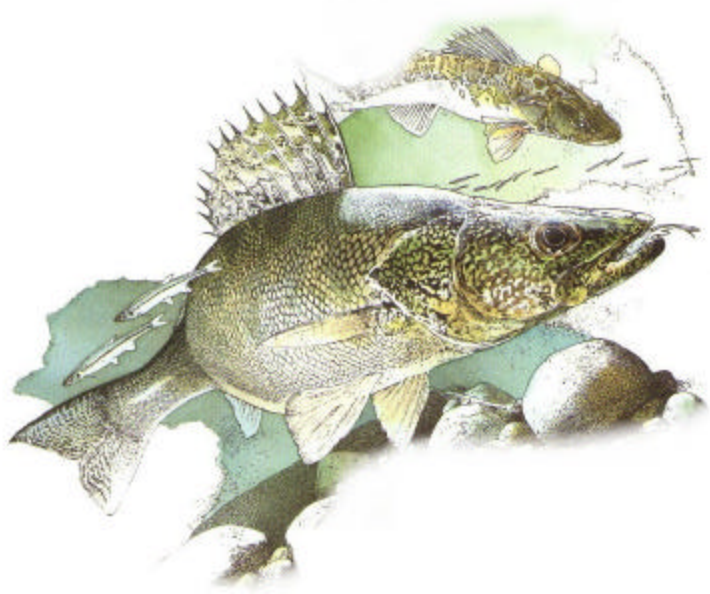
Report for 2004 by the

LAKE ERIE WALLEYE TASK GROUP

March 2005



Prepared by members:

Mike Thomas, *Michigan Department of Natural Resources*
Don Einhouse, *New York Department of Environmental Conservation*
Dan Isermann, *Ohio Department of Natural Resources*
Kevin Kayle, *Ohio Department of Natural Resources*
Mark Turner, *Ohio Department of Natural Resources*
Chris Vandergoot (co-chairman), *Ohio Department of Natural Resources*
Megan Belore, *Ontario Ministry of Natural Resources*
Andy Cook, *Ontario Ministry of Natural Resources*
Tim Johnson, *Ontario Ministry of Natural Resources*
Phil Ryan, *Ontario Ministry of Natural Resources*
Elizabeth Wright (co-chairman), *Ontario Ministry of Natural Resources*
Roger Kenyon, *Pennsylvania Fish and Boat Commission*

Presented to:

Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission
Niagara Falls, Ontario, March 30-31, 2005

Note: The data and management summaries contained in this report are provisional. Every effort has been made to insure their correctness. Contact individual agencies for complete state and provincial data.

Charges to the WTG from the STC, 2004-2005

The charges from the Standing Technical Committee (STC) to the Walleye Task Group (WTG) for the period from March 2004 to February 2005 were to:

1. Maintain and update centralized time database for population modeling; including tagging, fishing harvest and effort by grid, growth, maturity, and abundance indices. Additionally, note the continuing effort to establish Biological Reference Points by examining walleye SSB, S/R or Spawner –Recruit relationships for use with ADMB.
2. Assist Lake Erie Committee in the final development of the Walleye Management Plan by 2005 and an RAH strategy for 2005.
3. Assemble data for development of a spatially-explicit database describing the Lake Erie walleye resource, for evidence of stock discreteness and contribution to lake-wide fisheries.
4. Develop alternate eastern basin and migratory catch-at-age analyses for 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 Decision Analysis/risk assessment tool.

Review of Walleye Fisheries in 2004

Fishery effort and walleye harvest data were combined for all jurisdictions and Management Units (Figure 1) to produce lake-wide estimates. The 2004 total estimated lake-wide harvest of walleye was 2.45 million fish, which was an 11% decrease from the 2.7 million fish caught in 2003 (Tables 1 and 2). A total of 2.39 million fish were harvested in the TAC area. This harvest represents 99.7% of the 2004 total allowable catch (TAC) of 2.40 million walleye and includes walleye harvested in lake-wide commercial and sport fisheries. An additional 58,233 fish were harvested outside of the TAC area. The sport harvest of approximately 1.1 million fish was the second lowest since 1976 and only represented a 6.5% increase from the year 2002, which was the lowest in this period. (Table 2, Figure 2). The Ontario commercial harvest of approximately 1.4 million fish in 2004 was the lowest since 1983 and slightly lower than the harvest observed between 2001-2003, the period during the Coordinated Percid Management Strategy (CPMS, Table 2, Figure 2).

In 2004, sport effort decreased 13% from 2003 for a total of 2.9 million angler hours and was the lowest amount of effort recorded since 1976. The declining trend in sport effort beginning in 1988 continued in 2004 (Table 3, Figure 3). Sport effort declined between 14 and 41% compared to 2003 in Management Units 1, 3, and 4; however, a 9% increase occurred in Management Unit 2. In Management Unit 1 sport effort increased by 55% in Michigan but decreased by 27% in Ohio. Sport effort decreased in both Pennsylvania (45%) and New York (38%) in 2004. Lake-wide commercial gill net effort decreased 24% to 9,494 kilometers of net in 2004 and was the lowest amount of effort

since 1980. The decline in gill net effort was observed in all Management Units (Table 3, Figure 4).

Sport catch-per-unit-effort (CUE, walleye/ angler hour) increased in Management Units 2 and 3 but declined in Management Units 1 and 4. For the purpose of this report, CUE reflects the number of fish harvested. The lake-wide average sport catch rate of 0.35 fish/ hour was 19% below the 1975-2004 mean but only 5% below the 2003 sport catch rate (Table 4, Figure 5). In Management Units 2, and 3 catch rates were above the long term mean, whereas in Management Unit 1, sport catch rates were below the 1975-2004 mean. Sport catch rates in Management Unit 4 was equal to the long term average of 0.16 fish/ angler hour. Average commercial gill net CUE (all Management Units combined) increased 28% to 146 walleye/ kilometer of net in 2004. Gill net catch rates were above the 1975-2004 average for all Management Units. This marks the fourth consecutive year of increasing catch rates for the commercial fishery and represents a reversal in the trend of declining CUE's observed since the mid 1980's (Table 4, Figure 5). Gill net catch rates in 2004 were 37% higher than the 1975-2004 average for all Management Units.

The 2001 year-class (i.e., age-3 walleye) contributed 46% of the total harvest for the sport fishery and 49% of the commercial fishery. Age-4 walleye (i.e., 1999 year-class) contributed 30% to the sport fishery but only 11% to the commercial fishery; however, the 2003 year-class (i.e., age-1 walleye) comprised 27% of the commercial catch in numbers of fish (Tables 5, 6). Lake-wide the 2001, 1999 and 2003 year-classes contributed 48, 19 and 16%, respectively, to the total harvest for both fisheries. As observed in previous years, older fish (age-7+) made up a larger proportion of the catch from in eastern Management Units (Units 3 and 4) relative to the western Management Units (Units 1 and 2).

Across all management units, the mean age of walleye in the harvest ranged from 4.7 to 7.4 years old in the sport fishery and from 3.0 to 6.1 years old in the commercial fishery (Table 7, Figure 6). The mean age of fish increased in the sport fishery and decreased in the commercial fishery from 2003 values. The mean age in the sport fishery was 5.1 years, remaining above the long-term mean of 4.0 years (1975-2004). In the commercial fishery, mean age decreased from 4.1 in 2003 to 3.0 years in 2004, falling below the long-term mean of 3.5 years (1975 to 2004).

Walleye Management Plan

In 2001 the three year Coordinated Percid Management Strategy (CPMS) was put into action in response to declines in the abundance of walleye in Lake Erie. By the end of 2003, the west and central basin walleye population had begun to recover from the extremely low levels of abundance observed in the late 1990s. In 2004, a conflict resolution process was employed by the Great Lakes Fishery Commission (Ayles and Conlin 2004) to facilitate the determination of the 2004 TAC. Upon the completion of the CPMS, the WTG, STC and LEC began to draft a Walleye Management Plan (WMP) that would guide walleye management from 2005 into the future. Upon the completion

of the CPMS, the WTG, STC and LEC began to draft a Walleye Management Plan (WMP) that would guide walleye management from 2005 into the future.

The WMP was drafted during 2004 and early 2005, documenting past walleye management actions in Lake Erie. It identifies limits and uncertainties on walleye management as well as sustainability thresholds. The WMP recognizes the Lake Erie Fish Community Goals and Objectives which indicate that a sufficient abundance of walleye need to be present to act as a keystone predator and to allow stakeholders to realize a broad distribution of benefits throughout Lake Erie (Ryan et al. 2003).

The WMP documents the walleye fishery objectives for each LEC agency. Each jurisdiction's objectives outline specific targeted population abundance and catch per unit effort goals for their respective fisheries. The LEC combined their individual agencies fishery objectives into a set of categories for walleye abundance to assist in managing walleye by providing population thresholds and targets. These categories are summarized below. The LEC defined the maintenance category as a walleye population that was expected to provide fisheries that met the objectives of all five jurisdictions.

Crisis fisheries	<15 million walleye
Rehabilitation fisheries	15-20 million walleye
Low quality fisheries	20-25 million walleye
Maintenance fisheries	25-40 million walleye
High quality fisheries	>40 million walleye

The WMP also documents the exploitation strategy that the LEC agreed upon in 2005 and explains how it will be used in the future to manage walleye. This policy takes effect as of March 2005, and will continue to be used for the foreseeable future. Additional details on this policy can be found in *Harvest Policy and Recommended Allowable Harvest for 2005* section in this document.

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. (1985). The walleye task group has been using this model for several years and started with the application version called CAGEAN (Deriso et al., 1985). 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. 1985; Quinn and Deriso, 1999).

In 2004 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 2004 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 2004 population estimate was 19 million age-2+ walleye (Table 8, Figure 7) with approximately 6 million age-4+ walleye (Table 8). The decrease in the walleye population, from 2003 levels, was caused by the poor recruitment of a weak 2002 year-class, contributing approximately 0.2 million age-2 fish to the population (Table 8).

Recruitment Estimator for Incoming Age-2 Walleye and 2005 Population Size Projection

A linear regression model was used to estimate age-2 recruitment for 2005 and 2006. 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 (Tables 8 and 9, Figure 8). The most recent (2004) age-2 estimate from catch-at-age analysis has the widest error bounds, and therefore this value was not used in the linear regression to estimate recruitment. Trawl surveys in 2003 indicated that numerous young-of-year walleye were produced and the 2003 year-class is expected to be one of the strongest on record, projected to add 30 million age-2 fish to the 2005 population (Table 9, Figure 9). The trawl surveys conducted in 2004 indicated that the 2004 year-class is among the weakest observed over the 1987-2004 series, comparable to the 1998 year-class. The linear regression model estimated that approximately 5 million age-2 walleye will recruit to the fishery in 2006 (Table 9, Figure 9).

Stock size estimates for 2005 were projected using catch-at-age analysis estimates of the 2004 population size, estimated survival rates in 2004 and the age-2 recruitment estimate for 2005 (Table 8). The 2005 estimated abundance of age-2+ walleye is approximately 42 million (Table 8, Figure 10), a 121% increase from 2004. The projected abundance of age-4+ walleye (spawners) in 2005 is about 12 million walleye (Table 8). This abundance of spawners is in the 67 percentile of spawners from 1978-2005.

The abundance of age-3 and older walleye in 2006 was estimated based on expected survival using the targeted 2005 fishing rate (Table 10). The estimate of recruitment in 2006 (4.8 million age-2 walleye) was included in the 2006 population estimate of age-2 and older fish.

Harvest Policy and Recommended Allowable Catch for 2005

The harvest management policy chosen by the LEC is a feedback, or state-dependent approach, that varies fishing mortality rate with population abundance. It employs a

precautionary approach that varies fishing mortality (F) with abundance. The rate of change of F is altered when the population drops below a threshold identified and agreed upon by the WTG and the LEC. This type of variable fishing mortality precautionary approach is now a standard approach in Northwest Atlantic Fisheries Organization and International Commission for the Conservation of Atlantic Tunas fisheries (Serchuk et al. 1997; Rosenberg 2002; Gerrodette et al. 2002; Mace and Sissenwine 2002).

The policy stipulates that when the walleye abundance is less than 15 million fish, fishing mortality is set to F=0.1, which is lower than rates used during the Coordinated Percid Management Strategy. At abundance levels from 15-40 million, the policy employs a variable fishing mortality, or sliding F, that is scaled with the population abundance. The sliding F values are calculated using regression equations where N = abundance in millions and where F=0.02(N)-0.2, for populations of 15-20 million walleye (range of F=0.1-0.2), and F=0.0075(N)+0.05 for populations of 20-40 million walleye (range of F=0.2-0.35). At abundances of 40 million walleye or greater, the fishing mortality rate is F=0.35. This rate was set at a level consistent with the mean F value for fully recruited walleye caught in 1978-2004. The change in the slope at the population of 20 million, F=0.2, is approximately that set during the recent CPMS.

Therefore, the management policy, shown in Figure 11, is as follows:

< 15 million walleye	F = 0.1
15-20 million walleye	F = 0.1-0.2
20-40 million walleye	F = 0.2-0.35
> 40 million walleye	F = 0.35

Based on this harvest policy and the estimated abundance 42.4 million walleye in 2005, the recommended allowable harvest (RAH) for 2005 is 5.8 million walleye (Table 10). Given the regression value of age-2 fish recruiting in 2006, and current selectivity and fishing mortality rates, the projected walleye population would be 30.7 million fish in 2006. However, the 2006 population projection is an estimated value and will be finalized once the ADMB model is run with the 2005 harvest data in 2006.

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

Four research projects were supported by the Walleye Task Group in 2004. The first was spatial analyses of walleye movement in Lake Erie (*Spatial Analysis of Movement, Life History, and Habitat Quality of Walleye in Lake Erie*, the basis of a M.S. by Hui-Yu Wang at the University of Michigan). Ms. Wang summarized tagging and catch data from 1990 to 2001 and used a spatially-explicit growth rate potential model to relate distribution with habitat quality in Lake Erie. The modelling results indicate larger, older walleye leave the western basin to avoid unfavourably high water temperatures, while walleye age-2 and younger remain in the warmer, and more productive western basin. A draft manuscript describing these findings will be shared with the Walleye Task Group by summer 2005.

The second project (*Spatial and Temporal Distribution of Lake Erie Walleye*, James Murphy, M.S. Cornell University, 2004) developed a dispersal model for walleye using the interagency walleye tagging database to relate tagging site with point of subsequent recapture. Key findings included the Monroe stock fish showing the greatest affinity to move upstream through the Detroit River, the Sandusky stock to move into the central and eastern basins, and the Chicken and Hen Island stock showing the highest probability of remaining in the western basin. Across all stocks, larger fish showed tendencies to move further from their stock origins, creating a convergence in migratory pattern among stocks. Van Buren Bay stock walleye did not migrate from the east basin. Walleye tagged at US sites tended to remain in US waters, while walleye tagged at Canadian sites remained in Canadian waters. Mr. Murphy expects to provide a copy of his thesis to the Walleye Task Group in the spring of 2005.

Sarah Bartnik's thesis (*Population Dynamics of Age-0 Walleye in Western Lake Erie*, M.Sc., University of Windsor, 2005) research included two components – a temporal analysis of factors affecting recruitment of walleye, and a spatial analysis of stock differences using otolith microchemistry. The first chapter evaluated a number of environmental indices that had proven useful in the past to explain walleye recruitment variation: spring warming rate, wind velocity and direction, river discharge, prey composition and size. Unfortunately, none of these predictors, alone or together, explained any significant amount of variation in walleye recruitment from 1987-2001. The second chapter used unique micro-elemental signatures of walleye otoliths to perform a mixed stock analysis on the August age-0 cohort of walleye in 2003. Her results suggest four stocks contributed to the catch, with most fish coming from the Maumee River, following by Hen Island, Sandusky Bay, and the US reefs. Ms Bartnik will be defending her research in March 2005, and plans to submit both of her chapters to journals.

The final project (*Stock Discrimination of Lake Erie Walleye: A Mixed Stock Analysis Contrasting Genetic Techniques)* was coordinated by Tim Johnson (OMNR, Wheatley) and challenged three prominent genetics labs to perform a mixed stock analysis on walleye whose origin was known only to Dr. Johnson. Each lab used one or more of the following techniques to discriminate the walleye: mitochondrial DNA, microsatellite DNA, and major histocompatibility genes. No single technique was able to correctly classify more than 29% of the individual fish to natal stock. Classification success rose to 53.3% (range 20.7 to 87.9%) when fish were assigned to regions (separate basins within Lake Erie). Numerous recommendations were made to both scientists and managers to improve the success of a true mixed stock analysis including: develop and maintain open access to current and complete stock libraries, and improve communication between science and management to ensure expectations of each are known upfront. Copies of the report have been distributed to all WTG and LEC members, and will be available from the GLFC website.

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. These research projects are now nearing completion and should directly support development of a stock assessment model for the eastern basin walleye resource.

The WTG has also been pursuing the development of an ADMB catch-at-age model for eastern Lake Erie's walleye resource. This developing stock assessment model incorporates catch-at-age walleye harvest and fishing effort values from Ontario commercial gill nets, New York and Pennsylvania angling fisheries, in addition to survey data from Ontario and New York. A long-term New York walleye tagging study provided the instantaneous natural mortality estimate (M) of 0.16 used for this model. Additional data processing efforts during 2004 have now expanded the historical fisheries catch-at-age data series by four years (1993 to 1995; and 2004) in addition to one year forward (2004). Presently twelve years of data have been included in this base line effort (1993 to 2004). The current east basin model description for walleye population dynamics is provided in this report for illustrative purposes only. The most apparent shortcoming for the current configuration of this east basin model is that walleye movements into the basin by the much larger western basin spawning stocks are presently not accounted for in the model, which may confound estimates of survival, exploitation, and abundance. This developing east basin model ultimately needs to account for walleye movement dynamics from western Lake Erie to become a viable tool for walleye population assessment. Assessing the annual contribution by western basin walleye stocks to the eastern basin walleye resource may be aided by incorporating the findings of the three aforementioned GLFC-sponsored research projects. Currently the 2004

estimate of walleye abundance in the eastern basin model is 622,091 walleye, which is the lowest population abundance observed in the time series (Table 11).

Decision Analysis

The development of a Decision Analysis (DA) model to improve the ability of the LEC to incorporate uncertainty and risk into management decisions continued in 2004. A DA Team, which included some members of the WTG, participated in meetings and workshops with Mike Jones and Wenjing Dai of Michigan State University. The DA model was refined as needed and gaming was done to determine what level of risk was associated with various management options, including the chosen harvest policy.

The DA model describes the long term outcome of a simulated fishing management policy, quantifies uncertainties specific to the Lake Erie walleye population, and provides managers with critical information about the variability of the walleye population. The current version of the DA model is applicable to the Lake Erie walleye population until additional information is provided that might change what is currently known about this population (e.g., additional information on natural mortality, stock structure or recruitment). At this time, the charge to the WTG to assist with the development of the DA model has been completed. In the future, with the availability of new information, the WTG may be tasked to update and execute the DA model again.

Acknowledgements

The WTG would like to express its appreciation for support during the past year from the Great Lakes Fishery Commission, which continued to handle the financial end of the reward tag study and hosted the summer and fall WTG meetings.

Literature Cited

Ayles, B. and M. Conlin. 2004. Report on the first stage in the conflict resolution process: 2004 TAC for Lake Erie walleye. Great Lakes Fishery Commission, Ann Arbor.

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.

Gerrodette, T., P. K. Dayton, S. Macinko, and M.J. Fogarty. 2002. Precautionary management of marine fisheries: moving beyond burden of proof. Bulletin of Marine Science 70:657-668.

Mace, P. M. and M. P. Sissenwine. 2002. Coping with uncertainty: Evolution of the relationship between science and management. American Fisheries Society Symposium 27:9-28.

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

Rosenburg, A. A. 2002. The precautionary approach in application from a manager's perspective. Bulletin of Marine Science 70: 577-588.

Ryan, P., R. Knight, R. MacGregor, G. Towns, R. Hoopes, and W. Culligan. 2003. Fish-Community Goals and Objectives of Lake Erie. Great Lakes Fishery Commission special publication 03-02. 56 pp.

Serchuk, F. M., D. Rivard, J. Casey, and R.K. Mayo. 1997. Report of the ad hoc Working Group of the NAFO Scientific Council on the Precautionary Approach. NAFO SCS Document 97/12, Serial No. N2911. 61 pp.

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.

Cover art with permission from Mark Peloza, Hawg Heaven Guide Service, 9121 Bayshore Drive, Gladstone, Michigan, 49837, website: http://www.hawgheaven.upmichigan.net/index.html.

Table 1. Lake Erie walleye total allowable catch (top) and measured harvest (bottom, bold), in numbers of fish, from 1977-2004. 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 [a]	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**
2004 TAC	127,200	1,233,600	1,039,200	2,400,000				**0**	**2,400,000**
Har	**114,958**	**859,366**	**1,419,237**	**2,393,561**	**8,400**	**19,969**	**29,864**	**58,233**	**2,451,794**

[a] Ontario sport harvest values from 1998 to 2004 are estimated from a 1998 creel survey, these values are included in Ontario's total walleye harvest, but are not used in catch-at-age analysis

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
1975	77	4	7	88	10	--	10	--	--	--	--	--	--	0	98	--	--	--	--	0
1976	605	30	50	685	35	--	35	--	--	--	--	--	--	0	720	113	44	--	--	157
1977	2,131	107	69	2,307	37	--	37	--	--	--	--	--	--	0	2,344	235	67	--	--	302
1978	1,550	72	112	1,734	37	--	37	--	--	--	--	--	--	0	1,771	274	60	--	--	334
1979	3,254	162	79	3,495	60	--	60	--	--	--	--	--	--	0	3,555	625	30	--	--	655
1980	2,096	183	57	2,336	49	--	49	24	--	24	--	--	--	0	2,409	953	40	--	--	993
1981	2,857	95	70	3,022	38	--	38	48	--	48	--	--	--	0	3,108	1,037	119	3	--	1,159
1982	2,959	194	49	3,202	49	--	49	8	--	8	--	--	--	0	3,259	1,077	134	2	--	1,213
1983	1,626	146	41	1,813	212	--	212	26	--	26	--	--	--	0	2,051	1,129	167	80	--	1,376
1984	3,089	351	39	3,479	787	--	787	179	--	179	--	--	--	0	4,445	1,639	392	108	--	2,139
1985	3,347	461	57	3,865	294	--	294	89	--	89	--	--	--	0	4,248	1,721	432	225	--	2,378
1986	3,743	606	52	4,401	480	--	480	176	--	176	--	--	--	0	5,057	1,651	558	356	--	2,565
1987	3,751	902	51	4,704	550	--	550	132	--	132	--	--	--	0	5,386	1,611	622	405	--	2,638
1988	3,744	1,997	18	5,759	584	--	584	562	--	562	--	--	85	85	6,990	1,866	762	409	--	3,037
1989	2,891	1,092	14	3,997	867	35	902	434	80	514	--	--	129	129	5,542	1,656	621	386	--	2,663
1990	1,467	747	35	2,249	389	14	403	426	23	449	--	--	47	47	3,148	1,615	529	302	--	2,446
1991	1,104	132	39	1,275	216	24	240	258	44	302	--	--	34	34	1,851	1,446	440	274	--	2,160
1992	1,479	250	20	1,749	338	56	394	265	25	290	--	--	14	14	2,447	1,547	534	316	--	2,397
1993	1,846	270	37	2,153	450	26	476	372	12	384	--	--	40	40	3,053	2,488	762	496	--	3,746
1994	992	216	21	1,229	291	20	311	186	21	207	--	--	59	59	1,806	2,307	630	432	--	3,369
1995	1,161	108	32	1,301	159	7	166	115	27	141	--	--	27	27	1,635	2,578	681	489	--	3,748
1996	1,442	175	17	1,634	645	8	653	229	27	256	--	89	39	128	2,671	2,777	1,107	589	--	4,473
1997	929	122	8	1,059	188	2	190	132	5	138	--	89	29	118	1,505	2,585	928	544	--	4,057
1998	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
1999	812	140	34	986	139	5	144	83	5	88	19	89	23	131	1,349	2,461	631	317	68	3,477
2000	674	252	34	961	165	5	170	93	5	98	19	78	29	125	1,354	1,603	444	196	48	2,291
2001	941	160	34	1,135	171	5	176	46	5	51	19	53	15	87	1,449	1,004	310	141	20	1,475
2002	516	194	34	744	141	5	146	46	5	51	19	22	18	59	1,000	937	309	146	17	1,409
2003	715	129	34	878	232	5	237	68	5	73	19	44	27	90	1,278	948	283	182	14	1,427
2004	515	115	34	664	272	5	277	72	5	77	19	20	8	47	1,065	866	334	175	11	1,386
Mean	1,803	318	40	2,161	270	14	278	175	19	187	19	68	39	47	2,641	1,491	453	293	29	2,121

[a] Ontario sport harvest values from 1998 to 2004 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								
Year	OH	MI	ON[c]	Total	OH	ON[c]	Total	OH	ON[c]	Total	ON[c]	PA	NY	Total	Total	Unit 1 ON	Unit 2 ON	Unit 3 ON	Unit 4 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
2004	1,257	504	--	1,761	736	--	736	178	--	178	--	88	101	189	2,864	3,875	2,977	2,401	240	9,494
Mean	3,571	836	107	4492	790	63	811	472	125	522	217	261	284	246	6000	10,474	6,372	5,314	819	21,445

[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 1999-2004 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
2004	.41	.23	--	.36	.37	--	.37	.40	--	.40	--	.23	.08	.16	.35	223.5	112.1	73.0	45.4	146.0
Mean	.48	.38	.39	.46	.31	.29	.31	.33	.19	.31	.09	.25	.13	.16	.43	149.8	74.0	57.3	37.4	106.8

[a] Sport CPE = Number harvested/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 1999-2004 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 2004. Units 4 and 5 are combined in Unit 4.

		Commercial	Sport					All Gears	
Unit	Age	OMNR	OMNR[a]	ODNR	MDNR	NYDEC	PA	Total	OMNR	Total
1	1	203,955		445	90	--	--	535	203,955	204,490
	2	3,267		179	134	--	--	313	3,267	3,580
	3	477,833		250,501	49,739	--	--	300,240	477,833	778,073
	4	61,639		14,225	12,359	--	--	26,584	61,639	88,223
	5	81,384		172,135	33,618	--	--	205,753	81,384	287,137
	6	16,185		20,342	7,275	--	--	27,617	16,185	43,802
	7+	21,863		57,351	11,744	--	--	69,095	21,863	90,958
	Total	866,126	34,000	515,178	114,958	--	--	664,136	900,126	1,530,262
2	1	135,359		0	--	--	--	0	135,359	135,359
	2	3,770		0	--	--	--	0	3,770	3,770
	3	125,912		133,784	--	--	--	133,784	125,912	259,696
	4	24,660		7,843	--	--	--	7,843	24,660	32,503
	5	32,666		67,438	--	--	--	67,438	32,666	100,104
	6	5,674		17,353	--	--	--	17,353	5,674	23,027
	7+	5,852		45,286	--	--	--	45,286	5,852	51,138
	Total	333,893	5,000	271,704	--	--	--	276,704	338,893	610,597
3	1	39,879		0	--	--	--	0	39,879	39,879
	2	0		209	--	--	--	209	0	209
	3	72,106		23,728	--	--	--	23,728	72,106	95,834
	4	10,487		1,799	--	--	--	1,799	10,487	12,286
	5	32,401		22,468	--	--	--	22,468	32,401	54,869
	6	7,002		3,593	--	--	--	3,593	7,002	10,595
	7+	13,343		20,687	--	--	--	20,687	13,343	34,030
	Total	175,218	5,000	72,484	--	--	--	77,484	180,218	252,702
4	1	1,199		--	--	0	0	0	1,199	1,199
	2	0		--	--	0	0	0	0	0
	3	884		--	--	689	1,426	2,115	884	2,999
	4	821		--	--	0	4,279	4,279	821	5,100
	5	1,702		--	--	689	5,705	6,394	1,702	8,096
	6	1,618		--	--	2,202	4,279	6,481	1,618	8,099
	7+	4,640		--	--	4,820	4,279	9,099	4,640	13,739
	Total	10,864	19,000	--	--	8,400	19,969	47,369	29,864	58,233
All	1	380,392		445	90	0	0	535	380,392	380,927
	2	7,037		388	134	0	0	522	7,037	7,559
	3	676,735		408,013	49,739	689	1,426	459,867	676,735	1,136,602
	4	97,607		23,867	12,359	0	4,279	40,505	97,607	138,112
	5	148,153		262,041	33,618	689	5,705	302,054	148,153	450,207
	6	30,479		41,288	7,275	2,202	4,279	55,044	30,479	85,523
	7+	45,698		123,324	11,744	4,820	4,279	144,167	45,698	189,865
	Total	1,386,101	63,000	859,366	114,958	8,400	19,969	1,065,693	1,449,101	2,451,794

[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 2004. Units 4 and 5 are combined in Unit 4.

		Comm'l	Sport						All Gears
Unit	Age	OMNR	OMNR[a]	ODNR	MDNR	NYDEC	PA	Total	Total
1	1	23.5	--	0.1	0.1	--	--	0.1	13.7
	2	0.4	--	0.0	0.1	--	--	0.0	0.2
	3	55.2	--	48.6	43.3	--	--	47.6	52.0
	4	7.1	--	2.8	10.8	--	--	4.2	5.9
	5	9.4	--	33.4	29.2	--	--	32.7	19.2
	6	1.9	--	3.9	6.3	--	--	4.4	2.9
	7+	2.5	--	11.1	10.2	--	--	11.0	6.1
	Total	100	--	100	100	--	--	100	100
2	1	40.5	--	0.0	--	--	--	0.0	22.4
	2	1.1	--	0.0	--	--	--	0.0	0.6
	3	37.7	--	49.2	--	--	--	49.2	42.9
	4	7.4	--	2.9	--	--	--	2.9	5.4
	5	9.8	--	24.8	--	--	--	24.8	16.5
	6	1.7	--	6.4	--	--	--	6.4	3.8
	7+	1.8	--	16.7	--	--	--	16.7	8.4
	Total	100	--	100	--	--	--	100	100
3	1	22.8	--	0.0	--	--	--	0.0	16.1
	2	0.0	--	0.3	--	--	--	0.3	0.1
	3	41.2	--	32.7	--	--	--	32.7	38.7
	4	6.0	--	2.5	--	--	--	2.5	5.0
	5	18.5	--	31.0	--	--	--	31.0	22.2
	6	4.0	--	5.0	--	--	--	5.0	4.3
	7+	7.6	--	28.5	--	--	--	28.5	13.7
	Total	100	--	100	--	--	--	100	100
4	1	11.0	--	--	--	0.0	0.0	0.0	3.1
	2	0.0	--	--	--	0.0	0.0	0.0	0.0
	3	8.1	--	--	--	8.2	7.1	7.5	7.6
	4	7.6	--	--	--	0.0	21.4	15.1	13.0
	5	15.7	--	--	--	8.2	28.6	22.5	20.6
	6	14.9	--	--	--	26.2	21.4	22.8	20.6
	7+	42.7	--	--	--	57.4	21.4	32.1	35.0
	Total	100	--	--	--	100	100	100	100
All	1	27.4	--	0.1	0.1	0.0	0.0	0.1	15.9
	2	0.5	--	0.0	0.1	0.0	0.0	0.1	0.3
	3	48.8	--	47.5	43.3	8.2	7.1	45.9	47.6
	4	7.0	--	2.8	10.8	0.0	21.4	4.0	5.8
	5	10.7	--	30.5	29.2	8.2	28.6	30.1	18.8
	6	2.2	--	4.8	6.3	26.2	21.4	5.5	3.6
	7+	3.3	--	14.4	10.2	57.4	21.4	14.4	7.9
	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
1975	2.53	2.53	3.26	2.59	1.53	--	1.53	--	--	--	--	--	--	--	2.48	--	--	--	--	--
1976	2.49	2.49	2.35	2.48	2.05	--	2.05	--	--	--	--	--	--	--	2.46	1.51	1.51	--	--	1.51
1977	3.29	3.29	2.64	3.27	2.44	--	2.44	--	--	--	--	--	--	--	3.26	2.74	2.74	--	--	2.74
1978	3.50	3.62	3.07	3.48	3.33	--	3.33	--	--	--	--	--	--	--	3.48	2.69	2.69	--	--	2.69
1979	2.71	2.71	2.67	2.71	2.29	--	2.29	--	--	--	--	--	--	--	2.70	2.83	2.83	--	--	2.83
1980	3.00	3.00	2.84	3.00	2.92	--	2.92	2.65	--	2.65	--	--	--	--	2.99	2.96	2.96	--	--	2.96
1981	3.61	2.97	3.47	3.59	2.62	--	2.62	2.72	--	2.72	--	--	--	--	3.56	3.00	3.00	2.99	--	3.00
1982	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
1983	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
1984	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
1985	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
1986	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
1987	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
1988	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
1989	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
1990	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
1991	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
1992	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
1993	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
1994	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
1995	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
1996	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
1997	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
1998	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
1999	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
2000	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
2001	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
2002	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
2003	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
2004	4.77	4.41	--	4.70	5.11	--	5.11	6.42	--	6.42	--	5.86	11.11	7.41	5.05	2.96	2.59	3.49	6.07	2.96
Mean	3.77	3.50	3.67	3.72	3.98	6.58	4.00	5.00	6.72	5.02	8.85	6.91	7.62	7.13	3.96	3.30	3.52	4.55	6.38	3.46

Table 8. Estimated abundance at age, survival (S) and maximum exploitation (U) for Lake Erie walleye, 1978–2004 from the 2005 catch-at-age analysis model in ADMB, M=0.32. West and central basin population modeled, east basin stock excluded. 2005 projected abundance of ages 3 to 7+ is based on survival from 2004, and projected 2005 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	2,314,200	5,676,590	1,111,080	81,401	184,165	26,166	9,393,602	0.528	0.284
1979	16,900,500	1,494,860	2,783,480	541,684	39,685	102,604	21,862,813	0.574	0.366
1980	11,098,600	10,447,100	633,951	1,170,010	227,692	60,126	23,637,479	0.576	0.263
1981	7,022,670	7,232,890	5,328,720	320,403	591,332	145,695	20,641,710	0.468	0.397
1982	11,758,000	4,259,320	2,887,460	2,103,740	126,493	291,502	21,426,515	0.550	0.329
1983	7,747,990	7,408,980	1,940,930	1,301,510	948,252	189,594	19,537,256	0.568	0.260
1984	48,784,300	5,041,190	3,821,390	985,386	660,759	578,929	59,871,954	0.620	0.273
1985	6,399,720	31,551,100	2,540,070	1,897,110	489,190	618,965	43,496,155	0.579	0.198
1986	18,264,300	4,294,990	17,784,000	1,419,940	1,060,520	621,837	43,445,587	0.580	0.241
1987	16,959,200	12,001,600	2,276,560	9,304,660	742,918	883,711	42,168,649	0.600	0.207
1988	44,890,900	11,329,800	6,696,010	1,256,870	5,137,030	902,286	70,212,896	0.618	0.226
1989	14,370,800	29,727,800	6,143,750	3,590,090	673,874	3,242,530	57,748,844	0.586	0.205
1990	11,163,800	9,608,150	16,633,000	3,401,400	1,987,600	2,183,910	44,977,860	0.611	0.166
1991	6,214,020	7,587,520	5,686,350	9,744,160	1,992,650	2,454,560	33,679,260	0.624	0.141
1992	13,027,400	4,265,160	4,662,390	3,454,240	5,919,200	2,715,670	34,044,060	0.616	0.177
1993	20,258,400	8,799,240	2,495,620	2,689,500	1,992,580	4,999,470	41,234,810	0.595	0.234
1994	3,512,080	13,305,800	4,756,920	1,320,510	1,423,100	3,746,810	28,065,220	0.560	0.224
1995	12,898,700	2,314,720	7,317,570	2,555,350	709,361	2,816,460	28,612,161	0.580	0.248
1996	14,524,400	8,393,640	1,232,460	3,787,780	1,322,720	1,859,300	31,120,300	0.536	0.329
1997	1,631,950	9,050,280	3,917,110	554,940	1,705,530	1,457,780	18,317,590	0.518	0.273
1998	14,590,200	1,048,370	4,631,080	1,944,690	275,506	1,588,690	24,078,536	0.548	0.345
1999	6,886,630	9,003,190	476,707	2,025,420	850,520	837,914	20,080,381	0.541	0.293
2000	5,433,750	4,375,590	4,471,990	228,955	972,779	822,215	16,305,279	0.528	0.307
2001	16,431,400	3,427,620	2,121,430	2,095,700	107,295	852,110	25,035,555	0.613	0.238
2002	2,155,630	10,783,000	1,839,890	1,116,400	1,102,850	512,255	17,510,025	0.617	0.146
2003	18,851,200	1,476,480	6,576,430	1,109,400	673,155	976,776	29,663,441	0.645	0.167
2004	215,759	12,787,500	877,253	3,851,550	649,729	973,112	19,354,903	0.635	0.113
2005	30,129,169	149,894	8,137,510	553,408	2,429,758	1,028,154	42,427,892		

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 2005-2006, 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	2.221050	14.371	2.665198
1990	1988	20.70	3.030037	11.164	2.412676
1991	1989	5.60	1.722767	6.214	1.826808
1992	1990	47.03	3.850722	13.027	2.567055
1993	1991	68.02	4.219831	20.258	3.008570
1994	1992	4.64	1.534714	3.512	1.256208
1995	1993	97.78	4.582730	12.899	2.557127
1996	1994	62.15	4.129615	14.524	2.675830
1997	1995	2.67	0.980954	1.632	0.489776
1998	1996	93.13	4.533964	14.590	2.680350
1999	1997	24.75	3.208825	6.887	1.929582
2000	1998	13.67	2.615130	5.434	1.692630
2001	1999	58.14	4.062785	16.431	2.799194
2002	2000	3.19	1.161274	2.156	0.768083
2003	2001	31.16	3.439264	18.851	2.936577
2004	2002	0.17	-1.748700	0.216	
2005	2003	204.02	5.318223	**30.129** [1]	
2006	2004	6.96	1.940453	**4.769** [2]	

[1]This regression estimate was used for 2005 age-2 projection.
[2]This regression estimate was used for 2006 age-2 projection.

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

$$Y = 0.5457\ (0.0917)\ X + 0.5032\ (0.0298)$$

with n=15, F=35.38, $p<0.0001$ and an $r^2=0.73$. Both parameters were transformed by natural logarithm (LN).

Table 10. Estimated harvest of Lake Erie walleye for 2005 and population projection for 2006. Fishing mortality for the fully-selected age groups is derived from the regression equation described in the Harvest Policy section of this report. Abundance of age-2 and older walleye is from ADMB catch-age results and trawl regressions. Stock size and catch in numbers are in millions of fish.

	2005 Stock Size (millions)		Rate Functions					2005 RAH (millions of fish)	2006 Stock Size (millions)
Age	**Mean**	**F**	**s(age)**	**(F)**	**(Z)**	**(S)**	**(u)**	**Mean**	**Mean**
2	30.129		0.314	0.110	0.430	0.651	0.089	2.691	4.769
3	0.150		0.938	0.328	0.648	0.523	0.242	0.036	19.601
4	8.138		1.000	0.350	0.670	0.512	0.255	2.076	0.078
5	0.553		1.000	0.350	0.670	0.512	0.255	0.141	4.164
6	2.430		1.000	0.350	0.670	0.512	0.255	0.620	0.283
7+	1.028		0.949	0.332	0.652	0.521	0.244	0.251	1.779
Total	42.428	0.350					0.137	5.815	30.675
(3+)	12.299								25.906

Table 11. East basin walleye ADMB catch-age model results in numbers of fish (a), and biomass (b) by age, based on PA, NY and ONT Units 4 and 5 data; M=0.16.

(a)

	Age										
Number	2	3	4	5	6	7	8	9	10	11+	Total
1993	244,008	410,537	180,927	170,742	65,236	251,602	132,857	342,319	65,729	75,640	1,939,597
1994	124,614	207,672	342,379	138,869	128,540	49,112	189,413	100,019	257,707	49,482	1,587,807
1995	329,892	105,971	169,422	230,713	92,134	85,281	32,583	125,668	66,358	170,978	1,409,000
1996	449,922	280,634	88,355	133,004	173,397	69,245	64,094	24,489	94,448	49,873	1,427,461
1997	51,168	382,057	226,550	59,097	83,026	108,241	43,225	40,010	15,287	58,958	1,067,620
1998	193,716	43,532	316,321	167,464	42,670	59,948	78,155	31,211	28,889	11,038	972,944
1999	75,061	164,720	35,725	224,276	114,912	29,280	41,136	53,629	21,416	19,823	779,979
2000	319,624	63,782	134,647	25,453	150,429	77,075	19,639	27,591	35,971	14,365	868,576
2001	220,310	271,348	50,832	82,424	14,759	87,227	44,693	11,388	15,999	20,858	819,837
2002	59,311	187,206	219,513	33,363	52,091	9,328	55,127	28,245	7,197	10,111	661,493
2003	372,668	50,432	153,557	155,327	22,831	35,647	6,383	37,725	19,329	4,925	858,824
2004	9,574	316,557	40,279	92,871	91,216	13,408	20,934	3,748	22,154	11,351	622,091

(b)

Biomass	Age										
(kgs)	2	3	4	5	6	7	8	9	10	11+	Total
1993	139,328	440,096	194,497	251,162	107,248	569,627	315,270	1,015,660	217,957	263,228	3,514,073
1994	85,486	217,847	424,892	265,518	340,501	111,876	513,310	290,654	775,440	172,199	3,197,723
1995	228,285	113,177	224,484	448,737	164,643	175,508	93,286	384,543	199,672	578,418	2,610,753
1996	287,500	260,990	140,131	240,737	345,581	142,506	165,492	71,164	284,194	173,557	2,111,852
1997	32,697	355,313	359,309	106,965	165,471	222,760	111,608	116,269	45,998	205,174	1,721,564
1998	123,785	40,485	501,684	303,109	85,042	123,374	201,795	90,698	86,927	38,411	1,595,310
1999	64,928	178,062	58,981	440,253	231,548	62,308	108,558	147,748	54,441	65,040	1,411,867
2000	230,769	84,958	210,050	43,015	313,946	177,581	49,687	89,892	102,840	44,674	1,347,412
2001	152,014	308,251	72,486	158,006	23,570	185,358	141,765	34,539	52,365	68,706	1,197,060
2002	33,333	230,825	311,050	58,986	109,079	18,217	137,597	79,878	18,935	33,145	1,031,045
2003	260,123	71,058	236,324	241,689	42,626	89,261	17,924	89,370	47,066	14,618	1,110,058
2004	6,424	369,422	51,114	178,312	192,830	30,140	52,104	9,409	54,520	28,196	972,471

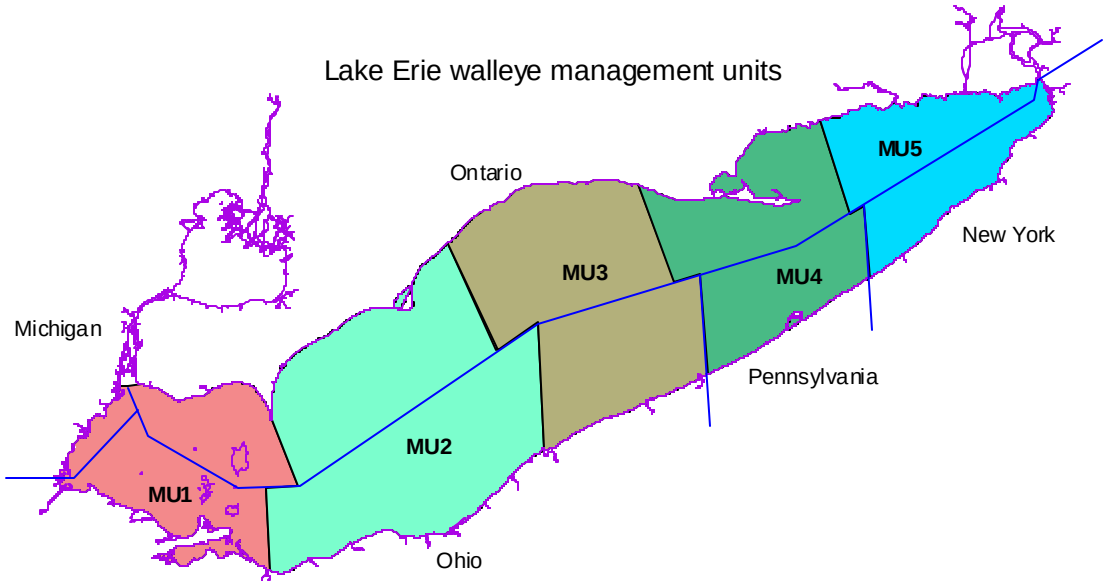


Figure 1. Map of Lake Erie with management units recognized by the Walleye Task Group for interagency management of walleye.

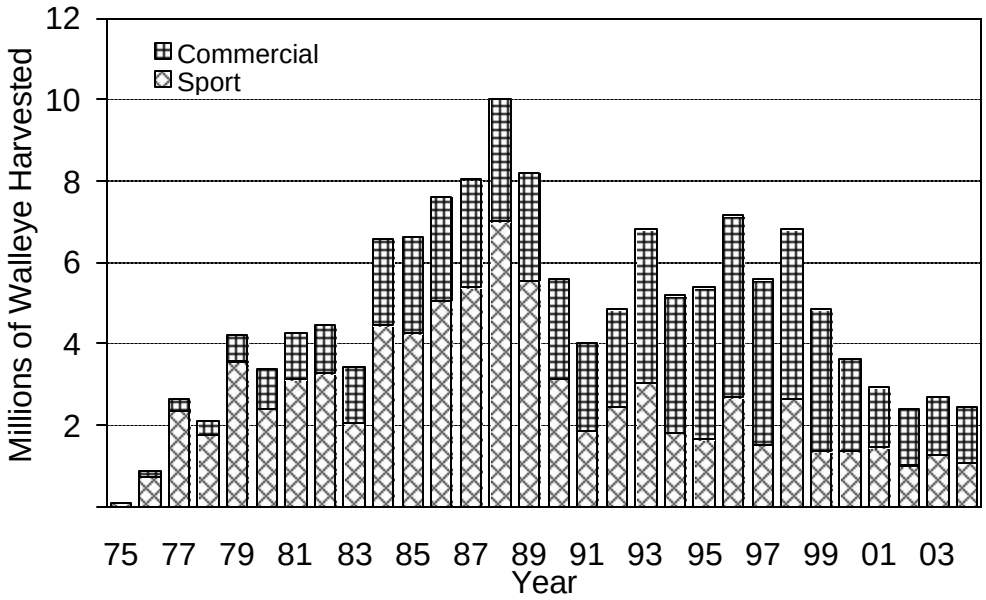


Figure 2. Lakewide harvest of Lake Erie walleye by sport and commercial fisheries, 1975-2004.

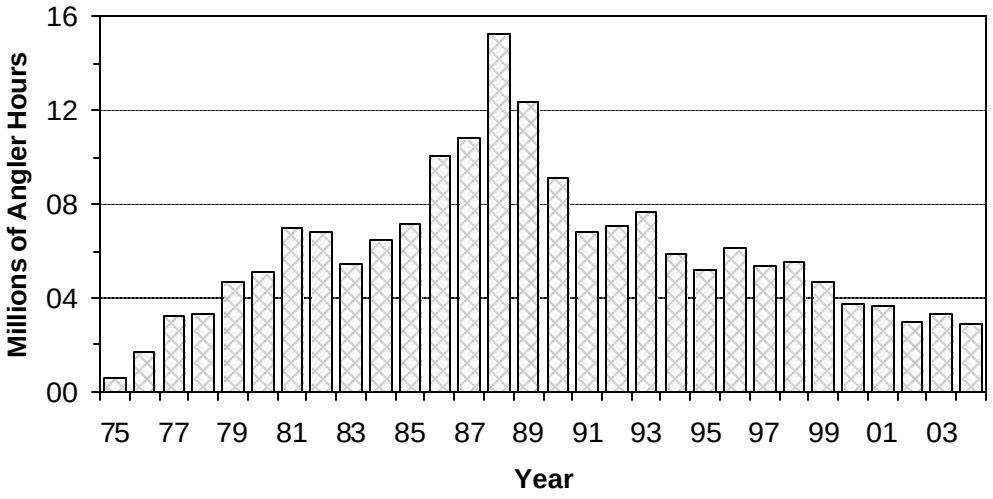


Figure 3. Lakewide total effort (angler hours) by sport fisheries for Lake Erie walleye, 1975–2004 (1999-2004 excludes Ontario sport effort).

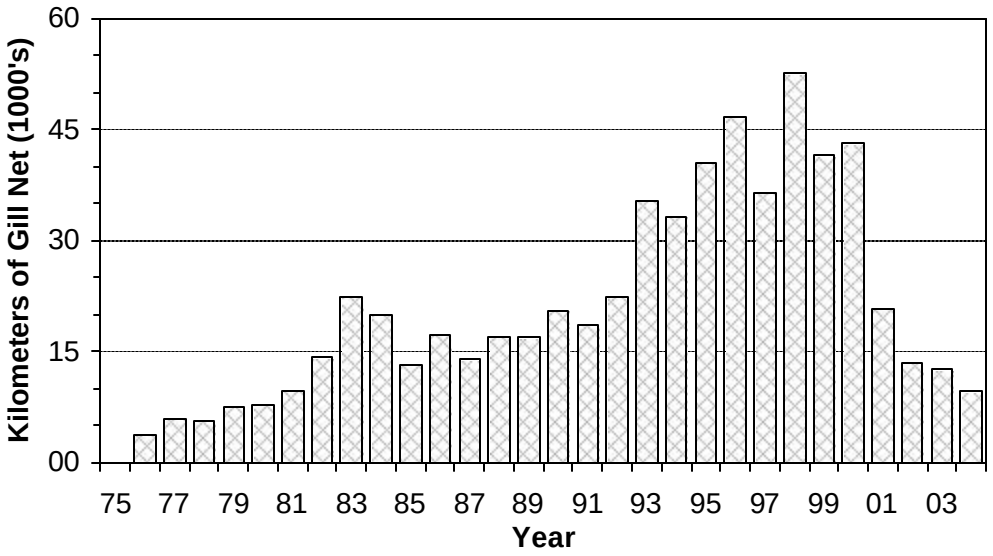


Figure 4. Lakewide total effort (kilometers of gill net) by commercial fisheries for Lake Erie walleye, 1975-2004.

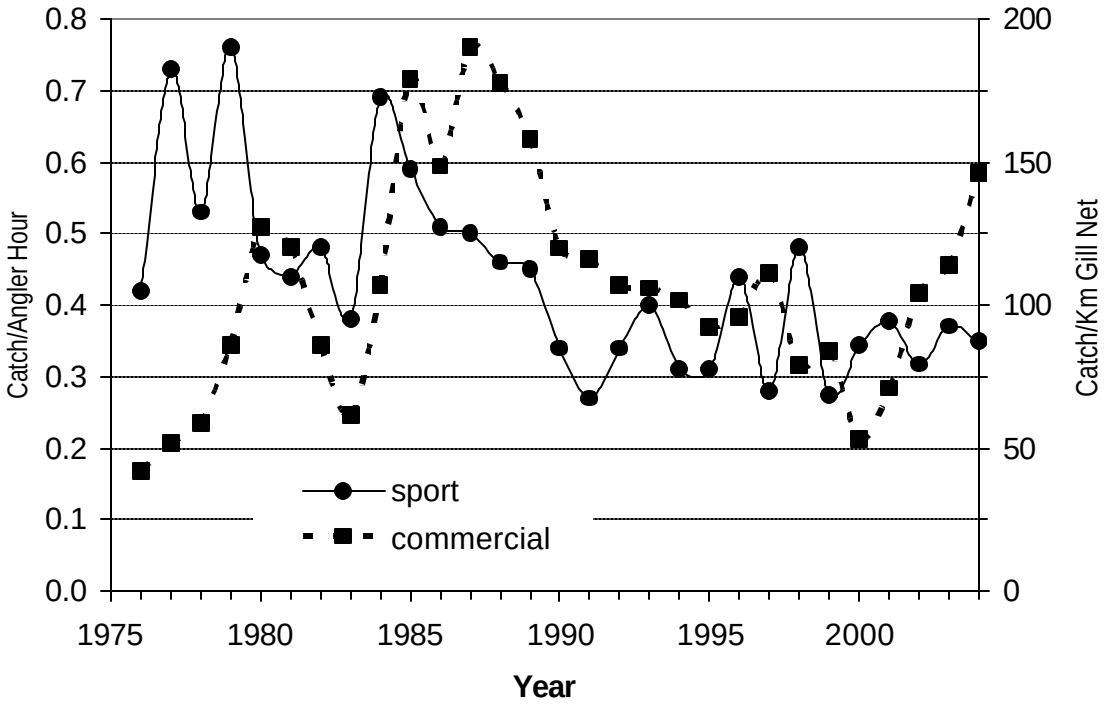


Figure 5. Lakewide CUE for Lake Erie sport and commercial walleye fisheries, 1975-2004.

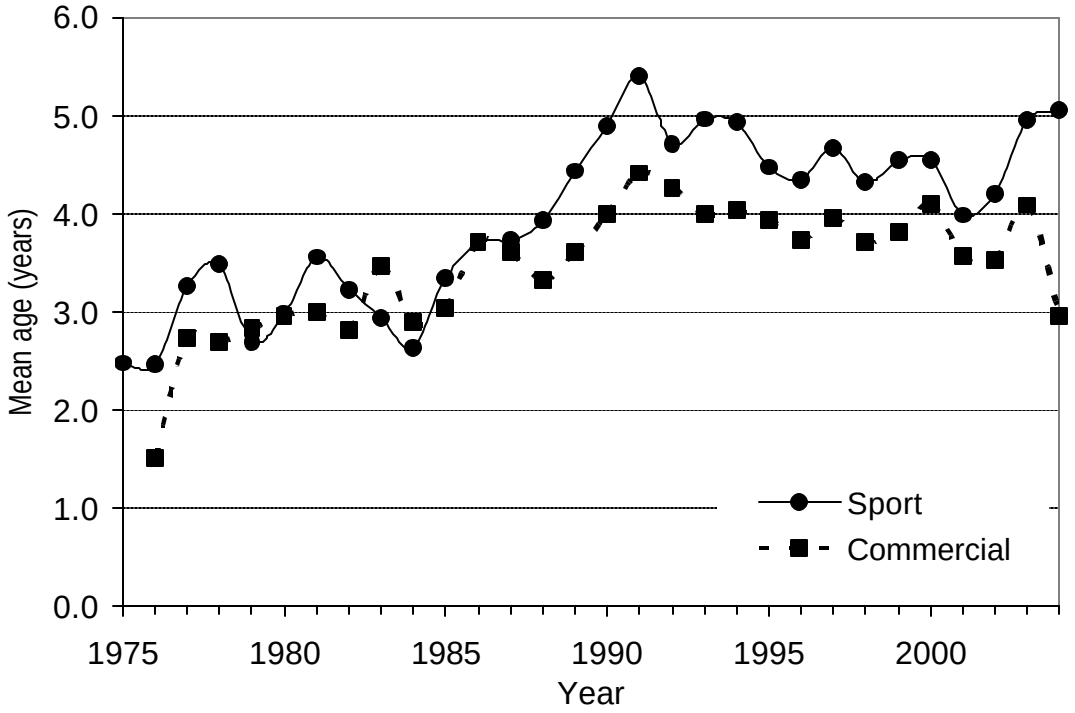


Figure 6. Lakewide mean age of Lake Erie walleye in sport and commercial harvests, 1975-2004.

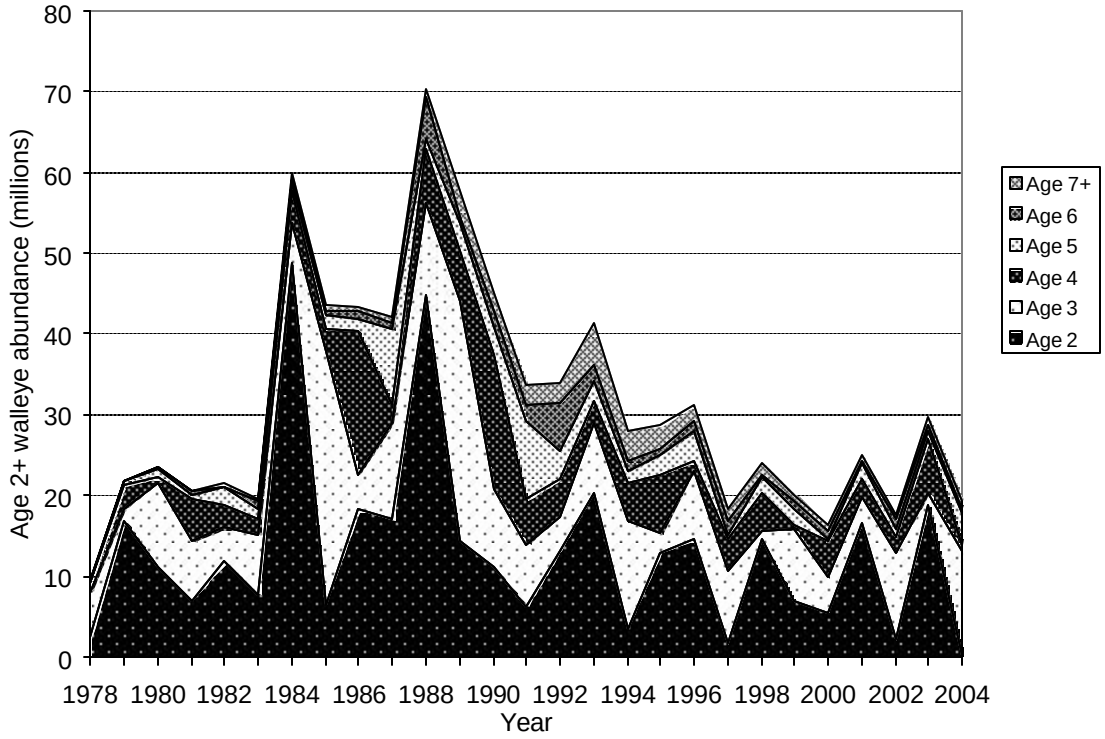


Figure 7. Age class composition of Lake Erie walleye 1978-2004. Data are from Table 8 in this document.

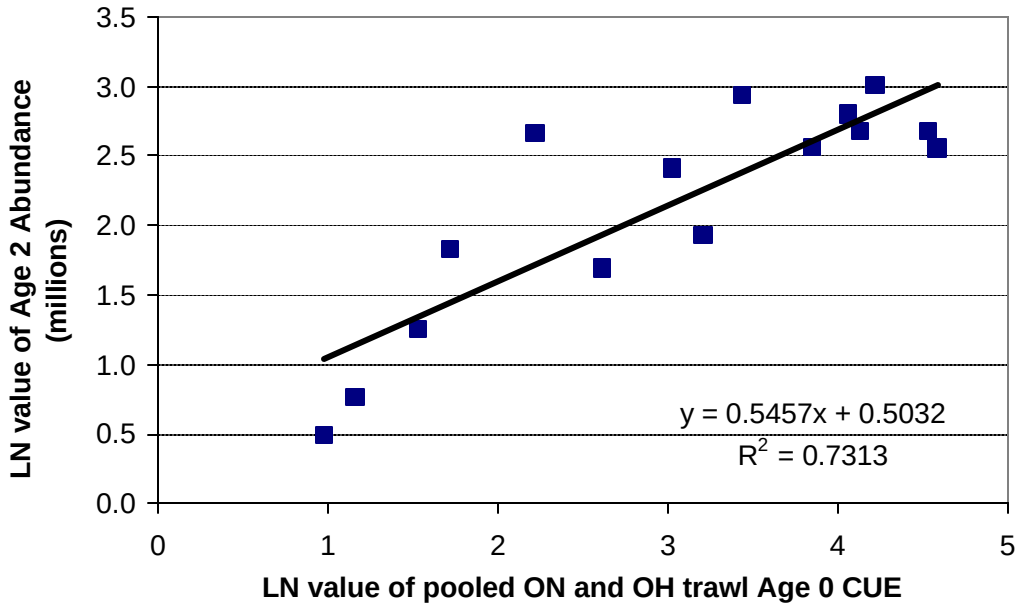


Figure 8. Regression estimates of abundance for age-2 Lake Erie walleye using natural logarithm transformed ADMB 2005 model catch-at-age estimates (y) and pooled Ontario and Ohio young-of-the-year trawl indices (x).

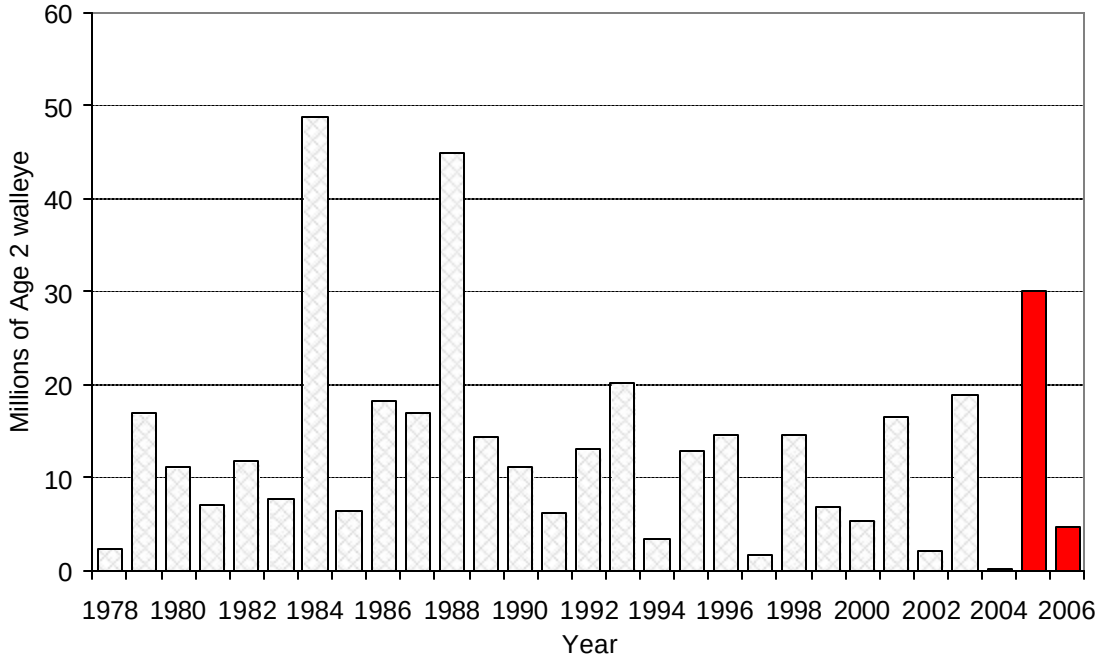


Figure 9. Catch-at-age estimates of age-2 Lake Erie walleye for 1978 to 2004. Estimates for 2005-2006 are from the regression of YOY index and numbers of age-2 from catch-at-age analysis (see Table 9).

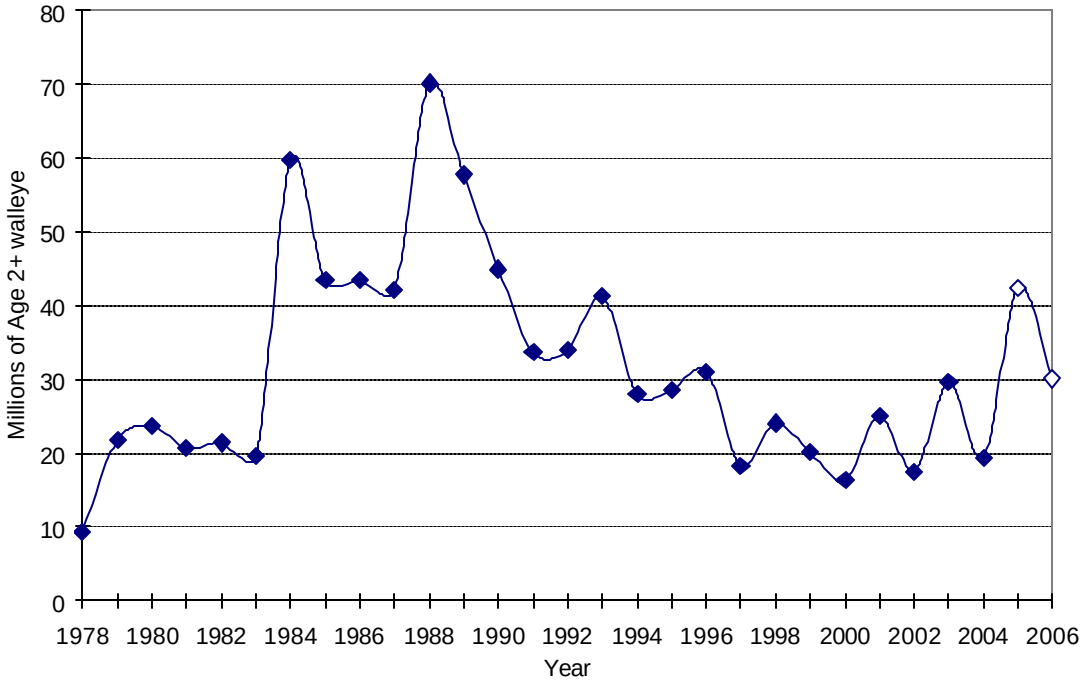


Figure 10. Abundance of Lake Erie walleye from 1978-2004, forecasting two additional years of population abundance in 2005 and 2006.

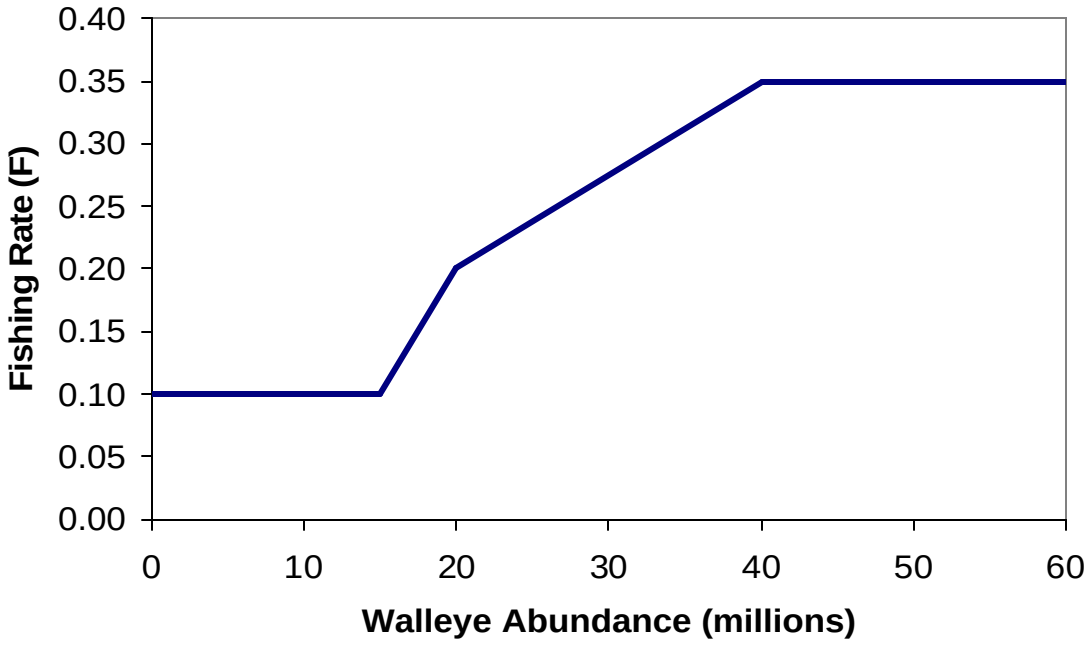


Figure 11. Lake Erie walleye harvest policy, below 15 million fish F=0.1, between 15 and 20 million fish F= 0.02(N)-0.2 (N is abundance in millions of fish), between 20 and 40 million fish F= 0.0075(N)+0.05, and at 40 million fish and above F=0.35.