

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-81-R-3

Study No.: 436

Title: Vital Statistics of walleyes in Saginaw Bay

Period Covered: October 1, 2001 to September 30, 2002

Study Objective: To determine exploitation, abundance, growth, mortality, movement, and recruitment for the walleye population in Saginaw Bay.

Summary: A total of 2,993 walleyes (*Stizostedion vitreum*) were tagged in 2002 in the Tittabawassee River. The composition of walleyes collected for tagging in 2002 was again skewed towards males. A total of 126 tags were reported by anglers in 2001, representing 11 year classes. The tag recovery software, ESTIMATE was again used to analyze tag returns. The tag recovery rate was 1.73 percent for 2001, yielding a corresponding corrected exploitation rate of 4.9%. This estimate of exploitation rate represents a substantial decrease from previous years yet harvest decreased only slightly. It is believed that the 2001 walleye fishery was largely dependent on the strong 1997 and 1998 year classes which didn't begin recruiting to the spawning migration until 2002. Consequently, the population of tagged fish at-large in 2001 didn't fully represent the fishable population and exploitation was probably underestimated for that year (2001). Total annual survival for 2000 (the most recent year estimated) was 55.2%. Age and growth analysis of 2002 samples is pending scale aging.

Findings: Jobs 1, 2, and 3 were active this year, and progress is reported below.

Job 1. Title: Tag walleyes—In 2002, a total of 2,993 serially-numbered monel tags were applied to the jaws of walleyes below Dow Dam on the Tittabawassee River, a tributary to Saginaw Bay (Table 1). Walleyes were collected with 230-volt DC electrofishing gear. We used a single boat and one or two tagging crews. Over 1,000 walleyes were typically tagged per day. Tagging spanned about four days of work in late March. The collection effort also doubled as a spawn collection opportunity for the Michigan state hatchery system. Fingerlings and fry reared from spawn collected from Tittabawassee River walleyes are used for stocking in the Lake Huron watershed. The 2002 tagging effort brought the study total to 74,087 walleyes tagged since 1981 (Table 1).

Biological data were collected from all walleyes handled as part of the tagging program. Fish were measured for total length to the nearest mm. Tagging was limited to fish meeting or exceeding the 381-mm minimum length limit in the recreational fishery. Fish were externally sexed: mature males were ripe and easily identified; fish identified as females could have included some immature individuals of both sexes. Scales were taken from all walleyes tagged. A subsample of these scales from the height of the run is being aged. A single day of scale collection was selected for aging when the sex ratio most closely approximated 1:1.

Job 2. Title: Determine tag correction factor—This job is complete (see 2001 Performance Report for details). The tag reporting correction factor is 2.85.

Job 3. Title: Analyze data and prepare performance and final reports—The composition of walleyes collected from the spawning migration in the Tittabawassee River was again skewed towards male fish in 2001 but is considered to be an artifact of sex specific spawning migration

patterns and not necessarily representative of the overall sex ratio in the population (Table 2). Mean total length of males from the spawning migration has not changed appreciably in recent years (Table 2) but mean length of females declined some in 2002.

Analysis of age structure and the corresponding growth rate of walleyes in the spawning migration has not yet been performed for 2002. The age structure of walleyes from the 2001 migration indicated little change for females but male mean age decreased substantially (Table 3). The 1996 year class continues to make a weaker showing in the age structure in 2001 relative to those ages in previous years. The strong 1997 and 1998 year classes have now begun to recruit to the spawning migration. This accounts for the substantial decrease in mean ages of male walleyes which mature first around age 3. Female walleye mean age should also decrease in the 2003 migration. Female maturation usually begins around age 4.

Mean length-at-age exceeded the state average reported by Schneider et al. (2000) (Table 4). The fast growth rate of Saginaw Bay walleyes, which has long been documented under Michigan Federal Aid Study 466, indicates the population is well below carrying capacity of the bay's habitat and prey base (Fielder et al. 2000). Walleye growth rate has been a primary means of evaluating the status of recovery of the Saginaw Bay walleye population (Fielder et al. 2000). This analysis will be updated with the 2002 data upon completion of the scale aging.

In 2001, a total of 126 tags, spanning 11 year classes, were reported by anglers (Table 5). Using the tag-recovery program, ESTIMATE-Model 1 (for year-specific survival, fishing, and reporting rates) (Brownie et al. 1985), the following values were estimated.

2001 recovery rate (percent)	1.73
95% confidence interval	1.27-2.20
2000 survival rate (percent)	55.2
95% confidence interval	34.41-76.01
Mean adult life span after tagging (years)	2.21
95% confidence interval	2.10-2.34

Recovery rates reported here and in Table 5 represent year-specific rates from the ESTIMATE analysis and are the most up-to-date values. These may differ slightly from values previously reported for this study. The mean recovery rate for all years since 1984 was 3.50 (Table 5). Similarly, survival estimates used to determine total annual mortality rate (Table 6) are year specific and improve with reporting over time. Exploitation rate was estimated by expanding the year-specific recovery rate by a correction factor (for non-reporting) of 2.85, determined from Job 2 of this study.

Exploitation of walleyes in Saginaw Bay dropped to an all time low in 2001 (Table 6). Open water harvest, however, decreased only slightly from previous years. (G. Rakoczy, Michigan Department of Natural Resources, unpublished data). Age structure of the walleye harvest for 2001 was not available from Federal Aid Study 427 in time for this report, however, it is believed that the fishery was largely made up of walleyes from the strong 1997 and 1998 year classes. These year classes are just now recruiting to the spawning migration and thus have not so far been subject to tagging. Consequently, the tagged population at large in 2001 did not accurately reflect the total population vulnerable to angler harvest. Therefore, the number of tags returned in 2001 was lower than usual, yielding an artificially low exploitation rate. For this reason, any use of the 2001 exploitation rate should be applied with caution; the mean exploitation rate (over multiple years; Table 6) may be more representative of the 2001 fishery. As the strong 1997 and

1998 year classes get included in tagging operations in the years to come, we expect tag returns and exploitation rate estimation to regain greater accuracy. Total annual mortality derived from the ESTIMATE survival estimates declined in 2000, the most recent value calculable with ESTIMATE (Table 6). This decrease in total annual mortality probably partially reflects the decreased exploitation that year.

More background and the history of this study can be found in Keller et al. (1987) and Mrozinski et al. (1991) who summarized results through 1988. Fielder et al. (2000) summarized results from 1989 through 1997 and related the findings to other work on Saginaw Bay including movement based on tag returns.

Analysis of the 2002 fishing season tag returns will take place in 2003.

Literature Cited:

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Table 1.–Number of walleyes tagged in the Saginaw Bay system, by site, Saginaw Bay watershed 1985-2002.

Site	Year																	Study total ^e		
	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000 ^d	2001		2002	
Tittabawassee River																				
Dow Dam	3,335	2,923	6,020	4,036	2,494	2,488	3,079	2,995	2,989	2,999	2,970	2,992	2,993	2,490	2,999	3,299	2,997	2,993	62,198	
Sanford Dam	531	608	-	-	497	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,636
Other rivers																				
Kawkawlin River	-	-	56	-	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	368
AuGres River	174	59	215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	448
Saginaw River	-	-	-	115 ^a	-	418	-	-	-	-	-	-	-	-	-	-	-	-	-	533
Flint River ^b	-	-	-	-	-	-	-	-	-	-	-	-	-	2,994	2,997	2,993	-	-	-	5,991
Saginaw Bay Consumers																				
Power	-	0	-	-	207	-	-	-	-	-	-	-	-	-	-	-	-	-	-	217
Pt. AuGres	60	511	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	914
Catfish Hole ^c	-	529	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	529
Pinconning	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56
Sand Point	-	-	1,108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,197
Total	4,100	4,630	7,399	4,151	3,272	2,906	3,079	2,995	2,989	2,999	2,970	2,992	2,993	5,484	5,996	6,292	2,997	2,993	74,087	

^aTagged on May 7, 1988, in Saginaw River at Wickes Park during a walleye tournament.

^bReturns analyzed and reported separately and not included in estimate model analysis.

^cA 19-foot deep depression about seven miles southwest of Pt. AuGres in Grid 1507 (includes 98 tagged).

^dIncludes 300 reward-tagged fish.

^eTotal number since study inception in 1981.

Table 2.—Average total length (mm) of walleyes collected by electrofishing below Dow Dam, Tittabawassee River, March-April 1981-2002.

Year	Female		Male		Total	
	Length	Number	Length	Number	Length	Number
1981	528	87	350	272	394	399
1982	516	179	452	513	467	697
1983	549	2,082	498	1,300	528	3,413
1984	584	1,052	472	2,421	505	3,540
1985	531	1,322	457	1,662	490	2,984
1986	536	1,370	465	2,023	493	3,574
1987	546	1,736	472	3,829	485	5,976
1988	582	549	477	3,338	490	4,033
1989	561	1,774	485	1,244	528	3,064
1990	582	972	493	1,481	528	2,467
1991	584	2,232	488	843	559	3,079
1992	610	1,491	483	1,497	556	2,995
1993	582	1,323	488	1,666	531	2,989
1994	599	1,452	531	1,534	564	2,999
1995	589	962	538	2,003	556	2,970
1996	627	1,376	556	1,614	589	2,992
1997	630	1,905	554	1,088	604	2,993
1998	589	1,170	544	1,311	564	2,489
1999	620	957	549	2,031	569	2,995
2000	630	531	540	2,756	555	3,299
2001	635	576	518	2,421	540	2,997
2002	594	809	536	2,178	551	2,993

Table 3.—Age composition (percent) of walleyes sampled from Tittabawassee River (Dow Dam) during spring electrofishing, 1988-2001.

	Age														Mean age
	1	2	3	4	5	6	7	8	9	10	11	12	13	14+	
1988															
Female	—	—	4.0	18.5	32.8	25.7	10.5	5.7	3.0	—	—	—	—	—	5.5
Male	—	0.5	29.5	22.8	25.5	14.5	3.8	2.3	1.1	—	—	—	—	—	4.5
1989															
Female	—	—	1.5	41.4	27.3	23.1	5.7	1.1	—	—	—	—	—	—	4.9
Male	—	0.8	5.8	58.5	20.4	8.2	4.4	1.2	0.6	—	—	—	—	—	4.5
1990															
Female	—	0.1	0.1	1.2	37.1	34.7	22.9	3.6	0.4	—	—	—	—	—	5.9
Male	—	3.1	5.0	14.0	49.2	21.1	7.1	0.5	0.1	—	—	—	—	—	5.0
1991															
Female	—	—	0.1	18.8	19.2	45.7	11.5	2.6	1.5	0.6	—	—	—	—	5.7
Male	—	0.1	43.8	9.6	19.6	20.5	3.6	2.6	0.2	—	—	—	—	—	4.4
1992															
Female	—	0.1	0.0	9.4	14.5	12.1	17.9	13.7	10.2	12.9	4.6	3.0	1.7	0.2	7.5
Male	—	0.6	19.5	30.8	17.4	17.6	11.4	1.0	1.0	0.3	0.4	—	—	—	4.8
1993															
Female	—	—	1.6	13.7	31.8	11.7	18.6	14.6	6.5	1.2	0.3	—	—	—	6.1
Male	—	—	33.3	25.6	14.2	12.6	9.0	2.9	1.1	1.3	—	—	—	—	4.6
1994															
Female	—	—	1.3	17.3	32.7	16.0	7.7	12.2	7.7	1.9	1.3	0.6	—	—	6.0
Male	—	—	4.9	18.9	12.8	10.4	13.4	17.1	12.8	4.9	1.2	—	—	—	6.5
1995															
Female	—	—	—	9.4	53.1	13.4	9.1	7.1	3.9	2.4	1.2	0.4	—	—	5.8
Male	—	—	1.3	9.0	20.5	21.0	12.7	14.0	12.5	7.6	0.7	0.4	0.2	—	6.7
1996															
Female	—	—	—	0.2	9.1	18.4	22.6	13.1	12.6	15.9	6.9	1.3	—	—	7.8
Male	—	—	0.6	0.8	6.3	16.1	18.9	21.9	18.4	13.0	3.1	0.9	—	—	7.8
1997															
Female	—	—	0.4	4.1	1.3	11.8	26.8	22.9	12.4	8.4	7.1	4.9	—	—	7.9
Male	—	—	—	1.5	0.3	15.2	23.6	27.3	16.1	9.2	4.0	2.0	—	0.6	7.9
1998															
Female	—	—	1.7	22.8	11.0	6.6	11.3	19.6	12.8	7.3	4.0	2.7	0.3	—	7.0
Male	—	—	6.8	9.3	3.4	4.8	16.4	22.7	17.7	10.3	6.2	1.5	0.9	—	7.6
1999															
Female	—	—	0.4	8.0	13.3	4.9	4.5	11.4	21.2	18.6	9.8	6.8	0.4	0.4	8.3
Male	—	0.6	1.7	13.2	8.5	5.2	7.4	23.5	19.8	12.4	4.5	1.2	0.8	—	7.6
2000															
Female	—	—	—	0.6	11.2	14.9	10.6	4.3	13.0	20.5	13.7	8.1	2.5	—	8.7
Male	—	4.4	11.7	2.2	9.0	11.4	5.8	8.2	21.8	14.1	8.3	2.5	0.6	—	7.4
2001															
Female	—	—	2.7	7.5	5.8	8.4	13.3	8.0	9.7	15.5	14.6	11.5	2.2	0.9	8.6
Male	—	—	25.4	9.5	3.0	9.1	10.5	11.0	14.2	9.5	5.4	1.9	0.5	—	6.6

Table 4.—Mean total length (mm) at age of walleyes from tagging operation, Tittabawassee River, spring 1998-2001.

Year class	Age	Male		Female		Age	Male		Female	
		Length	Number	Length	Number		Length	Number	Length	Number
		1998				1999				
1998	—	—	—	—	—	1	—	0	—	0
1997	—	—	—	—	—	2	394	3	—	0
1996	—	—	—	—	—	3	430	9	500	1
1995	3	432	44	495	10	4	481	68	525	21
1994	4	478	60	523	137	5	515	44	559	35
1993	5	505	22	559	66	6	530	27	585	13
1992	6	526	31	584	40	7	543	38	643	12
1991	7	544	106	612	68	8	562	121	643	30
1990	8	561	147	635	118	9	582	102	663	56
1989	9	584	115	655	77	10	597	64	678	49
1988	10	594	67	671	44	11	604	23	699	26
1987	11	610	40	701	24	12	608	6	708	18
1986	12	610	10	686	16	13	610	4	—	0
1985	13	632	6	—	0	14	—	0	—	0
1984	14	—	0	—	0	15	—	0	—	0
1983	15	—	0	—	0	16	—	0	—	0
1982	16	—	0	—	0					
1981	17	—	0	—	0					
Total			648		600			509		261
		2000				2001				
1998	2	390	32	—	—	3	447	145	480	6
1997	3	446	84	—	—	4	478	54	538	17
1996	4	477	16	533	1	5	507	17	542	13
1995	5	510	65	553	18	6	530	52	606	19
1994	6	529	82	580	24	7	550	60	610	30
1993	7	540	42	600	17	8	565	63	641	18
1992	8	552	59	633	7	9	582	81	646	22
1991	9	569	157	632	21	10	582	54	688	35
1990	10	589	102	672	33	11	600	31	702	33
1989	11	599	60	677	22	12	613	11	705	26
1988	12	614	18	702	13	13	616	3	741	5
1987	13	608	4	705	4	14	—	—	754	2
1986	14	—	—	—	—	15	—	—	—	—
1985	15	—	—	730	1	16	—	—	—	—
1984	16	—	—	—	—	17	—	—	—	—
1983	17	—	—	—	—	18	—	—	—	—
Total			721		161			571		226

Table 5.—Tag return matrix for walleyes tagged at Dow Dam, Tittabawassee River, during spring, 1984-2001.

Tag year	Recovery year																	Total returns	Estimated recovery rate			
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000			2001		
1984	69																		0	363	1.94	
1985		112																		0	337	3.36
1986			118																	0	309	4.27
1987				308																0	586	4.94
1988					161															0	367	3.89
1989						68														1	239	3.37
1990							59													0	224	2.36
1991								71												0	289	2.56
1992									165											1	353	5.50
1993										150										1	311	4.78
1994											76									4	253	2.58
1995												52								3	224	2.04
1996													45							3	271	2.58
1997														51						7	246	3.13
1998															72					12	186	3.47
1999																87				15	162	4.09
2000																	126			27	98	3.16
2001																		98		52	52	1.73
Mean																						3.50
Total	69	200	281	515	380	268	188	223	438	375	210	162	226	306	311	395	239	126	126	4,944		

Table 6.—Walleye year class percent composition in Saginaw Bay sport fishery, April – October harvest (2 SE of the mean), adjusted annual exploitation rate, and total annual mortality rate, 1989 through 2001.

Year class	Creel Survey Year											2001 ^c	Mean		
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999			2000	
1981	-	-	0.8	1.3	0.6	0.2	-	-	-	-	-	-	-	-	-
1982	5.1	-	2.4	3.1	2.1	-	0.7	0.2	-	-	-	-	-	-	-
1983	5.1	-	6.5	4.5	4.1	1.8	1.4	2.2	0.6	-	-	-	-	-	-
1984	13.6	-	8.4	4.9	4.8	4.4	4.2	2.7	2.4	0.2	-	-	-	-	-
1985	28.8	-	14.5	10.7	12.7	8.4	8.7	7.7	3.6	1.2	-	-	-	-	-
1986	45.7	-	16.1	18.3	10.6	11.6	9.7	10.2	6.7	2.5	-	0.9	-	-	-
1987	1.7	-	12.0	11.6	7.6	9.2	8.3	6.2	6.1	3.5	0.5	0.5	-	-	-
1988	-	-	20.2	16.5	14.1	13.8	11.1	7.0	6.7	3.7	0.5	1.1	-	-	-
1989	-	-	19.1	24.6	23.0	17.6	16.3	11.7	5.2	9.6	5.8	3.4	-	-	-
1990	-	-	-	4.5	15.5	14.8	12.7	9.2	9.7	11.3	9.7	3.9	-	-	-
1991	-	-	-	-	4.9	17.8	20.3	19.0	18.2	12.5	12.3	4.6	-	-	-
1992	-	-	-	-	-	0.4	6.4	6.7	11.5	8.0	8.9	8.7	-	-	-
1993	-	-	-	-	-	-	0.2	1.2	1.2	3.3	5.8	6.2	-	-	-
1994	-	-	-	-	-	-	-	15.7	25.2	28.1	24.9	13.5	-	-	-
1995	-	-	-	-	-	-	-	-	3.0	15.4	15.0	11.6	-	-	-
1996	-	-	-	-	-	-	-	-	-	0.6	4.7	3.2	-	-	-
1997	-	-	-	-	-	-	-	-	-	-	11.8	16.4	-	-	-
1998	-	-	-	-	-	-	-	-	-	-	-	26.0	-	-	-
1999	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
No. aged	59	-	491	224	631	500	424	401	330	512	990	438	-	-	-
Harvest ^a	56,337 (10,580)	-	61,028 (10,817)	64,447 (8,702)	125,160 (18,357)	68,170 (11,907)	47,887 (9,208)	47,566 (9,990)	78,128 (15,109)	80,801 (11,614)	43,747 (16,893)	58,018 (28,002)	44,178 (17,832)	64,425	-
Exploitation	9.3	7.2	7.0	14.9	13.1	7.0	5.7	7.2	8.8	9.5	11.5	8.5	4.9	8.8	-
Total mortality ^b	31.1	30.3	42.0	39.8	34.6	22.9	39.5	24.6	32.7	28.8	52.5	44.8	---	35.3	-

^a From previous MDNR creel survey reports. ^b Annual rate for last year cannot yet be calculated. ^c 2001 age data not yet available.