

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-53-R-13

Study No.: 468

Title: Natural reproduction by walleye in
Saginaw Bay.

Period Covered: April 1, 1996 to March 31, 1997

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 1996, the search for remaining reef habitat in Saginaw Bay was resumed and concluded. A total of 16 suspected reef sites were inspected with U/W video. This work supplemented earlier efforts of nearly 75 linear miles of search effort. While many outer bay areas were inventoried, only two inner bay locations met the criteria for further sampling. They are Duck Reef off of Duck Island and North Island Reef. No more reef search is planned. Some sampling of reef habitat was conducted in spring of 1996 in the Pt. Au Gres area. Sampling for larval fish and zooplankton detected no evidence of natural reproduction in that vicinity. Similar sampling was conducted in the mouth of the Saginaw River where larval walleye were sampled on three dates. These would have been wild fish as no fish were stocked in 1996. This kind of sampling along with egg pumping and sampling for adult spawners will be conducted in 1997 on Duck and North Island Reefs. The annual summer age-0 recruits search conducted by District 8 collected 88 walleye. The alternate year stocking strategy continued with no fish being stocked in 1996. There is only one remaining year planned for no stocking. Nearly 25,000 walleye fry were experimentally marked with oxytetracycline (OTC) in 1996 at Wolf Lake Fish Hatchery. Those fish were reared in ponds at the Saline Fisheries Research Station. Subsequent examination has confirmed 100% marked at high quality. This immersion marking of larval walleye with OTC is scheduled for all the hatchery walleye to be released in Saginaw Bay in 1997. This technique will allow hatchery recruits to be positively identified and should greatly enhance the ability to determine the contribution of stocking and the extent of natural reproduction. The new technique has garnered the attention of inland fisheries managers and is tentatively planned to be applied in a total of four districts statewide. Otoliths from the 1996 annual age-0 recruit search have been archived with no progress made on establishing a graduate research assistantship for their analysis via mass-spectrometry.

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

Findings: A total of 16 suspected reefs were inspected during the summer of 1996. This supplemented some through-the-ice search conducted early in 1996 of three other locations. This was in addition to over 120 km of linear U/W search in previous years. In all, a total of nearly 150 individual U/W observations were made in 1996 using video. The search criteria was for 100% rock, with as much structure (relief) as possible and preferably in the inner bay. Only two areas meet the criteria, Duck Reef which is located off of Duck Island just south of

Heisterman Island and North Island Reef which is the area between Heisterman and North Islands. These two areas will be intensively sampled in the spring of 1997 for evidence of walleye spawning. Time allowing, similar sampling will also be conducted on the artificial reef in Tawas Bay and in the Charity Island vicinity. No other reef search work is planned for the remainder of this study. It is concluded that Saginaw Bay's famed inner bay reef habitat is largely degraded due to sedimentation. This severely restricts the prospects for using reef spawning as a means by which to move the walleye population to a fully recovered level.

Sampling was conducted during the spring of 1996 to determine the potential for reef spawning in the Pt. Au Gres area. Although of low quality, this rocky area was located during the through-the-ice reef search work early in 1996. Sampling for larval walleye was performed using a neuston net. Zooplankton levels were also monitored. For comparison, similar sampling was performed in the Saginaw River and at the mouth of the Saginaw River (Table 1). Larval walleye were only sampled on three dates between the Saginaw River and its mouth. This conforms to the findings of the annual summer age-0 recruit search where most are collected near the mouth of the Saginaw River. This suggests that walleye natural reproduction in Saginaw Bay is primarily limited to the Saginaw River system. Density of zooplankton is reported in Table 2. These densities are low for larval walleye survival according to Li and Mathias (1982) but are within the range reported by for successful fry survival in Lake Erie (see Study 476).

Job 2. Title: Collect walleye recruits.

Findings: Collection of walleye recruits was performed in late summer 1996 with electrofishing and bottom trawling. A total of 88 age-0 walleye were collected giving the first measure of that, all wild, year class. An index of recruitment based on relative abundance of yearling walleye is also compiled under Federal Aid Study 466. Table 3 summarizes the 1996 age-0 catch for Saginaw Bay. The age-0 recruits will be used to evaluate survival of stocked fingerlings in 1997 by examining for fluorescent marks on their otoliths after treatment with oxytetracycline (OTC) at the hatchery.

Job 3. Title: Determine source of walleye recruits.

Findings: The alternate year stocking strategy continued in 1996 as a nonstocked year. The collection of larval walleye in the spring and age-0 recruits in the summer confirms that there was at least some natural reproduction in 1996. The full strength of that year class will be determined under Study 466 in 1997. One final year of nonstocking remains to be implemented. No determination as to any value of stocking can be made based on the alternate year schedule so far.

A total of 25,000 walleye fry were experimentally marked with OTC at Wolf Lake Fish Hatchery in 1996. This was done via immersion marking. Those fish were subsequently reared in ponds at the Saline Fisheries Research Station. Examination with fluorescence microscopy later in the fall confirmed 100% marked at high quality. Examination is performed on the fishes otolith. This technique will be applied to all the walleye stocked in Saginaw Bay in 1997. It is expected that this new methodology will greatly enhance our ability to determine the source of recruits in Saginaw Bay.

No progress has been made securing a graduate research assistantship for the analysis of the age-0 recruit's otoliths via mass-spectrometry. Table 4 summarizes the otolith archive available for analysis.

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

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

References:

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

Table 1.- Larval fish density from 4 sites in Saginaw Bay, Spring 1996.

Date	Location	Temp °C	Average density (#/m ³)					
			Walleye	Yellow perch	Whitefish	White sucker	Rainbow smelt	Unidentified
5/9/96	Charity Island	5.6	–	–	0.0097	–	–	–
5/9/96	Pt. AuGres	6.1	–	–	0.0027	–	–	–
5/28/96	Pt. AuGres	13.3	–	0.0090	–	–	0.0058	0.0007
6/4/96	Pt. AuGres	16.7	–	0.1840	–	–	0.0160	0.0011
6/11/96	Pt. AuGres	15.0	–	0.0561	–	–	0.0159	–
5/14/96	Saginaw River Mouth	11.7	–	–	–	–	–	–
5/21/96	Saginaw River Mouth	18.9	0.0011	0.0194	–	–	0.0079	0.0011
5/28/96	Saginaw River Mouth	15.0	–	0.0020	–	–	0.0215	0.0003
6/5/96	Saginaw River Mouth	16.7	0.0007	0.0284	–	–	0.3233	0.0040
6/12/96	Saginaw River Mouth	17.8	–	0.0041	–	–	0.0470	0.0038
5/14/96	Saginaw River	11.7	–	–	–	–	–	–
5/21/96	Saginaw River	18.3	0.0007	0.0097	–	–	0.0218	–
5/28/96	Saginaw River	15.0	–	0.0012	–	–	0.0463	0.0003
6/5/96	Saginaw River	19.4	–	0.0166	–	–	0.3651	–
6/12/96	Saginaw River	18.9	–	0.0063	–	–	0.0733	0.0015
5/7/88	Saginaw River Mouth ¹	15.2	0.0350	NR	NR	NR	NR	NR

¹ Jude 1992, NR is not reported

Table 2.-Zooplankton density from 3 sites around Saginaw Bay, spring 1996.

Location	Date	Average density ³ (number/liter)
Saginaw River Mouth	5/14/96	0.3519
	5/21/96	0.5925 ²
	5/28/96	0.3950
	6/5/96	12.4090
	6/12/96	7.0132
Saginaw River ¹	5/14/96	0.9249
	5/21/96	0.2565 ²
	5/28/96	4.9582
	6/5/96	15.8205
	6/12/96	6.9536
Pt. AuGres	5/28/96	4.0344
	6/4/96	13.8758
	6/12/96	23.2296

¹ Location about 1 mile upstream from mouth.

² Larval walleye were collected at these dates and locations.

³ Density is average number of plankters/liter of water sampled. Major taxonomic groups sampled included daphnia, bosmina, calanoid copepod, cyclopoid copepod, copepod nauplii and rotifers.

Table 3.-Annual summer age-0 walleye recruit catch for 1993-96 in Saginaw Bay
(time in hours in parentheses).

Location	1993 ¹	1994	1995	1996 ¹
Electrofishing only:				
Tittabawassee R.				
Dow	68 (3.4)	6 (3.0)	2 (2.5)	6 (1.6)
Sanford Dam	3 (1.6)	–	–	0 (2.5)
Center Rd.	1 (1.0)	0 (1.1)	–	0 (2.0)
Flint R.	–	7 (1.3)	–	3 (2.0)
Cass R.	–	0 (0.9)	–	–
Lower Saginaw R.	–	0 (0.9)	0 (0.9)	64 (2.8)
Hot Ponds/Spoils	–	4 (1.4)	0 (2.6)	1 (2.0)
Linwood/Nayanquing	–	10 (2.1)	4 (2.3)	0 (2.0)
Pine/Rifle/Saganing	–	0 (1.5)	7 (2.1)	0 (2.0)
AuGres	–	–	9 (4.3)	0 (2.0)
West Shore (Saginaw R.-Kawkawlin R.)	–	–	30 (2.6)	0 (1.1)
Total	72 (6.0)	27 (12.6)	52 (14.8)	74 (18.0)
Trawling only:				
Lower Saginaw R.	28 (4.2)	17 (2.0)	12 (2.0)	14 (2.0)
Saganing/Rifle/Pine	0 (1.2)	0 (2.0)	2 (2.0)	0 (2.0)
Hot Ponds/Spoils Island	9 (4.5)	3 (2.0)	1 (2.0)	0 (2.0)
Linwood/Nayanquing	0 (1.3)	3 (2.0)	0 (2.0)	0 (2.0)
Kawkawlin-Saginaw R.	0 (0.9)	–	0 (0.3)	–
Geiger Rd.	–	1 (1.9)	0 (2.0)	0 (1.8)
Total	37 (12.1)	24 (8.0)	15 (10.3)	14 (9.8)
Grand total	109	51	67	88

¹ 1993 and 1996 were years of no walleye stocking.

Table 4.—Summary of age-0 walleye otolith collection from specimens taken from Saginaw Bay or research ponds 1990-95. Mark refers to strontium chloride immersion treatment.

Treatment	Year						
	1990	1991	1992	1993	1994	1995	1996
Known wild	—	—	—	142	—	—	88
Known marked	—	—	—	370	—	—	—
Wild & unmarked hatchery mix	11	101	—	—	59	71	—
Wild & marked hatchery mix	—	—	112	—	—	—	—

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