



Lake Sturgeon Status Survey in Saginaw Bay of Lake Huron as Reported by Commercial Fishers.



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**Status of Lake Sturgeon in Michigan Waters of Lake Huron,
Reported by Commercial Fisheries 2001**

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INTRODUCTION

The largest indigenous fish to the Great Lakes is the lake sturgeon (*Acipenser fulvescens*) reaching lengths of over 6ft and weighing over 200 lbs. The largest on record was 7' 11" and weighed 310 lbs. Sturgeon are the oldest known taxa of fish living today, dating to the Upper Cretaceous period (136 million years ago). Lake sturgeon are relatively young for sturgeon species, and are thought to have evolved from the Mississippi River Valley sturgeon 14 thousand years ago. Since that time sturgeon have flourished in the Great Lakes occupying all five of the lakes.



Native Americans have always used lake sturgeon for products such as: food, oil, and leather (Holzkamm and Wilson 1988). Holzkamm and McCarthy (1988) indicated that some Native American tribes supplied isinglass (a clarifying agent made from sturgeon swim bladders) to the Hudson Bay Company. By 1880 European settlers began utilizing lake sturgeon for such products as caviar, isinglass, fresh, smoked, or salted flesh, oil, fertilizer, leather, and delicacies from the brain, notochord, and belly (Prince 1905). This new demand for lake sturgeon initiated a commercial harvest that reached its peak in 1885-1889 with 15,806,100 lbs harvested, basin wide, during the five year period. For the five-year period 1890-1994, the harvest of lake sturgeon had fallen to 1,781,316 lbs (Auer 1999).

Currently there is no commercial fishing for lake sturgeon in U.S. waters of Lake Huron and sport fishing is very limited. Canada does allow some commercial harvest on Lake Huron and some sport fishing. Both are very limited. Lake sturgeon is now considered threatened or endangered by 19 of the 20 states within its original range in the U.S. (Auer 1991). The primary cause for these listings is over-fishing and loss of habitat due to man-made obstructions such as hydroelectric dams, which block access to spawning habitat, pollution, and sedimentation from urbanization. Lake sturgeon, as a species, cannot rebound quickly from these affects because of their life history characteristics.

Lake sturgeon spend their entire life in fresh water, unlike most other sturgeon species that spend most of their life in the ocean only entering fresh water rivers to spawn. Lake sturgeon spawn from mid-April through mid-May. Males and females migrate to the spawning grounds when water temperature is 13-18°C. Peak spawning temperature for lake sturgeon appears to be 15-16°C (Kempinger 1988). The habitat characteristics of lake sturgeon spawning grounds consist of water depths ranging from 2-15 ft, with varying velocities and substrates (usually cobble and/or pebble substrate) (Organ 1978). An ovulating female may be accompanied by two or more males. Lake sturgeon do not create a redd (nest) for their eggs but rather disperse them in the current. The males fertilize the eggs as they leave the female. The eggs then adhere to the substrate of the spawning grounds. Females produce as much as 5,000 eggs per pound of body weight. These eggs are left unguarded by the parents and fall prey to many fish species such as white sucker *Catostomus commersoni*, other sucker species, and the exotic round goby (*Neogobius melanostomus*). Eggs will hatch within 5-10 days beginning the most vulnerable stage in a lake sturgeon's life, between hatching and development of the sharp bony scutes (plates on the outside of the body). For a short time after hatching the larvae stay close to the spawning site embedded in the gravel while they absorb their yolk sac. After the yolk is absorbed the larvae start drifting down stream to nursery areas where they start feeding on invertebrates such as zooplankton. It is during these drifts that the larvae are most vulnerable (Auer 2001).

Food items are taken in by a tube like structure that extends and retracts from the underside of the snout to suck prey from the substrate. Sensitive barbells (antenna like appendages) at the end of the snout are used to locate food items. As lake sturgeon grow they feed on nymphs and larvae of aquatic insects such as midges (Chironomids), mayfly (Ephemeroptera), caddis flies (Trichoptera) and spongellaflyies (Neuroptera). As they grow they move to a more diverse diet that includes crayfish, fish eggs, fishes, worms (nematodes), leeches, amphipods, decapods, and a few plants (Harkness and Dymond 1961).

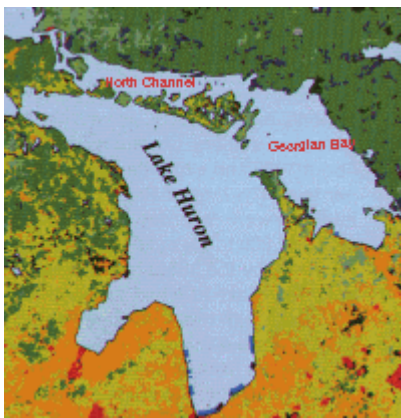
Lake sturgeon do not reach sexual maturity for several years. Males reach maturity around 13 yrs, females reach maturity around 19 yrs (Houston 1987). Males reproduce every two years. Females reproduce every 4-6yrs, but can be as long as nine years (Roussow 1957).

Because these fish are long lived (the oldest recorded lake sturgeon was 154 yrs), slow growing, late maturing, and do not spawn every year it is impossible for these giants of the Great Lakes to rebound quickly from over-fishing and loss of habitat. Because of their life history, efforts to restore these fish will not be recognized for many years.

The U.S. Fish and Wildlife Service-Alpena Fishery Resource Office (FRO) began monitoring lake sturgeon in Saginaw Bay of Lake Huron in 1995. Lake sturgeon became a species of concern because of the potential for federal listing and the need for a recovery plan. This report summarizes the activities of this project for 2001. Previous years reports can be found on the Alpena FRO web page (www.fws.gov/r3pao/alpena/index.htm) under station reports.

Study Site

Lake Huron was formed approximately 10,000 years ago following the Wisconsin glaciation (Ryder 1972).



Lake Huron has a surface area of 23,000 square miles (60,000km²)-- slightly smaller than West Virginia -- making it the fifth-largest freshwater lake in the world. Its name comes from early French explorers, who dubbed it "Lac des Hurons" (Lake of the Huron Indians). Bordered by the province of Ontario and the state of Michigan, Lake Huron measures about 206 miles long (332km) and 183 miles wide (295km) and has nearly 3,200 miles (5152 km) of shoreline.

Figure 1. Lake Huron is comprised of three basins; the main basin, the North Channel, and Georgian Bay.

At 579 feet (175m) above sea level, it averages 195 feet (59m) deep with a maximum depth of 750 feet (227m) and has a flushing time of about 22 years. About two-thirds of the lake's 51,700-square-mile (135,454 km²) watershed is still covered by forests, and the lake contains more than 30,000 islands. 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 (Figures 2 and 3). Saginaw Bay is the second largest bay in the Great Lakes. It is 26 miles (42km) wide and is 51 miles (82km) projected into the land mass (Beeton et al 1967). Total area of the bay is 1,043 square miles (2,771 km²). The bay is divided evenly between the inner bay with a mean depth of 15 feet (5m) and the outer bay with mean depths of 51 feet (82 km) for a total water volume of 24.5 km³. It is a shallow, well-mixed extension of the western shoreline of Lake Huron. Bottom substrates in Saginaw Bay range from silt to mostly cobble and rock.



Figure 2. Satellite photo of Lake Huron.



Figure 3. Satellite photo of Saginaw Bay.

Methods

Using trap nets to harvest lake whitefish *Coregonus clupeaformis*, yellow perch *Perca flavescens*, and channel catfish *Ictalurus punctatus* Michigan state-licensed and tribal commercial fishers sometimes catch lake sturgeon as by-catch. These incidentally caught sturgeon are used to collect data needed to assist in preservation of the species. Total length (TL), fork length (FL), and girth were measured for most captured lake sturgeon using a soft measuring tape. The leading (marginal) ray of the left pectoral fin was removed from some fish using a fin ray saw to estimate age. The distal portion of the fin ray is being utilized for genetic analysis. Fish are 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 are handled by the commercial fishers, including data collection and tagging. All materials necessary to collect the biotic information were provided by the Alpena FRO (Figure 4). 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) are recorded.



Figure 4. Equipment provided by Alpena FRO to each commercial fisherman for taking and recording data from captured sturgeon.

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

Since 1995, 302 lake sturgeon have been captured from Michigan waters and had biological data collected. Of the total, 254 have been tagged. This would not have been possible without the assistance of commercial fishers (Table 1). During the 2001 fishing season sturgeon were most frequently caught during the months of May and October (Figure 5). Figure 6 shows the months sturgeon were most frequently caught from 1995-2001.

Table 1. Number of sturgeon caught by commercial fisherman assisting with data collection since 1995. (n/a indicates the fisher was not participating).

Fisher	Enrolled	1995	1996	1997	1998	1999	2000	2001	Total
Barbeaux Fishery	1996	n/a	1	7	0	0	0	7	15
Bay Port Fish Company	1995	13	7	10	8	12	3	2	55
Beardsley Fishery	1997	n/a	n/a	0	0	0	0	1	1
Cedarville Fishery	1997	n/a	n/a	1	7	9	4	7	28
Gauthier-Spaulling Fishery	1995	2	0	2	2	4	1	0	11
Kuhl Fishery	1999	n/a	n/a	n/a	n/a	1	0	2	3
Lentz Fishery	1995	3	8	8	9	10	6	7	51
M & W Fish Company	1995	1	3	4	4	2	14	17	45
Sebewaing Fish Company	2001	n/a	n/a	n/a	n/a	n/a	n/a	2	2
Serafin Fishery	1996	n/a	10	17	3	4	8	20	62
Warren Beers Fishery	1995	2	0	1	0	0	0	2	5
Whytes Fishery	1995	2	7	3	4	3	3	2	24
Total		23	36	53	37	45	39	69	302

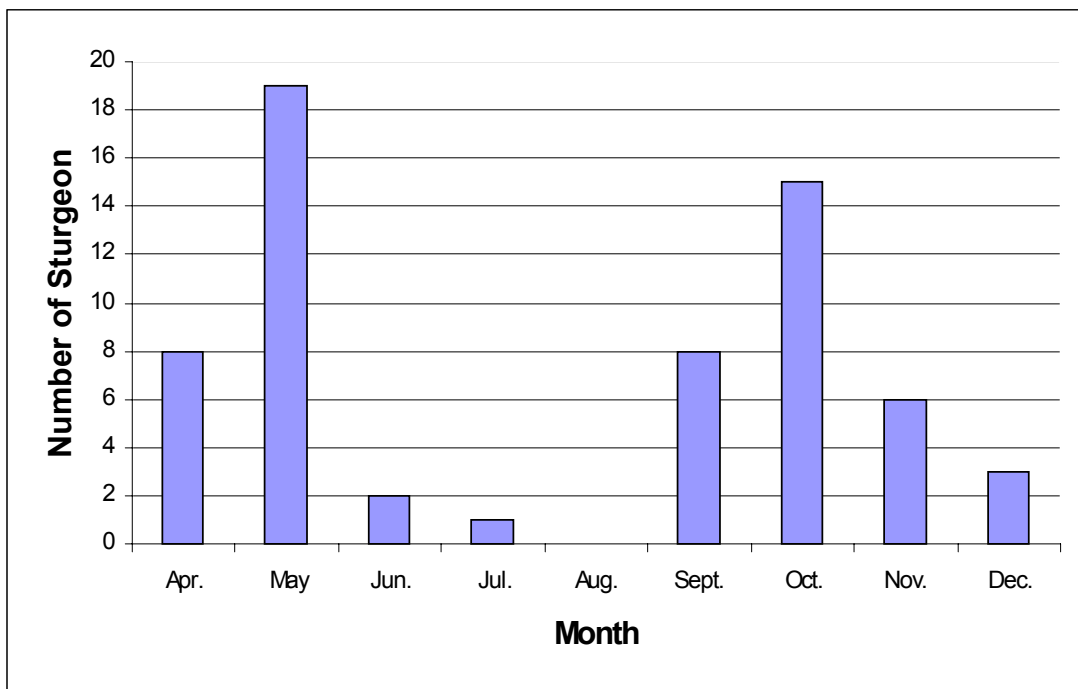


Figure 5. Number of sturgeon caught by month in Saginaw Bay by commercial fishers during the 2001 fishing season.

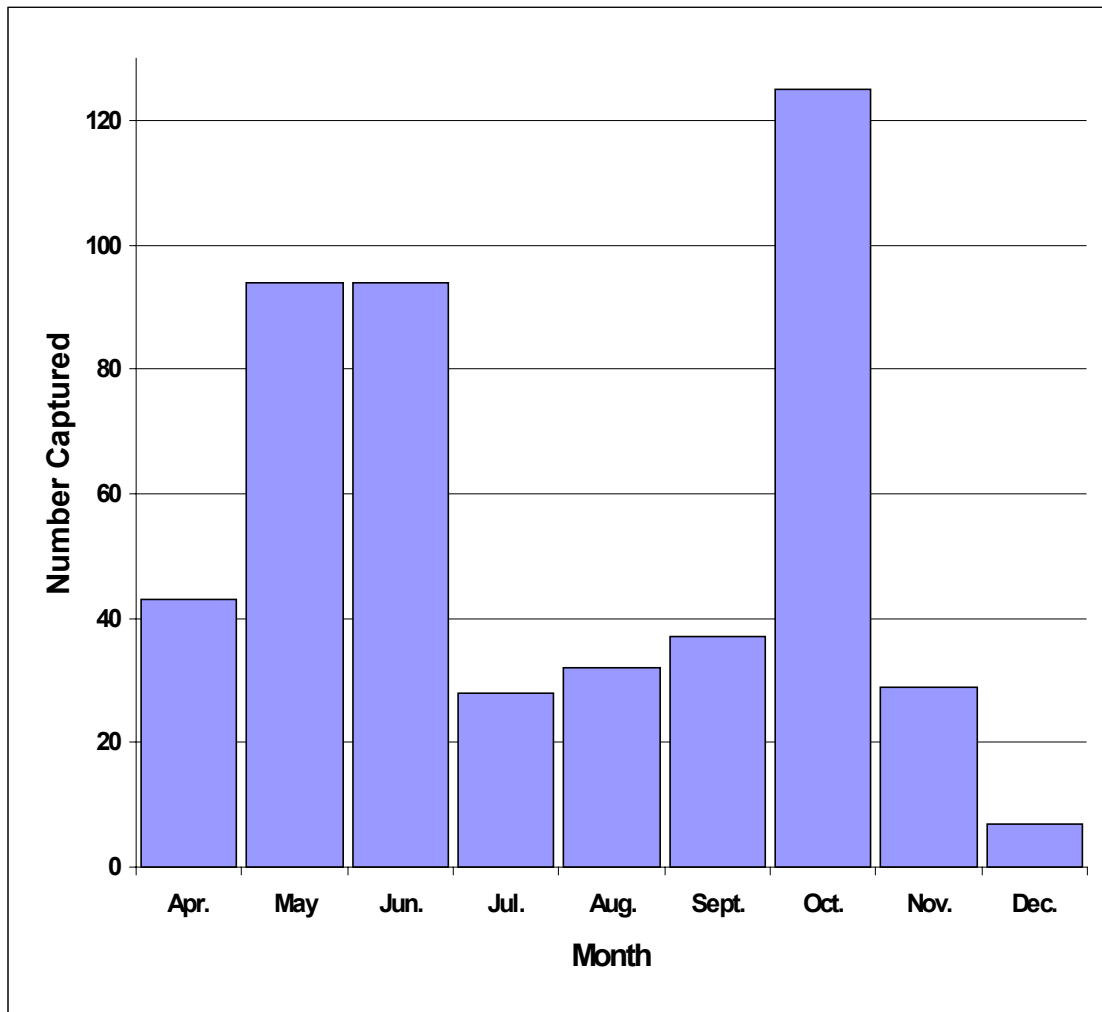


Figure 6. Number of sturgeon caught by month during the fishing seasons from 1995-2001 in Saginaw Bay by commercial fishers.

The biological data collected consists of total length (TL), fork length (FL), and girth and is summarized in Table 2 for 2001 and Table 3 for 1995-2001. The mean FL was 106 cm and ranged from 48 cm to 183 cm. The mean TL was 114 cm and ranged from 53 cm to 191 cm. The mean girth was 45 cm and ranged from 15 cm to 83 cm. Comparison of Tables 2 and 3 shows the sturgeon collected in 2001 are consistent in size with previous years. Figure 7 illustrates the length frequency for sturgeon captured in 2001. Sturgeon within the 100 cm range were the size most frequently caught. Figure 8 illustrates the length frequency of sturgeon captured from 1995 through 2001. Again, sturgeon in the 100 cm range were most frequently caught. Sturgeon with a length 90-110 cm are usually sexually immature for both sexes averaging around 11 yrs old. Examining the age

structure of sturgeon in Saginaw Bay reveals that fish 11-20 yrs old are most frequently caught.

The sex and state of maturity of these fish is unknown, therefore, it is unknown whether these are sexually mature males or all sexually immature males and females (Figure 9). The next age group most frequently captured was those fish ages 3 to 10. Very few (if any) of these fish would be sexually mature.

Table 2. Summary of TL, FL, and Girth Data Collected by commercial fishers during 2001.

<i>FLEN (cm)</i>		<i>TLEN (cm)</i>		<i>GIRTH (cm)</i>	
Mean	105.54	Mean	114.45	Mean	44.69
Standard Error	3.19	Standard Error	3.26	Standard Error	2.58
Median	108.00	Median	116.84	Median	45.00
Mode	114.30	Mode	129.54	Mode	45.00
Standard Deviation	28.28	Standard Deviation	28.50	Standard Deviation	14.52
Sample Variance	799.60	Sample Variance	811.97	Sample Variance	210.94
Kurtosis	0.44	Kurtosis	0.41	Kurtosis	2.78
Skewness	0.32	Skewness	0.21	Skewness	0.59
Range	134.88	Range	137.50	Range	68.00
Minimum	48.00	Minimum	53.00	Minimum	15.00
Maximum	182.88	Maximum	190.50	Maximum	83.00
Sum	7176.77	Sum	7782.72	Sum	759.70
Count	68.00	Count	68.00	Count	17.00
Confidence Level(95.0%)	1.89	Confidence Level(95.0%)	1.99	Confidence Level(95.0%)	1.79

Table 3. Summary of TL, FL, and Girth Data Collected by commercial fishers from 1995 through 2001.

<i>FLEN (cm)</i>		<i>TLEN (cm)</i>		<i>GIRTH (cm)</i>	
Mean	105.87	Mean	115.29	Mean	44.35
Standard Error	3.20	Standard Error	3.28	Standard Error	2.57
Median	104.57	Median	115.57	Median	43.00
Mode	99.00	Mode	117.00	Mode	41.00
Standard Deviation	26.59	Standard Deviation	27.89	Standard Deviation	13.14
Sample Variance	707.16	Sample Variance	777.83	Sample Variance	172.75
Kurtosis	0.13	Kurtosis	0.16	Kurtosis	0.71
Skewness	0.19	Skewness	0.17	Skewness	0.68
Range	145.00	Range	154.28	Range	81.52
Minimum	40.00	Minimum	45.72	Minimum	15.00
Maximum	185.00	Maximum	200.00	Maximum	96.52
Sum	42160.04	Sum	35163.77	Sum	13172.46
Count	298.00	Count	302.00	Count	297.00
Confidence Level(95.0%)	2.22	Confidence Level(95.0%)	2.23	Confidence Level(95.0%)	1.77

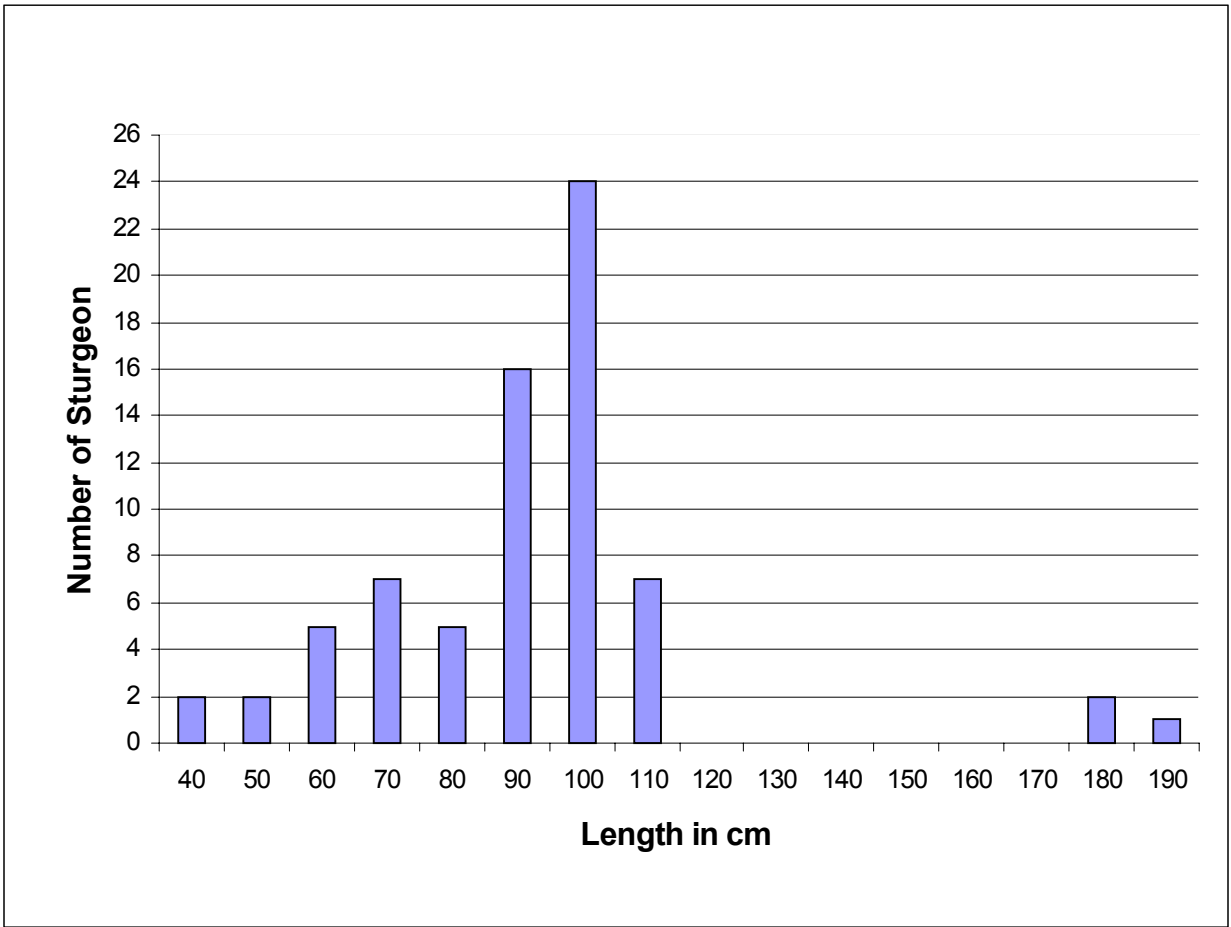


Figure 7. Number of sturgeon caught by commercial fishers, by length, for 2001.

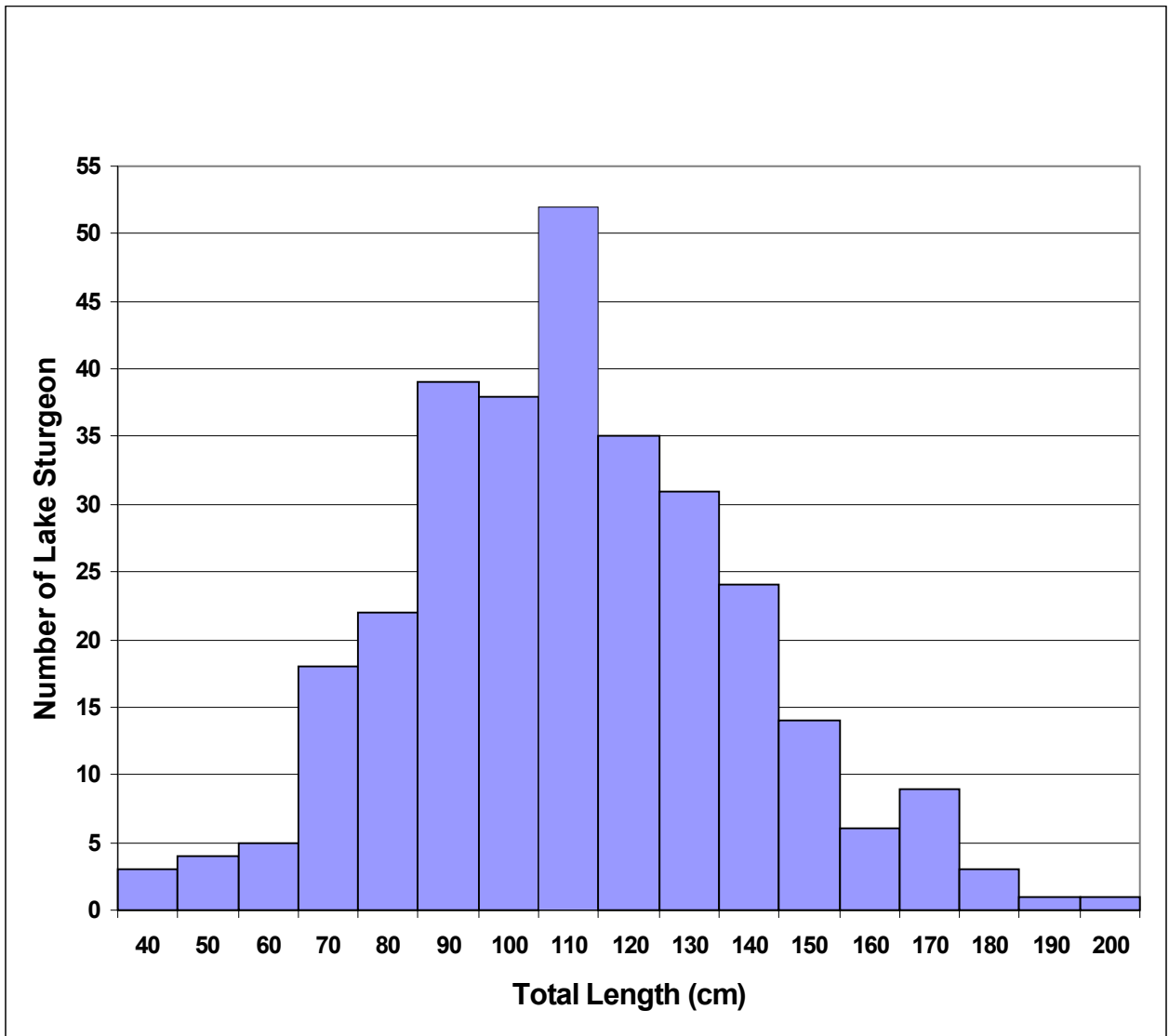


Figure 8. Length frequency of 254 Lake Huron lake sturgeon captured by commercial fishers from 1995 to 2001.

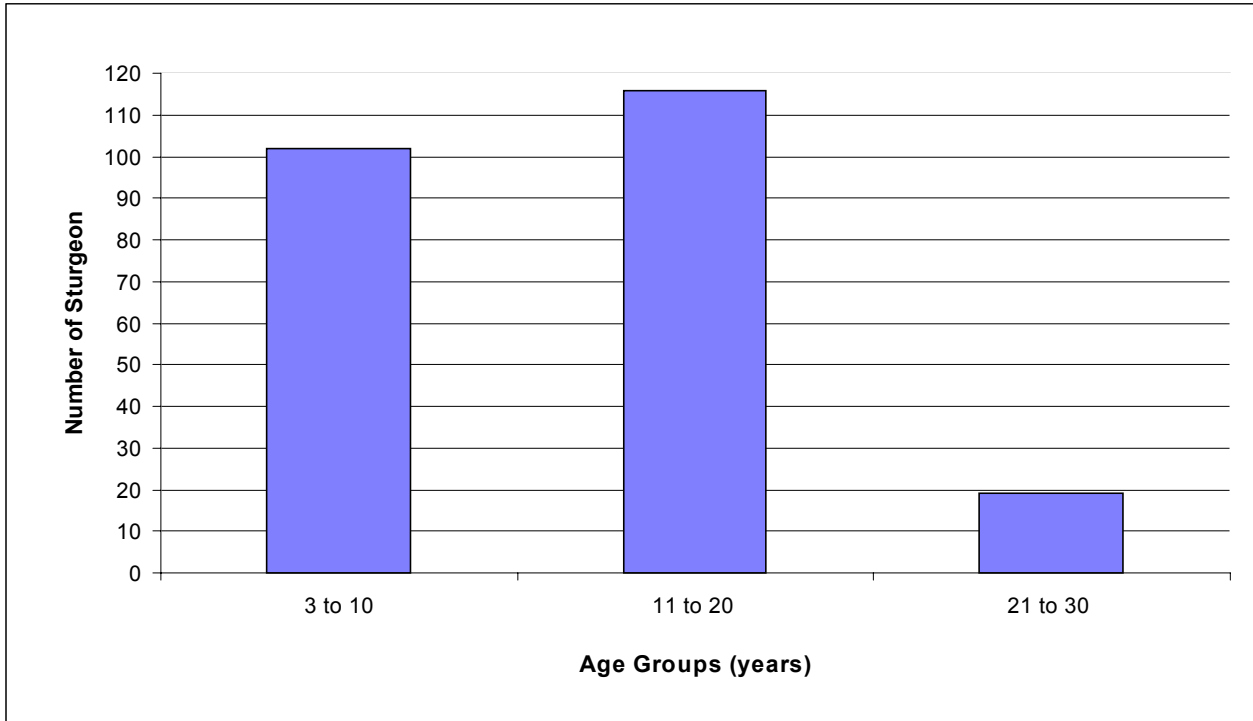


Figure 9. Age frequency of Lake Huron lake sturgeon caught by commercial fishers in Saginaw Bay from 1995 to 2001.

Figure 10 illustrates the length to age relationship for fish caught in 2001 in Saginaw Bay. Figure 11 illustrates the relationship for 1995-2001 in Saginaw Bay.

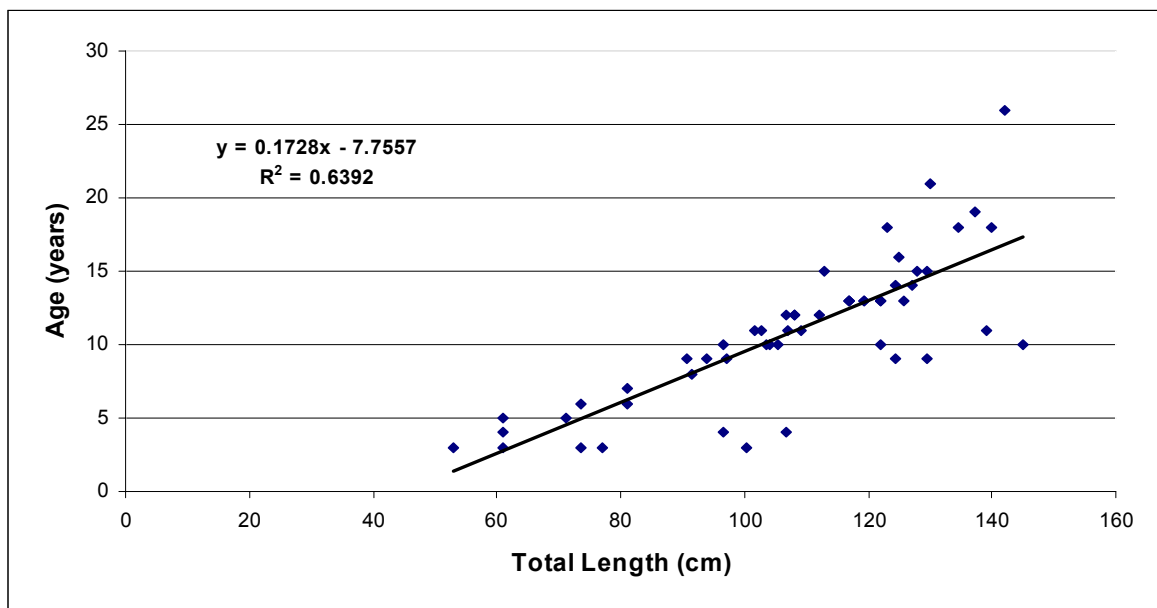


Figure 10. Age-Length relationship for lake sturgeon caught by commercial fishers in Saginaw Bay during 2001.

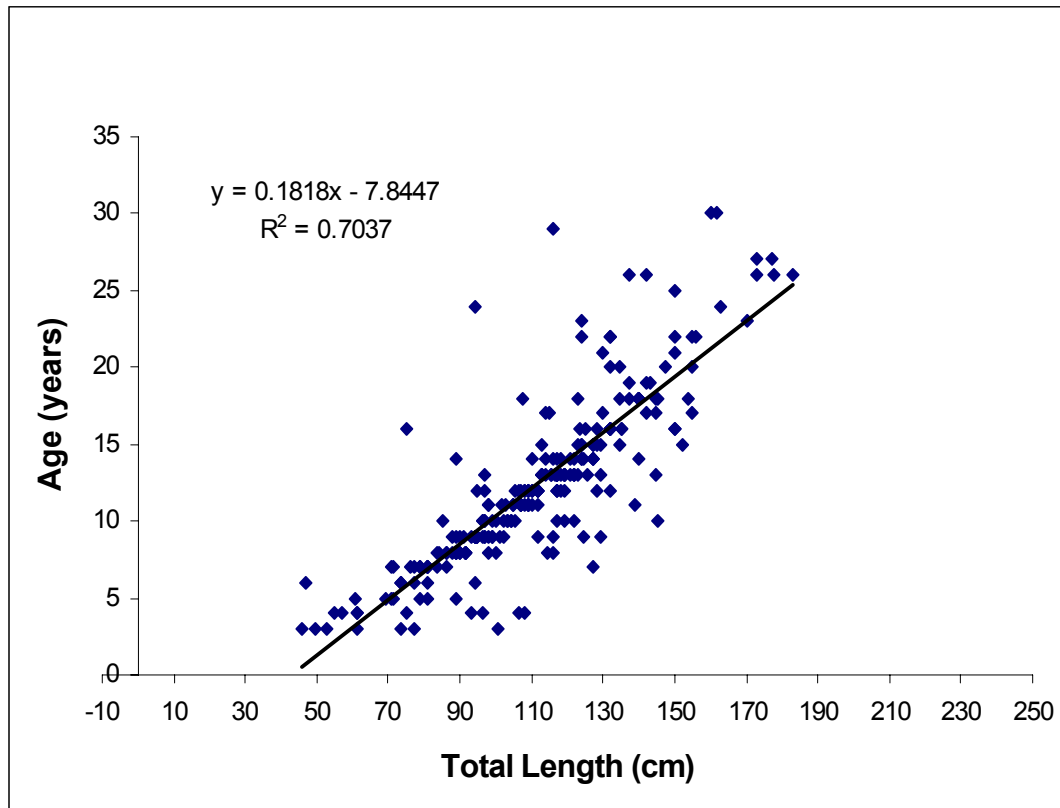


Figure 11. Age-length relationship for lake sturgeon caught by commercial fishers in Saginaw Bay from 1995-2001.

There were 12 sturgeon recaptured in 2001. Figure 12 illustrates the number of recaptured sturgeon from 1996 to 2001. Table 4 shows the date each recapture was originally tagged, date recaptured, TL at tagging, TL at recapture, FL at tagging, FL at recapture, girth at tagging, and girth at recapture. Not all fish were measured at tagging and or recapture therefore some data are missing.

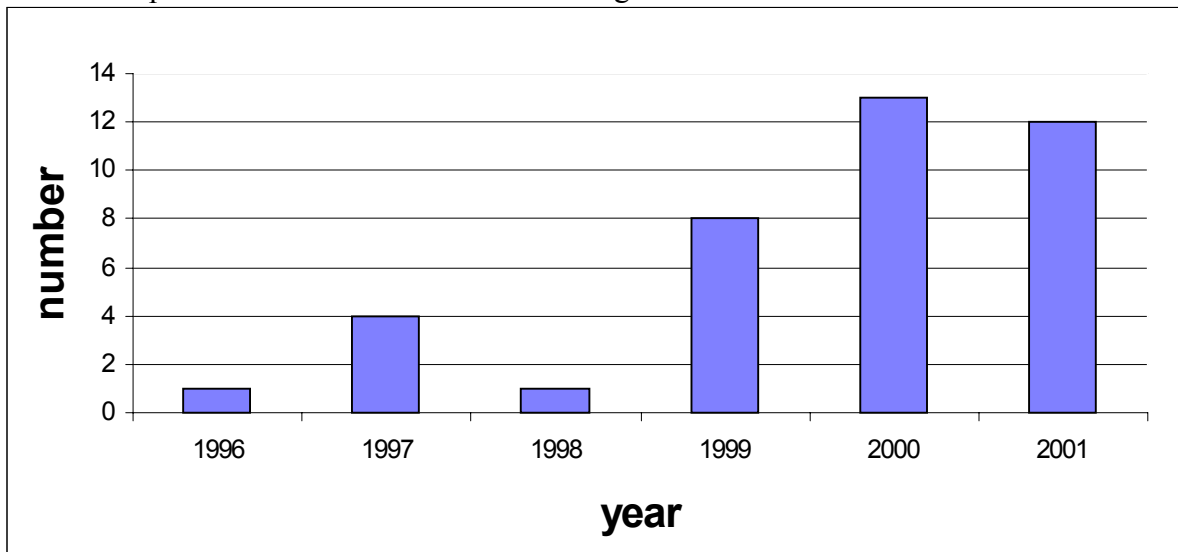


Figure 12. Number of sturgeon recaptured by commercial fishers from 1996 through 2001.

Table 4. Date and growth pattern of each sturgeon recaptured by commercial fishers from 1996 through 2001.

Tag Number	Date Tagged	Date Recap	TL tagged	TL Recap	FL Tagged	FL Recap	Girth Tagged	Girth recap
4005	8/19/97	5/29/00	130.00	137.00	122.00	129.00	61.00	62.00
4033	10/29/96	5/22/97	77.00	77.00	74.00	72.00	29.00	29.00
4036	4/26/97	4/26/00	104.00	112.00	93.00	102.00	38.00	39.00
4050	10/16/97	4/29/00	150.00	157.00	141.00	143.00	59.00	61.00
4054	4/28/97	2/28/01	103.00	128.00	92.00	118.00	39.00	49.00
4056	10/24/97	4/26/01	98.00	113.00	90.00	103.00	32.00	39.00
4064	9/25/99	5/22/00	89.00	91.00	82.00	83.00	31.00	32.00
4064		8/8/00		91.00		84.00		33.00
4093	4/17/99	5/14/01	140.00	142.00	127.00	132.00	58.00	58.00
4110	11/17/98	5/21/00	152.00	155.00	140.00	142.00	56.00	58.00
4114	9/20/98	4/26/99	75.00		67.00		24.00	
4125	9/29/97	10/30/01	94.00	117.00	86.00	110.00	33.00	36.00
4159	10/12/98	4/20/99	116.00		111.00		38.00	
4204	10/25/98	6/13/00	98.00	102.00	91.00	96.00	36.00	39.00
4258	4/11/00	4/27/00	145.00	145.00	137.00	137.00	53.00	53.00
4255	5/30/00	2/28/01	140.00	139.00	132.00	134.00	55.00	56.00
6270	10/19/98	6/13/00		121.00		112.00		45.00
6785	11/2/95	12/2/00		117.00		108.00		38.00

DISCUSSION

Not all lake sturgeon captured during this study have had aging structures collected. Therefore to get a complete age structure for the fish collected in this study three regressions (total length vs age, fork length vs age, and girth vs age) were developed for all the known age fish captured from 1995 through 2001. These regressions produce an equation that can be used to age fish with a known total length, fork length, or girth. All three regressions were applied to each sturgeon without an age structure. The results of each regression were then averaged and this value was assigned as the age of the fish.. This process produced a product that on average was ± 3 years from the actual age of the fish. This process is not as reliable for assigning ages to lake sturgeon beyond 30 years. Saginaw Bay seems to be an area occupied by juvenile to sub-adult lake sturgeon. This result may be biased by the gear used to collect the lake sturgeon. The trap nets may not be big enough for a large sturgeon (the target species are lake whitefish and yellow perch). Another reason may be that larger sturgeon are occupying different areas of the Bay than are being fished. Because limited numbers of adult lake sturgeon have been caught in the Bay and restoration of the species is dependent on spawning adults, future agency assessment should focus on determining whether or not adult sturgeon do occupy the Bay.

During the 2001 fishing season more sturgeon were caught than any previous year of this study. There was a total of 69 sturgeon caught. The 1997 season was the next highest season with 53 sturgeon caught. Of the 69 sturgeon caught 12 were recaptures. Prior to the 2001 catch there were 233 sturgeon tagged in Saginaw Bay. Twelve recaptures represent 5% of the tagged sturgeon.

Acknowledgements

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