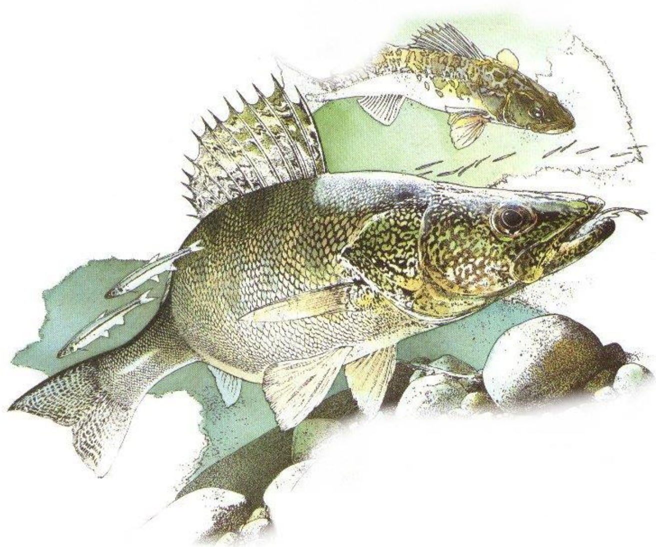
Report for 2015 by the

LAKE ERIE WALLEYE TASK GROUP

March 2016



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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, 2015-2016

The charges from the Lake Erie Committee's (LEC) Standing Technical Committee (STC) to the Walleye Task Group (WTG) for the period from April 2015 to March 2016 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 and reliable method for estimating and forecasting abundance, recruitment, and mortality.
    a. Explore additional recruitment indices for incorporation into catch-at-age model.
    b. Explore ways to account for tag loss and non-reporting in natural mortality (M) estimates for Statistical Catch at Age modeling.
    c. Explore and advise on feasibility of integrating east basin walleye assessments into lake wide management.
3. Report Recommended Allowable Harvest (RAH) levels for 2016.
4. Provide guidance/recommendations for future tagging strategies to the LEC.

Review of Walleye Fisheries in 2015

Fishery effort and Walleye harvest data were combined for all fisheries, jurisdictions and Management Units (Figure 1) to produce lake-wide summaries. The 2015 total estimated lake-wide harvest of Walleye was 2.713 million Walleye (Table 1), with a total of 2.522 million Walleye harvested in the total allowable catch (TAC) area. This harvest represents 61% of the 2015 TAC (4.114 million Walleye) and includes Walleye harvested in commercial and sport fisheries in Management Units 1, 2, and 3. An additional 191,606 Walleye (7% 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; Table 1). The estimated sport fish harvest of 1.325 million Walleye in 2015 represents a 16% decrease from the 2014 harvest of 1.577 million Walleye; this harvest is 43% below the long-term (1975-2014) average of 2.327 million fish. The 2015 Ontario commercial harvest was 1.388 million Walleye lake-wide, with 1.311 million caught in the TAC area (Table 2). Ontario does not conduct angler creel surveys on an annual basis, and thus some estimates of harvest and effort for this fishery component are not compiled annually for Ontario waters. Ontario sport harvest values were estimated from the 2014 lakewide aerial creel survey. These values are included in Ontario's total walleye harvest, but are not used in catch-at-age analysis. Based on the 2014 lakewide aerial creel, Ontario assumes a total of 72,000 Walleye were harvested by the sport fishery in Ontario within the TAC area during 2015. Thus the total harvest of Walleye in Ontario waters was 1.383 million Walleye, representing 78% of the 2015 Ontario TAC allocation of 1.771 million Walleye. Although the lakewide Ontario commercial harvest was 7% higher than in 2014, the 2015 harvest is 31% below the long-term average (1978-2014; Table 2, Figure 2).

Sport fishing effort decreased 2% in 2015 from 2014 to a total of 2.876 million angler hours (Table 3, Figure 3). Compared to 2014, sport effort in 2015 decreased by 5% in Management

Unit 1, and 23% in Management Unit 3; while increases were observed in Management Unit 2 and 4&5 by 23% and 5% respectively. Lake-wide commercial gill net effort in 2015 (19,637 km) increased by 31% from 2014 and for the first time in over a decade is above the long term-average by 5% (Table 3, Figure 4).

The 2015 lake-wide average sport harvest per unit effort (HUE) of 0.43 Walleye/angler hours, which is a 16% decrease from 2014 and is now equal to the long-term mean of 0.43 (1979-2014) Walleye/angler hours. Compared to 2014, sport harvest per unit of effort (Walleye/angler hour) for agencies combined decreased in all Management Units. Management Unit 1 decreased 10% from 0.56 in 2014 to 0.51 in 2015; while Management Unit 2 and 3 decreased by 14% (0.33) and 17% (0.41) respectively. The largest decrease of 34% in the sport harvest per unit of effort was observed in Management Unit 4&5. However, Management Units 1, 3 and 4&5 remain above their respective long-term means, while the sport harvest per unit of effort was equivalent to the long-term mean in Management Unit 2 (Table 4, Figure 5).

In 2015, total commercial gill net HUE (70.7 Walleye/kilometer of net) decreased 18% relative to 2014, and was 42% below the long-term lake-wide average (121.9 Walleye/kilometer; Table 4, Figure 5). Similar to the sport harvest rates, the 2015 commercial gill net harvest rates decreased in all Management Units. Largest decreases were observed in the eastern end of the lake with Management Unit 3 and 4&5 seeing decreases of 26% and 38% respectively. While Management Units 1 & 2 decreased by 12% and 7% respectively.

For the recreational and commercial fisheries, the harvest was dominated by Walleye originating from the 2003 (ages 7 and older group) year class, with moderate contributions by 2010 (age 5) and 2011 (age 4) (Tables 5 and 6) year classes. Ages 7-and-older Walleye comprised 40% and 39% of the lake-wide sport and commercial fishery harvest, respectively. The 2010 year class represented 14% of the total sportfish harvest and 11% of the total commercial fish harvest while the 2011 year class represented 21% of the total sport harvest and 11% of the total commercial harvest. The proportion of older fish (age 7+) in the total sport and commercial Walleye harvest combined was greater in Management Unit 3 (63%) and Management Unit 4 (56%) compared to Management Unit 1 (29%) and Management Unit 2 (41%). A higher proportion of younger fish were observed in the commercial fishery, especially in the west end of the lake with age 1 and age 2 fish comprising 26% and 17% of the harvest in Management Unit 1 and 15% (age 1) and 11% (age 2) in Management Unit 2.

Across all jurisdictions, the mean age of Walleye in the 2015 harvest ranged from 5.9 to 8.7 years old in the sport fishery, and from 4.6 to 8.6 years old in Ontario's commercial fishery (Table 7, Figure 6). Overall, an increase in mean age of Walleye harvested was observed from 2014 to 2015 in both the recreational (+3%) and commercial fisheries (+2%). However, this trend was not consistent in all Management Units. The mean age of harvested Walleye in the sport fishery decreased 3% in Management Units 2 and 4&5 and the mean age of harvested Walleye in the commercial fishery decreased in Management Unit 1 by 13% and in Management Unit 4 by 3%. The mean age in the sport fishery (6.7 years) was above the long-term mean (1975-2014) of 4.3 years, and was the highest on record since 1975. In the commercial fishery, the mean age was 6.1 years, higher than the long-term mean (1975-2014) of 3.8 years, and also the highest value in the time series. The mean age of the total harvest (sport and commercial fisheries) in 2015 (6.4 years) rose to the highest value ever observed in the time series (1975-2014). This reflects the continued dependence of the fisheries on the 2003 and 2007 (age 7+) year classes, with contributions to the fisheries from the 2010 (age 5) and 2011 (age 4) cohorts in 2015. We do expect this trend to reverse as strong year classes observed in 2014 and 2015 begin to recruit to the fisheries.

Catch-at-Age Population Analysis and Abundance

The WTG uses a SCAA model to estimate the abundance of Walleye in Lake Erie between 1978 and 2015. The stock assessment model estimates population abundance utilizing both fishery dependent and independent data sources. The model includes fishery-dependent data from the Ontario commercial fishery (Management Units 1-3) and sport fisheries in Ohio (Management Units 1-3) and Michigan (Management Unit 1). Since 2002, the WTG model has included data collected from three fishery-independent, gill net assessment surveys (i.e., Ontario Partnership, Michigan and Ohio). Due to similarities between Michigan and Ohio surveys and the desire for improved precision, Michigan gill net survey data were pooled with Ohio's data in the SCAA model. The Lake Erie Percid Management Advisory Group (LEPMAG) developed an updated walleye model, which the WTG began using in 2013. This model also includes: 1) estimated selectivity for all ages within the model without the assumptions of known selectivity at age; 2) integrated age-0 trawl survey data into the model; 3) a multinomial distribution for the age composition data; and 4) time varying catchability using a random walk for fishery and survey data including the age-0 trawl survey. Instantaneous natural mortality (*M)* is assumed to be constant (0.32) among years (1978-2015) and ages (ages 2 through 7 and older). The abundances-at-age were derived from the estimated parameters using an exponential survival equation.

Based on the 2016 integrated SCAA model, the 2015 west-central population (Management Units 1-3) estimate was 25.604 million age 2 and older Walleye (Table 8, Figure 7). The estimated number of age-7+ fish originating from the 2007 and older year classes in 2015 was 6.178 million fish and represented 24% of the Walleye (age 2 and older) in the population. The second most abundant age group (26%) was age 2 Walleye, followed by the age 4 fish (16%). Based on the integrated model, the number of age 2 recruits entering the population in 2016 (2014 year-class) and 2017 (2015 year-class) will be 16.538 and 38.233 million Walleye, respectively (Table 9; Figure 8). The projected abundance of age 2 and older Walleye in the west-central population in 2016 is 33.246 million fish (Table 8; Figure 7).

Harvest Policy and Recommended Allowable Harvest (RAH) for 2015

In March 2016, the WTG applied the following Harvest Control Rules as identified in the Walleye Management Plan (WMP; 2015-2019):

- *Target Fishing Mortality* of **60%** of the Maximum Sustainable Yield (60%F_{MSY}) ;
- Threshold *Limit Reference Point* of **20%** of the Unfished Spawning Stock Biomass (20%SSB_0);
- Probabilistic Control Rule, P-star, P*=**0.05** ;
- A limitation on the annual change in TAC of $\pm$**20%**.

Using results from the 2016 integrated SCAA model, the estimated abundance of 33.246 million age 2 and older Walleye in 2016, and a harvest policy (described above), the calculated mean RAH for 2016 is 4.998 million Walleye, with a range from 3.799 (minimum) to 6.197 (maximum) million Walleye (Table 9). The WTG RAH range estimate is an AD Model Builder (ADMB, Fournier et al. 2012) generated value based on estimating +/- one standard deviation of the mean RAH. ADMB uses a statistical technique called the delta method to determine this standard deviation for the calculated RAH, incorporating the standard errors from abundance estimate at age and combined gear selectivity at age that go into the calculation of the RAH. The target fishing rate, ($F_{60\%MSY}$ =0.318) in the harvest policy was applied since the probability that the projected spawner biomass in 2017 (38.887million kg) could fall below the limit reference point ($SSB_{20\%}$ = 12.773 million kg) after fishing at $F_{60\%MSY}$ in 2016 was less than 5% (P<0.0001). Thus the probabilistic control rule that could have reduced the target fishing rate to conserve spawner biomass will not be invoked during the 2016 process to determine RAH.

In addition to the RAH, the Harvest Control Rule adopted by LEPMAG, limits the annual change in TAC to ± 20%. If the LEC were to invoke the 20% maximum change rule from the previous year's TAC, then the 2015 TAC range would be (+) or (-) 20% of the TAC (4.114 million fish). This 2016 TAC range for LEC consideration would be from 3.291 million fish to 4.937 million fish.

Other Walleye Task Group Charges

Centralized Datasets

The WTG 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, data from these surveys are 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 (WTG 2003).

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 SCAA 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.

Investigating Auxiliary Recruitment Indices

Although Walleye management areas of Lake Erie may be recognized functionally as within or outside of the international TAC area, multiple Walleye stocks exist in Lake Erie. Stock productivity is believed to decrease from west to east; but, due to the migratory behavior of Walleye, eastern basin Walleye dynamics cannot be considered independent. To address uncertainty surrounding juvenile dispersal and productivity of Walleye stocks across Lake Erie, the WTG has compared lake-wide densities of yearling Walleye with standardized gill net indices since 2011 (WTG 2012). Site specific yearling Walleye catches standardized to 50 foot panels per mesh size for mesh sizes ≤5.5" (140 mm) are presented for agency index gill nets fished on bottom (Figure 9a) and suspended (Figure 9b) in 2015. Yearling Walleye catches in bottom nets occurred in the west basin, central basin and southern waters of eastern Lake Erie in 2015 (Figures 9a,b). Age 1 Walleye were caught in western and parts of central Lake Erie in suspended nets, but not in northern waters of eastern Lake Erie where suspended index nets were fished (Figure 9b). Sampling in the southern portion of the central basin was reduced in 2015, limiting comparisons of the central basin yearling densities. High densities of yearling Walleye were observed in bottom nets in Ontario waters of the west basin (Figure 9a) and in nets suspended in Ohio waters of west and central Lake Erie (Figure 9b). Albeit with differences in gear and coverage, the distribution of the 2014 Walleye cohort extended lake-wide, inferring greater abundance in the west but with regional differences in eastern Lake Erie that may be associated with local stocks.

Currently, the interagency west basin young-of-the-year (YOY) Walleye bottom trawl index (Table 10) is integrated in the SCAA model to contribute to age 2 abundance estimates and recruitment forecasts to the year of RAH and the following year. While this survey is considered to be a reliable predictor of recruitment, the inclusion of additional recruitment data may augment the recruitment estimation process. Although both young-of-the-year and yearling indices are candidates for a composite index, yearling Walleye indices cannot be used to forecast recruitment 2 years in advance, a requirement for the probabilistic harvest control rule P*, an existing component of the Walleye Management Plan (Kayle et al. 2015). Since yearling data are not compatible with this control rule, options include the exclusion of yearling data from a composite index, removal of the P* control rule from the Walleye Management Plan Harvest Policy or running two (2) integrated SCAA models; one with YOY and yearling data and the second model using only YOY data.

To address the charge for incorporating multiple Walleye recruitment indices into annual WTG assessment, the task group compiled 25 assessment indices from state, federal and provincial programs. These indices include young-of-the-year (YOY) and yearling indices from bottom trawl and index gillnet surveys; however, indices varied in time series length and missing years of data. The longest time series was 48 years long, from1968 to 2015 and the shortest one was 2013 to 2015. Several recruitment indices available were not mutually exclusive, raising survey independence as a criterion for selection. Inclusion of yearling indices in a composite index remains uncertain due to an existing WMP harvest control rule requiring 2 year recruitment projections. Therefore, two separate YOY and yearling composite indices were generated. Interim criteria for selection of individual recruitment indices included 1) minimum time series length of 20 years, 2) no missing recent years and 3) surveys must be independent. Based on these criteria, 6/9 YOY surveys and 10/16 yearling indices were used in Principal Components Analysis (PCA) to produce two composite Walleye recruitment indices.

Each index was standardized to have a mean=0 and standard deviation=1 prior to analyses. A principal component analysis (PCA) was applied to the selected recruitment indices to reduce the number of dimensions without losing much information in the data sets. The resulting principle components are mutually orthogonal and thus used as independent variables to predict the number of age 2 fish from a linear regression analysis. Each principle component is a linear combination of the 15 selected indices and their coefficients (i.e. Eigenvectors) representing the contribution of each survey index to the corresponding principle component.

The PCA analyses on the selected YOY and yearling recruitment indices showed that the first principal component (PRIN 1) was able to explain 69% and 54% of total variance respectively. To fit composite recruit indices to SCAA age 2 estimates, first principal components were independent variables in linear regressions with dependant statistical catch at age (SCAA) age 2 estimates in either $\log_e$ transformed or untransformed versions. Linear regressions were highly significant for YOY and Yearling principal components (PRIN 1) and transformed and untransformed SCAA age 2 estimates ($P<0.0001$). Fits differed for $\log_e$ transformed and untransformed age 2 abundance (dependant variables) and the YOY composite index (R^2=0.81 and 0.70 respectively) and yearling composition indices (R^2=0.64 and 0.93 respectively). Using the YOY composite index as the predictor, a leverage point (i.e. 2003 year class) was identified through the examination and analysis of residuals from both linear regression models (i.e. $\log_e$ transformed versus untransformed age-2 recruitment dependent variable). Using the yearling composite index as the predictor, a simple linear regression resulted in an apparent curved residual pattern for the model with $\log_e$ transformed recruitment; but the pattern was not evident for untransformed recruitment model.The yearling composite index lacked the 2003 cohort value due to missing data within source indices, which may have influenced regression fit. The sensitivity of regressions to log transformation of SCAA age 2 estimates infers challenges for integrating PCA derived composite recruitment indices in SCAA models.

Potential criteria for survey inclusion in composite recruitment indices includes time series length, annual sample intensity, missing years of data, survey independence, spatial or stock considerations and gear selectivity. The efficacy of these criteria and possibly others will be evaluated further. Comparisons between PCA and alternative methods such as mixed model inference (MMI) introduced in the LEPMAG Yellow Perch assessment will occur to fulfill this charge.

Explore ways to account for tag loss and non-reporting in natural mortality (M)

Interagency Walleye tagging on Lake Erie extends over decades using jaw tags, PIT (Passive Integrated Transponder) tags or a combination since 2005, and more recently still, using acoustic tags. PIT tags have been used to quantify jaw tag loss in Walleye (Vandergoot et al. 2012), facilitating estimation of movement parameters and natural mortality rates of Lake Erie Walleye (Vandergoot and Brendan, 2014). The WTG has been working with Lake Erie PIT tag mark recapture data to estimate natural and fishing mortality rates without concern for tag reporting rates that must be addressed for external tags. For the model, the number of PIT tags detected annually was expanded by dividing total harvest by the proportion of harvest scanned. Sport fishery effort was standardized by dividing sport harvest by commercial targeted Walleye catch rates. PIT tag detection efficiency in the commercial fishery was considered to be 80% based on scanning packers with tagged Walleye repeatedly following mixing (N=20). Brownie's tag-recovery Model (Brownie et al. 1985) modified by Pollock et al. 1991 used annual PIT recovery estimates and standardized effort to estimate natural mortality, catchability, and estimates of annual total instantaneous fishing mortality. The model was implemented in ADMB, and designed to test multiple assumptions, such as including survey recaptures and effort to supplement fishery data. Preliminary results for the west/central stocks produced a natural mortality rate estimate of 0.29 with instantaneous fishing mortality rates ranging from 0.09 to 0.32. The model estimates were not sensitive to including survey recaptures. Brownie model total fishing mortality estimates exceeded SCAA model fishing mortality estimates for 2005-2014 (WTG 2015). A complete report addressing additional model assumptions will be produced.

East Basin Walleye Assessment

Catch-at-age assessment models assume that information collected from fisheries and surveys track the same cohorts 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. (2011) used a mark-recapture analysis to quantify the contribution of both sources. They estimated that, on average, about 90% of all Walleye harvested in the east basin were seasonal migrants from the west basin. However, there exists a large amount of uncertainty and variability 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.

At least part of the rationale for spatially investigating relative abundance of yearling walleye (*Investigating Auxiliary Recruitment Indices*; above), was to get a picture of relative annual eastern stock specific abundance, based on the assumption that yearling walleye have moved little beyond their basin of production. Ongoing work toward improved gear standardization will necessarily also contribute to describing and assessing eastern production independent of western. Apparent from that exercise is the potential for intra-basin differences in eastern production, (Figure 9a) perhaps related to unique characteristics of local stocks. Assumptions based on movement patterns, and site fidelity, will also be informed in the future by ongoing, lake wide, spatial ecology studies (*Studies Using Acoustic Telemetry;* below)

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 support of Charge 2c 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 include a stock assessment approach that does not utilize a catch-at-age modeling of absolute abundance. The task group is optimistic that ongoing eastern basin-specific additions to the Lake Erie Walleye Spatial Ecology study (below) will contribute substantially to this eastern exercise.

Additional Walleye Task Group Activities

Studies Using Acoustic Telemetry

In 2010, an inter-lake Walleye spatial ecology study was initiated between the Michigan Department of Natural Resources, Ohio Department of Natural Resources, United States Geological Survey, Carleton University, and Great Lakes Fishery Commission. The objectives of the study are to 1) determine the proportion of Walleyes spawning in the Tittabawassee River or in the Maumee River that reside in the Lake Huron main basin population, move into and through the Huron-Erie-Corridor, and reside in Lake Erie, 2) identify the environmental characteristics associated with the timing and extent of Walleye movement from riverine spawning grounds into Lake Huron and back again, 3) determine whether Walleye demonstrate spawning site fidelity, and 4) compare unbiased estimates of mortality parameters of Walleyes from Saginaw Bay and the Maumee River.

A similar spatial ecology study was initiated during the spring of 2013. One hundred sixty-five Walleye (n=100 male and 65 female) were collected with gill nets during the spawning period on (males) or in the vicinity of (females) Toussaint Reef. An additional 108 Walleye (n = 75 male and 33 female) were tagged in 2014. Each fish was implanted with an acoustic transmitter and had an external reward tag ($100) attached. Captured fish should be reported to the phone number listed on the tags, via the internet by logging onto http://data.glos.us/glatos, or by contacting one of the LEC agencies.

The objectives of this study are to: 1) determine the proportion of Walleye originating from two western basin spawning stocks (i.e., Toussaint Reef and Maumee River) that migrate out of the western basin of Lake Erie after spawning, 2) compare spawning site fidelity rates between these two spawning stocks, 3) determine if female Walleye from these spawning stocks are annual spawners, and 4) compare total mortality rates (i.e., fishing and natural) for these spawning stocks. This study was funded by the Great Lakes Fishery Commission, Ohio Department of Natural Resources and the Ontario Ministry of Natural Resources and is a collaborative effort of the LEC agencies, the United States Geological Survey and Carleton University.

An additional study focused on the effects of a dam removal in the Sandusky River began in 2014. Walleye (n = 101; 48 males and 53 females) were collected via electrofishing during the spawning period and tagged. The objectives of this study are to: 1) determine if Sandusky River Walleye move upstream of the Ballville Dam once it is removed and hydrologic connectivity is reestablished, 2) determine the spatial distribution of Walleye spawning activity in the Sandusky River following dam removal, and 3) to compare survival rates of Sandusky River Walleye to other discrete Walleye spawning stocks in Lake Erie.

In 2015 a cooperative eastern basin walleye acoustic telemetry study was initiated involving the New York State Department of Environmental Conservation, Ohio Department of Natural Resources, Pennsylvania Fish and Boat Commission, Ontario Ministry of Natural Resources and Forestry, Great Lakes Fishery Commission, and Michigan State University. Acoustic transmitters and external reward tags were applied to 70 Walleye (35 males and 35 females) from the Van Burn Bay spawning shoal and 70 Walleye (35 males and 35 females) from the Grand River stock in the spring 2015. The broad goal of this work is to address areas of uncertainty that prevent the inclusion of the eastern basin in a multi-jurisdictional assessment. The objectives of this study are to: 1) estimate the annual contribution of western basin walleye to the eastern basin fishery, 2) quantify the timing, magnitude, demographics, and spatial distribution of central and western basin migrants in the eastern basin, 3) estimate and compare spawning site fidelity rates in the eastern basin, 4) describe the movements of eastern basin walleye out of the eastern basin, and 5) estimate total mortality rates (i.e., fishing and natural) for the major spawning stocks in the eastern basin.

A subcomponent of the eastern basin study, also begun in 2015, asks questions about access to spawning habitat and behavior in relation to a lowhead dam at Dunnville, 8km upstream from the lake. The eastern basin acoustic receiver network was extended 34km upstream in order to monitor 35 (of the 70 noted above) tagged walleye placed above the barrier, as well as those (n =35) left below. Subcomponent objectives include 1) determining the extent to which previously mapped habitat (above and below) is utilized during spawning and 2) determining the timing of movement between river and lake relative to environmental variables (temperature and hydrology) particularly if differences in behaviour exist between above- and below-dam individuals. Information gained about the timing of migration will also be used to assess current sport fish regulations meant to protect the stock during spawning. Whereas the Sandusky River study will monitor behavior following a dam removal, results from this study will inform decisions around whether or not to remove the first upstream barrier on the Grand River.

Results from these telemetry studies will be forthcoming during the coming years.

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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 2015. TAC allocations for 2015 on are based on water area: 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**	**34,552**	**54,056**	**23,324**	**111,932**	**2,108,943**
2011	TAC	170,178	1,491,901	1,256,921	2,919,000				0	2,919,000
	Har	**50,490**	**417,314**	**1,224,057**	**1,691,861**	**31,506**	**45,369**	**28,873**	**105,748**	**1,797,609**
2012	TAC	203,292	1,782,206	1,501,502	3,487,000				0	3,487,000
	Har	**86,658**	**921,390**	**1,355,522**	**2,363,570**	**36,975**	**44,796**	**28,260**	**110,031**	**2,473,601**
2013	TAC	195,655	1,715,252	1,445,094	3,356,000				0	3,356,000
	Har	**54,167**	**1,083,395**	**1,274,945**	**2,412,507**	**34,553**	**60,332**	**30,591**	**125,476**	**2,537,983**
2014	TAC	234,774	2,058,200	1,734,026	4,027,000				0	4,027,000
	Har	**42,142**	**1,303,133**	**1,324,201**	**2,669,476**	**61,982**	**84,843**	**52,675**	**199,500**	**2,868,977**
2015	TAC	239,846	2,102,665	1,771,488	4,114,000				0	4,114,000
	Har	**65,740**	**1,073,263**	**1,382,600**	**2,521,603**	**55,201**	**46,523**	**89,882**	**191,606**	**2,713,209**

[a] Ontario sport harvest values were estimated from the 2014 lakewide aerial 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. Means contain data from 1975 to 2014.

	Sport Fishery															Commercial Fishery				
	Unit 1				Unit 2			Unit 3			Units 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	2	44	27	73	1,261	948	283	182	14	1,427
2004	515	115	34	664	272	2	274	72	0	72	2	20	8	30	1,040	866	334	175	11	1,386
2005	374	38	27	438	110	2	112	126	0	126	2	20	27	49	725	1,878	625	401	15	2,920
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
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
2008	524	121	44	689	333	2	335	225	0	225	2	74	29	105	1,354	954	335	241	35	1,565
2009	553	94	44	691	287	2	288	128	0	128	2	42	14	58	1,166	705	212	135	28	1,079
2010	587	55	44	686	257	2	259	114	0	115	2	54	37	93	1,152	607	184	147	23	962
2011	224	50	44	318	104	2	106	89	0	90	2	45	32	79	593	736	262	181	29	1,208
2012	596	87	44	726	233	2	235	93	0	93	2	45	37	84	1,138	834	285	191	28	1,338
2013	757	54	44	855	190	2	192	136	0	136	2	60	35	97	1,280	737	297	195	31	1,260
2014	909	42	45	996	177	13	190	218	13	231	13	85	62	160	1,577	756	259	238	40	1,292
2015	746	66	45	857	187	13	200	140	13	153	13	47	55	115	1,325	633	354	325	77	1,388
Mean	1,531	264	40	1,834	272	10	278	167	12	176	8	69	37	61	2,327	1,383	432	284	32	2,024

[a] Ontario sport harvest values were estimated from the 2014 lakewide aerial creel survey. 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 2014.

	Sport Fishery [a]															Commercial Fishery [b]				
	Unit 1				Unit 2			Unit 3			Units 4 & 5					Unit 1	Unit 2	Unit 3	Units 4&5	
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	3,555	440	144	4,200	1,220	79	1,320	715	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	6,100	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	409	217	390	280	670	5,252	19,027	19,397	13,253	818	52,495
1999	2,368	411	--	2,779	603	--	603	323	--	323	--	397	171	568	4,273	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	321	3,277	4,476	3,946	3,725	365	12,512
2004	1,257	504	--	1,761	736	27	736	178	7	178	--	88	101	189	2,864	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	--	188	140	328	2,828	1,918	1,371	1,401	247	4,937
2011	862	165	--	1,026	346	--	346	217	--	217	--	156	145	301	1,891	2,646	1,884	1,572	489	6,591
2012	1,283	242	--	1,525	560	--	560	182	--	182	--	160	169	329	2,597	4,674	2,480	2,298	352	9,804
2013	1,424	182	--	1,606	503	--	503	236	--	236	--	154	143	297	2,641	3,802	2,774	2,624	304	9,503
2014	1,552	131	101	1,683	459	85	459	441	71	441	70	171	187	358	2,940	7,351	4,426	2,911	254	14,943
2015	1,430	165	--	1,595	564	--	564	341	--	341	--	162	215	377	2,876	6,980	6,487	5,379	792	19,637
Mean	3,017	700	102	3,782	760	62	776	417	111	451	106	214	232	259	5,212	8,973	5,492	4,493	572	18,634

[a] Ohio, Michigan, Pennsylvania and New York 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 2014 lakewide aerial creel survey, values are in rod hours

[d] Ontario sport fishing effort is not included in area and lakewide totals due to effort reporting in rod hours

Table 4. Annual catch per unit effort for Lake Erie walleye by gear, management unit, and agency. Means contain data from 1975 to 2014.

	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	0.18	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	0.30	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	0.28	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	--	0.29	0.26	0.28	0.39	316.7	134.5	105.0	94.5	194.9
2011	0.26	0.31	--	0.27	0.30	--	0.30	0.41	--	0.41	--	0.29	0.22	0.26	0.29	278.3	138.9	115.0	59.0	183.3
2012	0.46	0.36	--	0.45	0.42	--	0.42	0.51	--	0.51	--	0.28	0.22	0.25	0.42	178.4	114.8	83.1	80.3	136.5
2013	0.53	0.30	--	0.51	0.38	--	0.38	0.58	--	0.58	--	0.39	0.24	0.32	0.47	194.0	107.0	74.2	100.7	132.5
2014	0.59	0.32	0.45	0.56	0.39	0.16	0.39	0.49	0.19	0.49	0.18	0.50	0.33	0.41	0.51	102.8	58.4	81.8	156.8	86.5
2015	0.52	0.40	--	0.51	0.33	--	0.33	0.41	--	0.41	--	0.29	0.26	0.27	0.43	90.6	54.5	60.3	97.3	70.7
Mean	0.48	0.36	0.40	0.46	0.33	0.26	0.33	0.38	0.19	0.37	0.11	0.32	0.17	0.22	0.43	172.9	87.3	70.7	67.1	121.9

[a] Ohio, Michigan, Pennsylvania and New York sport CPE = Number/angler hour

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

[c] Ontario sport fishing CPE was estimated from the 2014 lakewide aerial creel survey values are in number/rod hour

[d] Ontario sport fishing CPE is not included in area and lakewide totals due to effort reporting in rod hours

Table 5. Catch at age of walleye harvest by management unit, gear, and agency in Lake Erie during 2015. 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	165,250	0	45			45	165,295
	2	105,517	76,149	6,438			82,587	188,104
	3	69,040	74,194	10,669			84,863	153,903
	4	76,050	187,034	15,162			202,196	278,246
	5	48,951	109,318	11,290			120,608	169,559
	6	14,458	47,265	2,374			49,639	64,097
	7+	153,268	252,006	19,761			271,767	425,035
	Total	632,534	745,966	65,740	--	--	811,706	1,444,240
2	1	52,197	0				0	52,197
	2	39,755	24,762				24,762	64,517
	3	29,199	13,531				13,531	42,730
	4	44,276	38,170				38,170	82,446
	5	35,379	20,734				20,734	56,113
	6	12,057	9,735				9,735	21,792
	7+	140,897	80,309				80,309	221,206
	Total	353,760	187,241	--	--	--	187,241	541,001
3	1	6,723	0				0	6,723
	2	3,375	6,327				6,327	9,702
	3	10,191	7,036				7,036	17,227
	4	32,502	18,680				18,680	51,182
	5	43,819	11,801				11,801	55,620
	6	23,394	6,481				6,481	29,875
	7+	204,525	89,732				89,732	294,257
	Total	324,529	140,057	--	--	--	140,057	464,586
4	1	0			0	0	0	0
	2	443			0	1,907	1,907	2,350
	3	1,420			9,844	10,296	20,140	21,560
	4	5,387			2,195	3,623	5,818	11,205
	5	18,809			10,671	8,389	19,060	37,869
	6	3,701			929	572	1,501	5,202
	7+	47,263			31,561	21,737	53,298	100,561
	Total	77,023	--	--	55,201	46,524	101,725	178,748
All	1	224,170	0	45	0	0	45	224,215
	2	149,090	107,238	6,438	0	1,907	115,583	264,673
	3	109,850	94,761	10,669	9,844	10,296	125,571	235,421
	4	158,215	243,884	15,162	2,195	3,623	264,864	423,079
	5	146,958	141,853	11,290	10,671	8,389	172,203	319,161
	6	53,610	63,481	2,374	929	572	67,357	120,967
	7+	545,953	422,047	19,761	31,561	21,737	495,106	1,041,059
	Total	1,387,846	1,073,264	65,740	55,201	46,524	1,240,729	2,628,575

[a] Ontario sport harvest values by age were not estimated from the 2014 creel survey; 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 2015. 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	26.1	0.0	0.1	--	--	0.0	11.4
	2	16.7	10.2	9.8	--	--	10.2	13.0
	3	10.9	9.9	16.2	--	--	10.5	10.7
	4	12.0	25.1	23.1	--	--	24.9	19.3
	5	7.7	14.7	17.2	--	--	14.9	11.7
	6	2.3	6.3	3.6	--	--	6.1	4.4
	7+	24.2	33.8	30.1	--	--	33.5	29.4
	Total	100.0	100.0	100.0	--	--	100.0	100.0
2	1	14.8	0.0	--	--	--	0.0	9.6
	2	11.2	13.2	--	--	--	13.2	11.9
	3	8.3	7.2	--	--	--	7.2	7.9
	4	12.5	20.4	--	--	--	20.4	15.2
	5	10.0	11.1	--	--	--	11.1	10.4
	6	3.4	5.2	--	--	--	5.2	4.0
	7+	39.8	42.9	--	--	--	42.9	40.9
	Total	100.0	100.0	--	--	--	100.0	100.0
3	1	2.1	0.0	--	--	--	0.0	1.4
	2	1.0	4.5	--	--	--	4.5	2.1
	3	3.1	5.0	--	--	--	5.0	3.7
	4	10.0	13.3	--	--	--	13.3	11.0
	5	13.5	8.4	--	--	--	8.4	12.0
	6	7.2	4.6	--	--	--	4.6	6.4
	7+	63.0	64.1	--	--	--	64.1	63.3
	Total	100.0	100.0	--	--	--	100.0	100.0
4	1	0.0	--	--	0.0	0.0	0.0	0.0
	2	0.6	--	--	0.0	4.1	1.9	1.3
	3	1.8	--	--	17.8	22.1	19.8	12.1
	4	7.0	--	--	4.0	7.8	5.7	6.3
	5	24.4	--	--	19.3	18.0	18.7	21.2
	6	4.8	--	--	1.7	1.2	1.5	2.9
	7+	61.4	--	--	57.2	46.7	52.4	56.3
	Total	100.0	--	--	100.0	100.0	100.0	100.0
All	1	16.2	0.0	0.1	0.0	0.0	0.0	8.5
	2	10.7	10.0	9.8	0.0	4.1	9.3	10.1
	3	7.9	8.8	16.2	17.8	22.1	10.1	9.0
	4	11.4	22.7	23.1	4.0	7.8	21.3	16.1
	5	10.6	13.2	17.2	19.3	18.0	13.9	12.1
	6	3.9	5.9	3.6	1.7	1.2	5.4	4.6
	7+	39.3	39.3	30.1	57.2	46.7	39.9	39.6
	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 2014.

	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	6.50	7.50	10.01	8.40	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
2011	5.98	4.35	--	5.68	7.79	--	7.79	8.03	--	8.03	--	8.40	7.76	8.13	6.74	4.86	5.26	6.73	8.33	5.31	5.78
2012	4.97	4.46	--	4.91	5.78	--	5.78	8.13	--	8.13	--	8.92	7.65	8.35	5.60	4.86	5.33	7.15	7.25	5.34	5.47
2013	5.16	4.26	--	5.10	6.91	--	6.91	8.09	--	8.09	--	8.79	8.13	8.55	5.95	4.91	4.64	7.09	7.36	5.24	5.60
2014	5.79	6.05	--	5.80	7.13	--	7.13	8.30	--	8.30	--	8.29	8.00	8.17	6.57	5.26	5.80	8.29	8.35	6.02	6.31
2015	6.23	5.85	--	6.20	6.88	--	6.88	8.73	--	8.73	--	7.43	8.29	7.89	6.74	4.57	6.30	8.58	8.08	6.14	6.42
Mean	4.13	3.80	3.66	4.08	4.45	6.58	4.47	5.47	6.72	5.49	8.07	6.93	7.49	7.06	4.37	3.60	3.82	4.92	6.80	3.80	4.04

Table 8. Estimated abundance at age, survival (S), fishing mortality (F) and exploitation (u) for Lake Erie walleye, 1980-2016 (from ADMB 2016 catch at age analysis recruitment integrated model, M=0.32).

	Age							Ages 2+		
Year	2	3	4	5	6	7+	Total	S	F	u
1980	10,446,800	9,201,250	568,422	1,563,390	560,314	130,278	22,470,454	0.598	0.194	0.152
1981	7,282,650	6,674,460	5,219,620	313,888	863,732	369,841	20,724,191	0.564	0.253	0.193
1982	17,656,500	4,542,810	3,620,430	2,739,400	164,720	619,003	29,342,863	0.608	0.177	0.139
1983	10,359,800	11,320,000	2,581,530	2,011,730	1,526,560	413,356	28,212,976	0.624	0.152	0.121
1984	79,363,400	6,877,920	6,824,380	1,542,560	1,210,230	1,150,460	96,968,950	0.666	0.086	0.071
1985	6,708,320	53,629,300	4,312,540	4,240,340	962,476	1,445,290	71,298,266	0.652	0.107	0.087
1986	23,884,600	4,608,690	34,852,600	2,778,760	2,738,260	1,526,140	70,389,050	0.636	0.132	0.106
1987	23,826,700	16,073,500	2,873,230	21,504,300	1,728,220	2,612,100	68,618,050	0.641	0.124	0.100
1988	55,831,000	16,061,500	10,070,800	1,780,660	13,443,200	2,660,040	99,847,200	0.639	0.128	0.104
1989	12,004,500	37,096,800	9,785,730	6,060,470	1,087,260	9,731,360	75,766,120	0.635	0.135	0.108
1990	10,199,800	8,113,970	23,334,600	6,103,120	3,828,130	6,709,480	58,289,100	0.642	0.123	0.099
1991	5,160,280	6,947,000	5,156,630	14,761,800	3,903,110	6,668,480	42,597,300	0.652	0.108	0.088
1992	16,716,400	3,549,810	4,493,920	3,327,550	9,595,880	6,809,430	44,492,990	0.646	0.117	0.095
1993	22,764,600	11,333,000	2,226,360	2,809,970	2,102,000	10,276,000	51,511,930	0.622	0.155	0.123
1994	3,495,910	15,036,600	6,695,320	1,313,580	1,682,880	7,310,910	35,535,200	0.610	0.175	0.138
1995	19,224,000	2,331,360	9,043,240	4,031,900	803,495	5,459,930	40,893,925	0.619	0.159	0.126
1996	21,209,000	12,635,800	1,351,950	5,265,790	2,389,620	3,686,330	46,538,490	0.596	0.198	0.154
1997	2,470,400	13,624,000	6,968,000	748,611	2,980,230	3,412,950	30,204,191	0.587	0.213	0.165
1998	22,763,900	1,619,740	7,874,580	4,037,920	441,474	3,743,820	40,481,434	0.602	0.187	0.147
1999	11,345,400	14,568,600	884,439	4,322,260	2,266,920	2,328,830	35,716,449	0.617	0.164	0.130
2000	10,509,900	7,518,810	8,607,400	524,613	2,608,150	2,762,890	32,531,763	0.629	0.144	0.115
2001	32,937,700	7,041,980	4,553,160	5,232,570	324,180	3,312,270	53,401,860	0.679	0.067	0.056
2002	3,941,440	22,822,500	4,621,860	2,984,410	3,454,430	2,380,740	40,205,380	0.678	0.068	0.057
2003	26,625,600	2,766,800	15,408,300	3,117,900	2,025,900	3,949,980	53,894,480	0.688	0.054	0.045
2004	417,375	18,681,600	1,866,500	10,380,700	2,110,860	4,023,300	37,480,335	0.686	0.057	0.048
2005	109,825,000	297,330	12,799,800	1,277,130	7,132,020	4,195,570	135,526,850	0.702	0.034	0.028
2006	3,797,990	77,712,600	201,007	8,664,800	869,451	7,701,650	98,947,498	0.677	0.070	0.058
2007	7,520,860	2,690,980	52,477,400	135,621	5,877,220	5,780,840	74,482,921	0.678	0.069	0.057
2008	1,995,120	5,337,320	1,819,140	35,382,900	91,811	7,842,820	52,469,111	0.683	0.061	0.051
2009	19,468,800	1,416,620	3,629,260	1,236,400	24,167,100	5,392,920	55,311,100	0.694	0.045	0.038
2010	7,190,190	13,860,800	969,551	2,481,260	848,770	20,245,400	45,595,971	0.692	0.049	0.041
2011	7,317,050	5,135,710	9,560,460	667,493	1,713,220	14,465,000	38,858,933	0.693	0.047	0.039
2012	12,656,400	5,211,290	3,529,920	6,573,960	460,975	11,144,700	39,577,245	0.680	0.066	0.055
2013	9,163,280	8,924,990	3,474,310	2,352,240	4,408,090	7,733,630	36,056,540	0.675	0.073	0.060
2014	4,655,580	6,467,350	5,944,540	2,308,940	1,571,210	8,048,760	28,996,380	0.654	0.105	0.085
2015	6,644,740	3,254,300	4,187,090	3,838,520	1,500,670	6,178,440	25,603,760	0.653	0.107	0.087
2016	16,538,400	4,621,150	2,077,870	2,667,630	2,465,270	4,876,160	33,246,480			

Table 9. Estimated harvest of Lake Erie walleye for 2016, and population projection for 2017 when fishing with 60% Fmsy. The 2016 and 2017 projected spawning stock biomass values are from the ADMB-2016 recruitment-integrated model. The range in the RAH was calculated using ± one standard deviation from the mean RAH.

SSB_0=	63.865	million kilograms
20% SSB_0=	12.773	million kilograms
F_{msy} =	0.530	

	2016 Stock Size (millions of fish)	60% F_{msy}		Rate Functions			2016 RAH (millions of fish)			Projected 2017 Stock Size (millions)	
Age	**Mean**	**F**	**Sel(age)**	**(F)**	**(S)**	**(u)**	**Min.**	**Mean**	**Max.**	**Mean**	
2	16.538		0.296	0.094	0.661	0.077	0.941	1.274	1.607	38.233	
3	4.621		0.917	0.292	0.542	0.218	0.785	1.008	1.232	10.931	
4	2.078		0.947	0.301	0.537	0.224	0.359	0.466	0.574	2.507	
5	2.668		0.887	0.282	0.548	0.212	0.433	0.565	0.698	1.116	
6	2.465		0.918	0.292	0.542	0.218	0.412	0.538	0.665	1.461	
7+	4.876		1.000	0.318	0.528	0.235	0.871	1.146	1.422	3.913	
Total (2+)	33.246	0.318				0.150	3.799	4.998	6.197	58.161	
Total (3+)	16.708						2.859	3.725	4.590	19.928	
SSB	32.437	mil. kgs								38.887	mil. kgs

probability of 2016 spawning stock biomass being less than 20% SSB_0 = 0.001%

Table 10. Western basin age 0 walleye recruitment index observed in bottom trawls by the Ontario Ministry of Natural Resources (ONT) and Ohio Department of Natural Resources (OH) between 1988 and 2015.

Year Class	Year of Recruitment to Fisheries	OH+ONT Trawl Age-0 CPHa
1988	1990	18.280
1989	1991	6.094
1990	1992	39.432
1991	1993	59.862
1992	1994	6.711
1993	1995	108.817
1994	1996	63.921
1995	1997	2.965
1996	1998	85.340
1997	1999	24.185
1998	2000	14.313
1999	2001	44.189
2000	2002	4.113
2001	2003	28.499
2002	2004	0.139
2003	2005	183.015
2004	2006	5.402
2005	2007	12.665
2006	2008	2.051
2007	2009	25.408
2008	2010	7.238
2009	2011	7.107
2010	2012	26.260
2011	2013	6.502
2012	2014	6.417
2013	2015	10.584
2014	2016	29.050
2015	2017	84.105

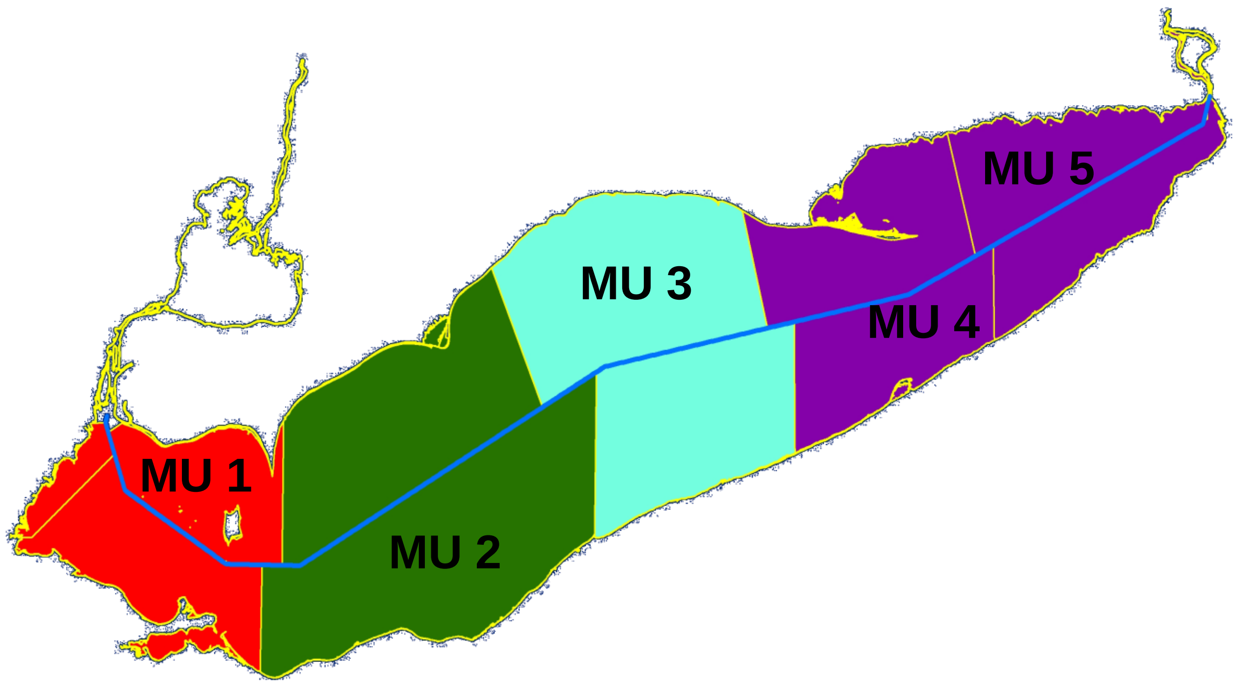

Figure 1. Map of Lake Erie with management units recognized by the Walleye Task Group for interagency management of Walleye.

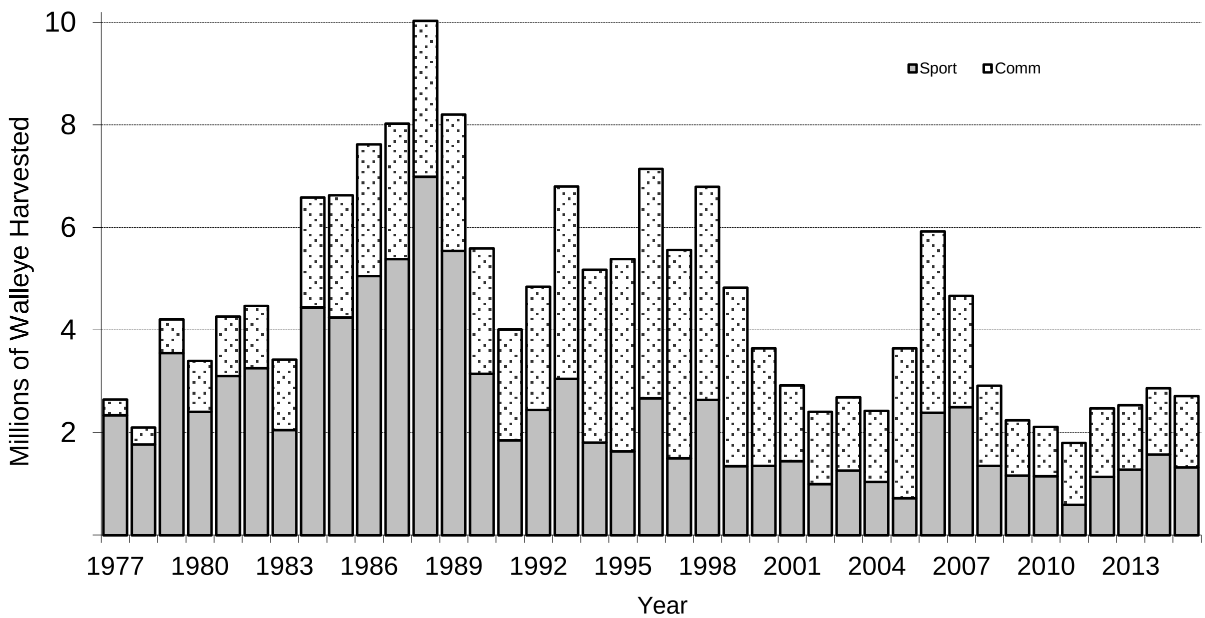

Figure 2. Lake-wide harvest of Lake Erie Walleye by sport and commercial fisheries, 1977-2015.

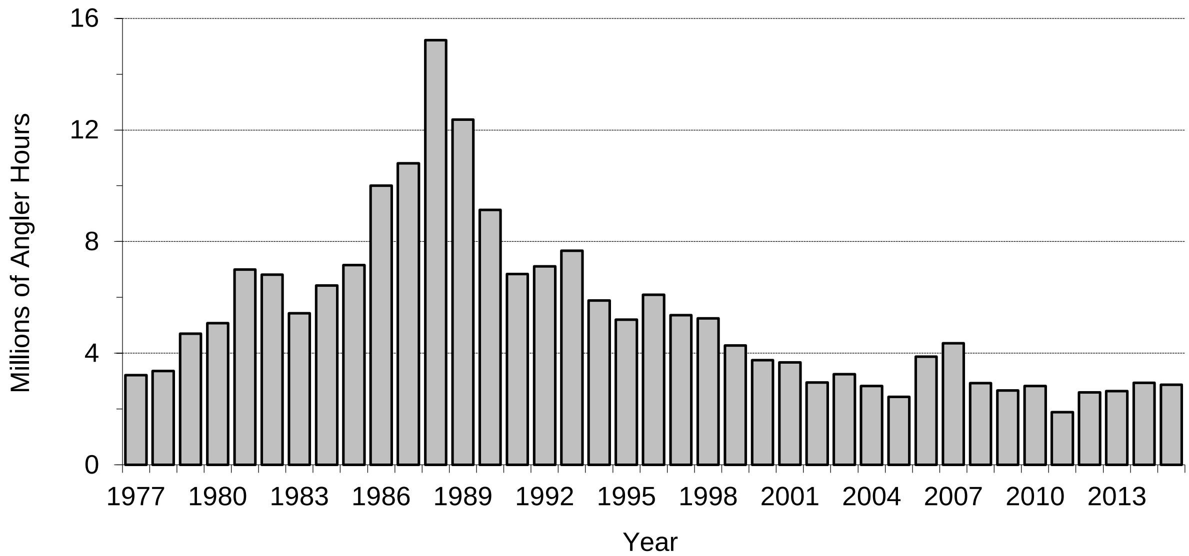

Figure 3. Lake-wide total effort (angler hours) by sport fisheries for Lake Erie Walleye, 1977-2015.

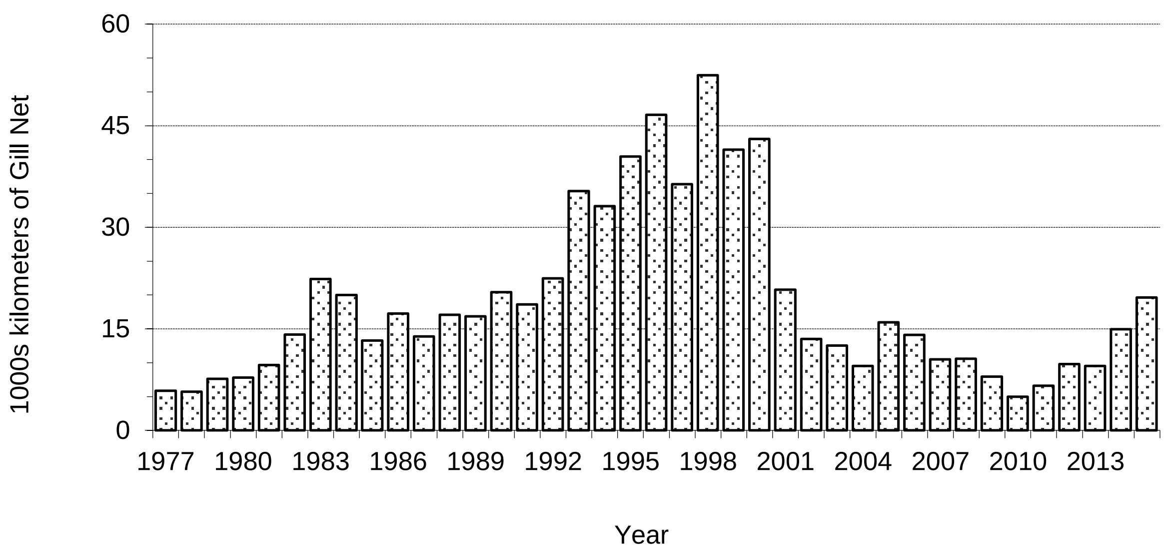

Figure 4. Lake-wide total effort (kilometers of gill net) by commercial fisheries for Lake Erie Walleye, 1977-2015.

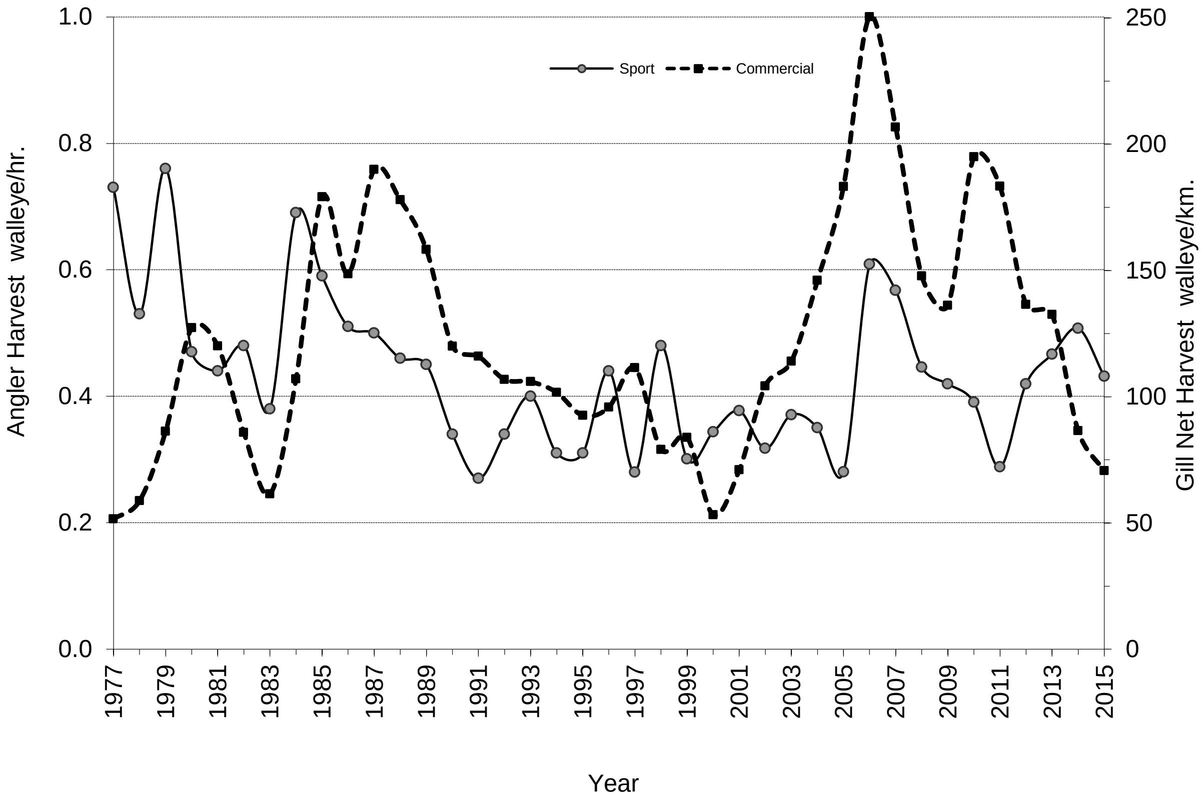

Figure 5. Lake-wide harvest per unit effort (HPE) for Lake Erie sport and commercial Walleye fisheries, 1977-2015.

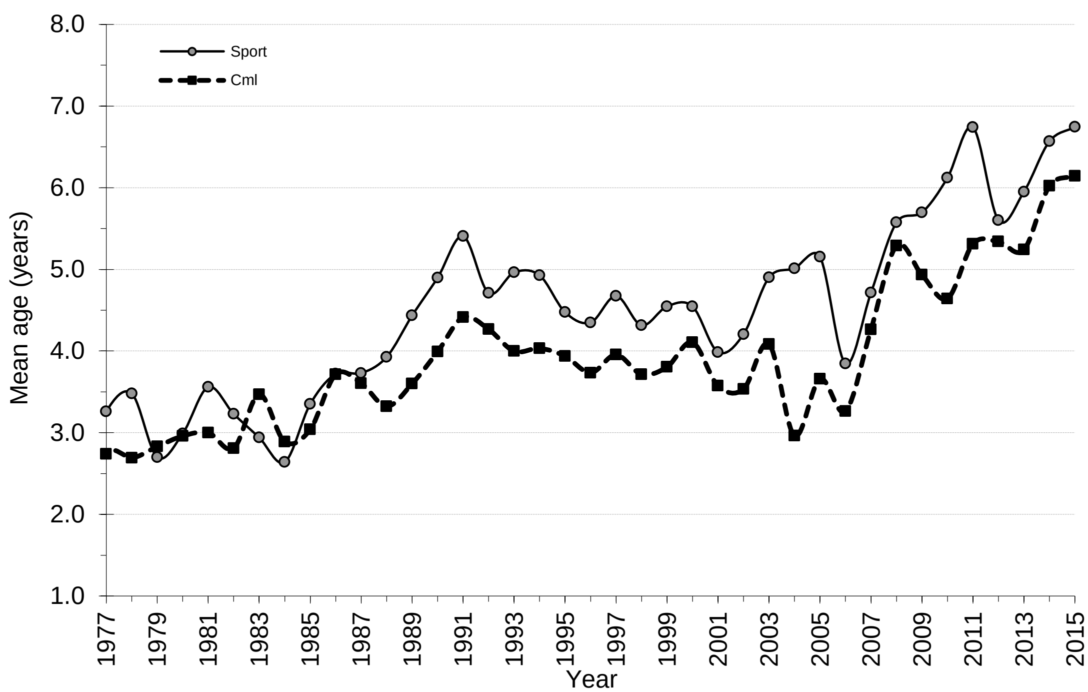

Figure 6. Lake-wide mean age of Lake Erie Walleye in sport and commercial harvests, 1977-2015.

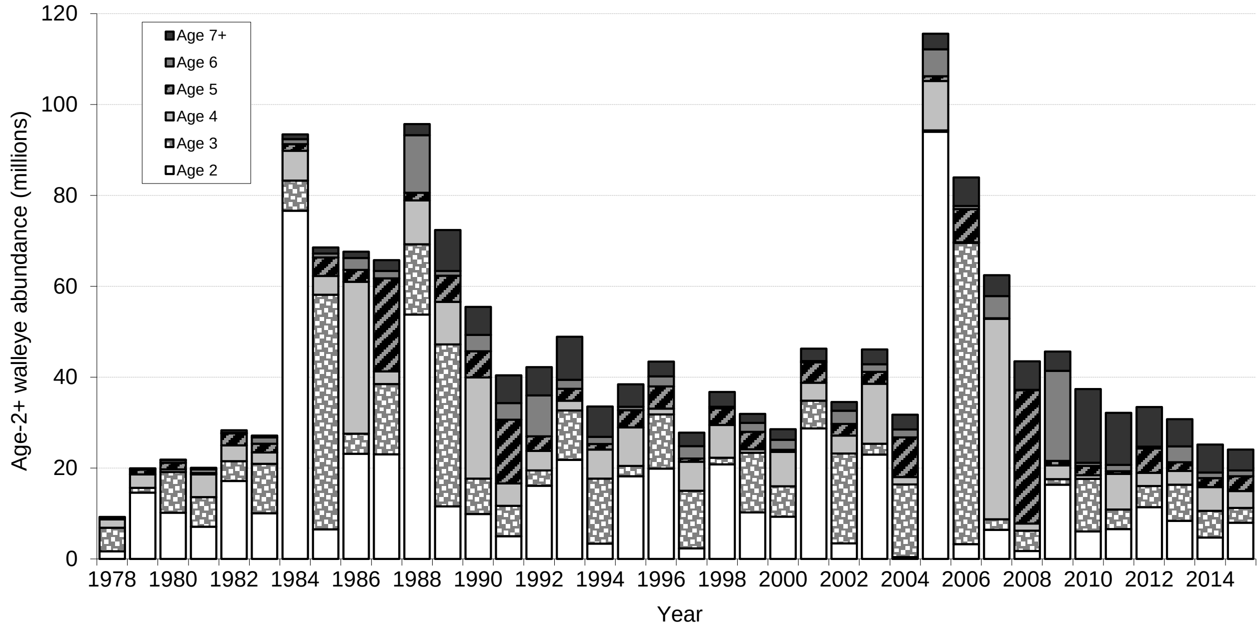

Figure 7. Abundance at age for age-2 and older walleye in Lake Erie's west and central basins from 1978 to 2016, estimated from the latest ADMB integrated model run. Data shown are from Table 8.

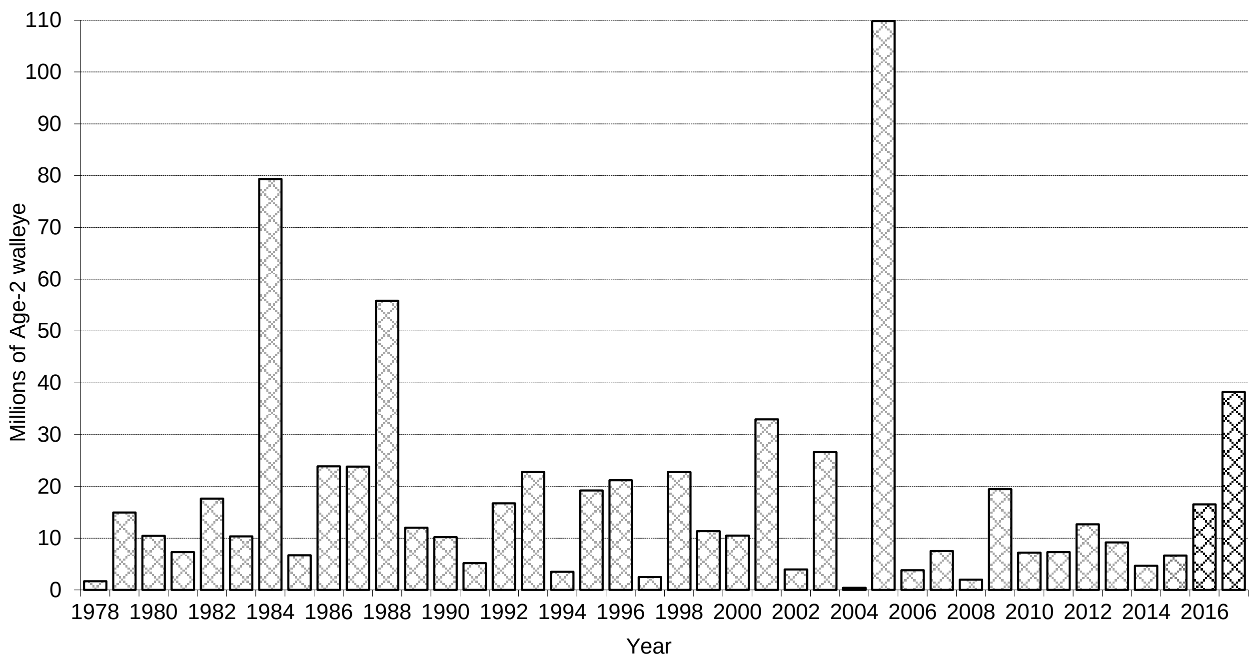

Figure 8. Estimated (1978 – 2015) and projected (2016 and 2017) number of age 2 Walleye in the west-central Lake Erie Walleye population between using the 2016 ADMB statistical catch at age model.

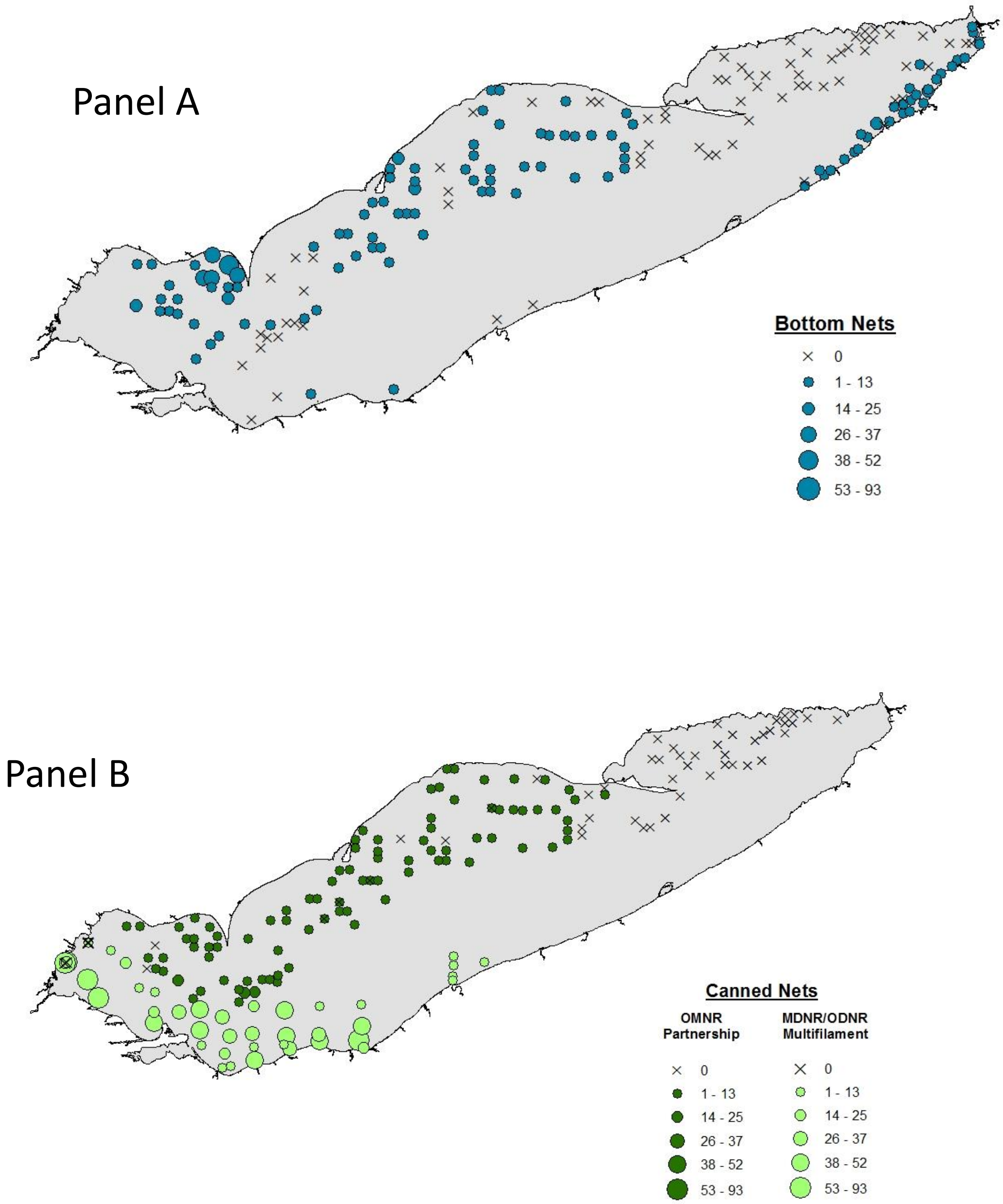

Figure 9. Relative abundance of yearling walleye captured in bottom-set (Panel A) and suspended or kegged multifilament (Panel B) gillnets from Michigan, Ohio, New York, and Ontario waters in 2015. Catches in the bottom-set nets have been adjusted to reflect panel length (standardized to 50ft panels of monofilament) and differences in the presence of large mesh (>5"). Catches in the kegged multifilament gillnets are the observed catches