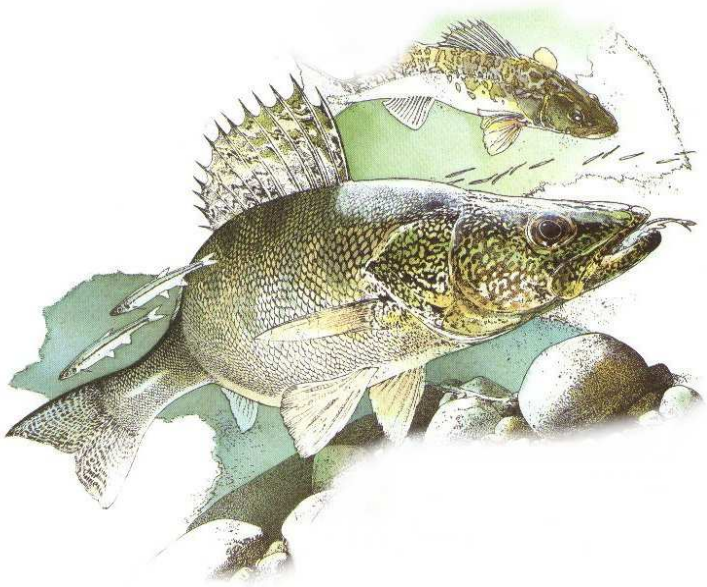
Report for 2010 by the

LAKE ERIE WALLEYE TASK GROUP

March 2011



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***Note**: 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.*

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Charges to the Walleye Task Group, 2010-2011

The charges from the Lake Erie Committee's (LEC) Standing Technical Committee (STC) to the Walleye Task Group (WTG) for the period from March 2010 to February 2011 were to:

1. Maintain and update centralized time series of datasets required for population models and assessment including;
    a. Tagging and population indices (abundance, growth, maturity).
    b. Fishing harvest and effort by grid.
2. Improve existing population models to produce the most scientifically-defensible method for estimating and forecasting abundance, recruitment, and mortality. Continue to explore data pooling, catchability blocks, lambdas, and alternate selectivities to improve the existing model.
3. Report Recommended Allowable Harvest (RAH) levels for 2011.
4. Review jaw and PIT tagging study results and provide guidance/recommendations for future tagging strategies to the LEC.
5. Assist the Habitat Task Group with the identification and collection of habitat metrics for the purpose of re-examining the extent of suitable adult walleye habitat in Lake Erie.
6. Assist the STC with a five-year review of the Walleye Management Plan.

Review of Walleye Fisheries in 2010

Fishery effort and walleye harvest data were combined for all jurisdictions and Management Units (Figure 1) to produce lake-wide estimates. The 2010 total estimated lake-wide harvest of walleye was 2.116 million walleye (Tables 1 and 2), with a total of 1.997 million walleye harvested in the total allowable catch (TAC) area. This harvest represents 91% of the 2010 TAC of 2.200 million walleye and includes walleye harvested in commercial and sport fisheries in Management Units 1, 2, and 3. An additional 115,057 walleye (5% of the lake-wide total) were harvested outside of the TAC area in Management Units 4 and 5 (referred to as Unit 4 in the Tables). The sport fish harvest of 1.153 million walleye in 2010 was nearly unchanged from the 2009 harvest of 1.166 million, but was 53% below the long-term (1975-2010) average of 2.458 million. The 2010 Ontario commercial harvest was approximately 0.962 million walleye lake-wide, with 0.939 million caught in the TAC area (Table 2). Ontario does not conduct angler creel surveys annually. The most recent Ontario creels were completed in 2008, 2004, and 2003 in walleye MUs 1, 2 - 3, and 4 - 5, respectively. If the 2010 Ontario sport harvest was comparable to these earlier reference years, then Ontario lake-wide sport harvest would be approximately 48 thousand walleye, with 46 thousand harvested within the TAC area. Combined with reported commercial walleye harvest in the TAC area, this total harvest would represent 104% of the Ontario TAC allocation of 0.947 million walleye. Ontario commercial harvest data in this report have not been

adjusted by the 3.3% deducted from individual transferable quotas for icing fish. Taking into account Ontario's commercial icing protocol and unknown sport harvest, it is possible that Ontario exceeded the 2010 TAC, but if so, by an amount less than 1%. The Ontario commercial harvest was 11% lower than the 2009 harvest and 46% of the long-term average (1978-2010; Table 2, Figure 2).

Sport fishing effort increased 6% in 2010 from 2009, to a total of 2.8 million angler hours (Table 3, Figure 3). Compared to 2009, sport effort increased in Management Units 1 and 4, but decreased in Management Units 2 and 3. Lake-wide commercial gill net effort in 2010 (4,937 km) decreased 38% from 2009 to the lowest effort observed since 1975 (Table 3, Figure 4).

Sport harvest per unit of effort (HUE, walleye/angler hour) in Unit 1 (0.47 walleye/angler hour) decreased (16%); however, in Management Unit 2 (0.39 walleye/angler hour), Management Unit 3 (0.52 walleye/angler hour), and Management Unit 4 (0.30 walleye/angler hour), rates increased by 7%, 18%, and 18%, respectively, compared to 2009. In Management Unit 1, the sport harvest rate was 15% below the long-term average (0.46 walleye per angler hour; Table 4, Figure 5). In contrast, the sport harvest rates in Management Unit 2 (22%), Management Unit 3 (46%), and Management Unit 4 (41%) were all above the long term means in 2010. The 2010 lake-wide average sport HUE of 0.39 walleye/angler hour was 9% lower than the long-term mean of 0.43 walleye/angler hour.

In 2010, total commercial gill net harvest per unit effort (HUE; 194.9 walleye/kilometer of net) increased 43% relative to 2009, and was 62% above the long-term lake-wide average (120 walleye/kilometer; Table 4, Figure 5). Commercial gill net harvest rates in 2010 increased for each Management Unit compared with 2009. Increases of 59%, 37%, 36%, and 65% were recorded for Management Units 1 through 4, respectively.

Fishing success was largely based on two age groups, ages 7-and-older fish (largely composed of the 2003 year class) and age 3 fish (the 2007 year class) evident from the age composition in the harvest. Ages 7-and-older walleye comprised 63% of the lake-wide sport fishery harvest and 36% of the total commercial fishery harvest (Tables 5 and 6). The 2007 year class (age 2 walleye) represented 21% of the total sport harvest and 42% of the total commercial harvest (Table 6). Lake-wide, ages 7-and-older fish accounted for 51% of the harvest, while the 2007 year class contributed 31%. The low contributions from the age 4, 5, and 6 cohorts (2006, 2005, and 2004 year classes, respectively) is an indication of their relatively low abundance.

Across all jurisdictions, the mean age of walleye in the harvest ranged from 5.4 to 7.3 years old in the sport fishery, and from 4.1 to 7.8 years old in Ontario's commercial fishery (Table 7, Figure 6). The mean age of walleye increased in the sport fishery for the 4th consecutive year, but decreased for a second consecutive year in the commercial fishery. The mean age in the sport fishery was 6.1 years, above the long-term (1975-2009) mean of 4.2 years, and the highest recorded since at least 1975. In the commercial fishery, the mean age was 4.6 years, higher than the long-term (1975-

2009) mean of 3.6 years, and the 3rd highest in the time series (1975-2010). The mean age of the total harvest in 2010 (5.4 years) was the highest in the time series (1975-2010). This reflects the continued dependence of the fisheries on the 2003 (age-7) and 2007 (age-4) year classes, with little contribution to the fisheries from any other cohort in 2010.

Catch-at-Age Population Analysis and Abundance

The WTG continued to use the Automatic Differentiation Model Builder (ADMB) catch-at-age analysis to estimate walleye population abundance from 1978 to 2010 (Walleye Task Group 2001). The model continues to include fishery data from the Ontario commercial fishery (west and central basins) and sport fisheries in Ohio (west and central basins) and Michigan (west basin). Since 2002, the standard WTG model has included 3 index gill net surveys. Over the years, evidence mounted that pooling the Michigan and Ohio gill net surveys had both a logical and statistical basis. In fall 2010, after conferring with Michigan State University's Quantitative Fisheries Center, the WTG elected to combine the MI and OH index gill net survey data sets for the WTG 2011 model. This two-survey configuration will now be considered the standard model configuration.

The model assumes log-normal distributions for catch-at-age (ages 2 through 7+, i.e., seven and older) and fishing effort. Natural mortality (M) is fixed in the model for all ages and years at 0.32. The key parameters, including age-2 recruitment and population size in the first year of the model, fisheries catchability, and selectivity, are estimated using a maximum likelihood approach with a concentrated likelihood configuration. The abundances-at-age were derived from the estimated parameters using an exponential survival equation. Since 2010, lambdas have been derived based on an expert opinion approach described in the ***Review of Lambda Weightings*** section of the 2010 Walleye Task Group Report (WTG 2010)**.**

The ADMB estimate of age-2 abundance in the last year of the model is known to have the highest error bounds, since the model contains little data about this year class. In 2010, the age-2 estimate for 2009 (i.e., the 2007 year class) was assessed to be an outlier by the WTG, and the WTG substituted an alternate age 2 estimate for the 2007 year class in 2009 (WTG 2010). In late summer 2010, the WTG requested guidance and recommendations from the Quantitative Fisheries Center (QFC) at Michigan State University on how best to assess status of the age-2 abundance estimated by the ADMB model for the most recent year of the fishery. The QFC recommended that the WTG utilize the regression estimate of abundance derived from the age-0 interagency trawl catch rate for that cohort as the age-2 estimate. By consensus the WTG adopted that recommendation and will continue to use the regression estimate for the age-2 estimated abundance in the latest year of the fishery. See ***Recruitment Estimator for Incoming Age 2 Walleye and 2011 Population Size Projection*** section below for details on methodology.

The 2010 west-central population estimate from the 2011 WTG model was 22.966 million age 3 and older walleye (Table 8, Figure 7). The 2011 model estimate of age 2 fish in 2010 (2008 year class) was 11.201 million fish. The regression estimate of age 2 fish in 2010 was 3.731 million fish (Table 9). The total 2010 west-central population estimate (age 2 regression estimate for the 2008 cohort plus age 3 and older walleye estimate from 2011 WTG model) was 26.697 million walleye (Table 8). Two age groups accounted for 79% of the 2010 stock size. Abundance of age-3 fish (2007 year class) was estimated at 13.322 million fish, while age 7 and older fish (mainly 2003 year class) abundance was estimated at 7.834 million. There were an estimated 9.642 million age 4 and older walleye in 2010. The abundance of the 2003 year class at age-2 in 2005 (68.824 million) is now estimated to be 26% higher than the strong 1982 (54.051 million) yearclass and 49% higher than the 1986 (45.164 million) year class at age-2 (Table 8).

Recruitment Estimator for Incoming Age-2 Walleye and 2011 Population Size Projection

A linear regression model was used to estimate age-2 walleye recruitment for 2010 and 2011. This regression utilizes estimates of age-2 walleye abundance from the catch-at-age analysis of the WTG model and walleye catches from pooled Ontario and Ohio bottom trawling reported as number of young-of-the-year walleye per hectare (Table 9, Figure 8). Linear regression used by the WTG to predict the abundance of these cohorts excludes the most recent ADMB age-2 estimate (the 2008 year class), as it has the widest estimation error due to the presence of only a single estimate of age in the model time series. The 2010 age-2 population estimate (2008 year class) from linear regression was 3.731 million walleye (Table 9). This cohort and the 2009 year class (3.550 million walleye) appear comparable in strength.

The standard process for projecting age-3 and older abundance for the year in which RAH is reported (i.e., 2011 in this case) involves applying statistical catch-age analyses (SCAA) survival estimates from the last year in the ADMB model to the abundance estimate of age-2 and older walleye in the last year (2010). Estimated age-specific survival is a function of estimated instantaneous fishing mortality (F), selectivity, and assumed natural mortality (M, 0.32) during 2010.

The 2011 estimated abundance of age-2 and older walleye is approximately 21.243 million (Table 10, Figure 10). It is projected that the 2003 year class (age-7) and older cohorts will represent 25% (5.384 million), whereas the 2007 year class will comprise 41% (8.701 million) of the population in 2011. Walleye spawner abundance in 2011 (ages-4 and older) exceeds the estimated values for 24 of the 34 previous years modeled (1978-2010). However, the spawner-recruit relationship for Lake Erie walleye is poorly understood, with recruitment influenced by a combination of abiotic and biotic factors.

Harvest Policy and Recommended Allowable Harvest for 2010

The RAH is determined by the harvest policy, along with population and parameter estimates produced by the WTG 2011 model. The harvest management policy adopted by the LEC in the Walleye Management Plan (WMP; Locke et al. 2005) is a sliding F-scale that has a feedback or state-dependent approach, and varies targeted fishing mortality rate based on population abundance (Figure 11). The policy stipulates that when walleye abundance is 20-40 million walleye, the targeted fishing mortality rate should be between F=0.20 and F=0.35, and when abundance is between 15-20 million walleye, the fishing rate should be between F=0.1 and F=0.2 (Figure 11; Locke et al. 2005). Using results from the WTG 2011 model, the estimated abundance of 21.243 million walleye in 2011, and the sliding-F harvest policy of F=0.209, the calculated mean RAH for 2011 is 2.919 million walleye, with a range from 1.832 (minimum) to 4.202 (maximum) million walleye (Table 11).

East Basin Walleye Assessment

During past years, the WTG attempted a broad-based assessment of the walleye resource in the east basin using a cohort-based stock assessment model, i.e. statistical catch-at-age analysis (SCAA) using the AD Model Builder platform, similar to the walleye assessment in the west and central basin. The assessment provided abundance estimates of the east basin walleye population from 1993 to 2009. These previous efforts were especially helpful for assembling walleye fishery and survey data from all east basin jurisdictions to support a more comprehensive assessment than had previously been possible. Additionally, the east-basin SCAA model was expected to provide a coarse scale for describing east basin walleye abundance relative to the resource in the quota management area.

The SCAA model depends on the catch-at-age information collected from fisheries and surveys and assumes the same cohorts are tracked through time. However, many studies have shown the walleye resource in the east basin during harvest season is a mixture of walleye sub-populations from both west basin and east basin (Einhouse and MacDougall 2010). In a recent study, Zhao et al (in press) used a mark-recapture analysis to quantify the contribution of both sources. They estimated that, on average, about 90% of walleyes harvested in the east basin were seasonal migrants from the west basin. However, there exists a large amount of uncertainty and variation associated with the annual age and size structure of the walleye population migrating from the west basin. Further, it is unlikely that this migration occurs in a consistent way by exactly the same segment of the population each year. The study suggests that catch-at-age information cannot track the same cohort of walleye from year to year in the east basin and the core assumption of tracking cohorts in a cohort-based model is likely violated. Therefore, this year, WTG removed the East Basin ADMB abundance estimates from the WTG report.

The WTG member agencies from the east basin continue assessment surveys to track changes in the abundance of walleye population, and walleye fisheries are closely monitored and regulated in the east basin. In the future, WTG members will continue to examine the walleye resource inhabiting eastern Lake Erie to develop a multi-jurisdictional assessment that recognizes both expansive seasonal movements from the west-central quota management area, as well as the dynamics of smaller and localized east basin spawning stocks. This may necessarily include a stock assessment approach that does not utilize a catch-at-age modeling of absolute abundance.

Other Walleye Task Group Charges

Centralized Databases

Walleye Task Group members currently manage several databases. These databases consist of harvest and population assessment surveys conducted by the respective agencies that manage the walleye population in Lake Erie. Annually, information from these surveys is compiled to assist WTG members in the decision-making process regarding recommended harvest levels and current status and trends of the walleye population. Use of WTG databases by non-members is only permitted following a specific protocol established in 1994, described in the 1994 WTG Report, and reprinted in the 2003 WTG Report (Walleye Task Group 2003).

The Lake Erie Walleye Tagging database consists of biological information collected from walleye tagged in the tributaries and main lake areas of Lake Erie. The tagging program dates back to 1986, and has been maintained at the Lake St. Clair Fisheries Research Station of the MDNR. Annually, agencies submit information regarding tagging activities in their jurisdictions. In addition to updating the database with new tagging information, the database also maintains a record of the tagged walleye which are reported as harvested in a given year. The information is used to estimate the movements of different spawning stocks within the lake proper and connecting waters of Lake Erie. Estimates of survival and exploitation are also generated with this information. Due to recent changes in staffing at the MDNR Lake St. Clair Fisheries Research Station, the Lake Erie Walleye Tagging database will now be maintained at the Sandusky office of the Ohio Department of Natural Resources, Division of Wildlife.

Fishery harvest and population assessment survey information are annually compiled by the WTG and are used for estimating the population abundance of walleye in Lake Erie via catch-at-age analysis (Deriso et al. 1985). A spatially-explicit version of agency-specific harvest data (e.g., harvest-at-age and fishery effort by management unit) and population assessment (e.g., the interagency trawl program and gill net surveys) databases are maintained by the WTG. Annual population abundance estimates are used to assist LEC members with setting TACs for the upcoming year as well as to evaluate past harvest policy decisions.

Lake Erie Walleye Tagging Study

A final report to the USFWS summarizing a lake-wide research tagging initiative undertaken by the WTG in 2005 was completed in October 2009. A copy of this project is available upon request by contacting Chris Vandergoot at the ODNR (christopher.vandergoot@dnr.state.oh.us) or by contacting a walleye task group representative. Specific recommendations to the LEC with respect to addressing Charge 4 for the WTG (Review jaw and PIT tagging results and provide guidance and/or recommendations for future tagging strategies to the LEC) are forthcoming. A doctoral dissertation is expected to be completed in late 2012 which will address tag loss, reporting rates, estimates of natural (M) and fishing (F) mortality and future tagging recommendations.

Habitat Metrics for Suitable Walleye Habitat

The current definition of adult walleye habitat, used by the LEC for the purposes of allocating fishery quota, is based on the Scientific Protocol Committee (SPC) 1976 description of: “lake surface area that lies inside of the 7 fathom (~13 m) depth contour.” The inclusion of alternate or additional habitat metrics in the definition (e.g., measures of spawning and nursery habitat), was originally “postponed pending acquisition of more definitive data” (Standing Technical Committee 2007).

The WTG is currently working with the Habitat Task Group (HTG) in an effort to produce a more realistic definition of walleye habitat by utilizing additional data describing walleye movements and environmental conditions that have become available since the time of the initial definition. This process will incorporate GIS technology, habitat mapping, and spatial calculations to consider; for example, habitat volume as an alternative to surface area calculations. Consideration of lake-wide habitat will expand upon currently calculated habitat (only Management Units 1 to 3).

For more details on progress please refer to the 2011 annual report of the HTG at: http://glfc.org/lakecom/lec/HTG.htm

Walleye Management Plan Review

In 2005, the Lake Erie Walleye Task Group completed the Lake Erie Walleye Management Plan (WMP; Locke et al. 2005). Within this plan, it was recommended that the actions, and the outcomes of these actions, be reviewed on a five-year basis in order to measure the success of the plan and evaluate its objectives. Recommendations within this review included: 1) review the overall status of the walleye population relative to changes in carrying capacity; 2) evaluate the impact of long-term exploitation policy implementation on population abundance and demographic attributes; and 3) determine if the exploitation policy is working as it was intended to in the plan. If necessary, the review should include recommendations on improvements to the WMP to achieve its objectives.

The STC, with help from the WTG, was charged in 2009-2010 to begin the five-year review of the WMP. The document, still in draft form, contains background information on the WMP, a review of walleye stocks over the 5-year review period (2005-2009), and an evaluation of the performance of the WMP. Initial conclusions from the review were that the WMP performance varied. While some fishery catch rate objectives were achieved, other factors such as instability in harvest and TAC, due in part to recruitment patterns, caused concern for fisheries managers and stakeholders. Recommendations under consideration include the incorporation of auxiliary information into the harvest strategy using a Traffic Light Approach, the development of a Decision Table for TACs, the consideration of alternate exploitation policies, and the use of age 3+ population thresholds for establishing fishery objectives.

During the 2010-2011 reporting cycle, the WMP underwent a rigorous review by the WTG. The WTG provided a review document to the STC, and the STC took the WTG's comments under consideration. The WMP is currently under review by the LEC. As part of the review of the WMP, the LEC organized a facilitated stakeholder workshop, which was a systematic and inclusive process for the development of lake-wide fisheries management plans. This workshop was held by an independent third party, including staff from Michigan State University's QFC, and offered an opportunity for stakeholders to have direct input on the LEC process. Stakeholders from all five jurisdictions attended, and discussed fishery objectives, options, and uncertainties around the management of Lake Erie fisheries. Feedback from the stakeholders and LEC representatives was positive, and QFC is now proceeding with the technical work on developing harvest policy evaluation models. The future of the WMP is dependent on the LEC review as well as on the outcome of the facilitated stakeholder involvement process and the QFC's work.

Acknowledgments

The WTG would like to express its appreciation for support during the past year from the Great Lakes Fishery Commission which continued to disperse reward tag payments. The WTG would like to thank the staff at the Quantitative Fisheries Center for their assistance with the ADMB models, involvement with the WMP review stakeholder consultation, and input on questions related to ADMB outlier detection. The WTG would also like to thank the members of the Habitat Task Group for their work addressing the walleye habitat charge.

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Table 1. Annual Lake Erie walleye total allowable catch (TAC, top) and measured harvest (Har; bottom, bold), in numbers of fish from 1980 to 2010. TAC allocations for 2010 are based on water areas: Ohio, 51.11%; Ontario, 43.06%; and Michigan, 5.83%. New York and Pennsylvania do not have assigned quotas but are included in annual total harvest.

	TAC Area (MU-1, MU-2, MU-3)				Non-TAC Area (MUs 4&5)				All Areas
Year	Michigan	Ohio	Ontario [a]	Total	NY	Penn.	Ontario	Total	Total
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**
2005 TAC	308,195	2,988,910	2,517,895	5,815,000				0	5,815,000
Har	**37,599**	**610,449**	**2,933,393**	**3,581,441**	**27,370**	**20,316**	**17,394**	**65,080**	**3,646,521**
2006 TAC	523,958	5,081,404	4,280,638	9,886,000				0	9,886,000
Har	**305,548**	**1,868,520**	**3,494,551**	**5,668,619**	**37,161**	**151,614**	**68,774**	**257,549**	**5,926,168**
2007 TAC	284,080	2,755,040	2,320,880	5,360,000				0	5,360,000
Har	**165,551**	**2,160,459**	**2,159,965**	**4,485,975**	**29,134**	**116,671**	**37,566**	**183,371**	**4,669,346**
2008 TAC	209,530	1,836,893	1,547,576	3,594,000				0	3,594,000
Har	**121,072**	**1,082,636**	**1,574,723**	**2,778,431**	**29,017**	**74,250**	**34,906**	**138,173**	**2,916,604**
2009 TAC	142,835	1,252,195	1,054,970	2,450,000				0	2,450,000
Har	**94,048**	**967,476**	**1,095,500**	**2,157,024**	**13,727**	**42,422**	**27,725**	**83,874**	**2,240,898**
2010 TAC	128,260	1,124,420	947,320	2,200,000				0	2,200,000
Har	**55,248**	**958,366**	**983,397**	**1,997,011**	**36,683**	**55,050**	**23,324**	**115,057**	**2,112,068**

[a] Ontario sport harvest values were estimated from the most recent creel surveys in each basin; 2008 in Unit 1, 2004 in Units 2 and 3, and 2003 in Unit 4. 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. Means contain data from 1975 to 2010.

	Sport Fishery															Commercial Fishery					
	Unit 1				Unit 2			Unit 3			Units 4 & 5					Unit 1	Unit 2	Unit 3	Unit 4		Grand
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	Total
1975	77	4	7	88	10	--	10	--	--	--	--	--	--	0	98	--	--	--	--	0	98
1976	605	30	50	685	35	--	35	--	--	--	--	--	--	0	720	113	44	--	--	157	877
1977	2,131	107	69	2,307	37	--	37	--	--	--	--	--	--	0	2,344	235	67	--	--	302	2,645
1978	1,550	72	112	1,734	37	--	37	--	--	--	--	--	--	0	1,771	274	60	--	--	334	2,106
1979	3,254	162	79	3,495	60	--	60	--	--	--	--	--	--	0	3,555	625	30	--	--	655	4,211
1980	2,096	183	57	2,336	49	--	49	24	--	24	--	--	--	0	2,409	953	40	--	--	993	3,402
1981	2,857	95	70	3,022	38	--	38	48	--	48	--	--	--	0	3,108	1,037	119	3	--	1,159	4,268
1982	2,959	194	49	3,202	49	--	49	8	--	8	--	--	--	0	3,259	1,077	134	2	--	1,213	4,470
1983	1,626	146	41	1,813	212	--	212	26	--	26	--	--	--	0	2,051	1,129	167	80	--	1,376	3,427
1984	3,089	351	39	3,479	787	--	787	179	--	179	--	--	--	0	4,445	1,639	392	108	--	2,139	6,584
1985	3,347	461	57	3,865	294	--	294	89	--	89	--	--	--	0	4,248	1,721	432	225	--	2,378	6,627
1986	3,743	606	52	4,401	480	--	480	176	--	176	--	--	--	0	5,057	1,651	558	356	--	2,565	7,622
1987	3,751	902	51	4,704	550	--	550	132	--	132	--	--	--	0	5,386	1,611	622	405	--	2,638	8,024
1988	3,744	1,997	18	5,759	584	--	584	562	--	562	--	--	85	85	6,990	1,866	762	409	--	3,037	10,026
1989	2,891	1,092	14	3,997	867	35	902	434	80	514	--	--	129	129	5,542	1,656	621	386	--	2,663	8,206
1990	1,467	747	35	2,249	389	14	403	426	23	449	--	--	47	47	3,148	1,615	529	302	--	2,446	5,595
1991	1,104	132	39	1,275	216	24	240	258	44	302	--	--	34	34	1,851	1,446	440	274	--	2,160	4,011
1992	1,479	250	20	1,749	338	56	394	265	25	290	--	--	14	14	2,447	1,547	534	316	--	2,397	4,844
1993	1,846	270	37	2,153	450	26	476	372	12	384	--	--	40	40	3,053	2,488	762	496	--	3,746	6,800
1994	992	216	21	1,229	291	20	311	186	21	207	--	--	59	59	1,806	2,307	630	432	--	3,369	5,176
1995	1,161	108	32	1,301	159	7	166	115	27	141	--	--	27	27	1,635	2,578	681	489	--	3,748	5,384
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	7,143
1997	929	122	8	1,059	188	2	190	132	5	138	--	89	29	118	1,505	2,585	928	544	--	4,057	5,563
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	6,793
1999	812	140	34	986	139	5	144	83	5	88	19	89	23	131	1,349	2,461	631	317	68	3,477	4,827
2000	674	252	34	961	165	5	170	93	5	98	19	78	29	125	1,354	1,603	444	196	48	2,291	3,645
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	2,924
2002	516	194	34	744	141	5	146	46	5	51	19	22	18	59	1,000	937	309	146	17	1,409	2,409
2003	715	129	34	878	232	5	237	68	5	73	2	44	27	73	1,261	948	283	182	14	1,427	2,688
2004	515	115	34	664	272	2	274	72	0	72	2	20	8	30	1,040	866	334	175	11	1,386	2,426
2005	374	38	27	438	110	2	112	126	0	126	2	20	27	49	725	1,878	625	401	15	2,920	3,645
2006	1,194	306	27	1,526	503	2	505	170	0	170	2	152	37	191	2,392	2,137	784	545	66	3,532	5,924
2007	1,414	166	27	1,607	578	2	580	169	0	169	2	116	29	147	2,502	1,348	450	333	35	2,167	4,669
2008	524	121	44	689	333	2	335	225	0	225	2	74	29	105	1,354	954	335	241	35	1,565	2,919
2009	553	94	44	691	287	2	289	128	0	128	2	42	14	58	1,166	705	212	135	28	1,079	2,244
2010	587	55	44	686	257	2	259	114	0	114	2	55	37	94	1,153	607	184	147	23	962	2,116
Mean	1,632	286	40	1,958	282	11	289	171	13	180	9	71	36	56	2,458	1,454	449	295	31	2,107	4,565

[a] Ontario sport harvest values were estimated from the most recent creel surveys in each basin; 2008 in Unit 1, 2004 in Units 2 and 3, and 2003 in Unit 4. These values are included in Ontario's total walleye harvest, but are not used in catch-at-age analysis.

Table 3. Annual fishing effort for Lake Erie walleye by gear, management unit, and agency. Means contain data from 1975 to 2010.

	Sport Fishery [a]														Commercial Fishery [b]				
	Unit 1				Unit 2			Unit 3			Units 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	30	159	162	351	3,307	4,476	3,946	3,725	365	12,512
2004	1,257	504	--	1,761	736	27	763	178	7	185	--	88	101	189	2,898	3,875	2,977	2,401	240	9,493
2005	1,180	212	40	1,392	573	--	573	261	--	261	--	109	142	251	2,477	7,083	4,174	4,503	174	15,934
2006	1,757	587	--	2,344	899	--	899	260	--	260	--	239	137	376	3,879	5,689	4,008	3,589	822	14,107
2007	2,076	448	--	2,524	1,147	--	1,147	321	--	321	--	232	135	367	4,358	4,509	2,927	2,665	383	10,484
2008	1,027	392	63	1,419	809	--	809	356	--	356	--	187	156	343	2,927	4,990	3,193	1,909	497	10,590
2009	1,063	310	--	1,373	777	--	777	289	--	289	--	124	100	224	2,663	3,537	2,164	1,746	478	7,925
2010	1,403	226	--	1,629	652	--	652	219	--	219	--	170	140	310	2,810	1,918	1,371	1,401	247	4,937
Mean	3,212	757	102	4,040	793	60	812	436	114	477	124	228	245	258	5,532	9,470	5,789	4,779	641	19,596

[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 was estimated from the most recent creel surveys in each basin; 2008 in Unit 1, 2004 in Units 2 and 3, and 2003 in Unit 4.

Table 4. Annual catch per unit effort for Lake Erie walleye by gear, management unit, and agency. Means contain data from 1975 to 2010.

	Sport Fishery [a]															Commercial Fishery [b]				
	Unit 1				Unit 2			Unit 3			Units 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	0.16	0.13	0.16	0.16	0.17	--	0.17	--	--	--	--	--	--		0.16	--	--	--	--	--
1976	0.45	0.36	0.50	0.45	0.22	--	0.22	--	--	--	--	--	--		0.42	63.0	22.9	--	--	42.2
1977	0.77	0.62	0.53	0.75	0.24	--	0.24	--	--	-	--	--	--		0.73	54.9	42.6	--	--	51.6
1978	0.54	0.41	0.76	0.54	0.24	--	0.24	--	--	--	--	--	--		0.53	52.2	138.2	--	--	58.8
1979	0.78	0.63	0.81	0.77	0.36	--	0.36	--	--	--	--	--	--		0.76	107.9	16.7	--	--	86.3
1980	0.53	0.29	0.62	0.50	0.21	--	0.21	0.13	--	0.13	--	--	--		0.47	153.0	25.3	--		127.3
1981	0.50	0.21	0.51	0.48	0.14	--	0.14	0.12	--	0.12	--	--	--		0.44	150.7	55.4	4.9		120.1
1982	0.50	0.43	0.45	0.49	0.22	--	0.22	0.07	--	0.07	--	--	--		0.48	102.2	45.9	2.8		85.8
1983	0.39	0.32	0.34	0.38	0.37	--	0.37	0.20	--	0.20	--	--	--		0.38	100.7	31.2	13.7		61.5
1984	0.76	0.63	0.48	0.74	0.60	--	0.60	0.46	--	0.46	--	--	--		0.69	141.9	65.3	44.4		107.0
1985	0.73	0.50	0.68	0.69	0.27	--	0.27	0.19	--	0.19	--	--	--		0.59	229.6	154.5	75.6		179.1
1986	0.58	0.33	0.49	0.52	0.44	--	0.44	0.33	--	0.33	--	--	--		0.51	211.0	99.0	93.7		148.6
1987	0.57	0.41	0.61	0.53	0.38	--	0.38	0.28	--	0.28	--	--	--		0.50	244.2	146.5	133.1		190.0
1988	0.50	0.46	0.21	0.48	0.35	--	0.35	0.52	--	0.52	--	--	0.18	0.18	0.46	249.0	131.4	108.2		177.9
1989	0.55	0.29	0.17	0.44	0.57	0.45	0.56	0.49	0.39	0.47	--	--	0.23	0.23	0.45	211.1	112.7	111.2		158.3
1990	0.36	0.41	0.29	0.37	0.23	0.42	0.24	0.49	0.28	0.47	--	--	0.11	0.11	0.34	179.1	90.7	54.5		120.0
1991	0.31	0.30	0.27	0.30	0.17	0.30	0.18	0.36	0.28	0.34	--	--	0.08	0.08	0.27	138.8	87.0	87.1		116.0
1992	0.37	0.35	0.19	0.37	0.29	0.69	0.32	0.41	0.18	0.37	--	--	0.05	0.05	0.34	163.1	77.3	52.3		106.8
1993	0.47	0.39	0.30	0.45	0.33	0.37	0.34	0.35	0.09	0.32	--	--	0.13	0.13	0.40	152.8	65.4	66.8		106.0
1994	0.35	0.27	0.17	0.33	0.28	0.31	0.28	0.31	0.16	0.28	--	--	0.17	0.17	0.31	138.2	63.2	66.9		101.7
1995	0.36	0.39	0.25	0.36	0.20	0.12	0.19	0.32	0.21	0.29	--	--	0.10	0.10	0.31	125.7	56.2	62.2		92.6
1996	0.47	0.34	0.13	0.44	0.57	0.13	0.55	0.46	0.21	0.41	--	0.28	0.15	0.22	0.44	139.0	70.6	53.6		95.9
1997	0.34	0.33	0.10	0.33	0.22	0.04	0.21	0.27	0.06	0.24	--	0.23	0.11	0.17	0.28	164.6	80.1	59.8		111.5
1998	0.59	0.31	0.33	0.56	0.34	0.10	0.32	0.73	0.08	0.65	0.09	0.32	0.12	0.18	0.48	131.3	60.1	34.8	34.2	79.1
1999	0.34	0.34	--	0.34	0.23	--	0.23	0.26	--	0.26	--	0.22	0.14	0.22	0.27	114.8	57.6	41.6	47.4	83.9
2000	0.34	0.47	--	0.37	0.31	--	0.31	0.33	--	0.33	--	0.32	0.16	0.32	0.34	72.1	40.2	24.8	27.1	53.2
2001	0.48	0.44	--	0.48	0.25	--	0.25	0.18	--	0.18	--	0.22	0.09	0.22	0.38	107.1	54.0	28.1	32.1	71.0
2002	0.37	0.32	--	0.36	0.32	--	0.32	0.19	--	0.19	--	0.17	0.14	0.17	0.32	211.5	73.4	33.0	37.4	104.3
2003	0.42	0.40	--	0.41	0.34	--	0.34	0.29	--	0.29	0.07	0.28	0.17	0.21	0.37	211.8	71.7	48.9	38.4	114.1
2004	0.41	0.23	--	0.36	0.37	0.06	0.36	0.40	--	0.40	--	0.23	0.08	0.15	0.35	223.5	112.2	73.0	45.3	146.0
2005	0.32	0.18	0.67	0.31	0.19	--	0.19	0.48	--	0.48	--	0.18	0.19	0.19	0.29	265.2	149.8	89.1	86.4	183.2
2006	0.68	0.52	--	0.64	0.56	--	0.56	0.65	--	0.65	--	0.63	0.27	0.50	0.61	375.7	195.6	151.9	80.8	250.4
2007	0.68	0.37	--	0.63	0.50	--	0.50	0.53	--	0.53	--	0.50	0.21	0.40	0.57	298.9	153.8	124.9	91.4	206.7
2008	0.51	0.31	--	0.45	0.41	--	0.41	0.63	--	0.63	--	0.40	0.19	0.30	0.45	191.2	104.9	126.2	70.4	147.8
2009	0.52	0.30	--	0.47	0.37	--	0.37	0.44	--	0.44	--	0.34	0.14	0.25	0.42	199.2	97.9	77.1	58.0	136.1
2010	0.42	0.24	--	0.39	0.39	--	0.39	0.52	--	0.52	--	0.32	0.26	0.30	0.39	316.7	134.5	105.0	94.5	194.9
Mean	0.48	0.37	0.40	0.46	0.32	0.27	0.32	0.37	0.19	0.36	0.08	0.31	0.15	0.21	0.43	171	85	68	57	120

[a] Sport CPE = Number/angler hour

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

[c] Ontario sport fishing CPE was estimated from the most recent creel surveys in each basin; 2008 in Unit 1, 2004 in Units 2 and 3, and 2003 in Unit 4.

Table 5. Catch at age of walleye harvest by management unit, gear, and agency in Lake Erie during 2010. Units 4 and 5 are combined in Unit 4.

		Commercial	Sport					All Gear
Unit	Age	Ontario	Ohio	Michigan	New York	Pennsylvania	Total	Total
1	1	3,242	0	0	--	--	0	3,242
	2	90,646	34,909	3,051	--	--	37,960	128,606
	3	309,613	161,832	19,849	--	--	181,681	491,294
	4	4,941	23,601	246	--	--	23,847	28,788
	5	28,597	23,475	2,312	--	--	25,787	54,384
	6	12,466	11,798	1,337	--	--	13,135	25,601
	7+	157,940	331,368	28,452	--	--	359,820	517,760
	Total	607,445	586,983	55,248	--	--	642,231	1,249,676
2	1	2,381	0	--	--	--	0	2,381
	2	21,227	17,146	--	--	--	17,146	38,373
	3	67,493	41,361	--	--	--	41,361	108,854
	4	5,139	8,404	--	--	--	8,404	13,543
	5	6,734	10,491	--	--	--	10,491	17,225
	6	9,499	4,901	--	--	--	4,901	14,400
	7+	71,881	174,604	--	--	--	174,604	246,485
	Total	184,354	256,907	--	--	--	256,907	441,261
3	1	2,477	0	--	--	--	0	2,477
	2	6,116	372	--	--	--	372	6,488
	3	24,055	9,131	--	--	--	9,131	33,186
	4	2,640	2,085	--	--	--	2,085	4,725
	5	8,603	2,859	--	--	--	2,859	11,462
	6	2,564	2,441	--	--	--	2,441	5,005
	7+	100,663	97,589	--	--	--	97,589	198,252
	Total	147,118	114,477	--	--	--	114,477	261,595
4	1	0	--	--	0	0	0	0
	2	90	--	--	1343	2,015	3,358	3,448
	3	1,274	--	--	1,735	2,604	4,339	5,613
	4	1,473	--	--	4,695	7,046	11,741	13,214
	5	1,350	--	--	2,461	3,694	6,155	7,505
	6	367	--	--	393	589	982	1,349
	7+	18,770	--	--	26,056	39,101	65,157	83,927
	Total	23,324	--	--	36,683	55,049	91,732	115,056
All	1	8,100	0	0	0	0	0	8,100
	2	118,079	52,427	3,051	1,343	2,015	58,836	176,915
	3	402,435	212,324	19,849	1,735	2,604	236,512	638,947
	4	14,193	34,090	246	4,695	7,046	46,077	60,270
	5	45,284	36,825	2,312	2,461	3,694	45,292	90,576
	6	24,896	19,140	1,337	393	589	21,459	46,355
	7+	349,254	603,561	28,452	26,056	39,101	697,170	1,046,424
	Total	962,241	958,367	55,248	36,683	55,049	1,105,347	2,067,588

[a] Ontario sport harvest values were not estimated from creel surveys in 2010; they are not used in catch-at-age analysis.

Table 6. Age composition (in percent) of walleye harvest by management unit, gear, and agency in Lake Erie during 2010. Units 4 and 5 are combined in Unit 4.

		Commercial	Sport					All Gears
Unit	Age	Ontario	Ohio	Michigan	New York	Pennsylvania	Total	Total
1	1	0.5	0.0	0.0	--	--	0.0	0.3
	2	14.9	5.9	5.5	--	--	5.9	10.3
	3	51.0	27.6	35.9	--	--	28.3	39.3
	4	0.8	4.0	0.4	--	--	3.7	2.3
	5	4.7	4.0	4.2	--	--	4.0	4.4
	6	2.1	2.0	2.4	--	--	2.0	2.0
	7+	26.0	56.5	51.5	--	--	56.0	41.4
	Total	100.0	100.0	100.0	--	--	100.0	100.0
2	1	1.3	0.0	--	--	--	0.0	0.5
	2	11.5	6.7	--	--	--	6.7	8.7
	3	36.6	16.1	--	--	--	16.1	24.7
	4	2.8	3.3	--	--	--	3.3	3.1
	5	3.7	4.1	--	--	--	4.1	3.9
	6	5.2	1.9	--	--	--	1.9	3.3
	7+	39.0	68.0	--	--	--	68.0	55.9
	Total	100.0	100.0	--	--	--	100.0	100.0
3	1	1.7	0.0	--	--	--	0.0	0.9
	2	4.2	0.3	--	--	--	0.3	2.5
	3	16.4	8.0	--	--	--	8.0	12.7
	4	1.8	1.8	--	--	--	1.8	1.8
	5	5.8	2.5	--	--	--	2.5	4.4
	6	1.7	2.1	--	--	--	2.1	1.9
	7+	68.4	85.2	--	--	--	85.2	75.8
	Total	100.0	100.0	--	--	--	100.0	100.0
4	1	0.0	--	--	0.0	0.0	0.0	0.0
	2	0.4	--	--	3.7	3.7	3.7	3.0
	3	5.5	--	--	4.7	4.7	4.7	4.9
	4	6.3	--	--	12.8	12.8	12.8	11.5
	5	5.8	--	--	6.7	6.7	6.7	6.5
	6	1.6	--	--	1.1	1.1	1.1	1.2
	7+	80.5	--	--	71.0	71.0	71.0	72.9
	Total	100.0	--	--	100.0	100.0	100.0	100.0
All	1	0.8	0.0	0.0	0.0	0.0	0.0	0.4
	2	12.3	5.5	5.5	3.7	3.7	5.3	8.6
	3	41.8	22.2	35.9	4.7	4.7	21.4	30.9
	4	1.5	3.6	0.4	12.8	12.8	4.2	2.9
	5	4.7	3.8	4.2	6.7	6.7	4.1	4.4
	6	2.6	2.0	2.4	1.1	1.1	1.9	2.2
	7+	36.3	63.0	51.5	71.0	71.0	63.1	50.6
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 7. Annual mean age (years) of Lake Erie walleye by gear, management unit, and agency. Means include data from 1975 to present.

	Sport Fishery															Commercial Fishery					All Gears
	Unit 1				Unit 2			Unit 3			Units 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	Total
1975	2.53	2.53	3.26	2.59	1.53	--	1.53	--	--	--	--	--	--	--	2.48	--	--	--	--	--	2.42
1976	2.49	2.49	2.35	2.48	2.05	--	2.05	--	--	--	--	--	--	--	2.46	1.51	1.51	--	--	1.51	2.29
1977	3.29	3.29	2.64	3.27	2.44	--	2.44	--	--	--	--	--	--	--	3.26	2.74	2.74	--	--	2.74	3.21
1978	3.50	3.62	3.07	3.48	3.33	--	3.33	--	--	--	--	--	--	--	3.48	2.69	2.69	--	--	2.69	3.37
1979	2.71	2.71	2.67	2.71	2.29	--	2.29	--	--	--	--	--	--	--	2.70	2.83	2.83	--	--	2.83	2.72
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	2.98
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	3.41
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	3.12
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	3.15
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	2.72
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	3.24
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	3.72
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	3.69
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	3.74
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	4.16
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	4.49
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	4.85
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	4.46
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	4.42
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	4.32
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	4.08
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	3.91
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	4.11
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	3.82
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	3.89
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	4.12
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	3.75
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	3.78
2003	4.67	4.16	--	4.59	4.67	--	4.67	5.87	--	5.87	3.35	7.50	10.01	8.31	4.90	3.68	4.36	5.58	6.59	4.09	4.46
2004	4.77	4.41	--	4.70	5.11	6.56	5.12	6.42	--	6.42	--	5.86	11.11	7.41	5.01	2.96	2.59	3.49	6.07	2.96	3.82
2005	5.33	4.26	3.35	5.12	4.21	--	4.21	5.53	--	5.53	--	6.61	6.72	6.68	5.15	3.61	3.16	4.64	4.70	3.66	3.96
2006	3.86	3.24	--	3.73	3.68	--	3.68	4.57	--	4.57	--	4.10	6.38	4.55	3.85	3.19	3.19	3.44	4.82	3.26	3.50
2007	4.64	4.42	--	4.62	4.79	--	4.79	4.89	--	4.89	--	4.89	6.80	5.27	4.71	4.20	4.29	4.25	6.55	4.26	4.50
2008	5.42	5.60	--	5.46	5.90	--	5.90	5.21	--	5.21	--	5.67	7.21	6.10	5.57	5.21	5.38	5.06	8.28	5.29	5.42
2009	5.39	4.78	--	5.30	6.14	--	6.14	6.43	--	6.43	--	6.47	6.84	6.56	5.70	4.67	5.17	5.40	7.45	4.93	5.33
2010	5.72	5.38	--	5.69	6.37	--	6.37	7.30	--	7.30	--	7.16	7.16	7.16	6.12	4.11	4.82	6.14	7.79	4.64	5.44
Mean	3.98	3.69	3.66	3.93	4.18	6.58	4.20	5.13	6.72	5.15	7.02	6.26	7.42	6.84	4.16	3.45	3.66	4.60	6.48	3.61	3.84

Table 8. Estimated abundance at age, survival (S), fishing mortality (F) and exploitation (u) for Lake Erie walleye, 1980-2010 (from ADMB WTG 2011 catch at age analysis, M=0.32). 2010 and 2011 age-2 are from the regression of pooled trawl YOY data and ADMB age-2 walleye abundance (see Table 9). Projected 2011 ages 3 to 7+ population is based on survival from 2010.

	Age							Ages 2+		
Year	2	3	4	5	6	7+	Total	S	F	u
1980	10,162,100	9,769,890	719,997	1,226,550	371,679	78,913	22,329,129	0.585	0.216	0.167
1981	6,878,930	6,652,670	5,153,120	379,194	645,974	237,896	19,947,784	0.470	0.435	0.305
1982	11,533,100	4,126,400	2,673,970	2,067,300	152,123	356,304	20,909,197	0.537	0.301	0.224
1983	7,535,260	7,117,010	1,812,520	1,172,140	906,201	225,895	18,769,026	0.589	0.209	0.163
1984	54,461,800	4,969,740	3,856,670	979,225	633,254	615,131	65,515,820	0.637	0.131	0.105
1985	5,223,470	35,809,800	2,665,070	2,062,680	523,724	675,970	46,960,714	0.617	0.163	0.129
1986	20,013,900	3,580,290	21,796,400	1,619,800	1,253,670	734,776	48,998,836	0.614	0.168	0.133
1987	19,265,600	13,432,000	2,059,240	12,509,800	929,662	1,149,720	49,346,022	0.615	0.166	0.132
1988	46,163,600	12,942,800	7,773,240	1,189,750	7,227,680	1,211,640	76,508,710	0.617	0.163	0.130
1989	11,564,900	30,443,600	7,142,450	4,281,720	655,349	4,660,260	58,748,279	0.590	0.207	0.161
1990	9,690,590	7,724,090	17,370,700	4,068,040	2,438,690	3,072,710	44,364,820	0.620	0.159	0.126
1991	5,502,070	6,596,810	4,654,190	10,448,700	2,446,980	3,345,360	32,994,110	0.630	0.142	0.113
1992	13,908,700	3,785,390	4,078,890	2,872,010	6,447,690	3,613,230	34,705,910	0.624	0.151	0.121
1993	19,705,000	9,408,320	2,226,450	2,393,120	1,685,030	5,952,710	41,370,630	0.594	0.202	0.157
1994	3,734,030	12,901,600	5,020,630	1,183,390	1,271,980	4,179,940	28,291,570	0.570	0.241	0.185
1995	13,859,700	2,474,760	7,145,480	2,769,380	652,756	3,096,550	29,998,626	0.586	0.214	0.166
1996	15,310,400	9,040,480	1,304,940	3,748,890	1,452,960	2,045,480	32,903,150	0.529	0.317	0.234
1997	2,045,050	9,467,310	4,063,080	582,323	1,672,930	1,624,030	19,454,723	0.524	0.327	0.241
1998	13,999,100	1,317,350	4,813,420	2,054,230	294,413	1,711,110	24,189,623	0.551	0.276	0.208
1999	6,263,200	8,685,600	597,424	2,168,670	925,529	952,258	19,592,681	0.543	0.290	0.217
2000	5,612,180	4,005,010	4,320,420	295,439	1,072,450	955,126	16,260,625	0.545	0.287	0.215
2001	17,361,200	3,578,680	1,984,390	2,128,760	145,569	1,024,270	26,222,869	0.624	0.152	0.121
2002	1,412,720	11,478,000	1,965,580	1,086,420	1,165,460	657,616	17,765,796	0.615	0.165	0.131
2003	13,455,300	966,090	6,994,730	1,195,320	660,680	1,116,580	24,388,700	0.627	0.147	0.117
2004	291,620	9,022,020	553,569	3,995,860	682,848	1,033,620	15,579,537	0.626	0.149	0.119
2005	68,824,300	204,919	5,628,890	344,777	2,488,730	1,079,580	78,571,196	0.660	0.095	0.078
2006	2,055,990	46,440,200	114,044	3,118,920	191,038	2,002,280	53,922,472	0.634	0.135	0.109
2007	3,366,640	1,452,910	29,317,000	71,900	1,966,360	1,398,290	37,573,100	0.626	0.149	0.119
2008	1,243,560	2,362,750	899,275	18,113,800	44,424	2,093,210	24,757,019	0.616	0.164	0.130
2009	18,877,200	869,095	1,445,940	549,211	11,062,600	1,330,120	34,134,166	0.673	0.076	0.063
2010	3,731,456	13,322,700	549,398	912,738	346,686	7,834,150	26,697,128	0.663	0.091	0.075
2011	3,550,152	2,653,285	8,701,273	358,462	595,528	5,383,908	21,242,609			

Table 9. Data used to estimate the recruitment of age-2 walleye by linear regression. Y is the ADMB WTG 2011 model estimate of age-2 walleye and X is the mean catch per hectare of age-0 walleye for combined OH and ON August trawls. Values in bold are the regression estimates and are used for RAH projections in 2011 and forecast estimates of recruits in 2011 and 2012. Regression statistics are given at the bottom of the page.

Year Class	Year of Recruitment to Fisheries	OH+ONT Trawl Age-0 CPHa	ln (OH+ONT Trawl CPHa)	ADMB-estimated Age-2 walleye recruits (in millions)	ln (ADMB-estimated Age-2 walleye recruits in millions)
1988	1990	18.28	2.906	9.691	2.271
1989	1991	6.09	1.807	5.502	1.705
1990	1992	39.43	3.675	13.909	2.633
1991	1993	59.86	4.092	19.705	2.981
1992	1994	6.71	1.904	3.734	1.317
1993	1995	108.82	4.690	13.860	2.629
1994	1996	63.92	4.158	15.310	2.729
1995	1997	2.97	1.087	2.045	0.715
1996	1998	85.34	4.447	13.999	2.639
1997	1999	24.19	3.186	6.263	1.835
1998	2000	14.31	2.661	5.612	1.725
1999	2001	44.19	3.788	17.361	2.854
2000	2002	4.11	1.414	1.413	0.346
2001	2003	28.50	3.350	13.455	2.599
2002	2004	0.14	-1.973	0.292	-1.232
2003	2005	183.02	5.210	68.824	4.232
2004	2006	5.33	1.673	2.056	0.721
2005	2007	12.67	2.539	3.367	1.214
2006	2008	2.05	0.718	1.244	0.218
2007	2009	25.41	3.235	18.877	2.938
2008 [1]	2010	7.24	1.979	**3.731**	
2009 [2]	2011	6.75	1.910	**3.550**	
2010 [3]	2012	26.20	3.266	**9.380**	

[1] The latest ADMB age-2 estimate has the widest error bounds and is not used in the recruitment estimator.

[2] This regression estimate is for 2011age-2 recruitment projection.

[3] This regression estimate is for 2012 age-2 recruitment projection.

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

$Y = 0.7166\ (0.0560)\ X - 0.1016\ (0.0.1779)$

with $n = 20$, $F = 164$, $p < 0.0001$ and $r^2 = 0.901$.

Table 10. Estimated population of Lake Erie walleye for 2011 based on fishing mortality (F) and survival (S) at age from ADMB WTG 2011 model. Age-2 walleye estimates for 2010 and 2011 are from regressions presented in Table 9.

	2010 Parameters			Rate Functions					2011 Parameters			
	Stock Size (numbers)			Mortality Rates				Survival		2011Stock Size (mils of fish)		
Age	**Mean**	**Min.**	**Max.**	**(F)**	**(Z)**	**(A)**	**(u)**	**(S)**	**Age**	**Mean**	**Min.**	**Max.**
2	3.731	2.796	4.980	0.021	0.341	0.289	0.018	0.711	2	3.550	2.670	4.720
3	13.323	10.160	16.486	0.106	0.426	0.347	0.086	0.653	3	2.653	1.988	3.541
4	0.549	0.438	0.661	0.107	0.427	0.348	0.087	0.652	4	8.701	6.635	10.767
5	0.913	0.742	1.083	0.107	0.427	0.348	0.087	0.652	5	0.358	0.285	0.431
6	0.347	0.285	0.408	0.107	0.427	0.348	0.087	0.652	6	0.596	0.484	0.707
7+	7.834	6.531	9.137	0.098	0.418	0.342	0.080	0.658	7+	5.384	4.486	6.282
Total	26.697	20.952	32.756	0.091	0.411	0.337	0.075	0.663	Total	21.243	16.550	26.448
(3+)	22.966	18.156	27.775	0.103	0.423	0.345	0.084	0.655	(3+)	17.692	13.879	21.728

Table 11. Estimated harvest of Lake Erie walleye for 2010 and population projection for 2011. 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 WTG 2011 model catch-age results, and trawl regressions. Stock size and catch in numbers are in millions of fish.

	2011 Stock Size (millions)					Rate Functions					2011RAH (millions of fish)			Projected 2012 Stock Size (millions)
Age	**Min**	**Mean**	**Max**	**F**	**sel(age)**	**(F)**	**(Z)**	**(S)**	**(u)**		**Min**	**Mean**	**Max**	**Mean**
2	2.670	3.550	4.720		0.194	0.041	0.361	0.697	0.034		0.068	0.121	0.190	9.380
3	1.988	2.653	3.541		0.991	0.207	0.527	0.590	0.161		0.258	0.427	0.665	2.476
4	6.635	8.701	10.767		1.000	0.209	0.529	0.589	0.162		0.869	1.412	2.037	1.566
5	0.285	0.358	0.431		1.000	0.209	0.529	0.589	0.162		0.037	0.058	0.082	5.127
6	0.484	0.596	0.707		1.000	0.209	0.529	0.589	0.162		0.063	0.097	0.134	0.211
7+	4.486	5.384	6.282		0.912	0.191	0.511	0.600	0.149		0.536	0.804	1.095	3.582
Total	16.550	21.243	26.448	0.209					0.137	**RAH 2+**	1.832	2.919	4.202	22.342
(3+)	13.879	17.692	21.728							**RAH 3+**	1.764	2.798	4.012	12.962
										F	0.131	0.209	0.248	

	2012 Stock Size (millions)		Rate Functions					Projected 2012 RAH (millions of fish)	Projected 2013 3+ Stock Size (millions)
Age	**Mean**	**F**	**sel(age)**	**(F)**	**(Z)**	**(S)**	**(u)**	**Mean**	**Mean**
2	9.380		0.194	0.042	0.362	0.696	0.035	0.333	*
3	2.476		0.991	0.216	0.536	0.585	0.167	0.414	6.529
4	1.566		1.000	0.218	0.538	0.584	0.169	0.264	1.448
5	5.127		1.000	0.218	0.538	0.584	0.169	0.864	0.915
6	0.211		1.000	0.218	0.538	0.584	0.169	0.036	2.994
7+	3.582		0.912	0.199	0.519	0.595	0.155	0.556	2.255
Total	22.342	0.218					0.110	2.466	--
(3+)	12.962								14.141

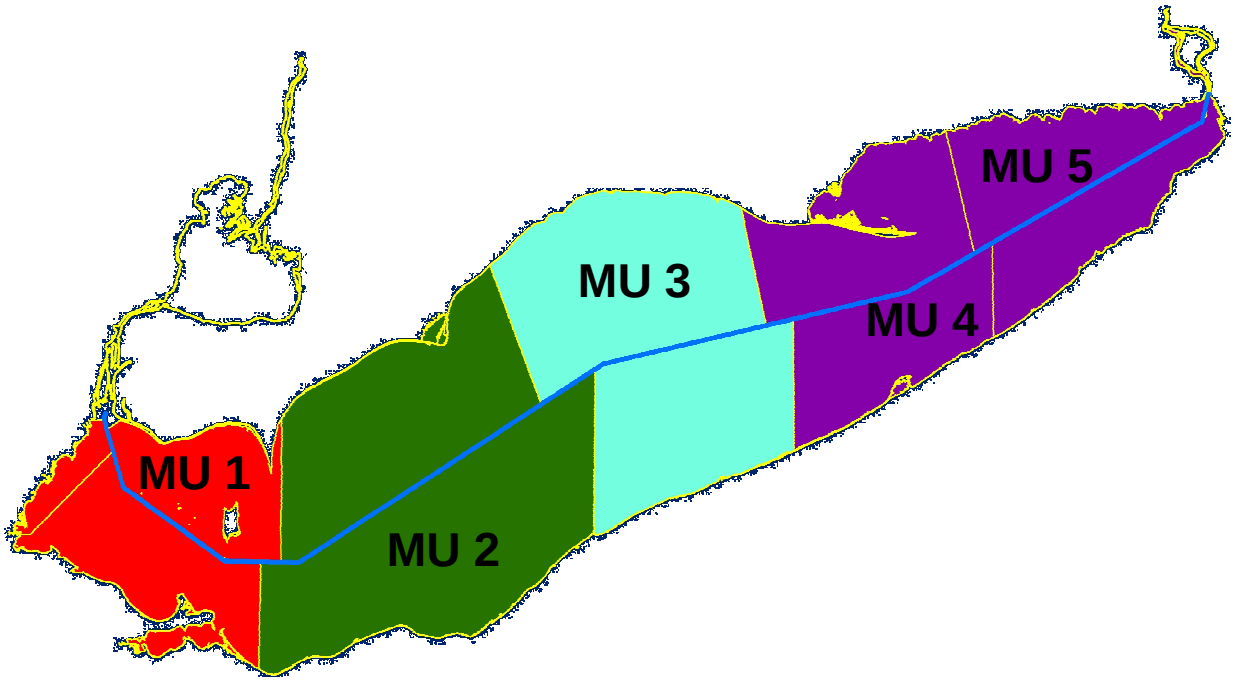

Figure 1. Map of Lake Erie with management units recognized by the Walleye Task Group for interagency management of walleye.

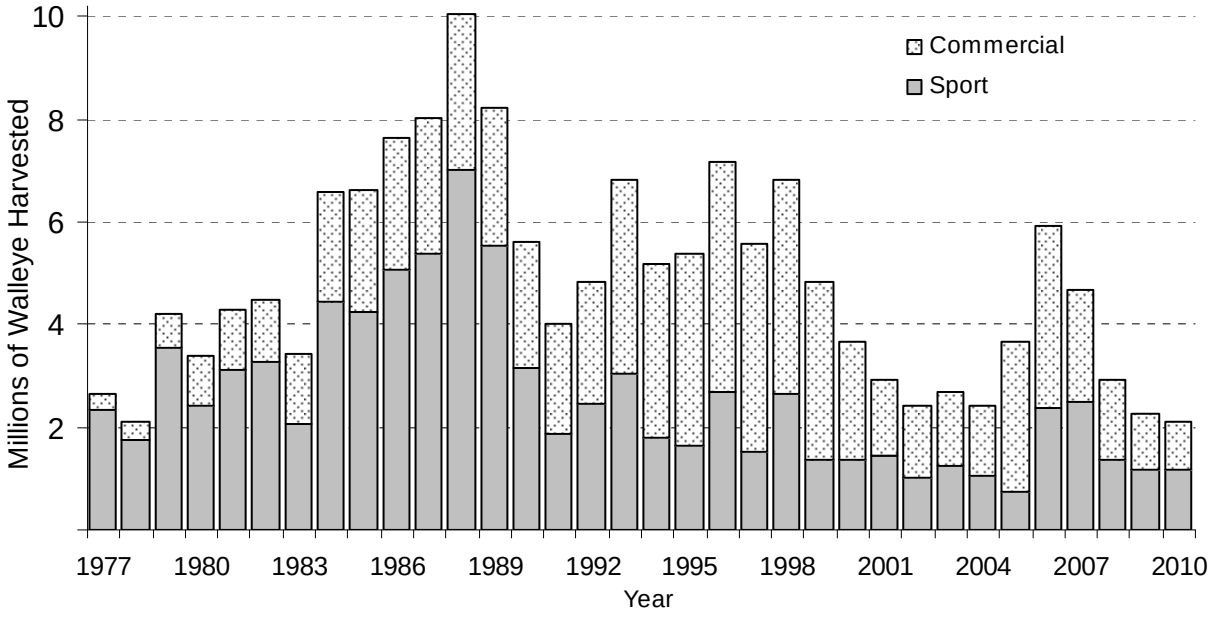

Figure 2. Lake-wide harvest of Lake Erie walleye by sport and commercial fisheries, 1977-2010.

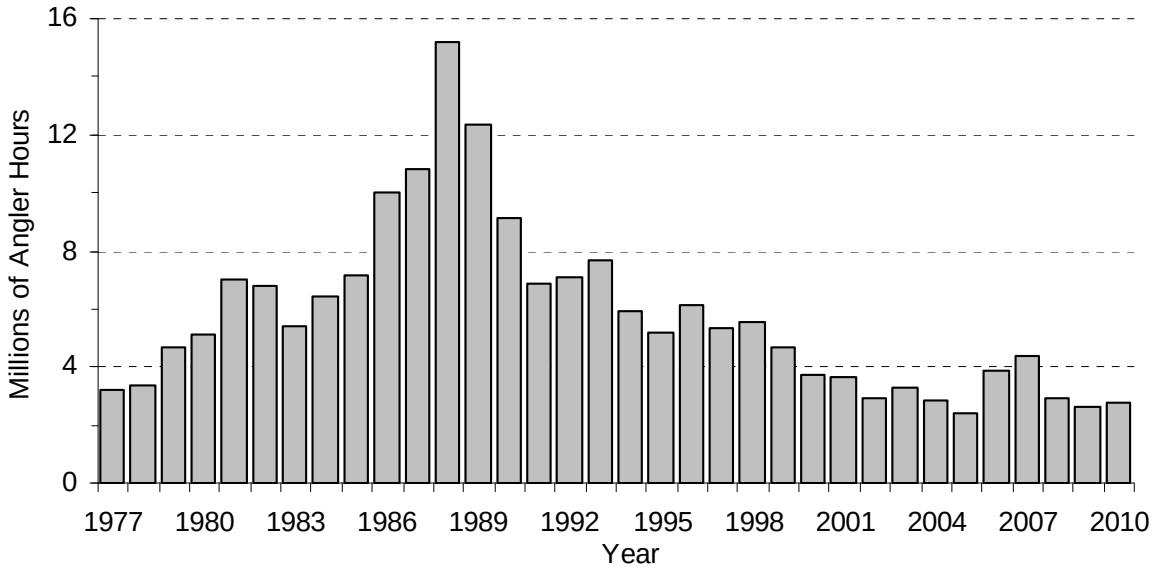

Figure 3. Lake-wide total effort (angler hours) by sport fisheries for Lake Erie walleye, 1977-2010. Years 1999-2010 exclude Ontario sport effort.

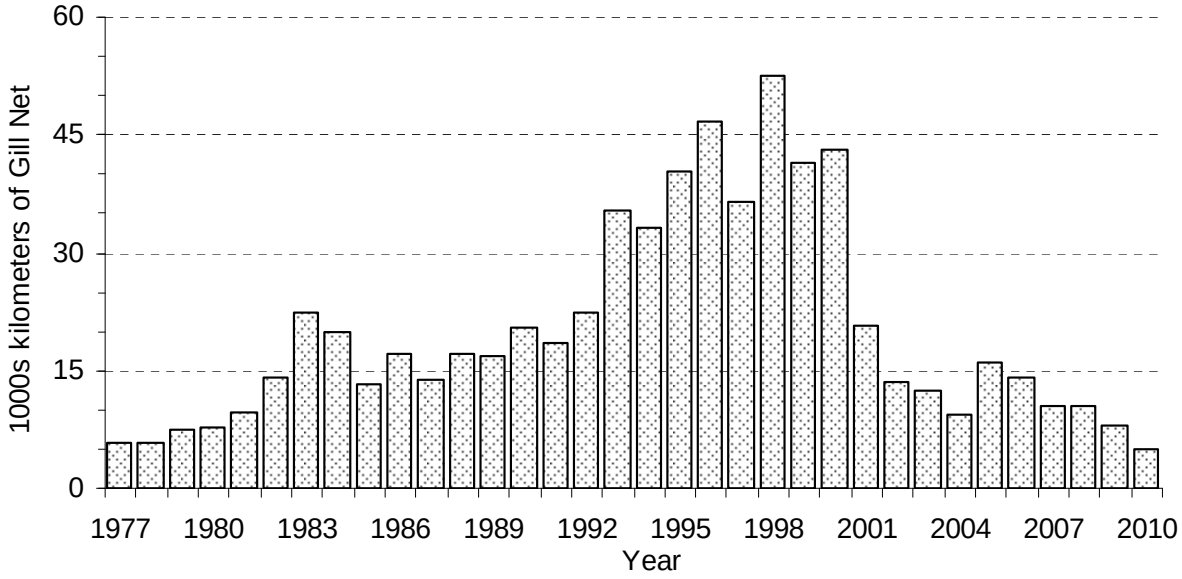

Figure 4. Lake-wide total effort (kilometers of gill net) by commercial fisheries for Lake Erie walleye, 1977-2010.

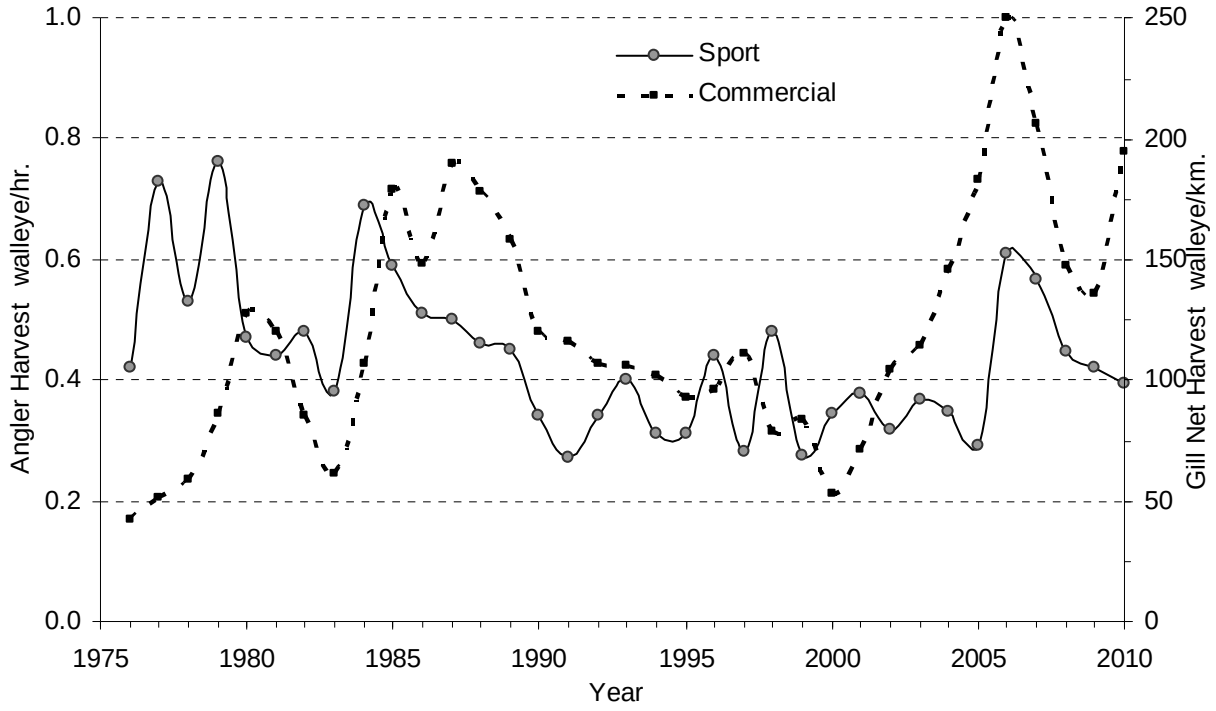

Figure 5. Lake-wide harvest per unit effort (HPE) for Lake Erie sport and commercial walleye fisheries, 1975-2010.

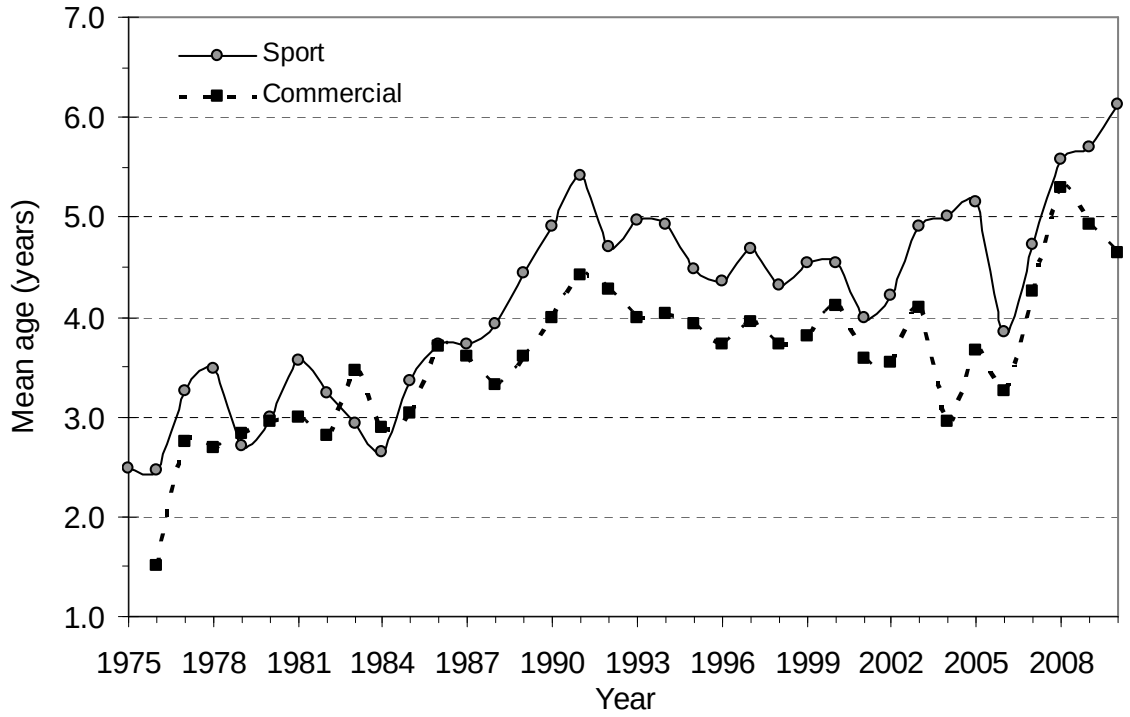

Figure 6. Lake-wide mean age of Lake Erie walleye in sport and commercial harvests, 1975-2010.

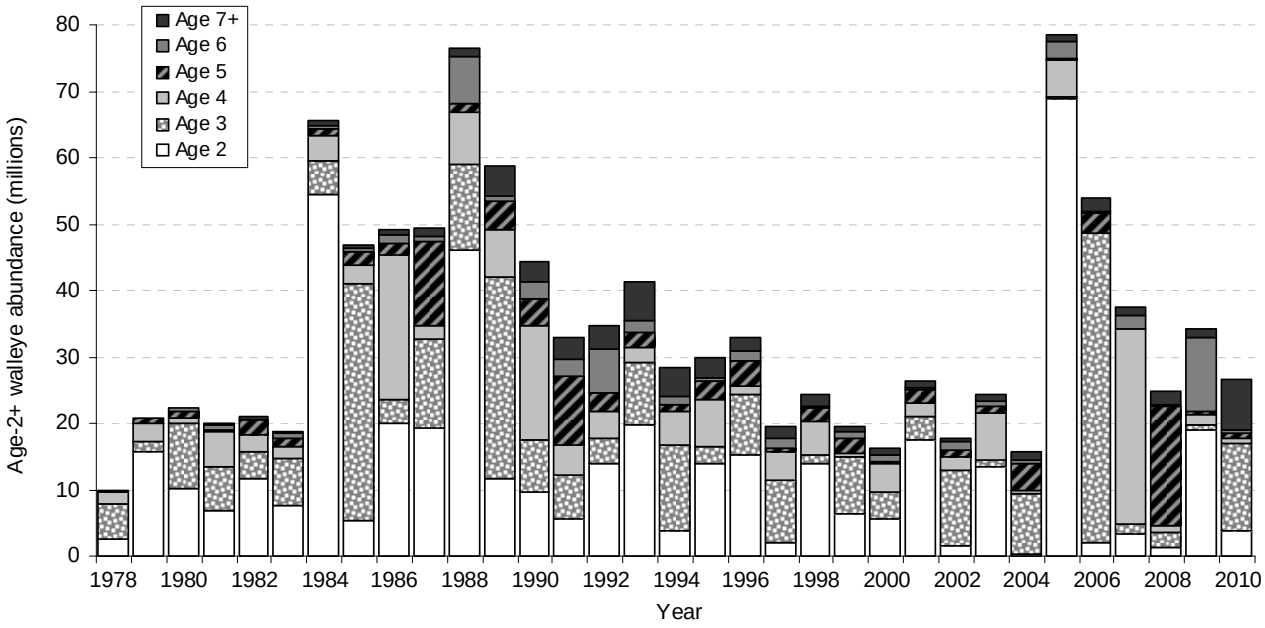

Figure 7. Estimates of abundance by age of Lake Erie walleye 1978-2010. Age-2 estimate in 2010 from regression. Data are from Table 8.

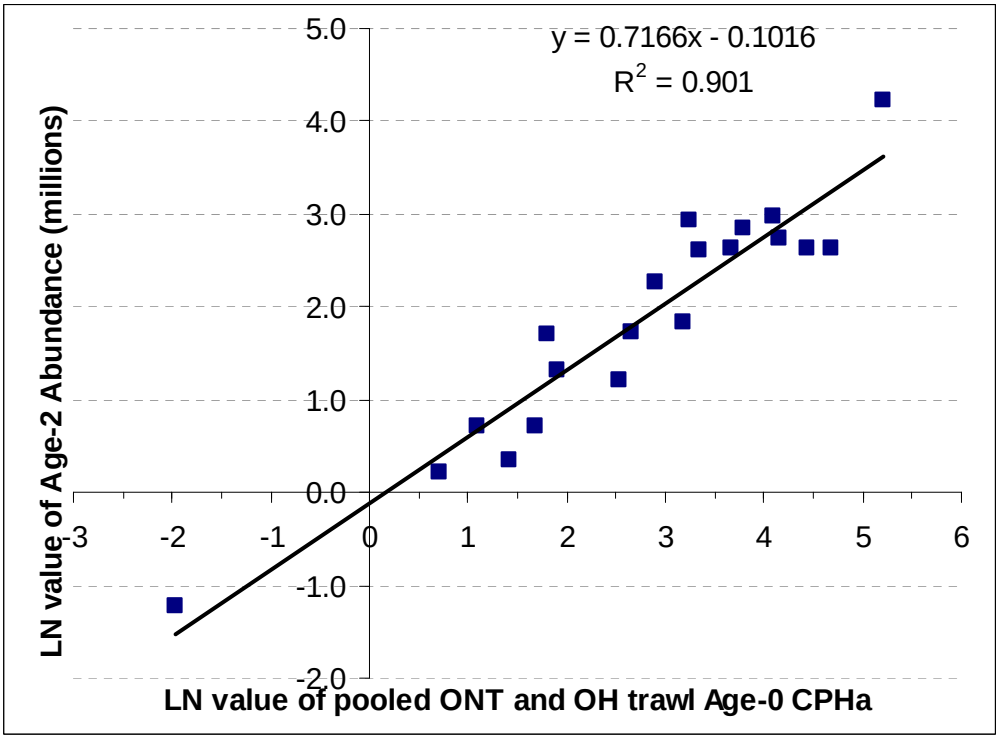

Figure 8. Regression used for estimates of abundance for age-2 Lake Erie walleye using natural logarithm transformed ADMB 2011 model catch-at-age estimates (y) and pooled Ontario and Ohio young-of-the-year trawl indices (x).

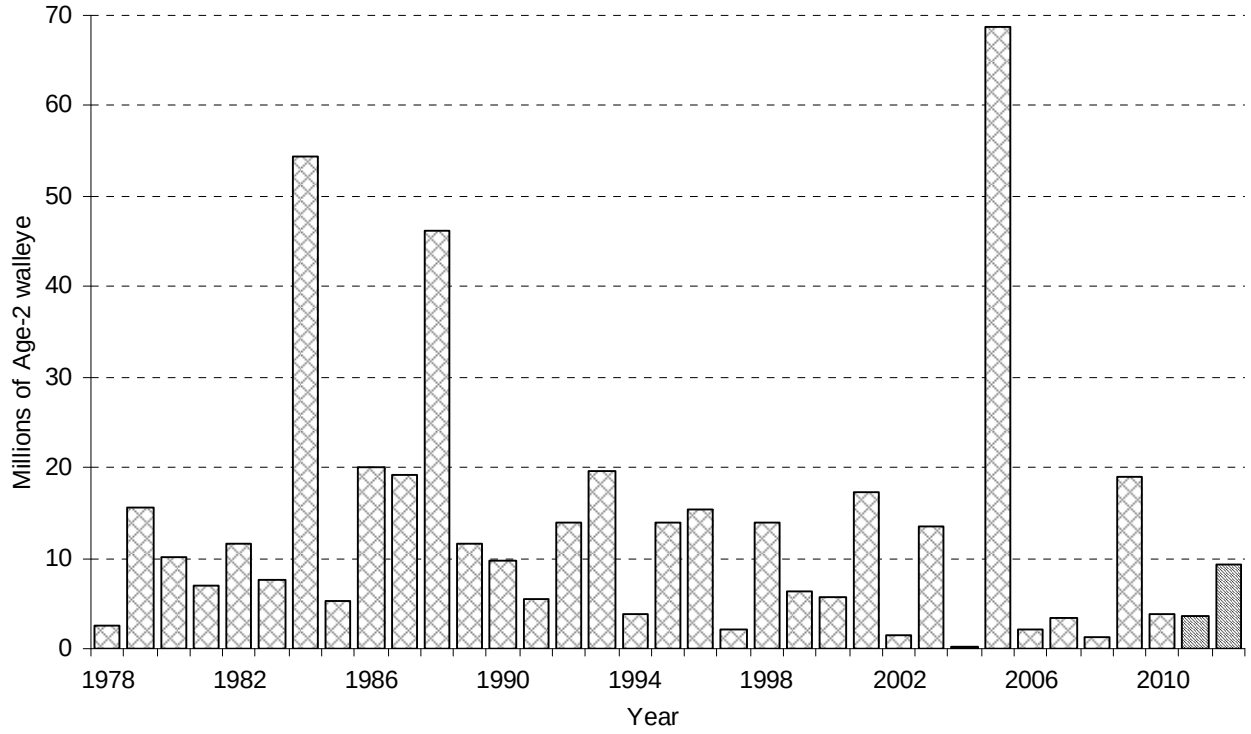

Figure 9. Abundance estimates (from the ADMB WTG 2011 model) of age-2 Lake Erie walleye for 1978 to 2010. Estimates for 2011 and 2012 are from the regression of YOY catch per hectare and numbers of age-2 from catch-at-age analysis (see Table 9 and Figure 8).

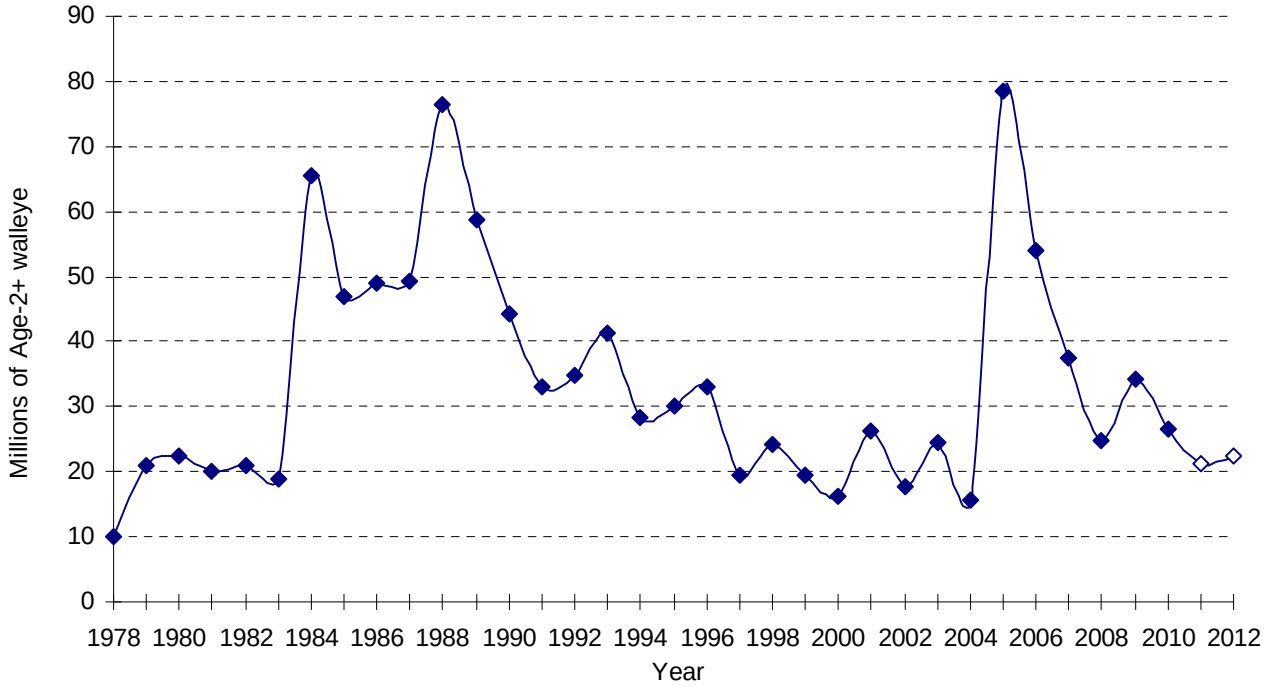

Figure 10. Abundance of Lake Erie walleye (from the ADMB WTG 2011 model) from 1978-2012, forecasting two years of population abundance from regressions (open diamonds).

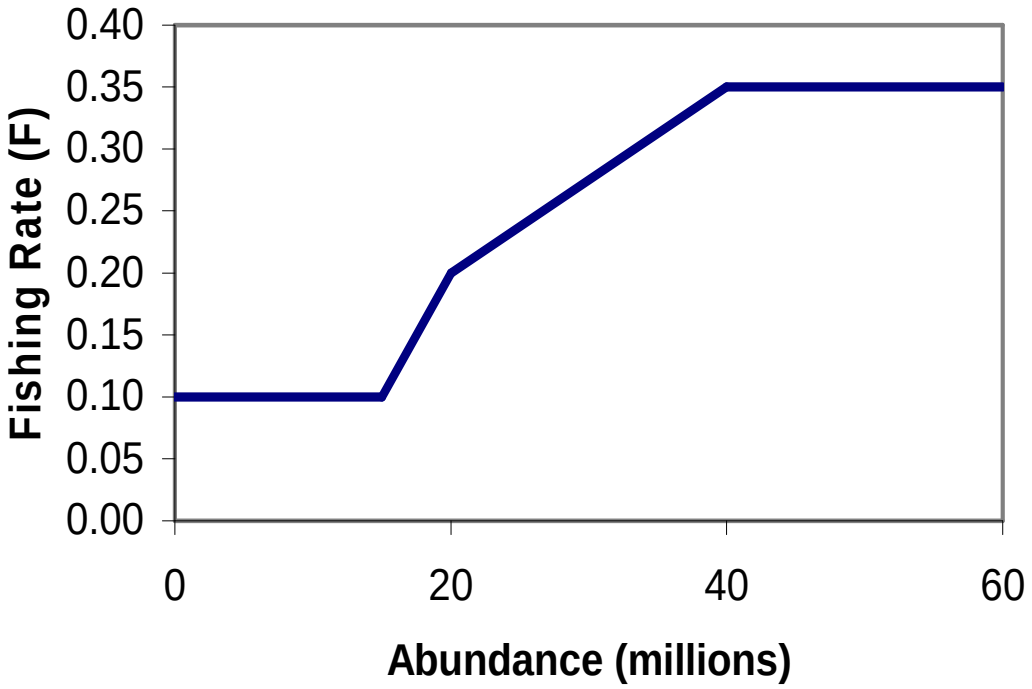

Figure 11. Lake Erie walleye harvest policy for age-2 and older walleye: below 15 million fish, F=0.1; between 15 and 20 million fish, F= 0.02(N)-0.02 (N is abundance in millions of fish); between 20 and 40 million fish, F= 0.0075(N)+0.05; and at 40 million fish and above, F=0.35.

Appendix 1. Lambda (λ) values and relative number of terms associated with catch-at-age analysis data sources.

Model	Data Source	λ	Relative Number of Terms
West/Central Basin Expert Opinion Lambdas (results presented in Table 8)	Commercial Gill Net Effort	0.89	1
	Ohio Sport Effort	0.86	1
	Michigan Sport Effort	0.80	1
	Commercial Gill Net Harvest	0.91	6
	Ohio Sport Harvest	0.85	6
	Michigan Sport Harvest	0.76	6
	Partnership Gill Net Index Catch Rates	1.00	6
	OH+MI Index Survey Catch Rates	0.86	6