

## STUDY FINAL REPORT

**State:** Michigan

**Project No.:** F-81-R-1

**Study No.:** 470

**Title:** Great Lakes zooplankton populations near historical and potential walleye spawning rivers

**Period Covered:** October 1, 1999 to September 30, 2000

**Study Objective:.** To describe Great Lakes macro-zooplankton populations during spring and early summer in the vicinity of major tributaries (i.e., potential walleye spawning grounds). To learn whether food availability during various walleye fry stages is important to survival and recruitment to the adult walleye population.

**Summary:** Recent walleye catch per effort data were gathered from various sources for Lake Erie, Lake St. Clair, and Saginaw Bay and used to supplement my inventory of walleye year class strengths. Catch data from 1978-2000 were used to rank year classes in each body of water. Four sources of Lake Erie catch data were used and there was very good agreement between them. Angler diary data obtained from the Ontario Ministry of Natural Resources (OMNR) and the Michigan Department of Natural Resources (MDNR) were used to estimate year class strength in Lake St. Clair. Angler harvest data and age samples from gill nets and electrofishing on Saginaw River spawning grounds, all collected by MDNR, were used to estimate year class strength in Saginaw Bay. There was moderate similarity in year class ranks between Saginaw Bay and Lake St. Clair but Lake Erie was very different with the exception of the very poor 1992 year class.

**Job 5. Title:** Analyze walleye age/year class data.

**Findings:** Historical walleye year class strength was estimated from catch data for Lake Erie, Lake St. Clair, and Saginaw Bay. Trawl catches of age-0 and gill net catches of yearling walleye are highly variable and may not accurately represent the success of some year classes. A comparison of total harvest of 1974-1997 year classes with the Ohio Department of Natural Resources trawl catch of young-of-year from year classes in Western Lake Erie during 1969-1999 (Figure 1) showed that trawl catches could be substantially lower or higher than expected and therefore were relatively unreliable estimators of eventual harvest. More reliable estimates of year class strength can be obtained from repeated captures of each cohort throughout the major portion of their life. The strength of year classes was updated for this report because additional catch information became available. Walleye harvest data collected in 1999 provided valuable new information on relative strength of the 1992, 1993, and 1994 year classes.

Catch samples from a particular location during non-spawning seasons might not reflect local year class strength if significant movement of adult walleyes occurs between areas. A geographical summary of tag returns from walleye tagged at seven spawning sites associated with the five estuaries (Table 1) showed that Saginaw River tags were not recovered in Lake St. Clair or Lake Erie. However, Lake Erie tags, and Lake St. Clair tags to some extent, were

recovered from the other areas in large enough numbers to potentially conceal area-specific year class strength.

Spring trap nets fished for a period of 3 weeks or more near Monroe, MI are thought to be one source of reliable walleye catch rates. The mean catch rates summed over ages 1-11 generated from this operation during the period from 1978-2000 are shown in Table 2. Comparable data are also shown for total fishery harvest of walleye and the MDNR fall gill net survey. These data provide the best long-term comparison of walleye spawning success and form the basis for testing whether the food base for walleye fry at various spawning tributaries was an important determinant of recruitment. Walleye populations in Michigan's waters of Lake Erie are being monitored as part of F-53-R-15, Study 460.

For Lake Erie, the combined lakewide angler and commercial harvest estimates (Great Lakes Fishery Commission, Lake Erie Committee Walleye Task Group, unpublished data) were used. These data were used to develop a mean rank for the 1974-1997 year classes, some of which were not yet completely represented throughout their life (Table 2). Total harvest included the sport and commercial catches from the Western and Central basins of Lake Erie. Trap and gill net CPE data came from MDNR spring and fall surveys. Year classes were ranked for each capture method and then averaged. There was very good agreement between the three gear types and a nonparametric statistical comparison showed no significant differences. The top six year classes were 1982, 1986, 1985, 1991, 1984, and 1993. Two of the phase 1 study years, 1991 and 1993, produced very strong year classes of walleye in Lake Erie.

Walleye year class strength in Lake St. Clair for the 1982-1997 time-period was ranked by manipulating results from an angler diary study. These data were provided by an interagency diary program that has operated on Lake St. Clair from 1993 to present. Age data from three geographical areas, the Detroit River, Lake St. Clair, and the St. Clair River, were tabulated separately and converted to percent contribution by year class and summed across ages 3-5. Contributions from the 1990-1994 year classes were incomplete because some of the cohorts were not represented at all ages in the short time series. Numerical rankings for Lake St. Clair year classes were compared in Table 3 with ranks for 1990-1994 Lake Erie cohorts. There was only slight similarity between the estimated ranks for the two lakes and it appears that year class strength is quite different. There is strong evidence from tagging studies (see Table 1 and F-53-R-15, Study 460) that large numbers of Lake Erie walleye migrate through Lake St. Clair during summer and fall, when they contribute significantly to angler harvest which might bias the year class structure toward that found in Lake Erie.

Walleye year class strength for Saginaw Bay during 1990-1994 was ranked according to MDNR electrofishing and gill net surveys and harvest data from MDNR annual creel surveys for 1991-2000 (see F-53-R-15, Study 436 and Study 466). The same prediction technique as above, based on the percent contributions of year classes in Saginaw bay aged samples, was used to determine numerical ranks. Rankings for Saginaw Bay year classes were compared in Table 3 with ranks for 1990-1994 Lake Erie and Lake St. Clair cohorts. There was very little similarity between the estimated ranks between Saginaw Bay and Lake Erie, but substantial agreement with Lake St. Clair. Annual plantings of walleye fingerlings are typically made in Saginaw Bay and are known to be producing recruitment. Good agreement between ranks from Saginaw Bay and Lake St. Clair, however, suggests that natural recruitment may have played an important role in the Saginaw Bay walleye population.

The 1992 year class was the only universally poor reproductive year for walleye across the geographical area examined in this study. It was an unusually cool spring and summer due to

atmospheric contamination from the June, 1991 eruption of Mt. Pinetubo in the Philippines. The 1990 and 1991 year classes were relatively strong across all areas (no rank above 3 in Table 3). The 1993 year class was ranked strongest in Lake Erie and relatively weak in Lake St. Clair and Saginaw Bay. The cooling effect of Mt. Pinetubo's eruption may have extended through 1993 at higher latitudes encompassing Lake St. Clair and Saginaw Bay. The 1994 year class was rated as strong in Saginaw Bay and Lake St. Clair and relatively weak in Lake Erie.

**Job 6. Title:** Prepare final report.

**Findings:** This report was prepared on schedule. A research report is being prepared which will summarize all of the walleye year class information in reference to results from the nutrient and plankton data (Haas and Thomas, 1997) collected during phase 1 of this study.

**Literature Cited:**

Haas, R. C. and M. V. Thomas. 1997. Nutrient levels and plankton populations of five Great Lakes tributaries and their relation to walleye year class strength (spawning success). Michigan Department of Natural Resources, Fisheries Research Report 2022, Ann Arbor.

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## Lake Erie Walleye

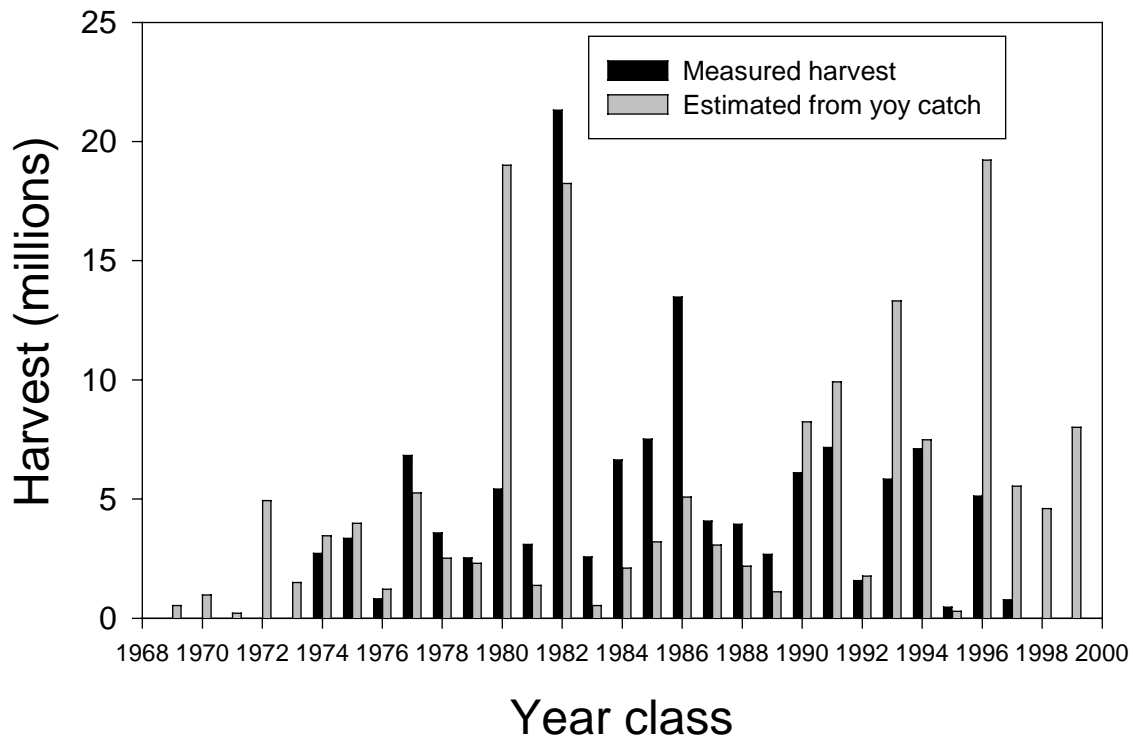


Figure 1.—Harvest by year class for Western Lake Erie walleye from 1973-97. Black bars show measured harvest compiled from Great Lakes Fishery Commission files maintained by the Walleye Task Group. Stippled bars show harvest estimates derived from average bottom trawl catches of young-of-year by the Ohio Department of Natural Resources under Federal Aid in Sport Fish Restoration Project F-69-P.

Table 1.—Percent of walleye tags recovered from seven tag sites by their Great Lakes recovery location. All tag sites were associated with the estuaries examined during phase 1 of this study.

Locations where tags were recovered	Locations where walleye were tagged						
	Saginaw Bay		Lake St. Clair		Lake Erie		
	Tittabawassee River <sup>1</sup>	Flint River <sup>1</sup>	Clinton River <sup>2</sup>	Thames River <sup>3</sup>	Huron River <sup>2</sup>	Lake Erie Monroe, MI <sup>2</sup>	Maumee River <sup>3</sup>
Saginaw River System	50.4	55.9	0.0	0.5	0.0	0.0	0.0
Saginaw Bay	40.9	36.7	3.2	2.9	1.6	0.5	1.4
Lake Huron proper	7.8	7.4	4.6	9.7	0.8	0.6	0.6
St. Clair River	0.5	0.0	28.0	33.3	18.7	6.2	4.5
Lake St. Clair	0.1	0.0	54.6	26.6	9.8	4.4	3.5
Thames River	0.0	0.0	1.4	15.5	0.0	0.0	0.0
Detroit River	0.1	0.0	4.6	3.4	22.8	10.6	5.1
Huron River	0.0	0.0	0.0	0.0	3.3	0.0	0.0
Lake Erie - West Basin	0.2	0.0	2.1	2.4	26.8	54.5	38.1
Maumee River	0.0	0.0	0.0	0.0	3.3	2.0	31.1
Lake Erie - Central Basin	0.0	0.0	1.1	4.8	8.9	19.2	14.0
Lake Erie - East Basin	0.0	0.0	0.4	1.0	4.1	1.8	1.8
Total tags recovered	4,951	270	282	207	123	2,050	514

<sup>1</sup> Unpublished tag recovery data from Michigan Department of Natural Resources Dingell-Johnson study 436, F-53-R-15.

<sup>2</sup> Unpublished tag recovery data from Michigan Department of Natural Resources Dingell-Johnson study 460, F-53-R-15.

<sup>3</sup> Unpublished tag recovery data from the Walleye Task Group of the Lake Erie Committee, Great Lakes Fishery Commission

Table 2.—Mean rank of Lake Erie walleye year classes, 1994-97 based on measured harvest and survey catch per effort.

Year class	Total harvest <sup>1</sup>	Harvest rank	Trap CPUE	Trap rank	Gill CPUE	Gill net rank	Mean rank
1974	2,727,989	17	0.4	24	13.6	23	21.3
1975	3,356,110	15	1.3	21	42.8	19	18.3
1976	812,855	22	0.8	23	18.4	21	22.0
1977	6,837,878	6	10.2	15	171.0	5	8.7
1978	3,578,926	14	8.9	16	61.6	17	15.7
1979	2,535,057	20	8.7	18	72.4	15	17.7
1980	5,426,616	10	21.5	6	92.7	13	9.7
1981	3,093,746	16	16.9	11	72.3	16	14.3
1982	21,305,596	1	98.6	1	306.2	1	1.0
1983	2,572,846	19	21.4	7	34.6	20	15.3
1984	6,639,741	7	28.1	3	147.7	8	6.0
1985	7,518,595	3	27.0	5	177.2	4	4.0
1986	13,469,004	2	56.6	2	297.5	2	2.0
1987	4,081,685	12	27.5	4	127.8	11	9.0
1988	3,941,361	13	15.7	12	125.0	12	12.3
1989	2,688,970	18	8.7	17	52.6	18	17.7
1990	6,106,960	8	20.5	9	136.4	9	8.7
1991	7,163,771	4	20.3	10	194.3	3	5.7
1992	1,579,416	21	1.8	20	16.4	22	21.0
1993	5,837,762	9	20.7	8	168.9	6	7.7
1994	7,110,788	5	12.4	14	127.9	10	9.7
1995	472,806	24	0.9	22	6.4	24	23.3
1996	5,125,107	11	13.6	13	152.3	7	10.3
1997	780,840	23	3.9	19	88.6	14	18.7
Mean	5,198,518		18.6		112.7		

<sup>1</sup> Total harvest determined by summing each agencies sport and commercial age specific harvest estimates.

Table 3.—Rank of walleye year classes produced in Saginaw Bay, St. Clair system, and Lake Erie during phase 1 of this study, 1990-94.

Year class	Saginaw Bay			St.Clair system			Lake Erie			
	Tittabawassee River	Saginaw Bay		St.Clair River	Lake St. Clair	Detroit River	Creel survey <sup>1</sup>	Trawl survey <sup>2</sup>	Trap net survey <sup>3</sup>	Gill net survey <sup>3</sup>
	Electrofishing survey <sup>1</sup>	Creel survey <sup>1</sup>	Gill net survey <sup>1</sup>	Angler diary <sup>1</sup>	Angler diary <sup>1</sup>	Angler diary <sup>1</sup>				
1990	72.4	43.0	58.2	60.9	87.6	85.9	133.6	22.10	14.21	133.5
1991	15.6	57.1	48.2	33.5	75.4	67.4	144.7	26.60	15.02	189.9
1992	1.9	24.6	16.7	6.9	10.7	9.5	17.4	4.75	0.94	13.1
1993	10.3	5.7	14.3	30.9	69.8	53.4	150.0	35.71	19.79	167.5
1994	23.0	78.0	53.8	100.6	107.1	103.9	134.3	20.08	12.42	127.9

#### Numerical rank

(1 denotes strongest year class, based on numbers above)

1990	1	3	1	2	2	2	4	3	3	3
1991	3	2	3	3	3	3	2	2	2	1
1992	5	4	4	5	5	5	5	5	5	5
1993	4	5	5	4	4	4	1	1	1	2
1994	2	1	2	1	1	1	3	4	4	4

#### Median rank

1990	1			2					3	
1991	3			3					2	
1992	4			5					5	
1993	5			4					1	
1994	2			1					4	

<sup>1</sup> Data summed across sample years from a year class's percent composition in sequential samples at ages 3-5.

<sup>2</sup> Data are geometric mean catch per unit of effort in Ohio DNR trawl survey for each year class at age-0.

<sup>3</sup> Data summed across sample years from a year class's catch per unit of effort in sequential surveys at ages 2-5.