



Status of Lake Sturgeon in the Great Lakes

Formerly Indicator #125

Overall Assessment

Status: **Fair**

Trend: **Improving**

Rationale: **There are remnant populations in each basin of the Great Lakes, but few of these populations are large. Progress continues as agencies learn more about population status in many tributaries and the Great Lakes proper. Confirmed observations and captures of lake sturgeon continue to increase in all lakes. Stocking is contributing to increased abundance in some areas. There remains a need for information on some remnant spawning populations. Researchers are learning more 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: Fair

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 half (11 of 22) known historic spawning locations.

Lake Michigan

Status: Fair

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: Fair

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: Fair

Trend: Improving and Undetermined

Rationale: Lakewide incidental catches since 1992 indicate a possible improvement in their status in lake Erie. Spawning occurs in four known locations in the basin, all located in the connecting waters between lakes Huron and Erie. The Huron Erie Corridor supports a robust population of all age classes. 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 and foraging

areas for adults.

Lake Ontario/St. Lawrence River

Status: Fair

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.

Ecological Condition

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.

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.

STATE OF THE GREAT LAKES 2012 - DRAFT

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 (DeHaan et al. 2006, Welsh et al. 2008).

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 22 Lake Superior tributaries supported spawning lake sturgeon populations (Harkness and Dymond 1961; Auer 2003; Quinlan 2007). Successful reproduction was confirmed in the St. Louis River in spring 2011 through capture of larval fish. Lake sturgeons currently reproduce in at least 11 of 22 tributaries. The Lake Sturgeon Rehabilitation Plan for Lake Superior (Auer 2003) serves as the guiding document for agency activities. Populations in the Sturgeon River, Michigan, and Bad River, Wisconsin, meet rehabilitation plan criteria for self-sustaining populations (Auer 2003, Auer and Baker 2007, GLIFWC unpublished data, Quinlan 2007). Improvements in assessment techniques have provided better estimates of lakewide abundance (Auer and Baker 2007, Schram 2007, and GLIFWC unpublished data). The estimated combined spawning run population size in the Bad and White rivers, Wisconsin, was 844 individuals, 666 in the Bad River and 178 in the White River (Schloesser and Quinlan 2011). The estimated number of lake sturgeon in annual spawning run in the Sturgeon River, MI range from 350 to 400 adults (Auer and Baker 2007), Stocking in the St. Louis and Ontonagon rivers have resulted in increases in abundance in localized areas. Genetic analysis has shown that lake sturgeon populations in Lake Superior are distinct from one another and significantly different from those in the other Great Lakes (Welsh et al. 2008).

Studies and assessments continue in key tributaries, embayments and nearshore waters including the Kaministiquia River, Ontario, Chequamegon Bay, Wisconsin, Batchawana and Goulais bays, Ontario, Pigeon Bay, Minnesota/Ontario in Keweenaw Bay and in nearshore waters off the Ontonagon River, Michigan. A key study on the Kaministiquia River, Ontario, examined the effect of controlled flow regimes at Kakabeka Falls on the migratory behavior and reproductive response of lake sturgeon from 2002-2009 (Friday 2009). Habitat (substrate type and water depth) for adult and juvenile fish was geo-referenced and quantified using hydroacoustics in the Kaministiquia River, Ontario (Biberhofer and Prokopec 2005) and Bad River (Cholwek *et al.* 2005). Habitat preference of stocked sturgeon is being studied in the Ontonagon and St. Louis rivers using radio telemetry (Fillmore 2003, 1854 Authority unpublished data). Due to potential for overexploitation, sport fishing regulations in Ontario waters have been changed to eliminate harvest. There remains a prohibition of commercial harvest of lake sturgeon in Lake Superior. Regulation of recreational and subsistence/home use harvest in Lake Superior varies by agency.

In 2011, fishery agencies conducted a coordinated lakewide juvenile lake sturgeon index survey that will provide the most comprehensive data set to date for Lake Superior lake sturgeon. Despite limited progress, challenges remain. Spawning runs are absent in 11 of 22 historic spawning tributaries, and only two populations meet targets identified in the 2003 Rehabilitation Plan. Overall, lake sturgeon abundance remains a small fraction of historical abundance, estimated at 870,000 (Hay-Chmielewski and Whelan 1997) and basic abundance and biological data is unavailable for many stocks.

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 10,000 fish, well below 1% of the most conservative estimates of historic abundance (Hay-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, Elliott 2008). 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

STATE OF THE GREAT LAKES 2012 - DRAFT

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. Recent recruitment estimates have been made from research efforts in the Peshtigo River indicating that in some years, several hundred fall recruits are produced from that system (Caroffino et al. 2007), and research and assessment efforts in the Manistee and Muskegon rivers indicate significant recruitment from those systems as well (Smith, MDNR, personal communication). In addition, abundance of spawners in some rivers appears to have increased in the last decade, indicating that increased recruitment may have been occurring for several years in some rivers. Two other rivers, the Manistique and Kalamazoo, appear to have annual spawning runs of less than 20 fish, and some 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 or how regularly spawning occurs in these systems, and their reproductive status is uncertain. A large self-sustaining population exists in the Lake Winnebago system upstream of the lower Fox River.

Active management in the form of reintroduction stocking and rearing assistance has been implemented in 7 Lake Michigan basin tributaries. Commencing in 2005, Lake sturgeon are being reared from eggs using streamside rearing facilities and stocked as fingerlings into the Milwaukee, Manitowoc, Cedar and Whitefish rivers where sturgeon have been considered extirpated for some time. Over the next 25 years, these reintroductions are intended to rebuild self-sustaining populations that use these rivers to spawn. A streamside rearing facility also is being used to increase the survival of naturally produced larvae in the Manistee River since 2003 (Holtgren et al 2007). Stocking also has been conducted in the upper Menominee River and in the Winnebago system for several years. Though limited recreational harvest is allowed in both the upper Menominee River and the Winnebago system, no harvest is allowed from other Lake Michigan tributaries or from Lake Michigan. Habitat evaluations have been conducted in many sturgeon tributaries within the Lake Michigan basin (Daugherty et al. 2008), and improvements in flow conditions and increased planning for fish passage at barriers has the potential to continue to improve habitat conditions in several tributaries.

Lake Huron

Lake sturgeon populations continue to be well below historical levels. Spawning has been identified in the Garden, Mississauga 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, although sufficient spawning habitat does exist below the Dow Dam (Midland, MI) on the Tittabawassee River, and below Hamilton Dam (Flint, MI) on the Flint River. Also, creation of a rock ramp at the Chesaning Dam (Chesaning, MI) on the Cass river in 2010 now allows lake sturgeon passage and provides access to approximately 40 miles of high gradient quality spawning habitat above the former dam site. Research since 2007 on the St. Mary's River system has yet to determine a spawning stock of Lake Sturgeon. Barriers in Michigan's tributaries to Lake Huron continue to be a major impediment to successful rehabilitation in Lake Huron.

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 7,000 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, telemetry studies, and genetic collections 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. In October 2009 Ontario closed both commercial and recreational harvest of Lake Sturgeon. Regulation of recreational and subsistence/home use harvest in Lake Huron varies by

agency and is largely unknown.

Lake Erie

Lake sturgeon populations continue to be well below historical levels with the exception of the stocks located in the Huron Erie Corridor which are close to historic levels. Spawning has been identified at four locations in the connecting waters between Lakes Huron and Erie (Manny and Kennedy 2002; Roseman et al. 2011) and is likely occurring in the upper Niagara River (B. Trometer, USFWS, pers. comm.). Tag recovery data and telemetry research indicate that a robust lake sturgeon stock of approximately 15,000 fish reside in the North Channel of the St. Clair River and Lake St. Clair (Thomas and Haas 2002, 2008). 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 and research fishing nets. Survey work conducted in 2005 and 2006 indicated that no lake sturgeon spawning is taking place in the Maumee River (OH) although spawning and nursery habitat requirements would support a reintroduced population. An observed concentration of sturgeon in the spring of 2009 and the collection of 2 males in June 2011 outside the Buffalo Harbor suggest spawning is occurring in the area.

Research efforts will continue to focus on identifying new spawning locations, genetic difference between stocks, habitat requirements, and migration patterns. In October 2009 Ontario closed both commercial and recreational harvest of Lake Sturgeon. Regulation of recreational and subsistence/home use harvest in Lake Huron varies by agency and is largely unknown

Lake Ontario/St. Lawrence River

Lake Ontario has lake sturgeon spawning activity documented in three tributaries, the Niagara, Trent, and Black rivers. 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.

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 has been 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 many of the Great Lakes is the ecosystem changes that are resulting from high densities of invasive species such as dreissenid mussels and round gobies and the presumed related spread of Botulism Type E which has produced die-offs of lake sturgeon in most years since 2001.

Management Challenges/Opportunities

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

STATE OF THE GREAT LAKES 2012 - DRAFT

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, Boase *et al.* 2008) 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 and recruitment levels for juvenile lake sturgeon (ages 0 to 2). Several agencies are also working in concert on reintroduction and rearing assistance programs to strengthen and reintroduce lake sturgeon into various waters where populations are lacking or at risk from further declines. This approach has recently been strengthened with completion of genetic stocking guidelines for the stocking of lake sturgeon in the Great Lakes (Welsh *et al.* 2010).

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.

Assessing Data Quality

Insert "x" under the statement that best corresponds with each data characteristic

Data Characteristics	Strongly Agree	Agree	Neutral or Unknown	Disagree	Strongly Disagree	Not Applicable
1. Data are documented, validated, or quality-assured by a recognized agency or organization		x				
2. Data are traceable to original sources	x					
3. The source of the data is a known, reliable and respected generator of data	x					
4. Geographic coverage and scale of data are appropriate to the Great Lakes basin	x					
5. Data obtained from sources within the U.S. are comparable to those from Canada		x				

STATE OF THE GREAT LAKES 2012 - DRAFT

6. Uncertainty and variability in the data are documented and within acceptable limits for this indicator report		x			
Clarifying Notes:					

Acknowledgments

Authors:

Robert Elliott, USFWS, Green Bay National Fish and Wildlife Conservation Office, New Franken, WI 54229
 Henry Quinlan, USFWS, Ashland National Fish and Wildlife Conservation Office, Ashland, WI 54806
 James Boase, USFWS, Alpena National Fish and Wildlife Conservation Office, Alpena, MI, 49707
 Betsy Trometer, U.S. Fish and Wildlife Service (USFWS), Lower Great Lakes National Fish and Wildlife Conservation Office, Amherst, NY 14228

Information Sources

Auer, N.A. (ed.). 2003. *A lake sturgeon rehabilitation plan for Lake Superior*. Great Lakes Fishery Commission Misc. Publ. 2003-02.

Auer, N.A. and E.A. Baker. 2007. Assessment of lake sturgeon spawning stocks using fixed-location, split-beam sonar technology. *J. Applied Ichth.* Vol. 23:113-121.

Baldwin, N.S., Saalfeld, R.W., Ross, M.A., and Buettner, H.J. 1979. *Commercial fish production in the Great Lakes 1867-1977*. Great Lakes Fishery Commission Technical Report 3.

Biberhofer, J. and C.M. Prokopec, 2005. Description and quantification of the submerged aquatic substrates in the lower Kaministiquia River. Draft Report. National Water Resource Institute, Environment Canada.

Boase, J., Elliott, R., Quinlan, H., Trometer, B. 2005. Proceedings of the third Great Lakes lake sturgeon coordination meeting, November 29-30, 2006. Sault Ste. Marie, MI.

Bronte, C.R., Ebener, M.P., Schreiner, D.R., DeVault, D.S., Petzold, M.M., Jensen, D.A., Richards, C., and Lozano, S.J. 2003. Fish community changes in Lake Superior, 1970-2000. *Can. J. Fish. Aquat. Sci.* 60:1552-1574.

Caroffino, D.C., T.M. Sutton, R.F. Elliott, and M.C. Donofrio. 2007. Abundance and mortality of early life stages of lake sturgeon in the Peshtigo River, Wisconsin. 68th Midwest Fish and Wildlife Conference, Madison, WI. December 9-12, 2007.

Cholwek, G., D. Yule, M. Eitrem, H. Quinlan, T. Doolittle. 2005. Mapping potential lake sturgeon habitat in the lower Bad River complex. U.S.G.S. Lake Superior Biol. Station report. 21 pp.

DeHaan, P., S. Libants, R. F. Elliott, and K. T. Scribner. 2006. Genetic population structure of remnant lake sturgeon populations in the upper Great Lakes basin. *Transactions of the American Fisheries Society.* 135:1478-1492.

Daugherty, D. J., T. M. Sutton, and R. F. Elliott. 2008. Suitability modeling of lake sturgeon habitat in five northern Lake Michigan tributaries: implications for population rehabilitation. *Restoration Ecology*. doi: 10.1111/j.1526-100X.2008.00368.

STATE OF THE GREAT LAKES 2012 - DRAFT

- Eckert, T.H. 2004. Summary of 1976-2003 Warm Water Assessment. In *New York State Department of Environmental Conservation. Lake Ontario Annual Report 2003*. Bureau of Fisheries, Lake Ontario Unit and St. Lawrence River Unit. Cape Vincent and Watertown, NY.
- Elliott, R.F. Status and trends in lake sturgeon. In Clapp, D.F., and W. Horns [editors]. 2008. *The state of Lake Michigan in 2005*. Great Lakes Fish. Comm. Spec. Pub. (in press).
- Friday, M.J. 2009. The migratory and reproductive response of spawning lake sturgeon to controlled flows over Kakabeka Falls on the Kaministiquia River, 2009. Ontario MNR Upper GL Management Unit. Tech. Report. 21 p.
- Harkness, W.J., and Dymond, J.R. 1961. *The lake sturgeon: The history of its fishery and problems of conservation*. Ontario Dept. of Lands and Forests, Fish and Wildl. Branch. 120 pp.
- Hay-Chmielewski, E.M., and Whelan, G.E. 1997. *Lake sturgeon rehabilitation strategy*. Michigan Department of Natural Resources Fisheries Division: Special Report Number 18, Ann Arbor, MI.
- Holey, M.E., Baker, E.A., Thuemler, T.F., and Elliott, R.F. 2000. Research and assessment needs to restore Lake Sturgeon in the Great Lakes: results of a workshop sponsored by the Great Lakes Fishery Trust. Lansing, MI.
- Holtgren, J. M., A.J.Paquet, and S. Fajfer. 2007. Design of a portable streamside rearing facility for lake sturgeon. *North American Journal of Aquaculture* 69:317-323, 2007
- Manny, B.A., and Kennedy, G.W. 2002. Known lake sturgeon (*Acipenser fulvescens*) spawning habitat in the channel between Lakes Huron and Erie in the Laurentian Great Lakes. *J. Applied Ichthyology* 18:486-490.
- Ontario Ministry of Natural Resources. 2004. *Lake Ontario Fish Communities and Fisheries: 2003 Annual Report of the Lake Ontario Management Unit*. Ontario Ministry of Natural Resources, Picton, ON.
- Quinlan, H. 2007. Lake sturgeon. In *The state of Lake Superior in 2000*. ed Mark P. Ebener. Great Lakes Fish. Comm. Spec. Pub. 07-02, pp. 29-32.
- Quinlan, H., Elliott, R., Zollweg, E., Bryson, D. Boase, J., and Weisser, J. 2005. Proceedings of the second Great Lakes lake sturgeon coordination meeting, November 9-10, 2004. Sault Ste. Marie, MI.
- Schram, S.T. 2007. Dispersal of stocked lake sturgeon in Wisconsin waters of Lake Superior. Wis. Dept. of Nat. Res. Fish Manage. Report No. 152. October 2007.
- Schneeberger, P.J. Elliott, R.F., Jonas, J.L. and Hart, S. 2005. Benthivores. In *The state of Lake Michigan in 2000*. eds. M.E. Holey and T.N. Trudeau. Great Lakes Fish. Comm. Spec. Pub. 05-01, pp. 25-32.
- Schloesser, J. and Quinlan, H. 2011. Status of the 2010 lake sturgeon spawning population in the Bad and White Rivers, Wisconsin. USFWS Ashland Fish and Wildlife Conservation Office. Technical Report No. 01. 26 p..
- Thomas, M.V., and Haas, R.C. 2002. Abundance, age structure, and spatial distribution of lake sturgeon, *Acipenser fulvescens*, in the St. Clair system. *J. Applied Ichthyology* 18: 495-501.

STATE OF THE GREAT LAKES 2012 - DRAFT

Welsh, A., T. Hill, H. Quinlan, C. Robinson, B. May. 2008. Genetic assessment of lake sturgeon population structure in the Laurentian Great Lakes. *North Amer. J. of Fish. Manage.* Vol. 28: 572-591.

Welsh, A.B., Elliott, R.F., Scribner, K.T., Quinlan, H.R., Baker, E.A., Eggold, B.T., Holtgren, J.M., Krueger, C.C., May, B. Genetic guidelines for the stocking of lake sturgeon (*Acipenser fulvescens*) in the Great Lakes basin. *Great Lakes Fish. Comm. Misc. Publ.* 2010-01

Zollweg, E.C., Elliott, R.F., Hill, T.D., Quinlan, H.R., Trometer, E., and Weisser, J.W. (eds.). 2003. Great Lakes Lake Sturgeon Coordination Meeting. In *Proceedings of the December 11-12, 2002 Workshop*, Sault Ste. Marie, MI.

List of Figures

Figure 1. Historic lake sturgeon harvest from each of the Great Lakes.

Source: Baldwin *et al.* 1979

Figure 2. Historic distribution of lake sturgeon.

Source: Zollweg *et al.* 2003

Figure 3. Current distribution of lake sturgeon.

Source: Zollweg *et al.* 2003

Last Updated

State of the Lakes Ecosystem Conference (SOLEC) 2011

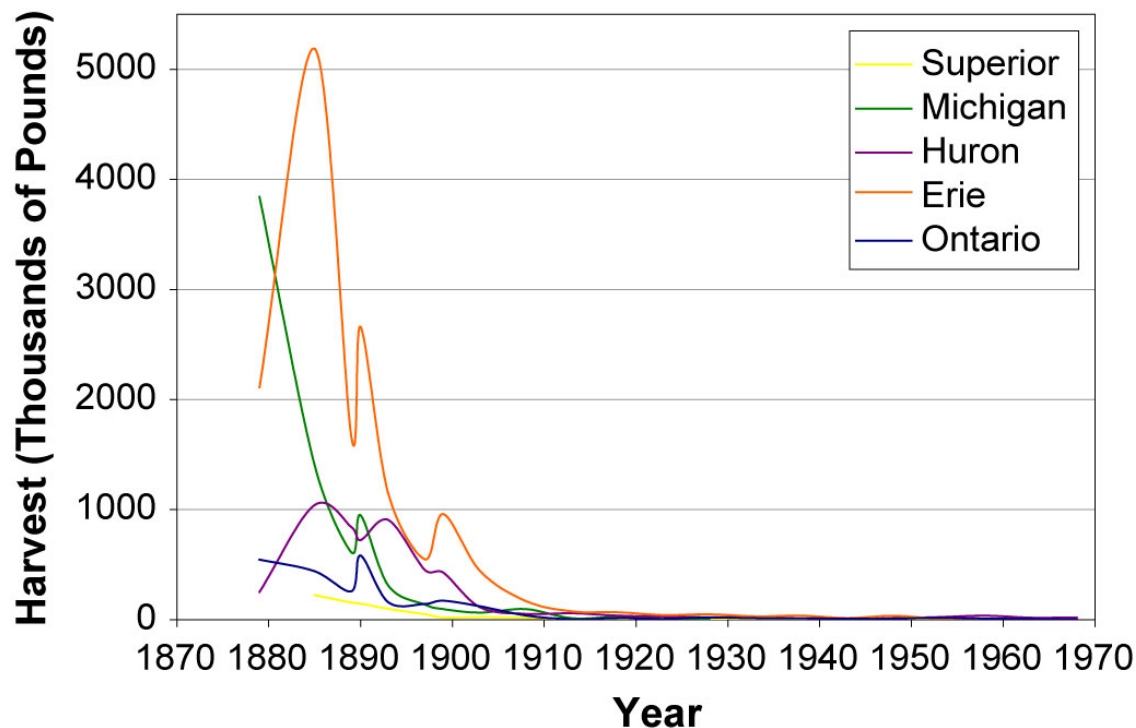


Figure 1. Historic lake sturgeon harvest from each of the Great Lakes.

Source: Baldwin *et al.* 1979

STATE OF THE GREAT LAKES 2012 - DRAFT

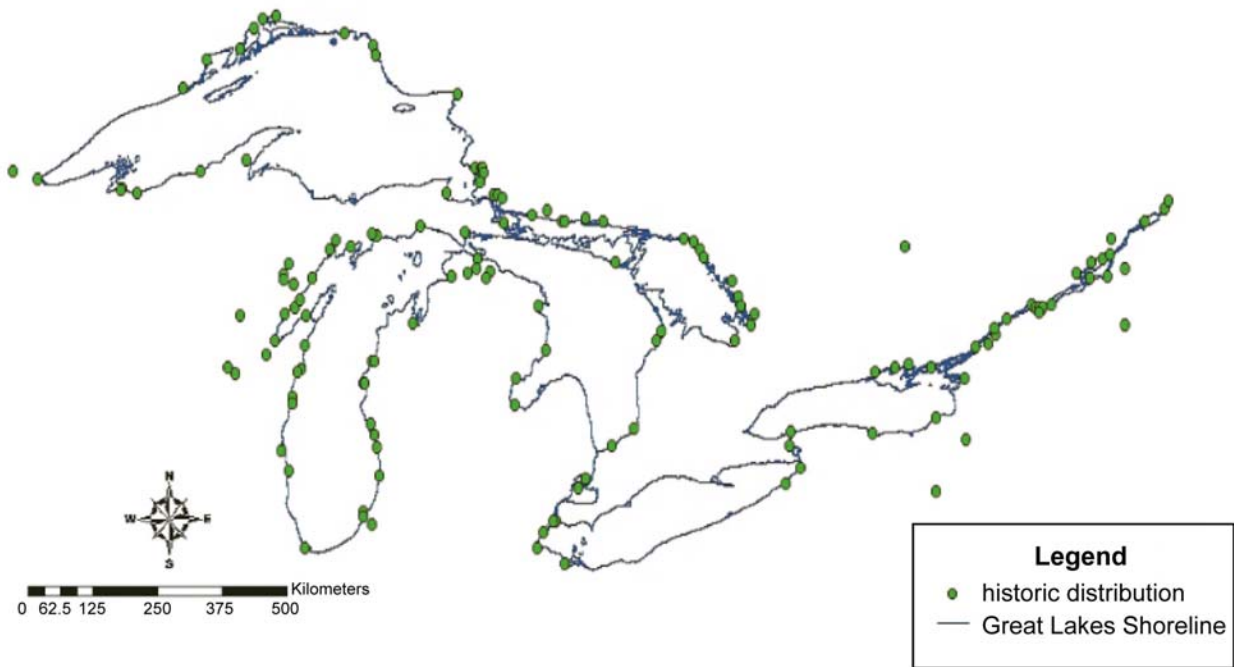


Figure 2. Historic distribution of lake sturgeon.
Source: Zollweg *et al.* 2003

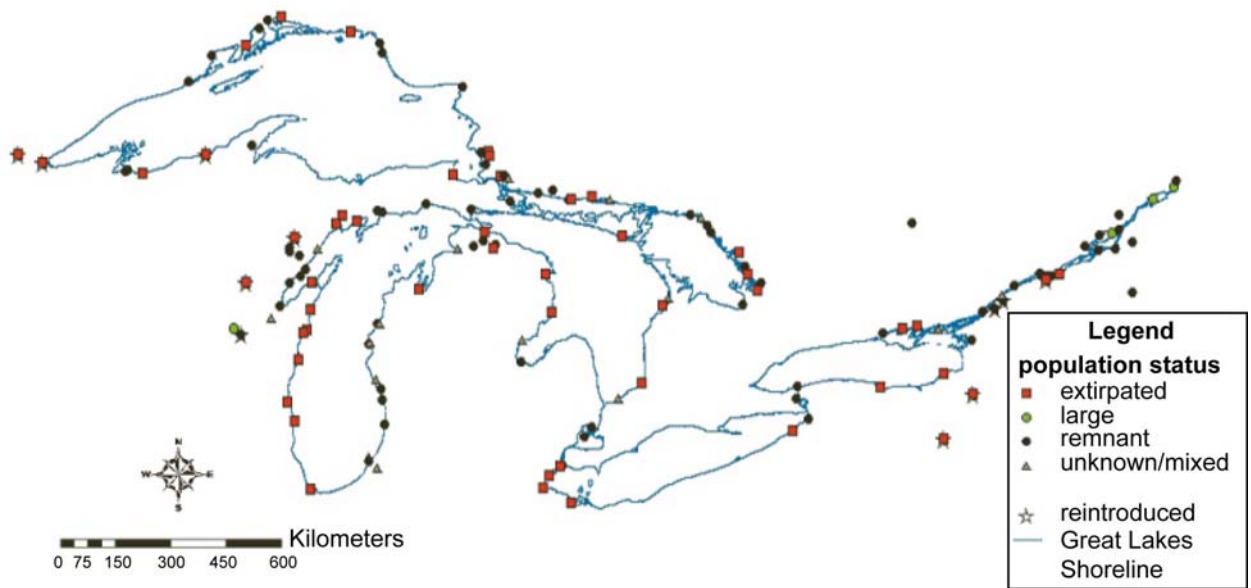


Figure 3. Current distribution of lake sturgeon.
Source: Zollweg *et al.* 2003