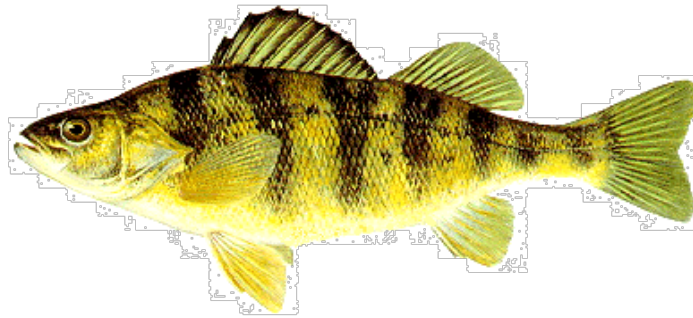


Report of the Lake Erie Yellow Perch Task Group

March 30th, 2016



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Presented to:

Standing Technical Committee
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Note: The data and management summaries contained in this report are provisional. Every effort has been made to ensure their accuracy. Contact individual agencies for complete state and provincial data. Data reported in pounds for years prior to 1996 have been converted from metric tonnes. Please contact the Yellow Perch Task Group or individual agencies before using or citing data published herein.

Introduction

From April 2015 through March 2016 the Yellow Perch Task Group (YPTG) addressed the following charges:

1. Maintain and update the centralized time series of datasets required for population models and assessment including:
 - a. Fishery harvest, effort, age composition, biological and stock parameters.
 - b. Survey indices of young of year, juvenile and adult abundance, size at age and biological parameters.
 - c. Fishing harvest and effort by grid.
2. Report Recommended Allowable Harvest (RAH) levels for 2016.
3. Participate in the LEPMAG Yellow Perch harvest strategy evaluation process by assisting the STC with the development of new catch-at-age models and exploitation strategies for Yellow Perch, leading to the development of a Yellow Perch Management Plan.

Charge 1: 2015 Fisheries Review and Population Dynamics

The lakewide total allowable catch (TAC) of Yellow Perch in 2015 was 10.528 million pounds. This allocation represented a 5.0% decrease from a TAC of 11.081 million pounds in 2014. For Yellow Perch assessment and allocation, Lake Erie is partitioned into four management units (Units, or MUs; Figure 1.1). The 2015 TAC allocation by management unit was 1.592, 4.450, 3.962, and 0.524 million pounds for Units 1 through 4, respectively. In 2015, the Lake Erie Committee (LEC) set the TAC for MU1, MU3, and MU4 higher than the mean RAH values suggested in the March 2015 YPTG report which were 1.551, 2.739, and 0.344 million pounds, respectively. For MU2, the LEC set the TAC equal to the mean RAH of 4.450 million pounds. For MU3, the LEC set the TAC at 3.962 million pounds, which exceeded the maximum RAH of 3.811 million pounds by approximately 4%, and represented a 20% decline from the 2014 MU3 TAC of 4.953 million pounds. The LEC chose to exceed the MU3 maximum RAH to align the Yellow Perch harvest policy with that of Walleye, which recently had been updated through the LEPMAG process and is described in the most recent Lake Erie Walleye Management Plan (2015-2019). TAC for Walleye is constrained to vary by no more than 20% between years, to maintain stability in harvest, which is valued by both commercial fishermen and recreational anglers. The lakewide harvest of Yellow Perch in 2015 was 6.918 million pounds, or 65.7% of the total 2015 TAC. This was a 22.9% decrease from the 2014 harvest of 8.972 million pounds. Harvest from Yellow Perch management units 1 through 4 was 1.122, 2.621, 2.782, and 0.393 million pounds, respectively (Table 1.1). The portion of TAC harvested was 70.5%, 58.9%, 70.2%, and 75.1%, in MUs 1

through 4, respectively. In 2015, Ontario harvested 4.460 million pounds, followed by Ohio (2.190 million lbs.), Michigan (94,225 lbs.), Pennsylvania (87,613 lbs.), and New York (85,535 lbs.).

Ontario's fraction of allocation harvested was 83.9% in MU1, 73.4% in MU2, 102.9% in MU3, and 97.9% in MU4 (see comments below regarding Ontario's harvest reporting and commercial ice allowance policy). Ohio fishers attained 60.6% of their TAC in the western basin (MU1), 46.8% in the west central basin (MU2), and 44.6% in the east central basin (MU3). Michigan anglers in MU1 attained 65.0% of their TAC. Pennsylvania fisheries harvested 12.8% of their TAC in MU3 and 17.3% of their TAC in MU4. New York fisheries attained 52.8% of their TAC in MU4.

Ontario's portion of the lakewide Yellow Perch harvest in 2015 (64.5%) was similar to 2014 (62.0%; Table 1.1). Ohio's proportion of lakewide harvest in 2015 (31.7%) was also similar to 2014 (33.2%). Harvest in Michigan, Pennsylvania, and New York waters combined represented 3.9% of the lakewide harvest in 2015.

Ontario continued to employ a commercial ice allowance policy implemented in 2002, by which 3.3% is subtracted from commercial landed weight. This step was taken so that ice was not debited towards fishers' quotas. Ontario's landed weights in the YPTG report have not been adjusted to account for ice content. Ontario's reported Yellow Perch harvest in tables and figures is represented exclusively by the commercial gill net fishery. Reported sport harvests for Michigan, Ohio, Pennsylvania, and New York are based on creel survey estimates. Ohio, Pennsylvania, and New York trap net harvest and effort are based on commercial catch reports of landed fish. Additional fishery documentation is available in annual agency reports.

Harvest, fishing effort, and fishery harvest rates are summarized for the time period of 2000 to 2015 by management unit, year, agency, and gear type in Tables 1.2 to 1.5. Trends across a longer time series (1975 to 2015) are depicted graphically for harvest (Figure 1.2), fishing effort (Figure 1.3), and harvest rates (Figure 1.4) by management unit and gear type. The spatial distributions of harvest (all gears) and effort by gear type for 2015 in ten-minute interagency grids are presented in Figures 1.5 through 1.8.

Ontario's Yellow Perch harvest from large mesh (3 inches or greater) gill nets in 2015 was 1.6%, 1.2%, and 2.0% of the gill net harvest in management units 1, 2 and 3, respectively, but was negligible in MU4 (0.36%). Harvest, effort, and catch per unit effort from (1) small mesh Yellow Perch effort (<3 inch stretched mesh) and (2) larger mesh sizes, are distinguished in Tables 1.2 to 1.5. Harvest from targeted small mesh gill nets in 2015 decreased by 10.7% in MU1, 5.1% in MU2, 19.7% in MU3, and 38.7% in MU4. Ontario trap net harvest was minimal (59

pounds in 2015) and is included in the total harvest of Yellow Perch in MU1 (Tables 1.1 and 1.2). Ontario commercial smelt trawlers incidentally catch Yellow Perch in management units 2, 3 and 4, and this harvest is included in Tables 1.3 to 1.5. In 2015, 58 pounds of Yellow Perch were harvested in trawl nets in MU2, 3,544 pounds of Yellow Perch were harvested in trawl nets in MU3, and 800 pounds were harvested in MU4.

Targeted (i.e. small mesh) gillnet effort in 2015 increased from 2014 by 19.9% in MU1, by 42.2% in MU2, and decreased by 11.9% in MU3 and by 12.0% in MU4. Gill net effort in 2015 was also lower when compared to the 1990s and earlier decades (Figure 1.3). Targeted gill net harvest rates in 2015 decreased by 25.5% in MU1, 33.3% in MU2, 8.8% in MU3, and 30.4% in MU4 from 2014 rates (Figure 1.4).

In 2015, sport harvest in U.S. waters increased by 21.1% in MU1, and decreased by 51.7% in MU2, by 57.2% in MU3, and by 52.5% in MU4 compared to the 2014 harvest (Figure 1.2). Angling effort in U.S. waters increased in 2015 from 2014 in MU1 (+12.5%), and decreased in MU2 (-22.3%), MU3 (-33.7%), and MU4 (-31.0%; Figure 1.3).

Sport fishing harvest rates are commonly expressed as fish harvested per angler hour for those anglers seeking Yellow Perch. These harvest rates are presented in Tables 1.2 to 1.5. Compared to 2014 rates, harvest per angler hour increased in Ohio waters of MU1 (+3.3%) and in Michigan waters of MU1 (+22.8%), but declined in Ohio waters of MU2 (-44.4%) and MU3 (-20%), in Pennsylvania waters of MU3 (-40.9%) and MU4 (-48.3%), and in New York waters of MU4 (-27.7%).

Angler harvest rates in kilograms per angler hour are presented graphically in Figure 1.4 for each management unit, by pooling jurisdictions' harvest weights and effort. In 2015, the sport harvest rate (in kg/hr) increased in MU1 (0.33; +7.6%), but decreased in MU2 (0.26; -37.9%), MU3 (0.61; -35.4%), and MU4 (0.54; -31.2%) from 2014 rates. Differences between harvest rates reported in fish per angler hour and kg per angler hour reflect the influence of size and age composition on harvest rates.

Trap net harvest decreased by 21.5% in MU2, increased by 2.4% in MU3, and increased by 107.7% in MU4. Compared to 2014, trap net effort (lifts) in 2015 increased in MU2 by 10.4%, increased in MU3 by 79.5%, and increased in MU4 by 107.0%. There has been no trap net harvest or effort in MU1 since 2011. In 2015, trap net harvest rate decreased in MU2 by 28.9%, decreased in MU3 by 43.0%, and increased in MU4 by 0.45%.

Age Composition and Growth

Lakewide, age-2, age-4, age-5, and age-6⁺ (age-6-and-older) fish contributed fairly equitably to the Yellow Perch harvest, with age-3 fish (2012 year class, 34.5%; Table 1.6) contributing most. In MU1, age-2 fish (2013 year class, 46.1%), age-3 fish (2012 year class, 26.4%), and age-5 fish (2010 year class, 12.2%) contributed most to the fishery. In MU2, age-3 fish (2012 year class, 47.9%) contributed most to the fishery, with age-5 fish (18.2%), age-4 fish (2011 year class, 15.7%), and age-6⁺ fish (2009 and older year classes, 12.1%) contributing similarly to the harvest. In MU3, age-3 fish (23.9%), age-4 fish (25.5%), age-5 fish (24.5%), and age-6⁺ fish (25.2%) contributed equitably to the harvest. In MU4, age-3 fish (51.1%) contributed most of the harvest, followed by age-5 fish (23.2%), age-4 fish (10.7%), and age-6⁺ fish (10.0%).

Yellow Perch growth differs among life stages and between basins, as illustrated by trends in total length-at-age (Figure 1.9). For simplicity, Figure 1.9 is comprised of young-of-the-year data from summer and fall interagency trawls, while data for ages 1 through 4 are from Ontario Partnership gill net surveys (MUs 1 and 4) and Ohio fall trawls (MUs 2 and 3). As these data are taken from fall surveys, caution must be exercised when evaluating these figures. Seasonal exploitation patterns and density-dependent effects may alter the overall picture of growth trends. In addition, separate surveys in the same MU may show dissimilar trends in size-at-age due to north-south growth differences or fishery influences; however, size-at-age long-term time series results describe relatively stable length-at-age for ages 0 through 4 across the management units. Yellow Perch condition (K) in Figure 1.10 is comprised of data from Ontario Partnership gill net surveys (MUs 1 and 4) and Ohio fall trawls (MUs 2 and 3). Trends in condition may be influenced by seasonal differences in sampling. Additional data from Long Point Bay trawl surveys are used to determine condition of age-0 Yellow Perch in MU4.

The task group continues to update Yellow Perch growth data in: (1) weight-at-age values recorded annually in the harvest and (2) length- and weight-at-age values taken from interagency trawl and gill net surveys. These values are applied in the calculation of population biomass and the forecasting of harvest in the approaching year. Therefore, changes in weight-at-age factor into the changes in overall population biomass and determination of recommended allowable harvest (RAH). The YPTG uses a three-year average of weight-at-age to minimize the impacts of weak year classes on determining the mean weight-at-age of Yellow Perch in the population and in the harvest.

Statistical Catch-at-Age Analysis

Population size for each management unit was estimated by statistical catch-at-age analysis (SCAA) using the Auto Differentiation Model Builder (ADMB) computer program (Fournier et al. 2012), with a standard version that incorporates commercial gill net catchability coefficients based on the seasonal distribution of harvest and relative catch rates. Estimates of population size from 1994 to 2015, and projections for 2016 based on 2015 fishing, mortality and recruitment rates, are presented in Table 1.7. Abundance, biomass, survival, and exploitation rates are presented by management unit graphically for 1975 to 2015 in Figures 1.11 to 1.14. Mean weights-at-age from assessment surveys were applied to abundance estimates to generate population biomass estimates (Table 1.8 and Figure 1.12). Population abundance and biomass estimates are critical to monitoring the status of stocks and determining recommended allowable harvest.

Abundance estimates should be interpreted with several caveats. Inclusion of abundance estimates from 1975 to 2015 implies that the time series are continuous. Lack of data continuity for the entire time series weakens the validity of this assumption. Survey data from multiple agencies are represented only in the latter part of the time series (since the late 1980s); methods of fishery data collection have also varied. Some model parameters are constrained to constants, such as natural mortality, catchability, and selectivity blocks. This technique lessens our ability to directly compare abundance levels over three decades. In addition, commercial gill net selectivity is estimated independently in the latter part of the time series using gill net selectivity curves derived from index gillnet data by the method of Helser (1998), involving back calculation of length-at-age and weightings based on the monthly distribution of harvest-at-age. With SCAA the most recent year's population estimates inherently have the widest error bounds; this is to be expected for cohorts that remain at-large under less than full selectivity in the population.

The Partnership survey catchability estimate in MU4 was revised in 2013-2014 to use a single time block for the entire survey time series. Previously, MU4 Partnership survey catchability was estimated using two time blocks (due to two missing years in the data set). However, this was inconsistent with the constant catchability assumption applied in MUs 1 through 3. Estimating a single time block for MU4 Partnership survey catchability ensures consistency with how Partnership survey catchability is estimated in the model.

In the SCAA model, population estimates are derived by minimizing an objective function weighted by data sources, including fishery effort, fishery catch, and survey catch rates. In 2011-2012, the YPTG group determined data weightings (referred to as lambdas in ADMB) using an

expert opinion approach for evaluating potential sources of bias in data sets that could negatively influence model performance (YPTG 2012). These data weightings were also used again in 2013-2016 and are presented in Appendix A Table 1.

Recruitment Estimator for Incoming Age-2 Yellow Perch

In 2014, the YPTG implemented a multi-model inference (MMI) based approach for predicting age-2 recruitment; this method was continued in 2016. Previously, age-2 recruitment was predicted by robust regression of juvenile Yellow Perch trawl and gill net indices against SCAA estimates of two-year-old abundance in each management unit. Under the previous method, only young-of-year and yearling indices that performed well in the regressions ($r^2 > 0.50$) with age-2 abundance estimates were used for predicting age-2 recruitment (YPTG 2013) and mean values were generated from averaging results from those significant models. The newer approach, developed by Michigan State University's Quantitative Fishery Center (QFC) during the LPMAG process, provides a more objective response by using a multi-model information-theoretic recruitment estimate that is calculated using R code (Calcagno 2013). This approach generates a list of all possible (2^n) non-redundant model formulas from a list of n explanatory variables (i.e. surveys) and fits each model with a pre-specified function (i.e. Generalized Linear Model or glm). All models falling within 2 AIC units of the 'best' model comprise the confidence set of models which generate the model-averaged coefficients. Surveys are not weighted equally in the models; the surveys which are more highly correlated with ADMB age-2 estimates are weighted more, thus having greater influence on the predictions. One caveat with the new approach is that years with any missing survey data cannot be used in the model, thereby truncating the time series. Furthermore, any survey required for the current year age-2 projection that was not performed must be removed from the list of n explanatory variables used by the *glmulti* analysis to generate possible candidate models. Only survey data from within each individual management unit was used to predict age-2 abundance in that management unit.

Estimates of 2016 age-2 Yellow Perch recruitment (the 2014 year class) were 39.997, 27.589, 17.507, and 4.860 million fish in management units 1 through 4, respectively (Table 1.7, Appendix A Table 2a). Parameter estimates for the model-averaged coefficients for each MU are detailed in Appendix A Table 2b. Despite lower selectivity of age-2 fish, the 2014 year class will make a strong contribution to the fishery in management unit 1 and 2, but a modest contribution in management unit 3 and 4, in 2016.

Data from trawl and gill net index series for the time period examined are presented in

Appendix A Table 3, while a key that summarizes abbreviations used for the trawl and gill net series is presented as a Legend in Appendix A Table 4. A subset of surveys listed in Appendix A Table 3 (in italics) are excluded from the multi-model estimation either because they were components of an included composite survey known to better represent the distribution of age-0 and age-1 Yellow Perch abundance. Surveys shaded grey in Appendix A Table 3 are used in the multi-model estimation but were excluded in the 2016 model run because they failed to meet R multi-model data constraints (i.e. missing data from years needed to project age-2 recruitment in the model year).

2016 Population Size Projection

Stock size estimates for Yellow Perch ages-3-and-older in 2016 were projected from SCAA estimates of 2015 population size and age-specific survival rates in 2015 (Table 1.8). Projected age-2 Yellow Perch recruitment from the 2014 year class (method described above) was added to the 2016 population estimate for older fish in each unit, producing the total standing stock in 2016 (Table 1.8). Standard errors and ranges for estimates are provided for each age in 2015 and following estimated survival from SCAA, for 2016. Descriptions of *min*, *mean*, and *max* population estimates refer to the age-specific mean estimates minus or plus one standard deviation (Table 1.8).

Stock size estimates for 2015 from SCAA in this report (Table 1.7) were lower than those projected previously in management units 1, 2, and 4 (YPTG 2015), and higher than previously projected in management unit 3. Differences in stock size estimates were due to additional data in the model and differences in age-2 estimates projected in 2015 compared to those estimated by the model in 2016. Current estimates of age-2 fish in 2015 are from the SCAA's first assessment of this cohort and, as such, have the widest error bounds.

Stock size estimates projected for 2016 were higher than 2015 estimates in management units 1, 2, and 4, and comparable in management unit 3 (Table 1.8, Figure 1.11). Abundance projections for 2016 were 56.096, 47.826, 39.137, and 8.370 million age-2-and-older Yellow Perch in management units 1 through 4, respectively. Abundance estimates of age-2-and-older Yellow Perch in 2016 are projected to increase by 94.7%, 14.8%, and 35.7% in MU1, MU2, and MU4, respectively, and to decrease by 0.5% in MU3 compared to the 2015 abundance estimates. Ages-3-and-older Yellow Perch abundance in 2016 is projected to be 16.099, 20.237, 21.629, and 3.507 million fish in Units 1 through 4, respectively. Lakewide abundance of age-2-and-older Yellow Perch in 2016 is projected to be 151.4 million fish, an increase of 31% from 2015. Model

estimates of abundance for age-3-and-older Yellow Perch for 2016 are projected to increase from the 2015 estimates by 119.4% in MU1, and decrease by 37.3%, 30.6%, and 35.4% in MU2, MU3, and MU4, respectively.

As a function of population estimates and mean weight-at-age from surveys, total biomass estimates of age-2-and-older Yellow Perch for 2016 are projected to increase in MU1 (+85.8%) and in MU4 (+1.3%), and to decrease in MU2 (-1.2%) and MU3 (-14.1%), compared to 2015 estimates (Table 1.8 and Figure 1.12). In 2016, age-2 (2014 year class) Yellow Perch are expected to represent the largest fraction of biomass in MU1, age-2 (2014 year class) and age-4 (2012 year class) Yellow Perch are expected to represent the largest fraction of biomass in MU2, age-6-and-older (pooled older cohorts) Yellow Perch are expected to represent the largest fraction of biomass in MU3, and age-2 and age-6-and-older Yellow Perch are expected to represent the largest fraction of biomass in MU4.

Estimates of Yellow Perch survival for ages-3-and-older in 2014 were 41.7%, 38.9%, 55.2%, and 51.3% in MUs 1 through 4, respectively (Figure 1.13). In 2015, estimated survival rates of ages-3-and-older fish were 47.3%, 46.7%, 52.2%, and 56.4% in Units 1 through 4 (Table 1.8 and Figure 1.13). Estimates of Yellow Perch survival in 2015 for ages-2-and-older fish were: 55.9% in MU1, 48.6% in MU2, 55.0% in MU3, and 56.9% in MU4 (Table 1.8 and Figure 1.13). Survival estimates are a function of natural mortality and age-specific fishing mortality. Yellow Perch SCAA models used in this report assume that natural mortality is 0.4.

Estimated exploitation rates of ages-3-and-older Yellow Perch in 2014 were 31.6%, 35.3%, 14.7%, and 19.5% in management units 1 through 4, respectively. Exploitation rates for ages-3-and-older fish in 2015 were estimated at 24.5%, 25.3%, 18.4%, and 13.1%, for MUs 1 through 4, respectively (Figure 1.14). Estimates of Yellow Perch exploitation for ages-2-and-older fish in 2015 were: 13.8% in MU1, 22.9% in MU2, 14.9% in MU3, and 12.5% in MU4 (Table 1.8 and Figure 1.14).

Charge 2: Harvest Strategy and RAH

Fishing rates applied in 2016 are presented in Table 2.1, along with associated recommended allowable harvest (RAH) values for each management unit. Harvest strategies were developed for a draft Yellow Perch Management Plan (YPMP) and tested using a Yellow Perch simulation (see YPTG 2010 report). The Yellow Perch simulation determined that fishing rates that were one-half of F_{msy} could support viable sport and commercial fisheries without inviting excessive biological risk. Fishing rates currently applied in calculating RAH in MUs 1, 2, 3, and 4,

are 0.67, 0.67, 0.70, and 0.30, respectively. These target fishing rates applied to population estimates and their standard errors, were used to determine *min*, *mean*, and *max* RAH's for 2016 for each management unit (Tables 2.1 and 2.2).

Quota allocation by management unit and jurisdiction for 2016 was determined by the same methods applied in 2009-2015, using GIS applications of jurisdictional surface area of waters within each MU (Figure 2.1).

The allocation of shares by management unit and jurisdiction are:

Allocation of TAC within Management Unit and Jurisdiction, 2016:

<u>MU1:</u>	ONT	40.6%	OH	50.3%	MI	9.1%
<u>MU2:</u>	ONT	45.6%	OH	54.4%		
<u>MU3:</u>	ONT	52.3%	OH	32.4%	PA	15.3%
<u>MU4:</u>	ONT	58.0%	NY	31.0%	PA	11.0%

Charge 3: Yellow Perch Management Plan and Lake Erie Percid Management Advisory Group Management Strategy Evaluation

Pursuant to the goal of developing the YPMP, the Lake Erie Committee (LEC), Standing Technical Committee (STC), QFC, and stakeholder groups from all Lake Erie jurisdictions have formed the Lake Erie Percid Management Advisory Group (LEPMAG), to address stakeholder objectives, modeling concerns, and exploitation policies for Lake Erie percid. In 2015, LEPMAG, facilitated by the QFC, reviewed existing YPTG models and data sources, discussed potential modifications to the assessment model, and continued discussion on stakeholder objectives and catch-at-age modeling concerns for Yellow Perch. These discussions are expected to produce updated SCAA models and new harvest exploitation strategies that lead to the completion of a new Lake Erie Yellow Perch Management Plan.

In 2014, a Technical Review Panel (TRP) was engaged to review potential modifications to the Yellow Perch assessment model. These proposed changes included: model estimated selectivities, constrained random walk catchability, commercial selectivity time blocks, Ontario survey catchability connection to account for the break in the time series in MU3 and MU4, multinomial distribution for age composition data, and the inclusion of additional datasets to the model. The TRP suggested additional modifications including incorporating sexual dimorphism into the model and expanding the number of age groups used in the model. These suggestions will

continue to be evaluated during the upcoming year.

In 2015, the LEPMAG, facilitated by the QFC, began to address issues raised by the TRP concerning the YPTG assessment model. The QFC presented to the LEPMAG, a preliminary length/sex-based SCAA model for MU2 designed to account for sexual dimorphism in growth. Diagnostic analyses were performed on three Yellow Perch SCAA models in MU2 and presented to the LEPMAG. Models tested included the sex-based model, the current YPTG model, and an updated YPTG model incorporating a subset of changes made to the WTG model during its revision through the LEPMAG process. Parameter correlations were estimated, residuals were examined, sensitivity analyses were performed, and models were investigated for retrospective patterns. At the 15th meeting of the LEPMAG, the QFC presented preliminary results from a simulation model designed to examine the potential management importance of using a sex-specific assessment model.

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Table 1.1. Lake Erie Yellow Perch harvest in pounds by management unit (Unit) and agency, 2000-2015.

	Year	Ontario*		Ohio		Michigan		Pennsylvania		New York		Total Harvest
		Harvest	%	Harvest	%	Harvest	%	Harvest	%	Harvest	%	
Unit 1	2000	980,323	47	1,038,687	50	67,010	3	--	--	--	--	2,086,020
	2001	813,066	45	915,641	51	70,910	4	--	--	--	--	1,799,617
	2002	1,454,105	50	1,316,553	45	147,065	5	--	--	--	--	2,917,723
	2003	1,179,667	44	1,406,385	53	84,878	3	--	--	--	--	2,670,930
	2004	1,698,761	59	1,090,669	38	94,732	3	--	--	--	--	2,884,162
	2005	1,513,890	60	965,231	38	49,485	2	--	--	--	--	2,528,606
	2006	1,325,464	54	1,055,378	43	62,854	3	--	--	--	--	2,443,696
	2007	727,678	41	982,677	55	62,815	4	--	--	--	--	1,773,170
	2008	580,050	56	409,705	39	47,934	5	--	--	--	--	1,037,689
	2009	853,137	61	463,564	33	87,319	6	--	--	--	--	1,404,020
	2010	879,358	47	889,512	48	83,725	5	--	--	--	--	1,852,595
	2011	870,802	48	796,447	44	145,960	8	--	--	--	--	1,813,209
	2012	752,872	44	883,245	51	93,291	5	--	--	--	--	1,729,408
	2013	648,884	43	789,088	52	76,994	5	--	--	--	--	1,514,966
	2014	620,667	56	391,361	36	87,511	8	--	--	--	--	1,099,539
2015	541,938	48	485,744	43	94,225	8	--	--	--	--	1,121,907	
Unit 2	2000	1,484,125	56	1,169,333	44	--	--	--	--	--	--	2,653,458
	2001	1,794,275	51	1,747,069	49	--	--	--	--	--	--	3,541,344
	2002	2,190,621	52	1,986,730	48	--	--	--	--	--	--	4,177,351
	2003	2,107,639	50	2,113,285	50	--	--	--	--	--	--	4,220,924
	2004	2,051,473	48	2,246,264	52	--	--	--	--	--	--	4,297,737
	2005	2,666,231	59	1,843,190	41	--	--	--	--	--	--	4,509,421
	2006	3,102,269	69	1,393,732	31	--	--	--	--	--	--	4,496,001
	2007	1,847,139	45	2,244,656	55	--	--	--	--	--	--	4,091,795
	2008	1,990,237	50	2,005,000	50	--	--	--	--	--	--	3,995,237
	2009	2,495,611	58	1,801,978	42	--	--	--	--	--	--	4,297,589
	2010	1,888,876	56	1,457,823	44	--	--	--	--	--	--	3,346,699
	2011	1,665,258	54	1,399,503	46	--	--	--	--	--	--	3,064,761
	2012	1,877,615	50	1,851,846	50	--	--	--	--	--	--	3,729,461
	2013	1,803,684	51	1,721,668	49	--	--	--	--	--	--	3,525,352
	2014	1,679,175	52	1,543,226	48	--	--	--	--	--	--	3,222,401
2015	1,489,433	57	1,131,993	43	--	--	--	--	--	--	2,621,426	
Unit 3	2000	771,646	62	443,250	36	--	--	32,613	3	--	--	1,247,509
	2001	999,450	64	464,811	30	--	--	91,211	6	--	--	1,555,472
	2002	1,192,691	60	640,104	32	--	--	140,821	7	--	--	1,973,616
	2003	1,667,133	72	481,558	21	--	--	177,516	8	--	--	2,326,207
	2004	1,453,419	62	659,447	28	--	--	244,063	10	--	--	2,356,929
	2005	1,771,800	75	457,593	19	--	--	142,028	6	--	--	2,371,421
	2006	3,451,499	90	271,144	7	--	--	106,260	3	--	--	3,828,903
	2007	2,997,101	84	391,285	11	--	--	193,065	5	--	--	3,581,451
	2008	2,200,168	74	629,366	21	--	--	155,014	5	--	--	2,984,548
	2009	2,266,727	74	597,214	20	--	--	190,742	6	--	--	3,054,683
	2010	3,370,099	85	476,808	12	--	--	117,640	3	--	--	3,964,547
	2011	3,366,412	81	636,686	15	--	--	153,233	4	--	--	4,156,331
	2012	3,768,183	81	746,999	16	--	--	161,751	3	--	--	4,676,933
	2013	2,983,539	76	796,307	20	--	--	155,193	4	--	--	3,935,039
	2014	2,668,921	70	979,937	26	--	--	168,690	4	--	--	3,817,548
2015	2,131,211	77	572,736	21	--	--	77,558	3	--	--	2,781,505	
Unit 4	2000	35,686	73	--	--	--	--	10,950	22	2,458	5	49,094
	2001	35,893	60	--	--	--	--	8,337	14	15,319	26	59,549
	2002	87,541	54	--	--	--	--	46,903	29	26,903	17	161,347
	2003	84,772	60	--	--	--	--	39,821	28	16,511	12	141,104
	2004	98,733	49	--	--	--	--	46,344	23	54,862	27	199,939
	2005	195,347	67	--	--	--	--	42,226	15	53,468	18	291,041
	2006	230,226	69	--	--	--	--	57,005	17	48,107	14	335,338
	2007	185,954	78	--	--	--	--	25,859	11	25,935	11	237,748
	2008	240,270	77	--	--	--	--	31,325	10	40,809	13	312,404
	2009	272,579	72	--	--	--	--	37,991	10	70,030	18	380,600
	2010	467,612	89	--	--	--	--	19,989	4	37,730	7	525,331
	2011	468,001	80	--	--	--	--	37,040	6	80,848	14	585,889
	2012	502,778	77	--	--	--	--	41,362	6	106,499	16	650,639
	2013	496,666	72	--	--	--	--	74,277	11	119,869	17	690,812
	2014	485,899	74	--	--	--	--	16,671	3	149,668	23	652,238
2015	297,716	76	--	--	--	--	10,055	3	85,535	22	393,306	
Lakewide Totals	2000	3,271,780	54	2,651,270	44	67,010	1	43,563	<1	2,458	<1	6,036,081
	2001	3,642,684	52	3,127,521	45	70,910	1	99,548	1	15,319	<1	6,955,982
	2002	4,924,958	53	3,943,387	43	147,065	2	187,724	2	26,903	<1	9,230,037
	2003	5,039,211	54	4,001,228	43	84,878	1	217,337	2	16,511	<1	9,359,165
	2004	5,302,386	54	3,996,380	41	94,732	1	290,407	3	54,862	<1	9,738,767
	2005	6,147,268	63	3,266,014	34	49,485	<1	184,254	2	53,468	<1	9,700,489
	2006	8,109,458	73	2,720,254	24	62,854	<1	163,265	1	48,107	<1	11,103,938
	2007	5,757,872	59	3,618,618	37	62,815	<1	218,924	2	25,935	<1	9,684,164
	2008	5,010,725	60	3,044,071	37	47,934	<1	186,339	2	40,809	<1	8,329,878
	2009	5,888,054	64	2,862,756	31	87,319	1	228,733	3	70,030	1	9,136,892
	2010	6,605,945	68	2,824,143	29	83,725	1	137,629	1	37,730	<1	9,689,172
	2011	6,370,473	66	2,832,636	29	145,960	2	190,273	2	80,848	1	9,620,190
	2012	6,901,448	64	3,482,090	32	93,291	1	203,113	2	106,499	1	10,786,441
	2013	5,932,773	61	3,307,063	34.2	76,994	1	229,470	2	119,869	1	9,666,169
	2014	5,454,662	62.0	2,914,524	33.2	87,511	1	185,361	2	149,668	2	8,791,726
2015	4,460,298	64.5	2,190,473	31.7	94,225	1	87,613	1	85,535	1	6,918,144	

*processor weight (quota debit weight) to 2001; fisher/observer weight from 2002 to 2015 (negating ice allowance).

Table 1.2. Harvest, effort and harvest per unit effort summaries for Lake Erie Yellow Perch fisheries in Management Unit 1 (Western Basin) by agency and gear type, 2000-2015.

		Unit 1					
		Michigan	Ohio		Ontario	Gill Nets	Ontario
Year		Sport	Trap Nets	Sport	Small Mesh	Large Mesh*	Trap Nets
Harvest (pounds)	2000	67,010	240,578	798,109	980,323	--	2,834
	2001	70,910	179,234	736,407	711,745	101,321	11,904
	2002	147,065	337,829	978,724	1,359,637	94,468	8,326
	2003	84,879	250,456	1,155,929	1,151,358	28,309	5,443
	2004	94,732	289,136	801,533	1,637,488	61,273	1,634
	2005	49,485	357,182	608,049	1,402,523	111,082	5,605
	2006	62,854	235,852	819,526	1,264,370	61,094	5,270
	2007	62,815	200,818	781,859	671,536	56,142	6,721
	2008	47,934	0	409,705	484,409	49,378	46,263
	2009	87,319	0	463,564	728,012	125,024	70
	2010	83,725	195,674	693,838	815,170	64,188	0
	2011	145,960	156,138	640,309	792,336	78,363	103
	2012	93,291	0	883,245	718,585	34,172	115
	2013	76,994	0	789,088	608,241	40,617	26
	2014	87,511	0	391,361	596,956	23,633	78
2015	94,225	0	485,744	533,167	8,712	59	
Harvest (Metric (tonnes)	2000	30	109	362	445	--	1.3
	2001	32	81	334	323	46	5.4
	2002	67	153	444	617	43	3.8
	2003	38	114	524	522	13	2.5
	2004	43	131	364	743	28	0.7
	2005	22	162	276	636	50	2.5
	2006	29	107	372	573	28	2.4
	2007	28	91	355	305	25	3.0
	2008	22	0	186	220	22	21.0
	2009	40	0	210	330	57	0.03
	2010	38	89	315	370	29	0.00
	2011	66	71	290	359	36	0.05
	2012	42	0	401	326	15	0.05
	2013	35	0	358	276	18	0.01
	2014	40	0	177	271	11	0.04
2015	43	0	220	242	4	0.03	
Effort (a)	2000	122,447	4,026	965,628	6,741	--	
	2001	97,761	1,518	720,923	2,167	2,142	
	2002	190,573	2,715	900,289	4,546	739	
	2003	121,638	2,213	1,182,694	3,725	395	
	2004	206,902	4,351	833,690	6,052	901	
	2005	98,429	3,903	816,959	5,170	1,182	
	2006	118,628	3,517	683,994	5,194	787	
	2007	181,698	2,951	823,624	2,230	1,125	
	2008	95,925	0	519,050	1,653	899	
	2009	130,556	0	578,303	3,058	1,680	
	2010	132,852	2,607	798,240	3,152	845	
	2011	139,344	3,219	729,369	2,571	682	
	2012	128,013	0	896,083	2,244	438	
	2013	130,809	0	946,138	3,412	547	
	2014	76,996	0	630,989	3,398	362	
2015	137,246	0	659,460	4,074	508		
Harvest Rates (b)	2000	2.2	27.1	3.0	66.0	--	
	2001	2.9	53.5	3.4	149.0	21.5	
	2002	2.5	56.4	3.4	135.6	58.0	
	2003	2.4	51.3	3.5	140.2	32.5	
	2004	1.6	30.1	3.0	122.7	30.8	
	2005	1.7	41.5	3.1	123.0	42.6	
	2006	1.7	30.4	4.2	110.4	35.2	
	2007	1.0	30.9	3.4	136.6	22.6	
	2008	1.5	--	2.7	132.9	24.9	
	2009	2.7	--	3.1	108.0	33.8	
	2010	2.3	34.0	3.4	117.3	34.4	
	2011	3.4	22.0	3.5	139.8	52.1	
	2012	2.4	--	3.6	145.3	35.4	
	2013	1.7	--	2.8	80.8	33.7	
	2014	2.2	--	3.0	79.7	29.6	
2015	2.7	--	3.1	59.4	7.8		

(a) sport effort in angler-hours; gill net effort in km; trap net effort in lifts

(b) harvest rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift

(*) large mesh catch rates are not targeted and are therefore of limited value.

Table 1.3. Harvest, effort and harvest per unit effort summaries for Lake Erie Yellow Perch fisheries in Management Unit 2 (western Central Basin) by agency and gear type, 2000-2015.

	Year	Unit 2				
		Ohio		Ontario	Gill Nets	Ontario
		Trap Nets	Sport	Small Mesh	Large Mesh*	Trawls
Harvest (pounds)	2000	565,108	604,225	1,484,125	--	13,089
	2001	905,088	841,981	1,593,704	200,571	7,444
	2002	1,099,971	886,759	1,892,070	298,551	8,255
	2003	1,255,205	858,080	2,019,617	88,022	867
	2004	1,287,747	958,517	1,893,871	157,602	37,155
	2005	1,162,746	680,444	2,446,007	219,723	5,563
	2006	744,452	649,280	2,981,793	120,476	524
	2007	1,701,552	543,104	1,561,287	173,699	112,153
	2008	1,376,588	628,412	1,669,682	253,984	66,203
	2009	1,338,616	463,362	1,994,208	482,402	17,315
	2010	935,616	522,207	1,410,051	470,926	7,899
	2011	1,070,817	328,686	1,312,168	339,404	13,686
	2012	1,285,336	566,510	1,550,104	314,440	13,071
	2013	1,230,249	491,419	1,657,811	145,475	398
	2014	1,280,184	263,042	1,550,722	128,453	0
	2015	1,005,061	126,932	1,471,107	18,268	58
Harvest (Metric) (tonnes)	2000	256	274	673	--	5.9
	2001	410	382	723	91	3.4
	2002	499	402	858	135	3.7
	2003	569	389	916	40	0.4
	2004	584	435	859	71	16.9
	2005	527	309	1,109	100	2.5
	2006	338	294	1,352	55	0.2
	2007	772	246	708	79	50.9
	2008	624	285	757	115	30.0
	2009	607	210	904	219	7.9
	2010	424	237	639	214	3.6
	2011	486	149	595	154	6.2
	2012	583	257	703	143	5.9
	2013	558	223	752	66	0.2
	2014	581	119	703	58	0.0
	2015	456	58	667	8	0.0
Effort (a)	2000	5,272	601,712	6,266	--	
	2001	4,747	594,741	3,445	4,975	
	2002	7,675	658,799	4,786	3,209	
	2003	10,214	632,813	5,311	1,555	
	2004	12,023	659,454	4,929	2,787	
	2005	9,103	784,942	9,716	2,173	
	2006	7,544	499,412	11,692	1,925	
	2007	9,158	498,843	2,966	2,826	
	2008	3,983	450,060	3,124	2,629	
	2009	6,317	417,660	5,545	4,241	
	2010	6,701	502,507	3,783	3,905	
	2011	5,707	395,407	4,214	3,789	
	2012	6,919	456,404	4,616	2,942	
	2013	5,851	428,187	6,821	1,951	
	2014	5,713	280,018	6,653	1,816	
	2015	6,309	217,637	9,459	1,207	
Harvest Rates (b)	2000	48.6	2.9	107.4	--	
	2001	86.5	3.2	209.9	18.3	
	2002	65.0	3.1	179.3	42.1	
	2003	55.7	3.3	172.5	25.7	
	2004	48.6	3.7	174.3	25.6	
	2005	57.9	2.8	114.2	45.9	
	2006	44.8	3.7	115.7	28.4	
	2007	84.3	2.8	238.7	27.9	
	2008	156.7	3.5	242.4	43.8	
	2009	96.1	3.0	163.1	51.6	
	2010	63.3	3.2	169.0	54.7	
	2011	85.1	2.6	141.2	40.6	
	2012	84.2	3.1	152.3	48.5	
	2013	95.4	2.6	110.2	33.8	
	2014	101.6	2.7	105.7	32.1	
	2015	72.2	1.5	70.5	6.9	

(a) sport effort in angler-hours; gill net effort in km; trap net effort in lifts

(b) harvest rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift

(*) large mesh catch rates are not targeted and therefore of limited value

Table 1.4. Harvest, effort and harvest per unit effort summaries for Lake Erie Yellow Perch fisheries in Management Unit 3 (eastern Central Basin) by agency and gear type, 2000-2015.

		Unit 3						
		Ohio		Pennsylvania		Ontario	Gill Nets	Ontario
Year		Trap Nets	Sport	Trap Nets	Sport	Small Mesh	Large Mesh*	Trawls
Harvest (pounds)	2000	156,510	286,740	5,930	26,683	771,646	--	6,866
	2001	4,472	460,339	2,602	96,946	948,622	50,828	8,928
	2002	0	640,104	2,009	138,812	1,094,894	97,797	8,157
	2003	0	481,559	5,050	172,467	1,647,047	20,086	6,280
	2004	0	659,447	7,753	236,310	1,443,314	10,105	38,096
	2005	43,253	414,340	15,228	126,800	1,657,498	113,969	5,116
	2006	70,310	200,834	20,467	85,793	3,332,037	119,461	8
	2007	48,286	342,999	23,471	169,594	2,941,451	42,570	13,080
	2008	139,023	490,343	22,927	132,087	2,160,041	32,673	7,454
	2009	112,030	485,184	35,296	155,446	2,180,834	77,858	8,035
	2010	153,097	323,711	36,026	104,224	3,065,336	302,410	2,353
	2011	327,871	308,815	1,542	151,691	2,911,506	451,628	3,278
	2012	469,401	277,598	15,405	146,346	3,653,296	114,640	247
	2013	300,346	495,961	790	154,403	2,818,241	164,712	586
	2014	265,963	713,974	506	168,184	2,597,079	71,136	706
2015	266,030	306,706	6,854	70,704	2,084,595	43,072	3,544	
Harvest (Metric) (tonnes)	2000	71	130	2.7	12	350	--	3.1
	2001	2.0	209	1.2	44	430	23	4.0
	2002	0	290	0.9	63	497	44	3.7
	2003	0	218	2.3	78	747	9.1	2.8
	2004	0	299	3.5	107	655	4.6	17.3
	2005	20	188	6.9	58	752	52	2.3
	2006	32	91	9.3	39	1,511	54	0.0
	2007	22	156	10.6	77	1,334	19	5.9
	2008	63	222	10.4	60	980	15	3.4
	2009	51	220	16.0	70	989	35	3.6
	2010	69	147	16.3	47	1,390	137	1.1
	2011	149	140	0.7	69	1,320	205	1.5
	2012	213	126	7.0	66	1,657	52	0.1
	2013	136	225	0.4	70	1,278	75	0.3
	2014	121	324	0.2	76	1,178	32	0.3
2015	121	139	3.1	32	945	20	1.6	
Effort (a)	2000	1,640	214,825	231	48,561	2,342	--	
	2001	32	269,062	175	90,214	2,451	1,047	
	2002	0	416,543	95	123,287	2,490	1,055	
	2003	0	256,890	87	138,720	4,617	316	
	2004	0	368,537	70	175,596	3,750	268	
	2005	947	305,885	129	127,462	5,098	743	
	2006	881	139,536	124	60,612	11,130	1,030	
	2007	713	218,683	88	135,611	6,115	614	
	2008	1,288	234,179	78	110,403	3,336	417	
	2009	482	289,602	121	139,438	4,050	728	
	2010	972	182,485	128	85,294	5,747	1,125	
	2011	1,108	182,630	37	94,025	6,093	1,481	
	2012	2,074	154,474	87	98,234	7,847	991	
	2013	1,014	232,234	25	83,739	6,037	968	
	2014	581	336,607	186	90,024	5,678	422	
2015	1,067	212,226	310	70,490	5,000	560		
Harvest Rates (b)	2000	43.3	3.0	11.6	1.9	149.4	--	
	2001	63.4	2.9	6.7	2.6	175.4	22.0	
	2002	--	2.7	9.6	3.6	199.6	41.7	
	2003	--	3.1	26.3	5.3	161.8	28.8	
	2004	--	4.3	50.2	3.9	174.6	17.1	
	2005	20.7	3.1	53.5	2.9	147.4	69.6	
	2006	36.2	3.3	74.9	3.7	135.8	52.6	
	2007	30.7	3.4	121.0	3.8	218.2	31.4	
	2008	49.0	4.6	133.3	4.5	293.6	35.5	
	2009	105.4	3.5	132.3	4.8	244.2	48.5	
	2010	71.4	4.0	127.6	4.0	241.9	121.9	
	2011	134.2	4.1	18.9	5.3	216.7	138.3	
	2012	102.6	4.5	80.3	4.7	211.1	52.5	
	2013	134.3	5.0	14.3	5.2	211.7	77.2	
	2014	207.6	4.0	1.2	4.7	207.4	76.4	
2015	113.1	3.2	10.0	2.8	189.1	34.9		

(a) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(b) harvest rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift
(*) large mesh catch rates are not targeted and therefore of limited value

Table 1.5. Harvest, effort and harvest per unit effort summaries for Lake Erie Yellow Perch fisheries in Management Unit 4 (Eastern Basin) by agency and gear type, 2000-2015.

		Unit 4						
		New York		Pennsylvania		Ontario Gill Nets		Ontario
Year		Trap Nets	Sport	Trap Nets	Sport	Small Mesh	Large Mesh*	Trawls
Harvest	2000	625	1,833	0	10,950	35,686	--	232
(pounds)	2001	27	15,292	0	8,337	34,284	1,608	4,817
	2002	1,951	24,952	29	46,874	85,935	1,606	15,518
	2003	1,048	15,464	0	39,822	84,648	124	7,328
	2004	3,907	50,955	0	90,514	98,716	17	822
	2005	7,726	45,742	0	42,226	195,258	52	672
	2006	9,423	38,684	0	57,005	229,063	1,163	2,488
	2007	9,511	16,424	0	25,859	179,595	3,076	3,283
	2008	11,136	29,673	0	31,325	234,366	2,689	3,215
	2009	13,476	56,554	0	37,991	266,425	4,738	1,416
	2010	11,772	25,958	0	26,263	465,775	1,517	320
	2011	15,045	65,803	0	37,040	464,331	2,761	909
	2012	17,709	88,790	0	41,362	499,359	833	2,586
	2013	15,814	104,055	0	74,277	492,233	2,778	1,665
	2014	10,355	139,313	0	16,671	482,925	1,160	1,814
	2015	21,503	64,032	0	10,055	295,833	1,083	800
Harvest	2000	0.3	0.8	0	5.0	16.2	--	0.1
(Metric	2001	0.01	6.9	0	3.8	15.5	0.73	2.2
(tonnes)	2002	0.9	11.3	0.01	21.3	39.0	0.70	7.0
	2003	0.5	7.0	0	18.1	38.4	0.06	3.3
	2004	1.8	23.1	0	41.0	44.8	0.01	0.4
	2005	3.5	20.7	0	19.2	88.6	0.02	0.3
	2006	4.3	17.5	0	25.9	103.9	0.53	1.1
	2007	4.3	7.4	0	11.7	81.4	1.40	1.5
	2008	5.1	13.5	0	14.2	106.3	1.22	1.5
	2009	6.1	25.6	0	17.2	120.8	2.15	0.6
	2010	5.3	11.8	0	11.9	211.2	0.69	0.1
	2011	6.8	29.8	0	16.8	210.6	1.25	0.4
	2012	8.0	40.3	0	18.8	226.5	0.38	1.2
	2013	7.2	47.2	0	33.7	223.2	1.26	0.8
	2014	4.7	63.2	0	7.6	219.0	0.53	0.8
	2015	9.8	29.0	0	4.6	134.2	0.49	0.4
Effort	2000	44	2,606	0	21,146	314	--	
(a)	2001	39	22,950	0	12,451	128	28.0	
	2002	89	44,270	9	61,734	224	28.0	
	2003	91	33,162	0	32,525	373	21.0	
	2004	44	73,056	0	62,639	355	3.2	
	2005	179	58,667	0	70,921	782	7.8	
	2006	208	46,174	0	47,274	1,007	31.8	
	2007	144	29,999	0	31,545	550	62.1	
	2008	137	34,511	0	27,041	569	69.2	
	2009	215	58,829	0	58,475	718	50.9	
	2010	287	35,526	0	26,544	1,227	21.7	
	2011	383	50,479	0	48,537	1,564	28.6	
	2012	428	58,621	0	49,577	1,770	12.9	
	2013	364	65,750	0	48,093	1,932	14.5	
	2014	213	76,817	0	13,959	2,016	8.3	
	2015	441	44,029	0	18,638	1,774	44.7	
Harvest Rates	2000	6.4	0.20	--	1.7	51.5	--	
(b)	2001	0.3	1.65	--	1.5	121.5	26.0	
	2002	9.9	1.13	1.5	2.4	174.0	25.0	
	2003	5.2	0.76	--	1.9	102.9	2.9	
	2004	40.3	1.14	--	1.7	126.1	2.4	
	2005	19.6	1.23	--	1.8	113.2	3.0	
	2006	20.5	1.36	--	2.9	103.2	16.6	
	2007	30.0	0.97	--	1.5	148.1	22.5	
	2008	36.9	1.68	--	6.4	186.8	17.6	
	2009	28.4	1.77	--	3.2	168.3	42.2	
	2010	18.6	1.31	--	2.2	172.1	31.7	
	2011	17.8	2.01	--	2.9	134.6	43.8	
	2012	18.8	2.17	--	2.5	127.9	29.3	
	2013	19.7	2.59	--	2.9	115.5	87.1	
	2014	22.0	2.78	--	2.3	108.6	63.4	
	2015	22.1	2.01	--	1.2	75.6	11.0	

(a) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
 (b) harvest rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift
 (*) large mesh catch rates are not targeted and therefore of limited value

Table 1.6. Estimated 2015 Lake Erie Yellow Perch harvest by age and numbers of fish by gear and management unit (Unit).

Gear	Age	Unit 1		Unit 2		Unit 3		Unit 4		Lakewide	
		Number	%	Number	%	Number	%	Number	%	Number	%
Gill Nets	1	0	0.0	1,896	0.0	0	0.0	0	0.0	1,896	0.0
	2	372,274	21.5	366,717	7.8	12,797	0.2	48,561	5.7	800,350	5.6
	3	538,766	31.1	2,343,279	49.5	1,402,573	20.3	510,881	59.9	4,795,498	33.7
	4	143,167	8.3	769,787	16.3	1,826,947	26.5	95,248	11.2	2,835,149	19.9
	5	415,099	24.0	696,648	14.7	1,807,831	26.2	160,284	18.8	3,079,862	21.7
	6+	263,068	15.2	552,549	11.7	1,845,035	26.8	38,250	4.5	2,698,903	19.0
Total		1,732,374	47.3	4,730,877	58.4	6,895,184	80.5	853,225	83.7	14,211,659	65.0
Trap Nets	1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	2	0	0.0	70,883	2.3	12,379	1.5	0	0.0	83,262	2.1
	3	0	0.0	1,385,769	45.4	352,130	43.9	1,111	2.0	1,739,010	44.5
	4	0	0.0	471,688	15.5	143,583	17.9	3,704	6.7	618,975	15.8
	5	0	0.0	735,254	24.1	167,491	20.9	21,854	39.3	924,599	23.7
	6+	0	0.0	386,168	12.7	126,109	15.7	28,892	52.0	541,169	13.9
Total		0	0.0	3,049,762	37.6	801,692	9.4	55,561	5.4	3,907,015	17.9
Sport	1	79,713	3.2	11,823	3.7	8,379	1.0	0	0.0	99,915	2.7
	2	1,563,901	63.5	43,491	13.5	41,973	4.9	1,881	1.7	1,651,246	43.9
	3	567,249	23.0	153,374	47.6	289,111	33.4	9,465	8.6	1,019,199	27.1
	4	74,260	3.0	26,957	8.4	213,109	24.7	9,737	8.8	324,062	8.6
	5	97,565	4.0	41,753	13.0	126,541	14.6	54,822	49.5	320,681	8.5
	6+	80,949	3.3	44,714	13.9	185,252	21.4	34,800	31.4	345,715	9.2
Total		2,463,636	58.7	322,112	4.0	864,365	10.1	110,706	10.9	3,760,818	17.2
All Gear	1	79,713	1.9	13,719	0.2	8,379	0.1	0	0.0	101,812	0.5
	2	1,936,175	46.1	481,091	5.9	67,149	0.8	50,442	4.9	2,534,858	11.6
	3	1,106,015	26.4	3,882,422	47.9	2,043,814	23.9	521,458	51.1	7,553,708	34.5
	4	217,426	5.2	1,268,432	15.7	2,183,639	25.5	108,689	10.7	3,778,187	17.3
	5	512,663	12.2	1,473,655	18.2	2,101,863	24.6	236,960	23.2	4,325,142	19.8
	6+	344,017	8.2	983,431	12.1	2,156,396	25.2	101,942	10.0	3,585,787	16.4
Total		4,196,010	19.2	8,102,751	37.0	8,561,241	39.1	1,019,491	4.7	21,879,492	100.0

Note: Values in *italics* delineate harvest percentage by gear in each Unit, while the values in the 'All Gear' boxes are for lakewide harvest percentage by Unit.

Table 1.7. Yellow Perch stock size (millions of fish) in each Lake Erie management unit. Abundance in the years 1995 to 2015 are estimated by ADIMB catch-age analysis. The 2016 population estimates use age-2 Yellow Perch estimates derived from multi-model averaging of generalized linear models of ADIMB age-2 abundance against YOY and yearling survey indices (see Appendix A) in an R program.

Age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Unit 1																								
2	9.352	23.334	29.165	22.563	43.794	10.393	34.004	33.470	7.764	40.718	3.219	53.216	1.578	9.221	10.105	23.949	15.328	9.647	13.709	2.220	6.628	21.474	39.997	
3	1.518	5.605	14.166	17.228	13.896	26.774	6.609	21.565	21.531	4.955	25.528	2.042	32.895	1.010	5.526	6.213	15.088	9.761	6.165	8.558	1.336	3.763	12.627	
4	2.166	0.636	2.475	6.022	7.881	6.860	14.513	3.600	12.677	11.042	2.702	11.760	1.002	12.992	0.542	2.870	3.180	7.896	5.257	3.193	3.949	0.608	1.830	
5	0.310	0.499	0.179	0.674	1.898	2.950	3.135	7.285	1.962	5.211	4.943	1.005	4.261	0.408	5.219	0.294	1.398	1.511	3.740	2.504	1.336	1.660	0.282	
6+	0.028	0.074	0.172	0.092	0.164	0.480	1.292	1.983	4.826	2.399	3.120	2.343	0.984	1.606	0.773	2.970	1.543	1.344	1.273	2.287	1.945	1.306	1.360	
2 and Older	13.374	30.149	46.157	46.579	67.634	47.457	59.554	67.903	48.758	64.325	39.513	70.366	40.720	25.236	22.165	36.297	36.536	30.158	30.145	18.763	15.194	28.811	56.096	
3 and Older	4.022	6.814	16.991	24.017	23.840	37.064	25.550	34.434	40.995	23.607	36.293	17.150	39.142	16.016	12.060	12.347	21.209	20.512	16.436	16.543	8.566	7.337	16.099	
Unit 2																								
2	12.600	13.074	26.843	14.281	61.554	15.340	54.475	48.041	11.220	87.836	5.025	196.440	5.243	23.516	26.883	54.072	45.669	7.834	20.078	11.157	39.578	9.369	27.589	
3	2.980	7.200	7.266	13.036	7.413	32.676	9.483	32.813	28.460	7.063	53.043	3.271	126.410	3.452	15.307	17.730	35.028	29.647	5.149	12.581	6.956	23.147	5.147	
4	4.005	1.050	2.633	2.874	4.226	3.187	18.170	5.219	18.573	15.239	3.967	28.128	1.898	71.826	2.062	9.303	10.500	20.820	18.190	3.061	6.932	3.497	11.774	
5	0.672	0.817	0.208	0.578	0.514	0.907	1.567	8.740	2.552	8.460	6.505	1.908	12.626	1.122	34.837	1.099	4.606	5.578	11.419	9.293	1.357	2.452	1.332	
6+	0.104	0.158	0.195	0.089	0.077	0.091	0.413	0.920	4.724	3.300	5.071	5.324	3.272	7.508	4.137	20.881	10.603	7.785	7.157	9.517	8.283	3.192	1.984	
2 and Older	20.361	22.299	37.146	30.858	73.784	52.201	84.106	95.733	65.529	121.897	73.612	235.070	149.448	107.424	83.227	103.085	106.407	71.665	61.993	45.608	63.105	41.657	47.826	
3 and Older	7.761	9.225	10.303	16.577	12.230	36.861	29.632	47.692	54.308	34.061	68.587	38.630	144.206	83.908	56.344	49.013	60.737	63.831	41.915	34.451	23.527	32.288	20.237	
Unit 3																								
2	6.560	7.427	14.006	11.065	45.197	12.812	48.269	28.138	7.063	39.697	4.752	163.416	6.501	33.745	51.301	47.931	56.804	6.741	28.689	13.114	15.066	8.141	17.507	
3	1.536	3.788	4.611	8.931	7.012	29.359	8.336	31.287	18.071	4.546	25.783	3.120	108.588	4.311	21.310	34.140	32.035	37.675	4.507	18.457	8.454	9.697	5.354	
4	1.014	0.809	2.230	2.715	4.974	4.258	18.854	5.291	19.906	11.312	2.826	15.962	1.936	61.245	2.659	13.510	22.366	20.534	24.784	2.729	11.127	5.002	5.517	
5	0.450	0.333	0.411	1.134	1.397	2.811	2.679	11.483	3.290	11.954	6.654	1.667	9.253	1.072	35.301	1.614	8.496	13.514	13.075	13.833	1.617	6.133	2.611	
6+	0.195	0.234	0.292	0.353	0.709	1.103	2.405	3.061	8.972	7.392	11.385	10.591	7.158	7.488	4.874	24.383	16.300	14.647	17.725	17.230	17.738	10.345	8.147	
2 and Older	9.755	12.591	21.550	24.198	59.290	50.342	80.544	79.261	57.301	74.902	51.400	194.756	133.435	107.862	115.445	121.579	136.000	93.110	88.780	65.362	54.003	39.318	39.137	
3 and Older	3.196	5.165	7.543	13.133	14.093	37.530	32.275	51.123	50.238	35.205	46.648	31.340	126.934	74.116	64.144	73.647	79.197	86.369	60.091	52.249	38.936	31.177	21.629	
Unit 4																								
2	0.129	1.147	0.670	0.295	3.515	1.382	11.323	2.410	1.614	6.097	1.111	8.585	0.720	6.530	6.870	5.561	8.776	0.837	9.536	2.154	3.427	0.742	4.860	
3	0.142	0.083	0.755	0.441	0.194	2.354	0.915	7.552	1.615	1.081	4.071	0.735	5.670	0.479	4.313	4.559	3.723	5.815	0.553	5.967	1.371	2.143	0.449	
4	0.022	0.068	0.048	0.432	0.250	0.127	1.488	0.602	5.043	1.067	0.704	2.609	0.454	3.287	0.309	2.775	2.996	2.326	3.514	0.330	3.218	0.764	1.250	
5	0.042	0.008	0.033	0.023	0.211	0.156	0.078	0.960	0.401	3.254	0.671	0.436	1.558	0.253	2.073	0.195	1.769	1.775	1.365	1.863	0.167	1.648	0.442	
6+	0.074	0.038	0.021	0.025	0.023	0.138	0.176	0.163	0.743	0.716	2.439	1.870	1.338	1.518	1.116	1.970	1.346	1.802	1.996	1.628	1.640	0.871	1.368	
2 and Older	0.409	1.344	1.526	1.216	4.193	4.157	13.980	11.686	9.417	12.215	8.996	14.235	9.740	12.068	14.680	15.059	18.610	12.555	16.965	11.942	9.823	6.168	8.370	
3 and Older	0.280	0.197	0.856	0.921	0.678	2.775	2.657	9.276	7.802	6.118	7.886	5.650	9.020	5.538	7.810	9.498	9.835	11.719	7.428	9.788	6.396	5.426	3.510	

Table 1.8. Projection of the 2016 Lake Erie Yellow Perch population. Stock size estimates are derived from ADMB 2015 abundance and survival, and incoming age-2 estimates for 2016 are derived from multi-model averaging of generalized linear models of ADMB age-2 abundance against YOY and yearling survey indices (see Appendix A) in an R program. Standard errors are produced from ADMB catch-age and MMI analyses.

Unit	Age	2015 Parameters										2016 Parameters										3-yr Mean Weight in Pop'n. (kg)		millions kg		millions lbs.		
		Stock Size (millions of fish)					Mortality Rates					Survival Rate					Stock Size (millions of fish)					Age	Mean	Max.	2015	2016	2015	2016
		Mean	Std. Error	Min.	Max.	(F)	(Z)	(A)	(U)	(S)	(F)	(Z)	(A)	(U)	(S)	Min.	Mean	Max.										
Unit 1	2	21.474	12.857	8.617	34.331	0.131	0.531	0.412	0.102	0.588	0.131	0.531	0.412	0.102	0.588	34.434	39.997	46.459	0.078	1.696	3.120	6.879						
	3	3.763	1.683	2.081	5.446	0.321	0.721	0.514	0.229	0.486	0.321	0.721	0.514	0.229	0.486	5.067	12.627	20.187	0.118	0.470	1.486	3.276						
	4	0.608	0.248	0.360	0.856	0.369	0.769	0.537	0.257	0.463	0.369	0.769	0.537	0.257	0.463	1.012	1.830	2.648	0.142	0.091	0.260	0.573						
	5	1.660	0.703	0.957	2.363	0.343	0.743	0.524	0.242	0.476	0.343	0.743	0.524	0.242	0.476	0.167	0.282	0.397	0.160	0.257	0.045	0.100						
	6+	1.306	0.565	0.742	1.871	0.428	0.828	0.563	0.291	0.437	0.428	0.828	0.563	0.291	0.437	0.779	1.360	1.941	0.199	0.273	0.271	0.598						
	Total (3+)	28.811	12.756	44.866	44.866	0.182	0.582	0.441	0.138	0.559	0.182	0.582	0.441	0.138	0.559	41.458	56.096	71.632	0.092	2.788	5.182	11.426						
		7.337	4.140	10.535	10.535	0.348	0.748	0.527	0.245	0.473	0.348	0.748	0.527	0.473	7.025	16.099	25.173	0.128	1.092	2.062	4.547							
Unit 2	2	9.369	4.962	4.407	14.330	0.199	0.599	0.451	0.150	0.549	0.199	0.599	0.451	0.150	0.549	25.379	27.589	29.990	0.090	0.928	2.474	5.455						
	3	23.147	9.083	14.064	32.230	0.276	0.676	0.491	0.201	0.509	0.276	0.676	0.491	0.201	0.509	2.421	5.147	7.873	0.132	3.079	0.678	1.494						
	4	3.497	1.190	2.307	4.687	0.565	0.965	0.619	0.362	0.381	0.565	0.965	0.619	0.362	0.381	7.154	11.774	16.394	0.157	0.525	1.845	4.067						
	5	2.452	0.895	1.558	3.347	0.612	1.012	0.637	0.385	0.363	0.612	1.012	0.637	0.385	0.363	0.879	1.332	1.786	0.193	0.483	0.258	0.568						
	6+	3.192	1.250	1.942	4.442	0.672	1.072	0.658	0.412	0.342	0.672	1.072	0.658	0.412	0.342	1.231	1.984	2.737	0.257	0.820	0.509	1.123						
	Total (3+)	41.657	24.278	59.036	59.036	0.322	0.722	0.514	0.229	0.486	0.322	0.722	0.514	0.229	0.486	37.064	47.826	58.779	0.120	5.834	5.763	12.707						
		32.288	19.871	44.706	44.706	0.361	0.761	0.533	0.253	0.467	0.361	0.761	0.533	0.467	11.685	20.237	28.789	0.163	4.907	3.289	7.252							
Unit 3	2	8.141	5.145	2.996	13.286	0.019	0.419	0.342	0.016	0.658	0.019	0.419	0.342	0.016	0.658	15.113	17.507	20.281	0.071	0.554	1.237	2.728						
	3	9.697	4.529	5.168	14.226	0.164	0.564	0.431	0.125	0.569	0.164	0.564	0.431	0.125	0.569	1.971	5.354	8.738	0.114	1.038	0.612	1.350						
	4	5.002	2.037	2.965	7.038	0.250	0.650	0.478	0.184	0.522	0.250	0.650	0.478	0.184	0.522	2.941	5.517	8.094	0.143	0.690	0.789	1.740						
	5	6.133	2.371	3.762	8.504	0.258	0.658	0.482	0.189	0.518	0.258	0.658	0.482	0.189	0.518	1.548	2.611	3.674	0.171	1.000	0.447	0.985						
	6+	10.345	3.676	6.669	14.021	0.333	0.733	0.520	0.236	0.480	0.333	0.733	0.520	0.236	0.480	5.153	8.147	11.141	0.171	2.514	1.893	4.174						
	Total (3+)	39.318	21.561	57.076	57.076	0.198	0.598	0.450	0.149	0.550	0.198	0.598	0.450	0.149	0.550	26.725	39.137	51.928	0.127	5.795	4.978	10.976						
		31.177	18.565	43.790	43.790	0.250	0.650	0.478	0.184	0.522	0.250	0.650	0.184	0.522	11.612	21.629	31.647	0.173	5.241	3.740	8.248							
Unit 4	2	0.742	0.478	0.264	1.220	0.102	0.502	0.395	0.080	0.605	0.102	0.502	0.395	0.080	0.605	3.397	4.860	6.952	0.090	0.077	0.436	0.961						
	3	2.143	1.069	1.074	3.211	0.139	0.539	0.417	0.107	0.583	0.139	0.539	0.417	0.107	0.583	0.160	0.449	0.739	0.158	0.334	0.071	0.156						
	4	0.764	0.349	0.415	1.113	0.147	0.547	0.421	0.113	0.579	0.147	0.547	0.421	0.113	0.579	0.626	1.250	1.873	0.213	0.334	0.071	0.156						
	5	1.648	0.760	0.889	2.408	0.212	0.612	0.458	0.159	0.542	0.212	0.612	0.458	0.159	0.542	0.240	0.442	0.644	0.267	0.445	0.118	0.260						
	6+	0.871	0.454	0.417	1.325	0.207	0.607	0.455	0.155	0.545	0.207	0.607	0.455	0.155	0.545	0.709	1.368	2.028	0.326	0.306	0.446	0.983						
	Total (3+)	6.168	3.058	3.058	9.278	0.164	0.564	0.431	0.125	0.569	0.164	0.564	0.431	0.125	0.569	5.132	8.370	12.236	0.160	1.319	1.336	2.947						
		5.426	2.794	8.057	8.057	0.173	0.573	0.436	0.131	0.564	0.173	0.573	0.436	0.131	0.564	1.735	3.510	5.284	0.257	1.242	0.901	1.986						

Table 2.1. Estimated harvest of Lake Erie Yellow Perch for 2016 using the proposed fishing policy and selectivity-at-age from combined fishing gears.

Age	2016				2016				3-yr Mean		2016 Harvest Range						
	Stock Size (millions of fish)				Exploitation Rate				Weight in		Catch (millions of kg)		Catch (millions of lbs)				
	Min.	Mean	Max.	F	s(age)	F(age)	(u)	Min.	Mean	Max.	Harvest (kg)	Min.	Mean	Max.	Min.	Mean	Max.
Unit 1																	
2	34.434	39.997	46.459	0.670	0.189	0.127	0.098	3.390	3.937	4.574	0.102	0.346	0.402	0.467	0.762	0.886	1.029
3	5.067	12.627	20.187	0.670	0.607	0.407	0.279	1.414	3.525	5.635	0.128	0.181	0.451	0.721	0.399	0.995	1.590
4	1.012	1.830	2.648	0.670	0.770	0.516	0.338	0.342	0.618	0.895	0.143	0.049	0.088	0.128	0.108	0.195	0.282
5	0.167	0.282	0.397	0.670	0.777	0.521	0.340	0.057	0.096	0.135	0.159	0.009	0.015	0.021	0.020	0.034	0.047
6+	0.779	1.360	1.941	0.670	0.818	0.548	0.354	0.276	0.482	0.687	0.172	0.047	0.083	0.118	0.105	0.183	0.261
Total (3+)	41.458	56.096	71.632		0.154		0.293	5.479	8.658	11.925	0.120	0.632	1.039	1.455	1.394	2.292	3.209
	7.025	16.099	25.173		0.293			2.089	4.720	7.352	0.135	0.286	0.638	0.989	0.632	1.406	2.180
Unit 2																	
2	25.379	27.589	29.990	0.670	0.177	0.119	0.093	2.348	2.553	2.775	0.129	0.303	0.329	0.358	0.668	0.726	0.789
3	2.421	5.147	7.873	0.670	0.368	0.247	0.182	0.440	0.935	1.429	0.137	0.060	0.128	0.196	0.133	0.282	0.432
4	7.154	11.774	16.394	0.670	0.743	0.498	0.329	2.350	3.868	5.386	0.143	0.336	0.553	0.770	0.741	1.220	1.698
5	0.879	1.332	1.786	0.670	0.766	0.513	0.337	0.296	0.468	0.601	0.155	0.046	0.069	0.093	0.101	0.153	0.205
6+	1.231	1.984	2.737	0.670	0.809	0.542	0.351	0.432	0.697	0.961	0.179	0.077	0.125	0.172	0.171	0.275	0.379
Total (3+)	37.064	47.826	58.779		0.178		0.294	5.866	8.501	11.152	0.142	0.822	1.205	1.589	1.814	2.656	3.504
	11.685	20.237	28.789		0.294			3.518	5.948	8.377	0.147	0.520	0.875	1.231	1.146	1.930	2.715
Unit 3																	
2	15.113	17.507	20.281	0.700	0.080	0.056	0.045	0.680	0.787	0.912	0.116	0.079	0.091	0.106	0.174	0.201	0.233
3	1.971	5.354	8.738	0.700	0.342	0.239	0.177	0.349	0.947	1.545	0.132	0.046	0.125	0.204	0.101	0.276	0.450
4	2.941	5.517	8.094	0.700	0.646	0.452	0.304	0.895	1.679	2.463	0.148	0.132	0.248	0.365	0.292	0.548	0.804
5	1.548	2.611	3.674	0.700	0.676	0.473	0.316	0.489	0.824	1.160	0.163	0.080	0.134	0.189	0.176	0.296	0.417
6+	5.153	8.147	11.141	0.700	0.732	0.512	0.336	1.732	2.738	3.744	0.180	0.312	0.493	0.674	0.687	1.087	1.486
Total (3+)	26.725	39.137	51.928		0.178		0.286	4.143	6.975	9.825	0.157	0.649	1.092	1.537	1.430	2.408	3.390
	11.612	21.629	31.647		0.286			3.464	6.188	8.913	0.162	0.570	1.001	1.432	1.256	2.206	3.157
Unit 4																	
2	3.397	4.860	6.952	0.300	0.132	0.040	0.032	0.109	0.156	0.223	0.138	0.015	0.021	0.031	0.033	0.047	0.068
3	0.160	0.449	0.739	0.300	0.335	0.101	0.079	0.013	0.036	0.058	0.151	0.002	0.005	0.009	0.004	0.012	0.019
4	0.626	1.250	1.873	0.300	0.486	0.146	0.112	0.070	0.140	0.210	0.167	0.012	0.023	0.035	0.026	0.052	0.078
5	0.240	0.442	0.644	0.300	0.737	0.221	0.165	0.040	0.073	0.106	0.204	0.008	0.015	0.022	0.018	0.033	0.048
6+	0.709	1.368	2.028	0.300	0.731	0.219	0.163	0.116	0.224	0.332	0.234	0.027	0.052	0.078	0.060	0.115	0.171
Total (3+)	5.132	8.370	12.236		0.075		0.135	0.347	0.628	0.929	0.187	0.064	0.118	0.174	0.141	0.259	0.384
	1.735	3.510	5.284		0.135			0.238	0.472	0.706	0.203	0.049	0.096	0.143	0.108	0.212	0.316

Table 2.2. Lake Erie Yellow Perch fishing rates and the Recommended Allowable Harvest (RAH; in millions of pounds) for 2016 by Management Unit (Unit).

Unit	Fishing Rate	Recommended Allowable Harvest (millions lbs.)		
		MIN	MEAN	MAX
1	0.670	1.394	2.292	3.209
2	0.670	1.814	2.656	3.504
3	0.700	1.430	2.408	3.390
4	0.300	0.141	0.259	0.384
Total		4.779	7.615	10.487

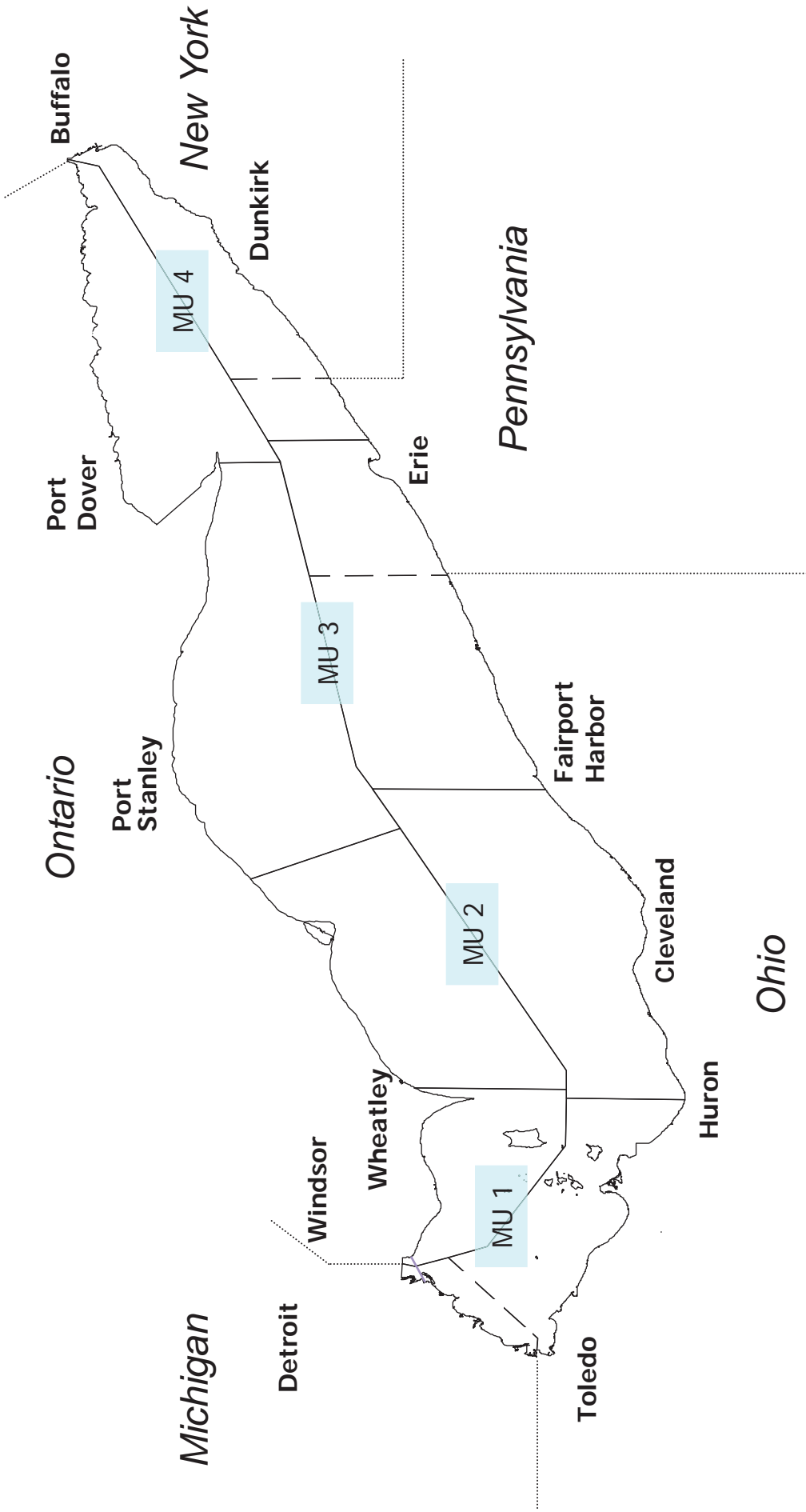


Figure 1.1. The Yellow Perch Management Units (MUs) of Lake Erie defined by the YPTG and LEC, for illustrative purposes.

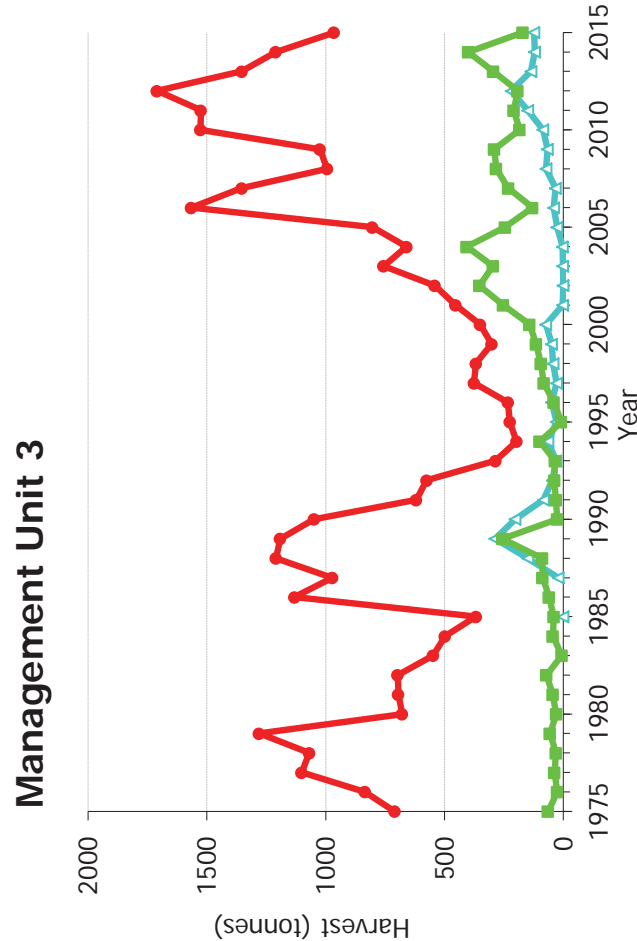
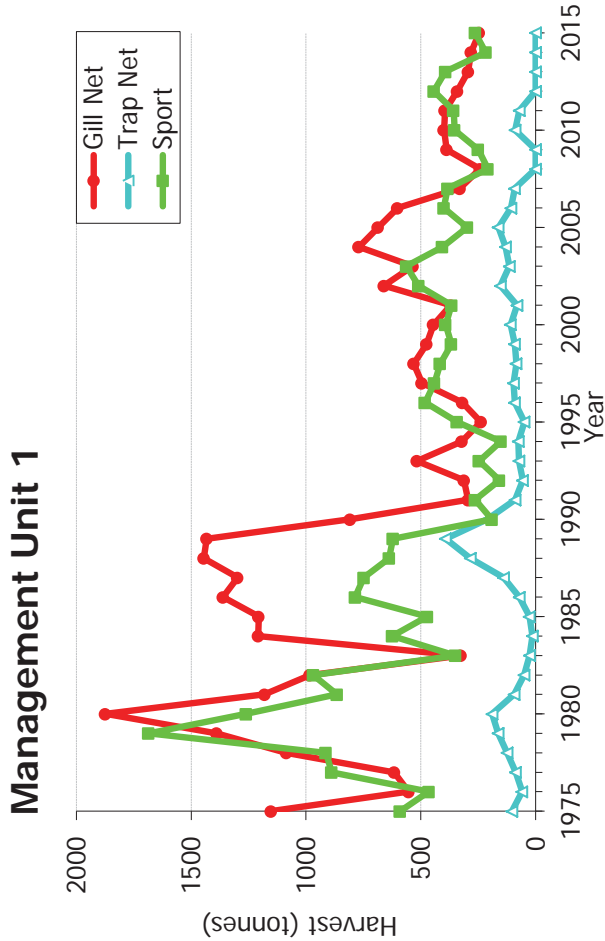
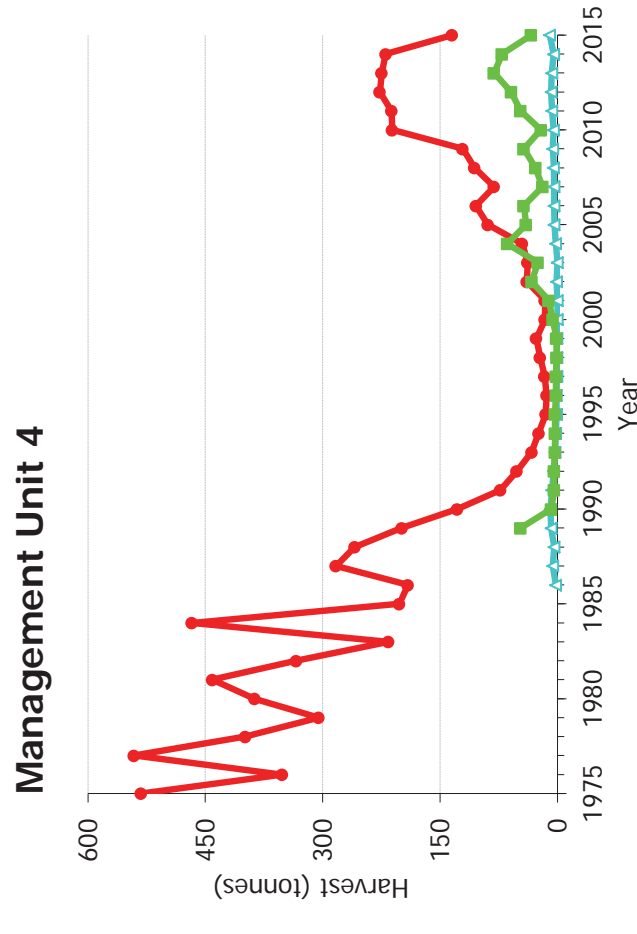
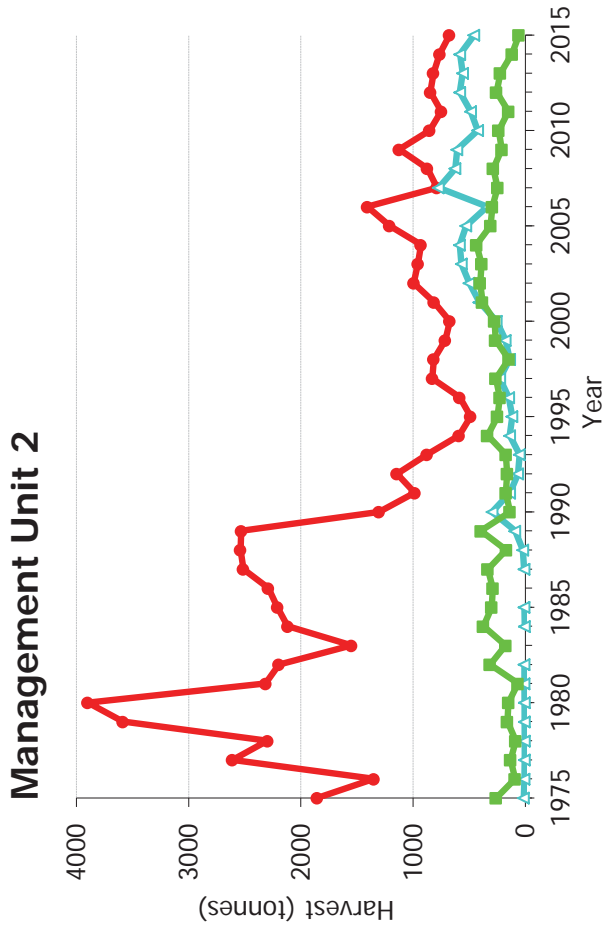


Figure 1.2. Historic Lake Erie Yellow Perch harvest (metric tonnes) by management unit and gear type.

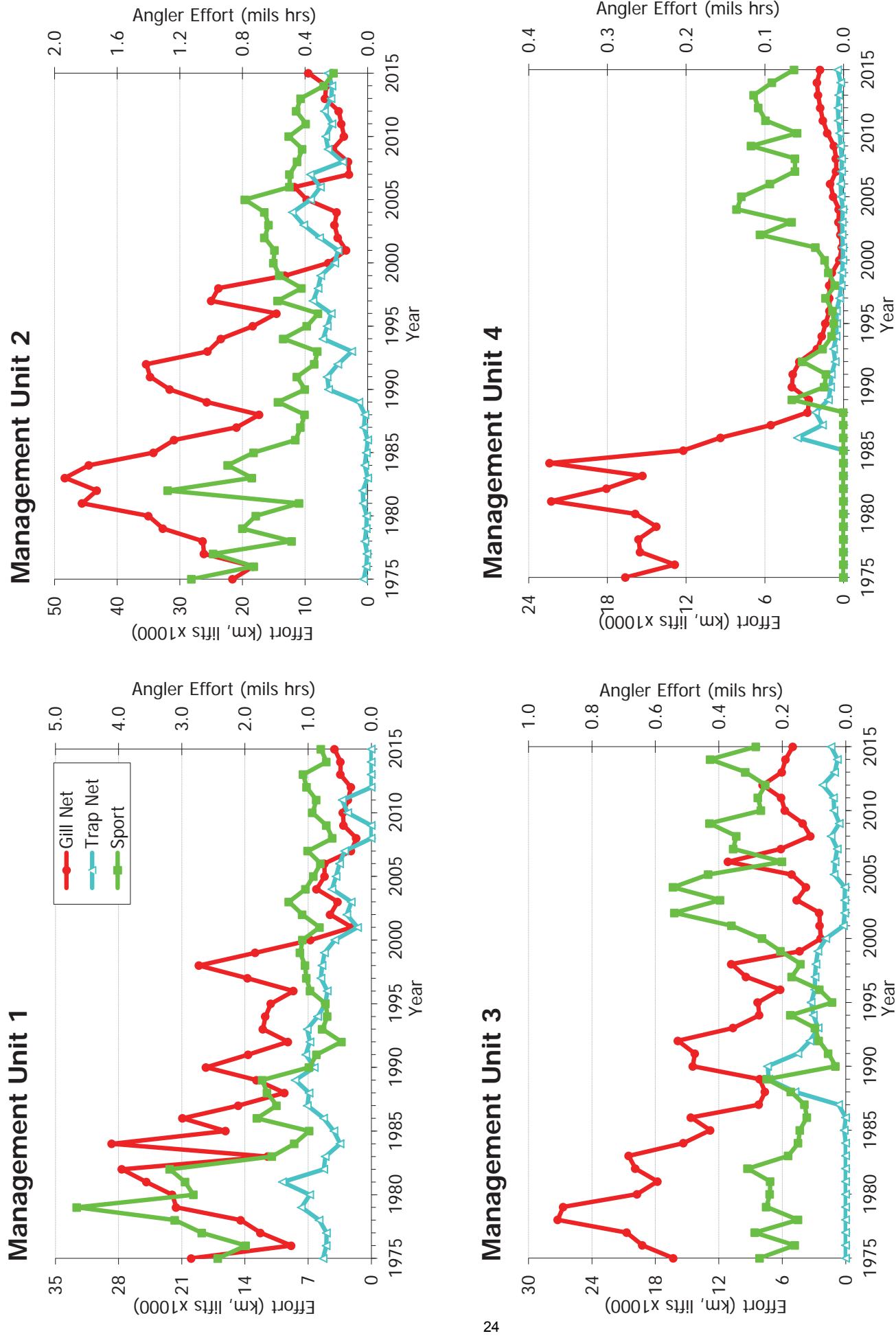


Figure 1.3. Historic Lake Erie Yellow Perch effort by management unit and gear type. Note: gill net effort presented is targeted effort with small mesh (< 3").

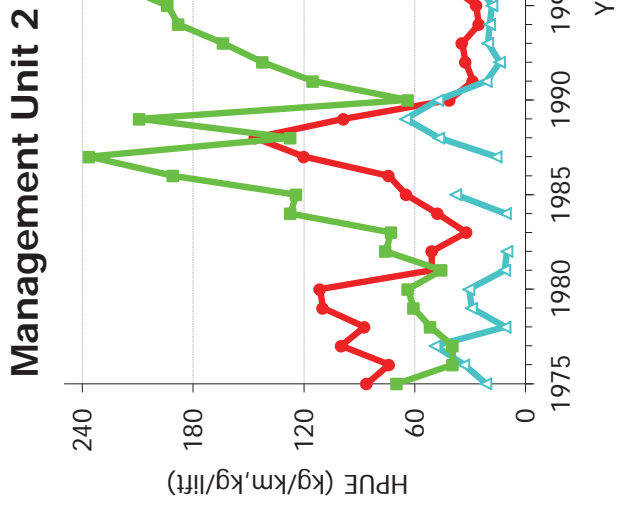
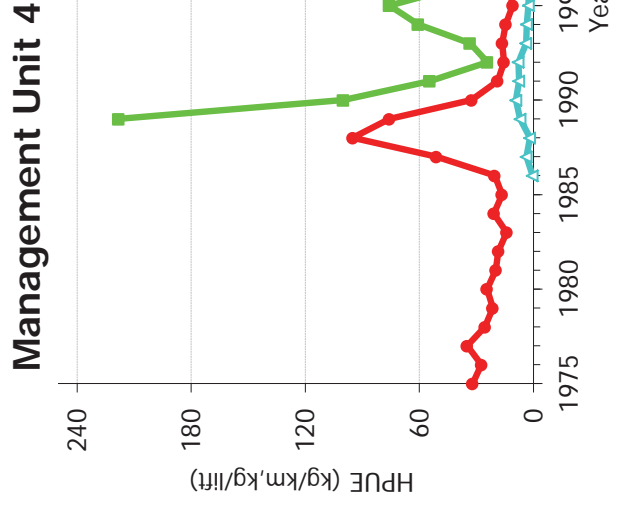
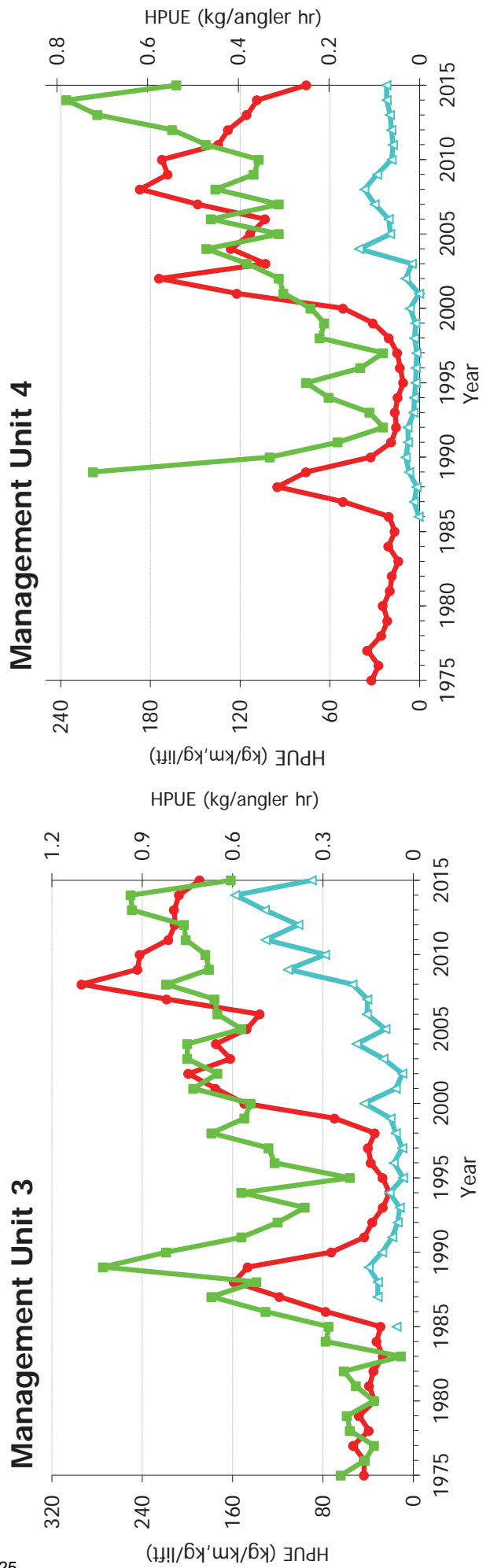
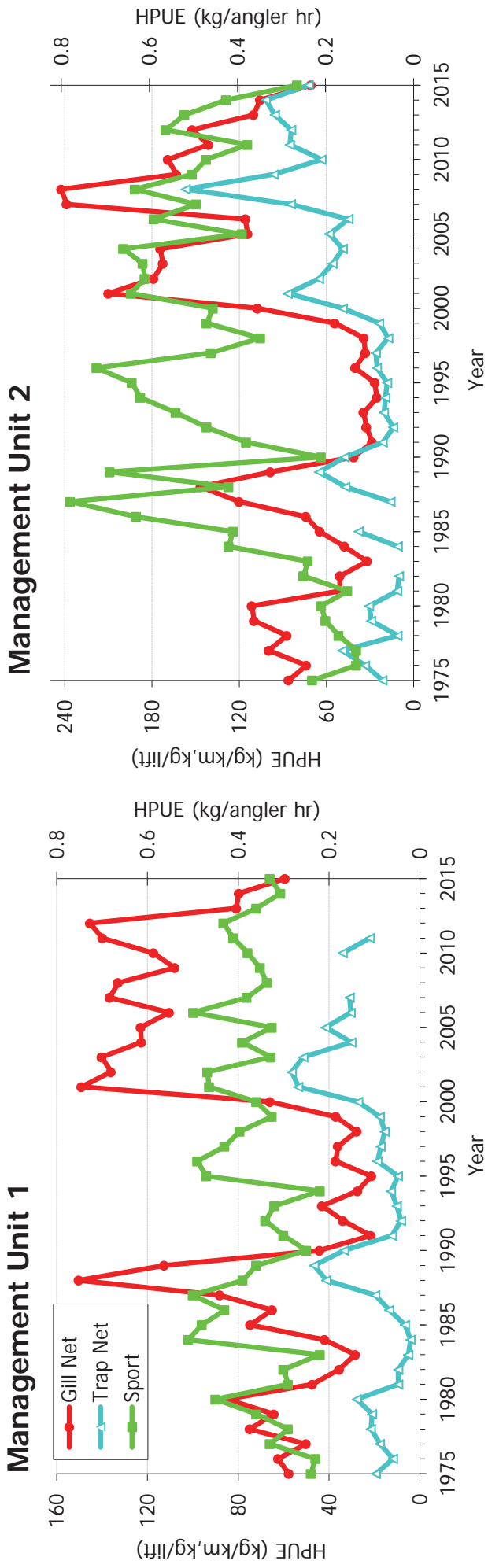


Figure 1.4. Historic Lake Erie Yellow Perch harvest per unit effort (HPUE) by management unit and gear type. Note: gill net CPUE for 2001 to 2015 is for small mesh (< 3") only.



Figure 1.5. Spatial distribution of Yellow Perch total harvest (lbs.) in 2015 by 10-minute grid.



Figure 1.6. Spatial distribution of Yellow Perch small mesh gill net effort (km) in 2015 by 10-minute grid.



Figure 1.7. Spatial distribution of Yellow Perch sport effort (angler hours) in 2015 by 10-minute grid.



Figure 1.8. Spatial distribution of Yellow Perch trap net effort (lifts) in 2015 by 10-minute grid.

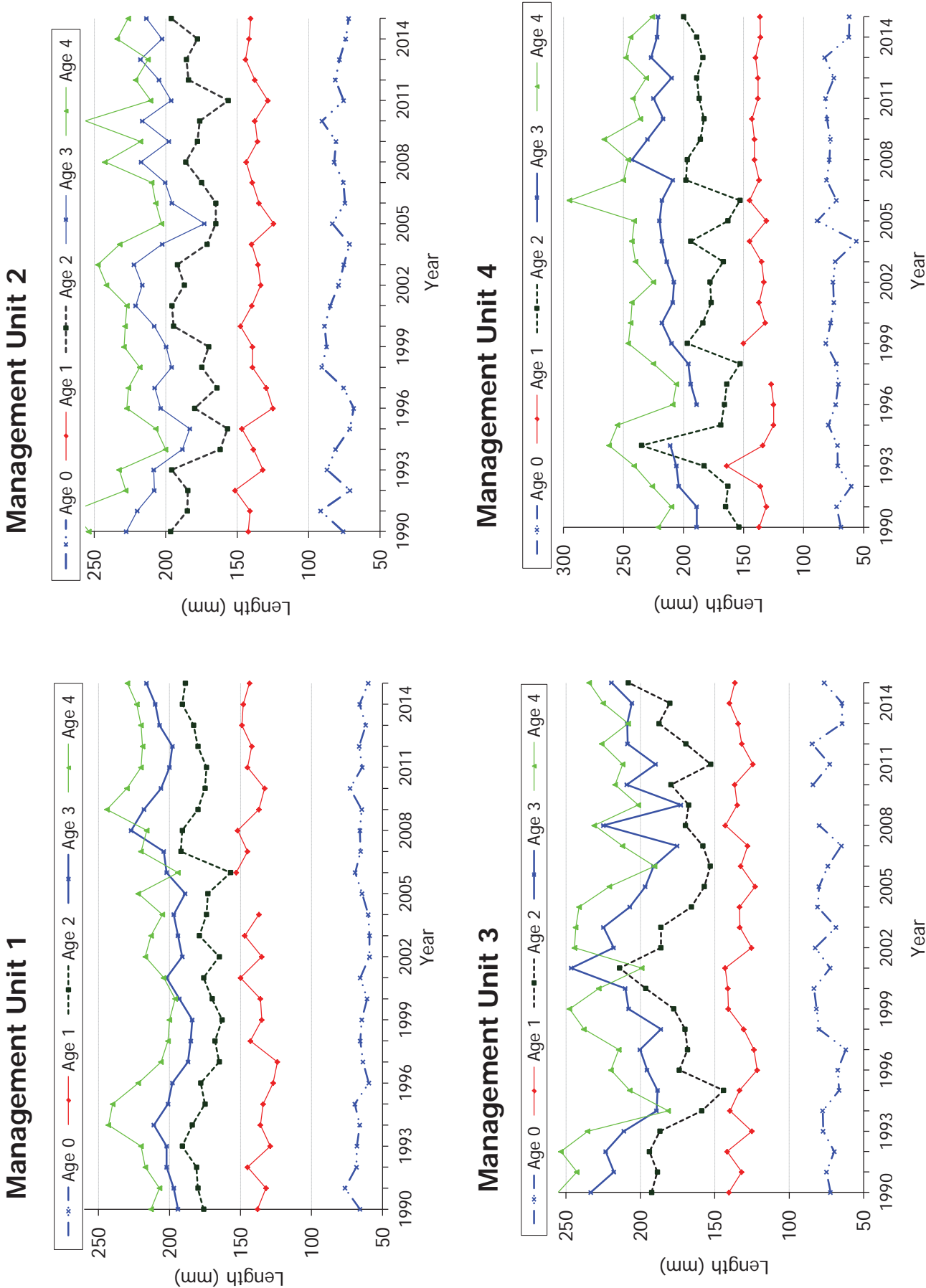
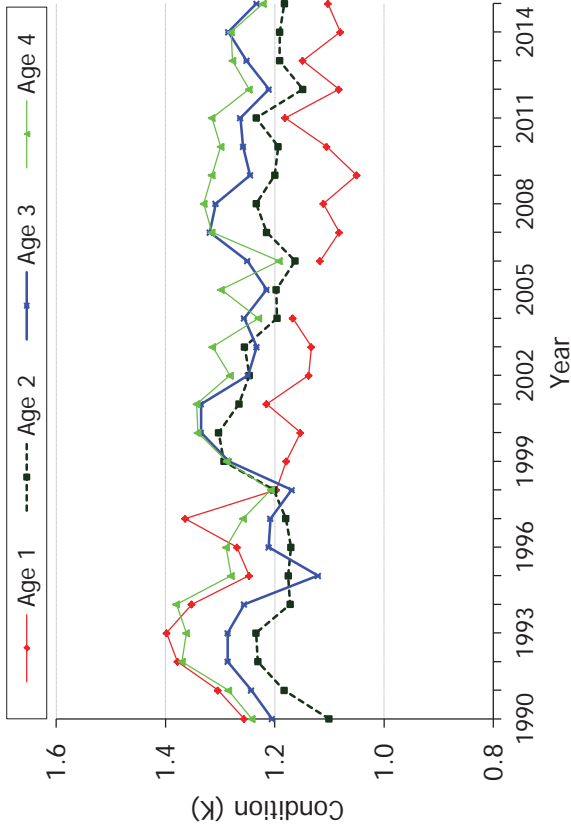
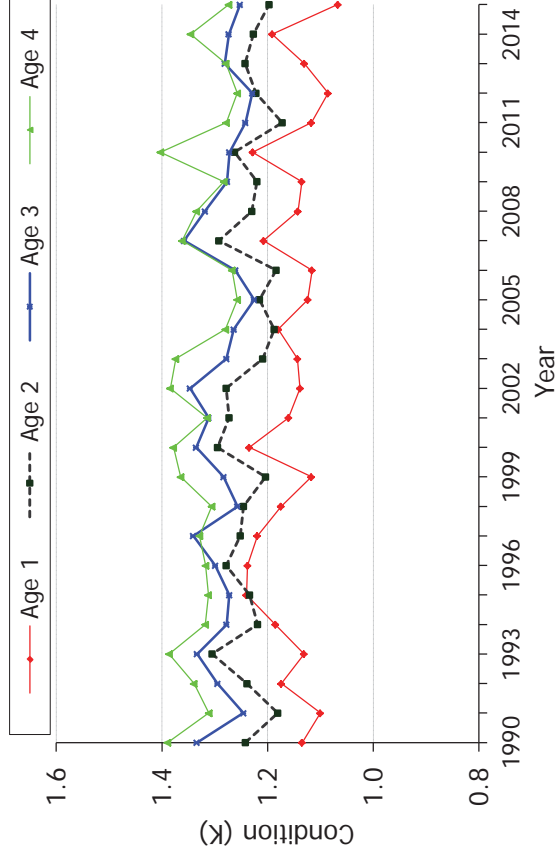


Figure 1.9. Yellow Perch total length-at-age from 1990-2015 fall interagency experimental samples for ages 0-4 by management unit (MU).

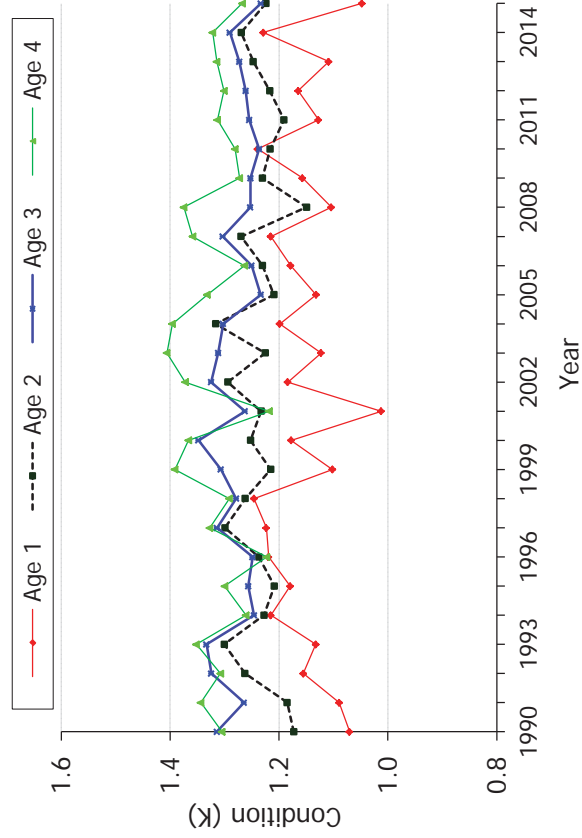
Management Unit 1



Management Unit 2



Management Unit 3



Management Unit 4

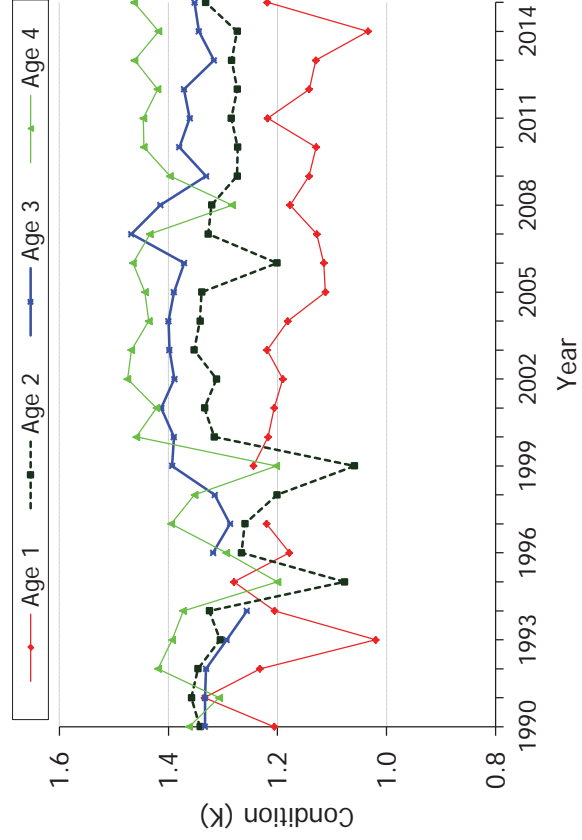


Figure 1.10. Yellow Perch condition (K) at age from 1990-2015 fall interagency experimental samples for ages 1-4 by management unit (MU).

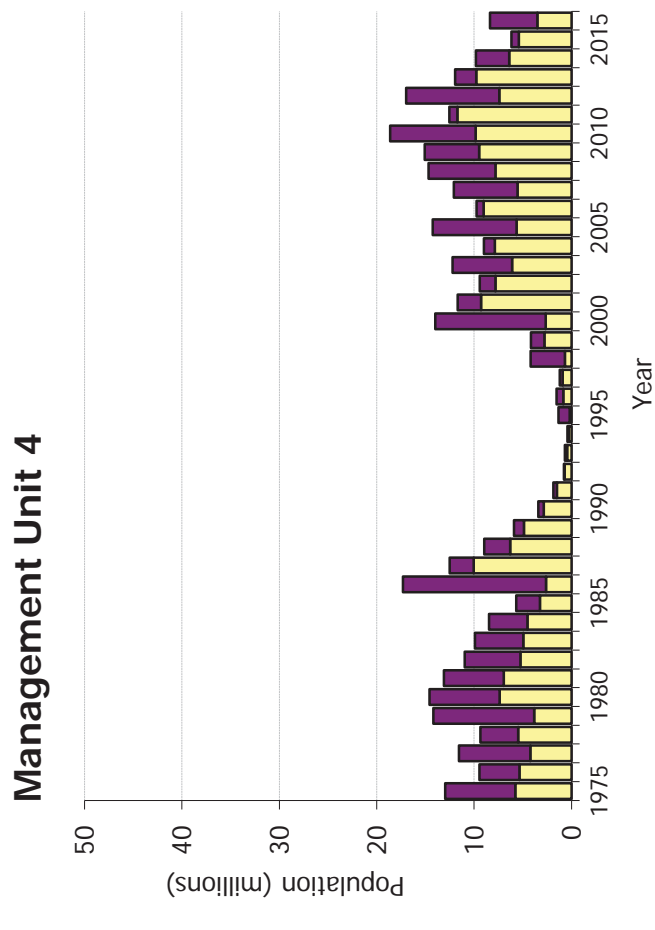
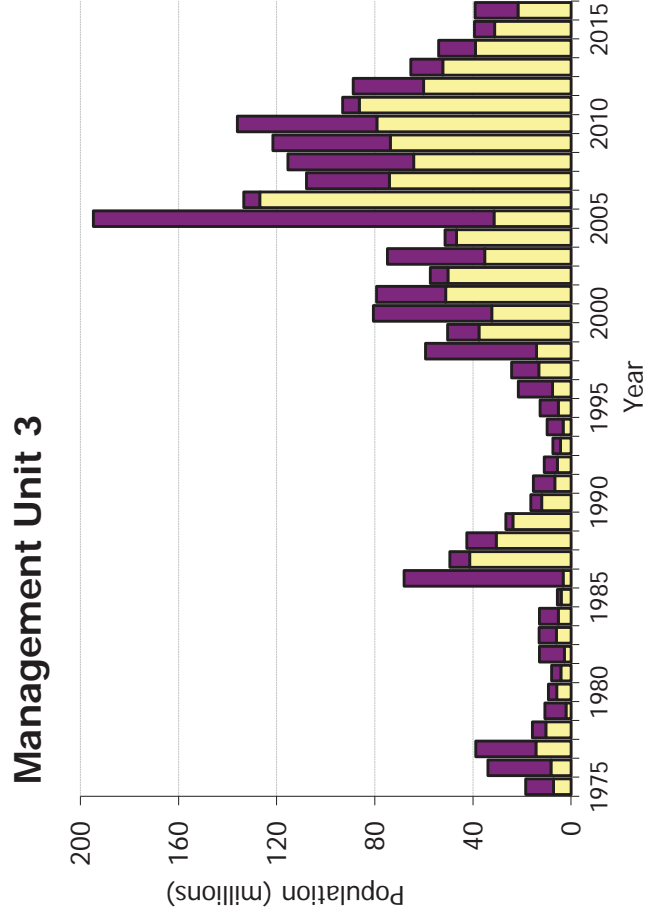
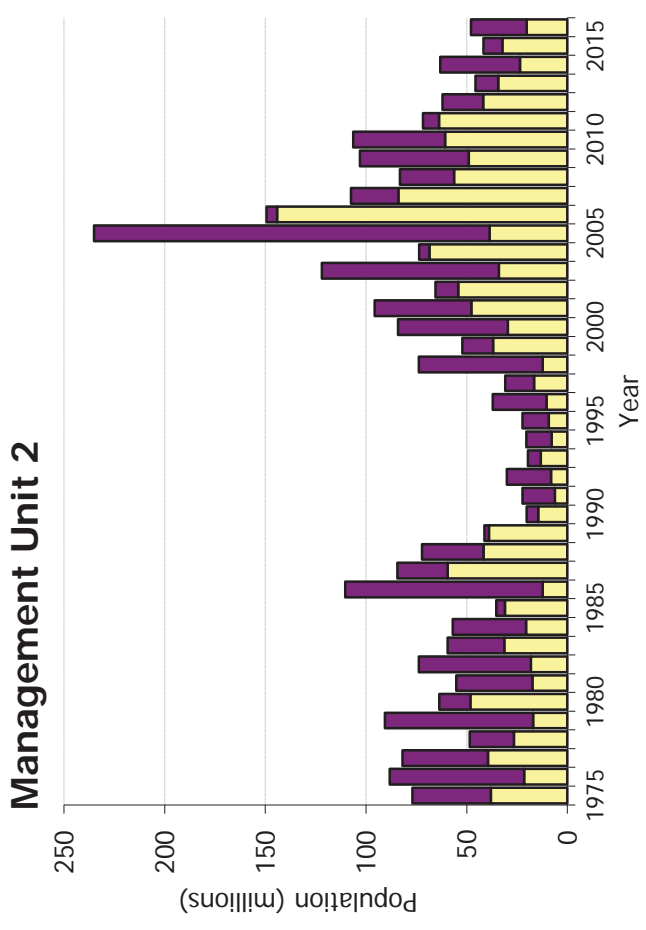
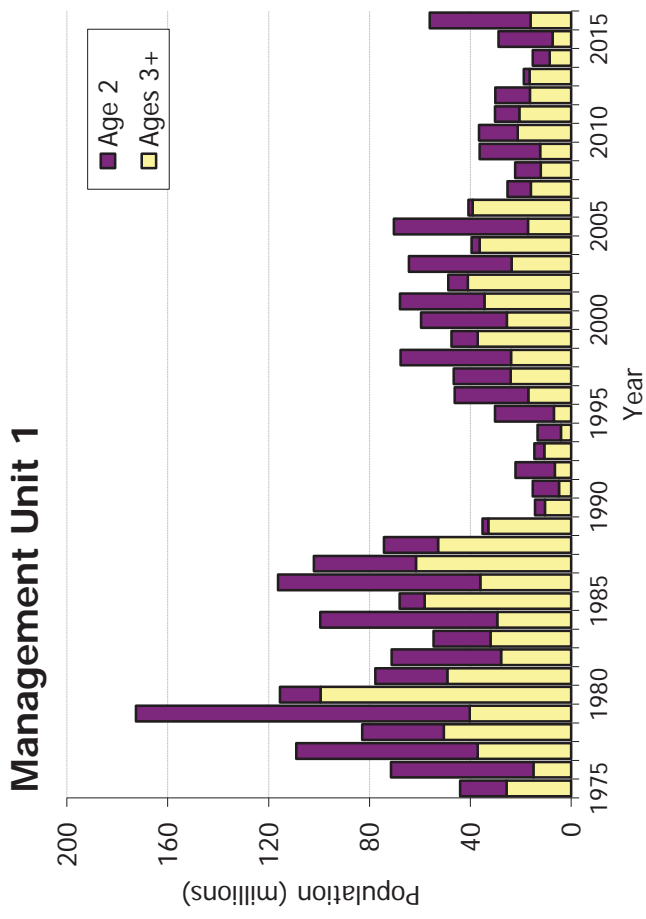


Figure 1.11. Lake Erie Yellow Perch population estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 2016 are from ADMI and regressions for age 2 from survey gears.

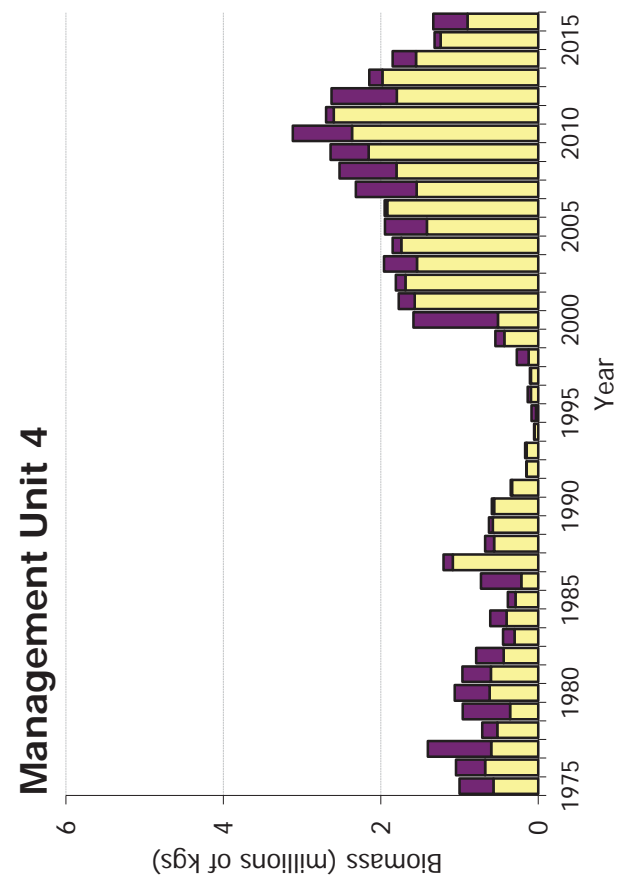
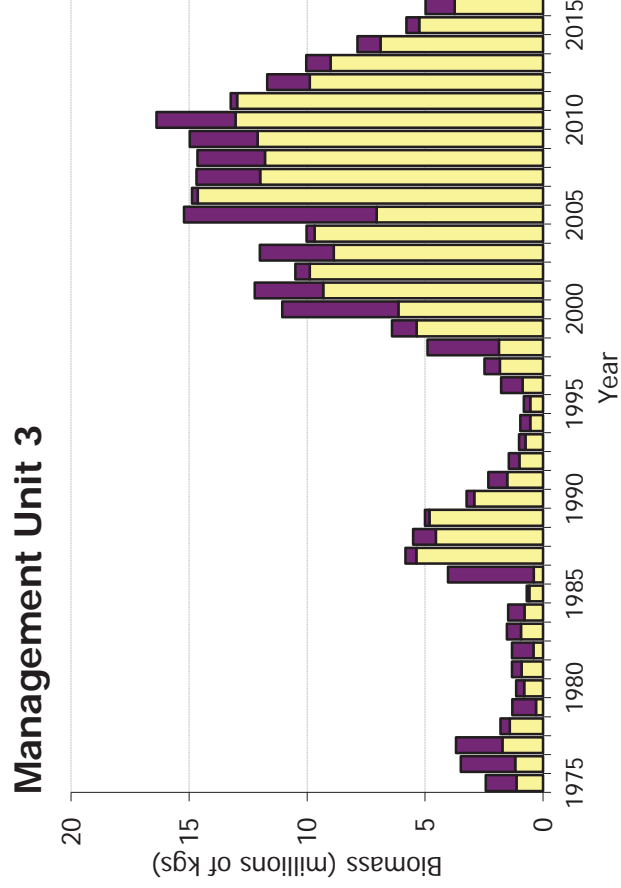
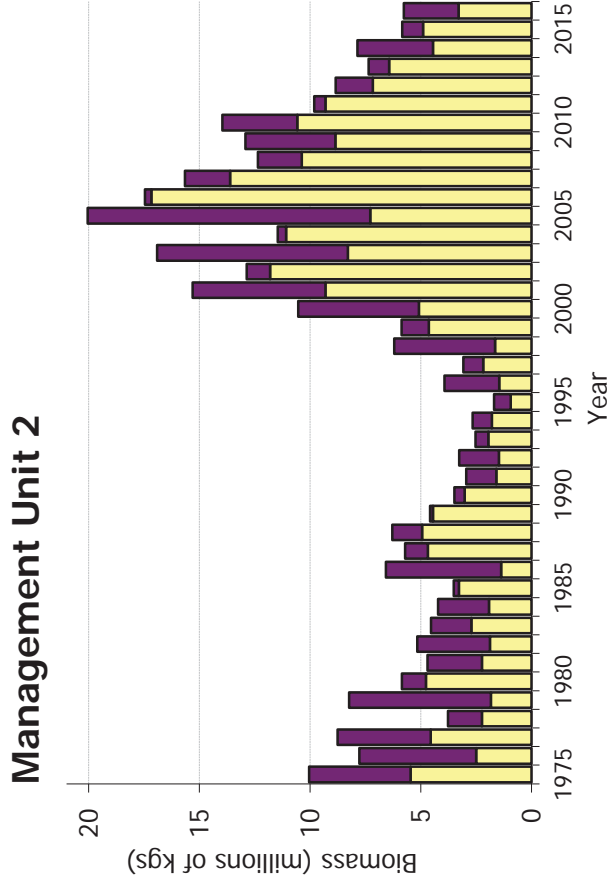
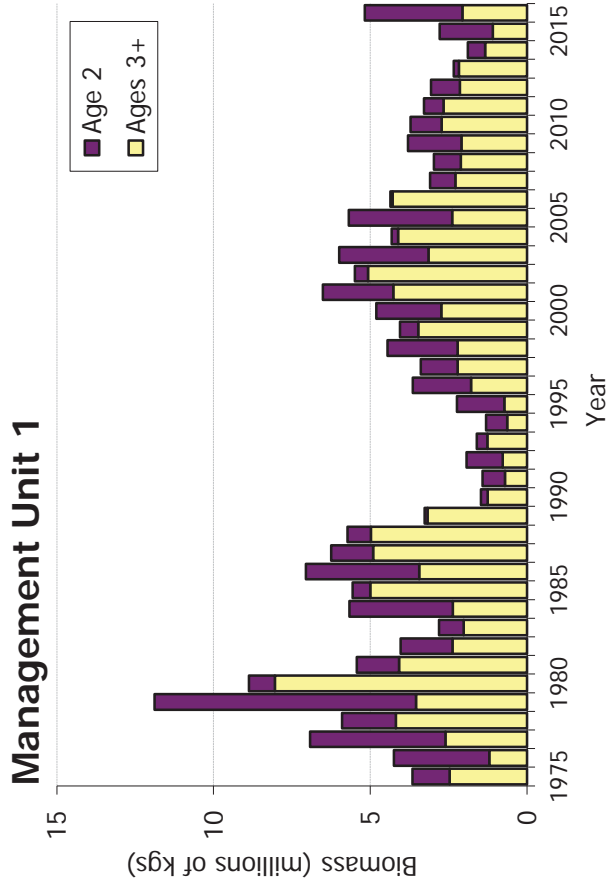


Figure 1.12. Lake Erie Yellow Perch biomass estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 2015 are from ADMB and regressions for age 2 from survey gears.

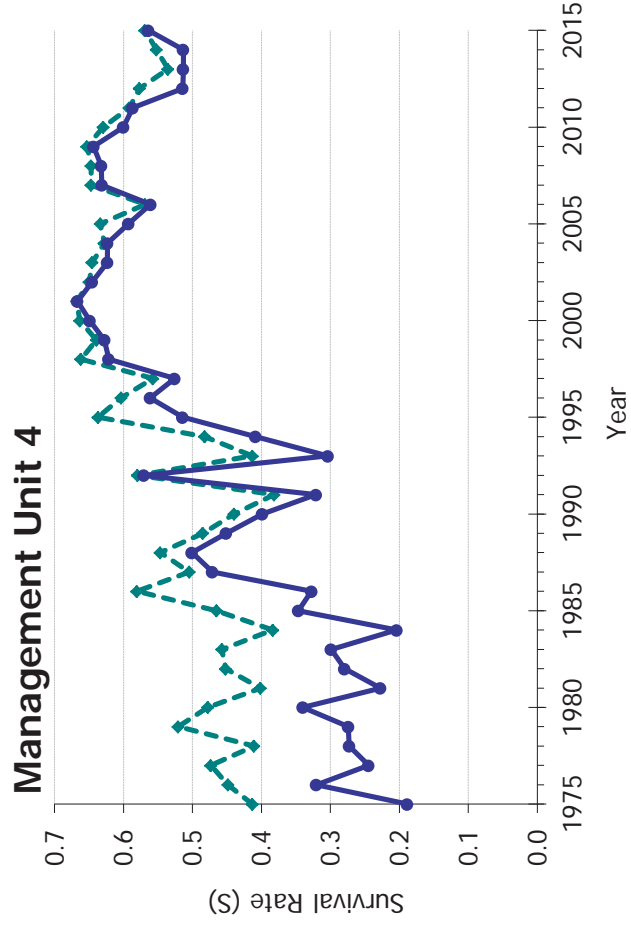
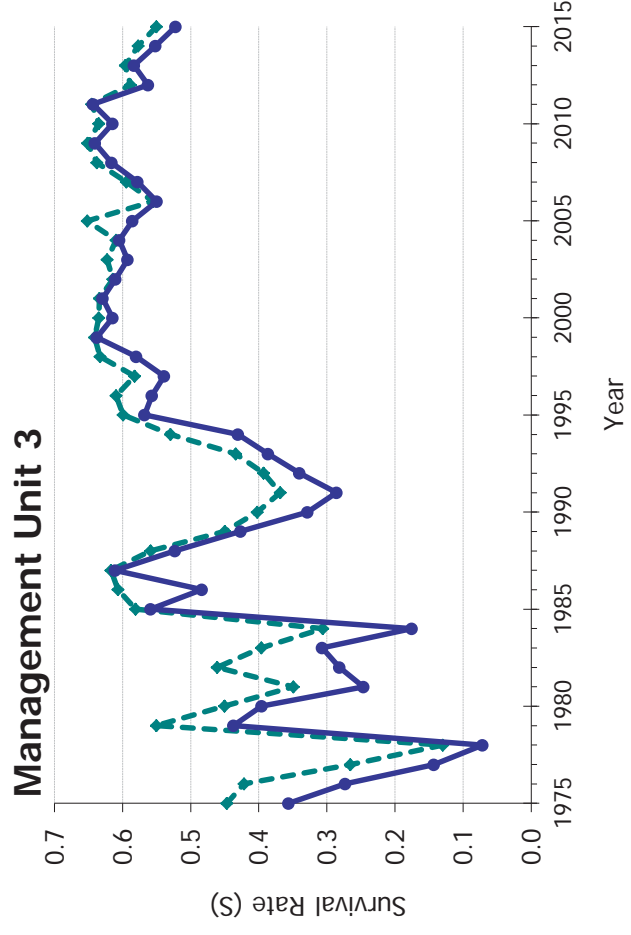
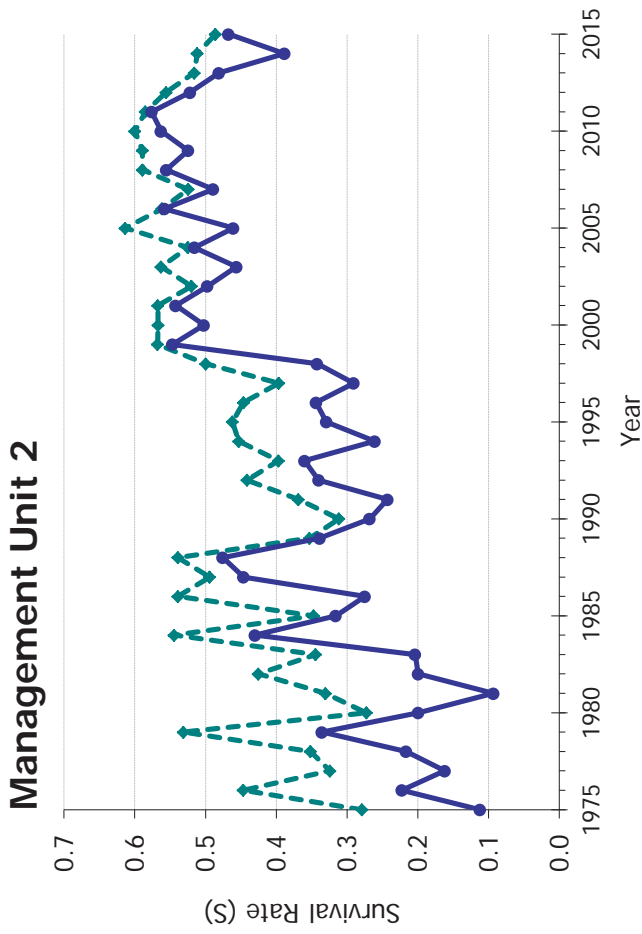
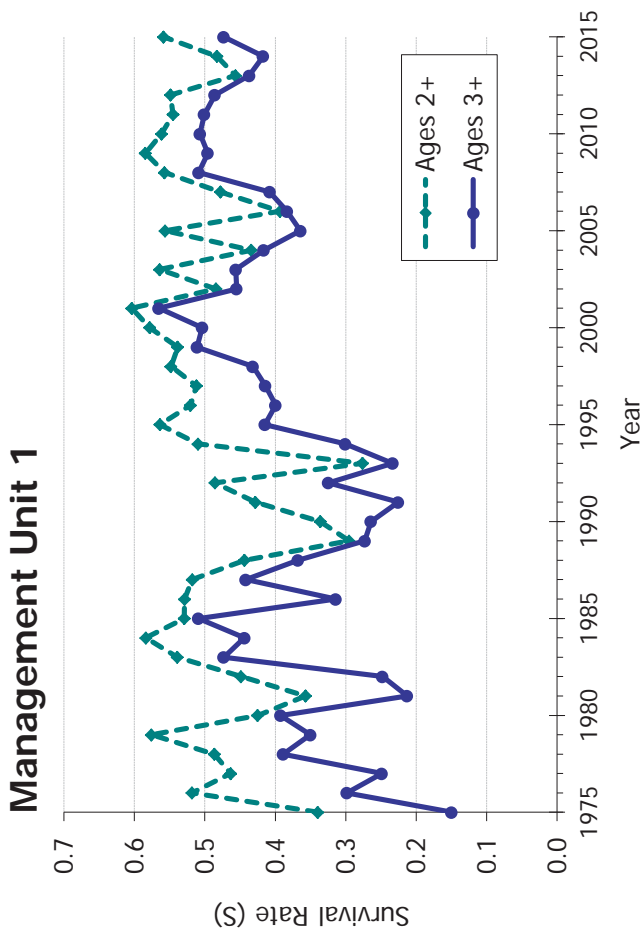


Figure 1.13. Lake Erie Yellow Perch survival rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from ADMB.

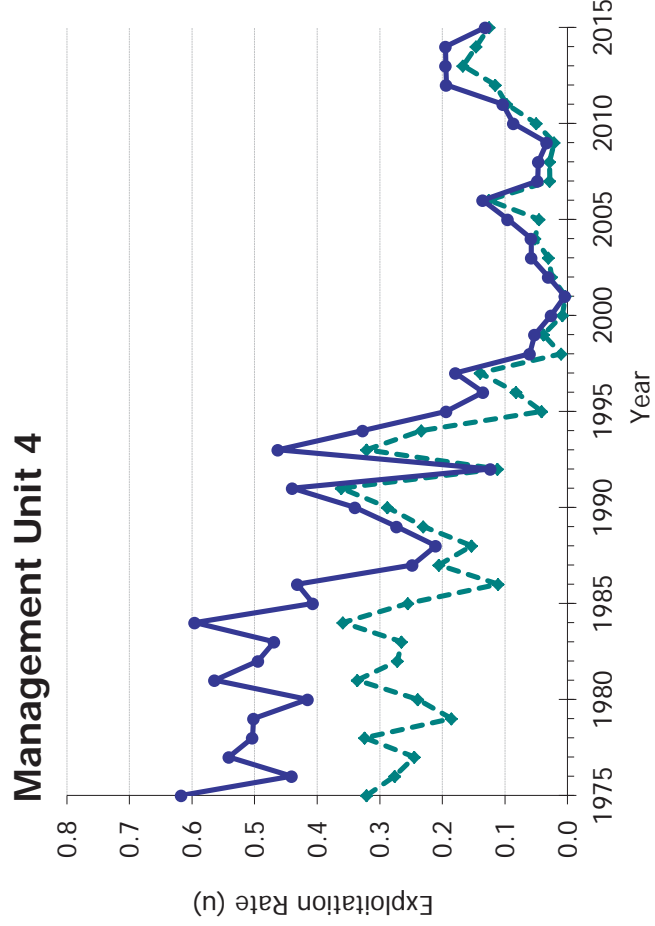
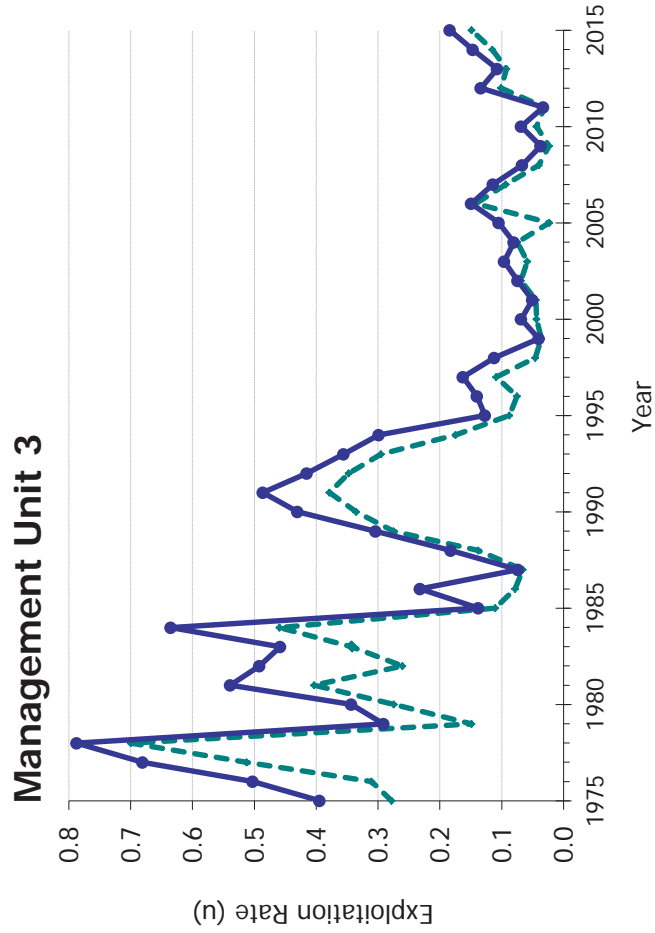
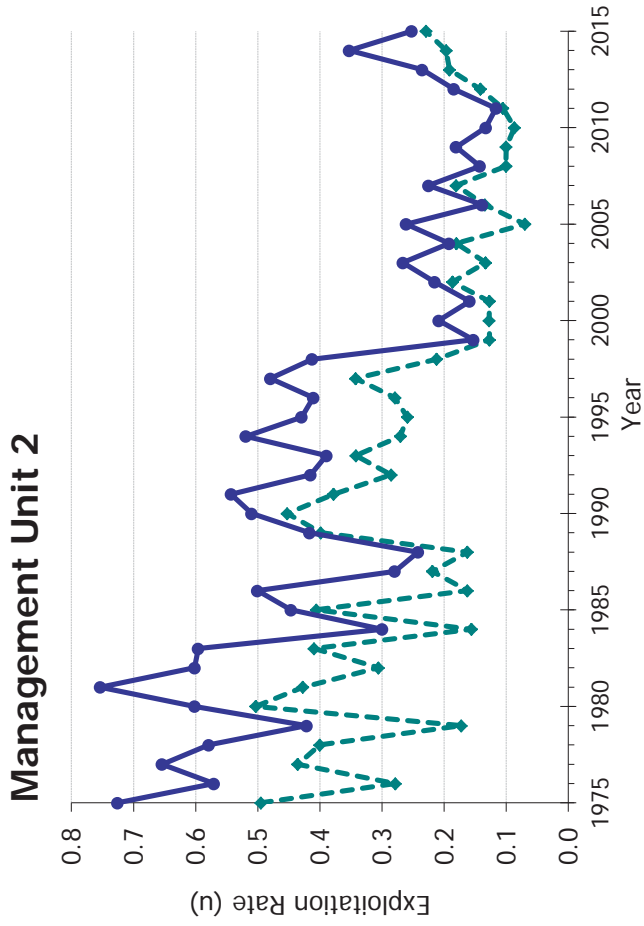
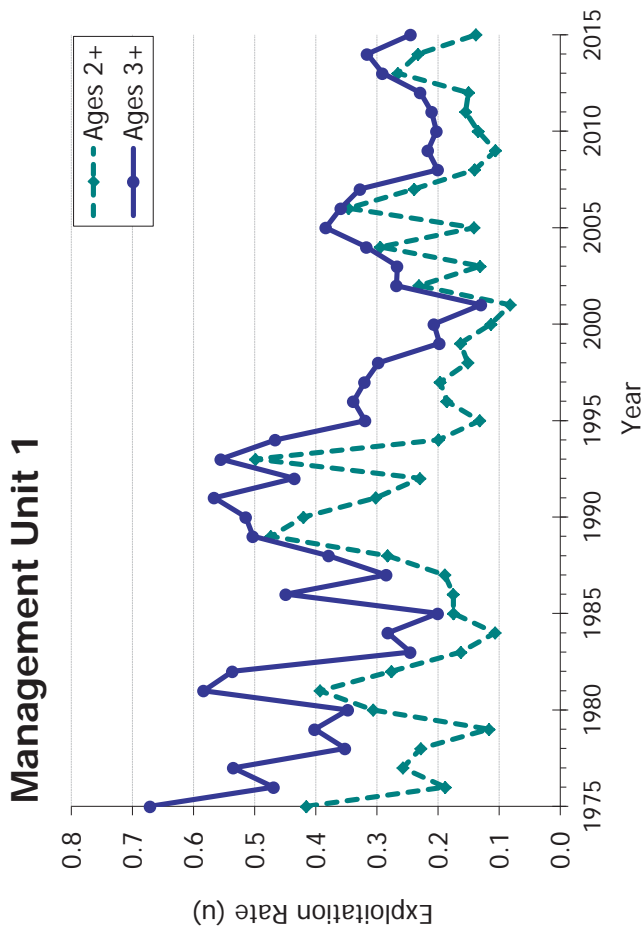
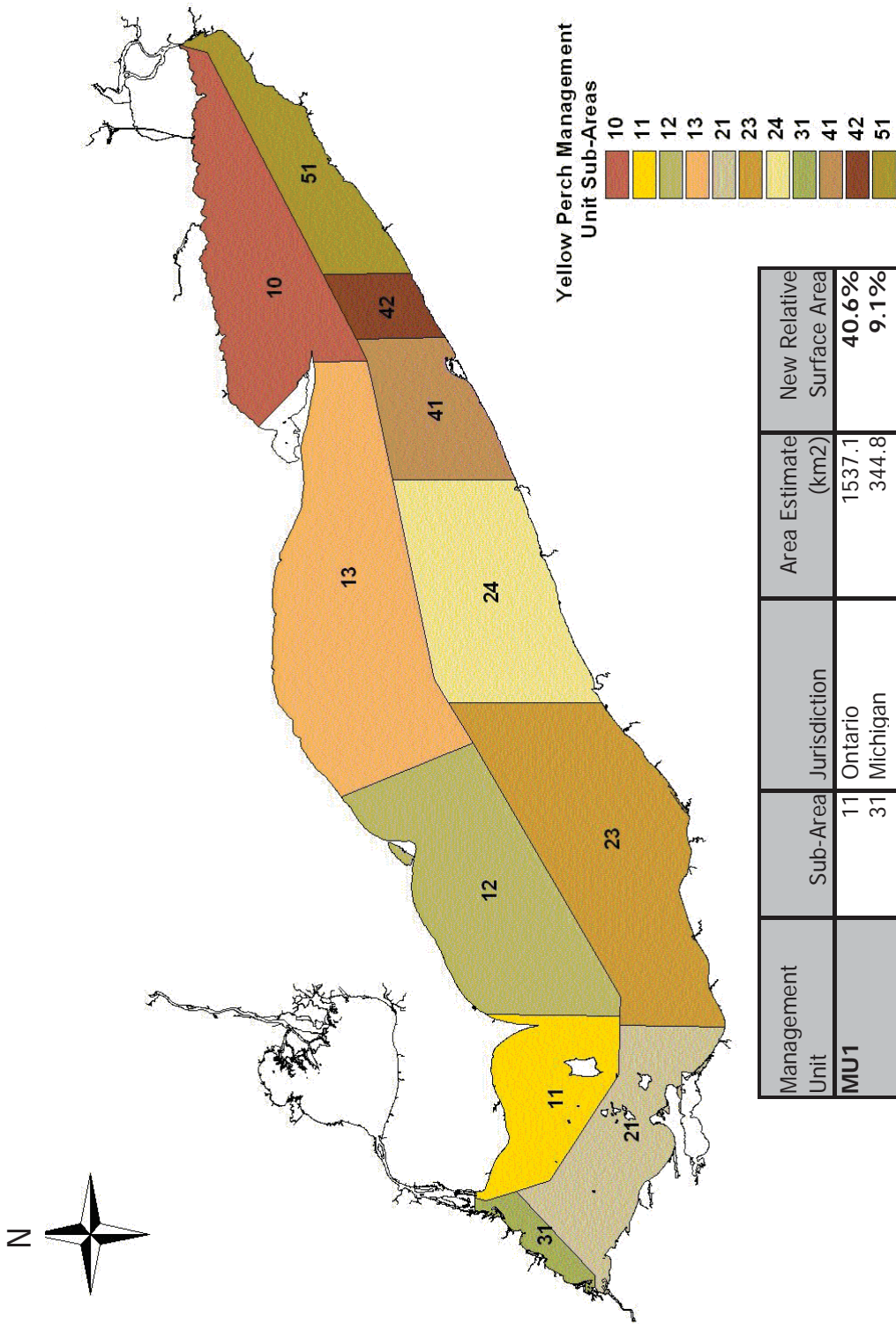


Figure 1.14. Lake Erie Yellow Perch exploitation rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from ADMB.



Management Unit	Sub-Area	Jurisdiction	Area Estimate (km ²)	New Relative Surface Area
MU1	11	Ontario	1537.1	40.6%
	31	Michigan	344.8	9.1%
	21	Ohio	1905.6	50.3%
		MU1 Total	3787.5	
MU2	12	Ontario	3497.4	45.6%
	23	Ohio	4175.3	54.4%
		MU2 Total	7672.7	
MU3	13	Ontario	4749.9	52.3%
	24	Ohio	2943.7	32.4%
	41	Pennsylvania	1385.8	15.3%
		MU3 Total	9079.4	
MU4	10	Ontario	2818.7	58.0%
	42	Pennsylvania	535.6	11.0%
	51	New York	1507.2	31.0%
		MU4 Total	4861.4	

Figure 2.1. Calculations for subunit areas in the Yellow Perch Task Group Management Units.

Appendix A Table 1. Expert Opinion (EO) Lambda (λ) values and relative number of terms associated with catch-at-age analysis data sources by management unit (Unit).

Unit	Data Source	λ	Relative Number of Terms
1	Commercial Gill Net Effort	0.8	1
	Sport Effort	0.7	1
	Commercial Trap Net Effort	0.5	1
	Commercial Gill Net Harvest	1.0	5
	Sport Harvest	0.9	5
	Commercial Trap Net Harvest	0.7	5
	Trawl Survey Catch Rates	1.0	3
	Partnership Gill Net Index Catch Rates	1.0	5
2	Commercial Gill Net Effort	0.8	1
	Sport Effort	0.8	1
	Commercial Trap Net Effort	0.6	1
	Commercial Gill Net Harvest	1.0	5
	Sport Harvest	0.9	5
	Commercial Trap Net Harvest	0.7	5
	Trawl Survey Catch Rates	0.9	4
	Partnership Gill Net Index Catch Rates	1.0	5
3	Commercial Gill Net Effort	0.8	1
	Sport Effort	0.8	1
	Commercial Trap Net Effort	0.6	1
	Commercial Gill Net Harvest	1.0	5
	Sport Harvest	0.8	5
	Commercial Trap Net Harvest	0.6	5
	Trawl Survey Catch Rates	1.0	4
	Partnership Gill Net Index Catch Rates	1.0	5
4	Commercial Gill Net Effort	0.8	1
	Sport Effort	0.7	1
	Commercial Trap Net Effort	0.6	1
	Commercial Gill Net Harvest	1.0	5
	Sport Harvest	0.7	5
	Commercial Trap Net Harvest	0.6	5
	NY Gill Net Survey Catch Rates	1.0	5
	Partnership Gill Net Index Catch Rates	0.9	5

Appendix A Table 2a. Projected Lake Erie Yellow Perch age-2 estimates (in millions of fish) from multi-model inference recruitment models run for each management unit.

2016 Age-2 Projections

Management Unit	Age-2 Recruitment Estimates			Number of years in model	Number of models averaged
	2016				
	Min.	Mean	Max.		
1	34.434	39.997	46.459	23	3
2	25.379	27.589	29.99	20	3
3	15.113	17.507	20.281	16	1
4	3.397	4.860	6.952	19	2

Appendix A Table 2b. Parameters from multi-model inference age-2 recruitment models run for each management unit.

2016 Age-2 Projections

MU1

Age_2 ~ Intercept + OOS11 + OHF10 + OHF11 + OPSF11

Survey	Estimate	Uncond. variance	Number of models	Importance	(alpha = 0.05)
OPSF11	0.014	0.001	1	0.248	0.052
OHF11	0.071	0.003	2	0.751	0.119
(Intercept)	-0.503	0.105	3	1.000	0.679
OHF10	0.303	0.017	3	1.000	0.276
OOS11	0.403	0.023	3	1.000	0.318

MU2

Age_2 ~ Intercept + OPSF21 + OHS20B + OHF20B

Survey	Estimate	Uncond. variance	Number of models	Importance	(alpha = 0.05)
OHF20B	0.134	0.019	2	0.605	0.290
OHS20B	0.100	0.004	2	0.797	0.138
(Intercept)	0.966	0.069	3	1.000	0.553
OPSF21	0.361	0.005	3	1.000	0.148

MU3

Age_2 ~ Intercept + OHS30B

Survey	Estimate
(Intercept)	1.162
OHS30B	0.445

MU4

Age_2 ~ Intercept + NYF41 + LPC41

Survey	Estimate	Uncond. variance	Number of models	Importance	(alpha = 0.05)
LPC41	0.095	0.017	1	0.449	0.278
(Intercept)	-0.499	0.163	2	1.000	0.854
NYF41	0.505	0.023	2	1.000	0.323

Appendix A Table 3. Interagency trawl surveys indices. All trawl series are reported in arithmetic mean catch per hectare, all gill net series are in numbers of fish per lift. Trawl series in italics are not used to estimate age-2 recruitment. Series in grey are used, but failed to meet R GLMULTI data constraints for 2016 model run and were excluded from recruit

Year	OHF10	OHF11	OHS10	OOS10	OHS20B	OHF21B	OHF30B	OHF31B	OHS21B	OHS30B	OHS31B	OHJ21B	OHJ31B	NYF40	NYF41	LPS41	LP40	LP41	OPSF11	OPSF21	OPSF41		
1984																	119.1	5.9					
1985																	3.8	30.5					
1986																	212.7	6.9					
1987																	0.8	36.7					
1988				212.6	13.3												1.1	105.8	0.4				
1989			265.4	12.5													6.3	82.1	16.4		6.8		
1990	310.1	82.0	259.2	35.2	52.2	23.0	21.2	12.4	1.7	67.4	1.2	7.5				0.0	26.7	5.6	41.3	68.9	29.7	0.6	
1991	58.1	0.4	113.2	42.1	9.3	50.0	1.2	19.7	5.4	43.5	5.2	77.7	19.7			1.7	17.8	3.2	63.3	56.6	3.8	1.6	
1992	90.9	0.7	94.1	16.5	36.3	15.0	37.3	3.3	7.2	8.0	24.3	2.7	18.5	0.8	10.4	2.3	5.6	70.3	4.6	47.5	8.0	5.7	
1993	256.4	3.7	862.5	39.5	10.6	49.0	27.3	12.1	41.7	29.1	39.7	16.0	10.1	4.7	110.1	3.0	7.9	30.6	2.6	146.9	112.0	93.2	0.1
1994	287.1	73.1	469.7	62.9	71.9	12.0	16.1	3.4	73.3	5.0	77.2	16.7	23.3	10.2	47.7	8.4	2.7	34.7	6.2	317.8	22.5	39.7	7.4
1995	82.4	0.1	478.7	113.5	2.8	73.5	14.1	27.5	2.8	120.5	27.3	21.0			5.7	14.2	15.2	4.3	10.9	362.5	81.3	55.2	9.6
1996	579.3	82.3	2544.9	122.8	129.6	13.2	116.5	3.5	1059.9	12.1	2006.8	3.6	8.9	0.9	106.3	0.3	0.4	33.6	1.1	198.4	70.8		
1997	33.7	104.9	55.2	93.8	11.6	147.3	2.6	40.0	29.0	677.7		493.9	64.0	0.2	5.5	4.4	4.4	7.1	139.3	350.5	177.9		
1998	250.9	16.0	170.6	8.2	72.6	6.0	38.1	3.7	225.4	3.4	275.5	3.7	21.5	16.2	1.5	0.2	8.4	127.8	1.7	17.5	6.7	6.2	0.0
1999	155.3	47.1	330.0	75.0	68.3	41.8	25.7	41.7	29.5	19.4	44.8	63.5	402.8	97.3	36.1	33.5	23.0	16.1	110.0	440.6	107.6	67.9	119.9
2000	41.5	38.0	102.5	113.6	18.2	56.9	1.6	19.4	0.6	86.6	84.8	51.4	10.2	23.1	6.6	0.7	3.6	11.3	106.1	162.4	55.5	36.9	
2001	246.3	10.3	398.4	11.3	119.2	5.3	13.6	0.4	341.9	6.4	1283.7	10.2	279.8	4.3	97.9	11.5	4.8	69.4	2.0	12.9	9.6	1.9	9.5
2002	30.4	86.5	26.4	59.5	3.3	46.1	3.0	51.9	0.3	191.0	1.7	749.6	239.6	37.7	9.3	15.5	6.8	1.0	6.6	198.7	245.2	186.6	19.7
2003	1111.6	7.1	1620.8	12.3	136.9	2.9	53.2	1.0	1180.4	3.8	1170.2	2.3	9.5	2.5	472.5	1.9	1.3	222.8	2.3	2.7	2.6	7.2	3.2
2004	9.3	127.7	45.2	240.7	7.7	224.2	1.9	45.2	32.8	316.2	3.6	61.9	410.3	42.7	1.5	28.7	6.5	0.1	12.4	976.2	1187.6	332.5	7.6
2005	62.3	2.0	114.8	5.2	43.9	19.2	156.2	132.3	105.2	22.3	278.2	82.3	51.2	19.3	57.8	5.4	0.4	124.4	0.1	0.0	2.2	2.5	0.2
2006	121.9	12.5	222.8	12.4	8.3	4.6	17.0	11.9	4.9	2.2	60.7	10.8	29.7	113.6	283.2	39.9	19.5	30.1	12.1	15.7	28.5	94.8	129.7
2007	631.5	23.6	444.6	18.8	151.0	20.7	177.8	37.0	245.8	21.3	237.0	40.9	287.6	281.8	401.3	41.2	9.1	63.5	7.9	184.4	203.9	202.5	43.4
2008	74.7	15.3	387.2	142.1	31.5	53.4	52.8	26.4	210.5	62.6	558.3	150.2	303.5	97.2	1088.3	44.3	5.7	279.4	20.8	333.1	310.6	150.6	87.0
2009	69.4	57.0	136.6	88.4	1.6	20.2	0.5	139.4	14.2	62.7	0.1	104.3	125.9	48.2	11.6	62.5	0.7	0.4	10.7	265.2	121.4	190.0	30.6
2010	26.9	17.8	96.9	26.4	41.1	11.9	96.3	12.4				29.2	12.1	192.7	4.0	1.7	51.8	0.2	49.5	18.1	36.2	15.7	
2011	12.0	10.0	178.0	25.9	10.3	6.3	15.1	55.5	7.1	34.5	14.1	41.3	70.8	41.7	87.2	138.2	5.0	176.7	2.6	158.7	101.8	218.6	95.4
2012	35.0	6.0	68.1	4.0	69.2	7.4	134.4	23.3	65.9	9.2	154.3	23.5	42.5	76.5	272.9	16.3	13.7	27.4	2.0	53.1	21.9	48.7	117.8
2013	337.0	3.7	315.6	17.8	8.9	34.9	8.9	109.5	2.6	52.2	3.5	272.9	84.2	116.2	4.2	23.8	2.2	0.5	0.8	64.1	71.4	152.1	30.4
2014	521.7	17.8	859.6	51.1	37.7	15.4	49.1	24.2	33.6	2.8	45.8	15.4			267.2	2.8	0.9	28.4	0.0	315.0	34.7	16.4	2.2
2015	224.0	63.1	494.3	117.2	19.6	41.3	18.6	30.2							66.9	55.9	4.0	58.5	1.6	424.3	66.5	212.7	170.9

Year	OHS10	OHS11	OLPM0	OLPM1	ILP40	ILP41	OLP04	OLP04	OLP04
1984			283.9	9.7	761.7	44.5	7.3	0.0	
1985			2.4	32.6	20.8	125.5	1.6	17.1	
1986			102.0	0.2	1859.5	61.7	0.0	0.3	
1987	16.3	74.9	3.4	284.1	3.8	39.7	0.0	2.1	
1988	188.6	11.2	667.7	0.8	305.0	2.9	0.4	0.0	
1989	106.1	11.8	296.9	53.2	457.7	84.6	0.4	1.9	
1990	144.4	20.7	43.3	12.0	202.6	21.0	0.0	2.6	
1991	146.9	27.6	15.5	1.0	144.0	24.5	0.7	0.6	
1992	60.7	9.5	54.3	9.0	594.0	32.8	0.0	0.1	
1993	1164.2	14.4	21.6	4.5	239.8	17.9	2.9	0.2	
1994	508.5	57.7	159.8	15.3	84.0	29.8	10.6	1.7	
1995	348.9	128.8	6.0	33.7	5.3	54.3	4.0	1.7	
1996	3290.8	79.9	199.1	2.6	53.6	6.1	7.9	0.1	
1997	52.2	121.8	18.9	59.8	21.5	5.4	0.0	0.1	
1998	174.5	4.8	114.9	1.2	1005.9	14.9	8.1	0.0	
1999	270.1	68.5	2.5	69.5	34.0	155.7	15.5	109.3	
2000	186.4	85.3	10.2	2.1	1.2	4.8	3.0	13.4	
2001	322.1	12.8	76.7	2.0	463.8	2.7	13.8	1.9	
2002	33.1	77.1	0.6	13.9	8.3	42.6	0.0	0.7	
2003	1509.9	3.0	93.3	0.8	224.0	1.5	240.6	2.6	
2004	40.9	210.7	0.5	4.3	0.1	21.4	0.1	12.2	
2005	124.2	5.2	10.3	0.1	8.8	0.2	156.2	0.0	
2006	180.2	6.4	2.8	1.4	0.3	4.8	380.0	14.6	
2007	592.9	14.5	6.3	0.9	73.9	3.0	700.0	9.6	
2008	267.0	23.5	4.9	6.6	0.3	4.1	356.0	25.1	
2009	186.0	85.3	1.5	4.2	0.0	0.0	0.3	13.1	
2010	58.2	22.2	13.2	0.6	5.7	0.6	63.5	0.0	
2011	29.9	15.5	3.9	1.9	3.9	12.8	224.6	1.3	
2012	74.5	2.2	11.3	1.1	1.6	1.7	33.2	2.2	
2013	398.7	10.3	1.8	0.5	2.1	5.6	0.1	0.1	
2014	668.9	17.4	80.1	0.2	4.7	0.0	24.6	0.0	
2015	264.9	61.7	78.5	0.3	326.0	3.0	18.7	1.6	

Appendix A Table 4. Legend. Lakewide trawl index codes and series names used in Appendix A Tables 2 and 3. All series are reported in arithmetic mean catch per hectare, except LPS41 and OPSF11-41, gill net indices which are reported in mean catch per lift. Abbreviations in Appendix T3 ending with a 'B' represent survey indices blocked by depth strata.

Abbreviation	Series
OHS10	Ohio Management Unit 1 summer age 0
OHS11	Ohio Management Unit 1 summer age 1
OHF10	Ohio Management Unit 1 fall age 0
OHF11	Ohio Management Unit 1 fall age 1
OOS10	Ontario/Ohio Management Unit 1 summer age 0
OOS11	Ontario/Ohio Management Unit 1 summer age 1
OHS20	Ohio Management Unit 2 summer age 0
OHF20	Ohio Management Unit 2 fall age 0
OHS21	Ohio Management Unit 2 summer age 1
OHF21	Ohio Management Unit 2 fall age 1
OHS30	Ohio Management Unit 3 summer age 0
OHF30	Ohio Management Unit 3 fall age 0
OHS31	Ohio Management Unit 3 summer age 1
OHF31	Ohio Management Unit 3 fall age 1
OHJ21	Ohio Management Unit 2 June age 1
OHJ31	Ohio Management Unit 3 June age 1
OLPN40	Outer Long Point Bay Nearshore Management Unit 4 age 0
OLPN41	Outer Long Point Bay Nearshore Management Unit 4 age 1
OLPO40	Outer Long Point Bay Offshore Management Unit 4 age 0
OLPO41	Outer Long Point Bay Offshore Management Unit 4 age 1
ILPF40	Inner Long Point Bay Management Unit 4 age 0
ILPF41	Inner Long Point Bay Management Unit 4 age 1
LPC40	Long Point Composite Management Unit 4 age 0
LPC41	Long Point Composite Unit 4 age 1
LPS41	Long Point Bay Management Unit 4 summer Gill Net age 1
NYF40	New York Management Unit 4 fall age 0
NYF41	New York Management Unit 4 fall age 1
OPSF11	Ontario Partnership Gill Net Management Unit 1 fall age 1
OPSF21	Ontario Partnership Gill Net Management Unit 2 fall age 1
OPSF31	Ontario Partnership Gill Net Management Unit 3 fall age 1
OPSF41	Ontario Partnership Gill Net Management Unit 4 fall age 1