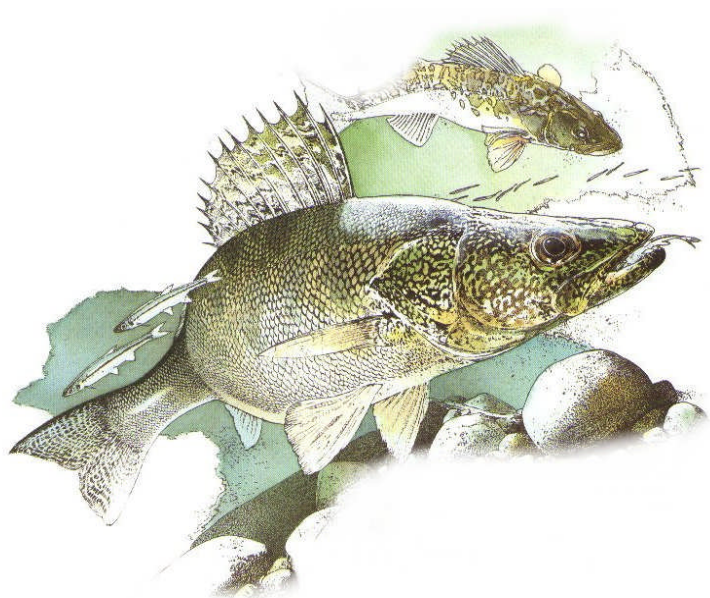
Report for 2003 by the

LAKE ERIE WALLEYE TASK GROUP

March 2004



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Charges to the WTG from the STC, 2003-2004

The charges from the Standing Technical Committee (STC) to the Walleye Task Group (WTG) for the period from March 2003 to February 2004 were to:

1) Produce RAH levels in 2004 and 2005 that promote rehabilitation of Lake Erie walleye stocks.
2) Maintain and update centralized time database for population modeling; including tagging, fishing harvest and effort by grid, growth rate, maturity schedule and agency or interagency abundance indices. Additionally, note the continuing effort to establish biological reference points (BRP's) by examining walleye spawning stock biomass (SSB), stock recruitment (S/R) or Spawn-Recruit relationships for use with ADMB software.
3) Assemble data for development of a spatially explicit database describing the Lake Erie walleye resource, to search for evidence of stock discreteness and contributions to lake-wide fisheries.
4) Develop catch-age analysis for Eastern Basin walleye in cooperation with studies underway by P. Sullivan, E. Rutherford and B. Shuter.
5) Continue the pursuit of walleye management aided by the development of a risk assessment analysis tool.

Review of Walleye Fisheries in 2003

Fishery effort and walleye harvest data were combined for all jurisdictions and Management Units (Figure 1) to produce lake-wide estimates. The 2003 total estimated lake-wide harvest of walleye was 2.7 million fish, which was a 12% increase from the 2.4 million fish caught in 2002 (Tables 1 and 2). This harvest represented approximately 80% of the 2003 total allowable catch (TAC) of 3.4 million walleye and included walleye harvested in commercial and sport fisheries. The sport harvest of 1.3 million fish was the second lowest since 1976 but represented an increase of 28% from the year 2002, which was the lowest in this period. (Table 2, Figure 2). The Ontario commercial harvest of 1.4 million fish in 2003 was 1% higher than the 2002 harvest (Table 2, Figure 2). The commercial harvests in 2002 and 2003 were the lowest since 1983 and only 66% of the 1975-2003 mean. These harvests were low due to the reduced TAC during the period of the Coordinated Percid Management Strategy (CPMS) 2001 – 2003.

In 2003, sport effort increased from 2002 up to a total of 3.3 million angler hours. This level of sport effort remains generally consistent with a declining trend that began in 1988 (Table 3, Figure 3). Sport effort declined by 4% in Management Unit 3, and increased slightly in Management Units 1 and 4 (2% and 22% respectively). The increase in effort in Management Unit 1 was due to increased effort in Ohio.

Conversely, effort in Michigan declined in Management Unit 1 by 46%. Also observed in 2003, was an increase in sport effort of 52% in Management Unit 2 (Ohio). Lake-wide commercial gill net effort decreased 8% to 12,512 kilometers of net and was the lowest total effort since 1981. This decline in gill net activity was observed in all Management Units, with the exception of Management Unit 1 where there was a small increase in commercial effort (Table 3, Figure 4).

Sport catch-per-unit-effort (CUE) increased in all areas of the lake. The lake-wide average sport catch rate of 0.37 fish per rod hour was 14% below the 1975-2003 mean (Table 4, Figure 5). However, it was a 16% increase over the 2002 value. In Management Units 2, and 4 catch rates were above the long term mean, whereas in Management Units 1 and 3, sport catch rates were below the 1975-2003 mean. Average commercial gill net CUE (units combined) increased slightly to 114 walleye for every kilometer of net in 2003. Gill net catch rates were above average in Management Units 1 and 4, but below average in Management Unit 3 and only slightly below average in Management Unit 2. This marks the third consecutive year of increasing catch rates for the commercial fishery, and represents a reversal of the trend of declining CUE's observed since the mid 1980's (Table 4, Figure 5). The increase in 2003 represents a 114% increase over the year 2000 catch rate of 53.2 walleye/kilometer.

A substantial portion of walleye harvested in both the sport (40.0%) and commercial (35.5%) fisheries were age 4 walleye (the 1999 year class). Age 2 walleye (the 2001 year-class) also contributed significantly in both fisheries, 26.4% (commercial) and 18.1% (sport) (Tables 5, 6). Together these year-classes comprised 65% of the harvest in Management Unit 1, 57% in Management Unit 2, 48% in Management Unit 3, and 14% in Management Unit 4. Harvests of older fish typically increases from west to east with 34% and 60% of the fish harvested in Management Units 3 and 4 being age-7 and older.

Across all management units, the mean age of walleye in the harvest ranged from 4.6 to 8.5 years old in the sport fishery and from 3.7 to 6.6 in the commercial fishery, with a mean of 4.5 years old for all walleye in the combined fisheries (Table 7, Figure 6). The mean age of fish in both the sport and commercial fisheries increased from 2002 values. The mean age increased from 4.2 to 5.0 years (19%) in the sport fishery, and 3.5 to 4.1 years (17%) in the commercial fishery in 2003. The mean ages for both fisheries were above the long-term means of 3.9 (sport) and 3.5 (commercial) from 1975 to 2003.

Coordinated Percid Management Strategy

The Lake Erie Committee (LEC) announced in March, 2000 that it would develop a Coordinated Percid Management Strategy to protect and rebuild the walleye and yellow perch stocks in Lake Erie. To promote an increase in the abundance of walleye, the LEC proposed substantial cuts to the walleye harvest. It was decided that a conservative total allowable catch (TAC) for 2001 to 2003 (inclusive) would best achieve the CPMS objectives, and an annual TAC ceiling of 3.4 million fish was established for 2001 to 2003 walleye harvests. 2003 was the final year of the CPMS initiative and a report on the strategy will soon be completed and available from the LEC.

Relative Abundance and Catch-at-Age Analysis

The walleye catch-at-age model used for the purposes of this report was derived from the model of Deriso et al. (1986). The walleye task group has been using this model for several years and started with the application version called CAGEAN (Deriso et al., 1986). In addition to using fishery derived data, this model includes information from three index gill net surveys from: Michigan (far west end of the west basin of Lake Erie), Ohio (southern half of the west and west central basins of Lake Erie) and Ontario (northern half of western and central Lake Erie). The catch at age model uses natural log (LN) transformed catch and effort data to estimate the abundance at age of fish. The solution of the catch at age equation is obtained using non-linear sums of squares and a penalized likelihood function. The variance ratio technique was employed to estimate the weights assigned to the variances of each of the surveys (Deriso et al., 1986 and Quinn and Deriso, 1999).

In 2003 the walleye ADMB model was updated to include only data from Management Units 1, 2, and 3 (west and central basins). Fishery and survey data from Michigan, Ohio, and Ontario were used in the 2003 model. This modification was performed in order to standardize the data input into the catch-at-age model with the area where walleye quota is set. The walleye population in the east basin was modeled separately (see section: "*Eastern Basin Catch-At-Age Analysis*").

The 2003 population estimate was 29 million age 2+ walleye (Table 8, Figure 7) with approximately 9 million age 4+ walleye (Table 8). The increase in the walleye population, from 2002 levels, was caused by the recruitment of a strong 2001 year class, contributing almost 19 million age 2 fish to the population (Table 8).

Recruitment Estimator for Incoming Age 2 Walleye and 2004 Population Size Projection

A linear regression model was used to estimate age 2 recruitment for 2004 and 2005. This regression utilized estimates of age 2 abundance from catch-at-age analysis and young-of-year trawl data from pooled Ontario and Ohio trawling (Table 9, Figure 8). Trawl surveys in 2002 indicated that very few young-of-year walleye were produced in that year. Therefore, the 2002 year class is expected to be the lowest on record and is projected to add only 0.58 million age 2 fish to the 2004 population (Table 9, Figure 9). In contrast, the trawl surveys conducted in 2003 indicated that the 2003 year class is the largest observed over the 1987-2003 series, and may be comparable to the historically strong year classes of the 1980s. The linear regression method estimated that age 2 recruitment in 2005 will be approximately 30 million walleye (Table 9, Figure 9).

Stock size estimates for 2004 were projected using catch-at-age analysis estimates of the 2003 population size, estimated survival rates in 2003 and the age 2 recruitment estimate for 2004 (Table 8). The 2004 estimated abundance of age 2+ walleye is approximately 19 million (Table 8, Figure 10), a 34% decline from 2003. The abundance of age 4+ walleye (spawners) in 2004 was about 6 million walleye (Table 8). However, due to the maturing 2001 year class, the abundance of age 4+ walleye in 2005 is projected to increase.

The abundance of walleye in 2005 was estimated based on varying levels of fishing mortality on the fishable stock in 2004 (Table 10). The estimate of recruitment in 2005 (30.6 million age 2 walleye) was included in the 2005 population estimate of age 2 and older fish

Harvest Decision Table for 2004

The first objective of the CPMS was to reverse declines and rebuild stocks of walleye in Lake Erie. To do this, the LEC desired a single TAC to serve as a ceiling for 2001-2003. A ceiling TAC of 3.4 million walleye was recommended. 2003 was the final year that the CPMS 3.4 million fish ceiling TAC was in effect. For 2004, no exploitation policy was defined, so no specific RAH range could be put forward by the WTG. However, in 2003 the WTG projected a decline in walleye abundance for 2004 and recommended all agencies prepare stakeholders for a significant reduction in TAC. The projected walleye abundance in 2004 (19 million fish) represents a decrease of 34% from the 2003 estimated abundance of 29 million walleye. In order to inform decision makers, the WTG prepared Table 10 which illustrates the results of various harvest scenarios by applying a range of fishing mortality rates to the projected standing stock size estimate for the 2004 walleye population. Included in the table are survival rates, exploitation rates, and the estimated 2005 population abundance resulting from a given level of fishing mortality, as well as several reference fishing rates representing targeted and observed fishing rates for the walleye population during recent years. Note that an increase in walleye abundance is forecasted for 2005 (relative to 2004) as the exceptionally strong 2003 cohort recruits to the population as 2 year olds.

Other Walleye Task Group Charges

Centralized Databases

WTG members currently manage several databases. The tagged walleye database, consisting of tag return and tagged population information dating back to 1986, is maintained by MDNR. Fishery characteristics (catch at age and effort) are part of the database used in catch-at-age analysis. A spatially explicit version of these data (e.g., catch and effort by statistical grid) is managed by MDNR. Growth, maturity, catch, and effort data are stored in an interagency gill net database that is managed by ODNR-Sandusky. This database is in the process of being reformatted and converted into a relational database. Growth and relative abundance data from the interagency trawl program in the western basin are stored in databases managed jointly by Ohio DNR and Ontario MNR. Use of WTG databases by non-members is permitted following protocol established in the 1994 WTG Report and reprinted in the 2003 WTG Report.

Analysis of Walleye Distribution Data and Stock Discrimination

To answer the third charge and address issues that are important to the rebuilding of walleye stocks in Lake Erie, several research projects are underway. Three separate teams of researchers are examining walleye stock structure using different genetic techniques, morphometrics, and analysis of chemical composition and shape of otoliths. These studies are complimentary and will provide different levels of stock discrimination, information about walleye life history in relation to habitat, and an economically feasible and practical method to discriminate stocks. They are occurring at Cleveland State University (Dr. Carol Stepien), Trent University (Dr. Chris Wilson) and the University of Windsor (Dr. Peter Sale and Dr. Tim Johnson OMNR - Wheatley).

Two other projects, which are funded primarily by the Great Lake Fisheries Commission, are focused on modeling walleye distribution and movement. At Cornell University, Dr. Pat Sullivan and a M.Sc. candidate are developing a spatio-temporal model using catch, effort, and tag return data. This work is expected to be complete in 2004. In 2003, work was completed, by Dr. Ed Rutherford and his graduate students at the University of Michigan, on a spatial model relating walleye movements and growth to water temperature and forage abundance in Lake Erie. This bioenergetics model uses walleye fishery and tag return data, forage fish abundance, and water surface temperature derived from satellite imagery to estimate the growth potential of walleye in each basin of the Lake. The results of the above studies will be reported upon independently by their principal investigators.

Eastern Basin Catch-At-Age Analysis

The Walleye Task Group has been partnering with three research projects funded by the Great Lakes Fisheries Commission's Coordination Activities Program (CAP), and the U.S. Fish and Wildlife Restoration Act. These efforts have been assembling and analyzing temporally and spatially explicit fisheries statistics for the Lake Erie walleye resource with the objective of incorporating knowledge of dynamics of individual walleye stocks, and broad seasonal movement patterns into the walleye stock assessment model. The completion of these research projects is expected during 2004 and should directly support development of a stock assessment model for the eastern basin walleye resource.

The WTG also began development of this preliminary ADMB catch-at-age model for eastern Lake Erie's walleye resource. This model incorporates catch-at-age walleye harvest values from Ontario commercial gill nets, New York and Pennsylvania anglers, in addition to survey data from Ontario and New York. A long-term New York walleye tagging study provided the natural mortality estimate of 0.16 used for this model. Presently eight years of data have been included in preliminary efforts (1996 to 2003) and the WTG is working to assemble data for years prior to 1996 in support of this project. The final model will also incorporate the findings of the three aforementioned GLFC-sponsored research projects.

Decision Analysis

In 2002, the WTG was charged with investigating the merits of a Decision Analysis (DA) model to enhance the ability of the LEC to understand levels of uncertainty and risk with respect to achieving population targets when setting annual TACs and developing long term management strategies for walleye. In 2002, Dr. Mike Jones (MSU and GLFC PERM) led a CAP funded workshop to educate the LEC and WTG on the DA process, and to take steps toward building a DA model for Lake Erie walleye. In 2003, the LEC obtained CAP funding to develop the Decision Analysis model with the assistance of Dr. Mike Jones and a decision analysis team consisting of Members of the LEC and WTG. During 2003, members of the WTG and of the decision analysis team worked on several tasks with deliverables for use in the DA including; investigating natural mortality rates for Lake Erie walleye, describing the walleye stock size and recruitment relationship, and creating fishery objectives for use in the model. Through 2003, significant progress was made, and it is expected that the DA model will be completed by early 2005 for evaluation and possible use in March 2005.

Acknowledgements

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Literature Cited

Deriso, R.B., T.J. Quinn II and P.R. Neal. 1985. Catch-age analysis with auxiliary information. Can. J. Fish. Aquat. Sci. 42: 815 –824.

Quinn, Terrance and Richard Deriso. 1999. *Quantitative Fish Dynamics*. Oxford University Press. London.

Walleye Task Group (WTG). 2003. Report of the Lake Erie Walleye Task Group to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission.

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Table 1. Lake Erie walleye total allowable catch (top) and measured harvest (bottom, bold), in numbers of fish, from 1977 to 2003. Allocations based on water area are: Ohio, 51.4%; Ontario, 43.3%; and Michigan, 5.3%. New York and Pennsylvania do not have assigned quotas but are included in the annual catch total.

		TAC Area (MU-1, MU-2, MU-3)				Non TAC Area (MU-4)				All Areas
Year		Michigan	Ohio	Ontario	Total	NY	Penn.	Ontario	Total	Total
1977	TAC	87,600	521,600	386,300	995,500				0	995,500
	Har	**106,530**	**2,167,500**	**371,403**	**2,645,433**				**0**	**2,645,433**
1978	TAC	73,000	433,000	321,000	827,000				0	827,000
	Har	**72,195**	**1,586,756**	**446,774**	**2,105,725**				**0**	**2,105,725**
1979	TAC	207,000	1,230,000	911,000	2,348,000				0	2,348,000
	Har	**162,375**	**3,314,442**	**734,082**	**4,210,899**				**0**	**4,210,899**
1980	TAC	261,700	1,558,600	1,154,100	2,974,400				0	2,974,400
	Har	**183,140**	**2,169,800**	**1,049,269**	**3,402,209**				**0**	**3,402,209**
1981	TAC	367,400	2,187,900	1,620,000	4,175,300				0	4,175,300
	Har	**95,147**	**2,942,900**	**1,229,017**	**4,267,064**				**0**	**4,267,064**
1982	TAC	504,100	3,001,700	2,222,700	5,728,500				0	5,728,500
	Har	**194,407**	**3,015,400**	**1,260,852**	**4,470,659**				**0**	**4,470,659**
1983	TAC	572,000	3,406,000	2,522,000	6,500,000				0	6,500,000
	Har	**145,847**	**1,864,200**	**1,416,101**	**3,426,148**				**0**	**3,426,148**
1984	TAC	676,500	4,028,400	2,982,900	7,687,800				0	7,687,800
	Har	**351,169**	**4,055,000**	**2,178,409**	**6,584,578**				**0**	**6,584,578**
1985	TAC	430,700	2,564,400	1,898,800	4,893,900				0	4,893,900
	Har	**460,933**	**3,730,100**	**2,435,627**	**6,626,660**				**0**	**6,626,660**
1986	TAC	660,000	3,930,000	2,910,000	7,500,000				0	7,500,000
	Har	**605,600**	**4,399,400**	**2,617,507**	**7,622,507**				**0**	**7,622,507**
1987	TAC	490,100	2,918,500	2,161,100	5,569,700				0	5,569,700
	Har	**902,500**	**4,433,600**	**2,688,558**	**8,024,658**				**0**	**8,024,658**
1988	TAC	397,500	3,855,000	3,247,500	7,500,000				0	7,500,000
	Har	**1,996,788**	**4,890,367**	**3,054,402**	**9,941,557**	**85,282**			**85,282**	**10,026,839**
1989	TAC	383,000	3,710,000	3,125,000	7,218,000				0	7,218,000
	Har	**1,091,641**	**4,191,711**	**2,793,051**	**8,076,403**	**129,226**			**129,226**	**8,205,629**
1990	TAC	616,000	3,475,500	2,908,500	7,000,000				0	7,000,000
	Har	**747,128**	**2,282,520**	**2,517,922**	**5,547,570**	**47,443**			**47,443**	**5,595,013**
1991	TAC	440,000	2,485,000	2,075,000	5,000,000				0	5,000,000
	Har	**132,118**	**1,577,813**	**2,266,380**	**3,976,311**	**34,137**			**34,137**	**4,010,448**
1992	TAC	329,000	3,187,000	2,685,000	6,201,000				0	6,201,000
	Har	**249,518**	**2,081,919**	**2,497,705**	**4,829,142**	**14,384**			**14,384**	**4,843,526**
1993	TAC	556,500	5,397,000	4,546,500	10,500,000				0	10,500,000
	Har	**270,376**	**2,668,684**	**3,821,386**	**6,760,446**	**40,032**			**40,032**	**6,800,478**
1994	TAC	400,000	4,100,000	3,500,000	8,000,000				0	8,000,000
	Har	**216,038**	**1,468,739**	**3,431,119**	**5,115,896**	**59,345**			**59,345**	**5,175,241**
1995	TAC	477,000	4,626,000	3,897,000	9,000,000				0	9,000,000
	Har	**107,909**	**1,435,188**	**3,813,527**	**5,356,624**	**26,964**			**26,964**	**5,383,588**
1996	TAC	583,000	5,654,000	4,763,000	11,000,000				0	11,000,000
	Har	**174,607**	**2,316,425**	**4,524,639**	**7,015,671**	**38,728**	**89,087**		**127,815**	**7,143,486**
1997	TAC	514,000	4,986,000	4,200,000	9,700,000				0	9,700,000
	Har	**122,400**	**1,248,846**	**4,072,779**	**5,444,025**	**29,395**	**88,682**		**118,077**	**5,562,102**
1998	TAC	546,000	5,294,000	4,460,000	10,300,000				0	10,300,000
	Har	**114,606**	**2,303,911**	**4,173,042**	**6,591,559**	**34,090**	**124,814**	**47,000**	**205,904**	**6,797,463**
1999	TAC	477,000	4,626,000	3,897,000	9,000,000				0	9,000,000
	Har	**140,269**	**1,033,733**	**3,454,250**	**4,628,252**	**23,133**	**89,038**	**87,000**	**199,171**	**4,827,423**
2000	TAC	408,100	3,957,800	3,334,100	7,700,000				0	7,700,000
	Har	**252,280**	**932,297**	**2,287,533**	**3,472,110**	**28,599**	**77,512**	**67,000**	**173,111**	**3,645,221**
2001	TAC	180,200	1,747,600	1,472,200	3,400,000				0	3,400,000
	Har	**159,186**	**1,157,914**	**1,498,816**	**2,815,916**	**14,669**	**52,796**	**39,498**	**106,963**	**2,922,879**
2002	TAC	180,200	1,747,600	1,472,200	3,400,000				0	3,400,000
	Har	**193,515**	**703,000**	**1,436,000**	**2,332,515**	**18,377**	**22,000**	**36,000**	**76,377**	**2,408,892**
2003	TAC	180,200	1,747,600	1,472,200	3,400,000				**0**	**3,400,000**
	Har	**128,852**	**1,014,688**	**1,457,014**	**2,600,554**	**27,480**	**43,581**	**32,692**	**103,753**	**2,704,307**

Table 2. Annual harvest (thousands of fish) of Lake Erie walleye by gear, management unit, and agency.

	Sport Fishery															Commercial Fishery				
	Unit 1				Unit 2			Unit 3			Unit 4 & 5					Unit 1	Unit 2	Unit 3	Unit 4	
Year	OH	MI	ON[a]	Total	OH	ON[a]	Total	OH	ON[a]	Total	ON[a]	PA	NY	Total	Total	ON	ON	ON	ON	Total
75	77	4	7	88	10	--	10	--	--	--	--	--	--	0	98	--	--	--	--	0
76	605	30	50	685	35	--	35	--	--	--	--	--	--	0	720	113	44	--	--	157
77	2,131	107	69	2,307	37	--	37	--	--	--	--	--	--	0	2,344	235	67	--	--	302
78	1,550	72	112	1,734	37	--	37	--	--	--	--	--	--	0	1,771	274	60	--	--	334
79	3,254	162	79	3,495	60	--	60	--	--	--	--	--	--	0	3,555	625	30	--	--	655
80	2,096	183	57	2,336	49	--	49	24	--	24	--	--	--	0	2,409	953	40	--	--	993
81	2,857	95	70	3,022	38	--	38	48	--	48	--	--	--	0	3,108	1,037	119	3	--	1,159
82	2,959	194	49	3,202	49	--	49	8	--	8	--	--	--	0	3,259	1,077	134	2	--	1,213
83	1,626	146	41	1,813	212	--	212	26	--	26	--	--	--	0	2,051	1,129	167	80	--	1,376
84	3,089	351	39	3,479	787	--	787	179	--	179	--	--	--	0	4,445	1,639	392	108	--	2,139
85	3,347	461	57	3,865	294	--	294	89	--	89	--	--	--	0	4,248	1,721	432	225	--	2,378
86	3,743	606	52	4,401	480	--	480	176	--	176	--	--	--	0	5,057	1,651	558	356	--	2,565
87	3,751	902	51	4,704	550	--	550	132	--	132	--	--	--	0	5,386	1,611	622	405	--	2,638
88	3,744	1,997	18	5,759	584	--	584	562	--	562	--	--	85	85	6,990	1,866	762	409	--	3,037
89	2,891	1,092	14	3,997	867	35	902	434	80	514	--	--	129	129	5,542	1,656	621	386	--	2,663
90	1,467	747	35	2,249	389	14	403	426	23	449	--	--	47	47	3,148	1,615	529	302	--	2,446
91	1,104	132	39	1,275	216	24	240	258	44	302	--	--	34	34	1,851	1,446	440	274	--	2,160
92	1,479	250	20	1,749	338	56	394	265	25	290	--	--	14	14	2,447	1,547	534	316	--	2,397
93	1,846	270	37	2,153	450	26	476	372	12	384	--	--	40	40	3,053	2,488	762	496	--	3,746
94	992	216	21	1,229	291	20	311	186	21	207	--	--	59	59	1,806	2,307	630	432	--	3,369
95	1,161	108	32	1,301	159	7	166	115	27	141	--	--	27	27	1,635	2,578	681	489	--	3,748
96	1,442	175	17	1,634	645	8	653	229	27	256	--	89	39	128	2,671	2,777	1,107	589	--	4,473
97	929	122	8	1,059	188	2	190	132	5	138	--	89	29	118	1,505	2,585	928	544	--	4,057
98	1,790	115	34	1,939	215	5	220	299	5	304	19	125	34	178	2,641	2,497	1,166	462	28	4,153
99	812	140	34	986	139	5	144	83	5	88	19	89	23	131	1,349	2,461	631	317	68	3,477
00	674	252	34	961	165	5	170	93	5	98	19	78	29	125	1,354	1,603	444	196	48	2,291
01	941	160	34	1,135	171	5	176	46	5	51	19	53	15	87	1,449	1,004	310	141	20	1,475
02	516	194	34	744	141	5	146	46	5	51	19	22	18	59	1,000	937	309	146	17	1,409
03	715	129	34	878	232	5	237	68	5	73	19	44	27	90	1,278	948	283	182	14	1,427
Mean	1,848	325	41	2,213	270	15	278	179	20	191	19	74	41	47	2,696	1,514	457	298	33	2,146

[a] Ontario sport harvest values from 1998 to 2003 are estimated from a 1998 creel survey, these values are used to determine Ontario's total walleye harvest, but are not included in catch-at-age analysis.

Table 3. Annual fishing effort for Lake Erie walleye by gear, management unit, and agency.

	Sport Fishery [a]															Commercial Fishery [b]				
	Unit 1				Unit 2			Unit 3			Unit 4 & 5					Unit 1	Unit 2	Unit 3	Unit 4	
Year	OH	MI	ON [c]	Total	OH	ON [c]	Total	OH	ON [c]	Total	ON [c]	PA	NY	Total	Total	ON	ON	ON	ON	Total
1975	486	30	46	562	61	--	61	--	--	--	--	--	--	0	623	--	--	--	--	--
1976	1,356	84	98	1,538	163	--	163	--	--	--	--	--	--	0	1,701	1,796	1,933	--	--	3,729
1977	2,768	171	130	3,069	151	--	151	--	--	--	--	--	--	0	3,220	4,282	1,572	--	--	5,854
1978	2,880	176	148	3,204	154	--	154	--	--	--	--	--	--	0	3,358	5,253	436	--	--	5,689
1979	4,179	257	97	4,533	169	--	169	--	--	--	--	--	--	0	4,702	5,798	1,798	--	--	7,596
1980	3,938	624	92	4,654	237	--	237	187	--	187	--	--	--	0	5,078	6,229	1,565	--	--	7,794
1981	5,766	447	138	6,351	264	--	264	382	--	382	--	--	--	0	6,997	6,881	2,144	622	--	9,647
1982	5,928	449	108	6,484	223	--	223	114	--	114	--	--	--	0	6,821	10,531	2,913	689	--	14,133
1983	4,168	451	118	4,737	568	--	568	128	--	128	--	--	--	0	5,433	11,205	5,352	5,814	--	22,371
1984	4,077	557	82	4,716	1,322	--	1,322	392	--	392	--	--	--	0	6,430	11,550	6,008	2,438	--	19,996
1985	4,606	926	84	5,616	1,078	--	1,078	464	--	464	--	--	--	0	7,158	7,496	2,800	2,983	--	13,279
1986	6,437	1,840	107	8,384	1,086	--	1,086	538	--	538	--	--	--	0	10,008	7,824	5,637	3,804	--	17,265
1987	6,631	2,193	84	8,908	1,431	--	1,431	472	--	472	--	--	--	0	10,811	6,595	4,243	3,045	--	13,883
1988	7,547	4,362	87	11,996	1,677	--	1,677	1,081	--	1,081	--	--	462	462	15,216	7,495	5,794	3,778	--	17,067
1989	5,246	3,794	81	9,121	1,532	77	1,609	883	205	1,088	--	--	556	556	12,374	7,846	5,514	3,473	--	16,833
1990	4,116	1,803	121	6,040	1,675	33	1,708	869	83	952	--	--	432	432	9,132	9,016	5,829	5,544	--	20,389
1991	3,616	440	144	4,200	1,241	79	1,320	724	155	880	--	--	440	440	6,840	10,418	5,055	3,146	--	18,619
1992	3,955	715	105	4,775	1,169	81	1,249	640	145	786	--	--	299	299	7,109	9,486	6,906	6,043	--	22,435
1993	3,943	691	125	4,759	1,349	70	1,418	1,062	125	1,187	--	--	305	305	7,669	16,283	11,656	7,420	--	35,359
1994	2,808	788	125	3,721	1,025	65	1,090	599	130	729	--	--	355	355	5,894	16,698	9,968	6,459	--	33,125
1995	3,188	277	125	3,589	803	65	868	355	130	485	--	--	259	259	5,201	20,521	12,113	7,850	--	40,484
1996	3,060	521	125	3,706	1,132	65	1,197	495	130	625	--	316	256	572	6,101	19,976	15,685	10,990	--	46,651
1997	2,748	374	88	3,210	864	45	909	492	91	583	--	388	273	661	5,363	15,708	11,588	9,094	--	36,390
1998	3,010	374	103	3,487	635	51	686	409	55	464	217	390	280	887	5,524	19,027	19,397	13,253	818	52,495
1999	2,368	411	--	2,779	603	--	603	323	--	323	--	397	171	568	4,699	21,432	10,955	7,630	1,444	41,461
2000	1,975	540	--	2,516	540	--	540	281	--	281	--	244	177	421	3,757	22,238	11,049	7,896	1,781	43,054
2001	1,952	362	--	2,314	697	--	697	261	--	261	--	241	163	404	3,676	9,372	5,746	5,021	639	20,778
2002	1,393	606	--	1,999	444	--	444	246	--	246	--	130	132	262	2,951	4,431	4,212	4,427	445	13,515
2003	1,719	326	--	2,045	675	--	675	236	--	236	--	159	162	321	3,277	4,476	3,946	3,725	365	12,512
Mean	3,650	848	107	4587	792	63	814	485	125	537	217	283	295	248	6108	10,709	6,493	5,441	915	21,872

[a] Sport units of effort are thousands of angler hours.

[b] Estimated Standard (Total) Effort in kilometers of gill net = (walleye targeted effort x walleye total harvest) / walleye targeted harvest.

[c] Ontario sport fishing effort has not been estimated since a 1998 creel survey and 1999-2003 Ontario sport effort is assumed to be the same as 1998 effort, these values are not used in catch-at-age analysis.

Table 4. Annual catch per unit effort for Lake Erie walleye by gear, management unit, and agency.

	Sport Fishery [a]															Commercial Fishery [b]				
	Unit 1				Unit 2			Unit 3			Unit 4 & 5					Unit 1	Unit 2	Unit 3	Unit 4	
Year	OH	MI	ON[c]	Total	OH	ON[c]	Total	OH	ON[c]	Total	ON[c]	PA	NY	Total	Total	ON	ON	ON	ON	Total
1975	.16	.13	.16	.16	.17	--	.17	--	--	--	--	--	--		.16	--	--	--	--	--
1976	.45	.36	.50	.45	.22	--	.22	--	--	--	--	--	--		.42	63.0	22.9	--	--	42.2
1977	.77	.62	.53	.75	.24	--	.24	--	--	-	--	--	--		.73	54.9	42.6	--	--	51.6
1978	.54	.41	.76	.54	.24	--	.24	--	--	--	--	--	--		.53	52.2	138.2	--	--	58.8
1979	.78	.63	.81	.77	.36	--	.36	--	--	--	--	--	--		.76	107.9	16.7	--	--	86.3
1980	.53	.29	.62	.50	.21	--	.21	.13	--	.13	--	--	--		.47	153.0	25.3	--	--	127.3
1981	.50	.21	.51	.48	.14	--	.14	.12	--	.12	--	--	--		.44	150.7	55.4	4.9	--	120.1
1982	.50	.43	.45	.49	.22	--	.22	.07	--	.07	--	--	--		.48	102.2	45.9	2.8	--	85.8
1983	.39	.32	.34	.38	.37	--	.37	.20	--	.20	--	--	--		.38	100.7	31.2	13.7	--	61.5
1984	.76	.63	.48	.74	.60	--	.60	.46	--	.46	--	--	--		.69	141.9	65.3	44.4	--	107.0
1985	.73	.50	.68	.69	.27	--	.27	.19	--	.19	--	--	--		.59	229.6	154.5	75.6	--	179.1
1986	.58	.33	.49	.52	.44	--	.44	.33	--	.33	--	--	--		.51	211.0	99.0	93.7	--	148.6
1987	.57	.41	.61	.53	.38	--	.38	.28	--	.28	--	--	--		.50	244.2	146.5	133.1	--	190.0
1988	.50	.46	.21	.48	.35	--	.35	.52	--	.52	--	--	.18	.18	.46	249.0	131.4	108.2	--	177.9
1989	.55	.29	.17	.44	.57	.45	.56	.49	.39	.47	--	--	.23	.23	.45	211.1	112.7	111.2	--	158.3
1990	.36	.41	.29	.37	.23	.42	.24	.49	.28	.47	--	--	.11	.11	.34	179.1	90.7	54.5	--	120.0
1991	.31	.30	.27	.30	.17	.30	.18	.36	.28	.34	--	--	.08	.08	.27	138.8	87.0	87.1	--	116.0
1992	.37	.35	.19	.37	.29	.69	.32	.41	.18	.37	--	--	.05	.05	.34	163.1	77.3	52.3	--	106.8
1993	.47	.39	.30	.45	.33	.37	.34	.35	.09	.32	--	--	.13	.13	.40	152.8	65.4	66.8	--	106.0
1994	.35	.27	.17	.33	.28	.31	.28	.31	.16	.28	--	--	.17	.17	.31	138.2	63.2	66.9	--	101.7
1995	.36	.39	.25	.36	.20	.12	.19	.32	.21	.29	--	--	.10	.10	.31	125.7	56.2	62.2	--	92.6
1996	.47	.34	.13	.44	.57	.13	.55	.46	.21	.41	--	.28	.15	.22	.44	139.0	70.6	53.6	--	95.9
1997	.34	.33	.10	.33	.22	.04	.21	.27	.06	.24	--	.23	.11	.17	.28	164.6	80.1	59.8	--	111.5
1998	.59	.31	.33	.56	.34	.10	.32	.73	.08	.65	.09	.32	.12	.18	.48	131.3	60.1	34.8	34.2	79.1
1999	.34	.34	--	.34	.23	--	.23	.26	--	.26	--	.22	.14	.18	.27	114.8	57.6	41.6	47.4	83.9
2000	.34	.47	--	.37	.31	--	.31	.33	--	.33	--	.32	.16	.24	.34	72.1	40.2	24.8	27.1	53.2
2001	.48	.44	--	.48	.25	--	.25	.18	--	.18	--	.22	.09	.16	.38	107.1	54.0	28.1	32.1	71.0
2002	.37	.32	--	.36	.32	--	.32	.19	--	.19	--	.17	.14	.15	.32	211.5	73.4	33.0	37.4	104.3
2003	.42	.40	--	.41	.34	--	.34	.29	--	.29	--	.28	.17	.22	.37	211.8	71.7	48.9	38.4	114.1
Mean	.48	.38	.39	.46	.31	.29	.30	.32	.19	.31	.09	.25	.13	.16	.43	147.2	72.7	56.6	36.1	105.4

[a] Sport CPE = Number/angler hour

[b] Commercial CPE = Number/kilometer of gill net

[c] Ontario sport fishing CPE has not been estimated since a 1998 creel survey and 1999-2003 Ontario CPE is assumed to be the same as 1998 CPE.

Table 5. Catch at age of walleye harvest by management unit, gear, and agency in Lake Erie during 2003. Units 4 and 5 are combined in Unit 4.

		Comm'l	Sport						All Gears	
Unit	Age	OMNR	OMNR[a]	ODNR	MDNR	NYDEC	PA	Total	OMNR	Total
1	1	0		0	0	--	--	0	0	0
	2	284,111		130,335	21,664	--	--	151,999	284,111	436,110
	3	115,229		36,572	7,013	--	--	43,585	115,229	158,814
	4	366,956		287,612	73,324	--	--	360,936	366,956	727,892
	5	101,373		95,779	10,781	--	--	106,560	101,373	207,933
	6	32,174		26,116	4,577	--	--	30,693	32,174	62,867
	7+	47,850		138,291	11,493	--	--	149,784	47,850	197,634
	Total	947,693	34,000	714,705	128,852	--	--	877,557	981,693	1,825,250
2	1	0		0	--	--	--	0	0	0
	2	64,132		58,307	--	--	--	58,307	64,132	122,439
	3	36,079		9,689	--	--	--	9,689	36,079	45,768
	4	84,043		86,758	--	--	--	86,758	84,043	170,801
	5	45,236		27,983	--	--	--	27,983	45,236	73,219
	6	16,726		6,502	--	--	--	6,502	16,726	23,228
	7+	36,870		42,506	--	--	--	42,506	36,870	79,376
	Total	283,086	5,000	231,745	--	--	--	236,745	288,086	519,831
3	1	0		0	--	--	--	0	0	0
	2	27,833		7,652	--	--	--	7,652	27,833	35,485
	3	4,545		1,243	--	--	--	1,243	4,545	5,788
	4	52,982		31,286	--	--	--	31,286	52,982	84,268
	5	17,907		5,454	--	--	--	5,454	17,907	23,361
	6	15,216		935	--	--	--	935	15,216	16,151
	7+	63,752		21,668	--	--	--	21,668	63,752	85,420
	Total	182,235	5,000	68,238	--	--	--	73,238	187,235	255,473
4	1	0		--	--	0	2,905	2,905	0	2,905
	2	746		--	--	0	1,453	1,453	746	2,199
	3	213		--	--	0	1,453	1,453	213	1,666
	4	2,470		--	--	2,968	4,358	7,326	2,470	9,796
	5	3,011		--	--	7183	4,358	11,541	3,011	14,552
	6	1,288		--	--	0	1,453	1,453	1,288	2,741
	7+	5,964		--	--	17,329	27,601	44,930	5,964	50,894
	Total	13,692	19,000	--	--	27,480	43,581	90,061	32,692	103,753
All	1	0		0	0	0	2,905	2,905	0	2,905
	2	376,822		196,294	21,664	0	1,453	219,411	376,822	596,233
	3	156,066		47,504	7,013	0	1,453	55,970	156,066	212,036
	4	506,451		405,656	73,324	2,968	4,358	486,306	506,451	992,757
	5	167,527		129,216	10,781	7,183	4,358	151,538	167,527	319,065
	6	65,404		33,553	4,577	0	1,453	39,583	65,404	104,987
	7+	154,436		202,465	11,493	17,329	27,601	258,888	154,436	413,324
	Total	1,426,706	63,000	1,014,688	128,852	27,480	43,581	1,277,601	1,489,706	2,704,307

[a] Ontario sport harvest values are estimated from a 1998 creel survey, these values are used to determine Ontario's total walleye harvest, but are not used in catch-at-age analysis.

Table 6. Percent age composition of walleye harvested by management unit, gear, and agency in Lake Erie during 2003. Units 4 and 5 are combined in Unit 4.

		Commercial	Sport						All Gears
Unit	Age	OMNR	OMNR	ODNR	MDNR	NYDEC	PA	Total	Total
1	1	0.0	--	0.0	0.0	--	--	0.0	0.0
	2	30.0	--	18.2	16.8	--	--	18.0	24.3
	3	12.2	--	5.1	5.4	--	--	5.2	8.9
	4	38.7	--	40.2	56.9	--	--	42.8	40.6
	5	10.7	--	13.4	8.4	--	--	12.6	11.6
	6	3.4	--	3.7	3.6	--	--	3.6	3.5
	7+	5.0	--	19.3	8.9	--	--	17.8	11.0
	Total	100	--	100	100	--	--	100	100
2	1	0.0	--	0.0	--	--	--	0.0	0.0
	2	22.7	--	25.2	--	--	--	25.2	23.8
	3	12.7	--	4.2	--	--	--	4.2	8.9
	4	29.7	--	37.4	--	--	--	37.4	33.2
	5	16.0	--	12.1	--	--	--	12.1	14.2
	6	5.9	--	2.8	--	--	--	2.8	4.5
	7+	13.0	--	18.3	--	--	--	18.3	15.4
	Total	100	--	100	--	--	--	100	100
3	1	0.0	--	0.0	--	--	--	0.0	0.0
	2	15.3	--	11.2	--	--	--	11.2	14.2
	3	2.5	--	1.8	--	--	--	1.8	2.3
	4	29.1	--	45.8	--	--	--	45.8	33.6
	5	9.8	--	8.0	--	--	--	8.0	9.3
	6	8.3	--	1.4	--	--	--	1.4	6.4
	7+	35.0	--	31.8	--	--	--	31.8	34.1
	Total	100	--	100	--	--	--	100	100
4	1	0.0	--	--	--	0.0	6.7	4.1	3.4
	2	5.4	--	--	--	0.0	3.3	2.0	2.6
	3	1.6	--	--	--	0.0	3.3	2.0	2.0
	4	18.0	--	--	--	10.8	10.0	10.3	11.6
	5	22.0	--	--	--	26.1	10.0	16.2	17.2
	6	9.4	--	--	--	0.0	3.3	2.0	3.2
	7+	43.6	--	--	--	63.1	63.3	63.2	60.0
	Total	100	--	--	--	100	100	100	100
All	1	0.0	--	0.0	0.0	0.0	6.7	0.2	0.1
	2	26.4	--	19.3	16.8	0.0	3.3	18.1	22.6
	3	10.9	--	4.7	5.4	0.0	3.3	4.6	8.0
	4	35.5	--	40.0	56.9	10.8	10.0	40.0	37.6
	5	11.7	--	12.7	8.4	26.1	10.0	12.5	12.1
	6	4.6	--	3.3	3.6	0.0	3.3	3.3	4.0
	7+	10.8	--	20.0	8.9	63.1	63.3	21.3	15.6
	Total	100	--	100	100	100	100	100	100

Table 7. Annual mean age (years) of Lake Erie walleye by gear, management unit, and agency.

	Sport Fishery															Commercial Fishery				
	Unit 1				Unit 2			Unit 3			Unit 4 & 5					Unit 1	Unit 2	Unit 3	Unit 4	
Year	OH	MI	ON	Total	OH	ON	Total	OH	ON	Total	ON	PA	NY	Total	Total	ON	ON	ON	ON	Total
75	2.53	2.53	3.26	2.59	1.53	--	1.53	--	--	--	--	--	--	--	2.48	--	--	--	--	--
76	2.49	2.49	2.35	2.48	2.05	--	2.05	--	--	--	--	--	--	--	2.46	1.51	1.51	--	--	1.51
77	3.29	3.29	2.64	3.27	2.44	--	2.44	--	--	--	--	--	--	--	3.26	2.74	2.74	--	--	2.74
78	3.50	3.62	3.07	3.48	3.33	--	3.33	--	--	--	--	--	--	--	3.48	2.69	2.69	--	--	2.69
79	2.71	2.71	2.67	2.71	2.29	--	2.29	--	--	--	--	--	--	--	2.70	2.83	2.83	--	--	2.83
80	3.00	3.00	2.84	3.00	2.92	--	2.92	2.65	--	2.65	--	--	--	--	2.99	2.96	2.96	--	--	2.96
81	3.61	2.97	3.47	3.59	2.62	--	2.62	2.72	--	2.72	--	--	--	--	3.56	3	3.00	2.99	--	3.00
82	3.25	3.25	2.76	3.24	2.58	--	2.58	2.51	--	2.51	--	--	--	--	3.23	2.81	2.81	2.81	--	2.81
83	3.03	3.03	3.17	3.03	2.25	--	2.25	2.07	--	2.07	--	--	--	--	2.94	3.47	3.47	3.47	--	3.47
84	2.64	2.64	2.90	2.64	2.61	--	2.61	2.68	--	2.68	--	--	--	--	2.64	2.89	2.89	2.89	--	2.89
85	3.36	3.36	3.17	3.36	3.24	--	3.24	3.58	--	3.58	--	--	--	--	3.35	3.04	3.04	3.04	--	3.04
86	3.73	3.61	3.54	3.71	3.69	--	3.69	4.08	--	4.08	--	--	--	--	3.72	3.61	3.70	4.22	--	3.71
87	3.83	3.32	3.78	3.73	3.68	--	3.68	4.10	--	4.10	--	--	--	--	3.73	3.71	3.47	3.40	--	3.61
88	3.97	3.43	4.58	3.78	3.81	--	3.81	5.37	--	5.37	--	--	4.87	4.87	3.93	3.27	3.15	3.89	--	3.32
89	4.48	3.75	4.29	4.28	4.65	4.29	4.64	5.13	4.29	5.00	--	--	5.59	5.59	4.44	3.49	3.51	4.22	--	3.60
90	4.44	4.64	5.00	4.52	5.31	5.41	5.31	6.41	5.41	6.36	--	--	5.70	5.70	4.90	3.91	3.90	4.60	--	3.99
91	4.91	5.29	5.01	4.95	6.22	6.03	6.20	6.70	5.91	6.58	--	--	6.36	6.36	5.41	4.21	4.63	5.14	--	4.41
92	4.60	3.49	3.45	4.43	4.89	6.72	5.15	5.67	6.42	5.73	--	--	6.35	6.35	4.71	4.03	4.23	5.49	--	4.27
93	4.60	4.41	4.09	4.57	5.79	6.45	5.83	5.98	6.17	5.99	--	--	6.15	6.15	4.96	3.64	4.38	5.21	--	4.00
94	4.53	4.19	5.84	4.49	5.38	6.41	5.45	6.22	6.85	6.28	--	--	6.49	6.49	4.93	3.65	4.36	5.60	--	4.03
95	4.04	3.55	4.74	4.02	6.07	7.29	6.12	6.08	7.17	6.33	--	--	6.80	6.80	4.48	3.38	4.63	5.92	--	3.94
96	3.98	3.46	4.31	3.93	4.22	7.22	4.26	6.06	7.57	6.22	--	--	6.47	6.47	4.35	3.57	3.36	5.21	--	3.73
97	4.21	3.99	4.21	4.18	5.30	5.30	5.30	6.27	6.27	6.22	--	--	6.25	6.25	4.67	3.87	3.68	4.83	--	3.96
98	3.74	3.13	3.15	3.69	4.66	8.09	4.74	4.64	7.81	4.69	9.55	--	10.13	9.92	4.32	3.26	4.00	5.26	7.00	3.72
99	3.72	3.16	3.43	3.63	5.35	9.17	5.48	5.95	10.00	6.18	8.15	--	10.29	9.32	4.55	3.41	4.29	5.28	6.76	3.81
00	3.94	3.27	--	3.76	4.12	--	4.12	6.36	--	6.36	--	--	9.75	9.75	4.55	3.69	4.67	5.65	6.46	4.11
01	3.66	3.02	--	3.57	4.09	--	4.09	6.14	--	6.14	--	7.70	9.09	8.01	3.99	3.19	3.77	5.52	6.00	3.57
02	3.80	3.83	--	3.81	4.57	--	4.57	5.46	--	5.46	--	6.59	8.05	7.25	4.21	3.22	3.50	5.37	5.80	3.54
03	4.67	4.16	--	4.59	4.67	--	4.67	5.87	--	5.87	--	7.50	10.01	8.45	4.95	3.68	4.36	5.58	6.59	4.09
Mean	3.73	3.47	3.67	3.69	3.94	6.58	3.96	4.95	6.72	4.97	8.85	7.26	7.40	7.11	3.93	3.31	3.55	4.59	6.44	3.48

Table 8. Estimated abundance at age, mean survival (S) and mean exploitation (U) for Lake Erie walleye, 1978 – 2003 from the 2004 catch-at-age analysis model in ADMB, M=0.32. West and central basin population modeled, east basin stock excluded. 2004 projected abundance of ages 3 to 7+ is based on survival from 2003, and projected 2004 age 2 abundance is based on regression of pooled trawl YOY data and ADMB age 2 abundance (see Table 9).

	Age								
Year	2	3	4	5	6	7+	Total	S	U
1978	2,323,440	5,545,880	1,086,010	79,701	179,061	25,276	9,239,368	0.514	0.253
1979	16,767,300	1,488,330	2,717,540	529,146	38,834	99,609	21,640,759	0.455	0.324
1980	10,907,400	10,267,700	634,211	1,147,970	223,526	58,733	23,239,540	0.532	0.231
1981	7,018,540	7,068,710	5,249,620	321,355	581,676	143,204	20,383,105	0.437	0.346
1982	11,704,400	4,231,270	2,874,250	2,111,660	129,265	292,008	21,342,853	0.484	0.288
1983	7,735,580	7,329,200	1,942,350	1,305,630	959,220	192,317	19,464,297	0.535	0.227
1984	48,728,600	5,016,420	3,791,950	989,715	665,276	587,784	59,779,745	0.524	0.241
1985	6,376,220	31,372,000	2,532,220	1,886,880	492,482	626,395	43,286,197	0.579	0.175
1986	18,052,600	4,262,190	17,687,900	1,416,300	1,055,350	627,719	43,102,059	0.547	0.213
1987	16,640,700	11,806,200	2,256,530	9,246,680	740,400	882,702	41,573,212	0.571	0.184
1988	44,277,100	11,062,700	6,564,070	1,241,730	5,088,310	896,594	69,130,504	0.558	0.200
1989	14,334,600	29,180,700	5,989,140	3,514,360	664,816	3,207,930	56,891,546	0.573	0.182
1990	11,014,900	9,541,950	16,292,900	3,309,510	1,941,980	2,152,600	44,253,840	0.601	0.148
1991	6,137,270	7,459,880	5,628,160	9,514,090	1,932,550	2,399,620	33,071,570	0.621	0.124
1992	12,839,200	4,203,610	4,571,330	3,409,990	5,764,400	2,636,060	33,424,590	0.594	0.157
1993	20,130,900	8,647,490	2,451,140	2,628,410	1,960,670	4,844,640	40,663,250	0.552	0.207
1994	3,453,360	13,186,100	4,661,970	1,293,940	1,387,520	3,629,400	27,612,290	0.558	0.200
1995	12,771,700	2,269,420	7,208,740	2,490,060	691,120	2,710,640	28,141,680	0.542	0.219
1996	14,292,500	8,296,670	1,203,740	3,719,430	1,284,770	1,781,770	30,578,880	0.482	0.292
1997	1,614,230	8,876,810	3,852,620	539,889	1,668,200	1,394,520	17,946,269	0.522	0.243
1998	14,390,700	1,033,660	4,510,320	1,900,350	266,307	1,524,760	23,626,097	0.469	0.306
1999	6,778,850	8,846,610	466,792	1,961,000	826,236	796,090	19,675,578	0.505	0.263
2000	5,434,020	4,286,280	4,341,280	221,561	930,781	778,714	15,992,636	0.491	0.280
2001	16,525,200	3,398,920	2,034,790	1,991,340	101,630	792,604	24,844,484	0.537	0.224
2002	1,801,680	10,720,300	1,775,100	1,041,100	1,018,870	463,246	16,820,296	0.608	0.140
2003	18,938,700	1,224,360	6,413,620	1,049,170	615,339	878,277	29,119,466	0.590	0.161
2004	580,592	12,723,783	709,793	3,660,939	598,893	857,886	19,131,885		

Table 9. Data used to estimate the abundance of age 2 walleye by simple linear regression where Y=ADMB AGE 2 and X=Pooled ON-OH YOY Trawl. Values in bold are regression estimates and used for RAH projections 2004-2005, respectively. Regression statistics are given at the bottom of the page.

Year of Recruitment to fisheries	**Year Class**	**Pooled ON and OH YOY Trawl**	**LN Pooled ON and OH YOY Trawl**	**ADMB AGE 2 Estimated Age 2 walleye (millions)**	**LN Estimated Age 2 walleye (millions)**
1989	1987	9.22	2.2210496	14.335	2.662676
1990	1988	20.70	3.0300371	11.015	2.399249
1991	1989	5.60	1.7227666	6.137	1.814380
1992	1990	47.03	3.8507219	12.839	2.552503
1993	1991	68.02	4.2198312	20.131	3.002256
1994	1992	4.64	1.5347144	3.453	1.239348
1995	1993	97.78	4.5827303	12.772	2.547232
1996	1994	62.15	4.1296152	14.293	2.659735
1997	1995	2.67	0.9809542	1.614	0.478858
1998	1996	93.13	4.5339642	14.391	2.666582
1999	1997	24.75	3.2088255	6.779	1.913807
2000	1998	13.67	2.6151305	5.434	1.692679
2001	1999	58.14	4.0627851	16.525	2.804886
2002	2000	3.19	1.1612740	1.802	0.588720
2003	2001	31.16	3.4392636	18.939	2.941207
2004	2002	0.17	-1.7487000	**0.581**[1]	**-0.543707**
2005	2003	204.02	5.3182229	**30.579**[2]	**3.420310**

[1]This regression estimate was used for 2004 age 2 projection.
[2]This regression estimate was used for 2005 age 2 projection.

Note: The regression equation, with standard errors in parentheses, was,

$$Y = 0.5609\ (0.0952)\ X + 0.4372\ (0.3094)$$

with $n=15$, $F=34.7$, $p<0.0001$ and an $r^2=0.73$. Both parameters were transformed by natural logarithm (LN).

Table 10. Walleye stock size in 2004, projected harvest in 2004, stock size in 2005, survival and exploitation as a function of fishing rates that range from 0 to 1. Input parameters are listed at the bottom of the table. East basin stock excluded. 2004 population estimate ± 15% (one standard error). Age 2 recruitment estimates and standard errors are presented below table. Estimates of population size and related parameters assume M=0.32. Approximate historic fishing rates are listed for reference in table. Precise fishing rates are presented below table. Abundance estimates of mature walleye (age 4 and older) that correspond to historic strong year classes are presented below the table for reference.

Reference	**F**	**2004 Stock Size 2+ ($x10^6$)**	**2004 Harvest ($x 10^6$)**	**2005 Stock Size 2+ ($x10^6$)**	**2005 Stock Size 3+ ($x10^6$)**	**2005 Stock Size 4+ ($x10^6$)**	**Exploitation**	**Survival**
	0.00	19.132	0.000	44.471	13.893	13.471	0.0%	72.6%
	0.05	19.132	0.750	43.836	13.257	12.842	3.9%	69.3%
	0.10	19.132	1.466	43.230	12.652	12.243	7.7%	66.1%
2004 GLFC recom. approx.	**0.15**	19.132	2.152	42.653	12.074	11.672	11.2%	63.1%
2002 $F_{full\ obs}$, $F_{CPMS\ mean}$ approx	**0.20**	19.132	2.807	42.102	11.523	11.128	14.7%	60.2%
2003 $F_{full\ obs}$ approx	**0.25**	19.132	3.434	41.576	10.997	10.608	17.9%	57.5%
	0.30	19.132	4.033	41.075	10.496	10.114	21.1%	54.9%
2001 $F_{full\ obs}$, 2000 $F_{0.1}$ approx	**0.35**	19.132	4.606	40.597	10.018	9.642	24.1%	52.4%
	0.40	19.132	5.155	40.142	9.563	9.192	26.9%	50.0%
2000 $F_{full\ obs}$ approx	**0.45**	19.132	5.679	39.707	9.128	8.763	29.7%	47.7%
	0.50	19.132	6.181	39.292	8.713	8.355	32.3%	45.5%
	0.55	19.132	6.661	38.897	8.318	7.965	34.8%	43.5%
	0.60	19.132	7.120	38.520	7.941	7.593	37.2%	41.5%
	0.65	19.132	7.560	38.160	7.581	7.239	39.5%	39.6%
	0.70	19.132	7.981	37.817	7.238	6.902	41.7%	37.8%
	0.75	19.132	8.383	37.490	6.911	6.580	43.8%	36.1%
	0.80	19.132	8.769	37.178	6.599	6.273	45.8%	34.5%
	0.85	19.132	9.137	36.880	6.301	5.981	47.8%	32.9%
	0.90	19.132	9.491	36.596	6.017	5.702	49.6%	31.5%
	0.95	19.132	9.829	36.325	5.746	5.436	51.4%	30.0%
	1.00	19.132	10.153	36.067	5.488	5.182	53.1%	28.7%

F	Historic Reference
0.206	2002 F_{full} observed
0.241	2003 F_{full} observed
0.326	2000 $F_{0.1}$ targeted
0.350	2001 F_{full} observed
0.459	2000 F_{full} observed
0.147	2004 GLFC recommendation
	CPMS
0.144	2001 targeted
0.187	2002 targeted
0.250	2003 targeted
0.194	$F_{CPMS\ MEAN}$

Age	S_{age}*
2	0.323
3	0.938
4	1.000
5	1.000
6	1.000
7+	0.958

* $Sage = Fage/F_{full}$ from catch-at-age analysis
where S_{age} = age specific selectivity 2002-2003 average
where F_{age} = avg total fishing mortality at age 2002 - 2003
and F_{full} = maximum Fage

Age 2 Recruitment Estimate (millions)

Year	Abundance	Standard Error
2004	0.581	1.225
2005	30.579	1.151

Year class	**Abundance Age 4+ x 10^6**
2003	8.956
1999	4.050
1996	7.990
1994	10.972
1986	20.787
1982	5.407

Note: F_{full} observed values indicate most recent estimated fishing rates for fully selected age groups from catch-at-age analysis. Targeted fishing rates refer to exploitation strategies for the years stated. $F_{0.1}$ refers to the Beverton-Holt Yield per Recruit $F_{0.1}$ harvest strategy. 2004 GLFC recommendation based on 2004 Lake Erie walleye arbitration process recommending 2.107 million walleye total allowable catch (TAC). Coordinated Percid Management Strategy (CPMS) targeted fishing rates presented for 2001, 2001, and 2003 with mean. Age 2 recruitment estimates presented for 2004 and 2005 with standard error.

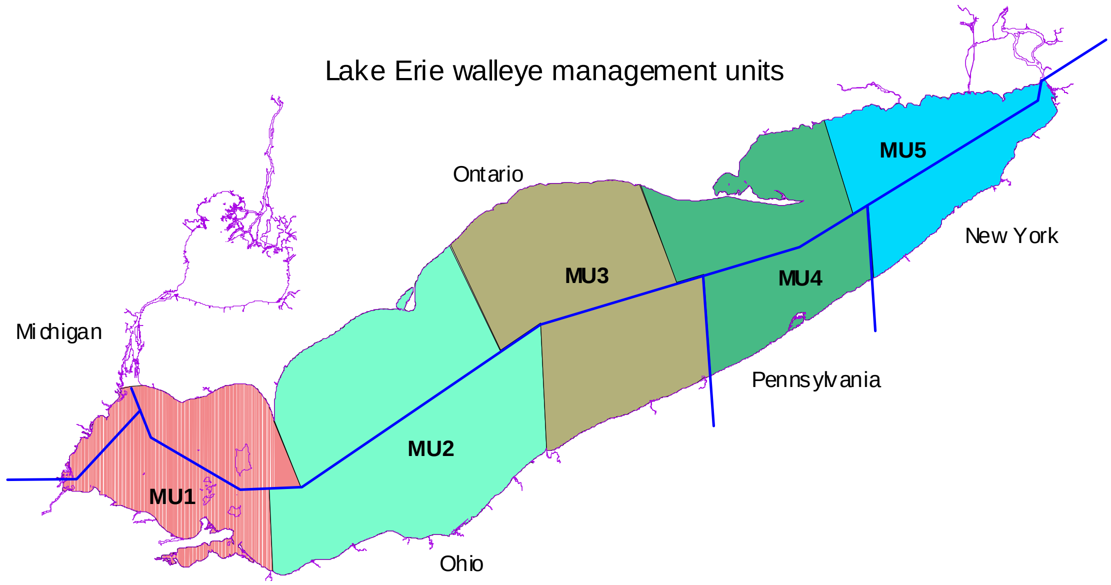

Figure 1. Map of Lake Erie with management units recognized by the Walleye Task Group for interagency management of walleye.

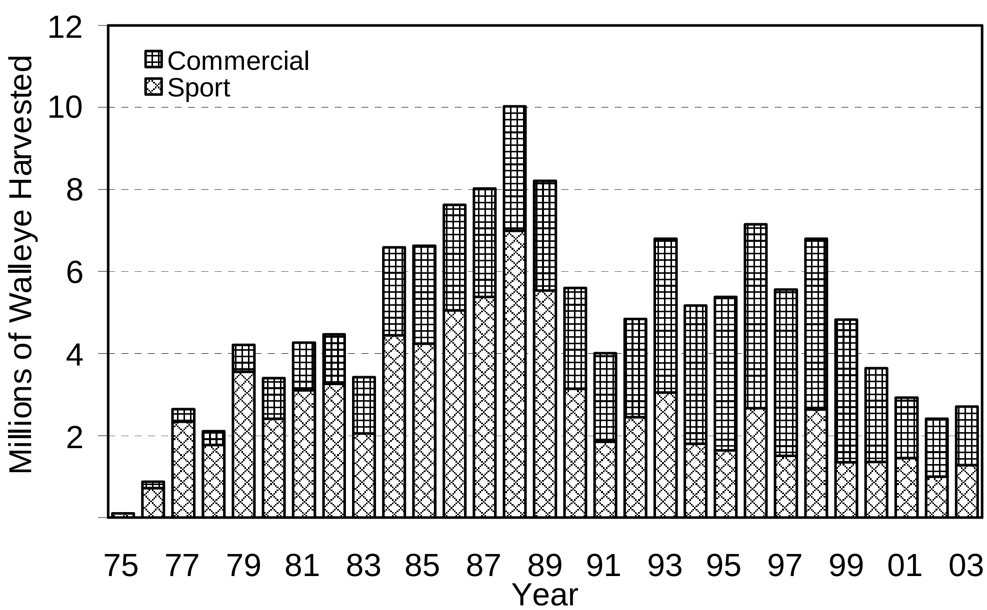

Figure 2. Lakewide harvest of Lake Erie walleye by sport and commercial fisheries, 1975 - 2003.

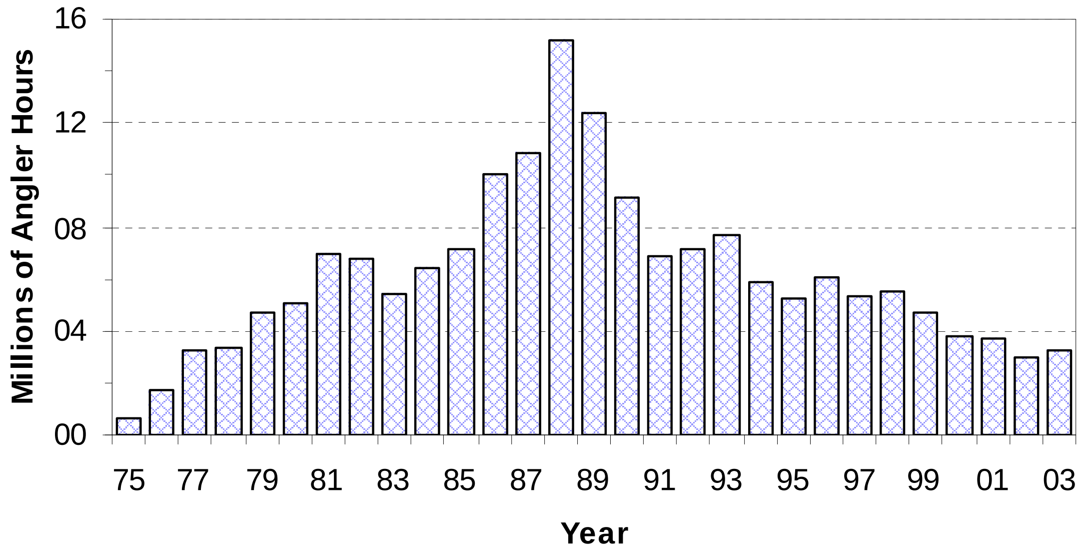

Figure 3. Lakewide total effort (angler hours) by sport fisheries for Lake Erie walleye, 1975 – 2003 (1999-2003 excludes Ontario sport effort).

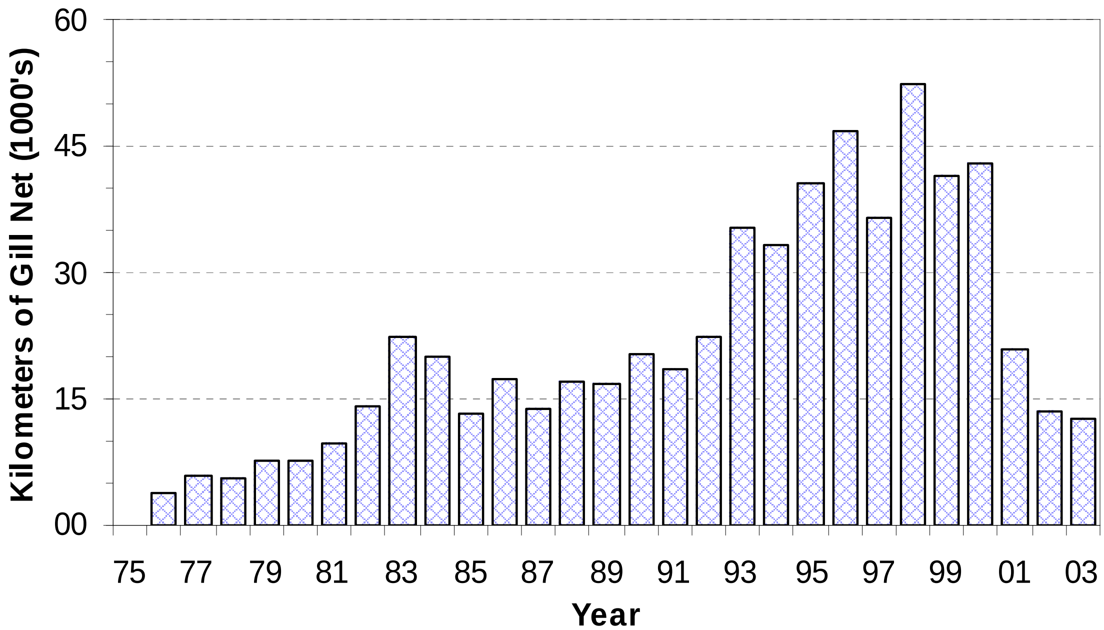

Figure 4. Lakewide total effort (kilometers of gill net) by commercial fisheries for Lake Erie walleye, 1975-2003.

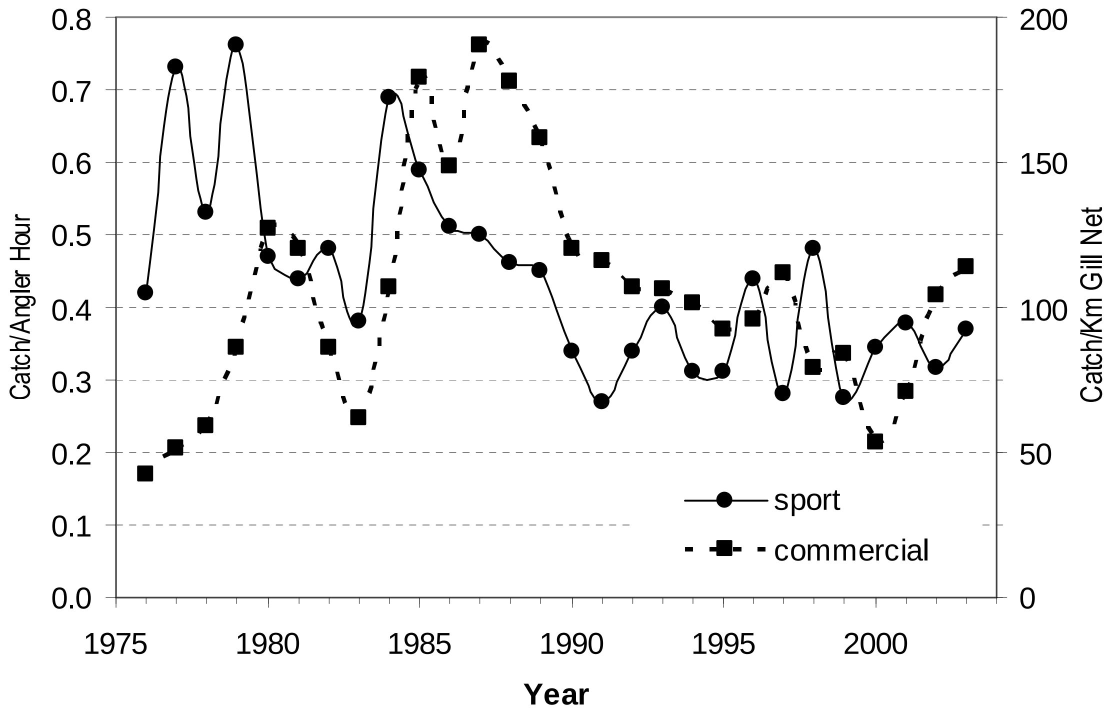

Figure 5. Lakewide CUE for Lake Erie sport and commercial walleye fisheries, 1975-2003.

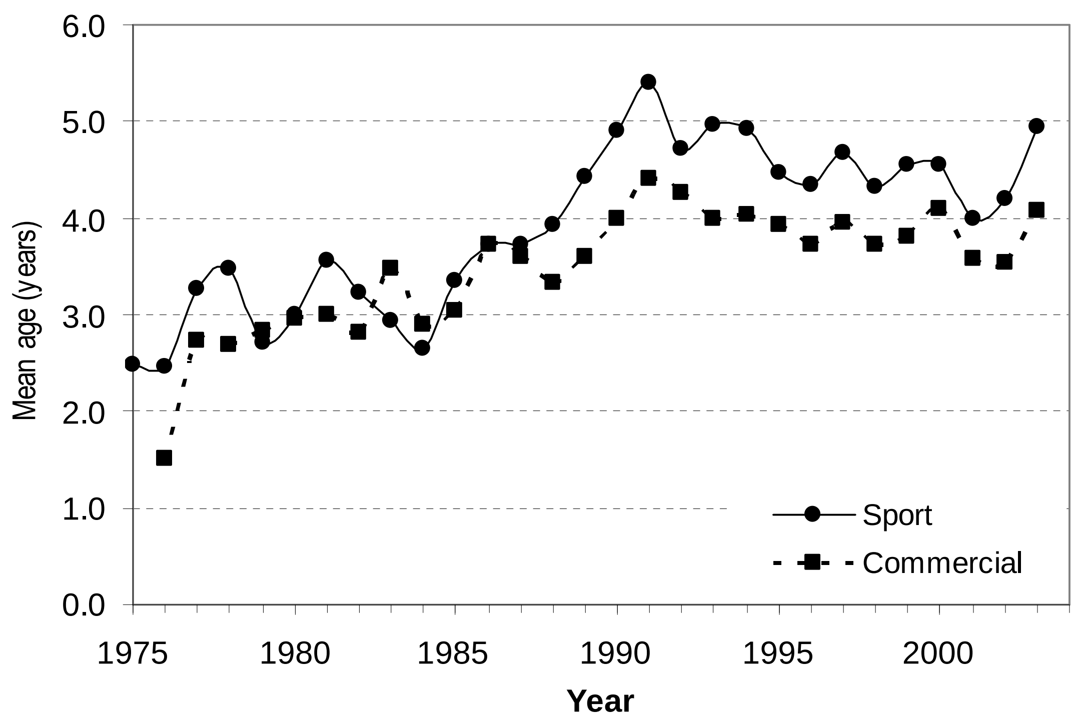

Figure 6. Lakewide mean age of Lake Erie walleye in sport and commercial harvests, 1975-2003.

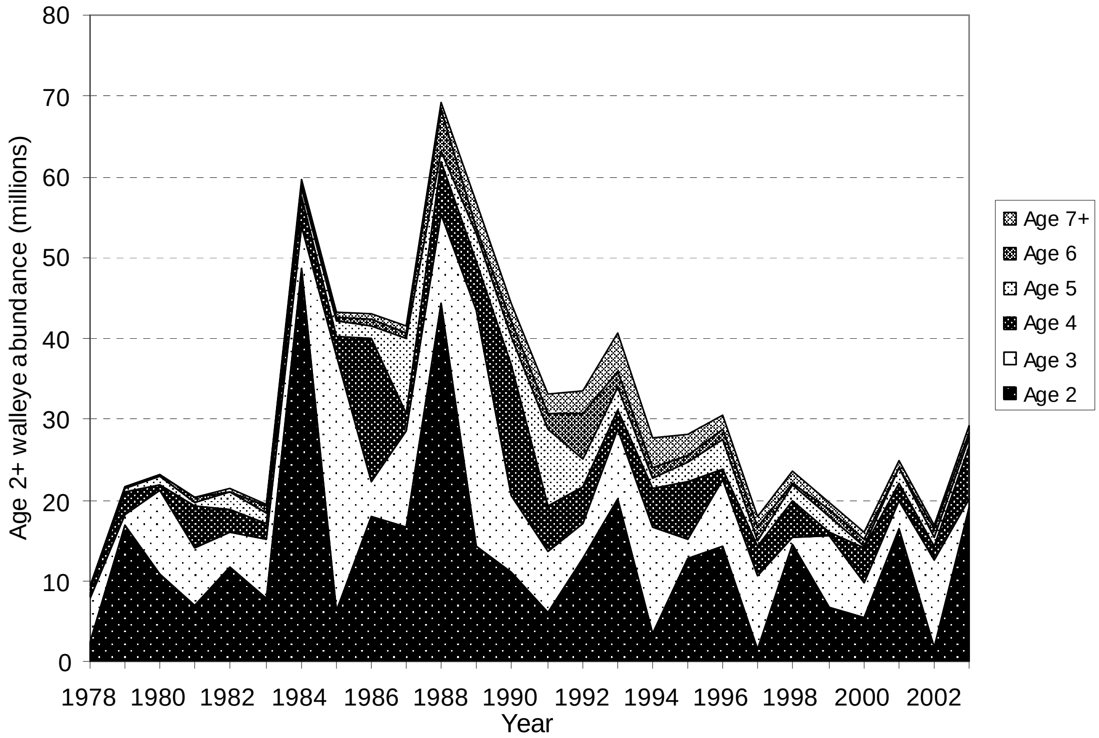

Figure 7. Age class composition of Lake Erie walleye 1978-2003. Data are from Table 8 in this document.

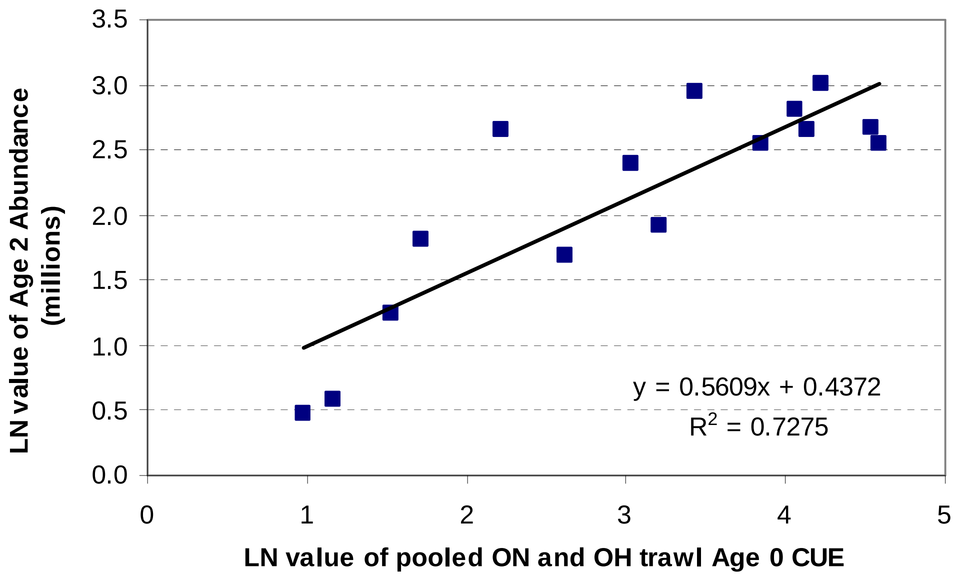

Figure 8. Regression estimates of abundance for age-2 Lake Erie walleye using natural logarithm transformed ADMB 2004 model catch-at-age estimates (y) and pooled Ontario and Ohio young-of-the-year trawl indices (x).

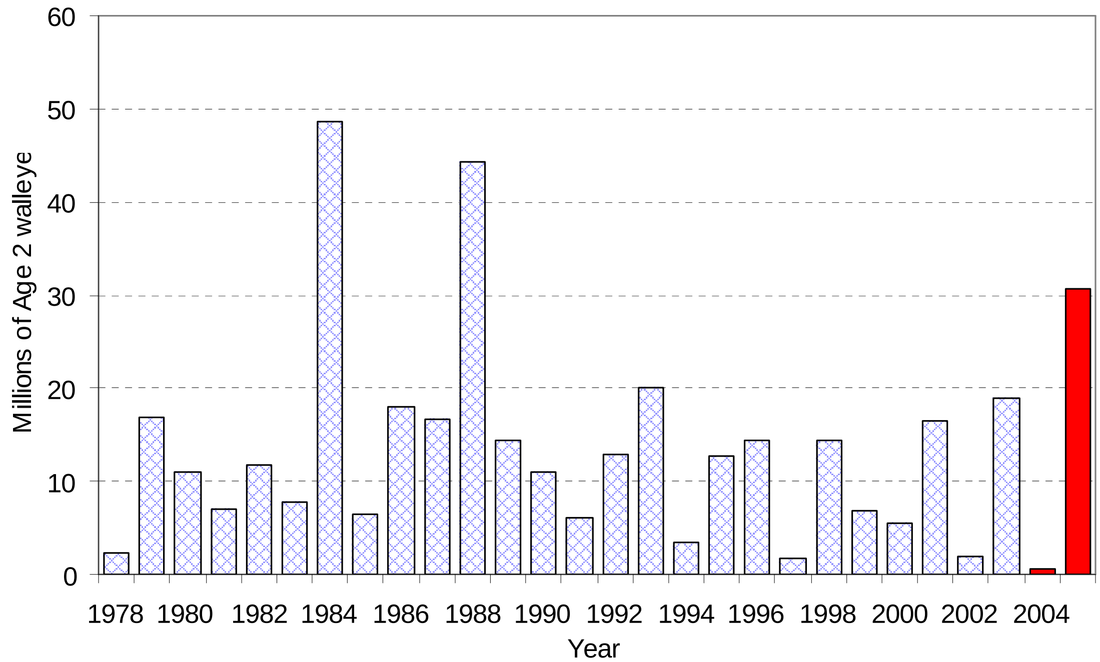

Figure 9. Catch-at-age estimates of age-2 Lake Erie walleye for 1978 to 2003. Estimates for 2004-2005 are from the regression of YOY index and numbers of age-2 from catch-at-age analysis (see Table 9).

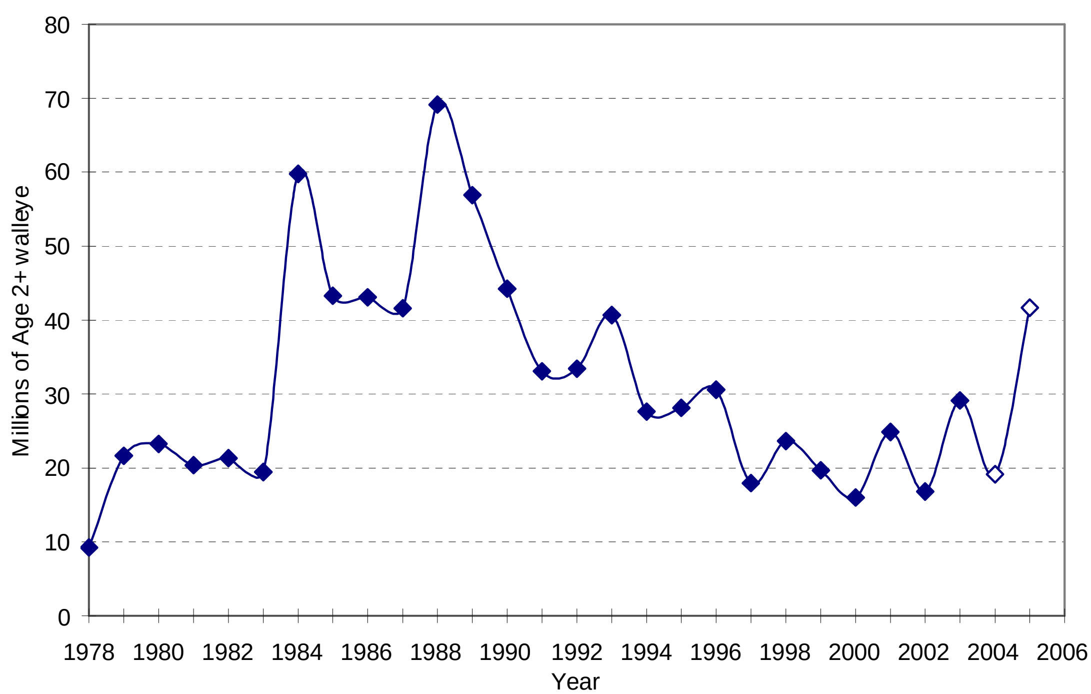

Figure 10. Abundance of Lake Erie walleye from 1978-2003, forecasting two additional years of population abundance assuming 2003 harvest rates.