STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-81-R-2

Study No.: 460 **Title:** Dynamics of Lake Erie walleye and yellow perch populations and fisheries

Period Covered: October 1, 2000 to September 30, 2001

Study Objective: To work with Ohio, New York, Pennsylvania, and Ontario to develop and verify models for inter-agency harvest quotas of walleye and yellow perch in Lake Erie using population samples taken each spring and fall.

Summary: In 2000 and 2001, walleye and yellow perch samples were collected from a spring trap net survey, a fall gill net survey, and an on-site creel survey. To fulfill inter-agency objectives, Michigan's survey data and data analyses were shared with the other Lake Erie fishery management agencies. The inter-agency task groups combined their walleye tag data, and their walleye and yellow perch survey data, to produce estimates of mortality and exploitation rates. These estimates were used to establish harvest quota recommendations for the lakewide recreational and commercial percid fisheries.

Job 1. Title: Carry out trap-net sampling.

Findings: In spring 2000, the Michigan Department of Natural Resources (MDNR) made 51 trap-net lifts off the city of Monroe in Michigan waters of Lake Erie. However, in spring 2001, only 12 trap net lifts were made at the Monroe site due to vessel maintenance scheduling. Since the 12 lifts occurred in late May, data collected cannot be considered comparable to the previous 23 years of the data time series.

Age and growth data were collected from walleye and yellow perch. Total number and total weight data were collected for all fish species. In 2000, the combined catch-per-net-lift (CPUE) for all species was below the long-term mean, but well above the mean for the 1990-99 time period (Table 1). CPUE values for smallmouth bass, white bass, white perch, redhorse spp., and common carp were all above the 23-year means. The walleye catch rate increased for the third consecutive year, closely approaching the long-term mean. Smallmouth bass catch rates have been highest since 1994. This is likely an indication of increased abundance since the mid-90s, probably a result of improving habitat conditions for smallmouth bass in Michigan's waters of Lake Erie. Yellow perch catch per net lift in 2000 declined from 1999, but remained above the mean for the 1990-99 time period. Lake whitefish have rarely been seen during the 20-year history of this survey. However, during 1997-2000 several whitefish have been captured each spring in the index trap nets. The reason for the unusual presence of lake whitefish was not immediately clear.

To date, 44,025 walleyes have been tagged at the Monroe tag site, including 2,082 captured in the trap nets in spring 2000.

Job 2. Title: Analyze growth data from trap nets and angler catches.

Findings: Scale samples collected from walleye and yellow perch in 2000 have been processed and aged. Scales collected during 2001 have not yet been interpreted for ages. Age 4 walleyes made up 35% of the 2000 trap net walleye catch, reflecting the strength of the 1996-year class (Table 2). The 1997 and 1994 year classes were also well represented, accounting for an additional 35% of the total catch combined. Age 5 walleyes were comparatively scarce (1.7%), illustrating poor recruitment in 1995. Growth, as reflected by mean length at age, remained good for both male and female walleyes (Table 3). No trend in growth was apparent for either sex during recent years.

The age distribution of yellow perch caught in the trap nets in 2000 (Table 4) was dominated by age 4 (34%), age 5 (30%), and age 6 (18%) fish. The comparatively poor contribution by age 3 fish (6.3%) indicated that the 1997 year class is likely quite weak. After a period of improved growth rates during the mid-1990's, there has been no apparent trend in yellow perch growth rates in recent years (Table 5).

Sport-caught walleye and yellow perch from Michigan's Lake Erie waters have been sampled for biological data (length, weight, and age) as part of Michigan's Great Lakes creel survey (Federal Aid Study 427). A total of 605 walleyes and 703 yellow perch scale samples collected during the 2000 creel survey were interpreted for ages. Age 2 (25%), age 3 (34%), and age 4 (28%) walleyes accounted for the largest portion of the walleye recreational harvest (Table 6). Age 4 fish accounted for an additional 15% of the total catch. No trend in growth was apparent for sport-caught walleyes over the past six years (Table 6).

Three strong year classes dominated the yellow perch sport catch in 2000. The 1996-year class (age 4) accounted for 41% of the total catch (Table 7). The 1995-year class (age 5) added an additional 20% to the total. Age 2 (1998-year class) and age 3 (1997-year class) accounted for 14% and 18% of the total harvest, respectively. Contributions from all other year classes were minor. Although yellow perch growth appeared to improve in the interval from 1990 to 1995, growth has declined for most ages during the past 3 years. This is likely a result of increased yellow perch abundance due to good recruitment in 1994, 1995, and 1996.

Job 3. Title: Collect tag recovery data.

Findings: A total of 44,025 walleyes have been tagged at the Monroe station since spring 1978. Of those, 3,860 (8.8%) have been reported caught by anglers and commercial fishermen through 2000. A total of 2,082 walleyes were tagged in 2000; of which, 4.2% were subsequently recovered by fishermen. There were 131 reported recoveries from all years of tagging, at Monroe, during the 2000 fishing season. The geographical distribution of the 2000 returns was as follows: Lake Huron 0.8%; St. Clair River 4.6%; Lake St. Clair 6.1%; Detroit River 15.1%; Western Basin-Lake Erie 65.6%; Central Basin-Lake Erie 5.6%; and Eastern Basin-Lake Erie 2.3%. Recoveries were reported from all months except January and February, with over 75% reported during the months of May (16.2%), June (13.8%), July (23.8%), and August (21.3%).

The geographical distribution of tag recoveries shifted slightly during the period from 1991 to 2000 (Table 8). The percentage of recoveries reported from Western Lake Erie waters increased, with a concomitant decrease occurring in the Central Basin. These changes likely reflect variations in fishing effort and access. The heavier relative contribution of tag recaptures from connecting waters north of Lake Erie beginning in 1998 continued in 2000. This pattern was also observed in our walleye tag studies prior to 1990. Unfortunately, interpretation of such changes is difficult

without information on fishing effort and catch rates. However, it is clear from the time series of geographical distribution of tag recoveries that large numbers of walleyes move northward out of Lake Erie each year and contribute substantially to the walleye fisheries in the Detroit River, Lake St. Clair, the St. Clair River, and even Lake Huron.

Job 4. Title: <u>Analyze tag recovery data.</u>

Findings: Walleye tag data were analyzed to estimate annual rates for tag recovery and survival during the period from 1986 through 2000. The computer program, known as ESTIMATE (Brownie et al. 1985), was used and all parameter estimates were taken from Model 1 under the assumption that survival and reporting rates were year-specific. Model 1 was more compatible with all data sets than three alternative models and probably produced the least biased estimates. Another assumption made was that all tag recoveries attributable to the 2000 fishing year had been received; thus, the recovery rate estimates for 2000 were comparable to those for prior years.

Walleye tag and recovery data from the Ohio, Ontario, and Michigan surveys covered the period from 1986 through 2000 (Table 9). Walleyes were not tagged by Ontario in 1989 and 1996 and Ohio in 1999; and May tag recovery data from Ontario might have been biased by heavy commercial fishing effort near tag sites. Michigan, Ontario, and Ohio used a monel metal tag placed in the lower jaw. During some years, Ontario also used a plastic streamer tag sewn into the dorsal musculature with monofilament nylon. Based on a literature review of studies comparing different tag types, tag loss was considered to be a potential problem only with the plastic streamer tag.

Analysis of the combined data produced an estimate for mean annual survival of 64.9% and mean recovery rate of 3.4% (Table 10). These values were used to estimate instantaneous natural mortality (M) according to the relationship $M = Z - \mathbf{u}Z/A$ where ($\mathbf{u}Z/A = F$) for type II fisheries; where, Z is instantaneous total mortality, **u** is the exploitation rate, A is the total mortality rate, and F is the instantaneous fishing rate (Ricker 1975). A walleye reward tag study, funded by the Ontario Ministry of Natural Resources, was conducted during 1990 by Ontario, Ohio, and Michigan. This study, based on random application of $100.00 US tags to 10% of the walleye, produced a reward/non-reward ratio of 2.69 (Thomas and Haas 1999). A value for **u** of 9.15% was generated by expanding mean recovery rate (3.4%) by the non-reporting rate (2.69). The resulting value for M was 0.32. It is important to note that survival rate estimates from program "ESTIMATE" are independent of recovery rates; thus, expansion of the tag recovery rate by reward/non-reward ratios will not alter survival rate estimates in any way.

The highest walleye exploitation (**u)**, 13.6%, occurred in 1993 and was significantly higher compared to **u** in the remaining 14 years. Exploitation was also high in 1996 (11.1%) and 1992 (10.5%). Both values were consistent with higher sport angler catch/effort values documented by creel surveys.

The reward tag program was replicated in 2000, to provide an updated non-reporting rate. Funding for the $100.00 US tags was provided by the US agencies (NY, PA, OH, and MI). Reward tags were applied to 10% of the tagged walleye population at the Chicken and Hen Island site in Ontario, the Lackawanna and Van Buren Bay sites in New York, the Grand River and Sandusky Bay sites in Ohio, and the Raisin River site in Michigan (Table 11). Anglers reported catching 114 non-reward and 36 reward tags from the 2000 tagged population during the 2000 fishing season. The non-reporting ratio for anglers was 2.52, which was very similar to the 2.69 value calculated from the long-term recovery data from the 1990 reward study. However, commercial operators

reported 34 reward tags and only 12 non-reward tags, resulting in a non-reporting ratio of 22.37. This was much higher than any non-reporting ratios encountered during the 1990-99 period suggesting that the commercial operators, during 2000, dramatically altered how frequently they reported non-reward tags. These data were not used to calculate a new non-reporting ratio because they need to be adjusted for this change in reporting behavior. The reporting pattern for the reward tags may provide a basis for adjusting the non-reward tag numbers.

The Lake Erie Committee of the Great Lakes Fishery Commission reported at the annual meeting in March, 2001 that about 2.4 million walleyes were harvested by the commercial fishery and only about 1.3 million by anglers. There is an apparent discrepancy because nearly equal numbers of reward tags were reported from the two fisheries. We believe this can be explained by differences in geographical extent of the two fisheries; commercial fisheries operated within Lake Erie only, while angling also occurred throughout Lake St. Clair, the connecting rivers, and southern Lake Huron. The angling fishery was expected to report a higher frequency of reward (and non-reward) tags, relative to the commercial fishery, because significant numbers of the 2000 tagged population would have migrated through Lake St. Clair and into Lake Huron.

Job 5. Title: Carry out gill net sampling.

Findings: The MDNR has fished experimental gill nets at two stations in western Lake Erie since the fall of 1978, as part of the inter-agency assessment program. The 2000 fall gill net survey included two 1300-foot sets of variable-mesh multi-filament gill net at each index station. All nets were suspended from the surface. A total of 492 walleyes were captured, and sampled for age and growth information.

Job 6. Title: Analyze growth and abundance data from gill net sampling.

Findings*:* Scale samples taken from walleyes captured in 2000 fall gill-nets have been processed and aged. Mean length (mm) at age is presented in Table 12. No trends in walleye growth were evident over the last five years. Mean length of yearlings collected in 2000 remained well within the range observed since 1978 and very near the long-term mean of 330 mm (Table 13). Total walleye catch-per-effort for the index sites (Table 14) increased from 1999, but was slightly below the long-term mean annual CPUE of 127.4. The 1999-year class (age 1 fish), accounted for 46% of the total catch rate, suggesting it is probably above average in abundance. The extremely poor recruitment for Lake Erie walleye in 1992 and 1995 is well illustrated in the low catch rates for these cohorts over the past 8 years.

Historical walleye catch data were used to develop a mean rank for the 1974-97 year classes, some of which were not yet completely represented throughout their life (Table 15). Total harvest included the sport and commercial catches from the Western and Central basins of Lake Erie. Trap and gill net catch-per-effort data came from Michigan's 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 five year classes were 1982, 1986, 1985, 1991, and 1984. The worst five year classes were the 1995, 1976, 1974, 1992, and 1997. There have not been any strong year classes in the six years examined since 1991, and three of those (1991, 1995, and 1997) produced very weak year classes. The adult walleye stock is declining because it was dominated through the 1980s and early 1990s by strong year classes, like 1982 and 1986.

Job 7. Title: Participate in inter-agency work groups.

Findings: Data summaries and analyses for 2000 MDNR surveys were completed and presented (as computer files and hard copies) to the Scientific Technical Committee, the Walleye Task Group, the Forage Task Group, and the Yellow Perch Task Group. Inter-agency walleye tag data for 2000 and 2001 were compiled and disseminated to each agency. Extensive walleye and yellow perch population modeling was done utilizing the inter-agency tag and fishery data sets. Estimates of walleye size selectivity by the commercial and sport fisheries were determined from tag recovery data and submitted to the Walleye Task Group to assist with development of a walleye management model. We also participated in an external review process of the walleye and yellow perch task group catch-at-age analyses.

Job 8. Title: Prepare annual reports.

Findings: This progress report was prepared. A final report presenting the results of this study for the period from 1994-98 was completed (Thomas and Haas 2000). Additionally, some of the data collected during this study were presented in the annual "Status of the fisheries in Michigan waters of Lake St. Clair and Lake Erie" report prepared each winter by the Mt. Clemens Fisheries Research Station for the Great Lakes Fisheries Commission's Lake Erie Committee Annual Meeting.

Literature cited:

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Table 1.–Mean catch per trap-net lift for all species taken during spring trap net surveys in Michigan waters of Lake Erie, 1995-00.

Species	Survey year						78-89 Mean	90-99 Mean	78-00 Mean
	1995[1]	1996	1997	1998	1999	2000			
Walleye	26.2	52.0	30.2	34.8	38.0	41.4	42.3	43.1	42.6
Smallmouth bass	2.2	2.1	1.2	1.9	1.9	2.2	0.1	1.1	0.6
Yellow perch	10.3	36.6	30.7	33.3	61.0	50.1	254.6	41.5	153.0
Rock bass	4.1	1.1	0.9	1.0	2.8	0.7	1.2	1.4	1.2
White bass	2.1	0.6	2.6	1.3	4.6	4.0	3.9	1.5	2.9
White perch	72.8	5.9	10.2	8.7	79.4	54.7	40.0	29.4	36.0
Pumpkinseed	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Bluegill	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Black crappie	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.1
Channel catfish	3.7	8.8	4.4	11.4	16.0	5.2	5.5	7.4	6.3
Brown bullhead	0.2	1.1	0.4	0.0	1.0	2.9	2.7	2.7	2.7
White sucker	7.4	14.0	4.7	15.0	6.0	5.8	10.1	9.4	9.6
Redhorse sp.	1.0	5.5	1.9	3.3	2.2	3.8	1.3	2.3	1.9
Freshwater drum	13.0	15.4	6.8	28.3	50.4	11.3	25.8	18.3	21.9
Common carp	2.9	8.2	0.6	3.1	8.0	12.2	6.7	3.4	5.5
Goldfish	0.1	0.5	0.1	0.0	0.1	0.0	1.0	0.5	0.8
Gizzard shad	1.7	0.3	0.0	0.0	0.2	2.4	9.9	0.6	5.5
Longnose gar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bowfin	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Quillback	6.7	8.9	2.2	7.9	8.5	3.7	3.7	5.1	4.3
Stonecat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	155.2	161.2	96.9	150.0	280.3	200.4	409.0	167.8	295.1
% yellow perch	6.2	22.7	31.7	22.2	21.8	25.0	55.2	24.8	40.7
% white perch	46.9	3.6	10.5	5.8	28.3	27.3	11.1	15.7	13.8
Net lifts	39	45	57	44	45	51	49	48	49

[1]Sampling period delayed two weeks.

Table 2.–Age composition (expressed as percentage) of annual walleye catch in survey trap nets for Lake Erie, near Monroe, 1991-00.

	Survey year									
Age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	0.04	–	–	0.08	0.29	0.04	–	–	0.06	0.19
2	5.77	11.00	3.31	0.76	63.60	5.53	0.98	31.50	23.70	9.08
3	15.15	6.75	32.18	30.86	0.59	25.30	32.30	3.39	49.70	26.70
4	12.08	11.30	4.61	23.31	13.10	1.54	22.30	23.1	0.93	35.00
5	41.32	12.20	9.41	4.22	4.81	19.70	1.95	13.7	6.47	1.71
6	7.80	33.20	11.22	6.45	1.57	15.50	15.10	2.67	5.60	8.51
7	11.11	10.00	23.49	13.99	4.91	5.36	8.23	10.3	2.33	5.18
8	3.68	10.20	7.92	11.59	6.58	9.35	5.75	4.37	4.02	4.04
9	2.74	2.17	4.02	5.27	2.55	8.45	5.23	3.52	1.92	3.80
10	0.14	2.65	1.69	2.19	1.47	5.83	4.89	4.17	2.45	2.66
11	0.07	0.14	1.95	0.84	0.10	1.97	2.13	1.24	1.05	1.28
12	0.07	0.05	0.13	0.38	0.29	0.94	0.52	1.43	1.16	1.23
13	–	–	0.06	0.04	–	0.21	0.29	0.39	0.35	0.24
14	–	–	–	–	–	0.04	0.06	–	0.06	0.19
15	–	–	–	–	–	–	0.06	0.06	0.06	–
Total aged	2,782	2,073	1,542	2,387	1,017	2,330	1,737	1,532	1,714	2,112

Table 3.–Mean length-at-age (mm) and standard error (SE) of walleyes caught in trap nets in Michigan waters of Lake Erie during spring surveys 1995-00. Sample size in parentheses.

	1995		1996		1997		1998		1999		2000	
Age	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
						Males						
2	342	2.0	346	2.5	354	6.0	337	0.9	343	1.8	358	1.4
	(57)		(75)		(13)		(301)		(171)		(159)	
3	420	1.5	410	1.0	411	0.9	408	3.5	407	0.8	418	1.0
	(2)		(500)		(513)		(49)		(711)		(533)	
4	450	2.6	459	5.4	456	1.4	446	1.4	466	7.3	455	1.0
	(81)		(26)		(307)		(323)		(11)		(609)	
5	488	3.6	482	1.4	491	5.8	478	2.1	483	2.5	486	3.1
	(35)		(408)		(30)		(198)		(95)		(28)	
6	518	7.4	510	1.6	508	1.8	512	5.3	498	3.1	512	2.3
	(13)		(304)		(241)		(37)		(78)		(150)	
7	537	5.3	534	3.0	533	2.6	521	2.3	508	5.9	532	3.0
	(40)		(113)		(127)		(147)		(33)		(89)	
8	560	5.1	551	2.3	558	3.4	549	4.3	544	5.2	556	3.4
	(51)		(194)		(94)		(58)		(60)		(77)	
9	560	5.4	568	2.8	579	3.7	575	5.6	572	7.3	567	4.1
	(18)		(165)		(86)		(46)		(24)		(61)	
10	580	8.5	577	3.7	580	4.8	585	5.4	594	5.7	583	5.8
	(9)		(107)		(71)		(45)		(33)		(44)	
11	600		609	6.2	581	7.8	593	9.0	594	8.7	596	7.8
	(2)		(31)		(29)		(13)		(15)		(18)	
						Females						
2	—	—	—	—	—	—	332	—	—	—	345	20.5
							(1)				(2)	
3	—	—	453	17.5	443	3.7	518	—	451	—	431	—
			(5)		(14)		(1)		(1)		(1)	
4	501	6.2	517	14.0	497	3.7	488	4.8	528	37.5	505	3.3
	(17)		(8)		(41)		(29)		(2)		(78)	
5	509	25.3	539	4.6	511	20.4	532	12.3	549	12.1	546	14.1
	(4)		(37)		(3)		(7)		(7)		(5)	
6	—	—	572	4.8	517	11.0	588	16.2	579	4.6	601	6.9
			(55)		(16)		(4)		(5)		(20)	
7	—	—	593	12.7	586	11.6	605	10.1	615	5.0	616	6.8
			(12)		(13)		(11)		(2)		(14)	
8	636	21.1	637	10.4	614	9.0	636	11.7	641	12.0	614	14.4
	(7)		(22)		(2)		(9)		(7)		(7)	
9	663	30.0	652	9.6	645	25.9	648	7.8	634	10.4	654	5.0
	(3)		(29)		(3)		(8)		(3)		(18)	
10	682	13.4	662	6.5	667	16.6	677	8.2	658	19.5	693	9.1
	(3)		(29)		(12)		(18)		(7)		(11)	
11	690	—	685	8.3	687	17.3	688	17.3	646	85.0	690	12.6
	(1)		(15)		(7)		(6)		(2)		(8)	
12	685	—	720	15.4	709	25.9	726	10.4	722	14.3	705	13.1
	(1)		(9)		(3)		(8)		(3)		(13)	

Table 4.–Yellow perch catch per unit effort (CPUE) by age for trap net surveys in Michigan waters of Lake Erie during 1989-00 (expressed as number caught per net per 24 h).

Year	Days	Age							Total CPUE
		2	3	4	5	6	7	Age 8+	
1989	95.5	0.02	26.64	50.02	39.27	24.63	2.89	1.28	144.83
1990	139.2	0.04	0.35	4.20	8.72	5.82	2.90	1.73	24.58
1991	86.0	0.03	2.74	2.41	9.29	7.99	6.29	1.79	31.91
1992	98.6	0.22	2.31	2.47	1.68	5.04	4.47	2.41	19.50
1993	99.1	0.25	6.28	5.34	2.31	1.58	2.51	0.81	20.24
1994	95.0	0.20	1.70	4.39	2.20	1.29	0.52	0.65	10.95
1995[1]	88.9	0.01	0.09	1.39	1.60	0.84	0.15	0.09	4.16
1996	100.7	0.20	2.42	2.87	4.38	2.82	2.24	0.67	15.60
1997	93.0	0.00	4.87	6.11	2.82	2.67	1.66	0.68	18.82
1998	88.0	0.42	6.30	4.70	2.39	1.68	0.65	0.38	16.51
1999	105.4	0.39	6.57	6.38	10.69	2.42	0.26	0.17	26.88
2000	128.8	0.55	1.24	6.71	6.04	3.66	1.39	0.25	19.84

[1]Sampling period delayed two weeks.

Table 5.–Mean length-at-age (mm) and standard error (SE) of yellow perch caught in trap nets in Michigan waters of Lake Erie during spring surveys 1995-00. Sample size in parentheses.

	1995		1996		1997		1998		1999		2000	
Age	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
						Males						
2	187 (1)	—	173 (8)	2.2	—	—	—	—	175 (5)	4.5	183 (6)	4.9
3	194 (4)	0.7	191 (33)	1.9	191 (30)	1.9	206 (7)	12.6	185 (32)	3.4	207 (7)	8.9
4	243 (11)	4.6	216 (21)	4.5	212 (25)	3.1	207 (72)	2.3	212 (26)	4.8	213 (35)	3.8
5	250 (12)	2.4	244 (26)	4.0	231 (16)	5.6	226 (26)	3.9	230 (42)	3.6	238 (37)	3.6
6	256 (7)	5.0	258 (22)	3.8	257 (17)	4.8	250 (8)	7.8	248 (10)	5.5	251 (15)	3.7
7	265 (2)	13.5	258 (10)	6.4	255 (18)	1.8	268 (12)	5.0	—	—	252 (4)	12.4
8	273 (1)	—	277 (4)	12.8	266 (2)	2.0	290 (1)	—	—	—	—	—
9	286 (2)	7.0	284 (3)	12.4	—	—	—	—	—	—	307 (1)	—
10	—	—	—	—	—	—	—	—	—	—	—	—
						Females						
3	251 (1)	—	223 (8)	6.7	215 (14)	3.7	199 (5)	14.4	224 (22)	4.8	220 (9)	7.8
4	278 (31)	4.2	243 (21)	3.3	238 (48)	3.0	240 (53)	3.8	249 (23)	5.8	249 (36)	4.3
5	287 (39)	3.0	282 (33)	4.2	261 (23)	5.8	254 (38)	4.9	275 (58)	3.9	264 (19)	5.6
6	288 (20)	5.6	287 (17)	4.2	295 (27)	3.7	279 (15)	5.6	278 (16)	6.7	286 (23)	4.0
7	290 (3)	4.2	302 (23)	3.5	305 (10)	6.2	308 (9)	5.8	308 (4)	7.4	289 (10)	6.8
8	—	—	351 (1)	—	317 (10)	6.3	305 (4)	10.2	327 (4)	7.9	314 (2)	2.0
9	—	—	316 (2)	30.0	—	—	320 (1)	—	334 (1)	—	324 (2)	16.5
10	—	—	344 (1)	—	—	—	—	—	—	—	—	—

Table 6.–Mean length-at-age (mm) of walleyes sampled from Michigan's Lake Erie sport fishery, 1995-00. Sample size in parentheses.

	Survey year											
Age	1995		1996		1997		1998		1999		2000	
1	—	—	—	—	—	—	—	—	—	—	357	(2)
2	352	(330)	348	(132)	339	(5)	341	(196)	357	(105)	363	(152)
3	418	(34)	414	(322)	415	(192)	431	(72)	411	(211)	430	(208)
4	451	(250)	454	(18)	465	(182)	473	(147)	446	(66)	470	(170)
5	488	(62)	489	(83)	518	(21)	513	(25)	496	(21)	500	(28)
6	513	(14)	547	(27)	519	(44)	548	(14)	561	(4)	510	(19)
7	544	(20)	528	(10)	558	(30)	576	(8)	567	(4)	555	(10)
8	556	(22)	566	(14)	565	(16)	583	(8)	569	(3)	561	(6)
9	614	(24)	631	(11)	623	(12)	655	(3)	628	(6)	638	(2)
10	658	(7)	662	(5)	625	(4)	651	(5)	546	(2)	650	(4)
11	684	(6)	671	(4)	680	(3)	—	—	—	—	742	(2)
12	664	(2)	560	(2)	625	(1)	—	—	655	(2)	746	(1)
13	—	—	—	—	—	—	—	—	572	(1)	—	—
Mean	426	(771)	430	(628)	467	(510)	424	(478)	416	(425)	437	(607)

Table 7.–Mean length-at-age (mm) of yellow perch sampled from Michigan's Lake Erie sport fishery, 1995-00. Sample size in parentheses.

	Survey year											
Age	1995		1996		1997		1998		1999		2000	
1	173	(21)	154	(11)	—	—	162	(2)	164	(3)	185	(1)
2	193	(414)	190	(355)	182	(101)	182	(224)	179	(26)	185	(100)
3	212	(121)	206	(273)	197	(356)	202	(268)	202	(419)	195	(127)
4	240	(41)	223	(18)	217	(178)	218	(187)	215	(183)	212	(289)
5	252	(40)	255	(8)	233	(24)	242	(45)	233	(86)	218	(140)
6	276	(6)	288	(4)	263	(3)	253	(3)	243	(31)	241	(33)
7	282	(2)	229	(1)	292	(1)	273	(2)	266	(12)	257	(10)
8	—	—	—	—	—	—	—	—	263	(5)	315	(1)
9	315	(1)	—	—	—	—	—	—	—	—	282	(1)
10	—	—	—	—	—	—	—	—	—	—	—	—
Mean	204	(646)	198	(670)	202	(663)	203	(731)	211	(765)	208	(704)

Table 8.–Geographical distribution of tag recoveries, 1991-00, from walleyes tagged at Monroe, Michigan, Lake Erie (expressed as a percentage of the total number recovered each year).

	Percent of tags recovered by location									
Geographical area	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Lake Huron - Saginaw Bay	0.4	0.5	1.6	2.0	0.8	1.7	0.0	2.4	1.2	0.8
St. Clair River	7.1	2.7	6.1	6.2	8.3	2.8	4.2	7.9	9.5	4.6
Lake St. Clair	3.1	4.1	2.6	3.1	2.3	4.5	4.9	7.1	4.8	6.1
Detroit River	17.3	9.5	8.1	8.8	12.1	11.2	12.2	6.3	8.3	15.3
Western Basin-Lake Erie	56.9	64.5	58.7	54.1	43.9	54.1	57.1	56.7	53.6	65.6
Central Basin-Lake Erie	11.6	13.1	17.7	21.6	28.8	22.9	20.1	16.5	20.2	5.3
Eastern Basin-Lake Erie	1.8	2.7	3.5	4.1	3.8	2.8	1.6	3.1	1.2	2.3
Lake Erie-total	70.3	80.3	79.9	79.8	76.5	79.8	78.8	73.2	75.0	73.2

Table 9.–Tag recovery data for walleyes tagged by Ohio, Ontario, and Michigan at Lake Erie sites, 1986-00.

Year	Number tagged	Year 1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Percent recovered
1986	5,645	158	88	93	51	33	28	10	15	9	3	5	2	3	0	1	8.8
1987	4,308	–	163	147	57	28	18	16	10	5	9	0	3	3	0	1	10.7
1988	6,871	–	–	234	120	64	35	33	21	15	3	5	12	2	2	0	7.9
1989	4,059	–	–	–	134	62	48	34	21	22	10	6	5	2	1	0	8.5
1990	4,352	–	–	–	–	152	114	72	58	30	18	14	11	7	2	0	11.0
1991	6,568	–	–	–	–	–	242	180	116	52	39	34	17	15	4	1	10.6
1992	5,649	–	–	–	–	–	–	237	184	77	36	34	19	11	6	4	10.7
1993	5,279	–	–	–	–	–	–	–	306	94	64	52	21	15	8	4	10.6
1994	4,545	–	–	–	–	–	–	–	–	152	104	71	36	33	10	7	8.9
1995	4,704	–	–	–	–	–	–	–	–	–	157	87	44	22	4	4	6.6
1996	5,718	–	–	–	–	–	–	–	–	–	–	253	123	57	31	9	8.1
1997	3,460	–	–	–	–	–	–	–	–	–	–	–	132	84	31	14	7.1
1998	1,668	–	–	–	–	–	–	–	–	–	–	–	–	28	20	2	2.9
1999	1,630	–	–	–	–	–	–	–	–	–	–	–	–	–	36	27	2.1
2000	4,469	–	–	–	–	–	–	–	–	–	–	–	–	–	–	91	2.0

Table 10.–Annual survival and recovery rate (percent) during 1986-00 for Lake Erie walleyes from Ohio, Ontario, and Michigan non-reward tags produced by program "ESTIMATE" (combined data).

Fishing Year	Tag recovery rate	Standard error	Walleye survival rate	Standard error
1986	2.80	0.22	56.46	3.87
1987	3.35	0.23	92.11	5.97
1988	3.44	0.19	52.92	3.75
1989	3.18	0.21	48.33	3.46
1990	3.44	0.21	70.71	4.22
1991	3.58	0.18	65.67	3.65
1992	4.00	0.20	63.22	3.70
1993	5.04	0.24	61.95	4.09
1994	3.37	0.20	84.38	6.32
1995	2.74	0.18	48.51	3.60
1996	4.13	0.22	54.16	4.31
1997	3.92	0.27	121.38	18.87
1998	1.88	0.27	28.56	5.59
1999	2.63	0.35	59.90	11.24
2000	2.04	0.21	–	–
Mean	3.39	0.06	64.88	1.31

Table 11.–Preliminary results from the $100 reward tagging effort in Michigan, Ohio, and Ontario during year 2000.

Tag location	Tags applied non-reward	Reward	Non-reward tags returned	Reward tags returned	Non-reward rate	Reward rate	Non-reporting ratio
			Angler tag returns				
Chicken and Hen Islands (Ontario)	1,091	115	15	2	0.014	0.017	1.265
Grand River (Ohio)	152	0	7	0	0.046	–	–
Lackawanna Shoreline (New York)	239	29	10	1	0.042	0.034	0.824
Raisin River (Michigan)	1,874	208	45	21	0.024	0.101	4.204
Sandusky Bay (Ohio)	1,460	162	15	8	0.010	0.049	4.807
Van Buren Bay (New York)	761	92	22	4	0.029	0.043	1.504
Total angler	5,577	606	114	36	0.027	0.049	2.521
			Commercial tag returns				
Chicken and Hen Islands (Ontario)	1,091	115	5	14	0.005	0.122	26.563
Grand River (Ohio)	152	0	0	0	–	–	–
Lackawanna Shoreline (New York)	239	29	0	1	0.000	0.034	–
Raisin River (Michigan)	1,874	208	5	15	0.003	0.072	27.029
Sandusky Bay (Ohio)	1,460	162	2	3	0.001	0.019	13.519
Van Buren Bay (New York)	761	92	0	1	0.000	0.011	–
Total commercial	5,577	606	12	34	0.002	0.052	22.37

Table 12.–Mean total length-at-age (mm) for walleyes caught in Michigan waters of Lake Erie during fall in survey index multi-filament gill nets (sample size in parentheses) 1996-00.

Age	Survey year									
	1996		1997		1998		1999		2000	
Sexes combined										
1	326	(18)	306	(210)	319	(357)	339	(233)	327	(228)
2	404	(273)	380	(7)	404	(593)	416	(301)	410	(118)
3	452	(62)	443	(63)	439	(7)	462	(218)	447	(81)
4	504	(2)	475	(35)	487	(38)	514	(5)	484	(53)
5	488	(39)	523	(7)	514	(20)	515	(16)	513	(3)
6	533	(7)	521	(13)	525	(12)	535	(10)	525	(7)
7	568	(3)	556	(5)	517	(6)	554	(6)	492	(1)
8	550	(3)	572	(3)	525	(1)	562	(2)	530	(1)
9	640	(2)	581	(3	525	(1)	569	(1)	–	–
10	–	–	604	(3)	586	(1)	648	(2)	–	–
Mean	422	(409)	372	(349)	382	(1036)	412	(795)	388	(492)
Males										
1	325	(8)	302	(94)	317	(133)	337	(87)	326	(91)
2	397	(138)	372	(4)	396	(328)	406	(154)	401	(81)
3	435	(39)	429	(37	428	(3)	444	(133)	441	(63)
4	456	(1)	462	(27)	473	(27)	480	(3)	467	(40)
5	484	(35)	475	(4)	502	(15)	492	(10)	494	(2)
6	500	(4)	499	(9)	525	(12)	511	(7)	498	(5)
7	533	(1)	542	(4)	517	(6)	544	(4)	492	(1)
8	523	(2)	572	(3)	525	(1)	562	(2)	530	(1)
9	578	(1)	537	(2)	525	(1)	569	(1)	–	–
10	–	–	554	(2)	586	(1)	–	–	–	–
Mean	419	(229)	380	(186)	388	(527)	411	(402)	398	(492)
Females										
1	327	(10)	310	(115)	321	(223)	340	(146)	328	(136)
2	410	(135)	392	(3)	413	(265)	426	(147)	428	(37)
3	480	(23)	463	(25)	447	(4)	489	(85)	471	(17)
4	553	(1)	519	(8)	522	(11)	564	(2)	535	(13)
5	522	(4)	586	(3)	550	(5)	553	(6)	550	(1)
6	577	(3)	571	(4)	–	–	592	(3)	594	(2)
7	586	(2)	612	(1)	–	–	572	(2)	–	–
8	604	(1)	670	(1)	–	–	–	–	–	–
9	701	(1)	704	(1)	–	–	–	–	–	–
Mean	425	(180)	364	(161)	376	(508)	414	(393)	374	(206)

Table 13.–Mean total length (mm) for yearling walleyes caught in fall gill-net surveys in Michigan waters of Lake Erie (sample size in parentheses) 1978-00.

Survey year	Year class	Mean length		Standard error
1978	1977	343	(410)	1.0
1979	1978	330	(115)	1.9
1980	1979	344	(222)	1.3
1981	1980	336	(86)	2.0
1982	1981	333	(143)	1.9
1983	1982	308	(116)	1.7
1984	1983	311	(18)	4.7
1985	1984	329	(279)	1.2
1986	1985	339	(392)	1.0
1987	1986	332	(387)	1.1
1988	1987	347	(18)	4.2
1989	1988	336	(246)	1.2
1990	1989	352	(64)	2.4
1991	1990	345	(218)	1.3
1992	1991	309	(252)	1.4
1993	1992	331	(13)	6.5
1994	1993	328	(415)	1.0
1995	1994	318	(444)	1.1
1996	1995	326	(18)	4.0
1997	1996	306	(210)	1.3
1998	1997	319	(357)	1.0
1999	1998	339	(233)	1.1
2000	1999	327	(228)	1.0

Table 14.–Walleye CPUE (number per net lift), by cohort, in multi-filament gill nets during fall surveys on Michigan waters of Lake Erie, 1983-00.

Year class	Total CPUE	Survey year																
		1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1973	1.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1974	13.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1975	42.8	0.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1976	18.4	0.3	0.0	0.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1977	171.0	2.5	3.0	0.5	0.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1978	61.6	2.5	1.8	0.5	1.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1979	72.4	4.3	2.3	2.0	0.5	0.5	0.3	–	–	–	–	–	–	–	–	–	–	–	–
1980	92.7	14.5	5.0	5.3	2.3	0.5	0.3	0.0	0.3	–	–	–	–	–	–	–	–	–	–
1981	72.3	21.3	7.8	3.8	2.8	2.3	0.5	0.3	0.0	–	–	–	–	–	–	–	–	–	–
1982	306.2	29.0	91.8	95.8	44.3	28.5	5.3	7.5	3.5	0.5	–	–	–	–	–	–	–	–	–
1983	34.6	–	4.5	12.0	4.0	5.0	3.5	1.8	1.8	2.0	–	–	–	–	–	–	–	–	–
1984	147.7	–	–	69.8	34.3	20.5	3.5	8.0	8.3	2.0	0.5	0.3	0.5	–	–	–	–	–	–
1985	177.2	–	–	–	98.0	42.5	9.3	14.3	8.5	1.5	1.3	0.8	1.0	–	–	–	–	–	–
1986	297.5	–	–	–	–	96.8	30.3	90.3	43.5	19.5	11.0	3.8	2.0	0.3	–	–	–	–	–
1987	127.8	–	–	–	–	–	4.5	53.8	26.8	20.0	13.8	2.5	3.8	1.0	0.5	0.8	–	0.3	–
1988	125.0	–	–	–	–	–	–	61.5	35.8	9.3	7.3	4.5	4.5	0.5	0.8	0.8	–	–	–
1989	52.6	–	–	–	–	–	–	–	16.0	17.0	10.0	2.8	3.3	1.3	0.8	0.8	0.3	0.3	–
1990	136.4	–	–	–	–	–	–	–	–	54.5	48.0	13.0	16.5	1.5	1.3	1.3	0.0	0.3	–
1991	194.3	–	–	–	–	–	–	–	–	–	63.0	47.3	61.5	11.3	6.8	2.8	1.3	0.3	–
1992	16.7	–	–	–	–	–	–	–	–	–	–	2.0	7.3	2.0	0.3	1.5	2.3	1.0	0.3
1993	169.2	–	–	–	–	–	–	–	–	–	–	–	73.3	71.0	11.8	8.08	3.3	1.5	0.3
1994	129.7	–	–	–	–	–	–	–	–	–	–	–	–	63.3	43.0	14.0	4.8	2.8	1.8
1995	7.2	–	–	–	–	–	–	–	–	–	–	–	–	–	3.3	1.3	0.8	1.0	0.8
1996	165.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	37.5	84.3	30.5	13.3
1997	108.9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	54.3	34.3	20.3
1998	55.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	26.0	29.5
1999	57.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	57.0
	Total	74.9	116.2	190.2	187.8	196.6	57.5	237.5	144.5	126.3	154.9	77.0	173.7	152.2	68.6	68.8	151.4	98.3	123.3
	Net lifts	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Table 15.–Mean rank of Lake Erie walleye year classes based on measured harvest and survey catch per effort.

Year class	Total harvest[1]	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		

[1]Total harvest determined by summing each agencies sport and commercial age specific harvest estimates.