Sub-Indicator: Lake Sturgeon

Overall Assessment

Status: Poor

Trends:

10-Year Trend (2014-2023): Improving

Long-term Trend (1983-2023): Undetermined

Rationale: There are remnant populations of Lake Sturgeon in each of the Great Lakes basins, 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 several areas. The trend for the overall and lake-by-lake assessments are Improving over the last ten years based on increased observations, stocking, and habitat restoration efforts, however the number of self-sustaining populations remains Poor compared to historical estimates. In many areas, habitat restoration is needed to attain full or significant recovery because spawning and rearing habitat has been destroyed or altered, or access has been blocked. The long-term trend is assessed as Undetermined due to a lack of comprehensive data over the long-term time period.

Lake-by-Lake Assessment

Lake Superior

Status: Poor

10-Year Trend (2014-2023): Improving

Long-term Trend (1983-2023): Improving

Rationale: Lake Sturgeon populations in Lake Superior are self-sustaining in three of 19 historic spawning tributaries. The three tributaries are the Goulais River, Canada, and Bad, and Sturgeon rivers, United States. Spawning and natural reproduction has been confirmed in eight additional tributaries and in several tributaries to Lake Nipigon. The eight tributaries to Lake Superior are the Kaministiquia, Black Sturgeon, Nipigon, Pic, White, Michipicoten, and Batchawana, rivers in Canada and St. Louis River, United States. A standardized index survey to assess juvenile and sub-adult Lake Sturgeon is conducted on a 5-year cycle (2011, 2016, 2021) near the mouth of all 19 rivers in which Lake Sturgeon spawned historically. In 2021, 37% of locations surveyed (seven of 19) met or exceeded the target of 0.5 geometric mean catch per unit effort set by Lake Superior fishery agencies (Schloesser et al. 2024). That was the same percentage as 2011 and higher than 21% in 2016. The seven tributaries in 2021 were the Goulais, Batchawana, Michipicoten, Pic/White, Ontonagon, and Bad rivers. Juvenile abundance is increasing at the Pic/White and Goulais rivers through natural reproduction and at the Ontonagon River where stocking is on-going. Stocking initiated in 1983 has resulted in large increase in adult abundance in the St. Louis River, Minnesota/Wisconsin (Welsh et al. 2018, Estep et al. 2020) and successful spawning has been documented in most years since 2011 (Mutchler and Bogyo, 2023). However, there is little evidence of natural recruitment to the population based on lack of juvenile captures (Schloesser et al. 2024). Comprehensive data was not available to report a trend over the long-term time period.

Lake Michigan

Status: Poor

10-Year Trend (2014-2023): Improving

Long-term Trend (2005-2023): Undetermined

Rationale: Lake Sturgeon are present or have been reintroduced to 25 of the 33 historic spawning populations, however, only five populations are considered self-sustaining including: three segments of the Menominee River (below Hattie St. Dam, below Grand Rapids Dam, and below White Rapids Dam), Peshtigo River, and the Winnebago System which includes the Upper Fox River and Wolf River downstream of Shawano Dam. Evidence of spawning and wild recruitment has been documented in 13 of the 33 historic spawning populations. Stocking appears to be reestablishing populations associated with several rivers, and ongoing supplementation continues to enhance recruitment for two wild populations. Sturgeon from stocking efforts are just beginning to mature and some have been observed returning to target rivers during the spawning season. Access to spawning and rearing habitat has increased with removal of several dams on some rivers, creation of spawning habitat on others, and continued passage of sturgeon around the lower two dams on the Menominee River. Catch rates of both wild and stocked juvenile Lake Sturgeon have increased in assessment gill nets in several areas over the past 10 years suggesting increasing recruitment. Comprehensive data was not available to report a trend over the long-term time period.

Lake Huron (including St. Marys River)

Status: Poor

10-Year Trend (2014-2023): Improving

Long-term Trend (2000-2023): Undetermined

Rationale: Lake Sturgeon populations meet Lake Huron self-sustaining criteria in five of 33 historic spawning tributaries. These five tributaries are the St. Marys, Mississagi, Spanish, Nottawasaga, and upper St. Clair rivers. Wild populations of Lake Sturgeon spawn annually and recruitment can be detected in nine tributaries to Lake Huron. Stocks of mixed sizes are consistently captured in the North Channel, Georgian Bay, St. Marys River, southern Lake Huron and Saginaw Bay. Lake Sturgeon stocking is taking place in the Saginaw River watershed, a tributary to Lake Huron. Catch per unit effort of juvenile Lake Sturgeon is increasing in Saginaw Bay and the St. Marys River based on fishery independent surveys. Comprehensive data was not available to report a trend over the long-term time period.

Lake Erie (including St. Clair-Detroit River Ecosystem and Upper Niagara River)

Status: Poor

10-Year Trend (2014-2023): Improving

Long-term Trend (1990-2023): Undetermined

Rationale: Lake Sturgeon status remains Poor as only three self-sustaining populations have been identified in the St. Clair, Detroit, and upper Niagara rivers, out of the 15 Lake Erie historic spawning tributaries. Within the St Clair-Detroit River system, Lake Sturgeon populations appear to be stable. Although Lake Sturgeon spawn in the Upper Niagara River, juveniles have not been caught in assessment surveys. In Lake Erie fisheries and surveys, Lake Sturgeon are caught mainly in the west basin, with infrequent or rare catches in the central and east basins respectively. Maumee River stocking efforts since 2018 appear to be successful as many stocked fish have been

caught in west basin surveys. The Improving 10-year trend assessment is based on the presence of stocked Lake Sturgeon in fishery independent survey gear in the western basin, increased catch rates in the North Channel of the St. Clair River, and improved river connectivity resulting from dam removals.

Lake Ontario (including Lower Niagara River and International section of the St. Lawrence River)

Status: Poor

10-Year Trend (2014-2023): Improving

Long-term Trend (2000-2023): Undetermined

Rationale: Lake Sturgeon status remains Poor as only two self-sustaining populations have been identified in the Lower Niagara and Upper St. Lawrence Rivers, out of the 15 Lake Ontario historic spawning tributaries. Lake-wide incidental catches since 1995 and an increase in observed spawning behavior in once-extirpated systems indicate a gradual improvement in their status. Spawning has been observed in the lower Niagara River, Black River, Genesee River, Grasse River, St. Lawrence River, Oneida Lake, and Cayuga Lake. Whether the spawning is enough to be considered self-sustaining is Undetermined in all but the lower Niagara River and St. Lawrence River. Stocking to restore spawning adult populations in New York began in 1995 and was scheduled to cease in 2024 if six of the seven state populations met state-specific criteria. This goal was not met, so it was determined that New York will continue to stock hatchery raised yearlings into Lake Ontario tributaries for another two to five years to continue bolstering populations within the system. The Improving 10-year trend assessment is based on stocking programs and improved river connectivity. Comprehensive data was not available to report a status over the long-term time period.

Status Assessment Definitions

The status assessment is based on the number of historic Lake Sturgeon populations (Proceedings of the 2008 Great Lakes Lake Sturgeon Coordination Meeting) and updated frequently by Lake Sturgeon Working Groups within each lake. A self-sustaining population is defined as containing 750 sexually mature adults and successful spawning and recruitment occurs in most years. The figures are meant to describe the “status” of Lake Sturgeon in tributaries historically known to support populations with access to the Great Lakes. The status, names, and location of historical tributaries can be seen in Tables 1 – 5.

Note: The estimated number of historic Lake Sturgeon populations by lake was:

- Lake Superior: 19;
- Lake Michigan: 33;
- Lake Huron: 33;
- Lake Erie: 16; and
- Lake Ontario: 15

Good: Greater than 75% of all historic populations are self-sustaining.

Fair: Between 50-75% of all historic populations are self-sustaining.

Poor: Fewer than 50% of all historic populations are self-sustaining.

Undetermined: Data are not available or are insufficient to assess condition of the ecosystem components.

Trend Assessment Definitions

Improving: Number of self-sustaining populations of Lake Sturgeon has increased and/or model-generated estimates of abundance have increased and/or catch per unit effort of juvenile Lake Sturgeon from fishery independent surveys have increased.

Unchanging: Number of self-sustaining populations of Lake Sturgeon remains unchanged or model-generated estimates of abundance remain unchanged or catch per unit effort of juvenile Lake Sturgeon from fishery independent surveys remain unchanged.

No Trend: Data are available for a 10-year or longer period, however the metrics do not indicate a clear overall trend.

Deteriorating: Number of self-sustaining populations of Lake Sturgeon has decreased and/or model-generated estimates of abundance have decreased and/or catch per unit effort of juvenile Lake Sturgeon from fishery independent surveys have decreased.

Undetermined: A sufficient amount of data are not available to report on a trend.

Endpoints and/or Targets

Sufficient self-sustaining Lake Sturgeon populations which would allow state and provincial agencies to remove this species from threatened or endangered lists.

Sub-Indicator Purpose

The purpose of this sub-indicator is to measure status and trends in population abundance of key life stages, distribution, habitat utilization, and recruitment of Lake Sturgeon in the Great Lakes and their connecting waterways and tributaries. Lake Sturgeon are representative of healthy fish communities in major habitats of the Great Lakes and support valuable fisheries in the Great Lakes and reflect ecosystem health through their roles in the aquatic food web.

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 and provincial de-listings of classifications that derive from degraded or impaired populations (e.g., threatened, endangered or at-risk species).

This sub-indicator best supports work towards General Objective #5 of the 2012 Great Lakes Water Quality Agreement which states that the Waters of the Great Lakes should “support healthy and productive wetlands and other habitats to sustain resilient populations of native species.”

Methods

This sub-indicator consists of standardized scoring of lake-specific adult abundance, juvenile abundance (recruitment), and number of self-sustaining populations for Lake Sturgeon. Data availability (quantity and quality) may limit complete spatial coverage of each lake and may only reflect area ranges of Lake Sturgeon stocks in each

lake. Information from a specific area representing ideal habitats for Lake Sturgeon in that lake is considered appropriate for the purpose of this sub-indicator. The standard scoring of each fish species at each lake/location should be developed by fisheries experts in the inter-jurisdictional Lake Technical Committees of the Great Lakes Fishery Commission. The following hierarchy of data sources are used for calculating adult abundance and recruitment scores:

1. Number of Great Lakes self-sustaining Lake Sturgeon populations
2. Model-generated estimates of abundance for Lake Sturgeon under inter-jurisdictional fisheries management
3. Catch per unit effort of juvenile Lake Sturgeon from fishery-independent survey gears

Discussion

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 in each of the Great Lakes (Baldwin *et al*. 1979, Hay-Chmielewski and Whelan 1997, Haxton *et al.* 2014). 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. Sturgeon remain extirpated from many tributaries and waters where they once spawned and flourished (Figures 2-7). 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 waters of the Great Lakes.

Status of Lake Sturgeon

Wild Lake Sturgeon populations remain throughout the Great Lakes basin though most persist at a small fraction of their historical abundance. The number of self-sustaining populations is less than half of what was historically estimated in each of the Great Lakes. 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 (Figures 3-7) and a few of these populations are large in number (thousands of fish). 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

Three of 19 tributaries to Lake Superior where lake sturgeon historically spawned currently meet Great Lakes wide criteria for self-sustaining populations (Holey *et al.* 2000; Auer 2003; Pratt *et al.* 2016, ECCC and EPA 2022). Populations in the Bad River, Wisconsin, Sturgeon River, Michigan and Goulais River, Ontario meet criteria for self-sustaining populations (Hayes and Caroffino 2012, Pratt *et al.* 2016, Schloesser and Quinlan 2019; ECCC and EPA

2022, van der Lee et al. 2022). The Pic, White, Michipicoten, and Kaministiquia rivers in Ontario and St. Louis River in Minnesota/Wisconsin meet most rehabilitation criteria. Additional assessments are needed in Canadian rivers to adequately evaluate population status (Pratt *et al.* 2016).

The Lake Superior Fish Community Objective (FCO) for Lake Sturgeon uses indicators to measure progress toward self-sustaining populations. Those indicators are 1) 400 Lake Sturgeon in an annual spawning run and sex ratio around 4:1 or lower in a common tributary, and 2) 0.5 mean catch per unit effort (CPUE) of ages 4-8 in the Lake Sturgeon Index Survey. These FCO indicators are in line with criteria of the Lake Superior Rehabilitation Plan and State of the Great Lakes sub-indicator reporting to measure rehabilitation progress.

Extant populations with mature adults in spawning runs are found in 11 Lake Superior tributaries (Figure 3; Table 1). Lake Sturgeon in the Kaministiquia River, Ontario are considered year-round residents and in 2005 and 2006 genetic analysis of 769 larvae estimated the effective population size to be fewer than 100 breeders (Friday and Chase 2005, Welsh *et al.* 2015). In the Black Sturgeon River, Ontario mark-recapture analysis estimated approximately 90 spawners below the Camp 43 Dam in both 2003 and 2004 (Friday 2004). In the Nipigon River, Ontario, only 17 adult Lake Sturgeon were captured over three years of spring sampling between 2013 and 2015 and it is unknown if recruitment has occurred due to spawning in the river over the last decade (Barth *et al.* 2018; Lacho *et al.* 2021). In the Pic and White rivers, Ontario, 321 Lake Sturgeon were captured and 95 were tagged in a movement study that observed presumed spawners moving upriver to the first insuperable barrier (Ecclestone *et al.* 2020). Spawning was documented in the Michipicoten River in 2016, but the population is thought to be small (Lacho *et al.* 2021). There is no recent data from the Batchawana or Chippewa rivers, though the population is believed to be stable (Lacho *et al.* 2021). In the Goulais River, Ontario, juvenile CPUE has increased over time and an estimate of 440 adult females and 625 adult males was back-calculated from juvenile abundance estimates in Goulais Bay (van der Lee *et al.* 2022). In the St. Louis River, Minnesota/Wisconsin the catch of spawning run adults increased since 2006 to a high of 330 fish below the Fond du Lac Dam, Minnesota. The sex ratio remains highly skewed towards males but is improving each year as females mature and enter the spawning run. The Bad River, Wisconsin population size was estimated at 1,426 males and 882 females in 2017 and annual spawning run estimates indicated a stable to increasing population trajectory (Schloesser and Quinlan 2019). In the Ontonagon River, Michigan a few (<5) fish have been captured or observed upriver near suspected spawning areas, which represent some of the first documented adults returning to spawning grounds from stockings that started in 1998 (stocking continues to present day). In the Sturgeon River, Michigan spawning population size was estimated at 1,808 fish, and this population is the gamete source for stocking efforts in the Ontonagon River and Upper St. Louis River (Hayes and Caroffino 2012). Among all Lake Superior spawning tributaries, adult abundance is highly variable and ranges from extirpated to self-sustaining. There are no assessment activities on many spawning tributaries making it difficult to fully measure rehabilitation progress or population trends.

Juvenile Lake Sturgeon abundance (age 4-8) is measured through the Lake Sturgeon Index Survey for Lake Superior, which is conducted lake-wide on a five-year cycle (2011, 2016, and 2021) and annually at select locations (e.g. St. Louis River, Ontonagon River, Goulais River; Schloesser 2020). Mean CPUE over the three lakewide surveys exceeded the recruitment target of 0.5 juveniles/net at the Pic/White, Michipicoten, Batchawana/Chippewa, Goulais, Bad, and Ontonagon rivers. However, that threshold was derived using the same survey data we are evaluating here, so caution must be used if trying to determine rehabilitation progress. Catch rates of juvenile Lake Sturgeon were similar or higher in 2021 than 2011 and 2016 Index Surveys at most locations. Catch rates of juveniles in Goulais Bay were significantly higher than any other Lake Superior tributary. Juvenile abundance in Goulais Bay, Ontario was estimated at 4,977 (95% CI 3,295-7,517; Pratt *et al.* 2014). In general, catch rates of juvenile Lake Sturgeon in the lake-wide Index Surveys were unchanged over three sampling periods. In the St. Louis River, natural reproduction documented through larval drift was first documented in 2011 and has been detected in 8 of the past 11 years (Mutchler and Bogyo 2024).

Spawning runs are absent, very small (<25 individuals), or undocumented in at least eight Lake Superior tributaries. Lake Sturgeon abundance remains a small fraction of historical abundance. Haxton *et al.* (2014) used two methods to estimate historical Lake Superior adult abundance at 44,000 and 14,127 individuals, which they considered conservative. The 10-year trend and long-term trends are assessed as Improving based on the Goulais River population meeting self-sustaining criteria, increasing juvenile abundance in several rivers through natural reproduction and stocking, and evidence of increased adult abundance and consistent spawning success in the lower St. Louis River. Adult spawning assessments are needed on many tributaries to determine population and spawning run size and evaluate rehabilitation progress.

Lake Michigan

Currently, Lake Sturgeon have established populations or have been reintroduced in 25 out of the original 33 historic sturgeon populations (Figure 4, Table 2). Spawning and/or evidence of natural reproduction from collection of fry, age-0, or yearlings has been documented in 13 of these populations including: three segments of the Menominee River (1a, 1b, 1c; Table 2), Indian Lake, Manistee River, Muskegon River, Grand River, Kalamazoo River, Lower Fox River, Winnebago System, Wolf River upstream of Shawano Dam, Oconto River, and Peshtigo River (Schneeberger et al. 2005, Clapp et al. 2012, Hayes and Caroffino 2012, WDNR 2019). We also report on a recently established population - the Legend Lake Chain in Menominee County, WI. Continued monitoring and assessment has provided a growing collection of data on abundance, reproduction and recruitment for many of these Lake Michigan tributary populations (Caroffino et al. 2007, Harris et al. 2017, Lawrence et al. 2020, LRBOI 2020, Tucker et al. 2021, E. Baker, MDNR, unpublished data, J. Lorenz, Gun Lake Tribe, personal communication, C. Jerome, Little River Band of Ottawa Indians, personal communication). These efforts suggest abundance of spawning adults in several rivers has increased over the last two decades. Additionally, catch rates of wild juveniles in assessment gill nets in Lake Michigan has increased over the past 10 years (Broadway et al. 2019, Ben Turschak, MDNR, unpublished data). This and other genetic based mixed stock analysis suggest that increased recruitment for many populations has been occurring for several years (Scribner et al. 2022).

Lake Michigan partner agencies define a self-sustaining sturgeon population as one that contains ≥ 750 adults from 20 or more year classes spawning within a major tributary and evidence of recruitment. Population estimates are difficult to obtain so for many populations we rely on expert opinion. The estimates we do have vary widely between populations with several large, self-sustaining populations and many small populations with adult estimates in the 10's to 100's of adults. A large self-sustaining population exists in the Winnebago system which includes the Upper Fox River and Wolf River downstream of Shawano Dam (estimated adult abundance > 40,000 [WDNR 2023]). This population spawns in the Wolf and Upper Fox Rivers and supports an active but highly regulated winter recreational spear fishery. The Winnebago System sturgeon stock is disconnected from the Lake Michigan population by a series of nine dams and 17 locks on the Fox River. Out migration of sturgeon over these barriers occasionally occurs but upstream migration is completely blocked. The Menominee River has the next largest self-sustaining population with approximately 3,000-4,000 spawning adults and 4,000 subadults spread across four sections of the river (1a, 1b, 1c, 1d; Table 2; WDNR 2019). The sections downstream of Grand Rapids to Green Bay support a hook and line fishery. The Peshtigo River downstream of the first barrier at Peshtigo Dam supports an estimated population > 500 adults and is considered self-sustaining. The Legend Lake Chain has an estimated population of 1,000 adults and 1,000 subadults, but is not considered self-sustaining because it was created and maintained through stocking (Ryan Weise, Menominee Indian Tribe of Wisconsin, personal communication). Migration from this population to both the Upper Wolf River and Upper Oconto River is possible. The remaining sturgeon populations have relatively low numbers of mature adults: Cedar River (< 25), Manistique River (< 25), Indian Lake (60), Millecoquins River (< 25), Manistee River (150 - 400), Muskegon River (< 150), Grand River (~ 100), Kalamazoo River (> 100), St. Joseph River (< 25), Lower Fox River (~ 300 [100-500]), Wolf River – upstream of Shawano Dam (25-50), Oconto River (> 100; Baker 2006, Elliott and Gunderman 2008, Hayes

and Caroffino 2012, Harris et al. 2017, WDNR 2019, Partridge 2021, Tucker et al. 2021, Corey Jerome, Little River Band of Ottawa Indians, personal communication, Jason Lorenz, Gun Lake Tribe, personal communication). Population sizes are unknown for the Whitefish, Sturgeon, Boardman, Manitowoc, and Kewaunee rivers. Detections of spawning adults by PIT antennas in the Milwaukee River indicate > 60 adults have entered the river during spring spawning periods in recent years, but model estimates from Bruch et al. (2021) suggest the true population size including Milwaukee Harbor and nearshore waters could be as high as 889 adults with > 8,000 subadults. Due to the large number of fish stocked into this system over the last 20 years and assumed high survival rates, significant numbers of fish will be maturing each year from now on, adding to the overall spawning population.

One of the bright spots that has emerged over the last decade has been the proliferation of habitat improvement work, dam removals, and environmental cleanups in the basin that directly benefit sturgeon. Habitat evaluations have been conducted in many of Lake Michigan's sturgeon tributaries (Daugherty et al. 2008) and have guided restoration efforts. Starting in 2015 a fish lift went into operation at the Hattie Street Dam, the first barrier on the Menominee River, with the goal of collecting and passing spawning adults upstream so they can access high-quality spawning and nursery habitat downstream of Grand Rapids Dam. The annual target for the fish lift is to pass 200 spawning adults upstream. Since its inception over 1,000 fish have been passed upstream to spawn (Darren Kramer, Michigan DNR, unpublished data). Early evidence from an on-going UW-Green Bay movement study suggests some age-0 fish are able to migrate downstream from the Grand Rapids section and out into Green Bay past the lowermost two dams on the river (Steve Hughes, University of Wisconsin-Green Bay, unpublished data). On the Milwaukee River, multiple fish passage projects (i.e., dam removals, construction of nature-like fishways) have opened up over 30 miles for upstream passage from Lake Michigan to high-quality spawning habitat (A. Schiller, WDNR, personal communication). The final nature-like fishway will be completed at Estabrook Falls in Milwaukee during 2025 – from that point onwards sturgeon should be able to move freely between Lake Michigan and their upstream spawning sites during most flow conditions. The only major dam on the Root River, the Horlick Dam in Racine, WI, is set to be removed in 2025 and the resulting rapids/riffle habitat that will be constructed in its place will offer potential spawning habitat for lithophilic spawners including sturgeon. In the Lower Fox River downstream of De Pere Dam, a spawning reef is being designed to provide high-quality spawning habitat for sturgeon that is less vulnerable to water level changes and resulting desiccation from seiches and hydropower operations that likely hinder natural recruitment (Tucker et al. 2021). On the Boardman River the first upstream barrier (i.e., Union Street Dam) is being removed and replaced with a fish passage-friendly structure that will allow upstream passage of native species. This project builds on three previous dam removals from 2012-2018 (Brown Bridge, Boardman, and Sabin dams) and collectively these projects will open up > 160 miles of fish passage in the Boardman watershed. The Kalamazoo River has been the focus of significant restoration activities recently with six dams slated for removal or already gone (i.e., Otsego Township Dam, Plainwell Dam, Trowbridge Dam, Plainwell #2 Dam, Otsego City Dam, and Allegan City Dam). The Allegan City Dam is the first barrier upstream on the river so its likely removal along with the other dam removals will reconnect 50 miles of the mainstem Kalamazoo River. A major project is now underway on the Grand River in Grand Rapids, MI with the goal of restoring the namesake rapids that gave the city its name. This project will involve removal of four low head dams and demolition of the larger Sixth Street Dam. In the process of removing the dams the underlying rapids and riffles will be exposed and additional rock will be brought in to provide resting habitat and spawning habitat. This project was designed with sturgeon as a primary beneficiary.

Many tributaries that sturgeon historically used were developed for industry and heavily polluted. In the last couple decades environmental cleanups whether through the Natural Resource Damage Assessment and Restoration (NRDAR) or the Environmental Protection Agency's Area of Concern (AOC) program have resulted in historic levels of environmental cleanup, many of which are still under way, all of which will benefit sturgeon. The White Lake

AOC was delisted in 2014 and Lower Menominee AOC was delisted in 2020. The following AOC's have completed all management actions necessary for them to be delisted: Manistique River, Muskegon Lake, and Sheboygan River. Extensive habitat improvement work is ongoing in the Lower Fox River and Green Bay AOC following the NRDAR-mandated polychlorinated biphenyl (PCB) sediment cleanup that was completed in 2022. Sediment cleanup is now underway throughout the Milwaukee Estuary AOC and work continues in the Kalamazoo River AOC.

One area of continued management focus is minimizing mortality of age-0 sturgeon associated with sea lamprey treatments in high alkalinity rivers like the Muskegon and Manistee Rivers. Mortalities in these two rivers have been documented since 2013 and suggest that recruitment may have been reduced in these rivers during treatment years for decades (Smith 2014, LRBOI 2016, Pratt et al. 2020, LRBOI 2020). Mitigation measures including the capture and removal of juvenile sturgeon from these rivers during treatment periods have been implemented by a partnership of Tribal, State and Federal agencies since 2016.

The coordinated use of streamside facilities to culture sturgeon for reintroduction and supplementation stocking is an important component of Lake Sturgeon restoration in Lake Michigan. Since 2006, a multitude of partners including Michigan Department of Natural Resources (DNR), Wisconsin DNR (WDNR), U.S. Fish and Wildlife Service, Little River Band of Ottawa Indians, Gun Lake Tribe, Grand Traverse Band of Ottawa and Chippewa Indians, University of Wisconsin-Green Bay, Riveredge Nature Center, and other volunteer groups, have coordinated in the use of streamside facilities to rear and stock over 54,000 4-6 month old fingerling sturgeon into nine rivers (Milwaukee, Manitowoc, Kewaunee, Cedar, Whitefish, Manistee, Menominee, Boardman, and Kalamazoo; Eggold et al. 2012). Currently, there are streamside facilities operating on the Milwaukee, Kewaunee, Cedar, Menominee, Manistee, Boardman, and Kalamazoo rivers. Methods follow the 2010 genetic guidelines for the stocking of Lake Sturgeon in the Great Lakes basin (Welsh et al. 2010) which include using appropriate donor sources, rearing fish in natal river water to facilitate imprinting, and maximizing genetic diversity. Multiple year classes of stocked juveniles have been captured in assessment gillnets fished in adjacent Lake Michigan waters and catch rates have increased since stocking began (Troy Zorn, Michigan DNR, unpublished data; Tom Burzinski, Wisconsin DNR, unpublished data). Some of the earliest stocked fish are beginning to mature and have been observed returning to target rivers during the spawning season (A. Schiller, WDNR, personal communication, LRBOI 2020). The intent is to continue these stocking efforts for at least 20 years to establish founding populations of at least 750 mature adults in each river.

Stocking by WDNR from non-streamside rearing facilities (i.e., traditional hatcheries) has taken place in five rivers and two lake systems (Menominee, Milwaukee, Manitowoc, Upper Fox/Lake Winnebago system, Lower Fox, Wolf, and Legend Lake Chain; WDNR 2024). Stocking by WDNR occurred in the Menominee River below Sturgeon Falls from 1982-2017 (>114,000 fall age-0 and > 8,000 yearlings). In the Milwaukee River approximately 64,000 fry, > 3,000 fall age-0, and 400 yearlings were stocked during 2003-2006, prior to establishment of the streamside rearing facility. In the Manitowoc River approximately 120,000 fry, 1,000 fall age-0, and 199 yearlings were stocked during 2003-2006 prior to the short-lived operation of the Manitowoc River streamside rearing facility. The Upper Fox and several of its tributaries in the Lake Winnebago system have received approximately 37,000 fall age-0 and > 3,600 yearlings, most of this stocking occurred during 2002-2022. Recently, stocking began in the lower Fox River downstream of De Pere Dam (the lowermost barrier on the Fox) with 3,518 fall age-0 stocked during 2021-2022. In the Wolf River upstream of Shawano/Balsam Row dams > 700 fall age-0 were stocked from 2011-2022. Wisconsin DNR also traps and transports approximately 100 spawning adults annually from the Lower Wolf River upstream to Keshena Falls area as part of a memorandum of understanding with the Menominee Tribe. The Legend Lake Chain in Menominee County consists of multiple basins, two drain to the Wolf River and 6 drain to the upper Oconto River; from 2002-2010 this system was stocked with 3,200 age-0 and ~ 4,600 yearlings and supports a fishery with an annual harvest quota of 100 fish.

Sturgeon populations in Lake Michigan continue to sustain themselves at a small fraction of their historical abundance and just the Winnebago, Menominee, and Peshtigo River populations are currently abundant enough to be considered healthy and secure. An optimistic estimate of the lake-wide adult abundance is < 10,000 adult fish, well below 1% of the most conservative estimates of historic abundance (Hay-Chmielewski and Whelan 1997, Haxton et al. 2014). In all waters of the basin (including upstream of first barriers) there are approximately 50,000 adults. Right now these estimates do not account for most fish stocked by the streamside rearing facilities or other hatcheries because the majority of these fish are subadults and population estimates aren't available for many systems. The Improving 10-year trend assessment is based on increased abundance and recruitment (based on expert opinion), stocking, and improved river connectivity. Comprehensive data was not available to report a status over the long-term time period.

Lake Huron

Lake Sturgeon populations meet Lake Huron self-sustaining criteria in five of 33 historic spawning tributaries. These five tributaries are the St. Marys, Mississagi, Spanish, Nottawasaga, and upper St. Clair rivers. Additionally, Lake Sturgeon spawning has been identified in the Garden, Moon, Musquash, and Severn rivers, however additional information is needed to determine self-sustaining status (Figure 5; Table 3). During the spring of 2019, eggs and larvae were collected in the Moon and Musquash rivers corroborating continued use of these rivers by spawning Lake Sturgeon (L. O'Connor, DFO, personal communication). Between 2016 – 2018, 875 larvae were collected in the Garden River during assessments conducted by the Garden River First Nations and Anishinabek/Ontario Fisheries Resource Centre (Lake Huron Lake Sturgeon Working Group Report, 2018). Since the last reporting period, Lake Sturgeon spawning was documented in the Severn River by the Shawanaga First Nation and Georgian Bay Biosphere when eggs and larvae were collected in the spring of 2021 (Katrina Krievins, Georgian Bay Biosphere, personal communication). Lake Sturgeon eggs and larvae were collected in the St. Marys River during the summer of 2018 and 2019 and multiple age-classes of juvenile sturgeon are captured during fish community surveys (Roseman et al. 2020; O'Connor et al. *in review*). The spawning population in the upper St. Clair River near southern Lake Huron contains one of the largest populations of Lake Sturgeon in the Great Lakes with a stock size of 20,184 (95% CI = 12,533 – 27,816; Chiotti et al. 2023). The population growth rate for the southern Lake Huron population was estimated at 1.16 (95% CI = 0.80 – 1.51) suggesting a stable population. The population size of Lake Sturgeon in the St. Marys River was last estimated in 2007 at 505 (95% CI = 388 – 692; Bauman *et al.* 2011). In 2019, a mark-recapture assessment was initiated in the St. Marys River as a result of increased capture of juvenile Lake Sturgeon in both a 2017 fish community survey and in Michigan DNR creel (N. Godby, MDNR, personal communication; O'Connor *et al.* 2019). Since 2019, over 200 Lake Sturgeon have been tagged, with 108 juveniles (< 1000 mm total length) captured during surveys in 2023. Spawning surveys in the Mississagi and Nottawasaga Rivers have consistently captured hundreds of Lake Sturgeon while over 50 fish are commonly captured during surveys in the Spanish River.

Lake Sturgeon stocking began in the Saginaw River watershed in the fall of 2017. A total of 5,976 fall fingerlings have been stocked into the Cass, Flint, Shiawassee, and Tittabawassee rivers. In a fishery independent survey conducted by the Michigan Department of Natural Resources in Saginaw Bay, juvenile Lake Sturgeon were captured in 2021 and 2022, the first since the survey began in 1989 (Fielder and Briggs, *in press*). Angler reports of juvenile Lake Sturgeon have also increased in the Saginaw River and Bay in recent years. Reconnecting habitat in the Saginaw River watershed continues to be a priority with the Hamilton Dam (Flint River) and Dow Dam (Tittabawassee River) slated for removal in upcoming years, both are first barriers to upstream fish migration.

Stocks of Lake Sturgeon in Lake Huron are monitored by various resource management agencies along with the volunteer efforts of commercial fishers. To date the combined efforts of researchers in U.S. and Canadian waters have resulted in thousands of Lake Sturgeon tagged in Saginaw Bay, southern Lake Huron, St. Mary's River,

Georgian Bay and the North Channel, with stocks of relatively 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. There is currently no commercial or recreational harvest of Lake Sturgeon in Lake Huron. Regulation of subsistence harvest in Lake Huron varies by agency and is largely unknown.

Acoustic telemetry continues to be an important tool to assess Lake Sturgeon survival, habitat use, and movement patterns in Lake Huron. In an effort to understand the migration patterns of Lake Sturgeon in the St. Clair – Detroit River System, nearly 300 adult Lake Sturgeon have been implanted with acoustic transmitters. Utilizing the Great Lakes Acoustic Telemetry Observation System (GLATOS) over 25 million detections have been documented since 2011, providing valuable information regarding the movements of adult Lake Sturgeon into Lake Huron (Hondorp *et al.* 2017; Kessel *et al.* 2018; Colborne *et al.* 2019). In the Saginaw River watershed, 320 fall fingerling Lake Sturgeon have been implanted with acoustic transmitters to assess survival, habitat use, and movement patterns. This information will be used to evaluate dispersal patterns, predation, and physical habitat that may influence stocking success and long-term population goals. Since 2021, a total of 83 adult and juvenile Lake Sturgeon have received acoustic transmitters in the St. Marys River in a collaborate effort between Tribal/First Nations, State, and Federal agencies to assess movement patterns, habitat use, and survival (Kevin Kapuscinski, Lake Superior State University, personal communication). To address potential impacts resulting from a proposed pumped hydro storage project, the Saugeen Ojibway Nation has tagged 31 adult and juvenile Lake Sturgeon in the Nottawasaga River and Bay since 2022 and plan to continue tagging into the future (Kathleen Ryan, Saugeen Ojibway Nation and Ryan Lauzon, Chippewas of Nawash Unceded First Nation, personal communication). An additional 26 Lake Sturgeon have been tagged in the Mississagi River through a collaborative project between Mississauga First Nation, Ontario Ministry of Natural Resources, and Mount Allison University.

The Lake Sturgeon population in Lake Huron continues to be well below estimated historical levels (Hay-Chmielewski and Whelan 1997, Haxton *et al.* 2014). Only two self-sustaining populations exist in Michigan waters of Lake Huron (St. Marys and St. Clair Rivers), while five (St. Marys, southern Lake Huron (upper St. Clair), Spanish, Mississagi, and Nottawasaga rivers) exist in Canadian waters. The Improving 10-year trend assessment is based on an increase in catch per unit effort of juvenile Lake Sturgeon from fishery independent survey gear in the St. Marys River and Saginaw Bay, evidence of natural recruitment documented in an additional tributary (Severn River), and improved river connectivity. Comprehensive data was not available to report a status over the long-term time period. Barriers and habitat degradation in Michigan's and Ontario's tributaries to Lake Huron continue to be a major impediment to successful rehabilitation in Lake Huron.

Lake Erie (including St. Clair River, Lake St. Clair, Detroit River and Upper Niagara River)

Spawning has been identified at eight locations in the connecting waters between Lakes Huron and Erie (Figure 6; Table 4; Caswell *et al.* 2004; Manny and Kennedy 2002; Fischer *et al.* 2018) and was also detected in Buffalo Harbor during the spring of 2017 (Neuenhoff *et al*. 2018). The St. Clair – Detroit River System contains the largest population of Lake Sturgeon with unimpeded access to the Great Lakes with stock sizes of 20,184 (95% CI = 12,533 – 27,816) in the upper St. Clair River/southern Lake Huron, 6,523 (95% CI = 5,720 – 7,327) in the lower St. Clair River, and 6,416 (95% CI = 4,065 – 8,767) in the Detroit River. The geometric mean population growth rate for all stocks exhibit stable populations and range from 1.00 – 1.16 (Chiotti et al. 2023). The population size of adult Lake Sturgeon in the upper Niagara River between 2012 – 2018 was estimated at 889 (95% CI = 611 – 1,352; Withers *et al.* 2019).

Recreational angling for Lake Sturgeon continues within Michigan waters of Lake St. Clair and the St. Clair River. While angling effort has increased over time, there has been no detectable population-level effect on Lake Sturgeon in the system (Briggs et al. 2020). In other jurisdictions where fisheries of Lake Erie and the St. Clair –

Detroit River System are managed, fishing for and possessing Lake Sturgeon is prohibited. Incidental catch and release of Lake Sturgeon are estimated or reported by recreational and commercial fisheries. The North Channel of the St. Clair River, Detroit River (East of Fighting Island), and the western basin near the Detroit River mouth have been identified as nursery areas indicated by consistent catches of juvenile sturgeon in survey fishing gear (Mettler et al. 2022). In an effort to understand the migration patterns of Lake Sturgeon in the St. Clair – Detroit River System, nearly 300 adult Lake Sturgeon have been implanted with acoustic transmitters. Utilizing the Great Lakes Acoustic Telemetry Observation System (GLATOS) over 25 million detections have been documented since 2011, describing detailed movements of Lake Sturgeon (Hondorp *et al.* 2017; Kessel *et al.* 2018; Colborne *et al.* 2019). Telemetry data suggests the presence of two semi-independent populations, with resident individuals using either the Detroit River or the St. Clair River and migratory individuals accessing adjacent waters of Lake St Clair, Lake Erie and Lake Huron (Kessel et al. 2018, Colborne et al. 2019). Telemetry research in the Detroit River-St Clair system also described the effects that river channelization may have had on Lake Sturgeon movement and mortality related to ship strikes (Hondorp et al. 2017).

Lake Sturgeon stocking began in the Maumee River, OH during the fall of 2018. A total of 14,016 fall fingerlings have been stocked. Commercial fishermen in Ohio and fishery-independent surveys have recaptured 31 stocked fish based on PIT tag information. Juvenile Lake Sturgeon acoustic telemetry studies are taking place in the western basin and in the Maumee River to evaluate survival and movement. Annual survival estimates have ranged from 19-69% based on three cohorts of stocked fish into the Maumee River, with a high proportion detected on acoustic receivers in Ohio waters along the southern shore (J. McKenna, USFWS, personal communication).

In 2017, Lake Sturgeon eggs were collected from Bird Island Reef, at the headwaters of Niagara River using egg mats set near areas where mature Lake Sturgeon were caught previously during spring (Neuenhoff et al. 2018). Additional Lake Sturgeon spawning habitat may be detected using sidescan sonar imagery for a roughly seven square mile (18 square kilometers) section of Buffalo Harbor in order to develop a categorical spawning habitat map. August surveys (electrofishing and gill netting) in the Upper Niagara River in 2019 and 2022 did not catch any Lake Sturgeon (MNRF 2020, 2024). However, the upper Niagara River remains a suspected nursery area based on reports from anglers and divers (C. Legard NYSDEC, personal communication). More thorough assessment in the upper Niagara River may be needed to confirm these reports. Between 2014-2018, 59 adult Lake Sturgeon were implanted with acoustic transmitters at Buffalo Harbor. While some tagged Lake Sturgeon demonstrated large-scale movements that included traveling into western Lake Erie, the majority of individuals spent their time in the eastern basin (Withers et al. 2021).

Fishery independent surveys in Lake Erie catch Lake Sturgeon infrequently with the highest catch rates occurring in the west basin. Although precision of the Lake Sturgeon index was low in Ontario's fall west basin Partnership gill net survey, the current decade (2014-2023) mean (0.10 Lake Sturgeon/gang) of annual catch rates exceeded mean catch rates of the previous two decades (2004-2013: 0.06 Lake Sturgeon/gang, 1994-2003: 0.03 Lake Sturgeon/gang). Similarly, the 2014-2023 decade mean catch rate (0.05 Lake Sturgeon / ha) in the west basin interagency trawl survey exceeded means of the previous two decades (2004-2013: 0.02 Lake Sturgeon/ha, 1994-2003: 0.03 Lake Sturgeon/ha). In the central and eastern basin of Lake Erie including Long Point Bay, detection of Lake Sturgeon is uncommon with occasional catches of sub-adult or adult Lake Sturgeon in commercial and research fishing nets.

The number of Lake Sturgeon populations in Lake Erie and connecting waters remains well below historical levels due mainly to past fishing practices, river barriers and other habitat impacts. Self-sustaining populations are found in three (St. Clair, Detroit, and upper Niagara Rivers) of 15 historic tributaries in Lake Erie. Research continues to identify rivers with suitable habitat for reintroduction efforts, describe habitat requirements, migration patterns and address impediments to rehabilitation. The Improving 10-year trend assessment is based on the presence of

stocked Lake Sturgeon in fishery independent survey gear in the western basin, increased catch rates in the North Channel of the St. Clair River, and improved river connectivity resulting from dam removals. Although a gradual improvement in Lake Sturgeon status was evident over three decades of fishery independent assessment in western Lake Erie, low precision of Lake Sturgeon assessment renders this trend inconclusive.

Lake Ontario (including Lower Niagara and Upper St. Lawrence River)

The size of adult spawning populations of Lake Sturgeon are not well quantified for most of the spawning areas surrounding Lake Ontario; however, data is available to assess Lake Sturgeon status (Figure 7; Table 5). Current mark-recapture population estimates of 6,500 (95% confidence interval of 6,000 to 7,000) mature and immature fish have been reported for the lower Niagara River (Beisinger *et al.* 2014). Also, numbers of Lake Sturgeon counted at or near the two artificial spawning beds constructed in the vicinity of Iroquois Dam in the upper St. Lawrence River ranged between 122 and 395 at the peak of spawning activity during 2008-2012 (NYSDEC 2013). Spawning populations also exist at Black River, NY (Klindt and Gordon 2014) however, populations are small – likely in the 10s to 100s of fish.

Several actions have been taken to promote sturgeon recovery. Commercial harvest of sturgeon in Lake Ontario and upper St. Lawrence River was banned in 1976 in New York and in 1984 in Ontario. In addition, all recreational fishing has been closed since 1979. During the past two decades, artificial spawning shoals for Lake Sturgeon have been created in the upper St. Lawrence River and their success has been evaluated showing egg deposition and emergence of larvae (NYSDEC 2013). The removal of the Hogansburg hydroelectric dam on the St. Regis River has opened up over 30 kilometers of potential habitat and released the population trapped above the impoundment (McKenna *et al.* 2015). Adult Lake Sturgeon habitat use and spawning behavior in the St. Regis River is being evaluated by the Saint Regis Mohawk Tribe environment division with the use of acoustic telemetry.

Between 1993 and 2022, New York State Department of Environmental Conservation in collaboration with U.S. Fish and Wildlife Service, have stocked approximately 330,000 (averaging 15,101 fish per year) Lake Sturgeon into the Lake Ontario system. Gametes for these efforts were collected in St. Lawrence River (below Moses-Saunders power dam since 1996). Stocking locations extend from the Genesee River east to Lake St. Francis tributaries. Research on sturgeon stocked in the lower Genesee River documented high level of survival and good growth suggesting these types of habitats are highly suitable for sturgeon and also that stocking has the potential to increase sturgeon abundance substantially (Dittman and Zollweg 2006). It is expected that spawning populations based on stocked fish will develop in the Genesee River, as well as the Oswego River (Chalupnicki *et al.* 2011). In the last few years, both male and female spawning adults were observed in the Genesee River, with few wild yearlings subsequently captured in the fall of 2022 and 2023. Cornell University researchers have captured wild produced fish from the 2011, 2012, and 2014 year classes in Oneida Lake (Jackson *et al.* 2017). Spawning is also suspected within Oneida/ Seneca/ Oswego River system at Fulton, Cayuga outlet, and Caughdenoy Dam. Spawning beds built in Montezuma National Wildlife Refuge attracted spawning adults in 2016.

Research will continue assessing the Lake Sturgeon spawning shoals for aggregations of adults, egg deposition, and fry emergence. Monitoring of sturgeon catches and population age structure via agency fish community assessment programs will provide an index of population status in, and recruitment to, Lake Ontario. Targeted surveys of sturgeon in the lower Niagara River are required to monitor this population. Efforts to stock sturgeon by agencies appear to be highly successful and monitoring of its effects should continue. Because sturgeon become sexually mature at an advanced age, a decade or more may be needed to observe responses to restoration efforts.

The Lake Sturgeon population in Lake Ontario/Upper St. Lawrence River continues to be well below historical levels. Self-sustaining populations are found in two (Lower Niagara and Upper St. Lawrence Rivers) of the estimated 15 tributaries with historic Lake Sturgeon populations in this system. The Improving 10-year trend

assessment is based on stocking programs and improved river connectivity. Comprehensive data was not available to report a status over the long-term time period.

Linkages

- Benthos – degradation of benthos and changes in the macroinvertebrate community likely affect Lake Sturgeon growth and habitat use.
- Aquatic Habitat Connectivity – loss of aquatic connectivity has contributed to the decline of Lake Sturgeon.
- Impact of Aquatic Invasive Species, Rate of Invasion of Aquatic Non-Native Species and Dreissenid Mussels – An additional concern for Lake Sturgeon in many of the Great Lakes is the ecosystem changes that have resulted from high densities of invasive species such as Dreissenid Mussels and round gobies and the presumed related exposure to Botulism Type E which has produced measurable die-offs of Lake Sturgeon in several years since 2001.
- Sea Lamprey – best management practices should be employed when controlling sea lamprey populations in tributaries where age-0 Lake Sturgeon may be present (O'Connor *et al.* 2017; Pratt *et al*. 2020). Sea lamprey wounding rates and potential impacts to juvenile and adult Lake Sturgeon should continue to be monitored (Dobiesz *et al.* 2018; Briggs *et al*. 2021).
- Surface Water Temperature and Precipitation Amounts – the effect of watershed impacts and changing physical conditions on available habitat for all life stages is a continued research need. Model predications suggest that the amount of Lake Sturgeon habitat will decrease in the future as water temperature approaches thermal tolerance values near 28 – 30°C (Lyons and Stewart 2014).

Citizen Science, Traditional Ecological Knowledge (TEK), and other Bodies of Knowledge

In Lake Huron, the Shawanaga First Nation and the Georgian Bay Biosphere are collaborating on a Lake Sturgeon monitoring and conservation initiative (C. Rouleau, Shawanaga First Nation, personal communication). The project revolves around the marriage of Western scientific monitoring techniques with a two-eyed approach to conservation (Almack et al. 2023). Monitoring is conducted at sites known to have current or historic Lake Sturgeon spawning activity. The aim of this monitoring is to identify areas along eastern Georgian Bay where Lake Sturgeon are currently spawning, as well as identify potential stressors in the habitat. This monitoring is run in conjunction with an initiative to gather TEK from First Nations communities on Eastern Georgian Bay. Project staff conduct interviews with Elders and Knowledge Keepers from these communities to discuss TEK of Lake Sturgeon. Sites for monitoring were selected in part due to their being noted as having high levels of Lake Sturgeon activity by interviewees. The objective of this work is to utilize TEK and scientific monitoring methods to assess the status of Lake Sturgeon in Eastern Georgian Bay, and work towards drafting a conservation plan for the population. Mississauga First Nation, Ontario Ministry of Natural Resources and Mount Allison University are also engaged in a partnership to improve knowledge of Lake Sturgeon in the Mississagi River using a combination of netting surveys, telemetry and TEK. The project began in 2023 and will combine these sources of information over two years of study.

Assessing Data Quality

Data Characteristics	Agree	Neutral or Unknown	Disagree	Not Applicable
Data are documented, validated, or quality-assured by a recognized agency or organization	X			
Data are from a known, reliable and respected generator of data and are traceable to original sources	X			
Geographic coverage and scale of data are appropriate to the Great Lakes Basin		X		
Data obtained from sources within the U.S. are comparable to those from Canada	X			
Uncertainty and variability in the data are documented and within acceptable limits for this sub-indicator report*	X			
Data used in assessment are openly available and accessible	No			

Notes on Accessing Data

Due to a numerous federal, state, non-governmental, and Tribal/First Nations collecting information on Lake Sturgeon around the Great Lakes, the accessibility of data varies based on agency specific policies.

Data Limitations

Monitoring of Lake Sturgeon populations is relatively costly, and requires coordination between federal, state, tribal, and provincial agencies. Stocking programs should last 20-25 years in order to ensure a sufficient level of genetic diversity in the donor population (Welsh *et al.* 2010). In order to obtain accurate measures of adult abundance, assessments need to take place over at least seven years (upper end of time interval between female spawning events) to ensure females or their progeny have the opportunity to be captured on subsequent surveys. Variations in spawning periodicity of Lake Sturgeon and the effect that river flow rates have on spawning could affect annual results and complicate interpretation of long-term trends. More monitoring is needed to determine the current status of Great Lakes Lake Sturgeon populations, particularly the juvenile life stage (age 0-15). Considerable research is required to continue to determine the habitat preferences and location of this age group of Lake Sturgeon.

Additional Information

Lake Sturgeon is identified as an important species in Great Lakes Fishery Commission's 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.

The “mesotrophic” cool-water fish community is associated with more productive waters in nearshore areas. Mesotrophic communities, along with oligotrophic and eutrophic communities are found to varying degrees in all five of the Great Lakes. Lake Erie contains mostly mesotrophic habitat. The iconic Lake Sturgeon is the longest lived and largest of all Great Lake fishes, and an indicator of the connectivity of tributaries. Being co-evolved with the rest of the fish community and the natural ecosystem of the Great Lakes, Lake Sturgeon and other native species represent the natural biodiversity of the lakes. They have been subjected to the full slate of environmental effects resulted from human disruption of the Great Lakes including habitat loss, nutrient pollution, and persistent toxic pollutants. While restoration efforts like stocking can complicate interpretation of their status, the successes of these species are indicative of progress toward the goals of the Great Lakes Water Quality Agreement (GLWQA).

Research and development is needed to determine ways to selectively pass Lake Sturgeon around man-made barriers on rivers while not passing undesirable species. In addition, there are significant, legal, logistical, and financial hurdles to overcome in order to restore degraded spawning and nursery habitats in connecting waterways and tributaries to the Great Lakes. More monitoring is needed to more accurately determine the current status of Great Lakes Lake Sturgeon populations, particularly the juvenile life stage.

As monitoring programs and techniques are refined, the ability to detect Lake Sturgeon has likely increased making it difficult to determine whether changes observed are a result of increasing populations or reflect more efficient monitoring. Integration and continuation of long-term standardized monitoring programs will help effectively assess the status of Lake Sturgeon stocks in each lake into the future.

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Source: New York Lake Sturgeon Working Group, and Tim Haxton, OMNRF.

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Table 1. Lake Sturgeon population status in Lake Superior, 2023. Source: Lake Superior Lake Sturgeon Working Group, Great Lakes Fishery Commission.

Map number	Population/River	Status
1	Pigeon River	Extirpated
2	Kaminsitiquia River	Extant
3	Wolf River	Extirpated
4	Black Sturgeon River	Extant
5	Nipigon River	Extant
6	Gravel River	Extirpated
7	Prairie River	Extirpated
8	Pic River	Extant
9	White River	Extant
10	Michipicoten River	Extant
11	Batchawana River	Extant
12	Chippewa River	Extirpated
13	Goulais River	Extant
14	Tahquamenon River	Extirpated
15	Sturgeon River	Extant
16	Ontonagon River	Extirpated-Reintroduced
17	Montreal River	Extirpated
18	Bad River	Extant
19a	St. Louis River - Lower	Extirpated-Reintroduced-Extant
19b	St. Louis River - Upper	Extirpated-Reintroduced

Table 2. Lake Sturgeon population status in Lake Michigan, 2023. Source: Lake Superior Lake Sturgeon Working Group, Great Lakes Fishery Commission.

Map number	Population/River	Status
1a	Menominee River (below Hattie St. dam)	Extant
1b	Menominee River (below Grand Rapids dam)	Extant
1c	Menominee River (below White Rapids dam)	Extant
1d	Menominee River (below Sturgeon Falls)	Extirpated-Reintroduced
2	Cedar River	Unknown-Reintroduced
3	Escanaba River	Unknown
4	Whitefish River	Extirpated-Reintroduced
5	Sturgeon River	Extant
6	Manistique River	Extant
7	Indian Lake	Extant
8	Millecoquins River	Unknown
9	Bear Creek	Unknown
10	Boardman River	Unknown-Reintroduced
11	Manistee River	Extant-Supplementation
12	Pere Marquette River	Unknown
13	Ludington Shoal	Unknown
14	White River	Unknown
15	Muskegon River	Extant
16	Grand River	Extant
17	Kalamazoo River	Extant-Supplementation
18	St. Joseph Shoal	Unknown
19	St. Joseph River	Extant
20	Chicago Reef complex	Extirpated
21	Root River	Extirpated
22	Milwaukee River	Extirpated-Reintroduced
23	Barr Creek	Extirpated
24	Sheboygan River	Extirpated
25	Manitowoc River	Extirpated-Reintroduced
26	East/West Twin Rivers	Extirpated
27	Kewaunee River	Extirpated-Reintroduced
28	Sturgeon Bay area shoals	Extirpated
29	Lower Fox River	Extant
30	Winnebago System	Extant
31	Wolf River – upstream of Shawano dam	Extirpated-Reintroduced
32	Oconto River	Extant
33	Peshtigo River	Extant

Table 3. Lake Sturgeon population status in Lake Huron, 2023. Source: Lake Huron Lake Sturgeon Working Group, Great Lakes Fishery Commission.

Map number	Population/River	Status
1	St. Marys River	Extant
2	Root River	Extirpated
3	Garden River	Extant
4	Echo River	Extant
5	Thessalon River	Extant
6a	Mississagi R (N. Channel)	Extant
6b	Mississagi River (river pop'n)	Extant
7	Blind River	Extirpated
8	Serpent River	Extirpated
9	Spanish River	Extant
10	French River	Extant
11	Key River	Unknown
12	Magnetawan River	Extant
13	Naiscoot River	Extant
14	Seguin River	Extant
15	Moon River	Extant
16	Go Home River	Extirpated
17	Musquash River	Extant
18	Severn River	Extant
19	Sturgeon River	Extirpated
20	Nottawasaga River	Extant
21	Manitou River	Unknown
22	Sauble River	Unknown
23	Saugeen River	Unknown
24	AuSable River	Extirpated
25a	Saginaw River	Extirpated-Reintroduced-Extant
25b	Tittabawassee River	Extirpated-Reintroduced
25c	Flint River	Extirpated-Reintroduced
25d	Shiawassee River	Extirpated-Reintroduced
25e	Cass River	Extirpated-Reintroduced
26	Rifle River	Unknown
27	Au Gres River	Unknown
28	AuSable River	Extant
29	Thunder Bay River	Extirpated
30	Ocqueoc River	Unknown
31a	Cheboygan River	Extant
31b	Black Lake	Extant-Supplementation
31c	Black River	Extant-Supplementation
31d	Mullett Lake	Extant-Supplementation
31e	Burt Lake	Extant-Supplementation
32	Carp River	Extant
33	Munuscong River	Extant

Table 4. Lake Sturgeon population status in Lake Erie, 2023. Source: Lake Erie Lake Sturgeon Working Group, Great Lakes Fishery Commission.

Map number	Population/River	Status
1	Upper Niagara River/Buffalo Harbor	Extant
2	Cattaraugus Creek	Extirpated
3	Walnut Creek, PA nearshore	Unknown
4	Conneaut, OH nearshore	Extirpated
5	Cuyahoga River	Extirpated
6	Sandusky River	Extirpated
7	Portage River	Unknown
8	Maumee River	Extirpated-Reintroduced
9	Raisin River	Extirpated
10	Huron River	Extirpated
11	Detroit River	Extant
12	Lower St. Clair River	Extant
13	Upper St. Clair River	Extant
14	Clear Creek	Unknown
15	Grand River, ON	Extirpated
16	Thames River, ON	Extirpated

Table 5. Lake Sturgeon population status in Lake Ontario, 2023. Source: Lake Ontario Lake Sturgeon Working Group, Great Lakes Fishery Commission.

Map number	Population/River	Status
1	Don River	Extirpated
2	Ganaraska River	Extirpated
3	Trent River	Extirpated
4	Salmon River	Extirpated
5	Napanee River	Extirpated
6	Amherst Island shoal	Unknown
7	Black River	Extant
8a	Oswego River	Extirpated-Reintroduced
8b	Oneida Lake	Extirpated-Reintroduced
9	Cayuga Lake	Extirpated-Reintroduced
10	Genesee River	Extirpated-Reintroduced
11	Lower Niagara River	Extant
12	St. Lawrence River – Thousand Islands	Extant
13	Oswegatchie River	Extant-Supplementation
14	Black Lake	Extant-Supplementation
15	St. Lawrence River – Lake St. Lawrence	Extant

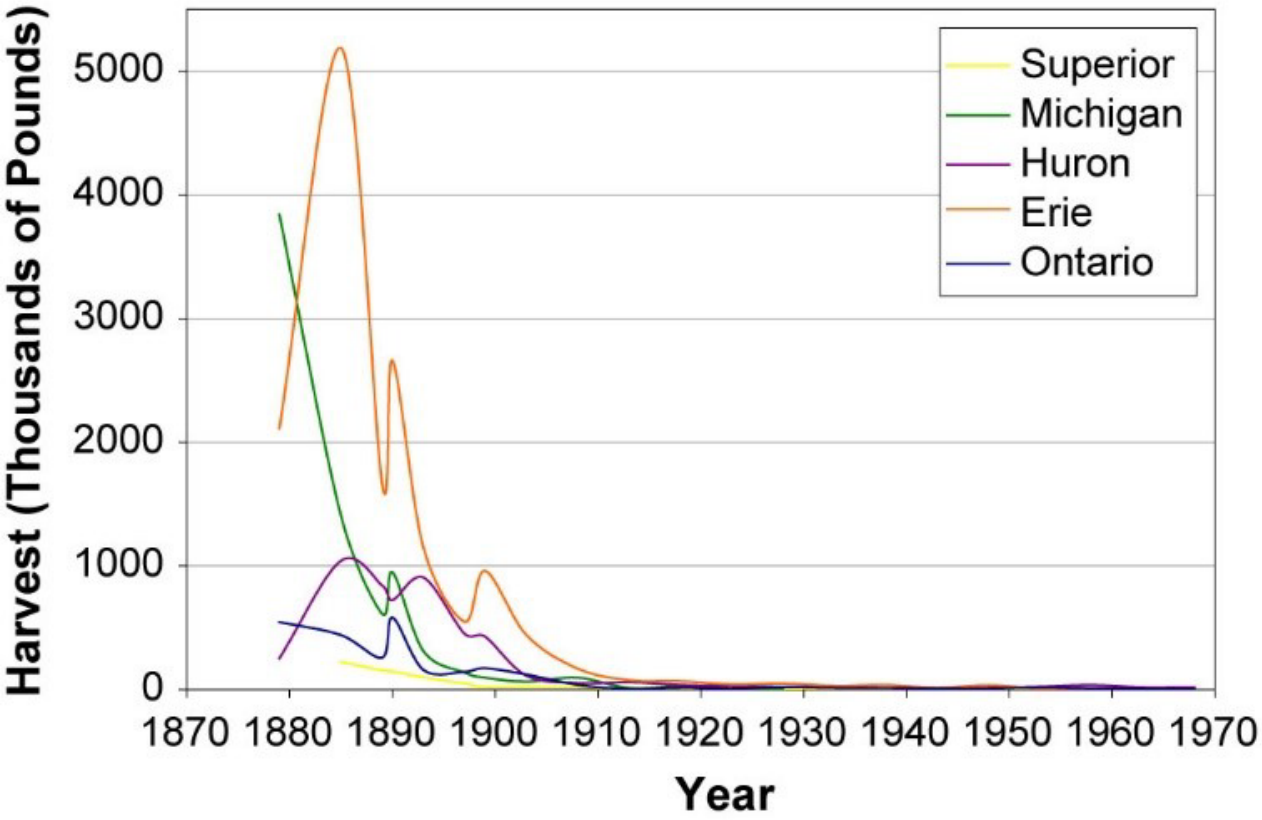
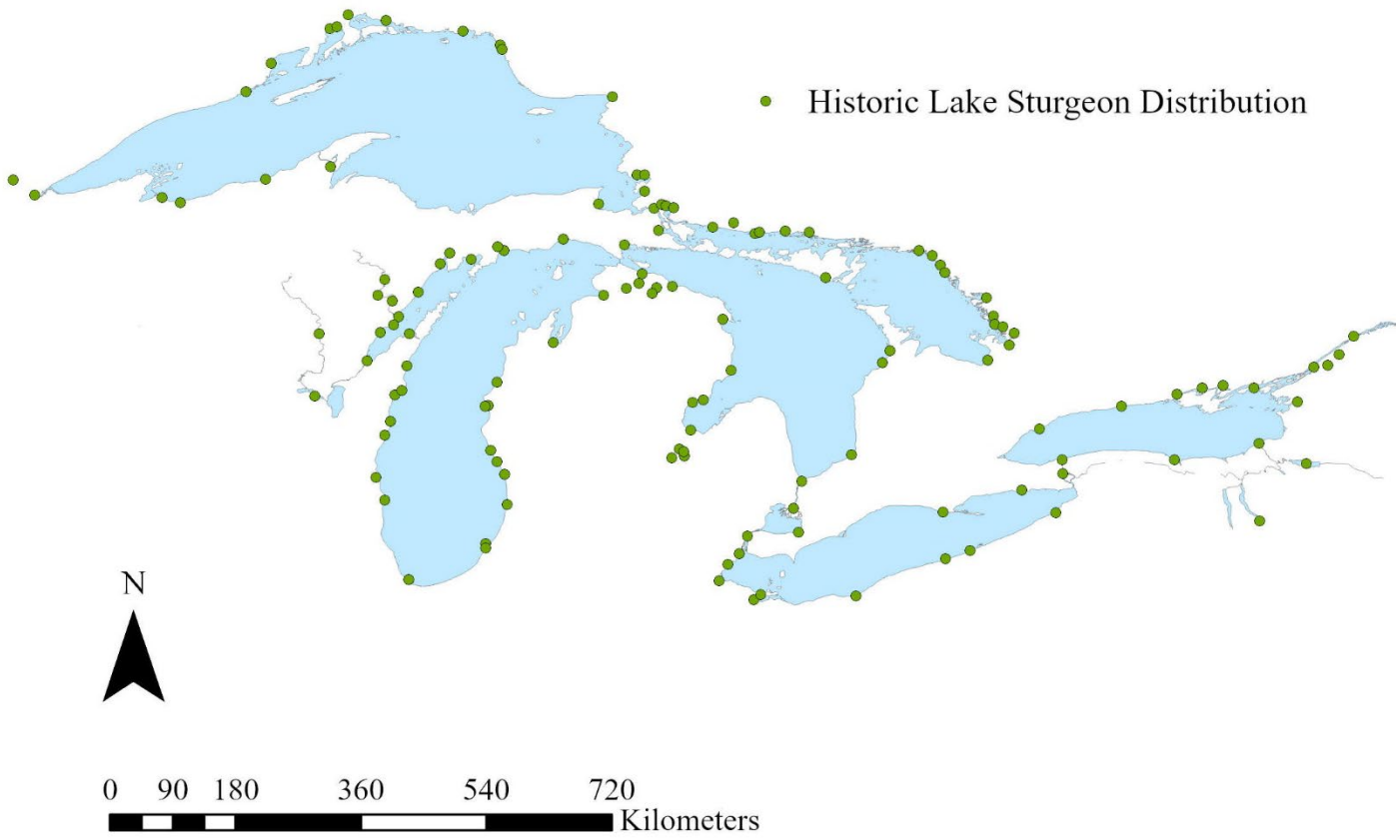


Figure 1. Historic Lake Sturgeon harvest from each of the Great Lakes.

Source: Baldwin *et al*. 1979



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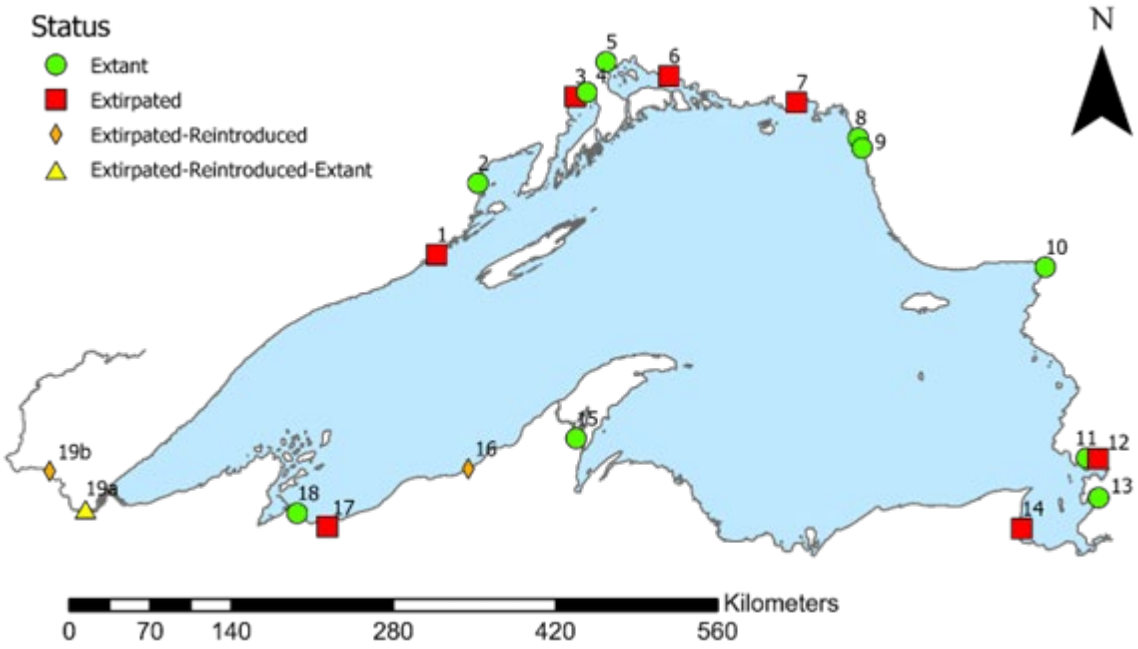
Source: Lake Sturgeon Working Groups, Great Lakes Fishery Commission.



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Source: Lake Superior Lake Sturgeon Working Group, Great Lakes Fishery Commission.

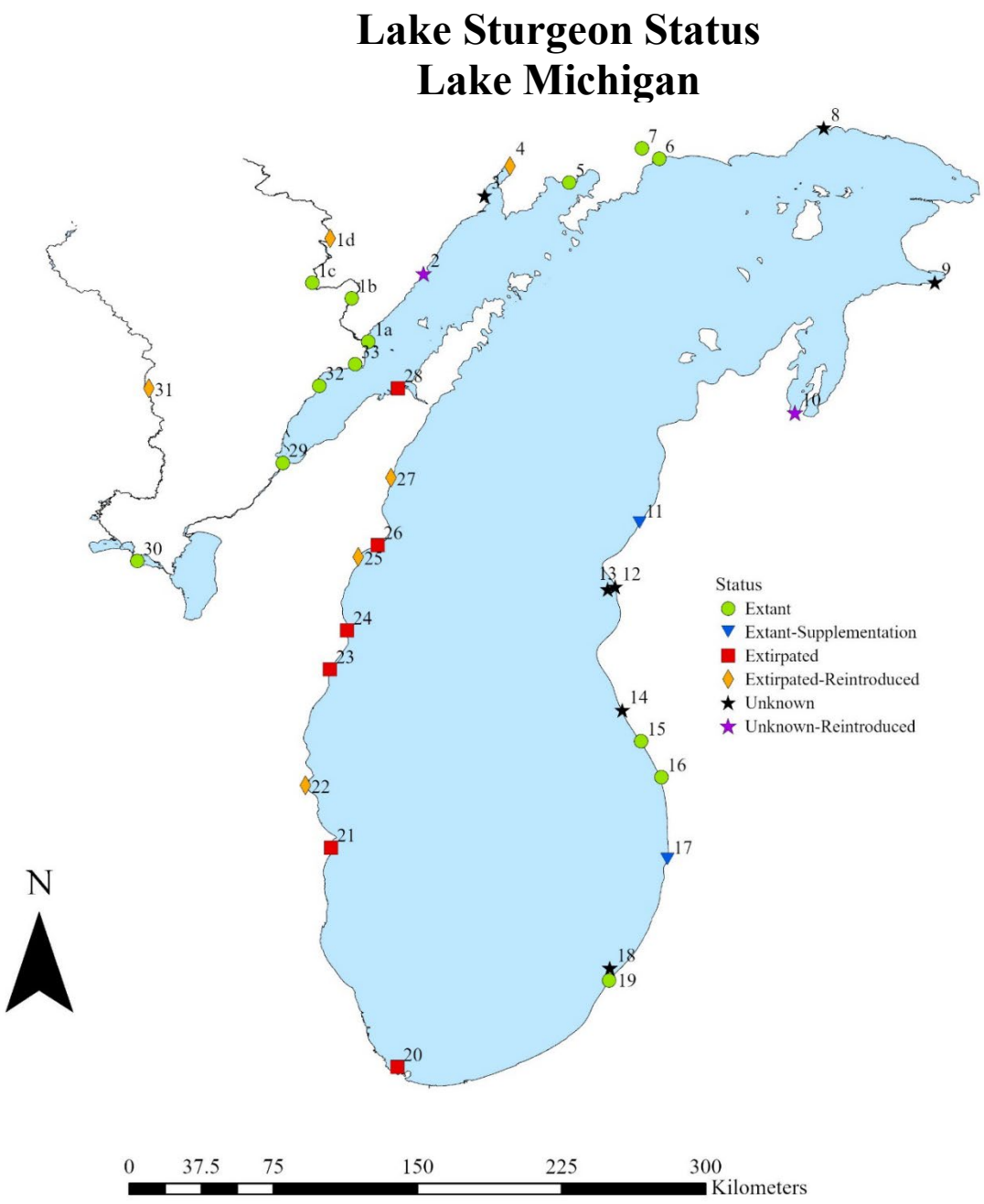

Figure 4. Lake Sturgeon population status in Lake Michigan, 2023. See figure 3 for population status definitions.

Source: Lake Michigan Lake Sturgeon Working Group, Great Lakes Fishery Commission.

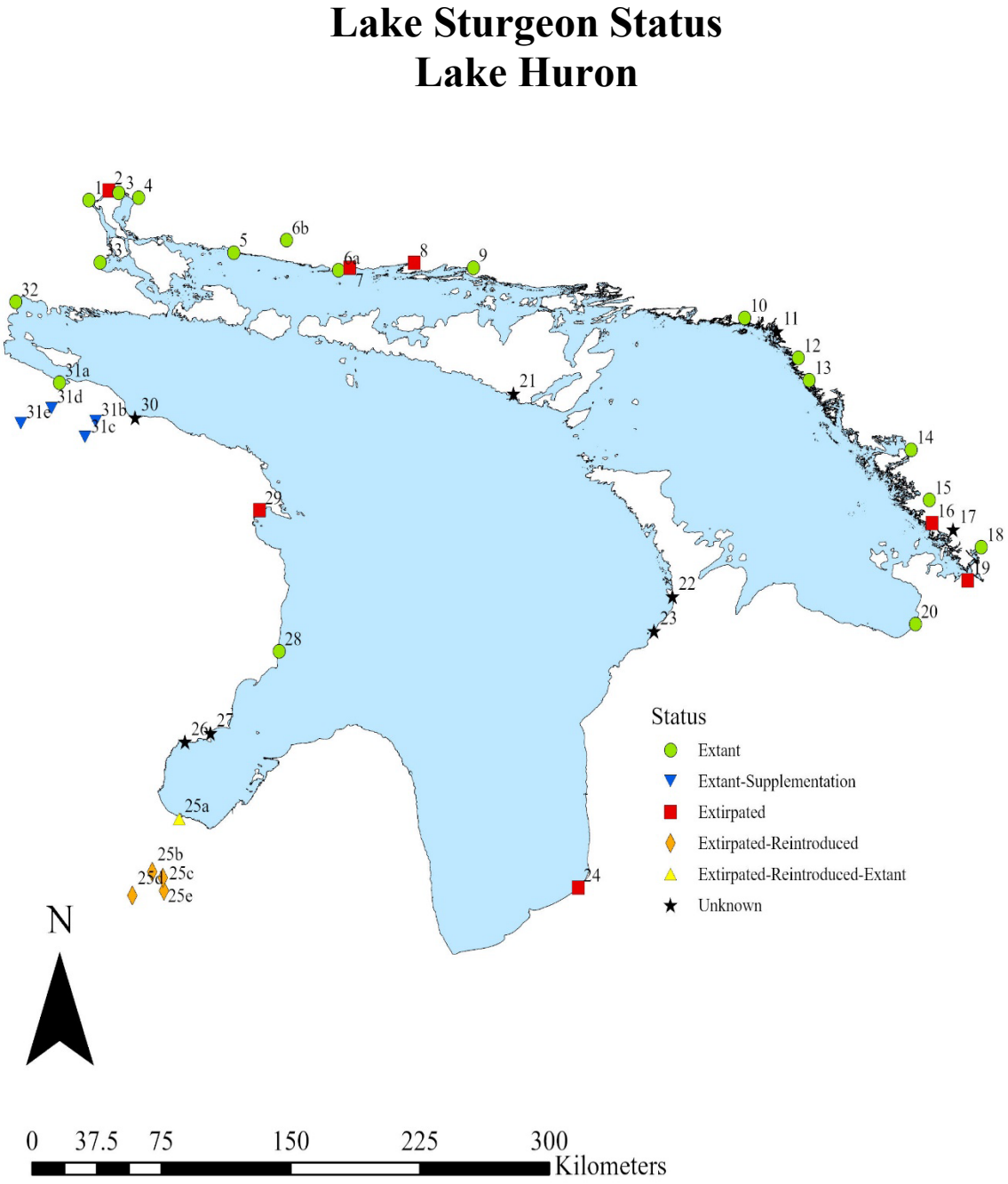

Figure 5. Lake Sturgeon population status in Lake Huron, 2023. See figure 3 for population status definitions.

Source: Lake Huron Lake Sturgeon Working Group, Great Lakes Fishery Commission.

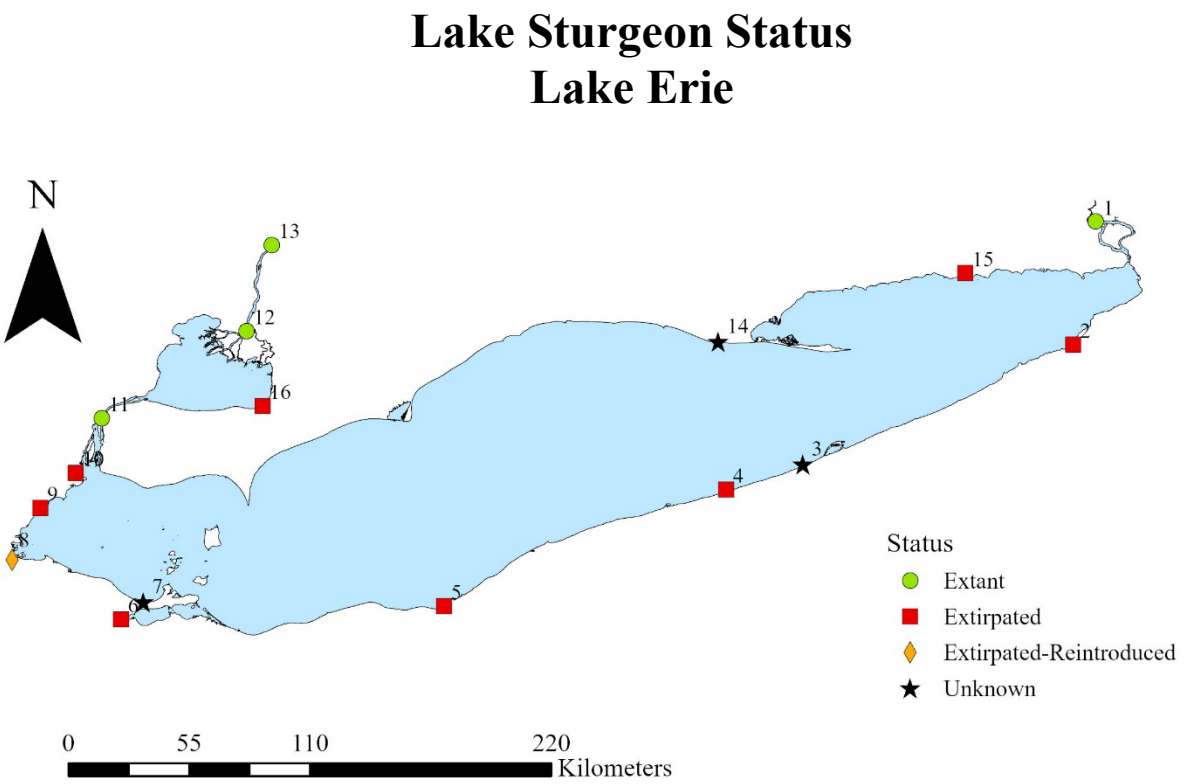

Figure 6. Lake Sturgeon population status in Lake Erie, 2023. See figure 3 for population status definitions.

Source: Lake Erie Lake Sturgeon Working Group, Great Lakes Fishery Commission.

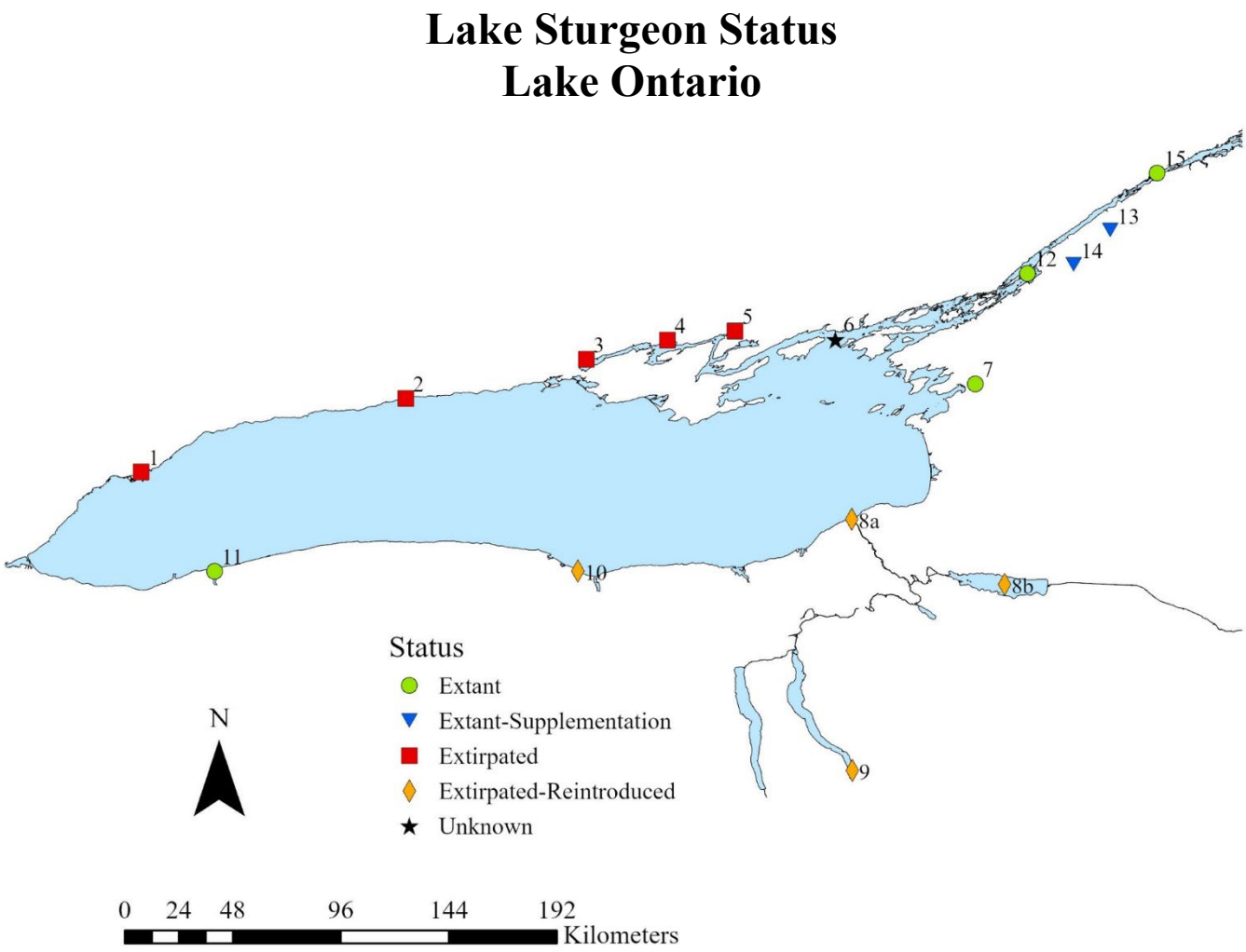

Figure 7. Lake Sturgeon population status in Lake Ontario, 2023. See figure 3 for population status definitions.

Source: New York Lake Sturgeon Working Group.