
Pennsylvania	52, 53		- 52, 53
Saskatchewan	167, 181, 200, 201		- 167, 181, 200, 201
South Dakota	22	22	No change
Wisconsin	01, 03, 03 flowage, 04, 05, 07, 09, 115, 208, 209, 210, 211, 212, 103, 170, 117, 213, 214, 116	01, 03, 03 flowage, 04, 05, 07, 09, 115, 205, 208, 209, 210, 211, 103	+ 205 - 212, 170, 117, 213, 214, 116

Indiana

Lake sturgeon populations have been reduced due to pollution, habitat loss, and over-exploitation. Habitat protection, regulations, and population studies are currently underway to maintain and monitor populations. Lake sturgeon are not stocked in Indiana waters. All

harvest is prohibited. Eggs, larvae, and juvenile lake sturgeon have not been sampled in the last three years. Poaching is not believed to be a problem.



Mississippi River (Navigation Pool 15) lake sturgeon nearly cut in half, presumably by a towboat prop.

Iowa

Decreased abundance of lake sturgeon was attributed to construction of dams, loss of spawning habitat due to siltation, and commercial over-harvest. Lake sturgeon were stocked into Pool 24 of the Mississippi River. No commercial or sport harvest of lake sturgeon is allowed in Iowa. Eggs, larvae, and juveniles have not been sampled in the past three years. Poaching of lake sturgeon is not a concern.

Kansas

The loss of lake sturgeon was attributed to loss of habitat but respondents suggested lake sturgeon were never abundant in Kansas. Lake sturgeon populations decreased in the late 1800's and early 1900's due to over-exploitation and structures that interfered with long-range migrations. Recent sightings of lake sturgeon have resulted from Missouri's stockings into the lower Missouri River basin; however, Kansas has not stocked lake sturgeon. There is no sport or commercial fishing season. Eggs, larvae, and juvenile lake sturgeon have not been sampled in the last three years. Poaching is not a concern.

Kentucky

Construction of dams for navigation has lead to the destruction of living and breeding habitat.

Manitoba

The deteriorating status of lake sturgeon was attributed to past over-exploitation and hydroelectric dams. Sturgeon are stocked in Manitoba to restore populations. All harvest is prohibited. Eggs, larvae, and juvenile lake sturgeon have not been sampled in the last three years. There is some concern for losses due to poaching.

Michigan

Where lake sturgeon were stable there seemed to be a linkage with a more natural hydrograph. Dams and commercial fishing pressure caused the decline in past years. Michigan is developing a lake sturgeon management plan and is engaged in tagging studies in the Huron and Keweenaw Bays (Lake Superior). Lake sturgeon are stocked in Michigan. Michigan has a sport only fishery. The hook and line season is open for two months (January- February) inland, and ten months (July 1- April 30) in the Great Lakes. There is also a one month spearing season in February. One fish per season is allowed each

fishermen, with a 127 cm minimum size limit, and 15 to 25 fish are harvested annually. There is a nine-month tribal season on Keweenaw Bay and Portage Lake. Approximately 21 native fisherman participate in the season; 10 fish are harvested on average, totaling about 200 kg. No harvest is allowed in Keweenaw Bay spawning areas for three months each year. Eggs are not legally taken for the production of caviar. Eggs, larvae, and juvenile lake sturgeon have been collected in the Sturgeon River, Portage Lake, Lake Superior, Lake Michigan, Lake Huron, Lake Erie, and their tributaries (Table 10). The Sturgeon River is barrier and industry free while Portage Lake is large, deep, and organic. Poaching remains a concern.

Table 10. Rivers and lakes where eggs, larvae and juvenile lake sturgeon have been collected in the last three years.

State	Eggs	Larvae	Juveniles
Michigan	103, 104, 105, 106 and Tributaries	103, 104, 105, 106 and Tributaries, 116	103, 104, 105, 106 and Tributaries, 116, 117
Minnesota			113
Missouri			22*
New York	107, 119, 202	107, 202	107, 202
Ontario	108, 109, 110, 111		108, 110, 111
Saskatchewan	112	112	
Wisconsin	115,118	115,116	115, 116, 117, 103

Minnesota

Lake sturgeon populations were extirpated in the St. Louis River due to several hydropower dams which blocked passage from Lake Superior. Populations declined in the Kettle River from over-exploitation and habitat alteration. The Kettle River fishery was closed in 1996. Natural populations were extirpated in the late 1800's from over-exploitation and industrial pollution associated with logging operations. In 1983, Wisconsin and Minnesota initiated a stocking program. Currently lake sturgeon are expanding their numbers and some of these fish have shown up in historical spawning areas. In 1997, the Fond Du Lac Band of Chippewa will also begin stocking lake sturgeon. Eggs are not legally harvested for the production of caviar in Minnesota. Juvenile lake sturgeon specimens have been sampled in the St. Louis River Estuary (Table 10). Poaching is a concern.

Missouri

Lake sturgeon populations decreased because of loss of habitat, low populations of adults, siltation, dams, and pollution. To restore lake sturgeon populations Missouri has reintroduced lake sturgeon into the upper Mississippi and lower Missouri rivers. Since 1986, nearly 100,000 fingerlings have been stocked, and an additional 100,000 will be stocked in the future, after which a stocking evaluation will be implemented. Tagged fish have been captured in the Mississippi, Missouri, Gasconade and Osage rivers. Commercial fisherman have reported the incidental catch of stocked lake sturgeon. There is no sport or commercial fishery for lake sturgeon in Missouri, and eggs are not legally harvested for the production of

caviar. Three juvenile lake sturgeon were reported in the spring of 1996 (Table 10). These fish were less than 150 mm in length. Since stocked fish were typically a minimum 254 mm in length, there is at least some reason to suspect limited natural reproduction. Poaching is not a concern.

Nebraska

Lake sturgeon may have never been common in the Missouri River in Nebraska but may now outnumber pallid sturgeon based on angler reports. Nebraska is working with the U.S. Army Corps of Engineers to restore off-channel habitats to the channelized section of the Missouri River. This habitat may provide spawning, feeding, and nursery areas that were otherwise unavailable. Lake sturgeon are not stocked in Nebraska. All harvest of lake sturgeon and their eggs is prohibited. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is not a concern.

New York

Populations initially decreased due to dam construction and subsequent habitat degradation, commercial over-harvest, and water pollution. Populations are increasing due to pollution abatement programs, reduced exploitation, and a stocking program for the Oswegatchie River and Black Lake. Spawning sites have been enhanced by artificial reefs and other habitat projects in the St. Lawrence and Grasse rivers. There is no sport or commercial fishing season in New York, and eggs are not legally harvested for the production of caviar. Eggs, larvae, juveniles, and adults have been sampled in the St. Lawrence River, and eggs have been sampled in the Grasse River (Table 10). Juveniles have also been captured in Lake Erie and the Niagara River. Poaching is not believed to be a problem.

Ohio

Ohio has considered re-establishment of lake sturgeon in Lake Erie. There is no sport or commercial fishery for lake sturgeon in Ohio, and eggs are not legally harvested for the production of caviar. Eggs, larvae, and juvenile sturgeon have not been sampled in the last three years. Poaching is not a concern.

Ontario

Lake sturgeon were over-exploited by the turn of the century as a result of commercial fishing. Loss of habitat, especially spawning and rearing areas on the Rainy River, a result of pollution from pulp and paper mills upstream, eliminated lake sturgeon. Recovery of lake sturgeon populations in the Rainy River and adjacent areas in Lake of the Woods has paralleled significant improvements in water quality (i.e., including improved dissolved oxygen levels and reduced effluent toxicity). Paper and pulp mills were required to treat effluent, secondarily, which resulted in a 95% reduction in wood fiber and dissolved solids discharges; their adherence to these regulations have been closely monitored since the 1970's. There are also limited quotas on the commercial harvest of sturgeon. Ontario and Minnesota work together to control exploitation and protect habitat of lake sturgeon in the boundary waters. Less than 2 to 3 kg of sturgeon eggs are taken for the production of caviar, annually. Ontario has both a sport and commercial fishery. The sport fishery is open 10.5 months during which time 300 to 500 fisherman harvest 40 fish, weighing 500 kg. There is a one fish per day

limit and a 1.14 m minimum size limit. The commercial season is also open for 10.5 months, and there are six commercial fisherman who harvest about 160 fish, weighing 2,000 kg. Net mesh size must be a minimum of 30.5 cm. Ontario does not currently stock lake sturgeon. Eggs and juvenile lake sturgeon have been collected from the Moose River (Table 10). Eggs have also been collected from the Rainy, Little Fork and Namakan Rivers, while juveniles were collected from the Rainy and Namakan Rivers. The Little Fork River, a tributary of the Rainy River, has clean rock substrates and a natural hydrograph. The Namakan River is largely uncontrolled, has clean rock substrates, and commercial exploitation has been reduced. Poaching remains a concern. Lake sturgeon populations are capable of recovering without stocking hatchery fish if the habitat is restored and exploitation is reduced to preserve residual spawning stocks.

Saskatchewan

Damming of the Saskatchewan River isolated the most productive sturgeon habitat in 1963 and devastated the population through the elimination of spawning grounds. Continued commercial harvest during this period contributed to the reduction of lake sturgeon numbers. A four-year sturgeon population restoration study is in its third year with a goal to define habitat improvement techniques, stocking protocols, and harvest controls. At the present time Saskatchewan does not stock lake sturgeon. Eggs and larvae have been sampled from the mouth of the Torch River, a tributary to the Saskatchewan River, which is believed to be one of the few remaining spawning sites. Saskatchewan has both a sport and commercial fishery but eggs are not legally harvested. The sport season is open in May, during which time 450 fisherman harvest 250 fish, weighing 1,500 kg. The commercial season is open in June. There are 6 to 10 commercial fisherman who harvest 400 fish, weighing 4,000 kg. Poaching is a concern.

South Dakota

All harvest of lake sturgeon is prohibited in South Dakota. Lake sturgeon are not stocked. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is not a concern. Bailey and Allum (1962) listed lake sturgeon as "hypothetical in South Dakota."

Wisconsin

Historically, lake sturgeon declined as a result of habitat modifications, and the creation of barriers to migration. Habitat protection and enhancement, strict enforcement, high fines for illegal harvest, and extensive public involvement has helped stabilize and increase populations. Wisconsin has a sport only fishery. Douglas and Bayfield counties have closed the season due to a recent decline in lake sturgeon abundance. The Winnebago-Wolf-Fox system in East-central Wisconsin has a winter spear fishery that is open for 9 to 20 days. During that time, 5,000 to 7,000 fisherman harvest an average of 1,140 fish, weighing 24,000 kg. One fish is allowed per season with a minimum size limit of 1.14 m. The size limit may be changed because of present concern for the over-harvest of mature females. There is also a hook and line season which is open for 1.5 months, and native Americans harvest some fish. Lake sturgeon have been reintroduced into the Menominee, Flambeau, and Wisconsin Rivers. Larvae, fingerlings, and juveniles have been sampled in the Wolf River (Table 10). Larvae and juveniles have been sampled in the Sturgeon River and juveniles have been sampled in the Bad River. Eggs have also been sampled in the Chippewa River. Fingerlings have been

successfully captured by electrofishing in late summer over pea-sized gravel bars less than one m deep. Juveniles have been found in late summer in pools. The Bad River has suitable spawning substrate and a mean annual discharge of 8 m^3/sec. The Sturgeon River also has suitable spawning substrate. Poaching is a concern but has been controlled with high fines.

Current Status of Shovelnose Sturgeon

Twenty-seven respondents from 19 states provided information regarding the status of shovelnose sturgeon (Table 11). Status was reported as follows: 29.6% of the respondents listed shovelnose sturgeon as stable; 18.5% suggested they were declining; no respondent described them as increasing; 48.1% felt insufficient data existed to determine present status. Shovelnose sturgeon were classified as extirpated in 3% of the responses (Pennsylvania). Populations were decreasing in portions of Oklahoma, Iowa, Alabama, North Dakota, and Missouri, while stable populations were found in North Dakota, Montana, South Dakota, Kentucky, Kansas, Indiana, Iowa, Minnesota, and Nebraska.

Table 11. The relative status of shovelnose sturgeon from Survey Number 1.

State	Supervisors	Field biologists
Alabama	-	Decreasing
Arkansas	Stable to decreasing	-
Illinois	Unknown	-
Indiana	-	Stable to unknown
Iowa	Decreasing to unknown	Stable
Kansas	Unknown/ Unknown	-
Kentucky	Stable	-
Louisiana	Unknown	Unknown
Minnesota	Stable	-
Mississippi	Unknown	Unknown
Missouri	-	Unknown/ Unknown/ Unknown
Montana	Unknown/ Unknown/ Stable	-
Nebraska	Stable	-
North Dakota	Stable to decreasing	Stable
Ohio	-	Unknown
Oklahoma	Decreasing	-
Pennsylvania	Extirpated	-
South Dakota	Stable	-
Texas	Unknown	-
Wisconsin	Stable to unknown	-

Changes in the historical versus current range were less numerous for the shovelnose sturgeon than the other species described previously (Table 12). Shovelnose sturgeon have apparently been extirpated from Pennsylvania, New Mexico, and possibly Illinois. They have

Table 12. Historical range of shovelnose sturgeon based on Lee et al. (1980) and comments received from respondents; present range based on comments from respondents, and the changes which have occurred.

State	Historical range	Present range	Change
Alabama	Present (Lee et al. 1980)	Response inconclusive	Undocumented in this survey
Arkansas	01, 18, 78, 86, 87, 05, 97	same distribution but more limited	No change
Illinois	14		- 14
Indiana	52, 60, 34,152,153	52, 60, 34,152,153	No change
Iowa	22, 39, 37, 01, 13	22, 39, 37, 01, 13	No change
Kansas	22, 45, 46, 47, 78	22, 45, 46, 47, 78	No change
Kentucky	01, 52	01, 52	No change
Louisiana	01, 87, 88, 89, 90, 130	01, 87, 88, 89, 91, 130	No change
Minnesota	01, 02, 03	01, 02, 03	No change
Mississippi	Present (Lee et al. 1980)	Response inconclusive	Undocumented in this survey
Missouri	01, 22, 50	01, 22, 50, 13	+ 13
Montana	22, 24, 26, 29, 30	same distribution but more limited	No change
Nebraska	22	22	No change
New Mexico	Lee et al. (1980)	Extirpated	Extirpated
North Carolina	Lee et al. (1980)	No response	Undocumented in this survey
North Dakota	22, 26	22, 26	No change
Ohio	52	52	No change
Oklahoma	78, 87	78, 87	No change
Pennsylvania	52, 53		- 52, 53
South Dakota	22, 34, 36	22, 34, 36	No change
Tennessee	Lee et al. (1980)	No response	Undocumented in this survey
Texas	161, 87	Unknown	Undocumented in this survey
West Virginia	Lee et al. (1980)	Response inconclusive	Undocumented in this survey
Wisconsin	01, 03, 04, 07	01, 03, 04, 07	No change
Wyoming	Lee et al. (1980)	Not surveyed	Undocumented in this survey

been eliminated from the Illinois, Ohio, and Allegheny rivers. Missouri reported shovelnose sturgeon have been found in the Des Moines River.

Respondents provided new information regarding the causes probably associated with current status, and provided comments regarding, harvest, reproduction and survival. These data were summarized on a state-by-state basis:

Arkansas

White River populations are considered stable due to a somewhat natural hydrograph with seasonal floods, good gravel bars, and backwater complexes. Management and regulations have changed over time which has benefitted sturgeon; however, details were not provided. Shovelnose sturgeon eggs are harvested for the production of caviar and are valued at $45 per pound. The quantity harvested annually is unknown. Juvenile shovelnose sturgeon have been collected from the White River (Table 13). Poaching was not a concern.

Table 13. Rivers and lakes where eggs, larvae, and juvenile shovelnose sturgeon been collected in the last three years.

State	Eggs	Larvae	Juveniles
Arkansas	-	-	86
Indiana	-	-	60,153
Iowa	-	01	01
Kentucky	01, 52	01, 52	01, 52
Louisiana	-	-	01, 87
Mississippi	-	-	01
Missouri	-	01*	22, 01
Montana	22, 26	22, 26	22, 26
Nebraska	-	-	22
North Dakota	26	22, 26	22, 26

*Specimens were possibly pallid sturgeon

Illinois

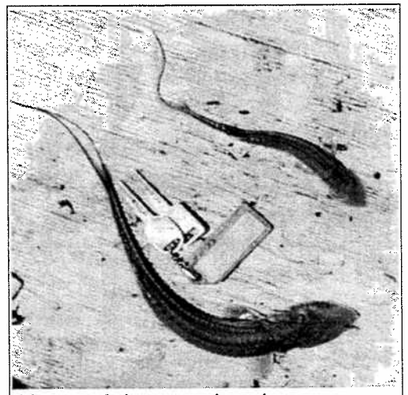
The loss of shovelnose sturgeon was ascribed to habitat degradation, sedimentation, navigation dams, and past over-harvest. Shovelnose sturgeon are not stocked. Eggs, larvae, and juveniles have not been sampled in the last three years. There is no sport or commercial harvest for shovelnose sturgeon or their eggs in Illinois. Poaching is not a concern.

Indiana

Indiana uses regulations and habitat protection, based on research surveys, to maintain a stable population of shovelnose sturgeon. This sturgeon has not been stocked. There is both a sport and commercial fishery, open year round, and eggs are legally taken for the production of caviar. Juvenile shovelnose sturgeon have been collected from the Wabash River (Table 13). Poaching was not considered a concern.

Iowa

Populations have decreased due to the construction of dams, loss of spawning habitat, siltation, and commercial over-harvest. Iowa is working with the U.S. Army Corps of Engineers to reverse some of the problems caused by the construction of dams in the Mississippi River basin. Shovelnose sturgeon have not been stocked. Iowa allows both sport and commercial harvest for shovelnose sturgeon. Sport harvest numbers were not reported. On average, 237 commercial fisherman harvest more than 8,000 kg, annually, but eggs are not legally harvested for the production of caviar. Larval and juvenile shovelnose sturgeon have been collected in the Mississippi River (Table 13). Poaching is not a concern.



Young of the year shovelnose sturgeon collected in a Mississippi River (Pool 14) main channel trawl.

Kansas

Respondents from Kansas attributed the decline of shovelnose sturgeon to habitat degradation and the construction of dams. Shovelnose sturgeon are not stocked in Kansas. There is a sport season for shovelnose sturgeon which is open year round. Their is no commercial fishery for meat or eggs of shovelnose sturgeon in Kansas. Eggs, larvae, and juvenile shovelnose sturgeon have not been sampled in the last three years. Poaching is not a concern.

Kentucky

Shovelnose sturgeon populations are still doing well in the lower Ohio River. Habitat and water quality are adequate, however, there is some commercial over-exploitation. Shovelnose sturgeon are not stocked. Commercial fisherman are required to purchase a license and report an estimate of the number of fish harvested by species on an annual basis. Only gillnets with a 10 cm mesh or larger are considered legal gear on the Ohio and Mississippi rivers. However, gillnets are not allowed on other streams in Kentucky but shovelnose sturgeon can be harvested commercially from these streams with trot lines and hoopnets. Eggs are legally harvested for the production of caviar but the quantity of eggs harvested was not reported. Eggs, larvae, and juveniles have been captured from the Mississippi and Ohio rivers (Table 13). Specimens from the Mississippi River were sampled in or near sandbars, islands, and side channels. Poaching is not a concern.

Louisiana

Shovelnose sturgeon are not stocked. All harvest for shovelnose sturgeon and their eggs has been prohibited since 1990. Poaching is a concern.

Minnesota

Populations are stable due to minimal pollution and the lack of barriers in existing waterways. Minnesota does not stock shovelnose sturgeon. There is a sport only fishery

which is open all year, and the fishery is managed with a ten-fish bag limit. All forms of commercial harvest and sale is prohibited. Eggs, larvae, and juveniles have not been sampled in the last three years. There is no evidence of poaching.

Mississippi

Habitat degradation was listed as the cause for reduced shovelnose sturgeon numbers. Shovelnose sturgeon have not been stocked. All harvest is prohibited. Juvenile specimens have been sampled in the Mississippi River (Table 13). Poaching of shovelnose sturgeon is not a concern.

Missouri

There is not much supporting data but populations of shovelnose sturgeon have probably been reduced due to a lack of natural hydrographs and habitat. Shovelnose sturgeon are not stocked in Missouri. Missouri has both a sport and commercial season, open all year. Sport harvest data is limited and was not reported. Less than 200 commercial fisherman annually harvest 3,700 kg of shovelnose sturgeon. All rivers in Missouri are open to shovelnose sturgeon commercial harvest. Eggs are taken for the production of caviar with the current market value ranging from $25 to $60 per pound. The actual quantity harvested was not reported. Juvenile specimens have been captured in the Mississippi and Missouri rivers (Table 13). Larval shovelnose sturgeon or possibly pallid sturgeon were collected from the Mississippi River.

Montana

Relative abundance, and the size distribution has suggested shovelnose sturgeon populations have been stable, which is probably due to a low exploitation rate, and a relatively natural habitat and hydrograph. Distribution in the Yellowstone River, which is otherwise unrestricted, is limited by a low head diversion dam at Forsyth. The species is not stocked. There is a sport only season with a five fish daily bag limit. Actual harvest data was not reported, but respondents believed it was approximately 1,000 fish. Eggs are not legally harvested. Eggs, larvae, and juveniles have been sampled in the Missouri and Yellowstone rivers (Table 13). Poaching is not a concern.

Nebraska

Individual fish exhibit slow growth rates and small size at maturity. This may be a result of lost habitat and changes in nutrient availability because of dams, channelization and artificial water management. Nebraska is working with the U.S. Army Corps of Engineers to restore off-channel habitats to the channelized section of the Missouri River. Shovelnose sturgeon are not stocked by Nebraska. There is a sport only fishery, open all year, and egg harvest is prohibited. Poaching is not a concern.

North Dakota

Dam construction has destroyed habitat, blocked migration, and altered the hydrograph, temperatures, and turbidity, all of which impact shovelnose sturgeon. Most shovelnose sturgeon production is assumed to be in the Yellowstone River. Shovelnose sturgeon are not

stocked. State regulations prohibit sport and commercial fishing for any sturgeon species or their eggs. Eggs, larvae, and juveniles have been sampled in the Missouri and Yellowstone rivers (Table 13). Poaching is not a concern.

Ohio

The shovelnose sturgeon is not stocked in Ohio. All forms of harvest is prohibited. Eggs, larvae, and juveniles have not been sampled in the last three years. Poaching is not a concern.

Oklahoma

Dams have caused a loss of habitat. The shovelnose sturgeon is not stocked. There is a sport fishing season only, and eggs are not legally harvested for the production of caviar. Eggs, larvae, and juveniles have not been sampled in the past three years. Poaching is not considered a threat.

South Dakota

Shovelnose sturgeon numbers initially decreased above Gavins Point Dam due to a reduction in riverine habitat. However, they now appear to have stabilized their numbers in the reach from Big Bend Dam to the South Dakota-Iowa border (Big Sioux River). Shovelnose sturgeon are not stocked. No sport or commercial fishing seasons or egg harvest for caviar occurs in South Dakota. Poaching is not a concern.

Wisconsin

Shovelnose sturgeon are not stocked in Wisconsin. Wisconsin has both a sport and commercial fishery, open all year. Sport harvest numbers were not reported. There were an average 391 commercial licenses issued annually in Wisconsin, and approximately 850 kg of fish are harvested. Eggs are not taken for the production of caviar. Eggs, larvae, and juveniles have not been sampled in the last three years.

Survey Number 2

Administrators Survey - Paddlefish

Individuals from 17 states responded to the paddlefish portion of the survey (Table 14). Iowa felt paddlefish were continuing to decline in abundance. Kentucky, Montana, Alabama, Arkansas, Missouri, Mississippi, Nebraska, Wisconsin, and Indiana felt paddlefish numbers were stable. Ohio, South Dakota, Kansas, Texas, and Oklahoma felt their numbers were increasing. Ninety-four percent of the respondents believed that populations of paddlefish could be enhanced in their states.

Administrators Survey - Pallid Sturgeon

Individuals from 10 states supplied information for the pallid sturgeon portion of the survey (Table 14). Arkansas listed pallid sturgeon as extirpated, while Kentucky, Montana, Iowa, Mississippi, Nebraska, and North Dakota considered pallid sturgeon to be decreasing in

Table 14. The relative status of paddlefish, pallid sturgeon, lake sturgeon, and shovelnose sturgeon from Survey Number 2.

State	Paddlefish	Pallid sturgeon	Lake sturgeon	Shovelnose sturgeon
Alabama	Stable		Extirpated	Decreasing
Alberta			Stable to increasing	
Arkansas	Stable	Extirpated	Extirpated	Stable
Georgia			Extirpated	Unknown
Illinois	No Response	No Response	No Response	No Response
Indiana	Stable		Decreasing	Stable
Iowa	Decreasing	Decreasing	Stable	Stable
Kansas	Increasing	Unknown	Unknown	Decreasing
Kentucky	Stable	Decreasing	Extirpated	Stable
Louisiana	No Response	No Response	No Response	No Response
Manitoba			Decreasing	
Michigan			Increasing	
Minnesota	No Response	No Response	No Response	No Response
Mississippi	Stable	Decreasing		Decreasing
Missouri	Stable	Unknown	Unknown	Stable
Montana	Stable	Decreasing		Stable
Nebraska	Stable	Decreasing	Decreasing	Stable
New Mexico				Extirpated
New York	No Response		No Response	
North Carolina	Unknown		Extirpated	Extirpated
North Dakota	Stable to decreasing	Decreasing		Stable
Ohio	Increasing		Stable	Decreasing
Oklahoma	Increasing			Unknown
Pennsylvania	No Response		No Response	
Saskatchewan			Decreasing	
South Dakota	Increasing	Unknown	Unknown	Stable
Texas	Increasing			Decreasing
Vermont			Decreasing	
Wisconsin	Stable		Stable to increasing	Stable

abundance. No respondent felt the species was increasing in numbers. Sixty-three percent of the states believed that populations could be enhanced (i.e., Kentucky, Montana, South Dakota, Missouri, Nebraska, and North Dakota). Eighteen percent did not believe it was possible to enhance populations (i.e., Arkansas and Mississippi); and 18% were not sure if it was possible to improve pallid sturgeon abundance (Iowa and Kansas).

When asked if they expected pallid sturgeon would be removed from the endangered species list in the next 10 to 20 years; 73 percent responded negatively (i.e., Kentucky, Montana, South Dakota, Iowa, Mississippi, Kansas, and North Dakota). Missouri and Nebraska thought it was possible to achieve that goal. Factors that may contribute to the delisting of pallid sturgeon were stocking and restoration of more natural habitats and hydrograph; the latter was considered most important.

Administrators Survey - Lake Sturgeon

Individuals from 18 states or provinces responded to the lake sturgeon portion of the survey. Lake sturgeon was considered extirpated in Alabama, Arkansas, Georgia, Kentucky, and North Carolina. Decreasing populations could be found in Vermont, Saskatchewan, Manitoba, Nebraska, and Indiana. Michigan considered lake sturgeon to be increasing in abundance, while stable described populations in Alberta, Iowa, Ohio, and Wisconsin. Sixty-seven percent of the respondents believed that populations could be enhanced, 17% did not believe it was possible any longer, and 17% were unsure.

Administrators Survey - Shovelnose Sturgeon

Individuals from eighteen states supplied information for the shovelnose sturgeon portion of the survey. North Carolina and New Mexico consider the species to be extirpated. Alabama, Ohio, Mississippi, Kansas, and Texas considered the species to be declining. Kentucky, Montana, Arkansas, Iowa, South Dakota, Missouri, Nebraska, Wisconsin, Indiana, and North Dakota felt the shovelnose sturgeon was stable. Sixty-eight percent of the responses suggested that shovelnose sturgeon populations could be enhanced in their respective states, including: Ohio, Kentucky, Montana, Alabama, Arkansas, Iowa, New Mexico, Missouri, Nebraska, Wisconsin, Kansas, Texas, and Indiana. Administrators from Georgia, South Dakota, Mississippi, and North Dakota did not feel it would be possible to enhance populations.

State administrators were asked to rate the importance of the target species on a scale of 1 to 10 (10 being the highest value) before and after additional enhancement work that might improve the populations in their state (Table 15). Values increased in seven of the 18 states that provided information on paddlefish. The most dramatic increase (2 before, 8 after) was in Mississippi. Wisconsin places a high value on the paddlefish fishery ranking it 10 today. North Dakota ranked the real value of the paddlefish fishery at 8, both before and after enhancements. Improvement was noted as well in Alabama (5 to 6), Arkansas (3 to 4), Iowa (1 to 2), Missouri (2 to 3), Nebraska (2 to 4), and Indiana (2 to 3).

Eight out of 14 administrators felt that the real value of lake sturgeon would increase after further enhancements (i.e., Kentucky, Georgia, Iowa, Missouri, Nebraska, Indiana, Saskatchewan and Michigan). Wisconsin lake sturgeon had a high rank (10) even before enhancement.

Seven out of 18 administrators felt that the real value of shovelnose sturgeon would increase with further enhancements in the population, including: Arkansas (3 to 4), Iowa (1 to 2), Mississippi (1 to 2), Nebraska (2 to 4), and North Dakota (2 to 3).. The most dramatic increase in value (5 to 10) occurred in Wisconsin. Alabama places a high value (6) on shovelnose sturgeon, which would increase to 7 after enhancements.

Table 15. Expectations regarding the value of the target species to state fisheries before and after enhancement.

State/Province	Paddlefish		Lake sturgeon		Shovelnose sturgeon	
	Before	After	Before	After	Before	After
Alabama	5	6	-	-	6	7
Alberta	-	-	1	1	-	-
Arkansas	3	4	-	-	3	4
Georgia	-	-	-	2	-	-
Indiana	2	3	1	4	1	1
Iowa	1	2	1	2	1	2
Kansas	3	3	1	1	2	2
Kentucky	2	2	-	2	2	2
Manitoba	-	-	5	5	-	-
Michigan	-	-	1	3	-	-
Mississippi	2	8	-	-	1	2
Missouri	2	3	0	3	1	1
Montana	5	5	-	-	2	2
Nebraska	2	4	1	2	2	4
New Mexico	-	-	-	-	1	1
North Carolina	1	1	1	1	1	1
North Dakota	8	8	-	-	2	3
Ohio	1	1	-	-	1	1
Oklahoma	5	5	-	-	-	-
Saskatchewan	-	-	4	5	-	-
South Dakota	3	3	-	-	2	2
Texas	1	1	-	-	1	1
Vermont	-	-	1	1	-	-
Wisconsin	10	10	10	10	5	10

There was considerable variability in the responses regarding important actions that would enhance populations; however, habitat restoration, and protection were the most prevalent responses (30%). Four of 23 responses (17%) indicated that maintaining a natural hydrograph and ensuring minimal flows was vital. Thirteen percent felt that a cooperative restoration program would enhance populations in their respective states. Eight percent felt that stocking was required, while 8% felt that building fish passages would be essential. Other important actions included the removal of dams and irrigation diversions, making commercial data reporting mandatory and verifiable, reducing controllable mortality, and stopping illegal harvest.

Administrators were asked to comment regarding their view of the future by indicating if they foresaw the listing of the three species, presently not on the federal list. Three of 16 respondents felt it might happen within the next 15-20 years for paddlefish; the remainder felt paddlefish would never need listing. Three of 12 respondents thought that lake sturgeon

may need to be listed in the next 10-20 year period, otherwise the remaining respondents felt they would not need to be listed. Five of 16 respondents believed that shovelnose sturgeon would be eventually listed during the next 5-20 year period. The other respondents felt they would not need to be listed.

Over-exploitation has been highlighted numerous times throughout this survey as an important aspect in the health and well-being of the target species. Administrators were asked to supply information for their state or province regarding the percentage of the fishery that would be categorized as either recreational or commercial based on the expectations of the fishermen in their states (Table 16).

Table 16. Recreational vs. commercial interest expressed as a percent in each state based on the views of administrators.

State	Paddlefish		Lake sturgeon		Shovelnose sturgeon	
	Recreational	Commercial	Recreational	Commercial	Recreational	Commercial
Alabama	50	50	-	-	-	-
Alberta	-	-	100	0	-	-
Arkansas	30	70	-	-	-	-
Georgia	-	-	100	0	-	-
Indiana	25	75	50	50	50	50
Iowa	100	0	100	0	10	90
Kansas	100	0	100	0	100	0
Kentucky	10	90	-	-	0	100
Manitoba	-	-	10	90	-	-
Michigan	-	-	100	0	-	-
Mississippi	10	90	-	-	0	20
Missouri	99	1	99	1	99	1
Montana	100	0	-	-	100	0
Nebraska	100	0	-	-	100	0
North Dakota	100	0	-	-	-	-
Ohio	-	-	-	-	-	-
Oklahoma	100	0	-	-	-	-
Saskatchewan	-	-	50	50	-	-
South Dakota	100	0	-	-	100	0
Texas	90	90	-	-	10	10
Wisconsin	10	10	100	0	0	10

Seven out of 15 respondents for paddlefish indicated that interest in the fishery was entirely recreational. The states included: Montana, Iowa, South Dakota, Nebraska, Kansas, Oklahoma, and North Dakota. In Missouri, over 99% of the interest was recreational. The commercial fishery became increasingly important in Alabama (50%), Arkansas (70%), Indiana (75%), Mississippi (90%), and Kentucky (90%). Texas felt that there was an equally

high interest in paddlefish by both sport and commercial fishermen, while Wisconsin felt there was an equally low interest.

Six out of 10 state or provincial administrators indicated that interest in the lake sturgeon population was entirely recreational. They included: Iowa, Wisconsin, Kansas, Alberta, Michigan, and Georgia. The interest in lake sturgeon in Missouri was estimated to be predominately recreational (i.e., 99%). The interest was more equally distributed among the two types of fisheries in Indiana and Saskatchewan.

Four out of 10 states indicated that interest in the shovelnose sturgeon fishery was 100% recreational (i.e., Montana, South Dakota, Nebraska, and Kansas). Missouri's fishermen with interest in shovelnose sturgeon were mostly recreational users. Recreational and commercial interests were equally represented in Indiana. In Texas, only 10% of the recreational and 10% of the commercial fisherman have an interest in a shovelnose sturgeon fishery.

Administrators believed that recreational angling made up a large percentage of interest in these species in most of the states and provinces; nine of 19 respondents listed >80% of the users were after the angling experience (Table 17). The recreational angling interest was greater than or equal to 75% in 11 out of 18 states or provinces. Arkansas, Indiana, and

Table 17. The estimated percent of fishermen engaged in the use of paddlefish and sturgeon for angling, meat, or caviar.

State	Angling value	Meat value	Egg value
Alabama	100	0	0
Alberta	100	0	0
Arkansas	5	30	65
Indiana	5	5	90
Iowa	80	20	0
Kansas	100	0	0
Kentucky	0	10	90
Manitoba	-	99	-
Michigan	100	0	0
Mississippi	5	15	80
Missouri	60	40	0
Montana	80	15	5
Nebraska	75	25	0
North Dakota	95	5	0
Oklahoma	75	25	0
Saskatchewan	50	50	0
South Dakota	100	0	0
Texas	0	0	0
Wisconsin	100	0	0

Mississippi administrators believed angling ranked low in the minds of users. In each of these states caviar production was believed to attract the community of users. Manitoba fishermen appeared to be predominantly commercial (99%), while Saskatchewan (50%), and Missouri (40%) fishermen also placed a high value on the flesh of these fishes.

Administrators were asked to provide their views regarding the role non-anglers and law enforcement played in the management of these species. Twenty-two respondents filled out this portion of the survey. Twelve state fisheries administrators placed a very high value on law enforcement. Five felt the role was moderately important. The remaining respondents felt enforcement was secondary to habitat management, and education. Missing from our survey was a question detailing the time conservation officers spend on paddlefish and sturgeon activities. Such a question might have highlighted the difference between perceived value and the actual expenditure for such enforcement work. Clearly, fisheries administrators saw an important role for non-anglers. The non-fishing public was seen as a source of funding for research; conservation; advocating appropriate flow regimes, habitat, pollution abatement, and additional law enforcement; political emphasis; and river restoration activities.

Survey Number 3

Hatchery Survey

Eight of 17 hatcheries responded to the survey. All eight hatcheries produced paddlefish, five produced pallid sturgeon, two produced lake sturgeon, and three produced shovelnose sturgeon. Pallid sturgeon are produced at Neosho National Fish Hatchery (NFH), Gavins Point NFH, Natchitoches NFH, Blind Pony SFH, and Garrison Dam NFH. Lake sturgeon are produced at Neosho NFH and Blind Pony SFH. Shovelnose sturgeon are produced at Gavins Point NFH, Natchitoches NFH, and Garrison Dam NFH (Table 18.)

Paddlefish

A. E. Wood SFH obtains paddlefish from Gavins Point NFH and Blind Pony SFH. Paddlefish (1,027,328) were stocked in Texas rivers between 1989-1996 including: the Trinity River, Neches/Angelina River, Sabine River, Big Cypress Bayou and Sulphur River. The Trinity River system in Texas was stocked with up to 15,000 paddlefish each year. Blind Pony SFH obtains paddlefish broodstock from Table Rock Reservoir in Missouri. Truman Reservoir and Lake of the Ozarks are each stocked with 10,000 fish per year while Table Rock Reservoir receives 5,000 fingerlings. Carbon Hill SFH receives paddlefish from the TVA-Cross Creek National Wildlife Refuge (NWR). Cherokee Reservoir in Tennessee is stocked with 8,000 fingerlings, annually. Garrison Dam NFH obtains broodstock from the Missouri and Yellowstone rivers. Forty-three thousand fingerlings were stocked into Lake Sakakawea in 1995. Gavins Point NFH obtains brood stock from Lewis and Clark Lake and Lake Francis Case. The Missouri River and Lake Francis Case receive 25,000 fish per year. Natchitoches NFH receives gametes from paddlefish collected in the Mermentau and Osage rivers. Neosho NFH paddlefish gametes are obtained from Grand Lake of the Cherokees in Fairland, Oklahoma. Approximately 3,050 are stocked into Truman Reservoir. Palestine SFH receives gametes from Gavins Point NFH (1992-1996) and the Aquaculture Research Center in Frankfort, Kentucky (1996). The Kanawha River received 462 fish while the Ohio River received over 6,000 of the fish. Uvalde NFH receives eggs and fry from the A. E.

Table 18. Number of paddlefish, pallid sturgeon, lake sturgeon, and shovelnose sturgeon hatched at hatcheries in the United States involved with the production of these species.

Hatchery	Paddlefish	Pallid sturgeon	Lake sturgeon	Shovelnose sturgeon
A. E. Wood SFH	>2,000,000			
Blind Pony SFH	1,000,000	50,000	50,000	
Carbon Hill SFH	Numbers not provided			
Garrison Dam NFH	50,000	Numbers not provided		15,000
Gavins Point NFH	5,000,000	<500		100,000
Natchitoches NFH	500,000-800,000			Numbers not provided
Neosho NFH	Numbers not provided		Numbers not provided	
Palestine SFH	Numbers not provided			
Uvalde NFH	10,000			

Wood SFH, Natchitoches NFH, and Tishomingo NFH. Paddlefish were stocked in the Angelina (247,717), the Neches (160,941), Sabine (295,142), Sulphur rivers (34,780), and Big Cypress Bayou (49,197) in Texas, and the Kaw Reservoir in Oklahoma received 5,000 fingerlings. Pennsylvania has stocked paddlefish into Pools 1 through 4 of the Ohio River, and Pools 1 through 5 of the Allegheny River

Pallid Sturgeon

Pallid sturgeon broodstock, used at Blind Pony SFH, were obtained from the Mississippi River. Seven thousand two hundred pallid sturgeon were stocked into the lower Mississippi and Missouri rivers in 1994. Garrison Dam NFH broodstock were from the Missouri and Yellowstone rivers. Broodstock held at Gavins Point NFH were obtained from the Missouri River in the reach from Lewis and Clark Lake to the Yellowstone River. Pallid sturgeon from Garrison and Gavins Point have not been stocked into any river. Neosho NFH received pallid sturgeon fry from Blind Pony SFH in 1992-1993. The pallid sturgeon were reared for research, and none have been stocked.

Lake Sturgeon

Blind Pony SFH obtains lake sturgeon gametes from stock in Wisconsin. The Mississippi and Missouri rivers were stocked with 100,000 fish since 1986. Neosho NFH receives fry from the Wolf River strain in Wisconsin. Legend Lake in Shawano, Wisconsin received 3,385 of these fish in 1995. Wisconsin and Minnesota have been stocking lake sturgeon since 1983; fish have been reared at the Wisconsin hatchery at Mahtomedi. Wisconsin has used these fish in the Menominee, Flambeau, and Wisconsin rivers. Michigan and Manitoba have

stocked lake sturgeon in the past, and the gametes were obtained from local populations. New York has stocked lake sturgeon into the Oswegatchie River and Black Lake. Gametes were from local populations. Lastly, Ohio has considered initiating a stocking program.

Shovelnose Sturgeon

Garrison Dam NFH broodstock were from the Missouri and Yellowstone rivers. Fry have been stocked in the Powder River in Wyoming. Gavins Point NFH brood stock was from the Missouri River reach between Lewis and Clark Lake and the Yellowstone River. Approximately 400 have been stocked into the Bighorn River in Wyoming. Natchitoches NFH brood stock is from the Old River Control Structure in Louisiana. None have been stocked to date.

Survey Number 4

Federal Aid Coordinator Survey

Federal Aid Coordinators in 30 states received Survey Number 4; 16 states responded (Table 19). Seven states indicated that no federal aid supported research or management was underway in their state. Eight states listed at least one project underway that resulted in data on paddlefish or sturgeon species. South Dakota and New York indicated that data was obtained with available state funds. A Mississippi River basin paddlefish tagging project was funded several years ago by MICRA; 22 states continue to cooperate with this project; however, data was not provided regarding the present status of MICRA's study.

Discussion

Two hundred eighty-one (281) rivers, creeks, lakes, oxbows, and bayous have been listed in Table 20 that were located in the geographic area currently or previously frequented by the target species. This list does not represent all of the streams and lakes in this area but rather those highlighted by MICRA, the respondents, and the published literature. Only four have been reported not to harbor at least one of the target species. Twenty-seven others may or may not have or had representatives of the target species; reports were not located that would document presence (historical or current) or absence. One hundred forty-two (142) streams and lakes were reported to have had paddlefish present but 18 (12.7%) do not presently have paddlefish. Twenty-one streams once were colonized by pallid sturgeon; 10 (47.6%) no longer are. Lake sturgeon were once found in 116 lakes and streams but not in 34 (29.3%) today. Finally, shovelnose sturgeon were present in 59 listed waters, but only 44 (25.4%) today.

A definitive status determination depended on a thorough review of all collection records, past and present. Changing status can only be supported by documented differences in indices of catch-per-unit-effort. Such records, if they exist, would be available in the files of state resource management agencies, natural history museums, colleges, universities, private institutions, among others. We depended on the workers, responsible for surveying these species, to summarize the information from their study areas before responding to the survey. Unfortunately just 31% of the primary status surveys were returned. Therefore, this report must be considered a starting point from which to work toward a definitive status review.

Table 19. List of current federal aid projects in states working with paddlefish, pallid sturgeon, lake sturgeon, and shovelnose sturgeon.

State	Project number	Project title	Project completion date	Principle investigator
Alabama	None			
Arkansas	?	Pallid sturgeon investigations on the Red River	1998	W. Layher and S. Filipek
Georgia	None			
Iowa	None			
Louisiana	F-6010	Assessments of paddlefish populations in Louisiana	Ongoing	B. Reed
Louisiana	F-1107	Status of pallid sturgeon in the Red River	30 June 1997	B. Reed
Michigan	F-35-R-661	Evaluation of lake sturgeon populations in Northern Michigan.	31 March 2001	E. Baker
Mississippi	None			
Missouri	14-48-006-94-930	Pallid sturgeon recovery plan at Blind Pony	?	J. Hamilton
Montana	SE-7, Section 6	Montana endangered fishes program: pallid sturgeon.	30 June 1999	W. Gardner
Montana	F-78-R	Missouri River pallid sturgeon; Fort Peck paddlefish creel; Yellowstone River paddlefish.	30 June 1999	W. Gardner, W. Wiedenheft, and P.Stewart
Nebraska	F-75-R	Missouri River Studies.	20 February 1997	G. Mestl
New Mexico	None			
New York	State funds	Not provided.		
North Carolina	None			
North Dakota	F-2-R-1	Aquatic investigations of the Missouri River system in North Dakota	?	J. Hendrickson
North Dakota	F-2-R-43-1	Life history and ecology of paddlefish in Lake Sakakawea	July 1996	C. Parkens
Ohio	F-69-R	Evaluation of paddlefish populations in the Scioto River Drainage	30 June 1997	M. Costello
Oklahoma	F-41-R	Distribution, abundance, and reproductive activity of paddlefish in the Arkansas River-Keystone Reservoir.	30 June 1998	W. Fisher
South Dakota	2102	Survey of Public Waters	31 December 2000	J. Riis and C. Stone
Texas	F-31-R-22	Assessment of paddlefish stockings in the Neches, Trinity, Angelina, and Sabine River Systems.	31 December 2002	V. M. Pitman

Table 20. Listing of rivers and lakes, including code numbers, in the geographical range of the target species as provided by the respondents (i.e., no reference noted) or from published and grey literature (i.e., references noted). Current range is denoted as follows: paddlefish (P), pallid sturgeon (PS), lake sturgeon (L), and shovelnose sturgeon (S); historical range is denoted as follows: paddlefish (HP), pallid sturgeon (HPS), lake sturgeon (HL), shovelnose sturgeon (HS).

River	Code number	Target species present
Alabama River	92	P
Allegheny River	53	P,HL,HS
Amite River	21	P
Amnicon River	213	HL
Angelina River	160	P
Apalachicola River	281	P
Arkansas River	78	P,S
Atchafalaya River	130	P,PS,S
Au Sable River	280	L or HL[24]
Bad River (WI)	117	L
Bad River (SD)	279	HP[14],HPS[14],HS[14]
Baraboo River	278	HL[25]
Barkley Lake	147	P
Bayou LaFourche	90	P,S
Beaver Lake	282	P
Bell Fourche River	33	None reported[14]
Big Black River	20	P[11]
Big Cypress Bayou	162	P
Big Fork River Rainy	193	L
Big Horn River	28	No report available
Big Muddy River	17	P[7],HS[7]
Big Nemaha river	44	HS
Big Sandy River	57	No report available
Big Sioux River	37	S,HP[15]
Big Sunflower River	277	PS[26]
Black Lake	175	L
Black River (AR, LA)	05	P,S
Big Blue River	47	P,S
Boeuf River	89	P,S
Bois d' Arc Creek	164	HP
Brickyard Lake (oxbow)	93	P
Burt Lake	176	L
Cache River	95	P
Cahaba River	126	P,S
Calcasieu River	100	P
Canadian River	156	P,HS

Caney River	83	No report available
Cayuga Lake	276	HL[23]
Cedar River	11	P
Chariton River	49	P
Chautauqua Lake	275	HP
Cheboygan River	274	L[24]
Cheyenne River	32	HP[14],HPS[14],HS[14]
Chikaskia River	80	No report available
Chippewa River	118	P,L,S
Churchill River	201	L
Cimarron River	81	P
Clam River	273	L[2]
Clarks Fork	27	No report available
Clear Creek (Powder)	272	P,S[12]
Clinch River	72	P[1]
Coosa River	127	P,HL
Crazy Woman Creek (Powder)	271	P,S[12]
Cross River	172	L
Cumberland Lake (KY)	149	P
Cumberland House Lake	183	L
Cumberland River	145	P
Current River	228	P
Cypress Bayou	131	P
Des Arc Bayou	123	P
Des Moines River	13	P,S
Detroit River	270	HL[30]
Eau Clair Lake Chain	206	HL
Eau Clair River	207	HL
Elk River	75	No report available
Elkhorn River	229	HL,HS
Embarrass River	61	HP[1]
English River	192	L
Flambeau River	269	HL[18]
Flint River (GA)	268	P
Fort Peck Reservoir	165	PS
Fox River	208	L
French Broad River	67	No report available
Galien	267	HL[28]
Genesse River	266	HL[23]
Grand Lake	140	P
Grand River (MI)	265	L or HL[24]

Grand River (SD)	264	HP[14],HPS[14],HS[14]
Grasse River	119	L
Green River	146	P
Groundhog River	263	L
Harry S. Truman Reservoir	223	P
Hiwassee River	73	No report available
Holston River (North Fork)	64	No report available
Holston River (South Fork)	65	No report available
Huron Bay	187	L
Illinois River	14	P,HPS[19]
Indian River	262	HL[23]
Iowa River	10	No report available
Iron River	214	HL
James River	36	P,S
John Redmond Reservoir (Neosho R.)	222	P
Kalamazoo River	261	HL[28]
Kanawha River	55	P[1]
Kankakee River	15	None listed[5]
Kansas River	45	P,S,HPS,HL
Kaskaskia River	16	P,S[8]
Kaw River	260	HS[21]
Kentucky Lake	148	P
Kentucky River	144	P
Kettle River	169	L
Keweenaw Bay	186	L
Lake Butte des Mort	210	L
Lake Champlain	259	L[23]
Lake Chicot	125	P
Lake Erie	105	L,HP
Lake Francis Case	258	P
Lake Huron	104	L,HP[1]
Lake Lewis and Clark	257	P
Lake Michigan	106	L,HP[1]
Lake of the Ozarks	224	P
Lake of the Woods	171	L
Lake Oahe	256	P
Lake Okoboji	150	HP
Lake Ontario	203	L
Lake Pontchartrain	138	P
Lake Poygan	212	L
Lake Sakakawea	255	P

Lake Seminole	254	P
Lake Sharpe	253	P;PS
Lake Superior	103	L,HP[1]
Lake Winneconne	211	L
Lamine River	101	P
Larto Lake	142	P
Levisa Fork	58	No report available
Licking River	143	P
Little Fork Rainy	109	L
Little Missouri River (AR)	120	P,HL
Little Missouri River (ND)	252	HPS[16]?,HS[16]
Little Nemaha River	43	HS
Little Powder River	251	P,S[12]
Little Red River	121	P
Little River	97	P,S
Little Sioux River	39	S,HP
Little Tennessee River	70	No report available
Little Wabash River	62	None listed[6]
Loup River	250	HS[31]
Madison River	23	No report available
Manistee River	249	L or HL[24]
Marais des Cygne	51	P
Marias River	248	S
Mattagami River	247	L
Medicine Lodge River	79	No report available
Menominee River	246	L[24]
Meramec River	227	P
Mermentau River	99	P
Metinak Lake	185	L
Milk River	24	P,S
Millecoquins River	245	L or HL[24]
Minnesota River/Big Stone Lake	02	P,L,S
Mississippi River	01	P,PS,L,S
Missouri River	22	P,PS,L,S
Mitzpah Creek	244	P,S[12]
Mobile Basin	243	P
Monongahela River	54	No report available
Moose River	111	L
Moreau River	242	HP[14],HPS[14],HS[14]
Mullett Lake	177	L
Murry's Lake (KS)	241	P[21]

Muskegon River	240	L or HL[24]
Namakan Lake	198	L
Namakan River	110	L
Namekagon River	239	L[24]
Neches River	159	P
Nelson River	180	L
Neosho River (Grand)	84	P,S
New River	56	No report available
Niagara River	114	L
Niobrara River	35	P,PS,S
Nishnabotna River	238	S[17]
Nolichucky River	68	No report available
North Platte	42	HS
Ocoee River	74	No report available
Ohio River	52	P,L,S
Ontanogan River	189	L
Osage River	50	P,S
Oswegatchie River	204	L
Oswego River	166	L
Ottawa River	237	L[27]
Ouachita	88	P,S
Owasco Lake	236	HL[23]
Pascagoula River	155	P
Pearl River	137	P
Pigeon River	69	HL
Pigeon River	179	None listed[9]
Pine River	215	HL
Platte River	40	P,PS,S,HL
Poplar River	25	P
Portage Lake	190	L
Powder River	30	P,S
Powell River	71	P[1]
Rainy River	108	L
Rainy Lake	197	L
Rapid River	194	L
Raquette River	191	L
Red Lakes (upper and lower)	235	HL
Red River of the North	173	HL
Red River of the South	87	P,PS,S
Republican River	46	S
Roc Roe Bayou	124	P

Rock River	09	L
Rock River	38	No report available
Round Lake	182	L
Russel Fork	59	No report available
Sabine River	128	P
Saline River	132	P
Salt River	226	P
San Jacinto River	157	P
Saskatchewan River	200	L
Saskatchewan River (North)	167	L
Saskatchewan River (South)	181	L
Scioto River	234	P[1]
Seine River	195	L
Seneca River	233	HL[23]
Shawnee Creek	163	HP
Shell Rock River	12	No report available
Shoal Creek	76	No report available
Silver River	188	L
Sipinesk Lake	184	L
Smoky Hill River	219	P,HS[21]
Snake River (MN)	168	L
Souris River	232	L[24]
South Platte	41	No report available
Spring River	85	P
St. Clair River	231	L or HL[24]
St. Croix Lake	205	P,L
St. Croix River	03	P,L,S
St. Francis River	18	P,S,HPS
St. Joseph River	230	L or HL[24]
St. Lawrence River	107	L
St. Louis River	170	L
St. Louis River Estuary	113	L
St. Marys River	31	HL[28]
St. Regis River	77	HL[23]
Sturgeon River	116	L
Sulphur River	161	P
Swan Lake	98	P
Table Rock Lake	225	P
Tahquamenon	96	HL[28]
Tallapoosa River	91	P
Tangipahoo River	135	P

Tchefuncte River	136	P
Tennessee River	63	P
Tensas River	133	P
Tickfaw River	134	P
Toledo Bend Reservoir	218	P
Tombigbee River	217	P
Tongue River	29	P,S,HPS[13]
Torch River	112	L
Trinity River	158	P
Turtle Lake	199	L
Turtle River	196	L
Tuttle Creek Reservoir (Blue R.)	221	P
Verdigris River	82	P,S
Vermillion River (LA)	129	P
Vermillion River (SD)	102	HP[3],S[3]
Wabash River	60	P,S
Waiska River	216	HL
Wakarusa River	220	P
Wapsipinicon River	08	No report available
Watauga River	66	No report available
Wattensaw Bayou	122	P
Welland River	141	L[22]
White Lake	139	P
White River (SD)	151	P,PS,S
White River (Arkansas)	86	P,S,HPS,HL
White River (East Fork) (IN)	152	P,LS,S
White River (IN)	34	P,S
White River (West Fork) (IN)	153	P,S
Wichita River	154	HP[29]
Wildcat Creek (KS)	174	HP[21]
Winnepeg River	178	L
Wisconsin River	07	P,L
Wolf River (WI)	115	L
Wolf River (KS)	202	P[21]
Yazoo River	19	P[10]
Yellowstone River	26	P,PS,S

[1]Graham (1993), [2]Fago and Hatch (1993), [3]Schmulbach and Braaten, [4]Durham (1993), [5]Kwak (1993), [6]Day et.al. (1993), [7]Burr and Warren (1993), [8]Larimore and Fritz (1993), [9]Saylor et al. (1993), [10]Jackson et al. (1993), [11]Holman et al. (1993), [12]Hubert (1993), [13]White and Bramblett (1993), [14]Ruelle et.al. (1993), [15]Nickum and Sinning (1971), [16]Personius and Eddy (1955), [17]Latka (1994), [18]Priegel and Wirth (1971), [19]Carlson (1981), [21]Cross and Shaw (1996), [22]Lowie (1996), [23]Carlson (1995), [24]Ostlie (1990), [25]Becker (1983), [26]Duffy et.al. (1996), [27]Fortin et.al. (1993), [28]Evers (1994), [29]Pitman (1991), [30]Scott and Crossman (1973), [31]Jones (1963).

One respondent from Minnesota said it quite plainly, "I am concerned about statements regarding status that cannot be supported. In the Wisconsin and Minnesota region of the upper Mississippi, data on population status continue to be severely lacking. Without adequate data, any report of status other than unknown would be misleading at best." We concur; clearly many respondents noted a serious lack of information; however, it may be acceptable to describe relative status based on the best evidence to date. The evidence, herein, supports a broad concern for the future of these unique species. Pallid sturgeon are especially at risk, and most respondents felt they were continuing to decline, moreover, there was a moderate level of pessimism regarding the chances to stabilize and restore the species. Lake sturgeon have been lost from a large number of streams and lakes. Shovelnose sturgeon have probably been considered less at risk but the evidence from this survey would suggest that the deterioration of its overall range is keeping pace with the other sturgeon species. Paddlefish may be a real success story, since they seem to be holding their own in a large portion of their historical range.

Paddlefish/sturgeon workers point to over-exploitation, pollution, habitat deterioration, and the loss of natural flow regimes as the primary underlying reasons for the deterioration of these species. Clearly, most states and provinces have adopted stringent harvest controls. In large measure these actions will help to safeguard breeding stocks for the short-term. Pollution is a site-specific problem and water quality must not be overlooked as a potential threat to the long-term survival of these species. For example, elevated levels of arsenic, cadmium, copper, lead, mercury, selenium, isomers of DDT, and PCB's were found in reproductive tissues of paddlefish, pallid sturgeon, and shovelnose sturgeon in the upper Missouri River (Ruelle and Keenlyne 1992, Welsh 1992). Deteriorating habitat and discharge are inextricably linked together. Respondents noted that where paddlefish and sturgeon have maintained relatively healthy populations, it was possible to point to a semi-natural hydrograph (e.g., Arkansas, Louisiana). The quality of instream habitat is a deterministic function of the flows within the river channel. The elimination or significant dampening of interannual variability in streamflow can reduce early life history success and thus alter biodiversity in free-flowing streams sections (Stalnaker et. al. 1996). Previously, streamflow management has focused on minimum flows; however, the recovery of river ecosystems requires consideration of the full range of flows experienced historically in North American river systems (Petts 1996).

Recommendations and Final Comments

Whether the data presented in this report can be considered a definitive statement of status for paddlefish and selected sturgeon species or not, it is clear that these ancient fishes are struggling to survive human interaction with their environment. While status is more fully evaluated, efforts should be initiated to restore the natural variation in stream flow that maintained essential riverine habitats for these fish. It is possible to achieve this goal as demonstrated by Hesse (1995).

We recommend that copies of this status report be mailed to each state and province fisheries division, selected federal agencies, each college and university, and selected private institutions within the geographical range of these four species. These responsible organizations should be asked to review the data for accuracy in representing the status and range of paddlefish and sturgeon in their area. They should be asked to supply

documentation of changing status by providing either raw or summarized catch data where it exists. They should be asked to provide a list of catch or observation records for their area in order to clearly identify which streams and lakes presently support the target species. They should be given sufficient time and gentle encouragement to obtain a complete record. Then these data should be incorporated into a GIS database that can and should be maintained and upgraded as frequently as is reasonable, maybe in repository fashion on an annual basis. We believe this can be accomplished within one or two years and we believe this will be the definitive status review that will provide a defensible argument to alter flow regimes, restore habitat, and recover these species before it is too late. We received just two comments regarding the information provided by our survey. One state biologist agreed that the information we had access to was "marginal at best" but concluded that MICRA did not have the time and resources to improve on this status review. Another state biologist noted that maybe the data we had was "better than the percent response might indicate" since, although only 33% of the surveys were returned from his state, those returns represented all of the waters with sturgeon and paddlefish in that state. We remain convinced that an ongoing, annually updated, "status" is critical for the management of these species. The record run-off in the Missouri River basin since 1993 makes a strong argument for a frequent review of status, since status likely changes in response to river hydrology. Moreover, new data is forthcoming from projects like the newly organized, 22-state MICRA tagging project. The first year of tagging resulted in 2,169 tagged wild paddlefish and more than 200,000 tagged hatchery paddlefish which were released into the basin's rivers by the end of 1995. These and other state project data will be used to implement a basinwide paddlefish stock assessment and will help to document distribution, movement, harvest, and exploitation (MICRA 1996).

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Appendix I

Survey Forms

Survey Number 1

STATE_____ **Preparer**_____

Primary Role: Administrator ____ Supervisor ____ Field Technician ____
Indicate extent of your study area or the area you are responsible for: single watershed ___ multiple watersheds ___ statewide___.
Complete survey based on your area of study or responsibility.

Describe your study area location in detail. Examples, city to city; river mile to river mile; county to county; etc.

1. Status	Never Present	Extirpated	Decreasing	Stable	Increasing	Unknown
Paddlefish	☐	☐	☐	☐	☐	☐
Pallid sturgeon	☐	☐	☐	☐	☐	☐
Lake sturgeon	☐	☐	☐	☐	☐	☐
Shovelnose sturgeon	☐	☐	☐	☐	☐	☐

2. Historical range

List rivers, by code number (page 5), and lakes by name, where the following species were found in your study area (use river codes throughout the survey).

Paddlefish:

Pallid sturgeon:

Lake sturgeon:

Shovelnose sturgeon:

3. Present Range

List rivers (by code number) and lakes of occurrence (by name).

Paddlefish:

Pallid sturgeon:

Lake sturgeon:

Shovelnose sturgeon:

4. List reasons for the present status of the four target species in your study area. Some examples might be the existence of natural hydrograph or habitat, pollution, exploitation, changes in the gene pool due to hybridization, hatchery raised fish, isolation, etc.

5. Are any methods currently being employed to maintain, stabilize or restore the target species in your state? YES ___ NO ___ . If yes, describe the methods?

6. Do you presently stock any of the target species in your study area? YES___ NO ___ If yes, indicate which species:

Paddlefish ___ Pallid sturgeon ___ Lake sturgeon ___ Shovelnose sturgeon ___

If stocking does occur, are the gametes taken from a local population in your study area? YES ___ NO ___. If no, what hatchery supplies the species being stocked?

7. Are eggs taken from target species in your study area commercially for the production of caviar? YES ___ NO ___. If yes, check the species:

Paddlefish ___ Pallid sturgeon ___ Lake sturgeon ___ Shovelnose sturgeon ___

What is the approximate current market value for the caviar? ____________

Approximately how many kilograms of eggs are harvested annually? ____________

8. Do you know or believe that poaching occurs in your study area for any of the target species?YES __ NO__. If yes, check those illegally harvested:

Paddlefish ___ Pallid sturgeon ___ Lake sturgeon ___ Shovelnose sturgeon ___

9. Have you collected, or are you aware of those who have collected, eggs YES ___ NO___ , larvae YES ___ NO ___ , or one to three year old specimens YES ___ NO ___ , of the target species from your study area in the past three years?
If yes, for each species list the river code or lake name, the life stage located: E=eggs, L=larvae, J=juvenile, and also any unique qualities of habitat or hydrology associated with each body of water that might account for reproductive success.

	******************Life stage******************				***************Unique qualities***************
River Code Number	Paddlefish	Pallid sturgeon	Lake sturgeon	Shovelnose sturgeon	

10. Harvest	Paddlefish	Pallid sturgeon	Lake sturgeon	Shovelnose Sturgeon
Season	YES ___ NO ___	YES ___ NO ___	YES ___ NO ___	YES ___ NO ___
Months open annually	_____	_____	_____	_____
Kilograms	_____	_____	_____	_____
Number	_____	_____	_____	_____
Number of fisherman	_____	_____	_____	_____
Special Restrictions*				

Annual Commercial Harvest	Paddlefish	Pallid sturgeon	Lake sturgeon	Shovelnose Sturgeon
Season	YES ___ NO ___	YES ___ NO ___	YES ___ NO ___	YES ___ NO ___
Months open annually	_____	_____	_____	_____
Kilograms	_____	_____	_____	_____
Number	_____	_____	_____	_____
Number of fishermen	_____	_____	_____	
Special Restrictions*				

*Additional notes here

11. Additional concerns not covered by survey or any comments you wish to make for inclusion in the summary report:

12. Please attach copies of federal aid reports and unpublished documents dealing with paddlefish or sturgeon dating from the mid 1980's to the present.

Thank you!

Survey Number 2

State_____ **Preparer**_____

1. Status	**Never Present**	**Extirpated**	**Declining**	**Stable**	**Increasing**
Paddlefish	____	____	____	____	____
Pallid sturgeon	____	____	____	____	____
Lake sturgeon	____	____	____	____	____
Shovelnose sturgeon	____	____	____	____	____

2. Do you believe that the populations of paddlefish and/or sturgeon species can be enhanced in your state? paddlefish: Yes____, No____; pallid sturgeon: Yes____, No____; lake sturgeon: Yes____, No____; shovelnose sturgeon: Yes____, No____.

3. How would you rank the real value of paddlefish and/or sturgeon species in the overall fisheries program in your state on a scale of 1 to 10? paddlefish:____, lake sturgeon:____, shovelnose sturgeon:____.

4. If the populations of these species could be enhanced, how would you rank the value of these species in your state on a scale of 1 to 10? paddlefish:____, lake sturgeon:____, shovelnose sturgeon:____.

5. Would you say the interest in paddlefish and sturgeon species in your state was mostly recreational or commercial? Please estimate the percentage of interest for each of total paddlefish/sturgeon fishermen:

paddlefish:
Recreational fishermen interest (%)____, Commercial fishermen interest (%)____.

lake sturgeon:
Recreational fishermen interest (%)____, Commercial fishermen interest (%)____.

shovelnose sturgeon:
Recreational fishermen interest (%)____, Commercial fishermen interest (%)____.

6. Is the interest in paddlefish and sturgeon species in your state driven by their sport angling value_____(%), by their meat value_____(%), by their egg value_____(%).

7. In your view, what is the single most important action, that if implemented, would enhance the populations of paddlefish or sturgeon species. Please be very specific:

_____

_____

_____.

8. Would anglers in your state be willing to pay extra for the privilege to catch these species? Yes____, No____.

9. If yes, how high a fee could be levied without altering harvest significantly?_____($).

10. What sort of management practice to enhance these species do you favor (e.g., length limits, seasons, protected zones, etc.):

_____
_____.

11. Do you envision that paddlefish, lake sturgeon, or shovelnose sturgeon will have to be listed with the Endangered Species Act during the next, paddlefish: 5 years____, 10 years____, 15 years____, 20 years, Will never need listing_____? lake sturgeon: 5 years____, 10 years____, 15 years____, 20 years, Will never need listing_____? shovelnose sturgeon: 5 years____, 10 years____, 15 years____, 20 years, Will never need listing_____? (check one).

12. Do you believe that pallid sturgeon can be recovered sufficiently to be de-listed in the next 10-20 years? Yes____, No____.

13. If yes, what is the single factor in your view that will contribute most to this outcome?

_____
_____.

14. What role do you see non-anglers playing in the preservation of these species?

_____
_____.

15. How important is law enforcement in your state to the preservation of these species?

_____
_____.

16. Please use this space to discuss anything else of importance, in your view that needs to be brought to the attention of others trying to manage paddlefish or sturgeon species.

_____
_____.

Survey Number 3

HATCHERY_____ PREPARER_____
State ___ Federal ___

1. Is your hatchery involved with the production of paddlefish and/or sturgeon species: paddlefish Yes ____, No ____; pallid sturgeon Yes ____, No ____; lake sturgeon Yes ____, No ____; shovelnose sturgeon: Yes ____ , No ____.

2. List the number of each species that are successfully raised to the fry stage: paddlefish _____, pallid sturgeon _____, lake sturgeon_____, shovelnose sturgeon_____ .

3. Where does your hatchery obtain brood stock?

Paddlefish _____

Pallid sturgeon_____

Lake sturgeon _____

Shovelnose sturgeon _____

4. Have any of your brood stock been genetically mapped: paddlefish Yes ____, No ____; pallid sturgeon Yes ____, No ____; lake sturgeon Yes ____, No ____; shovelnose sturgeon: Yes ____ , No ____.

5. If you answered yes to any species in question 4, please supply us with a report.

6. Below is a list of hatcheries that this survey has been distributed to. Are you aware of other hatcheries that are involved with paddlefish/sturgeon species? If so, please list them and the name of the manager.

A. E. Wood State Fish Hatchery
Bowden National Fish Hatchery
Genoa National Fish Hatchery
Warm Springs National Fish Hatchery
Natchitoches National Fish Hatchery
Uvalde National Fish Hatchery
Palestine State Fish Hatchery
Valley City State Fish Hatchery
College of S. Idaho Fish Hatchery
Gavins Point Nation Fish Hatchery
Orangeburg National Fish Hatchery
Blind Pony State Hatchery
Carbon Hill National Fish Hatchery
Garrison Dam National Fish Hatchery
Neosho National Fish Hatchery
Private John Allen NFH

_____ _____

7. List the rivers and/or lakes that are stocked with paddlefish and/or sturgeon species from your hatchery, and the number stocked in each.

Paddlefish	River or lake	Number stocked
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____

Pallid sturgeon

1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____

Lake sturgeon

1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____

Shovelnose sturgeon

1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____

Survey Number 4

State:_____ Federal Aid Coordinator_____

name

1. Project number:_____, Project name:_____

_____

Starting date:_____, Stopping date:_____,

Principle investigator:_____.

name

2. Project number:_____, Project name:_____

_____

Starting date:_____, Stopping date:_____,

Principle investigator:_____.

name

3. Project number:_____, Project name:_____

_____

Starting date:_____, Stopping date:_____,

Principle investigator:_____.

name

4. Project number:_____, Project name:_____

_____

Starting date:_____, Stopping date:_____,

Principle investigator:_____.

name

Others: Use the back of this sheet.