

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-81-R-2

Study No.: 491

Title: Evaluation of lake sturgeon *Acipenser fulvescens* populations in the St. Clair River and Lake St. Clair

Period Covered: October 1, 2000 to September 30, 2001

Study Objective: The objectives of this study are (1) to determine spawning period, areal distribution of spawning activity, and spawning habitat for lake sturgeon 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 lake sturgeon, (3) to document lake sturgeon population parameters for Lake St. Clair and the St. Clair River, including estimated abundance, exploitation rate, age composition, growth rate, age structure, and sex composition of the spawning stock.

Summary: Data entry and analysis for all 2000 field collections has been completed. A total of 233 lake sturgeon were collected from the St. Clair River and Lake St. Clair in 2000. Sturgeon were collected with bottom trawls and baited setlines. Pectoral fin ray sections were used to age 801 fish captured between 1997 and 2000. Ages ranged from 1 to 74 years and included 50 year classes. Mean length at age suggested that these sturgeon grew faster as juveniles, compared with lake sturgeon in Michigan's inland waters. A total of 217 sturgeon were tagged with serial-numbered monel cattle ear tags and released in 2000. An additional 160 sturgeon have been tagged and released through September 1, 2001. The total number of sturgeon tagged and released in the St. Clair system, since 1996, now exceeds 1000 fish. Tag recoveries have been sparse, comprising eleven recaptures with setlines, three recaptures with trawls, and fifteen reported recoveries by sport or commercial fishermen. Field collections in 2001, including setline and trawl sampling, have been conducted as scheduled. Data entry and analysis for 2001 sampling is underway.

Job 1. Title: Collect biological data, and tag juvenile and adult sturgeon with monel tags in the St. Clair River and Lake St. Clair.

Findings: Sturgeon were collected with two gear types in 2000. A total of 82 sturgeon, including three recaptures, was caught in 72 overnight sets using setlines in the North Channel of the St. Clair River, between May 8 and May 25. Total length of sturgeon caught on setlines ranged from 744 mm to 1,887 mm. Ages ranged from 6 to 74 years. All fish were tagged with monel cattle ear tags and released.

A total of 150 lake sturgeon, including two recaptures, was captured with 10 m headrope bottom trawls from June through October on Lake St. Clair. Total lengths of sturgeon captured ranged from 859 mm to 1,849 mm. Ages ranged from 6 to 59 years. All fish were tagged with monel cattle ear tags and released. One of the two fish recaptured with trawls in 2000 was a fish previously tagged in the opercle, but the tag had been lost. A scar was clearly evident on the opercle and the left pectoral fin ray had clearly been removed. This is the first documented case of tag loss during this study.

In 2001, we caught a total of 52 sturgeon, including 3 recaptures, with setlines in 56 overnight sets. An additional 20 sturgeon, including 1 recapture, were captured with trawls on Lake St. Clair through August 15. Passive integrated transponder (PIT) tags were applied to all sturgeon captured and released in 2001. The PIT tag is inserted under a dorsal scute and will allow us to evaluate tag loss of the monel tags. Processing of fin rays for age analysis for sturgeon captured in 2001 is underway.

Overall, the age distribution of lake sturgeon captured from 1997 through 2000 appeared well balanced, with a total of 50 year classes represented by the 801 lake sturgeon sampled for age (Table 2). This sample reveals consistently good recruitment from 1973 to 1993. 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 1993, 1991, 1985, 1979, and 1977. The 1995 to 1998 year classes were poorly represented in the sample. This could 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 appeared under-represented in the catch. This could be an indication that recruitment prior to 1965 was poor, but 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 in 1983 of sturgeon season during the spawning period in May and June).

Growth of lake sturgeon in the St. Clair ecosystem was good, with some fish attaining a total length of 1 m as early as age 8. A mean length of 1,270 mm is attained by age 19 (Table 3). In contrast, lake sturgeon in Michigan's inland waters grow slower, particularly from age 1 to age 15, and attain a mean length of 1270 mm at age 22 (Baker 1980). Based on age and growth data collected during this study, the MDNR implemented new regulations for sturgeon sport fishing on Lake St. Clair and the St. Clair River in 1999. The regulations included a "slot" size limit, with a minimum length limit of 1,067 mm (42 inches) and a maximum length limit of 1,270 mm (50 inches), a season bag limit of 1 fish, an open season from July 16 to September 30, and mandatory registration of harvested sturgeon at designated check stations. This "slot" limit will allow a limited harvest to continue, while protecting sexually mature female fish and potentially allowing older fish to increase in abundance.

Job 2. Title: Characterize adult spawning habitat and juvenile habitat: based on catch distribution and using underwater video, sidescan sonar, doppler flow meter, temperature and oxygen profiles.

Findings: 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 on June 13 and 14, 1997. The site is characterized by water depths of 9 m to 12 m, flow rates of 1 m/sec, and substrate composed of coal cinders ranging in size from <25 mm to over 200 mm in diameter. Water temperature at the peak of spawning in 1997 was 13.2 °C. In 1998, water temperatures reached 13 °C, and sturgeon began spawning on the site, on May 18. In 1999, water temperatures were 12 °C on May 20, when ripe sturgeon were first captured. The coal cinders are believed to have been deposited at the site during the late 1800s 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) provides a high level of interstitial space, offering excellent protection for deposited eggs. The cinder bed measures approximately 25 m by 54 m in size and roughly parallels the shoreline.

Efforts to map the spawning site with sidescan sonar have been largely unsuccessful. While good sidescan images of the site have been obtained from the Seascan system, signal returns from cinder substrate are not obviously different from the surrounding clay and gravel substrates. River currents tend to make the towfish unstable, resulting in distorted images. Also, steep bottom contours typical of the St. Clair River shorelines make it difficult to use the sidescan sonar effectively. Researchers from the USGS Great Lakes Science Center examined suspected sturgeon spawning sites in the St. Clair River and Detroit River in 2001 using underwater video on a remotely operated vehicle.

Efforts to identify habitat requirements of juvenile lake sturgeon have been impeded by our inability to consistently collect young lake sturgeon. Less than 1% of the sturgeon captured through 2000 were younger than age 3 (smaller than about 500 mm total length). Efforts to capture Age 0 lake sturgeon in littoral areas with a 4.8 m headrope trawl have been unsuccessful. Potentially, Age 0 lake sturgeon in the St. Clair system may inhabit deep channel areas of the St. Clair delta. However, sampling in these areas is extremely difficult. We examined one of the deep channel areas with underwater video during fall 2000. However, the search was ineffective due to camera instability resulting from current turbulence. Alternative methods of collecting juveniles will be explored in 2002. Smaller scale setlines or small minnow trap devices are possible sampling options yet to be investigated. Additional catch data from collections over the next few years may also help identify juvenile habitat based on the geographical distribution of juveniles in the catch.

Job 3. Title: Collect and analyze tag recovery data.

Findings: Tag recovery data remain sparse. Through 2000, only 29 lake sturgeon tagged and released during this study had been recaptured. Eleven were recovered during the setline surveys in the North Channel, while three were recovered while survey trawling. Seven recoveries were reported in 1998 and 1999 by sport anglers in the North Channel. Eight 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. This suggests that sturgeon movement between the St. Clair system and Lake Huron is common. Furthermore, it suggests that sturgeon spawning in the Michigan waters of the St. Clair River experience considerable fishing exploitation in the Ontario waters of southern Lake Huron. These factors should be recognized in future sturgeon management strategies on these waters.

Lake sturgeon movements are unrestricted by human or natural barriers in the St. Clair system. This potential for free immigration and emmigration makes it difficult to estimate abundance based on mark-recapture techniques. However, it is possible to produce some estimates of numerical abundance based on the mark-recapture data available from our survey gear. Using the SCHNABEL method (Ricker 1975) we estimated the abundance of lake sturgeon in the St. Clair system as 39,952 (95% CI=20,719-557,481). Using the CAPTURE software (White et al 1978) we estimated the abundance of lake sturgeon in the St. Clair system as 45,506 (95% CI=24,230-86,190). Despite the problems associated with the potential violation of various assumptions regarding these estimation techniques, we believe the magnitude of these estimates suggests subadult and adult sturgeon abundance in the St. Clair system exceeds 20,000 fish.

The adult sturgeon telemetry study (cooperative with the University of Michigan) has provided much more information about sturgeon movement within the St. Clair system. A total of 16 large adults captured near the North Channel spawning site, tagged with sonic tags and released, have been located periodically over the past 3 years. One movement pattern apparent from this study is that many adult sturgeon found in the North Channel during the spawning season moved into Lake

St. Clair and spent the summer and fall months in the deeper portions of the U.S. area of the lake. It was also apparent that some adult sturgeon remained in the St. Clair River throughout the year.

A sturgeon telemetry study was initiated in the Detroit River by researchers from the USFWS and Central Michigan University in spring 2000 and 2001. At least seven of the 20 fish implanted in the Detroit River were subsequently located during the summer in Lake St. Clair. This mixing of Detroit River and St. Clair River sonic tagged fish in Lake St. Clair during the summer confirms that the lake is used as summer habitat by adults from several spawning areas.

Job 4. Title: Analyze data and prepare annual performance report, final report, and other reports.

Findings: A summary of all Mt. Clemens sturgeon assessment activities was prepared for inclusion in the annual Interbasin Sturgeon Working Group Report, compiled by the US Fish and Wildlife Service Alpena Fisheries Resource Office, and distributed at the Great Lakes Fisheries Commission lake meetings. This annual performance report was also prepared. A paper summarizing the results of this study from 1996 to 2000 was prepared and presented orally at the 4th International Sturgeon Symposium in Oshkosh, Wisconsin, in July 2001. A manuscript was also prepared and submitted for inclusion in the symposium proceedings.

Literature Cited:

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Table 1.—Mean length and weight for lake sturgeon collected from St. Clair River and Lake St. Clair in 2000.

	Set-line	Trawl
Total number caught	83	150
Mean length	1,328 mm	1,252 mm
Length range	744 mm – 1,887 mm	859 mm – 1,849 mm
Mean weight	18.7 kg	12.3 kg
Weight range	2.3 kg – 53.6 kg	3.3 kg – 44.0 kg

Table 2.—Age distribution for all lake sturgeon sampled for age from the St. Clair River and Lake St. Clair in 1997, 1998, 1999, and 2000 with three gear types (TN=trap net, SL=setline, TR=trawl).

Year Class	1997			1998			1999		2000		Total Catch
	TN	SL	TR	TN	SL	TR	SL	TR	SL	TR	
1998	0	0	0	0	0	0	0	1	0	0	1
1997	0	0	0	0	0	0	0	1	0	0	1
1996	0	0	1	0	0	1	2	0	0	0	4
1995	0	0	0	1	0	0	0	3	0	0	4
1994	1	0	1	0	2	1	6	1	2	1	15
1993	0	1	6	0	8	4	8	5	2	10	45
1992	0	1	4	0	2	1	1	0	2	2	13
1991	1	4	6	0	4	3	4	2	3	6	33
1990	0	6	4	0	2	4	2	2	1	2	23
1989	0	2	5	0	5	7	0	4	0	8	31
1988	0	5	5	0	3	3	3	4	0	7	30
1987	0	2	3	0	1	6	0	1	4	2	19
1986	0	0	7	0	1	3	2	2	3	8	26
1985	2	4	6	0	2	5	7	3	1	6	36
1984	1	0	4	0	4	4	4	1	1	8	27
1983	0	4	4	0	0	3	1	2	1	10	25
1982	1	1	1	0	2	9	2	3	2	11	32
1981	0	1	0	0	1	6	2	1	4	4	19
1980	2	2	1	0	2	8	2	1	2	4	24
1979	2	3	1	0	3	5	3	4	5	8	34
1978	0	5	3	0	5	5	6	1	3	3	31
1977	0	4	3	0	3	11	3	4	6	0	34
1976	0	5	0	0	6	4	3	4	3	7	32
1975	0	3	7	0	1	6	6	1	3	5	32
1974	0	2	2	0	3	9	5	1	5	4	31
1973	0	4	2	0	5	2	4	2	4	5	28
1972	0	1	1	0	3	4	4	1	0	2	16
1971	0	2	1	0	0	2	2	1	0	1	9
1970	0	0	1	0	2	5	6	4	1	2	21
1969	0	1	0	0	3	7	1	0	1	5	18
1968	0	3	2	0	2	3	2	2	2	2	18
1967	0	2	1	0	1	9	1	0	4	4	22
1966	0	2	3	0	3	0	3	0	1	1	13
1965	0	1	1	0	2	2	4	0	1	1	12
1964	0	0	2	0	0	3	1	0	3	3	12
1963	0	0	1	0	2	3	1	0	1	0	8
1962	0	0	0	0	0	0	0	0	0	0	0
1961	0	1	0	0	0	0	1	1	0	1	4
1960	0	0	0	0	1	1	0	0	1	0	2
1959	0	0	0	0	0	0	0	0	1	1	2
1958	0	0	0	0	0	0	0	0	1	1	2
1957	0	0	0	0	1	0	0	1	0	0	2
1956	0	0	0	0	1	0	0	0	0	0	1
1955	0	1	0	0	1	0	0	0	1	1	4
1954	0	0	0	0	0	1	0	0	0	0	1
1953	0	0	0	0	0	0	1	0	0	0	1
1951	0	0	0	0	0	0	0	0	0	1	1

Table 2.—continued.

Year Class	1997			1998			1999		2000		Total Catch
	TN	SL	TR	TN	SL	TR	SL	TR	SL	TR	
1946	0	0	0	0	0	0	0	0	0	1	1
1945	0	0	0	0	1	0	0	0	0	0	1
1941	0	0	0	0	0	0	0	0	0	1	1
1937	0	0	0	0	0	0	1	0	0	0	1
1926	0	0	0	0	0	0	0	0	1	0	1

Table 3.—Mean length at age and standard error (SE) for all lake sturgeon sampled for age from the St. Clair River (SCR) and Lake St. Clair (LSC) for 1997-2000, compared to mean length at age from Michigan's inland lakes (Baker 1980).

Age	SCR & LSC		Michigan Inland
	Mean length (mm)	SE	Mean length (mm)
1	298	53.5	152
2	451	24.0	279
3	559	45.6	318
4	654	15.6	409
5	736	15.4	513
6	818	11.8	561
7	880	11.7	627
8	924	18.2	699
9	950	11.8	770
10	957	15.9	810
11	1026	15.2	884
12	1061	18.7	940
13	1086	17.9	1008
14	1126	15.5	1054
15	1187	28.2	1133
16	1177	24.3	—
17	1240	15.2	1171
18	1261	15.2	1171
19	1277	15.9	1173
20	1297	17.9	1242
21	1344	13.6	1245
22	1367	18.2	1278
23	1355	20.1	1288
24	1363	17.5	1293
25	1440	22.4	1341
26	1367	19.2	1344
27	1423	27.0	1392
28	1440	23.8	1389
29	1455	21.2	1463
30	1473	25.0	1384
31	1490	18.0	1466
32	1430	28.9	1453
33	1468	28.5	1440
34	1412	34.1	1511
35	1521	33.7	1496
36	1499	50.6	1529
37	1765	—	1557
38	1491	46.3	1542
39	1562	—	1638
40	1753	—	1651
41	1578	9.5	1590
42	1568	54.6	—
43	1529	—	—