

Report of the Lake Erie Yellow Perch Task Group

March 24th, 2011



Members:

Megan Belore (Co-chair)
Andy Cook
Don Einhouse
Travis Hartman
Mike Hosack
Kevin Kayle
Carey Knight (Co-chair)
Chuck Murray
Mike Thomas
Larry Witzel

Ontario Ministry of Natural Resources
Ontario Ministry of Natural Resources
New York Department of Environmental Conservation
Ohio Department of Natural Resources
Pennsylvania Fish and Boat Commission
Ohio Department of Natural Resources
Ohio Department of Natural Resources
Pennsylvania Fish and Boat Commission
Michigan Department of Natural Resources
Ontario Ministry of Natural Resources

Presented to:

Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission

Table of Contents

Introduction	1
Charge 1: 2010 Fisheries Review and Population Dynamics.....	1
Age Composition and Growth	3
ADMB Catch-at-Age Analysis	4
Recruitment Estimator for Incoming Age-2 Yellow Perch	6
2011 Population Size Projection	6
Charge 2: Harvest Strategy and RAH	8
Harvest Strategy Methodology	8
Harvest Strategies and RAH Determination	8
Charge 3: Lake Erie Yellow Perch Management Plan.....	9
Charge 4: Support QFC Modeling Efforts for Catch-Age Models.....	9
Acknowledgments.....	10
Literature Cited.....	11

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

Introduction

From April 2010 through March 2011, the Yellow Perch Task Group (YPTG) addressed the following charges:

1. Maintain and update 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. Support a sustainable harvest policy by:
 - a. Examining exploitation strategies
 - b. Recommending an allowable harvest for 2011 for each management unit
 - c. Supporting decision/risk analysis strategies for yellow perch management.
3. Support completion of a Lake Erie Yellow Perch Management Plan.
4. Support QFC modeling efforts for catch-age models and harvest policies.

Charge 1: 2010 Fisheries Review and Population Dynamics

The lakewide total allowable catch (TAC) in 2010 was 13.137 million pounds. This allocation represented a 9.4% increase from a TAC of 12.012 million pounds in 2009. For yellow perch assessment and allocation, Lake Erie is partitioned into four management units (Units, or MUs; Figure 1.1). The 2010 allocation by management unit was 2.094, 4.000, 6.251, and 0.792 million pounds for Units 1 through 4, respectively. Please note that in 2010, the LEC set the TAC for MU2 at 4.0 million pounds, which was higher than the mean RAH suggested by the YPTG in March 2010 (3.389 million pounds). The lakewide harvest of yellow perch in 2010 was 9.689 million pounds, or 73.8% of the total 2010 TAC. This was a 6.0% increase from the 2009 harvest of 9.137 million pounds. Harvest by Lake Erie Management Units 1 through 4 was 1.853, 3.347, 3.965, and 0.525 million pounds, respectively (Table 1.1). The portion of TAC harvested was 88.5%, 83.7%, 63.4%, and 66.3%, in MUs 1 through 4, respectively. In 2010, Ontario harvested 6.606 million pounds, followed by Ohio (2.824 million lbs.), Pennsylvania (138 thousand lbs.), Michigan (84 thousand lbs.), and New York (38 thousand lbs.).

Ontario's fraction of allocation harvested was 103.5% in MU1, 103.6% in MU2, 103.1% in MU3, and 101.9% in MU4 (see comments below regarding Ontario's harvest reporting and

commercial ice allowance policy). Ohio fishers attained 84.5% of their TAC in the western basin (MU1), 67.0% in the west central basin (MU2), and 23.5% in the east central basin (MU3). Michigan anglers in MU1 attained 43.8% of their TAC. Pennsylvania fisheries harvested 12.3% of their TAC in MU3 and 23.0% of their TAC in MU4. New York fisheries attained 15.3% of their TAC in MU4.

Ontario's portion of the lakewide yellow perch harvest increased slightly to 68.2% in 2010 from 64.4% in 2009 (Table 1.1). Ohio's proportion of lakewide harvest decreased slightly to 29.1% in 2010, from 31.3% in 2009. Harvest in Michigan, Pennsylvania, and New York waters combined represented 2.7% of the lakewide harvest in 2010.

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

Harvest, fishing effort, and fishery harvest rates are summarized for the time period 2000 to 2010 by management unit, year, agency, and gear type in Tables 1.2 to 1.5. Trends over a longer time series (1975 to 2010) 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 2010 in ten-minute interagency grids are presented in Figures 1.5 through 1.8.

Ontario's yellow perch harvest from large mesh (3 inches or greater) gill nets in 2010 was 7.3%, 25.0%, and 9.0% of the gill net harvest in MUs 1, 2 and 3, respectively, but was negligible in MU4 (0.3%). 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 2010 increased 12.0% in MU1, 40.6% in MU3, and 74.8% in MU4 but decreased 29.3% in MU2, from 2009 harvest. Ontario trap net harvest is minimal (none in 2010) and is included in the total harvest of yellow perch in MU1 (Tables 1.1 and 1.2). Ontario commercial smelt trawlers incidentally catch yellow perch in management units 2, 3 and 4. Trawl catches are included in the total harvest of yellow perch in Table 1.1 and documented by MU at the bottom of Tables 1.2 to 1.5.

Targeted gill net effort in 2010 increased from 2009 by 3.1% in MU1, 41.9% in MU3, and 71.0% in MU4, but decreased 31.8% in MU2. Gill net effort remained lower in 2010 compared to the 1990s and earlier decades (Figure 1.3). Targeted gill net harvest rates in 2010 were similar to 2009 with slight changes in all management units (Figure 1.4). Targeted gill net harvest rates in 2010 increased in MU1 (8.6%), MU2 (3.6%), and MU4 (2.2%), but decreased in MU3 (1.0%).

In 2010, sport harvest in U.S. waters increased 41.1% in MU1 and 12.7% in MU2, but decreased 36.7% in MU3 and 51.4% in MU4 from 2009 harvest (Figure 1.2). Angling effort in U.S. waters increased in 2010 from 2009 in MU1 (31.4%) and MU2 (20.3%), but decreased in MU3 (37.8%) and MU4 (49.9%; Figure 1.3). Estimates of yellow perch sport harvest estimates from Ontario waters are assessed periodically, but creel surveys were not performed in 2010.

Sport fishing harvest rates are commonly expressed as fish harvested per angler hour for those anglers seeking yellow perch. These harvest rates are presented in Tables 1.2 to 1.5. Compared to 2009 rates, harvest per angler hour increased in Ohio waters as angler harvest rates were up 9.7% in MU1, 6.7% in MU2, and 14.3% in MU3. In contrast, angler harvest rates decreased from 2009 in Michigan waters (14.8% in MU1), in Pennsylvania waters of MU3 (16.7% in MU3, 31.3% in MU4), and in New York waters (26.0% in MU4).

Angler harvest in kilograms per angler hour is presented graphically in Figure 1.4 for each management unit, by pooling jurisdictions' harvest weights and effort. In 2010, the sport harvest rate (in kg/hr) changed slightly relative to 2009 rates with increases in MU1 (7.5%) and MU3 (1.8%), and decreases in MU2 (6.3%) and MU4 (3.0%).

Harvest from Ohio, Pennsylvania, and New York commercial trap nets in 2010 decreased 30.1% in MU2 and 12.6% in MU4, but increased 28.4% in MU3 from 2009. Ohio trap netters were back in operation in MU1 in 2010 following a restriction to the Ohio waters of management units 2 and 3 in 2008 and 2009. Compared to 2009, trap net effort (lifts) in 2010 increased in MU2 (6.1%), MU3 (82.4%), and MU4 (33.5%). In 2010, trap net harvest rates decreased from 2009 in MU2 (34.1%), MU3 (29.6%) and MU4 (34.6%).

Age Composition and Growth

The yellow perch harvest in 2010 consisted mostly of the pooled older cohorts (2003 and prior; ages 6+), 2007 (age 3), and 2006 (age 4) year classes across all MUs, with a fair contribution of the 2005 (age 5) year class in MU2, MU3, and MU4 (Table 1.6). The pooled older year classes, comprised mostly by a strong 2003 year class (age 7), was a major contributor to all fisheries across all MUs; however, the 2007 year class (age 3) represented the second largest

proportion (28.6%) of harvest across all MUs, and was the strongest contributor to the harvest in MU4. Overall, ages 6+ (mainly the 2003 year class) accounted for the majority (30.1%) of the lakewide harvest.

Yellow perch growth differs among life stages and between basins as illustrated by trends in total length-at-age (Figure 1.9). For simplicity, Figure 1.9 is comprised of young-of-the-year data from summer and fall interagency trawls, while data for age 1 and successive ages to age 4 are from Ontario Partnership gill net surveys (MUs 1 and 4) and Ohio fall trawls (MUs 2 and 3). As these data are taken from fall surveys, caution must be exercised when evaluating these figures. Seasonal exploitation patterns and density-dependent effects may alter the overall picture of growth trends. However, size-at-age long-term time series results describe relatively stable length-at-age for ages 0 to 4 across the management units. Nevertheless, growth in MU1 decreased for ages 1-3 since 2008 and age 4 in 2010. Similar to MU1, MU4 showed declining growth for ages 2-3 since 2008. MU2 and MU3 exhibited increases in growth for ages 1-4 since 2009, except for a decline in age 2 in MU2. Because fall data are used to depict trends in growth, or total length-at-age, these data may be a reflection of fish that have not been harvested, thus, not an actual measure of growth. Yellow perch condition in Figure 1.10 is comprised of data from Ontario Partnership gill net surveys (MUs 1 and 4) and Ohio fall trawls (MUs 2 and 3). Trends in size and condition may be influenced by seasonal differences in sampling. Additional data from Long Point Bay trawl surveys are used to determine condition of age-0 yellow perch in MU4.

The task group continues to update yellow perch growth data in: (1) weight-at-age values recorded annually in the harvest and (2) length- and weight-at-age values taken from interagency trawl and gill net surveys. These values are applied in the calculation of population biomass and the forecasting of harvest in the approaching year. Therefore, changes in weight-at-age factor into the changes in overall population biomass and determination of recommended allowable harvest (RAH). In 2007, the YPTG moved from using a two-year average of weight-at-age to using a three-year average, and this was continued in 2010. This was done 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.

ADMB Catch-at-Age Analysis

Population size for each management unit was estimated by catch-at-age analysis using the Auto Differentiation Model Builder computer program (ADMB), with a standard version that

incorporates commercial gill net catchability coefficients based on the seasonal distribution of harvest and relative catch rates. The approach was identical to methods used in 2009-2010. Estimates of population size from 1990 to 2010 and projections for 2011 are presented in Table 1.7. Abundance, biomass, survival, and exploitation rates are presented by management unit graphically for 1975 to 2010 in Figures 1.11 to 1.14. Mean weights-at-age from assessment surveys were applied to abundance estimates to generate population biomass estimates (Table 1.8 and Figure 1.12). Population abundance and biomass estimates are critical to monitoring the status of stocks and determining allowable harvest.

Abundance estimates should be interpreted with several caveats. Inclusion of abundance estimates from 1975 to 2010 implies that the time series are continuous. Lack of data continuity for the entire time series weakens the validity of this assumption. Survey data from multiple agencies are represented only in the latter part of the time series (since the late 1980s); methods of fishery data collection have also varied. Some model parameters are constrained to constants, such as natural mortality, catchability, and selectivity blocks. This technique lessens our ability to directly compare abundance levels over three decades. In addition, commercial gill net selectivity, is estimated independently in the latter part of the time series using gill net selectivity curves derived from index gillnet data by the method of Helser (1998); involving back calculation of length-at-age and weightings based on the monthly distribution of harvest-at-age. With catch-at-age analysis the most recent year's population estimates inherently have the widest error bounds; this is to be expected for cohorts that remain at-large under less than full selectivity in the population.

Population estimates are derived by minimizing an objective function weighted by data sources including fishery effort, fishery catch, and survey catch rates. The data weightings (referred to as lambdas in ADMB) for effort data are calculated by the ratio of variance of observed log-catch to log-effort (Quinn and Deriso 1999). Weightings of fishery catch and survey catch rates are solved iteratively until convergence occurs; *i.e.* until lambdas remain relatively constant (they do not change by a factor of 0.1). Although lambdas within similar parameter groups (effort, catch, and surveys) are solved and weighted unequally, the groups themselves are given equal weight (the greatest lambdas for catch, effort, and surveys are 1.0). Data weighting lambdas are presented in Appendix A Table 1.

Recruitment Estimator for Incoming Age-2 Yellow Perch

Age-2 yellow perch recruitment in 2011 was predicted by linear least-squares regression of juvenile yellow perch trawl and gill net indices against catch-at-age analysis estimates of two-year-old abundance in each management unit. Age-2 yellow perch recruitment in 2011 was calculated using the mean of age-2 values predicted from the young-of-year and yearling indices that performed well in the regressions ($F < 0.01$, $r^2 > 0.50$) with age-2 abundance estimates (Appendix A Table 2). Data from trawl and gill net index series for the time period examined are presented in Appendix A Table 3, while a key that summarizes abbreviations used for the trawl and gill net series is presented as a legend in Appendix A Table 4.

Estimates of age-2 yellow perch recruitment for 2011 (the 2009 year class) were well below average in all MUs, and were estimated as the lowest since 1990 in MU3 (Table 1.7, Appendix A Table 2). Since 1990, young-of-year trawl surveys estimate the 2009 year class as below average in MU1, the 10th lowest depicted in MU2, the lowest in MU3, and 5th lowest in MU4 (Appendix A Table 3). The 2009 year class may have some moderate contribution to the fishery in MU1, but the age-2 estimate in MU2 currently comprises over 40% of the stock size and that mean value was derived from estimates ranging from 6 thousand to 55 million age-2 recruits. The weaker 2009 year class in MUs 3-4 is not anticipated to have contributions to their fisheries in 2011.

2011 Population Size Projection

Stock size estimates for 2011 yellow perch age-3-and-older were projected from statistical catch-at-age analysis (SCAA) estimates of 2010 population size and age-specific survival rates in 2010 (Table 1.8). Projected age-2 yellow perch recruitment from the 2009 year class (method described above) was added to the 2011 population estimate for older fish in each unit, producing the total standing stock in 2011 (Table 1.8). Standard errors and ranges for estimates are provided for each age in 2010, and following estimated survival from SCAA, for 2011. Descriptions of *min*, *mean*, and *max* population estimates refer to the age-specific estimates minus or plus one standard deviation (Table 1.8).

Management unit stock size estimates for 2010 from SCAA were lower than those projected in the spring of 2010 in MUs 1, 2 and 3, but were higher than predicted in MU4 (YPTG 2010). This was primarily due to differences in the SCAA estimate of age-2 fish in each unit. However, the estimate of age-3-and-older in MU3 is also moderately reduced from 2010

estimates. Current estimates of age-2 fish in 2010 are from the ADMB's first assessment of this cohort and as such have the widest error bounds.

Stock size estimates projected for 2011 were slightly lower than 2010 in MUs 1, 2, and 3, which, for MUs 1 and 3 were due primarily to reduced age-2 recruitment. Stock size estimates projected for 2011 were significantly lower than 2010 in MU4 due primarily to decreased age-2 recruitment (Tables 1.7, 1.8, Appendix A Table 2, and Figure 1.11). Abundance projections for 2011 were 20.7, 38.2, 51.4, and 19.9 million age-2-and-older yellow perch in management units 1 through 4, respectively. Abundance estimates of age-2-and-older yellow perch in 2011 are down by 14%, 14%, 36%, and 34% compared to the 2010 abundance estimates in management units 1 to 4, respectively. Age-3-and-older yellow perch abundance in 2011 is projected to be 11.7, 22.7, 49.3, and 19.5 million fish in Units 1 through 4, respectively. Model estimates of abundance for age-3-and-older yellow perch in 2011 are lower compared to the 2010 estimates in MU1 (down 40%), MU2 (22%) and MU3 (2%); however, estimates of age-3-and-older abundance were 30% higher in MU4 for 2011 compared to 2010.

As a function of population estimates and mean weight-at-age from surveys, total biomass estimates of age-2-and-older yellow perch for 2011 declined in each MU compared to 2010 (Table 1.8 and Figure 1.12): decreasing 9%, 22%, 15%, and 9% in MUs 1-4, respectively. The biomass estimates for 2010 are above the historic long-term (1975 to 2009) mean in MU3 (178% of the mean value), and MU4 (367%). The biomass estimates for 2010 are below the historic long-term (1975 to 2009) mean in MU1 (58.3% of the mean value) and MU2 (73.7%). In 2011, age-4 yellow perch (2007 year class) are expected to represent the largest fraction of biomass in MUs 1, 2, and 3. In MU4, age-3 yellow perch (2008 year class) are expected to represent the largest fraction of total biomass.

Estimates of yellow perch survival for age-3-and-older in 2009 were 48.7%, 44.2%, 62.3%, and 64.9% in MUs 1 to 4, respectively (Figure 1.13). In 2010, estimated survival rates of age-3-and-older were 45.5%, 44.7%, 58.1%, and 62.8% in Units 1 through 4 (Table 1.8 and Figure 1.13). Estimates of yellow perch survival in 2010 for age-2-and-older were 48.7% in MU1, 50.8% in MU2, 61.0% in MU3, and 64.7% in MU4 (Table 1.8 and Figure 1.13). Survival rates in 2010 compared to 2009 decreased in all management units.

Estimated exploitation rates in 2009 were 22.7%, 28.4%, 5.8%, and 2.6% in management units 1 to 4, respectively, for age-3-and-older. Exploitation rates for yellow perch age-3-and-older in 2010 were estimated at 26.8%, 27.8%, 11.0%, and 5.2%, for MUs 1 to 4, respectively (Figure 1.14). Estimates of yellow perch exploitation for age-2-and-older in 2010 were 22.8% in MU1,

20.1% in MU2, 7.4% in MU3, and 2.9% in MU4 (Table 1.8 and Figure 1.14). Exploitation rates of yellow perch in 2010 were a little higher for both age categories in all MUs except for age-3-and-older in MU2 which was relatively steady.

Charge 2: Harvest Strategy and RAH

Harvest Strategy Methodology

Fishing rates applied in 2011 are presented in Table 2.1, along with associated RAH values for each management unit. These fishing rates are similar to those used in 2009 and 2010. These interim harvest strategies were developed for a draft Yellow Perch Management Plan (YPMP), tested using an updated yellow perch simulation (see YPTG 2010 report).

Harvest Strategies and RAH Determination

Fishing rates for 2011 were based on updated interim harvest strategies from work on the YPMP and yellow perch simulation results (see Charge 3: Lake Erie Yellow Perch Management Plan). 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. These fishing rates were used to determine *min*, *mean*, and *max* RAH's for 2011 for each management unit (Tables 2.1 and 2.2).

In 2005, an exercise was completed to update the allocation area shares using geographical information system (GIS) mapping. In late 2008, the YPTG proposed that the line dividing MUs 3 and 4 be moved five minutes to the east in order to be consistent with Ontario's Eastern Basin Management Zone. The Lake Erie Committee (LEC) and Standing Technical Committee (STC) approved the change and new areas and allocation shares by jurisdiction were calculated (Figure 2.1). The change was implemented in 2009. These same allocation shares will be used in 2011. The allocation shares by management unit and jurisdiction are:

Allocation of TAC within Management Unit and Jurisdiction, 2011:

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

Charge 3: Lake Erie Yellow Perch Management Plan

With guidance from the STC, the YPTG was charged with supporting the development of a Lake Erie Yellow Perch Management Plan (YPMP) as a companion document to the Walleye Management Plan. In February 2009, a draft YPMP was submitted to Michigan State University's QFC for a technical review of the background material, exploitation strategies and associated yellow perch simulation. The QFC returned preliminary comments in March 2009; however, they indicated that additional time would be required to carry out a more thorough review of the harvest strategies and thresholds defined in the management plan.

During 2009 the YPTG implemented some of the suggestions put forth by the QFC, including changes to the yellow perch simulation and YPMP exploitation policies (see Charge 2: Harvest Strategy and RAH). Although the yellow perch simulation was used in 2010, full yellow perch exploitation strategies have not been completed for each management unit. The fishing rates currently applied for RAH in MUs 1, 2 and 3 are $\frac{1}{2}F_{msy}$. They are 0.67, 0.67, and 0.70 for management units 1–3, respectively. In MU4, a more conservative fishing rate of 0.30 was chosen. Emphasis has focused on maintenance level fishing rates while stock status thresholds and related exploitation policies have not been defined.

In 2010, a QFC - facilitated stakeholder workshop addressed yellow perch and walleye fishery concerns. Further collaboration with stakeholders in 2011 is expected to help shape the completion of the percid management plans.

Charge 4: Support QFC Modeling Efforts for Catch-Age Models

In 2005-2006, the YPTG was charged with reviewing the methodology of assigning weighting factors to data sources in the catch-at-age models. The current weighting methodology is described in Charge 1 of this report. The Lake Erie Walleye and Yellow Perch Task Groups continue to work with Drs. James Bence and Travis Brenden of Michigan State University's QFC and Yingming Zhao of OMNR to resolve the lambda weighting issues in the ADMB catch-at-age models. Previous external reviews by QFC modelers have shown that the current methods, while adequate, could be improved (STC 2007).

The QFC has appointed Ph.D. student, Aaron Berger, to investigate the file structure and dataset weighting of yellow perch and walleye models structure of the yellow perch and walleye models. Final results of this investigation are not expected for approximately two years; however, the task groups' modelers can incorporate valuable, substantial model improvements as they

become available upon presentation and discussion with the STC and LEC. At this time, the YPTG is continuing to utilize the population abundance estimation models which weigh datasets by the ratio of variance of observed log-catch to log-effort.

Acknowledgments

The task group members wish to thank the following people for providing support to the task group during the past year:

- Tim Bader, Ann Marie Gorman, and Jeff Tyson of the Ohio Department of Natural Resources, Division of Wildlife;
- Bob Sutherland and Dr. Yingming Zhao of the Ontario Ministry of Natural Resources;
- Dr. James Bence, Dr. Michael Jones, Aaron Berger and Travis Brenden of Michigan State University's Quantitative Fishery Center;
- Dr. Carol Stepien and Timothy Sullivan of the University of Toledo;
- Richard Kraus and Patrick Kocovsky of the U.S. Geological Survey, Biological Resources Division, Sandusky.

The YPTG report could not be completed without the contributions of all Lake Erie staff from the Michigan Department of Natural Resources, Ohio Division of Wildlife, Pennsylvania Fish and Boat Commission, New York Department of Environmental Conservation, US Geological Survey – Biological Resources Division, and the Ontario Ministry of Natural Resources. In addition, the YPTG expresses thanks to the Great Lakes Fishery Commission for their continued support.

Literature Cited

- Helser, T. E., J. P. Geaghan, and R. E. Condrey. 1998. Estimating gill net selectivity using nonlinear response surface regression. *Canadian Journal of Fisheries and Aquatic Sciences* 55: 1328-1337.
- Quinn, T. J. and R. B. Deriso. 1999. *Quantitative Fish Dynamics*. Oxford University Press.
- Standing Technical Committee. 2007. *Lambda Review Workshop Completion Report to the Lake Erie Committee of the Great Lakes Fishery Commission*. 8 pp.
- Yellow Perch Task Group (YPTG). 2004. *Report of the Yellow Perch Task Group, March 2004*. Presented to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. Ann Arbor, Michigan, USA.
- Yellow Perch Task Group (YPTG). 2005. *Report of the Yellow Perch Task Group, March 2005*. Presented to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. Ann Arbor, Michigan, USA.
- Yellow Perch Task Group (YPTG). 2009. *Report of the Yellow Perch Task Group, March 2010*. Presented to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. Ann Arbor, Michigan, USA.
- Yellow Perch Task Group (YPTG). 2010. *Report of the Yellow Perch Task Group, March 2010*. Presented to the Standing Technical Committee, Lake Erie Committee of the Great Lakes Fishery Commission. Ann Arbor, Michigan, USA.

Table 1.1. Lake Erie yellow perch harvest in pounds by management unit (Unit) and agency, 2000-2010.

	Year	Ontario*		Ohio		Michigan		Pennsylvania		New York		Total Harvest
		Harvest	%	Harvest	%	Harvest	%	Harvest	%	Harvest	%	
Unit 1	2000	980,323	47	1,038,650	50	67,010	3	--	--	--	--	2,085,983
	2001	813,066	45	915,641	51	70,910	4	--	--	--	--	1,799,617
	2002	1,454,105	50	1,316,553	45	147,065	5	--	--	--	--	2,917,723
	2003	1,179,667	44	1,406,385	53	84,878	3	--	--	--	--	2,670,930
	2004	1,698,761	59	1,090,669	38	94,732	3	--	--	--	--	2,884,162
	2005	1,513,890	60	965,231	38	49,485	2	--	--	--	--	2,528,606
	2006	1,325,464	54	1,055,378	43	62,854	3	--	--	--	--	2,443,696
	2007	727,678	41	982,677	55	62,815	4	--	--	--	--	1,773,170
	2008	580,050	56	409,705	39	47,934	5	--	--	--	--	1,037,689
	2009	853,137	61	463,564	33	87,319	6	--	--	--	--	1,404,020
2010	879,358	47	889,512	48	83,725	5	--	--	--	--	1,852,595	
Unit 2	2000	1,484,125	56	1,169,234	44	--	--	--	--	--	--	2,653,359
	2001	1,794,275	51	1,747,069	49	--	--	--	--	--	--	3,541,344
	2002	2,190,621	52	1,986,730	48	--	--	--	--	--	--	4,177,351
	2003	2,107,639	50	2,113,285	50	--	--	--	--	--	--	4,220,924
	2004	2,051,473	48	2,246,264	52	--	--	--	--	--	--	4,297,737
	2005	2,666,231	59	1,843,190	41	--	--	--	--	--	--	4,509,421
	2006	3,102,269	69	1,393,732	31	--	--	--	--	--	--	4,496,001
	2007	1,847,139	45	2,244,656	55	--	--	--	--	--	--	4,091,795
	2008	1,990,237	50	2,005,000	50	--	--	--	--	--	--	3,995,237
	2009	2,495,611	58	1,801,978	42	--	--	--	--	--	--	4,297,589
2010	1,888,876	56	1,457,823	44	--	--	--	--	--	--	3,346,699	
Unit 3	2000	771,646	62	443,250	36	--	--	32,613	3	--	--	1,247,509
	2001	999,450	64	464,811	30	--	--	91,211	6	--	--	1,555,472
	2002	1,192,691	60	640,104	32	--	--	140,821	7	--	--	1,973,616
	2003	1,667,133	72	481,558	21	--	--	177,516	8	--	--	2,326,207
	2004	1,453,419	62	659,447	28	--	--	244,063	10	--	--	2,356,929
	2005	1,771,800	75	457,593	19	--	--	142,028	6	--	--	2,371,421
	2006	3,451,499	90	271,144	7	--	--	106,260	3	--	--	3,828,903
	2007	2,997,101	84	391,285	11	--	--	193,065	5	--	--	3,581,451
	2008	2,200,168	74	629,366	21	--	--	155,014	5	--	--	2,984,548
	2009	2,266,727	74	597,214	20	--	--	190,742	6	--	--	3,054,683
2010	3,370,099	85	476,808	12	--	--	117,640	3	--	--	3,964,547	
Unit 4	2000	35,686	73	--	--	--	--	10,950	22	2,458	5	49,094
	2001	35,893	60	--	--	--	--	8,337	14	15,319	26	59,549
	2002	87,541	54	--	--	--	--	46,903	29	26,903	17	161,347
	2003	84,772	60	--	--	--	--	39,821	28	16,511	12	141,104
	2004	98,733	49	--	--	--	--	46,344	23	54,862	27	199,939
	2005	195,347	67	--	--	--	--	42,226	15	53,468	18	291,041
	2006	230,226	69	--	--	--	--	57,005	17	48,107	14	335,338
	2007	185,954	78	--	--	--	--	25,859	11	25,935	11	237,748
	2008	240,270	77	--	--	--	--	31,325	10	40,809	13	312,404
	2009	272,579	72	--	--	--	--	37,991	10	70,030	18	380,600
2010	467,612	89	--	--	--	--	19,989	4	37,730	7	525,331	
Lakewide Totals	2000	3,271,780	54	2,651,134	44	67,010	1	43,563	<1	2,458	<1	6,035,945
	2001	3,642,684	52	3,127,521	45	70,910	1	99,548	1	15,319	<1	6,955,982
	2002	4,924,958	53	3,943,387	43	147,065	2	187,724	2	26,903	<1	9,230,037
	2003	5,039,211	54	4,001,228	43	84,878	1	217,337	2	16,511	<1	9,359,165
	2004	5,302,386	54	3,996,380	41	94,732	1	290,407	3	54,862	<1	9,738,767
	2005	6,147,268	63	3,266,014	34	49,485	<1	184,254	2	53,468	<1	9,700,489
	2006	8,109,458	73	2,720,254	24	62,854	<1	163,265	1	48,107	<1	11,103,938
	2007	5,757,872	59	3,618,618	37	62,815	<1	218,924	2	25,935	<1	9,684,164
	2008	5,010,725	60	3,044,071	37	47,934	<1	186,339	2	40,809	<1	8,329,878
	2009	5,888,054	64	2,862,756	31	87,319	1	228,733	3	70,030	<1	9,136,892
2010	6,605,945	68	2,824,143	29	83,725	1	137,629	1	37,730	<1	9,689,172	

*processor weight (quota debit weight) to 2001; fisher/observer weight from 2002 to 2010 (negating ice allowance).

Table 1.2. Harvest, effort and harvest per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 1 (Western Basin) by agency and gear type, 2000-2010.

	Year	Unit 1				
		Michigan	Ohio		Ontario Gill Nets*	
		Sport	Trap Nets	Sport	Small Mesh	Large Mesh**
Harvest (pounds)	2000	67,010	240,541	798,109	980,323	--
	2001	70,910	179,234	736,407	711,745	101,321
	2002	147,065	337,829	978,724	1,359,637	94,468
	2003	84,879	250,456	1,155,929	1,151,358	28,309
	2004	94,732	289,136	801,533	1,637,488	61,273
	2005	49,485	357,182	608,049	1,402,523	111,082
	2006	62,854	235,852	819,526	1,264,370	61,094
	2007	62,815	200,818	781,859	671,536	56,142
	2008	47,934	0	409,705	484,409	49,378
	2009	87,319	0	463,564	728,012	125,024
	2010	83,725	195,674	693,838	815,170	64,188
Harvest (Metric) (tonnes)	2000	30	109	362	445	--
	2001	32	81	334	323	46
	2002	67	153	444	617	43
	2003	38	114	524	522	13
	2004	43	131	364	743	28
	2005	22	162	276	636	50
	2006	29	107	372	573	28
	2007	28	91	355	305	25
	2008	22	0	186	220	22
	2009	40	0	210	330	57
	2010	38	89	315	370	29
Effort (a)	2000	122,447	4,026	965,628	6,741	--
	2001	97,761	1,518	720,923	2,167	2,142
	2002	190,573	2,715	900,289	4,546	739
	2003	121,638	2,213	1,182,694	3,725	395
	2004	206,902	4,351	833,690	6,052	901
	2005	98,429	3,903	816,959	5,170	1,182
	2006	118,628	3,517	683,994	5,194	787
	2007	181,698	2,951	823,624	2,230	1,125
	2008	95,925	0	519,050	1,653	899
	2009	130,556	0	578,303	3,058	1,680
	2010	132,852	2,607	798,240	3,152	845
Harvest Rates (b)	2000	2.2	27.1	3.0	66.0	--
	2001	2.9	53.5	3.4	149.0	21.5
	2002	2.5	56.4	3.4	135.6	58.0
	2003	2.4	51.3	3.5	140.2	32.5
	2004	1.6	30.1	3.0	122.7	30.8
	2005	1.7	41.5	3.1	123.0	42.6
	2006	1.7	30.4	4.2	110.4	35.2
	2007	1.0	30.9	3.4	136.6	22.6
	2008	1.5	--	2.7	132.9	24.9
	2009	2.7	--	3.1	108.0	33.8
	2010	2.3	34.0	3.4	117.3	34.4

(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

(*) Ontario commercial trap netters harvested 46,263 pounds of yellow perch in MU1 in 2008.

(*) Ontario commercial trap netters harvested 70 pounds of yellow perch in MU1 in 2009.

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

Table 1.3. Harvest, effort and harvest per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 2 (western Central Basin) by agency and gear type, 2000-2010.

		Unit 2			
		Ohio		Ontario* Gill Nets	
	Year	Trap Nets	Sport	Small Mesh	Large Mesh**
Harvest (pounds)	2000	565,009	604,225	1,484,125	--
	2001	905,088	841,891	1,593,704	200,571
	2002	1,099,971	886,759	1,892,070	298,551
	2003	1,255,205	858,080	2,019,617	88,022
	2004	1,287,747	958,517	1,893,871	157,602
	2005	1,162,746	680,444	2,446,007	219,723
	2006	744,452	649,280	2,981,793	120,476
	2007	1,701,552	543,104	1,561,287	173,699
	2008	1,376,588	628,412	1,669,682	253,984
	2009	1,338,616	463,362	1,994,208	482,402
	2010	935,616	522,207	1,410,051	470,926
Harvest (Metric) (tonnes)	2000	256	274	673	--
	2001	410	382	723	91
	2002	499	402	858	135
	2003	569	389	916	40
	2004	584	435	859	71
	2005	527	309	1,109	100
	2006	338	294	1,352	55
	2007	772	246	708	79
	2008	624	285	757	115
	2009	607	210	904	219
	2010	424	237	639	214
Effort (a)	2000	5,272	601,712	6,266	--
	2001	4,747	594,741	3,445	4,975
	2002	7,675	658,799	4,786	3,209
	2003	10,214	632,813	5,311	1,555
	2004	12,023	659,454	4,929	2,787
	2005	9,103	784,942	9,716	2,173
	2006	7,544	499,412	11,692	1,925
	2007	9,158	498,843	2,966	2,826
	2008	3,983	450,060	3,124	2,629
	2009	6,317	417,660	5,545	4,241
	2010	6,701	502,507	3,783	3,905
Harvest Rates (b)	2000	48.6	2.9	107.4	--
	2001	86.5	3.2	209.9	18.3
	2002	65.0	3.1	179.3	42.1
	2003	55.7	3.3	172.5	25.7
	2004	48.6	3.7	174.3	25.6
	2005	57.9	2.8	114.2	45.9
	2006	44.8	3.7	115.7	28.4
	2007	84.3	2.8	238.7	27.9
	2008	156.7	3.5	242.4	43.8
	2009	96.1	3.0	163.1	51.6
	2010	63.3	3.2	169.0	54.7

(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

(*) Ontario commercial trawlers harvested 112,153 pounds of yellow perch in MU2 in 2007.

(*) Ontario commercial trawlers harvested 66,203 pounds of yellow perch in MU2 in 2008.

(*) Ontario commercial trawlers harvested 15,439 pounds of yellow perch in MU2 in 2009.

(*) Ontario commercial trawlers harvested 7,899 pounds of yellow perch in MU2 in 2010.

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

Table 1.4. Harvest, effort and harvest per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 3 (eastern Central Basin) by agency and gear type, 2000-2010.

		Unit 3					
		Ohio		Ontario* Gill Nets		Pennsylvania	
	Year	Trap Nets	Sport	Small Mesh	Large Mesh**	Trap Nets	Sport
Harvest (pounds)	2000	156,510	286,740	771,646	--	5,930	26,683
	2001	4,472	460,339	948,622	50,828	2,602	96,946
	2002	0	640,104	1,094,894	97,797	2,009	138,812
	2003	0	481,559	1,647,047	20,086	5,050	172,467
	2004	0	659,447	1,443,314	10,105	7,753	236,310
	2005	43,253	414,340	1,657,498	113,969	15,228	126,800
	2006	70,310	200,834	3,332,037	119,461	20,467	85,793
	2007	48,286	342,999	2,941,451	42,570	23,471	169,594
	2008	139,023	490,343	2,160,041	32,673	22,927	132,087
	2009	112,030	485,184	2,180,834	77,858	35,296	155,446
	2010	153,097	323,711	3,065,336	302,410	36,026	81,614
Harvest (Metric (tonnes)	2000	71	130	350	--	2.7	12
	2001	2.0	209	430	23	1.2	44
	2002	0	290	497	44	0.9	63
	2003	0	218	747	9.1	2.3	78
	2004	0	299	655	4.6	3.5	107
	2005	20	188	752	52	6.9	58
	2006	32	91	1,511	54	9.3	39
	2007	22	156	1,334	19	10.6	77
	2008	63	222	980	15	10.4	60
	2009	51	220	989	35	16.0	70
	2010	69	147	1,390	137	16.3	37
Effort (a)	2000	1,640	214,825	2,342	--	231	48,561
	2001	32	269,062	2,451	1,047	175	90,214
	2002	0	416,543	2,490	1,055	95	123,287
	2003	0	256,890	4,617	316	87	138,720
	2004	0	368,537	3,750	268	70	175,596
	2005	947	305,885	5,098	743	129	127,462
	2006	881	139,536	11,130	1,030	124	60,612
	2007	713	218,683	6,115	614	88	135,611
	2008	1,288	234,179	3,336	417	78	110,403
	2009	482	289,602	4,050	728	121	139,438
	2010	972	182,485	5,747	1,125	128	84,171
Harvest Rates (b)	2000	43.3	3.0	149.4	--	11.6	1.9
	2001	63.4	2.9	175.4	22.0	6.7	2.6
	2002	--	2.7	199.6	41.7	9.6	3.6
	2003	--	3.1	161.8	28.8	26.3	5.3
	2004	--	4.3	174.6	17.1	50.2	3.9
	2005	20.7	3.1	147.4	69.6	53.5	2.9
	2006	36.2	3.3	135.8	52.6	74.9	3.7
	2007	30.7	3.4	218.2	31.4	121.0	3.8
	2008	49.0	4.6	293.6	35.5	133.3	4.5
	2009	105.4	3.5	244.2	48.5	132.3	4.8
	2010	71.4	4.0	241.9	121.9	127.6	4.0

(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

(*) Ontario commercial trawlers harvested 13,080 pounds of yellow perch in MU3 in 2007.

(*) Ontario commercial trawlers harvested 7,454 pounds of yellow perch in MU3 in 2008.

(*) Ontario commercial trawlers harvested 8,035 pounds of yellow perch in MU3 in 2009.

(*) Ontario commercial trawlers harvested 2,353 pounds of yellow perch in MU3 in 2010.

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

Table 1.5. Harvest, effort and harvest per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 4 (Eastern Basin) by agency and gear type, 2000-2010.

		Unit 4					
		New York		Ontario* Gill Nets		Pennsylvania	
	Year	Trap Nets	Sport	Small Mesh	Large Mesh**	Trap Nets	Sport
Harvest (pounds)	2000	625	1,833	35,686	--	0	10,950
	2001	27	15,292	34,284	1,608	0	8,337
	2002	1,951	24,952	85,935	1,606	29	46,874
	2003	1,048	15,464	84,648	124	0	39,822
	2004	3,907	50,955	98,716	17	0	90,514
	2005	7,726	45,742	195,258	52	0	42,226
	2006	9,423	38,684	229,063	1,163	0	57,005
	2007	9,511	16,424	179,595	3,076	0	25,859
	2008	11,136	29,673	234,366	2,689	0	31,325
	2009	13,476	56,554	266,425	4,738	0	37,991
	2010	11,772	25,958	465,775	1,517	0	19,989
Harvest (Metric) (tonnes)	2000	0.3	0.8	16.2	--	0	5.0
	2001	0.01	6.9	15.5	0.73	0	3.8
	2002	0.9	11.3	39.0	0.70	0.01	21.3
	2003	0.5	7.0	38.4	0.06	0	18.1
	2004	1.8	23.1	44.8	0.01	0	41.0
	2005	3.5	20.7	88.6	0.02	0	19.2
	2006	4.3	17.5	103.9	0.53	0	25.9
	2007	4.3	7.4	81.4	1.40	0	11.7
	2008	5.1	13.5	106.3	1.22	0	14.2
	2009	6.1	25.6	120.8	2.15	0	17.2
	2010	5.3	11.8	211.2	0.69	0	9.1
Effort (a)	2000	44	2,606	314	--	0	21,146
	2001	39	22,950	128	28.0	0	12,451
	2002	89	44,270	224	28.0	9	61,734
	2003	91	33,162	373	21.0	0	32,525
	2004	44	73,056	355	3.2	0	62,639
	2005	179	58,667	782	7.8	0	70,921
	2006	208	46,174	1,007	31.8	0	47,274
	2007	144	29,999	550	62.1	0	31,545
	2008	137	34,511	569	69.2	0	27,041
	2009	215	58,829	718	50.9	0	58,475
	2010	287	35,526	1,227	21.7	0	23,248
Harvest Rates (b)	2000	6.4	0.20	51.5	--	--	1.7
	2001	0.3	1.65	121.5	26.0	--	1.5
	2002	9.9	1.13	174.0	25.0	1.5	2.4
	2003	5.2	0.76	102.9	2.9	--	1.9
	2004	40.3	1.14	126.1	2.4	--	1.7
	2005	19.6	1.23	113.2	3.0	--	1.8
	2006	20.5	1.36	103.2	16.6	--	2.9
	2007	30.0	0.97	148.1	22.5	--	1.5
	2008	36.9	1.68	186.8	17.6	--	6.4
	2009	28.4	1.77	168.3	42.2	--	3.2
	2010	18.6	1.31	172.1	31.7	--	2.2

(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

(*) Ontario commercial trawlers harvested 3,283 pounds of yellow perch in MU4 in 2007.

(*) Ontario commercial trawlers harvested 3,215 pounds of yellow perch in MU4 in 2008.

(*) Ontario commercial trawlers harvested 1,416 pounds of yellow perch in MU4 in 2009.

(*) Ontario commercial trawlers harvested 320 pounds of yellow perch in MU4 in 2010.

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

Table 1.6. Estimated 2010 Lake Erie yellow perch harvest by age and numbers of fish by gear and management unit (Unit).

Gear	Age	Unit 1		Unit 2		Unit 3		Unit 4		Lakewide	
		Number	%	Number	%	Number	%	Number	%	Number	%
Gill Nets	1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	2	70,544	2.5	179,821	3.4	31,503	0.3	9,871	0.9	291,738	1.6
	3	1,233,588	43.0	1,691,030	31.9	726,117	8.1	317,186	28.8	3,967,922	21.7
	4	826,618	28.8	1,199,374	22.6	2,416,781	26.8	391,586	35.6	4,834,359	26.4
	5	266,339	9.3	619,035	11.7	1,800,366	20.0	272,059	24.7	2,957,799	16.2
	6+	473,698	16.5	1,613,707	30.4	4,036,500	44.8	110,366	10.0	6,234,271	34.1
	Total	2,870,787	43.5	5,302,967	55.9	9,011,266	85.5	1,101,068	88.4	18,286,089	65.6
Trap Nets	1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	2	0	0.0	65,299	2.5	11,019	2.2	193	0.7	76,511	2.0
	3	132,754	20.7	515,072	19.8	95,916	19.1	1,545	5.3	745,287	19.7
	4	102,859	16.0	480,099	18.4	97,598	19.4	5,214	18.0	685,770	18.2
	5	165,182	25.8	619,605	23.8	120,227	23.9	7,531	26.0	912,546	24.2
	6+	240,173	37.5	924,449	35.5	177,348	35.3	14,483	50.0	1,356,453	35.9
	Total	640,968	9.7	2,604,524	27.4	502,108	4.8	28,967	2.3	3,776,567	13.5
Sport	1	3,218	0.1	4,973	0.3	0	0.0	0	0.0	8,191	0.1
	2	423,704	13.7	188,470	11.9	61,975	6.0	8,229	7.1	682,378	11.7
	3	2,035,290	65.8	818,719	51.7	381,168	37.2	29,410	25.5	3,264,586	56.1
	4	260,695	8.4	185,973	11.7	198,511	19.4	39,573	34.4	684,753	11.8
	5	126,792	4.1	136,195	8.6	102,330	10.0	15,411	13.4	380,728	6.5
	6+	245,045	7.9	248,603	15.7	280,743	27.4	22,521	19.6	796,912	13.7
	Total	3,094,744	46.8	1,582,933	16.7	1,024,726	9.7	115,144	9.2	5,817,548	20.9
All Gear	1	3,218	0.0	4,973	0.1	0	0.0	0	0.0	8,191	0.0
	2	494,248	7.5	433,590	4.6	104,497	1.0	18,293	1.5	1,050,627	3.8
	3	3,401,632	51.5	3,024,821	31.9	1,203,201	11.4	348,141	28.0	7,977,795	28.6
	4	1,190,173	18.0	1,865,446	19.7	2,712,890	25.7	436,373	35.0	6,204,882	22.3
	5	558,313	8.5	1,374,835	14.5	2,022,923	19.2	295,001	23.7	4,251,073	15.2
	6+	958,916	14.5	2,786,759	29.4	4,494,590	42.7	147,370	11.8	8,387,636	30.1
	Total	6,606,499	23.7	9,490,424	34.0	10,538,101	37.8	1,245,179	4.5	27,880,203	100.0

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

Table 1.7. Yellow perch stock size (millions of fish) in each Lake Erie management unit. Abundance in the years 1990 to 2010 are estimated by ADMB catch-age analysis. The 2011 population estimates use age-2 yellow perch estimates derived from regressions of ADMB age-2 abundance values against YOY and yearling trawl index values.

Age	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
Unit 1																							
2	3.694	10.450	14.032	4.516	10.189	22.864	26.108	21.182	41.306	10.266	32.547	31.896	8.228	39.114	3.129	53.487	1.863	9.458	9.919	21.598	4.419	8.990	
3	1.327	1.950	5.513	7.818	1.823	6.212	13.954	15.573	13.184	25.487	6.558	20.704	20.559	5.280	24.648	1.994	33.201	1.199	5.696	6.132	13.598	2.767	
4	5.316	0.508	0.617	1.998	2.123	0.821	2.817	6.191	7.447	6.760	14.073	3.618	12.275	10.831	2.937	11.647	0.996	13.398	0.656	3.018	3.127	6.553	
5	2.090	1.523	0.120	0.142	0.326	0.508	0.227	0.759	1.943	2.755	3.076	6.938	1.951	5.077	4.849	1.096	4.193	0.401	5.348	0.355	1.430	1.271	
6+	1.513	0.668	0.321	0.073	0.027	0.081	0.174	0.103	0.185	0.490	1.225	1.898	4.555	2.336	3.051	2.325	1.004	1.568	0.752	3.021	1.549	1.147	
2 and Older	13.939	15.099	20.604	14.546	14.488	30.487	43.280	43.808	64.065	45.759	57.479	65.054	47.568	62.637	38.613	70.549	41.256	26.025	22.371	34.124	24.123	20.729	
3 and Older	10.246	4.649	6.572	10.030	4.298	7.622	17.172	22.626	22.759	35.493	24.933	33.158	39.340	23.524	35.484	17.062	39.393	16.567	12.452	12.526	19.704	11.739	
Unit 2																							
2	5.883	16.440	22.788	7.231	12.578	13.744	27.786	15.844	59.984	14.064	48.875	38.982	9.547	79.039	5.309	170.574	4.823	18.158	14.712	22.598	15.535	15.487	
3	1.535	2.436	6.547	10.989	3.385	7.212	7.558	13.349	8.382	31.579	8.698	29.400	22.857	5.958	46.867	3.442	109.286	3.167	11.778	9.650	14.329	9.680	
4	8.105	0.564	0.787	2.373	4.119	1.225	2.595	2.989	4.599	3.607	17.556	4.766	16.408	11.861	3.254	24.070	1.963	60.845	1.871	6.950	5.305	7.354	
5	2.430	2.139	0.118	0.215	0.644	0.876	0.234	0.564	0.589	0.991	1.744	8.252	2.260	6.998	4.703	1.454	10.242	1.117	28.633	0.930	2.856	2.146	
6+	2.050	0.974	0.483	0.166	0.091	0.156	0.199	0.094	0.086	0.102	0.445	0.994	4.384	2.820	3.941	3.671	2.197	5.555	3.101	15.886	6.624	3.516	
2 and Older	20.003	22.554	30.723	20.974	20.819	23.213	38.372	32.841	73.640	50.343	77.318	82.394	55.456	106.676	64.074	203.212	128.511	88.843	60.096	56.014	44.649	38.184	
3 and Older	14.120	6.114	7.935	13.743	8.240	9.469	10.586	16.996	13.656	36.279	28.443	43.412	45.909	27.637	58.766	32.638	123.688	70.685	45.384	33.416	29.114	22.696	
Unit 3																							
2	3.851	7.796	5.426	2.998	6.313	7.183	13.508	9.688	36.837	12.460	45.283	24.990	7.241	38.091	3.608	119.023	4.464	23.845	28.243	33.969	30.406	2.099	
3	1.537	2.351	3.505	2.371	1.502	3.638	4.436	8.606	5.729	23.768	8.047	29.121	15.968	4.639	24.713	2.365	78.943	2.954	14.655	18.726	22.660	19.998	
4	3.802	0.735	0.823	1.214	1.022	0.796	2.141	2.625	3.871	3.404	15.102	5.049	18.392	9.908	2.872	15.182	1.445	43.008	1.756	9.051	12.104	14.050	
5	1.153	1.374	0.290	0.239	0.422	0.342	0.411	1.119	1.035	2.107	2.110	9.048	3.105	10.895	5.785	1.673	8.570	0.770	23.257	1.020	5.501	6.811	
6+	4.242	1.710	0.804	0.339	0.206	0.234	0.303	0.368	0.493	0.758	1.725	2.266	6.896	5.948	9.838	9.051	6.101	6.194	3.699	15.669	10.094	8.422	
2 and Older	14.585	13.966	10.848	7.161	9.464	12.193	20.799	22.406	47.965	42.497	72.267	70.475	51.603	69.482	46.816	147.293	99.524	76.770	71.609	78.437	80.764	51.380	
3 and Older	10.734	6.171	5.422	4.163	3.151	5.010	7.291	12.718	11.128	30.038	26.984	45.485	44.362	31.390	43.208	28.270	95.060	52.925	43.366	44.467	50.358	49.280	
Unit 4																							
2	0.572	0.412	0.105	0.278	0.146	1.259	0.784	0.340	4.165	1.591	13.390	2.990	2.499	7.732	1.395	10.285	0.780	8.970	9.980	9.492	15.172	0.389	
3	0.749	0.370	0.263	0.070	0.177	0.094	0.832	0.518	0.224	2.790	1.056	8.938	2.004	1.674	5.168	0.926	6.815	0.520	5.943	6.639	6.359	10.099	
4	1.033	0.377	0.167	0.170	0.031	0.087	0.056	0.495	0.305	0.148	1.782	0.696	5.968	1.326	1.096	3.345	0.583	4.043	0.338	3.861	4.376	4.083	
5	0.447	0.400	0.118	0.096	0.050	0.011	0.045	0.030	0.261	0.193	0.092	1.157	0.463	3.867	0.846	0.691	2.050	0.334	2.582	0.216	2.489	2.774	
6+	1.047	0.576	0.301	0.240	0.098	0.053	0.032	0.040	0.036	0.180	0.228	0.206	0.903	0.862	2.962	2.343	1.816	2.111	1.560	2.610	1.788	2.625	
2 and Older	3.848	2.135	0.955	0.855	0.503	1.505	1.751	1.423	4.990	4.901	16.547	13.988	11.837	15.461	11.468	17.590	12.044	15.977	20.403	22.818	30.184	19.921	
3 and Older	3.277	1.723	0.849	0.576	0.357	0.246	0.966	1.083	0.825	3.311	3.157	10.998	9.338	7.729	10.072	7.305	11.264	7.008	10.424	13.326	15.012	19.531	

Table 1.8. Projection of the 2011 Lake Erie yellow perch population. Stock size estimates are derived from ADMB and age 2 estimates for 2011 are derived from regressions of ADMB age-2 abundance against YOY and yearling trawl indices (see Appendix A). Standard errors are produced from ADMB catch-age and regression analyses.

		2010 Parameters										Rate Functions					2011 Parameters					Stock Biomass								
		Stock Size (numbers)					Mortality Rates					Survival Rate					Stock Size (numbers)					3-yr Mean Weight in		millions kg		millions lbs.				
Age		Mean	Std. Dev.	Min.	Max.	(Z)	(F)	(A)	(u)	(S)	(Z)	(F)	(A)	(u)	(S)	Age	Mean	Min.	Max.	Mean	Min.	Max.	Pop.n.	(kg)	2010	2011	2010	2011	2010	2011
Unit 1	2	4.419	2.708	1.711	7.127	0.068	0.468	0.374	0.054	0.626	0.468	0.374	0.054	0.626	0.626	2	8.990	7.100	10.879	8.990	7.100	10.879	0.073	0.073	0.283	0.656	0.283	0.656	1.447	1.447
	3	13.598	6.222	7.376	19.821	0.330	0.730	0.518	0.234	0.482	0.330	0.518	0.234	0.482	0.482	3	2.767	1.071	4.463	2.767	1.071	4.463	0.128	0.128	1.441	0.354	1.441	0.354	0.781	0.781
	4	3.127	1.281	1.846	4.408	0.500	0.900	0.593	0.330	0.407	0.500	0.593	0.330	0.407	0.407	4	6.553	3.554	9.552	6.553	3.554	9.552	0.161	0.161	0.488	1.055	0.488	1.055	2.326	2.326
	5	1.430	0.570	0.859	2.000	0.531	0.931	0.606	0.346	0.394	0.531	0.606	0.346	0.394	0.394	5	1.271	0.751	1.792	1.271	0.751	1.792	0.214	0.214	0.279	0.272	0.279	0.272	0.600	0.600
	6+	1.549	0.631	0.918	2.181	0.576	0.976	0.623	0.368	0.377	0.576	0.623	0.368	0.377	0.377	6+	1.147	0.685	1.610	1.147	0.685	1.610	0.238	0.238	0.367	0.273	0.367	0.273	0.602	0.602
	Total (3+)	24.123	10.999	12.710	35.536	0.320	0.720	0.513	0.228	0.487	0.320	0.513	0.228	0.487	0.487	Total (3+)	20.729	13.161	28.296	20.729	13.161	28.296	0.126	0.126	2.858	2.611	2.858	2.611	5.756	5.756
		19.704	8.295	10.999	28.409	0.387	0.787	0.545	0.268	0.455	0.387	0.545	0.268	0.455	0.455		11.739	6.061	17.417	11.739	6.061	17.417	0.166	0.166	2.575	1.954	2.575	1.954	4.309	4.309
Unit 2	2	15.535	8.295	7.240	23.830	0.073	0.473	0.377	0.058	0.623	0.473	0.377	0.058	0.623	0.623	2	15.487	11.630	19.344	15.487	11.630	19.344	0.074	0.074	1.150	1.146	1.150	1.146	2.527	2.527
	3	14.329	5.585	8.744	19.915	0.267	0.667	0.487	0.195	0.513	0.267	0.487	0.195	0.513	0.513	3	9.680	4.511	14.849	9.680	4.511	14.849	0.134	0.134	1.906	1.297	1.906	1.297	2.860	2.860
	4	5.305	1.789	3.516	7.094	0.505	0.905	0.595	0.332	0.405	0.505	0.595	0.332	0.405	0.405	4	7.354	4.488	10.221	7.354	4.488	10.221	0.179	0.179	0.865	1.316	0.865	1.316	2.903	2.903
	5	2.856	0.984	1.872	3.841	0.569	0.969	0.621	0.364	0.379	0.569	0.621	0.364	0.379	0.379	5	2.146	1.422	2.870	2.146	1.422	2.870	0.211	0.211	0.697	0.453	0.697	0.453	0.998	0.998
	6+	6.624	2.475	4.149	9.099	0.602	1.002	0.633	0.380	0.367	0.602	0.633	0.380	0.367	0.367	6+	3.516	2.233	4.798	3.516	2.233	4.798	0.255	0.255	1.928	0.897	1.928	0.897	1.977	1.977
	Total (3+)	44.649	18.280	25.520	63.778	0.277	0.677	0.492	0.201	0.508	0.277	0.492	0.201	0.508	0.508	Total (3+)	38.184	24.285	52.082	38.184	24.285	52.082	0.134	0.134	6.545	5.109	6.545	5.109	11.265	11.265
		29.114	16.182	14.224	46.588	0.019	0.419	0.342	0.016	0.447	0.019	0.342	0.016	0.447	0.447		22.696	12.655	32.738	22.696	12.655	32.738	0.175	0.175	5.395	3.963	5.395	3.963	8.738	8.738
Unit 3	2	30.406	16.182	14.224	46.588	0.019	0.419	0.342	0.016	0.658	0.419	0.342	0.016	0.658	0.658	2	2.099	1.402	2.796	2.099	1.402	2.796	0.058	0.058	1.794	0.122	1.794	0.122	0.268	0.268
	3	22.660	9.082	13.578	31.742	0.078	0.478	0.380	0.062	0.620	0.478	0.380	0.062	0.620	0.620	3	19.998	9.355	30.641	19.998	9.355	30.641	0.115	0.115	2.447	2.300	2.447	2.300	5.071	5.071
	4	12.104	4.217	7.887	16.321	0.175	0.575	0.437	0.133	0.563	0.175	0.437	0.133	0.563	0.563	4	14.050	8.419	19.681	14.050	8.419	19.681	0.164	0.164	1.707	2.304	1.707	2.304	5.081	5.081
	5	5.501	1.837	3.664	7.338	0.209	0.609	0.456	0.157	0.544	0.209	0.456	0.157	0.544	0.544	5	6.811	4.438	9.184	6.811	4.438	9.184	0.210	0.210	1.177	1.430	1.177	1.430	3.154	3.154
	6+	10.094	3.413	6.681	13.506	0.220	0.620	0.462	0.164	0.538	0.220	0.462	0.164	0.538	0.538	6+	8.422	5.587	11.257	8.422	5.587	11.257	0.274	0.274	2.846	2.308	2.846	2.308	5.088	5.088
	Total (3+)	80.764	31.810	46.034	115.495	0.094	0.494	0.390	0.074	0.610	0.494	0.390	0.074	0.610	0.610	Total (3+)	51.380	29.200	73.559	51.380	29.200	73.559	0.165	0.165	9.971	8.464	9.971	8.464	18.662	18.662
		50.358	10.553	4.619	25.725	0.007	0.407	0.334	0.006	0.581	0.007	0.334	0.006	0.581	0.581		49.280	27.798	70.762	49.280	27.798	70.762	0.169	0.169	8.178	8.342	8.178	8.342	18.394	18.394
Unit 4	2	15.172	10.553	4.619	25.725	0.007	0.407	0.334	0.006	0.666	0.407	0.334	0.006	0.666	0.666	2	0.389	0.283	0.496	0.389	0.283	0.496	0.093	0.093	1.305	0.036	1.305	0.036	0.080	0.080
	3	6.359	3.582	2.777	9.941	0.043	0.443	0.358	0.035	0.642	0.443	0.358	0.035	0.642	0.642	3	10.099	3.074	17.123	10.099	3.074	17.123	0.178	0.178	1.056	1.798	1.056	1.798	3.964	3.964
	4	4.376	2.261	2.115	6.637	0.074	0.474	0.377	0.059	0.623	0.074	0.377	0.059	0.623	0.623	4	4.083	1.783	6.383	4.083	1.783	6.383	0.240	0.240	1.103	0.980	1.103	0.980	2.161	2.161
	5	2.489	1.250	1.239	3.739	0.086	0.486	0.385	0.068	0.615	0.086	0.385	0.068	0.615	0.615	5	2.724	1.317	4.131	2.724	1.317	4.131	0.281	0.281	0.787	0.765	0.787	0.765	1.688	1.688
	6+	1.788	0.920	0.868	2.708	0.091	0.491	0.388	0.072	0.612	0.091	0.388	0.072	0.612	0.612	6+	2.625	1.293	3.957	2.625	1.293	3.957	0.315	0.315	0.576	0.827	0.576	0.827	1.824	1.824
	Total (3+)	30.184	15.012	11.618	48.750	0.035	0.435	0.353	0.029	0.647	0.435	0.353	0.029	0.647	0.647	Total (3+)	19.921	7.751	32.091	19.921	7.751	32.091	0.221	0.221	4.825	4.406	4.825	4.406	9.716	9.716
		15.012	6.999	6.999	23.025	0.065	0.465	0.372	0.052	0.628	0.065	0.372	0.052	0.628	0.628		19.531	7.468	31.595	19.531	7.468	31.595	0.224	0.224	3.521	4.370	3.521	4.370	9.636	9.636

Table 2.1. Estimated harvest of Lake Erie yellow perch for 2011 using the proposed fishing rate and selectivity-at-age from combined fishing gears.

Unit	Age	2011 Stock Size (numbers)			Exploitation Rate			2011 Catch (millions of fish)			3-yr Mean Harvest (kg)			2011 Harvest Range Catch (millions of kg)			2011 Harvest Range Catch (millions of lbs)					
		Mean	Min.	Max.	F	s(age)	F(age)	(u)	Mean	Min.	Max.	Weight in Harvest	Mean	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	
Unit 1	2	8.990	7.100	10.879	0.670	0.156	0.105	0.082	0.738	0.583	0.893	0.099	0.073	0.058	0.089	0.162	0.128	0.196				
	3	2.767	1.071	4.463	0.670	0.589	0.395	0.272	0.753	0.292	1.215	0.129	0.097	0.038	0.156	0.214	0.083	0.345				
	4	6.553	3.554	9.552	0.670	0.767	0.514	0.337	2.207	1.197	3.217	0.151	0.333	0.181	0.485	0.734	0.398	1.070				
	5	1.271	0.751	1.792	0.670	0.832	0.557	0.359	0.456	0.269	0.643	0.163	0.074	0.044	0.105	0.164	0.097	0.231				
	6+	1.147	0.685	1.610	0.670	0.854	0.572	0.366	0.420	0.250	0.589	0.177	0.074	0.044	0.104	0.164	0.098	0.230				
	Total (3+)	20.729	13.161	28.296				0.221	4.575	2.592	6.558	0.142	0.652	0.364	0.939	1.437	0.803	2.071				
		11.739	6.061	17.417			0.327	3.837	2.009	5.665	0.151	0.578	0.306	0.850	1.275	0.675	1.875					
Unit 2	2	15.487	11.630	19.344	0.670	0.111	0.074	0.059	0.917	0.689	1.146	0.126	0.116	0.087	0.144	0.255	0.191	0.318				
	3	9.680	4.511	14.849	0.670	0.422	0.283	0.205	1.983	0.924	3.043	0.142	0.282	0.131	0.432	0.621	0.289	0.953				
	4	7.354	4.488	10.221	0.670	0.790	0.529	0.345	2.535	1.547	3.523	0.151	0.383	0.234	0.532	0.844	0.515	1.173				
	5	2.146	1.422	2.870	0.670	0.831	0.557	0.358	0.769	0.510	1.029	0.162	0.125	0.083	0.167	0.275	0.182	0.367				
	6+	3.516	2.233	4.798	0.670	0.856	0.574	0.367	1.289	0.819	1.759	0.187	0.241	0.153	0.329	0.531	0.338	0.725				
	Total (3+)	38.184	24.285	52.082				0.196	7.493	4.488	10.499	0.153	1.146	0.687	1.604	2.526	1.515	3.537				
		22.696	12.655	32.738			0.290	6.576	3.800	9.353	0.157	1.030	0.601	1.460	2.271	1.324	3.218					
Unit 3	2	2.099	1.402	2.796	0.700	0.049	0.034	0.028	0.058	0.039	0.078	0.116	0.007	0.005	0.009	0.015	0.010	0.020				
	3	19.998	9.355	30.641	0.700	0.333	0.233	0.173	3.454	1.616	5.292	0.142	0.490	0.229	0.751	1.081	0.506	1.657				
	4	14.050	8.419	19.681	0.700	0.755	0.529	0.344	4.837	2.898	6.776	0.156	0.755	0.452	1.057	1.664	0.997	2.331				
	5	6.811	4.438	9.184	0.700	0.794	0.556	0.358	2.438	1.588	3.287	0.168	0.410	0.267	0.552	0.903	0.588	1.218				
	6+	8.422	5.587	11.257	0.700	0.807	0.565	0.362	3.052	2.024	4.079	0.198	0.604	0.401	0.808	1.332	0.884	1.781				
	Total (3+)	51.380	29.200	73.559				0.269	13.839	8.166	19.512	0.164	2.266	1.354	3.177	4.996	2.985	7.006				
		49.280	27.798	70.762			0.280	13.780	8.127	19.434	0.164	2.259	1.349	3.168	4.981	2.975	6.986					
Unit 4	2	0.389	0.283	0.496	0.300	0.051	0.015	0.013	0.005	0.004	0.006	0.123	0.001	0.000	0.001	0.001	0.001	0.002				
	3	10.099	3.074	17.123	0.300	0.346	0.104	0.082	0.823	0.251	1.396	0.166	0.137	0.042	0.232	0.301	0.092	0.511				
	4	4.083	1.783	6.383	0.300	0.557	0.167	0.128	0.521	0.227	0.814	0.187	0.097	0.043	0.152	0.215	0.094	0.336				
	5	2.724	1.317	4.131	0.300	0.789	0.237	0.175	0.477	0.231	0.723	0.197	0.094	0.045	0.142	0.207	0.100	0.314				
	6+	2.625	1.293	3.957	0.300	0.792	0.238	0.176	0.461	0.227	0.695	0.224	0.103	0.051	0.156	0.228	0.112	0.343				
	Total (3+)	19.921	7.751	32.091				0.115	2.287	0.939	3.635	0.189	0.432	0.181	0.683	0.952	0.399	1.506				
		19.531	7.468	31.595			0.117	2.282	0.936	3.629	0.189	0.431	0.180	0.682	0.951	0.398	1.504					

Table 2.2. Lake Erie yellow perch fishing rates and the Recommended Allowable Harvest (RAH; in millions of lbs) for 2011 by Management Unit (Unit).

Unit	Fishing Rate	Recommended Allowable Harvest (millions lbs.)		
		MIN	MEAN	MAX
1	0.670	0.803	1.437	2.071
2	0.670	1.515	2.526	3.537
3	0.700	2.985	4.996	7.006
4	0.300	0.399	0.952	1.506
Total		5.702	9.911	14.120

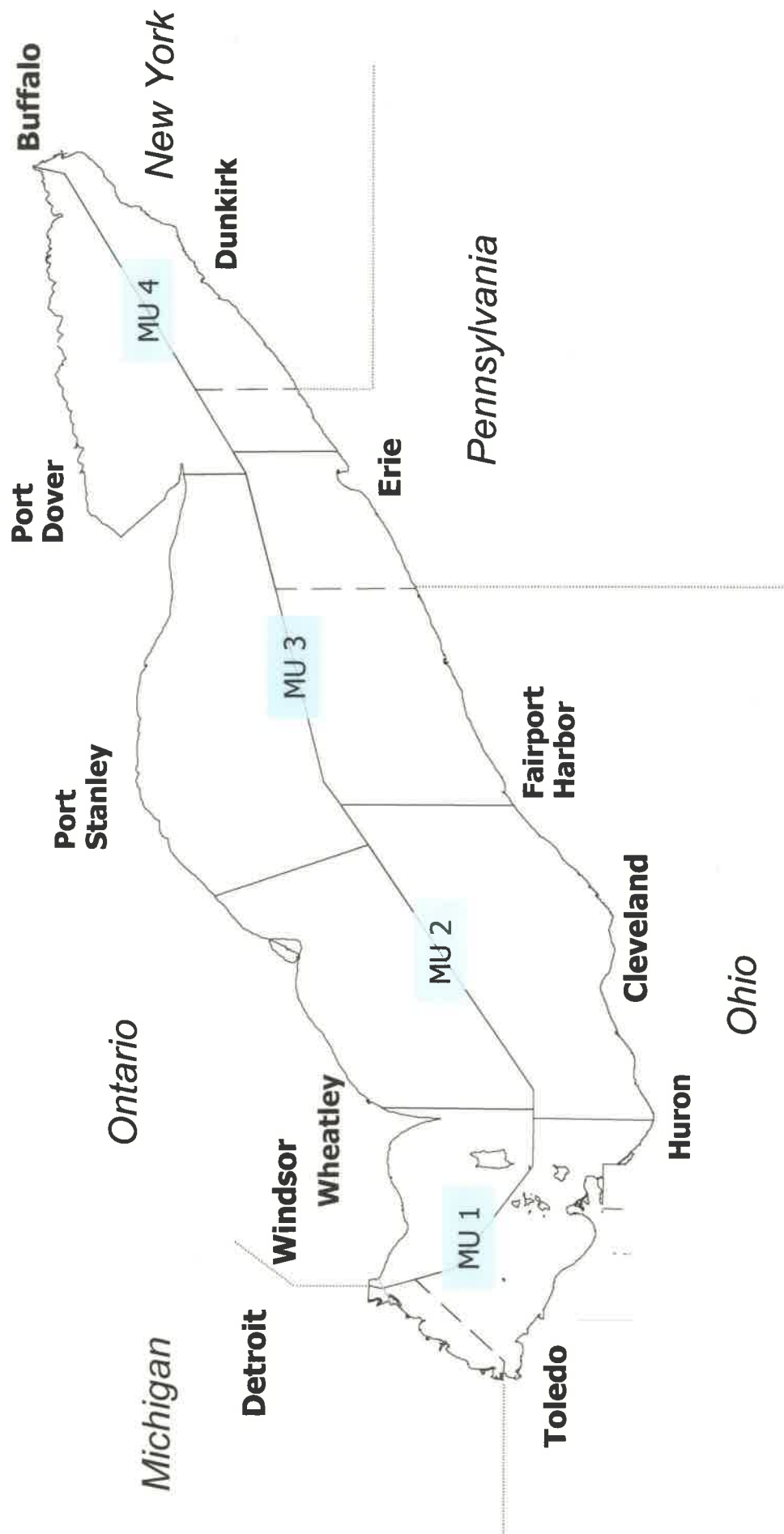


Figure 1.1.1. Yellow Perch Management Units (MUs) of Lake Erie. For illustrative purposes only, this map should not be used for quota determination or border delineation.

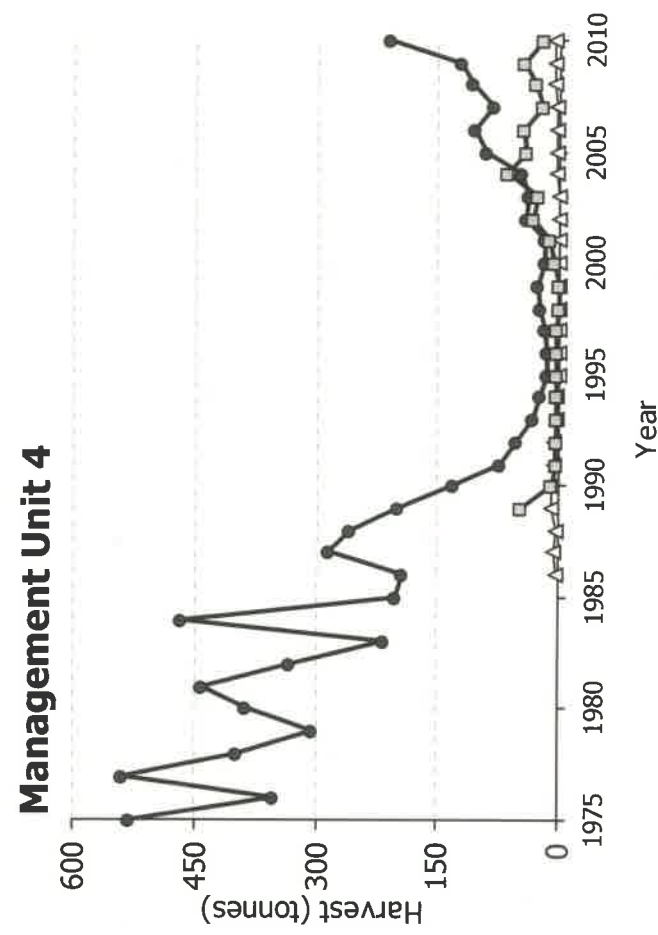
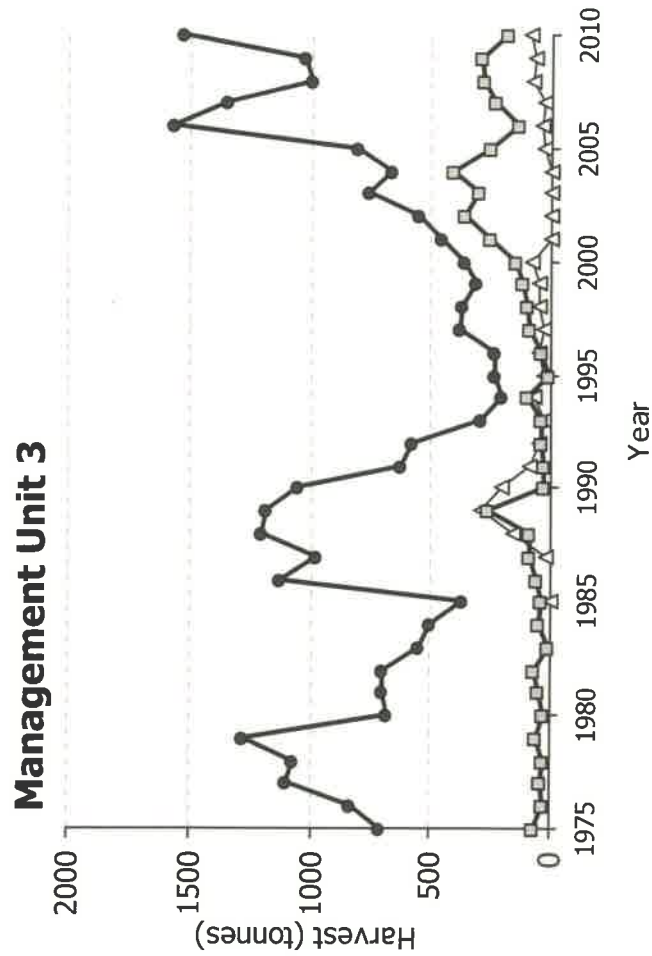
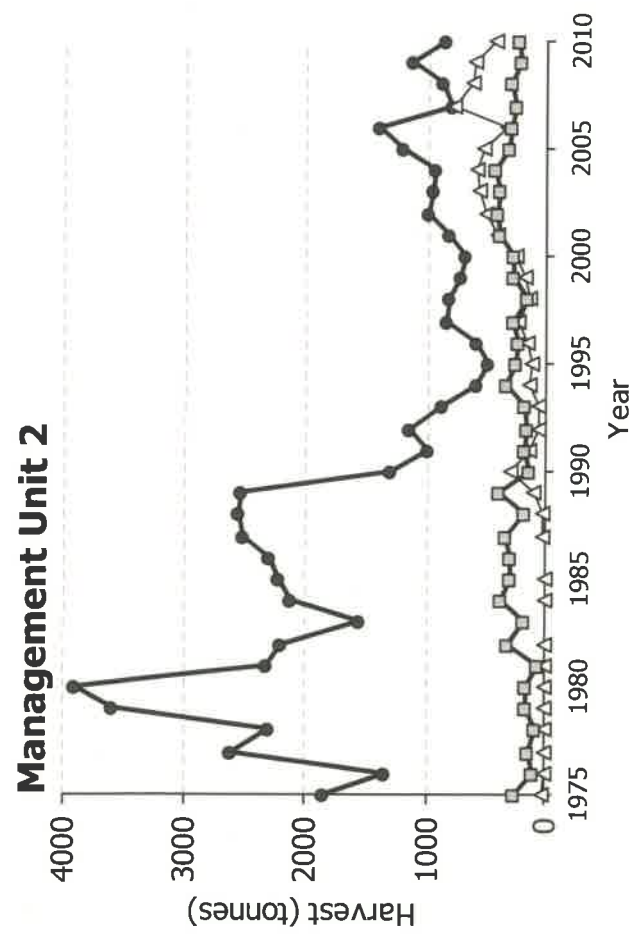
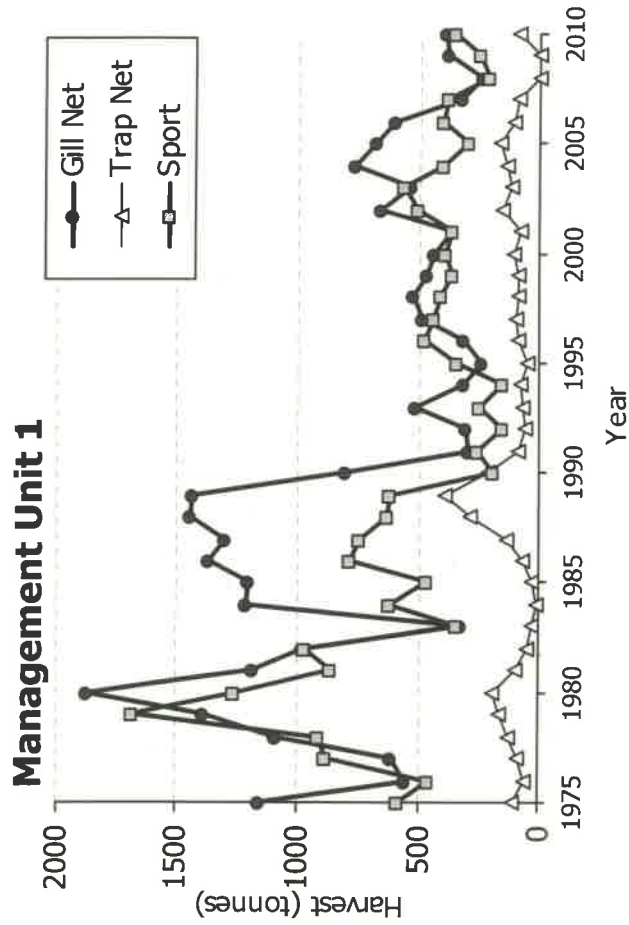


Figure 1.2. Lake Erie yellow perch harvest (metric tonnes) by management unit and gear type.

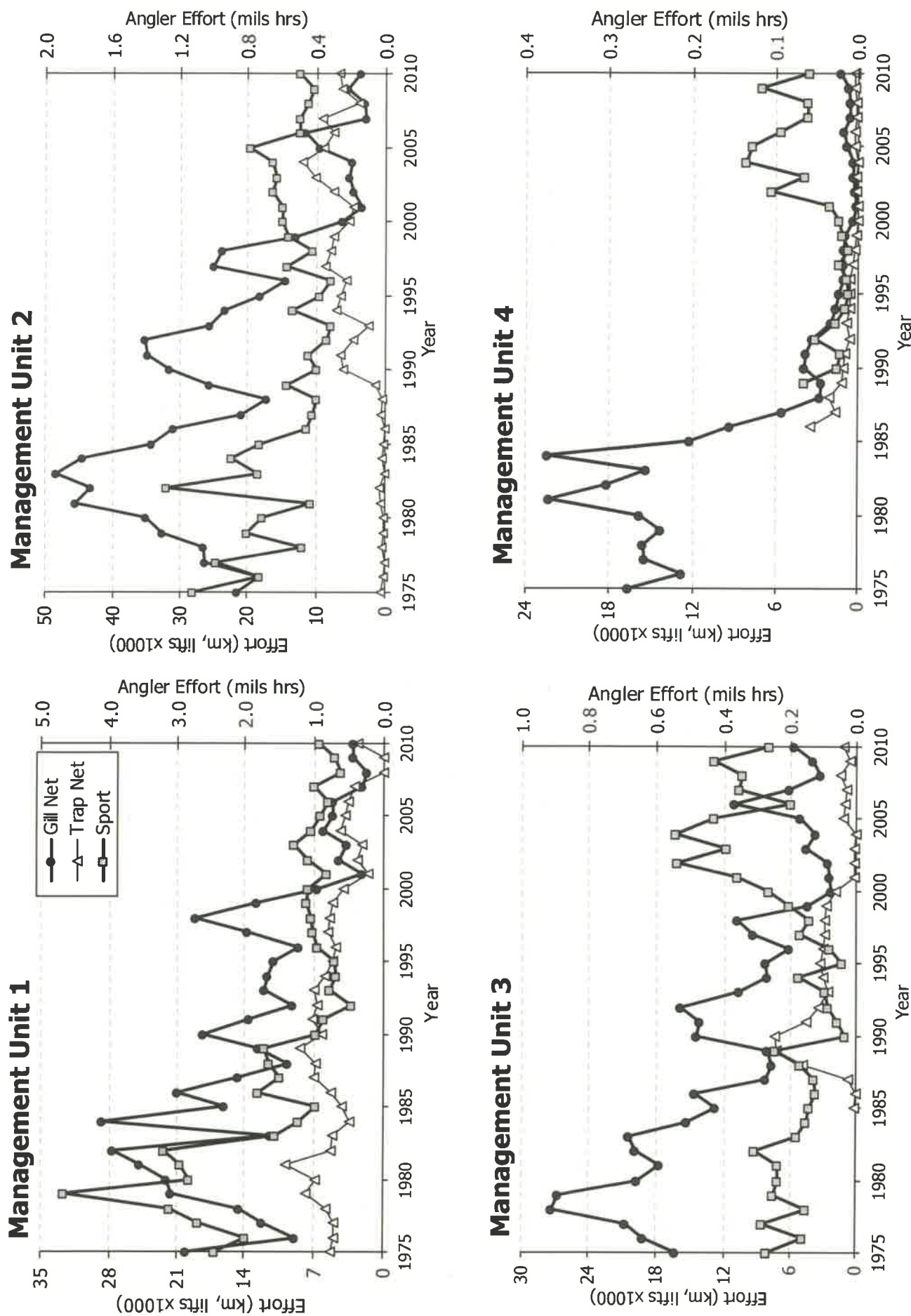


Figure 1.3. Lake Erie yellow perch effort by management unit and gear type. Note: gill net effort presented is targeted effort with small mesh (< 3") only.

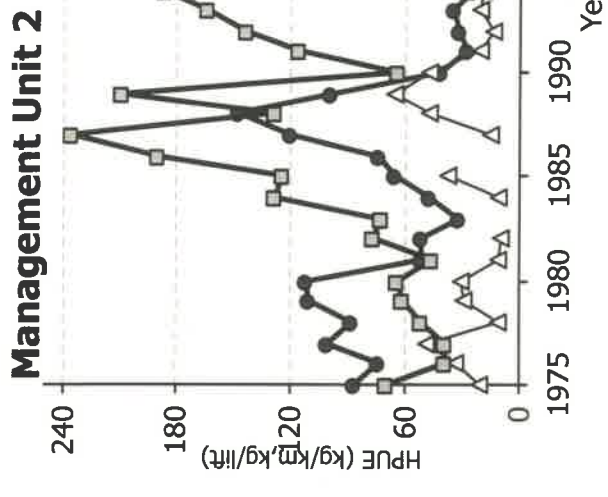
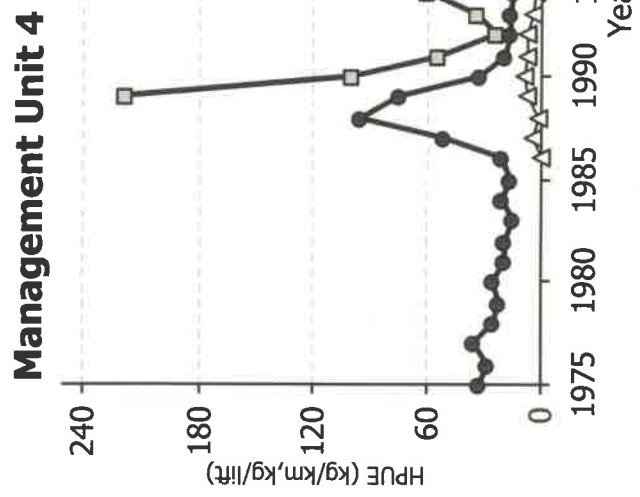
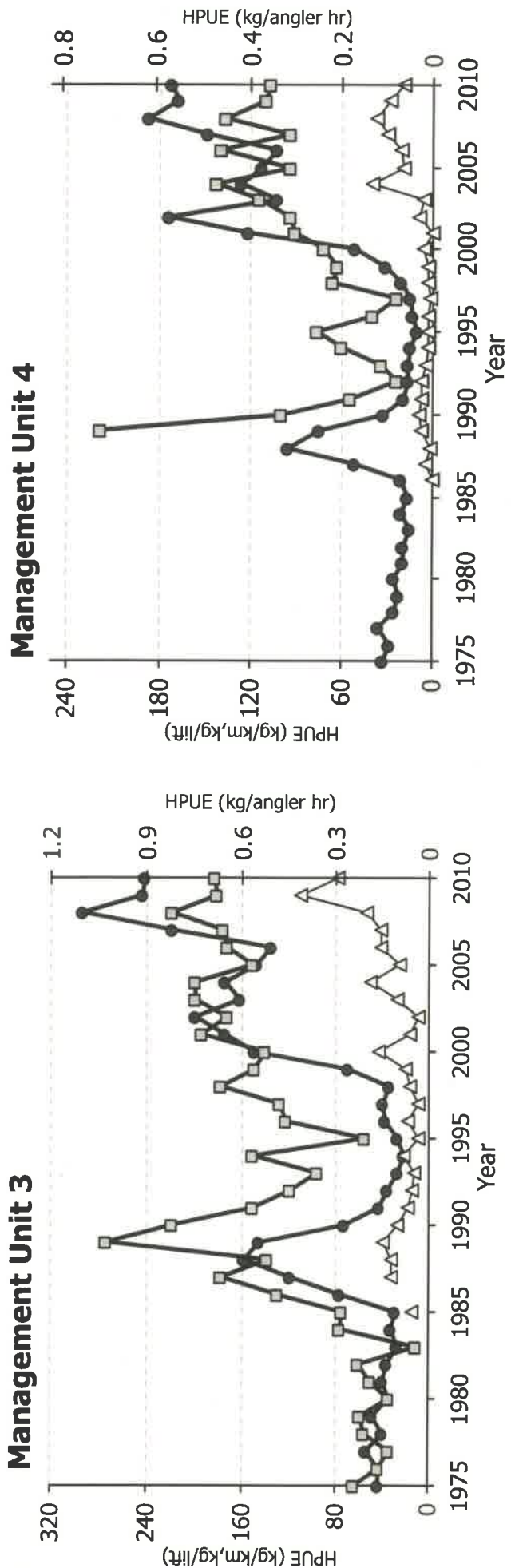
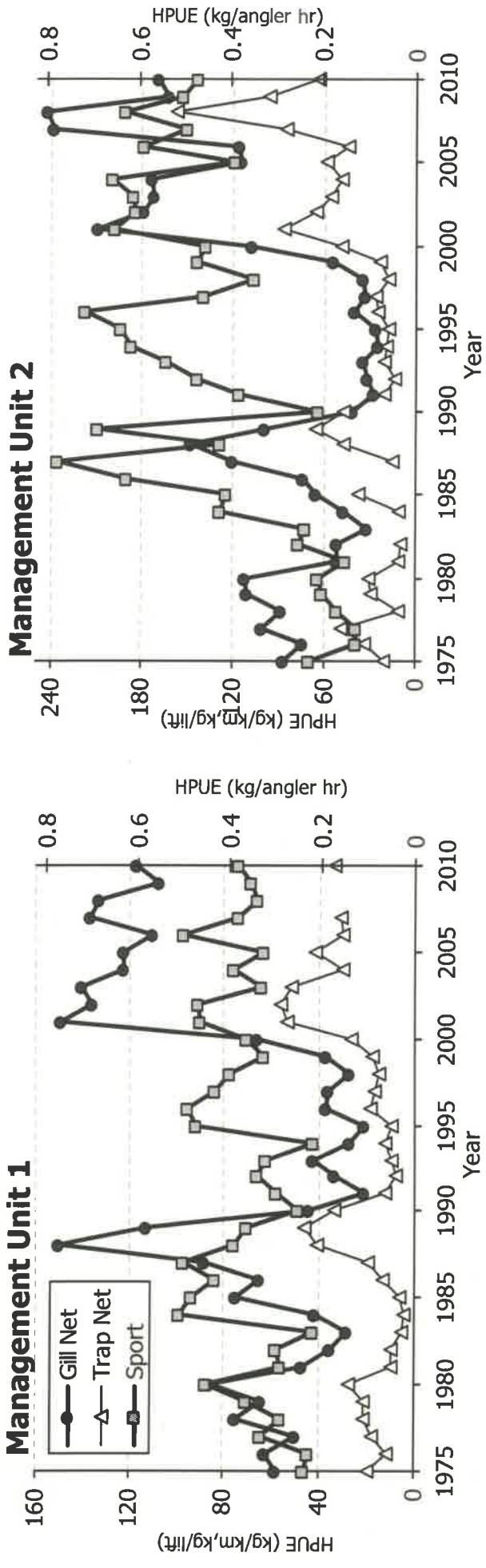


Figure 1.4. Lake Erie yellow perch harvest per unit effort (HPUE) by management unit and gear type. Note: 2001 to 2010 gill net CPUE is for small mesh (< 3") only.

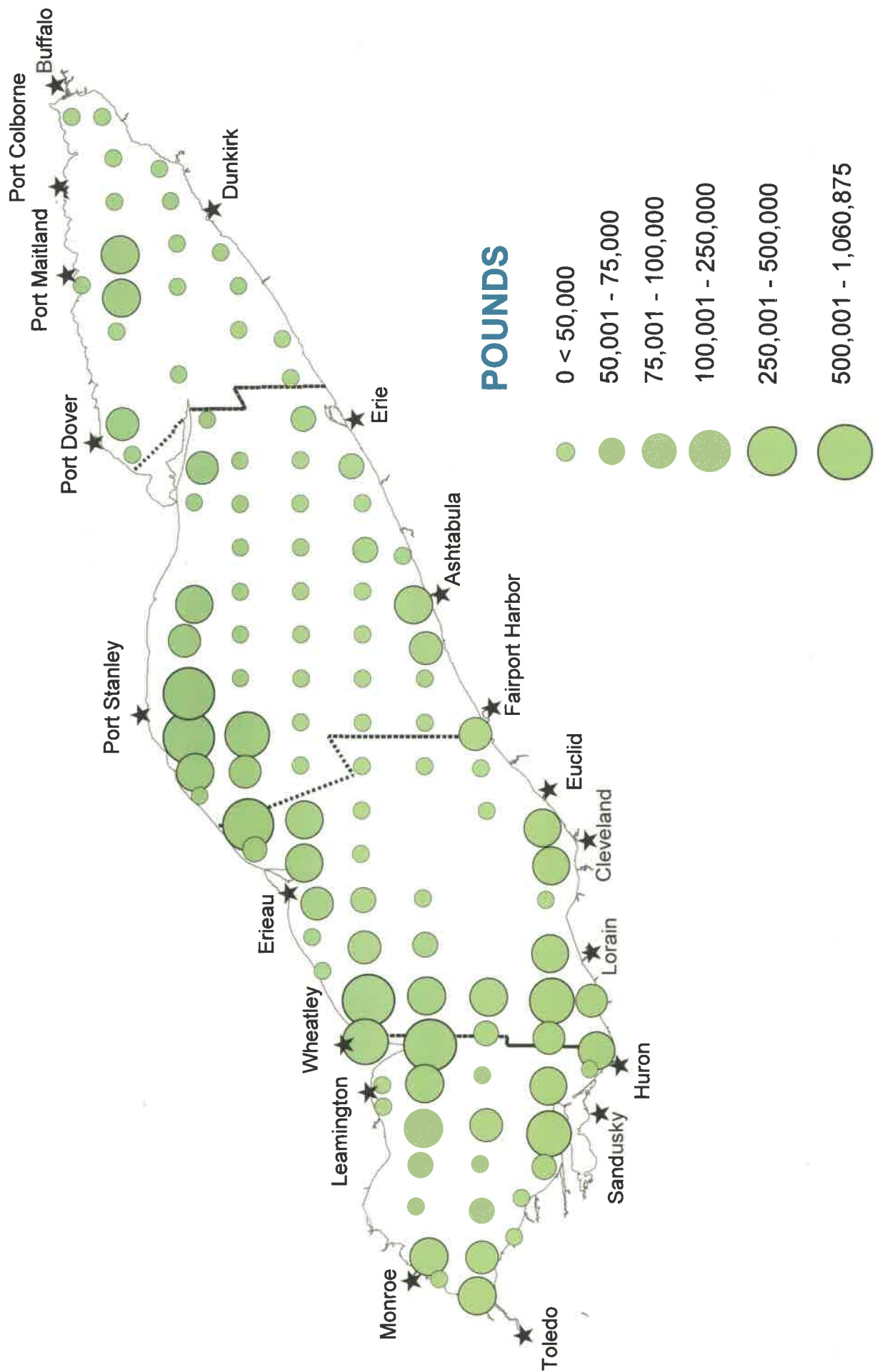


Figure 1.5. Spatial distribution of yellow perch total harvest (lbs.) in 2010 by 10-minute grid.

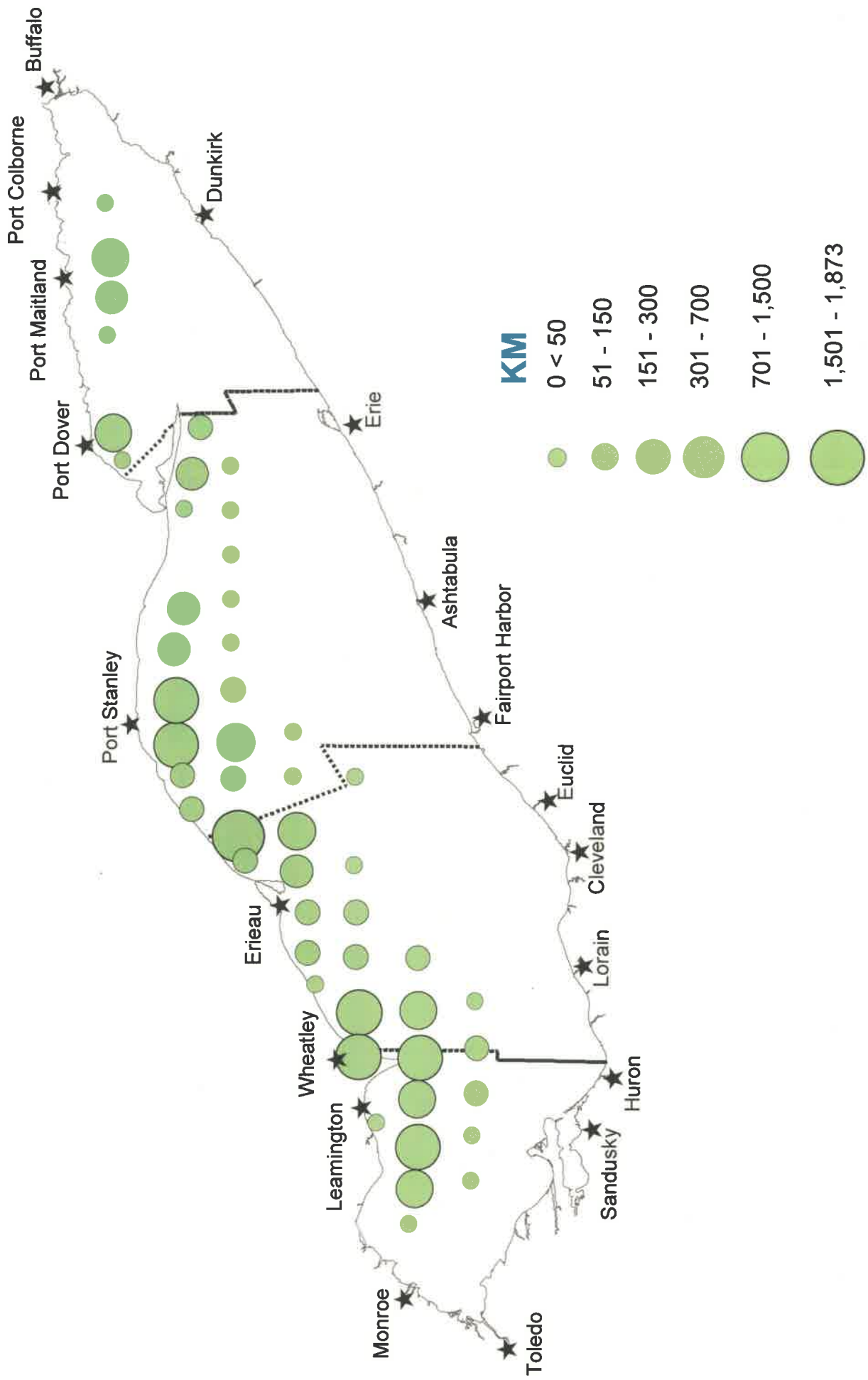


Figure 1.6. Spatial distribution of yellow perch gill net effort (km) in 2010 by 10-minute grid.

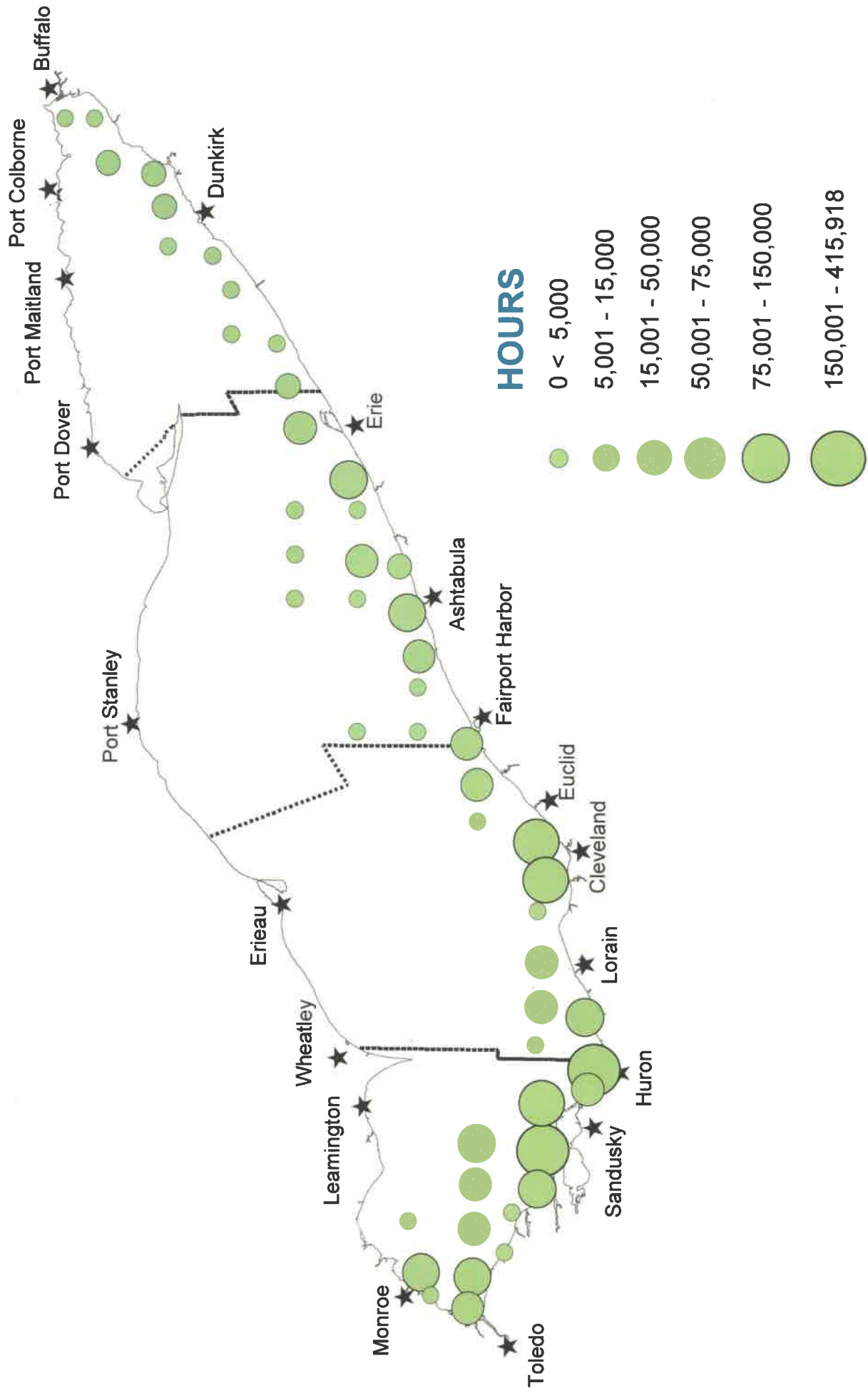


Figure 1.7. Spatial distribution of yellow perch sport angling effort (angler hours) in 2010 by 10-minute grid.

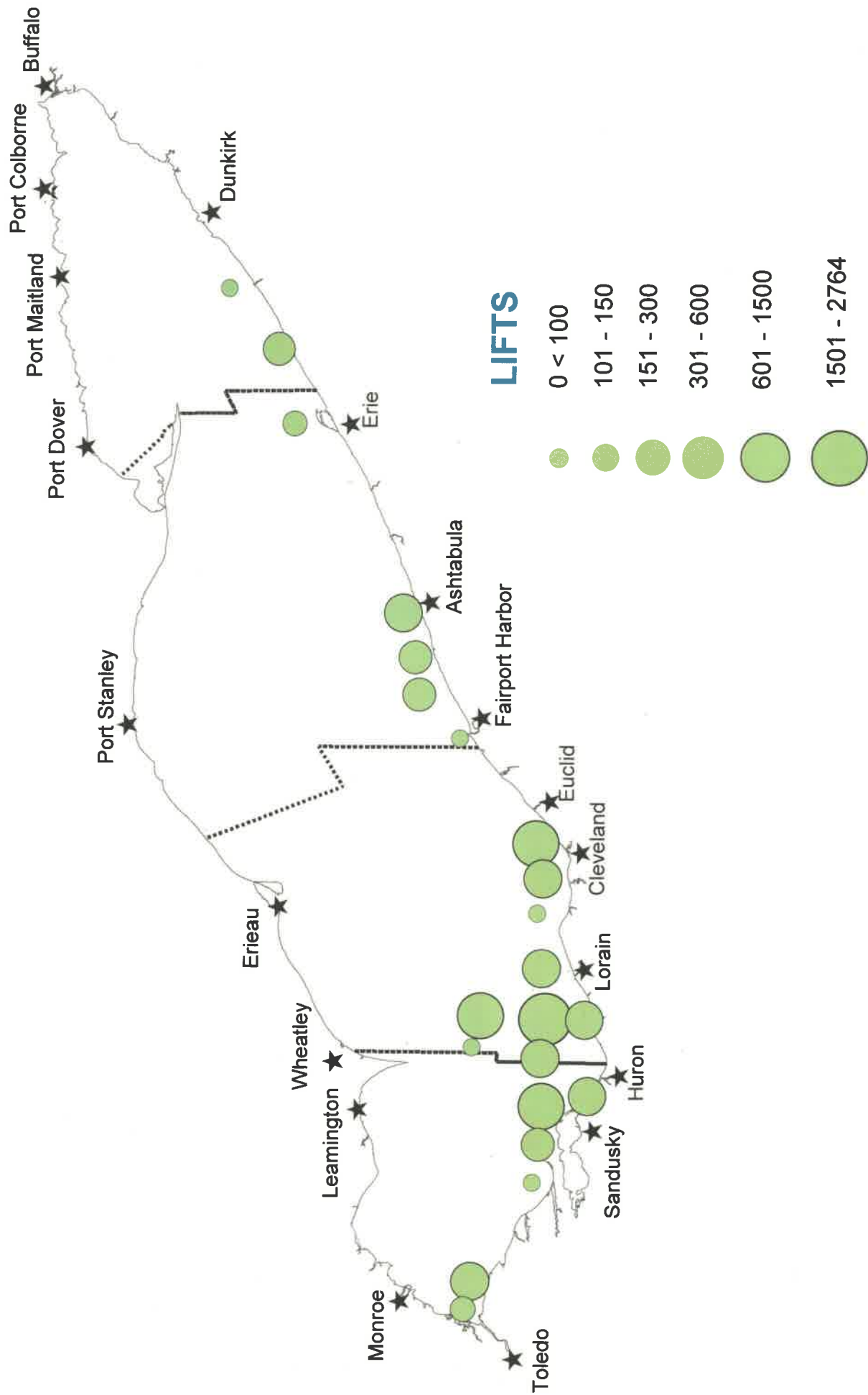


Figure 1.8. Spatial distribution of yellow perch trap net effort (lifts) in 2010 by 10-minute grid.

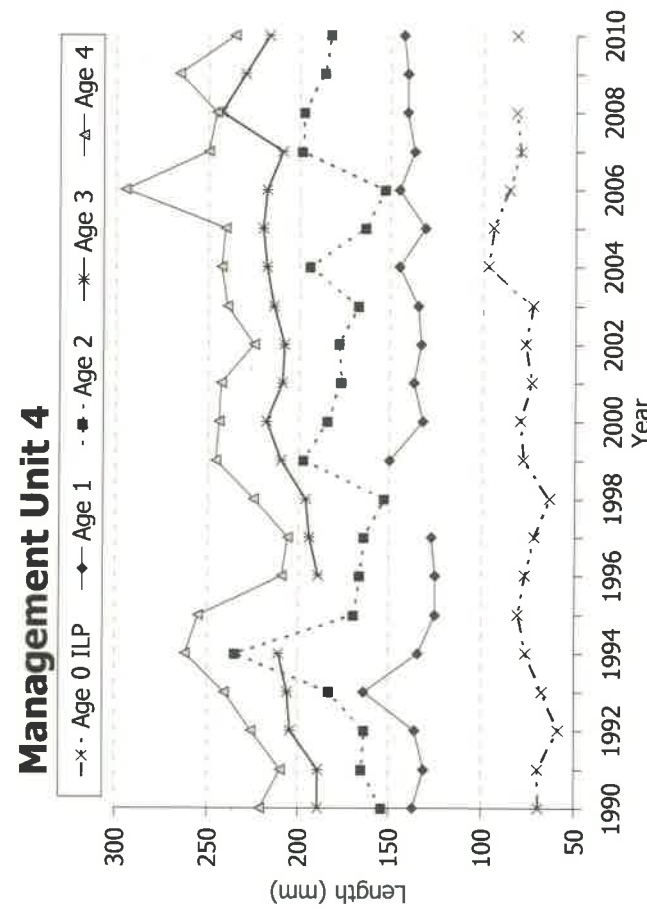
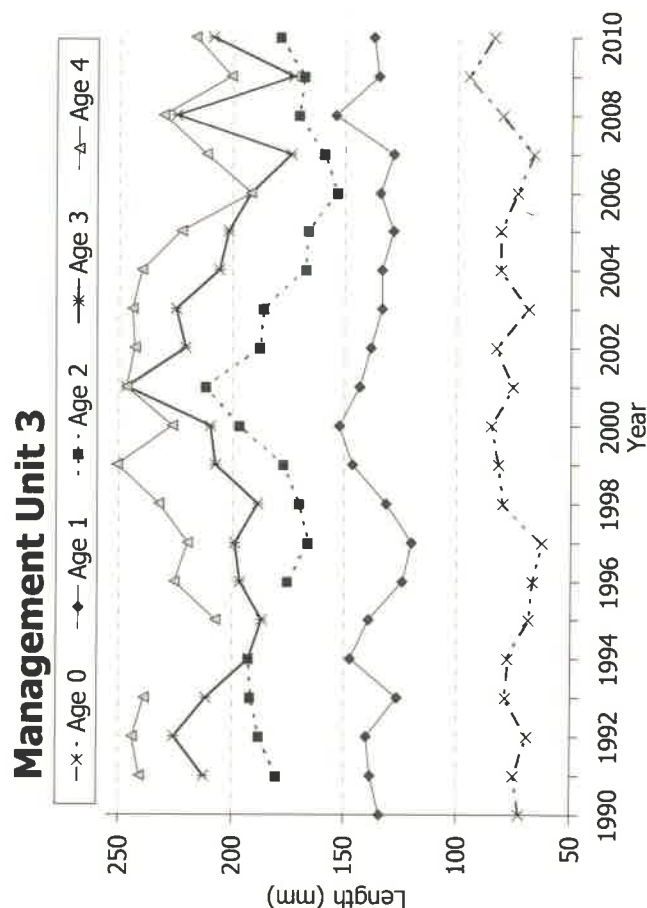
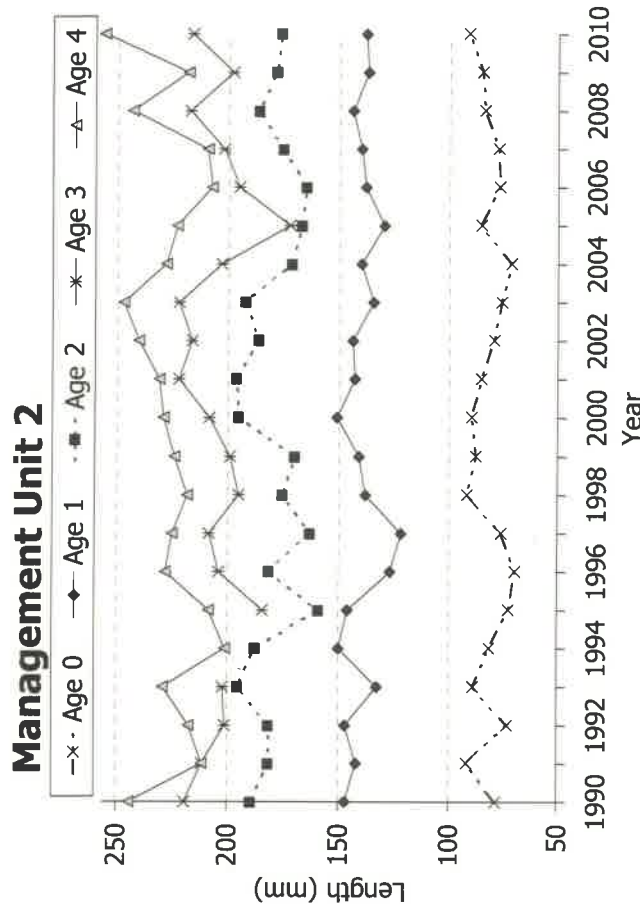
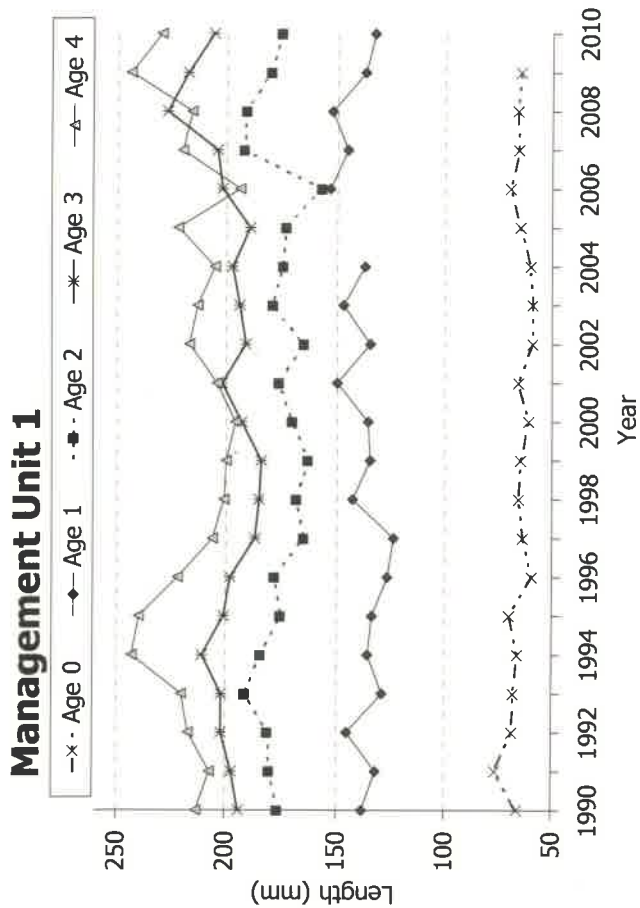
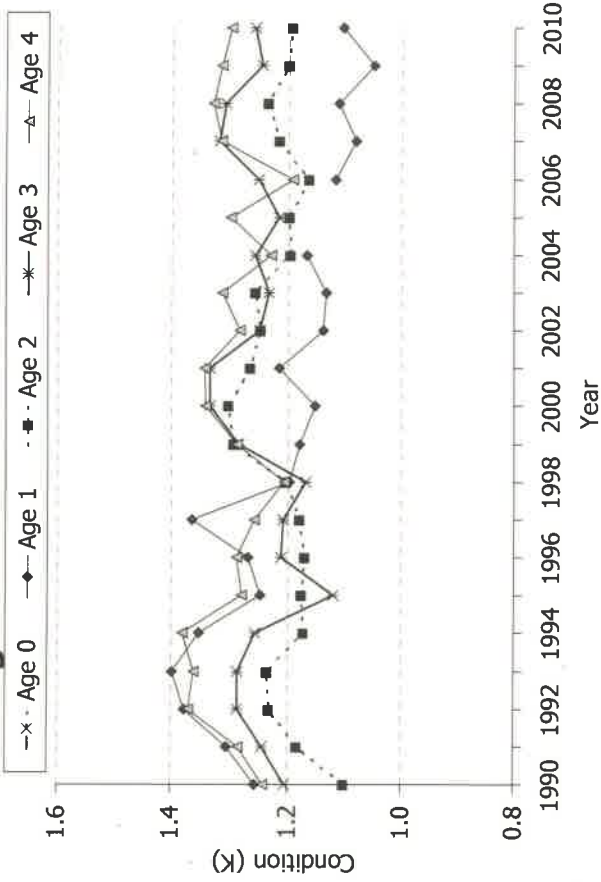
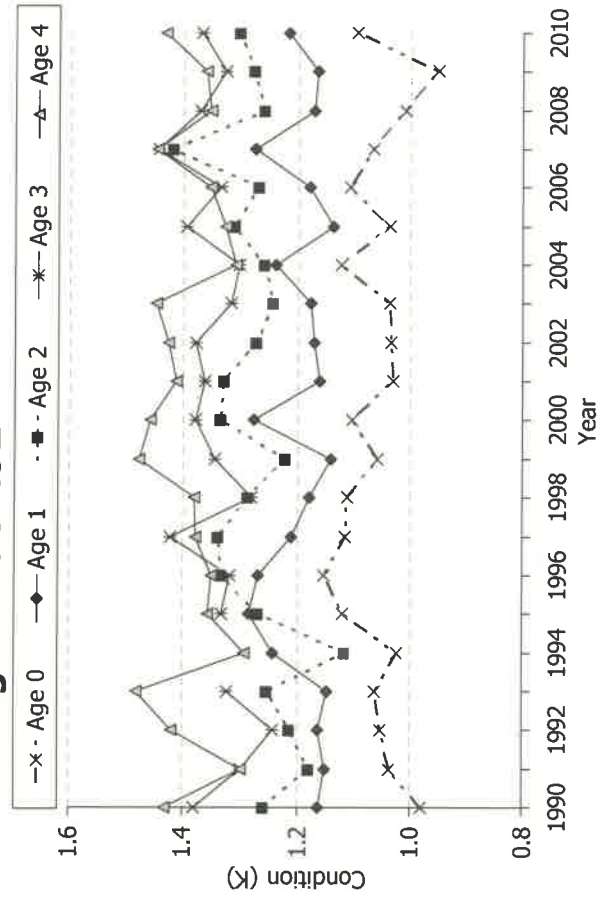


Figure 1.9. Yellow perch total length-at-age from 1990-2010 fall interagency experimental samples for ages 0-4 by management unit (MU). In MU4, ILP represents the Inner Long Point Bay series.

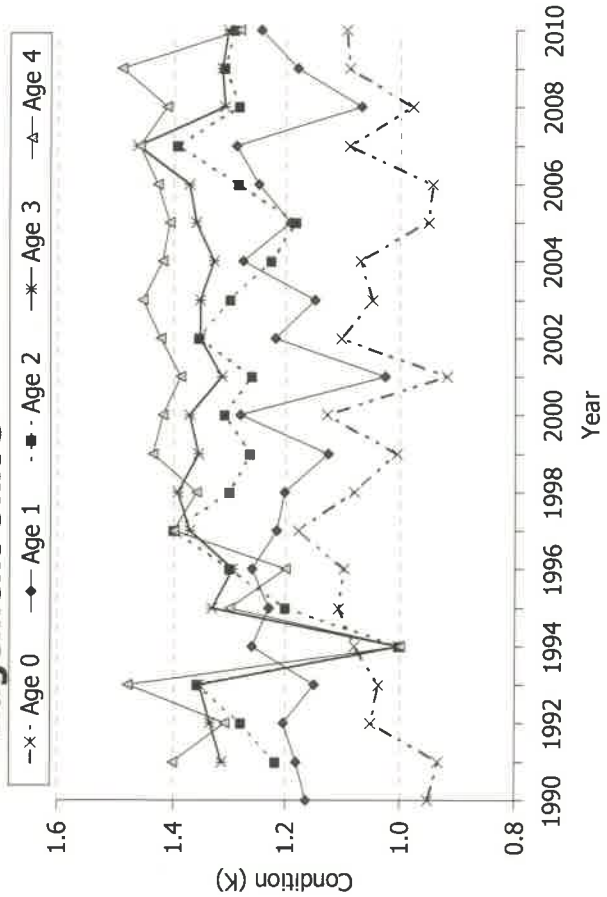
Management Unit 1



Management Unit 2



Management Unit 3



Management Unit 4

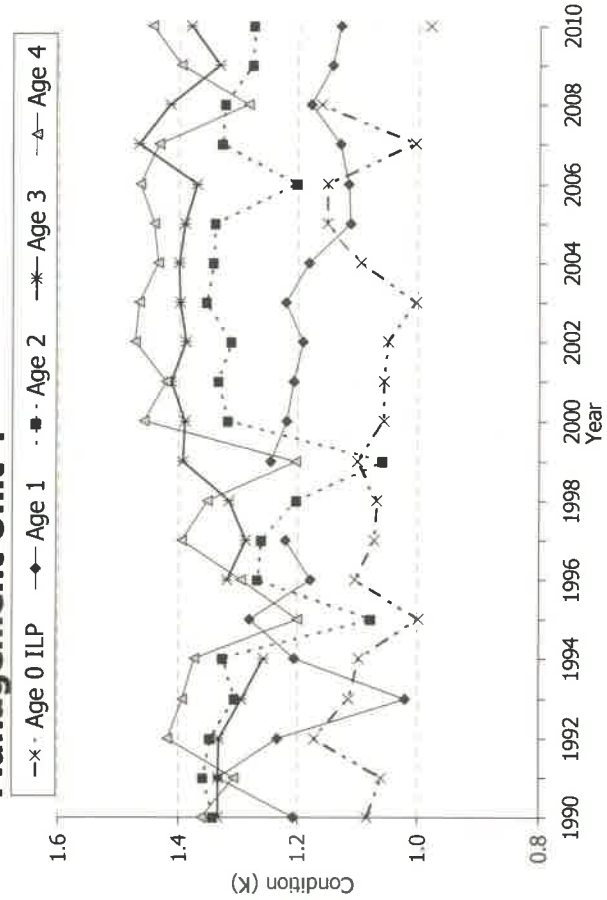


Figure 1.10. Yellow perch condition (K) at age from 1990-2010 fall interagency experimental samples for ages 0-4 by management unit (MU). In MU4, ILP represents the Inner Long Point Bay series.

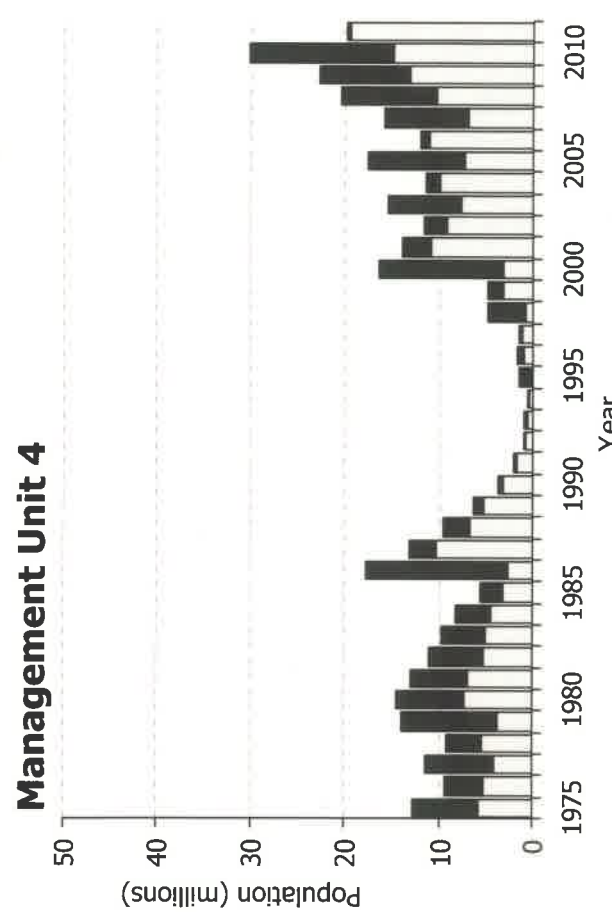
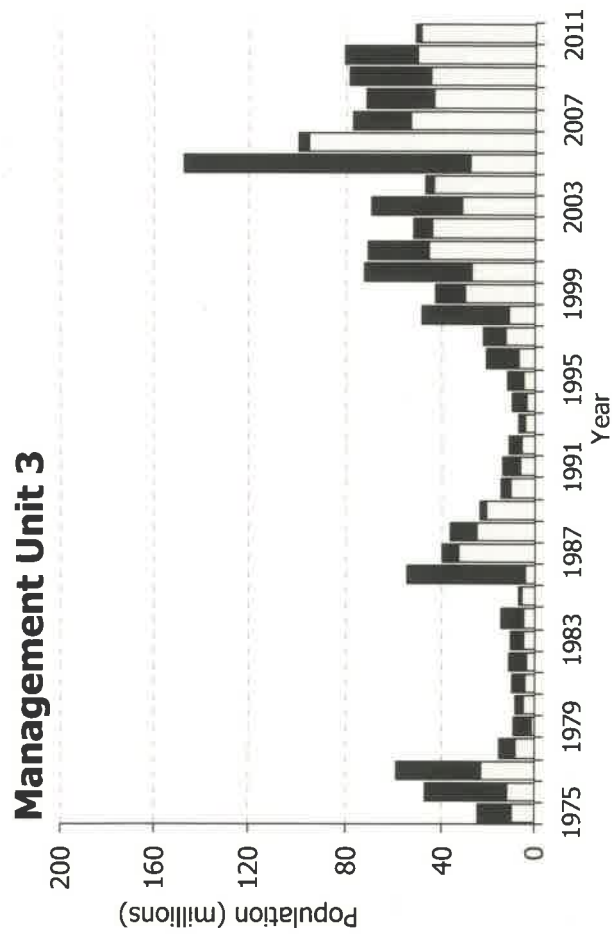
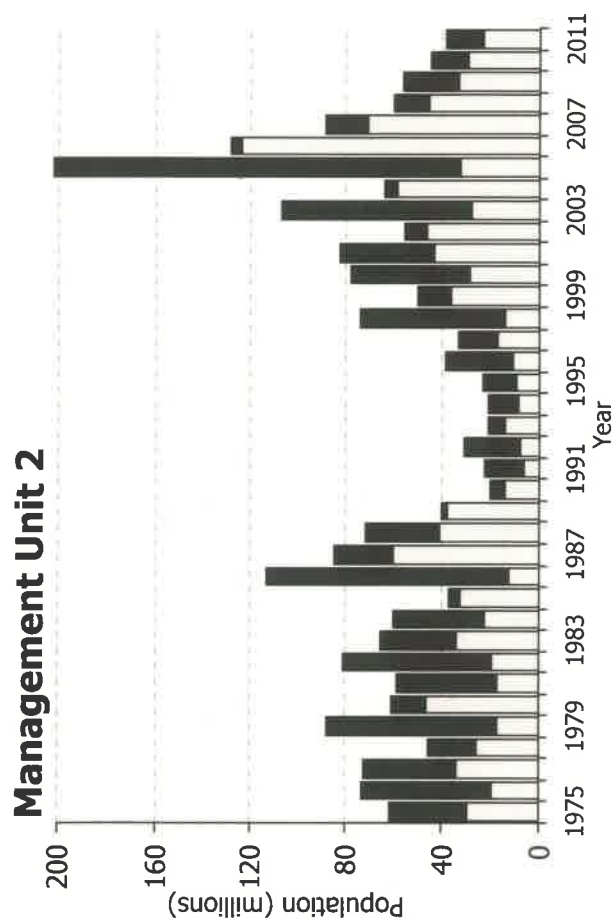
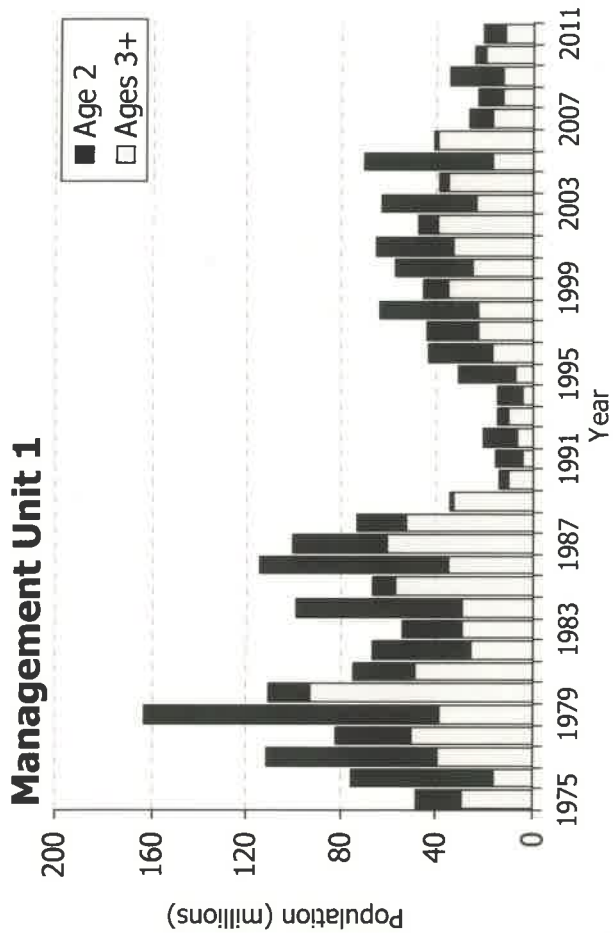


Figure 1.1.1. Lake Erie yellow perch population estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 2011 are from ADMI and regressions for age 2 from survey gears.

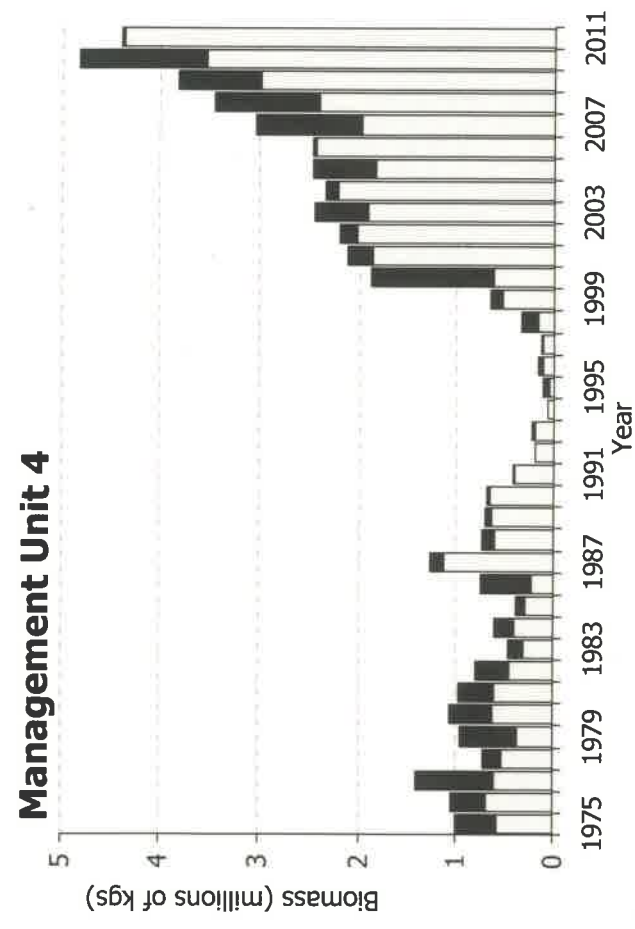
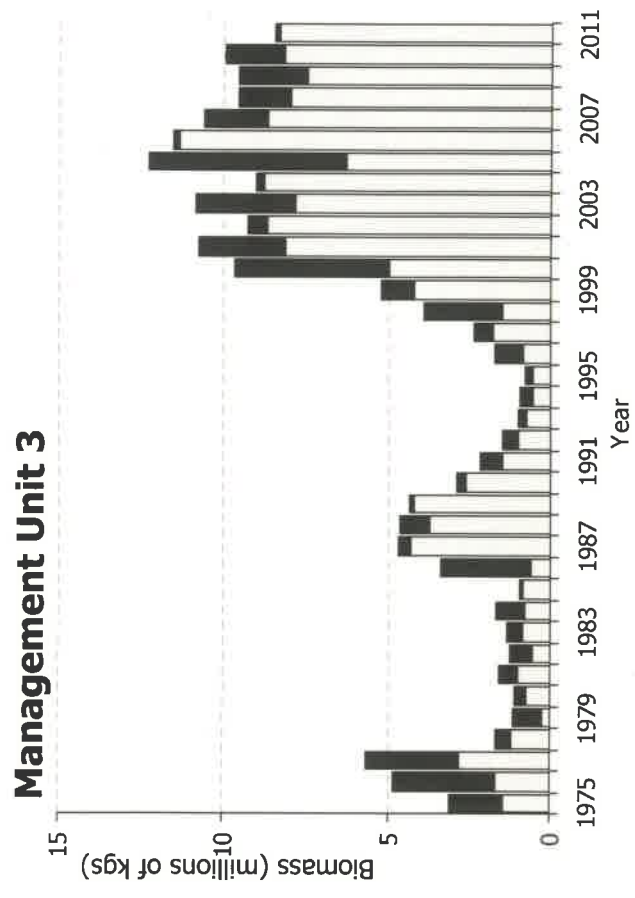
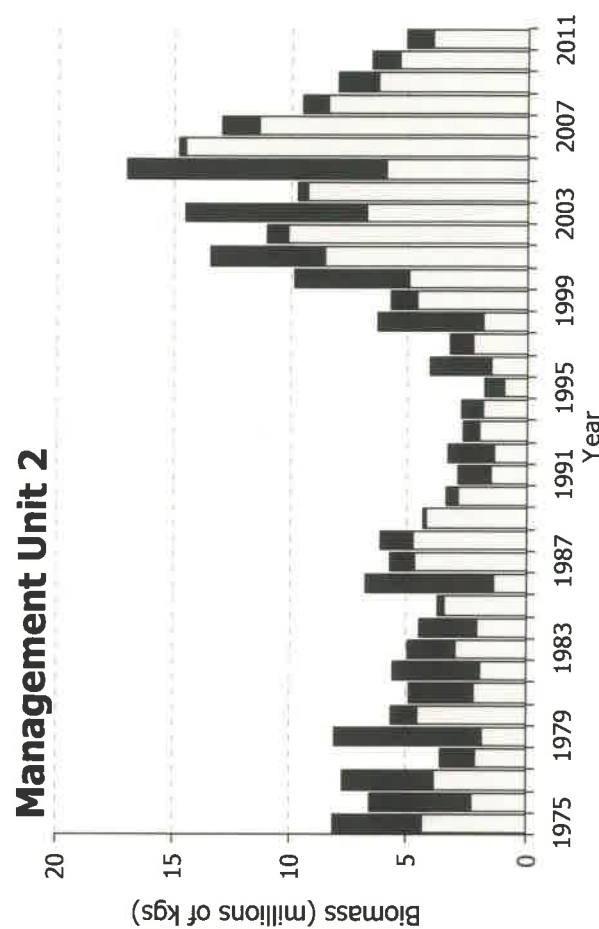
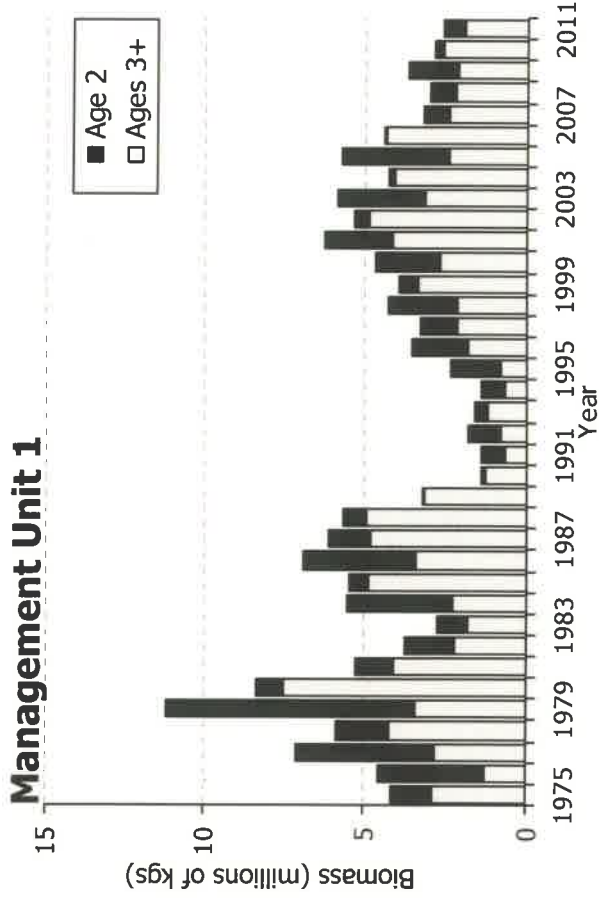


Figure 1.12. Lake Erie yellow perch biomass estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 2011 are from ADBM and regressions for age 2 from survey gears.

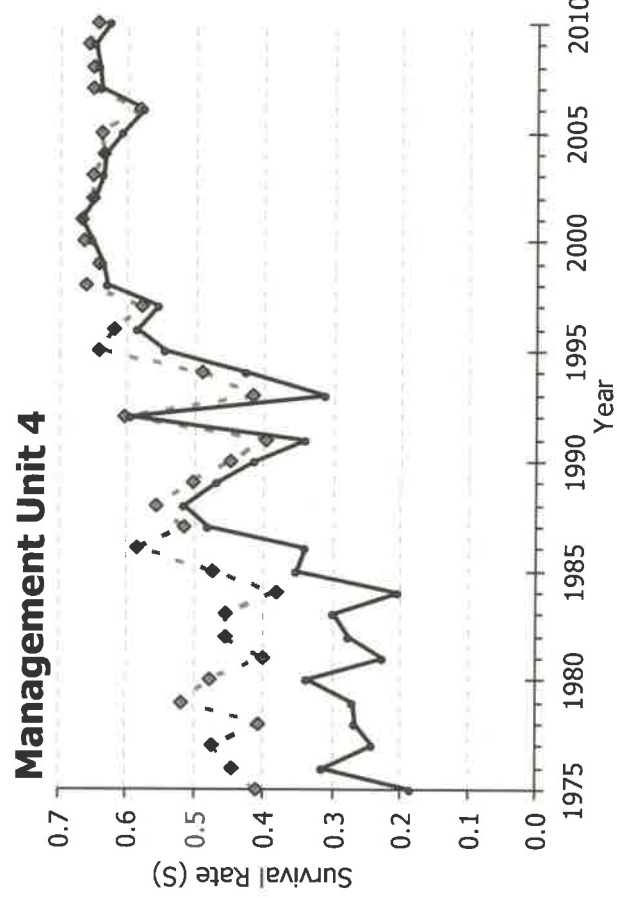
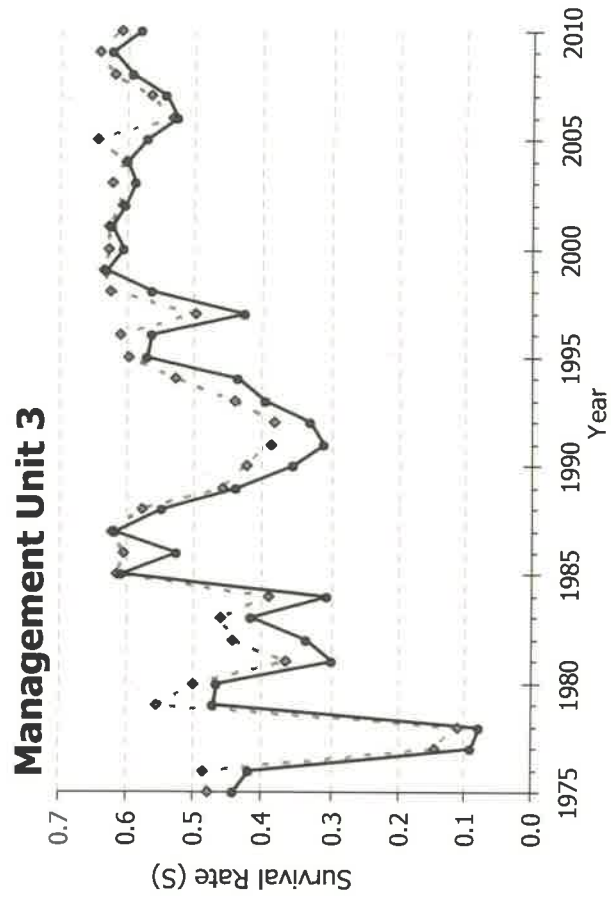
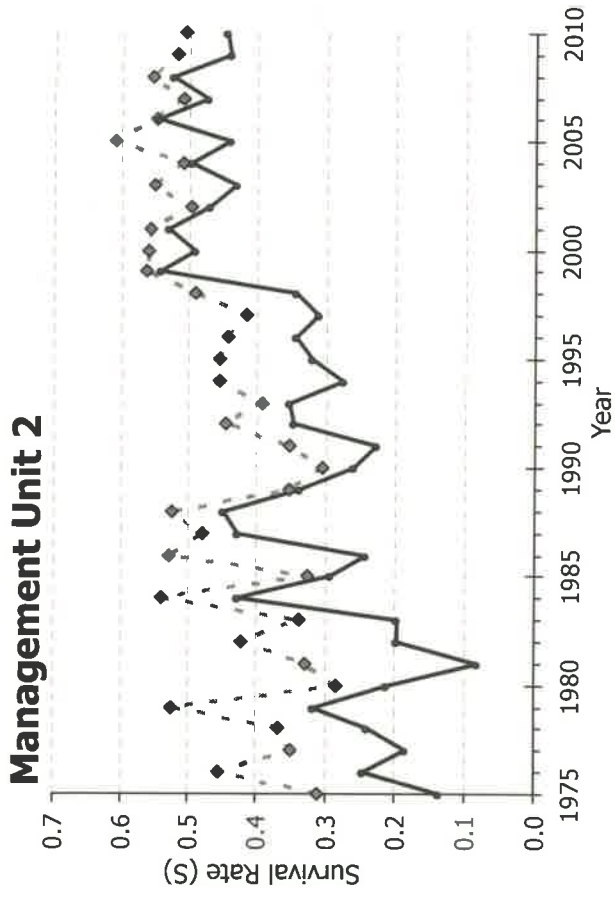
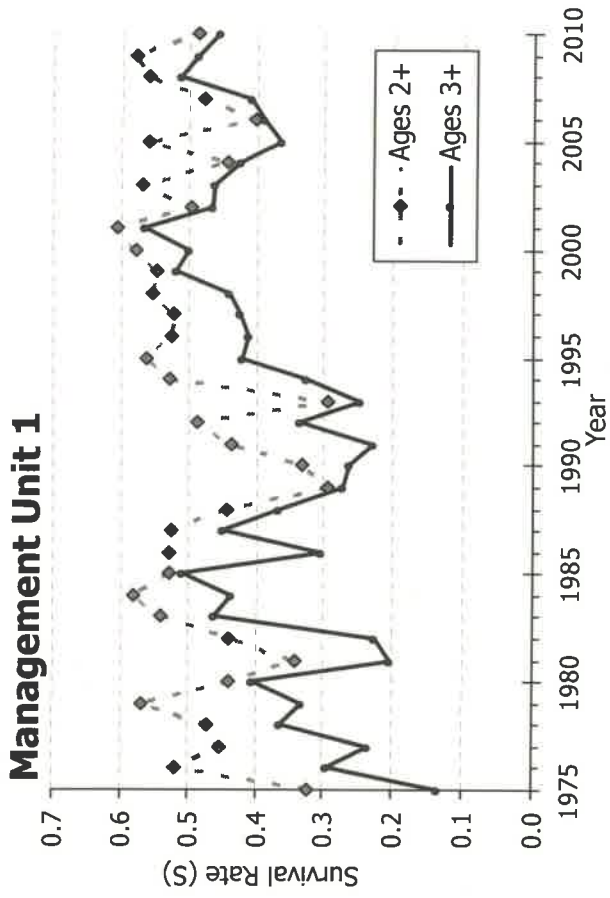


Figure 1.13. Lake Erie yellow perch survival rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from ADMB.

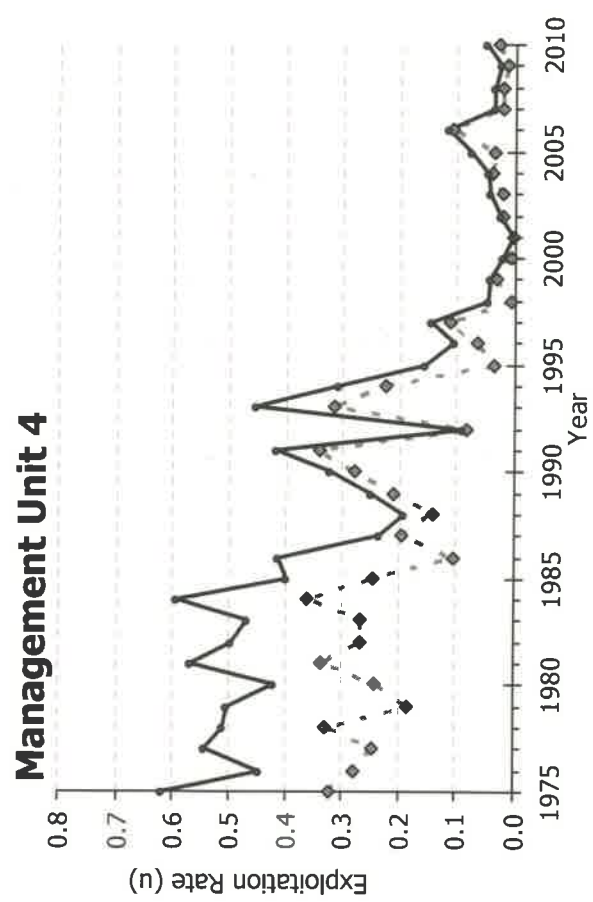
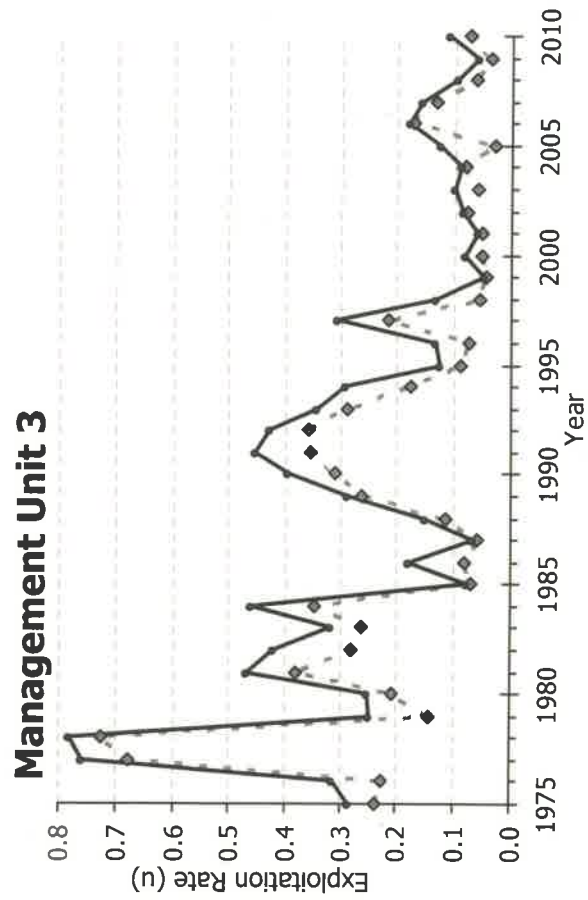
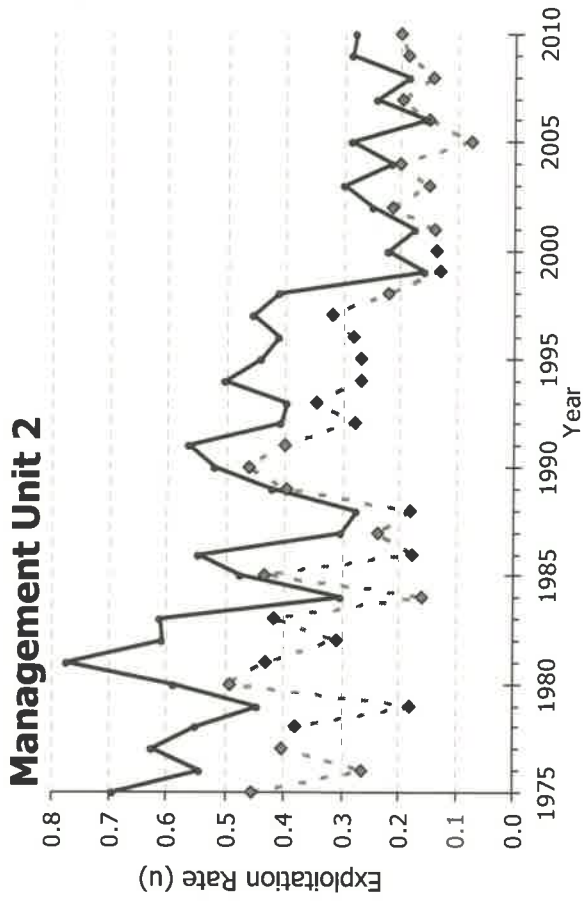
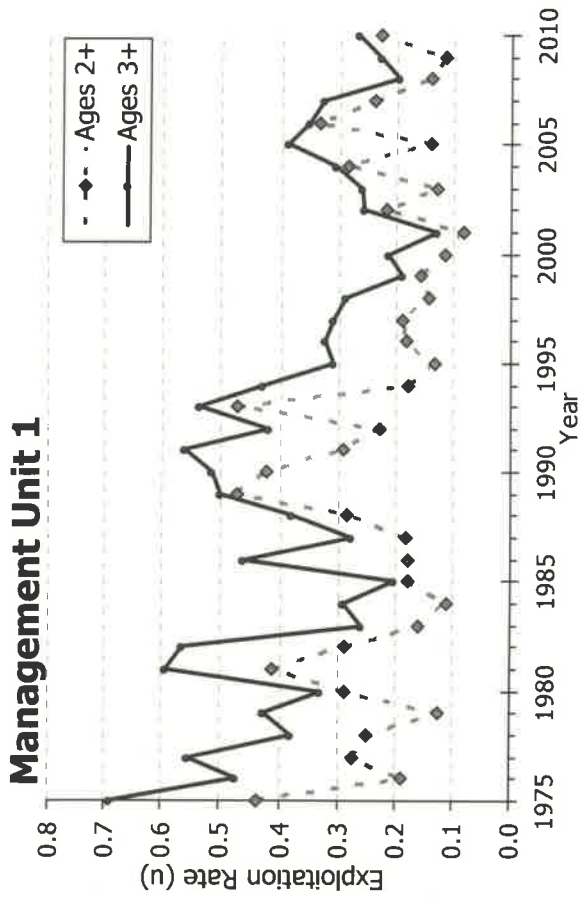
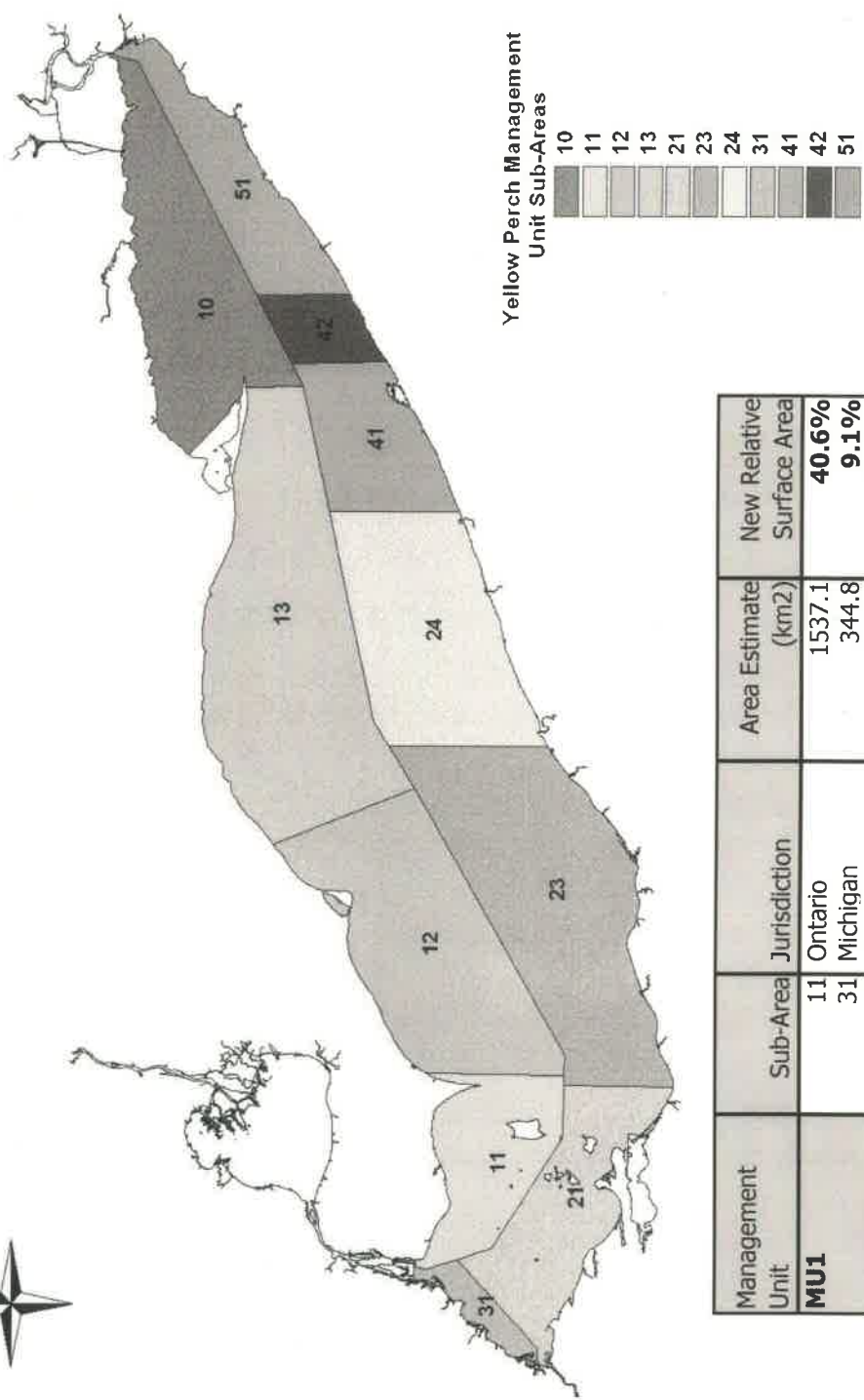


Figure 1.14. Lake Erie yellow perch exploitation rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from ADMB.



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

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

Appendix A Table 1. 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	0.6	1
	Sport Effort	1.0	1
	Commercial Trap Net Effort	0.6	1
	Commercial Gill Net Harvest	1.0	5
	Sport Harvest	1.0	5
	Commercial Trap Net Harvest	0.5	5
	Trawl Survey Catch Rates	0.4	3
	Partnership Gill Net Index Catch Rates	1.0	5
2	Commercial Gill Net Effort	0.2	1
	Sport Effort	1.0	1
	Commercial Trap Net Effort	1.0	1
	Commercial Gill Net Harvest	1.0	5
	Sport Harvest	0.6	5
	Commercial Trap Net Harvest	0.4	5
	Trawl Survey Catch Rates	1.0	4
	Partnership Gill Net Index Catch Rates	0.6	5
3	Commercial Gill Net Effort	0.3	1
	Sport Effort	1.0	1
	Commercial Trap Net Effort	0.5	1
	Commercial Gill Net Harvest	0.3	5
	Sport Harvest	1.0	5
	Commercial Trap Net Harvest	0.3	5
	Trawl Survey Catch Rates	0.8	4
	Partnership Gill Net Index Catch Rates	1.0	5
4	Commercial Gill Net Effort	0.3	1
	Sport Effort	1.0	1
	Commercial Trap Net Effort	0.6	1
	Commercial Gill Net Harvest	0.7	5
	Sport Harvest	1.0	5
	Commercial Trap Net Harvest	0.6	5
	NY Gill Net Survey Catch Rates	0.8	5
	Partnership Gill Net Index Catch Rates	1.0	5

Appendix A Table 2. Trawl regression indices used for projecting estimates of age-2 yellow perch recruiting in 2011 by Management Unit.

Management Unit 1

Index	R-Square	Slope	Index Value	Age-2 estimate	SE of slope	Lower Age-2 CI.	Upper Age-2 CI.
OHS11A	0.892	0.30363	93.6	28.420	0.02302	24.110	32.729
OHF20A	0.817	0.31407	1.6	0.503	0.03609	0.387	0.618
OHF21A	0.795	0.32163	11.9	3.827	0.03847	2.912	4.743
OHF11A	0.782	0.38466	56.6	21.772	0.04783	16.357	27.186
OHF10A	0.775	0.05951	69.4	4.130	0.00779	3.049	5.211
OOS10A	0.677	0.02607	132.4	3.452	0.00410	2.366	4.537
OHS20A	0.632	0.05160	16.0	0.826	0.00955	0.520	1.131
mean				8.990		7.100	10.879

Management Unit 2

Index	R-Square	Slope	Index Value	Age-2 estimate	SE of slope	Lower Age-2 CI.	Upper Age-2 CI.
OHF21A	0.855	0.68235	11.9	8.120	0.06625	6.543	9.697
OHS11A	0.830	0.59340	93.6	55.542	0.05860	44.572	66.512
OHF10A	0.821	0.12561	69.4	8.717	0.01423	6.742	10.692
OHS20A	0.790	0.11830	16.0	1.893	0.01478	1.420	2.366
OHF11A	0.701	0.74488	56.6	42.160	0.11473	29.173	55.148
OHF20A	0.678	0.58685	1.6	0.939	0.09801	0.625	1.253
OHS30A	0.626	0.06462	0.1	0.006	0.01248	0.004	0.009
OOS10A	0.578	0.04924	132.4	6.519	0.00966	3.961	9.077
mean				15.487		11.630	19.344

Management Unit 3

Index	R-Square	Slope	Index Value	Age-2 estimate	SE of slope	Lower Age-2 CI.	Upper Age-2 CI.
OHF21A	0.807	0.46518	11.9	5.536	0.05363	4.259	6.812
OHS20A	0.760	0.08154	16.0	1.305	0.01111	0.949	1.660
LPC40A	0.736	0.37944	0.4	0.152	0.04740	0.114	0.190
NYF40A	0.698	0.17741	11.6	2.058	0.03012	1.359	2.757
OHF20A	0.685	0.41446	1.6	0.663	0.06818	0.445	0.881
NYF41A	0.541	1.24421	4.0	4.977	0.28650	2.685	7.269
OHS30A	0.539	0.04210	0.1	0.004	0.00973	0.002	0.006
mean				2.099		1.402	2.796

Management Unit 4

Index	R-Square	Slope	Index Value	Age-2 estimate	SE of slope	Lower Age-2 CI.	Upper Age-2 CI.
NYF41A	0.890	0.27056	4.0	1.082	0.02379	0.892	1.273
LPC40A	0.678	0.06839	0.4	0.027	0.00982	0.020	0.035
LPS41A	0.642	0.50521	1.7	0.859	0.08041	0.585	1.132
NYF40A	0.558	0.02691	11.6	0.312	0.00618	0.169	0.456
LPC41A	0.556	0.19506	0.1	0.020	0.03556	0.012	0.027
OHF30A	0.519	0.07167	0.5	0.036	0.01672	0.019	0.053
mean				0.389		0.283	0.496

Appendix A Table 3. Interagency trawl surveys indices. All series are reported in arithmetic mean catch per hectare.

Year	OHS10A	OHF10A	OHS11A	OHF11A	OOS10A	OOS11A	OHS20A	OHF20A	OHS21A	OHF21A	OHS30A	OHF30A
1984	.	.	.	.	.	.	.	.	.	.	.	.
1985	.	.	.	.	.	.	.	.	.	.	.	.
1986	.	.	.	.	.	.	.	.	.	.	.	.
1987	16.3	.	74.9	.	.	.	.	.	.	.	.	.
1988	188.6	.	11.2	.	212.6	13.3	.	.	.	.	.	.
1989	106.1	.	11.8	.	265.4	12.5	.	.	.	.	.	.
1990	144.4	310.1	20.7	82.0	259.2	35.2	1.7	43.6	67.4	24.0	0.9	21.1
1991	146.9	58.1	27.6	0.4	113.2	42.1	5.4	10.8	43.5	51.6	4.5	1.3
1992	60.7	90.9	9.5	0.7	94.1	16.5	7.2	40.2	8.0	15.6	19.6	27.5
1993	1164.2	256.4	14.4	3.7	862.5	39.5	41.7	10.3	29.1	39.6	39.7	16.0
1994	508.5	287.1	57.7	73.1	469.7	62.9	73.3	77.1	5.0	11.1	77.2	14.7
1995	348.9	82.4	128.8	0.1	478.7	113.5	3.2	2.9	102.2	67.7	25.3	10.0
1996	3290.8	579.3	79.9	82.3	2544.9	122.8	998.1	128.7	11.6	13.0	1912.1	122.0
1997	52.2	33.7	121.8	104.9	55.2	93.8	29.0	9.3	677.7	148.0	.	2.9
1998	174.5	250.9	4.8	16.0	170.6	8.2	235.1	74.4	3.5	6.4	275.5	38.9
1999	270.1	155.3	68.5	47.1	330.0	75.0	31.4	63.1	19.4	41.7	44.8	22.0
2000	186.4	41.5	85.3	38.0	102.5	113.6	0.6	18.0	86.6	57.1	0.0	1.0
2001	322.1	246.3	12.8	10.3	398.4	11.3	313.2	118.0	7.7	5.2	1283.7	13.2
2002	33.1	30.4	77.1	86.5	26.4	59.5	0.3	3.8	191.0	45.9	1.7	3.1
2003	1509.9	1111.6	3.0	7.1	1620.8	12.3	1174.9	126.7	3.8	2.5	1170.2	56.5
2004	40.9	9.3	210.7	127.7	39.5	240.2	35.1	8.2	313.0	206.1	3.6	2.0
2005	124.2	62.3	5.2	2.0	114.8	5.2	108.8	43.9	23.1	19.2	278.2	126.8
2006	180.2	121.9	6.4	12.5	222.8	12.4	4.9	11.3	2.2	4.3	60.7	19.7
2007	592.9	631.5	14.5	23.6	444.6	18.8	237.0	150.6	22.6	20.2	237.0	166.5
2008	267.0	74.7	23.5	15.3	387.2	142.1	373.2	32.1	66.6	55.0	1339.9	52.8
2009	186.0	69.4	83.3	57.0	132.4	88.4	16.0	1.6	58.3	20.2	0.1	0.5
2010	58.2	26.9	93.6	56.6	95.4	26.1	.	41.1	.	11.9	.	96.3

Year	OHS31A	OHF31A	OLP40A	OLP41A	ILP40A	ILP41A	NYF40A	NYF41A	LPS41A	LPC40A	LPC41A
1984	.	.	237.8	6.6	1031.3	65.1	.	.	.	143.3	7.8
1985	.	.	3.1	61.5	21.8	122.5	.	.	.	3.6	33.3
1986	.	.	105.9	0.7	1169.5	36.4	.	.	7.6	138.3	4.3
1987	.	.	2.3	178.0	2.5	26.5	.	.	5.5	0.5	23.9
1988	.	.	410.6	0.6	238.0	3.1	.	.	1.1	70.7	0.4
1989	.	.	174.0	32.6	317.4	59.1	.	.	6.3	53.6	11.4
1990	9.2	13.4	31.4	10.0	160.3	27.9	.	.	0.0	20.8	6.1
1991	66.6	19.6	9.0	0.9	93.7	22.7	.	.	1.7	11.8	3.1
1992	4.4	3.1	34.1	6.9	378.3	21.5	10.4	2.3	5.6	44.7	3.2
1993	16.0	12.0	21.1	3.3	159.5	13.6	110.1	3.0	7.9	22.1	2.0
1994	16.7	4.0	98.8	10.9	59.2	20.3	47.7	8.4	2.7	19.6	3.4
1995	22.4	32.7	5.0	24.0	3.5	41.2	5.7	14.2	15.2	4.7	8.8
1996	3.2	3.7	130.0	2.2	37.5	4.2	106.3	0.3	0.4	24.3	0.8
1997	.	47.5	12.6	34.1	18.1	6.3	0.2	5.5	4.4	3.4	4.4
1998	3.7	4.0	84.1	1.2	854.2	14.3	1.5	0.2	8.4	108.1	1.7
1999	63.5	40.6	1.7	41.3	23.2	105.5	36.1	33.5	23.0	14.0	101.5
2000	84.8	19.9	8.7	2.8	1.9	3.0	23.1	6.6	0.7	3.5	11.1
2001	10.2	0.4	55.9	1.2	479.3	5.0	97.9	11.5	4.8	68.8	2.2
2002	749.6	49.5	0.3	10.8	6.5	36.7	9.3	15.5	6.8	0.7	5.7
2003	2.3	1.1	48.8	0.4	117.0	0.9	472.5	1.9	1.3	206.4	2.2
2004	61.7	44.4	0.3	3.5	0.1	15.5	1.5	28.7	6.5	0.1	11.6
2005	82.3	131.6	10.3	0.1	8.8	0.2	57.8	5.4	0.4	124.4	0.1
2006	10.8	13.6	2.0	1.0	0.6	3.9	283.2	39.9	19.5	30.0	11.9
2007	40.9	34.5	4.0	0.5	45.5	1.8	401.3	41.2	9.1	60.2	7.8
2008	150.2	26.4	3.1	4.1	0.2	3.0	1088.3	44.3	5.7	279.2	20.4
2009	104.3	137.2	0.9	2.4	0.0	0.0	11.6	62.5	0.7	0.4	10.5
2010	.	12.1	9.4	0.4	4.1	0.5	192.7	4.0	1.7	51.2	0.1

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 LPS41A, a gill net index which is reported in mean catch per lift.

Abbreviation	Series
OHS10A	Ohio Management Unit 1 summer age 0
OHS11A	Ohio Management Unit 1 summer age 1
OHF10A	Ohio Management Unit 1 fall age 0
OHF11A	Ohio Management Unit 1 fall age 1
OOS10A	Ontario/Ohio Management Unit 1 summer age 0
OOS11A	Ontario/Ohio Management Unit 1 summer age 1
OHS20A	Ohio Management Unit 2 summer age 0
OHF20A	Ohio Management Unit 2 fall age 0
OHS21A	Ohio Management Unit 2 summer age 1
OHF21A	Ohio Management Unit 2 fall age 1
OHS30A	Ohio Management Unit 3 summer age 0
OHF30A	Ohio Management Unit 3 fall age 0
OHS31A	Ohio Management Unit 3 summer age 1
OHF31A	Ohio Management Unit 3 fall age 1
OLP40A	Outer Long Point Bay Management Unit 4 age 0
OLP41A	Outer Long Point Bay Management Unit 4 age 1
ILP40A	Inner Long Point Bay Management Unit 4 age 0
ILP41A	Inner Long Point Bay Management Unit 4 age 1
LPS41A	Long Point Bay Unit 4 summer Gill Net age 1
LPC40A	Long Point Composite Unit 4 age 0
LPC41A	Long Point Composite Unit 4 age 1
NYF40A	New York Management Unit 4 fall age 0
NYF41A	New York Management Unit 4 fall age 1