

Lake Sturgeon Status Survey in Michigan Waters of Lake Huron as Reported by Commercial Fishers



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Introduction

There are 27 species of sturgeon worldwide, nine are endemic to North America; however, only the lake sturgeon, *Acipenser fulvescens*, is native to the Great Lakes basin. Lake sturgeon is one of the few sturgeon species which lives its entire life in freshwater (Auer 1999). Lake sturgeon once ranged throughout the Mississippi River, Hudson Bay and the Great Lakes basin (Harkness and Dymond 1961; Scott and Crossman 1973). Once an abundant member of the Great Lakes fish community, lake sturgeon were, and continue to be, commercially valuable and can provide tremendous sport fishing opportunities (Auer 1999). This species has and continues to represent an important biological component of the Great Lakes fish community. By the early 1900's many populations of lake sturgeon throughout their range had been greatly reduced or extirpated as a result of overfishing, habitat loss, the construction of dams, and pollution (Ono et al. 1983). Lake sturgeon are listed as either threatened or endangered by 19 of the 20 states within its original range in the United States (Auer 1991). The American Fisheries Society considers lake sturgeon a threatened species in North America (Williams et al. 1989). Considered relicts, fossil evidence suggests sturgeons existed one hundred to two hundred million years ago (Auer 1999).

Sturgeon retain many characteristics of primitive fishes. They possess a shark-like heterocercal tail, bony scutes along their head, back and sides, a cartilaginous skeleton, and a toothless, protrusible mouth (Auer 1999). Lake sturgeon are the largest freshwater fish in the Great Lakes basin. They feed on chironomid larvae, molluscs, mayfly nymphs, caddisfly larvae, crustaceans, and fish (Harkness and Dymond 1961; Thomas and Haas 1999). Lake sturgeon are late maturing, slow-growing, long-lived fish that reach ages of 100-150 years (Guenette et al. 1993). Unlike many fishes, lake sturgeon require fifteen to twenty-five years to reach sexual maturity and are intermittent spawners (Priegel and Wirth 1977).

The U.S. Fish and Wildlife Service-Alpena Fishery Resources Office (FRO) began investigating the Lake Huron lake sturgeon population in 1995. The purpose for the study was to gather critical information on Lake Huron lake sturgeon necessary for determination of federal listing and the development of recovery plans. Previous year's reports for this project can be found on the Alpena FRO web page (midwest.fws.gov/Alpena/index.htm) under station reports.

Study Site

Lake Huron is the second largest (by surface area) of the Great Lakes with a total surface area of 59,596 km². It is a deep oligotrophic lake, with a mean depth of 59 m and depths greater than approximately 30 m over two-thirds of its surface (Berst and Spangler 1973). Lake Huron lies in the center of the Great Lakes and receives discharge from both Lakes Superior and Michigan (Eshenroder et al. 1992).

Most of the lake sturgeon collected for this study came from Saginaw Bay, Lake Huron (Figure 1). Saginaw Bay is one of the largest bays in the Great Lakes. It is a shallow, well-mixed extension of the western shoreline of Lake Huron. Total area of the bay is 2,771 km², and total water volume is 24.5 km³. Bottom substrates in Saginaw Bay range from silt to mostly cobble and rock.

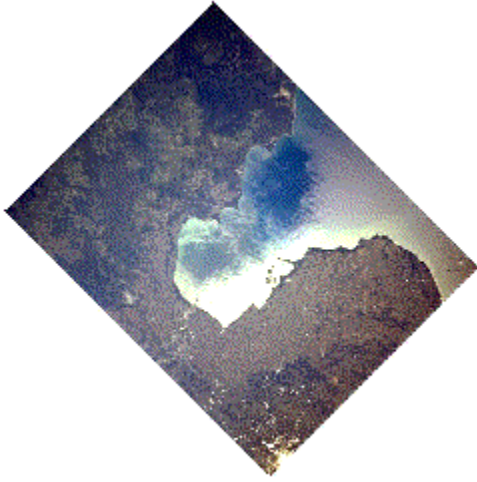


Figure 1. Satellite photo of Saginaw Bay, Lake Huron.

Methods

Lake sturgeon monitoring continued in 2000 for the sixth straight year. Similar to previous years, all lake sturgeon were collected by commercial fishers as by-catch in their trap net fishery (Hill and McClain 1998). Michigan state-licensed and tribal commercial fishers use large commercial trap nets to capture fishes. Lake whitefish *Coregonus clupeaformis*, yellow perch *Perca flavescens*, and channel catfish *Ictalurus punctatus* are the species primarily targeted by the trap net fishery. Lake sturgeon are often encountered as by-catch during normal fishing operations. This has allowed Alpena FRO staff an opportunity to obtain information from this prehistoric fish. Total length (TL), fork length (FL), and girth were measured for most captured lake sturgeon. The leading (marginal) ray of the left pectoral fin was removed from some fish to provide estimates of age. The distal portion of the fin ray is being utilized for genetic analysis. Fish were tagged in the left operculum with a serially numbered Monel self-piercing animal ear tag (National Band and Tag CO., Newport, Kentucky). All lake sturgeon were handled by the commercial fishers, including data collection and fish tagging. All materials necessary to collect the biotic information were provided by the Alpena FRO (Figure 2). Each fisher was provided a box containing instructions for fish tagging and fin ray removal, tags and an applicator, fin ray saw, data note book and cards, fin ray envelopes, a soft measuring tape and a disposable camera. Abiotic data recorded for each lake sturgeon captured included: date, latitude/longitude, water depth and temperature, and bottom type. In addition, tag type, agency, and identification number of tag applied or observed (if fish was tagged) were recorded.



To maximize the information being collected on Lake Huron lake sturgeon, the Alpena FRO has been working closely with the Ontario Ministry of Natural Resources-Lake Huron Management Unit (OMNR-LHMU). Coordination between OMNR-LHMU and the Alpena FRO resulted in standardized data collection for lake sturgeon. This coordination enhanced the chances of recovering tag information lakewide and allowed a better understanding of the seasonal movement patterns of Lake Huron lake sturgeon.

Results and Discussion

Assistance from commercial fishers has been invaluable to the success of this study. Eleven commercial fishers (operating 16 boats) are providing information on incidentally captured lake sturgeon; nine of these fishers operate in Saginaw Bay (Table 1). Biological data were recorded from 40 lake sturgeon in 2000. Since 1995, a total of 185 lake sturgeon have been tagged by commercial fishers.

Fork length of lake sturgeon captured in 2000 ranged from 40 cm to 143 cm with a mean fork length of 106 cm (Table 2). Age of these fish ranged from 4 to 28 years with a mean of 13 years. A summary of morphological data for lake sturgeon captured during the six years of this study are shown in Table 2. Figures 3 and 4 illustrate the length frequency and age frequency, respectively, of lake sturgeon collected during the course of this study. Biotic parameters collected from the lake sturgeon have been standardized to assist with data exchange among other agencies involved in sturgeon status surveys. Several relationships were developed with these parameters to aid information exchange between the agencies. These relationships are similar to information collected by OMNR-LHMU for Ontario waters of Lake Huron (Lloyd Mohr, personal communication).

Table 1. Number of lake sturgeon caught by participating commercial fishers in Lake Huron trap net fishery since 1995. Dash indicates the fisher was not participating in the program.

<i>Fisher</i>	<i>Year Enrolled</i>	<i>1995</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>	<i>2000</i>	<i>Total</i>
<i>Barbeaux Fishery</i>	1996	-	1	7	0	0	0	8
<i>Bay Port Fish Company</i>	1995	13	7	10	8	12	3	53
<i>Beardsley Fish Company</i>	1997	-	-	0	0	0	0	0
<i>Cedarville Fish Company</i>	1997	-	-	1	7	9	4	21
<i>Gauthier-Spaulling Fishery</i>	1995	2	0	2	2	4	1	11
<i>Kuhl Fishery</i>	1999	-	-	-	-	1	0	1
<i>Lentz Fishery</i>	1995	3	8	8	9	10	6	44
<i>M&W Fish Company¹</i>	1995	1	3	4	4	2	14	28
<i>Serafin Fishery</i>	1996	-	10	17	3	4	8	42
<i>Beers Fishery</i>	1995	2	0	1	0	0	0	3
<i>Whytes Fishery</i>	1995	2	7	3	4	3	3	22
<i>Total</i>		23	36	53	37	45	39	233 ²

¹Formerly Sam's Fishery

²Not all lake sturgeon caught were measured or tagged.

Table 2. Summary of morphological data collected on lake sturgeon by commercial fishers in Michigan waters of Lake Huron. Dash indicates data was not collected.

	<i>1995</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>	<i>2000</i>
<i>Mean Fork Length (cm)</i>	111	92	101	111	106	106
<i>Median Fork Length (cm)</i>	111	90	99	109	103	108
<i>Fork Length Range (cm)</i>	71 - 155	50 - 135	42 - 185	67 - 171	41 - 185	40 - 143
<i>Mean Age (years)</i>	-	-	17	14	15	13
<i>Median Age (years)</i>	-	-	13	12	13	13
<i>Age Range (years)</i>	-	-	4 - 72	4 - 59	3 - 30	4 - 28

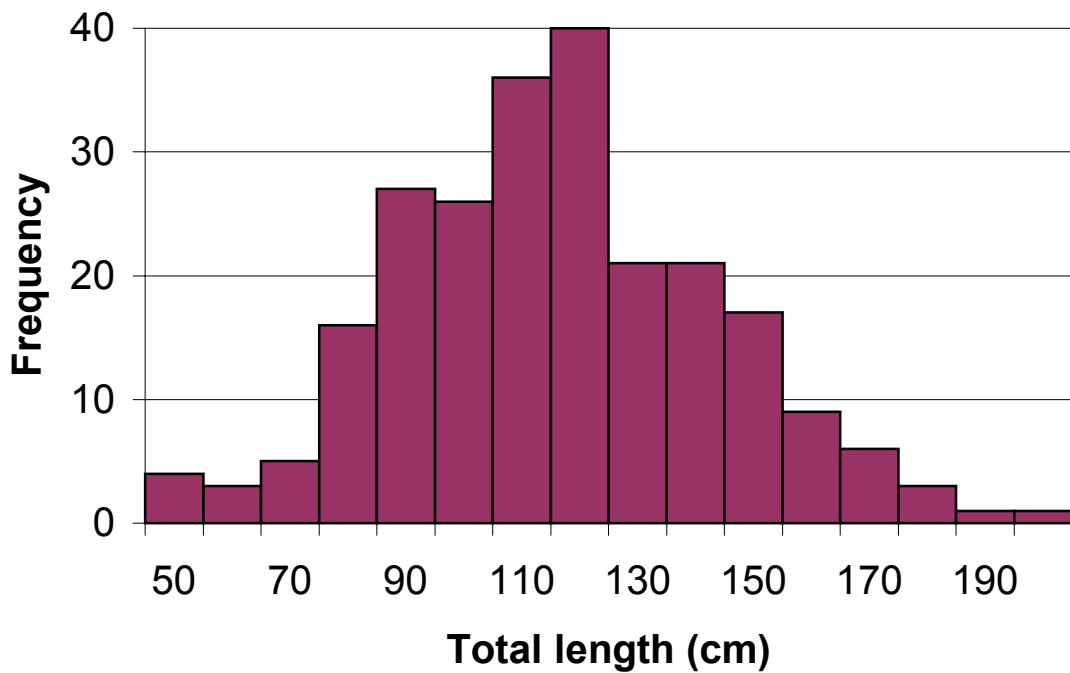


Figure 3. Length frequency of Lake Huron lake sturgeon captured as by-catch in the trap net fishery, 1995-2000.

Overall, the age distribution of lake sturgeon caught in 1997 through 2000 is dominated by sturgeon older than 11 years with a total of 30 year-classes represented (Figure 4). Lake sturgeon younger than 8 years old represent 14% of the sturgeon sampled in the trap net fishery. This may be due to poor recruitment, gear selectivity, distribution of young lake sturgeon, or it may indicate that Saginaw Bay is merely a staging area for sub-adult sturgeon. Mapping lake sturgeon locations by age lends support to the theory that Saginaw Bay is a staging area for sub-adult sturgeon (Figure 5). The majority of lake sturgeon captured in Saginaw Bay are less than 17 years old; conversely, most of the lake sturgeon caught outside of Saginaw Bay are over 16 years old.

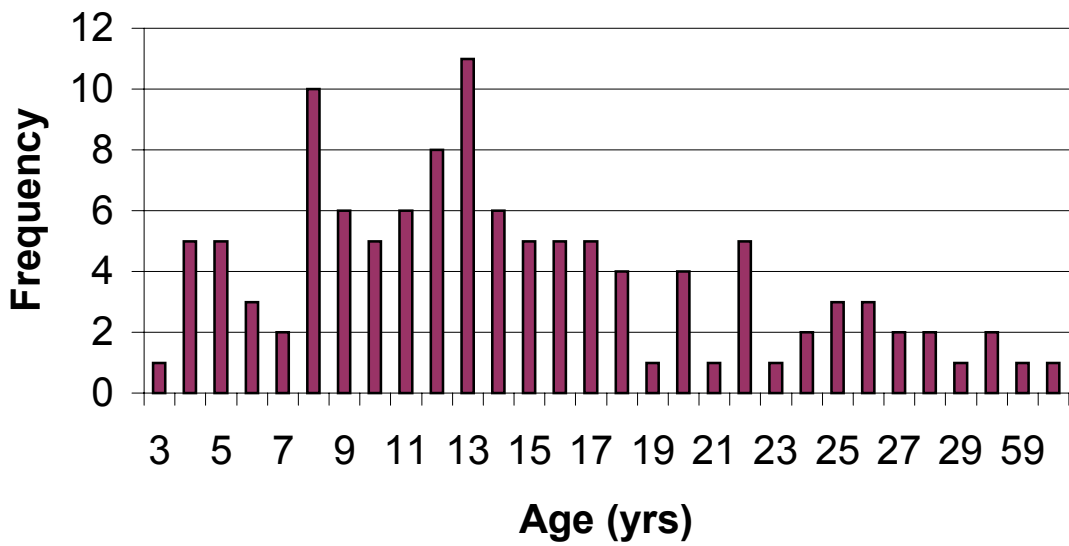


Figure 4. Age frequency of Lake Huron lake sturgeon captured as by-catch in the trap net fishery, 1997-2000.



Figure 5. Ages of lake sturgeon captured by commercial fisher 1995-2000.

Weight information is limited for the lake sturgeon collected during this study because the commercial fishers collecting the data are not equipped to record weight information. However, biologists working with lake sturgeon in Ontario waters of Lake Huron have developed an equation to predict weight of sturgeon based on total length and girth measurements. The equation is as follows:

$$\text{Log (Weight)} = \text{Log (Total length)} \times 2.44499 + \text{Log (Girth)} \times 1.00584 - 21.1645$$

where weight is in kg and total length and girth are in mm.

Locations of the 43 lake sturgeon caught in 2000 are shown in Figure 6. No lake sturgeon were reported north of Thunder Bay in 2000. All tagged lake sturgeon recaptured by Michigan state-licensed commercial fishers have been released unharmed. Thirty previously tagged lake sturgeon have been recaptured in Saginaw Bay, the Main Basin and North Channel of Lake Huron from 1995 to 2000. Coordination between OMNR-LHMU and the Alpena FRO on the lake sturgeon project in Lake Huron has provided documentation of interbasin movement of sturgeon between Saginaw Bay, the Main Basin and North Channel. In 2000, two lake sturgeon tagged by Saginaw Bay commercial fishers were recaptured in southern Lake Huron by Purdy Fisheries (Table 3). An additional 11 lake sturgeon were recaptured by Michigan state-licensed and tribal commercial fishers (Table 3). This represents the greatest number of lake sturgeon recaptured by the Michigan state-licensed commercial fishers during a single season since the project began in 1995 and a significant increase over the number of recaptures in any previous year (Figure 7).

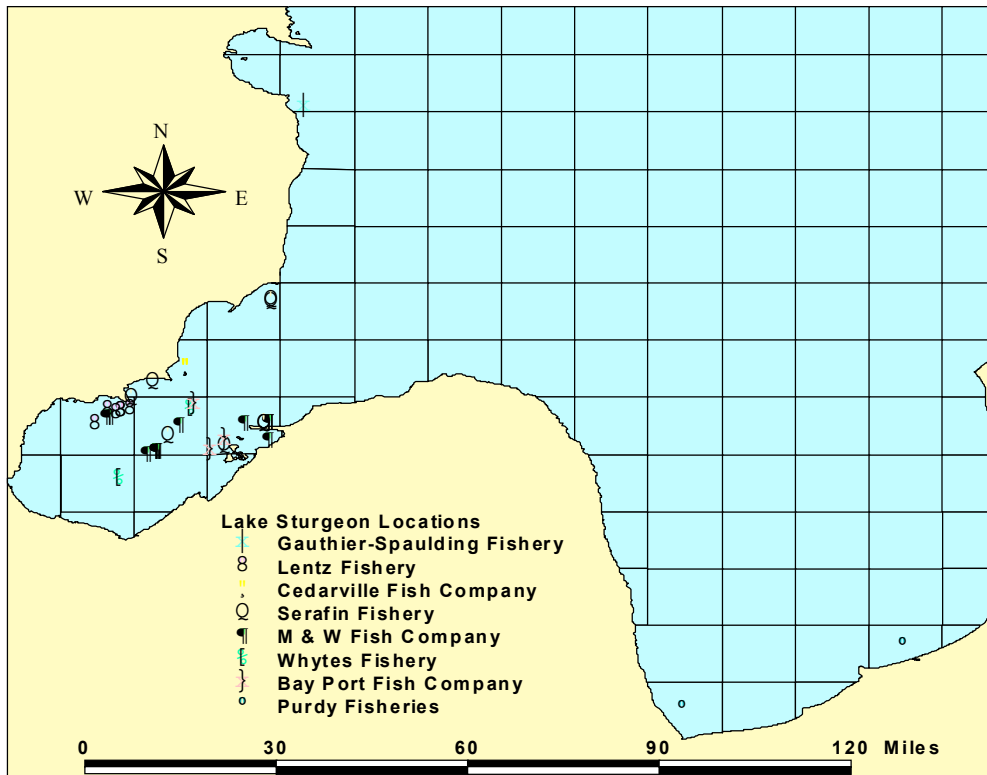


Figure 6. Locations of lake sturgeon tagged or recaptured in 2000.

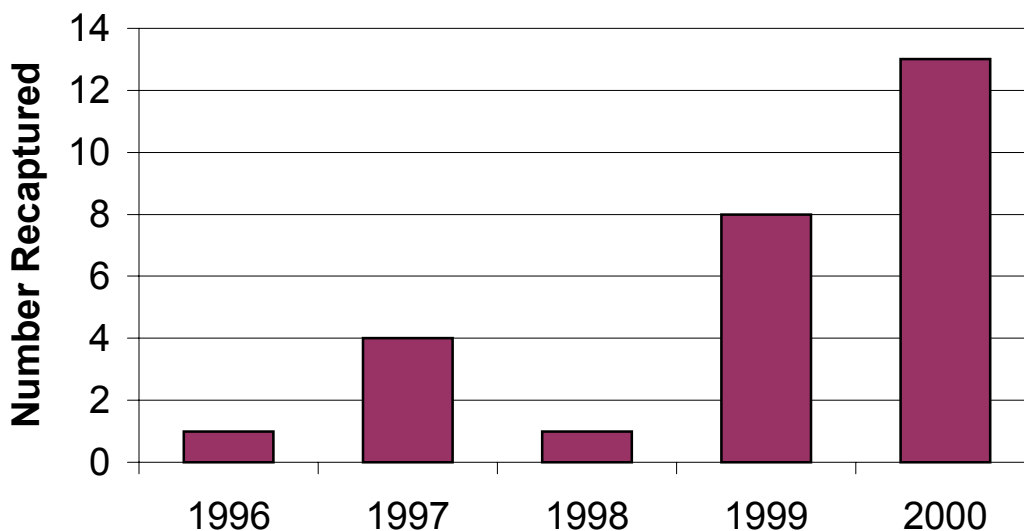


Figure 7. Number of lake sturgeon recaptured by Lake Huron commercial fishers, 1996-2000.

Table 3. Summary of lake sturgeon recapture information for 2000.

<i>Tag Number</i>	<i>Date Tagged</i>	<i>Date Recaptured</i>	<i>Tagging Grid</i>	<i>Recapture Grid</i>	<i>Tagging Fisher</i>	<i>Recapturing Fisher</i>
4005	8/19/1997	5/29/2000	1508	1918	M & W	Purdy Fisheries
4036	4/26/1997	4/26/2000	1508	1509	Serafin	M & W
4050	10/16/1997	4/29/2000	1508	2015	Serafin	Purdy Fisheries
4064	9/25/1999	5/22/2000	1508	1507	Whytes	M & W
4064		8/8/2000		1607		Whytes
4110	11/17/1998	10/11/1999	1507	1507	Lentz	Lentz
4110		11/25/1999		1507		Lentz
4110		5/21/2000		1507		Lentz
4152		10/19/2000		1309	Cedarville	Serafin
4204	10/25/1998	6/13/2000		1507	Serafin	Whytes
4258	4/11/2000	4/27/2000	1507	1509	M & W	M & W
6270	10/19/1998	6/13/2000	2016	1408	OMNR	Cedarville
6723		12/3/2000		1507	OMNR	Lentz
6778		5/1/2000		1509	OMNR	Bay Port
6785	11/2/1995	12/2/2000	2015	1509	OMNR	M & W
9158		12/2/2000		1508	OMNR	M & W

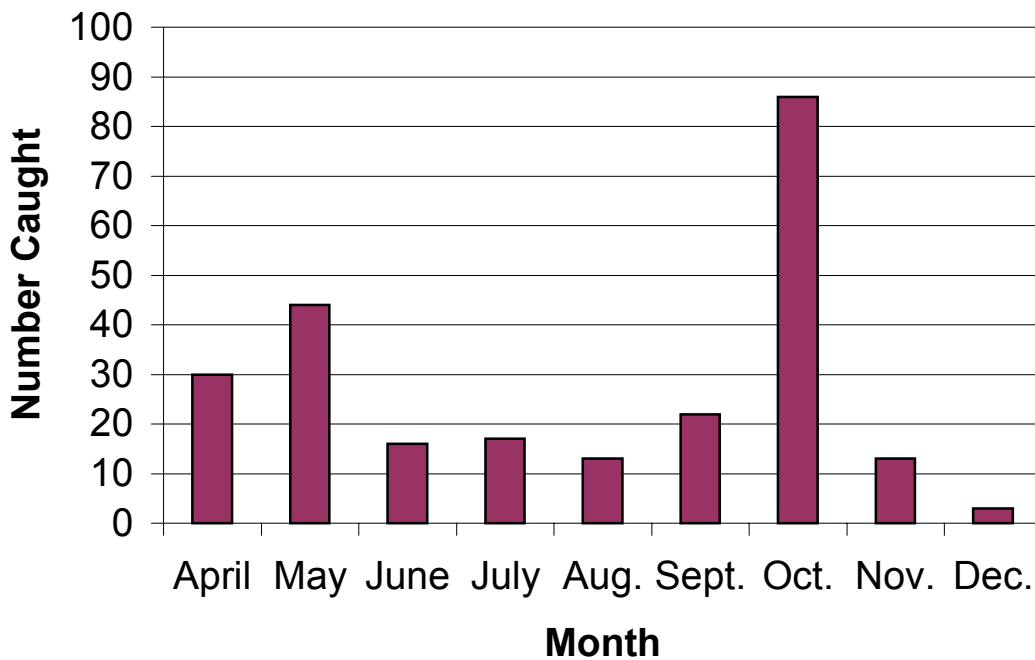


Figure 9. Number of lake sturgeon caught by Lake Huron commercial fishers by month (1995-2000).

Data collected on lake sturgeon by our commercial fishing partners are biased because the fishers are not targeting sturgeon. The lake sturgeon are captured as by-catch while the fishers are targeting other fish species. There are, however, temporal differences in habitat overlap between lake sturgeon and the commercially targeted species. The greatest overlap occurs in the spring and fall period. Lake sturgeon are captured most frequently in May and October (Figure 9). This temporal information may prove useful in developing sampling protocol for assessment activities targeting lake sturgeon.

Summary

The cooperation and assistance provided by Lake Huron commercial fishers provides crucial information on the lake sturgeon populations in Saginaw Bay and the northern regions of Lake Huron. Lake sturgeon appear to be less abundant in U.S. waters of Lake Huron than in Canadian waters based on by-catch return data. This is not surprising given that historically important spawning streams in Michigan have been blocked by hydropower projects. Several large streams with available spawning habitat are still free-flowing in Ontario, providing some degree of sustainability for lake sturgeon populations.

Increasing participation by commercial fishers should result in an escalation of lake sturgeon reports over the next few years. As the project continues and more lake sturgeon are tagged, additional information on seasonal movement should result from increased recaptures of previously tagged fish. In addition, collaboration between OMNR-LHMU and the Alpena FRO on the lake sturgeon project has begun to define movements of tagged sturgeon between the different basins of Lake Huron.

Despite the limited number of tagged lake sturgeon (185), a few discernible biotic and abiotic trends are developing. Personal discussions with the fishers indicate that small lake sturgeon have been observed in years prior to the initiation of this project. Although the mean age of captured lake sturgeon is 15 years, this mean was calculated from a small number of fish and may not represent the true age structure of the sturgeon population. Continued collection of age information should provide evidence of local recruitment in Michigan waters of Lake Huron if it is occurring. In addition, a few clusters of lake sturgeon captures are identifying areas that should be more closely examined for their habitat value to existing lake sturgeon populations and the possibility of supporting successful lake spawning stocks.

Expansion of the Alpena FRO and OMNR-LHMU efforts for lake sturgeon status surveys in the next few years will aid in understanding the current status, and the potential for a successful lake-wide recovery effort for this important native species.

Acknowledgements

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