STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-53-R-14

Study No.: 468 **Title:** Natural reproduction by walleye in Saginaw Bay.

Period Covered: April 1, 1997 to March 31, 1998

Study Objective: To identify the extent of natural reproduction of walleye in Saginaw Bay, relative to stocked and river-produced recruits, and to identify factors affecting reproductive success as well as the prospects for improving that success. To identify means of distinguishing walleye of various (hatchery, river, reef) sources.

Summary: In 1997, intensive sampling was performed at the two study reef sites identified last year. Duck and North Island Reefs were the only reefs of any quality located in the inner bay under the reef search portion of this study. Sampling collected 42 spawners including ripe, partially spent and spent female walleye. Egg pumping collected eggs believed to be walleye eggs and two were successfully hatched to confirm their species. Further sampling collected walleye larvae and documented zooplankton densities. This sampling confirmed that there is at least remnant reef spawning still occurring in Saginaw Bay. Genetic analysis was performed on some of the adult spawners and indicated that they were significantly different from the Tittabawassee strain of fish and unlike any previously described Great Lakes population. Further sampling of these and other sites is planned for 1998-99. Walleye fingerlings stocked in 1997 were marked with Oxytetracycline (OTC). Extensive sampling for young-of-the-year (YOY) was performed in the summer and fall. In all, over 400 YOY were collected and analyzed. Analysis indicates that 81% of the 1997 locally produced year class was a result of stocking (19% wild). Relative year class strength (percent of yearlings in total catch) from the gill netting performed under Study 466 indicated that the nonstocked year class of 1996 was weak. That sampling and others indicate that both nonstocked year classes (93 and 96) and one stocked year class (92) are weak relative to the other stocked years. It was decided to continue the stocking evaluation in 1998 by stocking OTC marked fish.

Job 1. Title: Explore and sample potential spawning reefs.

Findings: Variable mesh gill nets were used to sample Duck and North Island Reefs in April and early May, 1997. In all, 42 walleye were collected of varying maturity levels (Table 1). The collection included ripe, partially spent and spent females. The reef locations were not in close proximity to any rivers and thus it is believed that these fish were actively spawning on the reefs. To confirm spawning, an egg pump (Stauffer 1981) was used to collect eggs. Eggs were first collected April 21 (Table 2). Most eggs were of morphometry consistent with that of walleye eggs and two were successfully hatched producing walleye larvae. Larval fish collections were made to search for walleye fry using a Neuston net ($2m^2$ area, 500 micron mesh). Sampling spanned May and early June (Table 3). Walleye fry were collected at North Island Reef on May 13 and 21. The fish were less than five days old and believed to have been produced locally. Reef sampling included zooplankton collections at the same time as larval fish sampling. Sampling was performed with a student plankton net and densities of total plankters estimated

based on net opening and depth sampled (Table 4). These densities are low for larval walleye survival according to Li and Mathias (1982) but are with in the range reported by for successful fry survival in Lake Erie (see Study 476).

Adult spawners collected by gill nets from both reefs on April 28 (Table 1) were sent to Southern Illinois University, Cooperative Fisheries Research Laboratory for genetic analysis. The analysis was mitochondrial DNA analysis using both the whole molecule method and the PCR-RFLP approach. The latter (more sensitive) method did detect significant differences in haplotype frequencies between the reef fish and the Tittabawassee River run fish. Further, the reef fish were unlike other Great Lake population previously analyzed. This suggests that these fish were perhaps of a remnant reef spawning strain unique to Saginaw Bay. The results of the work are presented and available in a separate SIU report (Billington et al. 1998).

Job 2. Title: <u>Collect walleye recruits.</u>

Findings: Collection of YOY walleye in 1997 was expanded including other collection efforts that were also occurring in the bay area. These included bottom trawling by the USFWS during their annual exotic species survey. It included bottom trawling performed by the DNR Channel Cat during the summer and fall (under Study 466) and YOY collected by the gill net portion of Study 466. These efforts were in addition to the usual collection efforts of bottom trawling and electrofishing performed by DNR District 8 (Figure 1). In all just over 400 YOY walleye were collected. These specimens served as the source of OTC detection analysis described in Job 3. In addition, recruitment was also measured based on the collection of yearling walleye in Study 466.

Job 3. Title: <u>Determine source of walleye recruits.</u>

Findings: All walleye fingerlings stocked in Saginaw Bay and up the Michigan Lake Huron Coast as far as Thunder Bay, were immersion marked with OTC. The marking occurred according to the methods of Brooks (et al. 1994). Marked fingerlings were examined for quality control (percent marked and mark quality) at release (Table 5). Mark percent was 100% for all but one pond. While mark quality was less than excellent, it was sufficient to permit the evaluation to take place. Using the recruits collected under Job 2, analysis was performed using fluorescence microscopy. Figure 2 depicts the range of percent hatchery fish makeup of the YOY by location. Overall, 81% of the YOY analyzed were of hatchery origin and 19% wild.

The relative percentage of yearling walleye in the gill net collections under Study 466 also provides a measure of recruitment to the population. Those samples in 1997 found a weak 1996 year class. No fingerling walleye were stocked in 1996. A non-stocked year also occurred in 1993 and was also found to be weak. At present, the Saginaw Bay walleye population endures three weak locally produced year classes, two based on natural reproduction alone (years not stocked) and one from a stocked year (1992). These are in comparison to other stocked years. The year class strength is not always apparent in summer angler caught walleye age structures because of a masking effect due to immigration of walleye from Lakes Erie and St. Clair.

To date, three years of stocking evaluation have been achieved. Two by comparing years not stocked to years stocked and one by OTC differentiation. All three measurements indicate substantial contribution by stocked fish. Further evaluation is still planned under Study 468 based on the OTC marking technique. Alternate year stocking may again be employed at some

time in the future. Evaluation based on OTC marking has several advantages including evaluation without further jeopardizing the population or fishery by risking more weak (not stocked) year classes.

Job 4. Title: Analyze data and write progress report.

Findings: Field data has been analyzed. The annual report was prepared.

Literature Cited:

Billington, N., B. Sloss, and G. Moyer. 1998. Mitochondrial DNA analysis of walleye (*stizostedion vitreum*) populations from Michigan. Southern Illinois University, Cooperative Fisheries Research Laboratory. Technical report to Michigan DNR.

Brooks, R. C., R. C. Heidinger, and C. C. Kohler. 1994. Mass-marking otoliths of larval and juvenile walleye by immersion in oxytetracycline, calcein or calcein blue. North American Journal of Fisheries Management. 14:143-150.

Li, S., and J. A. Mathias. 1982. Causes of high mortality among cultured larval walleyes. Transactions of the American Fisheries Society 111:710-721.

Stauffer, T. M. 1981. Collecting gear for lake trout eggs and fry. The Progressive Fish Cultulrist. 43:186-193.

Prepared by: David Fielder
Date: March 31, 1998

Table 1.–Gill net collection of walleye from Duck and North Is. Reef, Saginaw Bay, April and May 1997.

	Duck Reef		North Is. Reef	
	Avg. CPUE	Sex/maturity	Avg. CPUE	Sex/maturity
April 14	17	15 male ripe 2 female spent	2	1 male ripe 1 spent female
April 21	11	9 male ripe 2 female ripe	0	0 0
April 28[1]	2	2 male 2 female partially spent	2	2 male 1 female unknown 1 female partially spent
May 13	4	1 male 2 female spent 1 female immature	0	0 0

[1] Fish analyzed for genetics.

Table 2.–Fish eggs collected from Duck and North Is. Reefs in Saginaw Bay, 1997. Not all eggs were walleye eggs. Some hatched and at least two were walleye.

Date	Temp °F	Duck Reef	North Is. Reef
April 14	39	0	0
April 21	44	48	12
April 28	51	6	5
May 7	51	0	4
May 13	51	10	6
May 21	51	47	15
May 27	53	---	10

Table 3.–Larval fish densities from Duck Reef and North Island Reef, Saginaw Bay, 1997. All densities are number per m^{3}.

Date	Walleye	Yellow perch	Whitefish	White sucker	R. smelt	Unidentified	Menominee	Notropis sp.	White perch	White bass
Duck										
5-7-97			.0293				.0080			
5-13-97		.7237	.0042		.0066	.0147				
5-21-97		.3377	.0018		.0067	.0065			.0158	
5-27-97		1.1532	.0035		.0139	.0521			.0121	
6-2-97	- - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - - -	No samples taken		- - - - - - - -	- - - - - -	- - - - - - - - - - - - - - - - -		- - - - - - - - - -	
6-9-97		.0596		.0084	.0008			.1099		
North Island										
5-7-97			.0446			.0197	.0020			
5-13-97	.0041	1.5785	.0202		.0052	.0248			.0148	.0016
5-21-97	.0016	.2907	.0048		.0007	.0063			.0066	
5-27-97		.7049	.0013	.0007	.0071	.0045			.0032	
6-2-97		.2530	.0004	.0005	.0175	.0009				
6-9-97		.0177		.0067	.0235			.0302		

Table 4.–Duck Reef and North Island Reef, Saginaw Bay, zooplankton density, 1997.

Date	(No./m^3)	No./l
	Duck	
5/13/97	6,522/ m^3	6.5228/l
5/21/97	10,391/ m^3	10.3915/l
5/27/97	18,3483/ m^3	18.3485/l
6/2/97	No samples taken	
6/9/97	30,970/ m^3	30.9705/l
	North Island	
5/13/97	9,113/ m^3	9.1135/l
5/21/97	13,514/ m^3	13.5145/l
5/27/97	16,618/ m^3	16.3618/l
6/2/97	14,844/ m^3	14.8449/l
6/9/97	18,883/ m^3	18.8834/l

Table 5.–Oxytetracycline walleye mark quality control analysis, 1997.

Pond	Source	Mark percent	Mark quality	N
Auburn West (D8)	Tittabawassee	100	Poor - Fair	11
Auburn East (D8)	Tittabawassee	100	Fair	6
Fish Pt. (D8)	Tittabawassee	100	Fair – Good	5
Gladwin (D7)	Tittabawassee	50-75	Poor - Fair	10

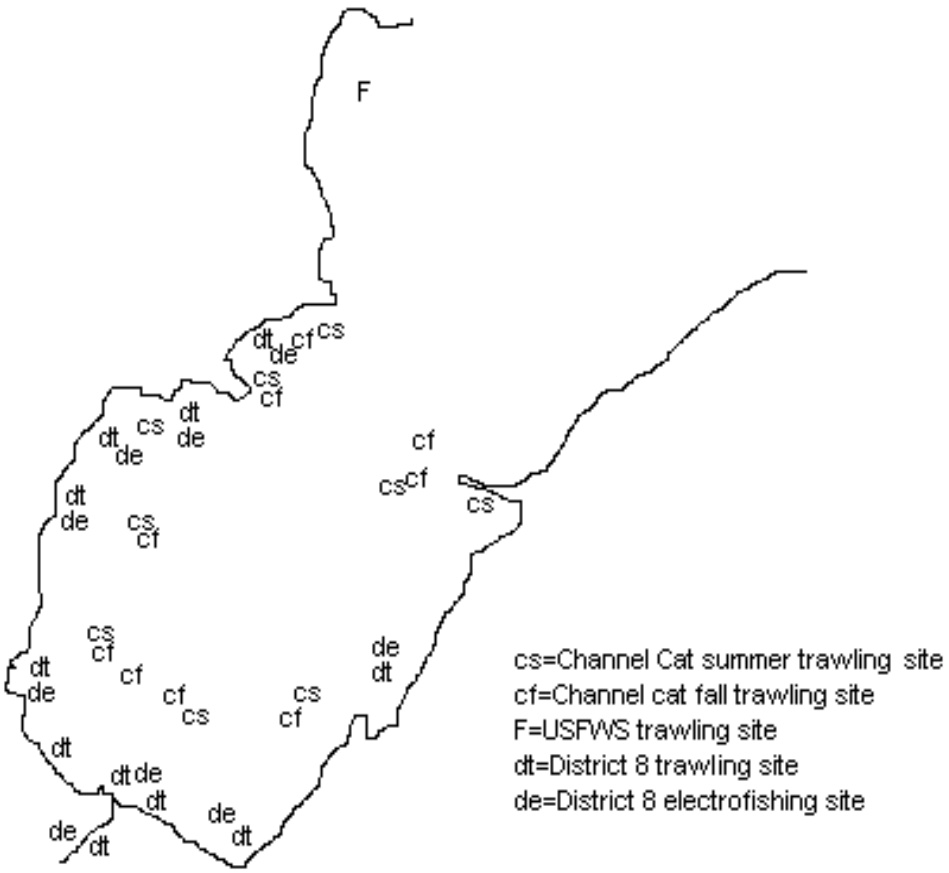

Figure 1.–Young-of-the-year walleye sampling locations, source, and collection method for Saginaw Bay, 1997.

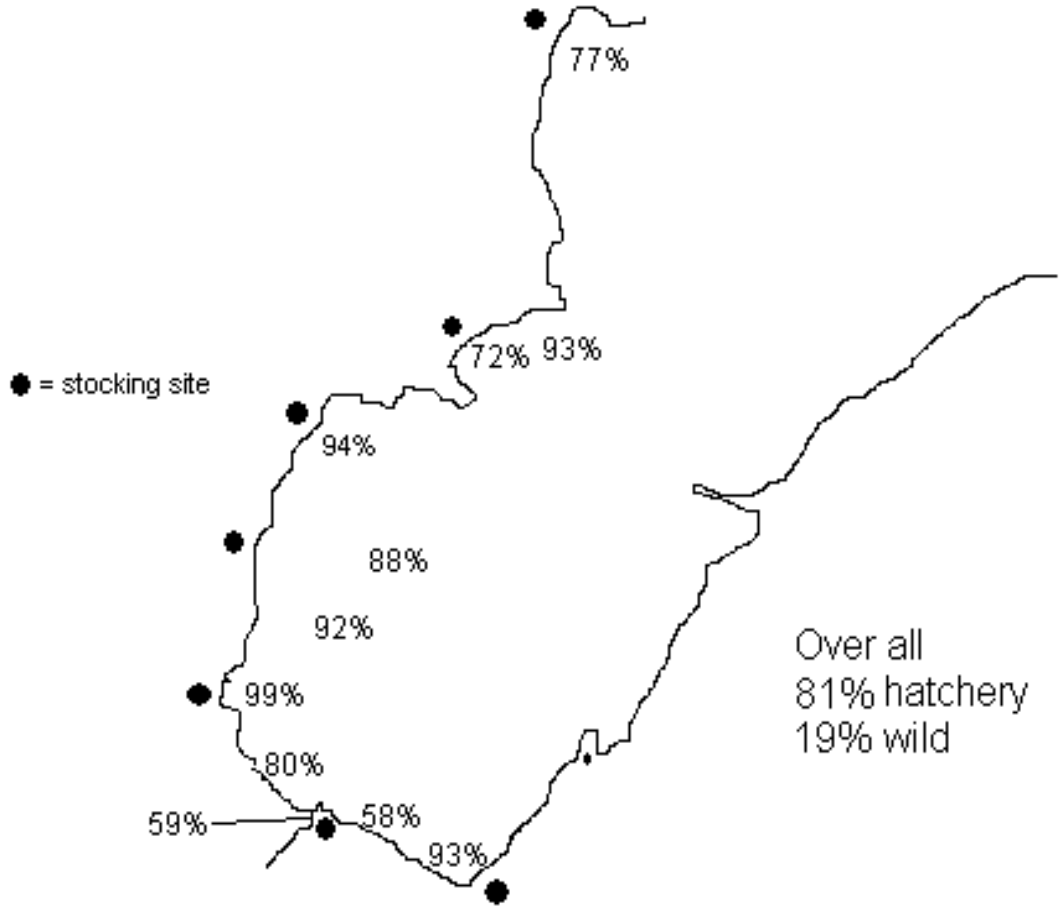

Figure 2.–Percent hatchery young-of-the-year in 1997 walleye year class as determined by oxytetracycline mark detection, Saginaw Bay.