# Report of the Lake Erie Yellow Perch Task Group

**March 28th, 2018**


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Presented to:

Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission

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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 before 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 2017 through March 2018 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 2018.

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.

4. Improve existing population models to produce the most scientifically defensible and reliable method for estimating and forecasting abundance, recruitment, and mortality.
    a. Explore additional recruitment indices for incorporation into catch-at-age model.

## Charge 1: 2017 Fisheries Review and Population Dynamics

The lakewide total allowable catch (TAC) of Yellow Perch in 2017 was 10.375 million pounds. This allocation represented a 13% increase from a TAC of 9.208 million pounds in 2016. For Yellow Perch assessment and allocation, Lake Erie is partitioned into four management units (MUs; Figure 1.1). The 2017 TAC allocation was 3.062, 3.237, 3.776, and 0.300 million pounds for MUs 1 through 4, respectively. In March 2017, the process of developing a new assessment model (PR model), management strategy evaluation, and harvest policy for Lake Erie Yellow Perch was underway, but not yet complete. Therefore, the Lake Erie Committee (LEC) set 2017 TACs after considering abundance estimates and RAH ranges from two assessment models that were presented by the YPTG (YPTG and PR models; YPTG 2017), with the TACs remaining close to the previous year's value (decided based on the YPTG model) as possible while remaining within the RAH range estimated using the PR model. For MU1 and MU2, the LEC set the TAC equal to the minimum RAH estimated by the PR model (3.062 and 3.237 million pounds, respectively). For MU3, the LEC set the TAC at 3.776 million pounds, which was equal to the 2016 TAC. For MU4, the LEC set the TAC at 0.300 million pounds, which represented a 22% decrease from the 2016 TAC.

The lake-wide harvest of Yellow Perch in 2017 was 7.789 million pounds, or 75% of the total 2017 TAC. This was a 7.8% increase from the 2016 harvest of 7.223 million pounds. Harvest from MUs 1 through 4 was 2.773, 2.142, 2.639, and 0.235 million pounds, respectively (Table 1.1). The portion of TAC harvested was 91%, 66%, 70%, and 78%, in MUs 1 through 4, respectively. In 2017, Ontario harvested 4.983 million pounds, followed by Ohio (2.387 million lbs.), Michigan (0.256 million lbs.), Pennsylvania (0.123 million lbs.), and New York (0.040 million lbs.).

Ontario's fraction of allocation harvested was 103% in MU1, 102% in MU2, 103% in MU3, and 103% in MU4 (see paragraph below regarding Ontario's harvest reporting and commercial ice allowance policy). Ohio fishers attained 80% of their TAC in the western basin (MU1), 37% in the west central basin (MU2), and 41% in the east central basin (MU3). Michigan anglers in MU1 attained 92% of their TAC. Pennsylvania fisheries harvested 19% of their TAC in MU3 and 49% of their TAC in MU4. New York fisheries attained 43% of their TAC in MU4. Ontario's portion of the lakewide Yellow Perch harvest in 2017 (64%) was comparable to 2016 (62%; Table 1.1). Ohio's proportion of lakewide harvest in 2017 (31%) was also similar to 2016, and harvest in Michigan, Pennsylvania, and New York waters combined represented 5.4% of the lakewide harvest in 2017.

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. Yellow Perch sport harvest from Ontario waters is assessed periodically, which last occurred in 2014, but is not reported here. 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 from 2008 to 2017 by management unit, year, agency, and gear type in Tables 1.2 to 1.5. Trends across a longer time series (1975 to 2017) 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 2017 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 2017 was 0.4%, 4.2%, and 3.0% of the gill net harvest in management units 1, 2 and 3, respectively, and was negligible (0.02%) in MU4. 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 2017 increased by 35% in MU1 and 15.1% in MU2, but declined by 2% in MU3 and 23% in MU4. Ontario trap net harvest was minimal (839 pounds in 2017) 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 2017, 57 pounds of Yellow Perch were harvested in trawl nets in MU2, 1,380 pounds of Yellow Perch were harvested in trawl nets in MU3, and 2,223 pounds were harvested in MU4.

Targeted (i.e., small mesh) gill net effort in 2017 decreased from 2016 across all four MUs (-7%, -5%, -20%, and -57%, respectively). Gill net effort in 2017 was also lower when compared to the 1990s and earlier decades (Figure 1.3). Targeted gill net harvest rates in 2017 increased relative to 2016 rates by 46% in MU1, 21% in MU2, 22% in MU3, and 78% in MU4 (Figure 1.4).

In 2017, sport harvest in U.S. waters decreased by 11% in MU1, 49% in MU2 and MU3, but increased by 85% in MU4 compared to the 2016 harvest (Figure 1.2). Similarly, angling effort in U.S. waters decreased in 2017 from 2016 in MU1 (-9%), MU2 (-42%), MU3 (-35%), and MU4 (-1%; 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 2016 rates, harvest per angler hour decreased in Michigan and Ohio waters of MU1 (-12%), in Ohio waters of MU2 (-19%) and MU3 (-16%), and in Pennsylvania waters of MU4 (-5%). Harvest rates increased in the Pennsylvania waters of MU3 (+8%) and New York waters of MU4 (+42%).

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 2017, the sport harvest rate (in kg/hr) decreased in MU1 (0.48; -3%), MU2 (0.20; -13%), and MU3 (0.34; -23%), but increased in MU4 (0.50; -87%) from 2016 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 14% in MU2, but increased by 333% in MU1, 24% in MU3, and 8% in MU4. Compared to 2016, trap net effort (lifts) in 2017 increased by 57% in MU1, decreased in MU2 by 43%, decreased by 26% in MU3, and decreased by 16% in MU4. Trap net harvest rate increased in all MUs (176%, 51%, 66%, and 29% increases, respectively).

### *Age Composition and Growth*

Lakewide, age-3 fish contributed the most to the Yellow Perch harvest (57%), followed by age-5 fish (16%), with age-2 and age-4 fish contributing roughly equally (11 and 10%, respectively; Table 1.6). In MU1, age-3 fish (2014 year class, 66%), and age-2 fish (2015 year class, 19%) contributed most to the fishery. In MU2, age-3 fish (2014 year class, 61%) and age-5 fish (2012 year class, 14%) contributed most to the fishery. In MU3, age-3 fish (2014 year class, 41%) and age-5 fish (2012 year class, 35%) contributed the most to the harvest. In MU4, age-3 fish (2014 year class, 49%) and age-2 fish (2015 year class, 28%) contributed the most to the harvest.

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 2018, 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), and the second was the model developed by the Quantitative Fisheries Centre (QFC) 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. Survey catch at age of age-2 and older fish from gill net and trawl surveys are also incorporated. 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. Commercial gill net catchability coefficients based on the seasonal distribution of harvest and relative catch rates are also used. 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 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., 2016 year class in the 2018 TAC year) are removed from the analysis. A list of all possible non-redundant models is generated from the survey data and fit using the glmulti package (Calcagno 2013). 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 that 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 recommended using the YPTG model in 2017 and 2018. The task group previously 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 harvest policy risk assessment (i.e., management strategy evaluation) has yet to be completed using the PR models (YPTG 2017). 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 PR model is sensitive to the recruitment data, and different recruitment surveys may be selected each year during the MMI process leading to instability in the abundance estimates. 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 use a pin file (containing prior values for parameter estimates). Despite using the pin file, the MU3 PR model would not converge on a whole value for the maximum effective sample size.

*YPTG and PR model results*

Estimates of population size for both models, from 2000 to 2017, and projections for 2018 based on 2017 fishing mortality rates and recruitment, are presented in Table 1.7. Abundance, biomass, survival, and exploitation rates are presented by management unit graphically for 1975 to 2017 in Figures 1.9 to 1.12. Mean weights-at-age from assessment surveys were applied to abundance estimates to generate population biomass estimates (Table 1.8 and Figure 1.10). 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 2017 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 across three decades. In addition, with SCAA the most recent year's population estimates inherently have the widest error bounds, which 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 2018 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 2018 age-2 Yellow Perch recruitment (the 2016 year class) were 4.923, 10.351, 25.922, and 10.136 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 2018, 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 2018 age-2 Yellow Perch recruitment (the 2016 year class) were 11.550, 11.112, 33.587, and 6.443 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, and 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.

### *2018 Population Size Projection*

Stock size estimates for age-3-and-older Yellow Perch in 2018 were projected from SCAA estimates of 2017 population size and age-specific survival rates in 2017 for both the YPTG and PR models (Table 1.8). Projected age-2 Yellow Perch recruitment from the 2016 year class (method described above) was added to the 2018 population estimate for older fish in each unit, producing the total standing stock in 2018 (Table 1.8). Standard errors and ranges for estimates are provided for each age in 2017 and following estimated survival from SCAA, for 2018. 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 2017 from the YPTG model (Table 1.7.a) were higher than those projected last year in MUs 1 and 2, but lower than projected in MUs 3 and 4 (YPTG 2017). Differences in stock size estimates were due to additional data in the model and differences in age-2 estimates projected in 2017 compared to those estimated by the model in 2018. Current estimates of age-2 fish in 2017 are from first assessment of this cohort and, as such, have the widest error bounds.

In the 2018 YPTG model run, stock size estimates projected for 2018 were lower than 2017 stock size estimates in MUs 1 and 2, and higher in MUs 3 and 4 (Table 1.8.a, Figure 1.9.a). Abundance projections for 2018 were 41.341, 43.279, 49.543, and 17.292 million age-2-and-older Yellow Perch in management units 1 through 4, respectively. Compared to the 2017 abundance estimates, estimates of age-2-and-older Yellow Perch in 2018 are projected to decrease by 40% and 25% in MU1 and MU2, respectively, and to increase by 19% in MU3 and 54% in MU4. Age-3-and-older Yellow Perch abundance in 2018 is projected to be 36.418, 32.929, 23.622, and 7.155 million fish in MUs 1 through 4, respectively. Model estimates of abundance for age-3-and-older Yellow Perch for 2018 are projected to increase from the 2017 estimates by 2%, 7%, and 24% in

MU1, MU2, and MU4, respectively, and decrease by 23% in MU3. Lakewide abundance of age-2-and-older Yellow Perch in 2018 is projected to be 151.5 million fish, a decrease of 16% from 2017.

As a function of population estimates and mean weight-at-age from fishery-independent surveys, total biomass estimates of age-2-and-older Yellow Perch for 2018 are projected to decrease in MU1 (-35%), MU2 (-25%), and in MU3 (-5%), and to increase in MU4 (+30%), compared to 2017 estimates (Table 1.8.a. and Figure 1.10.a).

Estimates of Yellow Perch survival for age-3-and-older in 2017 were 47%, 55%, 54%, and 62% in MUs 1 through 4, respectively (Table 1.8.a and Figure 1.11.a). Estimates of Yellow Perch survival in 2017 for age-2-and-older fish were: 53% in MU1, 57% in MU2 and MU3, and 64% 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 2017 were 25%, 15%, 16%, and 6% in management units 1 through 4, respectively. Estimates of Yellow Perch exploitation for ages-2-and-older fish in 2017 were: 18% in MU1, 12% in MU2, 13% in MU3, and 4% in MU4 (Table 1.8a and Figure 1.12a).

*PR model*

Stock size estimates for 2017 from the PR model (Table 1.7.b) were lower than those projected last year in MUs 1, 2 and 3, but higher than projected in MU 4 (YPTG 2017). Using the PR model, abundance projections for 2018 were 37.901, 53.868, 77.644, and 16.983 million age-2-and-older Yellow Perch in management units 1 through 4, respectively. Abundance estimates of age-2-and-older Yellow Perch in 2018 are projected to decrease by 35% in MU1 and 26% in MU2, and increase by 5% in MU3 and 4% in MU4 compared to the 2017 abundance estimates (Table 1.8.b, Figure 1.9.b). Age-3-and-older Yellow Perch abundance in 2018 is projected to be 26.351, 42.756, 44.056, and 10.540 million fish in MUs 1 through 4, respectively. Model estimates of abundance for age-3-and-older Yellow Perch for 2018 are projected to decrease from the 2017 estimates by 24% and 15% in MUs 1 and 3, respectively, and increase by 2% and 125% in MUs 2 and 4, respectively. Lakewide abundance of age-2-and-older Yellow Perch in 2018 is projected to be 186.4 million fish, a decrease of 16% from 2017.

As a function of population estimates and mean weight-at-age from fishery-independent surveys, total biomass estimates of age-2-and-older Yellow Perch for 2018 are projected to decrease in MU1 (-35%), MU2 (-27%), and MU3 (-9%), and increase in MU4 (+12%), compared to 2017 estimates (Table 1.8.b. and Figure 1.10.b).

Estimates of Yellow Perch survival for age-3-and-older in 2017 were 36%, 54%, 56%, and 61% in MUs 1 through 4, respectively (Table 1.8.b and Figure 1.11.b). Estimates of Yellow Perch survival in 2017 for age-2-and-older fish were: 45% in MU1, 59% in MU2 and MU3, and 65% in MU4. Estimated exploitation rates of ages-3-and-older Yellow Perch in 2017 were 39%, 16%, 14%, and 7% in management units 1 through 4, respectively. Estimates of Yellow Perch exploitation for ages-2-and-older fish in 2017 were: 27% in MU1, 10% in MU2 and MU3, and 3% in MU4 (Table 1.8b and Figure 1.12b).

## Charge 2: Harvest Strategy and Recommended Allowable Harvest

Fishing rates applied in 2018 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 2018 for each management unit (Tables 2.1 and 2.2).

Quota allocation by management unit and jurisdiction for 2018 was determined by the same methods applied in 2009-2017, 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, 2018:

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 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 2017, LEPMAG discussed stakeholder objectives and began working on a management strategy evaluation to evaluate current and alternative harvest strategies for the PR model. To date, work focused on MUs 1 and 4, although preliminary results are expected for all MUs during 2018.

### Charge 4: Improve existing population models

The YPTG explored additional recruitment indices for incorporation into the catch-at-age model. In 2018, the New York gill net age-1 recruitment index was added to the MU4 model. Additional central basin recruitment indices were examined, but not included at this time. Moving forward, the YPTG would like to examine all of the recruitment indices currently used to determine which ones are appropriate moving forward and remove those which may not be appropriate.

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**Table 1.1**. Lake Erie Yellow Perch harvest in pounds by management unit (Unit) and agency, 2008-2017.

| | | **Ontario*** | | **Ohio** | | **Michigan** | | **Pennsylvania** | | **New York** | | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Year** | Harvest | % | Harvest | % | Harvest | % | Harvest | % | Harvest | % | **Harvest** |
| **Unit 1** | 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 |
| | 2017 | 1,277,587 | 46 | 1,239,575 | 45 | 255,605 | 9 | | | | | 2,772,767 |
| **Unit 2** | 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 |
| | 2017 | 1,498,437 | 70 | 643,554 | 30 | | | | | | | 2,141,991 |
| **Unit 3** | 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 |
| | 2017 | 2,027,235 | 77 | 504,223 | 19 | | | 107,335 | 4 | | | 2,638,793 |
| **Unit 4** | 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 |
| | 2017 | 179,730 | 76 | | | | | 16,078 | 7 | 39,598 | 17 | 235,407 |
| **Lakewide 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 |
| | 2017 | 4,982,989 | 64 | 2,387,352 | 30.7 | 255,605 | 3 | 123,413 | 2 | 39,598 | 1 | 7,788,958 |

*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, 2008-2017.

| | | Unit 1 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Michigan | Ohio | | Ontario Gill Nets | | Ontario |
| | Year | Sport | Trap Nets | Sport | Small Mesh | Large Mesh* | Trap Nets |
| **Harvest** | 2008 | 47,934 | 0 | 409,705 | 484,409 | 49,378 | 46,263 |
| (pounds) | 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 |
| | 2017 | 255,605 | 447,263 | 792,312 | 1,271,282 | 5,466 | 839 |
| **Harvest** | 2008 | 22 | 0 | 186 | 220 | 22 | 21.0 |
| (Metric) | 2009 | 40 | 0 | 210 | 330 | 57 | 0.03 |
| (tonnes) | 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 |
| | 2017 | 116 | 203 | 359 | 577 | 2 | 0.38 |
| **Effort** | 2008 | 95,925 | 0 | 519,050 | 1,653 | 899 | |
| *(a)* | 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 | |
| | 2017 | 204,877 | 3,830 | 775,334 | 5,656 | 600 | |
| **Harvest Rates** | 2008 | 1.5 | -- | 2.7 | 132.9 | 24.9 | |
| *(b)* | 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 | |
| | 2017 | 4.3 | 53.0 | 3.6 | 101.9 | 4.1 | |

*(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 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 in Management Unit 2 (western Central Basin) by agency and gear type, 2008-2017.

| | | Unit 2 | | | | |
|---|---|---|---|---|---|---|
| | | Ohio | | Ontario Gill Nets | | Ontario |
| | Year | Trap Nets | Sport | Small Mesh | Large Mesh* | Trawls |
| **Harvest** | 2008 | 1,376,588 | 628,412 | 1,669,682 | 253,984 | 66,203 |
| (pounds) | 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 |
| | 2017 | 590,447 | 53,107 | 1,435,508 | 62,872 | 57 |
| **Harvest** | 2008 | 624 | 285 | 757 | 115 | 30.0 |
| (Metric) | 2009 | 607 | 210 | 904 | 219 | 7.9 |
| (tonnes) | 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 |
| | 2017 | 268 | 24 | 651 | 29 | 0.0 |
| **Effort** | 2008 | 3,983 | 450,060 | 3,124 | 2,629 | |
| *(a)* | 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 | |
| | 2017 | 2,567 | 119,163 | 6,094 | 1,946 | |
| **Harvest Rates** | 2008 | 156.7 | 3.5 | 242.4 | 43.8 | |
| *(b)* | 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 | |
| | 2017 | 104.3 | 1.0 | 106.8 | 14.7 | |

*(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, 2008-2017.

| | | Unit 3 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Ohio | | Pennsylvania | | Ontario Gill Nets | | Ontario |
| | Year | Trap Nets | Sport | Trap Nets | Sport | Small Mesh | Large Mesh* | Trawls |
| **Harvest** | 2008 | 139,023 | 490,343 | 22,927 | 132,087 | 2,160,041 | 32,673 | 7,454 |
| (pounds) | 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 |
| | 2017 | 449,979 | 54,244 | 45,741 | 61,594 | 1,964,728 | 61,127 | 1,380 |
| **Harvest** | 2008 | 63 | 222 | 10.4 | 60 | 980 | 15 | 3.4 |
| (Metric) | 2009 | 51 | 220 | 16.0 | 70 | 989 | 35 | 3.6 |
| (tonnes) | 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 |
| | 2017 | 204 | 25 | 20.7 | 28 | 891 | 28 | 0.6 |
| **Effort** | 2008 | 1,288 | 234,179 | 78 | 110,403 | 3,336 | 417 | |
| *(a)* | 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 | |
| | 2017 | 1,679 | 58,119 | 262 | 98,302 | 4,775 | 1,206 | |
| **Harvest Rates** | 2008 | 49.0 | 4.6 | 133.3 | 4.5 | 293.6 | 35.5 | |
| *(b)* | 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 | |
| | 2017 | 121.5 | 1.6 | 79.2 | 2.1 | 186.6 | 23.0 | |

*(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*
*(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, 2008-2017.

| | | Unit 4 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | New York | | Pennsylvania | | Ontario Gill Nets | | Ontario |
| | Year | Trap Nets | Sport | Trap Nets | Sport | Small Mesh | Large Mesh* | Trawls |
| **Harvest** | 2008 | 11,136 | 29,673 | 0 | 31,325 | 234,366 | 2,689 | 3,215 |
| (pounds) | 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 |
| | 2017 | 12,366 | 27,232 | 0 | 16,078 | 177,475 | 32 | 2,223 |
| **Harvest** | 2008 | 5.1 | 13.5 | 0 | 14.2 | 106.3 | 1.22 | 1.5 |
| (Metric) | 2009 | 6.1 | 25.6 | 0 | 17.2 | 120.8 | 2.15 | 0.6 |
| (tonnes) | 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 |
| | 2017 | 5.6 | 12.4 | 0 | 7.3 | 80.5 | 0.01 | 1.0 |
| **Effort** | 2008 | 137 | 34,511 | 0 | 27,041 | 569 | 69.2 | |
| *(a)* | 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 | |
| | 2017 | 208 | 26,154 | 0 | 12,843 | 565 | 6.0 | |
| **Harvest Rates** | 2008 | 36.9 | 1.68 | -- | 6.4 | 186.8 | 17.6 | |
| *(b)* | 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 | |
| | 2017 | 27.0 | 1.35 | -- | 1.2 | 142.3 | 2.4 | |

*(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 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 2017 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 | | 0.0 | | 0.0 | 0 | 0.0 |
| | 2 | 489,180 | 11.9 | 454,978 | 10.2 | 56,211 | 0.9 | 170,015 | 32.5 | 1,170,384 | 7.8 |
| | 3 | 2,868,936 | 69.5 | 2,553,885 | 57.5 | 2,452,950 | 41.2 | 289,661 | 55.4 | 8,165,431 | 54.2 |
| | 4 | 618,697 | 15.0 | 402,758 | 9.1 | 476,195 | 8.0 | 20,773 | 4.0 | 1,518,424 | 10.1 |
| | 5 | 81,640 | 2.0 | 812,830 | 18.3 | 2,252,521 | 37.8 | 27,702 | 5.3 | 3,174,693 | 21.1 |
| | 6+ | 66,991 | 1.6 | 220,126 | 5.0 | 722,747 | 12.1 | 14,543 | 2.8 | 1,024,407 | 6.8 |
| | **Total** | 4,125,444 | *45.5* | 4,444,578 | *69.8* | 5,960,624 | *81.1* | 522,693 | *83.9* | 15,053,339 | *64.3* |
| **Trap Nets** | 1 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| | 2 | 237,387 | 18.6 | 121,346 | 6.7 | 101,404 | 8.5 | 0 | 0.0 | 460,137 | 10.7 |
| | 3 | 880,779 | 69.1 | 1,272,168 | 70.4 | 535,787 | 44.9 | 2,025 | 6.7 | 2,690,759 | 62.5 |
| | 4 | 113,206 | 8.9 | 270,724 | 15.0 | 76,260 | 6.4 | 405 | 1.3 | 460,595 | 10.7 |
| | 5 | 24,507 | 1.9 | 92,058 | 5.1 | 262,610 | 22.0 | 15,996 | 52.7 | 395,171 | 9.2 |
| | 6+ | 18,913 | 1.5 | 51,747 | 2.9 | 216,724 | 18.2 | 11,946 | 39.3 | 299,330 | 7.0 |
| | **Total** | 1,274,792 | *14.1* | 1,808,043 | *28.4* | 1,192,785 | *16.2* | 30,372 | *4.9* | 4,305,992 | *18.4* |
| **Sport** | 1 | 34,034 | 0.9 | 400 | 0.4 | 0 | 0.0 | 0 | 0.0 | 34,434 | 0.8 |
| | 2 | 951,397 | 25.9 | 25,381 | 22.4 | 9,253 | 4.7 | 4,762 | 6.8 | 990,793 | 24.5 |
| | 3 | 2,270,763 | 61.9 | 50,065 | 44.1 | 43,221 | 21.9 | 12,966 | 18.6 | 2,377,015 | 58.7 |
| | 4 | 347,573 | 9.5 | 10,529 | 9.3 | 13,564 | 6.9 | 4,917 | 7.0 | 376,582 | 9.3 |
| | 5 | 44,756 | 1.2 | 15,500 | 13.7 | 61,977 | 31.5 | 21,599 | 30.9 | 143,832 | 3.6 |
| | 6+ | 22,459 | 0.6 | 11,597 | 10.2 | 69,007 | 35.0 | 25,576 | 36.6 | 128,639 | 3.2 |
| | **Total** | 3,670,982 | *40.5* | 113,472 | *1.8* | 197,021 | *2.7* | 69,820 | *11.2* | 4,051,296 | *17.3* |
| **All Gear** | 1 | 34,034 | 0.4 | 400 | 0.0 | 0 | 0.0 | 0 | 0.0 | 34,434 | 0.1 |
| | 2 | 1,677,964 | 18.5 | 601,705 | 9.5 | 166,868 | 2.3 | 174,777 | 28.1 | 2,621,314 | 11.2 |
| | 3 | 6,020,478 | 66.4 | 3,876,118 | 60.9 | 3,031,958 | 41.2 | 304,652 | 48.9 | 13,233,205 | 56.5 |
| | 4 | 1,079,476 | 11.9 | 684,011 | 10.7 | 566,019 | 7.7 | 26,095 | 4.2 | 2,355,601 | 10.1 |
| | 5 | 150,903 | 1.7 | 920,388 | 14.5 | 2,577,108 | 35.1 | 65,296 | 10.5 | 3,713,696 | 15.9 |
| | 6+ | 108,363 | 1.2 | 283,470 | 4.5 | 1,008,478 | 13.7 | 52,065 | 8.4 | 1,452,376 | 6.2 |
| | **Total** | 9,071,218 | 38.7 | 6,366,093 | 27.2 | 7,350,430 | 31.4 | 622,885 | 2.7 | 23,410,626 | 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 2017 are estimated by ADMB catch-age analysis. The 2018 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 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Unit 1** | 2 | 33.295 | 32.760 | 7.585 | 39.889 | 3.146 | 52.138 | 1.528 | 8.993 | 9.892 | 23.156 | 14.521 | 8.999 | 12.082 | 2.185 | 5.012 | 16.314 | 54.780 | 33.195 | 4.923 |
| | 3 | 6.446 | 21.084 | 21.046 | 4.835 | 24.963 | 1.994 | 32.182 | 0.977 | 5.370 | 6.064 | 14.554 | 9.224 | 5.733 | 7.487 | 1.293 | 2.674 | 8.886 | 31.321 | 19.558 |
| | 4 | 14.193 | 3.499 | 12.356 | 10.758 | 2.627 | 11.472 | 0.974 | 12.649 | 0.521 | 2.770 | 3.080 | 7.547 | 4.908 | 2.900 | 3.267 | 0.511 | 1.085 | 3.620 | 15.200 |
| | 5 | 3.058 | 7.114 | 1.905 | 5.071 | 4.810 | 0.976 | 4.164 | 0.396 | 5.077 | 0.281 | 1.337 | 1.447 | 3.523 | 2.266 | 1.131 | 1.160 | 0.193 | 0.380 | 1.396 |
| | 6+ | 1.262 | 1.928 | 4.699 | 2.326 | 3.025 | 2.293 | 0.961 | 1.561 | 0.750 | 2.866 | 1.473 | 1.268 | 1.190 | 2.077 | 1.637 | 0.913 | 0.768 | 0.297 | 0.264 |
| | **2 and Older** | 58.254 | 66.386 | 47.591 | 62.878 | 38.570 | 68.873 | 39.810 | 24.576 | 21.611 | 35.137 | 34.964 | 28.485 | 27.436 | 16.915 | 12.340 | 21.572 | 65.712 | 68.813 | 41.341 |
| | **3 and Older** | 24.959 | 33.625 | 40.006 | 22.990 | 35.424 | 16.735 | 38.281 | 15.583 | 11.719 | 11.982 | 20.444 | 19.485 | 15.354 | 14.730 | 7.328 | 5.258 | 10.931 | 35.618 | 36.418 |
| **Unit 2** | 2 | 53.894 | 47.508 | 11.131 | 86.763 | 4.980 | 193.308 | 5.189 | 23.224 | 26.536 | 53.250 | 44.872 | 7.689 | 19.651 | 11.777 | 32.182 | 9.665 | 39.456 | 26.535 | 10.351 |
| | 3 | 9.388 | 32.452 | 28.124 | 7.005 | 52.368 | 3.242 | 124.356 | 3.416 | 15.112 | 17.499 | 34.484 | 29.120 | 5.053 | 12.300 | 7.340 | 18.691 | 5.245 | 22.766 | 15.903 |
| | 4 | 17.980 | 5.162 | 18.337 | 15.028 | 3.924 | 27.742 | 1.877 | 70.564 | 2.034 | 9.170 | 10.339 | 20.450 | 17.830 | 2.995 | 6.755 | 3.624 | 9.352 | 2.779 | 12.978 |
| | 5 | 1.557 | 8.687 | 2.538 | 8.395 | 6.480 | 1.889 | 12.586 | 1.110 | 34.618 | 1.089 | 4.565 | 5.515 | 11.250 | 9.136 | 1.340 | 2.368 | 1.392 | 3.996 | 1.416 |
| | 6+ | 0.415 | 0.920 | 4.723 | 3.310 | 5.099 | 5.328 | 3.301 | 7.487 | 4.168 | 20.872 | 10.651 | 7.817 | 7.159 | 9.459 | 8.265 | 3.140 | 1.941 | 1.296 | 2.632 |
| | **2 and Older** | 83.234 | 94.730 | 64.853 | 120.501 | 72.851 | 231.508 | 147.308 | 105.801 | 82.468 | 101.879 | 104.910 | 70.590 | 60.941 | 45.666 | 55.881 | 37.488 | 57.386 | 57.373 | 43.279 |
| | **3 and Older** | 29.340 | 47.222 | 53.722 | 33.738 | 67.871 | 38.200 | 142.119 | 82.577 | 55.932 | 48.630 | 60.038 | 62.901 | 41.291 | 33.890 | 23.700 | 27.823 | 17.930 | 30.837 | 32.929 |
| **Unit 3** | 2 | 48.418 | 28.227 | 7.100 | 39.804 | 4.772 | 163.082 | 6.506 | 33.665 | 50.910 | 47.340 | 55.563 | 6.742 | 27.850 | 13.681 | 22.496 | 7.555 | 28.648 | 11.180 | 25.922 |
| | 3 | 8.366 | 31.385 | 18.129 | 4.570 | 25.855 | 3.133 | 108.370 | 4.315 | 21.258 | 33.880 | 31.641 | 36.848 | 4.508 | 17.900 | 8.814 | 14.510 | 4.974 | 18.123 | 7.136 |
| | 4 | 18.928 | 5.312 | 19.976 | 11.356 | 2.842 | 16.016 | 1.945 | 61.130 | 2.661 | 13.477 | 22.199 | 20.272 | 24.240 | 2.723 | 10.776 | 5.251 | 8.349 | 2.878 | 10.228 |
| | 5 | 2.694 | 11.542 | 3.304 | 11.999 | 6.681 | 1.677 | 9.288 | 1.077 | 35.240 | 1.616 | 8.475 | 13.407 | 12.905 | 13.505 | 1.611 | 5.999 | 2.794 | 4.224 | 1.528 |
| | 6+ | 2.428 | 3.088 | 9.026 | 7.435 | 11.438 | 10.640 | 7.195 | 7.522 | 4.897 | 24.372 | 16.295 | 14.621 | 17.632 | 17.053 | 17.409 | 10.284 | 8.234 | 5.311 | 4.730 |
| | **2 and Older** | 80.835 | 79.554 | 57.534 | 75.163 | 51.587 | 194.548 | 133.304 | 107.709 | 114.965 | 120.684 | 134.173 | 91.889 | 87.135 | 64.863 | 61.106 | 43.599 | 53.000 | 41.715 | 49.543 |
| | **3 and Older** | 32.417 | 51.327 | 50.435 | 35.359 | 46.815 | 31.466 | 126.798 | 74.044 | 64.055 | 73.344 | 78.610 | 85.147 | 59.285 | 51.182 | 38.611 | 36.044 | 24.352 | 30.535 | 23.622 |
| **Unit 4** | 2 | 11.153 | 2.362 | 1.581 | 6.019 | 1.094 | 8.490 | 0.710 | 6.454 | 6.792 | 5.510 | 8.730 | 0.831 | 9.525 | 1.956 | 4.276 | 1.011 | 5.411 | 5.475 | 10.136 |
| | 3 | 0.895 | 7.438 | 1.583 | 1.058 | 4.019 | 0.724 | 5.605 | 0.472 | 4.261 | 4.506 | 3.689 | 5.784 | 0.550 | 5.954 | 1.242 | 2.675 | 0.618 | 3.468 | 3.565 |
| | 4 | 1.473 | 0.588 | 4.967 | 1.046 | 0.689 | 2.574 | 0.447 | 3.240 | 0.304 | 2.740 | 2.962 | 2.303 | 3.490 | 0.327 | 3.189 | 0.693 | 1.581 | 0.376 | 2.194 |
| | 5 | 0.077 | 0.950 | 0.391 | 3.202 | 0.657 | 0.426 | 1.533 | 0.247 | 2.040 | 0.192 | 1.743 | 1.750 | 1.347 | 1.843 | 0.164 | 1.636 | 0.407 | 0.922 | 0.239 |
| | 6+ | 0.172 | 0.160 | 0.734 | 0.703 | 2.394 | 1.830 | 1.304 | 1.479 | 1.086 | 1.928 | 1.315 | 1.764 | 1.955 | 1.592 | 1.595 | 0.849 | 1.375 | 0.990 | 1.158 |
| | **2 and Older** | 13.770 | 11.498 | 9.257 | 12.028 | 8.853 | 14.044 | 9.599 | 11.892 | 14.483 | 14.875 | 18.439 | 12.431 | 16.867 | 11.673 | 10.466 | 6.864 | 9.392 | 11.232 | 17.292 |
| | **3 and Older** | 2.617 | 9.135 | 7.676 | 6.009 | 7.759 | 5.554 | 8.889 | 5.438 | 7.691 | 9.366 | 9.709 | 11.600 | 7.342 | 9.717 | 6.189 | 5.853 | 3.981 | 5.757 | 7.155 |

**Table 1.7.b.** Yellow Perch stock size (millions of fish) in each Lake Erie management unit. Abundance in the years 2000 to 2017 are estimated by ADMB catch-age analysis. The 2018 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 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Unit 1** | 2 | 29.208 | 27.874 | 7.049 | 34.331 | 3.628 | 41.056 | 1.931 | 10.273 | 13.382 | 29.219 | 23.399 | 9.399 | 11.521 | 2.671 | 6.455 | 18.922 | 51.897 | 23.555 | 11.550 |
| | 3 | 6.678 | 18.606 | 18.050 | 4.488 | 21.670 | 2.291 | 26.028 | 1.226 | 6.505 | 8.645 | 18.647 | 14.694 | 5.898 | 7.111 | 1.607 | 3.960 | 11.429 | 30.206 | 13.962 |
| | 4 | 13.670 | 3.594 | 10.918 | 9.726 | 2.374 | 10.970 | 1.181 | 13.475 | 0.660 | 3.774 | 4.698 | 9.563 | 7.543 | 2.932 | 3.159 | 0.747 | 1.710 | 4.086 | 11.508 |
| | 5 | 2.643 | 5.847 | 1.884 | 4.722 | 4.173 | 0.863 | 4.151 | 0.449 | 5.982 | 0.340 | 1.677 | 1.867 | 3.817 | 3.046 | 0.943 | 1.049 | 0.213 | 0.316 | 0.827 |
| | 6+ | 0.962 | 1.331 | 3.496 | 2.111 | 2.598 | 2.018 | 0.943 | 1.575 | 0.842 | 3.277 | 1.515 | 1.114 | 1.029 | 1.752 | 1.331 | 0.661 | 0.398 | 0.085 | 0.054 |
| | **2 and Older** | 53.160 | 57.251 | 41.397 | 55.378 | 34.443 | 57.198 | 34.233 | 26.999 | 27.372 | 45.254 | 49.936 | 36.636 | 29.809 | 17.513 | 13.495 | 25.338 | 65.646 | 58.248 | 37.901 |
| | **3 and Older** | 23.952 | 29.377 | 34.348 | 21.047 | 30.815 | 16.142 | 32.302 | 16.726 | 13.990 | 16.036 | 26.537 | 27.236 | 18.288 | 14.842 | 7.040 | 6.417 | 13.749 | 34.693 | 26.351 |
| **Unit 2** | 2 | 51.606 | 48.175 | 11.175 | 99.420 | 6.496 | 176.857 | 7.537 | 24.504 | 26.162 | 59.532 | 45.885 | 8.444 | 19.910 | 12.970 | 32.850 | 11.045 | 48.572 | 30.353 | 11.112 |
| | 3 | 8.803 | 33.474 | 31.488 | 7.279 | 64.940 | 4.254 | 115.262 | 4.933 | 16.203 | 17.319 | 39.189 | 30.260 | 5.572 | 13.097 | 8.492 | 21.518 | 7.195 | 31.856 | 19.983 |
| | 4 | 16.344 | 4.818 | 19.311 | 17.594 | 4.116 | 37.330 | 2.362 | 64.996 | 3.021 | 10.032 | 10.204 | 23.573 | 18.200 | 3.279 | 7.409 | 4.755 | 11.398 | 4.035 | 18.342 |
| | 5 | 1.087 | 6.914 | 2.299 | 8.474 | 7.864 | 1.905 | 16.121 | 1.053 | 34.920 | 1.684 | 4.935 | 5.279 | 12.173 | 8.885 | 1.455 | 3.165 | 1.763 | 4.879 | 1.861 |
| | 6+ | 0.399 | 0.543 | 3.163 | 2.087 | 4.078 | 4.813 | 2.549 | 7.413 | 4.198 | 20.481 | 9.950 | 7.053 | 5.843 | 7.843 | 6.490 | 2.940 | 1.874 | 1.347 | 2.569 |
| | **2 and Older** | 78.240 | 93.924 | 67.435 | 134.853 | 87.494 | 225.159 | 143.831 | 102.900 | 84.504 | 109.048 | 110.163 | 74.608 | 61.699 | 46.073 | 56.696 | 43.423 | 70.802 | 72.470 | 53.868 |
| | **3 and Older** | 26.633 | 45.749 | 56.260 | 35.434 | 80.998 | 48.302 | 136.294 | 78.396 | 58.342 | 49.516 | 64.278 | 66.165 | 41.788 | 33.104 | 23.846 | 32.378 | 22.230 | 42.117 | 42.756 |
| **Unit 3** | 2 | 44.853 | 31.834 | 8.866 | 50.908 | 6.143 | 126.247 | 8.603 | 34.803 | 43.898 | 60.455 | 52.173 | 12.040 | 29.420 | 23.199 | 45.718 | 9.872 | 52.211 | 22.441 | 33.587 |
| | 3 | 9.082 | 29.910 | 21.226 | 5.906 | 33.930 | 4.094 | 84.199 | 5.739 | 23.234 | 29.327 | 40.363 | 34.836 | 8.037 | 19.626 | 15.475 | 30.450 | 6.579 | 34.771 | 14.968 |
| | 4 | 17.281 | 5.767 | 19.053 | 13.483 | 3.701 | 21.530 | 2.591 | 52.052 | 3.656 | 15.012 | 18.831 | 25.620 | 22.041 | 5.026 | 12.330 | 9.545 | 18.707 | 3.966 | 21.387 |
| | 5 | 2.181 | 9.932 | 3.347 | 11.021 | 7.398 | 2.126 | 12.190 | 1.347 | 29.976 | 2.205 | 8.885 | 10.698 | 14.422 | 11.979 | 2.773 | 6.435 | 4.898 | 9.045 | 2.035 |
| | 6+ | 1.225 | 1.763 | 6.187 | 4.899 | 7.649 | 7.714 | 4.903 | 7.554 | 4.580 | 19.524 | 11.641 | 10.414 | 10.564 | 11.825 | 11.506 | 6.211 | 5.435 | 4.024 | 5.666 |
| | **2 and Older** | 74.623 | 79.206 | 58.679 | 86.218 | 58.820 | 161.710 | 112.485 | 101.494 | 105.345 | 126.523 | 131.892 | 93.609 | 84.484 | 71.654 | 87.801 | 62.513 | 87.830 | 74.247 | 77.644 |
| | **3 and Older** | 29.769 | 47.372 | 49.813 | 35.310 | 52.677 | 35.463 | 103.882 | 66.691 | 61.446 | 66.068 | 79.719 | 81.568 | 55.063 | 48.455 | 42.083 | 52.641 | 35.619 | 51.806 | 44.056 |
| **Unit 4** | 2 | 11.797 | 3.796 | 1.806 | 5.417 | 1.172 | 8.577 | 0.910 | 8.114 | 4.959 | 7.673 | 7.018 | 0.883 | 7.802 | 1.866 | 3.364 | 0.784 | 4.669 | 11.644 | 6.443 |
| | 3 | 0.975 | 7.870 | 2.538 | 1.203 | 3.604 | 0.778 | 5.651 | 0.597 | 5.367 | 3.277 | 5.050 | 4.592 | 0.574 | 5.056 | 1.199 | 2.147 | 0.504 | 3.026 | 7.674 |
| | 4 | 1.599 | 0.639 | 5.210 | 1.657 | 0.779 | 2.316 | 0.482 | 3.442 | 0.376 | 3.369 | 2.020 | 3.027 | 2.681 | 0.329 | 2.786 | 0.641 | 1.183 | 0.289 | 1.876 |
| | 5 | 0.175 | 1.026 | 0.417 | 3.296 | 1.035 | 0.477 | 1.321 | 0.267 | 2.040 | 0.221 | 1.902 | 1.086 | 1.540 | 1.315 | 0.150 | 1.199 | 0.292 | 0.585 | 0.166 |
| | 6+ | 0.697 | 0.570 | 1.043 | 0.925 | 2.646 | 2.274 | 1.657 | 1.744 | 1.258 | 1.987 | 1.323 | 1.830 | 1.623 | 1.684 | 1.538 | 0.927 | 1.077 | 0.789 | 0.824 |
| | **2 and Older** | 15.243 | 13.902 | 11.014 | 12.497 | 9.237 | 14.424 | 10.021 | 14.164 | 13.999 | 16.527 | 17.313 | 11.417 | 14.221 | 10.250 | 9.037 | 5.698 | 7.724 | 16.333 | 16.983 |
| | **3 and Older** | 3.446 | 10.106 | 9.208 | 7.081 | 8.065 | 5.847 | 9.111 | 6.050 | 9.040 | 8.854 | 10.295 | 10.535 | 6.419 | 8.384 | 5.673 | 4.914 | 3.056 | 4.689 | 10.540 |

**Table 1.8.a.** Projection of the 2018 Lake Erie Yellow Perch population. Stock size estimates are derived from ADMB 2017 abundance and survival, and incoming age-2 estimates for 2018 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***

| | | 2017 Parameters | | | | Rate Functions | | | | | 2018 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) | **2017** | **2018** | **2018** |
| **Unit 1** | 2 | 33.195 | 18.639 | 14.556 | 51.834 | 0.129 | 0.529 | 0.411 | 0.100 | 0.589 | 2 | 3.523 | 4.923 | 0.879 | 0.091 | 3.552 | 0.448 | 0.988 |
| | 3 | 31.321 | 12.905 | 18.416 | 44.226 | 0.323 | 0.723 | 0.515 | 0.230 | 0.485 | 3 | 8.576 | 19.558 | 30.540 | 0.121 | 4.040 | 2.360 | 5.204 |
| | 4 | 3.620 | 1.396 | 2.224 | 5.016 | 0.553 | 0.953 | 0.614 | 0.357 | 0.386 | 4 | 8.937 | 15.200 | 21.463 | 0.146 | 0.496 | 2.219 | 4.893 |
| | 5 | 0.380 | 0.156 | 0.224 | 0.537 | 0.589 | 0.989 | 0.628 | 0.374 | 0.372 | 5 | 0.858 | 1.396 | 1.934 | 0.167 | 0.065 | 0.234 | 0.515 |
| | 6+ | 0.297 | 0.135 | 0.161 | 0.432 | 0.486 | 0.886 | 0.588 | 0.322 | 0.412 | 6+ | 0.150 | 0.264 | 0.378 | 0.221 | 0.080 | 0.058 | 0.128 |
| | Total | 68.813 | | 35.582 | 102.045 | 0.236 | 0.636 | 0.471 | 0.175 | 0.529 | Total | 22.044 | 41.341 | 55.194 | 0.129 | 8.234 | 5.319 | 11.728 |
| | (3+) | 35.618 | | 21.026 | 50.211 | 0.348 | 0.748 | 0.527 | 0.245 | 0.473 | (3+) | 18.521 | 36.418 | 54.315 | 0.134 | 4.682 | 4.871 | 10.741 |
| **Unit 2** | 2 | 26.535 | 13.755 | 12.780 | 40.290 | 0.112 | 0.512 | 0.401 | 0.088 | 0.599 | 2 | 7.975 | 10.351 | 13.434 | 0.108 | 3.264 | 1.121 | 2.473 |
| | 3 | 22.766 | 8.788 | 13.978 | 31.555 | 0.162 | 0.562 | 0.430 | 0.124 | 0.570 | 3 | 7.659 | 15.903 | 24.146 | 0.140 | 3.597 | 2.226 | 4.909 |
| | 4 | 2.779 | 0.933 | 1.846 | 3.711 | 0.274 | 0.674 | 0.490 | 0.199 | 0.510 | 4 | 7.968 | 12.978 | 17.988 | 0.164 | 0.509 | 2.124 | 4.684 |
| | 5 | 3.996 | 1.353 | 2.644 | 5.349 | 0.295 | 0.695 | 0.501 | 0.213 | 0.499 | 5 | 0.941 | 1.416 | 1.892 | 0.197 | 0.907 | 0.279 | 0.615 |
| | 6+ | 1.296 | 0.491 | 0.805 | 1.788 | 0.310 | 0.710 | 0.508 | 0.222 | 0.492 | 6+ | 1.715 | 2.632 | 3.548 | 0.276 | 0.380 | 0.725 | 1.600 |
| | Total | 57.373 | | 32.053 | 82.692 | 0.155 | 0.555 | 0.426 | 0.119 | 0.574 | Total | 26.258 | 43.279 | 61.008 | 0.150 | 8.656 | 6.476 | 14.280 |
| | (3+) | 30.837 | | 19.272 | 42.402 | 0.194 | 0.594 | 0.448 | 0.146 | 0.552 | (3+) | 18.283 | 32.929 | 47.574 | 0.163 | 5.392 | 5.355 | 11.808 |
| **Unit 3** | 2 | 11.180 | 6.977 | 4.203 | 18.157 | 0.049 | 0.449 | 0.362 | 0.039 | 0.638 | 2 | 20.660 | 25.922 | 32.523 | 0.082 | 1.152 | 2.126 | 4.687 |
| | 3 | 18.123 | 8.395 | 9.728 | 26.517 | 0.172 | 0.572 | 0.436 | 0.131 | 0.564 | 3 | 2.683 | 7.136 | 11.589 | 0.121 | 2.519 | 0.861 | 1.899 |
| | 4 | 2.878 | 1.164 | 1.714 | 4.041 | 0.233 | 0.633 | 0.469 | 0.173 | 0.531 | 4 | 5.491 | 10.228 | 14.966 | 0.158 | 0.481 | 1.620 | 3.571 |
| | 5 | 4.224 | 1.679 | 2.545 | 5.903 | 0.305 | 0.705 | 0.506 | 0.219 | 0.494 | 5 | 0.910 | 1.528 | 2.146 | 0.188 | 0.904 | 0.287 | 0.632 |
| | 6+ | 5.311 | 2.139 | 3.171 | 7.450 | 0.298 | 0.698 | 0.502 | 0.215 | 0.498 | 6+ | 2.836 | 4.730 | 6.623 | 0.262 | 1.386 | 1.241 | 2.736 |
| | Total | 41.715 | | 21.361 | 62.068 | 0.169 | 0.569 | 0.434 | 0.129 | 0.566 | Total | 32.579 | 49.543 | 67.847 | 0.124 | 6.441 | 6.134 | 13.525 |
| | (3+) | 30.535 | | 17.159 | 43.911 | 0.216 | 0.616 | 0.460 | 0.162 | 0.540 | (3+) | 11.919 | 23.622 | 35.325 | 0.170 | 5.290 | 4.008 | 8.838 |
| **Unit 4** | 2 | 5.475 | 3.385 | 2.090 | 8.860 | 0.029 | 0.429 | 0.349 | 0.024 | 0.651 | 2 | 7.216 | 10.136 | 14.238 | 0.111 | 0.690 | 1.125 | 2.481 |
| | 3 | 3.468 | 1.632 | 1.837 | 5.100 | 0.058 | 0.458 | 0.367 | 0.047 | 0.633 | 3 | 1.361 | 3.565 | 5.769 | 0.190 | 0.739 | 0.679 | 1.496 |
| | 4 | 0.376 | 0.158 | 0.218 | 0.533 | 0.054 | 0.454 | 0.365 | 0.043 | 0.635 | 4 | 1.162 | 2.194 | 3.226 | 0.231 | 0.091 | 0.507 | 1.118 |
| | 5 | 0.922 | 0.368 | 0.554 | 1.290 | 0.103 | 0.503 | 0.395 | 0.081 | 0.605 | 5 | 0.139 | 0.239 | 0.339 | 0.283 | 0.285 | 0.068 | 0.149 |
| | 6+ | 0.990 | 0.409 | 0.581 | 1.400 | 0.101 | 0.501 | 0.394 | 0.079 | 0.606 | 6+ | 0.687 | 1.158 | 1.628 | 0.346 | 0.342 | 0.401 | 0.884 |
| | Total | 11.232 | | 5.280 | 17.183 | 0.051 | 0.451 | 0.363 | 0.041 | 0.637 | Total | 10.564 | 17.292 | 25.201 | 0.161 | 2.146 | 2.779 | 6.128 |
| | (3+) | 5.757 | | 3.190 | 8.323 | 0.072 | 0.472 | 0.376 | 0.057 | 0.624 | (3+) | 3.348 | 7.155 | 10.962 | 0.231 | 1.456 | 1.654 | 3.647 |

**Table 1.8.b.** Projection of the 2018 Lake Erie Yellow Perch population. Stock size estimates are derived from ADMB 2017 abundance and survival, and incoming age-2 estimates for 2018 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***

| | | 2017 Parameters | | | | Rate Functions | | | | | 2018 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) | **2017** | **2018** | **2018** |
| **Unit 1** | 2 | 23.555 | 4.184 | 19.372 | 27.739 | 0.123 | 0.523 | 0.407 | 0.096 | 0.593 | 2 | 6.558 | 11.550 | 20.341 | 0.091 | 2.520 | 1.051 | 2.318 |
| | 3 | 30.206 | 4.493 | 25.713 | 34.699 | 0.565 | 0.965 | 0.619 | 0.362 | 0.381 | 3 | 11.482 | 13.962 | 16.442 | 0.121 | 3.897 | 1.685 | 3.715 |
| | 4 | 4.086 | 0.691 | 3.395 | 4.777 | 1.198 | 1.598 | 0.798 | 0.598 | 0.202 | 4 | 9.796 | 11.508 | 13.220 | 0.146 | 0.560 | 1.680 | 3.705 |
| | 5 | 0.316 | 0.080 | 0.236 | 0.396 | 1.661 | 2.061 | 0.873 | 0.703 | 0.127 | 5 | 0.687 | 0.827 | 0.966 | 0.167 | 0.054 | 0.138 | 0.305 |
| | 6+ | 0.085 | 0.036 | 0.049 | 0.121 | 1.408 | 1.808 | 0.836 | 0.651 | 0.164 | 6+ | 0.038 | 0.054 | 0.070 | 0.221 | 0.023 | 0.012 | 0.026 |
| | Total | 58.248 | | 48.765 | 67.731 | 0.393 | 0.793 | 0.548 | 0.271 | 0.452 | Total | 28.562 | 37.901 | 51.039 | 0.120 | 7.054 | 4.566 | 10.069 |
| | (3+) | 34.693 | | 29.393 | 39.992 | 0.630 | 1.030 | 0.643 | 0.393 | 0.357 | (3+) | 22.004 | 26.351 | 30.698 | 0.133 | 4.534 | 3.515 | 7.751 |
| **Unit 2** | 2 | 30.353 | 5.267 | 25.086 | 35.621 | 0.018 | 0.418 | 0.342 | 0.015 | 0.658 | 2 | 7.283 | 11.112 | 16.956 | 0.108 | 3.733 | 1.204 | 2.654 |
| | 3 | 31.856 | 3.976 | 27.880 | 35.832 | 0.152 | 0.552 | 0.424 | 0.117 | 0.576 | 3 | 16.516 | 19.983 | 23.451 | 0.140 | 5.033 | 2.798 | 6.169 |
| | 4 | 4.035 | 0.507 | 3.528 | 4.543 | 0.374 | 0.774 | 0.539 | 0.260 | 0.461 | 4 | 16.053 | 18.342 | 20.632 | 0.164 | 0.738 | 3.002 | 6.620 |
| | 5 | 4.879 | 0.662 | 4.217 | 5.540 | 0.488 | 0.888 | 0.589 | 0.323 | 0.411 | 5 | 1.627 | 1.861 | 2.095 | 0.197 | 1.107 | 0.367 | 0.808 |
| | 6+ | 1.347 | 0.266 | 1.082 | 1.613 | 0.475 | 0.875 | 0.583 | 0.317 | 0.417 | 6+ | 2.186 | 2.569 | 2.952 | 0.276 | 0.395 | 0.708 | 1.562 |
| | Total | 72.470 | | 61.792 | 83.148 | 0.128 | 0.528 | 0.410 | 0.099 | 0.590 | Total | 43.664 | 53.868 | 66.086 | 0.150 | 11.007 | 8.078 | 17.813 |
| | (3+) | 42.117 | | 36.706 | 47.528 | 0.215 | 0.615 | 0.459 | 0.161 | 0.541 | (3+) | 36.382 | 42.756 | 49.130 | 0.161 | 7.274 | 6.875 | 15.158 |
| **Unit 3** | 2 | 22.441 | 3.911 | 18.530 | 26.352 | 0.005 | 0.405 | 0.333 | 0.004 | 0.667 | 2 | 26.919 | 33.587 | 41.907 | 0.082 | 2.311 | 2.754 | 6.073 |
| | 3 | 34.771 | 5.348 | 29.423 | 40.119 | 0.086 | 0.486 | 0.385 | 0.068 | 0.615 | 3 | 12.359 | 14.968 | 17.576 | 0.121 | 4.833 | 1.806 | 3.982 |
| | 4 | 3.966 | 0.617 | 3.349 | 4.583 | 0.267 | 0.667 | 0.487 | 0.195 | 0.513 | 4 | 18.097 | 21.387 | 24.677 | 0.158 | 0.662 | 3.386 | 7.467 |
| | 5 | 9.045 | 1.270 | 7.775 | 10.316 | 0.426 | 0.826 | 0.562 | 0.290 | 0.438 | 5 | 1.719 | 2.035 | 2.352 | 0.188 | 1.936 | 0.382 | 0.842 |
| | 6+ | 4.024 | 0.680 | 3.344 | 4.704 | 0.458 | 0.858 | 0.576 | 0.307 | 0.424 | 6+ | 4.822 | 5.666 | 6.511 | 0.262 | 1.050 | 1.486 | 3.278 |
| | Total | 74.247 | | 62.420 | 86.074 | 0.122 | 0.522 | 0.407 | 0.095 | 0.593 | Total | 63.916 | 77.644 | 93.022 | 0.126 | 10.793 | 9.815 | 21.642 |
| | (3+) | 51.806 | | 43.891 | 59.722 | 0.177 | 0.577 | 0.439 | 0.135 | 0.561 | (3+) | 36.997 | 44.056 | 51.116 | 0.160 | 8.481 | 7.061 | 15.569 |
| **Unit 4** | 2 | 11.644 | 1.856 | 9.788 | 13.500 | 0.017 | 0.417 | 0.341 | 0.014 | 0.659 | 2 | 3.508 | 6.443 | 11.833 | 0.111 | 1.467 | 0.715 | 1.577 |
| | 3 | 3.026 | 0.428 | 2.598 | 3.454 | 0.078 | 0.478 | 0.380 | 0.062 | 0.620 | 3 | 6.451 | 7.674 | 8.897 | 0.190 | 0.645 | 1.461 | 3.221 |
| | 4 | 0.289 | 0.047 | 0.242 | 0.336 | 0.155 | 0.555 | 0.426 | 0.119 | 0.574 | 4 | 1.611 | 1.876 | 2.142 | 0.231 | 0.070 | 0.433 | 0.956 |
| | 5 | 0.585 | 0.091 | 0.493 | 0.676 | 0.158 | 0.558 | 0.428 | 0.121 | 0.572 | 5 | 0.139 | 0.166 | 0.193 | 0.283 | 0.181 | 0.047 | 0.103 |
| | 6+ | 0.789 | 0.128 | 0.660 | 0.917 | 0.077 | 0.477 | 0.379 | 0.061 | 0.621 | 6+ | 0.692 | 0.824 | 0.956 | 0.346 | 0.272 | 0.285 | 0.629 |
| | Total | 16.333 | | 13.782 | 18.884 | 0.038 | 0.438 | 0.355 | 0.031 | 0.645 | Total | 12.401 | 16.983 | 24.020 | 0.173 | 2.634 | 2.942 | 6.486 |
| | (3+) | 4.689 | | 3.994 | 5.384 | 0.092 | 0.492 | 0.389 | 0.073 | 0.611 | (3+) | 8.893 | 10.540 | 12.188 | 0.211 | 1.167 | 2.226 | 4.909 |

**Table 2.1.a.** Estimated harvest of Lake Erie Yellow Perch for 2018 using the proposed fishing policy and selectivity-at-age from combined fishing gears.

***ADMB analysis uses the YPTG model***

| | | 2018 | | | | | | | 2018 | | | 3-yr Mean | 2018 Harvest Range | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Stock Size (millions of fish) | | | Exploitation Rate | | | | Catch (millions of fish) | | | Weight in | 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 | 3.523 | 4.923 | 0.879 | 0.670 | 0.170 | 0.114 | 0.089 | 0.314 | 0.438 | 0.078 | 0.115 | 0.036 | 0.050 | 0.009 | 0.080 | 0.111 | 0.020 |
| | 3 | 8.576 | 19.558 | 30.540 | 0.670 | 0.539 | 0.361 | 0.253 | 2.168 | 4.945 | 7.721 | 0.138 | 0.299 | 0.682 | 1.066 | 0.660 | 1.505 | 2.350 |
| | 4 | 8.937 | 15.200 | 21.463 | 0.670 | 0.740 | 0.496 | 0.327 | 2.927 | 4.978 | 7.029 | 0.155 | 0.454 | 0.772 | 1.090 | 1.000 | 1.701 | 2.402 |
| | 5 | 0.858 | 1.396 | 1.934 | 0.670 | 0.763 | 0.511 | 0.335 | 0.288 | 0.468 | 0.649 | 0.174 | 0.050 | 0.081 | 0.113 | 0.110 | 0.180 | 0.249 |
| | 6+ | 0.150 | 0.264 | 0.378 | 0.670 | 0.760 | 0.509 | 0.334 | 0.050 | 0.088 | 0.126 | 0.186 | 0.009 | 0.016 | 0.023 | 0.021 | 0.036 | 0.052 |
| | **Total** | 22.044 | 41.341 | 55.194 | | | | 0.264 | 5.747 | 10.918 | 15.604 | 0.147 | 0.848 | 1.602 | 2.300 | 1.871 | 3.533 | 5.072 |
| | **(3+)** | 18.521 | 36.418 | 54.315 | | | | 0.288 | 5.433 | 10.479 | 15.526 | 0.148 | 0.812 | 1.552 | 2.291 | 1.791 | 3.422 | 5.053 |
| **Unit 2** | 2 | 7.975 | 10.351 | 13.434 | 0.670 | 0.204 | 0.137 | 0.106 | 0.844 | 1.095 | 1.421 | 0.139 | 0.117 | 0.152 | 0.198 | 0.259 | 0.336 | 0.436 |
| | 3 | 7.659 | 15.903 | 24.146 | 0.670 | 0.358 | 0.240 | 0.177 | 1.357 | 2.818 | 4.278 | 0.146 | 0.198 | 0.411 | 0.625 | 0.437 | 0.907 | 1.377 |
| | 4 | 7.968 | 12.978 | 17.988 | 0.670 | 0.718 | 0.481 | 0.320 | 2.548 | 4.150 | 5.752 | 0.149 | 0.380 | 0.618 | 0.857 | 0.837 | 1.363 | 1.890 |
| | 5 | 0.941 | 1.416 | 1.892 | 0.670 | 0.764 | 0.512 | 0.336 | 0.316 | 0.476 | 0.635 | 0.154 | 0.049 | 0.073 | 0.098 | 0.107 | 0.161 | 0.216 |
| | 6+ | 1.715 | 2.632 | 3.548 | 0.670 | 0.824 | 0.552 | 0.356 | 0.611 | 0.937 | 1.263 | 0.185 | 0.113 | 0.173 | 0.234 | 0.249 | 0.382 | 0.515 |
| | **Total** | 26.258 | 43.279 | 61.008 | | | | 0.219 | 5.675 | 9.475 | 13.350 | 0.151 | 0.857 | 1.428 | 2.011 | 1.889 | 3.150 | 4.434 |
| | **(3+)** | 18.283 | 32.929 | 47.574 | | | | 0.254 | 4.832 | 8.380 | 11.929 | 0.152 | 0.739 | 1.276 | 1.813 | 1.630 | 2.814 | 3.998 |
| **Unit 3** | 2 | 20.660 | 25.922 | 32.523 | 0.700 | 0.078 | 0.055 | 0.044 | 0.906 | 1.137 | 1.427 | 0.125 | 0.113 | 0.142 | 0.178 | 0.250 | 0.313 | 0.393 |
| | 3 | 2.683 | 7.136 | 11.589 | 0.700 | 0.338 | 0.237 | 0.175 | 0.470 | 1.249 | 2.028 | 0.136 | 0.064 | 0.170 | 0.276 | 0.141 | 0.375 | 0.608 |
| | 4 | 5.491 | 10.228 | 14.966 | 0.700 | 0.658 | 0.461 | 0.309 | 1.696 | 3.159 | 4.623 | 0.150 | 0.254 | 0.474 | 0.693 | 0.561 | 1.045 | 1.529 |
| | 5 | 0.910 | 1.528 | 2.146 | 0.700 | 0.701 | 0.491 | 0.325 | 0.296 | 0.496 | 0.697 | 0.165 | 0.049 | 0.082 | 0.115 | 0.108 | 0.181 | 0.254 |
| | 6+ | 2.836 | 4.730 | 6.623 | 0.700 | 0.755 | 0.529 | 0.344 | 0.976 | 1.628 | 2.280 | 0.185 | 0.181 | 0.301 | 0.422 | 0.398 | 0.664 | 0.930 |
| | **Total** | 32.579 | 49.543 | 67.847 | | | | 0.155 | 4.344 | 7.670 | 11.055 | 0.152 | 0.661 | 1.169 | 1.684 | 1.457 | 2.578 | 3.714 |
| | **(3+)** | 11.919 | 23.622 | 35.325 | | | | 0.277 | 3.437 | 6.533 | 9.628 | 0.157 | 0.548 | 1.027 | 1.506 | 1.207 | 2.264 | 3.321 |
| **Unit 4** | 2 | 7.216 | 10.136 | 14.238 | 0.300 | 0.167 | 0.050 | 0.040 | 0.291 | 0.409 | 0.574 | 0.154 | 0.045 | 0.063 | 0.088 | 0.099 | 0.139 | 0.195 |
| | 3 | 1.361 | 3.565 | 5.769 | 0.300 | 0.336 | 0.101 | 0.079 | 0.108 | 0.283 | 0.457 | 0.158 | 0.017 | 0.045 | 0.072 | 0.038 | 0.098 | 0.159 |
| | 4 | 1.162 | 2.194 | 3.226 | 0.300 | 0.442 | 0.133 | 0.103 | 0.119 | 0.226 | 0.332 | 0.168 | 0.020 | 0.038 | 0.056 | 0.044 | 0.084 | 0.123 |
| | 5 | 0.139 | 0.239 | 0.339 | 0.300 | 0.780 | 0.234 | 0.173 | 0.024 | 0.041 | 0.059 | 0.194 | 0.005 | 0.008 | 0.011 | 0.010 | 0.018 | 0.025 |
| | 6+ | 0.687 | 1.158 | 1.628 | 0.300 | 0.766 | 0.230 | 0.171 | 0.117 | 0.197 | 0.278 | 0.212 | 0.025 | 0.042 | 0.059 | 0.055 | 0.092 | 0.130 |
| | **Total** | 10.564 | 17.292 | 25.201 | | | | 0.067 | 0.660 | 1.156 | 1.700 | 0.169 | 0.111 | 0.195 | 0.287 | 0.246 | 0.431 | 0.632 |
| | **(3+)** | 3.348 | 7.155 | 10.962 | | | | 0.104 | 0.369 | 0.747 | 1.125 | 0.177 | 0.067 | 0.132 | 0.198 | 0.147 | 0.292 | 0.437 |

**Table 2.1.b.** Estimated harvest of Lake Erie Yellow Perch for 2018 using the proposed fishing policy and selectivity-at-age from combined fishing gears.

***ADMB analysis uses the PR model***

| | | 2018 | | | | | | | 2018 | | | 3-yr Mean | 2018 Harvest Range | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Stock Size (millions of fish) | | | Exploitation Rate | | | | Catch (millions of fish) | | | Weight in | 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 | 6.558 | 11.550 | 20.341 | 0.670 | 0.117 | 0.078 | 0.062 | 0.409 | 0.720 | 1.267 | 0.115 | 0.047 | 0.083 | 0.146 | 0.104 | 0.182 | 0.321 |
| | 3 | 11.482 | 13.962 | 16.442 | 0.670 | 0.430 | 0.288 | 0.208 | 2.392 | 2.908 | 3.425 | 0.138 | 0.330 | 0.401 | 0.473 | 0.728 | 0.885 | 1.042 |
| | 4 | 9.796 | 11.508 | 13.220 | 0.670 | 0.756 | 0.507 | 0.333 | 3.263 | 3.833 | 4.403 | 0.155 | 0.506 | 0.594 | 0.682 | 1.115 | 1.310 | 1.505 |
| | 5 | 0.687 | 0.827 | 0.966 | 0.670 | 1.000 | 0.670 | 0.411 | 0.283 | 0.340 | 0.398 | 0.174 | 0.049 | 0.059 | 0.069 | 0.108 | 0.130 | 0.153 |
| | 6+ | 0.038 | 0.054 | 0.070 | 0.670 | 0.797 | 0.534 | 0.347 | 0.013 | 0.019 | 0.024 | 0.186 | 0.002 | 0.003 | 0.005 | 0.005 | 0.008 | 0.010 |
| | **Total** | 28.562 | 37.901 | 51.039 | | | | 0.206 | 6.359 | 7.819 | 9.517 | 0.146 | 0.934 | 1.141 | 1.374 | 2.060 | 2.516 | 3.031 |
| | **(3+)** | 22.004 | 26.351 | 30.698 | | | | 0.269 | 5.950 | 7.100 | 8.249 | 0.149 | 0.887 | 1.058 | 1.229 | 1.957 | 2.333 | 2.709 |
| **Unit 2** | 2 | 7.283 | 11.112 | 16.956 | 0.670 | 0.045 | 0.030 | 0.025 | 0.178 | 0.272 | 0.415 | 0.139 | 0.025 | 0.038 | 0.058 | 0.055 | 0.083 | 0.127 |
| | 3 | 16.516 | 19.983 | 23.451 | 0.670 | 0.304 | 0.204 | 0.153 | 2.525 | 3.056 | 3.586 | 0.146 | 0.369 | 0.446 | 0.524 | 0.813 | 0.984 | 1.154 |
| | 4 | 16.053 | 18.342 | 20.632 | 0.670 | 0.729 | 0.488 | 0.324 | 5.196 | 5.936 | 6.677 | 0.149 | 0.774 | 0.885 | 0.995 | 1.707 | 1.950 | 2.194 |
| | 5 | 1.627 | 1.861 | 2.095 | 0.670 | 1.000 | 0.670 | 0.411 | 0.669 | 0.766 | 0.862 | 0.154 | 0.103 | 0.118 | 0.133 | 0.227 | 0.260 | 0.293 |
| | 6+ | 2.186 | 2.569 | 2.952 | 0.670 | 0.965 | 0.647 | 0.401 | 0.876 | 1.030 | 1.183 | 0.185 | 0.162 | 0.191 | 0.219 | 0.357 | 0.420 | 0.483 |
| | **Total** | 43.664 | 53.868 | 66.086 | | | | 0.205 | 9.445 | 11.060 | 12.724 | 0.152 | 1.433 | 1.677 | 1.928 | 3.159 | 3.698 | 4.251 |
| | **(3+)** | 36.382 | 42.756 | 49.130 | | | | 0.252 | 9.267 | 10.788 | 12.309 | 0.152 | 1.408 | 1.639 | 1.870 | 3.105 | 3.614 | 4.124 |
| **Unit 3** | 2 | 26.919 | 33.587 | 41.907 | 0.700 | 0.019 | 0.013 | 0.011 | 0.293 | 0.366 | 0.457 | 0.125 | 0.037 | 0.046 | 0.057 | 0.081 | 0.101 | 0.126 |
| | 3 | 12.359 | 14.968 | 17.576 | 0.700 | 0.189 | 0.132 | 0.103 | 1.268 | 1.535 | 1.803 | 0.136 | 0.172 | 0.209 | 0.245 | 0.380 | 0.460 | 0.541 |
| | 4 | 18.097 | 21.387 | 24.677 | 0.700 | 0.526 | 0.368 | 0.257 | 4.651 | 5.496 | 6.341 | 0.150 | 0.698 | 0.824 | 0.951 | 1.538 | 1.818 | 2.097 |
| | 5 | 1.719 | 2.035 | 2.352 | 0.700 | 0.825 | 0.578 | 0.369 | 0.633 | 0.750 | 0.867 | 0.165 | 0.105 | 0.124 | 0.143 | 0.230 | 0.273 | 0.315 |
| | 6+ | 4.822 | 5.666 | 6.511 | 0.700 | 1.000 | 0.700 | 0.425 | 2.047 | 2.406 | 2.764 | 0.185 | 0.379 | 0.445 | 0.511 | 0.835 | 0.981 | 1.128 |
| | **Total** | 63.916 | 77.644 | 93.022 | | | | 0.136 | 8.892 | 10.553 | 12.232 | 0.156 | 1.390 | 1.648 | 1.908 | 3.065 | 3.633 | 4.207 |
| | **(3+)** | 36.997 | 44.056 | 51.116 | | | | 0.231 | 8.599 | 10.187 | 11.775 | 0.157 | 1.353 | 1.602 | 1.851 | 2.984 | 3.532 | 4.081 |
| **Unit 4** | 2 | 3.508 | 6.443 | 11.833 | 0.300 | 0.086 | 0.026 | 0.021 | 0.074 | 0.135 | 0.249 | 0.154 | 0.011 | 0.021 | 0.038 | 0.025 | 0.046 | 0.084 |
| | 3 | 6.451 | 7.674 | 8.897 | 0.300 | 0.389 | 0.117 | 0.091 | 0.588 | 0.699 | 0.811 | 0.158 | 0.093 | 0.110 | 0.128 | 0.205 | 0.244 | 0.282 |
| | 4 | 1.611 | 1.876 | 2.142 | 0.300 | 0.812 | 0.244 | 0.180 | 0.289 | 0.337 | 0.385 | 0.168 | 0.049 | 0.057 | 0.065 | 0.107 | 0.125 | 0.143 |
| | 5 | 0.139 | 0.166 | 0.193 | 0.300 | 0.876 | 0.263 | 0.192 | 0.027 | 0.032 | 0.037 | 0.194 | 0.005 | 0.006 | 0.007 | 0.011 | 0.014 | 0.016 |
| | 6+ | 0.692 | 0.824 | 0.956 | 0.300 | 0.563 | 0.169 | 0.129 | 0.089 | 0.106 | 0.123 | 0.212 | 0.019 | 0.023 | 0.026 | 0.042 | 0.050 | 0.058 |
| | **Total** | 12.401 | 16.983 | 24.020 | | | | 0.077 | 1.067 | 1.310 | 1.604 | 0.165 | 0.177 | 0.217 | 0.264 | 0.390 | 0.478 | 0.583 |
| | **(3+)** | 8.893 | 10.540 | 12.188 | | | | 0.111 | 0.993 | 1.174 | 1.356 | 0.167 | 0.166 | 0.196 | 0.226 | 0.365 | 0.432 | 0.498 |

**Table 2.2.a.** Lake Erie Yellow Perch fishing rates and the Recommended Allowable Harvest (RAH; in millions of pounds) for 2018 by Management Unit (Unit).

***ADMB analysis uses the YPTG model***

| | | Recommended Allowable Harvest (millions lbs.) | | |
|---|---|---|---|---|
| **Unit** | **Fishing Rate** | **MIN** | **MEAN** | **MAX** |
| **1** | 0.670 | 1.871 | 3.533 | 5.072 |
| **2** | 0.670 | 1.889 | 3.150 | 4.434 |
| **3** | 0.700 | 1.457 | 2.578 | 3.714 |
| **4** | 0.300 | 0.246 | 0.431 | 0.632 |
| **Total** | | 5.463 | 9.691 | 13.853 |

**Table 2.2.b.** Lake Erie Yellow Perch fishing rates and the Recommended Allowable Harvest (RAH; in millions of pounds) for 2018 by Management Unit (Unit).

***ADMB analysis uses the PR model***

| | | Recommended Allowable Harvest (millions lbs.) | | |
|---|---|---|---|---|
| **Unit** | **Fishing Rate** | **MIN** | **MEAN** | **MAX** |
| **1** | 0.670 | 2.060 | 2.516 | 3.031 |
| **2** | 0.670 | 3.159 | 3.698 | 4.251 |
| **3** | 0.700 | 3.065 | 3.633 | 4.207 |
| **4** | 0.300 | 0.390 | 0.478 | 0.583 |
| **Total** | | 8.675 | 10.324 | 12.071 |

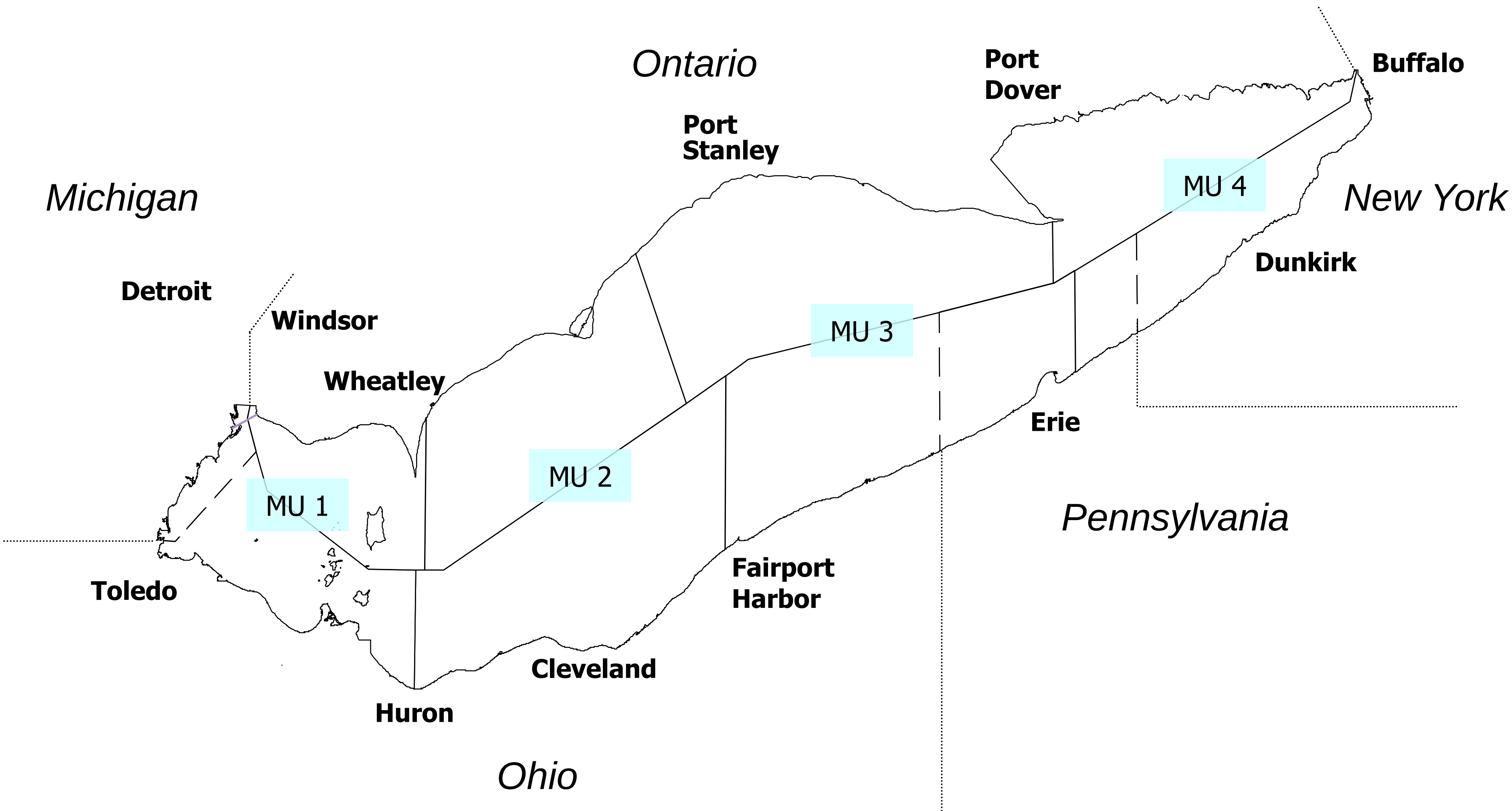



**Figure 1.1.** The Yellow Perch Management Units (MUs) of Lake Erie defined by the YPTG and LEC, for illustrative purposes.

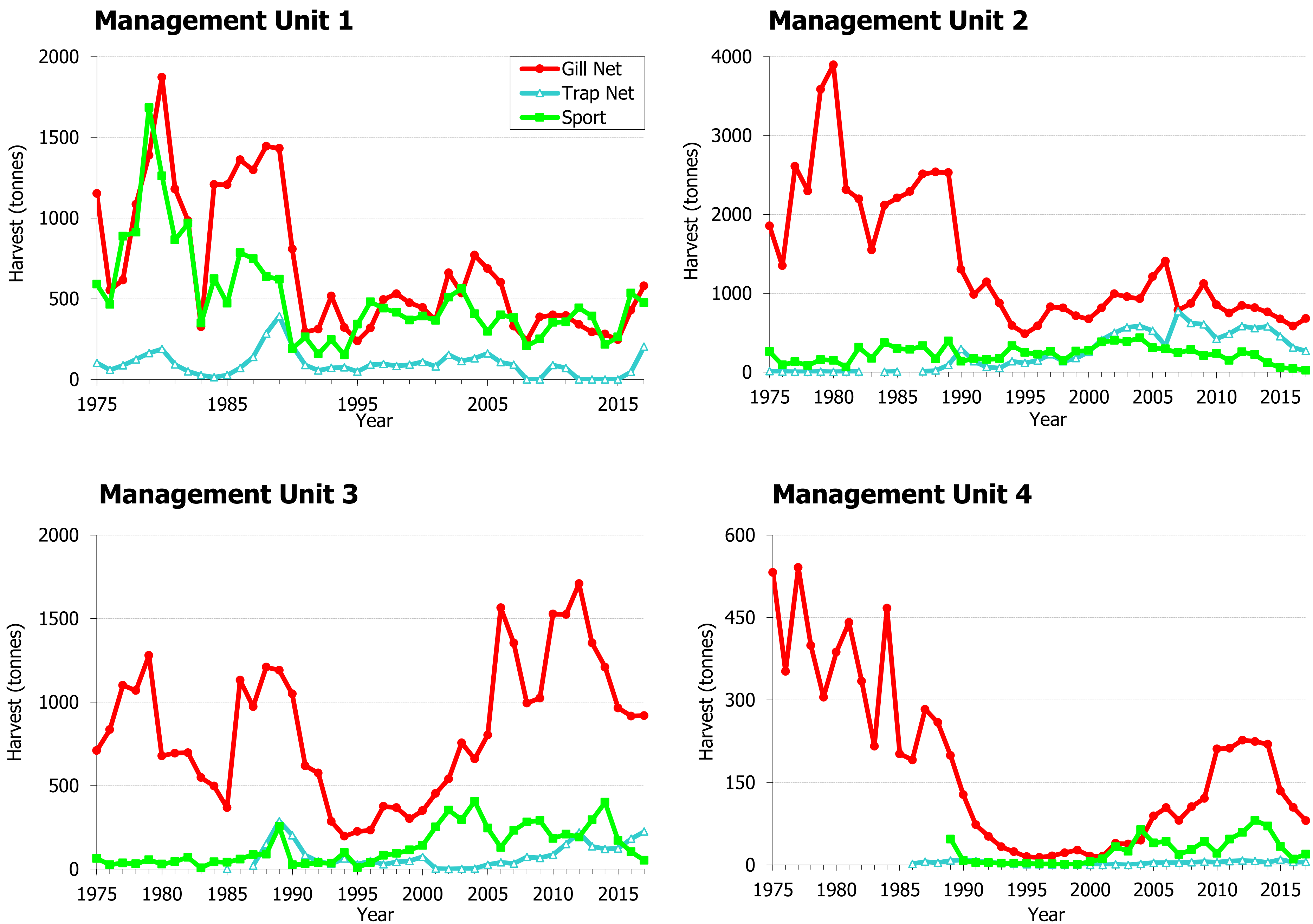



**Figure 1.2**. Historic Lake Erie Yellow Perch harvest (metric tonnes) by management unit and gear type.

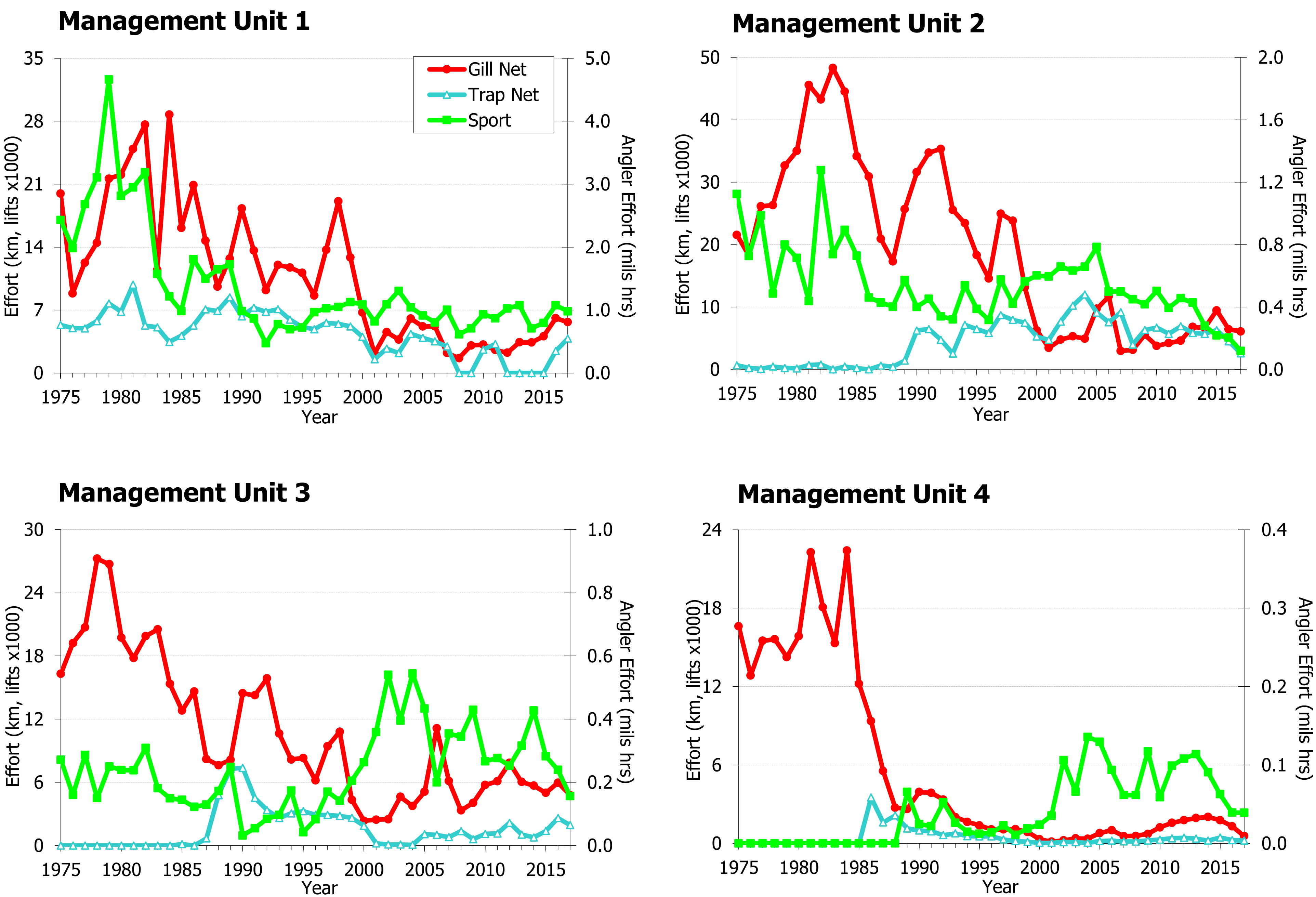



**Figure 1.3.** Historic Lake Erie Yellow Perch effort by management unit and gear type. Note: gill net effort presented is targeted effort with small mesh (< 3").

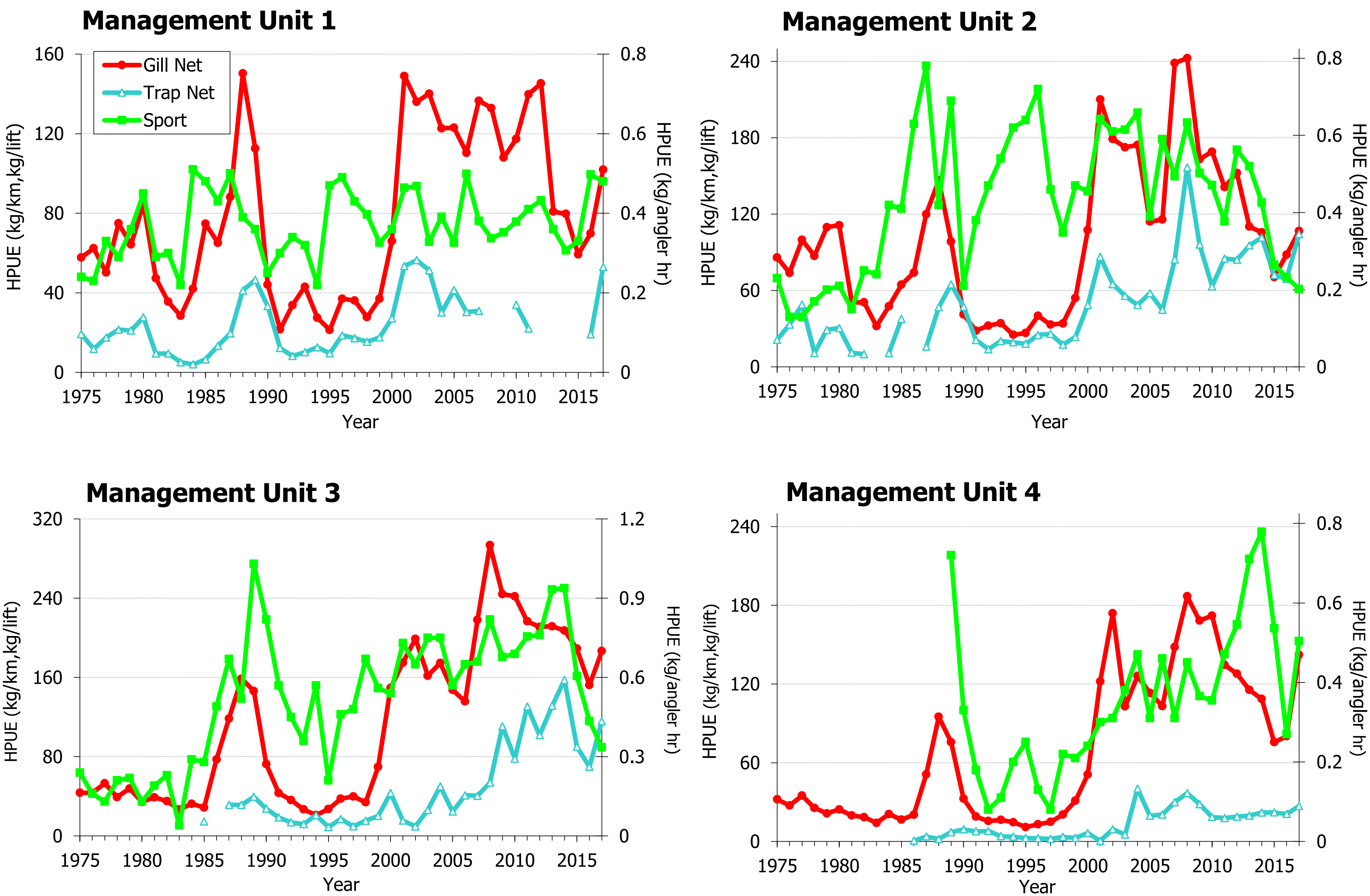



**Figure 1.4.** Historic Lake Erie Yellow Perch harvest per unit effort (HPUE) by management unit and gear type. Note: gill net CPUE for 2001 to 2017 is for small mesh (< 3″) only.

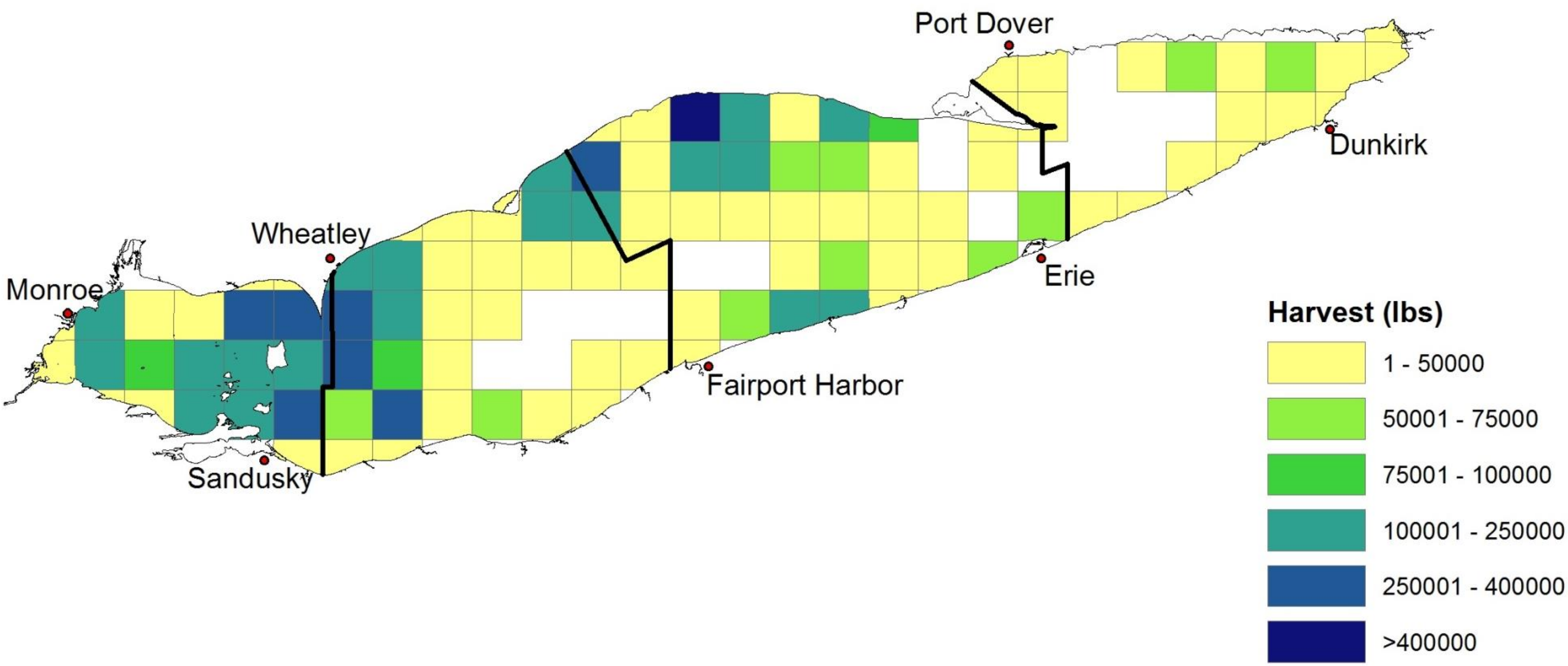



**Figure 1.5**. Spatial distribution of Yellow Perch total harvest (lbs.) in 2017 by 10-minute grid.

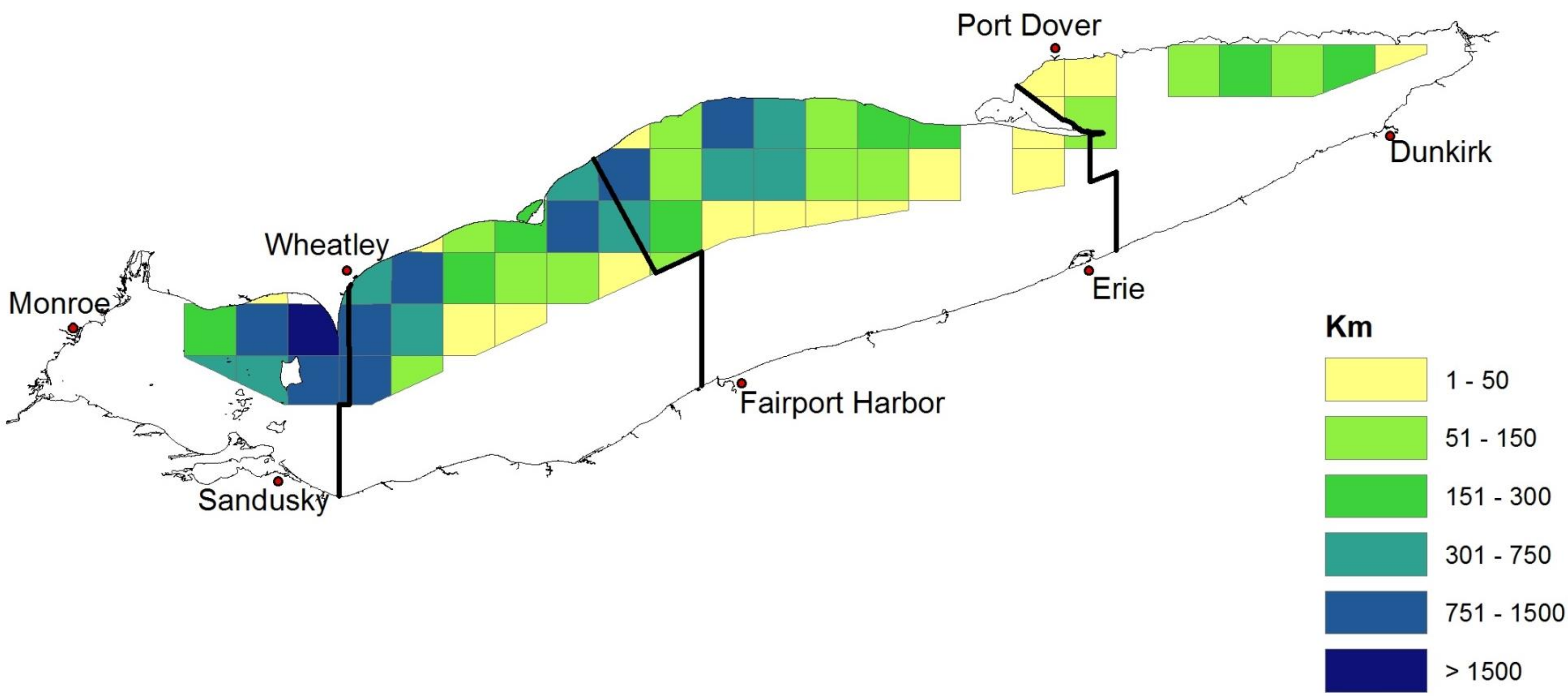



**Figure 1.6**. Spatial distribution of Yellow Perch small mesh gill net effort (km) in 2017 by 10-minute grid.

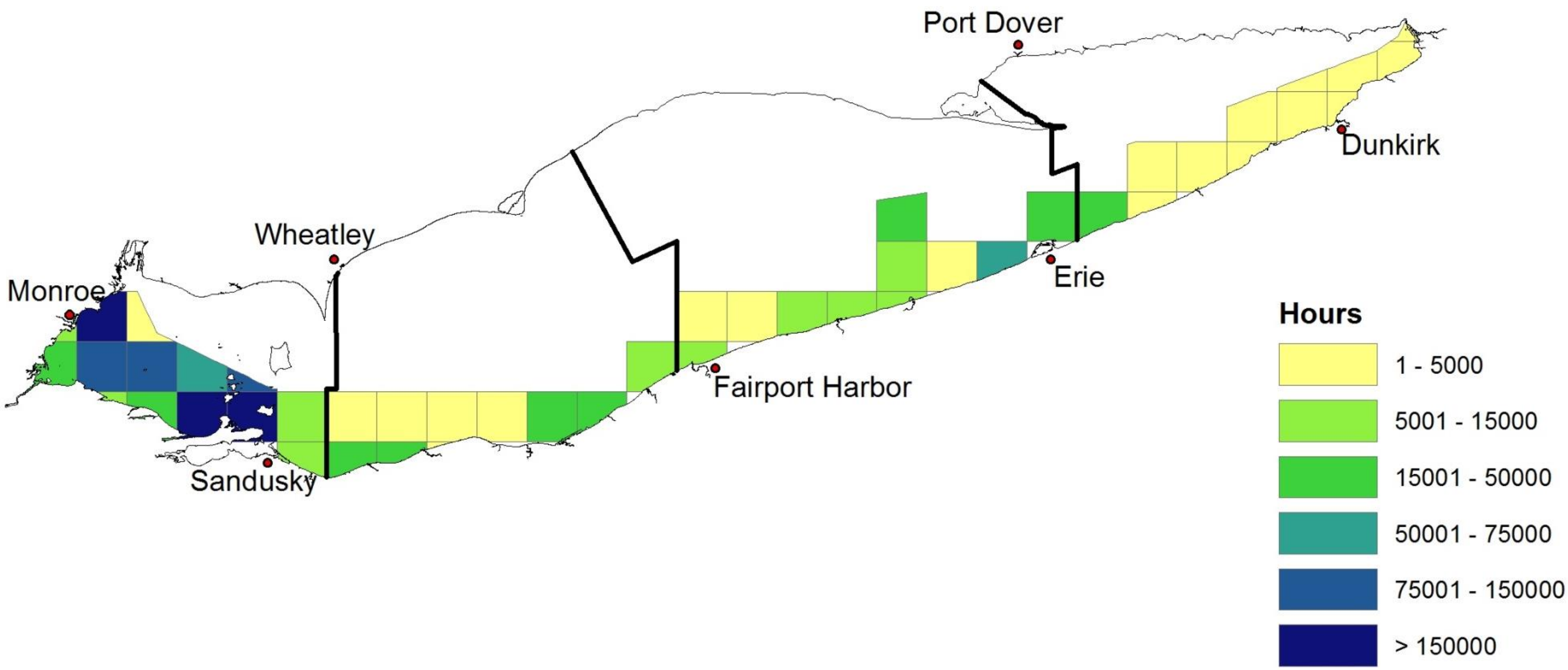



**Figure 1.7**. Spatial distribution of Yellow Perch sport effort (angler hours) in 2017 by 10-minute grid.

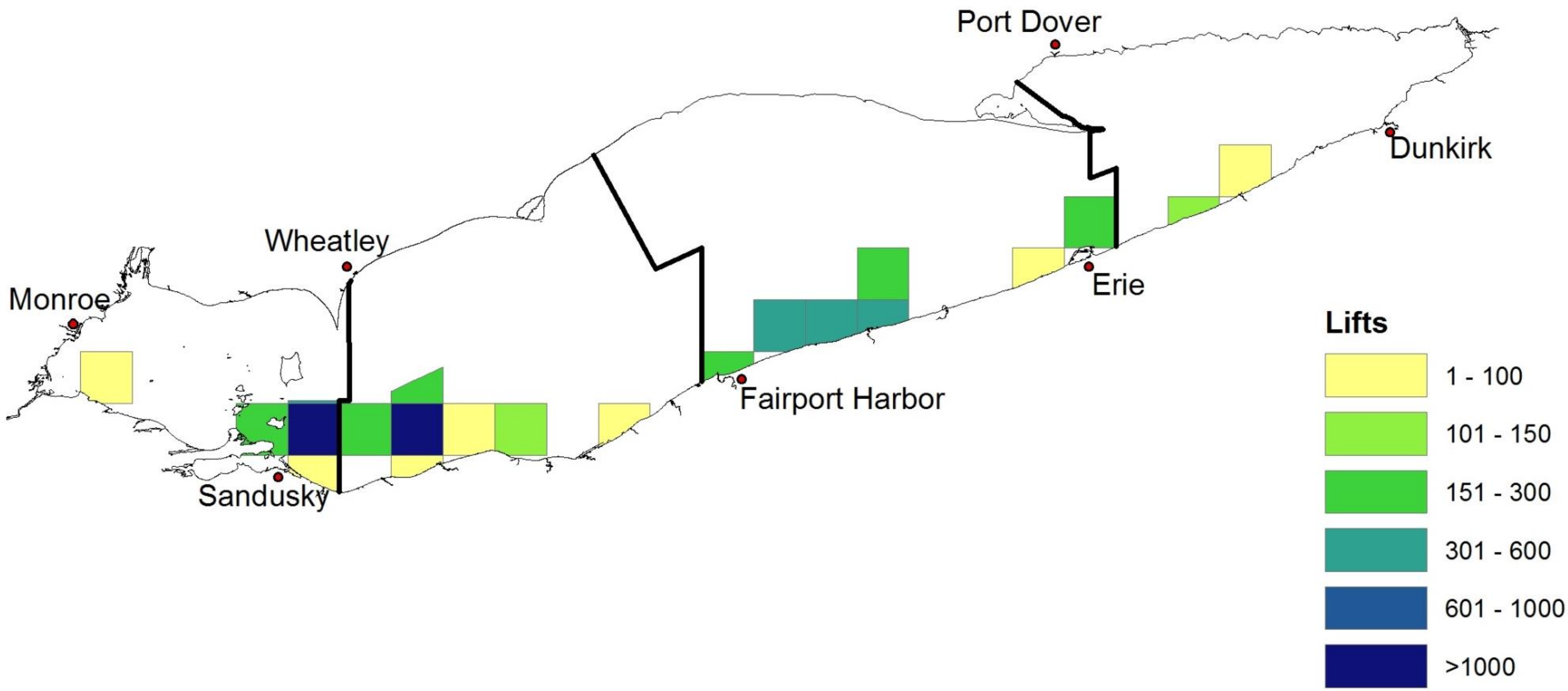



**Figure 1.8**. Spatial distribution of Yellow Perch trap net effort (lifts) in 2017 by 10-minute grid.

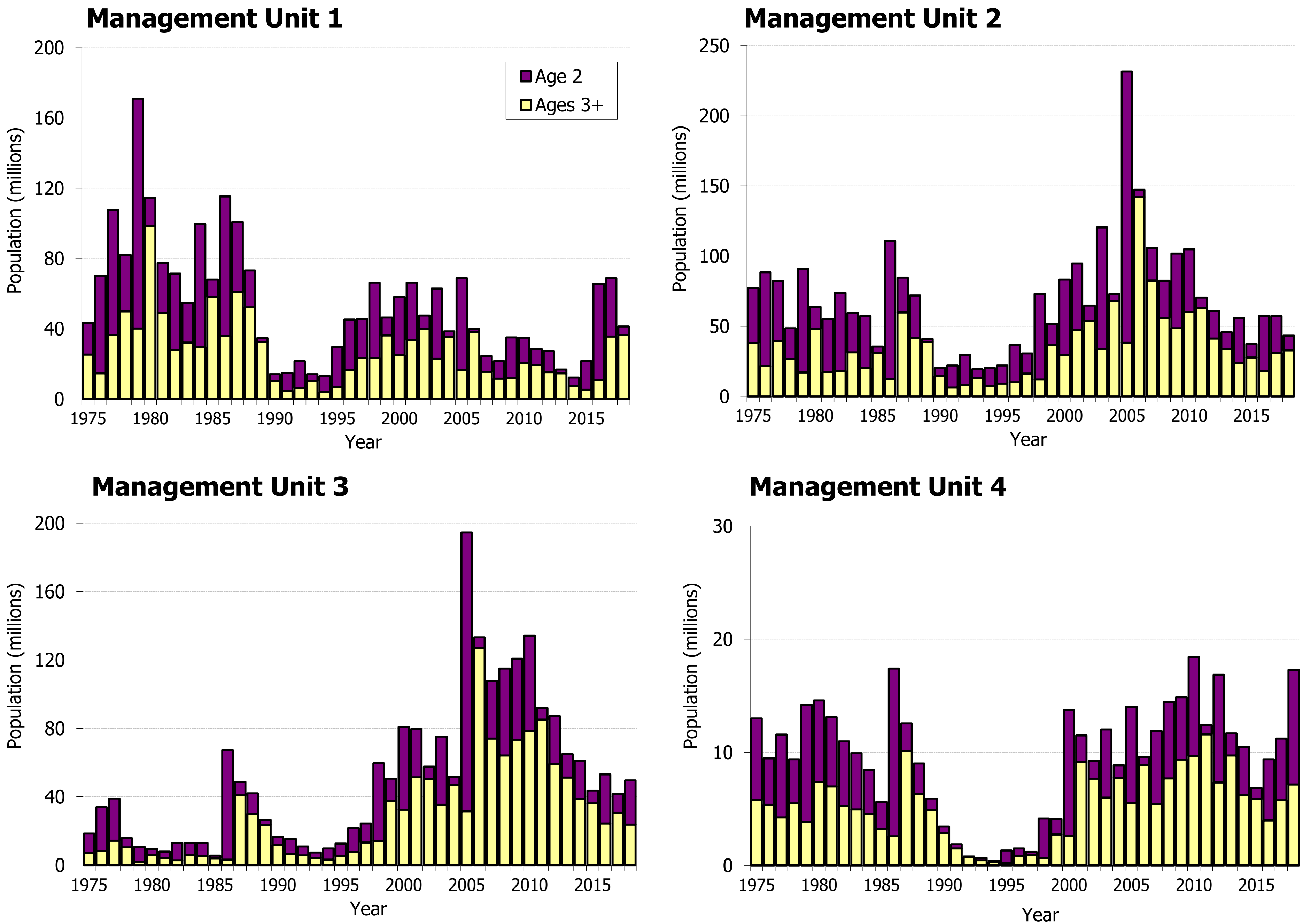



**Figure 1.9.a.** Lake Erie Yellow Perch population estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 1975 to 2017 are from the **YPTG ADMB model.** Estimates for 2018 are projected from the YPTG model and regressions for age 2 from survey gears.

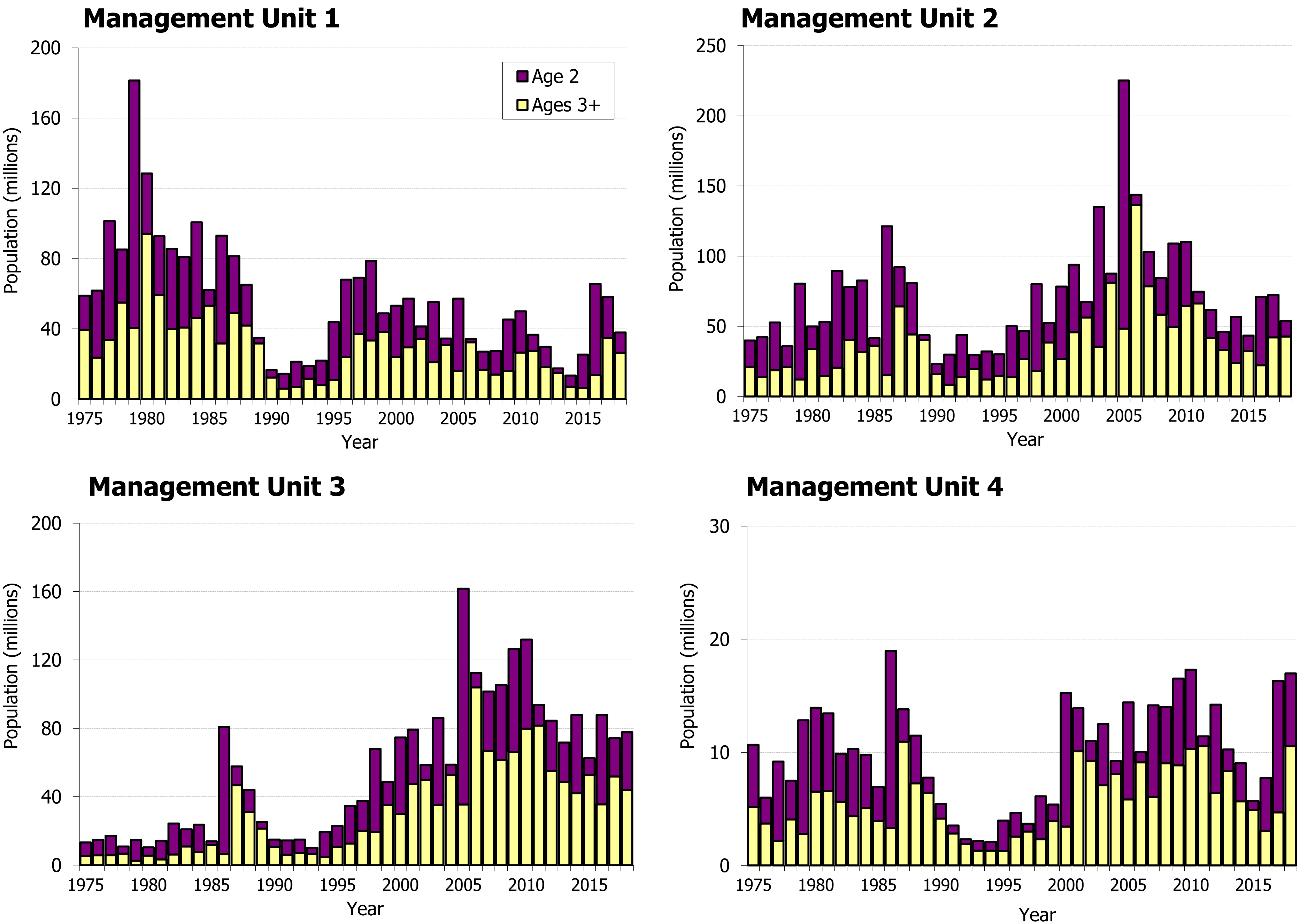



**Figure 1.9.b.** Lake Erie Yellow Perch population estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 1975 to 2017 are from the **PR ADMB model.** Estimates for 2018 are projected from the PR model and regressions for age 2 from survey gears.

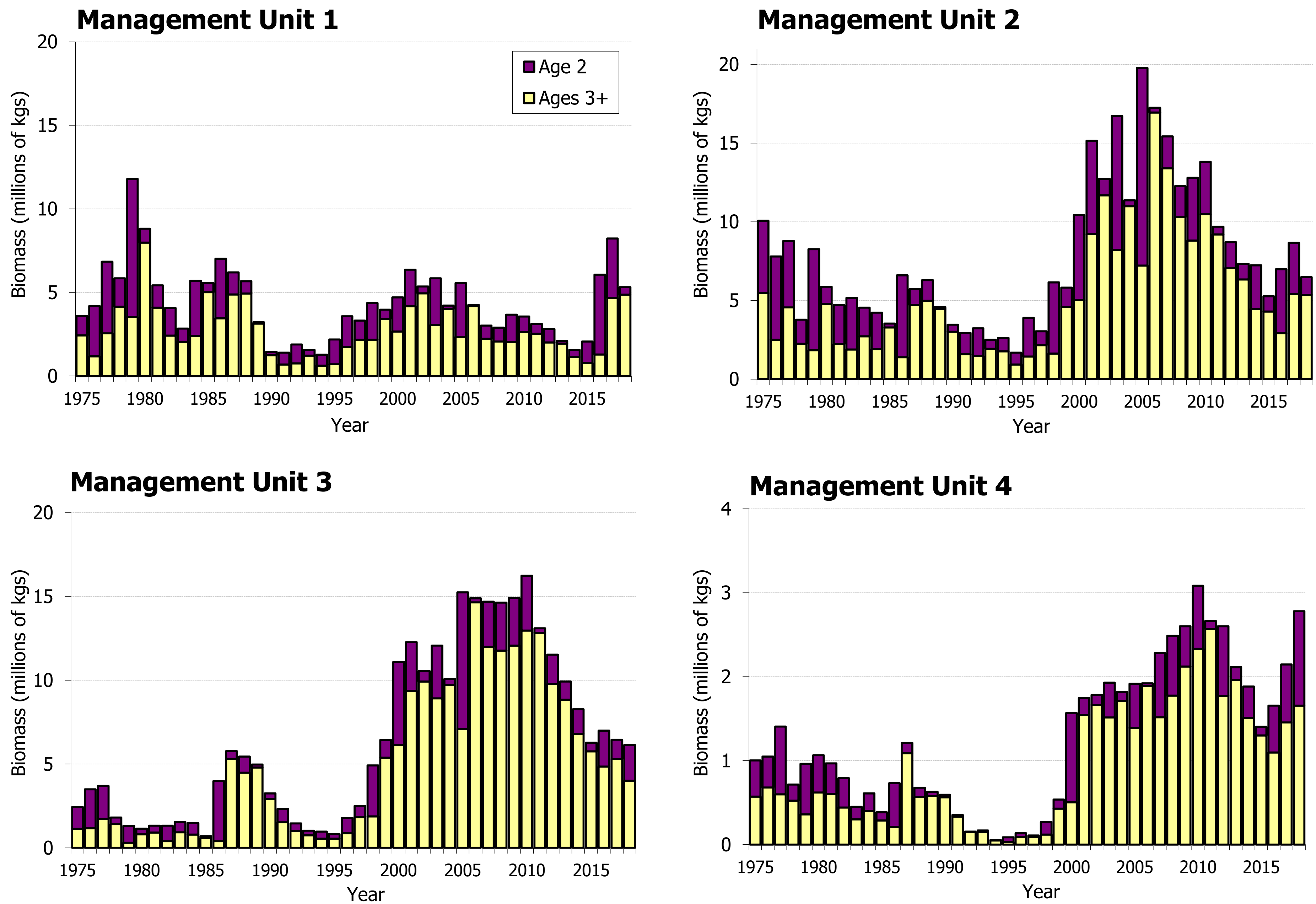



**Figure 1.10.a.** Lake Erie Yellow Perch biomass estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 1975 to 2016 are from the **YPTG ADMB model.** Estimates for 2017 are projected from the YPTG model and regressions for age 2 from survey gears.

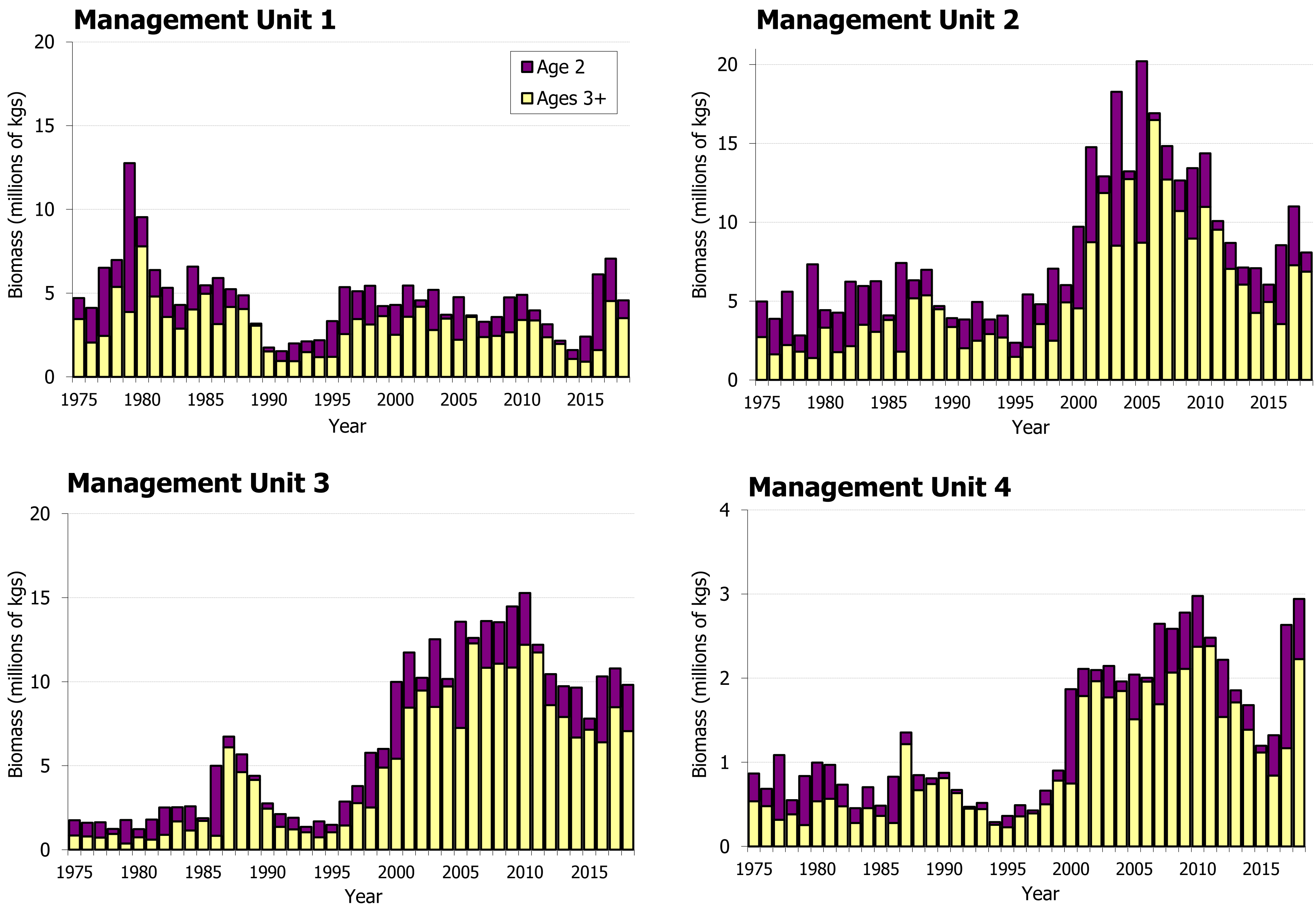



**Figure 1.10.b.** Lake Erie Yellow Perch biomass estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 1975 to 2017 are from the **PR ADMB model.** Estimates for 2018 are projected from the PR model and regressions for age 2 from survey gears.

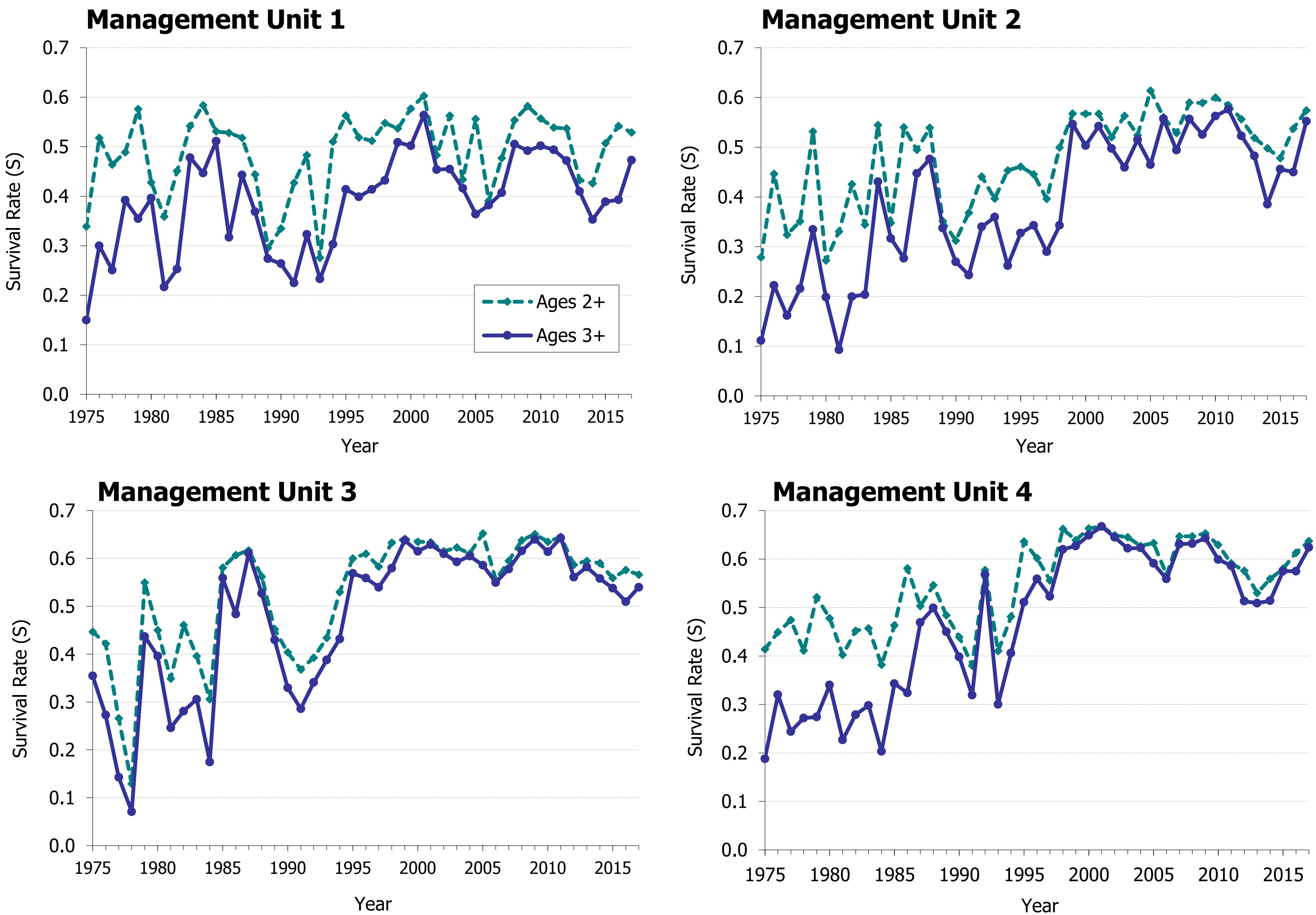



**Figure 1.11.a.** Lake Erie Yellow Perch survival rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from the **YPTG ADMB model**.

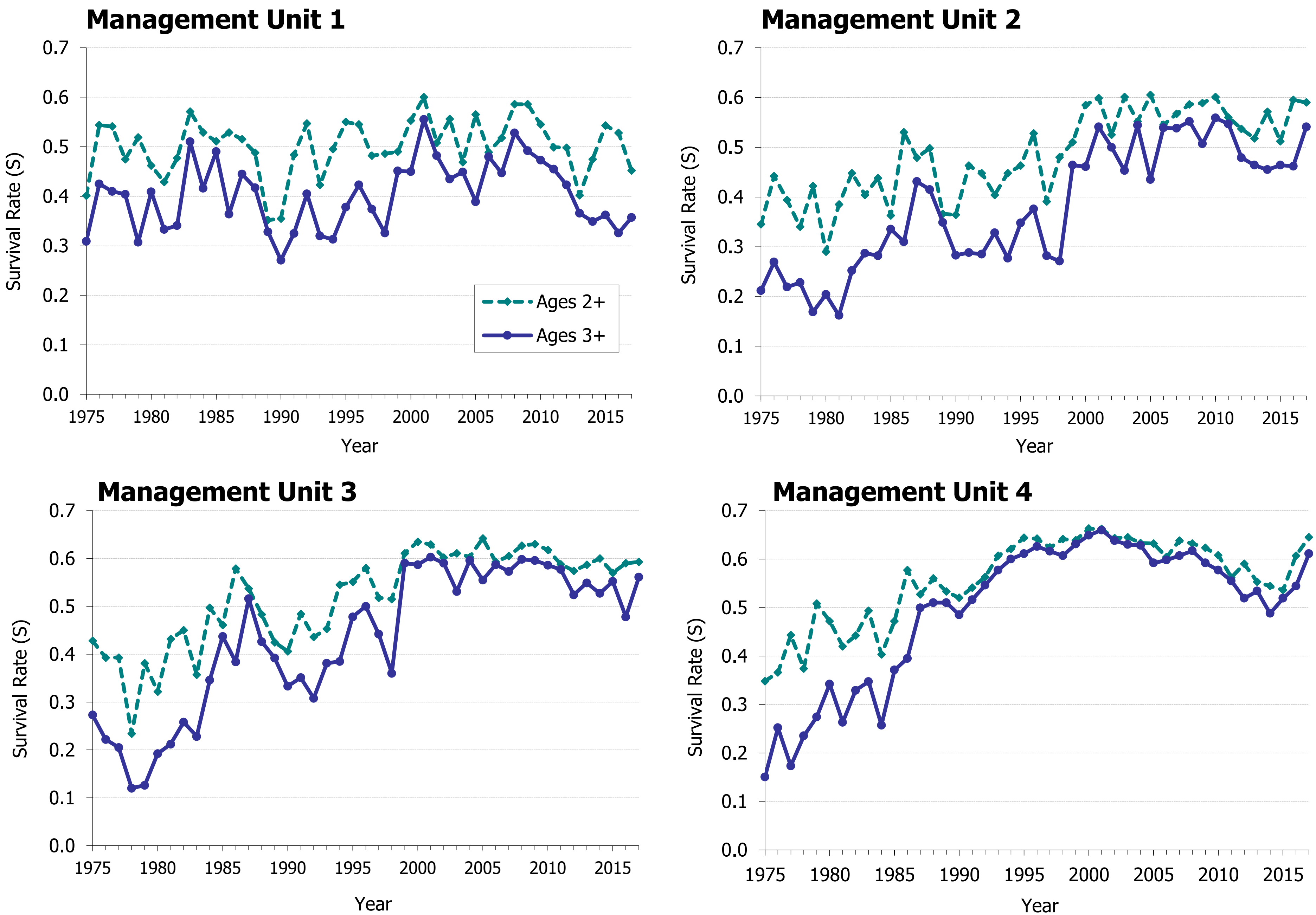



**Figure 1.11.b.** Lake Erie Yellow Perch survival rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from the **PR ADMB model**.

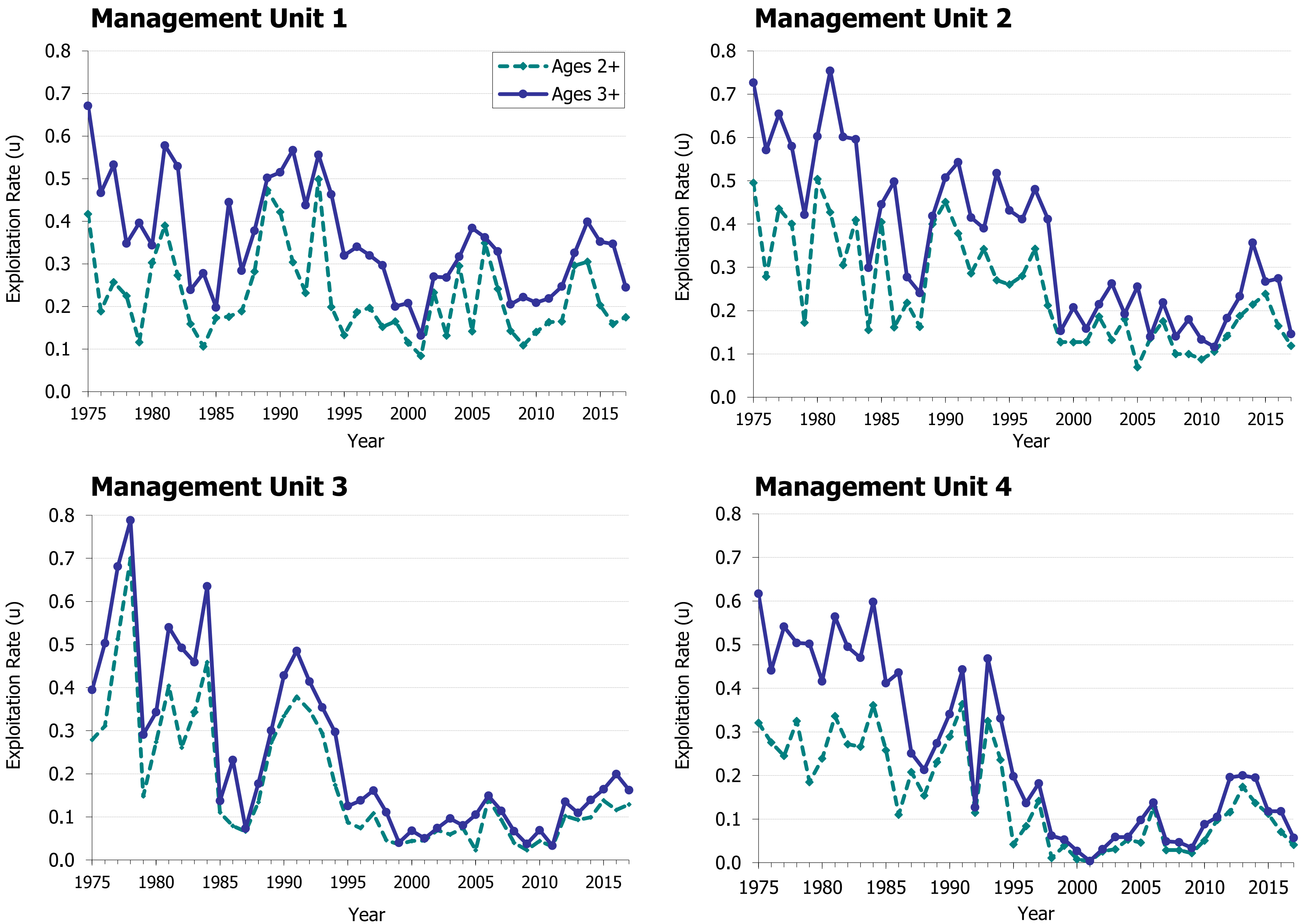



**Figure 1.12.a.** Lake Erie Yellow Perch exploitation rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from the **YPTG ADMB model**.

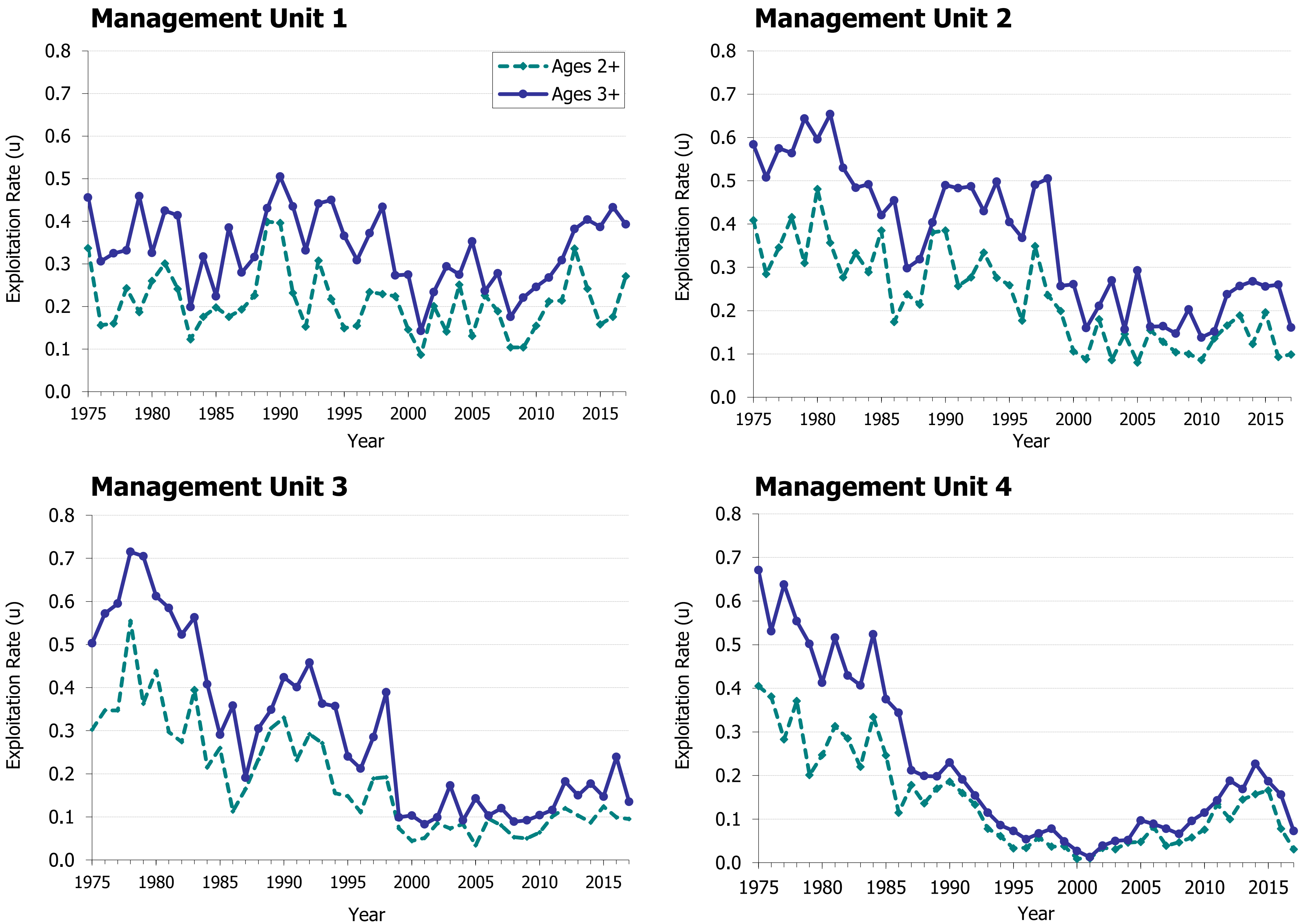
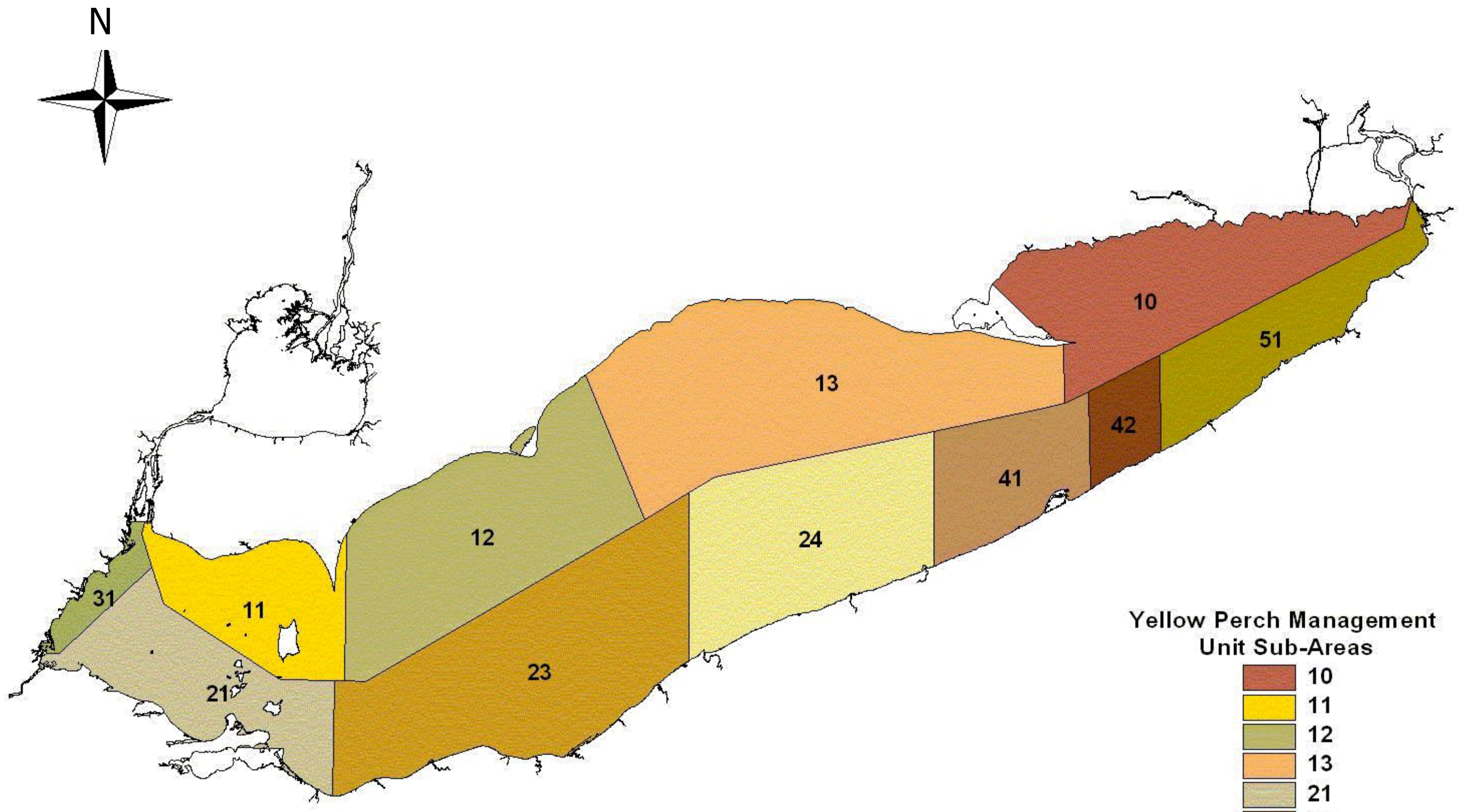



**Figure 1.12.b.** Lake Erie Yellow Perch exploitation rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from the **PR ADMB model**.




| 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 ($\lambda$) values and relative number of terms associated with catch-at-age analysis data sources by management unit (Unit).

| Unit | Data Source | $\lambda$ | 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 |
| | Long Point Bay Gill Net Index Catch Rates | 1.0 | 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***

**2018 Age-2 Projections**

| MU | Age-2 Recruitment Estimates 2018 Min. | Mean | Max. | Number of years in model | Number of models averaged |
|---|---|---|---|---|---|
| 1 | 3.523 | 4.923 | 0.879 | 17 | 2 |
| 2 | 7.975 | 10.351 | 13.434 | 16 | 2 |
| 3 | 20.660 | 25.922 | 32.523 | 13 | 2 |
| 4 | 7.216 | 10.136 | 14.238 | 13 | 1 |

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

**2018 Age-2 Projections**

**MU1**

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

| Survey | Estimate | Uncond. variance | Number of models | Importance | +/- (alpha = 0.05) |
|---|---|---|---|---|---|
| OPSF11 | 0.013 | 0.001 | 1 | 0.276 | 0.049 |
| (Intercept) | 13.178 | 0.092 | 2 | 1 | 0.630 |
| OHF10 | 0.321 | 0.015 | 2 | 1 | 0.252 |
| OHF11 | 0.101 | 0.002 | 2 | 1 | 0.095 |
| OOS11 | 0.385 | 0.020 | 2 | 1 | 0.292 |

**MU2**

`Age_2 ~ Intercept + OHJ21 + + OHF20 + OHS20 + OPSF21`

| Survey | Estimate | Uncond. variance | Number of models | Importance | +/- (alpha = 0.05) |
|---|---|---|---|---|---|
| OHJ21 | 0.105 | 0.007 | 1 | 0.722 | 0.178 |
| (Intercept) | 14.685 | 0.076 | 2 | 1 | 0.583 |
| OHS20 | 0.131 | 0.002 | 2 | 1 | 0.087 |
| OPSF21 | 0.352 | 0.004 | 2 | 1 | 0.133 |

**MU3**

`Age_2 ~ Intercept + OHJ31 + OPSF31`

| Survey | Estimate | Uncond. variance | Number of models | Importance | +/- (alpha = 0.05) |
|---|---|---|---|---|---|
| OHJ31 | 0.163 | 0.026 | 1 | 0.629 | 0.343 |
| (Intercept) | 14.524 | 0.160 | 2 | 1 | 0.856 |
| OPSF31 | 0.447 | 0.018 | 2 | 1 | 0.288 |

**MU4**

`Age_2 ~ Intercept + NYF41`

| Survey | Estimate |
|---|---|
| NYF41 | 0.622768 |
| (Intercept) | 13.10268 |

**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***

**2018 Age-2 Projections**

| MU | Age-2 Recruitment Estimates 2018 | | | Number of years in model | Number of models averaged |
|---|---|---|---|---|---|
| | Min. | Mean | Max. | | |
| 1 | 6.558 | 11.550 | 20.341 | 17 | 3 |
| 2 | 7.283 | 11.112 | 16.956 | 16 | 3 |
| 3 | 26.919 | 33.587 | 41.907 | 13 | 3 |
| 4 | 3.508 | 6.443 | 11.833 | 13 | 3 |

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

**2018 Age-2 Projections**

**MU1**

`Age_2 ~ Intercept + OOS11 + OOS10 + OPSF11`

| Survey | Estimate | Uncond. variance | Number of models | Importance | +/- (alpha = 0.05) |
|---|---|---|---|---|---|
| OOS11 | 0.256 | 0.047 | 2 | 0.684 | 0.465 |
| OOS10 | 0.259 | 0.029 | 2 | 0.786 | 0.367 |
| (Intercept) | 13.870 | 0.197 | 3 | 1.000 | 0.956 |
| OPSF11 | 0.101 | 0.001 | 3 | 1.000 | 0.074 |

**MU2**

`Age_2 ~ Intercept + OHS20 + OHF20 + OPSF21`

| Survey | Estimate | Uncond. variance | Number of models | Importance | +/- (alpha = 0.05) |
|---|---|---|---|---|---|
| OHS20 | 0.055 | 0.003 | 2 | 0.566 | 0.128 |
| OHF20 | 0.174 | 0.020 | 2 | 0.704 | 0.304 |
| (Intercept) | 15.046 | 0.066 | 3 | 1.000 | 0.558 |
| OPSF21 | 0.332 | 0.004 | 3 | 1.000 | 0.143 |

**MU3**

`Age_2 ~ Intercept + OHS31 + OHJ31 + OPSF31`

| Survey | Estimate | Uncond. variance | Number of models | Importance | +/- (alpha = 0.05) |
|---|---|---|---|---|---|
| OHS31 | 0.069 | 0.011 | 1 | 0.315 | 0.233 |
| OHJ31 | 0.114 | 0.021 | 1 | 0.442 | 0.320 |
| (Intercept) | 14.802 | 0.155 | 3 | 1.000 | 0.873 |
| OPSF31 | 0.411 | 0.012 | 3 | 1.000 | 0.247 |

**MU4**

`Age_2 ~ Intercept + LPC41 + NYF41`

| Survey | Estimate | Uncond. variance | Number of models | Importance | +/- (alpha = 0.05) |
|---|---|---|---|---|---|
| LPC41 | 0.241 | 0.033 | 2 | 0.734 | 0.400 |
| NYF41 | 0.321 | 0.046 | 2 | 0.779 | 0.474 |
| (Intercept) | 13.761 | 0.142 | 3 | 1.000 | 0.834 |

**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 | NYGN41 | LPS41 | LPC40 | LPC41 | OPSF11 | OPSF21 | OPSF31 | OPSF41 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 310.1 | 0.0 | 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 | 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 | 36.3 | 15.0 | 31.3 | 3.3 | 7.2 | 8.0 | 24.3 | 2.7 | 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 | 10.6 | 49.0 | 27.3 | 12.1 | 41.7 | 29.1 | 39.7 | 16.0 | 9.7 | 5.8 | 113.0 | 3.1 | 0.2 | 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 | 49.0 | 8.6 | 0.6 | 2.7 | 34.7 | 6.2 | 317.8 | 22.5 | 39.7 | 7.4 |
| 1995 | 82.4 | 0.1 | 478.7 | 113.5 | 2.8 | 73.5 | 14.1 | 27.5 | 2.8 | 120.5 | 27.3 | 21.0 | . | . | 5.9 | 13.6 | 0.6 | 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 | 105.8 | 0.3 | 0.1 | 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 | 5.7 | 0.0 | 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 | 1.3 | 0.4 | 0.0 | 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 | 35.9 | 33.3 | 13.1 | 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 | 0.0 | 84.8 | 51.4 | 10.2 | 23.9 | 7.0 | 3.3 | 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 | 100.4 | 11.7 | 2.2 | 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 | 9.5 | 16.0 | 0.9 | 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 | 484.8 | 2.0 | 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 | 7.7 | 224.2 | 1.9 | 45.2 | 32.8 | 316.2 | 3.6 | 61.9 | 410.3 | 42.7 | 1.5 | 29.4 | 2.9 | 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 | 59.3 | 5.6 | 0.4 | 0.4 | 124.4 | 0.1 | 0.0 | 2.2 | 2.5 | 0.2 |
| 2006 | 121.9 | 12.5 | 222.8 | 12.4 | 11.3 | 4.3 | 18.9 | 12.5 | 4.9 | 2.2 | 60.7 | 10.8 | 29.7 | 113.6 | 290.6 | 40.9 | 32.6 | 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 | 412.0 | 42.3 | 16.1 | 9.1 | 63.5 | 7.9 | 184.4 | 203.9 | 202.5 | 43.4 |
| 2008 | 74.7 | 15.3 | 387.2 | 142.1 | 32.1 | 55.0 | 52.8 | 26.4 | 210.5 | 62.6 | 558.3 | 150.2 | 303.5 | 97.2 | 1116.7 | 45.5 | 16.4 | 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 | 11.9 | 64.1 | 42.4 | 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 | 197.7 | 4.2 | 1.6 | 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 | 89.5 | 141.8 | 105.9 | 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 | 280.0 | 16.7 | 8.0 | 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 | 4.4 | 24.4 | 16.0 | 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 | 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 | 2.0 | 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 | 1.6 | 8.7 | 0.2 | 91.3 | 156.9 | 184.0 | 46.5 | 149.4 | 2178.2 | 53.0 | 10.4 | 31.7 | 360.6 | 91.7 | 105.6 | 50.4 | 35.1 | 298.2 |
| 2017 | 125.5 | 1.0 | 493.7 | 4.4 | 19.0 | 3.7 | 39.1 | 7.6 | 191.8 | 3.3 | 1399.9 | 65.1 | 7.2 | 17.6 | 247.0 | 129.5 | 77.4 | 37.6 | 65.5 | 4.4 | 90.3 | 65.3 | 104.8 | 414.1 |

| Year | *OHS10* | *OHS11* | *OLPN40* | *OLPN41* | *ILP40* | *ILP41* | *OLPO40* | *OLPO41* | *OHJY20B* | *OHJY21B* | *OHJY30B* | *OHJY31B* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | *144.4* | *20.7* | *43.3* | *12.0* | *202.6* | *21.0* | *0.0* | *2.6* | *1.5* | *18.6* | *0.9* | *42.6* |
| 1991 | *146.9* | *27.6* | *15.5* | *1.0* | *144.0* | *24.5* | *0.7* | *0.6* | . | . | *0.0* | *0.0* |
| 1992 | *60.7* | *9.5* | *54.3* | *9.0* | *594.0* | *32.8* | *0.0* | *0.1* | *0.0* | *10.9* | *0.0* | *0.7* |
| 1993 | *1164.2* | *14.4* | *21.6* | *4.5* | *239.8* | *17.9* | *2.9* | *0.2* | *0.0* | *13.2* | *0.0* | *19.1* |
| 1994 | *508.5* | *57.7* | *159.8* | *15.3* | *84.0* | *29.8* | *10.6* | *1.7* | *518.8* | *5.3* | *265.8* | *13.0* |
| 1995 | *348.9* | *128.8* | *6.0* | *33.7* | *5.3* | *54.3* | *4.0* | *1.7* | *28.9* | *8.5* | *28.5* | *1.0* |
| 1996 | *3290.8* | *79.9* | *199.1* | *2.6* | *53.6* | *6.1* | *7.9* | *0.1* | *1464.4* | *2.9* | *558.3* | *1.2* |
| 1997 | *52.2* | *121.8* | *18.9* | *59.8* | *21.5* | *5.4* | *0.0* | *0.1* | *0.0* | *68.1* | *0.7* | *225.2* |
| 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* | *0.3* | *32.5* | *68.9* | *58.3* |
| 2000 | *186.4* | *85.3* | *10.2* | *2.1* | *1.2* | *4.8* | *3.0* | *13.4* | *0.0* | *129.3* | *1.1* | *28.7* |
| 2001 | *322.1* | *12.8* | *76.7* | *2.0* | *463.8* | *2.7* | *13.8* | *1.9* | *54.3* | *11.3* | *263.5* | *20.8* |
| 2002 | *33.1* | *77.1* | *0.6* | *13.9* | *8.3* | *42.6* | *0.0* | *0.7* | *0.0* | *192.4* | . | . |
| 2003 | *1509.9* | *3.0* | *93.3* | *0.8* | *224.0* | *1.5* | *240.6* | *2.6* | *607.9* | *20.9* | *193.6* | *6.9* |
| 2004 | *40.9* | *210.7* | *0.5* | *4.3* | *0.1* | *21.4* | *0.1* | *12.2* | *0.0* | *60.5* | *0.2* | *55.9* |
| 2005 | *124.2* | *5.2* | *10.3* | *0.1* | *8.8* | *0.2* | *156.2* | *0.0* | *0.0* | *47.3* | *44.9* | *10.3* |
| 2006 | *180.2* | *6.4* | *2.8* | *1.4* | *0.3* | *4.8* | *38.0* | *14.6* | *13.4* | *78.0* | *250.8* | *14.3* |
| 2007 | *592.9* | *14.5* | *6.3* | *0.9* | *73.9* | *3.0* | *70.0* | *9.6* | *47.1* | *7.5* | *540.5* | *21.5* |
| 2008 | *267.0* | *23.5* | *4.9* | *6.6* | *0.3* | *4.1* | *356.0* | *25.1* | *2129.1* | *358.0* | *320.9* | *101.8* |
| 2009 | *186.0* | *85.3* | *1.5* | *4.2* | *0.0* | *0.0* | *0.3* | *13.1* | *0.0* | *24.2* | *0.0* | *109.9* |
| 2010 | *58.2* | *22.2* | *13.2* | *0.6* | *5.7* | *0.6* | *63.5* | *0.0* | *33.6* | *5.0* | . | . |
| 2011 | *29.9* | *15.5* | *3.9* | *1.9* | *3.9* | *12.8* | *224.6* | *1.3* | *25.7* | *32.3* | *49.1* | *45.5* |
| 2012 | *74.5* | *2.3* | *11.3* | *1.1* | *1.6* | *1.7* | *33.2* | *2.2* | *133.4* | *19.0* | *164.6* | *32.5* |
| 2013 | *398.7* | *10.3* | *1.8* | *0.5* | *2.1* | *5.6* | *0.1* | *0.1* | *3.9* | *49.1* | *0.6* | *45.3* |
| 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* | *327.8* | *333.1* | *86.9* | *83.4* |
| 2017 | *279.5* | *2.7* | *84.4* | *3.0* | *52.1* | *0.9* | *64.7* | *5.1* | *328.4* | *4.7* | *454.3* | *13.2* |

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 |
| OHJY20 | Ohio Management Unit 2 July age 0 |
| OHJY30 | Ohio Management Unit 3 July age 0 |
| OHJY21 | Ohio Management Unit 2 July age 1 |
| OHJY31 | Ohio Management Unit 3 July 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 trawl age 0 |
| NYF41 | New York Management Unit 4 fall trawl age 1 |
| NYGN41 | New York Management Unit 4 gill net 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 |