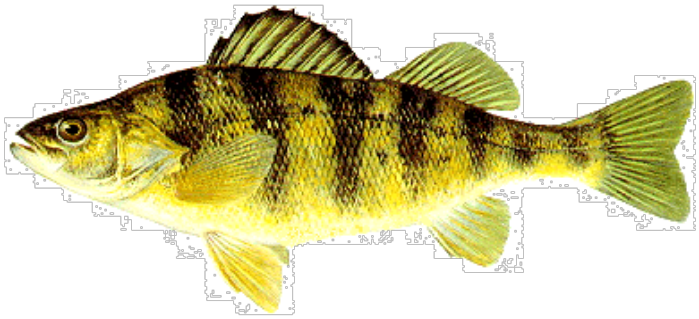
Report of the Lake Erie Yellow Perch Task Group

March 23th, 2017



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Presented to:

Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission

Table of Contents

***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 2016 through March 2017 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 2017.

3. Participate in the Lake Erie Percid Management Advisory Group (LEPMAG) Yellow Perch harvest strategy evaluation process by assisting the Standing Technical Committee (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: 2016 Fisheries Review and Population Dynamics

The lakewide total allowable catch (TAC) of Yellow Perch in 2016 was 9.208 million pounds. This allocation represented a 12.5% decrease from a TAC of 10.528 million pounds in 2015. For Yellow Perch assessment and allocation, Lake Erie is partitioned into four management units (MUs; Figure 1.1). The 2016 TAC allocation was 2.292, 2.756, 3.776, and 0.384 million pounds for MUs 1 through 4, respectively. In 2016, the Lake Erie Committee (LEC) set the TAC for MU2, MU3, and MU4 higher than the mean RAH values suggested in the March 2016 YPTG report, which were 2.656, 2.408, and 0.259 million pounds, respectively. For MU1, the LEC set the TAC equal to the mean RAH of 2.292 million pounds. For MU3, the LEC set the TAC at 3.776 million pounds, which exceeded the maximum RAH of 3.390 million pounds by approximately 11%, and represented a 5% decline from the 2015 MU3 TAC of 3.962 million pounds. The LEC chose to exceed the MU3 maximum RAH due to uncertainty regarding the strength of the 2014 year class recruiting in 2016.

The lakewide harvest of Yellow Perch in 2016 was 7.223 million pounds, or 78.4% of the total 2016 TAC. This was a 4.4% increase from the 2015 harvest of 6.918 million pounds. Harvest from MUs 1 through 4 was 2.230, 2.076, 2.651, and 0.266 million pounds, respectively (Table 1.1). The portion of TAC harvested was 97.3%, 75.3%, 70.2%, and 69.3%, in MUs 1 through 4, respectively. In 2016, Ontario harvested 4.482 million pounds, followed by Ohio (2.201 million

lbs.), Michigan (0.397 million lbs.), Pennsylvania (0.115 million lbs.), and New York (0.028 million lbs.).

Ontario's fraction of allocation harvested was 101.7% in MU1, 102.1% in MU2, 102.3% in MU3, and 103.6% in MU4 (see comments below regarding Ontario's harvest reporting and commercial ice allowance policy). Ohio fishers attained 76.8% of their TAC in the western basin (MU1), 52.9% in the west central basin (MU2), and 42.7% in the east central basin (MU3). Michigan anglers in MU1 attained 190.0% of their TAC. Pennsylvania fisheries harvested 18.7% of their TAC in MU3 and 16.2% of their TAC in MU4. New York fisheries attained 23.6% of their TAC in MU4.

Ontario's portion of the lakewide Yellow Perch harvest in 2016 (62.0%) was comparable to 2015 (64.5%; Table 1.1). Ohio's proportion of lakewide harvest in 2016 (30.5%) was also similar to 2015 (31.7%). Harvest in Michigan, Pennsylvania, and New York waters combined represented 7.5% of the lakewide harvest in 2016.

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. Yellow Perch sport harvest from Ontario waters is assessed periodically, but creel surveys were not performed in 2016. 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 from 2007 to 2016 by management unit, year, agency, and gear type in Tables 1.2 to 1.5. Trends across a longer time series (1975 to 2016) 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 2016 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 stretched mesh) gill nets in 2016 was 0.9%, 2.7%, and 0.8% of the gill net harvest in management units 1, 2 and 3, respectively, and was negligible in MU4 (0.03%). 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 2016 increased by 76.0% in MU1, and declined by 15.1% in MU2, 3.9% in MU3, and 22.1% in MU4. Ontario trap net harvest was minimal (49 pounds in 2016) and is included in the total harvest of Yellow Perch in MU1 (Tables 1.1 and 1.2). Ontario commercial Rainbow 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 2016, 19 pounds of Yellow Perch were harvested in trawl nets in MU2, 169 pounds of Yellow Perch were harvested in trawl nets in MU3, and 665 pounds were harvested in MU4.

Targeted (i.e., small mesh) gill net effort in 2016 increased from 2015 in MU1 (+49.5%), and MU3 (+19.3%), and decreased in MU2 (-32.1%) and MU4 (-26.5%). Gill net effort in 2016 was also lower when compared to the 1990s and earlier decades (Figure 1.3). Targeted gill net harvest rates in 2016 increased by 17.7% in MU1, 25.0% in MU2, and 6.0% in MU4 from 2015 rates, and declined 19.4% in MU3 (Figure 1.4).

In 2016, sport harvest in U.S. waters increased by 103.4% in MU1, and decreased by 17.4% in MU2, by 39.2% in MU3, and by 68.4% in MU4 compared to the 2015 harvest (Figure 1.2). Angling effort in U.S. waters increased in 2016 from 2015 in MU1 (+35.0%), and decreased in MU2 (-5.9%), MU3 (-15.4%), and MU4 (-37.2%; Figure 1.3).

Sport fishing harvest rates are commonly expressed as fish harvested per angler hour for those seeking Yellow Perch. These harvest rates are presented in Tables 1.2 to 1.5. Compared to 2015 rates, harvest per angler hour increased in Ohio waters of MU1 (+32.3%), in Michigan waters of MU1 (+79.4%) and in the Pennsylvania waters of MU4 (+8.4%), but declined in Ohio waters of MU2 (-18.0%) and MU3 (-40.6%), in Pennsylvania waters of MU3 (-29.1%), and in New York waters of MU4 (-52.7%).

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 2016, the sport harvest rate (in kg/hr) increased in MU1 (0.50; +50.6%), but decreased in MU2 (0.23; -12.2%), MU3 (0.44; -28.1%), and MU4 (0.27; -49.7%) from 2015 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 31.5% in MU2, increased by 46.9% in MU3, and decreased by 46.7% in MU4. Compared to 2015, trap net effort (lifts) in 2016 decreased in MU2 by 28.5%, increased in MU3 by 89.1%, and decreased in MU4 by 43.8%. In 2016, trap net harvest rate decreased in MU2 by 4.2%, in MU3 by 22.3%, and in MU4 by 5.2%. In 2016, trap net harvest occurred in MU1 for the first time since 2011, with a harvest of 0.103 million pounds in 2,446 trap

net lifts.

Age Composition and Growth

Lakewide, age-2, age-3, and age-4 fish contributed the most to the Yellow Perch harvest (28.3%, 18.0%, and 33.1% respectively). In MU1, age-2 fish (2014 year class, 52.6%), and age-3 fish (2013 year class, 33.1%) contributed most to the fishery. In MU2, age-4 fish (2012 year class, 39.4%) and age-2 fish (2014 year class, 24.3%) contributed most to the fishery. In MU3, age-4 fish (2012 year class, 52.4%) and age-6+ fish (2010 year class and older fish, 22.3%) contributed the most to the harvest. In MU4, age-2 fish (2014 year class, 43.9%) and age-4 fish (2014 year class, 26.0%) were most of the harvest, followed by age-6+ fish (17.7%).

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). In 2017 the YPTG used two ADMB models in each management unit to estimate abundance. The first was the model the YPTG has used in the past (hereafter referred to as the YPTG model; YPTG, 2016), the second was the model developed by the Quantitative Fisheries Centre at Michigan State University (hereafter referred to as the Peterson-Reilly or PR model) as part of the ongoing Lake Erie Percid Management Advisory Group (LEPMAG) review of Yellow Perch management on Lake Erie. Table and figure numbers in this report are designated for each model as YPTG (a) and PR (b).

YPTG model

The YPTG model uses harvest and effort data from commercial gill net, commercial trap net, and recreational fisheries. It also incorporates survey catch at age of age-2 and older fish from gill net and trawl surveys. The YPTG model incorporates commercial gill net selectivity estimated independently in the latter part of the time series using gill net selectivity curves derived from index gill net 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. It also uses commercial gill net catchability coefficients based on the seasonal distribution of harvest and relative catch rates. The model uses catchability blocks for each type of harvest gear, and constant catchability for surveys. The Ontario Partnership gillnet index catch rates are adjusted for selectivity bias associated with mesh size configuration (Helser, 1998) with an assumed selectivity of 1 for all age groups. The model is fit to catch at age data.

PR model

The PR model uses the same data sources as the YPTG model, with the addition of age-0 and age-1 recruitment data. The PR model estimates selectivity for all ages in the fishery and surveys. Since survey selectivities are estimated in this model, Ontario Partnership catch rates are not adjusted for selectivity bias. There is a commercial gill net selectivity block beginning in 1998. Catchabilities for all fisheries and surveys vary as a random walk. The model is fit to total catch and proportions-at-age (multinomial age composition) as separate data sets. Running the PR model is a three-step process. In the first step, an ADMB model without recruitment data is run iteratively until the maximum effective sample size for the multinomial age composition stabilizes

(i.e., does not change by more than 1-2 units).

Second, age-2 abundance estimates from the first model are added to age-0 and age-1 recruitment data in a multi-model inference (MMI) R-based glmulti model to determine parameters for estimating recruitment (see full explanation below). Recruitment data from the last nine years are removed from the model to minimize possible retrospective effects. Further, years with missing data in one or more data sets are removed from all data sets. Surveys missing data for the projection year (e.g., 2015 year class in the 2017 TAC year) are removed from the analysis. A list of all possible non-redundant models is generated from the survey data and fit using glmulti. All models falling within 2 AIC units of the best model are used to 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 heavily, and have greater influence on the recruitment predictions.

In the third step, the age-0 and age-1 recruitment data are added to the ADMB model along with the MMI coefficients from step two. This allows the model to estimate age-2 recruitment for each year class available in the recruitment data, and adds this as a data set in the objective function. This model is then run iteratively until the maximum effective sample size for the multinomial age composition stabilizes.

YPTG Recommendation

The YPTG recommends using the YPTG model in 2017. The task group discussed the merits of using the PR model relative to the current YPTG model in terms of model fit and performance presented at LEPMAG meetings (e.g., were the models providing similar abundance estimates, how did each model compare in terms of retrospective pattern, sensitivity to various parameters) and while the task group generally felt the PR models provides advantages relative to the YPTG models, a formal risk assessment (i.e., management strategy evaluation) has yet to be completed for the PR models. The current harvest policy was developed for the existing YPTG assessment models after conducting a stock recruitment simulation to evaluate the risks of various fishing strategies (YPTG, 2010). Further, the YPTG has not had sufficient time to vet the model due to the complex nature of the PR model. Additional concerns existed when running the MU3 PR model because the maximum effective sample size for the multinomial age composition would not converge after several (i.e., >10) model runs, and the task group was required to predict a central value to force convergence.

YPTG and PR model results

Estimates of population size for both models, from 2000 to 2016, and projections for 2017 based on 2016 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 2016 in Figures 1.11 to 1.14. Mean weight-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 2016 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, such as natural mortality, are constrained to constants. This technique lessens our ability to directly compare abundance levels over three decades. In addition, 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.

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 used during 2017 in both the YPTG and PR models and are presented in Appendix A Table 1. In the PR model, the additional recruitment survey data were given a lambda weighting of 1.

Recruitment Estimator for Incoming Age-2 Yellow Perch

YPTG model

In 2014, the YPTG implemented a multi-model inference based approach, recommended by LEPMAG, for predicting age-2 recruitment. This method provides an objective response by using a multi-model information-theoretic recruitment estimate that is calculated using the glmulti package in R (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). All models falling within 2 AIC units of the

'best' model comprise the confidence set of models used to generate the model-averaged coefficients. Surveys are not weighted equally in the models; the surveys that are more highly correlated with ADMB age-2 estimates are weighted more, thus having greater influence on the predictions. One caveat with this 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's 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 2017 age-2 Yellow Perch recruitment (the 2015 year class) were 16.745, 21.240, 17.736, and 6.535 million fish in management units 1 through 4, respectively (Table 1.7.a., Appendix A Table 2.a.i). Parameter estimates for the model-averaged coefficients for each MU are detailed in Appendix A Table 2.b.i.

PR model

The PR model also used a MMI approach to project age-2 recruitment in 2017, as described above. However, in this case the MMI parameters were estimated during step two of the PR model process where recruitment data from the last nine years were removed from the model to minimize possible retrospective effects (see section Statistical Catch-at-Age Analysis, PR model).

Estimates of 2017 age-2 Yellow Perch recruitment (the 2015 year class) were 23.799, 26.104, 52.168, and 9.848 million fish in management units 1 through 4, respectively (Table 1.7.b., Appendix A Table 2.a.ii). Parameter estimates for the model-averaged coefficients for each MU are detailed in Appendix A Table 2.b.ii.

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 because they were components of an included composite survey known to better represent the distribution of age-0 and age-1 Yellow Perch abundance.

2017 Population Size Projection

Stock size estimates for age-3-and-older Yellow Perch in 2017 were projected from SCAA estimates of 2016 population size and age-specific survival rates in 2016 for both the YPTG and PR models (Table 1.8). Projected age-2 Yellow Perch recruitment from the 2015 year class (method described above) was added to the 2017 population estimate for older fish in each unit, producing the total standing stock in 2017 (Table 1.8). Standard errors and ranges for estimates are provided for each age in 2016 and following estimated survival from SCAA, for 2017. Descriptions of *min, mean*, and *max* population estimates refer to the age-specific mean estimates minus or plus one standard deviation (Table 1.8).

YPTG model

Stock size estimates for 2016 from the YPTG model (Table 1.7.a) were higher than those projected last year in management units 1 to 4 (YPTG, 2016). Differences in stock size estimates were due to additional data in the model and differences in age-2 estimates projected in 2016 compared to those estimated by the model in 2017. Current estimates of age-2 fish in 2016 are from the SCAA's first assessment of this cohort and, as such, have the widest error bounds.

In the 2017 YPTG model run, stock size estimates projected for 2017 were lower than 2016 stock size estimates in management units 1, 2, and 3, and higher in management unit 4 (Table 1.8.a, Figure 1.11.a). Abundance projections for 2017 were 58.716, 48.386, 48.092, and 11.672 million age-2-and-older Yellow Perch in management units 1 through 4, respectively. Compared to the 2016 abundance estimates, estimates of age-2-and-older Yellow Perch in 2017 are projected to decrease by 21.4%, 5.1%, and 8.7% in MU1, MU2, and MU3, respectively, and to increase by 38.1% in MU4. Age-3-and-older Yellow Perch abundance in 2017 is projected to be 41.971, 27.146, 30.356, and 5.137 million fish in MUs 1 through 4, respectively. Model estimates of abundance for age-3-and-older Yellow Perch for 2017 are projected to increase from the 2016 estimates by 245.0%, 42.3%, 28.1%, 28.9% in MU1 to MU4 respectively. Lakewide abundance of age-2-and-older Yellow Perch in 2017 is projected to be 166.9 million fish, a decrease of 10.7% from 2016.

As a function of population estimates and mean weight-at-age from surveys, total biomass estimates of age-2-and-older Yellow Perch for 2017 are projected to decrease in MU1 (-5.8%), MU2 (-5.9%), and in MU3 (-17.1%), and to increase in MU4 (+15.4%), compared to 2016 estimates (Table 1.8.a. and Figure 1.12.a).

Estimates of Yellow Perch survival for age-3-and-older in 2016 were 42.8%, 45.6%, 50.8%, and 57.1% in MUs 1 through 4, respectively (Table 1.8.a and Figure 1.13.a). Estimates of Yellow Perch survival in 2016 for age-2-and-older fish were: 56.2% in MU1, 53.2% in MU2, 57.6% in MU3, and 60.8% in MU4. 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 2016 were 30.2%, 26.7%, 20.2%, and 12.3% in management units 1 through 4, respectively. Estimates of Yellow Perch exploitation for ages-2-and-older fish in 2016 were: 13.5% in MU1, 17.1% in MU2, 11.6% in MU3, and 7.7% in MU4 (Table 1.8a and Figure 1.14a).

PR model

Using the PR model, abundance projections for 2017 were 70.150, 79.663, 115.340, and 14.124 million age-2-and-older Yellow Perch in management units 1 through 4, respectively. Abundance estimates of age-2-and-older Yellow Perch in 2017 are projected to decrease by 17.5% and 9.6%, in MU1 and MU2 respectively, and to increase by 8.3% and 97.9% in MU3 and MU4 compared to the 2016 abundance estimates (Table 1.8.b, Figure 1.11.b). Age-3-and-older Yellow Perch abundance in 2017 is projected to be 46.350, 53.559, 63.172, and 4.276 million fish in MUs 1 through 4, respectively. Model estimates of abundance for age-3-and-older Yellow Perch for 2017 are projected to increase from the 2016 estimates by 157.3%, 79.9%, 38.2%, and 59.4% in MU1 to MU4 respectively. Lakewide abundance of age-2-and-older Yellow Perch in 2017 is projected to be 279.3 million fish, a decrease of 2.6% from 2016.

As a function of population estimates and mean weight-at-age from surveys, total biomass estimates of age-2-and-older Yellow Perch for 2017 are projected to decrease in MU1 (-3.9%), MU2 (-5.2%), and in MU3 (-2.6%), and increase in MU4 (+56.7%), compared to 2016 estimates (Table 1.8.b. and Figure 1.12.b).

Estimates of Yellow Perch survival for age-3-and-older in 2016 were 36.1%, 50.6%, 49.6%, and 52.6% in MUs 1 through 4, respectively (Table 1.8.b and Figure 1.13.b). Estimates of Yellow Perch survival in 2016 for age-2-and-older fish were: 54.5% in MU1, 60.8% in MU2, 59.3% in MU3, and 59.9% in MU4. Estimated exploitation rates of ages-3-and-older Yellow Perch in 2016 were 38.8%, 20.3%, 21.7%, and 17.9% in management units 1 through 4, respectively. Estimates of Yellow Perch exploitation for ages-2-and-older fish in 2016 were: 15.5% in MU1, 7.7% in MU2, 9.5% in MU3, and 8.8% in MU4 (Table 1.8b and Figure 1.14b).

Charge 2: Harvest Strategy and Recommended Allowable Harvest

Fishing rates applied in 2017 are presented in Table 2.1, along with associated RAH values for each management unit. The fishing rates applied to abundance estimates from the PR model were the same as those used for the YPTG model since a formal risk assessment and related new harvest policy has not been completed for the PR model. Harvest strategies were developed for a draft Yellow Perch Management Plan (YPMP) and tested using a Yellow Perch simulation with YPTG model results (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 values for 2017 for each management unit (Tables 2.1 and 2.2).

Quota allocation by management unit and jurisdiction for 2017 was determined by the same methods applied in 2009-2016, 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, 2017:

MU1:	ONT	40.6%	OH	50.3%	MI	9.1%
MU2:	ONT	45.6%	OH	54.4%		
MU3:	ONT	52.3%	OH	32.4%	PA	15.3%
MU4:	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 a 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 percids. The QFC and LEPMAG have been working on developing a new statistical catch at age model (PR model). This model estimates selectivities, uses random walk catchability, has commercial selectivity time blocks, Ontario survey catchability connection to account for the break in the time series in MU3

and MU4, and a multinomial distribution for age composition data. In 2016, the QFC added age-0 and age-1 recruitment survey data to the model (see section Statistical Catch-at-Age Analysis, PR model).

During 2016 LEPMAG, facilitated by the QFC, compared PR and YPTG model performance metrics relating to retrospectivity, standard errors, and sensitivity to natural mortality and data weightings. QFC also examined separating the MU4 model into a north and south model. It was decided to retain one model for MU4 due to wide error bounds on the separate models. Results from the PR SCAA models are presented in this report (Tables 1.7b to 2.2b, Figures 1.11b to 1.14b)

In 2017, LEPMAG will discuss stakeholder objectives and begin work on a management strategy evaluation to evaluate current and alternative harvest strategies for the PR model.

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Table 1.1. Lake Erie Yellow Perch harvest in pounds by management unit (Unit) and agency, 2007-2016.

		Ontario*		Ohio		Michigan		Pennsylvania		New York		Total
	Year	Harvest	%	Harvest	%	Harvest	%	Harvest	%	Harvest	%	Harvest
Unit 1	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
	2016	947,052	42	886,068	40	397,044	18	--	--	--	--	2,230,164
Unit 2	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
	2016	1,283,379	62	792,869	38	--	--	--	--	--	--	2,076,248
Unit 3	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
	2016	2,020,470	76	522,549	20	--	--	107,972	4	--	--	2,650,991
Unit 4	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
	2016	231,063	87	--	--	--	--	6,791	3	28,078	11	265,932
Lakewide	2007	5,757,872	59	3,618,618	37	62,815	<1	218,924	2	25,935	<1	9,684,164
Totals	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	2,914,524	33.2	87,511	1	185,361	2	149,668	2	8,791,726
	2015	4,460,298	64	2,190,473	31.7	94,225	1	87,613	1	85,535	1	6,918,144
	2016	4,481,964	62	2,201,486	30.5	397,044	5	114,763	2	28,078	0	7,223,335

*processor weight (quota debit weight) to 2001; fisher/observer weight from 2002 to 2016 (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, 2007-2016.

		Unit 1					
		Michigan	Ohio		Ontario Gill Nets		Ontario
	Year	Sport	Trap Nets	Sport	Small Mesh	Large Mesh*	Trap Nets
Harvest	2007	62,815	200,818	781,859	671,536	56,142	6,721
(pounds)	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
	2016	397,044	103,345	782,723	938,558	8,445	49
Harvest	2007	28	91	355	305	25	3.0
(Metric)	2008	22	0	186	220	22	21.0
(tonnes)	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
	2016	180	47	355	426	4	0.02
Effort	2007	181,698	2,951	823,624	2,230	1,125	
(a)	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	
	2016	251,426	2,446	824,418	6,091	431	
Harvest Rates	2007	1.0	30.9	3.4	136.6	22.6	
(b)	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	
	2016	4.8	19.2	4.1	69.9	8.9	

(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

(c) the Ontario sport fishery harvested approximately 19,579 lbs of yellow perch in the 2014 creel survey

(*) 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 ir Management Unit 2 (western Central Basin) by agency and gear type, 2007-2016.

		Unit 2				
		Ohio		Ontario Gill Nets		Ontario
	Year	Trap Nets	Sport	Small Mesh	Large Mesh*	Trawls
Harvest	2007	1,701,552	543,104	1,561,287	173,699	112,153
(pounds)	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
	2016	688,033	104,836	1,248,729	34,631	19
Harvest	2007	772	246	708	79	50.9
(Metric)	2008	624	285	757	115	30.0
(tonnes)	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
	2016	312	48	566	16	0.0
Effort	2007	9,158	498,843	2,966	2,826	
(a)	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	
	2016	4,510	204,745	6,424	1,934	
Harvest Rates	2007	84.3	2.8	238.7	27.9	
(b)	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	
	2016	69.2	1.2	88.2	8.1	

(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
(c) the Ontario sport fishery harvested approximately 6,825 lbs of yellow perch in the 2014 creel survey
(*) 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, 2007-2016.

		Unit 3						
		Ohio		Pennsylvania		Ontario Gill Nets		Ontario
	Year	Trap Nets	Sport	Trap Nets	Sport	Small Mesh	Large Mesh*	Trawls
Harvest	2007	48,286	342,999	23,471	169,594	2,941,451	42,570	13,080
(pounds)	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
	2016	349,844	172,705	51,148	56,824	2,003,842	16,459	169
Harvest	2007	22	156	10.6	77	1,334	19	5.9
(Metric)	2008	63	222	10.4	60	980	15	3.4
(tonnes)	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
	2016	159	78	23.2	26	909	7	0.1
Effort	2007	713	218,683	88	135,611	6,115	614	
(a)	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	
	2016	2,000	181,622	604	57,545	5,964	798	
Harvest Rates	2007	30.7	3.4	121.0	3.8	218.2	31.4	
(b)	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	
	2016	79.3	1.9	38.4	2.0	152.4	9.4	

(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
(c) the Ontario sport fishery harvested approximately 132,585 lbs of yellow perch in the 2014 creel survey
(*) 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, 2007-2016.

		Unit 4						
		New York		Pennsylvania		Ontario Gill Nets		Ontario
	Year	Trap Nets	Sport	Trap Nets	Sport	Small Mesh	Large Mesh*	Trawls
Harvest	2007	9,511	16,424	0	25,859	179,595	3,076	3,283
(pounds)	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
	2016	11,465	16,613	0	6,791	230,333	65	665
Harvest	2007	4.3	7.4	0	11.7	81.4	1.40	1.5
(Metric)	2008	5.1	13.5	0	14.2	106.3	1.22	1.5
(tonnes)	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
	2016	5.2	7.5	0	3.1	104.5	0.03	0.3
Effort	2007	144	29,999	0	31,545	550	62.1	
(a)	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	
	2016	248	27,436	0	11,934	1,303	11.2	
Harvest Rates	2007	30.0	0.97	--	1.5	148.1	22.5	
(b)	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	
	2016	21.0	0.95	--	1.3	80.1	2.6	

(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
(c) the Ontario sport fishery harvested approximately 21,361 lbs of yellow perch in the 2014 creel survey
(*) large mesh catch rates are not targeted and therefore of limited value

Table 1.6. Estimated 2016 Lake Erie Yellow Perch harvest by age and numbers of fish by gear and management unit (Unit).

		Unit 1		Unit 2		Unit 3		Unit 4		Lakewide	
Gear	Age	Number	%	Number	%	Number	%	Number	%	Number	%
Gill Nets	1		0.0		0.0		0.0	2,743	0.4	2,743	0.0
	2	1,355,489	41.3	938,494	23.4	264,206	4.2	347,331	47.9	2,905,520	20.2
	3	1,156,513	35.2	508,994	12.7	274,555	4.3	50,903	7.0	1,990,965	13.8
	4	583,876	17.8	1,686,377	42.0	3,400,212	53.5	182,377	25.1	5,852,842	40.7
	5	94,719	2.9	478,056	11.9	989,808	15.6	37,372	5.2	1,599,955	11.1
	6+	91,825	2.8	403,171	10.0	1,426,845	22.5	104,830	14.4	2,026,672	14.1
	Total	3,282,423	*40.2*	4,015,092	*64.9*	6,355,625	*80.1*	725,556	*91.2*	14,378,697	*62.3*
Trap Nets	1		0.0		0.0		0.0		0.0	0	0.0
	2	104,237	31.9	517,503	27.3	104,847	9.7	0	0.0	726,587	21.8
	3	137,589	42.0	355,892	18.8	172,918	16.0	591	2.0	666,990	20.0
	4	58,941	18.0	651,937	34.4	571,836	52.8	11,533	39.0	1,294,247	38.8
	5	2,811	0.9	115,144	6.1	68,171	6.3	2,070	7.0	188,196	5.6
	6+	23,671	7.2	256,760	13.5	165,787	15.3	15,377	52.0	461,595	13.8
	Total	327,249	*4.0*	1,897,236	*30.7*	1,083,559	*13.6*	29,571	*3.7*	3,337,615	*14.5*
Sport	1		0.0		0.0		0.0		0.0	0	0.0
	2	2,835,097	62.2	43,480	16.1	27,048	5.4	1,776	4.4	2,907,400	54.2
	3	1,410,960	31.0	30,582	11.3	45,924	9.2	1,101	2.7	1,488,567	27.7
	4	207,584	4.6	95,902	35.5	187,903	37.6	12,863	31.8	504,251	9.4
	5	35,389	0.8	56,307	20.8	63,653	12.7	4,197	10.4	159,547	3.0
	6+	66,861	1.5	44,150	16.3	174,849	35.0	20,541	50.7	306,401	5.7
	Total	4,555,891	*55.8*	270,421	*4.4*	499,377	*6.3*	40,477	*5.1*	5,366,166	*23.2*
All Gear	1	0	0.0	0	0.0	0	0.0	2,743	0.3	2,743	0.0
	2	4,294,823	52.6	1,499,477	24.3	396,101	5.0	349,107	43.9	6,539,507	28.3
	3	2,705,062	33.1	895,468	14.5	493,397	6.2	52,595	6.6	4,146,523	18.0
	4	850,401	10.4	2,434,216	39.4	4,159,951	52.4	206,772	26.0	7,651,340	33.1
	5	132,919	1.6	649,507	10.5	1,121,632	14.1	43,640	5.5	1,947,697	8.4
	6+	182,358	2.2	704,081	11.4	1,767,481	22.3	140,748	17.7	2,794,668	12.1
	Total	8,165,563	35.4	6,182,749	26.8	7,938,561	34.4	795,604	3.4	23,082,478	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.a. Yellow Perch stock size (millions of fish) in each Lake Erie management unit. Abundance in the years 2000 to 2016 are estimated by ADMB catch-age analysis. The 2017 population estimates use age-2 Yellow Perch estimates 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.

ADMB analysis uses the YPTG model

	Age	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Unit 1	2	33.541	33.034	7.651	40.218	3.172	52.585	1.545	9.065	9.933	23.306	14.701	9.127	12.242	2.219	5.392	17.744	62.575	16.745
	3	6.497	21.248	21.230	4.879	25.181	2.011	32.470	0.988	5.418	6.093	14.656	9.344	5.819	7.595	1.316	2.911	9.863	36.758
	4	14.273	3.526	12.455	10.848	2.651	11.572	0.982	12.749	0.527	2.795	3.095	7.605	4.978	2.948	3.332	0.534	1.237	4.361
	5	3.069	7.140	1.917	5.098	4.838	0.980	4.182	0.398	5.097	0.285	1.350	1.455	3.549	2.304	1.157	1.218	0.212	0.480
	6+	1.259	1.928	4.706	2.327	3.029	2.290	0.958	1.562	0.748	2.874	1.480	1.277	1.197	2.097	1.670	0.964	0.854	0.372
	2 and Older	58.637	66.876	47.959	63.370	38.871	69.440	40.136	24.761	21.723	35.353	35.282	28.808	27.786	17.162	12.868	23.371	74.741	58.716
	3 and Older	25.096	33.842	40.307	23.152	35.699	16.854	38.591	15.696	11.790	12.047	20.581	19.681	15.543	14.944	7.476	5.627	12.166	41.971
Unit 2	2	54.286	47.867	11.208	87.458	5.019	195.142	5.233	23.440	26.793	53.828	45.437	7.799	19.963	12.033	34.720	9.470	31.922	21.240
	3	9.461	32.702	28.353	7.055	52.810	3.268	125.568	3.446	15.256	17.671	34.868	29.495	5.126	12.506	7.508	20.290	5.195	18.454
	4	18.115	5.208	18.502	15.172	3.959	27.999	1.895	71.315	2.056	9.269	10.457	20.710	18.085	3.044	6.899	3.762	10.331	2.778
	5	1.567	8.741	2.556	8.458	6.519	1.906	12.659	1.120	34.842	1.099	4.608	5.573	11.389	9.268	1.364	2.461	1.479	4.505
	6+	0.416	0.924	4.745	3.323	5.114	5.354	3.309	7.536	4.180	20.975	10.693	7.855	7.210	9.558	8.381	3.253	2.069	1.409
	2 and Older	83.845	95.441	65.364	121.467	73.423	233.670	148.663	106.857	83.128	102.841	106.062	71.431	61.772	46.409	58.872	39.236	50.996	48.386
	3 and Older	29.559	47.575	54.156	34.009	68.403	38.528	143.430	83.417	56.335	49.013	60.625	63.633	41.809	34.376	24.153	29.766	19.075	27.146
Unit 3	2	48.155	28.078	7.054	39.602	4.743	162.438	6.474	33.534	50.770	47.275	55.651	6.716	27.959	13.697	20.175	8.034	28.955	17.736
	3	8.316	31.209	18.030	4.540	25.720	3.114	107.938	4.293	21.169	33.787	31.597	36.906	4.490	17.972	8.826	13.006	5.289	18.316
	4	18.801	5.278	19.854	11.286	2.822	15.921	1.931	60.827	2.647	13.416	22.131	20.242	24.274	2.713	10.820	5.246	7.471	3.054
	5	2.671	11.449	3.280	11.915	6.633	1.663	9.222	1.069	35.027	1.605	8.431	13.357	12.880	13.508	1.605	6.004	2.781	3.755
	6+	2.398	3.052	8.940	7.362	11.336	10.542	7.121	7.442	4.841	24.183	16.159	14.504	17.521	16.957	17.356	10.214	8.165	5.231
	2 and Older	80.341	79.065	57.159	74.704	51.253	193.677	132.687	107.166	114.453	120.265	133.970	91.724	87.125	64.848	58.781	42.505	52.661	48.092
	3 and Older	32.186	50.987	50.104	35.102	46.510	31.239	126.213	73.631	63.683	72.990	78.319	85.008	59.166	51.151	38.606	34.471	23.706	30.356
Unit 4	2	11.320	2.404	1.610	6.099	1.110	8.596	0.721	6.544	6.887	5.583	8.838	0.842	9.722	1.982	4.140	0.994	4.467	6.535
	3	0.912	7.550	1.611	1.078	4.073	0.735	5.676	0.480	4.322	4.570	3.739	5.857	0.557	6.088	1.261	2.593	0.608	2.860
	4	1.493	0.600	5.042	1.065	0.702	2.610	0.454	3.290	0.309	2.781	3.004	2.336	3.540	0.333	3.280	0.706	1.534	0.368
	5	0.078	0.963	0.399	3.252	0.669	0.434	1.558	0.252	2.074	0.195	1.772	1.779	1.371	1.880	0.168	1.692	0.415	0.891
	6+	0.176	0.163	0.746	0.716	2.438	1.868	1.335	1.515	1.114	1.969	1.346	1.803	2.001	1.638	1.650	0.884	1.429	1.018
	2 and Older	13.979	11.679	9.407	12.210	8.992	14.243	9.744	12.081	14.705	15.098	18.697	12.617	17.191	11.920	10.499	6.869	8.454	11.672
	3 and Older	2.659	9.276	7.798	6.111	7.882	5.647	9.023	5.537	7.818	9.515	9.860	11.775	7.469	9.938	6.359	5.876	3.987	5.137

Table 1.7.b. Yellow Perch stock size (millions of fish) in each Lake Erie management unit. Abundance in the years 2000 to 2016 are estimated by ADMB catch-age analysis. The 2017 population estimates use age-2 Yellow Perch estimates 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.

ADMB analysis uses the PR model

	Age	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Unit 1	2	29.074	27.771	7.096	34.284	3.590	41.240	1.944	10.484	13.749	30.092	24.404	9.959	12.493	3.044	7.591	24.624	67.014	23.799
	3	6.688	18.526	17.986	4.520	21.652	2.270	26.172	1.237	6.647	8.890	19.236	15.366	6.271	7.750	1.849	4.704	15.087	39.841
	4	13.588	3.590	10.856	9.676	2.387	10.955	1.170	13.565	0.666	3.861	4.848	9.936	7.969	3.159	3.538	0.889	2.140	5.905
	5	2.577	5.755	1.873	4.660	4.123	0.861	4.122	0.444	6.023	0.343	1.721	1.948	4.036	3.279	1.060	1.244	0.278	0.474
	6+	0.893	1.248	3.369	1.993	2.472	1.902	0.870	1.516	0.798	3.258	1.476	1.109	1.063	1.861	1.462	0.760	0.508	0.130
	2 and Older	52.820	56.890	41.179	55.134	34.223	57.228	34.279	27.246	27.883	46.444	51.686	38.318	31.832	19.094	15.500	32.221	85.027	70.150
	3 and Older	23.747	29.120	34.083	20.850	30.634	15.987	32.335	16.762	14.134	16.352	27.282	28.359	19.339	16.050	7.909	7.597	18.013	46.350
Unit 2	2	52.281	48.678	12.134	101.494	6.788	182.407	7.554	24.935	28.940	63.825	50.043	9.726	23.411	15.244	42.169	14.037	58.329	26.104
	3	8.655	33.931	31.833	7.910	66.341	4.448	118.983	4.948	16.499	19.172	42.068	33.044	6.427	15.429	10.009	27.719	9.198	38.478
	4	16.390	4.746	19.615	17.846	4.490	38.289	2.480	67.405	3.044	10.260	11.389	25.508	20.055	3.831	8.901	5.763	15.449	5.419
	5	1.088	6.908	2.262	8.605	7.983	2.081	16.561	1.110	36.424	1.709	5.117	5.975	13.392	10.035	1.770	4.045	2.405	7.460
	6+	0.366	0.520	3.098	2.014	4.026	4.763	2.564	7.511	4.270	21.340	10.432	7.434	6.430	8.802	7.593	3.702	2.725	2.202
	2 and Older	78.780	94.782	68.942	137.869	89.628	231.987	148.140	105.907	89.176	116.306	119.049	81.687	69.715	53.340	70.442	55.266	88.106	79.663
	3 and Older	26.499	46.104	56.808	36.375	82.840	49.580	140.587	80.972	60.236	52.481	69.006	71.961	46.304	38.096	28.273	41.230	29.777	53.559
Unit 3	2	47.049	33.151	9.376	54.691	6.614	139.532	9.776	39.666	51.169	70.649	61.183	14.940	35.275	28.187	57.701	13.378	60.792	52.168
	3	9.512	31.379	22.108	6.247	36.462	4.409	93.088	6.523	26.488	34.193	47.183	40.864	9.976	23.541	18.808	38.447	8.919	40.506
	4	17.901	6.061	20.045	14.085	3.940	23.243	2.805	58.004	4.175	17.172	22.041	30.103	25.991	6.274	14.860	11.678	23.804	5.448
	5	2.252	10.353	3.534	11.661	7.835	2.285	13.301	1.480	33.691	2.535	10.243	12.643	17.110	14.255	3.486	7.841	6.076	11.868
	6+	1.318	1.872	6.535	5.256	8.344	8.470	5.486	8.539	5.254	22.273	13.542	12.305	12.729	14.386	14.065	7.839	6.924	5.350
	2 and Older	78.032	82.816	61.599	91.940	63.195	177.939	124.456	114.212	120.777	146.822	154.192	110.855	101.081	86.642	108.920	79.182	106.515	115.340
	3 and Older	30.983	49.664	52.222	37.249	56.581	38.407	114.680	74.546	69.608	76.173	93.009	95.915	65.806	58.455	51.219	65.804	45.723	63.172
Unit 4	2	12.100	3.862	1.814	5.436	1.175	8.514	0.892	7.964	4.832	7.419	6.724	0.841	7.342	1.735	2.900	0.753	4.454	9.848
	3	1.021	8.073	2.582	1.209	3.617	0.780	5.608	0.585	5.267	3.193	4.880	4.398	0.547	4.752	1.112	1.843	0.481	2.866
	4	1.676	0.670	5.347	1.687	0.784	2.327	0.484	3.420	0.369	3.307	1.967	2.925	2.564	0.313	2.599	0.585	0.987	0.267
	5	0.187	1.077	0.438	3.387	1.055	0.481	1.328	0.268	2.027	0.217	1.863	1.055	1.480	1.247	0.139	1.077	0.252	0.458
	6+	0.752	0.615	1.107	0.982	2.747	2.357	1.717	1.790	1.290	2.001	1.332	1.815	1.599	1.638	1.470	0.877	0.963	0.686
	2 and Older	15.736	14.298	11.288	12.701	9.378	14.459	10.029	14.027	13.785	16.137	16.767	11.034	13.532	9.684	8.219	5.135	7.137	14.124
	3 and Older	3.636	10.436	9.474	7.265	8.202	5.945	9.137	6.063	8.953	8.718	10.043	10.193	6.190	7.949	5.320	4.381	2.682	4.276

Table 1.8.a. Projection of the 2017 Lake Erie Yellow Perch population. Stock size estimates are derived from ADMB 2016 abundance and survival, and incoming age-2 estimates for 2017 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.

ADMB analysis uses the YPTG model

		2016 Parameters				Rate Functions					2017 Parameters					Stock Biomass		
		Stock Size (millions of fish)				Mortality Rates				Survival Rate	Stock Size (millions of fish)				3-yr Mean Weight in	millions kg		millions lbs.
	Age	**Mean**	**Std. Error**	**Min.**	**Max.**	**(F)**	**(Z)**	**(A)**	**(u)**	**(S)**	**Age**	**Min.**	**Mean**	**Max.**	Pop'n. (kg)	**2016**	**2017**	**2017**
Unit 1	2	62.575	35.557	27.018	98.132	0.132	0.532	0.413	0.102	0.587	2	14.728	16.745	19.038	0.083	5.444	1.390	3.065
	3	9.863	4.238	5.625	14.100	0.416	0.816	0.558	0.284	0.442	3	15.871	36.758	57.646	0.117	1.065	4.301	9.483
	4	1.237	0.495	0.742	1.732	0.547	0.947	0.612	0.354	0.388	4	2.487	4.361	6.235	0.148	0.187	0.644	1.420
	5	0.212	0.088	0.124	0.300	0.657	1.057	0.653	0.406	0.347	5	0.288	0.480	0.672	0.168	0.037	0.080	0.177
	6+	0.854	0.373	0.481	1.227	0.652	1.052	0.651	0.403	0.349	6+	0.211	0.372	0.533	0.198	0.156	0.074	0.162
	Total	74.741		33.990	115.492	0.177	0.577	0.438	0.135	0.562	Total	33.585	58.716	84.124	0.111	6.889	6.489	14.308
	(3+)	12.166		6.972	17.360	0.447	0.847	0.572	0.302	0.428	(3+)	18.857	41.971	65.086	0.121	1.445	5.099	11.243
Unit 2	2	31.922	16.722	15.200	48.644	0.148	0.548	0.422	0.114	0.578	2	19.405	21.240	23.248	0.096	3.288	2.039	4.496
	3	5.195	2.027	3.169	7.222	0.226	0.626	0.465	0.168	0.535	3	8.787	18.454	28.121	0.128	0.670	2.356	5.195
	4	10.331	3.475	6.856	13.806	0.430	0.830	0.564	0.292	0.436	4	1.694	2.778	3.862	0.158	1.632	0.439	0.968
	5	1.479	0.506	0.972	1.985	0.478	0.878	0.584	0.318	0.416	5	2.990	4.505	6.020	0.183	0.247	0.824	1.818
	6+	2.069	0.795	1.274	2.865	0.557	0.957	0.616	0.359	0.384	6+	0.893	1.409	1.925	0.267	0.573	0.376	0.830
	Total	50.996		27.471	74.522	0.231	0.631	0.468	0.171	0.532	Total	33.770	48.386	63.176	0.125	6.411	6.035	13.306
	(3+)	19.075		12.271	25.878	0.386	0.786	0.544	0.267	0.456	(3+)	14.365	27.146	39.928	0.147	3.123	3.996	8.810
Unit 3	2	28.955	18.157	10.798	47.112	0.058	0.458	0.367	0.047	0.633	2	11.989	17.736	26.238	0.069	2.172	1.230	2.711
	3	5.289	2.456	2.833	7.745	0.149	0.549	0.422	0.115	0.578	3	6.830	18.316	29.801	0.111	0.614	2.039	4.496
	4	7.471	3.055	4.416	10.526	0.288	0.688	0.497	0.208	0.503	4	1.636	3.054	4.473	0.154	1.270	0.469	1.035
	5	2.781	1.089	1.692	3.870	0.294	0.694	0.500	0.212	0.500	5	2.220	3.755	5.290	0.177	0.517	0.663	1.463
	6+	8.165	3.090	5.075	11.255	0.354	0.754	0.530	0.249	0.470	6+	3.233	5.231	7.229	0.250	2.311	1.306	2.880
	Total	52.661		24.814	80.508	0.151	0.551	0.424	0.116	0.576	Total	25.908	48.092	73.030	0.119	6.883	5.707	12.585
	(3+)	23.706		14.016	33.396	0.277	0.677	0.492	0.202	0.508	(3+)	13.919	30.356	46.792	0.148	4.712	4.478	9.874
Unit 4	2	4.467	2.817	1.651	7.284	0.046	0.446	0.360	0.037	0.640	2	4.697	6.535	9.093	0.098	0.460	0.640	1.412
	3	0.608	0.296	0.312	0.904	0.101	0.501	0.394	0.079	0.606	3	1.057	2.860	4.663	0.172	0.123	0.493	1.087
	4	1.534	0.663	0.871	2.198	0.144	0.544	0.420	0.111	0.580	4	0.189	0.368	0.547	0.229	0.379	0.084	0.186
	5	0.415	0.171	0.244	0.586	0.201	0.601	0.452	0.151	0.548	5	0.506	0.891	1.276	0.271	0.112	0.241	0.532
	6+	1.429	0.629	0.801	2.058	0.192	0.592	0.447	0.145	0.553	6+	0.577	1.018	1.460	0.340	0.490	0.346	0.763
	Total	8.454		3.879	13.029	0.098	0.498	0.392	0.077	0.608	Total	7.026	11.672	17.039	0.155	1.564	1.805	3.979
	(3+)	3.987		2.228	5.745	0.160	0.560	0.429	0.123	0.571	(3+)	2.329	5.137	7.946	0.227	1.104	1.164	2.567

Table 1.8.b. Projection of the 2017 Lake Erie Yellow Perch population. Stock size estimates are derived from ADMB 2016 abundance and survival, and incoming age-2 estimates for 2017 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.

ADMB analysis uses the PR model

		2016 Parameters				Rate Functions					2017 Parameters					Stock Biomass		
		Stock Size (millions of fish)				Mortality Rates				Survival Rate	Stock Size (millions of fish)				3-yr Mean Weight in	millions kg		millions lbs.
	Age	**Mean**	**Std. Error**	**Min.**	**Max.**	**(F)**	**(Z)**	**(A)**	**(u)**	**(S)**	**Age**	**Min.**	**Mean**	**Max.**	Pop'n. (kg)	**2016**	**2017**	**2017**
Unit 1	2	67.014	11.586	55.428	78.600	0.120	0.520	0.405	0.094	0.595	2	20.573	23.799	27.531	0.083	5.830	1.975	4.356
	3	15.087	2.253	12.834	17.340	0.538	0.938	0.609	0.349	0.391	3	32.953	39.841	46.729	0.117	1.629	4.661	10.278
	4	2.140	0.339	1.801	2.478	1.107	1.507	0.778	0.572	0.222	4	5.024	5.905	6.787	0.148	0.323	0.872	1.923
	5	0.278	0.056	0.222	0.334	1.508	1.908	0.852	0.673	0.148	5	0.399	0.474	0.549	0.168	0.049	0.079	0.175
	6+	0.508	0.139	0.369	0.647	1.348	1.748	0.826	0.637	0.174	6+	0.097	0.130	0.162	0.198	0.093	0.026	0.057
	Total	85.027		70.655	99.399	0.207	0.607	0.455	0.155	0.545	Total	59.046	70.150	81.759	0.109	7.924	7.614	16.789
	(3+)	18.013		15.226	20.799	0.618	1.018	0.639	0.388	0.361	(3+)	38.473	46.350	54.228	0.122	2.094	5.639	12.433
Unit 2	2	58.329	10.547	47.782	68.876	0.016	0.416	0.340	0.013	0.660	2	24.047	26.104	28.337	0.096	6.008	2.506	5.526
	3	9.198	1.503	7.695	10.701	0.129	0.529	0.411	0.100	0.589	3	31.521	38.478	45.436	0.128	1.187	4.912	10.832
	4	15.449	2.001	13.448	17.450	0.328	0.728	0.517	0.233	0.483	4	4.534	5.419	6.305	0.158	2.441	0.856	1.888
	5	2.405	0.362	2.043	2.768	0.456	0.856	0.575	0.306	0.425	5	6.493	7.460	8.426	0.183	0.402	1.365	3.010
	6+	2.725	0.546	2.179	3.271	0.437	0.837	0.567	0.296	0.433	6+	1.812	2.202	2.592	0.267	0.755	0.588	1.296
	Total	88.106		73.147	103.065	0.098	0.498	0.392	0.077	0.608	Total	68.407	79.663	91.096	0.128	10.792	10.228	22.552
	(3+)	29.777		25.365	34.189	0.280	0.680	0.494	0.203	0.506	(3+)	44.360	53.559	62.759	0.144	4.784	7.722	17.026
Unit 3	2	60.792	12.237	48.555	73.029	0.006	0.406	0.334	0.005	0.666	2	38.318	52.168	71.024	0.069	4.559	3.617	7.975
	3	8.919	1.685	7.234	10.604	0.093	0.493	0.389	0.073	0.611	3	32.353	40.506	48.660	0.111	1.035	4.510	9.944
	4	23.804	3.544	20.260	27.348	0.296	0.696	0.501	0.213	0.499	4	4.418	5.448	6.477	0.154	4.047	0.837	1.846
	5	6.076	0.927	5.149	7.003	0.470	0.870	0.581	0.314	0.419	5	10.101	11.868	13.635	0.177	1.130	2.097	4.623
	6+	6.924	1.253	5.672	8.177	0.504	0.904	0.595	0.332	0.405	6+	4.454	5.350	6.245	0.250	1.960	1.336	2.945
	Total	106.515		86.869	126.161	0.122	0.522	0.407	0.095	0.593	Total	89.644	115.340	146.041	0.107	12.730	12.396	27.333
	(3+)	45.723		38.314	53.132	0.302	0.702	0.504	0.217	0.496	(3+)	51.326	63.172	75.017	0.139	8.171	8.779	19.358
Unit 4	2	4.454	0.730	3.724	5.185	0.041	0.441	0.357	0.033	0.643	2	6.472	9.848	14.985	0.098	0.459	0.965	2.128
	3	0.481	0.080	0.401	0.561	0.188	0.588	0.445	0.142	0.555	3	2.396	2.866	3.336	0.172	0.097	0.494	1.089
	4	0.987	0.140	0.847	1.128	0.369	0.769	0.537	0.257	0.463	4	0.223	0.267	0.311	0.229	0.244	0.061	0.135
	5	0.252	0.044	0.208	0.295	0.356	0.756	0.530	0.250	0.470	5	0.393	0.458	0.523	0.271	0.068	0.124	0.273
	6+	0.963	0.160	0.802	1.123	0.128	0.528	0.410	0.099	0.590	6+	0.571	0.686	0.801	0.340	0.330	0.233	0.514
	Total	7.137		5.982	8.291	0.112	0.512	0.401	0.088	0.599	Total	10.054	14.124	19.955	0.133	1.198	1.877	4.139
	(3+)	2.682		2.258	3.106	0.243	0.643	0.474	0.179	0.526	(3+)	3.582	4.276	4.971	0.213	0.739	0.912	2.011

Table 2.1.a. Estimated harvest of Lake Erie Yellow Perch for 2017 using the proposed fishing policy and selectivity-at-age from combined fishing gears.

ADMB analysis uses the YPTG model

		2017 Stock Size (millions of fish)			Exploitation Rate				2017 Catch (millions of fish)			3-yr Mean Weight in	2017 Harvest Range Catch (millions of kg)			Catch (millions of lbs)		
	Age	**Min.**	**Mean**	**Max.**	**F**	**s(age)**	**F(age)**	**(u)**	**Min.**	**Mean**	**Max.**	Harvest (kg)	**Min.**	**Mean**	**Max.**	**Min.**	**Mean**	**Max.**
Unit 1	2	14.728	16.745	19.038	0.670	0.182	0.122	0.095	1.399	1.591	1.809	0.109	0.153	0.173	0.197	0.336	0.382	0.435
	3	15.871	36.758	57.646	0.670	0.577	0.387	0.268	4.248	9.839	15.429	0.133	0.565	1.309	2.052	1.246	2.885	4.525
	4	2.487	4.361	6.235	0.670	0.748	0.501	0.330	0.822	1.440	2.059	0.154	0.127	0.222	0.317	0.279	0.489	0.699
	5	0.288	0.480	0.672	0.670	0.770	0.516	0.338	0.097	0.162	0.227	0.180	0.018	0.029	0.041	0.039	0.064	0.090
	6+	0.211	0.372	0.533	0.670	0.801	0.537	0.348	0.073	0.130	0.186	0.186	0.014	0.024	0.035	0.030	0.053	0.076
	Total	33.585	58.716	84.124				0.224	6.640	13.162	19.710	0.133	0.875	1.757	2.642	1.930	3.874	5.825
	(3+)	18.857	41.971	65.086				0.276	5.240	11.571	17.901	0.137	0.723	1.584	2.445	1.594	3.492	5.390
Unit 2	2	19.405	21.240	23.248	0.670	0.185	0.124	0.096	1.872	2.049	2.243	0.136	0.255	0.279	0.305	0.561	0.615	0.673
	3	8.787	18.454	28.121	0.670	0.345	0.231	0.171	1.506	3.163	4.820	0.139	0.209	0.440	0.670	0.462	0.969	1.477
	4	1.694	2.778	3.862	0.670	0.711	0.476	0.317	0.538	0.881	1.225	0.145	0.078	0.128	0.178	0.172	0.282	0.392
	5	2.990	4.505	6.020	0.670	0.745	0.499	0.329	0.984	1.483	1.982	0.151	0.149	0.224	0.299	0.328	0.494	0.660
	6+	0.893	1.409	1.925	0.670	0.821	0.550	0.355	0.317	0.500	0.684	0.188	0.060	0.094	0.129	0.132	0.207	0.283
	Total	33.770	48.386	63.176				0.167	5.217	8.077	10.954	0.144	0.750	1.164	1.581	1.654	2.567	3.485
	(3+)	14.365	27.146	39.928				0.222	3.345	6.028	8.711	0.147	0.496	0.886	1.275	1.093	1.953	2.812
Unit 3	2	11.989	17.736	26.238	0.700	0.077	0.054	0.043	0.519	0.768	1.137	0.125	0.065	0.096	0.142	0.143	0.212	0.313
	3	6.830	18.316	29.801	0.700	0.328	0.230	0.170	1.164	3.121	5.077	0.132	0.154	0.412	0.670	0.339	0.908	1.478
	4	1.636	3.054	4.473	0.700	0.673	0.471	0.314	0.515	0.961	1.407	0.150	0.077	0.144	0.211	0.170	0.318	0.465
	5	2.220	3.755	5.290	0.700	0.678	0.475	0.316	0.702	1.188	1.674	0.165	0.116	0.196	0.276	0.255	0.432	0.609
	6+	3.233	5.231	7.229	0.700	0.759	0.531	0.346	1.118	1.808	2.499	0.180	0.201	0.325	0.450	0.444	0.718	0.992
	Total	25.908	48.092	73.030				0.163	4.017	7.846	11.793	0.150	0.613	1.174	1.749	1.351	2.588	3.857
	(3+)	13.919	30.356	46.792				0.233	3.498	7.077	10.656	0.152	0.548	1.077	1.607	1.208	2.376	3.544
Unit 4	2	4.697	6.535	9.093	0.300	0.142	0.043	0.034	0.162	0.225	0.313	0.141	0.023	0.032	0.044	0.050	0.070	0.097
	3	1.057	2.860	4.663	0.300	0.313	0.094	0.074	0.078	0.212	0.346	0.153	0.012	0.032	0.053	0.026	0.071	0.117
	4	0.189	0.368	0.547	0.300	0.484	0.145	0.112	0.021	0.041	0.061	0.165	0.003	0.007	0.010	0.008	0.015	0.022
	5	0.506	0.891	1.276	0.300	0.765	0.230	0.170	0.086	0.152	0.217	0.191	0.016	0.029	0.041	0.036	0.064	0.091
	6+	0.577	1.018	1.460	0.300	0.759	0.228	0.169	0.098	0.172	0.247	0.218	0.021	0.038	0.054	0.047	0.083	0.119
	Total	7.026	11.672	17.039				0.069	0.445	0.802	1.184	0.171	0.076	0.137	0.202	0.168	0.303	0.446
	(3+)	2.329	5.137	7.946				0.112	0.283	0.577	0.871	0.183	0.053	0.106	0.158	0.117	0.233	0.349

Table 2.1.b. Estimated harvest of Lake Erie Yellow Perch for 2017 using the proposed fishing policy and selectivity-at-age from combined fishing gears.

ADMB analysis uses the PR model

		2017 Stock Size (millions of fish)			Exploitation Rate				2017 Catch (millions of fish)			3-yr Mean Weight in	2017 Harvest Range Catch (millions of kg)			2017 Harvest Range Catch (millions of lbs)		
	Age	**Min.**	**Mean**	**Max.**	**F**	**s(age)**	**F(age)**	**(u)**	**Min.**	**Mean**	**Max.**	Harvest (kg)	**Min.**	**Mean**	**Max.**	**Min.**	**Mean**	**Max.**
Unit 1	2	20.573	23.799	27.531	0.670	0.123	0.082	0.065	1.345	1.556	1.800	0.109	0.147	0.170	0.196	0.323	0.374	0.433
	3	32.953	39.841	46.729	0.670	0.448	0.300	0.216	7.113	8.600	10.086	0.133	0.946	1.144	1.342	2.086	2.522	2.958
	4	5.024	5.905	6.787	0.670	0.765	0.513	0.336	1.689	1.985	2.282	0.154	0.260	0.306	0.351	0.573	0.674	0.775
	5	0.399	0.474	0.549	0.670	1.000	0.670	0.411	0.164	0.195	0.226	0.180	0.030	0.035	0.041	0.065	0.077	0.090
	6+	0.097	0.130	0.162	0.670	0.833	0.558	0.359	0.035	0.047	0.058	0.186	0.006	0.009	0.011	0.014	0.019	0.024
	Total	59.046	70.150	81.759				0.177	10.346	12.382	14.452	0.134	1.389	1.663	1.941	3.062	3.667	4.279
	(3+)	38.473	46.350	54.228				0.234	9.001	10.826	12.652	0.138	1.242	1.493	1.744	2.739	3.293	3.846
Unit 2	2	24.047	26.104	28.337	0.670	0.044	0.029	0.024	0.576	0.626	0.679	0.136	0.078	0.085	0.092	0.173	0.188	0.204
	3	31.521	38.478	45.436	0.670	0.291	0.195	0.147	4.632	5.654	6.677	0.139	0.644	0.786	0.928	1.420	1.733	2.046
	4	4.534	5.419	6.305	0.670	0.705	0.472	0.315	1.429	1.708	1.987	0.145	0.207	0.248	0.288	0.457	0.546	0.635
	5	6.493	7.460	8.426	0.670	1.000	0.670	0.411	2.671	3.069	3.466	0.151	0.403	0.463	0.523	0.889	1.022	1.154
	6+	1.812	2.202	2.592	0.670	0.955	0.640	0.398	0.721	0.876	1.031	0.188	0.135	0.165	0.194	0.299	0.363	0.427
	Total	68.407	79.663	91.096				0.150	10.029	11.933	13.840	0.146	1.468	1.747	2.026	3.237	3.852	4.467
	(3+)	44.360	53.559	62.759				0.211	9.453	11.307	13.161	0.147	1.390	1.662	1.933	3.065	3.664	4.263
Unit 3	2	38.318	52.168	71.024	0.700	0.020	0.014	0.011	0.439	0.598	0.814	0.125	0.055	0.075	0.102	0.121	0.165	0.224
	3	32.353	40.506	48.660	0.700	0.190	0.133	0.103	3.335	4.176	5.017	0.132	0.440	0.551	0.662	0.971	1.215	1.460
	4	4.418	5.448	6.477	0.700	0.537	0.376	0.261	1.155	1.424	1.694	0.150	0.173	0.214	0.254	0.382	0.471	0.560
	5	10.101	11.868	13.635	0.700	0.837	0.586	0.373	3.763	4.421	5.080	0.165	0.621	0.730	0.838	1.369	1.609	1.848
	6+	4.454	5.350	6.245	0.700	1.000	0.700	0.425	1.891	2.271	2.651	0.180	0.340	0.409	0.477	0.750	0.901	1.052
	Total	89.644	115.340	146.041				0.112	10.584	12.891	15.255	0.153	1.630	1.978	2.333	3.594	4.361	5.145
	(3+)	51.326	63.172	75.017				0.195	10.145	12.293	14.441	0.155	1.575	1.903	2.232	3.473	4.197	4.921
Unit 4	2	6.472	9.848	14.985	0.300	0.089	0.027	0.022	0.141	0.214	0.326	0.141	0.020	0.030	0.046	0.044	0.067	0.101
	3	2.396	2.866	3.336	0.300	0.390	0.117	0.091	0.219	0.262	0.305	0.153	0.033	0.040	0.047	0.074	0.088	0.103
	4	0.223	0.267	0.311	0.300	0.822	0.247	0.182	0.040	0.049	0.057	0.165	0.007	0.008	0.009	0.015	0.018	0.021
	5	0.393	0.458	0.523	0.300	0.877	0.263	0.192	0.076	0.088	0.101	0.191	0.014	0.017	0.019	0.032	0.037	0.042
	6+	0.571	0.686	0.801	0.300	0.558	0.167	0.128	0.073	0.088	0.102	0.218	0.016	0.019	0.022	0.035	0.042	0.049
	Total	10.054	14.124	19.955				0.050	0.548	0.700	0.890	0.163	0.090	0.114	0.143	0.199	0.252	0.316
	(3+)	3.582	4.276	4.971				0.114	0.408	0.486	0.564	0.173	0.070	0.084	0.097	0.155	0.185	0.215

Table 2.2.a. Lake Erie Yellow Perch fishing rates and the Recommended Allowable Harvest (RAH; in millions of pounds) for 2017 by Management Unit (Unit).

ADMB analysis uses the YPTG model

		Recommended Allowable Harvest (millions lbs.)		
Unit	**Fishing Rate**	**MIN**	**MEAN**	**MAX**
1	0.670	1.930	3.874	5.825
2	0.670	1.654	2.567	3.485
3	0.700	1.351	2.588	3.857
4	0.300	0.168	0.303	0.446
Total		5.103	9.332	13.614

Table 2.2.b. Lake Erie Yellow Perch fishing rates and the Recommended Allowable Harvest (RAH; in millions of pounds) for 2017 by Management Unit (Unit).

ADMB analysis uses the PR model

		Recommended Allowable Harvest (millions lbs.)		
Unit	**Fishing Rate**	**MIN**	**MEAN**	**MAX**
1	0.670	3.062	3.667	4.279
2	0.670	3.237	3.852	4.467
3	0.700	3.594	4.361	5.145
4	0.300	0.199	0.252	0.316
Total		10.092	12.131	14.207

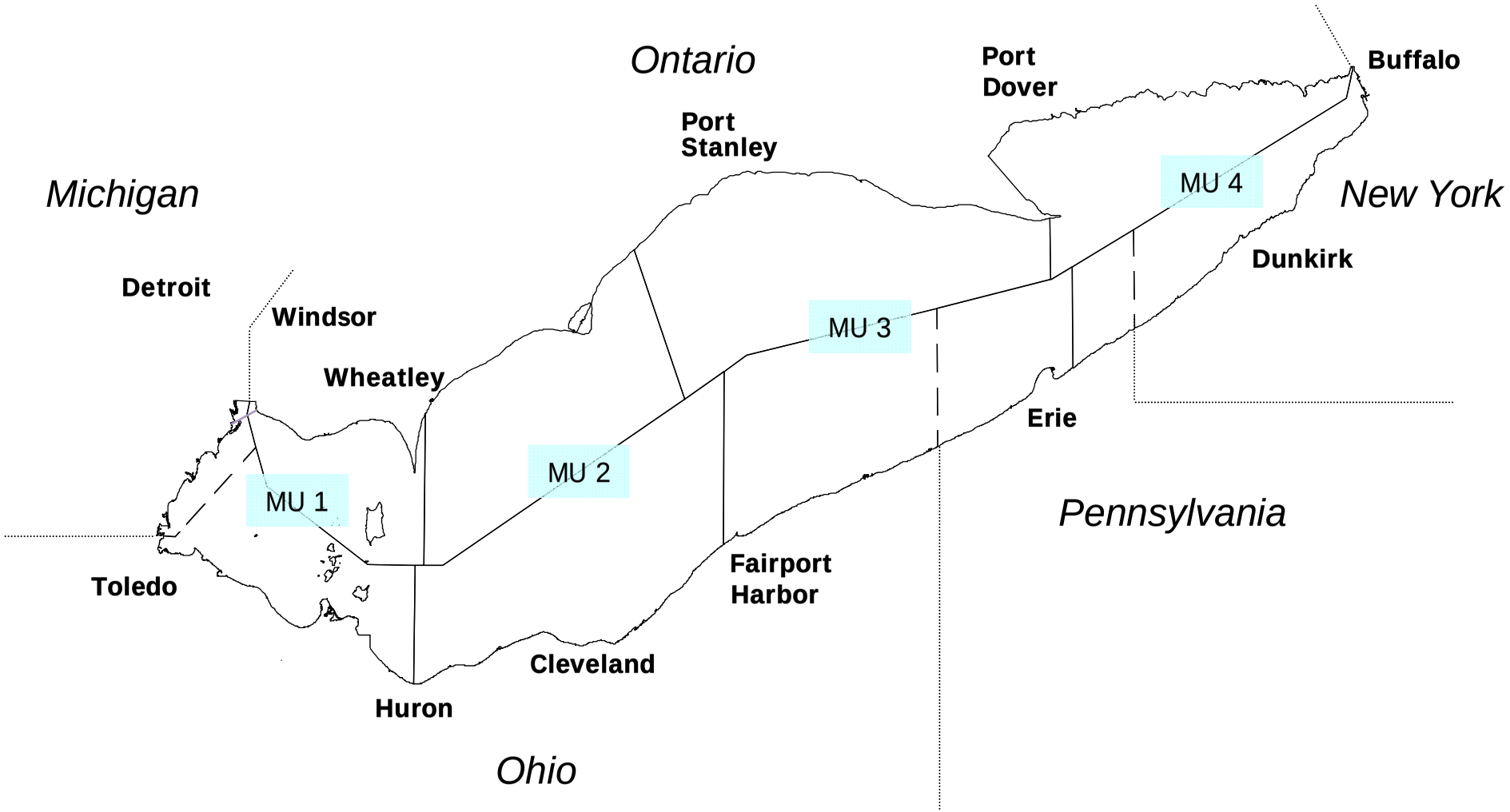


Figure 1.1. The Yellow Perch Management Units (MUs) of Lake Erie defined by the YPTG and LEC, for illustrative purposes.

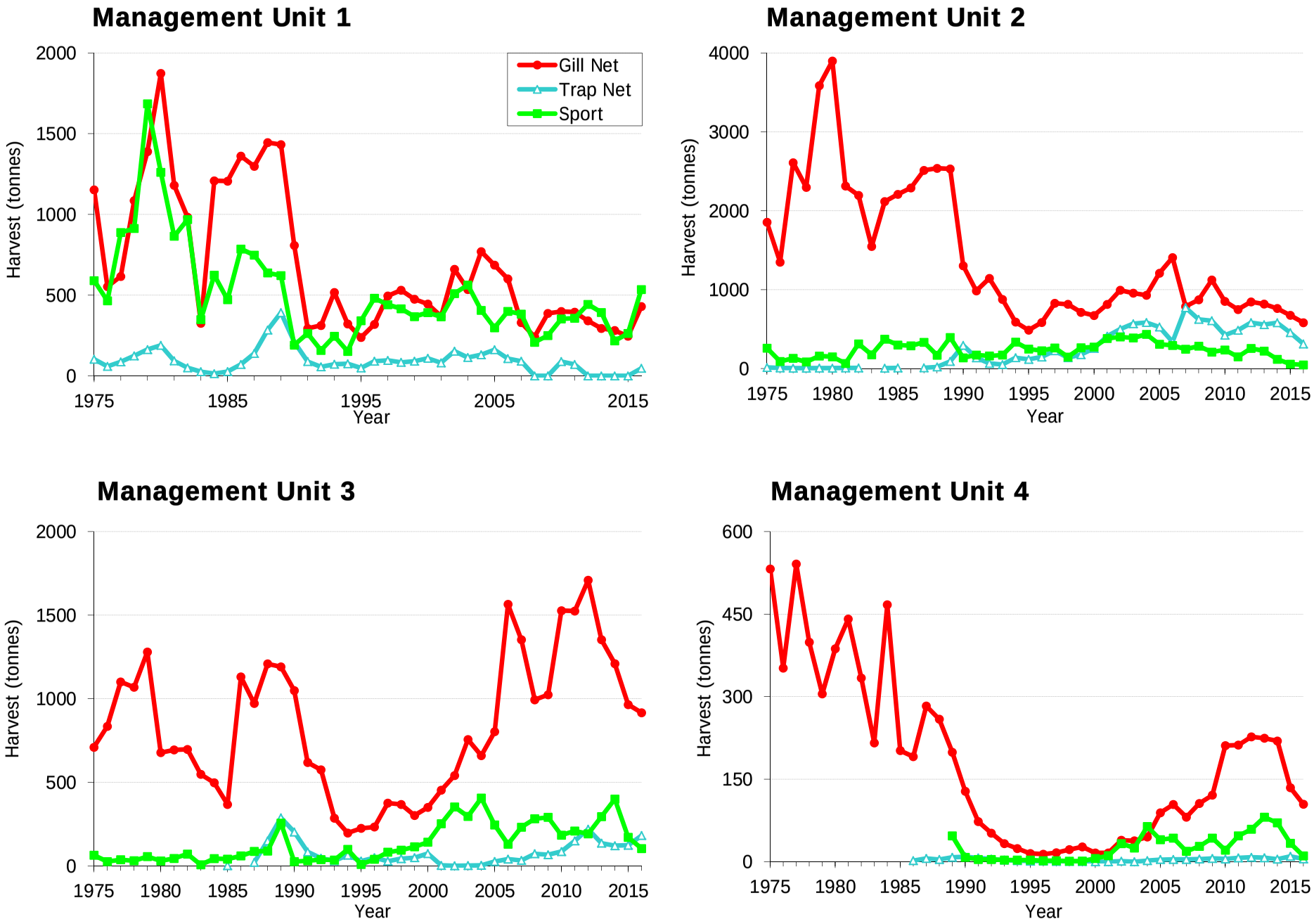


Figure 1.2. Historic Lake Erie Yellow Perch harvest (metric tonnes) by management unit and gear type.

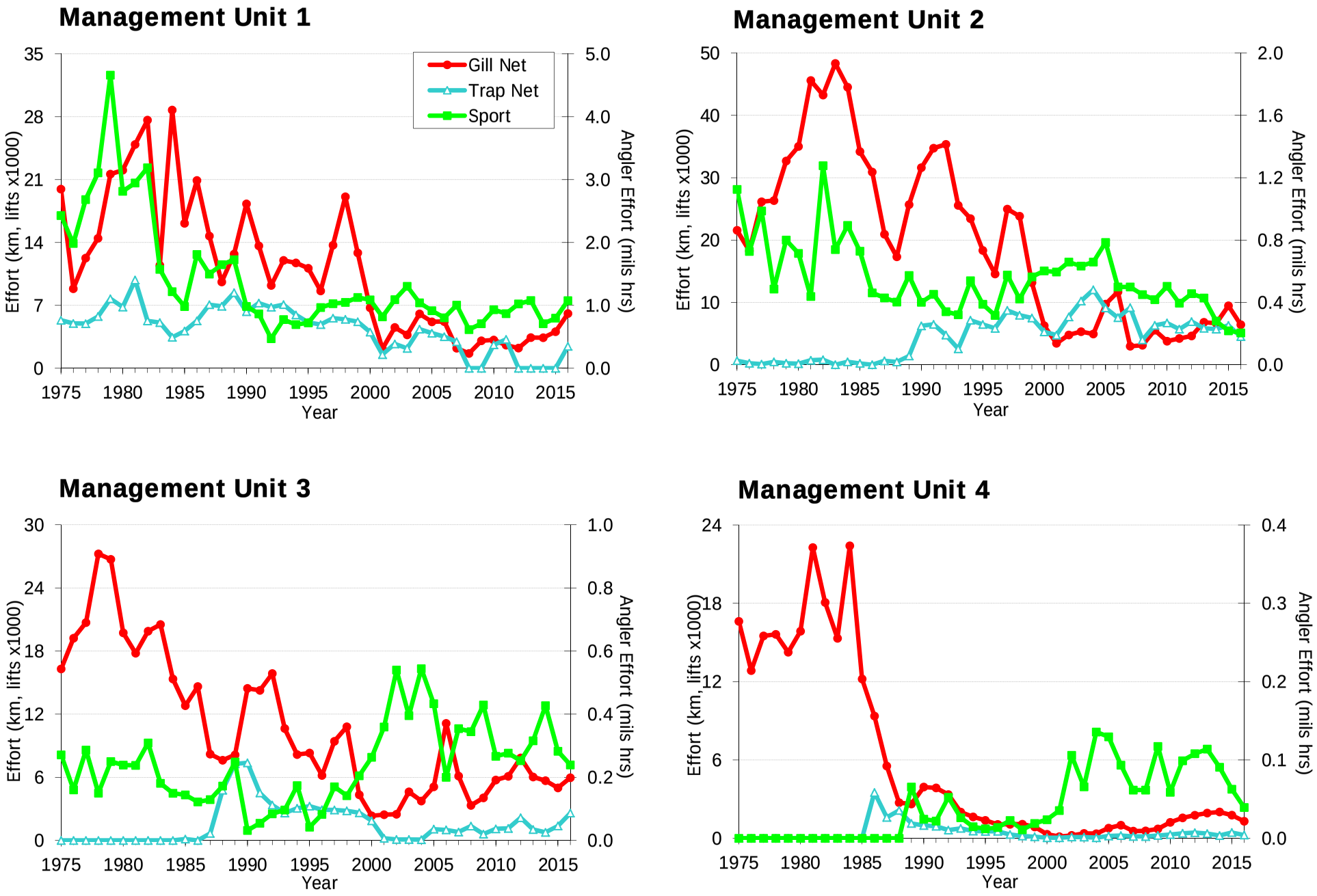


Figure 1.3. Historic Lake Erie Yellow Perch effort by management unit and gear type. Note: gill net effort presented is targeted effort with small mesh (< 3").

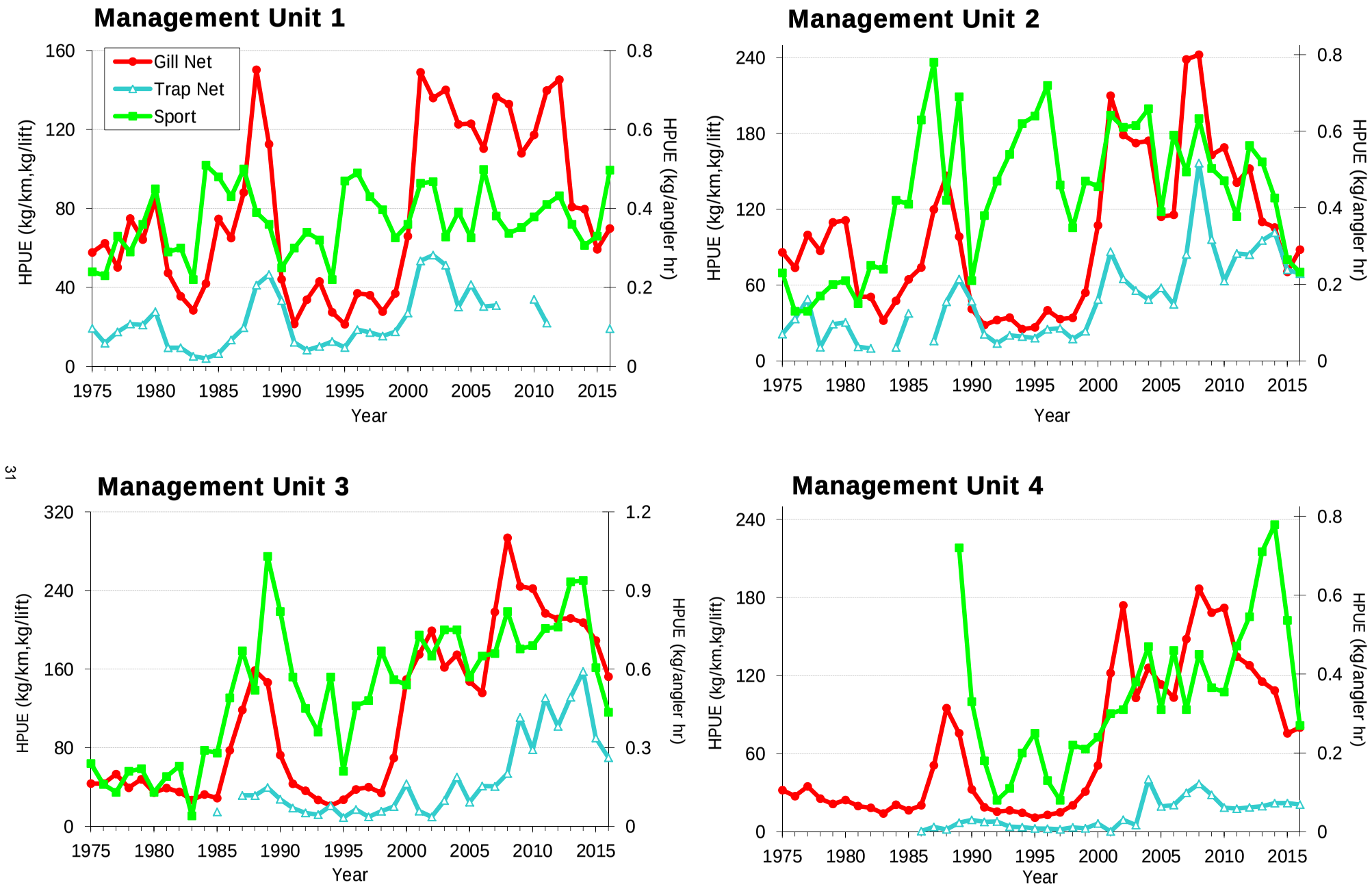


Figure 1.4. Historic Lake Erie Yellow Perch harvest per unit effort (HPUE) by management unit and gear type. Note: gill net CPUE for 2001 to 2016 is for small mesh (< 3") only.

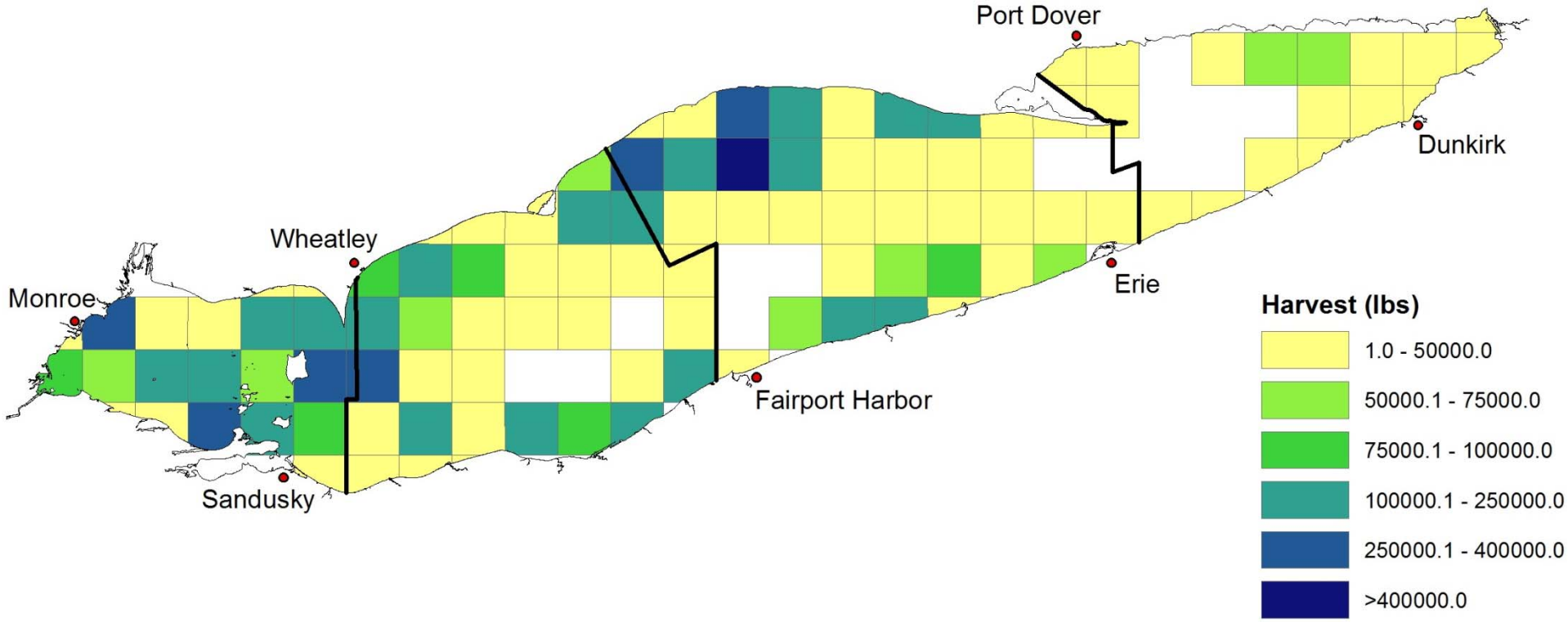


Figure 1.5. Spatial distribution of Yellow Perch total harvest (lbs.) in 2016 by 10-minute grid.

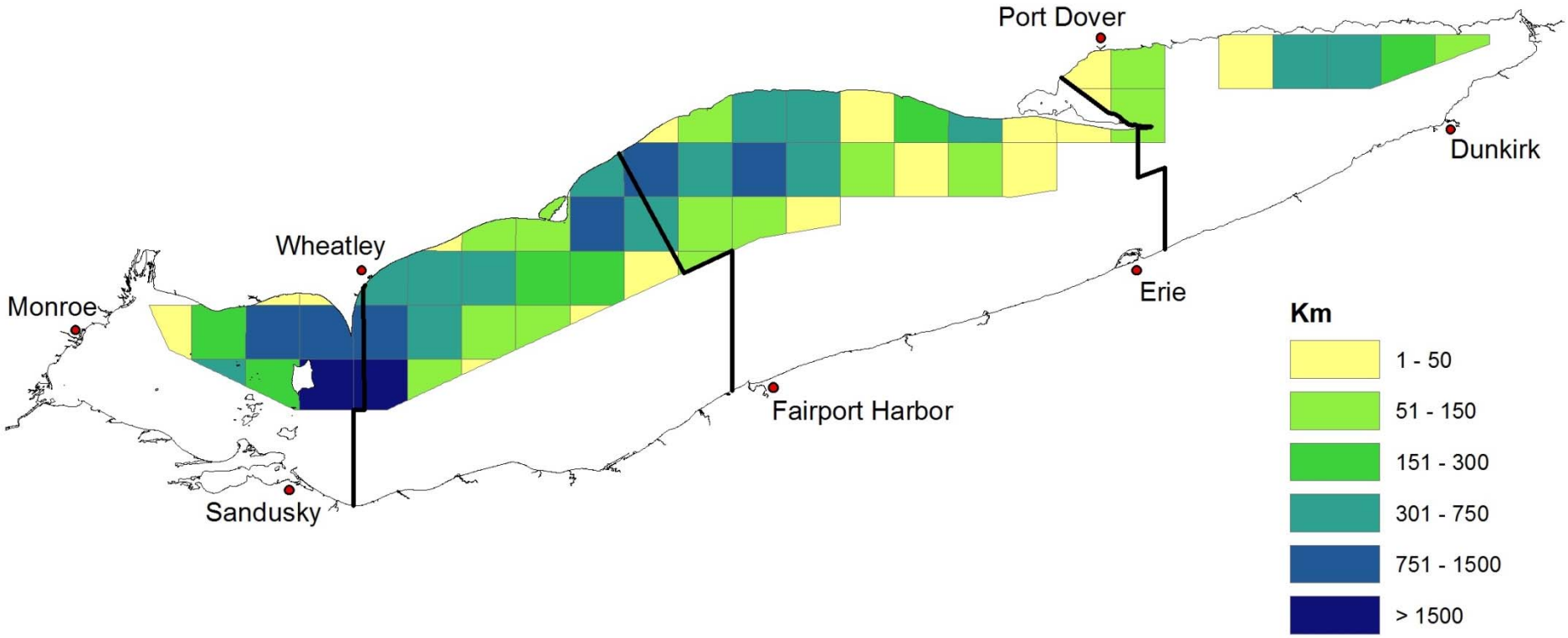


Figure 1.6. Spatial distribution of Yellow Perch small mesh gill net effort (km) in 2016 by 10-minute grid.

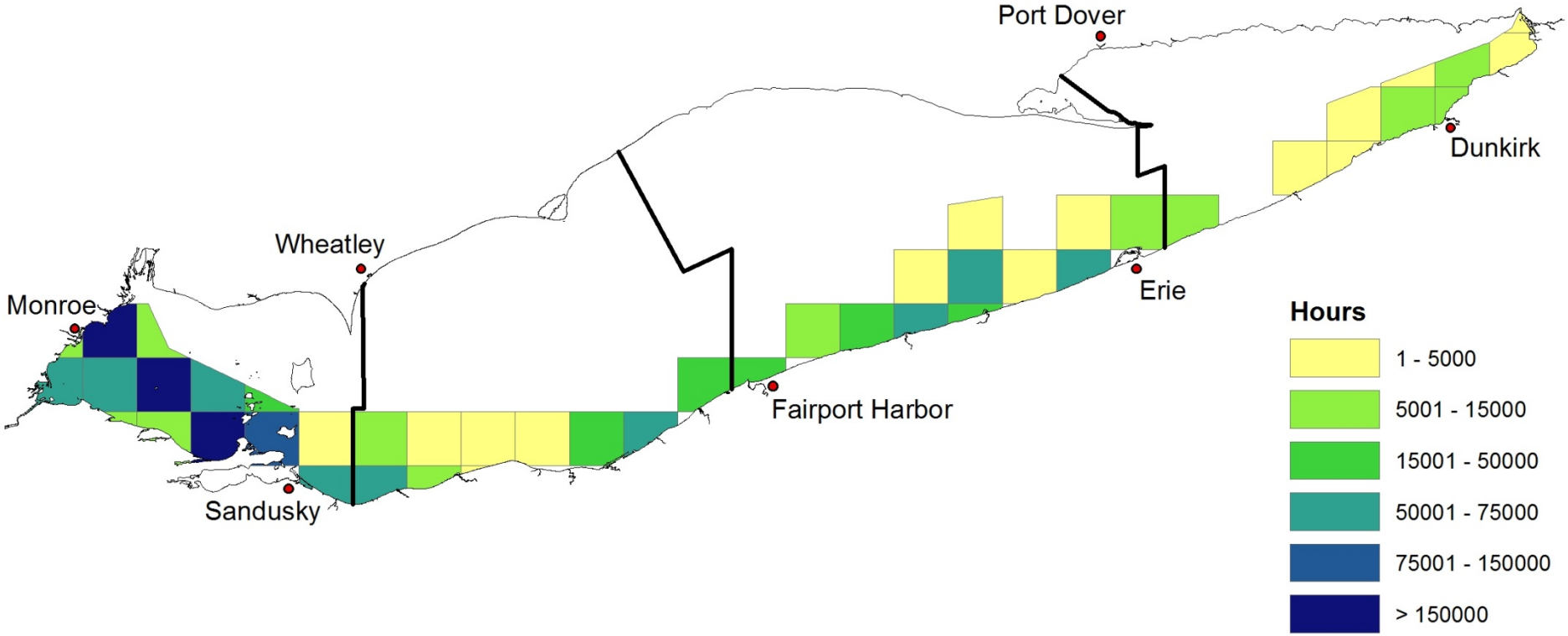


Figure 1.7. Spatial distribution of Yellow Perch sport effort (angler hours) in 2016 by 10-minute grid.

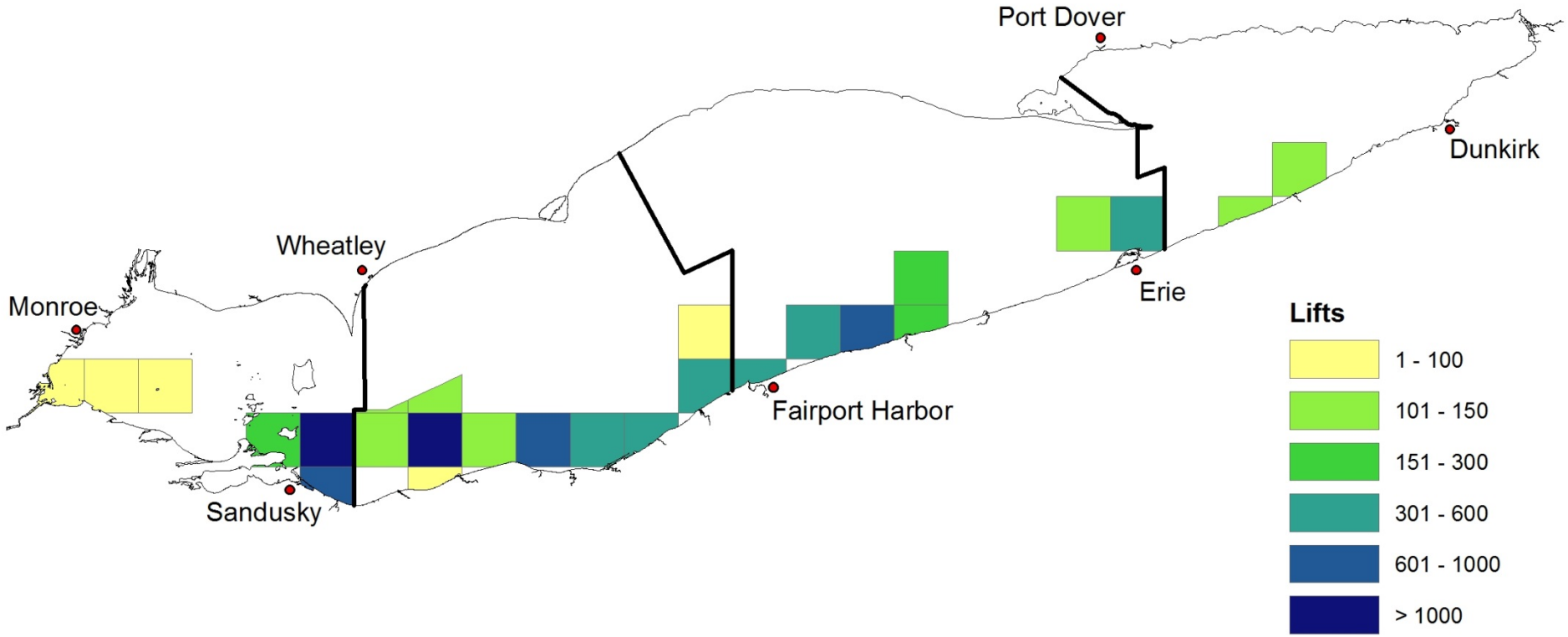


Figure 1.8. Spatial distribution of Yellow Perch trap net effort (lifts) in 2016 by 10-minute grid.

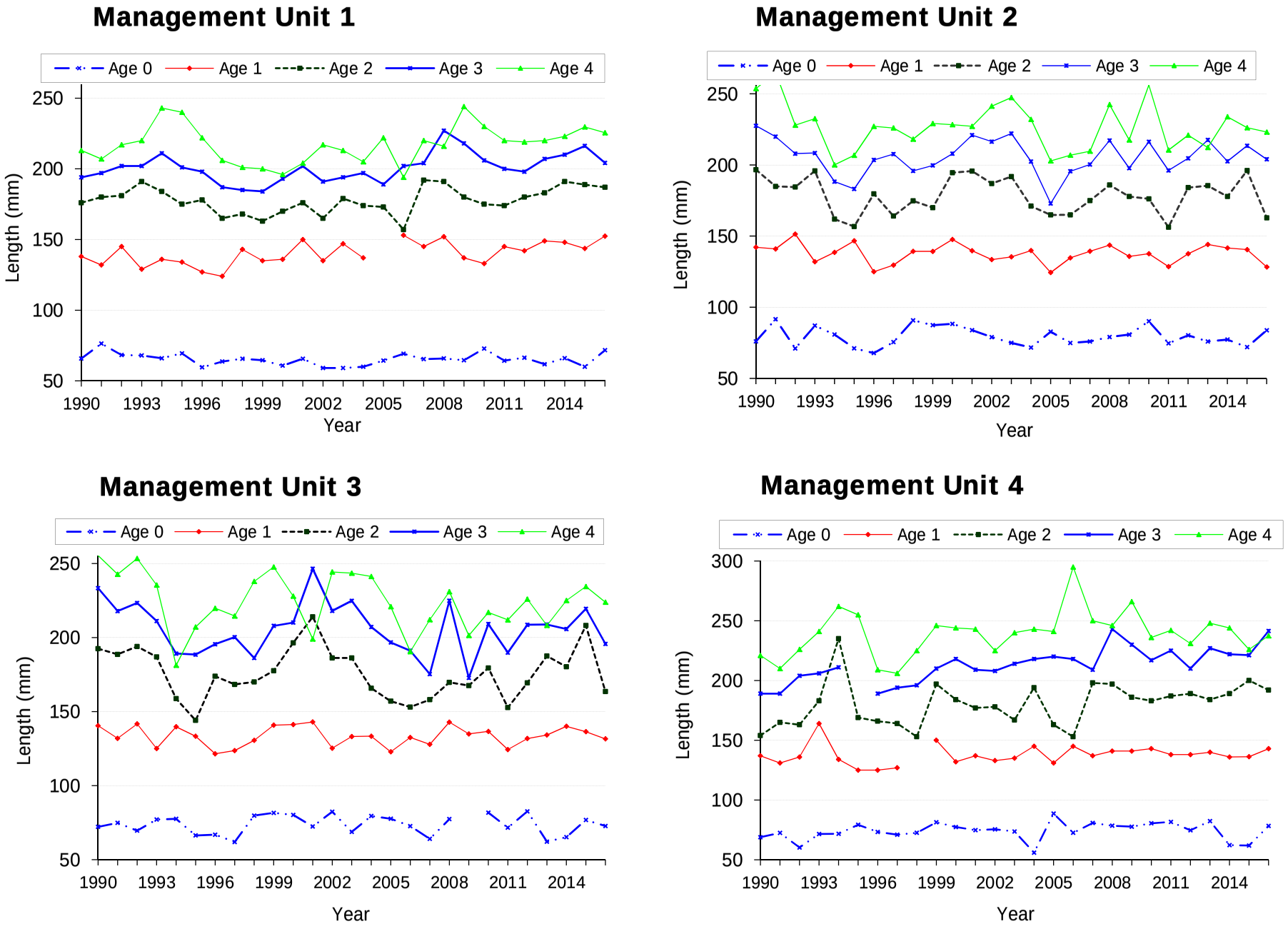


Figure 1.9. Yellow Perch total length-at-age from 1990 to 2016 fall interagency experimental samples for ages 0-4 by management unit.

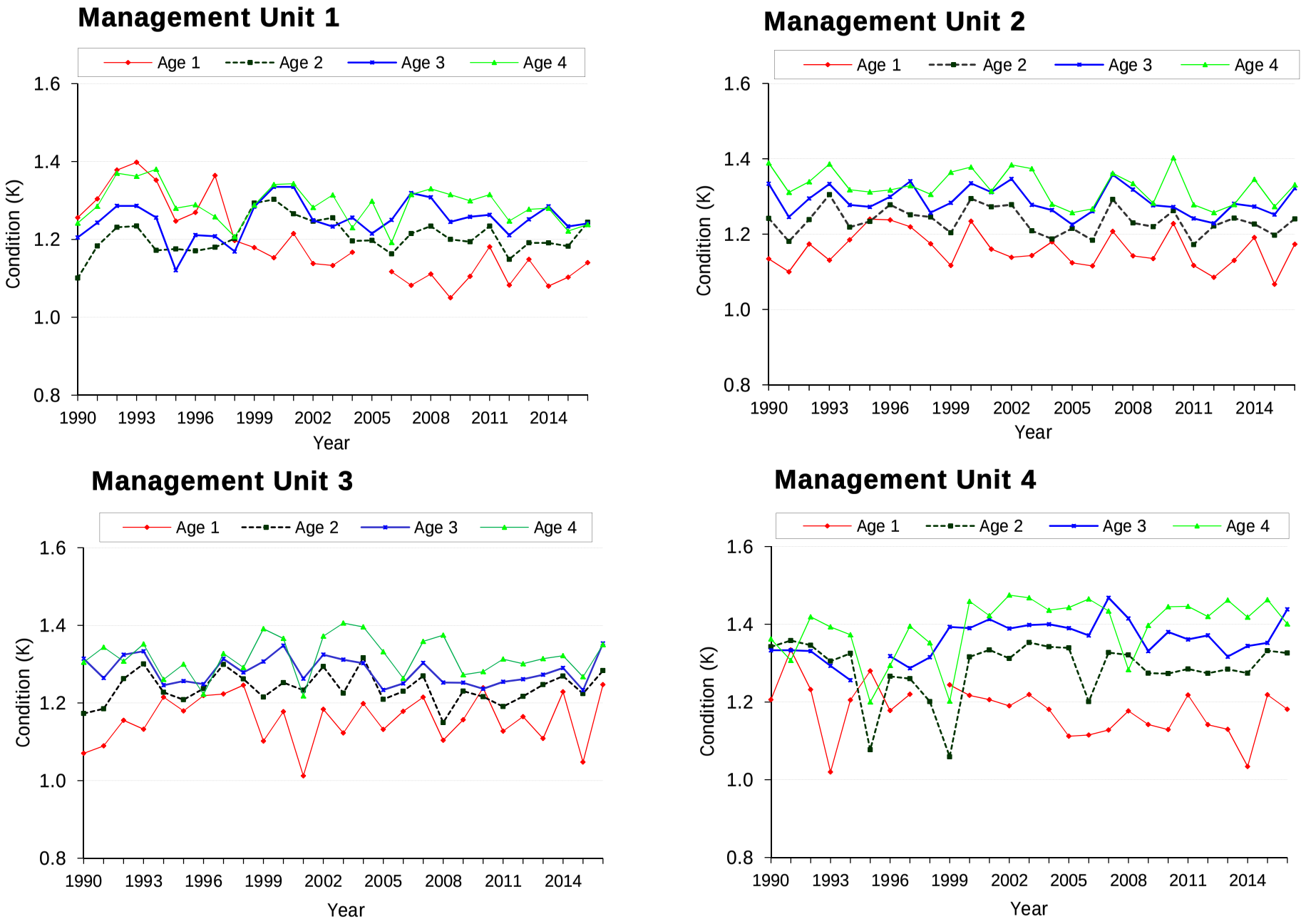


Figure 1.10. Yellow Perch condition (K) at age from 1990 to 2016 fall interagency experimental samples for ages 1-4 by management unit.

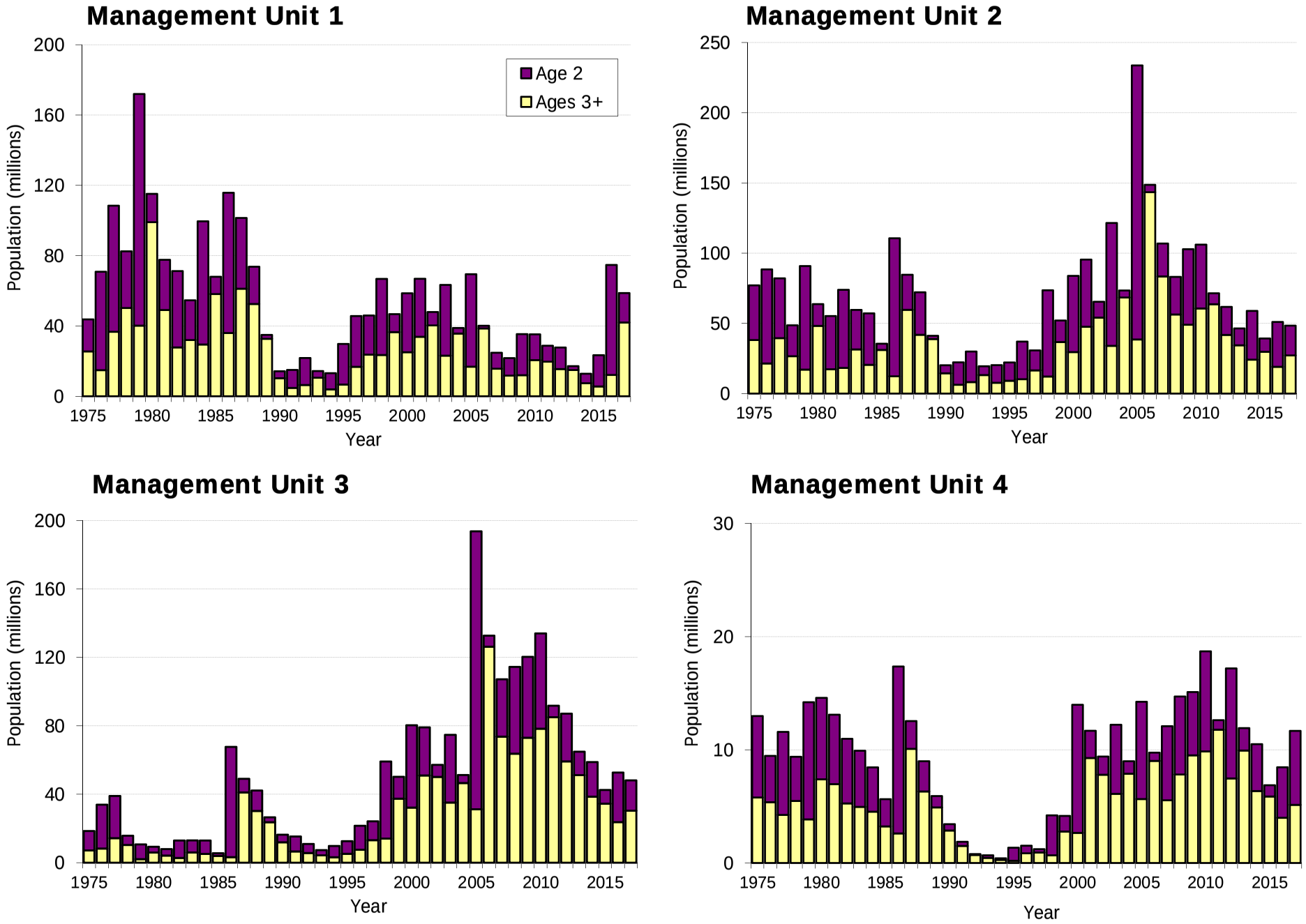


Figure 1.11.a. Lake Erie Yellow Perch population estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 1975 to 2016 are from the **YPTG ADMB model.** Estimates for 2017 are projected from the YPTG model and regressions for age 2 from survey gears.

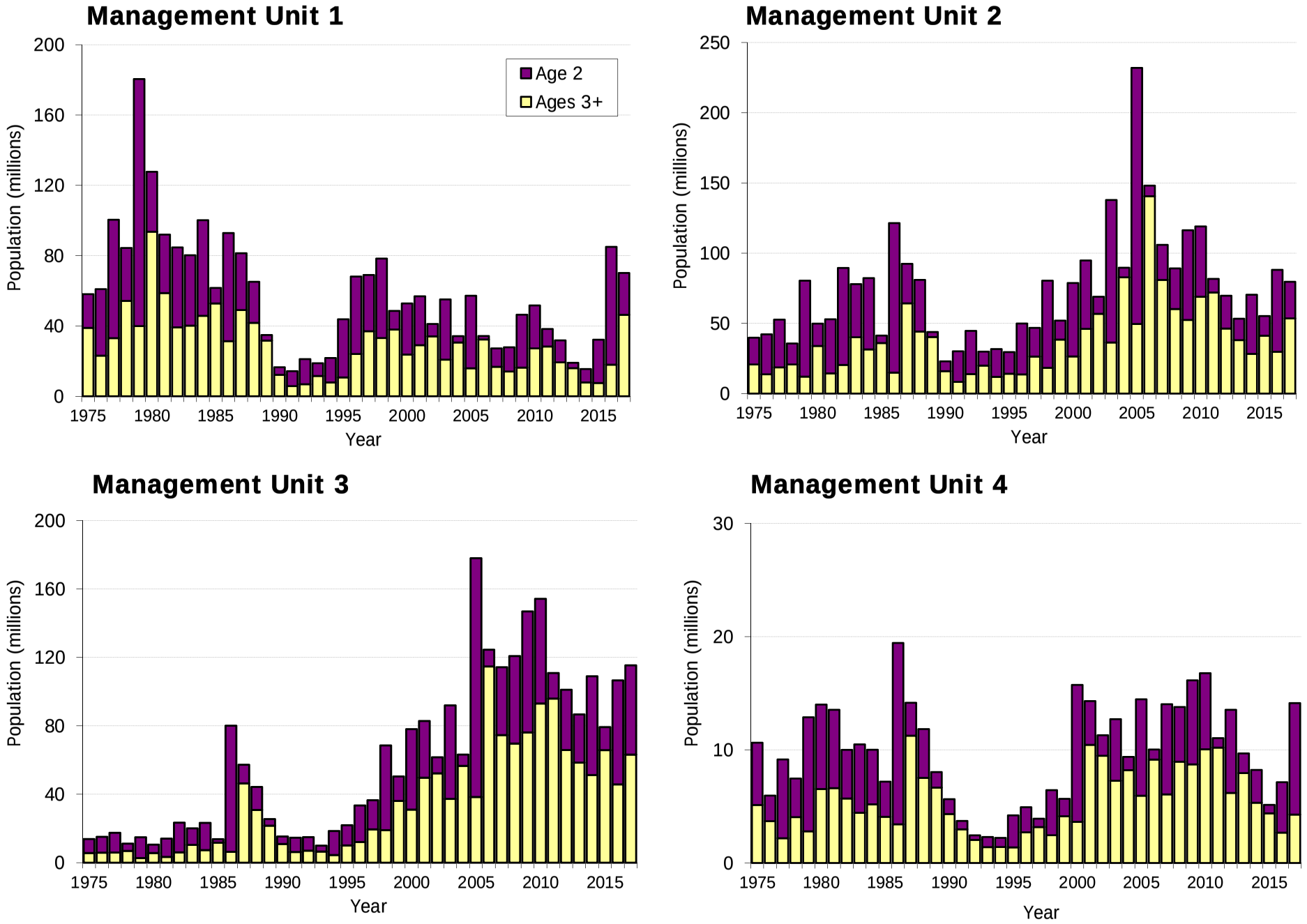


Figure 1.11.b. Lake Erie Yellow Perch population estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 1975 to 2016 are from the **PR ADMB model.** Estimates for 2017 are projected from the PR model and regressions for age 2 from survey gears.

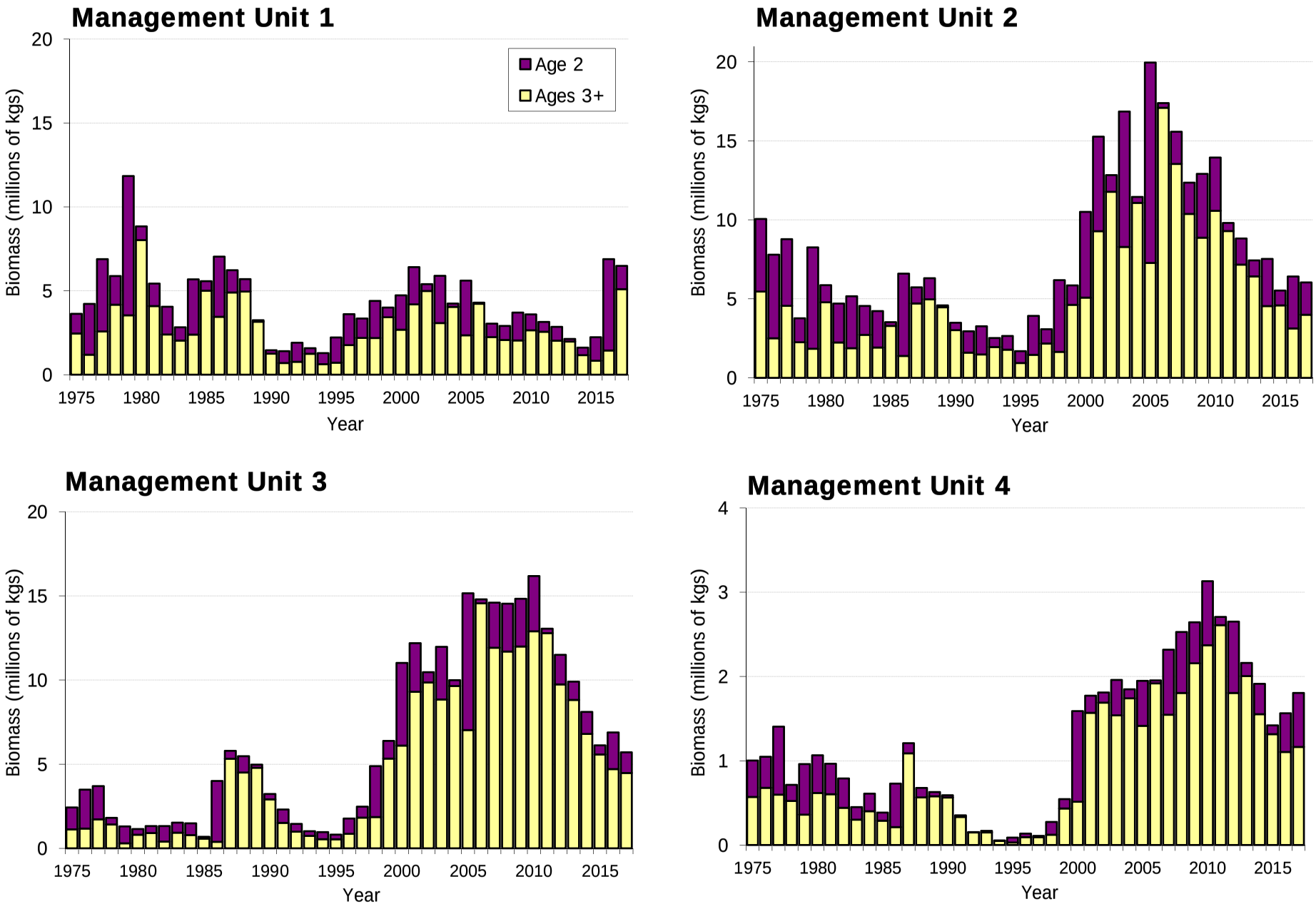


Figure 1.12.a. Lake Erie Yellow Perch biomass estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 1975 to 2016 are from the **YPTG ADMB model.** Estimates for 2017 are projected from the YPTG model and regressions for age 2 from survey gears.

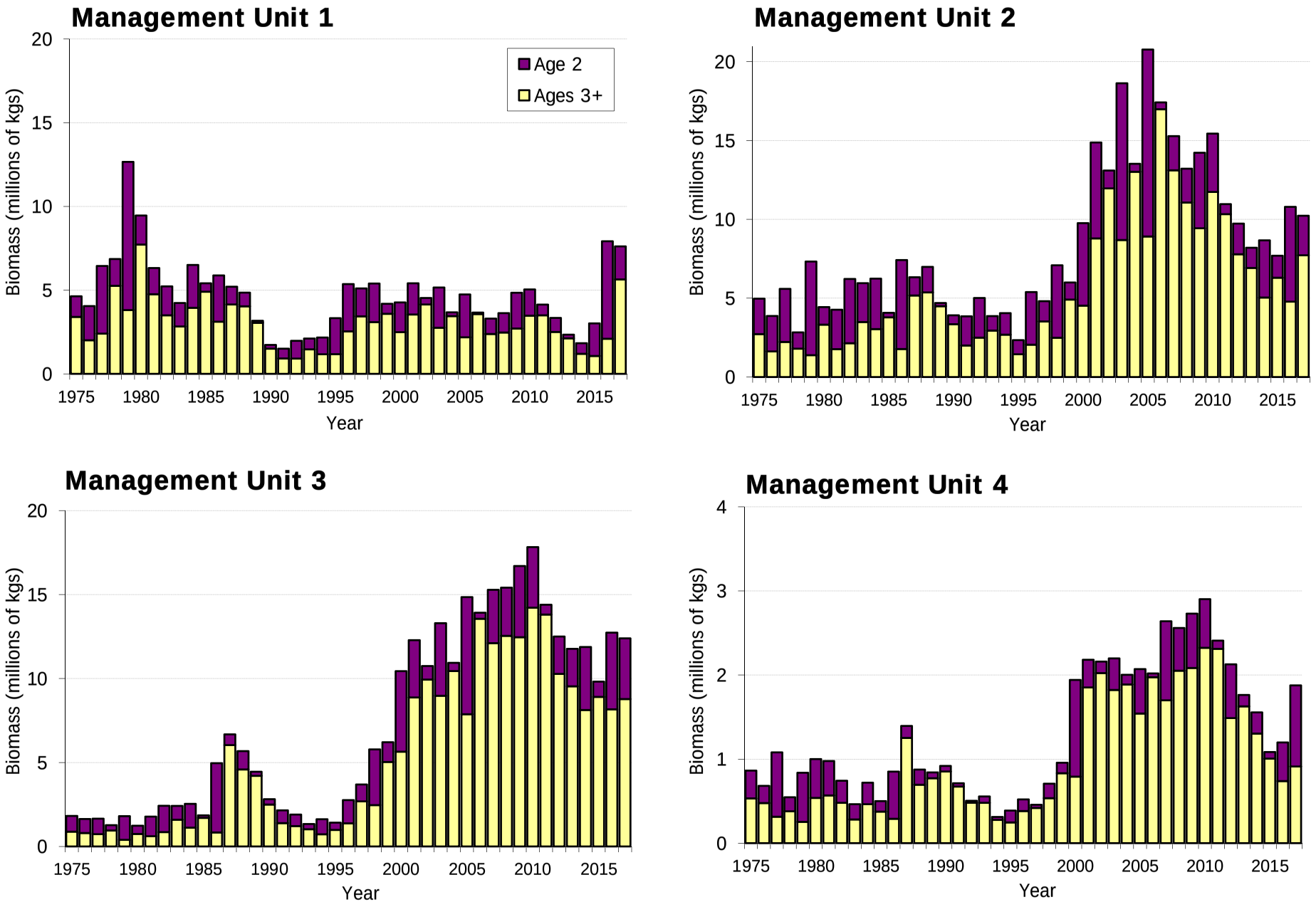


Figure 1.12.b. Lake Erie Yellow Perch biomass estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 1975 to 2016 are from the **PR ADMB model.** Estimates for 2017 are projected from the PR model and regressions for age 2 from survey gears.

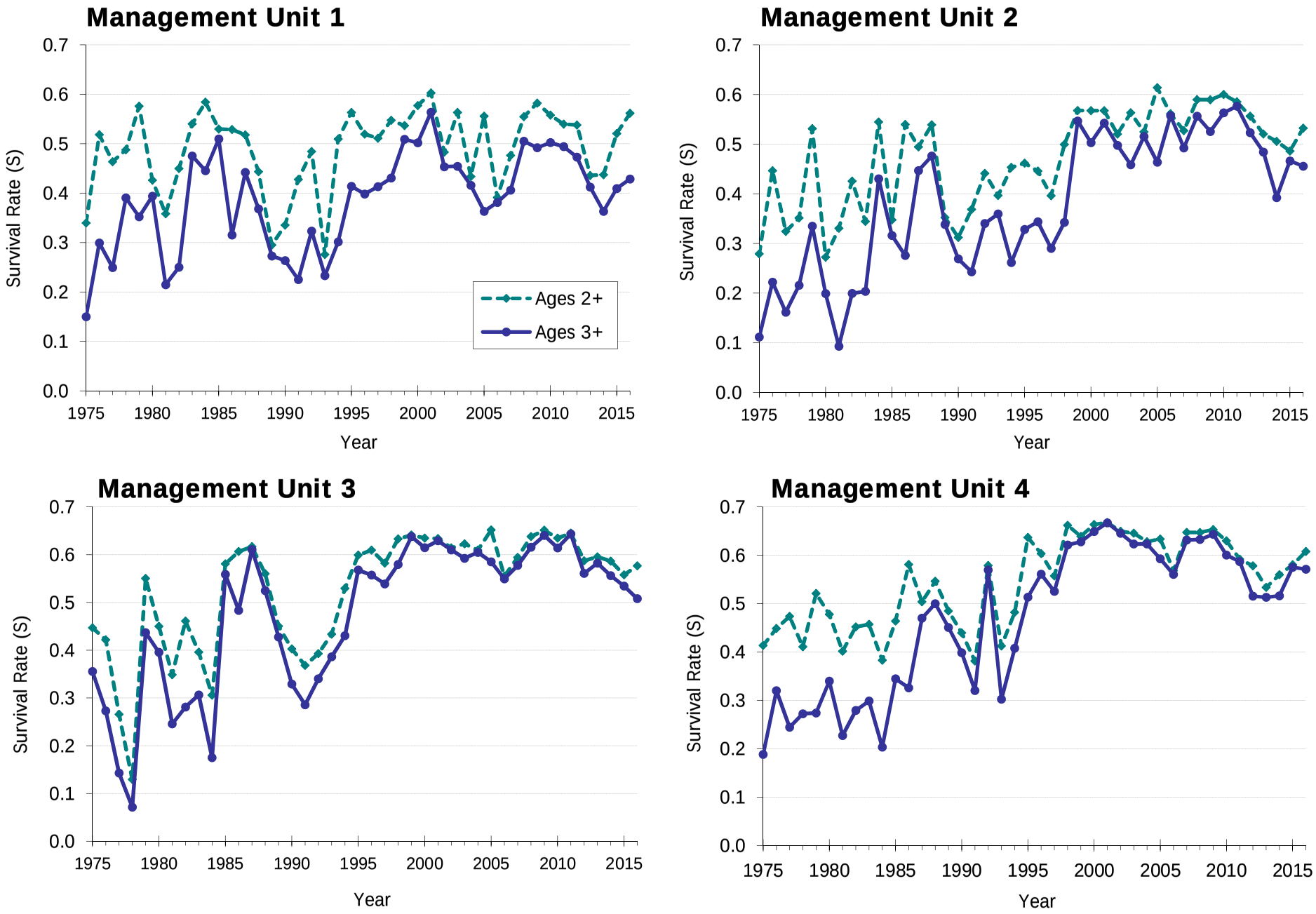


Figure 1.13.a. Lake Erie Yellow Perch survival rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from the **YPTG ADMB model**.

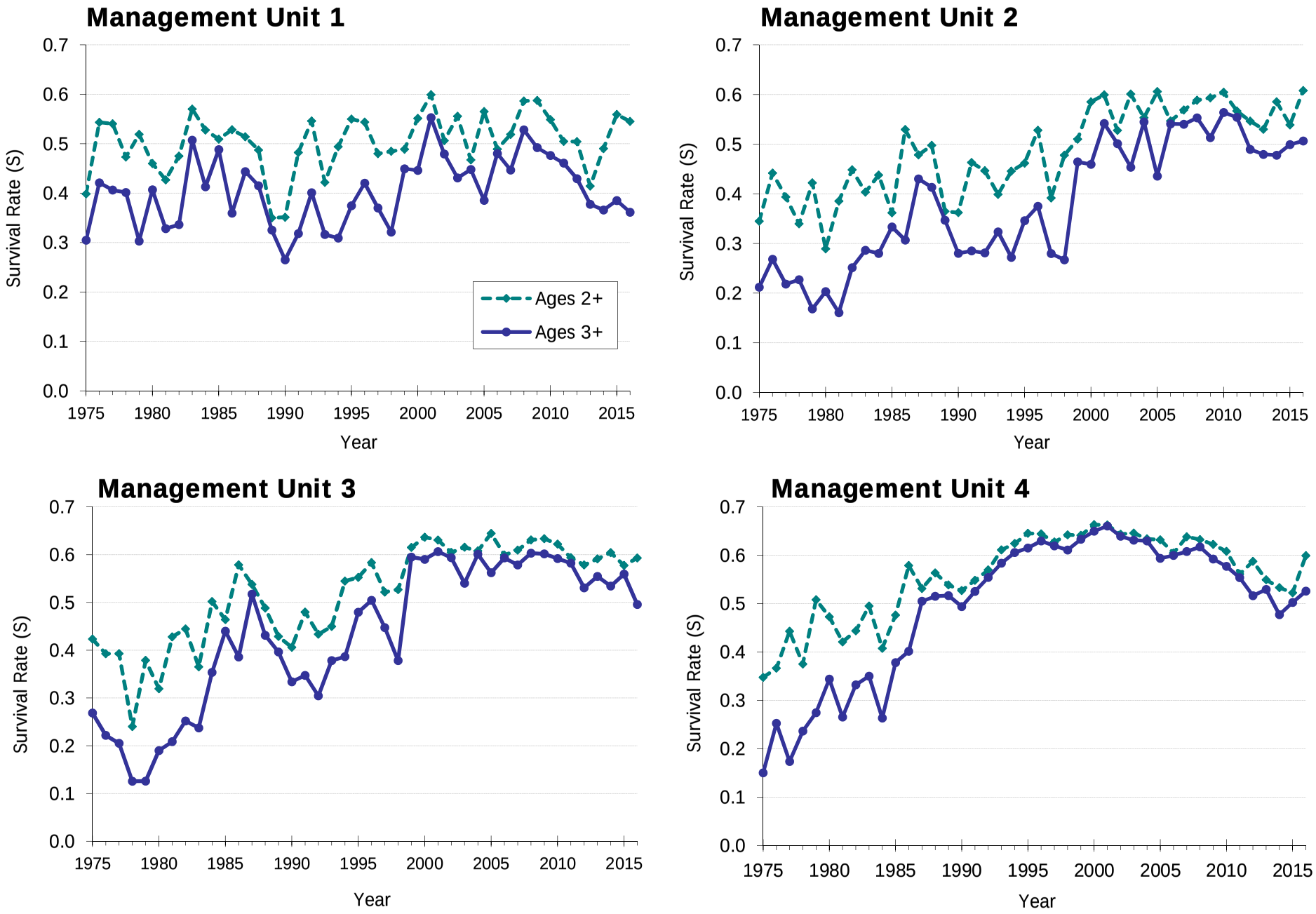


Figure 1.13.b. Lake Erie Yellow Perch survival rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from the **PR ADMB model**.

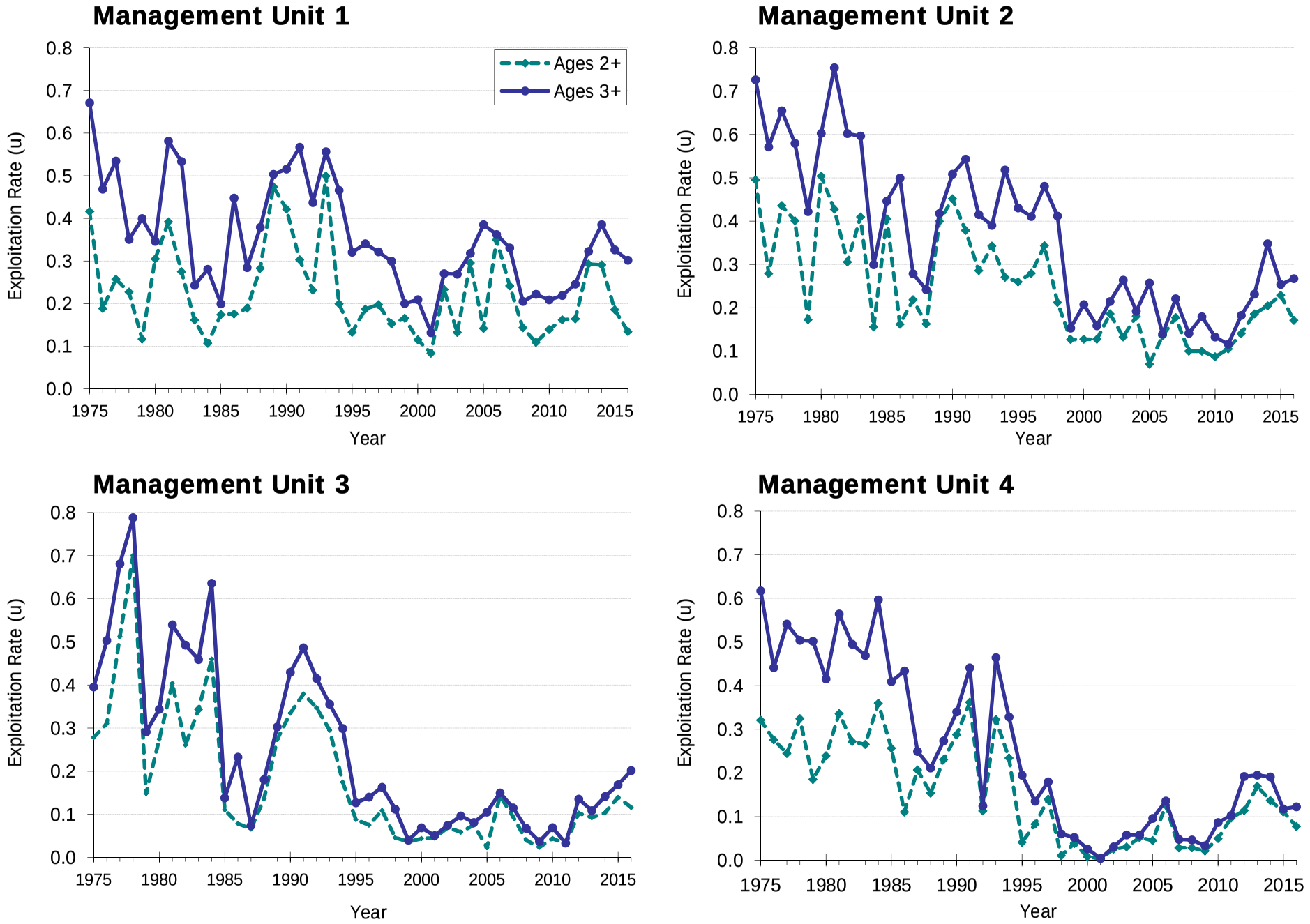


Figure 1.14.a. Lake Erie Yellow Perch exploitation rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from the **YPTG ADMB model**.

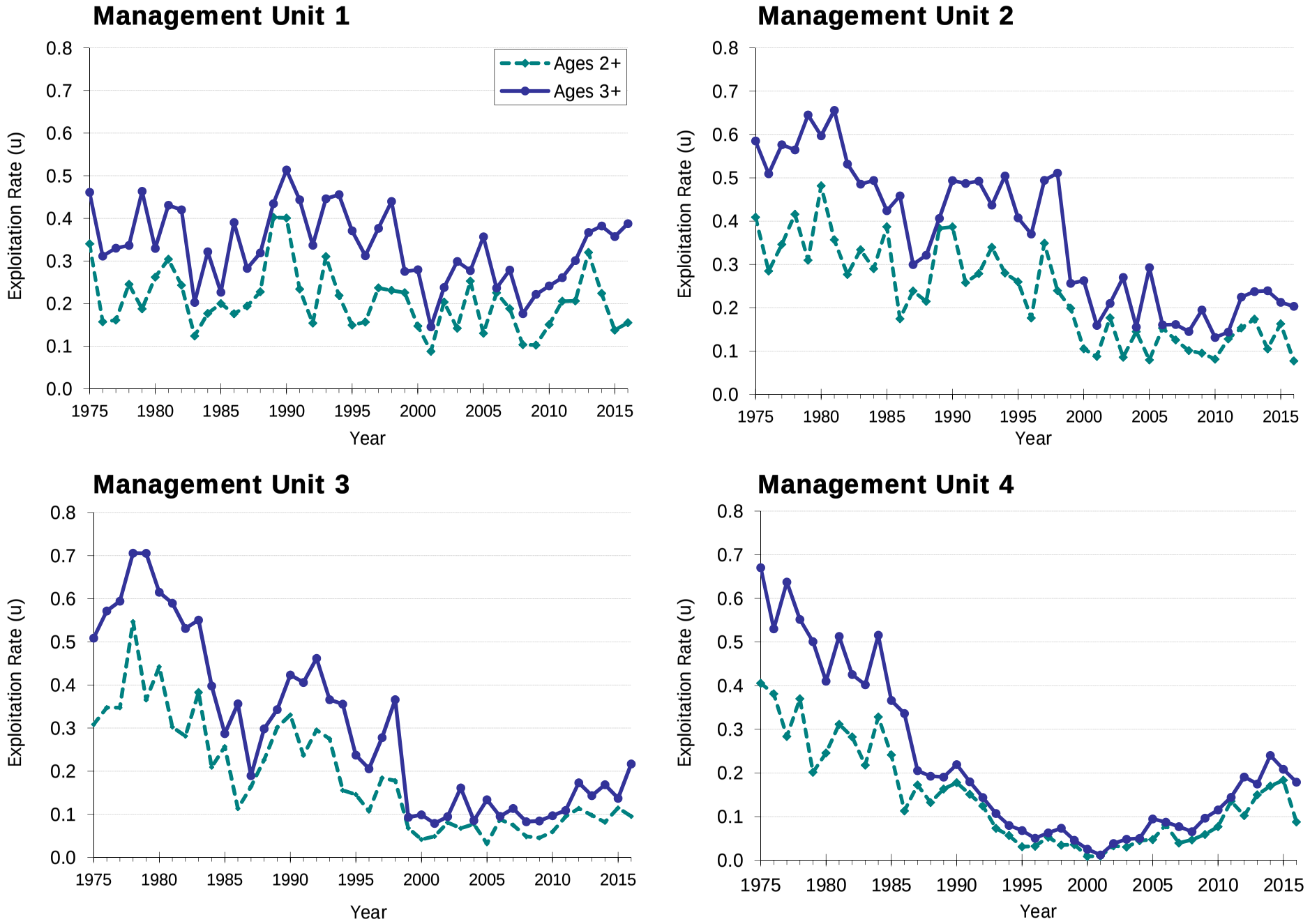
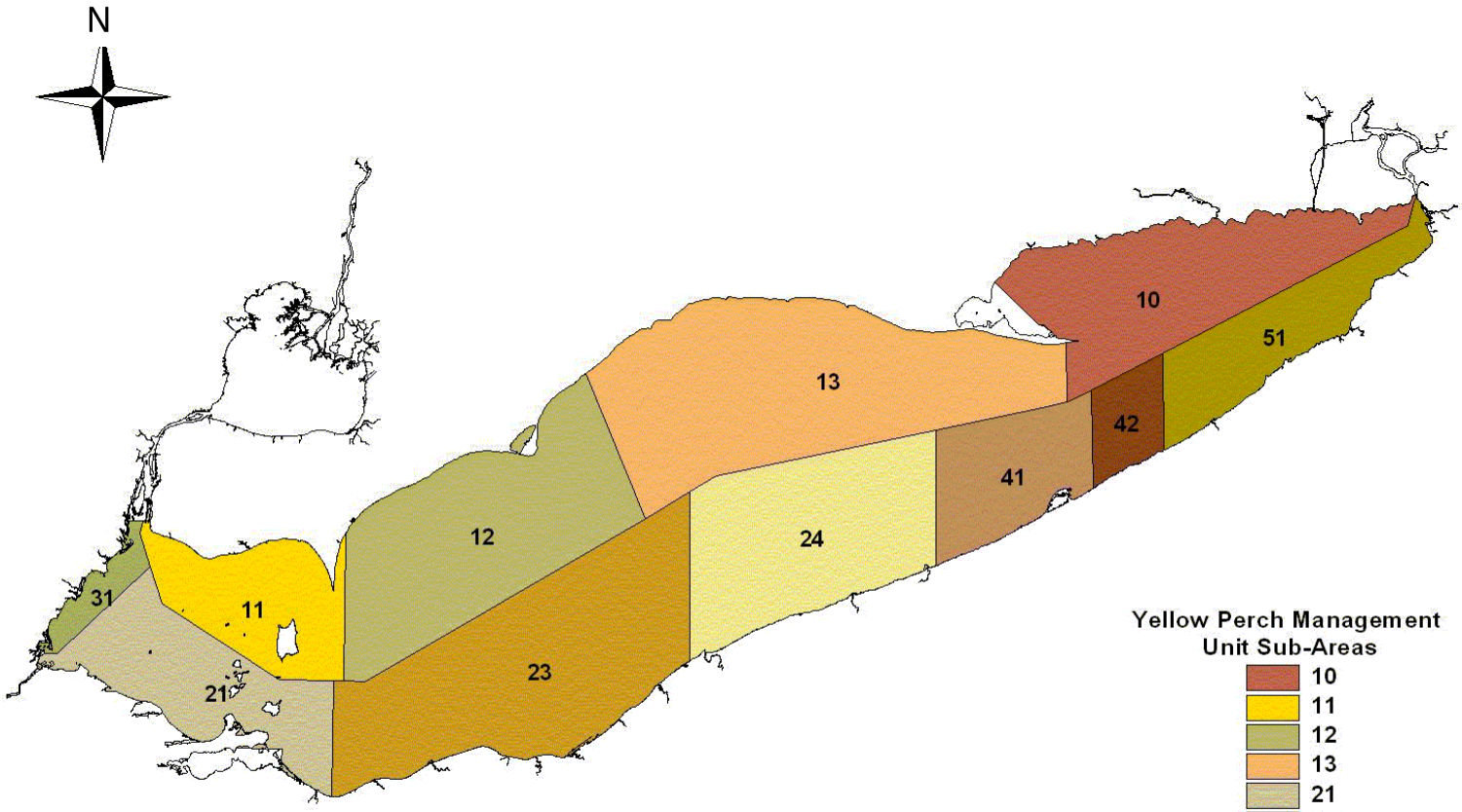


Figure 1.14.b. Lake Erie Yellow Perch exploitation rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from the **PR ADMB model**.



Management Unit	Sub-Area	Jurisdiction	Area Estimate (km2)	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 2.a.i. Projected Lake Erie Yellow Perch age-2 estimates (in millions of fish) from multi-model inference recruitment models run for each management unit.

MMI parameters estimates use age-2 values from the YPTG model

2017 Age-2 Projections

MU	Age-2 Recruitment Estimates 2016			Number of years in model	Number of models averaged
	Min.	Mean	Max.		
1	14.728	16.745	19.038	24	2
2	19.405	21.240	23.248	20	3
3	11.989	17.736	26.238	16	3
4	4.697	6.535	9.093	20	2

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

2017 Age-2 Projections

MU1

`Age_2 ~ Intercept + OPSF11 + OHF10 + OHF11 + OOS11`

Survey	Estimate	Uncond. variance	Number of models	Importance	+/- (alpha = 0.05)
OPSF11	0.014	0.001	1	0.295	0.053
(Intercept)	-0.560	0.094	2	1.000	0.640
OHF10A	0.307	0.015	2	1.000	0.253
OHF11A	0.102	0.002	2	1.000	0.098
OOS11A	0.380	0.019	2	1.000	0.290

MU2

`Age_2 ~ Intercept + OPSF21 + OHF20B + OHJ21B`

Survey	Estimate	Uncond. variance	Number of models	Importance	+/- (alpha = 0.05)
OHJ21B	0.091	0.009	2	0.589	0.206
OHF20B	0.168	0.014	2	0.778	0.251
(Intercept)	0.682	0.082	3	1.000	0.605
OPSF21	0.389	0.005	3	1.000	0.149

MU3

`Age_2 ~ Intercept + OPSF31 + OHJ31B + OHF31B`

Survey	Estimate	Uncond. variance	Number of models	Importance	+/- (alpha = 0.05)
OHF31B	0.082	0.015	1	0.334	0.265
OHJ31B	0.106	0.020	1	0.415	0.305
(Intercept)	0.314	0.222	3	1.000	1.016
OPSF31	0.518	0.017	3	1.000	0.278

MU4

`Age_2 ~ Intercept + NYF41 + LPC41`

Survey	Estimate	Uncond. variance	Number of models	Importance	+/- (alpha = 0.05)
LPC41A	0.040	0.005	1	0.316	0.150
(Intercept)	-0.668	0.152	2	1.000	0.819
NYF41A	0.595	0.021	2	1.000	0.308

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

MMI parameters estimates use age-2 values from the PR model

2017 Age-2 Projections

MU	Age-2 Recruitment Estimates 2016			Number of years in model	Number of models averaged
	Min.	Mean	Max.		
1	20.573	23.799	27.531	16	2
2	24.047	26.104	28.337	15	1
3	38.318	52.168	71.024	13	2
4	6.472	9.848	14.985	12	3

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

2017 Age-2 Projections

MU1

`Age_2 ~ Intercept + OOS11 + OOS10 + OPSF11`

Survey	Estimate	Uncond. variance	Number of models	Importance	+/- (alpha = 0.05)
OOS11A	0.095	0.021	1	0.364	0.313
(Intercept)	13.813	0.168	2	1.000	0.889
OOS10A	0.371	0.014	2	1.000	0.259
OPSF11	0.115	0.001	2	1.000	0.073

MU2

`Age_2 ~ Intercept + OHJ21B + OPSF21`

Survey	Estimate	Uncond. variance	Number of models	Importance	+/- (alpha = 0.05)
OHJ21B	0.159	0.062	1	1.000	< 0.001
(Intercept)	14.823	0.234	1	1.000	0.026
OPSF21	0.419	0.051	1	1.000	< 0.001

MU3

`Age_2 ~ Intercept + OHF30B + OHJ31B + OPSF31`

Survey	Estimate	Uncond. variance	Number of models	Importance	+/- (alpha = 0.05)
OHF30B	-0.082	0.018	1	0.288	0.297
(Intercept)	14.658	0.091	2	1.000	0.675
OHJ31B	0.385	0.016	2	1.000	0.280
OPSF31	0.383	0.013	2	1.000	0.259

MU4

`Age_2 ~ Intercept + LPC41 + NYF41`

Survey	Estimate	Uncond. variance	Number of models	Importance	+/- (alpha = 0.05)
LPC41A	0.260	0.037	2	0.730	0.433
(Intercept)	13.827	0.156	3	1.000	0.885
NYF41A	0.278	0.060	2	0.655	0.549

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.

Year	OHF10	OHF11	OOS10	OOS11	OHF20B	OHF21B	OHF30B	OHF31B	OHS20B	OHS21B	OHS30B	OHS31B	OHJ21B	OHJ31B	NYF40	NYF41	LPS41	LPC40	LPC41	OPSF11	OPSF21	OPSF31	OPSF41
1988	.	.	212.6	13.3	.	.	.	.	.	.	.	.	.	.	.	.	1.1	105.8	0.4	.	.	.	.
1989	.	.	265.4	12.5	.	.	.	.	.	.	.	.	.	.	.	.	6.3	82.1	16.4	.	.	6.8	76.6
1990	310.1	0.0	259.2	35.2	43.6	24.0	21.1	13.4	1.7	67.4	0.9	9.2	.	.	.	.	0.0	26.7	5.6	41.3	68.9	29.7	0.6
1991	58.1	0.4	113.2	42.1	10.8	51.6	1.3	19.6	5.4	43.5	4.5	66.6	216.5	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	40.2	15.6	27.5	3.1	7.2	8.0	19.6	4.4	18.5	0.8	10.7	2.4	5.6	70.3	4.6	47.5	8.0	5.7	6.3
1993	256.4	3.7	862.5	39.5	10.3	39.6	16.0	12.0	41.7	29.1	39.7	16.0	10.1	4.7	113.0	3.1	7.9	30.6	2.6	146.9	112.0	93.2	0.1
1994	287.1	73.1	469.7	62.9	77.1	11.1	14.7	4.0	73.3	5.0	77.2	16.7	23.3	10.2	49.0	8.6	2.7	34.7	6.2	317.8	22.5	39.7	7.4
1995	82.4	0.1	478.7	113.5	2.9	67.7	10.0	32.7	3.2	102.2	25.3	22.4	.	.	5.9	13.6	15.2	4.3	10.9	362.5	81.3	55.2	9.6
1996	579.3	82.3	2544.9	122.8	128.7	13.0	122.0	3.7	998.1	11.6	1912.1	3.2	7.9	0.9	105.8	0.3	0.4	33.6	1.1	198.4	70.8	.	.
1997	33.7	104.9	55.2	93.8	9.3	148.0	2.9	47.5	29.0	677.7	.	.	506.2	63.8	0.2	5.7	4.4	4.4	7.1	139.3	350.5	177.9	.
1998	250.9	16.0	170.6	8.2	74.4	6.4	38.9	4.0	235.1	3.5	275.5	3.7	22.5	16.2	1.3	0.4	8.4	127.8	1.7	17.5	6.7	6.2	0.0
1999	155.3	47.1	330.0	75.0	63.1	41.7	22.0	40.6	31.4	19.4	44.8	63.5	399.2	85.3	35.9	33.3	23.0	16.1	110.0	440.6	107.6	67.9	119.9
2000	41.5	38.0	102.5	113.6	18.0	57.1	1.0	19.9	0.6	86.6	.	84.8	50.6	10.3	23.9	7.0	0.7	3.6	11.3	106.1	162.4	55.5	36.9
2001	246.3	10.3	398.4	11.3	118.0	5.2	13.2	0.4	313.2	7.7	1283.7	10.2	299.0	4.3	100.4	11.7	4.8	69.4	2.0	12.9	9.6	1.9	9.5
2002	30.4	86.5	26.4	59.5	3.8	45.9	3.1	49.5	0.3	191.0	1.7	749.6	247.1	39.0	9.5	16.0	6.8	1.0	6.6	198.7	245.2	186.6	19.7
2003	1111.6	7.1	1620.8	12.3	126.7	2.5	56.5	1.1	1174.9	3.8	1170.2	2.3	10.4	2.6	484.8	2.0	1.3	222.8	2.3	2.7	2.6	7.2	3.2
2004	9.3	127.7	45.2	240.7	8.2	206.1	2.0	44.4	35.1	313.0	3.6	61.7	422.0	42.7	1.5	29.4	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	126.8	131.6	108.8	23.1	278.2	82.3	44.9	19.3	59.3	5.6	0.4	124.4	0.1	0.0	2.2	2.5	0.2
2006	121.9	12.5	222.8	12.4	3.6	5.1	18.9	13.3	4.9	2.2	60.7	10.8	29.7	113.6	290.6	40.9	19.5	30.1	12.1	15.7	28.5	94.8	129.7
2007	631.5	23.6	444.6	18.8	150.6	20.2	166.5	34.5	237.0	22.6	237.0	40.9	287.6	281.8	412.0	42.3	9.1	63.5	7.9	184.4	203.9	202.5	43.4
2008	74.7	15.3	387.2	142.1	31.2	53.4	52.8	26.4	219.5	63.1	558.3	150.2	303.5	97.2	1116.7	45.5	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	137.2	16.0	58.3	0.1	104.3	125.9	48.2	11.9	64.1	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	.	.	.	.	28.8	12.1	197.7	4.2	1.7	51.8	0.2	49.5	18.1	36.2	15.7
2011	12.0	10.0	178.0	25.9	10.5	6.4	15.1	55.5	7.1	34.5	14.1	41.3	70.8	40.8	89.5	141.8	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	64.0	9.3	157.0	22.3	46.4	76.5	280.0	16.7	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	3.4	262.6	84.2	116.2	4.4	24.4	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	.	.	274.2	2.9	0.9	28.4	0.02	315.0	34.7	16.4	2.2
2015	224.0	53.0	494.3	117.2	19.6	41.3	18.6	30.2	.	.	.	.	.	.	68.6	57.3	4.0	58.5	1.6	424.3	66.5	212.7	170.9
2016	146.8	22.9	404.1	33.2	0.5	5.0	1.5	8.4	0.2	91.3	164.0	184.6	46.5	174.9	2178.2	53.0	35.4	360.6	91.7	105.6	50.4	35.1	298.2

Year	*OHS10*	*OHS11*	*OLPN40*	*OLPN41*	*ILP40*	*ILP41*	*OLPO40*	*OLPO41*
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*	*38.0*	*14.6*
2007	*592.9*	*14.5*	*6.3*	*0.9*	*73.9*	*3.0*	*70.0*	*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*	*2.3*	*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*
2016	*329.4*	*13.5*	*20.2*	*1.8*	*121.2*	*13.8*	*440.8*	*115.0*

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