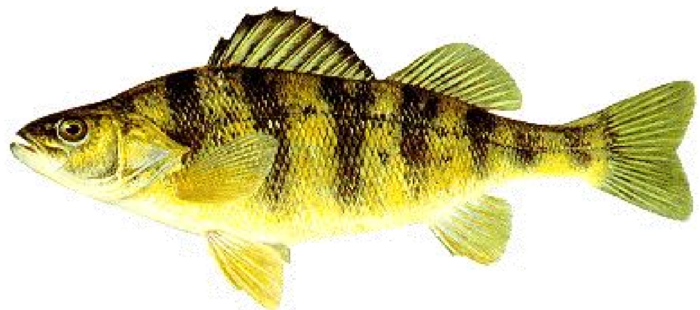
Report of the Lake Erie Yellow Perch Task Group

March 2024



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Introduction

From April 2023 through March 2024 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 LEC TAC decisions.

3. Ensure population models are current and produce the most scientifically defensible and reliable method for estimating and forecasting abundance, recruitment, and mortality.
    a. Evaluate the impact of recruitment indices on ADMB model results.
    b. Evaluate ADMB model parameter sensitivity.

4. Supply needed technical support throughout the upcoming Yellow Perch Management Plan (YPMP) review process.

Charge 1: 2023 Fisheries Review and Population Dynamics

The lakewide total allowable catch (TAC) of Yellow Perch in 2023 was 6.573 million pounds. This allocation represented a 9% decrease from a TAC of 7.185 million pounds in 2022. For Yellow Perch assessment and allocation, Lake Erie is partitioned into four management units (MUs; Figure 1.1). The 2023 TAC allocation was 2.430, 0.477, 3.082, and 0.584 million pounds for MUs 1 through 4, respectively. In March 2023 the Lake Erie Committee (LEC) applied the harvest policy within the Yellow Perch Management Plan to set the TAC. For MU1, the LEC set the TAC equal to 2.430 million pounds, which was a 20% decrease from 2022. In MU2, the target fishing mortality rate was reduced to F=0.106, lowering the mean RAH and range. The target fishing mortality rate was reduced to ensure the spawning stock biomass in 2024 would not fall below the limit reference point, B_{msy}, with a probabilistic risk tolerance of 0.20 (i.e., P*). For MU2, the LEC set the TAC at 0.477 million pounds, which was equal to the mean RAH, representing an 11% decrease from 2022. For MU3, the LEC set the TAC at the same amount as the 2022 TAC (3.082 million pounds). This was slightly lower than the mean RAH (3.543 millions pounds) due to uncertainty about the MU3 abundance estimates. In MU4, the LEC set the TAC at 0.584 million pounds, which was the mean RAH and was 11% higher than the 2022 TAC.

The lakewide harvest of Yellow Perch in 2023 was 4.305 million pounds, or 65% of the total 2023 TAC. This was a 27% increase from the 2022 harvest of 3.400 million pounds. Harvest from MUs 1 through 4 was 2.376, 0.287, 1.236, and 0.406 million pounds, respectively (Table 1.1). The portion of TAC harvested was 98%, 60%, 40%, and 70%, in MUs 1 through 4, respectively. In 2023, Ontario harvested 2.523 million pounds, followed by Ohio (1.554 million lbs.), Michigan (0.104 million lbs.), New York (0.069 million lbs.), and Pennsylvania (0.056 million lbs.).

Ontario's fraction of allocation harvested was 103% in MU1, 97% in MU2, 60% in MU3, and 99% in MU4 (see paragraph below regarding Ontario's harvest reporting and commercial ice allowance policy). Ohio fishers attained 103% of their TAC in the western basin (MU1), 29% in the west central basin (MU2), and 22% in the east central basin (MU3). Michigan anglers in MU1 attained 47% of their TAC. Pennsylvania fisheries harvested 12% of their TAC in MU3 and 2% of their TAC in MU4. New York fisheries attained 38% of their TAC in MU4. Ontario's portion of the lakewide Yellow Perch harvest in 2023 was 59% (Table 1.1). Ohio's proportion of lakewide harvest was 36%, and harvest in Michigan, Pennsylvania, and New York waters combined represented around 5% of the lakewide harvest in 2023.

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 2014 to 2023 by management unit, year, agency, and gear type in Tables 1.2 to 1.5. Trends across a longer time series (1975 to 2023) 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 2023 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 2023 was 2%, 10%, 2%, and <1% of the gill net harvest in management units 1 - 4, respectively. Harvest, effort, and catch per unit effort from (1) small mesh Yellow Perch effort (2.25”=<stretched mesh<3”) and (2) larger mesh sizes, are distinguished in Tables 1.2 to 1.5. Harvest from targeted small mesh gill nets in 2023 increased by 32% in MU1, 24% in MU2, 4% in MU3 and 7% in MU4, relative to 2022. Ontario trap nets, which primarily target white bass, harvested zero yellow perch in 2023. Ontario commercial Rainbow Smelt trawlers incidentally caught Yellow Perch in management units 3 and 4, and this harvest is included in Tables 1.4 and 1.5. In 2023, 11 pounds of Yellow Perch were harvested in trawl nets in MU3 and 453 pounds were harvested in MU4.

Targeted (i.e., small mesh) gill net effort in 2023 decreased from 2022 effort in MU1 (-16%) and increased in units MU2, MU3 and MU4 by 8%, 19%, and 25% respectively. Targeted gill net harvest rates in 2023 increased by 58% and 15% relative to 2022 rates in MU1 and MU2 respectively, while decreasing in MU3 by 12%, and MU4 by 15% (Figure 1.4).

Compared to 2022, sport harvest in 2023 in U.S. waters increased by 76% in MU1 (944,587 lbs), while decreasing 43% in MU2 (11,415 lbs.), 26% in MU3 (5,009 lbs) and 20% in MU4 (55,890 lbs.) (Figure 1.2). Angling effort in U.S. waters during 2023 was highest in MU1 and lowest in MU2. Angler effort in 2023 increased 39% compared to 2022 in MU1, and decreased 85%, 22%, and 34% in MU2, MU3 and MU4 respectively (Figure 1.3). In 2023, angling effort in U.S. waters of MU3 at 4,780 hours was at its lowest in the time series, while effort of 4,011 hours in MU2 was the second lowest in time series (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 2022 rates, harvest per angler hour increased in Michigan (+101%) and Ohio (+43%) waters of MU1. In the central basin, the sport angler harvest rate increased in the Ohio waters of MU2 (+35%) although the rate of 0.7 fish/hour is still one of the lowest in the time series. In MU3, the sport harvest rate increased (+209%) from the second lowest catch rate in the time series in the Ohio waters, while decreasing in Pennsylvania (-89%) waters of MU3 to the lowest value observed in the time series. Sport harvest rates in both MU2 and MU3 should be interpreted with caution as values are based on small sample sizes and continue to reflect low sport effort in the central basin. In MU4, harvest rates increased in New York waters (+34%) and Pennsylvania waters, where the catch rate increased from near 0 fish/hour to 1.3 fish per/hour.

Trap net harvest increased by 120% in MU1, and 1% in MU3, while decreasing by 34% in MU2 and 7% in MU4 compared to 2022 (Tables 1.2 to 1.5). Trap net effort (lifts) in 2023 decreased in MU2, MU3, and MU4 by 82%, 19%, and 11% respectively, relative to 2022 trap net effort, while increasing 35% in MU1. Total trap net effort during 2023 was highest in MU1 at

6,696 lifts. Trap net effort in MU2 during 2023 (289 lifts) was 4th lowest in the 1981-2023 time series reflecting the reduced 2023 TAC in MU2. Trap net harvest rates increased from 2022 rates by 62%, 261%, 26%, and 4% in MU1, MU2, MU3 and MU4, respectively. The trap net harvest rate in MU2 increased to 102 kg/lift in 2023 compared to 28 kg/lift in 2022 which was the lowest value observed since 1999.

Age Composition and Growth

Lakewide, age-2 fish (2021 YC) contributed the most to the Yellow Perch harvest (43%), followed by age-3 fish (2020 YC; 29%), with age-4, age-5, and age-6-and-older fish contributing 22%, 4%, and 2%, respectively; Table 1.6). In MU1, age-2 fish (2021 year class, 61%) contributed most to the fishery, followed by age-3 (2020 year class, 26%) and age-4 fish (2019 year class, 8%). In MU2, age-4 fish (2019 year class, 38%), age-2 fish (2021 year class, 29%) and age-3 fish (2020 year class 26%) contributed most to the fishery. In MU3, age-4 fish (2019 year class, 47%) contributed most to the fishery, followed by age-3 fish (2020 year class, 29%), and age-2 fish (2021 year class, 16%). In MU4, age-3 (2020 year class, 52%) contributed most to the fishery, followed by age-4 fish (2019 year class, 28%), and age-2 fish (2021 year class, 13%).

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 projections and determination of recommended allowable harvest (RAH).

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 2024, the YPTG continued to use the ADMB model developed by the Quantitative Fisheries Center (QFC) at Michigan State University (referred to as the Peterson-Reilly or PR model) as part of the Lake Erie Percid Management Advisory Group (LEPMAG) review of Yellow Perch management on Lake Erie.

The PR model uses harvest and effort data from commercial gill net, commercial trap net, and recreational fisheries within each MU. Survey catch-at-age of age-2 and older fish from gill net and trawl surveys are also incorporated. In addition, age-0 and age-1 recruitment data are incorporated into the model as a recruitment index. The PR model estimates selectivity for all ages in the fisheries and surveys. There is a commercial gill net selectivity block beginning in 1998. Catchabilities for all fisheries and surveys vary annually as a correlated 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 combined with age-0 and age-1 recruitment data (from trawl and gill net assessment surveys) in a multi-model inference (MMI) R-based model to determine parameters for estimating recruitment. 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., 2020 year class in the 2022 TAC year) are also removed from the analysis. A list of all possible non-redundant models is generated from the survey data and fit using the R-based *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 final model-averaged coefficients; each model may contain a different set of surveys and the models with lower AIC values are weighted more heavily and have greater influence on the recruitment predictions. Parameter estimates for the model-averaged coefficients for each MU are detailed in Appendix Table 2. A recruitment index is generated to estimate age-2 fish for each year class available in the recruitment data, using the age-0 and age-1 survey data. This process is repeated using just age-0 data, which is only used to estimate recruitment in two years' time. Data from trawl and gill net index recruitment series for the time period examined are presented in Appendix Table 3, and a key that summarizes abbreviations used for the trawl and gill net series is presented in Appendix Table 4.

In the third step, the recruitment index is added to the ADMB model, and this data set is used to inform age-2 abundance estimates within the objective function. This model is then run iteratively until the maximum effective sample size for the multinomial age composition stabilizes. Estimates of population size, from 2004 to 2023, and projections for 2024, are presented in Table 1.7. Abundance, biomass, survival, and exploitation rates are presented by management unit graphically for 1975 to 2023 in Figures 1.9 to 1.12. Mean weights-at-age from assessment surveys were applied to abundance estimates to generate population biomass estimates (Figure 1.10). Projections of abundance and biomass in 2024 are included in Figures 1.9 and 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 2023 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 2024 and are presented in Appendix Table 1. The additional recruitment index (generated from the glmulti process) was given a lambda weighting of 1 during the LEPMAG process.

2024 Population Size Projection

The SCAA model was used to project age-2-and-older Yellow Perch stock size in 2024 (Table 1.7). Standard errors and ranges for 2024 projections are provided for each age, and descriptions of minimum, mean, and maximum population estimates refer to the age-specific mean estimates minus or plus one standard deviation (Table 2.2).

Stock size estimates for 2023 (Table 1.7) were higher than those projected last year in MU1, MU2 and MU3, and slightly lower in MU4 (YPTG 2023). Increases in MU1, MU2 and MU3 were due to higher estimates of age-2 fish compared to those projected last year. Whereas the estimates of ages 3 and older fish were lower than those projected last year in MU1, MU2 and MU3. The lakewide projection of age-2 and older fish using 2022 data was 155.251 million age-2 and older Yellow Perch in 2023 (YPTG 2023), while estimates using 2023 data in the 2024 model run estimated 2023 abundance of age-2 and older Yellow Perch at 208.004 million fish. Lakewide abundance of age-2-and-older Yellow Perch in 2024 is projected to be 168.673 million fish, a decrease of 19% from 2023 estimates.

Abundance projections for 2024 are 59.552, 44.314, 56.598, and 8.210 million age-2-and-older Yellow Perch in management units 1 through 4, respectively. Abundance of age-2-and-older Yellow Perch in 2024 are projected to decrease 19%, 16%, 23%, and 3% in MU1, MU2, MU3, and MU4 respectively, relative to the 2023 abundance estimates (Table 1.7, Figure 1.9).

Projected age-2 Yellow Perch recruitment in 2024 (the 2022 year class) was 21.421, 9.836, 11.978, and 3.860 million fish in management units 1 through 4, respectively (Table 1.7.). Age-3-and-older Yellow Perch abundance in 2024 is projected to be 38.130, 34.478, 44.620, and 4.350 million fish in MUs 1 through 4, respectively. Abundance estimates for age-3-and-older Yellow Perch in 2024 are projected to increase from the 2023 estimates in MU1, MU2 and MU3 by 224%, 113%, and 87%, respectively. These increases are largely due to high estimates of age-2 fish in 2023, which are projected forward to age-3 fish in 2024. Abundance for age-3-and-older Yellow Perch for 2024 in MU4 are projected to decrease 13% from the 2023 estimates.

As a function of population abundance and mean weight-at-age from fishery-independent surveys, total biomass of age-2-and-older Yellow Perch for 2024 are projected to decrease in management units 1 - 4 by 18%, 12%, 7% and 3%, respectively, compared to 2023 estimates (Figure 1.10).

Estimates of Yellow Perch survival for age-3-and-older in 2023 were 30%, 62%, 51%, and 44% in MUs 1 through 4, respectively (Figure 1.11). Estimates of Yellow Perch survival in 2023 for age-2-and-older fish were: 52% in MU1, 65% in MU2, 61% in MU3, and 51% in MU4. Estimated exploitation rates of ages-3-and-older Yellow Perch in 2023 were 47%, 6%, 20%, and 29% in management units 1 through 4, respectively. Estimates of Yellow Perch exploitation for ages-2-and-older fish in 2023 were: 19% in MU1, 2% in MU2, 7% in MU3, and 19% in MU4 (Figure 1.12). Exploitation rate for ages-2-and-older fish in MU2 during 2021, 2022 and 2023 were the lowest in the 49 year time series.

Charge 2: Harvest Strategy and Recommended Allowable Harvest (RAH)

In 2024 the YPTG applied the harvest control rules finalized by the LEC and LEPMAG in 2020. The harvest control rules are comprised of:

- Target fishing mortality as a percent of the fishing mortality at maximum sustainable yield (F_{msy})
- Limit reference point of the biomass at maximum sustainable yield (B_{msy})
- Probabilistic risk tolerance, P-star, P*=0.20
- A limit on the annual change in TAC of ± 20% (when $P(SSB<B_{msy})<P^*$); see Yellow Perch Management Plan, Lake Erie Committee, 2020.

Target fishing rates and limit reference points are estimated annually using SCAA model results. Estimating reference points and recommended allowable harvest is a three-step process. First, estimated recruitment and spawning stock biomass from the SCAA model, along with maturity, weight, and average selectivity at age, are entered into an ADMB model that: 1) estimates the parameters of a Ricker stock-recruitment model and 2) calculates the theoretical spawning stock biomass without fishing (SSB_0). The stock-recruitment relationships for management units 1, 2, and 3, are fit using a hierarchical framework, while management unit 4 is fit independently. In the second step, maturity, weight, and average selectivity at age, along with the parameters of the stock-recruitment relationship are entered in an R-based model. This model estimates F_{msy} and B_{msy} for the harvest control rule. Finally, F_{msy}, F_{target} (as a percent of F_{msy}), and B_{msy} (as a percent of SSB_0), are entered into the SCAA model to estimate RAH in each management unit. If the model estimates that fishing at F_{target} meets or exceeds a 0.20 probability (P*) that the projected spawning stock biomass will be less than the limit reference point (B_{msy}), then the fishing rate is reduced until the probability is less than 0.20. Values of SSB_0, B_{msy}, F_{msy}, and F_{target} for each management unit can be found in Table 2.1. Target fishing rates are applied to population estimates and their standard errors to determine minimum, mean, and maximum RAH values for each management unit (Tables 2.2 and 2.3). In addition, RAH values may be subject to a ±20% limit on the annual change in TAC when P(SSB<Bmsy) < 0.20 (ie: when P* harvest control rule is not invoked).

With the addition of 2023 data, the limit reference point estimate, B_{msy} increased from 1.813 M to 2.193 M kg in MU1 while the target fishing rate, F_{target} decreased from 0.540 to 0.431. In MU2, B_{msy} increased marginally from 3.871 to 3.988 M kg and F_{target} increased from 0.588 to 0.620. In MU3, B_{msy} decreased slightly from 3.714 to 3.705 M kg and F_{target} decreased from 0.640 to 0.576. In MU4, B_{msy} decreased from 0.483 to 0.462 M kg and F_{target} decreased from 0.558 to 0.544 (Table 2.1).

The Yellow Perch Management Plan (YPMP) includes a provision on how to estimate RAH in a TAC year where P* is not invoked, but P* has persisted for multiple years prior. In this case the LEC will determine what the TAC would have been using the target F and the 20% TAC constraint for each of the years during that period, thus establishing what can be considered an "assumed TAC". The previous years assumed TAC can then be used as a benchmark for the implementation of the 20% TAC constraint and a new TAC moving forward (LEC, 2020). In 2024, the P value in MU2 is 0.11, marking the first year that MU2 has not invoked the P* rule since the YPMP took effect in 2019. Following guidance from the YPMP the maximum 2024 RAH in MU2 is 2.748 million pounds. However, there is evidence of retrospective patterns in SCAA abundance estimates (see Charge 3). Also, there are conflicting poor status indicators in MU2 and no indication of a large year class recruiting to the fishery. Therefore, a precautionary approach is warranted in MU2, and the YPTG recommends holding the 2024 MU2 TAC at the 2023 level (0.477 million pounds) or increasing by 20% (0.572 million pounds). The YPMP permits the LEC to deviate from the harvest control rules in cases where there is compelling evidence to indicate the sustainability of the yellow perch population is at risk, or if there is strong social or economic rationale to do so. If the LEC chooses to deviate from the harvest control rules, clear and transparent justification will be provided to stakeholders (LEC, 2020).

Quota allocation by management unit and jurisdiction for 2024 was determined by the same methods applied in 2009-2023, 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, 2024:

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: Utilize existing population models to produce the most scientifically defensible and reliable method for estimating and forecasting abundance, recruitment, and mortality.

The YPTG has been using the current configuration of the SCAA ADMB model for 6 years. It has been found that abundance estimates in the last year of the model often decrease between the first estimate in the model and subsequent years estimates in the model. On average age-2 estimates for the various MUs decrease between 11% and 40% from the first time they are estimated by the model to the second time they are estimated by the model. Further, age-2 estimates decrease an average of 29% to 63% between the first time they are estimated by the model to the third time they are estimated by the model, with the lowest change occurring in MU4 and the highest in MU1. In this year's model run the age-2 abundance values in 2023 are the first model estimates of this year class. The 2023 age-2 estimates are projected forward to age-3 abundance in 2024 using survival estimates. This leads to a potential overestimate of age-3 fish in 2024, which is used in RAH calculations.

Reasons for this retrospective pattern are unknown. The model estimates catchability using a random walk. Changes in catchability estimates between model runs can contribute to changes in abundance estimates, with increases in catchability leading to reduced abundance estimates. Patterns of declining catchability in surveys may be contributing to variable abundance estimates. In addition, constant selectivity in the model may contribute to different abundance estimates, as changes in selectivity will not be recognized by the model when they occur. There has been an increase in size at age of yellow perch in recent years, particularly in MU1 and MU2, which may be leading to changes in selectivity not observed in the model. Additional work is required to evaluate retrospective patterns in model results and their causes.

Charge 4. Supply needed technical support throughout the upcoming YPMP review process

The Yellow Perch Management Plan (YPMP) runs from 2020 to 2024. A review of the YPMP will evaluate the existing Yellow Perch assessment model and the harvest control rule. To begin the review, YPTG met with the Lake Erie Committee and Michigan State University's Quantitative Fisheries Center (QFC) to discuss several aspects of the YPMP to incorporate into the review. Some of the items discussed included: the use of the recruitment survey data in the assessment model, model convergence issues and retrospective patterns, methods used to estimate catchability and selectivity, the data used in the stock recruit relationship to estimate the reference points, and the harvest control rules. At this meeting the QFC recommended implementing the statistical catch-at-age models using Template Model Builder (TMB) to alleviate some concerns relating to the ADMB model. Converting the statistical catch-at-age models to TMB will be incorporated into the YPMP review which may take up to two years.

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Table 1.1. Lake Erie Yellow Perch harvest in pounds by management unit (Unit) and agency, 2014-2023

		Ontario*		Ohio		Michigan		Pennsylvania		New York		Total
	Year	Harvest	%	Harvest	%	Harvest	%	Harvest	%	Harvest	%	Harvest
Unit 1	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
	2018	1,262,229	54	956,016	41	107,789	5	--	--	--	--	2,326,034
	2019	847,476	69	357,533	29	15,745	1	--	--	--	--	1,220,754
	2020	857,561	64	391,231	29	84,613	6	--	--	--	--	1,333,405
	2021	959,259	58	625,787	38	69,575	4	--	--	--	--	1,654,621
	2022	770,476	51	658,935	44	67,667	5	--	--	--	--	1,497,078
	2023	1,016,545	43	1,254,927	53	104,388	4	--	--	--	--	2,375,860
Unit 2	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
	2018	1,271,365	69	559,122	31	--	--	--	--	--	--	1,830,487
	2019	740,490	63	433,477	37	--	--	--	--	--	--	1,173,967
	2020	407,553	60	268,213	40	--	--	--	--	--	--	675,766
	2021	205,377	63	121,200	37	--	--	--	--	--	--	326,577
	2022	177,919	60	117,860	40	--	--	--	--	--	--	295,779
	2023	210,716	73	76,269	27	--	--	--	--	--	--	286,985
Unit 3	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
	2018	1,807,645	78	460,797	20	--	--	54,085	2	--	--	2,322,527
	2019	1,328,966	79	320,756	19	--	--	38,953	2	--	--	1,688,675
	2020	478,837	71	175,550	26	--	--	18,022	3	--	--	672,408
	2021	704,636	75	220,127	23	--	--	18,938	2	--	--	943,701
	2022	932,682	77	211,444	18	--	--	63,872	5	--	--	1,207,998
	2023	959,420	78	222,369	18	--	--	54,538	4	--	--	1,236,327
Unit 4	2014	485,899	74	--	--	--	--	16,671	3	149,669	23	652,239
	2015	297,716	77	--	--	--	--	10,055	3	76,597	20	384,368
	2016	231,063	87	--	--	--	--	6,791	3	28,078	11	265,932
	2017	179,730	76	--	--	--	--	16,078	7	39,598	17	235,407
	2018	272,733	90	--	--	--	--	1,452	0	29,159	10	303,344
	2019	326,179	85	--	--	--	--	1,485	0	56,219	15	383,883
	2020	384,737	91	--	--	--	--	2,664	1	36,083	9	423,484
	2021	311,866	84	--	--	--	--	1,677	0	57,567	16	371,110
	2022	314,039	79	--	--	--	--	533	0	84,399	21	398,971
	2023	336,237	83					1,035	0	68,691	17	405,963
Lakewide Totals	2014	5,454,662	62	2,914,524	33	87,511	1	185,361	2	149,669	2	8,791,727
	2015	4,460,298	65	2,190,473	32	94,225	1	87,613	1	76,597	1	6,909,206
	2016	4,481,964	62	2,201,486	30	397,044	5	114,763	2	28,078	0	7,223,335
	2017	4,982,989	64	2,387,352	31	255,605	3	123,413	2	39,598	1	7,788,958
	2018	4,613,972	68	1,975,935	29	107,789	2	55,537	1	29,159	0	6,782,393
	2019	3,243,111	73	1,111,766	25	15,745	0	40,437	1	56,219	1	4,467,278
	2020	2,128,688	69	834,994	27	84,613	3	20,685	1	36,083	1	3,105,063
	2021	2,181,138	66	967,114	29	69,575	2	20,615	1	57,567	2	3,296,009
	2022	2,195,116	65	988,239	29	67,667	2	64,405	2	84,399	2	3,399,826
	2023	2,522,918	59	1,553,565	36	104,388	2	55,573	1	68,691	2	4,305,135

*processor weight (quota debit weight) to 2001; fisher/observer weight from 2002 to 2023 (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, 2014-2023.

		Unit 1					
		Michigan	Ohio		Ontario Gill Nets		Ontario
	Year	Sport	Trap Nets	Sport	Small Mesh	Large Mesh*	Trap Nets
Harvest	2014	87,511	0	391,361	596,956	23,633	78
(pounds)	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
	2018	107,789	439,720	516,296	1,248,042	14,031	156
	2019	15,745	193,243	164,290	818,773	28,670	33
	2020	84,613	136,555	254,676	853,096	4,463	2
	2021	69,575	182,521	443,266	939,063	20,179	17
	2022	67,667	188,739	470,196	756,770	13,706	0
	2023	104,388	414,728	840,199	1,001,296	15,249	0
Harvest	2014	40	0	177	271	11	0.04
(Metric)	2015	43	0	220	242	4	0.03
(tonnes)	2016	180	47	355	426	4	0.02
	2017	116	203	359	577	2	0.38
	2018	49	199	234	566	6	0.07
	2019	7	88	75	371	13	0.01
	2020	38	62	115	387	2	0.00
	2021	32	83	201	426	9	0.01
	2022	31	86	213	343	6	0.00
	2023	47	188	381	454	7	0.00
Effort	2014	76,996	0	630,989	3,398	362	--
(a)	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	--
	2018	137,930	3,500	500,695	5,143	667	--
	2019	57,929	3,811	284,068	6,363	714	--
	2020	151,528	3,341	500,595	9,183	393	--
	2021	113,935	3,741	628,491	10,489	1,124	--
	2022	115,916	4,943	621,067	8,588	1,354	--
	2023	97,889	6,696	923,523	7,212	1,020	--
Harvest Rates	2014	2.2	--	3.0	79.7	29.6	--
(b)	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	3.4	101.9	4.1	--
	2018	2.3	57.0	2.9	110.1	9.5	--
	2019	0.8	23.0	1.7	58.4	18.2	--
	2020	1.8	18.5	1.6	42.1	5.2	--
	2021	1.7	22.1	2.0	40.6	8.1	--
	2022	1.5	17.3	2.1	40.0	4.6	--
	2023	3.0	28.1	2.9	63.0	6.8	--

(a) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(b) harvest rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift
(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, 2014-2023.

		Unit 2				
		Ohio		Ontario Gill Nets		Ontario
	Year	Trap Nets	Sport	Small Mesh	Large Mesh*	Trawls
Harvest	2014	1,280,184	263,042	1,550,722	128,453	0
(pounds)	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
	2018	528,234	30,888	1,204,621	66,744	0
	2019	419,631	13,846	569,850	170,640	0
	2020	248,721	19,492	376,946	30,604	3
	2021	116,109	5,091	151,859	53,518	0
	2022	97,659	20,201	152,490	25,429	0
	2023	64,854	11,415	189,619	21,097	0
Harvest	2014	581	119	703	58	0.0
(Metric)	2015	456	58	667	8	0.0
(tonnes)	2016	312	48	566	16	0.0
	2017	268	24	651	29	0.0
	2018	240	14	546	30	0.0
	2019	190	6	258	77	0.0
	2020	113	9	171	14	0.0
	2021	53	2	69	24	0.0
	2022	44	9	69	12	0.0
	2023	29	5	86	10	0.0
Effort	2014	5,713	280,018	6,653	1,816	--
(a)	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	--
	2018	1,551	45,683	5,964	2,155	--
	2019	2,192	24,826	4,431	4,050	--
	2020	2,177	27,006	4,294	1,920	--
	2021	839	1,898	1,951	2,999	--
	2022	1,571	26,634	1,479	1,881	--
	2023	289	4,011	1,593	1,756	--
Harvest Rates	2014	101.6	2.7	105.7	32.1	--
(b)	2015	72.2	1.5	70.5	6.9	--
	2016	69.2	1.2	88.2	8.1	--
	2017	104.3	0.8	106.8	14.7	--
	2018	154.5	0.8	91.6	14.0	--
	2019	86.8	0.4	58.3	19.1	--
	2020	51.8	1.1	39.8	7.2	--
	2021	62.8	0.1	35.3	8.1	--
	2022	28.2	0.5	46.8	6.1	--
	2023	101.8	0.7	54.0	5.4	--

(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 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, 2014-2023.

		Unit 3						
		Ohio		Pennsylvania		Ontario Gill Nets		Ontario
	Year	Trap Nets	Sport	Trap Nets	Sport	Small Mesh	Large Mesh*	Trawls
Harvest	2014	265,963	713,974	506	168,184	2,597,079	71,136	706
(pounds)	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
	2018	439,233	21,564	51,093	2,992	1,743,484	63,902	259
	2019	318,089	2,667	34,323	4,630	1,261,586	67,230	150
	2020	171,180	4,370	14,961	3,061	403,720	75,102	15
	2021	206,384	13,743	17,303	1,635	622,917	81,711	8
	2022	207,890	3,554	60,665	3,207	904,990	27,671	21
	2023	218,689	3,680	53,209	1,329	942,641	16,768	11
Harvest	2014	121	324	0.2	76	1,178	32	0.3
(Metric)	2015	121	139	3.1	32	945	20	1.6
(tonnes)	2016	159	78	23.2	26	909	7	0.1
	2017	204	25	20.7	28	891	28	0.6
	2018	199	10	23.2	1	791	29	0.1
	2019	144	1	15.6	2	572	30	0.1
	2020	78	2	6.8	1	183	34	0.0
	2021	94	6	7.8	1	283	37	0.0
	2022	94	2	27.5	1	410	13	0.0
	2023	99	2	24.1	1	428	8	0.0
Effort	2014	581	336,607	186	90,024	5,678	422	--
(a)	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	--
	2018	2,233	16,805	324	7,836	5,204	1,031	--
	2019	2,901	2,475	382	5,668	6,956	1,264	--
	2020	1,811	5,022	241	1,697	3,968	1,275	--
	2021	2,075	9,688	92	3,301	5,191	1,519	--
	2022	2,405	2,341	150	3,779	4,942	788	--
	2023	1,784	2,566	277	2,214	5,872	907	--
Harvest Rates	2014	207.6	4.0	1.2	4.7	207.4	76.4	--
(b)	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	1.4	79.2	2.1	186.6	23.0	--
	2018	89.2	1.6	71.5	0.3	151.9	28.1	--
	2019	49.7	0.1	40.7	0.6	82.2	24.1	--
	2020	42.9	1.4	28.2	0.7	46.1	26.7	--
	2021	45.1	1.2	85.3	0.5	54.4	24.4	--
	2022	39.2	0.4	183.4	0.6	83.0	15.9	--
	2023	55.6	1.3	87.1	0.1	72.8	8.4	--

(a) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(b) harvest rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift
(c) the Ontario sport fishery harvested approximately 132,585 lbs of yellow perch in the 2014 creel survey
(*) large mesh catch rates are not targeted and therefore of limited value

Table 1.5. Harvest, effort and harvest per unit effort summaries for Lake Erie Yellow Perch fisheries in Management Unit 4 (Eastern Basin) by agency and gear type, 2014-2023.

		Unit 4						
		New York		Pennsylvania		Ontario Gill Nets		Ontario
	Year	Trap Nets	Sport	Trap Nets	Sport	Small Mesh	Large Mesh*	Trawls
Harvest	2014	10,356	139,313	0	16,671	482,925	1,160	1,814
(pounds)	2015	12,565	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
	2018	10,657	18,502	0	1,452	271,795	583	355
	2019	18,750	37,469	0	1,485	326,075	58	46
	2020	14,837	21,246	0	2,664	384,684	39	14
	2021	11,354	46,213	0	1,677	305,463	6,254	149
	2022	14,913	69,486	0	533	312,847	410	782
	2023	13,836	54,855	0	1,035	335,028	756	453
Harvest	2014	4.7	63.2	0	7.6	219.0	0.53	0.8
(Metric)	2015	5.7	29.0	0	4.6	134.2	0.49	0.4
(tonnes)	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
	2018	4.8	8.4	0	0.7	123.3	0.26	0.2
	2019	8.5	17.0	0	0.7	147.9	0.03	0.0
	2020	6.7	9.6	0	1.2	174.5	0.02	0.0
	2021	5.1	21.0	0	0.8	138.5	2.84	0.1
	2022	6.8	31.5	0	0.2	141.9	0.19	0.4
	2023	6.3	24.9	0	0.5	151.9	0.34	0.2
Effort	2014	213	76,817	0	13,959	2,016	8.3	--
(a)	2015	357	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	--
	2018	135	19,035	0	3,940	887	58.7	--
	2019	224	30,166	0	2,730	947	29.7	--
	2020	136	18,677	0	1,294	1,492	34.4	--
	2021	137	29,237	0	1,598	2,081	67.1	--
	2022	241	49,968	0	600	1,317	33.6	--
	2023	214	33,059	0	453	1,652	79.7	--
Harvest Rates	2014	22.0	2.78	--	2.3	108.6	63.4	--
(b)	2015	16.0	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	--
	2018	35.8	1.53	--	0.4	139.0	4.5	--
	2019	38.0	1.81	--	0.6	156.1	0.9	--
	2020	49.5	1.55	--	1.2	117.0	0.5	--
	2021	37.6	2.04	--	0.4	66.6	42.3	--
	2022	28.1	1.90	--	0.0	107.7	5.5	--
	2023	29.3	2.55	--	1.3	92.0	4.3	--

(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 2023 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	0.0
	2	2,282,172	64.5	215,106	33.5	382,418	12.6	125,292	13.6	3,004,989	37.0
	3	902,357	25.5	172,300	26.8	986,584	32.6	498,041	54.2	2,559,283	31.5
	4	265,839	7.5	236,173	36.7	1,537,507	50.8	258,623	28.2	2,298,142	28.3
	5	64,622	1.8	15,149	2.4	75,370	2.5	15,973	1.7	171,114	2.1
	6+	25,969	0.7	3,980	0.6	47,437	1.6	20,616	2.2	98,001	1.2
	Total	3,540,960	*45.7*	642,708	*80.0*	3,029,316	*82.9*	918,546	*88.0*	8,131,529	*61.4*
Trap Nets	1		0.0		0.0	0	0.0	0	0.0	0	0.0
	2	715,060	56.5	13,973	9.8	216,901	35.2	1,478	4.0	947,412	45.9
	3	354,788	28.0	37,759	26.4	76,718	12.4	14,286	38.7	483,551	23.4
	4	120,556	9.5	62,931	44.1	169,952	27.6	13,547	36.7	366,986	17.8
	5	65,715	5.2	19,199	13.4	64,957	10.5	2,463	6.7	152,334	7.4
	6+	9,807	0.8	8,961	6.3	88,041	14.3	5,172	14.0	111,981	5.4
	Total	1,265,926	*16.3*	142,823	*17.8*	616,569	*16.9*	36,946	*3.5*	2,062,264	*15.6*
Sport	1	27,529	0.9	563	3.2	210	2.6	454	0.5	28,755	0.9
	2	1,765,833	60.0	5,367	30.5	2,354	29.5	4,836	5.5	1,778,390	58.2
	3	719,741	24.5	1,929	11.0	1,037	13.0	31,551	35.8	754,257	24.7
	4	197,172	6.7	2,376	13.5	1,368	17.1	24,756	28.1	225,672	7.4
	5	203,757	6.9	1,355	7.7	691	8.7	4,535	5.1	210,338	6.9
	6+	29,169	1.0	6,023	34.2	2,327	29.1	21,954	24.9	59,473	1.9
	Total	2,943,200	*38.0*	17,613	*2.2*	7,987	*0.2*	88,085	*8.4*	3,056,885	*23.1*
All Gear	1	27,529	0.4	563	0.1	210	0.0	454	0.0	28,755	0.2
	2	4,763,065	61.5	234,446	29.2	601,673	16.5	131,606	12.6	5,730,791	43.2
	3	1,976,886	25.5	211,988	26.4	1,064,339	29.1	543,878	52.1	3,797,091	28.7
	4	583,568	7.5	301,480	37.5	1,708,827	46.8	296,926	28.5	2,890,800	21.8
	5	334,094	4.3	35,703	4.4	141,018	3.9	22,971	2.2	533,786	4.0
	6+	64,944	0.8	18,964	2.4	137,805	3.8	47,742	4.6	269,455	2.0
	Total	7,750,086	58.5	803,144	6.1	3,653,872	27.6	1,043,577	7.9	13,250,678	100.0

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

Table 1.7. Yellow Perch stock size (millions of fish) in each Lake Erie management unit. Estimated abundance in the years 2005 to 2023 and projected abundance in 2024 from the ADMB catch-age analysis.

	Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Unit 1	2	52.449	2.595	12.325	14.951	31.605	23.866	9.182	11.168	2.333	6.199	17.871	39.742	10.790	3.353	4.917	22.106	11.225	16.324	61.900	21.421
	3	2.885	33.275	1.647	7.835	9.656	20.047	14.884	5.720	6.846	1.386	3.751	10.610	22.429	6.174	1.975	2.908	12.188	6.103	9.133	34.604
	4	14.853	1.580	18.210	0.927	4.649	5.347	10.509	7.785	2.897	3.105	0.658	1.668	3.922	8.621	2.568	0.788	0.892	3.532	1.991	3.056
	5	1.371	6.940	0.736	9.250	0.516	2.286	2.399	4.698	3.483	1.080	1.206	0.231	0.419	1.024	2.463	0.620	0.120	0.122	0.599	0.365
	6+	7.294	4.739	5.732	3.773	7.405	4.566	3.539	3.005	3.761	3.210	2.092	1.452	0.679	0.394	0.433	0.664	0.289	0.102	0.051	0.105
	2 and Older	78.853	49.129	38.649	36.736	53.830	56.111	40.512	32.376	19.321	14.981	25.577	53.703	38.240	19.566	12.356	27.085	24.713	26.181	73.674	59.552
	3 and Older	26.404	46.534	26.325	21.785	22.226	32.246	31.330	21.208	16.988	8.781	7.706	13.961	27.450	16.213	7.439	4.979	13.489	9.857	11.774	38.130
Unit 2	2	172.345	6.991	22.707	24.106	54.930	41.284	7.121	17.489	10.642	25.595	7.719	25.170	10.453	4.742	4.668	10.772	12.007	12.223	36.586	9.836
	3	4.124	111.466	4.537	14.968	15.901	35.907	27.085	4.671	11.417	6.881	16.519	4.908	16.112	6.686	3.027	2.968	6.938	7.924	8.103	24.346
	4	36.309	2.261	61.985	2.750	9.176	9.191	21.245	15.979	2.674	6.177	3.635	7.909	2.451	8.059	3.319	1.447	1.531	4.209	4.927	5.197
	5	1.883	16.147	1.036	33.442	1.534	4.518	4.740	10.897	7.663	1.143	2.487	1.188	2.824	0.889	2.905	1.088	0.553	0.831	2.389	3.017
	6+	5.207	2.845	7.990	4.535	20.120	9.876	6.871	5.527	7.112	5.596	2.372	1.324	0.762	1.131	0.647	0.986	0.690	0.644	0.796	1.918
	2 and Older	219.868	139.711	98.254	79.801	101.662	100.776	67.063	54.564	39.507	45.392	32.730	40.499	32.602	21.508	14.567	17.262	21.718	25.832	52.801	44.314
	3 and Older	47.523	132.719	75.548	55.695	46.731	59.492	59.942	37.074	28.866	19.797	25.012	15.329	22.149	16.766	9.898	6.490	9.711	13.609	16.215	34.478
Unit 3	2	129.198	8.777	34.782	44.055	61.044	52.057	12.477	27.741	21.190	39.203	7.651	31.685	11.239	14.525	9.579	10.242	23.522	17.735	49.134	11.978
	3	4.139	85.972	5.830	23.161	29.381	40.670	34.655	8.301	18.422	14.069	25.959	5.065	20.909	7.433	9.572	6.254	6.780	15.559	11.739	32.490
	4	21.476	2.611	52.710	3.688	14.880	18.735	25.576	21.678	5.089	11.321	8.455	15.439	2.904	12.224	4.155	4.833	3.666	3.943	9.105	6.798
	5	2.126	12.304	1.379	30.348	2.217	8.766	10.619	14.300	11.501	2.716	5.699	4.136	6.863	1.356	5.056	1.307	2.270	1.685	1.845	4.136
	6+	8.666	5.685	8.642	5.345	20.473	12.431	11.132	11.209	12.205	11.415	6.181	5.061	3.412	4.138	1.851	1.620	1.187	1.366	1.231	1.196
	2 and Older	165.605	115.349	103.343	106.597	127.994	132.658	94.459	83.229	68.406	78.724	53.945	61.386	45.326	39.675	30.213	24.255	37.425	40.287	73.053	56.598
	3 and Older	36.407	106.572	68.561	62.541	66.950	80.601	81.981	55.488	47.216	39.521	46.294	29.700	34.088	25.151	20.633	14.014	13.903	22.552	23.919	44.620
Unit 4	2	4.963	0.570	5.473	3.756	4.315	5.530	0.563	6.009	1.252	2.418	0.400	2.349	3.105	8.915	0.949	1.551	4.507	5.386	3.484	3.860
	3	0.461	3.237	0.370	3.591	2.459	2.804	3.554	0.359	3.824	0.788	1.499	0.249	1.467	1.988	5.446	0.583	0.959	2.737	3.365	2.166
	4	1.319	0.273	1.876	0.225	2.167	1.432	1.560	1.920	0.191	1.936	0.373	0.721	0.122	0.801	0.886	2.471	0.274	0.416	1.341	1.616
	5	0.290	0.681	0.136	1.032	0.122	1.079	0.658	0.670	0.795	0.072	0.644	0.128	0.258	0.054	0.240	0.272	0.820	0.078	0.147	0.460
	6+	0.821	0.564	0.618	0.423	0.776	0.443	0.700	0.588	0.517	0.491	0.226	0.296	0.178	0.194	0.101	0.111	0.137	0.274	0.139	0.107
	2 and Older	7.854	5.326	8.472	9.027	9.839	11.287	7.034	9.546	6.579	5.705	3.141	3.743	5.130	11.951	7.623	4.987	6.697	8.891	8.476	8.210
	3 and Older	2.891	4.756	3.000	5.272	5.524	5.758	6.472	3.537	5.327	3.286	2.742	1.394	2.025	3.036	6.674	3.437	2.190	3.505	4.992	4.350

Table 2.1. Parameters of the stock-recruitment relationship, spawning stock biomass, limit reference point and target fishing rate for each management unit. (F_{actual} may be reduced from F_{target} if P(SSB<Bmsy) ≥ P*).

	Spawn/ Recruit Relationship Parameters			Spawning Stock Biomass (Unfished Population)		Spawning Stock Biomass (kgs)		Biomass at MSY (Limit Reference Point)			Fishing Rate			
Unit	**log(alpha)**	**beta**	**sigma**	**SSB_0**	**sd(logSSB_0)**	**2024**	**2025[a]**	**B_{msy}**	**%SSB_0**	**P**	**F_{msy}**	**% F_{msy}**	**F_{target}**	**F_{actual}**
MU1	2.48	2.55E-07	0.97	8,014,090	0.20	5,218,700	5,774,530	2,192,760	27%	0.00	1.54	28%	0.431	0.431
MU2	2.17	1.40E-07	0.97	14,152,966	0.22	6,365,940	5,401,060	3,987,859	28%	0.11	1.77	35%	0.620	0.620
MU3	2.21	1.42E-07	0.97	13,297,953	0.20	6,279,750	6,009,320	3,704,558	28%	0.03	1.80	32%	0.576	0.576
MU4	1.98	1.20E-06	1.02	1,626,858	0.25	1,052,110	1,062,740	461,961	28%	0.00	1.60	34%	0.544	0.544

(a) Spawning stock biomass when population is fished at target fishing rate

Table 2.2. Estimated harvest range of Lake Erie Yellow Perch for 2024 using the proposed fishing policy and selectivity-at-age from combined fishing gears.

		2024 Stock Size (millions of fish)			2024 Mean Biomass	Exploitation Rate				2024 Catch (millions of fish)			3-yr Mean Weight in	2024 Harvest Range Catch (millions of lbs)		
	Age	**Min.**	**Mean**	**Max.**	**mil. lbs**	**F**	**s(age)**	**F(age)**	**(u)**	**Min.**	**Mean**	**Max.**	Harvest (kg)	**Min.**	**Mean**	**Max.**
Unit 1	2	14.006	21.421	28.837	4.893	0.431	0.174	0.075	0.060	0.836	1.279	1.721	0.125	0.230	0.352	0.474
	3	26.736	34.604	42.472	11.047	0.431	0.571	0.246	0.181	4.848	6.275	7.702	0.153	1.635	2.117	2.598
	4	2.290	3.056	3.823	1.252	0.431	0.899	0.388	0.268	0.614	0.820	1.025	0.183	0.248	0.331	0.414
	5	0.241	0.365	0.489	0.170	0.431	1.000	0.431	0.293	0.070	0.107	0.143	0.227	0.035	0.053	0.072
	6+	0.057	0.105	0.153	0.059	0.431	0.384	0.166	0.126	0.007	0.013	0.019	0.271	0.004	0.008	0.012
	Total	43.330	59.552	75.774	17.420				0.143	6.376	8.494	10.611	0.153	2.149	2.861	3.569
	(3+)	29.324	38.130	46.937	12.528				0.189	5.540	7.215	8.890	0.158	1.923	2.509	3.095
Unit 2	2	7.110	9.836	12.562	2.472	0.620	0.083	0.051	0.041	0.294	0.407	0.520	0.141	0.092	0.127	0.162
	3	20.654	24.346	28.039	9.275	0.620	0.400	0.248	0.183	3.769	4.443	5.117	0.160	1.330	1.567	1.805
	4	4.463	5.197	5.930	2.666	0.620	0.775	0.480	0.319	1.425	1.659	1.893	0.193	0.606	0.706	0.806
	5	2.590	3.017	3.443	1.831	0.620	0.985	0.610	0.384	0.995	1.159	1.322	0.215	0.472	0.549	0.627
	6+	1.614	1.918	2.222	1.464	0.620	1.000	0.620	0.388	0.627	0.745	0.863	0.310	0.429	0.509	0.590
	Total	36.431	44.314	52.196	17.708				0.190	7.110	8.413	9.716	0.186	2.922	3.458	3.989
	(3+)	29.321	34.478	39.634	15.236				0.232	6.816	8.006	9.196	0.189	2.836	3.332	3.827
Unit 3	2	7.979	11.978	15.978	2.181	0.576	0.027	0.016	0.013	0.103	0.155	0.207	0.131	0.030	0.045	0.060
	3	26.392	32.490	38.587	9.290	0.576	0.240	0.138	0.107	2.823	3.475	4.128	0.150	0.934	1.149	1.365
	4	5.543	6.798	8.054	2.791	0.576	0.608	0.350	0.246	1.366	1.676	1.985	0.171	0.515	0.632	0.748
	5	3.215	4.136	5.057	2.122	0.576	0.850	0.490	0.324	1.042	1.341	1.639	0.196	0.450	0.579	0.708
	6+	0.860	1.196	1.532	0.906	0.576	1.000	0.576	0.368	0.316	0.440	0.563	0.256	0.178	0.248	0.318
	Total	43.989	56.598	69.206	17.290				0.125	5.652	7.087	8.523	0.170	2.104	2.654	3.200
	(3+)	36.010	44.620	53.229	15.108				0.155	5.548	6.932	8.316	0.171	2.078	2.609	3.140
Unit 4	2	2.304	3.860	5.416	0.949	0.544	0.090	0.049	0.039	0.091	0.152	0.213	0.139	0.028	0.047	0.065
	3	1.640	2.166	2.692	0.966	0.544	0.404	0.220	0.164	0.268	0.355	0.441	0.159	0.094	0.124	0.154
	4	1.192	1.616	2.041	0.934	0.544	0.842	0.458	0.308	0.367	0.497	0.628	0.174	0.141	0.191	0.241
	5	0.295	0.460	0.625	0.322	0.544	1.000	0.544	0.352	0.104	0.162	0.220	0.216	0.049	0.077	0.105
	6+	0.065	0.107	0.150	0.091	0.544	0.784	0.426	0.290	0.019	0.031	0.044	0.277	0.011	0.019	0.027
	Total	5.496	8.210	10.924	3.262				0.146	0.848	1.197	1.545	0.173	0.323	0.458	0.592
	(3+)	3.192	4.350	5.508	2.313				0.240	0.758	1.045	1.332	0.178	0.296	0.411	0.527

Table 2.3. Lake Erie Yellow Perch fishing rates and the Recommended Allowable Harvest (RAH; in millions of pounds) for 2024 by Management Unit (Unit). RAH values are calculated in Table 2.2. RAH values may be subject to a limit on the annual change in TAC (±20%).

	Fishing	Recommended Allowable Harvest (millions lbs.)			±20% of previous year TAC	
Unit	**Rate**	**MIN**	**MEAN**	**MAX**	MIN (-20%)	MAX (+20%)
1	0.431	2.149	2.861	3.569	1.944	2.916
2			See Text Page 9		0.382	0.572
3	0.576	2.104	2.654	3.200	2.466	3.698
4	0.544	0.323	0.458	0.592	0.467	0.701

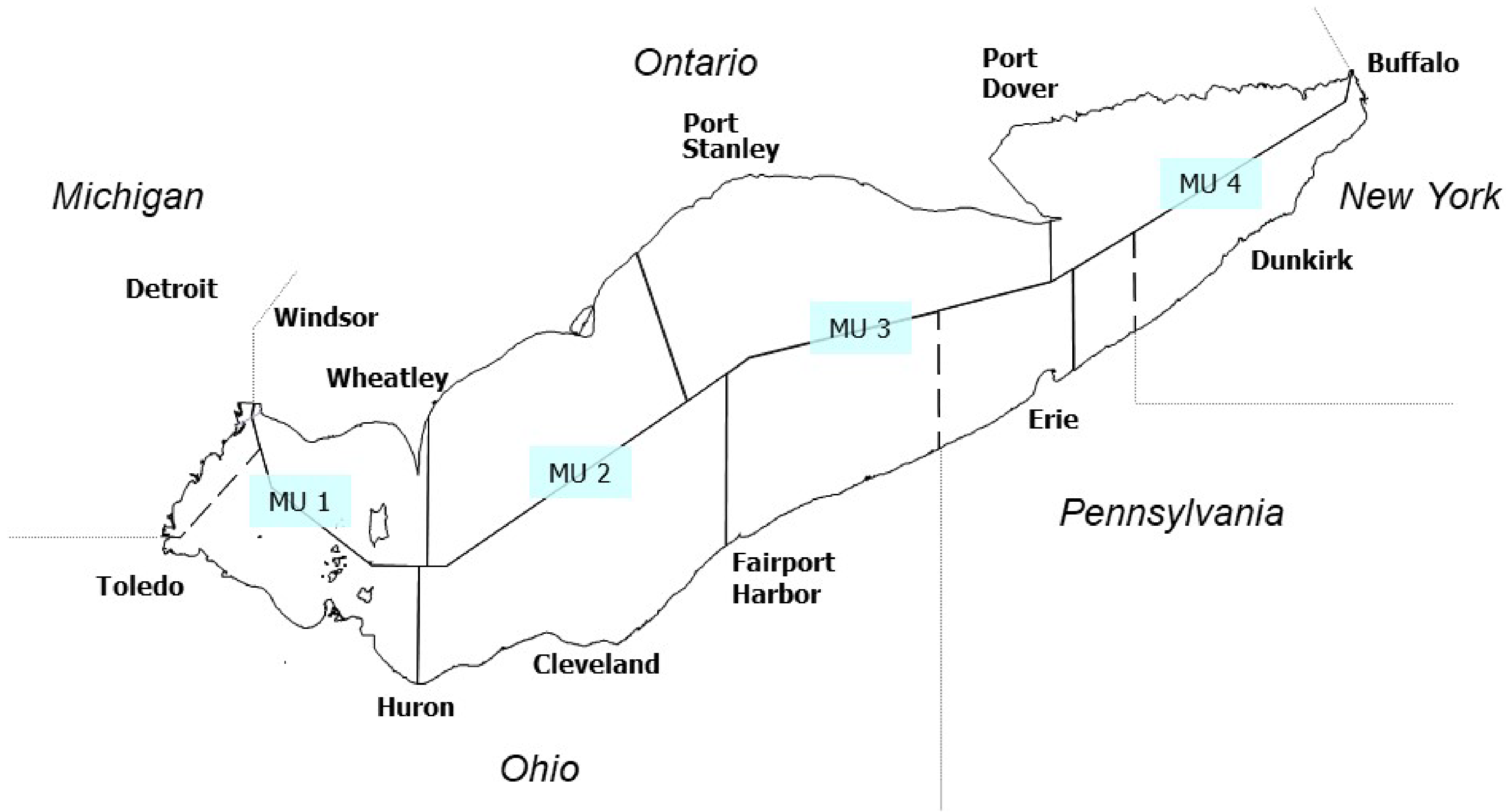


Figure 1.1. The Yellow Perch Management Units (MUs) of Lake Erie defined by the YPTG and LEC, for illustrative purposes.

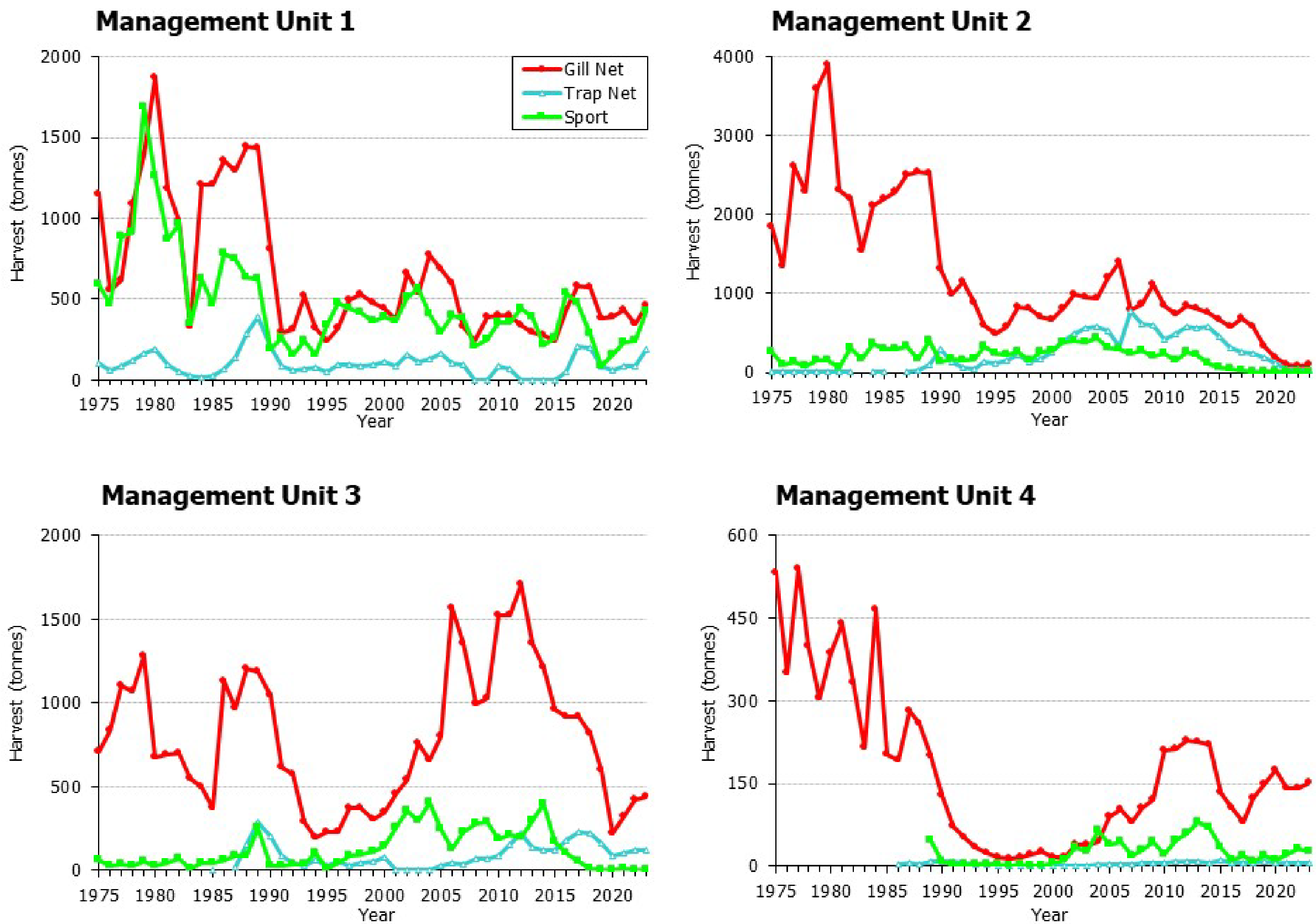


Figure 1.2. Historic Lake Erie Yellow Perch harvest (metric tonnes) by management unit and gear type.

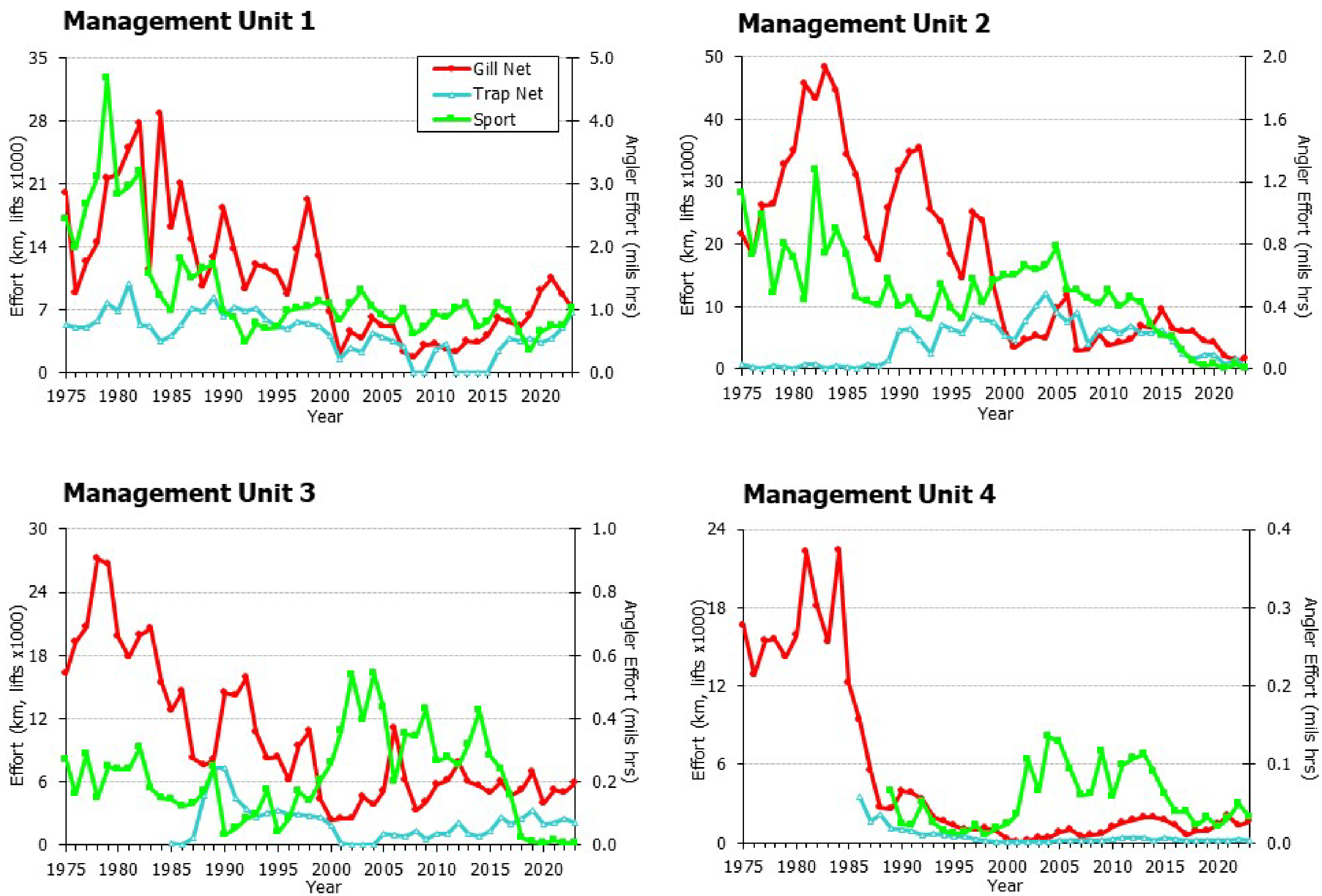


Figure 1.3. Historic Lake Erie Yellow Perch effort by management unit and gear type. Note: gill net effort presented is targeted effort with small mesh (< 3").

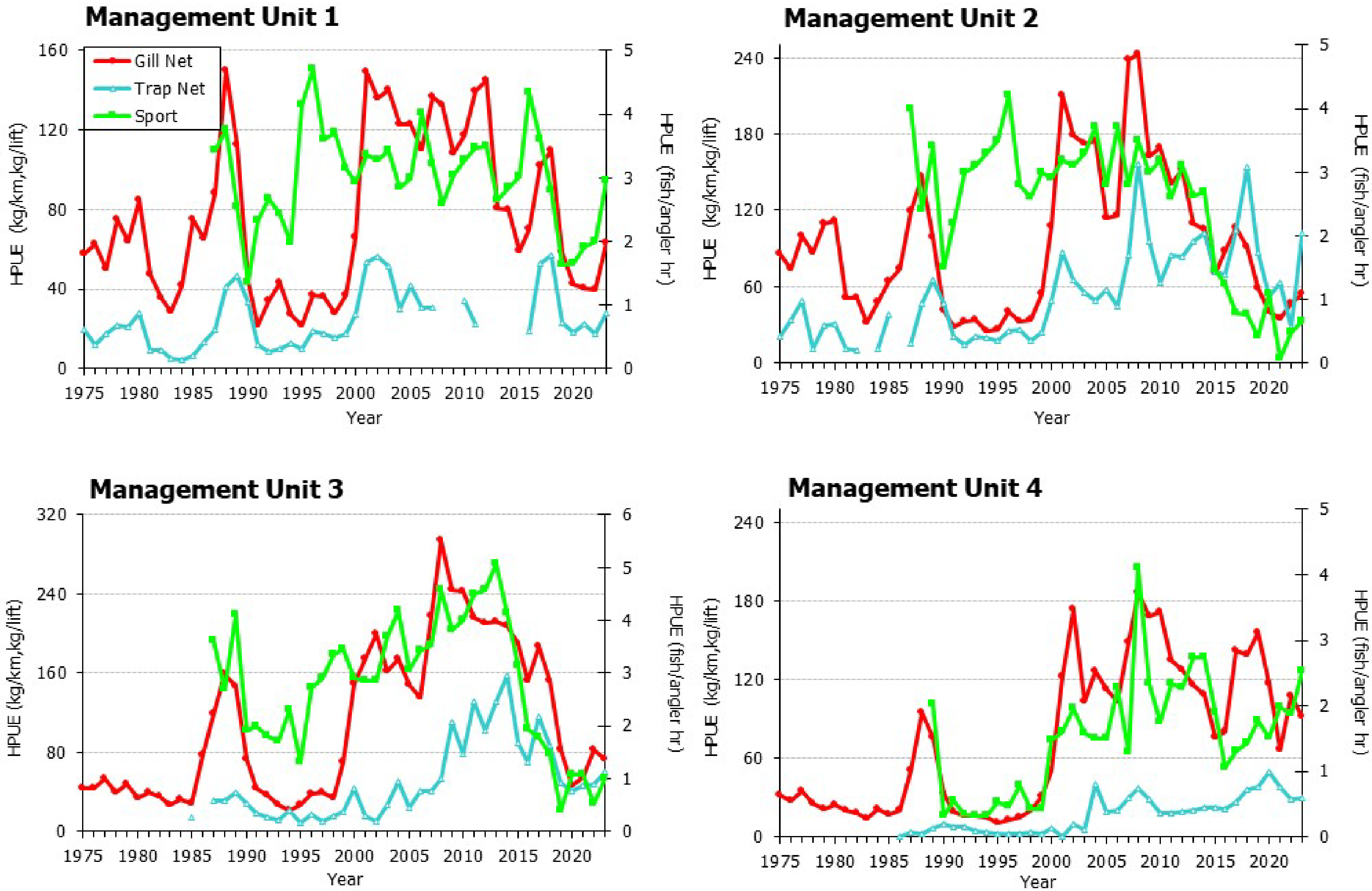


Figure 1.4. Historic Lake Erie Yellow Perch harvest per unit effort (HPUE) by management unit and gear type.
Note: gill net CPUE for 2001 to 2023 is for small mesh (< 3") only.

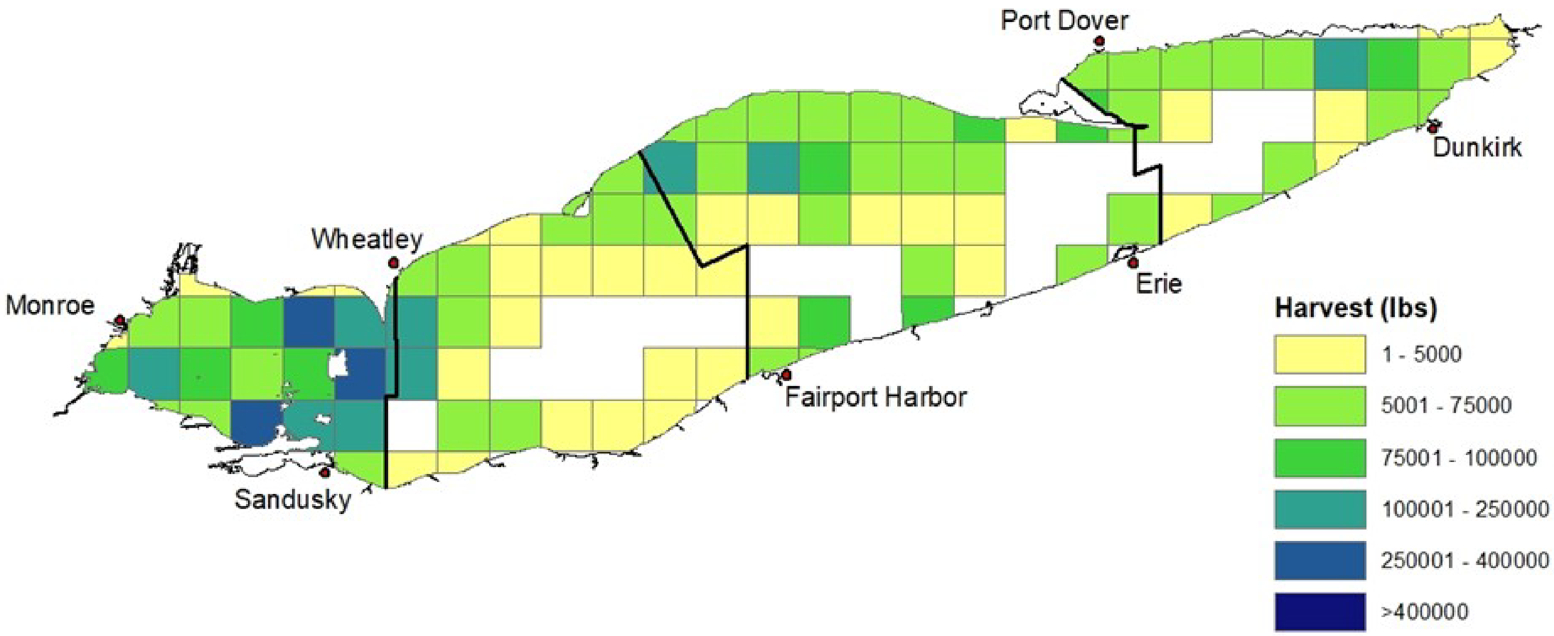


Figure 1.5. Spatial distribution of Yellow Perch total harvest (lbs.) in 2023 by 10-minute grid.

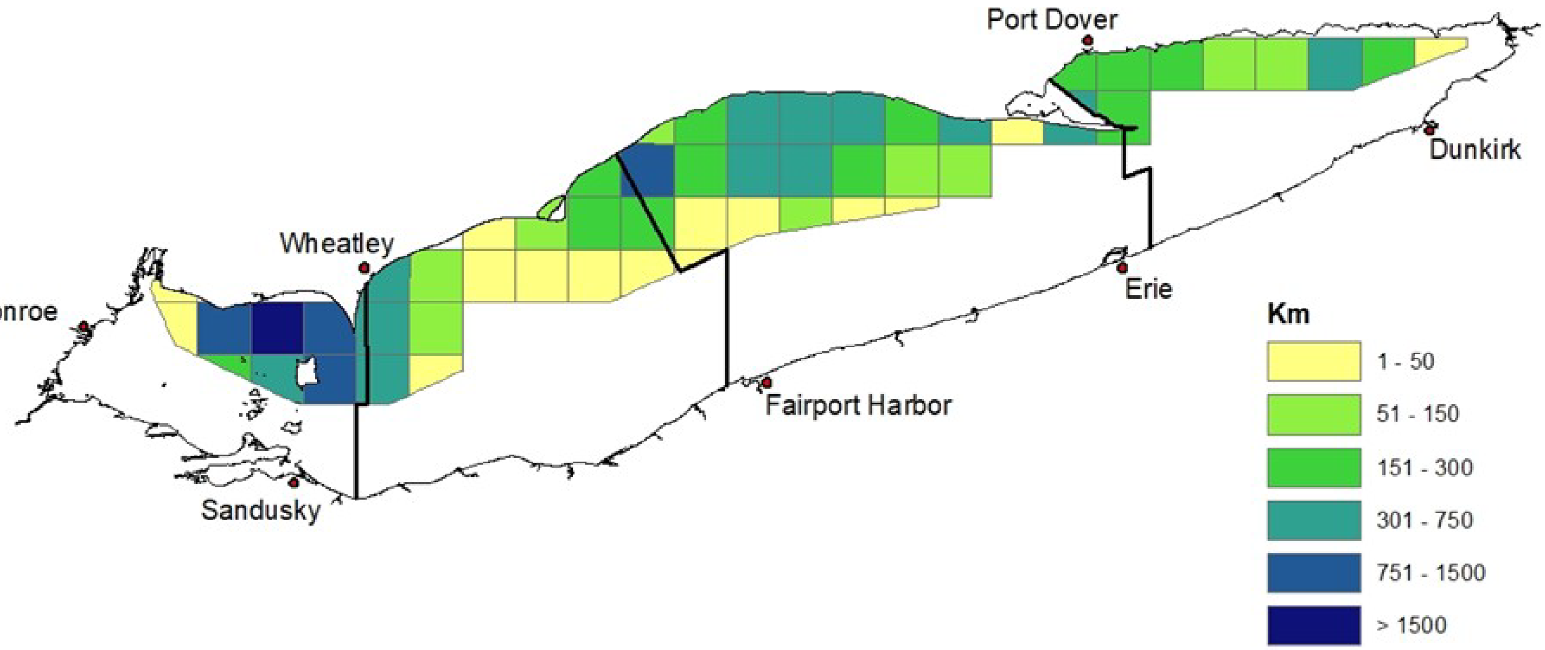


Figure 1.6. Spatial distribution of Yellow Perch small mesh gill net effort (km) in 2023 by 10-minute grid.

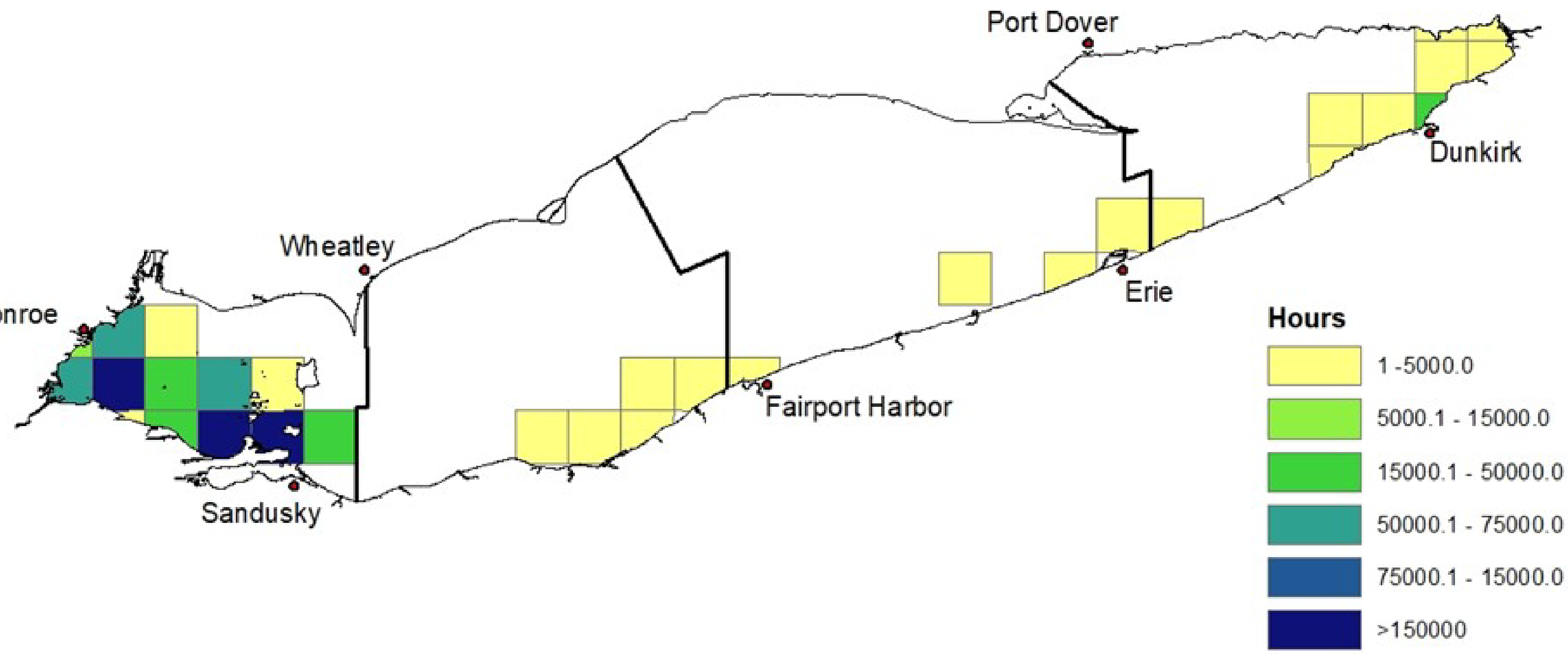


Figure 1.7. Spatial distribution of Yellow Perch sport effort (angler hours) in 2023 by 10-minute grid.

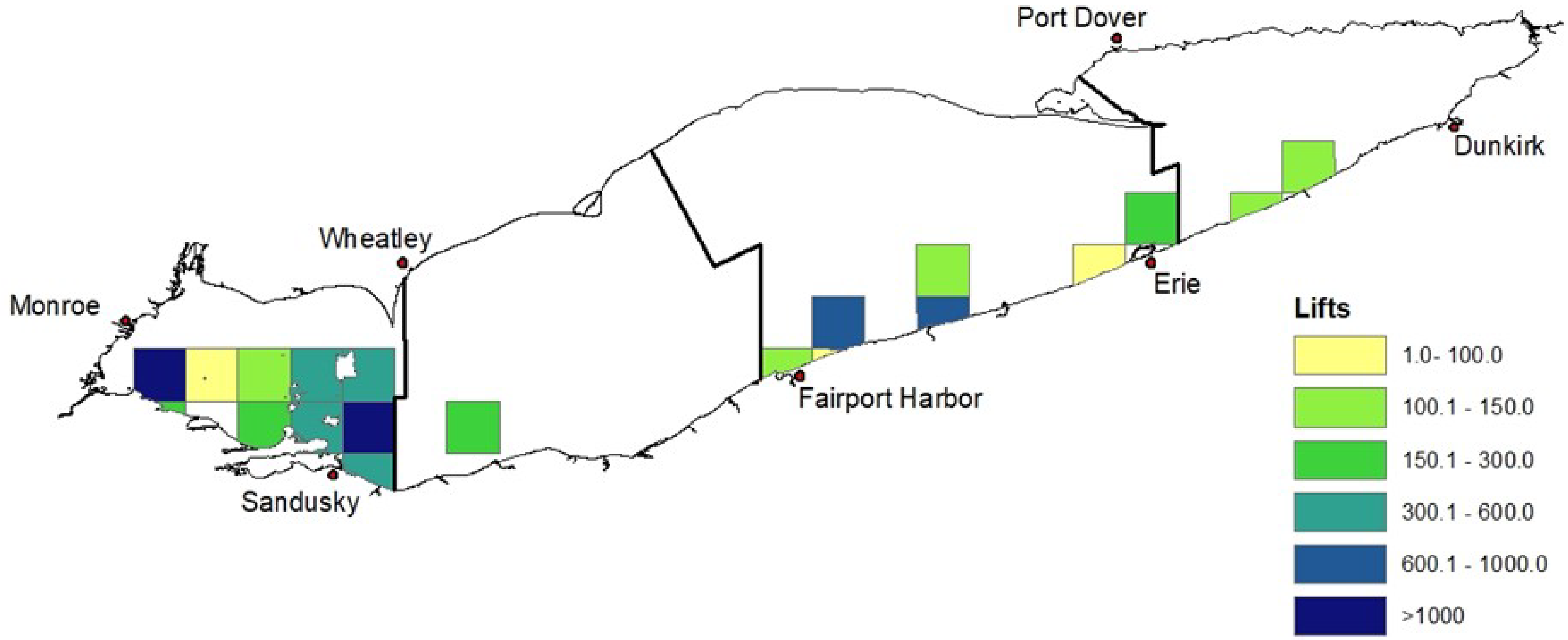


Figure 1.8. Spatial distribution of Yellow Perch trap net effort (lifts) in 2023 by 10-minute grid.

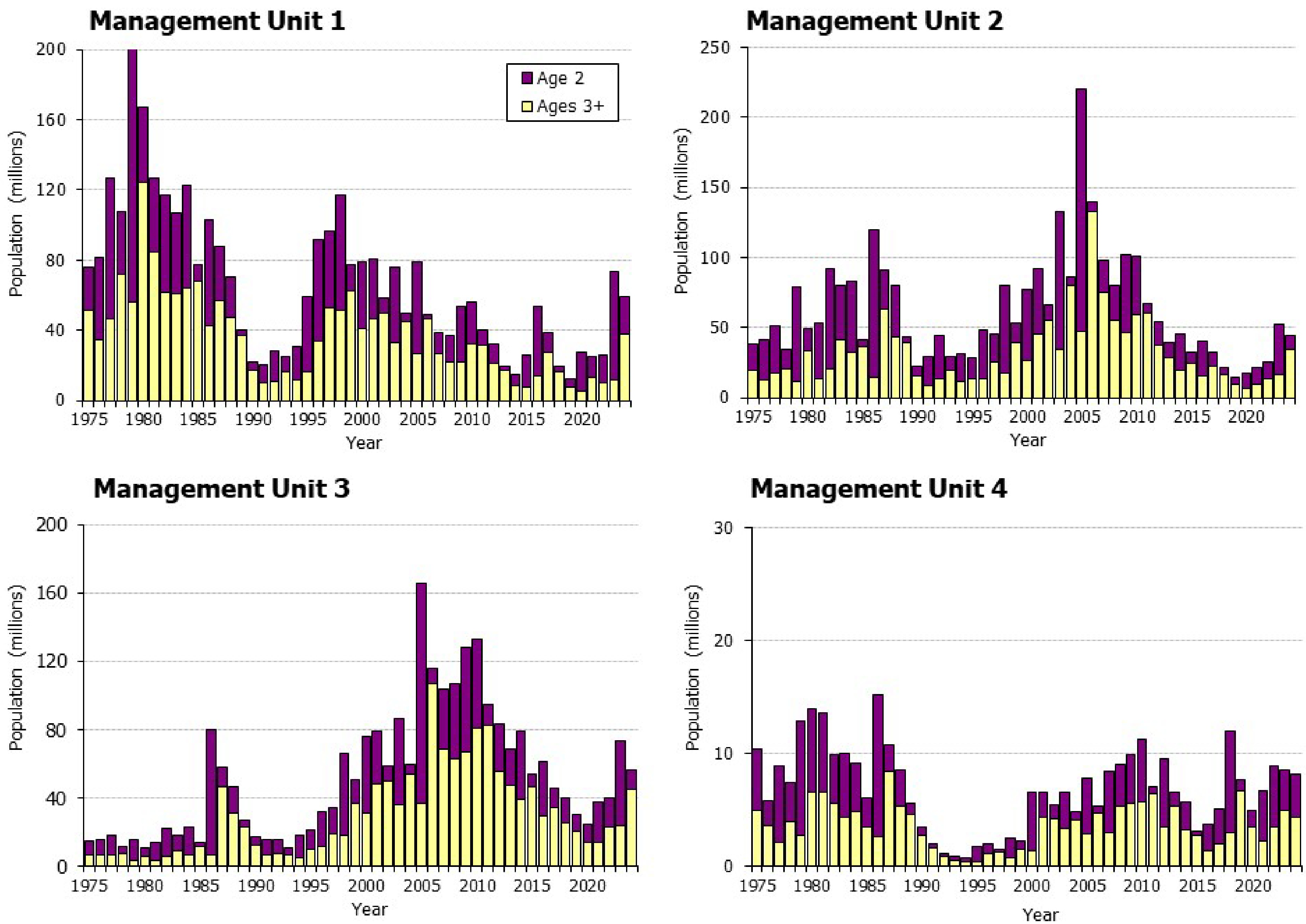


Figure 1.9. Lake Erie Yellow Perch population estimates by management unit for age 2 (dark bars) and ages 3+ (light bars), 1975 to 2024, from the ADMB model.

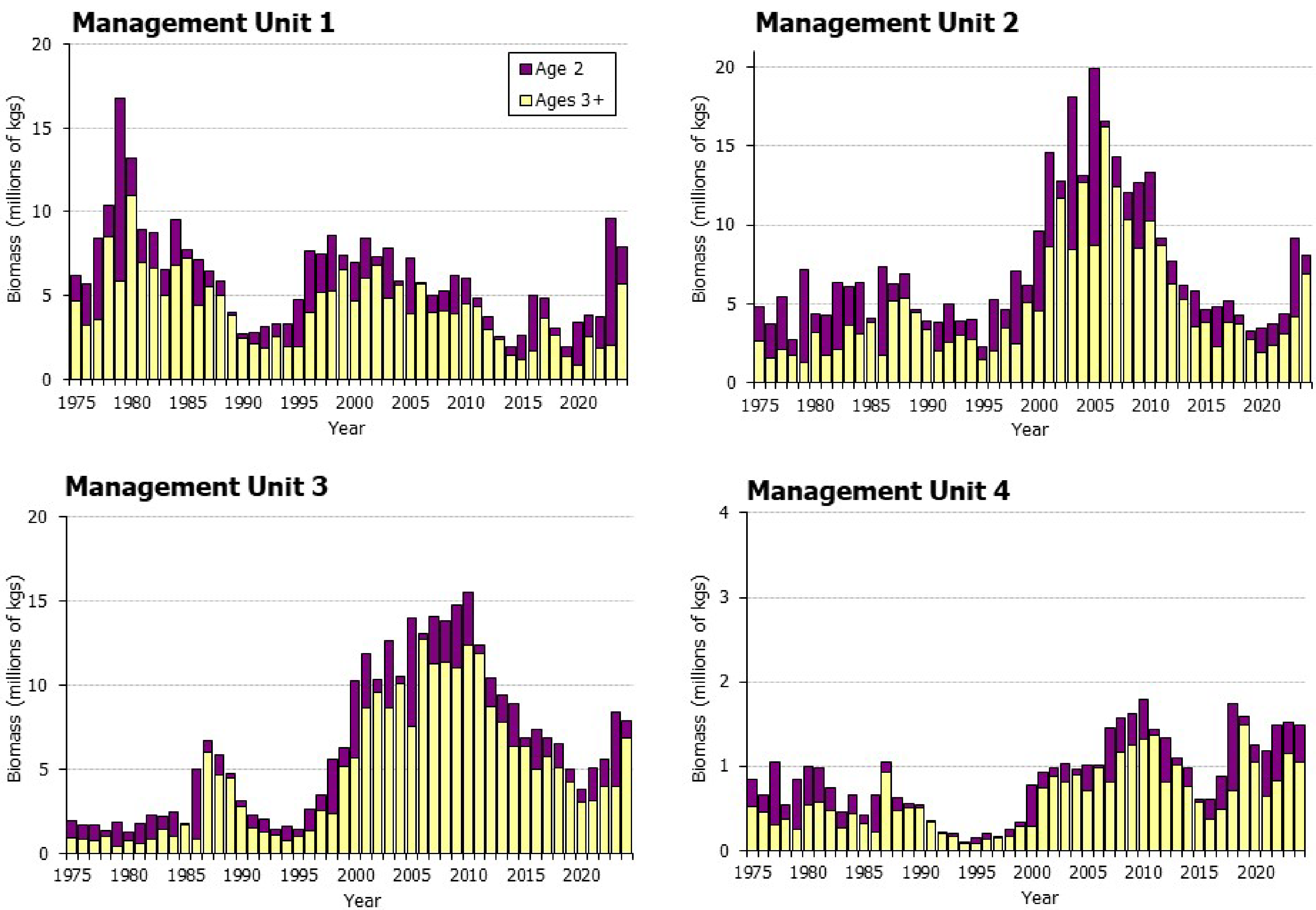


Figure 1.10. Lake Erie Yellow Perch biomass estimates by management unit for age 2 (dark bars) and ages 3+ (light bars), 1975 to 2024, from the ADMB model.

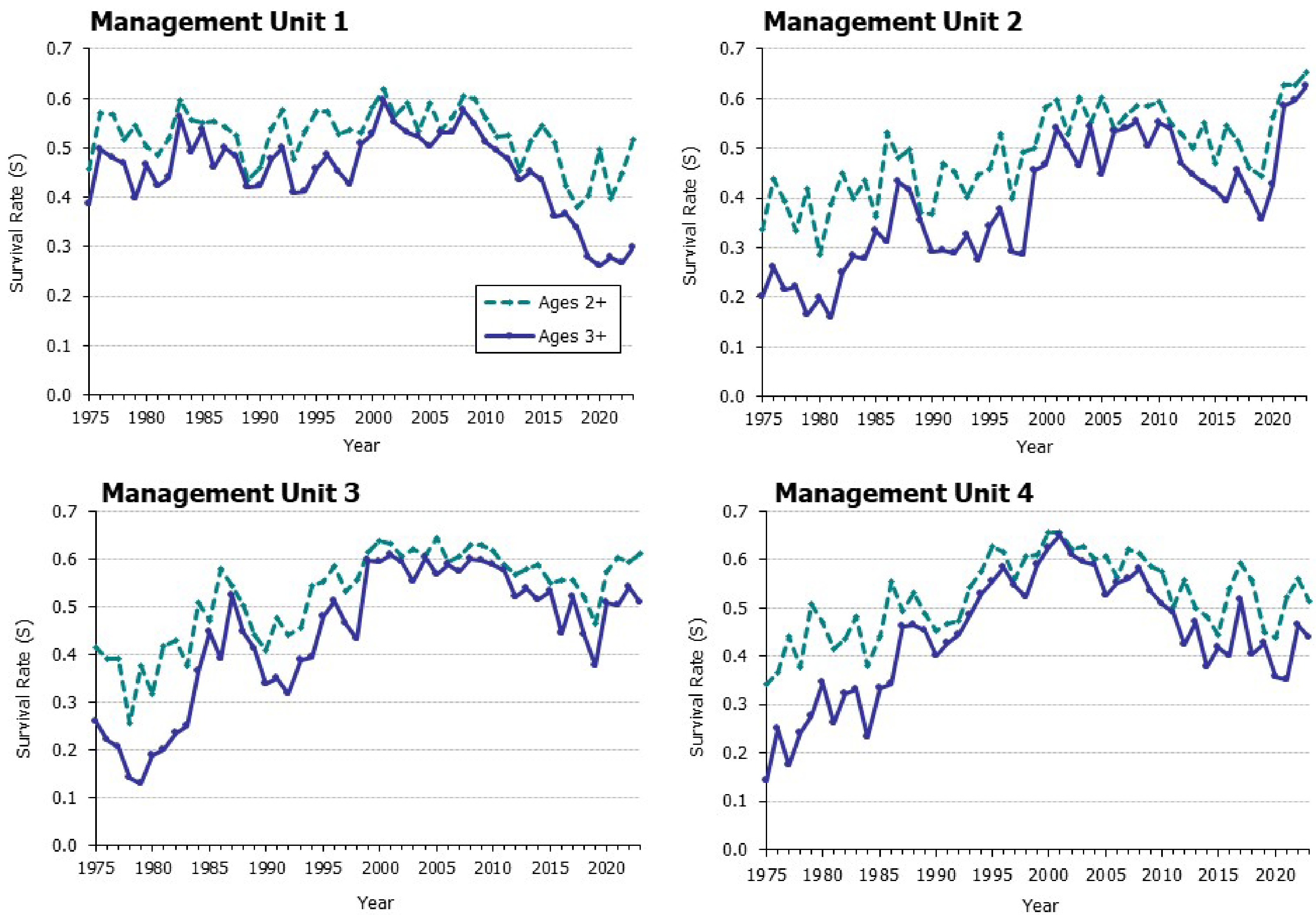


Figure 1.11. Lake Erie Yellow Perch survival rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line).

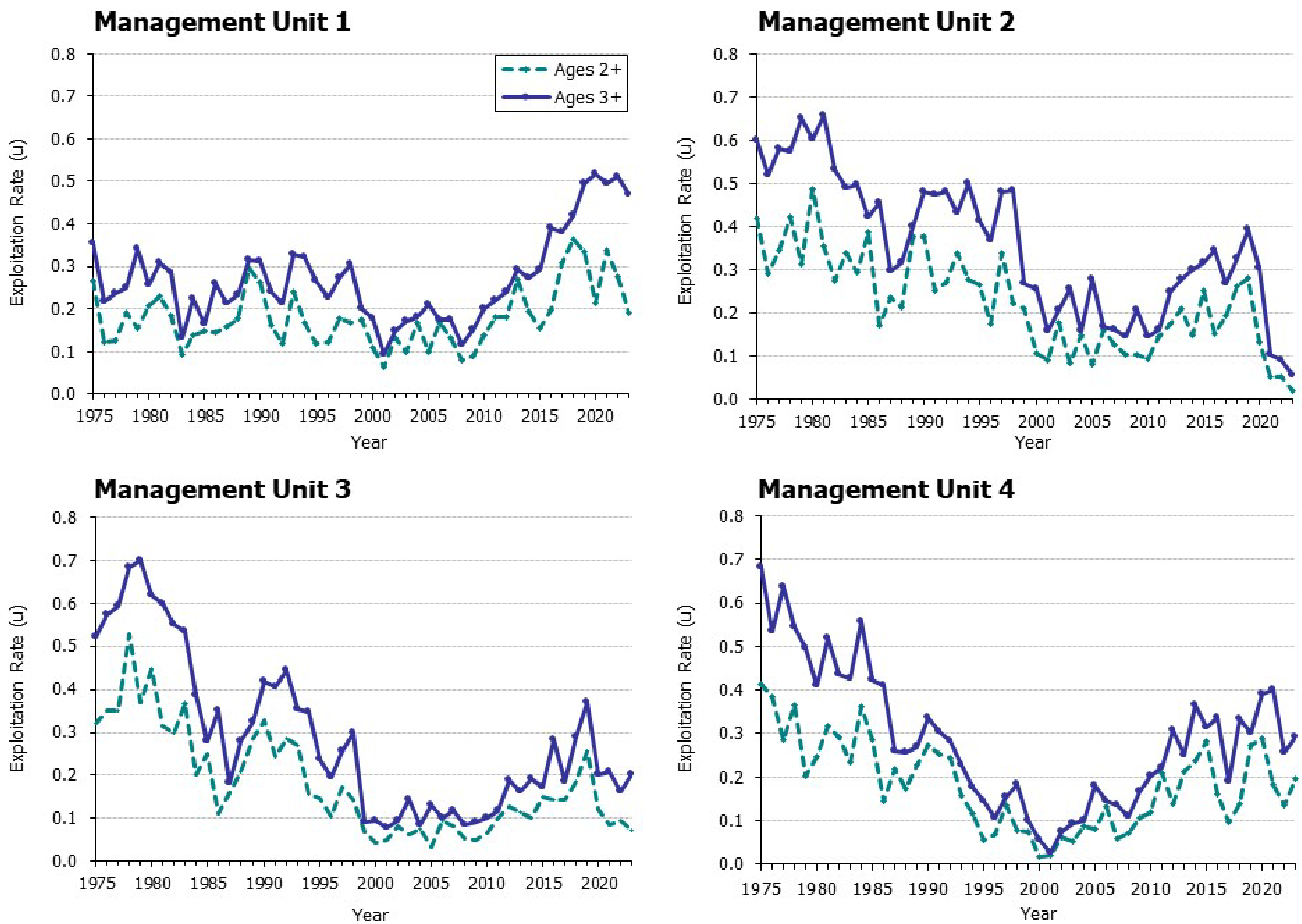
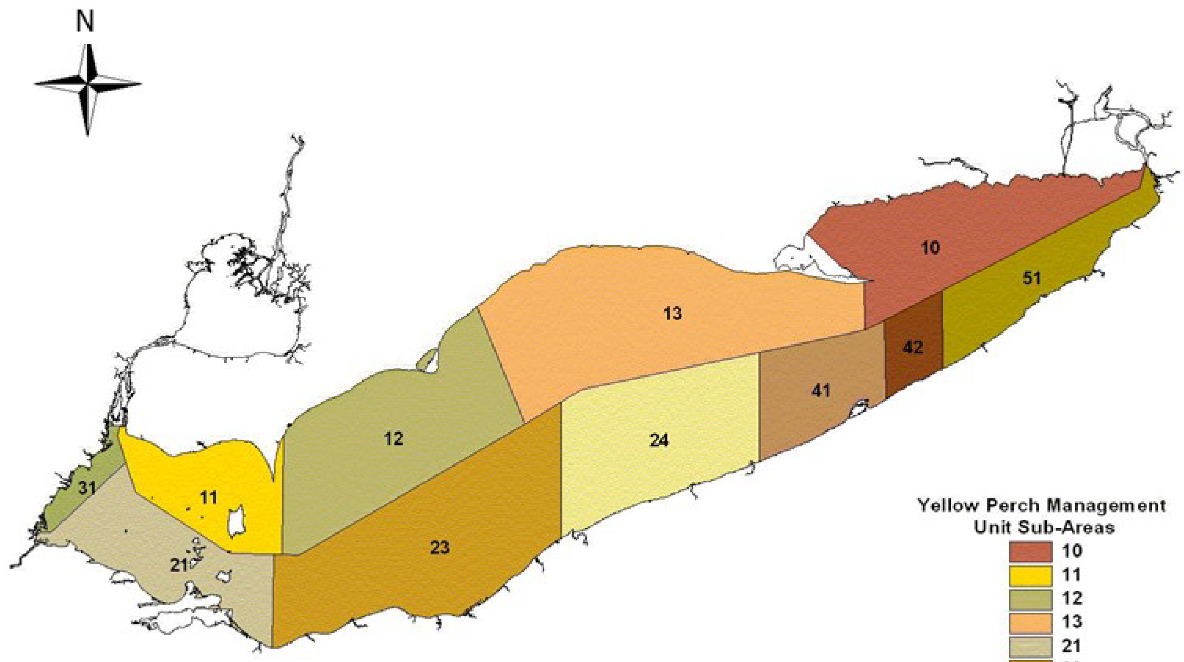


Figure 1.12. Lake Erie Yellow Perch exploitation rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line).



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%**
		MU 1 Total	**3787.5**	
MU2	12	Ontario	3497.4	**45.6%**
	23	Ohio	4175.3	**54.4%**
		MU 2 Total	**7672.7**	
MU3	13	Ontario	4749.9	**52.3%**
	24	Ohio	2943.7	**32.4%**
	41	Pennsylvania	1385.8	**15.3%**
		MU 3 Total	**9079.4**	
MU4	10	Ontario	2818.7	**58.0%**
	42	Pennsylvania	535.6	**11.0%**
	51	New York	1507.2	**31.0%**
		MU 4 Total	**4861.4**	

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

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

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

Appendix Table 2. Surveys selected by multi-model inference (MMI) age-2 recruitment

MU	Survey	Parameter Estimate	Number of Models
MU1	OHF10	0.223	1
	OOS11	0.594	2
	(Intercept)	13.560	2
MU2	OHF21	0.037	1
	OHF20	0.268	2
	OPSF21	0.301	2
	(Intercept)	14.804	2
MU3	OHJ31A	0.262	1
	OPSF31	0.310	1
	(Intercept)	14.899	1
MU4	OPSF41	-0.017	1
	NYGN41	-0.028	1
	NYF41	0.451	3
	LPC41	0.270	3
	(Intercept)	13.208	3

Appendix 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.

Year	OHF10	OHF11	OOS10	OOS11	OHF20B	OHF21B	OHF30B	OHF31B	OHJ21B	OHJ31B	NYF40	NYF41	NYGN41	LPC40	LPC41	OPSF11	OPSF21	OPSF31	OPSF41
1988	.	.	212.6	13.3	.	.	.	.	.	.	.	.	.	105.8	0.4	.	.	.	.
1989	.	.	265.4	12.5	.	.	.	.	.	.	.	.	.	82.1	16.4	.	.	6.8	76.6
1990	310.1	0.0	259.2	35.2	52.2	23.0	21.2	12.4	.	.	.	.	.	26.7	5.6	41.3	68.9	29.7	0.6
1991	58.1	0.4	113.3	42.1	9.3	50.0	1.2	19.7	216.5	19.7	.	.	.	17.8	3.2	63.3	56.6	3.8	1.6
1992	90.9	0.7	94.2	16.5	36.3	15.0	31.3	3.3	18.5	0.8	10.7	2.4	.	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	9.7	5.8	113.0	3.1	0.2	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	23.3	10.2	49.0	8.6	0.6	34.7	6.2	317.8	22.5	39.7	7.4
1995	82.4	0.1	478.8	113.5	2.8	73.5	14.1	27.5	.	.	5.9	13.6	0.6	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	8.9	0.9	105.8	0.3	0.1	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	493.9	64.0	0.2	5.7	0.0	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	21.5	16.2	1.3	0.4	0.0	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	402.8	97.3	35.9	33.3	13.1	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	51.4	10.2	23.9	7.0	3.3	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	279.8	4.3	100.4	11.7	2.2	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	239.6	37.7	9.5	16.0	0.9	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	9.5	2.5	484.8	2.0	2.0	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	410.3	42.7	1.5	29.4	2.9	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	51.2	19.3	59.3	5.6	0.4	124.4	0.1	0.0	2.2	2.5	0.2
2006	121.9	12.5	222.9	12.4	11.3	4.3	18.9	12.5	29.7	113.6	290.6	40.9	32.6	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	287.6	281.8	412.0	42.3	16.1	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	303.5	97.2	1116.7	45.5	16.4	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	125.9	48.2	11.9	64.1	42.4	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	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	70.8	41.7	89.5	141.8	105.9	176.7	2.6	158.7	101.8	218.6	95.4
2012	35.0	6.0	68.2	4.0	69.2	7.4	134.4	23.3	42.5	76.5	280.0	16.7	8.0	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	84.2	116.2	4.4	24.4	16.0	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	.	.	274.2	2.9	0.9	28.4	0.02	315.0	34.7	16.4	2.2
2015	224.0	53.0	494.3	117.2	19.6	41.3	18.6	30.2	.	.	68.6	57.3	2.0	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	46.5	149.4	2178.2	53.0	10.4	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	7.2	17.6	247.0	129.5	77.4	65.5	4.4	90.3	65.3	104.8	414.1
2018	429.6	17.4	959.3	21.6	28.4	7.9	50.8	6.6	14.9	50.4	662.4	11.4	1.7	328.8	2.9	78.5	28.3	130.2	23.3
2019	161.1	69.8	518.7	95.1	0.2	4.5	6.8	7.4	26.2	22.3	169.1	2.5	0.9	227.0	18.9	332.0	42.5	23.7	26.2
2020	99.9	14.2	566.4	23.1	5.7	4.9	3.9	0.6	.	.	91.6	56.2	17.2	73.7	21.1	93.5	31.7	87.5	314.3
2021	.	.	1358.0	36.7	13.0	13.0	2.2	4.8	13.9	3.7	284.2	33.5	15.3	14.0	8.1	145.9	27.7	96.3	252.2
2022	148.8	40.1	571.5	102.1	3.0	4.8	2.7	2.8	78.2	17.6	297.1	26.8	24.1	40.5	1.6	345.1	33.7	15.0	144.7
2023	151.5	20.5	381.4	41.0	12.9	4.7	3.0	4.5	7.8	4.6	34.5	40.9	4.8	15.8	4.1	84.5	22.9	25.1	16.0

Appendix Table 4. Lakewide recruitment index codes and series names used in Appendix Tables 2 and 3. All series are reported in arithmetic mean catch per hectare, except LPS41, NYGN41, and OPSF11-41, gill net indices which are reported in mean catch per lift. Abbreviations in Appendix Table 3 ending with a 'B' represent survey indices blocked by depth strata.

Abbreviation	Series
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
OHF20	Ohio Management Unit 2 fall age 0
OHF21	Ohio Management Unit 2 fall age 1
OHF30	Ohio Management Unit 3 fall age 0
OHF31	Ohio Management Unit 3 fall age 1
OHJ21	Ohio Management Unit 2 June age 1
OHJ31	Ohio Management Unit 3 June age 1
LPC40	Long Point Composite Management Unit 4 age 0
LPC41	Long Point Composite Management Unit 4 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