Activities of the Central Great Lakes Bi-National Lake Sturgeon Group in 1997 and 1998

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Preface

Lake sturgeon *Acipenser fulvescens* one of 27 sturgeon species world wide, is one of the oldest living vertebrates on earth. Considered "living fossils" lake sturgeon evolved 250 million years ago, surviving the sudden disappearance of most dinosaurs. Lake sturgeon are found in many large rivers and lakes of North America. Its range extends from the St. Lawrence River in the east, to Hudson Bay in the north, west to the North Saskatchewan River in Alberta, and south to the Tennessee River in Alabama. Lake sturgeon are the only sturgeon species endemic to the Great Lakes basin and are the largest freshwater fish in the basin. Historically, lake sturgeon were abundant in Lake Huron, Lake Erie, and the St. Clair waterway (St. Clair River, Lake St. Clair, Detroit River) that connects these two Great Lakes. Generally, it is believed that some level of self-sustainability remains in the St. Clair waterway, however, little biological information is currently available to support this belief. Lake sturgeon populations are now estimated to be about 1% of their former abundance. They are listed as either threatened or endangered by 19 of 20 states in its original range. Lake sturgeon have been identified as a species of special concern by the U.S. Fish and Wildlife Service and are considered a threatened species in North America by the American Fisheries Society.

In recent years, interest in the status of lake sturgeon in the Great Lakes basin has been increasing for all natural resource agencies involved in fisheries management. Federal, state, and provincial agencies have initiated status surveys and are in various stages of development of recovery or management plans for waters under their jurisdiction. Fish community objectives (FCO) for Lake Huron call for the recovery of lake sturgeon to levels allowing removal from threatened status. Although lake sturgeon are not identified specifically in Lake Erie FCO, they are considered an important native species with efforts underway to develop strategies for enhancement and management. The Province of Ontario is seeking biological information to aid in the protection of stocks in waters under it's jurisdiction. Ecosystem management goals and objectives developed by the Service's Great Lakes Basin Ecosystem Team contain several references to lake sturgeon and the need to inventory, protect, and restore the species to greater levels of abundance.

In 1995, the Alpena Fishery Resources Office (FRO) assumed the lead role in assembling resource personnel from federal, state, and provincial agencies for the development of a collaborative effort to better define the population status of lake sturgeon in Lakes Huron and Erie and their connecting waterways. These efforts resulted in the creation of the Central Great Lakes Bi-National Lake Sturgeon Group (CGLBLSG). The Alpena FRO has agreed to compile an annual report summarizing activities of agencies and organizations participating in the CGLBLSG. Following is a summary of 1997-1998 activities and plans for 1999. The purpose of this report is to inform all interested parties of the ongoing lake sturgeon efforts in Lakes Huron and Erie and their connecting waterways. The initiative that has been launched by the CGLBLSG to coordinate efforts and share information should enable the participating resource agencies to gather more information, in a timely manner, on the status of this historically important Great Lakes fish species.

LAKE HURON

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1997

General

Lake sturgeon assessment continued in 1997 for the third straight year. As in the previous two years, all lake sturgeon were collected by commercial fishermen in both the north channel and the main basin of Lake Huron. In the North Channel, lake sturgeon were either caught incidentally in small (64-127 mm) mesh gill nets or targeted in large (305-330 mm) mesh gill nets. All fish were handled by commercial fishermen themselves, including sampling and tagging the fish. In the southern main basin, the majority of the fish continued to be caught incidentally in trapnets which were fishing primarily walleye. Most of the sturgeon caught were returned to commercial holding facilities and Lake Huron Management Unit (LHMU) staff arrived to sample the fish. A small number of fish were also sampled by the fishermen on the lake.

A total of 617 lake sturgeon were captured and sampled in 1997. The large increase was due to the number of fish sampled in southern Lake Huron (Table 1). More lake sturgeon were sampled in southern Lake Huron in 1997 than in the whole lake in 1995 and 1996 combined. This brings the total number of lake sturgeon sampled in Ontario waters of Lake Huron to 1,017 fish. Sampling in the north channel has been somewhat more stable, steadily increasing as the program continues.

The majority of the fish continue to be caught in the early summer months of May and June in the north channel (77%) and during the fall months of September, October and November in the southern main basin (71%). It should be noted that this abundance pattern is most likely biased due to fishing effort targeted at other species. This is most probable in the southern main basin where all of the lake sturgeon catch is incidental while fishing for walleye. The spring harvest in the north channel is the result of targeting for lake sturgeon while the fall catch is incidental while fishing for yellow perch and to a lesser extent lake whitefish.

Table 1. Summary of lake sturgeon sampled in Lake Huron, Canadian waters from 1995 to 1997.

	1995	1996	1997	TOTAL
North Channel	114	125	131	370
S. Lake Huron	103	58	486	647
TOTAL	217	183	617	1,017

Biological Attributes

Several morphological parameters were measured from as many fish as possible in 1997 (Table 2). Fish that had not been captured before were generally sampled completely whereas fish that were current year recaptures where often not re-measured. Aging structures were taken only from fish which had not been previously captured. Sex determination was only done on fish that were harvested, allowing internal examination of gonads to verify sex and gonad state of maturity. Morphological relationships were plotted and regressions calculated for all sturgeon in both areas (Figures a to b).

Table 2. Summary of fish attributes collected in 1997 from Ontario waters of Lake Huron.

	North Channel	S. Lake Huron	Total
Number of Fish	131	486	617
Total Lengths	120	486	606
Fork Lengths	88	435	523
Dressed Lengths	58	484	542
Weights	56	486	542
Girths	110	484	594
Sex	23	147	170
Age Structure Removed	111	472	583
Tagged	78	289	367

The largest fish sampled in 1997 was from the north channel. It had a total length of 1770 mm but was unfortunately not weighed or aged. Based upon length weight regressions from that area, the fish would have weighed in excess of 53 kg or approximately 117 lbs. Two large fish (1605 mm total length) were sampled in southern Lake Huron, one a 28 year old female which weighed 32.4 kg (71.5 lb.) and the other a 36 year old male which weighed 27.4 kg (60.5 lb.). The smallest fish sampled was a one year old lake sturgeon caught in southern Lake Huron which was 290 mm in total length and weighed only 100 g. An age 2 lake sturgeon was sampled in the north channel and measured 380 mm in total length and weighed 100 g. A summary of morphological data is shown in Table 3 and in Figures a to b.

One new analysis which was done with the morphological data in 1997 was the development of an method to determine the weight of lake sturgeon using length and girth measurements. This was at the request of Conservation Officers and other biologists who were receiving information from anglers and citizens who did not have

access to weigh scales. A multiple regression equation was generated which describes the relationship quite well and predicts weights with fairly good accuracy ($r^2 = 0.9701$). Due to the non-linear nature of the relationship between weight and length and girth (power function), the data were log transformed. The equation is as follows:

$$\text{Log (RWT)} = \text{Log (TLEN)}*2.44499 + \text{Log (Girth)}*1.00584 - 21.1645$$

where Rwt is round weight in kg, TLEN is total length in mm and Girth is in mm.

More sex and maturity information was available in 1997 due to a slight change in sampling protocol. In southern Lake Huron, the majority of lake sturgeon were sampled by LHMU staff. These fish were caught by the commercial fishers and held in live tanks until LHMU staff could arrive and sample the fish. Fish which were of legal harvest size were not processed until LHMU staff had sampled them. This allowed a large number of fish to be sexed, all by internal visual inspection.

A total of 170 fish were sexed in 1997, 147 of them from southern Lake Huron. Interestingly, the sex ratio was virtually 1:1 (73 males, 74 females). This is not considered to be the norm for lake sturgeon populations where males are felt to be more abundant than females. The state of maturity of the fish however showed that 72% of the males sexed were sexually mature while only 26% of the females sexed were sexually mature. This suggests that sex ratios determined in a commercially exploited population are somewhat different than those determined in spawning run populations.

Being able to properly sex lake sturgeon is critical to sound management of this species. Due to the fact that not all researchers will have the ability to determine lake sturgeon sex, we decided to investigate the possibility of sexing lake sturgeon externally. The availability of known sexed fish made it possible for us to test our criteria immediately. Fish that were to be harvested, were first sexed using external characteristics only and then the fish was harvested and the sex determined visually.

External sex determination was tested on 2 separate occasions. On the first attempt, we sexed 25 fish and were correct 75% of the time. The technique was most accurate at determining males (92% correct) versus females (66.7%). On the second occasion, one month later, the technique was used on 35 fish and was correct only 60% of the time. Once again the technique was most successful at determining the sex of males (68%) versus females (54%). Photographs and descriptions were taken of all structures. These need to be reviewed to see if the technique can be refined to provide results which would be of use. This work will carry on into 1998.

Table 3. Summary of morphological data collected on lake sturgeon in Ontario waters of Lake Huron.

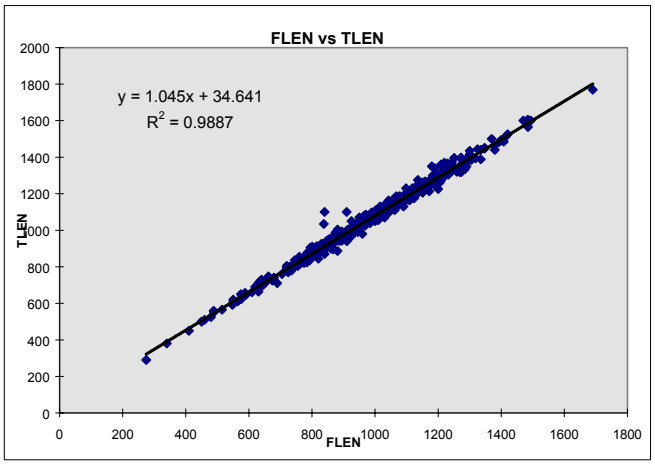
	Southern Lake Huron	North Channel
Mean Total Length (mm)	1066	901
Median Total Length (mm)	1054	893
Total Length Range (mm)	290 - 1605	355 -1770
Mean Round Weight (kg)	7.96	1.61
Modal Round Weight (kg)	4.1	2.0
Round Weight Range (kg)	0.1 - 32.4	0.1 - 4.2
Mean Age (yr.)	13.8	9.7
Median Age (yr.)	13	8
Age Range (yr.)	1 - 38	2 - 30

Habitat information was collected only from the North Channel sampling sites. Both depth of capture and substrate type were recorded. The average depth of capture throughout the year was approximately 19 metres. Lake sturgeon were generally caught in shallower water in the spring, averaging 17.4 metres and deeper water in the fall, averaging 22.8 metres. Sturgeon were generally not seen shallower than 5 metres nor deeper than 45m. Once again, due to the nature of the lake sturgeon fishery, this data is most likely biased to the species being targeted at the time. The spring data consists of lake sturgeon targeted effort, but the fall does not. However, we can still get a general feel for depths where lake sturgeon can in fact be found throughout the year.

The lake bottom type was recorded during the month of May and into early June in the north channel. This was during the period that lake sturgeon were being targeted. At the beginning of the month, all lake sturgeon were being caught over mud or rock bottom substrates. By the middle of the month, this changed to sand bottom substrates. All lake sturgeon caught from the 13th of May to the 6th of June were caught over sand substrates.

In 1997, a total of 399 fish were tagged, 303 in southern lake Huron and 96 in the north channel. This brings the total fish tagged in Canadian waters of Lake Huron to 521. A total of 32 fish were recaptured in 1997, 5 from 1995, 2 from 1996 and the remainder were within year recaptures. All of the fish recaptured in the north channel were originally tagged in the north channel. Two lake sturgeon originally tagged in Saginaw Bay and one originally tagged in Lake St. Clair were recaptured in southern Lake Huron. The remainder of recaptures in this part of the lake were originally tagged in southern Lake Huron. To date, no recaptured fish have been re-aged. This program will most likely begin in 1998. As in 1996, within year recaptures generally occur within one month of the original tagging. One individual lake sturgeon in the north channel was recaptured twice following the initial capture within a 10 km radius and over a 3 day period. Fish recaptured in southern Lake Huron which were from other jurisdictions were all captured in the late fall.

The lake sturgeon sampling program in Canadian waters of Lake Huron was fairly successful in 1997. More and more fish continue to be showing up in the commercial catches, both incidentally and when targeted. Cooperation by commercial fishermen continues to drive this program with more and more fishermen becoming interested in participating. Planned expansion into the north channel rivers did not take place and will be attempted once again in 1998. Also an effort to collect information in southern Georgian Bay must be attempted in 1998. Numerous accounts of lake sturgeon sightings have been recorded by commercial fishermen in that area, some estimating 20 to 30 fish incidentally caught per net. The number of juvenile fish continues to be high, suggesting stable populations, most likely larger than had previously been suggested. However, much more work is needed in order to better determine the size and status of lake sturgeon in the various regions of Lake Huron. Future work will focus on just that.


FLEN vs TLEN
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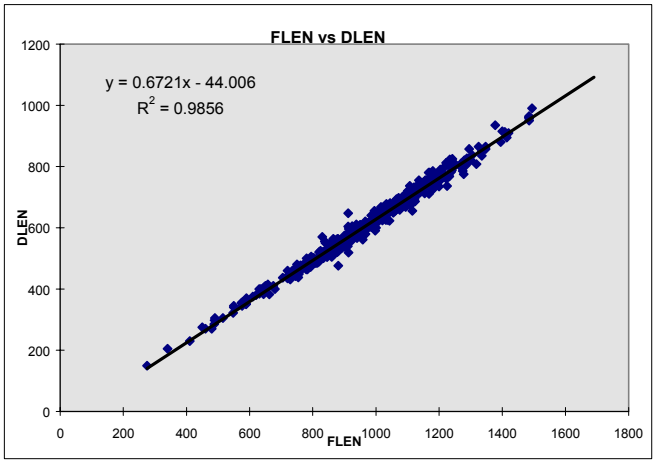
TLEN
FLEN
0
200
400
600
800
1000
1200
1400
1600
1800
2000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DLEN
FLEN
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400
600
800
1000
1200
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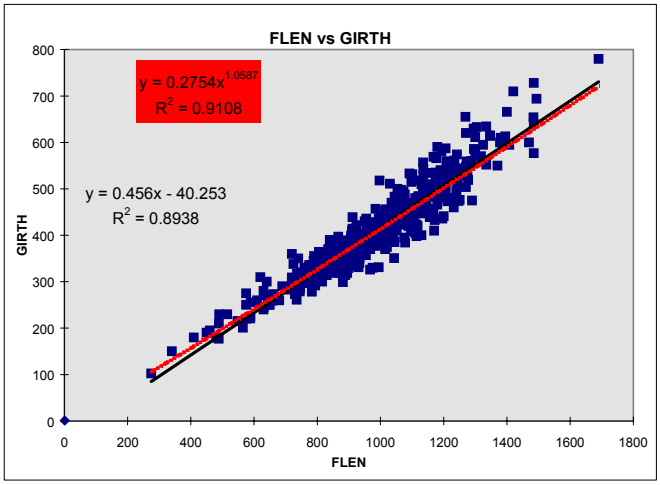
1800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R2 = 0.9108
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R2 = 0.8938
GIRTH
FLEN
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1600
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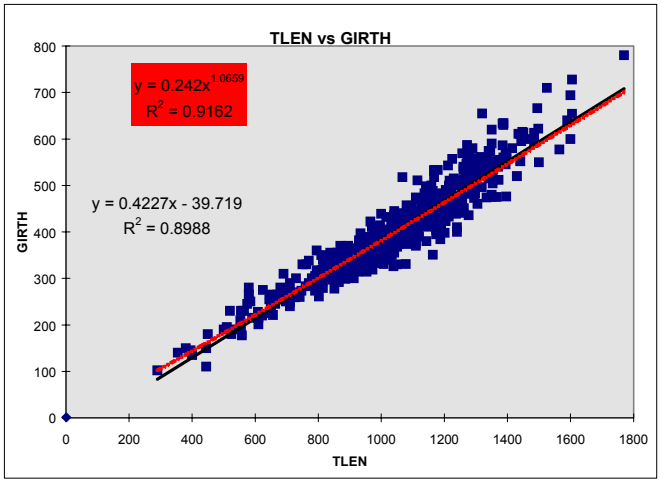
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R2 = 0.8988
GIRTH
TLEN
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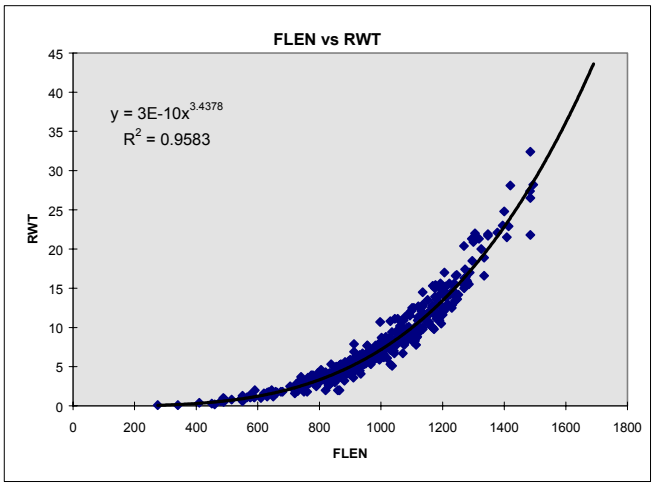
1600
1800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R2 = 0.9583
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FLEN
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20
25
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35
40
45
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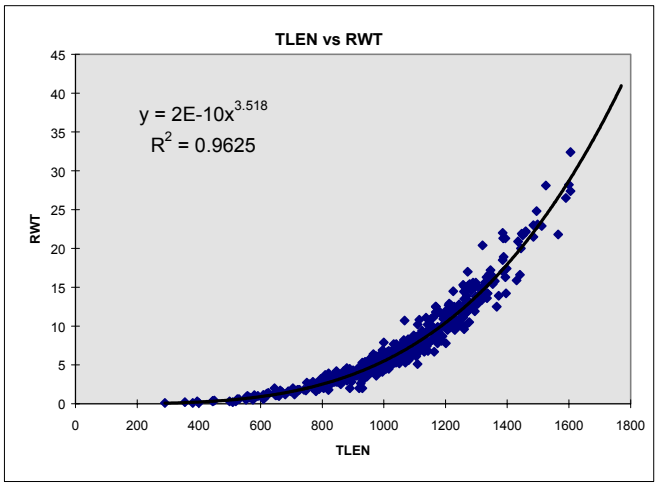
1000
1200
1400
1600
1800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TLEN
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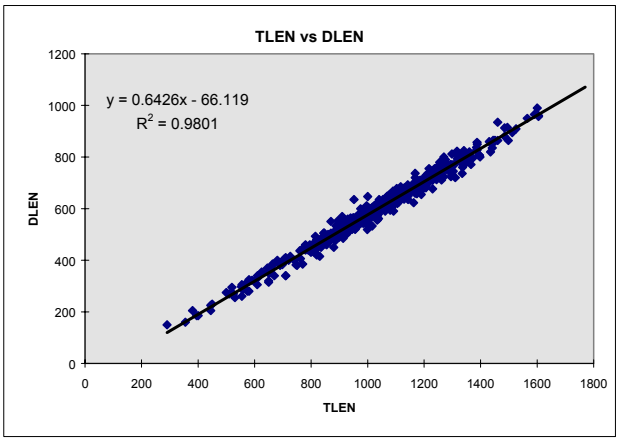
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TLEN
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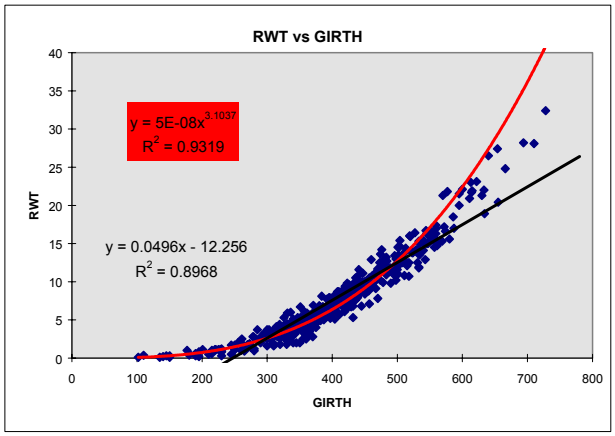
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R2 = 0.8968
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GIRTH
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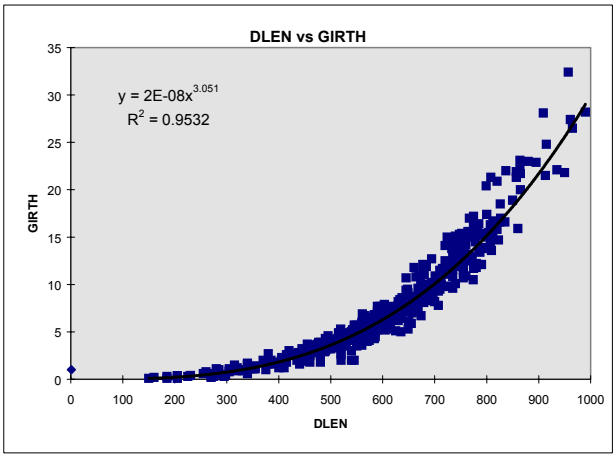
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DLEN
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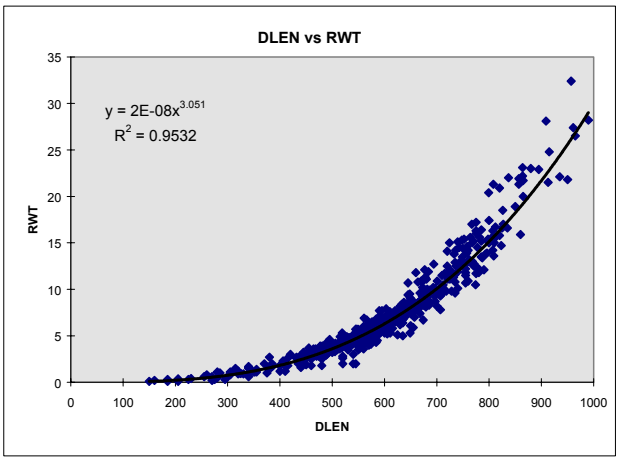
1000


DLEN vs RWT
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R2 = 0.9532
RWT
DLEN
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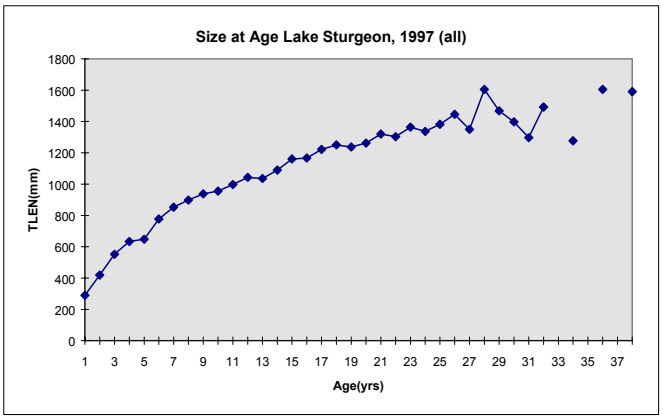
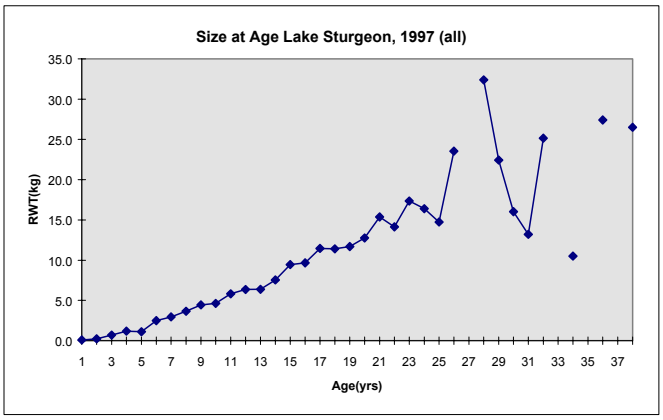
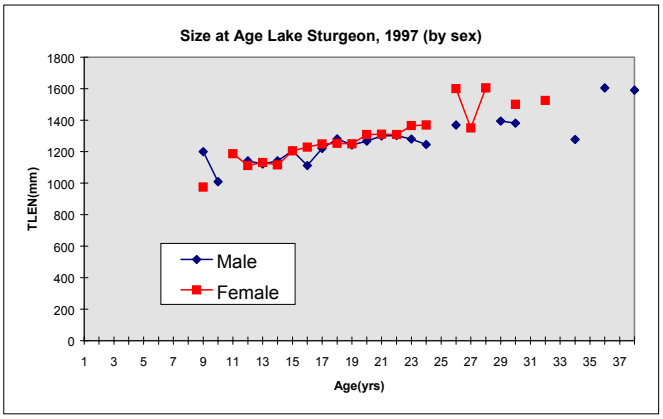
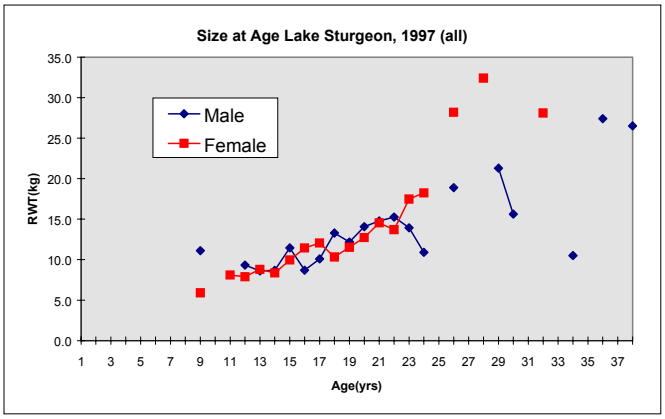
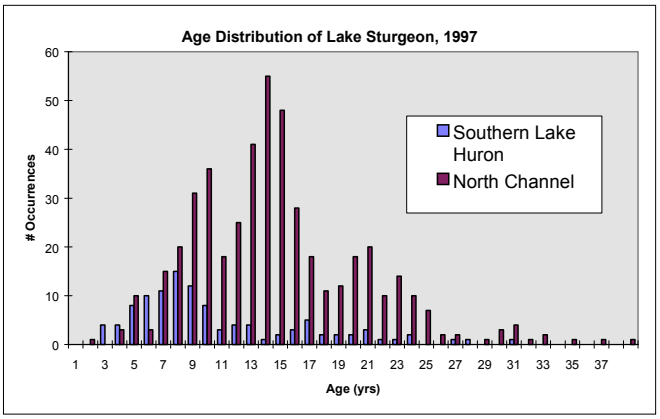
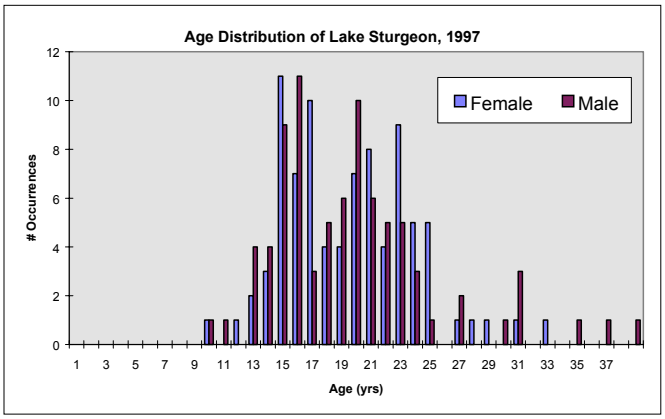

Size at Age Lake Sturgeon, 1997 (all)
TLEN(mm)
Age(yrs)

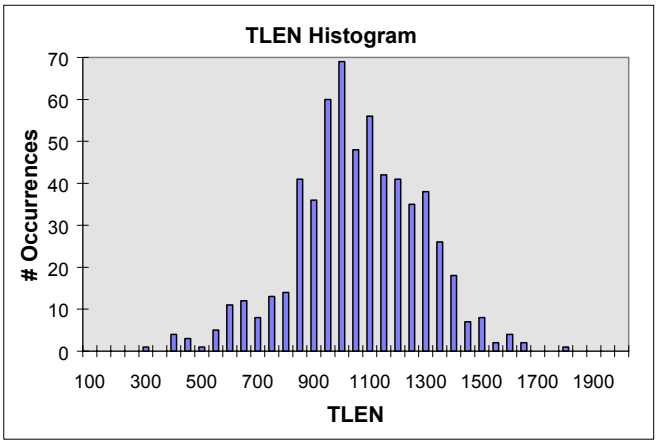

Size at Age Lake Sturgeon, 1997 (all)
RWT(kg)
Age(yrs)


Size at Age Lake Sturgeon, 1997 (by sex)
TLEN(mm)
Male
Female
Age(yrs)


Size at Age Lake Sturgeon, 1997 (all)
RWT(kg)
Male
Female
Age(yrs)


Age Distribution of Lake Sturgeon, 1997
Occurrences
Southern Lake Huron
North Channel
Age (yrs)


Age Distribution of Lake Sturgeon, 1997
Occurrences
Female
Male
Age (yrs)


TLEN Histogram
Occurrences
TLEN
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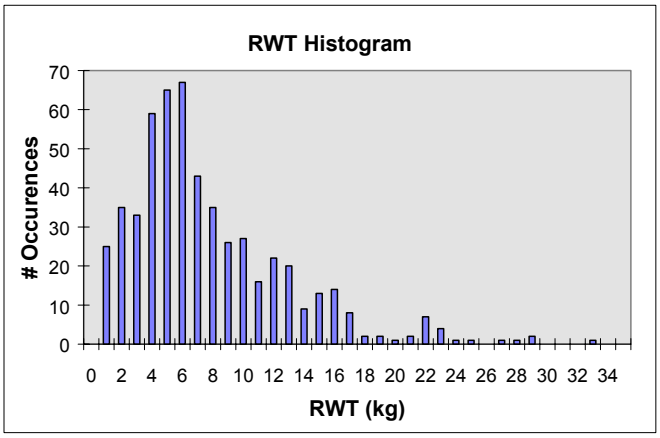
100 300 500 700 900 1100 1300 1500 1700 1900


RWT Histogram
Occurences
RWT (kg)
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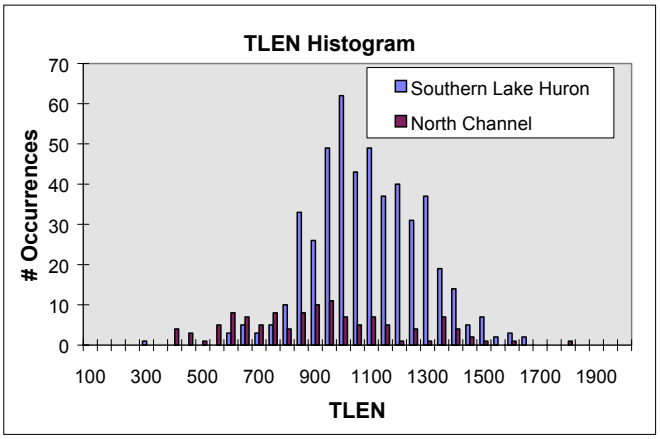
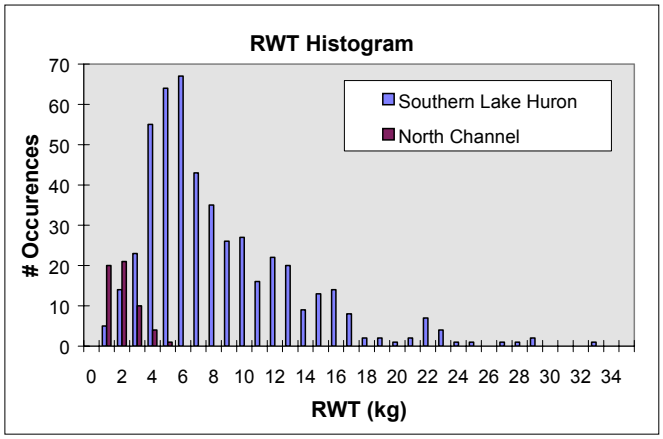

TLEN Histogram
Southern Lake Huron
North Channel
Occurrences
TLEN
0 10 20 30 40 50 60 70
100 300 500 700 900 1100 1300 1500 1700 1900


RWT Histogram
Southern Lake Huron
North Channel
Occurences
RWT (kg)
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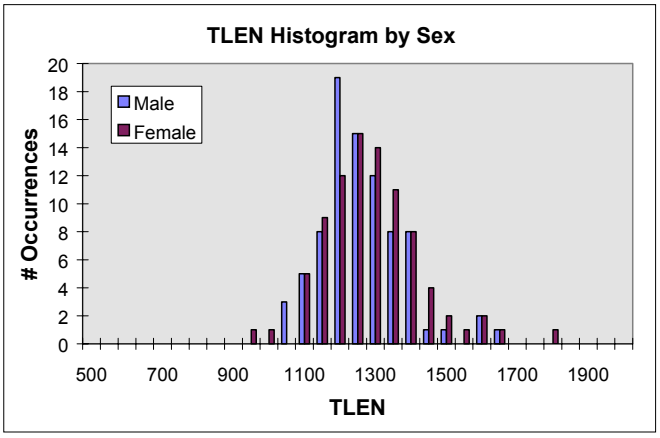
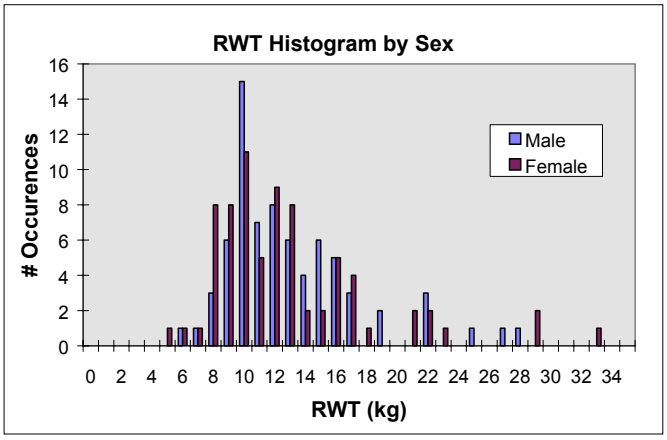
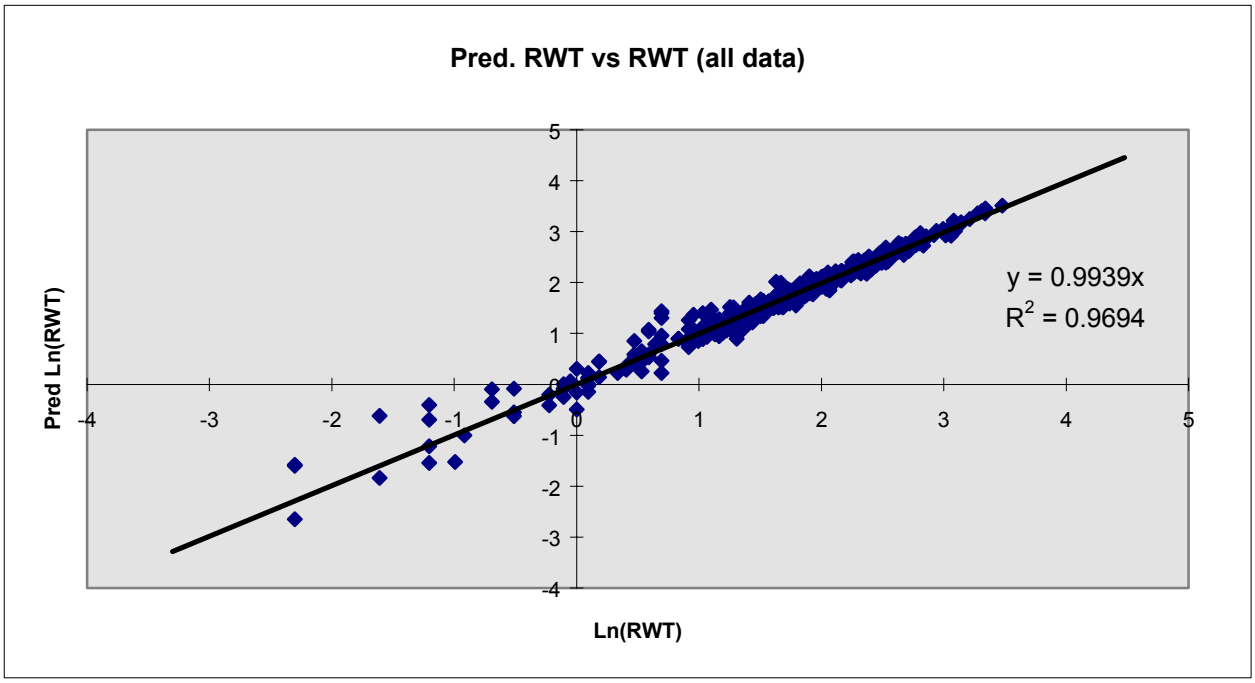
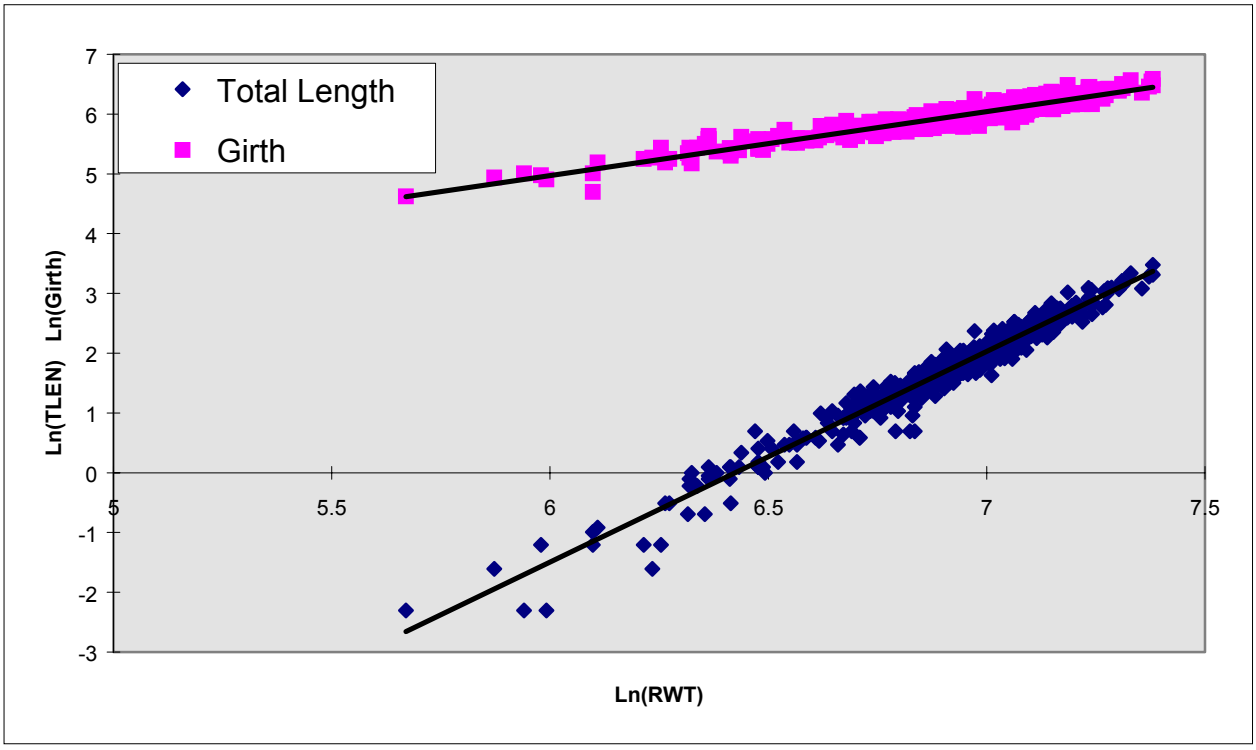
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34


TLEN Histogram by Sex
Male
Female
Occurrences
TLEN
0 2 4 6 8 10 12 14 16 18 20
500 700 900 1100 1300 1500 1700 1900


RWT Histogram by Sex
Male
Female
Occurences
RWT (kg)
0 2 4 6 8 10 12 14 16
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34


Pred. RWT vs RWT (all data)
Pred Ln(RWT)
Ln(RWT)
y = 0.9939x
R2 = 0.9694
5
4
3
2
1
0
-1
-2
-3
-4
-4
-3
-2
-1
0
1
2
3
4
5


Total Length
Girth
Ln(TLEN) Ln(Girth)
Ln(RWT)
7
6
5
4
3
2
1
0
-1
-2
-3
5
5.5
6
6.5
7
7.5

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1997

Since 1995, the Alpena FRO in cooperation with the Michigan Department of Natural Resources (MDNR) and commercial fishers in Lake Huron, have been involved in a tagging program to assemble crucial information on relative abundance, movement, and life history of Lake Huron lake sturgeon. From 1995 through August 1996, Floy Cinch-up tags (Model FT4, Floy Tag & Manufacturing, Inc., Seattle, Washington) were applied to all captured lake sturgeon. The tags were inserted through the musculature posterior to the dorsal fin. In September 1996, the Floy tag was replaced with a Monel self-piercing animal ear tag (National Band and Tag CO., Newport, Kentucky) that was attached to the left operculum of the lake sturgeon.

Total length (TL), fork length (FL), and girth were measured for all captured lake sturgeon. Sectioning of the pectoral fin ray is an accurate and non-lethal method for estimating age of lake sturgeon and is employed by both Ontario Ministry of Natural Resources - Lake Huron Management Unit (OMNR-LHMU) and MDNR. Therefore, in July 1997, commercial fishers were provided materials and instructions necessary for removing pectoral fin rays from captured lake sturgeon. The leading (marginal) ray of the left pectoral fin was removed from each fish to provide estimates of age. Abiotic data recorded for each lake sturgeon captured include; latitude/longitude, water depth, date, gear type, and mesh size. In addition, the tag type, agency, and identification number of tag applied to or observed on the fish was also recorded.

The number of Michigan state-licensed commercial fishers assisting with the lake sturgeon project has increased each year of the project (Table 1). In 1997, 10 commercial fishers (operating 16 boats) were involved in the project, eight of these fishers operated in Saginaw Bay. Biological data were recorded for 112 lake sturgeon captured by commercial fishers from 1995 to 1997. Length of these fish ranged from 46 to 188 cm (TL) with a mean length of 110 cm (Figure 2). The total number of lake sturgeon captured and tagged has increased each year of the project. Tags have been attached to 90 fish. Twelve lake sturgeon have been captured outside Saginaw Bay (Barbeaux Fishery, Detour and Gauthier-Spaulding Fishery, Roger City). Several relationships were developed to aid information exchange between the agencies involved in lake sturgeon status surveys. Figures 3 and 4 illustrate total length-fork length and total length-girth relationships, respectively. Twenty-four of the 53 lake sturgeon captured in 1997 had pectoral fin rays removed for aging. These fish ranged in age from

4 to 72 years with a mean age of 17.3 years. The age-length relationship is given by figure 5.

Table 1. Number of lake sturgeon encountered as by-catch by participating commercial fishers in Lake Huron trap net fishery since 1995. Numbers in parenthesis represent the number of fish tagged.

Fisher	Year enrolled	Number of sturgeon 1995	1996	1997	Total sturgeon captured
Barbeaux Fishery	1996	-	1 (1)	7 (7)	8 (8)
Bay Port Fish Company	1995	13 (13)	7 (7)	10 (10)	30 (30)
Beardsley Fish Company	1997	-	-	0	0
Cedarville Fish Company	1997	-	-	1 (1)	1 (1)
Gauthier-Spaulding Fishery	1995	2 (2)	0	2 (2)	4 (4)
Lentz Fishery	1995	3 (0)	8 (6)	8 (6)	19 (12)
Sam=s Fishery	1995	1 (0)	3 (1)	4 (4)	8 (5)
Serafin Fishery	1996	-	10 (7)	17 (17)	27 (24)
Warren Beers Fishery	1995	2 (0)	0	1 (0)	3 (0)
Whytes Fishery	1995	2 (0)	7 (3)	3 (3)	12 (6)
Total		23 (15)	36 (25)	53 (50)	112 (90)

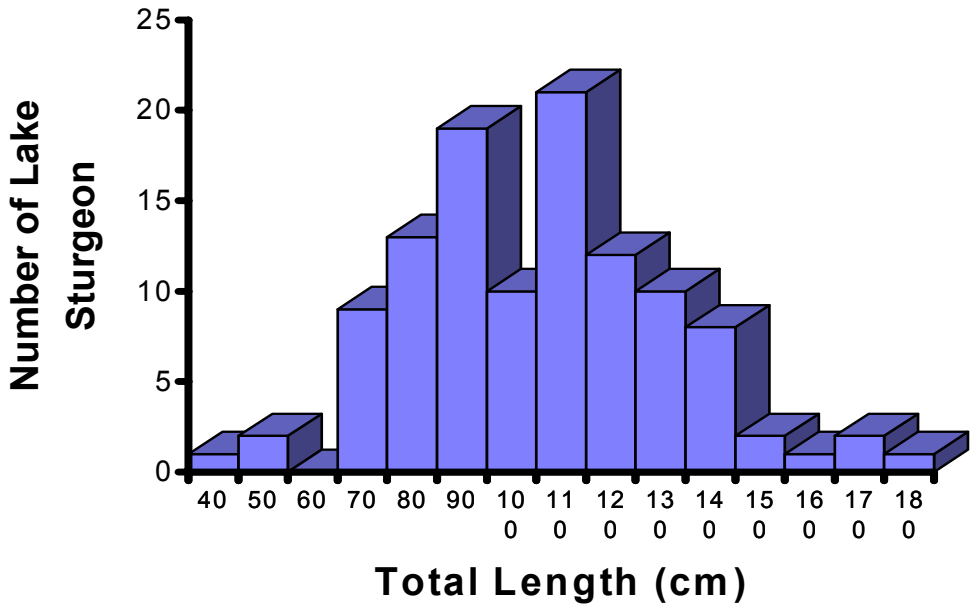

Figure 2. Length frequency of lake sturgeon captured as by catch in the Lake Huron trap net fishery, 1995-1997.

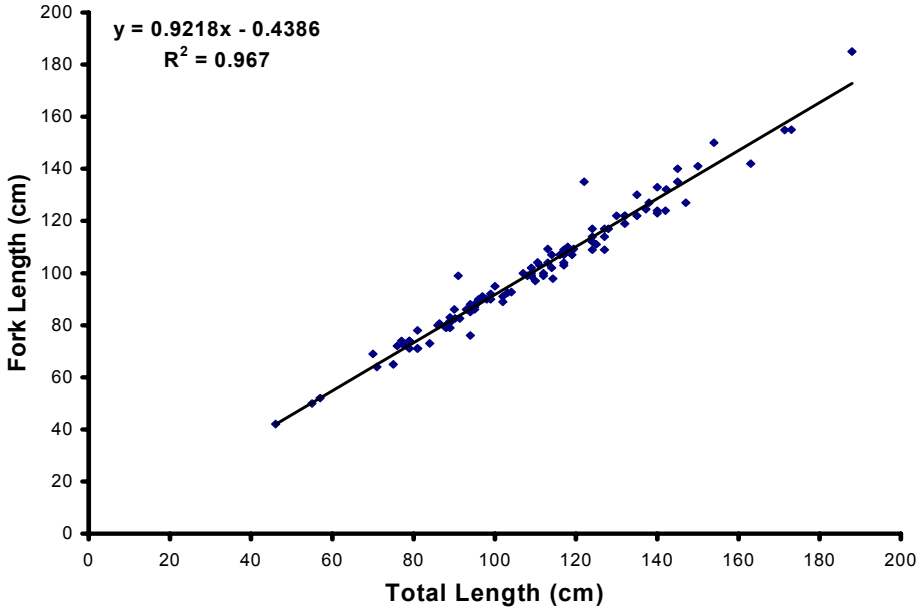

Figure 3. Total length to fork length relationships for lake sturgeon sampled by Michigan state-licensed commercial fishers from Lake Huron, 1995-1997.

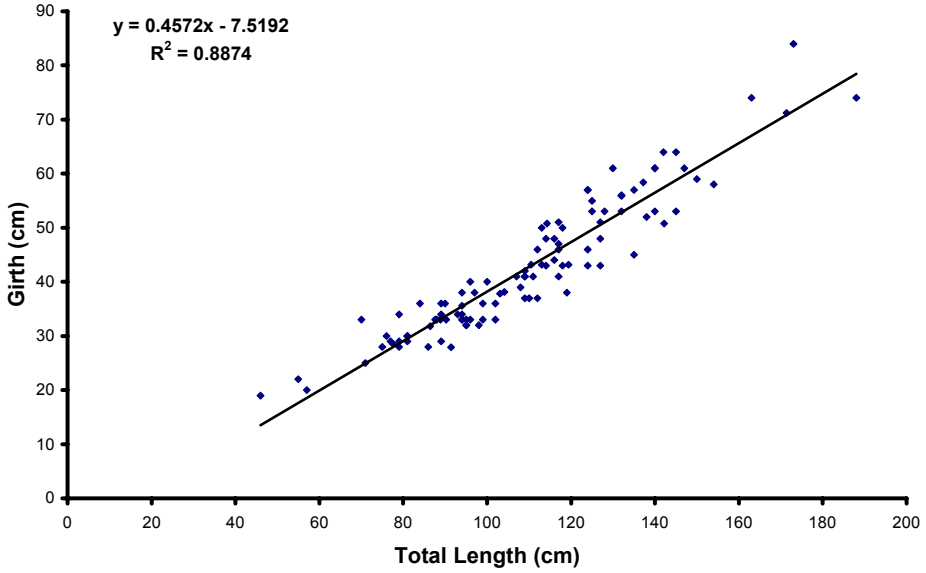

Figure 4. Total length to girth relationship for lake sturgeon sampled by Michigan state-licensed commercial fishers from Lake Huron, 1995-1997.

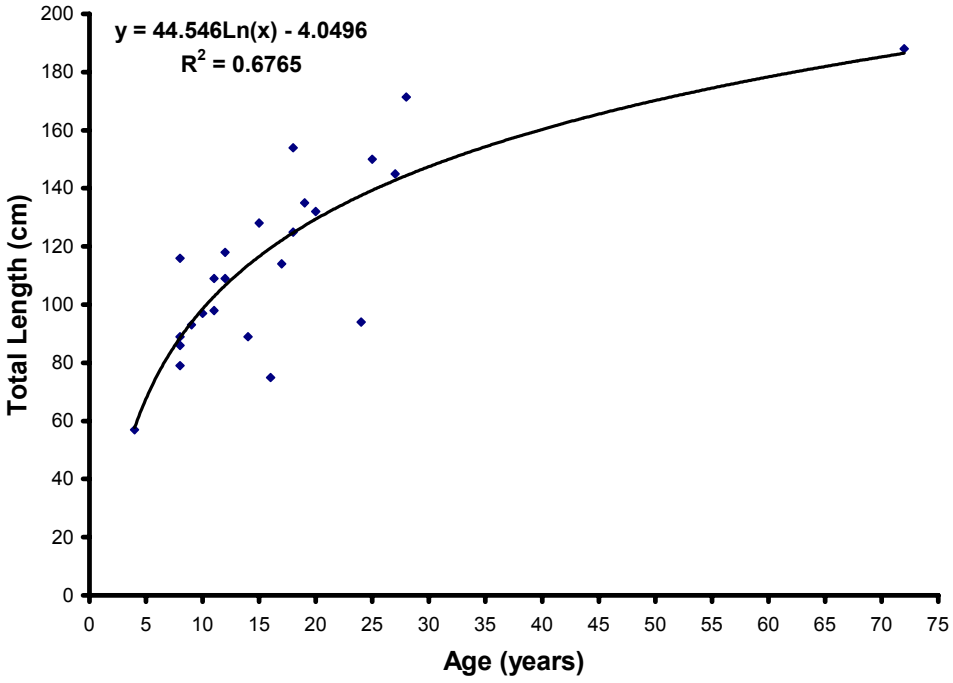

Figure 5. Age to length relationship for lake sturgeon sampled by Michigan state-licensed commercial fishers from Lake Huron in 1997.

Eight previously tagged lake sturgeon have been recaptured (Table 2). All recaptured fish were released unharmed. Coordination between OMNR-LHMU and the Alpena FRO on the lake sturgeon project in Lake Huron has provided documentation of interbasin movement of sturgeon (four fish). Two lake sturgeon tagged by Ontario commercial fishers (tag numbers 161 and 285) were recaptured by Michigan commercial fishers and two tagged by a Michigan fisher (tag numbers 4036 and 4041) were recaptured by an Ontario fisher (Table 2). Fish 4033 and 4036 were both tagged in western Saginaw Bay in early 1997 by Serafin Fishery. These fish were recaptured in the fall of 1997 in southern Lake Huron by Purdy Fisheries. Fish 161 and 285 tagged by Ontario fishers in June 1996 and October 1996, respectively were recaptured by Michigan fishers in October 1997 and July 1997, respectively. Lake sturgeon 161 and 49 were at large just over a year (16 and 14 months, respectively) prior to recapture; all other sturgeon were at large less than one year prior to recapture.

Table 2. Summary of lake sturgeon recapture information.

Tag number	Date tagged	Date recaptured	Grid where tagged	Grid where recaptured	Fisher tagging	Fisher recapturing
FWS00036	10/4/95	8/17/96	1509	1606	Bay Port	Sam=s
FWS00049	10/26/96	12/25/97	1608	Saginaw R.	Bay Port	Sport Angler
161	6/4/96	10/15/97	212	306	Nyman	Barbeaux
285	10/22/96	6/6/97	2016	1408	Purdy	Lentz
4033	10/29/96	5/22/97	1508	1508	Serafin	Serafin
4036	4/26/97	10/6/97	1508	2016	Serafin	Purdy
4041	7/2/97	10/6/97	1508	2016	Serafin	Purdy
4125	6/23/97	9/29/97	1508	1509	Lentz	Bay Port

Although areas in Saginaw Bay where lake sturgeon have been encountered as by-catch are biased by commercial fishing operations, there seem to be areas where sturgeon are captured more frequently (Figure 6). The area in eastern Saginaw Bay north of Sand Point (grid 1509) accounts for 19% of the total lake sturgeon captures, and is close to the location reported as a lake spawning site for sturgeon in the early 1900=s (Organ et al. 1978). Another area of interest is located at the mouth of the Rifle River (grid 1507) where 13 lake sturgeon have been captured. Thirty percent of the fish have been captured in the middle of Saginaw Bay (grid 1508). This location may, however, be primarily a result of the amount of effort that commercial fishers spend in this area targeting lake whitefish (J. Serafin, Whytes Fishery, personal communication). Clustered capture sites will be used in future years to assist in identifying focal points for more extensive sampling and for collection of habitat data.

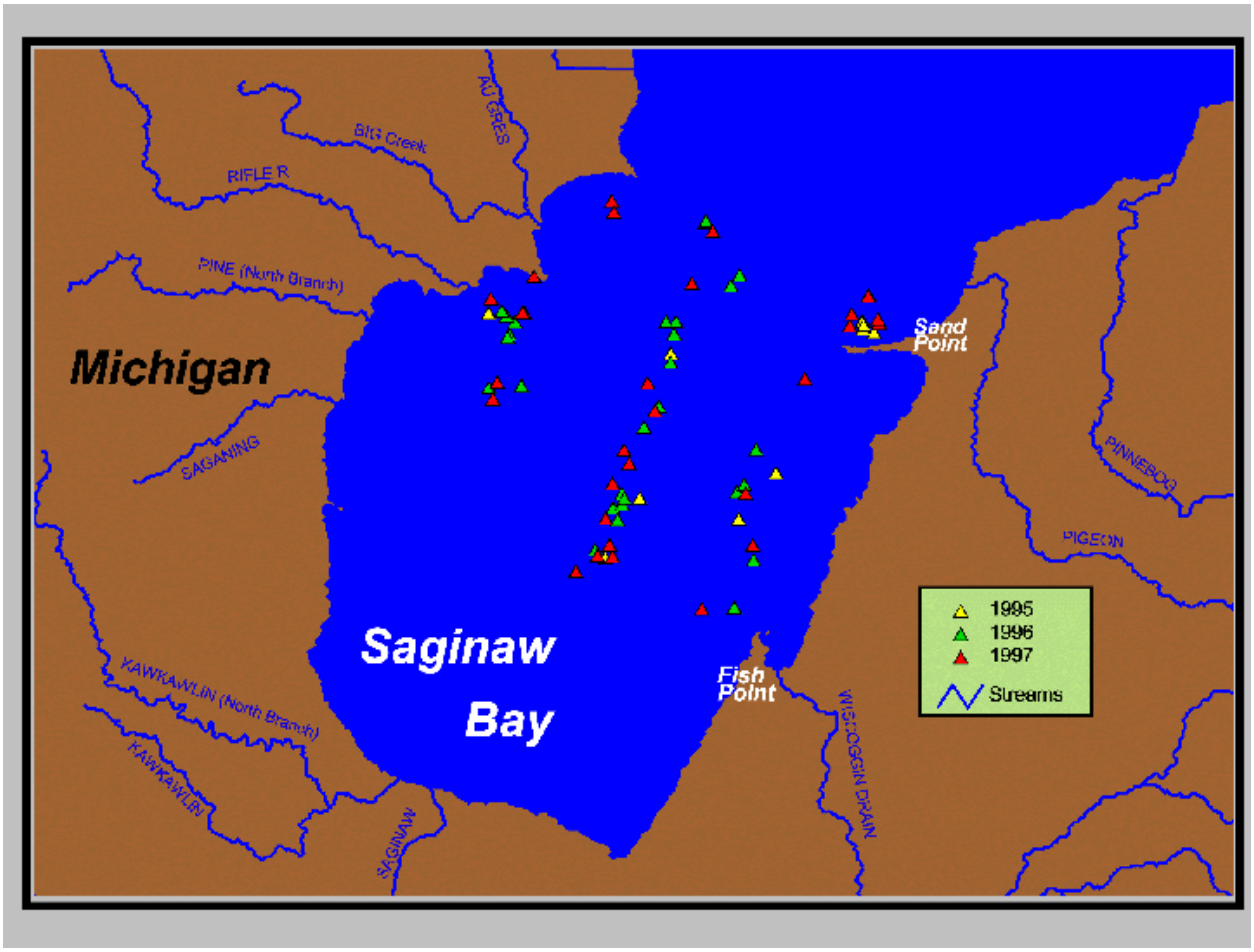

Figure 6. Location of Saginaw Bay, Lake Huron lake sturgeon captures as reported by Michigan state-licensed commercial fishers, 1995-1997.

Data collected to date on the Lake Huron lake sturgeon are primarily from the fishing locations selected by the fishers seeking target 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 7). This temporal information may prove useful in developing sampling protocol for assessment activities targeting lake sturgeon.

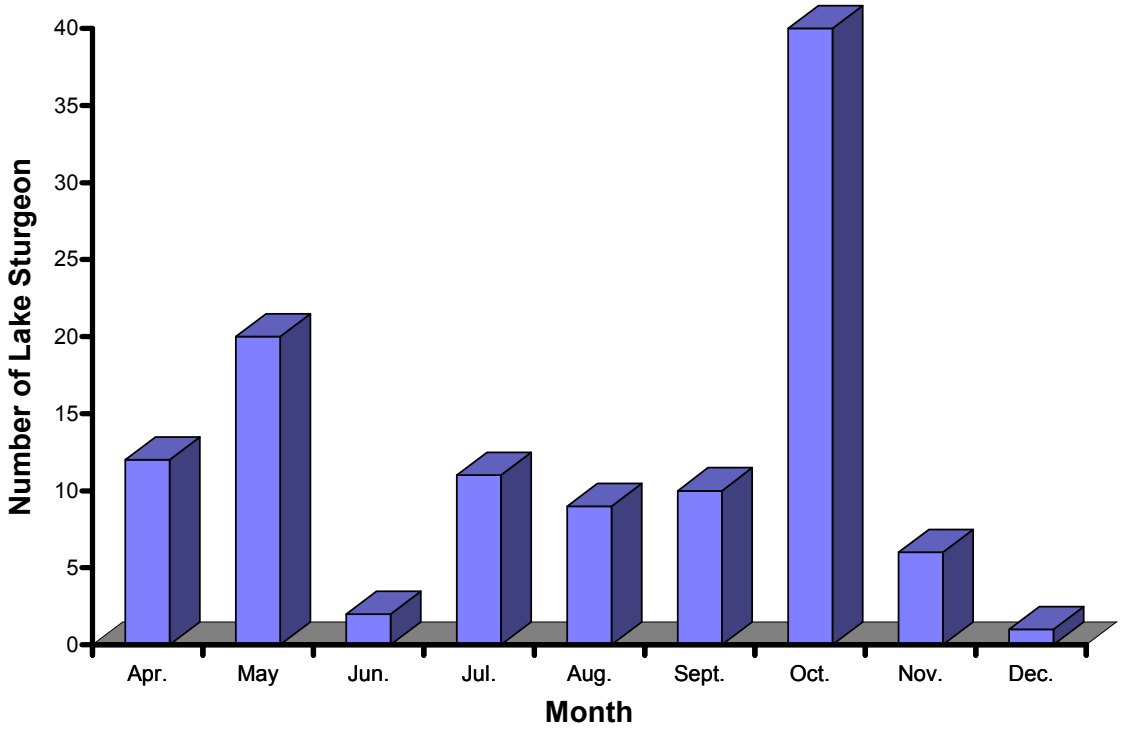

Figure 7. Number of lake sturgeon captured by Michigan state-licensed commercial fishers, 1995-1997.

The excellent cooperation and assistance of the commercial fishers has provided crucial information on the lake sturgeon populations in Saginaw Bay and northern areas of Lake Huron. Increasing participation by commercial fishers should result in an escalation of lake sturgeon reports over the next few years. With more fishers involved in the tagging operation, 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 among the different basins of Lake Huron.

A media event was held in October 1997 to cover the lake sturgeon tagging operations being conducted in cooperation with the commercial fishers. The central focus of the event was to publicly acknowledge the valuable voluntary assistance provided by the commercial fishers. The event, conducted out of Bay Port, Michigan with the assistance of the Bay Port Fish Company, involved 2 network television stations, 2 outdoor magazines, 1 outdoor television show, and 2 newspaper writers with coverage throughout the State of Michigan. In addition to the media event, the Alpena FRO hosted an Appreciation Dinner at the Bay Valley Resort in Bay City, Michigan, in honor of the assistance provide by the commercial fishers.

The Alpena FRO developed an Internet web page (midwest.fws.gov/alpena) with special emphasis focused on the lake sturgeon project. The web site is intended to provide information to the public and the CGLBLSG on activities and findings of the sturgeon project.

1998

Lake sturgeon monitoring continued in 1998 for the fourth straight year. Similar to previous years, all lake sturgeon were collected by commercial fishers as by-catch in their trap net fishery. All lake sturgeon were handled by the commercial fishers, including data collection and fish tagging. All materials necessary to collect the biotic information was provided by the Alpena FRO. Each fisher was provided a box containing instructions for fish tagging and fin ray removal, tags and an applicator, fin ray removal saw, data notebook and cards, fin ray envelops, a soft measuring tape and a disposable camera. New to the study in 1998, was the collection of genetic material. The distal portion of the fin ray is being utilized for genetic analysis.

Assistance from commercial fishers has been invaluable to the success of this study. Eleven commercial fishers (operating 18 boats) provided information on by-caught lake sturgeon, eight of these fishers operated in Saginaw Bay. One new fisher began assisting with the project in 1998 (Table 1). Biological data were recorded for 38 lake sturgeon in 1998. The total number of lake sturgeon tagged declined slightly in 1998; this may be due to high water temperatures and low water levels experienced in Saginaw Bay (personal communication, Sandra Whyte). A total of 129 lake sturgeon have been tagged by commercial fishers since 1995.

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

	Number of sturgeon tagged				
Fisher	1995	1996	1997	1998	Total Tagged
Barbeaux Fishery	-	1	7	0	8
Bay Port Fish Company	13	7	10	8	38
Beardsley Fish Company	-	-	0	0	0
Cederville Fish Company	-	-	1	7	8
Gauthier-Spaulding Fishery	2	0	2	2	6
Lentz Fishery	0	6	6	10	22
Lixey Fish Company	-	-	-	0	0
M & W Fish Company*	0	1	4	4	9
Serafin Fishery	-	7	17	3	27
Warren Beers Fishery	0	0	0	0	0
Whytes Fishery	0	3	4	4	11
Total by Year	15	25	51	38	129

*Formally Sam's Fishery

Fork length of lake sturgeon captured in 1998 ranged from 67 cm to 171 cm with a mean fork length of 112 cm (Table 2). Age of these fish ranged from 4 to 59 years with a mean of 14 years. A summary of morphological data for lake sturgeon captured during the four years of this study are shown in Table 2. Figures 1 and 2 illustrate the length frequency and age frequency, respectively, of lake sturgeon collected during the course of this study. Biotic parameters were collected to assist with data exchange among other agencies involved in lake sturgeon status surveys. Several relationships were developed with these parameters to aid information exchange between the agencies. Figures 3 and 4 illustrate total length-fork length and girth-fork length relationships, respectively.

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.

	1995	1996	1997	1998
Mean Fork Length (cm)	111	92	101	111
Median Fork Length (cm)	111	90	99	109
Fork Length Range (cm)	71 - 155	50 - 135	42 - 185	67 - 171
Mean Age (years)	-	-	17	14
Median Age (years)	-	-	13	12
Age Range (years)	-	-	4 - 72	4 - 59

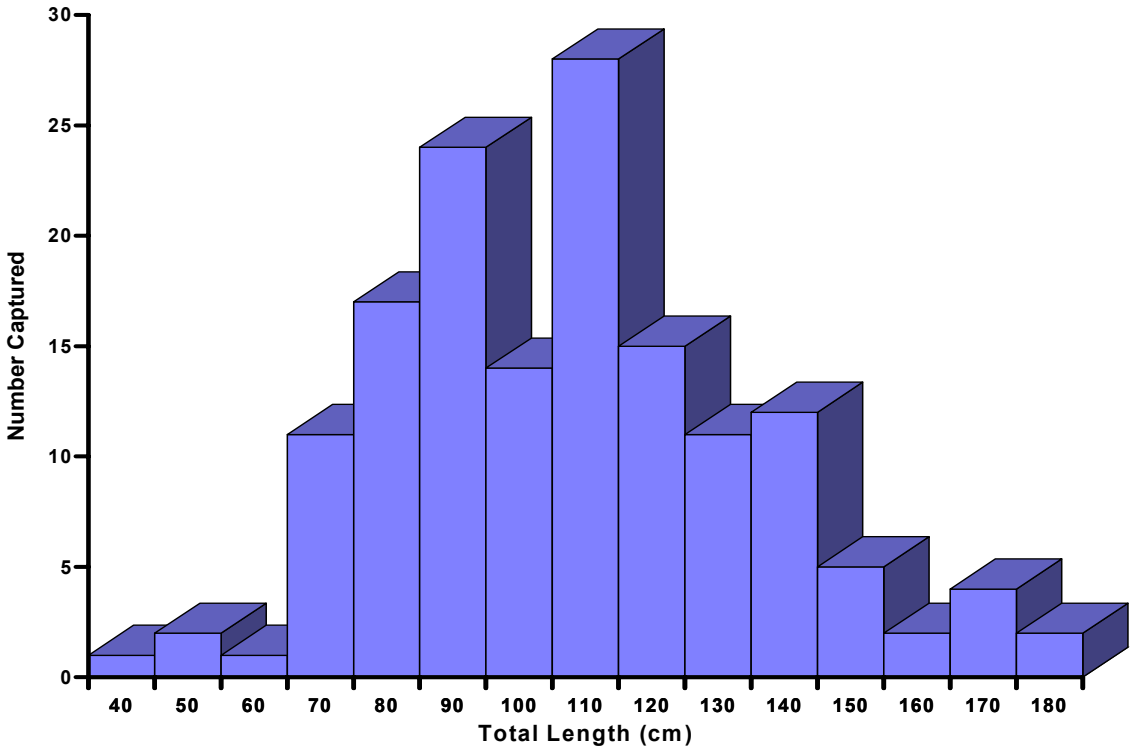

Figure 1. Length frequency of 149 Lake Huron lake sturgeon captured as by-catch in the trap net fishery, 1995-1998.

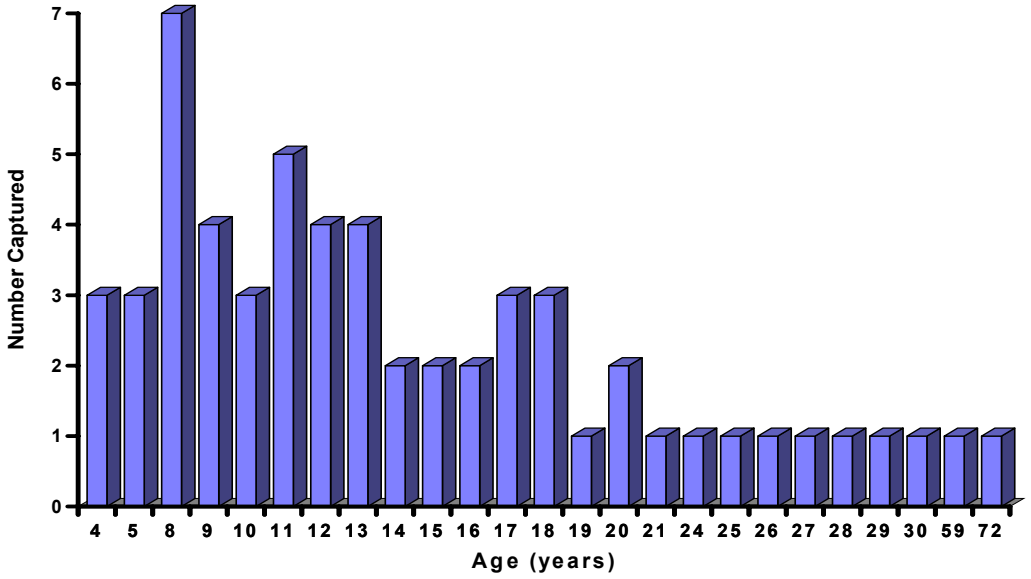

Figure 2. Age frequency of 58 Lake Huron lake sturgeon captured as by-catch in the trap net fishery, 1997-1998.

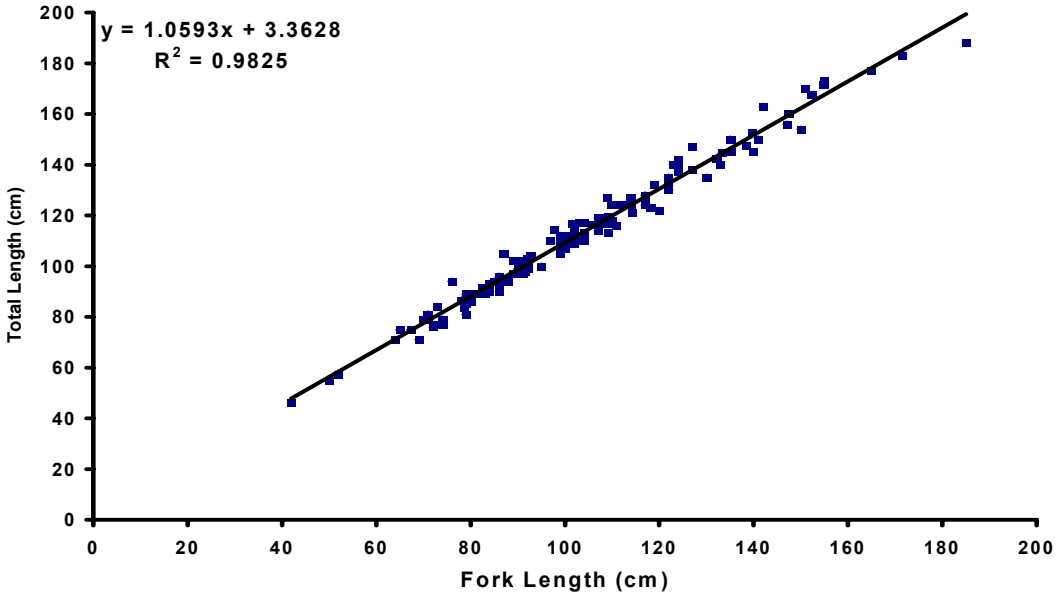

Figure 3. Fork length to total length relationship for Lake Huron lake sturgeon captured as by-catch in the trap net fishery, 1995-1998.

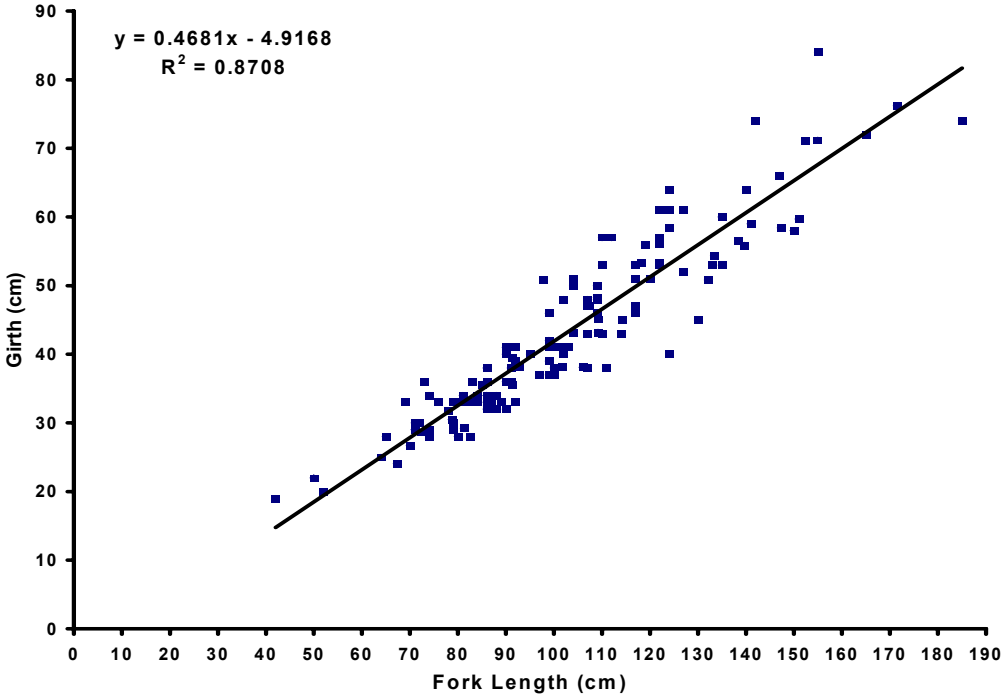

Figure 4. Fork length to girth relationship for Lake Huron lake sturgeon captured as by-catch in the trap net fishery, 1995-1998.

Overall, the age distribution of lake sturgeon caught in 1997 and 1998 is dominated by sturgeon older than 11 years with a total of 25 year-classes represented (Figure 2). Lake sturgeon younger than 8 years old represent 10% of the sturgeon sampled in the trap net fishery. This may be due to poor recruitment, gear selectivity, or distribution of young sturgeon. It may indicate that Saginaw Bay is a staging area for sub-adult lake sturgeon.

Four previously tagged lake sturgeon were recaptured in 1998. One fish was found dead, one was harvested by an Ontario commercial fisher and tag numbers were not collected on the other two fish. One of the recaptured fish had lost a tag and had a new tag attached. Another recaptured fish was caught during rough seas and it was not possible to obtain the tag number. Lake sturgeon number 4043 was tagged by Serafin fishery on 25 August 1997, this sturgeon was found dead off Grand Bend, Ontario on 28 August 1998. Cause of death was unknown. Lake sturgeon number 4087 was tagged by Bay Port Fish Company on 4 October 1998 in Saginaw Bay, it was recaptured and harvested by Purdy Fisheries six days later in southern Lake Huron.

Data collected on Lake Huron lake sturgeon are biased by the fishing locations selected by the fishers seeking target 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 5). This temporal information may prove useful in developing sampling protocol for assessment activities targeting lake sturgeon.

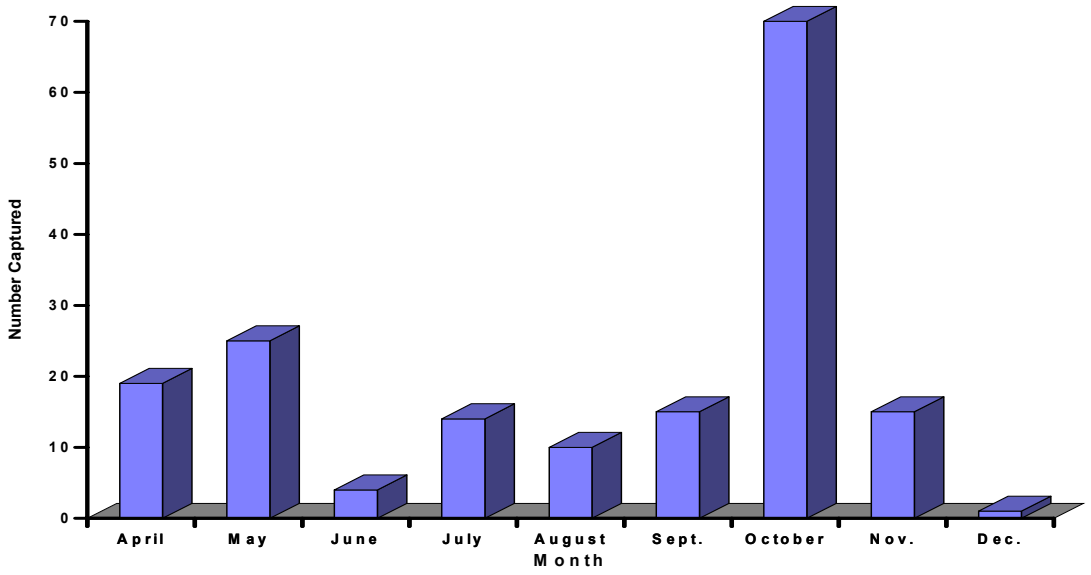

Figure 5. Number of lake sturgeon captured by Lake Huron commercial fishers, 1995-1998.

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 hydro-power projects. A number of large streams with available spawning habitat are still free-flowing in Ontario, providing some degree of sustainability for lake sturgeon populations.

Despite the limited number of tagged lake sturgeon (129), 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.

Alpena FRO staff again hosted an Appreciation Dinner to honor the commercial fishers assisting with the lake sturgeon project. The dinner was held on 14 December 1998 at the Holiday Inn Convention Center in Midland, Michigan. The dinner was followed by a short awards presentation. Tokens of appreciation were distributed to each of the participating fishers.

In addition to coordinating lake sturgeon data collection from the commercial fishers, other lake sturgeon activities were initiated in 1998. High-resolution underwater video equipment purchased by the Alpena FRO was placed on a historic lake sturgeon spawning site in the north channel of the St. Clair River in May 1998. Biological Science Technician Scott Koproski assisted MDNR and SCUBA divers with deployment and set up of the camera equipment. Technician Koproski also trained personnel from the

MDNR on operation of the camera. Approximately 80 hours of 8mm video tape was recorded while the camera was deployed in the river.

Biologist Tracy Hill developed a Great Lakes Lake Sturgeon web page (midwest.fws.gov/sturgeon) for the Great Lakes Basin Ecosystem Team. The purpose of the page is to consolidate information from the numerous agencies and organizations in the Great Lakes Basin that are involved in lake sturgeon recovery efforts. The page will also serve as a mechanism for educating the general public to agencies' roles, responsibilities, and activities regarding depleted native species such as lake sturgeon.

Biologist Hill was actively involved in coordinating workshops relative to lake sturgeon activities in the Great Lakes region as a function of his lead role for the CGLBLSG. A lake sturgeon internal sexing and state of maturity work shop was held in Sarnia, ONT 23 June. The purpose for the workshop was to allow biologists to determine the sex and state of maturity of lake sturgeon after examination of the gonads. The workshop was co-hosted by the Alpena FRO and the OMNR-LHMU. The workshop was instructed by Senior Fishery Biologist Ron Bruch from the Wisconsin Department of Natural Resources. Mr. Bruch is regarded as a North American Continent expert on lake sturgeon. The workshop was attended by thirty participants from state and federal agencies and universities from around the Great Lakes Region.

1999

A lake sturgeon aging workshop was held 25-26 January 1999 in Sarina, ONT. The workshop was hosted by the Alpena FRO, OMNR-LHMU, and the American Fisheries Society Canadian Aquatic Resources Section. Dr. John Casselman instructed the workshop. The purpose for the workshop was to standardize the techniques which are being used by agencies and universities to age lake sturgeon in the Great Lakes region. Dr. Casselman has developed computer software to aid in the aging process, he distributed and instructed workshop participants on the appropriate use of this software.

The cooperative lake sturgeon tagging and data collection activities made possible by the Lake Huron commercial fishers will continue in 1999. Habitats analysis will be conducted in areas of Saginaw Bay were clustered lake sturgeon captures have occurred.

Biologist Hill will continue working with Betty Wills of Earthwave Society on coordination of the *Sturgeon of the Great Lakes Video*. Several members of the CGLBLSG have committed funds for the project and Hill has been serving a lead role in organizing the project. A mass video shoot is tentatively scheduled for early June. Consolidation of the tagging data into a common database will also occur in 1999. Need for consolidation of all agencies' tag information into a single database has been identified as a critical need for the group since 1995.

ST. CLAIR WATERWAY

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1997

In 1997, we expanded our setline sampling efforts on the St. Clair River and continued trawling for sturgeon on Lake St. Clair. We also obtained sturgeon as by-catch while trap netting yellow perch in Lake St. Clair. For the second consecutive year, nearly all lake sturgeon collected were tagged with monel cattle ear tags. We have now tagged and released a total of 262 sturgeon (80 in 1996, and 182 in 1997) in the waters of Lake St. Clair and the St. Clair River. We also cooperated with the University of Michigan and the Alpena FRO in a sturgeon telemetry project on these waters in 1997.

Set-lines: Setlines were fished in the North Channel of the St. Clair River during late May and early July. Our effort increased from a total of 20 sets in 1996 to a total of 67 sets in 1997. A total of 84 sturgeon were caught, for a mean catch per set of 1.25. Comparison of various bait types clearly indicated round gobies were preferred. Sturgeon caught on setlines ranged from 633 mm to 1762 mm total length, with a mean total length of 1213 mm. Weight of sturgeon caught on set-lines ranged from 0.8 kg to 45.5 kg, with a mean weight of 14.2 kg. Sturgeon were aged by fin ray sections. Age ranged from 4 to 42 years, with a mean of 17.7 years. A total of 80 sturgeon were tagged with the monel cattle ear tag in the St. Clair River in 1997. Other notable events from our setline fishing in 1997 included: (1) Documentation of sturgeon spawning behavior and egg deposition on a site 35 to 40 feet deep; (2) Documentation of round goby predation on lake sturgeon eggs at the site; (3) Observance of increased foul-hooking of sturgeon on set-lines as spawning activity peaked; (4) Observation of an illegal snag fishery for sturgeon at the spawning site; (5) Incidental catch of non-target species was near zero with capture of one northern pike.

Trawling: Trawling was conducted in Lake St. Clair from June through 0ctober. A total of 90 sturgeon were captured in 168 tows made with a 10 m headrope bottom trawl. An additional 76 tows were made with a 4.9 meter headrope bottom trawl in shallow nearshore areas but no sturgeon were captured. Lake sturgeon total length ranged from 244 mm to 1613 mm with an average of 1055 mm. Weight ranged from 0.04 kg to 35.1 kg with an average of 9.78 kg. Based on fin ray sections, the age of sturgeon collected in trawls on Lake St. Clair ranged from 1 year to 36 years, with a mean age of 14.4 years.

A total of 89 sturgeon were tagged with monel cattle ear tags in Lake St. Clair in 1997. As in 1996, nearly all sturgeon collected with trawls in Lake St. Clair were captured in the two grids (23 and 24) located in the deepest water on the US side of the lake during July and August. Interestingly, several of the sturgeon tagged with sonic transmitters in the St. Clair River in May and June were repeatedly located by sonic signals in Lake St. Clair in these same grids (23 and 24) during July, August, and September.

Trap nets: A total of 13 lake sturgeon were collected incidentally in 36 trap net lifts targeting yellow perch in Lake St. Clair near the mouth of the North Channel. The nets were fished from May 6 to May 20. The sturgeon averaged 1104 mm total length and weighed an average of 9.33 kg. They ranged in age from 3 years to 18 years with an average of 13.1 years. All 13 were tagged with monel cattle ear tags.

Recaptures: One recapture has been reported from the 262 monel tagged sturgeon released in the St. Clair River and Lake St. Clair since 1996. Originally tagged in the St. Clair River in June 1997, the fish was recaptured in a commercial trap net in southern Lake Huron in October 1997 and released.

Age distribution: Thirty-three year classes are represented in the age distribution for the 172 lake sturgeon aged by fin ray sections from Lake St. Clair and the St Clair River in 1997 (Figure 1). Mature fish are well represented as are juveniles from 6 to 12 years old. However, the youngest ages (1 to 5) account for only 6% of the total sample. It is unclear if this is simply a function of size selective bias of our sampling gear, spatial distribution of the younger age groups, or poor recruitment. Round gobies were first found in the St. Clair River in 1990 and became abundant throughout the river by 1992. In 1997, we observed abundant round gobies on the sturgeon spawning site in the North Channel of the St. Clair River and found sturgeon eggs in the stomachs of round gobies collected at the site. It may not be coincidental that the poorly represented age groups in this distribution correspond to the time period that round gobies have been abundant in the St. Clair River (1992-1996).

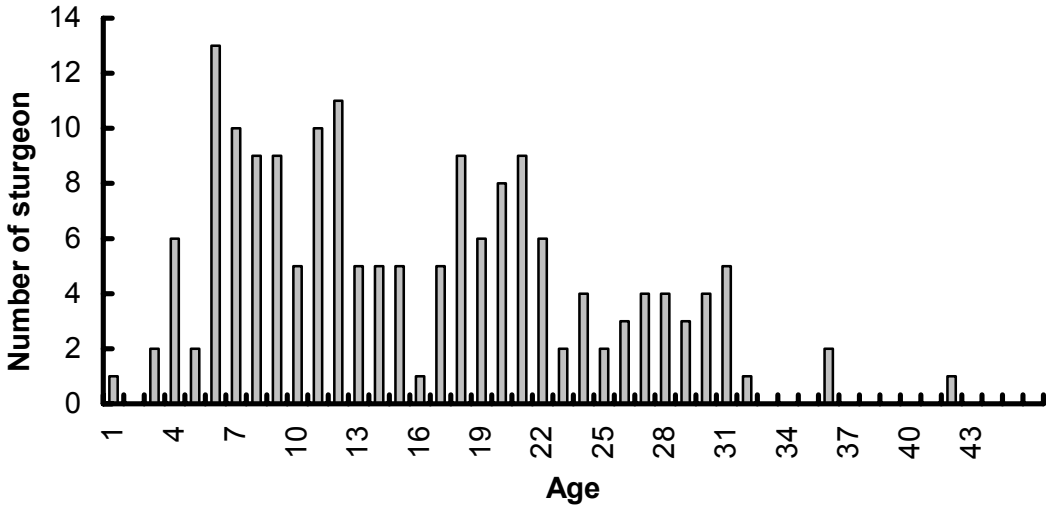

Figure 1. Age distribution of lake sturgeon sampled in 1997 from Lake St. Clair and the St. Clair River by the MDNR Mt. Clemens Research Station (n=172).

1998

1998 Summary: *A total of 244 lake sturgeon were collected from the St. Clair River and Lake St. Clair in 1998. Sturgeon were collected with trap nets, bottom trawls, and baited setlines. Pectoral fin ray sections were used to age 237 fish. Ages ranged from 2 to 43 years and included 39 year classes. Mean length at age suggests that these sturgeon grow faster as juveniles when compared with inland lake sturgeon in Michigan. A total of 242 sturgeon were tagged with serial numbered monel cattle ear tags and released in 1998, bringing the total number of sturgeon tagged and released since 1996 to 510 fish. Tag recoveries have been sparse, with four recaptures with setlines, and nine reported recoveries by sport or commercial fishermen. A spawning site was identified in the St. Clair River in 1997 and documentation of spawning activity and habitat characteristics at the site continued in 1998.*

The Mt. Clemens Fisheries Research Station began an investigation into the distribution and abundance of lake sturgeon in the St. Clair River and Lake St. Clair in 1996. This project was formalized as a federal aid research project in 1997. The objectives of the study are (1) to determine spawning period, areal distribution of spawning activity, and characterize spawning habitat in the St. Clair River, (2) to determine early (juvenile) life history of lake sturgeon in the St. Clair River and Lake St. Clair and identify habitat requirements of young lake sturgeon, (3) to document lake sturgeon population parameters for Lake St. Clair and the St. Clair River, including estimated abundance, exploitation, age composition, growth rate, and age/sex composition of the spawning stock.

Capture of juvenile and adult lake sturgeon to collect biological data and mark with monel tags in the St. Clair River and Lake St. Clair - Sturgeon were collected with three gear types in 1998. A total of 90 sturgeon were caught in 78 overnight sets using setlines in the North Channel of the St. Clair River between May 7 and May 29. We compared round gobies with other types of bait between May 7 and May 13. During this period, 14 lake sturgeon were caught on a total of 371 hooks baited with round gobies, while a total of 212 hooks baited with other types of bait caught no

lake sturgeon. After May 13, all hooks were baited with round gobies. Total length of sturgeon caught on setlines ranged from 589mm to 1714mm (Table 1). Age ranged from 3 to 43 years. A total of 87 fish were tagged with monel cattle ear tags and released. Additionally, 4 large sturgeon captured with setlines in the North Channel were implanted with sonic tags as part of a cooperative telemetry study with the University of Michigan and the Alpena USFWS FRO. In early June, 2 sturgeon were incidentally caught in trap nets set in the northern portion of Lake St. Clair, referred to as Anchor Bay. Both fish were also tagged with monel cattle ear tags and released.

A total of 209 trawl tows (127 10m headrope tows and 82 4.8m headrope tows) from June through October on Lake St. Clair captured 153 lake sturgeon. All sturgeon were collected in the 10m headrope bottom trawls. Total length of sturgeon captured ranged from 427mm to 1709mm. Age ranged from 2 to 38 years. A total of 153 fish were tagged with monel cattle ear tags and released into Lake St. Clair.

Overall, the age distribution of lake sturgeon caught in 1997 and 1998 appears well balanced with a total of 40 year-classes represented among the 411 lake sturgeon sampled for age (Figure 1). This sample reveals consistently good recruitment to this population from 1973 to 1991. It may not be coincidental that this period of recruitment followed the federal Clean Water Act of 1972. The strongest year-classes were produced in 1991, 1977, and 1967. Fish younger than age 4 are poorly represented in the sample. This may be due to gear selectivity, juvenile distribution, or poor recruitment in recent years. Since lake sturgeon are known to be capable of exceeding 50 years in age (Scott and Crossman 1973), year-classes prior to 1965 appear under-represented in the catch. This could be an indication that recruitment prior to 1965 was poor, and has improved dramatically since that time. Alternatively, those year-classes may have experienced high exploitation rates in the past, particularly during the 1970's and early 1980's, prior to the closure of sturgeon season during the spawning period in May and June for these waters in 1983.

Growth of lake sturgeon in the St. Clair ecosystem is good, with some fish attaining a total length of 1 m as early as age 8. A mean length of 1270mm is attained by age 19. In contrast, inland lake sturgeon in Michigan grow slower, particularly from age 1 to age 15, and attain a mean length of 1270mm at age 22 (Baker 1980). Based on age and growth data collected during this study, the MDNR has modified sport fishing regulations for lake sturgeon in the St. Clair River and Lake St. Clair. Effective April 1, 1999, lake sturgeon possession season will be open from July 16 to Sept.30, with a one fish per season bag limit. There is a minimum size limit of 42 inches and a maximum size limit of 50 inches for the St. Clair River and Lake St. Clair. This "slot" limit will allow a limited harvest to continue, while protecting sexually mature fish, and potentially allowing older fish to increase in abundance.

Characterization of adult spawning habitat and juvenile habitat, based on catch distribution, using underwater video, sidescan sonar, doppler flow meter, temperature and oxygen profiles - In 1997 we identified a spawning location in the North Channel of the St. Clair River. This site was initially discovered through contacts with local riparians, fishermen, and conservation officers. Sturgeon spawned on the site, which is characterized by water depths of 9m to 12m, flow rates of 1m/sec, and substrate composed of coal cinders ranging in size from <25mm to over 200mm in diameter, on

June 13 and 14, 1997. Water temperature at the peak of spawning in 1997 was 13.2 ^{o}C. In 1998, water temperatures reached 13 ^{o}C, and sturgeon began spawning on the site on May 18. An underwater video system was used to capture nearly 80 hours of video of fish activity on the spawning site. Numerous sturgeon spawning events were recorded as well as sturgeon, redhorse spp., and round goby feeding behavior. The coal cinders are believed to have been deposited at the site during the late 1800's when coal burning vessels moored and emptied their cinders into the river. The cinder substrate is now zebra mussel encrusted and the 3 dimensional structure of the cinders combined with the zebra mussel layer provide a high level of interstitial space, offering excellent protection for deposited eggs. The cinder bed measures approximately 25m by 54m in size and roughly parallels the shoreline.

Efforts to map the spawning site with sidescan sonar in 1998 were unsuccessful. Sidescan mapping will be undertaken again in 1999, with assistance from divers, and should produce georeferenced images of the site compatible with GIS.

Efforts to understand the habitat requirements of juvenile lake sturgeon have been impeded by our inability to consistently collect small lake sturgeon. Only 7% of the sturgeon captured during this study have been younger than age 6 (smaller than about 30 inches total length). Additional catch data from collections over the next few years may help identify a juvenile habitat based on the geographical distribution of juveniles in the catch.

Collection and analysis of tag recovery data - To date, thirteen lake sturgeon tagged and released during this study have been recaptured. Twelve were originally caught with setlines, tagged, and released in the North Channel of the St. Clair River. Four have been recovered during the setline survey portion of this study in the North Channel. Five recoveries were reported in 1998 and 1999 by sport anglers in the North Channel. Four recoveries have been reported from the Ontario commercial trap-net fishery in southern Lake Huron, approximately 70 kilometers from the tag site. All other recaptures have occurred within 10 km of the tag sites. Although trawling has accounted for 62% of the 510 sturgeon tagged and released during this study, only one recovery, 8% of the total, has been from a fish originally caught in a trawl on Lake St. Clair. This may be an indication that fish that reside year around in the St. Clair River or move north into southern Lake Huron experience a much higher level of fishing exploitation.

Telemetry tracking of adult lake sturgeon – In cooperation with the University of Michigan and the Alpena FRO, we have been tracking 10 fish tagged with sonic tags in the North Channel of the St. Clair River during the spawning season in 1997 and 1998. This effort has produced some interesting results. One of the fish was never found after its release. Eight of the fish quickly moved downstream and into Lake St. Clair and were routinely located throughout the summer and fall in the same area of the lake where sturgeon have been consistently caught in bottom trawls (Figure 2). One of the fish has regularly been located in the North Channel above the spawning site. These results suggest that many of the adult sturgeon found in the North Channel during the spawning season move into Lake St. Clair and spend the summer and fall months in the deepest portion of the US area of the lake.

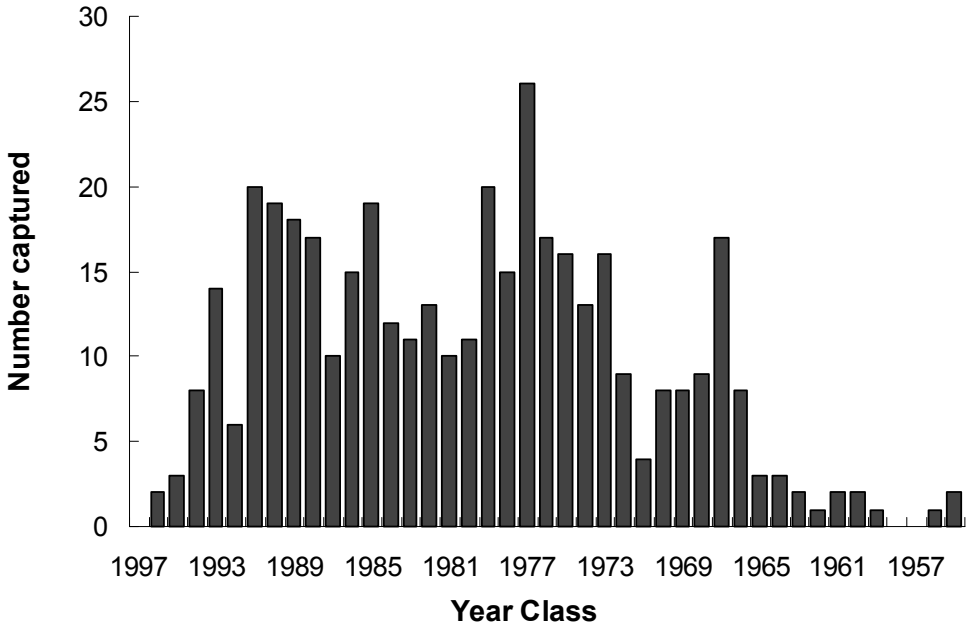

Figure 1. Year class frequency for lake sturgeon captured in the St. Clair River and Lake St. Clair in 1997 and 1998. Ages based on pectoral fin ray sections.

Table 1. Mean length and weight for lake sturgeon collected from St. Clair River and Lake St. Clair in 1998.

	Gear type		
	Trap net	Set-line	Trawl
Total number caught	2	88	153
Mean length	588 mm	1190 mm	1234 mm
Length range	470 mm – 706 mm	589 mm - 1714 mm	427 mm – 1709 mm
Mean weight	1.3 kg	13.3 kg	13.7 kg
Weight range	0.6 kg – 2.1 kg	1.0 kg – 36.0 kg	0.3 kg – 40.9 kg

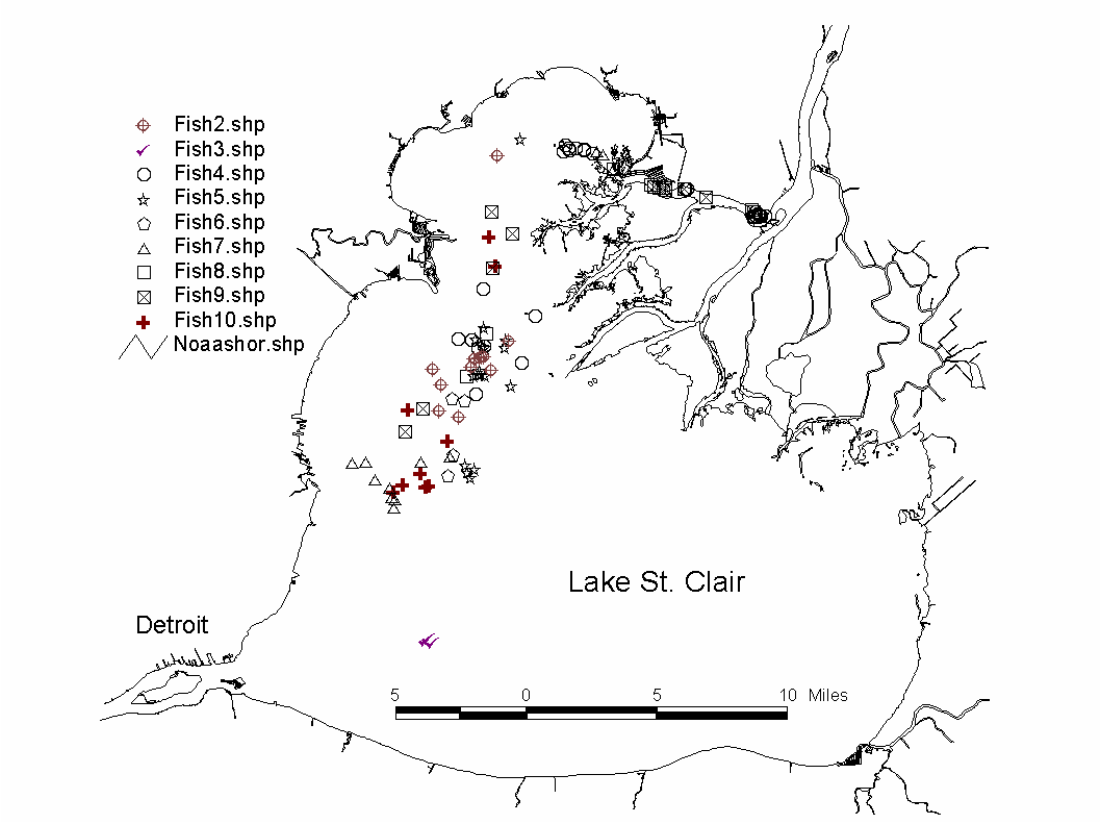

Figure 2. Locations of 9 sturgeon tracked with sonic tags from June 1997 to July 1998.

1999

1999 will be the third year of the current five year federal aid project. Our field sampling effort will be similar to 1998, with setline and trawl surveys continuing on the St. Clair River and Lake St. Clair. The adult telemetry project will be strengthened with the addition of EPA funding for a graduate student. We plan to implant 5 more adult fish in 1999. We also plan to focus more on characterizing the habitat in the area of Lake St. Clair where we have routinely found lake sturgeon with trawls and with sonic tracking during the past two years.

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1997

Within the St. Clair River system, a population of sturgeon exists which appears to spawn within the St. Clair River and juveniles continue to reside there for some period of time. Work in the early 1980s allowed us to collect small sturgeon throughout the year using setlines; work during the spawning season in 1996 and 1997 indicates that large adult sturgeon are common during the late May/early June spawning period. The nature of this stock is relatively unknown. This lack of knowledge stimulated Michigan DNR, University of Michigan, and the U.S. Fish and Wildlife Service-Alpena FRO to initiate complimentary studies on the sturgeon population. Mark-and-recapture estimates have indicated a fairly large population of sturgeon spawn in this area, but whether these sturgeon represent fish resident in Lake St. Clair or in the wider Great Lakes system is unknown. The purpose of this telemetry study is to evaluate both spawning site selection and long-range movements of sturgeon that spawn in the St. Clair River system.

Lake sturgeon spawning appears to occur in the north channel of the St. Clair River, in the main part of the channel at a depth of about 30-50 feet. Collections by setline are fairly useful in evaluating sturgeon numbers and collecting fish for implantation. For this study, we used fish in excess of 55 inches in length, so that they would be fully mature and also tolerate the large tags used.

Lake sturgeon were collected by setline, and either implanted immediately or held in a cage for later implantation. The fish were not anesthetized. Instead, they were restrained in a net stretcher and their heads covered with wet cloth to calm the fish. A small incision approximately two inches long was opened up in the abdominal cavity, and a second incision, approximately a quarter of an inch long, was opened up two inches further towards the posterior end. Ultrasonic transmitters were inserted directly into the body; radio antennas were inserted into the body with the whip of the antenna protruding out the quarter-inch hole into the exterior surface. The fish were sutured with dissolvable nylon suture material, and then injected with oxytetracyline (55 mm/kg body weight), as an antibiotic. Fish were held until they were able to swim and were released.

A total of six fish were implanted during the 1997 season. Statistics on the implanted fish are shown in Table 1. All of these fish were captured between late May and early June, and four of the six fish were followed through the summer period.

Four fish were tracked throughout the summer until July (1 fish) or October (Figure 1). All of these fish resided in the St. Clair River for a relatively short period of time, usually leaving the river within two weeks and moving out into Lake St. Clair. Contacts with three fish continued until the end of the summer, and probably can be reestablished in spring, assuming the fish continue to remain within the same habitat they selected all summer.

All fish collected within the St. Clair River were found in an area of the North Channel where spawning habitat was abundant (Figure 2). The fish appeared to move into a spawning habitat, apparently spawn, and then leave the area within two weeks of implantation. While we do not know that these fish necessarily spawned, it is likely that this occurred since they remained in the area for a long enough time to complete spawning, and departed when spawning season appeared to be finished based on capture by setline of other adult fish.

Once the fish left the river, they moved into Lake St. Clair and rapidly took up new habitats away from shore. Three of the four fish tracked in the lake moved to an area off Mt. Clement were they resided for the summer (Figure 3). In fact, three of these fish could often be detected in the same location, or close enough that all three signals were audible from the receiver in one location. They appeared to choose habitat which was about 15-18 feet deep and several miles offshore. This is somewhat surprising since shallow benthic prey in Lake St. Clair are relatively abundant, particularly mayflies that congregate in shallower water. However, none of the fish selected shallow waters during summer 1997.

One fish (sturgeon #3) moved rapidly from the St. Clair River down to near the source of the Detroit River. We located this fish twice near the Detroit River then, because of the distance involved, were unable to locate it again. Whether this fish remained in the southern part of Lake St. Clair, or moved into the Detroit River is unclear.

To our knowledge, this is the first study in open Great Lakes which has been able to maintain contact with adult sturgeon for more than a few weeks. Some studies in smaller river systems, Lake of the Woods, and the St. Lawrence River system have been able to do tracking of longer duration, but these systems are much less open and difficult for field work in telemetry compared to Lake St. Clair. Yet our tracking was relatively successful and should be coupled with additional work on habitat selection and habitat availability scheduled for the next couple of years.

Table 1. Length and tracking statistics for 6 sturgeon taken from the St. Clair River, 1997.

Fish	Size	Sex	Capture	Last Seen
1	60"	F	May 30	May 30
2	60	F	May 30	Oct 17
3	62	F	June 2	July 29
4	69	M	June 2	Sept 21
5	55	-	June 5	Oct 17
6	58	M	June 5	June 12

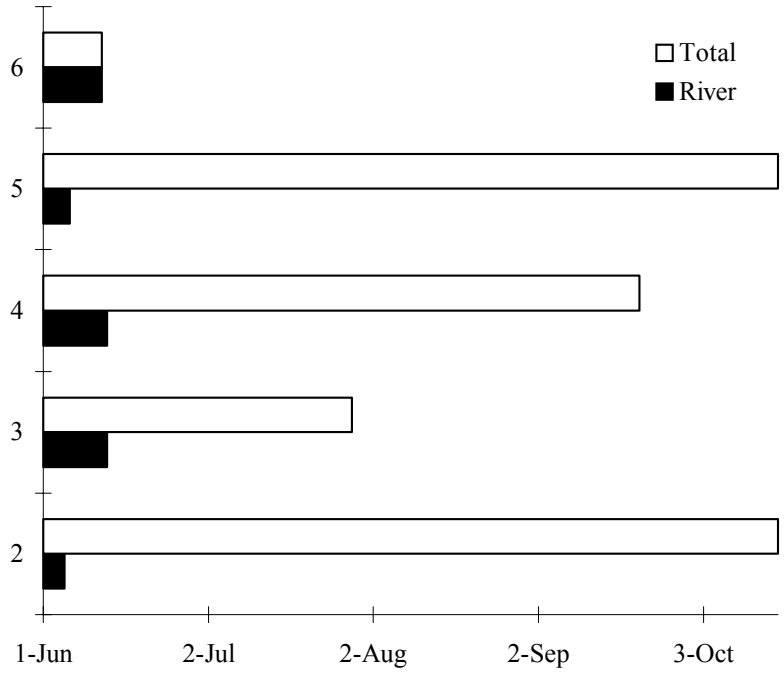

Figure 1. Residence time in the river and total tracking time for 5 sturgeon followed in the St. Clair System, 1997.

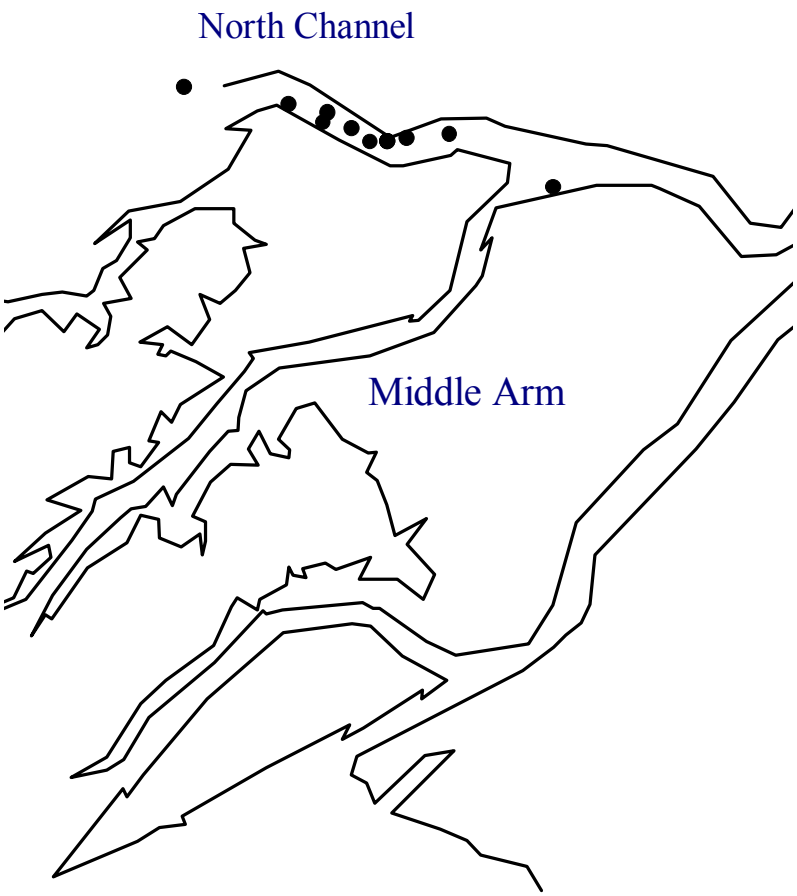

Figure 2. Map of the St. Clair River Delta, with daily locations of all fish tracked from May to July, 1997**.**

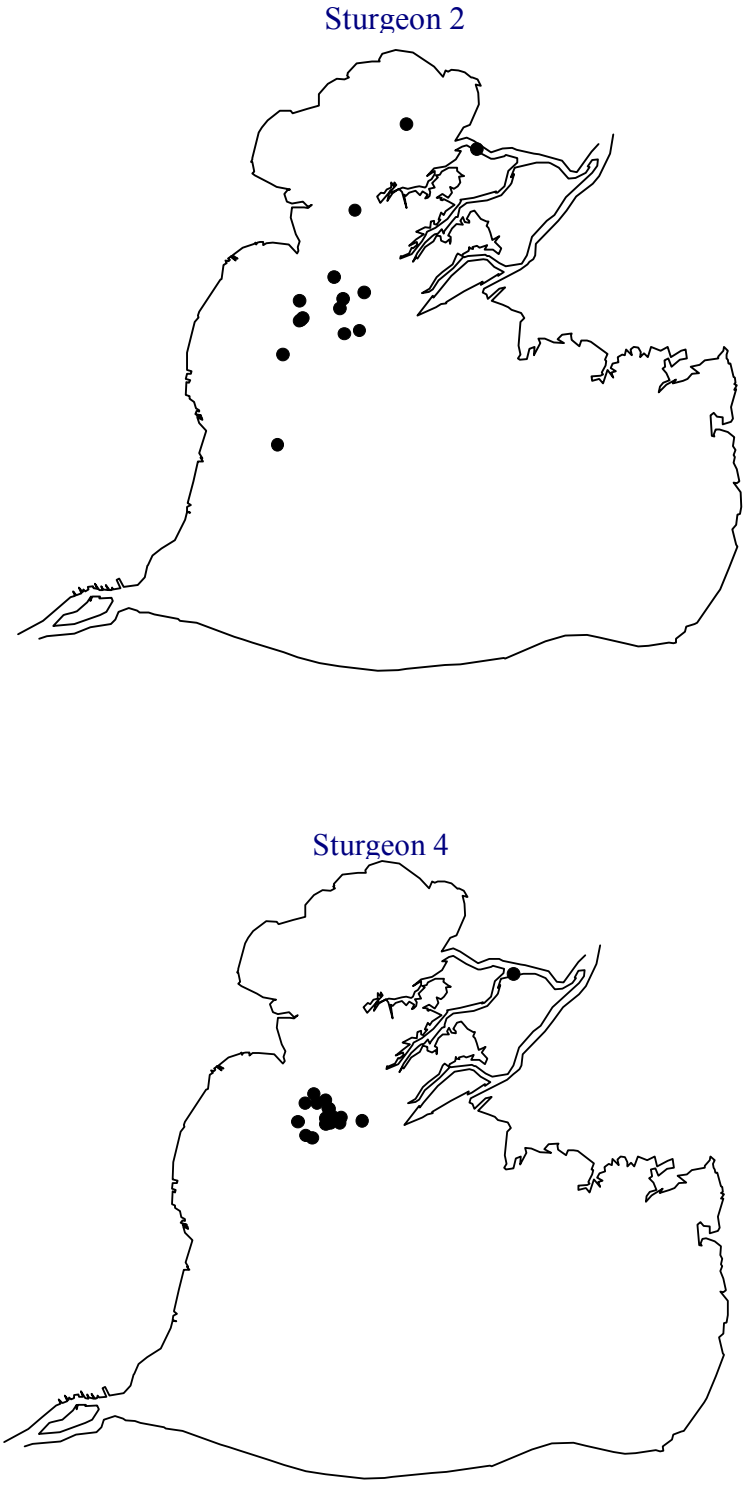

Figure 3. Maps of tracking locations for fish 2 and 4 in Lake St. Clair during summer 1997.

1998

The purpose of this telemetry study is to evaluate both spawning site selection and long-range movements of sturgeon in the St. Clair River system. During the spring of 1998, four more fish were implanted with ultrasonic transmitters. Ten fish appears to be the limit of fish that can be track at one time using ultrasonic transmitters. Statistics on the implanted fish are shown in Table 1. All of these fish were captured between late May and early June. Of the ten fish that have been implanted, we recorded fixes on nine of the fish at some point during the 1998 season.

During the 1998 season, contact was reestablished with five of the six sturgeon that we implanted in 1997. Fish number one was tagged on 30 May 1997 and has not been found since that date, we believe there was either equipment failure or that the fish has left the sampling area. Fish number two was tracked throughout the 1997 and 1998 season. The fish has resided in Anchor Bay or near the St. Clair light during the last two years (Figure 1).

Fish number three moved rapidly from the St. Clair River in 1997 to the southern end of the lake by the source of the Detroit River. We had difficulty tracking this fish due to its distance from the Mt Clemens Field Office and the number of times that we were able to survey that area. This fish was found again in June 1998 at the southern end of the lake, very close to the fixes we had in 1997 (Figure 1). Whether this fish remained in the southern part of Lake St. Clair, or moved into the Detroit River is unclear

Fish number four moved from the St Clair River into Lake St Clair shortly after it was implanted in 1997. It resided in the same general area as fish number two. Fish four moved back into the North Channel of the St Clair River by December 1997 and stayed there until June 1998 and then moved back into the lake (Figure 1). Fish number four moved back into the North Channel during the summer, and it resided there until recently when it was caught by an angler. We were able to get pictures of it and evaluate the condition of the surgery site and its overall condition. The fish was in excellent condition, other than having lost some weight most likely due to spawning.

Fish number five was tracked throughout the 1997 and 1998 season. The fish has resided in Anchor Bay or the St. Clair light area during the last two seasons (Figure 1). Fish number six was tracked in the north channel of the St Clair River for one week after it was implanted in June 1997. This fish was not relocated until December of the same year. It remained in the area off shore from Mt Clemens throughout the sampling period in 1998.

Four fish were implanted in May and June 1998 from the North Channel. The fish were captured using setlines. All fish collected within the St. Clair River were found in an area of the North Channel where spawning habitat was abundant. These fish followed similar patterns of movement as the fish that were collected the previous year. The fish appeared to move into a spawning habitat, apparently spawn, and then leave the area within two weeks of implantation.

All of the fish implanted in 1998 moved into the same general area of Lake St. Clair as the implanted fish from 1997. Their ranges overlapped to such an extent that there were times that up to three signals were audible from the receiver in one location. When all of the locations are superimposed on to one map it becomes quite apparent that there seems to be some type of specific habitat preference (Figure 2). The average depths of fish locations in Lake St. Clair ranged from 17 to 21 feet (Figure 3). No fish to date have been found in the central or eastern portions of the lake, the reason for this is unclear. At the onset of this project we expected to see movement or longer term residence of sturgeon in habitats that are shallower and closer to shore, areas such as these are very conducive to the production of benthic invertebrates, especially mayflies, a principal component of their diet. During the sampling period in 1997 or 1998, no fish were detected in shallow water near shore.

We still have contact with about eight sturgeon, although the batteries in the transmitters that were implanted in 1997 are expected to fail soon. The batteries are rated to last for 15 months and we have had better than expected results. Contacts with the four sturgeon implanted during 1998 or 1997 season should be reestablished in spring, assuming the fish remain in the same habitat they selected during the summer of 1998.

During this summer we plan to address some of the potential reasons why the sturgeon have selected certain locations in Lake St Clair. We will try to assess substrate, vegetation and benthic invertebrates throughout the lake. Substrate and vegetation measurements will be determined by direct observation using scuba diving, or video taping. In addition, transects using side scan sonar images may be compared with the direct observations. Benthic invertebrates will be sampled in the chosen habitat areas and will be compared with other areas of the lake. There are two extensive surveys of the distribution of the benthic populations in Lake St. Clair. Surveys were conducted by the Fish and Wildlife Service in the 1980's and again in the last couple of years; this information should provide excellent baseline information as a comparison with our results. This year greater effort will be invested to determine if sturgeon are moving into the central and eastern portions of the lake. We plan to circumnavigate Lake St. Clair every month looking for sturgeon in these areas, if fish are found to inhabit these areas then we will increase our surveillance. Due to the limited depth of Lake St. Clair, we are fairly certain that the lake rarely stratifies thermally during the summer. One question that we need to address is weather the lake stratifies for dissolved oxygen, so this season temperature and dissolved oxygen profiles will be taken throughout the lake in mid to late summer.

Table 1. Length and tracking statistics for 10 sturgeon taken from the St. Clair River, 1997 and 1998 (last tracking date 2 July 1998).

Fish	Size	Sex	Capture	Last Seen
1	60"	F	30 May 1997	30 May 1997
2	60	F	30 May 1997	2 July 1998
3	62	F	2 June 1997	16 June 1998
4	69	M	2 June 1997	25 June 1998
5	55	-	5 June 1997	2 July 1998
6	58	M	5 June 1997	7 May 1998
7	57	M	19 May 1998	2 July 1998
8	61	M	19 May 1998	11 June 1998
9	57	F	19 May 1998	2 July 1998
10	56	M	19 June 1998	2 July 1998

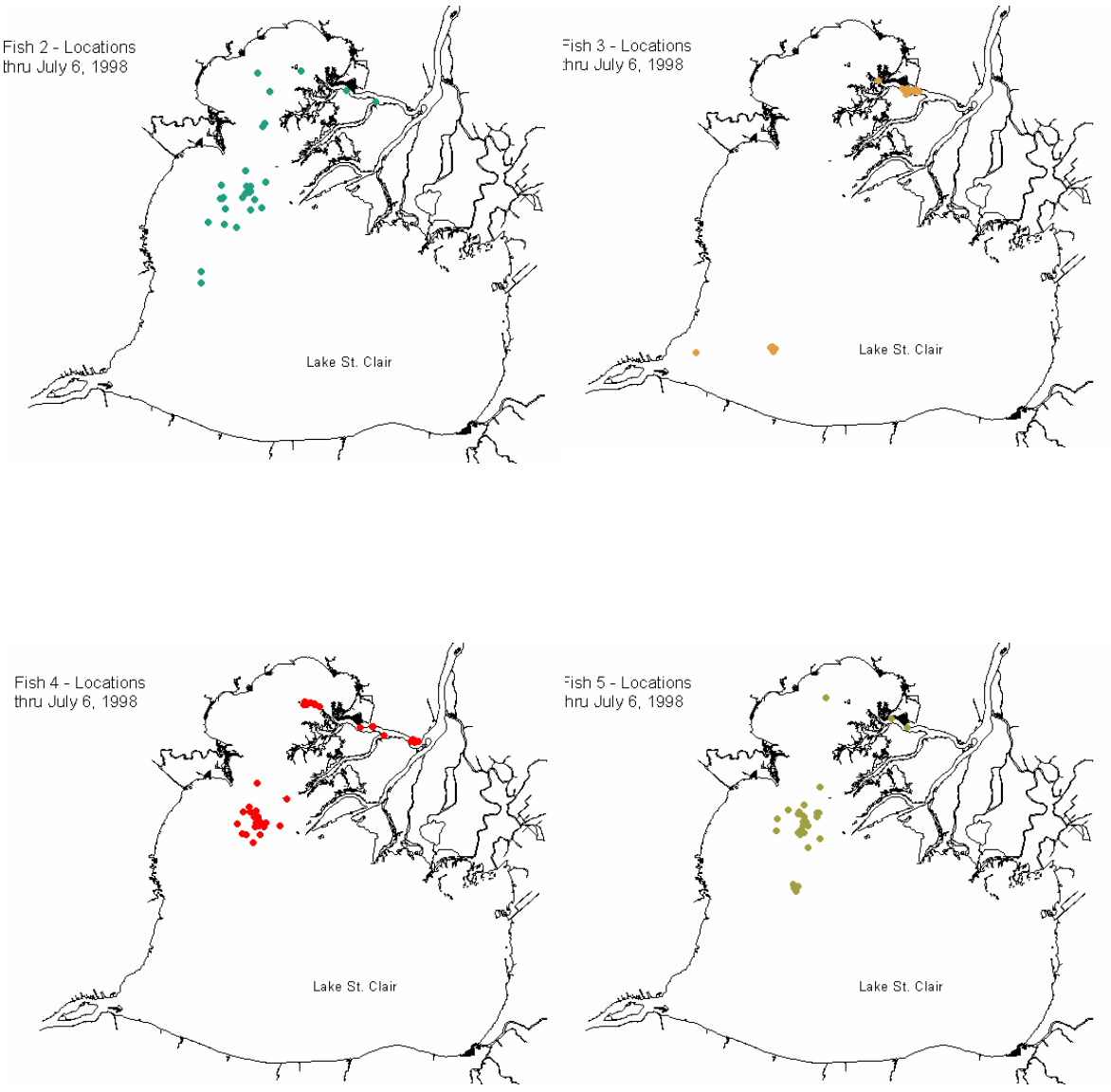

Figure 1. Tracking locations in Lake St. Clair and the North Channel of the St. Clair River for sturgeon # 2,3, 4, and 5 from May 1997 through July 1998.

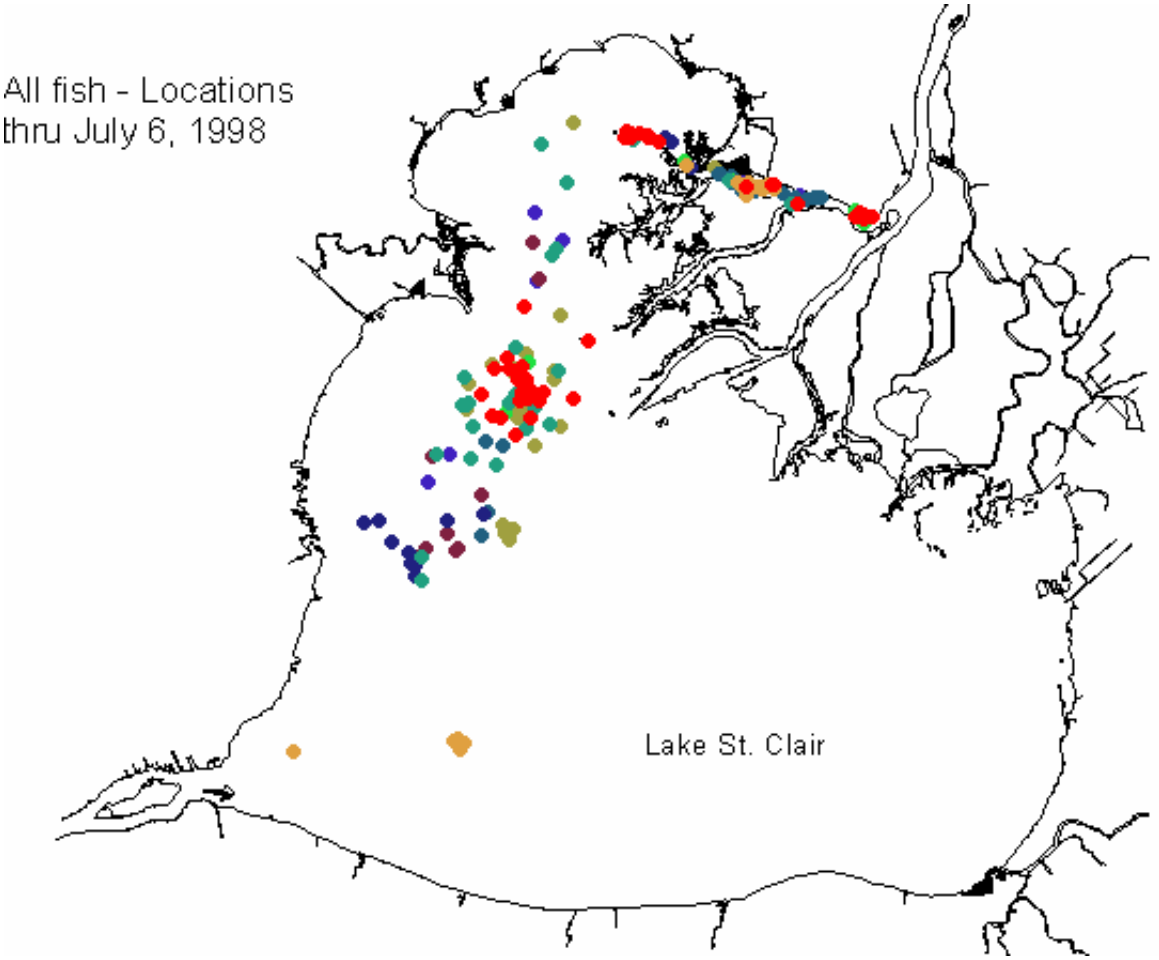

Figure 2. Tracking locations in Lake St. Clair and the North Channel of the St. Clair River for all sturgeon from May 1997 through July 1998.

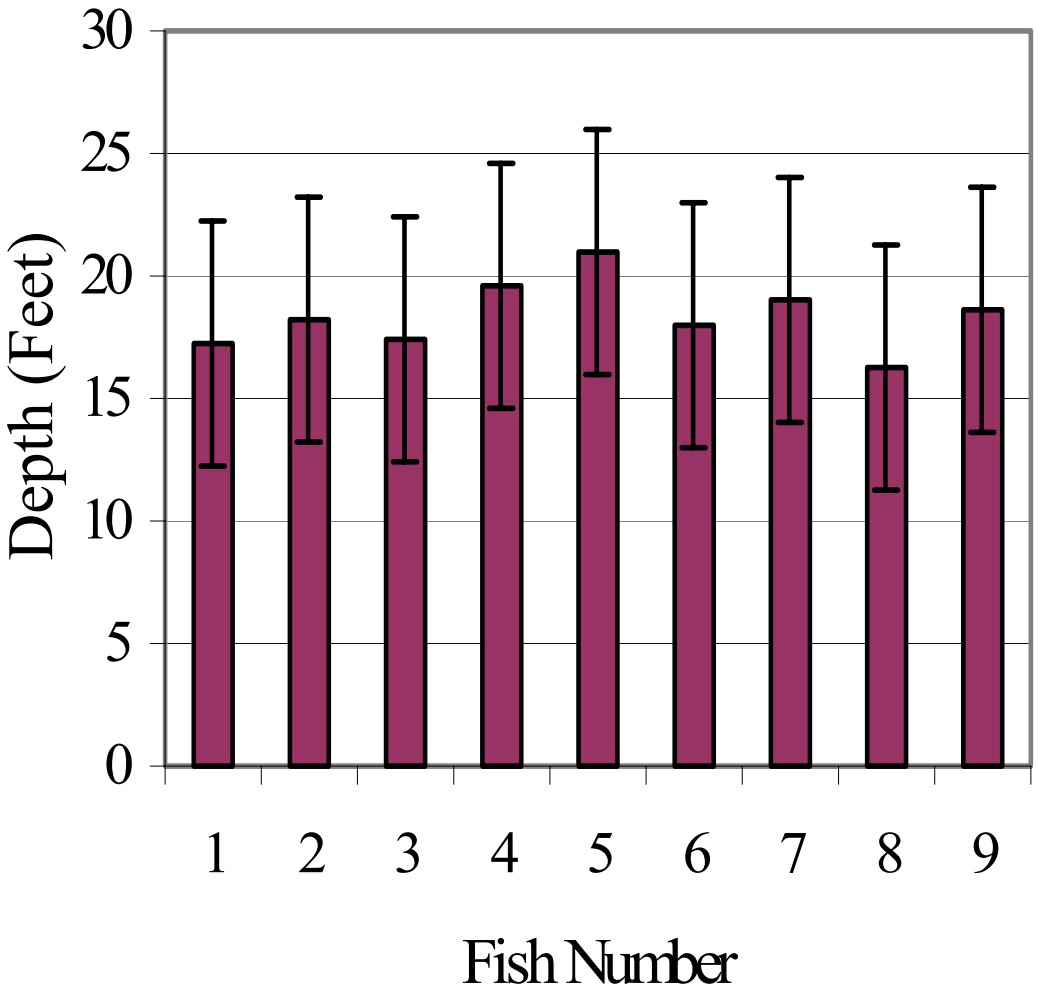

Figure 3. Average depth selected by lake sturgeon in Lake St. Clair during the 1997 and 1998 seasons.

1999

New funding for this project is being provided by the National Marine Fisheries Service, beginning in July 1999 for two years. Jim Boase, a graduate student, will begin working on the project in 1999. Funding by NMFS will cover his salary only. The Michigan Department of Natural Resources has committed to hire Jim in May so that we can get an early start this year.

We would like to keep ten fish in the water through this season and through the summer of 2000, so we would like to purchase another 10-15 ultrasonic transmitters. This should allow us to complete the work on adult fish by summer 2000. Six more sturgeon will be implanted with ultrasonic transmitters this spring. We expect to track the adult sturgeon for two additional summers. We feel the information obtained from this study is excellent and should provide valuable additions to the information taken from mark-and-recapture work. In fact, because few fish have been recaptured at present, only the telemetry work is providing any indication of stock movement.

DETROIT RIVER

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1998

Lake sturgeon are frequently encountered by sport fishers in U.S. and Canadian waters of the Detroit River and some target fishing is known to occur. However, essentially no biological information is available on this population and no knowledge exists relative to the connection or contribution of this population to those existing in the St. Clair system or western Lake Erie. The U.S. Fish and Wildlife Service-Alpena Fishery Resources Office (FRO) in cooperation with U.S. Geological Survey-Biological Resources Division-Great Lakes Science Center (GLSC) initiated a project in the fall of 1998 to begin filling the data gaps on Detroit River lake sturgeon and their habitats. This project will have long range benefits to basin-wide efforts to restore the species and protect remnant critical habitats.

Staff from the Alpena FRO initiated contact with local sports groups in the lower Detroit River in the Fall of 1998 to inform them about and solicit their assistance on a lake sturgeon project. Local anglers who specifically target lake sturgeon were identified as a result of these contacts. Three anglers agreed to tag and collect information on the lake sturgeon that they captured. The information provide here is a summary of the data collected on lake sturgeon captured by those anglers in 1998.

All lake sturgeon were captured using hook and line. Anglers fished from boats using dead bait, usually blunt nose minnows *Pimephales notatus*. Angling began in late-September and ended in early-December. Total length (TL), fork length (FL), and girth were measured, to the nearest cm, for all captured lake sturgeon. Weight was recorded to the nearest kilogram. The leading (marginal) ray of the left pectoral fin was removed from each fish to provide estimates of age. Distal portions of the fin ray was preserved in Sarcosyl for genetic analysis. All 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 released unharmed back into the Detroit River.

All materials necessary to collect the biotic information was provided by the Alpena FRO. The anglers were provided a box containing; instructions for fish tagging and fin ray removal, tags and an applicator, fin ray removal saw, data notebook and cards, fin ray envelops, 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 to the fish was also recorded.

A total of 21 lake sturgeon were captured in 25 fishing trips. Fork length of these fish ranged from 51 cm to 135 cm with a mean fork length of 106 cm (Figure 1). Age of lake sturgeon captured in the lower Detroit River ranged from 2 to 22 years with a mean of 12 years (Figure 2). A summary of morphological data collected from the lake sturgeon are shown in Table 1.

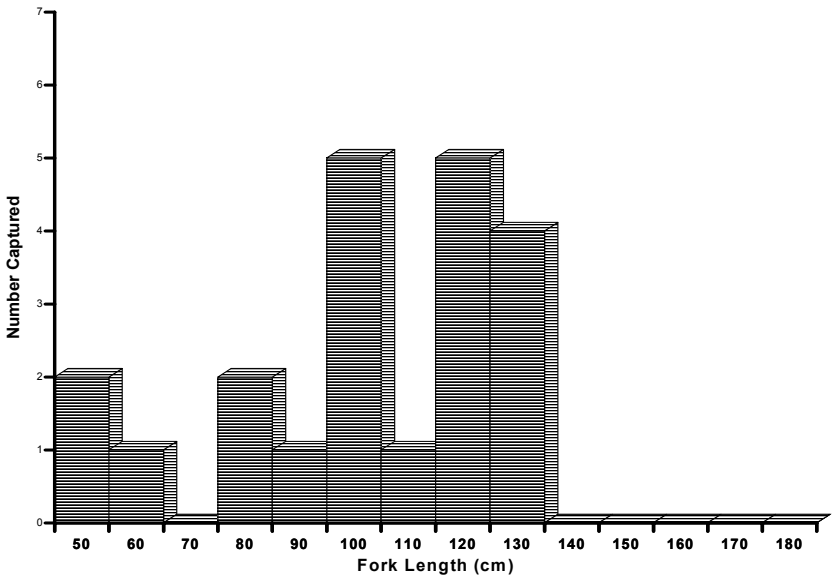

Figure 1. Length frequency of 21 Detroit River lake sturgeon captured by anglers between 30 September and 10 December 1998.

Biotic parameters were collected to assist with data exchange among other agencies involved in lake sturgeon status surveys. Several relationships were developed with these parameters to aid information exchange between the agencies. Figures 3 and 4 illustrate total length-fork length and girth-fork length relationships, respectively. Figures 5 and 6 illustrate weight-girth and weight-age relationships, respectively. These relationships will be compared with similar relationships produced for other lake sturgeon populations (St. Clair Waterway, southern Lake Huron and Saginaw Bay) in the central Great Lakes.

The excellent cooperation provided by the Detroit River anglers provided important information on the lake sturgeon population in this area of the Great Lakes. Although the data is biased by the collection technique, it is still valuable information. The age distribution of the lake sturgeon collected from the Detroit River was dominated by young lake sturgeon.

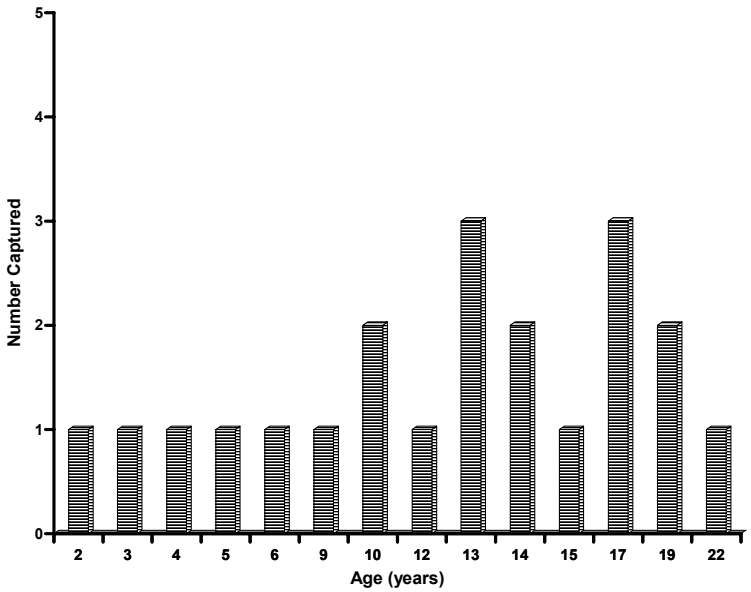

Figure 2. Age frequency of 21 Detroit River lake sturgeon capture by anglers between 30 September and 10 December 1998.

Table 1. Summary of morphological data collected from 21 Detroit River lake sturgeon captured by anglers between 30 September and 10 December 1998.

Variable	Mean	Median	Range
Fork Length (cm)	106	108	51 - 135
Total Length (cm)	116	119	58 - 148
Girth (cm)	43	44	20 - 57
Weight (kg)	11	11	1 - 20
Age (years)	12	13	2 - 22

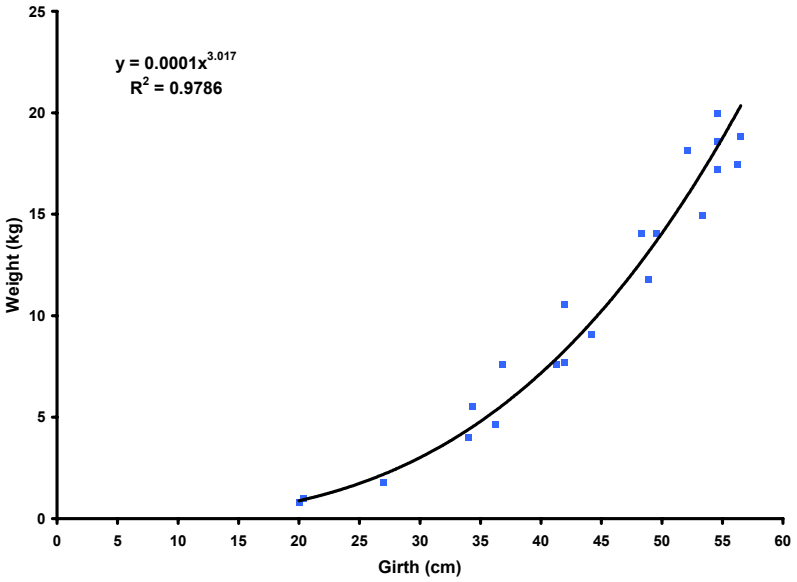

Figure 3. Girth to weight relationship for 21 Detroit River lake sturgeon captured by anglers between 30 September and 10 December 1998.

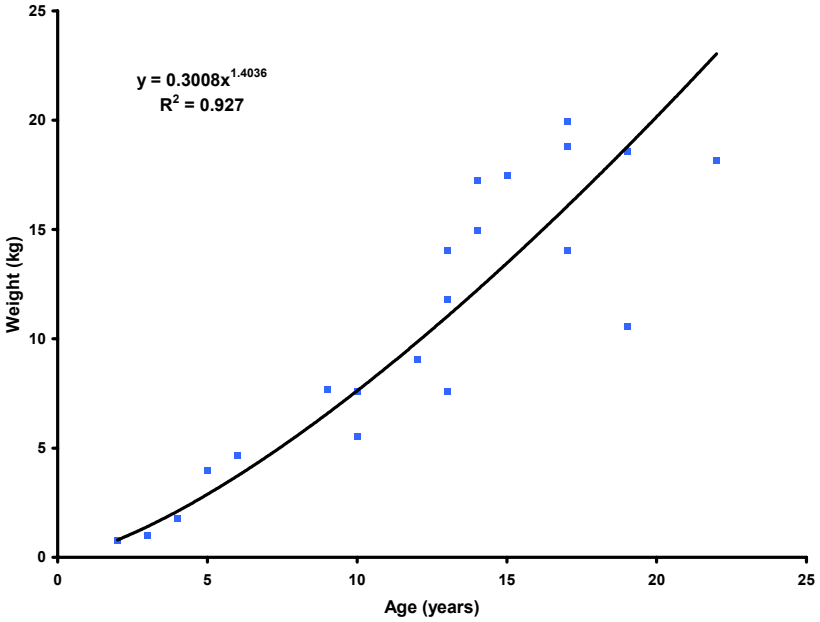

Figure 4. Age to weight relationship for 21 Detroit River lake sturgeon captured by anglers between 30 September and 10 December 1998.

1999

In 1999 historic spawning habitats in the Detroit River will be examined as part of a U.S. EPA-GLNPO funded project being conducted in collaboration with the GLSC. This project will provide data on the connection of this population with others being studied.

LAKE ERIE

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1997

We catalogued 64 lake sturgeon sightings from U.S. waters of Lake Erie for 1997. Eight of these sightings were for prior years. Sport fishing (22) and boater (9) sightings far exceeded the 11 previous sightings (1989-1996) from these sources. There were 9 Ohio lake shore sightings, where as none had been reported previously. Their distribution was lake-wide with the greatest occurrences, again, in the Lakeside-Marblehead and Cedar Point areas (Figure 1). The first occurrence of adult sturgeon sightings (3) from Sandusky Bay is noteworthy. The Sandusky River Basin is believed to be an ancestral sturgeon reproductive center. Sturgeon sightings occurred over a nine month period, April to December (Figure 2).

Information on 40 sturgeon in commercial by-catch from Ontario's western basin was, again provided by Gerry Penner, a Colechester Ontario fisherman. Ontario by-catch sampling and Ohio sighting reports detected similar relative size class abundances of young sturgeon in both 1996 and 1997 (Figure 3). Continued Ontario by-catch sampling and Ohio sighting report surveys may provide a means of tracking relative juvenile sturgeon age group abundances and their distribution in Lake Erie's western basin. Fin rays were collected in the 1997 by-catch sampling for age determination.

The promotion and distribution of our Sturgeon Sighting Alert card stimulated sighting reports from a number of sources (Figure 4).

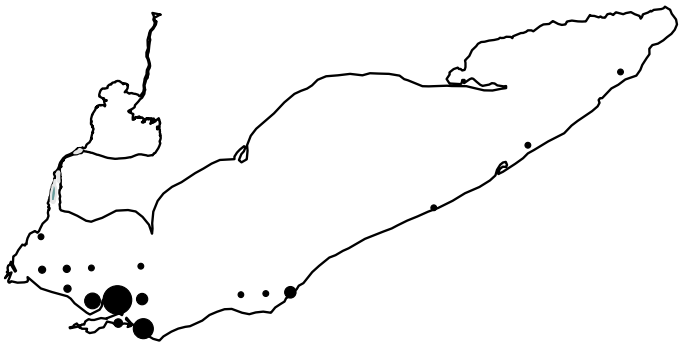

Figure 1. Sightings of lake sturgeon in Lake Erie, 1997, as reported to Ohio DOW from all sources. Relative size of circles denotes frequency of reports from individual sites.

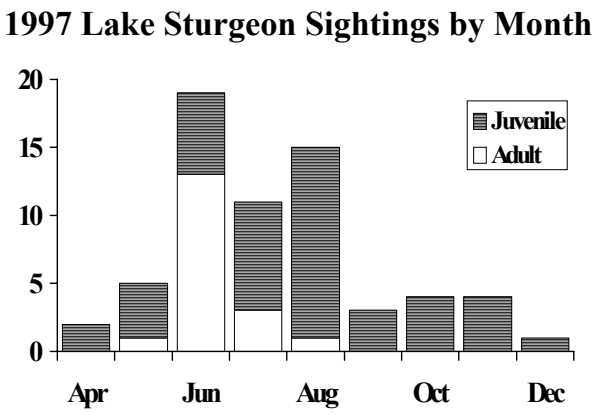

Figure 2. Lake sturgeon adult and juvenile sightings, by month, as reported to Ohio DOW from all sources from Lake Erie, 1997.

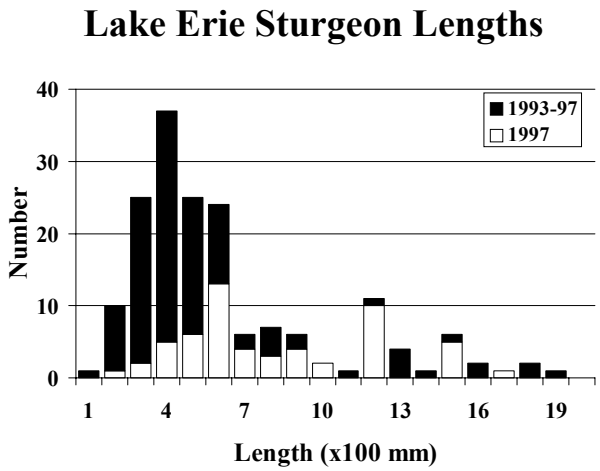

Figure 3. Length frequency distribution of Lake Erie lake sturgeon reported to Ohio DOW from all sources in the 1993-97 period, with the 1997 reports represented by the clear bars.

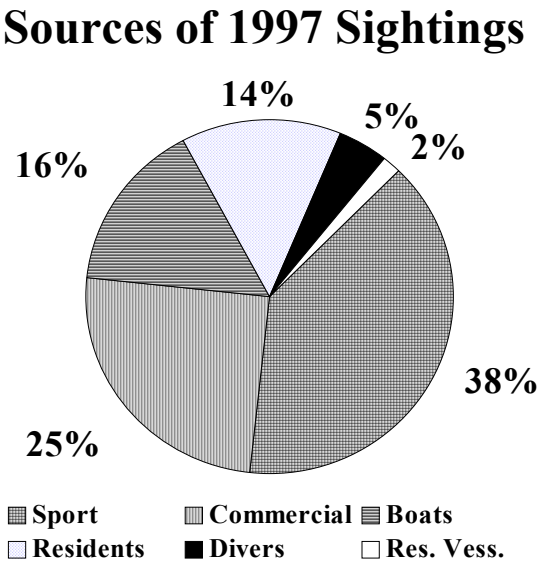

Figure 4. Sources, on a percentage basis, of Lake Erie lake sturgeon reports to the Ohio DOW in 1997.

1998

The program of lake sturgeon reporting was continued and efforts were made to expand the scope and level of interest throughout the Lake Erie basin. A total of 45 fish were reported to the Ohio DOW in 1998 as compared to 64 reported in 1997. Again, as was the case in 1997, lake sturgeon reports came from a variety of sources, including commercial fishers, sport fishers, shoreline residents and others (Figure 1).

Lake sturgeon sightings were reported for all open water months (March - December), with the greatest number of reports coming in the month of October (Figure 2). Seven of the ten fish reported in October came from commercial fishers.

Two lake sturgeon that had been previously tagged by commercial fishers in Lake Huron were reported to Ohio DOW. Fish #6313 had been tagged and released in Sarnia, Ontario on October 19, 1998 and was reported in Lake Erie on November 21, 1998. Fish # 6292 had also been tagged and released in the Sarnia area on October 19 and was captured in Lake Erie on December 10, 1998.

In addition, an adult sturgeon was recovered from an northwest Ohio farm pond and returned to the lake.

The length frequency distribution for lake sturgeon reported in 1998 is provided in Figure 3. Although no aging structures were collected from reporting sources, it is apparent that several age classes are represented in those fish reported in 1998.

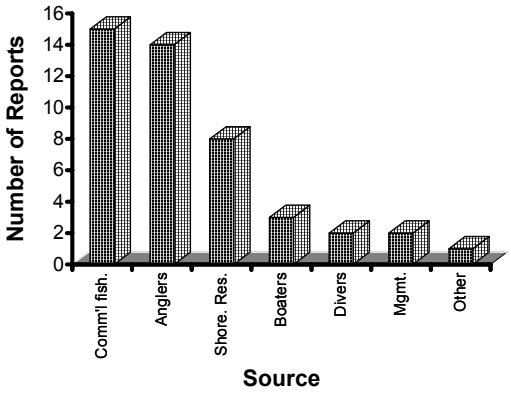

Figure 1. Numbers of Lake Erie lake sturgeon reported to Ohio DOW in 1998, by source.

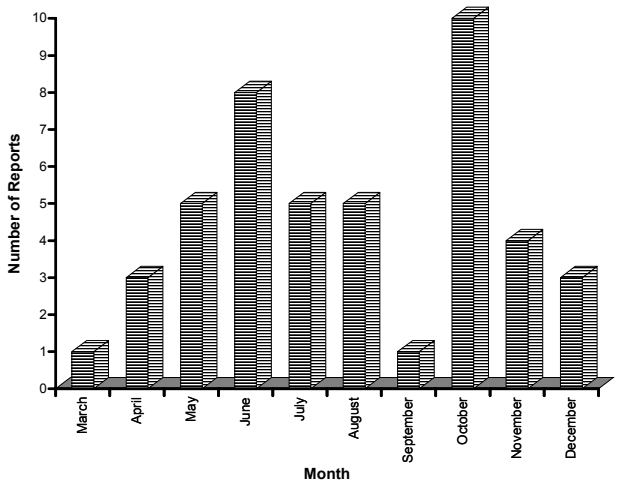

Figure 2. Numbers of Lake Erie lake sturgeon reported to Ohio DOW in 1998, by month.

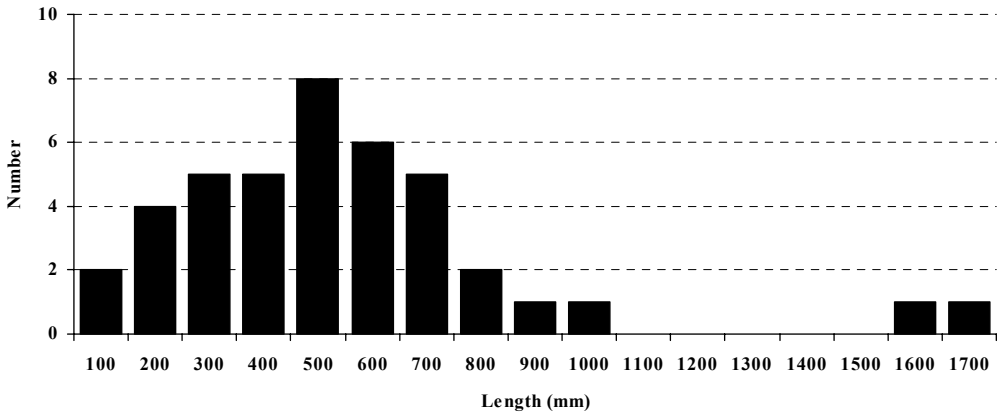

Figure 3. Length frequency distribution of lake sturgeon reported to Ohio DOW from all sources in Lake Erie, 1998.

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1997

The Lake Erie Management Unit continues to coordinate the collection of biological data on by-caught lake sturgeon from the commercial fishery in Ontario waters of western Lake Erie. One commercial fisher (Gerry Penner) has been cooperating on the project since 1996. Biotic data on length and weight are recorded for each fish encountered. Each fish is tagged in the left operculum with a Monel self-piercing animal ear tag. In addition, the leading ray of the left pectoral fin is also removed for aging purposes. Genetic samples were once again collected from representative samples of the lake sturgeon caught. A 1 cm^2 section of the pectoral fin is preserved in ethanol for this sample. The samples were forwarded to the USGS - Wellsboro Fishery Research Laboratory.

A total of 40 lake sturgeon were captured as by-catch in Penner's operation in 1997. Again, a majority of the fish reported in this fishery consist of juvenile fish <900 mm caught in small mesh perch gill nets (Figure 1). Although age data from this western Lake Erie source is not provided here it appears that since 1996 one or two large cohorts of lake sturgeon has been dominating the catch as it ages. The small fish, <500 mm, that were predominant in the 1996 catch were not present in the 1997 catch. Continued recovery of Lake Erie lake sturgeon will require persistent recruitment. The source of this recruitment has yet to be determined but associated studies in U.S. waters of Lake Erie and the lower Detroit River are seeking such information.

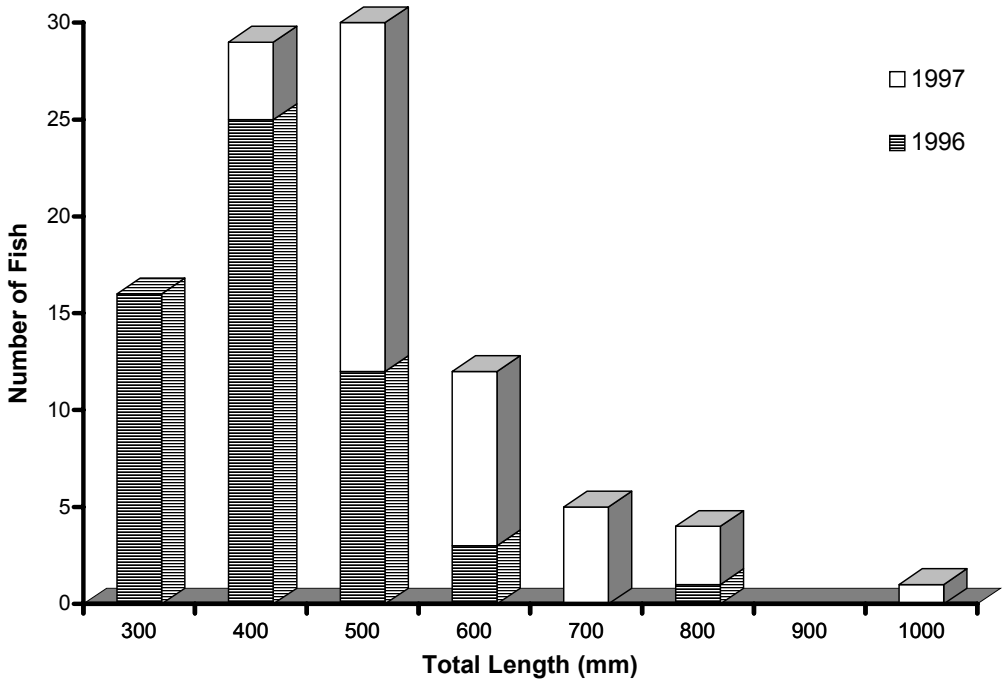

Figure 1. Length frequency distribution for lake sturgeon captured as by-catch in Ontario licensed Lake Erie commercial fishery in 1996 and 1997.

Data being compiled by the Central Great Lakes Bi-National Lake Sturgeon Group have been standardized to allow comparison of biotic information on basin specific populations. One such comparison is generation of morphological relationships. Figure 2 displays the total length to girth relationship for lake sturgeon captured in Ontario waters of the western basin of Lake Erie.

Efforts will be made to expand the voluntary participation of Ontario licensed commercial fishers in this program. Although additional information on western Lake Erie lake sturgeon populations is needed, essentially no information is available from the central and eastern basins of the Lake. This information will be critical for lakewide recovery efforts, especially as it relates to identification, protection, and restoration of critical micro-habitats.

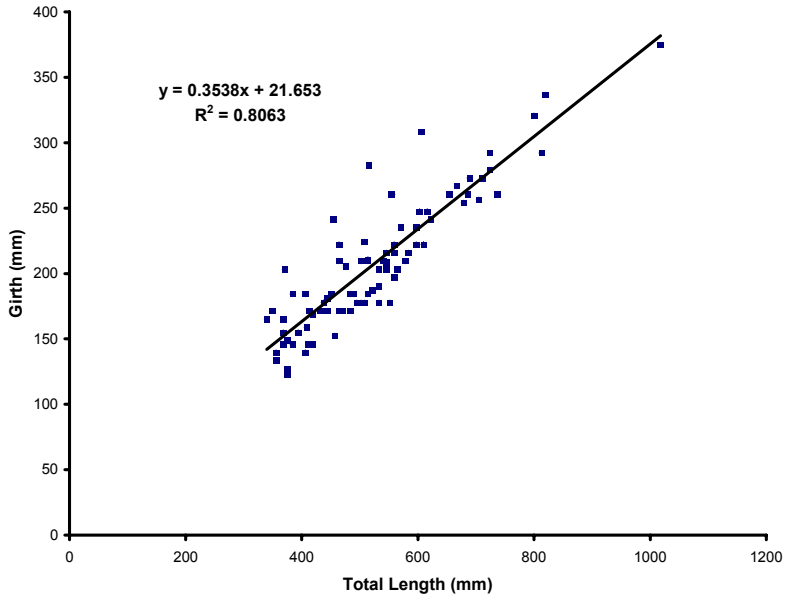

Figure 2. Total length to girth relationship for lake sturgeon captured as by-catch in Ontario licensed Lake Erie commercial fishery in 1996 and 1997.

NIAGARA RIVER / LAKE ONTARIO

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1997

Lake sturgeon activities conducted out of the LGLFRO in 1997 consisted mainly of consultation and coordination with other managers and researchers in the Lower Great Lakes and the connecting waterways. The office provided supplies for genetic sampling to an Ontario licensed Lake Erie commercial fisher (G. Penner) who is participating in

the overall lake sturgeon status and trends surveys being conducted by the Central Great Lakes Bi-National Lake Sturgeon Group.

In addition, improvement and expansion of a network of public interest groups for the recovery of anecdotal lake sturgeon sighting information was addressed. U.S. and Canadian dive groups are becoming more engaged in the project.

1994-97 sightings indicate successful natural reproduction, as well as year class structure within the population as suggested by annual sightings of juvenile $\leq$ 60 cm. Also, the west river (mostly Canadian waters) has significantly larger lake sturgeon (avg. 137 cm) reported than the east river (U.S. waters; avg. 53 cm). This suggests possible habitat differences between the west and east rivers; however, data provided by participants (mostly divers) indicate little difference. Average depth of sightings in the west and east rivers were 6 and 6.5 m, respectively and substrate descriptions were similar. Many sightings were reported in June and July; however, this is likely biased by increased diving activity.

The Frenchman's Creek area receives weekly dive trips throughout the season; however, a larger number of lake sturgeon are sighted during August, suggesting a high use area for the species during this time. The sightings, although anecdotal, are a first step in developing hypotheses about the Niagara River population. It appears the population is rebounding, but still reduced from historical abundance.

1998

Lake sturgeon sampling in 1998 focused primarily on the upper Niagara River (above Niagara Falls), and experimentally in the lower river. The objectives of the study were to: (1) determine the distribution, movements, and habitat utilization of adult and juvenile lake sturgeon, (2) determine the age and growth of adult and juvenile lake sturgeon, and (3) determine the genetic discreteness of Niagara River lake sturgeon.

The field season started 29 June, 1998 with six set lines deployed weekly in the east and west branches of the upper Niagara River. Set lines were configured according to protocols established by Michigan DNR, Mt. Clemens Fisheries Station. Set lines were baited primarily with round gobies; native chubs, earthworms, and crayfish used periodically. Set lines were typically set at a 45-50 degree angle from the shoreline due to poor boat maneuverability in the river flows. Lines were fished for approximately 24 hours.

Fifty-three set lines were fished for a total of 89 individual set line nights. No lake sturgeon were collected via this method; however, one channel catfish (62.5 cm) was captured. Many factors likely contributed to the lack of success. Most importantly, large amounts of drifting algae and macrophytes were believed to be "clogging" the lines and bait, resulting in inefficient sampling. In addition, macrophytes drifting on the surface

caused floats to submerge, creating unmarked sampling gear. The enormous weight of the vegetation coupled with the fast current made pulling the lines a 2-3 person task and required an entire day to clean the lines as we pulled them in. This problem was most pronounced with July sampling, when algae and macrophytes were abundant. Also, the "needle-in-a-haystack" concept is likely applicable due to the inability to sample a large area with low numbers of lake sturgeon present.

During August 1998, diver capture methods were implemented (experimentally) in the lower Niagara River. Chronologically, on 24 July our diver sighted numerous lake sturgeon while night diving in Peggy's Eddy, a slack water area on the U.S. side of the lower river just downstream of Joseph Davis State Park. On 31 July and 1 August, we attempted to capture lake sturgeon via underwater snagging and netting. On 31 July, according to the divers "lake sturgeon were everywhere"; however, none were collected via snagging. A few lake sturgeon were hooked; however, they were too strong to remain hooked long enough for the boat crew to fish them. On 1 August, the divers netted two lake sturgeon underwater using a standard salmon landing net and duck decoy bag (Table 1). On 14 August, the divers captured two more lake sturgeon in Peggy's Eddy using the nets (Table 1).

Table 1. Specifics of lake sturgeon collected in the lower Niagara River, 1998.

Date	Method	Total Length (mm)	Age	Depth of Capture (m)	Sonic Tag Number
1 August	Diver	337		13.7-15.2	
1 August	Diver	705	3	13.7-15.2	266
11 August	Gillnet	854	5	10.0	347
14 August	Diver	966	6	9.1	338
14 August	Diver	847	5	7.6-9.1	356
25 August	Gillnet	866	5	8.7	248
27 August	Gillnet	725	4	9.3	239

Set lining began in the lower river on 27 July, followed by gillnetting on 4 August, after the initial diver success. Set lines were configured as stated above. Experimental gillnets, ranging in size from 2.5 to 10 inch stretch mesh, were set in Peggy's Eddy, perpendicular and parallel to the shoreline. Six set line nights caught zero lake sturgeon (similar

problems existed as described above). Thirteen gillnet nights caught three juvenile lake sturgeon (Table 1).

Most lake sturgeon were captured in about 30 feet of water, with the exception of one fish caught by divers in 50 feet (Table 1). Biological data were collected from all fish, including tissue for genetics analysis. The six larger fish were marked with an external tag for individual identification and received an ultrasonic tag for tracking purposes (Table 1).

Tracking started on a daily basis immediately after release, then twice per week, followed by twice per month. The last date of tracking was 11 December 1998. In addition to individual day tracking events, 24 hour tracking was performed on 31 August, 2 September, and 3 September to determine diel movements. Fish #266 remained in Peggy's Eddy for 47 days, then moved downstream 5 km near the mouth of the river. Fish #347 entered Lake Ontario the day after it was released in Peggy's Eddy, 5.5 km from the capture site. This fish continued to move slowly offshore in the lake. Fish #338 moved 6 km upstream the day after release. This fish continued to move upstream, then back down to the Stella Niagara area. Twenty-five days after release this fish moved rapidly 13 km to Lake Ontario in a one week period. This rapid downstream movement of fish #338 occurred concurrent to a similar movement of fish #266 to the mouth of the river. To date, an analysis of environmental conditions, which may have provoked these fish to dramatically move downstream, has not been completed. Fish #356 remained in Peggy's Eddy for 88 days then moved upstream 6-8 km. Two lake sturgeon, #239 and #248, have remained in Peggy's Eddy during all tracking events. We believe these fish are still alive and moving within a small range. In 1999, sampling will verify if these are live fish or lost tags drifting in the eddy currents.

Sampling and tracking the six sub-adult lake sturgeon has provided preliminary information regarding macro-habitat utilization. For example, all lake sturgeon were collected in a back-eddy environment. While remaining in the river, the lake sturgeon occupied nearshore, slower currents (eddys), with the exception of one point when fish #356 was found near Lewiston, NY in the center of the river where water velocity is higher. Also, as stated above, two fish have entered the lake environment. Depth measurements have been fairly consistent among all lake sturgeon locations, averaging 10 meters. Individual fish did not make large scale movements between day and night hours. However, their activity seemed to increase during night hours as shown by several small-scale movements within their locale.

Public Participation

Anecdotal information of lake sturgeon has been reported by the general public, and by commercial fishermen. This initiative has been implemented in all lower Great Lakes waters and continues to provide substantial contribution to the pool of information on lake sturgeon populations in the Great Lakes. Public education was significantly increased in 1998. First, an appreciation dinner was held at the LGLFRO for divers participating in the sighting program. As suggested at the dinner, a poster of the upper

Niagara River was developed with current sightings and lake sturgeon educational items. The poster was placed in nine dive shops in Canada and the U.S. to increase awareness and sighting reports. A web page, entitled 'Niagara River Lake Sturgeon Project' was developed and placed on the Niagara Divers Association web site (www.vaxxine.com/nda). Lake Sturgeon Sighting Alert cards, developed by Ohio DNR, were distributed to approximately 200 marinas, bait shops, and boat launches. Also, an 'Alert' notice was placed in the NYSDEC 1998-99 Fishing Regulations Guide to increase angler awareness and reports. As a result of the increased effort, 86 lake sturgeon reports, with 120 sightings, were filed by our office in 1998. Previously, the most reports submitted in one year to the LGLFRO was 12.

Of 81 sightings from 59 reports provided in 1998, 69% were from the upper Niagara River. When compared to reports from 1994-1997, the 1998 sightings showed increased diversity in the lengths of lake sturgeon in both the east and west rivers. Most sightings were reported in June and July, likely due to increased diving activity. A significant finding from 1998 sightings was an abundance of YOY lake sturgeon at the northern tip of Grand Island, in the east river. Sixteen of twenty-four (66%) were sighted on 15 August. This location is called the Grasse Island area due to a large island of emergent vegetation. The water currents appear to be reduced in this area. Divers reported substrates primarily of sand and gravel with some reporting cobble. Total depths averaged 5 meters. Vegetation was reported to be sparse to moderate in the area. The LGLFRO set gillnets and trawled in the area in mid-October; however, only one mudpuppy was caught in the trawl.

During the appreciation dinner divers suggested conducting what was called a "mass dive." On 13 June, 1998, eight boats and a total of 26 divers from both Canada and the U.S. conducted the "mass dive" to better identify lake sturgeon distribution and abundance in the upper Niagara River. Two dives, spread across the width of the West Niagara River (Canadian side), covered approximately 6 km of river. Two juvenile lake sturgeon (approx. 30 and 60 cm) were sighted by divers. These sightings are important because prior to the "mass dive" only one juvenile had been reported in the West River during the 1994-1997 period. Juveniles in the West River could be an indicator of successful reproduction occurring within this river branch.

The "mass dive" provided an excellent opportunity for the diving community to interact with LGLFRO biologists and learn more about the lake sturgeon. It also allowed LGLFRO biologists to further explore the potential for the use of diver sightings as a method of lake sturgeon population assessment.

Oswegatchie River Juvenile Assessment

A cooperative project with the NYSDEC was initiated in 1998 to evaluate the success of their restoration/stocking efforts in the Oswegatchie River, tributary to the St. Lawrence River. To determine the success of the restoration effort the distribution, movement, habitat use, and growth of stocked juvenile (fingerling) lake sturgeon was assessed.

To determine the distribution of stocked lake sturgeon a total of 88 river kilometers were covered using experimental gillnets ranging in size from 50 to 127 mm stretch mesh. Gillnetting took place on 48 nights and totaled 244 individual gillnet sets. This effort yielded 290 lake sturgeon representing the three year classes of stocked fish. After three consecutive years of stocking, the lake sturgeon showed an interesting distribution pattern. The 1997 stocking year class was distributed in roughly the upper 40 kilometers of river (RKM 88 - 48), with the exception of one 1997 lake sturgeon captured in the lower 48 kilometers of river.

Radio telemetry was used to determine movements and habitat utilization of stocked juvenile lake sturgeon. A total of 20 juveniles were radio tagged and tracked biweekly. The radio tagged fish were composed of 10 newly released hatchery lake sturgeon and 10 naturalized lake sturgeon. The radio tagged lake sturgeon were released in pairs for comparison purposes, one naturalized fish and one newly released hatchery fish. The general pattern displayed by the ten naturalized lake sturgeon is localized movements (approx. 200 - 300 m) with some exceptions. The ten newly released hatchery lake sturgeon show a general pattern of downstream movement, in some cases in excess of 70 kilometers. All ten newly released hatchery lake sturgeon moved downstream an average of 32 kilometers. It is important to note that lake sturgeon used in the radio tagging portion of this study were larger than normally stocked fingerling lake sturgeon and may have no correlation to the behavior of stocked fingerlings. Habitat analysis was conducted for high use areas of both the newly released and the naturalized lake sturgeon.

As part of the Oswegatchie River juvenile lake sturgeon assessment, stomach contents were collected from approximately 100 lake sturgeon. This information, in conjunction with macroinvertebrate sampling, will provide data on juvenile lake sturgeon diets and food preferences.

Summary of Results, and 1999 Activities

The information collected from all activities suggests that lake sturgeon numbers are increasing but still impaired relative to historical abundance. Increased effort to educate the public has been extremely beneficial. Recent sightings indicate age-class structure within the current population. For example, 36 lake sturgeon <60 cm, 15 between 40 and 122 cm, 13 between 124 and 183 cm, and 1 greater than 183 cm have been reported in the West River. Although, set lines did not prove to be an effective method to capture adults in 1998, diver capture has proven to be effective with smaller lake sturgeon. In addition, areas have been identified where effective gillnetting and other methods can be implemented. Many factors likely contributed to the lack of set line success, which will be evaluated and adjustments made for the 1999 sampling season. The collection of tissue samples for genetic analysis is ongoing and our partners are in the process of identifying the DNA microsatellite loci for population identification. The LGLFRO will host a Great Lakes Lake Sturgeon Genetics Workshop in late-summer 1999.

A comprehensive study of the lake sturgeon population in the lower Niagara River will be the primary objective for 1999. Gillnetting, SCUBA, and baited set lines will be the primary methods used to capture adult and juvenile lake sturgeon. Lake sturgeon movements and habitat use will be examined in the Niagara River in order to identify and assess the current condition of adult spawning habitats, feeding habitats and juvenile nursery areas. Ultrasonic telemetry of adult and juvenile fish will provide the necessary information to identify lake sturgeon "high use" areas in the river and to collect biotic and abiotic data within the lake sturgeon's preferred habitats. Fish sampling in the upper Niagara River in 1999 will be more experimental in nature. Methods similar to those used on the lower river will be implemented on a limited basis, with a greater emphasis on locating concentrations of fish rather than capturing individuals.

With the Lake Sturgeon Sighting Program now in its sixth year, we will expand it even further. Updated posters, sturgeon alert cards and additional sighting forms will be distributed in several dive shops, marinas and bait shops in both the U.S. and Canada. The posting of the 'alert' notice in the NYSDEC 1998-99 Fishing Regulations Guide is suspected to gather considerable attention and result in a large number of sighting reports. In addition, we will likely perform two "mass dives" in the upper Niagara River during June and September, 1999.

Evaluating the success of the NYSDEC's hatchery product and stocking strategies utilized in the Oswegatchie River Restoration Project, was very successful in 1998. The distribution, survival, and movements of the juvenile lake sturgeon will be further analyzed in 1999.

Lastly, biologists from USGS Tunison-Cortland, Region 8 NYSDEC, and our office will be conducting lake sturgeon habitat assessments in the Genesee River, a tributary to Lake Ontario at Rochester. In brief, habitat and fish sampling will be conducted to evaluate the Lake Sturgeon Habitat Suitability Index Model, prepared by Ontario Hydro. Sampling will be conducted during the suspected spawning period and periodically throughout the summer months. If lake sturgeon are collected, radio transmitters will be applied for movement and habitat utilization information. At the end of our sampling efforts, if we determine suitable habitats exist, yet are confident no naturally occurring lake sturgeon inhabit the river, a few naturalized lake sturgeon from other systems will likely be transplanted into the river to study their behavior.