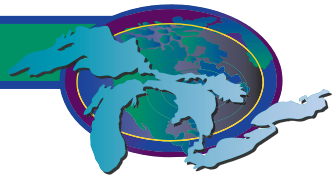

Status of Lake Sturgeon in the Great Lakes

Indicator #125

Overall Assessment

Status:	**Mixed**
Trend:	**Improving**
Rationale:	**There are remnant populations in each basin of the Great Lakes, but few of these populations are large. Much progress has been made in recent years learning about population status in many tributaries. Confirmed observations and captures of lake sturgeon are increasing in all lakes. Stocking is contributing to increased abundance in some areas. There remains a need for information on some remnant spawning populations. Little is known about the juvenile life stage. In many areas habitat restoration is needed because spawning and rearing habitat has been destroyed or altered, or access to it has been blocked.**

Lake-by-Lake Assessment

Lake Superior

Status:	Mixed
Trend:	Improving or Undetermined
Rationale:	Lake sturgeon abundance shows an increasing trend in a few remnant populations and where stocked in the Ontonagon and St. Louis rivers. Lake sturgeon currently reproduce in at least 10 of 21 known historic spawning tributaries.

Lake Michigan

Status:	Mixed
Trend:	Improving and Undetermined
Rationale:	Remnant populations persist in at least nine tributaries having unimpeded connections to Lake Michigan. Successful reproduction has been documented in seven rivers, and abundance has increased in a few in recent years. Active rehabilitation has been initiated through rearing assistance in one remnant population, and reintroductions have been initiated in three rivers.

Lake Huron

Status:	Mixed
Trend:	Improving and Undetermined
Rationale:	Current lake sturgeon spawning activity is limited to five tributaries, four in Georgian Bay and the North Channel and one in Saginaw Bay. Abundant stocks of mixed sizes are consistently captured in the North Channel, Georgian Bay, southern Lake Huron and Saginaw Bay.

Lake Erie

Status:	Poor
Trend:	Undetermined
Rationale:	Current lake sturgeon spawning activity is unknown except for three spawning areas identified in the Detroit and St. Clair Rivers. The western basin of Lake Erie, the Detroit River East of Fighting Island, the North Channel of the St. Clair River and Anchor Bay in Lake St. Clair appear to be nursery areas for juveniles. In the central and eastern basins lake sturgeon are scarcer.

Lake Ontario

Status:	Mixed
Trend:	Improving
Rationale:	Lakewide incidental catches since 1995 indicate a possible improvement in their status. Spawning occurs in the Niagara River, Trent River, and possibly the Black River. There are sizeable populations within the St. Lawrence River system. Stocking for restoration began in 1995 in New York.

Purpose

- To assess the presence and abundance of lake sturgeon in the Great Lakes and their connecting waterways and tributaries
- To infer the health and status of the nearshore benthivore fish community that does, could or should include lake sturgeon

Ecosystem Objective

Conserve, enhance or rehabilitate self-sustaining populations of lake sturgeon where the species historically occurred and at a level that will permit all state, provincial and federal delistings of classifications that derive from degraded or impaired populations, e.g., threatened, endangered or at risk species. Lake sturgeon is identified as an important species in the Fish Community Goals and Objectives for each of the Great Lakes. Lake Superior has a lake sturgeon rehabilitation plan, and many of the Great Lakes States have lake sturgeon recovery or rehabilitation plans which call for increasing numbers of lake sturgeon beyond current levels.

State of the Ecosystem

Background

Lake sturgeon (*Acipenser fulvescens*) were historically abundant in the Great Lakes with spawning populations using many of the major tributaries, connecting waters, and shoal areas across the basin. Prior to European settlement of the region, they were a dominant component of the nearshore benthivore fish community, with populations estimated in the millions in each of the Great Lakes (Baldwin *et al*. 1979). In the mid- to late 1800s, they contributed significantly as a commercial species ranking among the five most abundant species in the commercial catch (Baldwin *et al*. 1979, Figure 1).

The decline of lake sturgeon populations in the Great Lakes was rapid and commensurate with habitat destruction, degraded water quality, and intensive fishing associated with settlement and development of the region. Sturgeon were initially considered a nuisance species of little value by European settlers, but by the mid-1800s, their value as a commercial species began to be recognized and a lucrative fishery developed. In less than 50 years, their abundance had declined sharply, and since 1900, they have remained a highly depleted species of little consequence to the commercial fishery. Sturgeon is now extirpated from many tributaries and waters where they once spawned and flourished (Figures 2 and 3). They are considered rare, endangered, threatened, or of watch or special concern status by the various Great Lakes fisheries management agencies. Their harvest is currently prohibited or highly regulated in most waters of the Great Lakes.

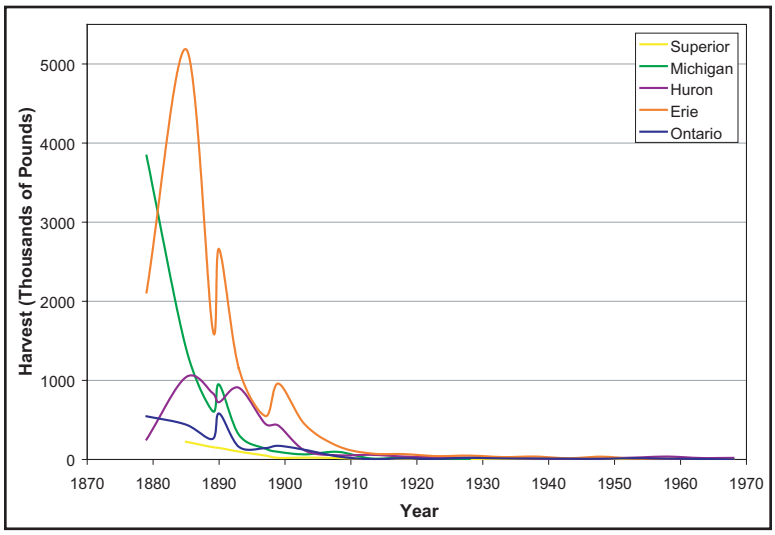

Figure 1. Historic lake sturgeon harvest from each of the Great Lakes.
Source: Baldwin *et al*. 1979

Status of Lake Sturgeon

Efforts continue by many agencies and organizations to gather information on remnant spawning populations in the Great Lakes. Most sturgeon populations continue to sustain themselves at a small fraction of their historical abundance. In many systems, access to spawning habitat has been blocked, and other habitats have been altered. However, there are remnant populations in each basin of the Great Lakes, and some of these populations are large in number (tens of thousands of fish, Figure 3). Genetic analysis has shown that Great Lakes populations are regionally structured and show significant diversity within and among lakes.

Lake Superior

The fish community of Lake Superior remains relatively intact in comparison to the other Great Lakes (Bronte *et al*. 2003). Historic and current information indicate that at least 21 Lake Superior tributaries supported spawning lake sturgeon populations (Harkness and Dymond 1961; Auer 2003; Holey *et al*. 2000). Lake sturgeon currently reproduce in at least 10 of these tributaries. Sturgeon populations in Lake Superior continue to sustain themselves at a small fraction of their historical abundance.

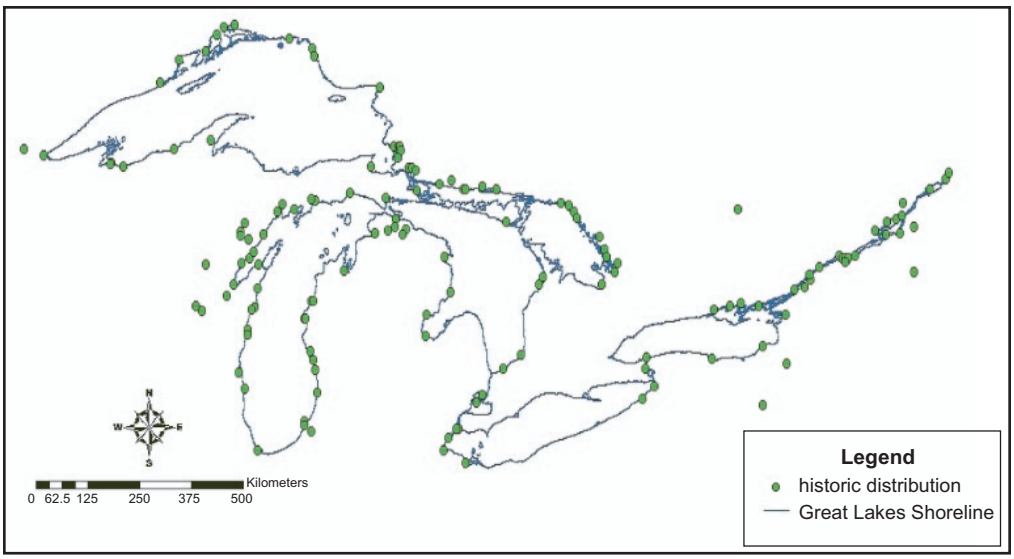

Figure 2. Historic distribution of lake sturgeon.
Source: Zollweg *et al.* 2003

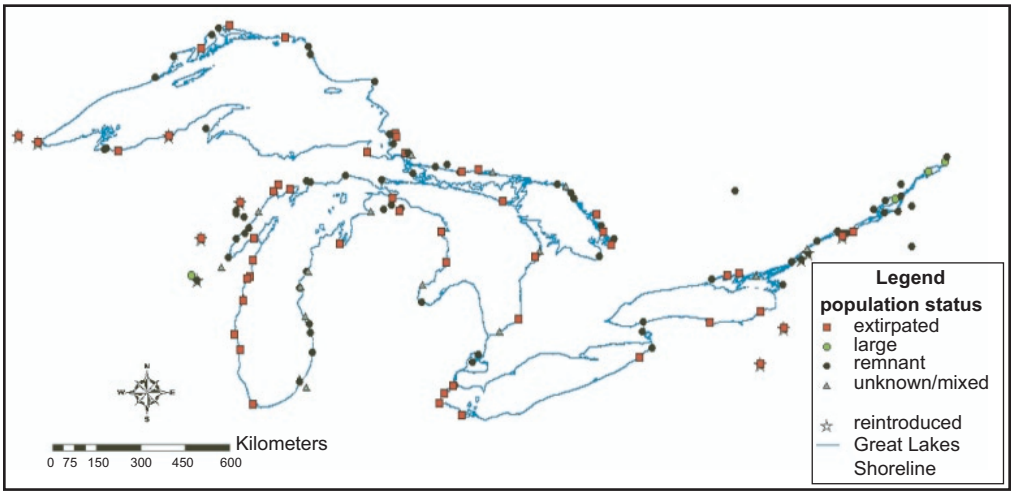

Figure 3. Current distribution of lake sturgeon.
Source: Zollweg *et al.* 2003

Kaministiquia River (Friday 2004). The Pic River also has the potential to support a river resident population. Juvenile lake sturgeon index surveys conducted by the Great Lakes Indian Fish and Wildlife Commission and USFWS in Wisconsin waters show a gradually increasing trend in catch per unit effort from 1994 through 2002 (Table 1). Since 2001, sturgeon spawning surveys have been conducted for the first time in eight tributaries. Genetic analysis has shown that lake sturgeon populations in Lake Superior are significantly different from those in the other Great Lakes. Currently, there is no commercial harvest of lake sturgeon allowed in Lake Superior. Regulation of recreational and subsistence/home use harvest in Lake Superior varies by agency.

Lake Michigan

Sturgeon populations in Lake Michigan continue to sustain themselves at a small fraction of their historical abundance. An optimistic estimate of the lakewide adult abundance is less than 5,000 fish, well below 1% of the most conservative estimates of historic abundance (Hay-

Current populations in Lake Superior are reduced from historic levels and none meet all rehabilitation targets. The number of lake sturgeon in annual spawning runs has been estimated over a multi-year period to range from 200 to 375 adults in the Sturgeon River, (Hay-Chmielewski and Whelan 1997; Holey *et al.* 2000), 200 to 350 adults in the Bad River in 1997 and 1998 (U.S. Fish and Wildlife Service (USFWS)) and 140 adults in the Kaministiquia River (Holey *et al.* 2000). Estimates of lakewide abundance are available from the period during or after targeted commercial harvests in the 1880s. Using data from Baldwin *et al.* (1979), Hay-Chmielewski and Whelan (1997) estimated that historic lake sturgeon abundance in Lake Superior was 870,000 individuals of all ages. If the Rehabilitation Plan targets of 1,500 adults were met in all 21 tributaries, the minimum lakewide abundance of adult fish would be 31,500.

Radio telemetry studies suggest that a river resident population of lake sturgeon inhabits the

Year	Month	CPE
1994	6	0.333333
1995	6	1
1996	6	0.714286
1997	6	1.142857
1998	6	1.769231
1999	6	2.5
2000	6	2.25
2001	6	4.5
2002	6	5.5

Table 1. Trends in juvenile lake sturgeon CPE during June in Lake Superior near the mouth of the Bad River.

Chmielewski and Whelan 1997). Remnant populations currently are known to spawn in waters of at least nine tributaries having unimpeded connections to Lake Michigan (Schneeberger *et al.* 2005). Two rivers, the Menominee and Peshtigo, appear to support annual spawning runs of 200 or more adults, and five rivers, the Manistee, Muskegon, Grand, Fox and Oconto, appear to support annual spawning runs of between 25 and 75 adults. Successful reproduction has been documented in all seven of these rivers, and age 0 juveniles can be captured regularly in several of these rivers. Although actual recruitment levels remain unknown, abundance in some of these rivers appears to be increasing in recent years. Two other rivers, the Manistique and Kalamazoo, appear to have annual spawning runs of less than 20 fish, and reproductive success remains unknown. Lake sturgeon have been observed during spawning times in a few other Lake Michigan tributaries such as the St. Joseph and Millecoquins, and near some shoal areas where sturgeon are thought to have spawned historically. It is not known if spawning occurs regularly in these systems, however, and their status is uncertain.

Lake Huron

Lake sturgeon populations continue to be well below historical levels. Spawning has been identified in the Garden, Mississaugi and Spanish rivers in the North Channel, in the Nottawasaga River in Georgian Bay and in the Rifle River in Saginaw Bay. Adult spawning populations for each of these river systems are estimated to be in the 10s and are well below rehabilitation targets (Hay-Chmielewski and Whelan 1997; Holey *et al*. 2000). Research in the Saginaw River Watershed in 2005 – 2007 indicated that lake sturgeon are no longer spawning in that watershed. Barriers on Michigan tributaries to Lake Huron continue to limit successful rehabilitation. Stocks of lake sturgeon in Lake Huron are monitored primarily through the volunteer efforts of commercial fishers cooperating with the various resource management agencies. To date the combined efforts of researchers in U.S. and Canadian waters has resulted in over 6,600 sturgeon tagged in Saginaw Bay, southern Lake Huron, Georgian Bay and the North Channel, with relatively large stocks of mixed sizes being captured at each of these general locations. Tag recoveries and telemetry studies indicate that lake sturgeon are moving within and between jurisdictional boundaries and between lake basins, supporting the need for more cooperative management between the states and between the U.S. and Canada. The Saginaw River watershed and the St. Mary's River systems are being assessed for spawning. Both projects are ongoing and will continue through 2008. Similar research is being planned for the Thunder and Rifle Rivers in Michigan.

Lake Erie

Lake sturgeon populations continue to be well below historical levels. Spawning has been identified at two locations in the St. Clair River and at one location in the Detroit River (Manny and Kennedy 2002). Tag recovery data and telemetry research indicate that a robust lake sturgeon stock (greater than 45,000 fish) reside in the North Channel of the St. Clair River and Lake St. Clair (Thomas and Haas 2002). The North Channel of the St. Clair River, Anchor Bay in Lake St. Clair, the Detroit River (East of Fighting Island), and the western basin of Lake Erie have been identified as nursery areas as indicated by consistent catches in commercial and survey fishing gears. In the central and eastern basins of Lake Erie, lake sturgeon are scarcer with only occasional catches of sub-adult or adult lake sturgeon in commercial fishing nets and none in research nets. A botulism-related die off in 2001 and 2002, and declines in sightings by anglers and others near Buffalo indicate a possible decline in population abundance of lake sturgeon in Lake Erie. Survey work conducted in 2005 and 2006 indicated that no lake sturgeon spawning is taking place in the Maumee River (OH). Research efforts will continue to focus on identifying new spawning locations, genetic difference between stocks, habitat requirements, and migration patterns.

Lake Ontario

Lake Ontario has lake sturgeon spawning activity documented in two major tributaries (Niagara River and Trent River) and suspected in at least one more (Black River) on an infrequent basis. There is no targeted assessment of lake sturgeon in Lake Ontario, but incidental catches in research nets have occurred since 1997 (Ontario Ministry of Natural Resources 2004) and 1995 (Eckert 2004), indicating a possible improvement in population status. Age analysis of lake sturgeon captured in the lower Niagara River indicates successful reproduction in the mid-1990s. The New York State Department of Environmental Conservation initiated a stocking program in 1995 to recover lake sturgeon populations. Lake sturgeon has been stocked in the St. Lawrence River and some of its tributaries, inland lakes in New York, and the Genesee River. There are sizeable populations within the St. Lawrence River system, most notably Lac St. Pierre and the Des Prairies and St. Maurice Rivers. However, access is inhibited for many of the historical spawning grounds in tributaries by small dams and within the St. Lawrence River by the Moses-Saunders Dam.

Pressures

Low numbers or lack of fish (where extirpated) is itself a significant impediment to recovery in many spawning areas. Barriers that prevent lake sturgeon from moving into tributaries to spawn are a major problem. Predation on eggs and newly hatched lake sturgeon by non-native predators may also be a problem. The genetic structure of remaining populations is being studied by

university researchers and fishery managers, and this information will be used to guide future management decisions. With the collapse of the Caspian Sea sturgeon populations, black market demand for sturgeon caviar could put tremendous pressure on Great Lakes lake sturgeon populations. An additional concern for lake sturgeon in Lake Erie and Lake Ontario is the presence of high densities of round gobies and the spread of Botulism Type E, which produced a die-off of lake sturgeon in Lake Erie in 2001 and 2002. Botulism may also have been the cause of similar mortalities observed in Lake Ontario in 2003 and in Green Bay of Lake Michigan.

Management Implications

Lake sturgeon is an important native species that is listed in the Fish Community Goals and Objectives for all of the Great Lakes. Many of the Great Lakes states and provinces either have or are developing lake sturgeon management plans promoting the need to inventory, protect and restore the species to greater levels of abundance.

While overexploitation removed millions of adult fish, habitat degradation and alteration eliminated traditional spawning grounds. Current work is underway by state, federal, tribal, provincial and private groups to document active spawning sites, assess habitat condition and availability of good habitat, and determine the genetics of remnant Great Lakes lake sturgeon populations.

Several meetings and workshops have been held focusing on identifying the research and assessment needs to further rehabilitation of lake sturgeon in the Great Lakes (Holey *et al*. 2000, Zollweg *et al*. 2003, Quinlan *et al*. 2005,) and a significant amount of research and assessment directed towards these needs has occurred in the last 10 years. Among these is the research to better define the genetic structuring of Great Lakes lake sturgeon populations, and genetics-based rehabilitation plans are being developed to help guide reintroduction and rehabilitation efforts being implemented across the Great Lakes. Research into new fish passage technologies that will allow safe upstream and downstream passage around barriers to migration also have been underway for several years. Many groups are continuing to work to identify current lake sturgeon spawning locations in the Great Lakes, and studies are being initiated to identify habitat preferences for juvenile lake sturgeon (ages 0 to 2).

Comments from the author(s)

Research and development is needed to determine ways for lake sturgeon to pass man-made barriers on rivers. In addition, there are significant, legal, logistical, and financial hurdles to overcome in order to restore degraded spawning habitats in connecting waterways and tributaries to the Great Lakes. More monitoring is needed to determine the current status of Great Lakes lake sturgeon populations, particularly the juvenile life stage. Cooperative efforts between law enforcement and fishery managers are required as world pressure on sturgeon stocks will result in the need to protect large adult lake sturgeon in the Great Lakes.

Acknowledgments

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