STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-81-R-7

Study No.: 230460 **Title:** Dynamics of Lake Erie walleye and yellow perch populations and fisheries

Period Covered: October 1, 2005 to September 30, 2006

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 2005 and 2006, walleye *Sander vitreus* and yellow perch *Perca flavescens* samples were collected from a spring trap net survey, a fall gill net survey, and an on-site creel survey. Spawning walleye were also captured by electrofishing in the Huron River, tagged, and released. 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.

Findings: Jobs 1 through 8 were scheduled for 2005-06, and progress is reported below.

Job 1. Title: Carry out trap-net sampling.–In spring 2006, a total of 29 net lifts were made between April 19 and May 1. To date, 52,934 walleye have been jaw tagged at the Monroe tag site, including 891 captured in the trap nets in spring 2006. Another 1,212 walleye caught in the trap nets in 2006 were only PIT tagged as part of an interagency PIT tag study. Similarly, an additional 1,494 walleye were both jaw and PIT tagged on the spawning run in the lower Huron River (site 64) in 2006 to boost total numbers tagged for the interagency PIT tag study.

A total of 42 net lifts were made between April 21 and May 9, 2005. Age and growth data were collected from walleye and yellow perch. Total number and total weight data were collected for all fish species. In 2005, the combined catch-per-net-lift (CPUE) for all species (121.7) was 50% less than the long-term mean and the lowest since 1997 (Table 1). The walleye, yellow perch, channel catfish *Ictalurus punctatus*, and freshwater drum *Aplodinotus grunniens* catch rates were all the lowest observed for those species during the 26 year history of the survey. The factors involved in the low catch rates for those species is unclear, but could be related to clearer than normal water conditions at the trap net site. Secchi depths during the survey period, which was delayed about 2 weeks later than the standard survey time, often exceeded 3 meters. Despite the 2 week delay, mean water temperature was not higher than normal. Interestingly, CPUE values for smallmouth bass *Micropterus dolomieu*, white bass *Morone chrysops*, and white perch *M. americana* were above the 26-year means for those species. 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 and food conditions for smallmouth bass in Michigan's waters of Lake Erie.

Job 2. Title: Analyze growth data from trap nets and angler catches.–Scale samples collected from walleye and yellow perch caught in trap nets in 2006 have not yet been processed and interpreted for ages.

Age-2 walleye (2003 year class) accounted for about 36% of the 2005 trap net walleye catch (Table 2). The 2001 year class (age 4) contributed 21% of the total catch. Thus in combination, the 2001 and 2003 cohorts represented about 57% of the walleye catch in the survey trap nets. Conversely, the age-3 cohort (2002 year class) was conspicuously absent. Similarly, the age-5 cohort (2000 year class) was poorly represented in the catch. Growth, as reflected by mean length at age, remained good for both male and female walleye (Table 3) with no apparent trends during recent years. The age distribution of yellow perch caught in the trap nets in 2005 (Table 4) was dominated by age-4 (51%), age-7 (18%), and age-5 (15%) fish. No trend in growth was apparent for either sex during 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). In 2005, a total of 1,106 walleye were sampled for length and weight. Ages were estimated using the Ohio DNR length-age key based on otoliths from the western basin sport fishery. Age-4 walleye accounted for the largest portion (41%) of the walleye recreational harvest (Table 6), reflecting the strength of the 2001 year class. Age-6 walleye (1999 year class) were also well represented in the catch, comprising another 22% of the total harvest. No trend in growth was apparent for sport-caught walleye over the past six years. The mean length for all walleye harvested in 2004 and 2005 was considerably higher than in previous years, likely a result of the change in the minimum size limit for walleye in Michigan waters of Lake Erie. The minimum size limit increased from 330 mm (13 in.) to 381 mm (15 in.) in 2004.

In 2005, a total of 694 yellow perch from the sport harvest were sampled for length, weight, and age. The 2003 year class was dominant in 2005, accounting for 45% of the total harvest (Table 7). Age-5 and older yellow perch represented over 30% of the total harvest. The average length of yellow perch harvested by Michigan sport anglers was 219 mm, reflecting the importance of the age-2 cohort which averaged 207 mm in total length. No obvious trend in growth was apparent for sport-caught yellow perch over the past six years.

Job 3. Title: Collect tag recovery data.–A total of 52,043 walleye have been tagged at Monroe (site 61) between 1978 and 2005. An additional 1,346 walleye were tagged on the spawning run in the lower Huron River (site 64) in 2005 to boost total number tagged. Of the Monroe tagged fish, 5,681 (11.0%) have been reported caught by anglers and commercial fishermen through 2005. A total of 1,829 walleye were tagged in 2005; of which 69 were subsequently recovered by fishermen in 2005. There were 95 reported recoveries from all years of tagging, at Monroe, and 61 recoveries from the 2005 Huron River tagging during the subsequent 2004 fishing season. The geographical distribution of the 2005 returns (Table 8) is as follows: St. Clair River 7.4%; Lake St. Clair 1.1%; Detroit River 18.9%; Western Basin-Lake Erie 65.3%; Central Basin-Lake Erie 6.1%; and Eastern Basin-Lake Erie 2.0%. Recoveries were reported from all months except January, November, and December with 91.6% reported during the months of April (17.9%), May (31.6%), June (22.1%), July (15.8%), and August (4.2%).

Job 4. Title: Analyze tag recovery data.–Walleye tag data were analyzed to estimate annual rates for tag recovery and survival during the period from 1990 through 2005. 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

2005 fishing year had been received; thus, the recovery rate estimates for 2005 were comparable to those for prior years.

Walleye tag and recovery data from the Ohio, Ontario, and Michigan surveys covered the period from 1990 through 2005 (Table 9). Walleye were not tagged by Ontario in 1996 and Ohio in 1999; and Michigan tagged very few (94) in 2001. Michigan, Ontario, and Ohio used a monel metal tag which was placed in the lower jaw. During some years, Ontario also used a plastic streamer tag which was 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 63.6% and mean recovery rate of 3.2% (Table 10). These values were used to estimate instantaneous natural mortality (M) according to the relationship $M = Z - uZ/A$ where ($uZ/A = F$) 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 2.73 (Thomas and Haas 1999). A value for u of 8.5% was generated by expanding mean recovery rate (3.11%) by the non-reporting rate (2.73). The resulting value for M was 0.38. 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 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. Anglers reported catching 320 non-reward and 157 reward tags from the 2000 tagged population during the 2000, 2001, 2002, 2003, 2004, and 2005 fishing seasons. The non-reporting ratio for anglers was 2.79 which was almost identical to the 2.73 value calculated from the long-term recovery data from the 1990 reward study. However, commercial operators reported 70 reward tags and only 40 non-reward tags resulting in a non-reporting ratio of 15.70. This was much higher than any non-reporting ratios encountered during the 1990-99 period suggesting that the commercial operators dramatically altered how frequently they reported non-reward tags after 1999. 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.

Job 5. Title: Carry out gill net sampling.–The MDNR has fished experimental gill net at two stations in western Lake Erie since the fall of 1978, as part of the inter-agency assessment program. The 2005 fall gill net survey included two 396-meter sets of variable-mesh multi-filament gill net at each index station. All nets were suspended from the surface. A total of 761 walleye were captured, and sampled for age and growth information.

Job 6. Title: Analyze growth and abundance data from gill net sampling.–Scale samples taken from walleye captured in 2005 fall gill-nets have been processed and aged. Mean length-at-age (mm) is presented in Table 12. Although no trends in walleye growth were evident over the last five years, the low mean size for the 2003 cohort (age-2) was striking. Mean length of yearlings collected in 2005 was near the low end of the range observed since 1978 (Table 13). The total walleye catch-per-effort for the index sites of 190.5 (Table 14) represented a 21% increase from

the previous year, due to the strong contribution from the 2003 cohort (157.5 fish/net-lift) which nearly doubled from the 2004 CPUE for that cohort. In fact, the age-2 CPUE for the 2003 cohort (157.5 fish/net-lift) is the highest age-2 CPUE recorded for any cohort, including the record 1982 and 1986 year classes. Clearly, the 2003 year class is very abundant. Unfortunately, based on yearling catch rates in the index gill net survey, the 2004 cohort appears rather weak. Similarly, catch rates for the 2002 and 2000 cohorts continue to verify their low abundances, suggesting walleye experienced extremely poor recruitment in Lake Erie in those years.

Historical walleye catch data were used to develop a mean rank for the 1974-2004 year classes, some of which were not yet completely represented throughout their life (Table 15). Total harvest included the sport and commercial catches from 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 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, 1996, and 1991. The worst five year classes were 2002, 1995, 1976, 2000, and 1992. Although a pattern of inconsistent recruitment is evident throughout the time series, it is evident that the period from 1992 through 2004 has been characterized by lower recruitment success. With four of the five worst year classes falling within that time frame, and only one of the top five year-classes, adult abundance declined dramatically.

Job 7. Title: Participate in inter-agency work groups.–Data summaries and analyses for 2005 MDNR surveys were completed and presented (as computer files and hard copies) to the Scientific Technical Committee, the Walleye Task Group (WTG), and the Yellow Perch Task Group. Inter-agency walleye tag data for 2005 were compiled and disseminated to each agency. Extensive walleye and yellow perch population modeling was done using the inter-agency tag and fishery data sets.

Job 8. Title: Prepare annual reports.–This progress report was prepared. Additionally, some of the data collected during this study were presented in the following annual status report prepared each winter by the Lake St. Clair Fisheries Research Station for the Great Lakes Fisheries Commission's Lake Erie Committee Annual Meeting:

Thomas, M. V., and R. C. Haas. 2006. Status of the fisheries in Michigan waters of Lake Erie and Lake St. Clair 2005. Report to the Lake Erie Committee of the Great Lakes Fisheries Commission. Michigan Department of Natural Resources, Mt. Clemens.

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Brownie, C., D. R. Anderson, K. P. Burnham, and D. S. Robson. 1985. Statistical inference from band recovery data - a handbook (2nd edition). U. S. Department of the Interior, Fish and Wildlife Service, Resource Publication 156, Washington, D. C.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada 191.

Thomas, M.V., and R. C. Haas. 1999. Dynamics of Lake Erie walleye and yellow perch populations and fisheries. Michigan Department of Natural Resources, Federal Aid in Sport Fish Restoration, Annual Report for Project F-81-R-1, Ann Arbor.

Thomas, M. V., and R. C. Haas. 2000. Status of yellow perch and walleye in Michigan waters of Lake Erie, 1994-98. Michigan Department of Natural Resources, Fisheries Research Report 2054, Ann Arbor.

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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, 1998 to 2005.

Species	Survey year						Mean		
	1998	1999	2000	2002	2004	2005	1978–89	1990–99	1978–2005
Walleye	34.8	38.0	41.4	35.7	38.7	11.6	42.3	43.1	42.2
Smallmouth bass	1.9	1.9	2.2	1.2	3.3	2.2	0.1	1.1	0.7
Yellow perch	33.3	61.0	50.1	74.5	11.2	2.0	254.6	41.5	144.2
Rock bass	1.0	2.8	0.7	1.1	0.9	0.6	1.2	1.4	1.2
White bass	1.3	4.6	4.0	3.0	7.7	6.8	3.9	1.5	3.1
White perch	8.7	79.4	54.7	36.3	62.2	84.1	40.0	29.4	37.1
Pumpkinseed	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0
Bluegill	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Black crappie	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1
Channel catfish	11.4	16.0	5.2	8.0	7.6	1.4	5.5	7.4	6.4
Brown bullhead	0.0	1.0	2.9	0.8	0.7	0.2	2.7	2.7	2.6
White sucker	15.0	6.0	5.8	6.3	4.3	1.6	10.1	9.4	9.3
Redhorse sp.	3.3	2.2	3.8	4.8	4.3	1.8	1.3	2.3	2.1
Freshwater drum	28.3	50.4	11.3	42.7	21.5	4.2	25.8	18.3	22.7
Common carp	3.1	8.0	12.2	1.6	7.6	1.6	6.7	3.4	5.4
Goldfish	0.0	0.1	0.0	0.0	0.1	0.2	1.0	0.5	0.7
Gizzard shad	0.0	0.2	2.4	0.1	0.0	0.2	9.9	0.6	5.1
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	7.9	8.5	3.7	20.8	14.2	3.3	3.7	5.1	5.4
Stonecat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	150.1	280.3	200.4	237.0	184.4	121.7	409.0	167.8	288.3
% yellow perch	22.2	21.8	25.0	31.4	6.1	1.7	55.2	24.8	38.9
% white perch	5.8	28.3	27.3	15.3	33.7	69.1	11.1	15.7	14.7
Net lifts	44	45	51	81	38	42	49	48	50

Table 2.–Age composition (expressed as percentage) of annual walleye catch in spring survey trap nets for Lake Erie, near Monroe, 1993 to 2005.

	Survey year											
Age	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2004	2005
1	–	0.08	0.29	0.04	–	–	0.06	0.19	–	–	–	–
2	3.31	0.76	63.60	5.53	0.98	31.50	23.70	9.08	69.8	4.8	–	35.6
3	32.18	30.86	0.59	25.30	32.30	3.39	49.70	26.70	7.5	55.6	34.8	0.6
4	4.61	23.31	13.10	1.54	22.30	23.1	0.93	35.00	3.8	8.9	3.2	21.5
5	9.41	4.22	4.81	19.70	1.95	13.7	6.47	1.71	3.8	9.7	31.1	4.1
6	11.22	6.45	1.57	15.50	15.10	2.67	5.60	8.51	1.9	9.5	6.5	15.7
7	23.49	13.99	4.91	5.36	8.23	10.3	2.33	5.18	4.7	1.9	8.5	9.0
8	7.92	11.59	6.58	9.35	5.75	4.37	4.02	4.04	0.9	4.4	8.5	5.3
9	4.02	5.27	2.55	8.45	5.23	3.52	1.92	3.80	1.9	1.6	2.2	4.5
10	1.69	2.19	1.47	5.83	4.89	4.17	2.45	2.66	0.9	1.8	2.4	1.8
11	1.95	0.84	0.10	1.97	2.13	1.24	1.05	1.28	2.8	1.0	0.7	1.4
12	0.13	0.38	0.29	0.94	0.52	1.43	1.16	1.23	1.9	0.5	1.1	0.4
13	0.06	0.04	–	0.21	0.29	0.39	0.35	0.24	–	0.1	0.5	–
14	–	–	–	0.04	0.06	–	0.06	0.19	–	–	0.3	–
15	–	–	–	–	0.06	0.06	0.06	–	–	–	0.1	–
Total aged	1,542	2,387	1,017	2,330	1,737	1,532	1,714	2,112	106	2,872	1,472	489

Table 3.–Mean length-at-age (mm) and standard error (SE) of walleye caught in trap nets during spring surveys 1998 to 2005. Sample size in parentheses.

	1998		1999		2000		2002		2004		2005	
Age	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
						Males						
2	337 (301)	0.9	343 (171)	1.8	358 (159)	1.4	358 (122)	1.4	–	–	340 (95)	2.1
3	408 (49)	3.5	407 (711)	0.8	418 (533)	1.0	418 (1410)	0.6	418 (454)	0.9	422 (1)	–
4	446 (323)	1.4	466 (11)	7.3	455 (609)	1.0	460 (215)	1.9	458 (38)	3.9	456 (70)	3.4
5	478 (198)	2.1	483 (95)	2.5	486 (28)	3.1	489 (241)	1.8	492 (351)	1.4	479 (13)	9.7
6	512 (37)	5.3	498 (78)	3.1	512 (150)	2.3	511 (217)	2.8	511 (70)	3.5	517 (38)	4.0
7	521 (147)	2.3	508 (33)	5.9	532 (89)	3.0	537 (44)	5.4	524 (107)	2.7	542 (32)	4.8
8	549 (58)	4.3	544 (60)	5.2	556 (77)	3.4	558 (107)	3.1	544 (93)	3.3	561 (18)	7.4
9	575 (46)	5.6	572 (24)	7.3	567 (61)	4.1	588 (40)	5.1	568 (27)	6.2	584 (9)	13.1
10	585 (45)	5.4	594 (33)	5.7	583 (44)	5.8	595 (45)	4.4	583 (32)	4.0	558 (5)	13.2
11	593 (13)	9.0	594 (15)	8.7	596 (18)	7.8	617 (23)	7.6	598 (9)	10.3	576 (4)	12.0
						Females						
2	332 (1)	–	–	–	345 (2)	20.5	–	–	–	–	–	–
3	518 (1)	–	451 (1)	–	431 (1)	–	452 (25)	4.1	448 (22)	3.6	–	–
4	488 (29)	4.8	528 (2)	37.5	505 (78)	3.3	513 (16)	8.6	500 (4)	25.3	499 (10)	12.5
5	532 (7)	12.3	549 (7)	12.1	546 (5)	14.1	538 (24)	6.1	550 (41)	7.5	562 (1)	–
6	588 (4)	16.2	579 (5)	4.6	601 (20)	6.9	575 (32)	5.0	583 (10)	16.3	570 (3)	29.5
7	605 (11)	10.1	615 (2)	5.0	616 (14)	6.8	628 (7)	6.2	599 (7)	11.8	–	–
8	636 (9)	11.7	641 (7)	12.0	614 (7)	14.4	638 (12)	11.6	629 (15)	7.9	685 (1)	–
9	648 (8)	7.8	634 (3)	10.4	654 (18)	5.0	656 (5)	10.3	604 (3)	14.0	705 (4)	18.4
10	677 (18)	8.2	658 (7)	19.5	693 (11)	9.1	693 (6)	10.7	653 (3)	6.1	715 (1)	–
11	688 (6)	17.3	646 (2)	85.0	690 (8)	12.6	697 (6)	14.5	657 (2)	38.0	745 (1)	–
12	726 (8)	10.4	722 (3)	14.3	705 (13)	13.1	728 (10)	11.8	704 (2)	14.5	712 (1)	–

Table 4.–Yellow perch catch per unit effort (CPUE) by age for spring trap net surveys during 1989 to 2004 (expressed as number caught per net per 24 h).

Year	Days	Age 2	3	4	5	6	7	Age 8+	Total CPUE
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
2001 [2]	21.6	0.00	4.98	2.21	6.48	1.74	0.79	0.24	16.44
2002	153.0	0.10	1.23	8.84	9.41	17.13	2.09	1.39	40.20
2004	89.0	0.00	1.39	0.46	1.12	2.88	1.54	0.92	8.33
2005	80.2	0.02	0.02	0.54	0.16	0.05	0.19	0.07	1.06

[1]Sampling period delayed six weeks.
[2]Sampling period delayed eight weeks.

Table 5.–Mean length-at-age (mm) and standard error (SE) of yellow perch caught in trap nets during spring surveys 1997 to 2005. Sample size in parentheses.

	1997		1998		1999		2000		2002		2004		2005	
Age	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Males														
2	–	–	–	–	175 (5)	4.5	183 (6)	4.9	201 (1)		–	–	–	–
3	191 (30)	1.9	206 (7)	12.6	185 (32)	3.4	207 (7)	8.9	199 (4)	7.0	189 (9)	1.4	–	–
4	212 (25)	3.1	207 (72)	2.3	212 (26)	4.8	213 (35)	3.8	219 (18)	7.5	208 (7)	10.9	232 (11)	10.2
5	231 (16)	5.6	226 (26)	3.9	230 (42)	3.6	238 (37)	3.6	242 (27)	4.4	240 (14)	5.6	246 (5)	14.7
6	257 (17)	4.8	250 (8)	7.8	248 (10)	5.5	251 (15)	3.7	245 (41)	3.9	252 (22)	3.3	256 (1)	–
7	255 (18)	1.8	268 (12)	5.0	–	–	252 (4)	12.4	271 (9)	5.5	250 (19)	4.5	261 (6)	10.4
8	266 (2)	2.0	290 (1)	–	–	–	–	–	295 (2)	31.5	246 (9)	4.5	–	–
9	–	–	–	–	–	–	307 (1)	–	–	–	264 (1)	–	309 (1)	–
10	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Females														
3	215 (14)	3.7	199 (5)	14.4	224 (22)	4.8	220 (9)	7.8	227 (4)	7.2	244 (24)	4.0	264 (2)	21.0
4	238 (48)	3.0	240 (53)	3.8	249 (23)	5.8	249 (36)	4.3	263 (33)	5.1	240 (6)	5.3	252 (32)	3.6
5	261 (23)	5.8	254 (38)	4.9	275 (58)	3.9	264 (19)	5.6	263 (15)	9.4	267 (12)	7.4	274 (8)	9.7
6	295 (27)	3.7	279 (15)	5.6	278 (16)	6.7	286 (23)	4.0	282 (51)	4.6	305 (39)	4.2	306 (3)	12.0
7	305 (10)	6.2	308 (9)	5.8	308 (4)	7.4	289 (10)	6.8	315 (6)	12.4	299 (14)	8.7	307 (9)	7.6
8	317 (10)	6.3	305 (4)	10.2	327 (4)	7.9	314 (2)	2.0	307 (8)	8.5	296 (13)	9.3	289 (1)	–
9	–	–	320 (1)	–	334 (1)	–	324 (2)	16.5	309 (3)	5.6	314 (5)	7.2	295 (2)	14.0
10	–	–	–	–	–	–	–	–	–	–	328 (3)	8.8	281 (1)	–

Table 6.–Mean length-at-age (mm) of walleye sampled from Michigan's Lake Erie sport fishery, 2000 to 2005. Sample size in parentheses.

Age	Survey year											
	2000		2001		2002		2003		2004		2005	
1	357	(2)	–	–	336	(4)	–	–	–	–	–	–
2	363	(152)	356	(142)	371	(22)	366	(146)	–	–	389	(191)
3	430	(208)	427	(75)	432	(419)	434	(37)	432	(308)	436	(25)
4	470	(170)	469	(45)	466	(80)	478	(380)	463	(68)	465	(527)
5	500	(28)	500	(27)	499	(52)	494	(54)	500	(246)	461	(19)
6	510	(19)	535	(5)	525	(38)	521	(35)	518	(48)	523	(245)
7	555	(10)	531	(7)	539	(11)	564	(28)	552	(33)	540	(35)
8	561	(6)	603	(4)	580	(17)	570	(11)	553	(29)	574	(23)
9	638	(2)	612	(3)	609	(12)	583	(9)	654	(5)	549	(20)
10	650	(4)	670	(3)	665	(4)	604	(11)	606	(7)	655	(1)
11	742	(2)	742	(1)	607	(4)	609	(4)	678	(5)	584	(4)
12	746	(1)	–	–	705	(3)	652	(3)	709	(2)	555	(4)
13	–	–	–	–	–	–	704	(3)	687	(2)	–	–
14	–	–	–	–	–	–	747	(1)	–	–	659	(9)
Mean	437	(607)	418	(312)	456	(667)	467	(722)	478	(753)	473	(1,106)

Table 7.–Mean length-at-age (mm) of yellow perch sampled from Michigan's Lake Erie sport fishery, 2000 to 2005. Sample size in parentheses.

Age	Survey year											
	2000		2001		2002		2003		2004		2005	
1	185	(1)	–	–	174	(19)	179	(2)	154	(9)	175	(2)
2	185	(100)	188	(63)	187	(24)	195	(180)	194	(9)	207	(313)
3	195	(127)	207	(107)	209	(242)	211	(82)	209	(341)	214	(53)
4	212	(289)	220	(33)	224	(325)	225	(240)	216	(79)	231	(95)
5	218	(140)	234	(33)	233	(104)	242	(160)	228	(108)	229	(133)
6	241	(33)	253	(2)	248	(92)	249	(54)	246	(73)	237	(51)
7	257	(10)	278	(2)	279	(24)	256	(33)	253	(14)	239	(28)
8	315	(1)	–	–	287	(5)	322	(1)	272	(7)	243	(13)
9	282	(1)	–	–	317	(3)	331	(3)	272	(5)	262	(2)
10	–	–	–	–	306	(2)	–	–	–	–	312	(2)
11	–	–	–	–	–	–	–	–	338	(1)		
Mean	208	(704)	208	(240)	224	(843)	223	(755)	219	(646)	219	(694)

Table 8.–Geographical distribution of tag recoveries, 1993 to 2005, from walleye tagged at Monroe, Michigan, Lake Erie (expressed as a percentage of the total number recovered each year).

Geographical area	1993	1994	1995	1996	1997	1998	1999	2000	2001[1]	2002	2003	2004	2005
Lake Huron – Saginaw Bay	1.6	2.0	0.8	1.7	0.0	2.4	1.2	0.8	0.0	1.0	0.8	1.0	0.0
St. Clair River	6.1	6.2	8.3	2.8	4.2	7.9	9.5	4.6	0.0	6.9	7.4	8.1	7.4
Lake St. Clair	2.6	3.1	2.3	4.5	4.9	7.1	4.8	6.1	0.0	7.4	4.9	2.0	1.1
Detroit River	8.1	8.8	12.1	11.2	12.2	6.3	8.3	15.3	4.3	27.5	18.9	10.1	18.9
Western Basin – Lake Erie	58.7	54.1	43.9	54.1	57.1	56.7	53.6	65.6	76.6	48.5	55.7	70.7	65.3
Central Basin – Lake Erie	17.7	21.6	28.8	22.9	20.1	16.5	20.2	5.3	13.8	6.7	8.2	6.1	6.3
Eastern Basin – Lake Erie	3.5	4.1	3.8	2.8	1.6	3.1	1.2	2.3	4.3	2.0	2.5	2.0	1.1
Lake Erie – total	79.9	79.8	76.5	79.8	78.8	73.2	75.0	73.2	93.6	57.2	66.4	78.8	72.6

[1] Only 94 tags applied in 2001.

Table 9.–Nonreward tag recovery data for walleye tagged by Ohio, Ontario, and Michigan at Lake Erie sites, 1990 to 2005.

Year	Number tagged	Year																Percent recovered
		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
1990	6,323	225	152	96	83	41	18	20	11	4	2	0	0	3	0	2	0	13.8
1991	8,602	–	275	224	160	72	50	43	21	15	4	2	3	0	3	1	0	9.7
1992	7,260	–	–	290	228	93	49	35	22	11	6	4	3	3	1	0	3	10.1
1993	7,359	–	–	–	402	142	84	70	29	15	9	4	3	4	2	0	0	10.2
1994	5,539	–	–	–	–	183	117	80	41	35	11	11	1	6	2	2	1	8.8
1995	5,540	–	–	–	–	–	169	92	46	22	4	6	5	5	5	2	1	6.4
1996	5,718	–	–	–	–	–	–	254	123	57	31	13	14	14	5	3	1	8.9
1997	6,261	–	–	–	–	–	–	–	195	83	35	18	7	17	4	4	4	5.8
1998	1,668	–	–	–	–	–	–	–	–	28	20	4	0	8	5	0	1	4.0
1999	1,630	–	–	–	–	–	–	–	–	–	36	32	13	13	4	4	1	6.1
2000	4,469	–	–	–	–	–	–	–	–	–	–	117	60	40	23	19	10	8.4
2001	2,719	–	–	–	–	–	–	–	–	–	–	–	79	32	33	13	23	6.7
2002	5,291	–	–	–	–	–	–	–	–	–	–	–	–	150	135	43	44	7.4
2003	3,461	–	–	–	–	–	–	–	–	–	–	–	–	–	159	52	29	7.5
2004	6,753	–	–	–	–	–	–	–	–	–	–	–	–	–	–	135	70	5.7
2005	7,447	179	–	–	–	–	–	–	–	–	–	–	–	–	–	–	179	2.4

Table 10.–Annual survival and recovery rate (percent) during 1990 to 2005 for Lake Erie walleye 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
1990	4.95	0.27	91.41	4.77
1991	2.88	0.15	67.10	3.43
1992	3.76	0.18	62.21	3.28
1993	4.98	0.21	58.98	3.54
1994	3.35	0.18	85.18	6.00
1995	2.53	0.16	42.96	3.03
1996	4.23	0.22	81.03	5.80
1997	2.76	0.17	74.92	10.07
1998	1.78	0.23	35.46	5.65
1999	2.19	0.26	46.16	5.31
2000	3.34	0.23	75.06	6.96
2001	2.64	0.23	54.94	5.11
2002	3.03	0.20	57.54	4.78
2003	4.36	0.30	54.42	5.41
2004	3.60	0.26	87.39	10.00
2005	2.40	0.18	–	–
Mean	3.36	0.06	64.98	0.85

Table 11.–Mean total length-at-age (mm) for walleye caught during fall in survey index multi-filament gill nets (sample size in parentheses) 2001 to 2005.

Age	Survey year									
	2001		2002		2003		2004		2005	
Sexes combined										
1	345	(26)	338	(316)	337	(8)	308	(688)	320	(15)
2	418	(293)	420	(51)	412	(253)	421	(22)	393	(630)
3	460	(59)	464	(244)	472	(11)	454	(269)	410	(26)
4	493	(61)	487	(48)	494	(55)	487	(26)	470	(40)
5	521	(39)	502	(33)	529	(8)	506	(86)	458	(8)
6	540	(3)	528	(15)	533	(10)	515	(20)	515	(27)
7	565	(3)	–	–	529	(9)	516	(17)	514	(4)
8	558	(2)	530	(2)	–	–	535	(8)	541	(4)
9	–	–	580	(1)	602	(1)	540	(3)	512	(1)
10	–	–	–	–	–	–	605	(3)	536	(3)
Mean	439	(486)	409	(710)	434	(356)	374	(1,144)	404	(761)
Males										
1	342	(17)	335	(140)	343	(1)	304	(330)	316	(330)
2	412	(181)	413	(35)	407	(186)	416	(13)	389	(13)
3	443	(40)	451	(170)	469	(10)	440	(179)	403	(179)
4	480	(46)	477	(34)	476	(39)	481	(22)	459	(22)
5	493	(22)	490	(26)	472	(2)	493	(71)	464	(71)
6	540	(3)	501	(11)	527	(5)	497	(14)	501	(14)
7	528	(2)	–	–	526	(7)	509	(16)	514	(16)
8	499	(1)	538	(1)	–	–	514	(6)	501	(6)
9	–	–	–	–	602	(1)	540	(3)	512	(3)
10	–	–	–	–	–	–	614	(2)	496	(2)
Mean	430	(312)	415	(417)	426	(252)	383	(657)	401	(509)
Females										
1	350	(9)	339	(176)	337	(7)	311	(355)	325	(8)
2	429	(112)	435	(16)	426	(67)	429	(6)	399	(212)
3	497	(19)	492	(74)			483	(77)	419	(12)
4	533	(15)	511	(14)	548	(8)	519	(4)	502	(10)
5	556	(17)	546	(7)	563	(4)	570	(14)	416	(1)
6	638	(1)	604	(4)	573	(2)	556	(5)	578	(5)
7	618	(1)	–	–	–	–	639	(1)	–	–
8	–	–	522	(1)	–	–	645	(1)	660	(1)
9	–	–	580	(1)	–	–	587	(1)	–	–
Mean	456	(174)	401	(293)	440	(88)	356	(465)	410	(252)

Table 12.–Mean total length (mm) for yearling walleye caught in Michigan fall gill-net surveys (sample size in parentheses) 1978 to 2005.

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
2001	2000	345	(26)	2.0
2002	2001	338	(316)	1.0
2003	2002	338	(8)	6.9
2004	2003	308	(688)	0.8
2005	2004	316	(7)	3.9

Table 13.–Walleye CPUE (number per net lift), by cohort, in multi-filament gill nets during fall surveys on Michigan waters of Lake Erie, 1988 to 2005.

Year class	Total CPUE	Survey year																	
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1976	18.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1977	171.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1978	61.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1979	72.4	0.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1980	92.7	0.3	0.0	0.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1981	72.3	0.5	0.3	0.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1982	306.2	5.3	7.5	3.5	0.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1983	34.6	3.5	1.8	1.8	2.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1984	147.7	3.5	8.0	8.3	2.0	0.5	0.3	0.5	–	–	–	–	–	–	–	–	–	–	–
1985	177.2	9.3	14.3	8.5	1.5	1.3	0.8	1.0	–	–	–	–	–	–	–	–	–	–	–
1986	297.5	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	17.0	–	–	–	–	–	2.0	7.3	2.0	0.3	1.5	2.3	1.0	0.3	–	–	–	0.3	–
1993	170.3	–	–	–	–	–	–	73.3	71.0	11.8	8.08	3.3	1.5	0.3	0.5	–	–	0.3	0.3
1994	131.8	–	–	–	–	–	–	–	63.3	43.0	14.0	4.8	2.8	1.8	0.8	–	–	0.8	0.5
1995	9.9	–	–	–	–	–	–	–	–	3.3	1.3	0.8	1.0	0.8	0.8	0.3	–	0.8	0.8
1996	180.0	–	–	–	–	–	–	–	–	–	37.5	84.3	30.5	13.3	9.8	1.8	1.0	1.5	0.3
1997	133.0	–	–	–	–	–	–	–	–	–	–	54.3	34.3	20.3	15.3	3.0	1.0	3.8	1.0
1998	82.4	–	–	–	–	–	–	–	–	–	–	–	26.0	29.5	14.8	6.3	1.0	3.8	1.0
1999	177.4	–	–	–	–	–	–	–	–	–	–	–	–	57.0	73.3	21.5	5.8	13.0	6.8
2000	19.6	–	–	–	–	–	–	–	–	–	–	–	–	–	6.5	6.3	0.8	4.0	2.0
2001	129.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	42.8	32.5	43.8	10.0
2002	11.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.8	4.0	6.5
2003	238.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	81.2	157.5
2004	3.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–		3.8
Total		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	121.8	82.0	42.1	157.3	190.5
Net lifts		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

Table 14.–Mean rank of Lake Erie walleye year classes based on measured harvest and survey catch per effort.

Year class	Total harvest	Harvest rank	Trap CPUE	Trap rank	Gill-net CPUE	Gill-net rank	Mean rank
1974	2,727,989	19	0.4	29	13.6	28	25.3
1975	3,356,110	16	1.3	26	42.8	23	21.7
1976	812,855	28	0.8	28	18.4	26	27.3
1977	6,837,878	7	10.2	18	171.0	8	11.0
1978	3,578,926	15	8.9	20	61.6	20	18.3
1979	2,535,057	22	8.7	21	72.4	18	20.3
1980	5,426,616	11	21.5	8	92.7	17	12.0
1981	3,093,746	17	16.9	13	72.3	19	16.3
1982	21,305,596	1	98.6	1	306.2	1	1.0
1983	2,572,846	21	21.4	9	34.6	24	18.0
1984	6,639,741	8	28.1	3	147.7	10	7.0
1985	7,518,595	4	27.0	5	177.2	7	5.3
1986	13,469,004	2	56.6	2	297.5	2	2.0
1987	4,081,685	13	27.5	4	127.8	15	10.7
1988	3,941,361	14	15.9	14	125.0	16	14.7
1989	2,688,970	20	8.9	19	52.6	22	20.3
1990	6,106,960	10	21.0	11	136.4	11	10.7
1991	7,163,771	5	21.1	10	194.3	4	6.3
1992	1,579,416	26	3.1	23	17.0	27	25.3
1993	6,356,968	9	22.1	7	170.3	9	8.3
1994	7,803,377	3	15.2	15	131.8	13	10.3
1995	851,533	27	2.1	25	9.9	30	27.3
1996	7,080,274	6	23.4	6	180.0	5	5.7
1997	2,413,865	23	12.3	16	133.0	12	17.0
1998	2,398,200	24	5.2	22	56.4	21	22.3
1999	4,606,869	12	17.9	12	177.4	6	10.0
2000	516,027	29	1.2	27	19.6	25	27.0
2001	2,925,740	18	11.9	17	129.1	14	16.3
2002	104,087	30	0.0	30	11.3	29	29.7
2003	1,886,218	25	2.2	24	238.7	3	17.3
2004	1,042	31	0.0		3.8	31	31.0
Mean	4,592,946		17		110		

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