

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-81-R-7

Study No.: 230466

Title: Fish community status in Saginaw Bay,
Lake Huron.

Period Covered: October 1, 2005 to September 30, 2006

Study Objective: To assess responses of the Saginaw Bay fish community to changing environmental and biological conditions. Of special interest is to monitor the response of the fish community to management actions and nonnative species.

Summary: The annual gillnetting and trawling surveys were performed in September 2006 as planned and data analysis is under way. Analysis of the 2005 survey indicates that walleye *Sander vitreus* and yellow perch *Perca flavescens* again produced large year classes as measured at age-0. The large 2004 walleye year class was observed as yearlings in the 2005 survey and produced a relatively strong year class but not in proportion to their abundance as first measured at the age-0 stage. Mean length of age-0 walleyes and yellow perch has been smaller since 2003 and survival may have been affected through predation or poor thermal tolerance to over-winter stress stemming from lower fat reserves. Abundance of age-1 and older yellow perch continues to decline. Mortality of age-0 yellow perch appears to be very high. The 2005 walleye year class (measured as age-0 fish in the trawl collections) was dominated by naturally reproduced fish (92% of the year class as determined by oxytetracycline marking of hatchery fish).

Findings: Jobs 1 through 5 were scheduled for 2005-06, and progress is reported below.

Job 1. Title: Relative abundance and community structure.—A total of 16 gill-net sets were fished in September of 2006 (Table 1) and a total of 30 trawl tows were made on the waters of inner Saginaw Bay in 2006 (Table 2). Laboratory and data analysis of the 2006 survey is still under way. Analysis of the 2005 survey has proceeded during this time period however, and select findings are presented here in addition to some findings of past years added for perspective.

In 2005, the gill-net portion of the fish community survey collected a total of 2,707 specimens representing a total of 17 different species. Walleye catch-per-unit-of-effort (CPUE) increased from the 2004 value to 19.2 walleyes/lift, the second highest value in the survey series history. Analysis of the age structure confirms that the strong reproductive success of walleyes documented by the trawling portion of the survey since 2003 is surviving and recruiting to the larger population. The CPUE of age-1 walleyes remained strong (Figure 1) but not as great as some recent years indicating that the 2004 year-class was not proportionally as large as first measured as age-0s. This suggests that survival from age-0 to age-1 has declined in Saginaw Bay perhaps due to predation, losses to over-winter thermal stress, or both factors. Mean total length of age-3 walleyes (which is used as an indicator of density dependent growth and relative progress towards walleye recovery) was 460mm, representing a decline by 10mm from 2004. The 2005 mean length (460mm) is 119% of the state average for age-3 walleyes. Fielder and Baker (2004) established a target recovery walleye density such that the growth rate of age-3 walleyes slows to 110% of the state average rate.

In the 2005 trawl collections, round gobies *Neogobius melanostomus* were the most abundant species with a mean CPUE of 300 per tow. Spottail shiners *Notropis hudsonius* were the second

most abundant species, followed by yellow perch, white perch *Morone americana*, and trout-perch *Percopsis omiscomaycus*. Alewives *Alosa pseudoharengus* were conspicuously rare in the trawls with a CPUE of <1 per tow, the lowest CPUE for alewives since the survey started in 1971. Since all alewives captured in the trawls in Saginaw Bay are age-0 fish, this low value suggests that alewife adult abundance in 2006 will remain low in Lake Huron. The soft-rayed forage index value (sum of catch rates for alewives, emerald shiner *Notropis atherinoides*, gizzard shad *Dorosoma cepedianum*, rainbow smelt *Osmerus mordax*, round gobies, spottail shiner, and trout-perch) in 2005 is the lowest since 1991 and is mainly a result of comparatively low catch rates for alewives, smelt, trout-perch and spottail shiners.

Yellow perch age-0 CPUE exceeded 200 fish per 10 minute tow for the third consecutive year in 2005 (Table 3). Such sustained high catch rates had not previously been observed during the 36 year history of the trawl survey. The mean length of age-0 yellow perch in 2005 improved over the prior two large year-classes. The slow-growing 2003 and 2004 year classes both exhibited high mortality between age 0 and age 1 as indicated by the steep decline in age-specific CPUE for those cohorts (Table 4). The CPUE for age-1 yellow perch in 2004 was only 22.9 per tow (Table 4), representing a decline of 99% from the record age-0 CPUE of 2,450 in 2003. Similarly, the age-1 CPUE in 2005 was 20.7 per tow, representing a 95% decline from the age-0 CPUE of 461.8 in 2004. We suspect that the small size of fish in the 2003 and 2004 cohorts contributed to high over-winter mortality due to predation and low energy reserves.

Walleye reproductive success in 2005 was the second highest on record with an age-0 walleye CPUE of 31 (Table 5), representing the third straight year of record walleye age-0 catch rates. However, mean length of age-0 walleyes from the trawl tows remained low. This slow growth could contribute to decreased over-winter survival due to predation (including cannibalism) or starvation from low energy reserves as previously described for yellow perch. Trawl and gill-net surveys in 2006 will provide an evaluation of the survival of the 2005 yellow perch and walleye cohorts through the winter of 2005-06.

Job 2. Title: Process and analyze survey data.—Analysis of the study data has been performed by Michigan Department of Natural Resources Fisheries Division personnel from the Alpena Fisheries Research Station, and the Lake St. Clair Fisheries Research Station. Data and specimens from the 2006 survey are still being analyzed and will be reported on in 2007.

Job 3. Title: Determine year class composition.—Walleyes stocked in Saginaw Bay in 2005 were marked with oxytetracycline (OTC). Laboratory analysis of age-0 specimens collected that year indicate that just 8% of the year class could be attributed to stocking with 92% from natural reproduction. Walleye stocking was suspended for 2006 in Saginaw Bay, however, collections of age-1 walleye will be similarly analyzed for OTC marks to reexamine the proportion of hatchery-origin fish previously estimated for the 2005 year-class.

Job 4. Title: Prepare annual, final, and other reports.—This performance report summarizes data from 2005, and fulfills the requirements of Job 4. Although this study was renewed in 2005, a seven-year summary report was written to document findings spanning the survey years of 1998 through 2004.

Job 5. Title: Publish manuscript.—Publication of the summary report as a research report is complete and provided with the annual performance report for F-81-R-7, Study 230436.

Fielder, D. G., and M. V. Thomas. 2006. Fish Population Dynamics of Saginaw Bay, Lake Huron 1998–2004. Michigan Department of Natural Resources, Fisheries Research Report 2083, Ann Arbor.

Literature Cited:

Fielder, D. G., and J. P. Baker. 2004. Strategy and options for completing the recovery of walleye in Saginaw Bay. Michigan Department of Natural Resources, Special Report 29. Ann Arbor.

Fielder, D. G., J. E. Johnson, J. R. Weber, M. V. Thomas, and R. C. Haas. 2000. Fish Population Survey of Saginaw Bay, Lake Huron, 1989-97. Michigan Department of Natural Resources, Fisheries Research Report 2052, Ann Arbor.

Haas, R. C., and J. S. Schaeffer. 1992. Predator-prey and competitive interactions among walleye, perch, and forage species in Saginaw Bay, Lake Huron. Michigan Department of Natural Resources, Fisheries Research Report 1984, Ann Arbor.

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Table 1.—Number of fall gill-net sets (by location) for Saginaw Bay, Lake Huron, 1993-2006.

Station	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Pt. Lookout	1	1	4	3	1	1	1	1	1	1	1	1	—	—
Au Gres River	—	1	1	1	1	1	1	1	1	1	1	1	—	—
Pt. Au Gres	2	2	6	6	2	2	2	2	2	2	2	2	2	2
Black Hole	2	2	6	5	2	2	2	2	2	2	2	2	2	2
Coreyon Reef	2	2	3	2	2	2	2	2	2	2	2	2	2	2
Fish Pt.	2	2	3	5	2	2	2	2	2	2	2	2	2	2
North Island	—	1	6	5	2	2	2	2	2	2	2	2	2	2
Oak Pt.	1	1	6	5	2	2	2	2	2	2	2	2	2	2
Charity Is.	—	—	3	2	2	2	2	2	2	2	2	2	2	2
Tawas	—	—	2	2	2	2	2	2	2	2	2	2	2	2
Total	9	12	40	36	18	18	18	18	18	18	18	18	16	16

Table 2.—Location of trawl stations and number of tows performed in Saginaw Bay, 1992–2006. All sampling was conducted in fall except where indicated otherwise.

Quadrant	Site description	1992	1993	1994	1995 ^a	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
East	North Island and Wildfowl Bay	16	5	6	6	6	6	6	3	6	3	10	4	9	6	6
South	Coreyon Reef	6	5	3	9	6	7	6	6	6	3	7	9	9	3	3
West	Pinconning	3	13	13	9	12	9	9	9	9	9	10	7	9	6	12
North	Au Gres	11	15	10	15	6	9	6	9	9	12	10	10	9	12	9
Total		36	38	32	39	30	31	27	27	30	27	37	30	36	27	30

^a Total for north quadrant includes six experimental trawls near Charity Islands

Table 3.–Number of young-of-the-year yellow perch caught per ten-minute tow (CPUE) from Saginaw Bay, Lake Huron and their mean total length, fall 1970–2005^a.

Year	CPUE	Mean total length (mm)
1970	29.5	96.5
1971	20.2	91.4
1972	13.9	83.8
1973	30.6	91.4
1974	27.9	88.9
1975	247.9	88.9
1976	11.1	91.4
1977	52.9	91.4
1978	99.8	86.4
1979	166.7	78.7
1980	39.0	86.4
1981	71.3	83.8
1982	686.7	76.2
1983	251.9	76.2
1984	171.0	78.7
1985	147.8	78.7
1986	71.4	73.7
1987	131.5	81.3
1988	56.6	76.2
1989	252.8	71.1
1990	39.0	79.5
1991	110.8	70.2
1992	7.1	76.2
1993	0.5	90.7
1994	3.9	85.0
1995	98.9	72.8
1996	37.3	81.9
1997	83.3	73.8
1998	74.4	76.1
1999	19.5	92.4
2000	9.4	83.2
2001	133.9	77.1
2002	36.7	76.2
2003	2,450.7	69.7
2004	461.8	66.1
2005	233.6	79.0

^a Data prior to 1990 from Haas and Schaeffer (1992). Data from 1990 to 1997 from Fielder et al. (2000).

Table 4.—Mean CPUE (catch per 10-minute tow) by age for yellow perch from fall trawls in Saginaw Bay, 1986 to 2004 and by pre- and post-zebra mussel (zm) colonization.

Survey year	Age											All ages	Yearling and older
	0	1	2	3	4	5	6	7	8	9	10		
1986	117.6	132.8	125.9	128.4	21.2	3.0	0.7	0.5	0.0	0.0	0.0	530.0	412.4
1987	258.0	61.0	98.6	66.8	37.6	6.6	1.8	0.4	0.0	0.0	0.0	530.9	272.9
1988	458.9	263.8	248.6	309.4	171.6	56.8	13.5	1.7	0.9	0.0	0.0	1525.3	1066.4
1989	280.2	168.7	180.3	128.0	81.1	33.3	12.9	4.4	0.3	0.3	0.0	889.6	609.4
1990	34.0	37.8	20.2	20.5	12.6	6.1	2.8	0.9	0.3	0.1	0.1	135.3	101.3
1991	102.6	15.6	29.3	19.2	13.5	8.6	2.5	0.4	0.0	0.0	0.0	191.8	89.1
1992	7.7	44.5	8.5	6.6	4.0	2.5	0.7	0.3	0.0	0.0	0.0	74.9	67.2
1993	0.5	2.2	20.7	7.6	4.4	1.9	0.3	0.1	0.2	0.0	0.0	37.8	37.3
1994	3.5	1.4	2.8	10.1	2.5	1.0	0.2	0.1	0.0	0.0	0.0	21.7	18.2
1995	100.6	12.0	2.6	3.5	5.2	1.1	0.6	0.1	0.1	0.0	0.0	125.8	25.2
1996	37.9	30.9	5.9	3.7	2.7	3.2	0.8	0.0	0.0	0.0	0.0	85.0	47.1
1997	89.1	11.3	16.9	2.9	0.5	0.5	0.4	0.2	0.0	0.0	0.0	122.0	32.8
1998	74.4	54.1	11.7	6.6	1.7	0.4	0.3	0.1	0.0	0.0	0.0	149.2	74.8
1999	19.5	28.1	25.3	10.7	4.7	1.2	0.2	0.2	0.0	0.0	0.0	89.7	70.3
2000	9.4	4.0	11.6	8.3	4.3	1.0	0.5	0.2	0.0	0.0	0.0	39.2	29.8
2001	134.0	3.2	3.8	11.3	4.2	0.7	0.1	0.1	0.0	0.0	0.0	157.2	23.3
2002	36.7	28.1	1.1	1.6	2.0	0.5	0.2	0.1	0.0	0.0	0.0	70.3	33.6
2003	2450.3	4.6	11.1	1.1	0.5	0.8	0.3	0.1	0.0	0.0	0.0	2468.7	18.4
2004	461.8	22.9	2.0	2.8	0.5	0.4	0.3	0.0	0.0	0.1	0.0	490.7	28.9
2005	233.7	20.7	5.7	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	260.8	27.1
Mean all years	245.5	47.4	41.6	37.5	18.8	6.5	2.0	0.5	0.1	0.0	0.0	399.8	154.3
Mean Pre-zm (86 to 90)	229.7	132.8	134.7	130.6	64.8	21.2	6.3	1.6	0.3	0.1	0.0	722.2	492.5
Mean Post-zm (93 to 05)	284.8	16.9	9.6	5.8	2.8	1.1	0.4	0.1	0.0	0.0	0.0	321.4	36.6

Table 5.—Number of age-0 walleyes caught, and age-0 walleye catch rate (expressed as mean catch per 10-minute tow) and mean length of age-0 walleye for fall trawls on Saginaw Bay from 1986 to 2005.

Year	Number of age-0 walleyes captured	Age-0 walleye catch rate	Mean length (mm)
1986	20	0.43	
1987	34	0.46	
1988	39	0.59	
1989	19	1.27	
1990	0	0.00	
1991	28	1.89	
1992	6	0.16	
1993	1	0.02	
1994	22	0.64	
1995	14	0.36	
1996	0	0.00	
1997	83	2.18	
1998	149	8.55	212
1999	20	0.74	198
2000	5	0.30	180
2001	27	0.98	N/A
2002	84	2.54	176
2003	1,114	40.80	171
2004	822	22.93	117
2005	825	31.30	119

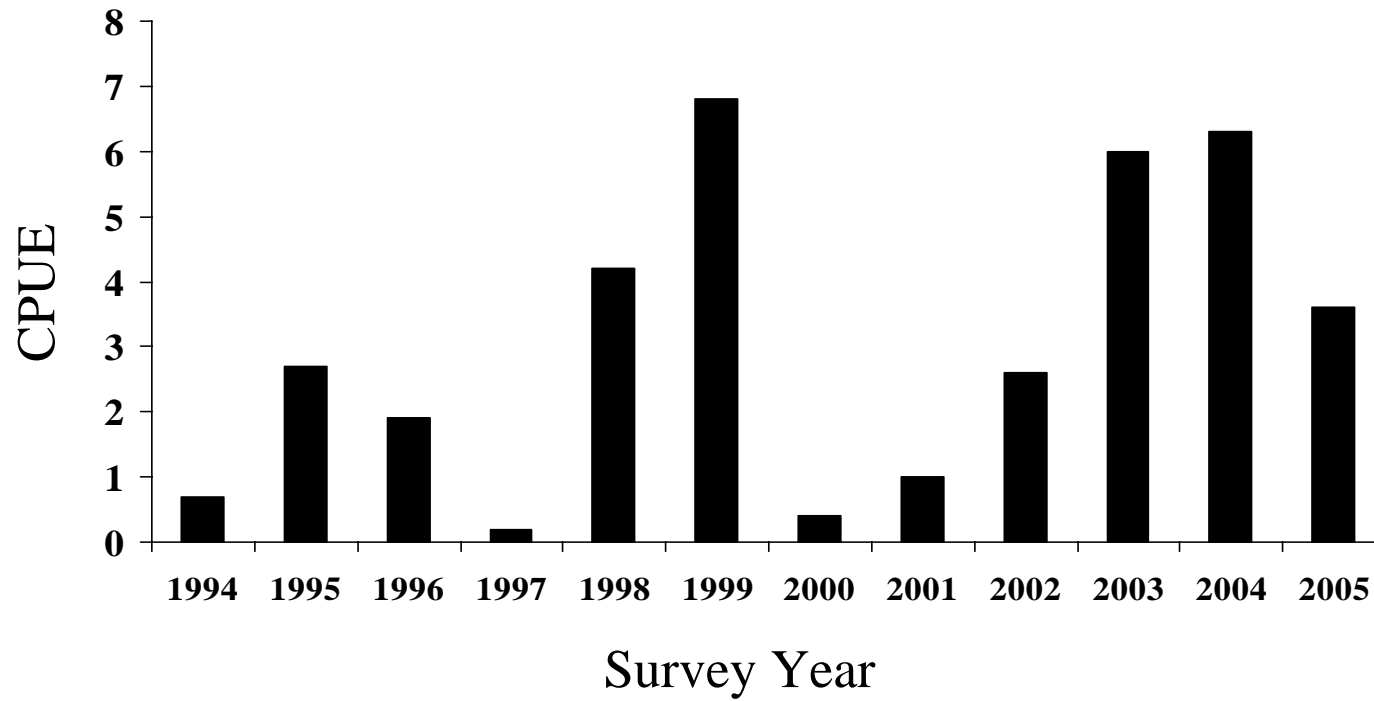


Figure 1.—Catch-per-unit-of-effort (CPUE) for age-1 walleyes in gill nets in Saginaw Bay 1994 – 2005, as a measure of walleye recruitment.