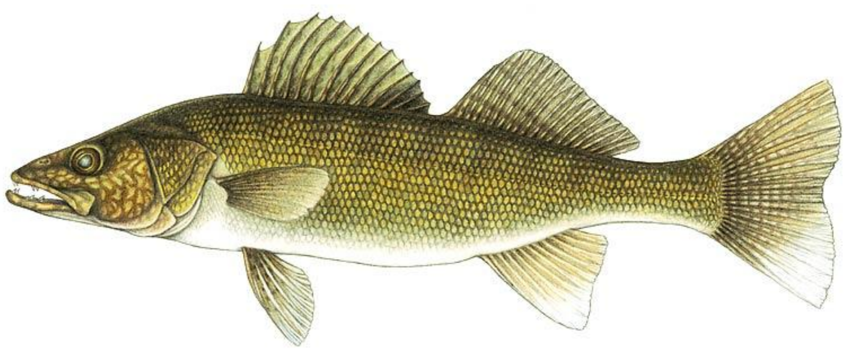
Report for 2019 by the

LAKE ERIE WALLEYE TASK GROUP

March 2020



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

Charges to the Walleye Task Group, 2019-2020

The charges from the Lake Erie Committee's (LEC) Standing Technical Committee (STC) to the Walleye Task Group (WTG) for the period of April 2019 to March 2020 were to:

1. Maintain and update the centralized time series of datasets:
    a. Required for bi-national population models and assessment and
    b. Produce the annual Recommended Allowable Harvest (RAH)
2. a. Maintain working knowledge of the most current academic and agency research related to Lake Erie walleye population assessment and modeling including estimating and forecasting:
    - Abundance
    - Age/Size/Spatial Stock structure (migration rates)
    - Recruitment, and
    - Mortality (M)

    b. Provide critical evaluation and guidance for incorporating new research into Lake Erie walleye management to produce the most scientifically sound and reliable population models.
    c. Support analysis and review of Walleye Management Plan and assessment models for potential 2024 renewal.

Review of Walleye Fisheries in 2019

Fishery effort and Walleye harvest data were combined for all fisheries, jurisdictions and Management Units (MUs) (Figure 1) to produce lake-wide summaries. The 2019 total estimated lake-wide harvest was 6.897 million Walleye (Table 1), of which 6.074 million were harvested in the total allowable catch (TAC) area. This TAC-area harvest represents 71% of the 2019 TAC (8.531 million Walleye) and includes Walleye harvested in commercial and sport fisheries in MU 1, 2, and 3. An additional 0.824 million Walleye (12% of the lake-wide total) were harvested outside of the TAC area in MU 4&5 (Table 1). The estimated sport fish harvest of 3.390 million Walleye in 2019 represented a 29% increase from the 2018 harvest of 2.627 million Walleye; this harvest was 50% above the long-term (1975-2018) average of 2.267 million fish (Table 2). The 2019 Ontario commercial harvest was 3.507 million Walleye lake-wide, with 3.290 million caught in the TAC area (Table 2). The 2019 Ontario angler estimates of harvest and effort were derived from the 2014 lake-wide aerial creel survey because angler creel surveys are not conducted annually in Ontario waters. It assumes 71,000 Walleye were harvested in Ontario within the TAC area during 2019; an estimate included in total Walleye harvest, but not used in catch-at-age analysis. Total harvest of Walleye in Ontario TAC waters was 3.362 million Walleye, representing 92% of the 2019 Ontario TAC allocation of 3.673 million Walleye. In 2019, the lake-wide Ontario commercial harvest was 4% lower than in 2018, and 69% above the long-term average (1976-2018; Table 2, Figure 2).

Sport fishing effort increased 30% from 2018 in 2019 to total 4.083 million angler hours (Table 3, Figure 3). Compared to 2018, sport effort increased by 34% in MU 1, 27% in MU 2, and 54% in MU4, while effort decreased in MU 3 (-13%). Lake-wide commercial gill net effort (14,285 km) decreased 17% from 2018 (Table 3, Figure 4).

The 2019 lake-wide average sport harvest per unit effort (HUE) of 0.81 Walleye/angler hour remained consistent relative to 2018 and was 85% above the long-term (1975-2018) average of 0.44 Walleye/angler hour (Table 4, Figure 5). In 2019, the sport HUE increased from 2018 levels in MU2 (+12%) and MU 3 (+3%), and decreased slightly in MU 1 (-5%) and MU 4&5 (-2%), although sport HUE was well above long-term averages in all MUs (Table 4).

The total commercial gill net HUE in 2018 (245.5 Walleye/kilometer of net) increased 15% relative to

2018 and remained above the long-term (1976-2018) lake-wide average (123.1 Walleye/kilometer of net; Table 4, Figure 5). Commercial gill net harvest rates increased in all MUs except MU 3, where a slight decrease occurred (Table 4). All MUs' HUE were more than 100% above their long-term averages (Table 4).

Lake-wide harvest in the sport and commercial fisheries was composed mostly of age 4 Walleye from the 2015 (76%) year class (Table 5; Table 6). Age 3 (2016 year class; 8%) and age 5 (2014 year class; 6%) were the next most harvested age groups, combining to represent 14% of the lakewide harvest in 2019. In the commercial fishery the 2015 year class comprised 77% of the harvest, followed by the 2017 year class (7% of lakewide harvest). Similarly, the 2015 year class (age 4) comprised 74% of lakewide sport fishery harvest, followed by the 2016 year class (13% of lakewide sport harvest).

Across all jurisdictions, the mean age of Walleye harvested in 2019 ranged from 4.1 to 5.1 years old in the sport fishery, and from 3.8 to 4.3 years old in the Ontario commercial fishery (Table 7, Figure 6). The mean age in the sport and commercial fisheries were approximately equal to the long-term means (1975-2018; Table 7).

Statistical Catch-at-Age Analysis (SCAA): Abundance

The WTG uses a SCAA model to estimate the abundance of Walleye in Lake Erie from 1978 to 2019. The stock assessment model estimates population abundance of age 2 and older Walleye using fishery-dependent and fishery-independent data sources. The model includes fishery-dependent data from the Ontario commercial fishery (MU 1-3) and sport fisheries in Ohio (MU 1-3) and Michigan (MU 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). Beginning in 2011, Michigan and Ohio gill net survey data were pooled in the SCAA because of similarities between the surveys. In 2016, Ohio switched from multifilament to monofilament gill nets[1] after completing several years (2007-2008, 2010-2013) of comparisons between the two gear types (see Vandergoot et al. 2011 and Kraus et al. 2017*)*. Michigan did not similarly change gear types. The WTG continues to work with Michigan State University's Quantitative Fisheries Center to evaluate alternative approaches to incorporate Ohio's gear change inside of the SCAA model. Specific items that will be addressed and evaluated in the coming year include data structure for ongoing (i.e., Michigan and Ohio gillnet data) and completed surveys (i.e., gear comparison data) within the SCAA model, along with sensitivity and performance of the SCAA around these various options.

While these evaluations are ongoing, the WTG used age-specific regressions to convert Ohio's monofilament gill net catches to a multifilament equivalent that were pooled with Michigan data in the SCAA model since 2016. These age-specific regressions were generated using catch data from the gear comparison study that occurred during 2007-2008 and 2010-2013 throughout the western and central basins of Lake Erie. Between 2017-2019, the WTG used linear regression to convert Ohio's monofilament to equivalent multifilament catches. In this report, robust regression rather than linear regression was used to create the age-specific regressions as it is better able to handle influential (i.e., outlier) observations within the gear comparison data and produced more realistic estimates. Robust

[1] In 2016, the ODNR switched to a monofilament gill net configuration. The ODNR's multifilament gill nets were 1,300 ft (396 m) in length, 6 ft (1.8m) deep, with thirteen 100-ft (30.5 m) panels consisting of mesh sizes from 2 to 5 inches (51-127 mm stretched) and twine diameter of 0.37mm. The monofilament gill nets are 1,200 ft long (366 m) by 6 ft deep (1.8 m) with twelve 100-ft (30.5 m) panels with mesh sizes from 1.5 to 7 inches (38–178) mm and twine diameter that varies with mesh size from 0.20 to 0.33 mm. Comparisons between these multifilament and monofilament index gill net configurations are described in Vandergoot et al. (2011) and Kraus et al. (2017).

regression models were estimated using the lmRob function in the robust R package (Wang et al. 2017).

The Lake Erie Percid Management Advisory Group (LEPMAG) developed an updated Walleye model, which the WTG began using in 2013. This model 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 (1978-2019) 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 2020 integrated SCAA model, the 2019 west-central population (MU1-3) was estimated at 47.132 million age 2 and older Walleye (Table 8, Figure 7). An estimated 24.617 million age 4 (2015 year class) fish comprised 52% of the age 2 and older Walleye population. Age 2 (2017 year class) Walleye represented the second largest (21%) and age 5 (2014 year class) the third largest (10%) components of the population. Based on the integrated model, the number of age 2 recruits entering the population in 2020 (2018 year class) and 2021 (2019 year class) are estimated to be 86.404 and 77.942 million Walleye, respectively (Table 9; Figure 8). The 2020 projected abundance of age 2 and older Walleye in the west-central population is estimated to be 116.354 million fish (Table 8; Figure 7).

Harvest Policy and Recommended Allowable Harvest (RAH) for 2020

In March 2020, the WTG applied the following Harvest Control Rules as identified in the Walleye Management Plan (WMP; 2015-2024):

- *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 ± **20%**.

Using results from the 2020 integrated SCAA model, the estimated abundance of 116.354 million age-2 and older Walleye in 2020, and the harvest policy described above, the calculated mean RAH for 2020 was 13.466 million Walleye, with a range from 10.012 (minimum) to 16.921 (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. AD Model Builder uses a statistical technique called the delta method to determine this standard deviation for the calculated RAH, incorporating the standard errors from abundance estimates at age and combined gear selectivity at age. The target fishing rate, (60%F_{MSY} = 0.331) in the harvest policy was applied since the probability of the projected spawner biomass in 2021 (96.566 million kg) falling below the limit reference point ($SSB_{20\%}$ = 11.861 million kg) after fishing at 60%F_{MSY} in 2020 was less than 5% ($p < 0.05$). Thus, the probabilistic control rule (P*) to reduce target fishing rate and conserve spawner biomass was not invoked during the 2020 determination of RAH.

In addition to the RAH, the Harvest Control Rule adopted by LEPMAG limits the annual change in TAC to ± 20% of the previous year's TAC. According to this rule, the maximum change in TAC would be (+) or (-) 20% of the 2019 TAC (8.531) million fish), and the range in 2020 TAC for LEC consideration would be from 6.825 million fish to 10.237 million fish.

Other Walleye Task Group Activities

The following represents WTG progress and developments on Charge 2a and 2b. During 2019-2020, this work focused on *(1) Movements, Migrations and Spatial Ecology, (2) Stock Structure,* (3) *Recruitment*.

Movements, Migration and Spatial Ecology

Since 2011, WTG members have participated collaboratively in numerous Great Lakes Acoustic Telemetry Observation System (GLATOS; https://glatos.glos.us/) studies across Lake Erie. Tagging in 2019 focused on the western basin's sport fishery in Michigan and Ohio waters, where an additional 135 Walleye were tagged and released during May-July. Smaller numbers of Walleye were also released during the spawning period in the western (n = 11) and central basins (n = 41). Work in 2019 focused on understanding monthly occupancy of western basin Walleye in the eastern basin during 2014-2018. Preliminary results suggested that occupancy peaked during the summer and declined later in the year. Numbers of western basin Walleye in the eastern basin also declined with distance from the western basin (e.g., fewer tagged fish were detected near Dunkirk, New York than were detected near the Pennsylvania Ridge). Members of the WTG are working with colleagues from the University of Windsor, Michigan State University, and USGS to draft and submit a manuscript that details these results in the coming year.

Stock structure

In recent years there has been an effort to improve our understanding of Walleye stock structure at the lake-wide scale to inform future iterations of the walleye management plan. One of the major information gaps associated with Walleye stock structure is how western and eastern basin stocks interact to influence fisheries and survey results in the eastern basin. Genetics samples from recreational and commercially caught fish in the eastern basin during 2017-2018 are being used to determine the relative contributions of western, eastern, and central basin spawning stocks to the eastern basin fisheries. Preliminary results suggested that by using restriction site-associated DNA sequencing of > 12 thousand loci, Walleye are able to be accurately (>90%) assigned to a basin of origin (i.e., western vs. eastern basin). Results from mixed stock samples taken from commercial and recreational fisheries in the eastern basin will be available during 2020. Members of the WTG are working with colleagues from the University of Wisconsin-Stevens Point and The Ohio State University to draft and submit a manuscript that details these results in the coming year.

Recruitment

Evidence of multiple Walleye stocks in Lake Erie exists, with decreasing stock productivity from west to east. However, migrations and mixing of stocks throughout the lake make evaluation of individual stock productivity difficult. For example, adult Walleye from western basin spawning grounds in the spring migrate to the cooler waters of the central and eastern basins in the summer, and then return to the west basin before spawning. While juvenile Walleye from both the western and eastern basin are believed to disperse from natal basins during the summer and fall, it is unknown if their migrations are similar to those of adults. To address uncertainty surrounding juvenile dispersal and productivity of Walleye stocks across Lake Erie, the WTG has reported basin-specific densities of yearling Walleye with standardized gill net indices since 2011 (WTG 2012).

In Figure 9, site-specific yearling Walleye catches are presented for the bottom set interagency (ON, NY) monofilament nets; the suspended (canned or kegged) Ohio monofilament nets (see footnote #1, page 3 for description); suspended Michigan multifilament nets; and suspended Ontario monofilament nets fished in 2019. Catches were standardized for net length (50 ft [15.2 m] panels) of mesh sizes ≤

5.5” (140 mm) but correction factors were not applied to standardize fishing power between monofilament and multifilament nets. New York and Ontario monofilament nets share the same configurations with the exception that Ontario nets contain 2 panels instead of the one 50 ft (15.2 m) panel for mesh sizes ≥ 2” (51 mm). New York’s index gill nets were fished exclusively on bottom and were confined to shallower depths than nets fished in Ontario’s waters of eastern Lake Erie (Figure 9a).

In 2019, yearling Walleye catches occurred lake-wide where index nets were fished but fish were absent from nets on the north shore of the east basin (Figures 9a and b). Yearlings were also absent from offshore bottom nets set in New York waters. In west and central Lake Erie trawl and gill net surveys conducted since 2016, the yearling Walleye indices from 2019 were second only to the 2016 assessment. These results suggest that only the 2015 hatch was stronger than the 2018 hatch during that time period in the west and central basins. Yearling Walleye catches in the east were lower in 2019 than in 2016 and 2017, suggesting that the 2018 hatch was not as strong as the 2015 and 2016 cohorts in the east basin. When bottom set and suspended nets were fished in the same area, yearling catches in suspended set nets exceeded bottom nets in the west and central basin. A comparison between suspended and bottom catches could not be made in the east due to low catches. In Ontario Partnership index nets, average catches of age 1 Walleye are often greater in suspended nets than in bottom nets, however this phenomenon varies by year and basin.

The mean length of yearling walleye from west basin interagency bottom trawls during August 2019 (216 mm) was lowest in the time series and well below average (272 mm) (Figure 10). This small mean length was for the 2018 cohort was also observed during August, 2018, and these small yearling Walleye were also observed in other trawl and gill net surveys during 2019. Smaller size at age may reflect slower density-dependent growth, and as these fish enter the fisheries in 2020 as smaller than usual sizes, the WTG expects to see an increased release rate in the sport fisheries (because anglers may encounter many sub-legal Walleye) and that these smaller fish will exhibit delayed vulnerability to commercial gill net fisheries.

Currently, the young-of-the-year (YOY) index from the interagency west basin bottom trawl survey (Table 10) is integrated into the SCAA model to estimate age-2 Walleye abundance and forecast recruitment. While the interagency bottom trawl survey is a robust recruitment predictor, inclusion of additional YOY and yearling indices to form a composite recruitment index could supplement recruitment estimates. However, there are two factors limiting the integration of a composite recruitment index into the SCAA model:

1. Yearling indices are not available far enough in advance to forecast age-2 recruitment, as required for the probabilistic harvest control rule (P*) of the current Walleye Management Plan (Kayle et al. 2015). Options for overcoming this limitation would be exclusion of yearling indices from a composite recruitment index, removal of the P* control rule from the Walleye Management Plan Harvest Policy, or running two integrated SCAA models (one with YOY and yearling data and the second model using only YOY data). It is important to note that the two SCAA model options could result in conflicting abundance estimates.

2. Spatial, temporal, and gear type (bottom set vs. suspended gill nets) variability exist in Walleye YOY and yearling indices, along with inconsistencies in sampling intensity and effort. Previous examination of the available recruitment indices using a Principal Components Analysis (PCA) approach revealed challenges for integrating a composite recruitment index into the SCAA model (WTG 2016). Data transformations and missing years of data in some indices were primary concerns.

The WTG will continue to update the dataset of recruitment indices. However, composite Walleye recruitment indices will not be presented until concerns related to data transformations, missing years of data, and recent changes in index gear configuration are addressed. The WTG will also continue to explore and evaluate alternative recruitment estimation approaches to be considered for adoption in future Lake Erie Walleye Management Plans.

WTG Centralized Datasets

WTG members currently manage several databases that consist of fishery-dependent (harvest) and fishery-independent (population) assessment surveys conducted by the respective agencies. Annually, data are compiled by WTG members to form spatially-explicit versions 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. These databases are used for trends and status evaluations, estimating population size and abundance using SCAA analysis, and the decision-making process regarding RAH. Ultimately, annual population abundance estimates are used to assist LEC members with setting TACs for the upcoming year and evaluate past harvest policy decisions. 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).

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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 2000 to 2019. TAC allocations 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
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**
2016	TAC	287,827	2,523,301	2,125,872	4,937,000				0	4,937,000
	Har	**65,816**	**855,820**	**1,959,573**	**2,881,209**	**50,963**	**32,937**	**112,743**	**196,643**	**3,077,852**
2017	TAC	345,369	3,027,756	2,550,874	5,924,000				0	5,924,000
	Har	**56,938**	**1,261,327**	**3,232,817**	**4,551,082**	**70,010**	**162,949**	**129,217**	**362,176**	**4,913,258**
2018	TAC	414,455	3,633,410	3,061,135	7,109,000				0	7,109,000
	Har	**176,089**	**1,972,295**	**3,478,713**	**5,627,097**	**123,503**	**270,189**	**263,204**	**656,896**	**6,283,993**
2019	TAC	497,357	4,360,194	3,673,449	8,531,000				0	8,531,000
	Har	**153,171**	**2,558,359**	**3,362,053**	**6,073,583**	**174,466**	**419,975**	**229,466**	**823,907**	**6,897,490**

[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 2018.

	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
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	288	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	115	2	54	37	93	1,152	607	184	147	23	962	2,115
2011	224	50	44	318	104	2	106	89	0	90	2	45	32	79	593	736	262	181	29	1,208	1,801
2012	596	87	44	726	233	2	235	93	0	93	2	45	37	84	1,138	834	285	191	28	1,338	2,476
2013	757	54	44	855	190	2	192	136	0	136	2	60	35	97	1,280	737	297	195	31	1,260	2,540
2014	909	42	45	996	177	13	190	218	13	231	13	85	62	160	1,577	756	259	238	40	1,292	2,869
2015	746	66	45	857	187	13	200	140	13	153	13	47	55	115	1,325	633	354	325	77	1,388	2,713
2016	577	66	45	688	139	13	152	140	13	153	13	33	51	97	1,090	946	594	348	100	1,988	3,078
2017	592	57	45	694	316	13	330	353	13	367	13	163	70	246	1,636	1,735	918	508	116	3,277	4,913
2018	955	176	45	1,177	666	13	679	351	13	365	13	270	124	407	2,627	1,523	1,433	451	250	3,657	6,284
2019	1,297	153	45	1,495	947	13	960	314	13	327	13	420	174	607	3,390	1,666	1,237	387	217	3,507	6,897
Mean	1,457	248	41	1,745	277	10	284	175	12	184	9	79	42	75	2,267	1,367	468	297	51	2,074	4,341

[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 2018.

	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
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
2016	1,514	236	--	1,750	439	--	439	397	--	397	--	141	217	358	2,944	6,980	7,969	4,523	1,448	20,920
2017	1,351	187	--	1,538	726	--	726	501	--	501	--	228	213	441	3,207	8,056	7,239	3,636	1,527	20,458
2018	1,239	261	--	1,500	813	--	813	354	--	354	--	248	229	477	3,144	5,215	7,421	2,636	1,896	17,168
2019	1,739	265	--	2,004	1036	--	1,036	307	--	307	--	439	297	736	4,083	4,165	6,365	2,402	1,353	14,285
Mean	2,869	655	102	3,584	749	62	764	415	111	446	106	211	231	273	5,015	8,771	5,658	4,446	733	18,719

[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 2018.

	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
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
2016	0.38	0.28	--	0.37	0.32	--	0.32	0.35	--	0.35	--	0.23	0.23	0.23	0.34	135.5	74.6	77.0	69.0	95.0
2017	0.44	0.30	--	0.42	0.44	--	0.44	0.70	--	0.70	--	0.71	0.33	0.53	0.48	215.3	126.9	139.6	76.2	160.2
2018	0.77	0.67	--	0.75	0.82	--	0.82	0.99	--	0.99	--	1.09	0.54	0.83	0.81	292.0	193.1	171.0	132.0	213.0
2019	0.75	0.58	--	0.72	0.91	--	0.91	1.02	--	1.02	--	0.96	0.59	0.81	0.81	399.9	194.4	161.3	160.1	245.5
Mean	0.49	0.37	0.40	0.47	0.34	0.26	0.34	0.41	0.19	0.40	0.11	0.36	0.19	0.25	0.44	173.92	89.58	75.03	72.13	123.1

[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 2019.
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	63,284		0			0	63,284
	2	154,347	9,517	2,552			12,069	166,416
	3	97,572	167,589	17,037			184,626	282,198
	4	1,209,344	973,753	107,672			1,081,425	2,290,769
	5	111,924	72,757	21,247			94,004	205,928
	6	5,364	8,991	2,269			11,260	16,624
	7+	23,822	64,184	2,394			66,578	90,400
	Total	1,665,657	1,296,791	153,171	--	--	1,449,962	3,115,619
2	1	18,083					0	18,083
	2	66,918	3,064				3,064	69,982
	3	39,250	111,299				111,299	150,549
	4	1,015,346	737,027				737,027	1,752,373
	5	74,890	44,813				44,813	119,703
	6	6,921	3,879				3,879	10,800
	7+	15,773	47,029				47,029	62,802
	Total	1,237,181	947,111	--	--	--	947,111	2,184,292
3	1	14,003					0	14,003
	2	20,820	.				0	20,820
	3	6,688	29,655				29,655	36,343
	4	323,929	234,585				234,585	558,514
	5	19,060	26,454				26,454	45,514
	6	593	4,647				4,647	5,240
	7+	2,345	19,118				19,118	21,463
	Total	387,438	314,459	--	--	--	314,459	701,897
4	1	10,961					0	10,961
	2	10,490			499	1,495	1,994	12,484
	3	5,526			44,397	41,848	86,245	91,771
	4	156,011			85,126	310,871	395,997	552,008
	5	10,820			7,517	22,419	29,935	40,755
	6	2,461			2,607	2,989	5,596	8,057
	7+	20,338			34,320	40,353	74,673	95,011
	Total	216,607	--	--	174,466	419,975	594,440	811,047
All	1	106,331	0	0	0	0	0	106,331
	2	252,575	12,581	2,552	499	1,495	17,127	269,702
	3	149,036	308,543	17,037	44,397	41,848	411,825	560,861
	4	2,704,630	1,945,365	107,672	85,126	310,871	2,449,034	5,153,664
	5	216,694	144,024	21,247	7,517	22,419	195,206	411,900
	6	15,339	17,517	2,269	2,607	2,989	25,382	40,721
	7+	62,278	130,331	2,394	34,320	40,353	207,398	269,676
	Total	3,506,883	2,558,361	153,171	174,466	419,975	3,305,972	6,812,855

Table 6. Age composition (in percent) of walleye harvest by management unit, gear, and agency in Lake Erie during 2019. 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	3.8	0.0	0.0	--	--	0.0	2.0
	2	9.3	0.7	1.7	--	--	0.8	5.3
	3	5.9	12.9	11.1	--	--	12.7	9.1
	4	72.6	75.1	70.3	--	--	74.6	73.5
	5	6.7	5.6	13.9	--	--	6.5	6.6
	6	0.3	0.7	1.5	--	--	0.8	0.5
	7+	1.4	4.9	1.6	--	--	4.6	2.9
	Total	100.0	100.0	100.0	--	--	100.0	100.0
2	1	1.5	0.0	--	--	--	0.0	0.8
	2	5.4	0.3	--	--	--	0.3	3.2
	3	3.2	11.8	--	--	--	11.8	6.9
	4	82.1	77.8	--	--	--	77.8	80.2
	5	6.1	4.7	--	--	--	4.7	5.5
	6	0.6	0.4	--	--	--	0.4	0.5
	7+	1.3	5.0	--	--	--	5.0	2.9
	Total	100.0	100.0	--	--	--	100.0	100.0
3	1	3.6	0.0	--	--	--	0.0	2.0
	2	5.4	.	--	--	--	0.0	.
	3	1.7	9.4	--	--	--	9.4	5.2
	4	83.6	74.6	--	--	--	74.6	79.6
	5	4.9	8.4	--	--	--	8.4	6.5
	6	0.2	1.5	--	--	--	1.5	0.7
	7+	0.6	6.1	--	--	--	6.1	3.1
	Total	100.0	100.0	--	--	--	100.0	100.0
4	1	5.1	--	--	0.0	0.0	0.0	1.4
	2	4.8	--	--	0.3	0.4	0.3	1.5
	3	2.6	--	--	25.4	10.0	14.5	11.3
	4	72.0	--	--	48.8	74.0	66.6	68.1
	5	5.0	--	--	4.3	5.3	5.0	5.0
	6	1.1	--	--	1.5	0.7	0.9	1.0
	7+	9.4	--	--	19.7	9.6	12.6	11.7
	Total	100.0	--	--	100.0	100.0	100.0	100.0
All	1	3.0	0.0	0.0	0.0	0.0	0.0	1.6
	2	7.2	0.5	1.7	0.3	0.4	0.5	4.0
	3	4.2	12.1	11.1	25.4	10.0	12.5	8.2
	4	77.1	76.0	70.3	48.8	74.0	74.1	75.6
	5	6.2	5.6	13.9	4.3	5.3	5.9	6.0
	6	0.4	0.7	1.5	1.5	0.7	0.8	0.6
	7+	1.8	5.1	1.6	19.7	9.6	6.3	4.0
	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 2018.

	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
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
2016	5.17	4.98	--	5.15	5.46	--	5.46	6.91	--	6.91	--	7.48	8.06	7.83	5.68	3.25	4.07	4.97	8.69	4.07	4.61
2017	4.54	4.39	--	4.52	3.52	--	3.52	3.67	--	3.67	--	4.17	5.68	4.63	4.14	2.90	2.65	2.86	5.86	2.93	3.32
2018	3.91	3.73	--	3.88	3.56	--	3.56	3.95	--	3.95	--	4.09	4.92	4.35	3.88	3.25	3.18	3.18	4.19	3.28	3.53
2019	4.36	4.12	--	4.33	4.37	--	4.37	4.53	--	4.53	--	4.70	5.10	4.82	4.45	3.82	3.99	3.86	4.29	3.91	4.17
Mean	4.21	3.88	3.66	4.16	4.49	6.58	4.50	5.51	6.72	5.52	8.07	6.67	7.39	6.95	4.44	3.59	3.85	4.92	6.78	3.83	4.08

Table 8. Estimated abundance at age, survival (S), fishing mortality (F) and exploitation (u) for Lake Erie walleye, 1985-2020 (from ADMB 2020 catch at age analysis recruitment integrated model, M=0.32).

	Age							Ages 2+		
Year	2	3	4	5	6	7+	Total	S	F	u
1985	6,935,890	55,691,900	4,533,900	4,480,230	1,027,450	1,621,950	74,291,320	0.655	0.103	0.084
1986	24,603,100	4,774,730	36,333,600	2,933,270	2,922,630	1,708,030	73,275,360	0.639	0.127	0.102
1987	24,457,700	16,597,900	2,992,810	22,530,300	1,846,300	2,890,920	71,315,930	0.645	0.118	0.096
1988	57,031,500	16,515,800	10,439,300	1,861,330	14,226,700	2,957,530	103,032,160	0.641	0.124	0.100
1989	12,216,000	37,957,500	10,104,100	6,303,640	1,148,030	10,561,100	78,290,370	0.638	0.130	0.105
1990	10,343,000	8,265,250	23,948,000	6,314,240	4,011,510	7,383,030	60,265,030	0.645	0.119	0.096
1991	5,207,330	7,049,220	5,267,620	15,166,000	4,065,290	7,304,540	44,060,000	0.655	0.103	0.084
1992	16,811,700	3,582,390	4,567,030	3,398,030	9,911,690	7,399,740	45,670,580	0.649	0.113	0.092
1993	22,889,500	11,393,600	2,249,350	2,851,900	2,158,930	10,964,300	52,507,580	0.624	0.152	0.121
1994	3,462,710	15,103,600	6,737,570	1,322,920	1,720,110	7,878,000	36,224,910	0.612	0.171	0.135
1995	19,109,600	2,306,810	9,093,840	4,044,250	813,988	5,906,010	41,274,498	0.620	0.158	0.126
1996	21,109,100	12,545,700	1,340,200	5,274,570	2,414,780	4,019,030	46,703,380	0.597	0.196	0.153
1997	2,420,500	13,533,100	6,924,890	737,749	3,009,240	3,677,140	30,302,619	0.588	0.212	0.164
1998	22,325,700	1,583,920	7,821,250	3,990,610	437,752	3,969,550	40,128,782	0.601	0.189	0.148
1999	11,035,400	14,247,600	864,371	4,259,140	2,255,660	2,496,760	35,158,931	0.616	0.165	0.131
2000	10,143,700	7,290,550	8,394,550	508,571	2,577,010	2,883,330	31,797,711	0.627	0.147	0.118
2001	31,431,300	6,772,620	4,397,400	5,058,370	314,473	3,388,770	51,362,933	0.677	0.070	0.058
2002	3,653,230	21,721,900	4,426,580	2,864,610	3,337,480	2,434,800	38,438,600	0.676	0.071	0.059
2003	24,738,800	2,558,490	14,608,800	2,970,140	1,941,750	3,911,660	50,729,640	0.685	0.058	0.048
2004	357,280	17,309,500	1,717,490	9,779,330	2,006,630	3,944,460	35,114,690	0.683	0.061	0.051
2005	103,588,000	254,380	11,800,900	1,167,970	6,700,770	4,069,070	127,581,090	0.701	0.036	0.030
2006	3,418,240	73,183,500	171,021	7,928,600	792,605	7,313,260	92,807,226	0.673	0.076	0.063
2007	6,810,310	2,419,430	49,114,500	114,495	5,359,690	5,466,570	69,284,995	0.673	0.075	0.062
2008	1,743,610	4,829,800	1,624,580	32,850,300	77,227	7,276,110	48,401,627	0.680	0.066	0.055
2009	17,298,600	1,236,000	3,259,570	1,094,180	22,327,400	4,987,960	50,203,710	0.691	0.049	0.041
2010	6,321,580	12,294,100	838,834	2,206,730	746,730	18,628,600	41,036,574	0.688	0.054	0.045
2011	6,393,180	4,508,150	8,407,800	571,944	1,514,340	13,234,800	34,630,214	0.688	0.053	0.045
2012	10,552,200	4,541,040	3,070,450	5,720,480	392,363	10,115,000	34,391,533	0.672	0.077	0.064
2013	7,879,530	7,407,360	2,977,490	2,007,850	3,788,080	6,939,550	30,999,860	0.666	0.086	0.071
2014	3,872,320	5,533,760	4,836,570	1,935,670	1,320,740	7,023,750	24,522,810	0.639	0.127	0.103
2015	5,737,380	2,685,430	3,478,680	3,023,670	1,229,380	5,259,500	21,414,040	0.638	0.129	0.104
2016	17,753,000	3,951,920	1,657,290	2,135,230	1,890,770	4,031,390	31,419,600	0.660	0.095	0.078
2017	56,078,100	12,235,000	2,446,120	1,020,790	1,340,110	3,700,280	76,820,400	0.673	0.076	0.063
2018	6,415,390	38,742,300	7,632,630	1,518,800	644,948	3,168,270	58,122,338	0.642	0.123	0.099
2019	9,813,280	4,461,680	24,616,700	4,827,930	975,649	2,436,620	47,131,859	0.635	0.133	0.107
2020	86,403,800	6,797,310	2,778,070	15,217,100	3,033,420	2,124,620	116,354,320			

Table 9. Estimated harvest of Lake Erie walleye for 2020, and population projection for 2021 when fishing with 60% Fmsy. The 2020 and 2021 projected spawning stock biomass values are from the ADMB-2020 recruitment-integrated model. The range in the RAH was calculated using ± one standard deviation from the mean RAH.

SSB_0=	59.305	million kilograms
20% SSB_0=	11.861	million kilograms
F_{msy} =	0.551	

	2020 Stock Size (millions of fish)	60% F_{msy}		Rate Functions			2020 RAH (millions of fish)			Projected 2021 Stock Size (millions)
Age	**Mean**	**F**	**Sel(age)**	**(F)**	**(S)**	**(u)**	**Min.**	**Mean**	**Max.**	**Mean**
2	86.404		0.285	0.094	0.661	0.077	4.862	6.673	8.484	77.942
3	6.797		0.952	0.315	0.530	0.233	1.223	1.584	1.945	57.094
4	2.778		1.000	0.331	0.522	0.243	0.514	0.675	0.836	3.603
5	15.217		0.894	0.296	0.540	0.221	2.542	3.358	4.175	1.449
6	3.033		0.903	0.298	0.539	0.223	0.504	0.675	0.846	8.223
7+	2.125		0.964	0.319	0.528	0.236	0.367	0.501	0.635	2.756
Total (2+)	116.354	0.331				0.116	10.012	13.466	16.921	151.067
Total (3+)	29.951						5.150	6.793	8.437	73.125
SSB	61.782	mil. kgs								96.566 mil. kgs

probability of 2020 spawning stock biomass being less than 20% SSB_0 = 0.000%

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 2019.

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
2016	2018	9.224
2017	2019	22.852
2018	2020	255.581
2019	2021	225.310

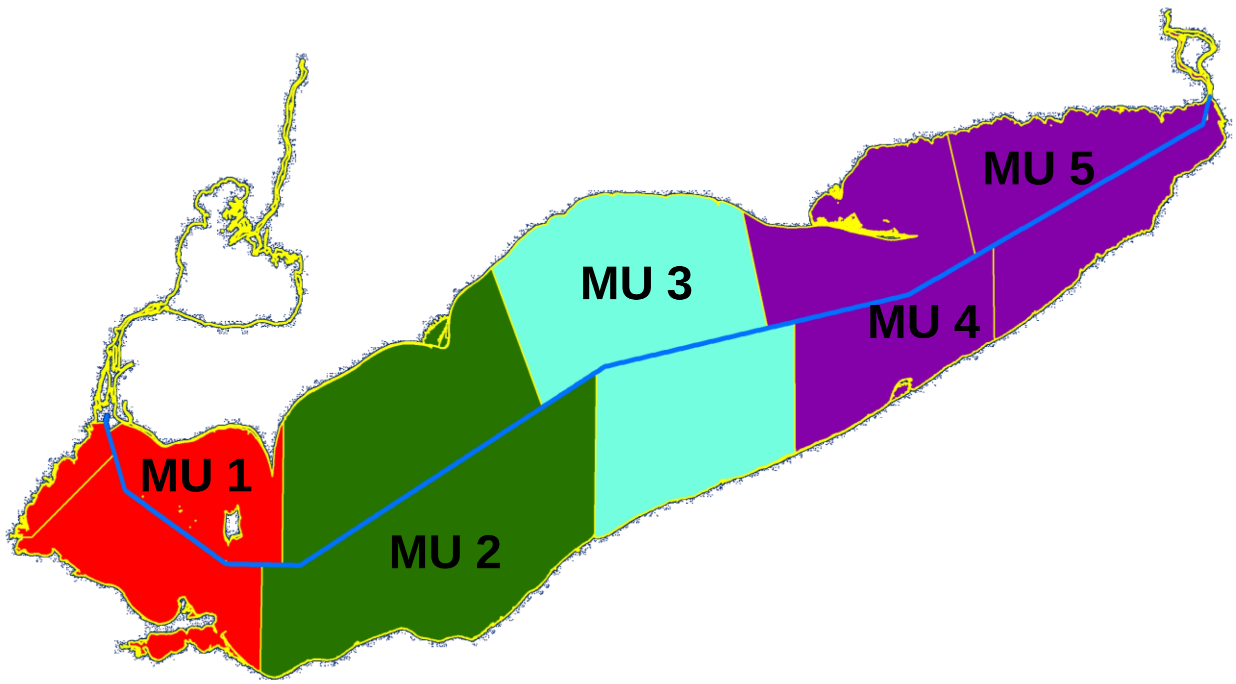

Figure 1. Map of Lake Erie with management units (MU) recognized by the Walleye Task Group for interagency management of Walleye.

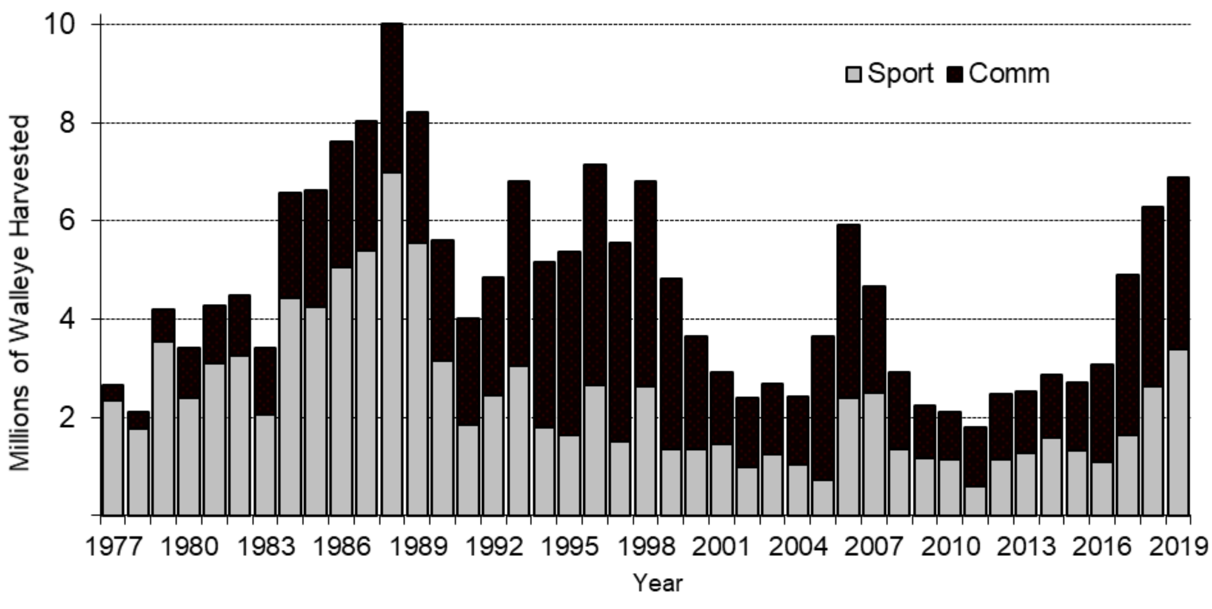

Figure 2. Lake-wide harvest of Lake Erie Walleye by sport and commercial fisheries, 1977-2019.

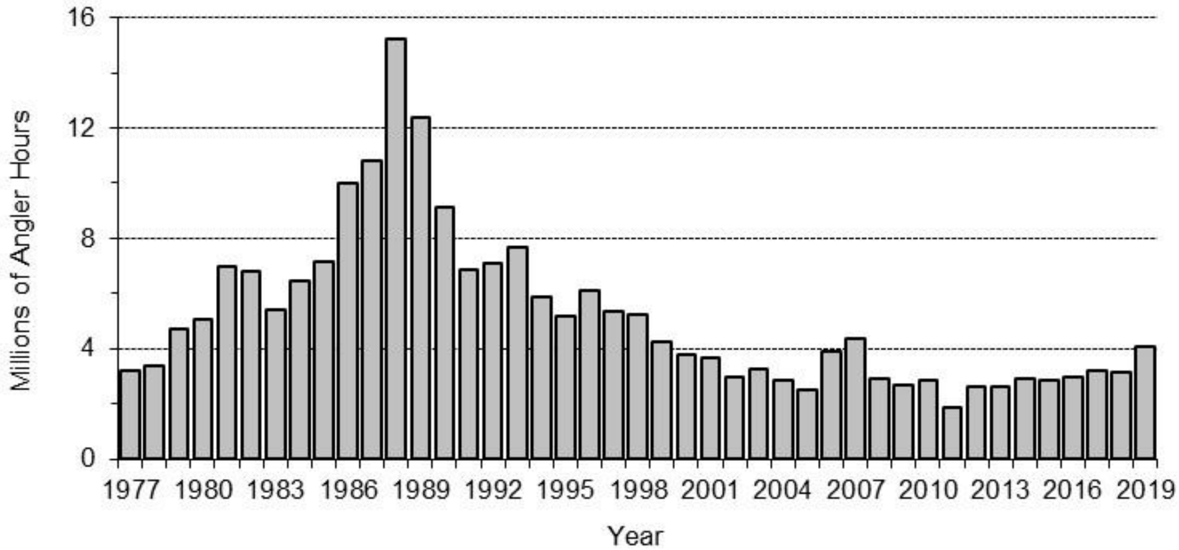

Figure 3. Lake-wide total effort (angler hours) by sport fisheries for Lake Erie Walleye, 1977-2019.

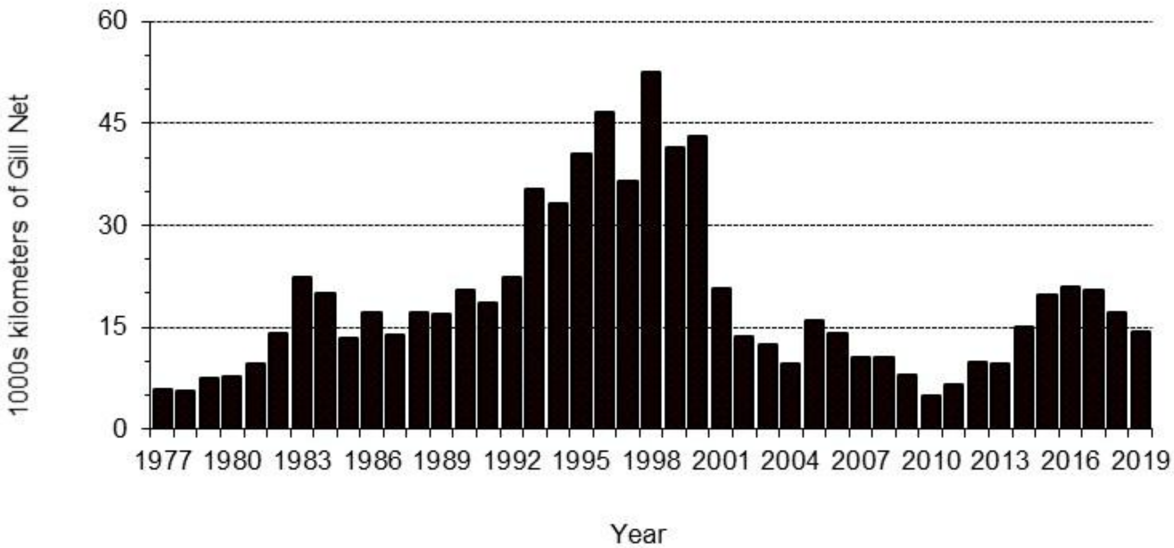

Figure 4. Lake-wide total effort (thousand kilometers of gill net) by commercial fisheries for Lake Erie Walleye, 1977-2019.

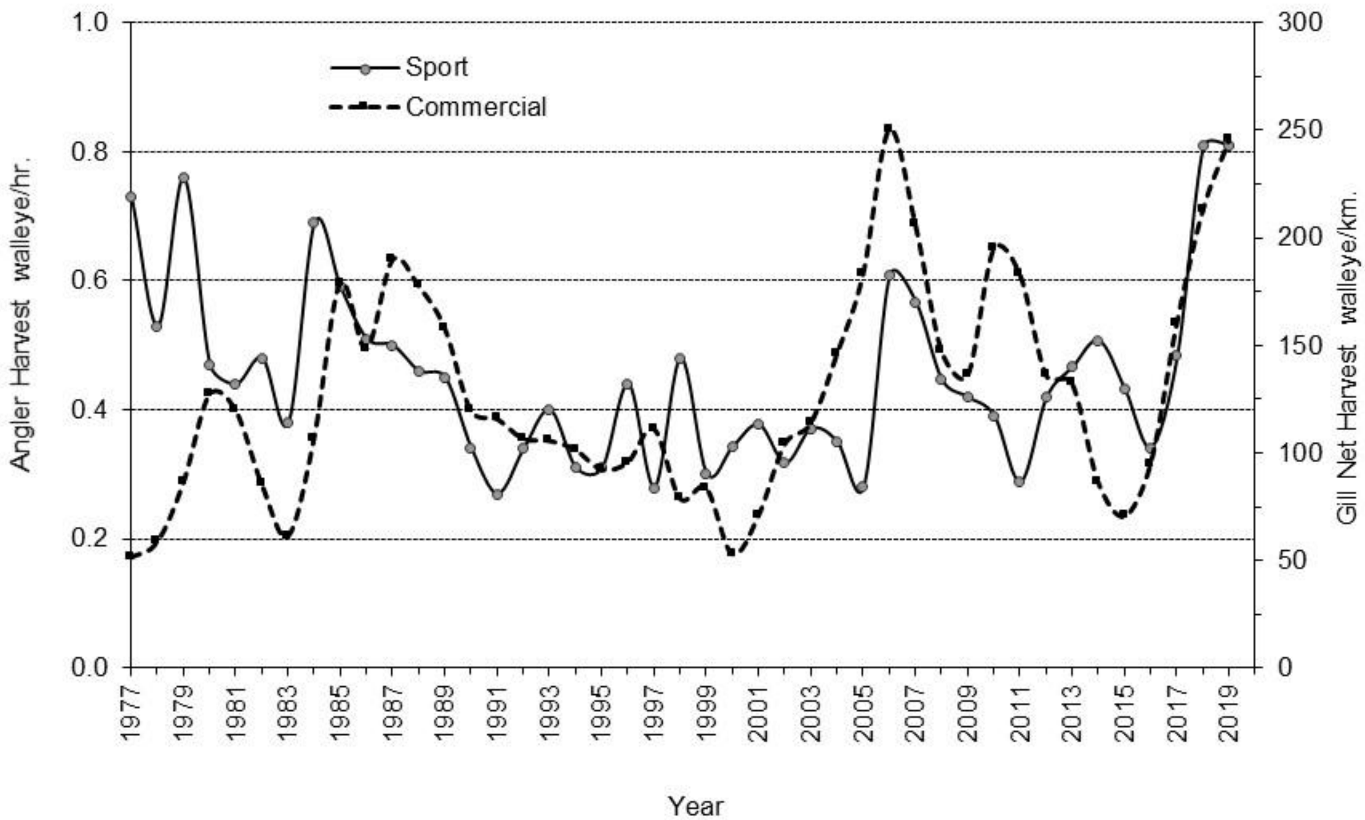

Figure 5. Lake-wide harvest per unit effort (HPE) for Lake Erie sport and commercial Walleye fisheries,1977-2019.

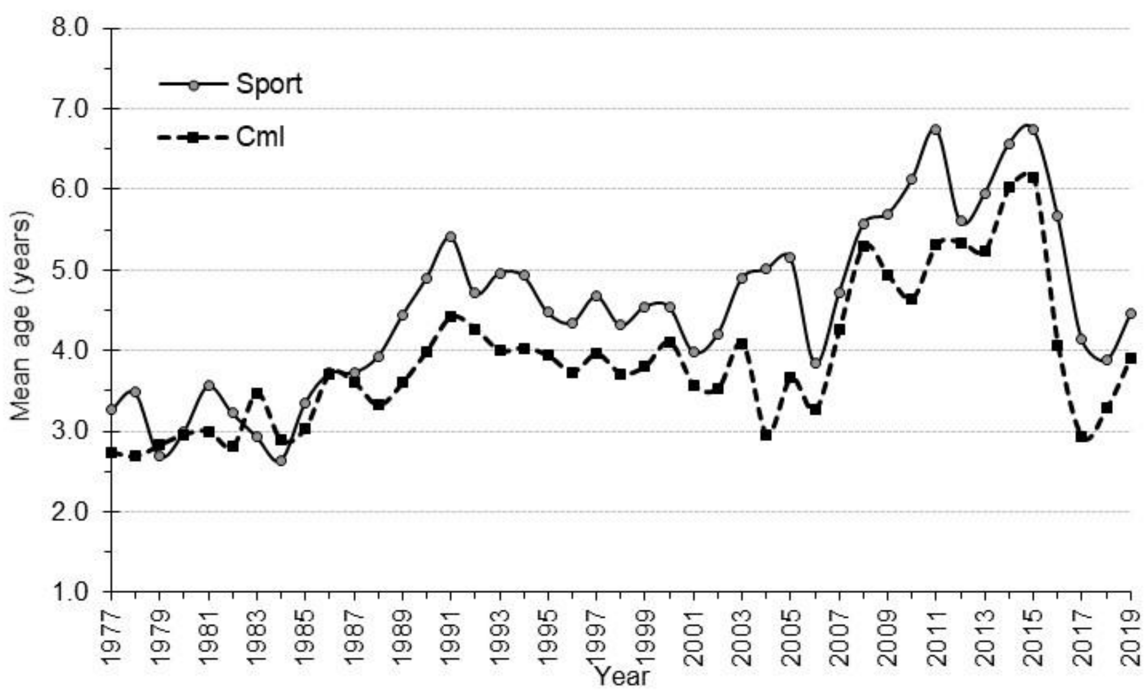

Figure 6. Lake-wide mean age of Lake Erie Walleye in sport and commercial harvests, 1977-2019.

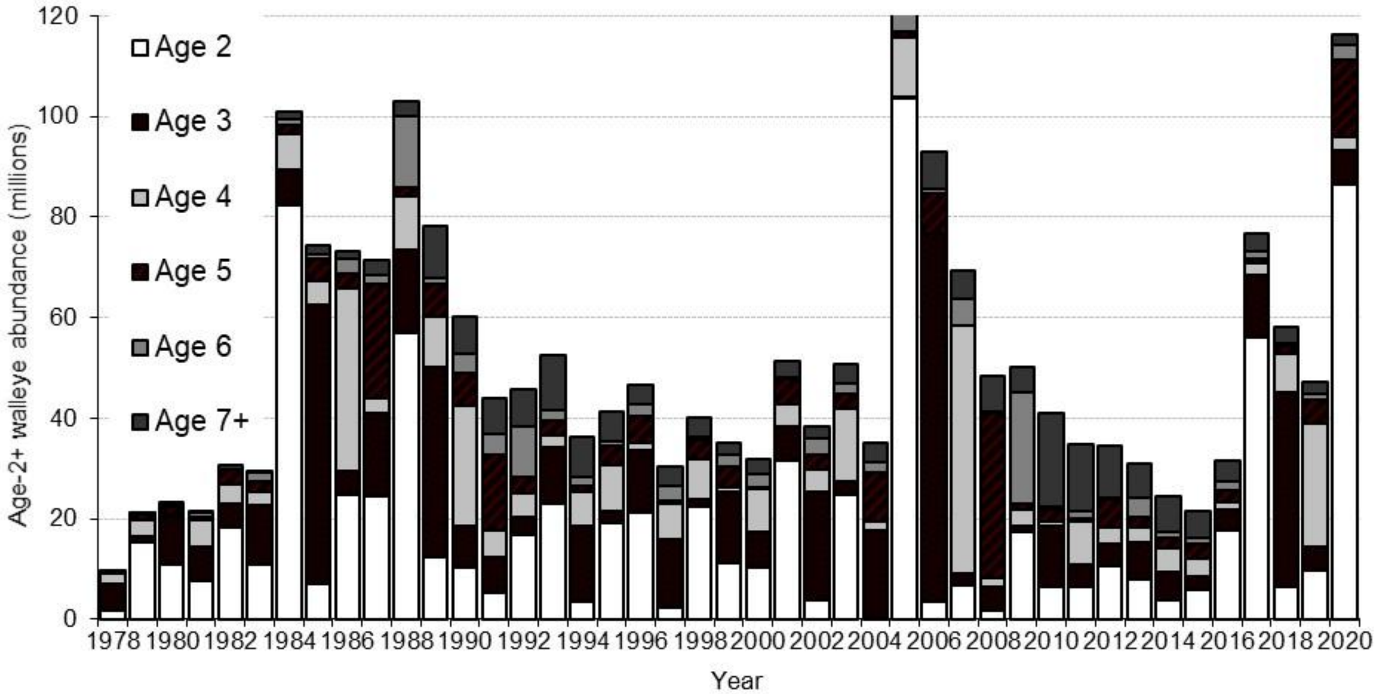

Figure 7. Abundance at age for age-2 and older Walleye in Lake Erie's west and central basins from 1978-2019, estimated from the latest ADMB integrated model run. Data shown are from Table 8.

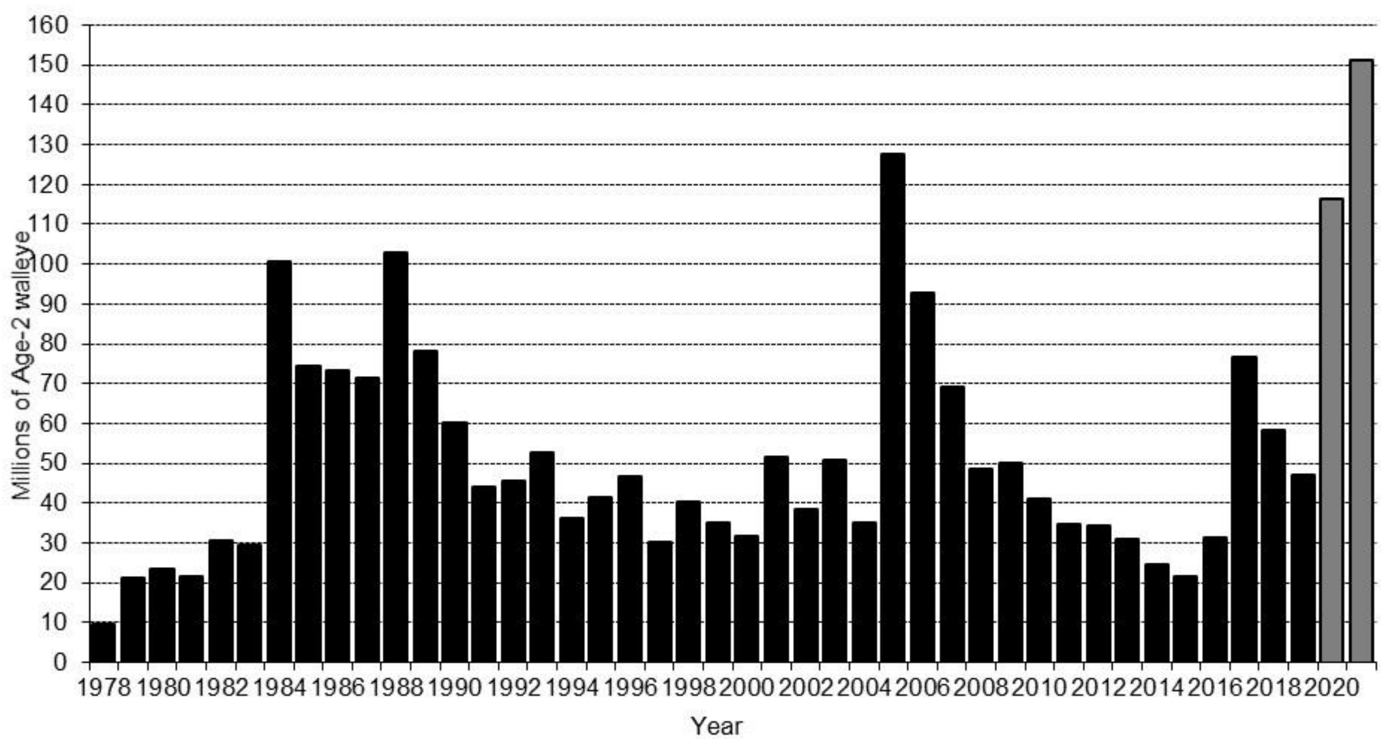

Figure 8. Estimated (1978 – 2019) and projected (2020 and 2020) number of age-2 Walleye in the west-central Lake Erie Walleye population from the latest ADMB integrated model run.

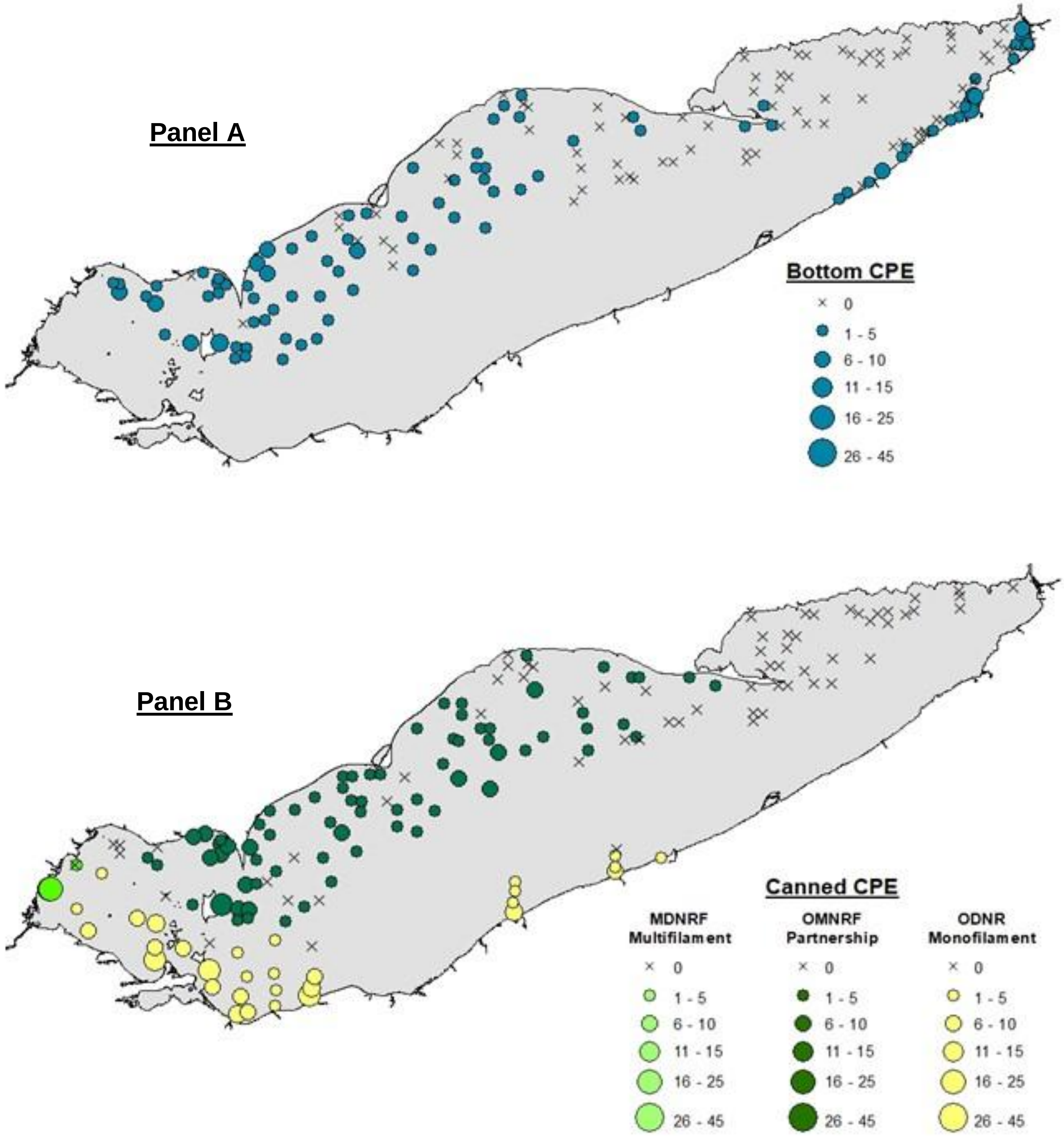

Figure 9. Relative abundance of yearling Walleye captured in bottom-set (Panel A) and suspended or kegged (canned) multifilament (Panel B) gillnets from Michigan, and monofilament gillnets from Ohio, New York, and Ontario waters in 2019. Catches have been adjusted to reflect panel length (standardized to 50 ft panels) and differences in the presence of large mesh (>5.5" excluded).

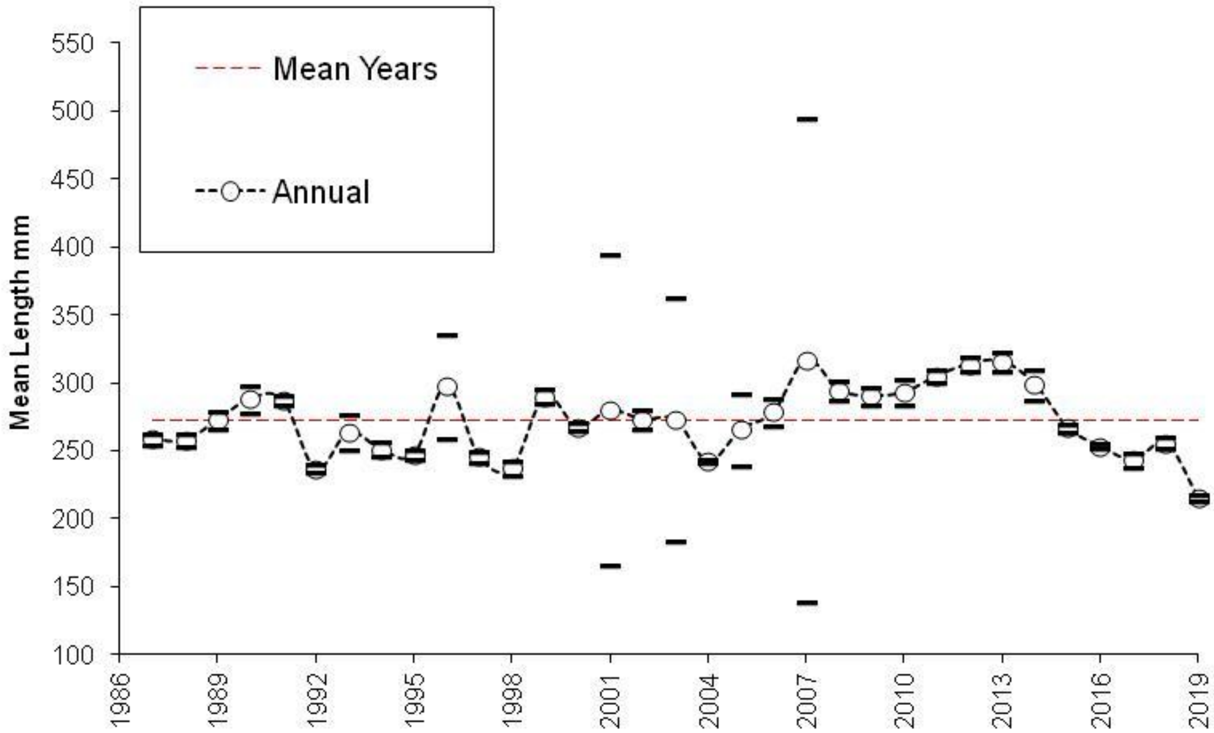

Figure 10. Annual mean total length of age 1 Walleye in Ohio and Ontario waters of western Lake Erie 1987-2019 with 95% confidence limits (black dashes above circles). Mean across years (1987-2019) presented as red dashed line.