Report of the Lake Erie Yellow Perch Task Group

March 2003

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Presented to:

Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission

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Note: The data and management summaries contained in this report are provisional. Every effort has been made to insure 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.

Correction: Since the Lake Erie Committee session March 24-25 2003, corrections were made to the reported harvest in Table 1.1 and associated text (March 27, 2003).

Introduction

From April 2002 through March 2003, the Yellow Perch Task Group (YPTG) addressed the following charges:

1) Maintain centralized time series of data sets required for population models including:
   a) fishery harvest, effort, age composition and biological parameters
   b) survey indices of adult abundance, size at age, and biological parameters
   c) recruitment indices and biological parameters of juvenile yellow perch

2) Support a sustainable harvest policy by:
   a) examining exploitation strategies
   b) recommending a range of allowable harvest for 2003 (RAH) for each management unit
   c) contributing to the Coordinated Percid Management Strategy (CPMS)

3) Contribute to lakewide genetic research on Lake Erie yellow perch stocks.

4) Examine the issues of Eastern Basin (MU4) sub-populations and explore whether there is support for re-defining boundaries within MU4 to manage as separate stocks.

This year, the task group continued with last year's advances in catch-at-age analysis using AD Model Builder (ADMB). In addition, population simulations incorporating stock recruitment relationships were developed to quantify risk associated with various levels of fishing. Our refined population models, in combination with risk assessment, support the Coordinated Percid Management Strategy (CPMS), and are expected to contribute to Decision Analysis (DA) next year as charge (2d) in 2003-2004. The status of Lake Erie yellow perch stocks is described herein. This year the reader will note a subtle change to the YPTG annual report. We have changed the numbering sequence of the Table of Contents, Tables and Figures to provide better linkage to the corresponding Charge that the information addresses. This is a similar methodology that several Lake Erie Task Groups have taken, and we hope it provides clarity to the information presented.

Charge 1: 2002 Fisheries Review and Population Dynamics

The lake-wide total allowable catch (TAC) in 2002 was 9.333 millions pounds. This allocation represented a 31.5 % increase from a TAC of 7.1 million pounds in 2001. For yellow perch assessment and allocation, Lake Erie is partitioned into four Management Units (Units, or

MUs; Figure 1.1). The 2002 allocation by management unit was 3.1, 4.1, 2.0 and 0.133 million pounds for Units 1 to 4, respectively.

The reported 2002 harvest of yellow perch from Lake Erie totaled 9.228 million pounds, which was a 33% increase over 2001 (Table 1.1). Harvest from Management Units 1 to 4 was 2.9, 4.2, 2.0 and 0.161 million pounds respectively. Although the 2002 harvest was within the lake-wide total allowable catch, TACs were exceeded by 2% in Unit 2 (Ontario), by 13% in Unit 3 (Ohio) and by 21% in Unit 4 (Pennsylvania and Ontario).

The distribution of harvest among jurisdictions in 2002 remained similar to 2001 (Table 1.1, Figure 1.2). Yield increased in 2002 for all jurisdictions: Ohio (26%), and Ontario (35%), and considerably for Michigan (107%), Pennsylvania (89%) and New York (76%). Harvest, fishing effort, and catch rates are summarized for the time period 1990-2002 by management unit, year, agency, and gear type in Tables 1.2 to 1.5. The spatial distribution of effort is presented in Figures 1.5 to 1.7. Trends over a longer time series (1975-2002) are depicted graphically for harvest (Figure 1.3), fishing effort (Figure 1.4), and catch rate (Figure 1.8) by management unit and gear type. Harvest summed by management unit increased from 2001 in all units by 62%, 18%, 27% and 168% for management units 1 through 4, respectively. Ontario's harvest increased in 2002 in MU 1 (79%), MU 2 (22%), MU 3 (19%) and MU 4 (144%). Michigan's harvest (Unit 1) doubled from 2001. Yellow perch harvests increased throughout Ohio's waters in 2002, with the greatest increase in Unit 1 (44%), and increases of 14% and 38% in Units 2 and 3, respectively. Pennsylvania's fisheries, albeit small, increased by more than half in Unit 3 and several fold (38,566 lbs) in Unit 4. New York's harvest in 2002 was 63% higher than 2001.

Ontario's reported yellow perch harvest is represented exclusively by the commercial gill net fishery, described above. The sport harvest of yellow perch in Ontario waters is not routinely assessed. Harvest from commercial trap nets increased in Unit 1 (89%) and Unit 2 (22%). Ohio trap net harvest in Unit 3 was zero as Ohio central basin commercial trap nets were fished exclusively in MU 2. Trap net harvest in Unit 3 represented by Pennsylvania, was 22% less than 2001. Trap net harvest in New York waters of MU 4 was much higher than recent years, but, along with Pennsylvania trap nets, represented 1% of the MU 4 harvest. In 2002, sport harvest increased in Unit 1 (39%), Unit 2 (5%), Unit 3 (40%) and doubled in Unit 4.

As in 2001, 10% of the 2002 lake wide gill net harvest was from mesh sizes 3 inches (76 mm) and greater. This component of the harvest included both targeted and incidental catch.

Harvest, effort and catch per unit effort from *a*) standard yellow perch effort (<3 inches) and *b*) larger mesh sizes, are distinguished in Tables 1.2 to 1.5. The harvest in larger mesh sizes reflects the composition of larger, older yellow perch among management units. Gill net effort was 23% greater than 2001 in MU 1, though large mesh gillnet effort declined (Table 1.2). Gill net effort decreased 5% in MU 2 with a reduced proportion of large mesh nets compared to 2001 (Table 1.3). In MU 3, the quantity and configuration of gill nets fished remained unchanged (Table 1.4), while in MU 4, gill net effort increased 62 % with no change in the amount of large mesh net fished (Table 1.5).

Trap net effort for 2002 increased 79% in Unit 1, 62% in Unit 2, more than doubled in Unit 4, but declined 54% in Unit 3. Compared to 2001, sport effort for 2002 increased 39% in Unit 1, 13% in Unit 2, 55% in Unit 3, but tripled in Unit 4 (Tables 1.2 to 1.5).

Catch rates (catch per unit of effort, or CPE) for the 2002 commercial small-mesh gill net fishery decreased marginally in MU 1 (9%) and MU 2 (15%), but increased in MU 3 (14%) and MU 4 (43%) (Tables 1.2 to 1.5). Commercial gill net catch rates in 2002 remained among the highest recorded by the Task Group in all Management Units (Figure 1.8). Trap net catch rates were also among the highest of the series in 2002 in Management Units 1 and 2, but not in Units 3 and 4 where fisheries have become or remained smaller in magnitude. Trap net catch rates increased 5% in MU 1 but declined 25% in MU 2 in 2002. The smaller trap net fisheries in Pennsylvania and New York showed marked increases in catch rates, though MU 3 catch rates declined, due primarily to the absence of Ohio's trap net fishery in MU 3 (Figure 1.8). Sport catch rates in Unit 1, 2002 remained the same as 2001 in Ohio or less in Michigan (14%). Little change in angler catch rates was evident in Units 2 and 3 in Ohio waters, though Pennsylvania catch rates improved 39% from 2001. Angler catch rates in 2002 remained high in Unit 4, with improvement in Pennsylvania waters (60%) but with a 35% decrease in New York angling success rates.

Age and Growth

The yellow perch harvest in 2002 consisted mostly of the 1998 (age 4) and 1999 (age 3) year classes, with other age groups including the 1996 year class contributing (Table 1.6). Recruitment of age 2 yellow perch to the fishery was low, due in part to low selectivity but also to year class strength that was characterized as weak based on survey data. The 1998 cohort was exceptionally abundant in the MU 4 harvest (64%), underscoring the differences in stock dynamics between Management Units (Table 1.6). Differences between the age composition of the harvest between areas and gear types reflect contrasting growth rates, the size selective nature of gear, and levels of abundance associated with recruitment and survival.

Yellow perch growth trends differ among life stages and between basins (Figure 1.9). Yellow perch from the 1996 year class were smaller compared to a number of other cohorts as juveniles up to age 6, supporting the plausibility of density dependent growth. Conditions for growth may have improved in recent years based on size at age of the strong 1998 and 1999 cohorts. Influence of thermal environment and changes in forage species composition may be contributing to improved growth of larger perch. Round gobies have become frequent prey of yellow perch since colonizing Lake Erie (Forage Task Group Report, 2001). An abundance of yellow perch growth data exists among Lake Erie agencies. For simplicity, Figure 1.9 is comprised on young-of-the-year data from summer and fall interagency trawls while age 1 and older data are from Ontario Partnership gill net surveys (MUs 1 and 4) and Ohio fall trawls (MUs 2 and 3).

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.

ADMB Catch-At-Age Analysis 2002/2003

Population size for each management unit was estimated by catch-at-age analysis, with the Commercial Selectivity Index (CSI) version, updated with 2002 data. The approach was unchanged from methodology described in the Yellow Perch Task Group Report (2002). Estimates of population size and parameters such as survival and exploitation rates are presented for 1990-2002 in Table 1.7 and for 1975-2002 in Figures 1.10 to 1.13. Estimates of age 2 recruitment in 2003 were derived using linear regression of age 2 population estimates and juvenile indices (Appendix A-1 to A-3). Population estimates for 2003 incorporate recruitment estimates of age 2 yellow perch (Table 1.8 and Figure 1.10). Mean weight-at-age from biological surveys was applied to abundance estimates to generate population biomass estimates (Table 1.8 and Figure 1.11).

Population 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 2002 implies that the time series are continuous. Lack of data continuity weakens the validity of this assumption. Survey data are represented in the latter third of the time series while methods of fishery data collection have also varied. Model parameter constants such as natural mortality, catchability and selectivity blocks, lessen our ability to directly compare abundance levels over three decades. With catch-at-age analysis, the most recent years' data estimates inherently have the widest error bounds. This is to be expected for cohorts that remain at large in the population.

Recruitment Estimator for Incoming Age 2 Yellow Perch

Age 2 recruitment in 2003 was predicted by linear regression of juvenile yellow perch trawl indices against catch-age analysis estimates of two-year-old abundance. Age 2 recruitment in 2003 was calculated using the mean of values predicted from the indices listed in the Appendix Table A-1. Data from trawl index series for the time period examined are presented in Appendix Table A-2 (geometric means) and A-3 (arithmetic means), while a key that summarizes abbreviations used for the trawl series is presented as a Legend in the Appendix.

The YPTG continues to examine density-dependent factors that influence recruitment of juvenile yellow perch to older ages. Evidence that survival of juveniles from weak cohorts may exceed survival of stronger cohorts is relevant to interpretation of surveys and age 2 recruitment projections.

Estimated recruitment of age 2 yellow perch for 2003 (the 2001 year class) was above average in all management units (Table 1.7, Appendix Table A-1). Indications from juvenile trawl surveys however, suggest the 2002 year class is very weak (Appendix A, Tables A-2 and A-3). Effects of poor recruitment from the 2002 year class will be realized by fisheries in 2004 and later.

2003 Population Size Projection

Stock size estimates for 2003 (ages 3 and older) were projected from catch-at-age analysis estimates of 2002 population size and age-specific survival rates in 2002 (Table 1.8). Projected age 2 recruitment from the 2001 year class (method described above) was added to the 2003 population estimate for older fish in each unit, producing the total standing stock in 2003 (Table 1.8). Standard errors and ranges about our estimates are provided for each age in

2002, and following estimated survival (from ADMB), for 2003. Descriptions of *mean*, *max* and *min* population estimates refer to the estimates plus or minus one standard error. Similarly, RAH references (*mean, max, min*) are based on population estimates plus or minus one standard error.

Stock size estimates for 2003 remained high relative to the time series, and increased from 2002 in all management units (Table 1.7 and Figure 1.10). This is due to favorable recruitment of two-year-old fish from the 2001 year class, though estimated abundance of older yellow perch in 2003 is lower than 2002 in all units. Overall, yellow perch abundance increased by 8%, 23%, 41% and 19% in management units 1 to 4 respectively.

Biomass estimates over the time series, while similar to abundance trends, were elevated more in recent years (Figure 1.11). Biomass is expected to remain approximately the same in 2003 compared to 2002. Population biomass is a function of abundance, age composition and mean weight at age. Mean weight at age values derived from experimental samples since the late 1980s are considered more accurate than historic samples. For the current projection (2003), the mean of the previous 2 years was applied. Historic experimental data lacked seasonal consistency, limiting comparisons of population biomass across decades. It is conceivable that mean weight at age was lower historically because of higher exploitation (Rosa Lee's phenomenon in Ricker 1975) or due to environmental conditions. Population biomass estimates for 2003 were influenced mostly by yellow perch ages 3 and older, although new recruits are expected to contribute significantly.

Catch-at-age analysis estimates of survival for yellow perch ages 2 and older in 2001 were 62%, 56%, 60% and 67% in MU 1, 2, 3 and 4, respectively (Figure 1.12). In 2002, estimated survival was 54%, 50%, 54% and 63% in units 1 through 4. Survival rates were lower, as expected, for fish ages 3 and older, since they are more vulnerable to fishing. Survival rates have increased gradually in all management units since early to mid 1990s**.**

Exploitation rates declined in all management units during the 1990s (Figure 1.13). Exploitation rate estimates for 2002 were higher than 2001, however, in response to changes in population size and TACs. From 2001 to 2002, exploitation rates for yellow perch ages 2 and older increased from 7% to 16% in MU 1, 13% to 21% in MU 2, 8% to 16% in MU 3 and 1% to 5% in MU 4. In 2002, fish ages 3 and older were exploited at higher rates of 19%, 24%, 17% and 6% in units 1 to 4 respectively.

Charge 2: Harvest Strategy and Recommended Allowable Harvest

Harvest Strategy Methodology

The Beverton-Holt yield per recruit model was used to calculate the recommended allowable harvest (RAH) for 2003 based on an optimal harvest rate F_{opt} strategy adopted by the YPTG in 1992. The optimal harvest rate, F_{opt}, is determined by balancing growth rate with natural mortality rate. A detailed description of Beverton-Holt Y/R methodology was provided in previous reports (YPTG 1991, 1995). Von Bertalanffy growth parameters were recalculated for this report to reflect current trends in growth, so that $F_{0.1}$ or F_{opt} values differ from last year (Table 2.1). The projected 2003 harvest by age was derived from F_{opt}, age specific selectivity, a natural mortality constant and population estimates by age (Table 2.1). Projected total harvest (weight) is the sum of the products of numbers of fish harvested and mean weight at age in the harvest. Selectivity values were calculated by expressing total fishing mortality (all gears) for each age as a proportion of the maximum total fishing mortality from catch-at-age model estimates for 2002. Mean weight in the harvest was based on the most recent two-year average from fishery samples.

Stock-Recruitment Simulation

The 2001 independent review (Myers and Bence 2001) recommended the YPTG consider alternative yield strategies that were more consistent with yellow perch assessment than the existing Beverton-Holt yield per recruit method. The current yield per recruit model assumes knife-edge recruitment, whereas catch-at-age and independent analyses indicate multiple age groups are partially selected to gear. In addition, the reviewers suggested the YPTG use stock recruitment relationships to evaluate alternative harvest policies. In 2001-2002, the YPTG examined the relationships between spawning stock, environmental variables, and recruitment. Spawner recruit (S/R) relationships were described by gamma functions (Reish et al. 1985 in Quinn et al. 1999) with the recognition that environmental factors exert major influence on recruitment. During 2002-2003, the YPTG created population simulations based on gamma stock recruitment functions, influenced by environmental factors. Environment Factors (EF) were derived from residuals of the S/R relationship as:

$$EF = (observed\ recruitment)/(predicted\ recruitment)$$

Using recent and forecasted abundance (2003-2004) to initiate simulations, recruitment for each year was estimated from the S/R function, then multiplied by an EF selected randomly from the observed distribution of residuals (EFs). This process extended over 20 years and 100 replicates under a broad range of fishing mortality rates (0 to 3) to produce measures of risk. Other model parameters included were consistent with ADMB catch-at-age analysis. This process, applied to populations in each management unit, allowed the YPTG to quantify risk associated with various fishing rates, while giving consideration to stock recruitment patterns and environmental influences experienced by yellow perch during recent decades in Lake Erie. Biological reference points including spawner biomass (as a fraction of an unfished population), survival rates, and the probability of attaining low levels of abundance comparable to 1993-94 were included as outputs. Preliminary results of this work in progress are presented for each management unit in Appendix B, Tables B-1 to B-4. To compare simulation results to current RAH considerations, projected harvest (2003, 2004) and abundance (2004-2005) at various levels of fishing intensity are presented. In the future, we plan to develop these approaches further to support the Coordinated Percid Management Strategy and the Decision Analysis process.

Recommended Allowable Harvest

The recommended allowable harvest (RAH) for 2003, based on the yield per recruit (Y/R) F_{opt} strategy, was calculated in Table 2.1 and summarized for management units 1 to 3 in Table 2.2. The exception for MU 4 is described below. The 2003 projected harvest estimates were influenced by updated F_{opt} values, estimated selectivity, ADMB estimates of 2002 population size and fishing mortality, and projected recruitment of the 2001 year class.

The expected age composition in the projected 2003 harvest reflects differences in population structure and growth rates between management units. In the west basin (MU 1), where slower growth occurs, fisheries will rely on the 1999 (age 4) and 1998 (age 5) year classes. In the central basin (MUs 2 & 3) where faster growth occurs, fisheries will be comprised of several cohorts including age 2 recruits (2001 year class), the 1999 (age 4) and 1998 (age 5) cohorts. In the east basin (MU 4), the harvest is expected to rely almost exclusively on the 1998 (age 5) year class. The 2000 cohort (age 3) was weak in all units, and is expected contribute minimally to fisheries in 2003.

The RAH mean value represents the F_{opt} strategy applied to the 2003 population estimate for each unit. The min and max RAH reflect the F_{opt} approach applied to the population estimate minus or plus one standard error. Deviation from the mean RAH would suggest uncertainty related to population estimates, Y/R model parameters and / or the degree to which the model fails to incorporate risk or address differences between fisheries.

In the case of risk, simulation scenarios presented in Appendix B illustrate that, over the long term, the rate of fishing that yields the mean RAH in 2003 could eventually lead to low population levels observed in 1993-94. Based on simulations with 100 replicates, the probability of this occurring in each management unit is approximately 0% in MU 1, 3% in MU 2, and 2% in MU 3. Other simulation reference points included mean survival rate and mean spawner biomass (expressed as a percentage of an unfished population) at various fishing rates. At fishing rates with yields that correspond to mean RAHs in Table 2.2, average survival of yellow perch ages 2 and older slightly exceeded 50% in all units, while survival of fish ages 3 and older was slightly above or below 50% (Appendix B). At the mean RAH, simulated spawner biomass (%) was 60% or greater in units 1 to 3.

In the short term, additional considerations include the poor 2002 year class that will contribute little support to fisheries in 2004. If fishing did not occur in 2003, the standing stock in 2004 would still fall below 2003 because of poor recruitment. For 2003, the task group recommends allowable catches near the mean RAH in MU 1 and near or below the mean in MUs 2 and 3. Deliberations by the YPTG and an independent review (Myers et al. 2001) both recognized the likely existence of sub-stocks in eastern Lake Erie. This consideration, plus heavy reliance on a single cohort (1998) by east basin fisheries, dictates that the Y/R F_{opt} strategy is not appropriate for MU 4. A more conservative harvest approach should be considered until east basin stocks have been characterized further.

Sustainability remains the primary management objective. The level of risk posed by any harvest strategy depends on whether conditions for recruitment and growth remain relatively constant, improve or deteriorate over the long term. The level of risk considered acceptable may vary depending on economic factors that are beyond the scope of task group activities. We anticipate that Yellow Perch Task Group implementation of decision analysis in the future will address risk and uncertainty in greater detail.

Charge 3: Yellow Perch Genetics

The task group has supported the genetic research initiatives of Dr. Carol Stepien at

Cleveland State University by collecting yellow perch tissue samples during spawning season lake-wide. Preliminary results from mitochondrial DNA analysis indicate significant differences between samples taken from the Western Basin (Mississippi refugium) versus the Eastern Basin (Atlantic refugium). Additional samples are required for improved resolution, particularly from the central basin of Lake Erie. Samples to be collected during the spring of 2003 will be included for stock identification in a database that will be accessible in the future for mixed stock analysis, pending funding approval. Yellow perch stock discrimination will be explored using both microsatellite and mitochondrial DNA methodology. The YPTG wishes to extend thanks to Dr. Carol Stepien and Alexander Ford for their efforts to keep us informed.

Charge 4: Eastern Basin (MU 4) Sub-stock Delineation and Boundaries

In the winter of 2003, the task group discussed the rationale for managing stocks believed to be separate within eastern Lake Erie. There is evidence of spatial isolation based on the distribution of yellow perch harvest and from tagging studies (MacGregor et al. 1987). In addition, an independent review of Lake Erie yellow perch assessment recommended that the stock definition of this region be reconsidered (Myers et al. 2001). This charge will be addressed in greater detail during 2003.

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Table 1.1. Lake Erie yellow perch harvest in pounds by management unit (Unit) and agency, 1990-2002.

		Ontario*		Ohio		Michigan		Pennsylvania		New York		Total
	Year	Catch	%	Catch	%	Catch	%	Catch	%	Catch	%	Catch
Unit 1	1990	1,781,640	67	652,680	24	231,525	9	--	--	--	--	2,665,845
	1991	648,270	46	681,345	48	94,815	7	--	--	--	--	1,424,430
	1992	687,960	59	405,720	35	66,150	6	--	--	--	--	1,159,830
	1993	1,139,985	62	577,710	31	123,480	7	--	--	--	--	1,841,175
	1994	710,010	59	434,385	36	66,150	5	--	--	--	--	1,210,545
	1995	524,790	38	784,980	57	77,175	6	--	--	--	--	1,386,945
	1996	704,167	36	1,125,716	57	134,810	7	--	--	--	--	1,964,693
	1997	1,091,844	48	1,071,025	47	111,819	5	--	--	--	--	2,274,688
	1998	1,170,533	52	968,842	43	132,051	6	--	--	--	--	2,271,426
	1999	1,048,100	51	908,548	44	101,549	5	--	--	--	--	2,058,197
	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
Unit 2	1990	2,873,115	75	952,560	25	--	--	--	--	--	--	3,825,675
	1991	2,171,925	76	683,550	24	--	--	--	--	--	--	2,855,475
	1992	2,522,520	83	500,535	17	--	--	--	--	--	--	3,023,055
	1993	1,933,785	80	493,920	20	--	--	--	--	--	--	2,427,705
	1994	1,300,950	55	1,045,170	45	--	--	--	--	--	--	2,346,120
	1995	1,073,835	57	804,825	43	--	--	--	--	--	--	1,878,660
	1996	1,290,998	61	823,425	39	--	--	--	--	--	--	2,114,423
	1997	1,826,180	63	1,079,882	37	--	--	--	--	--	--	2,906,062
	1998	1,797,458	74	627,944	26	--	--	--	--	--	--	2,425,402
	1999	1,572,829	62	974,123	38	--	--	--	--	--	--	2,546,952
	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
Unit 3	1990	2,127,825	76	504,945	18	--	--	185,220	7	--	--	2,817,990
	1991	1,212,750	75	253,575	16	--	--	152,145	9	--	--	1,618,470
	1992	1,190,700	82	185,220	13	--	--	77,175	5	--	--	1,453,095
	1993	606,375	78	145,530	19	--	--	24,255	3	--	--	776,160
	1994	379,260	48	359,415	45	--	--	55,125	7	--	--	793,800
	1995	465,255	80	83,790	14	--	--	30,870	5	--	--	579,915
	1996	512,293	72	186,695	26	--	--	9,041	1	--	--	708,029
	1997	829,353	77	219,664	20	--	--	23,360	2	--	--	1,072,377
	1998	811,903	73	274,993	25	--	--	28,527	3	--	--	1,115,423
	1999	665,703	65	352,635	34	--	--	8,925	1	--	--	1,027,263
	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
Unit 4	1990	282,240	88	--	--	--	--	0	0	37,485	12	319,725
	1991	160,965	87	--	--	--	--	0	0	24,255	13	185,220
	1992	114,660	85	--	--	--	--	0	0	19,845	15	134,505
	1993	72,765	85	--	--	--	--	0	0	13,230	15	85,995
	1994	52,920	83	--	--	--	--	0	0	11,025	17	63,945
	1995	33,075	83	--	--	--	--	0	0	6,615	17	39,690
	1996	30,495	82	--	--	--	--	2,205	6	4,472	12	37,172
	1997	36,171	87	--	--	--	--	3,049	7	2,387	6	41,607
	1998	48,457	93	--	--	--	--	538	1	3,175	6	52,170
	1999	59,842	92	--	--	--	--	2,216	3	3,234	5	65,292
	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
Lakewide Totals	1990	7,064,820	73	2,110,185	22	231,525	2	185,220	2	37,485	<1	9,629,235
	1991	4,193,910	69	1,618,470	27	94,815	2	152,145	3	24,255	<1	6,083,595
	1992	4,515,840	78	1,091,475	19	66,150	1	77,175	1	19,845	<1	5,770,485
	1993	3,752,910	73	1,217,160	24	123,480	2	24,255	<1	13,230	<1	5,131,035
	1994	2,443,140	55	1,838,970	42	66,150	1	55,125	1	11,025	<1	4,414,410
	1995	2,096,955	54	1,673,595	43	77,175	2	30,870	1	6,615	<1	3,885,210
	1996	2,537,953	53	2,135,836	44	134,810	3	11,246	<1	4,472	<1	4,824,317
	1997	3,783,548	60	2,370,571	38	111,819	2	26,409	<1	2,387	<1	6,294,734
	1998	3,828,351	65	1,871,779	32	132,051	2	29,065	<1	3,175	<1	5,864,421
	1999	3,346,474	59	2,235,306	39	101,549	2	11,141	<1	3,234	<1	5,697,704
	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

* processor weight

Table 1.2. Catch, effort and catch per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 1 (Western Basin) by agency and gear type, 1990-2002.

		Unit 1			
		Michigan	Ohio		Ontario
	Year	Sport	Trap Nets	Sport	Gill Nets
Catch (pounds)	1990	231,525	463,050	189,630	1,781,640
	1991	94,815	196,245	485,100	648,270
	1992	66,150	123,480	282,240	687,960
	1993	123,480	158,760	418,950	1,139,985
	1994	66,150	165,375	269,010	710,010
	1995	77,175	108,045	676,935	524,790
	1996	134,810	200,313	925,403	704,167
	1997	111,819	211,876	859,149	1,091,844
	1998	132,051	184,142	784,700	1,170,533
	1999	101,549	200,939	707,609	1,048,100
	2000	67,010	240,541	798,109	980,323
	2001	70,910	179,234	736,407	711,745 *(a)*
					101,321 *(b)*
	2002	147,065	337,829	978,724	1,359,637 *(a)*
					94,468 *(b)*
Catch (Metric) (tonnes)	1990	105	210	86	808
	1991	43	89	220	294
	1992	30	56	128	312
	1993	56	72	190	517
	1994	30	75	122	322
	1995	35	49	307	238
	1996	61	91	420	319
	1997	51	96	390	495
	1998	60	84	356	531
	1999	46	91	321	475
	2000	30	109	362	445
	2001	32	81	334	323 *(a)*
					46 *(b)*
	2002	67	153	444	617 *(a)*
					43 *(b)*
Effort *(c)*	1990	634,255	6,299	350,000	18,305
	1991	164,517	7,259	700,719	13,629
	1992	120,979	6,795	350,433	9,221
	1993	244,455	7,092	530,012	12,006
	1994	224,744	5,937	469,959	11,734
	1995	123,616	5,103	598,977	11,136
	1996	193,733	4,869	772,078	8,614
	1997	192,605	5,580	834,934	13,704
	1998	183,882	5,446	863,336	19,095
	1999	184,710	5,185	941,350	12,846
	2000	122,447	4,026	965,628	6,741
	2001	97,761	1,518	686,937	2,167 *(a)*
					2,142 *(b)*
	2002	190,573	2,715	900,289	4,546 *(a)*
					739 *(b)*
Catch Rates *(d)*	1990	1.3	33.3	1.4	44.1
	1991	1.9	12.3	2.4	21.6
	1992	2.1	8.2	2.8	33.8
	1993	1.9	10.2	2.6	43.1
	1994	1.1	12.6	2.2	27.4
	1995	2.8	9.6	4.3	21.4
	1996	3.3	18.7	4.9	37.0
	1997	2.8	17.2	3.7	36.1
	1998	3.2	15.3	3.8	27.8
	1999	2.1	17.6	3.3	37.0
	2000	2.2	27.1	3.0	66.0
	2001	2.9	53.5	3.4	149.1 *(a)*
					21.5 *(b)*
	2002	2.5	56.4	3.4	135.7 *(a)*
					58.2 *(b)*

(a) small mesh gill net effort
(b) large mesh gill net effort
(c) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(d) catch rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift

Table 1.3. Catch, effort and catch per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 2 (western Central Basin) by agency and gear type, 1990-2002

		Unit 2			
		Ohio		Ontario	
	Year	Trap Nets	Sport	Gill Nets	
Catch (pounds)	1990	650,475	302,085	2,873,115	
	1991	302,085	381,465	2,171,925	
	1992	145,530	355,005	2,522,520	
	1993	114,660	379,260	1,933,785	
	1994	304,290	740,880	1,300,950	
	1995	257,985	546,840	1,073,835	
	1996	323,334	500,091	1,290,998	
	1997	498,945	580,937	1,826,180	
	1998	304,661	323,283	1,797,458	
	1999	389,973	584,150	1,572,829	
	2000	565,009	604,225	1,484,125	
	2001	905,088	841,891	1,593,704	*(a)*
				200,571	*(b)*
	2002	1,099,971	886,759	1,892,070	*(a)*
				298,551	*(b)*
Catch (Metric) (tonnes)	1990	295	137	1,303	
	1991	137	173	985	
	1992	66	161	1,144	
	1993	52	172	877	
	1994	138	336	590	
	1995	117	248	487	
	1996	147	227	585	
	1997	226	263	828	
	1998	138	147	815	
	1999	177	265	713	
	2000	256	274	673	
	2001	410	382	723	*(a)*
				91	*(b)*
	2002	499	402	858	*(a)*
				135	*(b)*
Effort *(c)*	1990	6,238	400,676	31,613	
	1991	6,480	452,277	34,739	
	1992	4,753	340,917	35,348	
	1993	2,558	320,891	25,569	
	1994	7,139	538,977	23,441	
	1995	6,467	388,238	18,337	
	1996	5,834	316,736	14,572	
	1997	8,721	575,365	24,974	
	1998	7,943	422,176	23,823	
	1999	7,502	563,819	13,179	
	2000	5,272	601,712	6,266	
	2001	4,747	581,118	3,445	*(a)*
				4,975	*(b)*
	2002	7,675	658,799	4,786	*(a)*
				3,209	*(b)*
Catch Rates *(d)*	1990	47.3	1.5	41.2	
	1991	21.1	2.2	28.4	
	1992	13.9	3.0	32.4	
	1993	20.3	3.1	34.3	
	1994	19.3	3.3	25.2	
	1995	18.1	3.5	26.6	
	1996	25.1	4.2	40.1	
	1997	25.9	2.8	33.2	
	1998	17.4	2.6	34.2	
	1999	23.6	3.0	54.1	
	2000	48.6	2.9	107.4	
	2001	86.5	3.2	209.9	*(a)*
				18.3	*(b)*
	2002	65.0	3.1	179.3	*(a)*
				42.1	*(b)*

(a) small mesh gill net effort
(b) large mesh gill net effort
(c) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(d) catch rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift

Table 1.4. Catch, effort and catch per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 3 (eastern Central Basin) by agency and gear type, 1990-2002.

		Unit 3					
		Ohio		Ontario	Pennsylvania		
	Year	Trap Nets	Sport	Gill Nets	Gill Nets	Trap Nets	Sport
Catch (pounds)	1990	447,615	57,330	2,127,825	185,220		
	1991	185,220	68,355	1,212,750	152,145		
	1992	101,430	83,790	1,190,700	77,175		
	1993	68,355	77,175	606,375	24,255		
	1994	141,120	218,295	379,260	55,125		
	1995	63,945	19,845	465,255	30,870		
	1996	103,414	83,281	512,293	0	5,292	3,749
	1997	54,776	164,888	829,353	0	7,398	15,962
	1998	90,082	184,911	811,903	0	5,291	23,236
	1999	106,258	246,377	665,703	0	2,905	6,020
	2000	156,510	286,740	771,646	0	5,930	26,683
	2001	4,472	460,339	948,622 *(a)* 50,828 *(b)*	0	2,602	96,946
	2002	0	640,104	1,094,894 *(a)* 97,797 *(b)*	0	2,009	138,812
Catch (Metric) (tonnes)	1990	203	26	965	84		
	1991	84	31	550	69		
	1992	46	38	540	35		
	1993	31	35	275	11		
	1994	64	99	172	25		
	1995	29	9	211	14		
	1996	47	38	232	0	2.4	1.7
	1997	25	75	376	0	3.4	7.2
	1998	41	84	368	0	2.4	10.5
	1999	48	112	302	0	1.3	2.7
	2000	71	130	350	0	2.7	12.1
	2001	2.0	209	430 *(a)* 23 *(b)*	0	1.2	44.0
	2002	0	290	497 *(a)* 44 *(b)*	0	0.9	63.0
Effort *(c)*	1990	7,376	31,881	12,472	1,978		
	1991	4,516	54,607	12,247	2,018		
	1992	3,361	84,445	14,540	1,321		
	1993	2,610	96,619	10,017	620		
	1994	3,053	173,706	8,169	1,442		
	1995	3,258	42,234	6,843	1,465		
	1996	2,730	69,887	6,184	0	185	12,850
	1997	2,455	126,530	9,423	0	441	43,377
	1998	2,512	111,425	10,809	0	305	30,612
	1999	2,388	176,603	4,338	0	243	28,485
	2000	1,640	214,825	2,342	0	231	48,561
	2001	32	257,217	2,451 *(a)* 1,047 *(b)*	0	175	90,214
	2002	0	416,543	2,490 *(a)* 1,055 *(b)*	0	95	123,287
Catch Rates *(d)*	1990	27.5	1.9	77.4	42.5		
	1991	18.6	2.0	44.9	34.2		
	1992	13.7	1.8	37.1	26.5		
	1993	11.9	1.7	27.5	17.7		
	1994	21.0	2.3	21.1	17.3		
	1995	8.9	1.3	30.8	9.6		
	1996	17.2	2.8	37.5		13.0	0.8
	1997	10.1	3.1	39.9		7.6	0.9
	1998	16.3	3.6	34.0		7.9	1.4
	1999	20.2	3.5	69.6		5.4	1.3
	2000	43.3	3.0	149.4		11.6	1.9
	2001	63.4	2.9	175.4 *(a)* 22.0 *(b)*		6.7	2.6
	2002	--	2.7	199.6 *(a)* 41.7 *(b)*		9.6	3.6

(a) small mesh gill net effort
(b) large mesh gill net effort
(c) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(d) catch rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift

Table 1.5. Catch, effort and catch per unit effort summaries for Lake Erie yellow perch fisheries in Management Unit 4 (Eastern Basin) by agency and gear type, 1990-2002.

		Unit 4				
		New York		Ontario	Pennsylvania	
	Year	Trap Nets	Sport	Gill Nets	Trap Nets	Sport
	1990	19,845	17,640	282,240		
	1991	15,435	8,820	160,965		
	1992	11,025	8,820	114,660		
	1993	6,615	6,615	72,765		
	1994	4,410	6,615	52,920		
Catch	1995	3,122	6,615	33,075		
(pounds)	1996	2,822	1,650	30,495	0	2,205
	1997	1,241	1,146	36,171	0	3,049
	1998	1,345	1,830	48,457	0	538
	1999	694	2,540	59,842	0	2,216
	2000	625	1,833	35,686	0	10,950
	2001	27	15,292	34,284 *(a)*	0	8,337
				1,608 *(b)*		
	2002	1,951	24,952	85,935 *(a)*	29	46,874
				1,606 *(b)*		
	1990	9.0	8.0	128		
	1991	7.0	4.0	73		
	1992	5.0	4.0	52		
	1993	3.0	3.0	33		
	1994	2.0	3.0	24		
Catch	1995	1.4	3.0	15		
(Metric)	1996	1.3	0.7	14	0	1.0
(tonnes)	1997	0.6	0.5	16	0	1.4
	1998	0.6	0.8	22	0	0.2
	1999	0.3	1.2	27	0	1.0
	2000	0.3	0.8	16	0	5.0
	2001	0.01	6.9	16 *(a)*	0	3.8
				0.7 *(b)*		
	2002	0.9	11.3	39 *(a)*	0.01	21.3
				0.7 *(b)*		
	1990	981	24,463	3,924		
	1991	918	22,090	3,859		
	1992	632	52,398	3,351		
	1993	761	26,297	2,008		
	1994	555	14,800	1,642		
Effort	1995	532	12,115	1,375		
(c)	1996	533	6,535	1,063	0	7,292
	1997	292	8,905	1,073	0	13,747
	1998	178	7,073	1,081	0	3,784
	1999	118	5,410	872	0	13,623
	2000	44	2,606	314	0	21,146
	2001	39	22,950	128 *(a)*	0	12,451
				28 *(b)*		
	2002	89	44,270	224 *(a)*	9	61,734
				28 *(b)*		
	1990	9.2	0.3	32.6		
	1991	7.6	0.6	18.9		
	1992	7.9	0.3	15.5		
	1993	3.9	0.3	16.4		
	1994	3.6	0.3	14.6		
Catch Rates	1995	2.7	0.5	10.9		
(d)	1996	2.4	0.3	13.0		0.6
	1997	1.9	0.3	15.3		1.0
	1998	3.4	0.5	20.3		0.3
	1999	2.7	0.4	31.1		0.4
	2000	6.4	0.2	51.5		1.7
	2001	0.3	1.7	121.5 *(a)*		1.5
				26.0 *(b)*		
	2002	9.9	1.1	174.1 *(a)*	1.5	2.4
				25.0 *(b)*		

(a) small mesh gill net effort
(b) large mesh gill net effort
(c) sport effort in angler-hours; gill net effort in km; trap net effort in lifts
(d) catch rates for sport in fish/hr, gill net in kg/km, trap net in kg/lift

Table 1.6. Lake Erie 2002 yellow perch harvest in numbers of fish by gear, age and management unit (Unit).

		Unit 1		Unit 2		Unit 3		Unit 4		Lakewide	
Gear	Age	Number	%	Number	%	Number	%	Number	%	Number	%
	1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	2	59,933	1.3	210,360	3.0	16,527	0.5	0	0.0	286,820	1.9
	3	1,068,533	22.5	2,956,643	41.7	886,809	28.7	24,497	9.6	4,936,482	32.5
Gill Nets	4	2,058,649	43.3	2,521,282	35.5	1,207,048	39.0	178,601	70.1	5,965,580	39.3
	5	676,746	14.2	746,425	10.5	424,379	13.7	36,101	14.2	1,883,651	12.4
	6+	887,493	18.7	660,844	9.3	558,364	18.1	15,483	6.1	2,122,184	14.0
	Total	4,751,354		7,095,554		3,093,127		254,682		15,194,718	
	1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	2	710	0.1	14,794	0.5	0	0.0	39	1.1	15,543	0.4
	3	296,822	28.8	1,138,109	37.1	184	3.7	471	13.6	1,435,586	34.9
Trap Nets	4	579,723	56.3	1,617,869	52.7	1,195	23.9	1,739	50.2	2,200,526	53.5
	5	69,669	6.8	95,784	3.1	873	17.4	252	7.3	166,578	4.1
	6+	82,649	8.0	205,231	6.7	2,757	55.0	961	27.8	291,598	7.1
	Total	1,029,573		3,071,787		5,009		3,463		4,109,832	
	1	10,815	0.3	1,697	0.1	0	0.0	0	0.0	12,512	0.2
	2	149,770	4.0	98,112	4.6	45,598	3.0	2,500	1.9	295,980	3.9
	3	1,598,802	42.4	1,022,690	48.1	312,512	20.4	19,979	15.5	2,953,983	39.1
Sport	4	1,393,852	36.9	748,976	35.2	639,458	41.8	68,751	53.2	2,851,038	37.7
	5	270,842	7.2	108,675	5.1	169,241	11.1	8,764	6.8	557,522	7.4
	6+	350,431	9.3	147,234	6.9	362,603	23.7	29,295	22.7	889,563	11.8
	Total	3,774,512		2,127,384		1,529,413		129,290		7,560,599	
	1	10,815	0.1	1,697	0.0	0	0.0	0	0.0	12,512	0.0
	2	210,413	2.2	323,266	2.6	62,125	1.3	2,539	0.7	598,343	2.2
	3	2,964,157	31.1	5,117,442	41.6	1,199,505	25.9	44,948	11.6	9,326,052	34.7
All Gear	4	4,032,224	42.2	4,888,127	39.8	1,847,701	39.9	249,091	64.3	11,017,143	41.0
	5	1,017,257	10.7	950,884	7.7	594,493	12.8	45,118	11.6	2,607,752	9.7
	6+	1,320,573	13.8	1,013,309	8.2	923,725	20.0	45,739	11.8	3,303,346	12.3
	Total	9,544,624		12,294,725		4,627,549		387,435		26,865,148	

Table 1.7. Yellow perch stock size (millions of fish) in each Lake Erie management unit. The years 1990 to 2002 are estimated by ADMB catch-age analysis in a commercial selectivity input (CSI) model. The 2003 population estimates use age 2 values derived from regressions of ADMB age 2 abundance against YOY and yearling trawl indices

	Age	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Unit 1	2	3.732	10.079	13.706	4.294	10.077	22.901	26.812	22.128	46.101	11.820	41.613	34.927	10.707	31.347
	3	1.395	1.983	5.429	7.775	1.861	6.190	14.105	16.188	13.911	28.828	7.638	26.822	22.771	6.993
	4	5.719	0.531	0.630	1.988	2.189	0.830	2.798	6.261	7.800	7.241	16.403	4.376	16.361	12.981
	5	2.823	1.592	0.119	0.135	0.335	0.497	0.224	0.739	1.975	2.973	3.493	8.560	2.464	7.876
	6+	1.213	0.749	0.333	0.072	0.027	0.079	0.167	0.099	0.185	0.537	1.446	2.354	5.931	3.685
	2 and Older	14.881	14.933	20.217	14.264	14.489	30.497	44.107	45.415	69.972	51.399	70.594	77.038	58.233	62.882
	3 and Older	11.150	4.854	6.511	9.970	4.412	7.596	17.295	23.287	23.871	39.579	28.981	42.111	47.526	31.535
Unit 2	2	6.189	14.922	19.409	6.713	15.207	13.676	27.630	16.823	62.594	15.344	50.750	44.845	10.042	44.324
	3	1.573	2.384	6.174	9.295	3.175	8.753	7.714	13.397	8.759	33.341	9.458	30.560	26.609	6.282
	4	8.953	0.529	0.771	2.102	3.327	1.075	3.115	2.722	4.037	3.653	18.066	5.078	17.006	13.711
	5	2.858	2.148	0.119	0.207	0.597	0.681	0.232	0.529	0.462	0.853	1.791	8.613	2.429	7.386
	6+	2.243	0.977	0.533	0.177	0.097	0.142	0.180	0.070	0.068	0.081	0.384	1.005	4.607	3.042
	2 and Older	21.817	20.959	27.005	18.494	22.402	24.326	38.871	33.542	75.921	53.272	80.449	90.100	60.693	74.746
	3 and Older	15.628	6.037	7.597	11.781	7.196	10.651	11.241	16.719	13.326	37.928	29.699	45.255	50.651	30.422
Unit 3	2	3.325	6.789	5.227	2.759	5.653	6.093	11.127	7.367	29.173	8.035	25.833	12.149	1.861	22.667
	3	1.941	1.996	3.899	2.239	1.330	3.136	3.801	6.846	4.585	18.671	5.132	16.362	7.526	1.133
	4	4.347	0.790	0.768	1.251	0.867	0.638	1.851	2.139	3.590	2.658	11.677	3.131	9.961	4.303
	5	1.635	1.577	0.217	0.297	0.406	0.335	0.294	0.876	1.009	1.873	1.613	6.696	1.828	5.154
	6+	4.020	1.729	0.722	0.233	0.172	0.222	0.272	0.274	0.492	0.701	1.504	1.753	4.863	3.493
	2 and Older	15.268	12.881	10.832	6.779	8.428	10.424	17.345	17.502	38.847	31.938	45.760	40.091	26.039	36.750
	3 and Older	11.942	6.092	5.605	4.020	2.775	4.330	6.218	10.135	9.674	23.903	19.927	27.943	24.178	14.083
Unit 4	2	0.607	0.405	0.093	0.263	0.137	1.168	0.759	0.347	3.975	1.383	12.778	1.378	0.760	4.878
	3	0.635	0.391	0.257	0.062	0.165	0.087	0.767	0.500	0.228	2.662	0.916	8.526	0.924	0.509
	4	0.890	0.308	0.169	0.164	0.024	0.072	0.049	0.441	0.287	0.150	1.686	0.603	5.683	0.606
	5	0.367	0.310	0.084	0.095	0.037	0.007	0.033	0.024	0.217	0.180	0.092	1.087	0.399	3.520
	6+	0.949	0.592	0.336	0.243	0.119	0.062	0.037	0.036	0.032	0.150	0.199	0.187	0.841	0.763
	2 and Older	3.447	2.007	0.939	0.827	0.482	1.397	1.646	1.347	4.739	4.525	15.671	11.781	8.606	10.275
	3 and Older	2.840	1.601	0.846	0.564	0.345	0.229	0.886	1.000	0.764	3.142	2.893	10.403	7.847	5.397

Table 1.8. Projection of the 2003 Lake Erie yellow perch population. Stock size estimates are derived from ADMB CSI catch-age analysis. Age 2 estimates in 2003 are derived from regressions of ADMB age 2 abundance against YOY and yearling trawl indices. CV is coefficient of variation in stock size for the last year of ADMB catch-age analysis.

			2002 Parameters				Rate Functions					2003 Parameters				Stock Biomass			
			Stock Size (numbers)				Mortality Rates				Survival Rate		Stock Size (numbers)			Mean Weight in Pop. (kg)	millions kg		millions lbs.
	CV	**Age**	**Mean**	**Std. Err.**	**Min.**	**Max.**	**(F)**	**(Z)**	**(A)**	**(u)**	**(S)**	**Age**	**Mean**	**Min.**	**Max.**		**2002**	**2003**	**2003**
Unit 1		2	10.707	3.662	7.045	14.369	0.026	0.426	0.347	0.021	0.653	2	31.347	20.814	41.880	0.061	0.578	1.902	4.194
	0.342	3	22.771	7.788	14.983	30.558	0.162	0.562	0.430	0.124	0.570	3	6.993	4.601	9.384	0.097	1.981	0.678	1.494
		4	16.361	5.595	10.765	21.956	0.331	0.731	0.519	0.235	0.481	4	12.981	8.541	17.420	0.121	2.127	1.569	3.459
		5	2.464	0.843	1.621	3.306	0.389	0.789	0.546	0.269	0.454	5	7.876	5.183	10.570	0.162	0.411	1.274	2.808
		6+	5.931	2.028	3.902	7.959	0.438	0.838	0.567	0.297	0.433	6+	3.685	2.425	4.945	0.234	1.512	0.864	1.904
		Total	58.233	14.247	43.986	72.480	0.213	0.613	0.458	0.159	0.542	Total	62.882	41.564	84.200	0.100	6.610	6.286	13.860
		(3+)	47.526	11.627	31.272	63.780	0.261	0.661	0.484	0.191	0.516	(3+)	31.535	20.750	42.320	0.139	6.032	4.383	9.665
Unit 2		2	10.042	2.751	7.290	12.793	0.069	0.469	0.374	0.055	0.626	2	44.324	30.046	58.603	0.110	0.944	4.862	10.720
	0.274	3	26.609	7.291	19.318	33.899	0.263	0.663	0.485	0.192	0.515	3	6.282	4.561	8.004	0.174	4.683	1.093	2.410
		4	17.006	4.660	12.346	21.665	0.434	0.834	0.566	0.294	0.434	4	13.711	9.955	17.468	0.217	3.979	2.975	6.559
		5	2.429	0.666	1.764	3.095	0.434	0.834	0.566	0.294	0.434	5	7.386	5.362	9.409	0.273	0.671	2.014	4.442
		6+	4.607	1.262	3.345	5.870	0.441	0.841	0.569	0.298	0.431	6+	3.042	2.209	3.876	0.328	1.700	0.998	2.200
		Total	60.693	16.630	44.063	77.322	0.291	0.691	0.499	0.210	0.501	Total	74.746	52.132	97.360	0.160	11.977	11.941	26.329
		(3+)	50.651	13.878	36.773	64.530	0.341	0.741	0.523	0.241	0.477	(3+)	30.422	22.086	38.757	0.233	11.033	7.079	15.610
Unit 3		2	1.861	0.596	1.266	2.457	0.096	0.496	0.391	0.076	0.609	2	22.667	15.240	30.094	0.094	0.160	2.137	4.711
	0.320	3	7.526	2.408	5.117	9.934	0.159	0.559	0.428	0.122	0.572	3	1.133	0.771	1.496	0.152	1.159	0.173	0.381
		4	9.961	3.188	6.774	13.149	0.259	0.659	0.483	0.190	0.517	4	4.303	2.926	5.680	0.194	1.982	0.833	1.838
		5	1.828	0.585	1.243	2.414	0.261	0.661	0.484	0.191	0.516	5	5.154	3.504	6.803	0.232	0.415	1.196	2.637
		6+	4.863	1.556	3.307	6.419	0.246	0.646	0.476	0.181	0.524	6+	3.493	2.375	4.611	0.277	1.298	0.969	2.136
		Total	26.039	8.333	17.707	34.372	0.215	0.615	0.459	0.160	0.541	Total	36.750	24.817	48.684	0.144	5.015	5.307	11.703
		(3+)	24.178	7.737	16.441	31.915	0.224	0.624	0.464	0.167	0.536	(3+)	14.083	9.576	18.590	0.225	4.855	3.171	6.991
Unit 4		2	0.760	0.299	0.460	1.059	0.001	0.401	0.330	0.001	0.670	2	4.878	2.673	7.083	0.080	0.057	0.390	0.860
	0.394	3	0.924	0.364	0.560	1.288	0.022	0.422	0.344	0.018	0.656	3	0.509	0.308	0.709	0.156	0.147	0.079	0.174
		4	5.683	2.239	3.444	7.922	0.079	0.479	0.381	0.063	0.619	4	0.606	0.367	0.844	0.210	1.267	0.127	0.280
		5	0.399	0.157	0.242	0.557	0.086	0.486	0.385	0.068	0.615	5	3.520	2.133	4.907	0.251	0.099	0.882	1.944
		6+	0.841	0.331	0.510	1.172	0.086	0.486	0.385	0.068	0.615	6+	0.763	0.462	1.064	0.320	0.237	0.244	0.538
		Total	8.606	3.391	5.215	11.997	0.067	0.467	0.373	0.053	0.627	Total	10.275	5.943	14.606	0.168	1.807	1.722	3.798
		(3+)	7.847	3.092	4.755	10.938	0.073	0.473	0.377	0.058	0.623	(3+)	5.397	3.271	7.524	0.247	1.750	1.332	2.938

Table 2.1. Estimated harvest of Lake Erie yellow perch for 2003. The exploitation rate is derived from optimal yield policy, and the stock size estimate are from ADMB CSI catch-age analysis and trawl regressions. Stock size and catch in numbers are in millions of fish. Catch weight is presented in millions of kilograms and pounds. See text for the MU 4 exception to the RAH strategy.

		Stock Size (numbers)			Exploitation Rate				Catch (millions of fish)			Mean Wt. in Harvest	RAH Catch (millions of kg)			RAH Catch (millions of lbs)		
	Age	**Mean**	**Min.**	**Max.**	**F(opt)**	**s(age)**	**(F)**	**(u)**	**Mean**	**Min.**	**Max.**	(kg)	**Mean**	**Min.**	**Max.**	**Mean**	**Min.**	**Max.**
Unit 1	2	31.347	20.814	41.880	0.431	0.059	0.026	0.021	0.653	0.434	0.873	0.105	0.069	0.046	0.092	0.152	0.101	0.202
	3	6.993	4.601	9.384	0.431	0.370	0.159	0.122	0.854	0.562	1.146	0.127	0.108	0.071	0.145	0.239	0.157	0.321
	4	12.981	8.541	17.420	0.431	0.756	0.326	0.232	3.006	1.978	4.034	0.144	0.433	0.285	0.581	0.955	0.628	1.281
	5	7.876	5.183	10.570	0.431	0.888	0.383	0.265	2.091	1.376	2.806	0.148	0.310	0.204	0.416	0.683	0.449	0.917
	6+	3.685	2.425	4.945	0.431	1.000	0.431	0.293	1.079	0.710	1.448	0.174	0.188	0.124	0.252	0.415	0.273	0.557
	Total	62.882	41.564	84.200				0.122	7.683	5.059	10.306	0.144	1.108	0.729	1.487	2.443	1.609	3.278
	(3+)	31.535	20.750	42.320				0.223	7.030	4.625	9.434	0.148	1.039	0.684	1.395	2.292	1.508	3.075
Unit 2	2	44.324	30.046	58.603	0.463	0.156	0.072	0.058	2.559	1.735	3.383	0.125	0.321	0.217	0.424	0.707	0.479	0.934
	3	6.282	4.561	8.004	0.463	0.596	0.276	0.201	1.261	0.915	1.606	0.143	0.180	0.131	0.230	0.397	0.288	0.506
	4	13.711	9.955	17.468	0.463	0.984	0.456	0.306	4.198	3.048	5.349	0.159	0.669	0.486	0.852	1.475	1.071	1.879
	5	7.386	5.362	9.409	0.463	0.984	0.456	0.306	2.261	1.642	2.881	0.182	0.412	0.299	0.525	0.909	0.660	1.158
	6+	3.042	2.209	3.876	0.463	1.000	0.463	0.310	0.944	0.685	1.202	0.232	0.219	0.159	0.279	0.483	0.351	0.615
	Total	74.746	52.132	97.360				0.150	11.223	8.025	14.422	0.160	1.801	1.292	2.309	3.970	2.849	5.092
	(3+)	30.422	22.086	38.757				0.285	8.664	6.290	11.038	0.171	1.480	1.075	1.886	3.264	2.369	4.158
Unit 3	2	22.667	15.240	30.094	0.464	0.368	0.171	0.130	2.948	1.982	3.914	0.128	0.376	0.253	0.499	0.829	0.557	1.100
	3	1.133	0.771	1.496	0.464	0.609	0.283	0.205	0.232	0.158	0.306	0.160	0.037	0.025	0.049	0.082	0.056	0.108
	4	4.303	2.926	5.680	0.464	0.992	0.460	0.309	1.329	0.903	1.754	0.184	0.245	0.167	0.324	0.541	0.368	0.713
	5	5.154	3.504	6.803	0.464	1.000	0.464	0.311	1.601	1.089	2.114	0.213	0.342	0.232	0.451	0.753	0.512	0.994
	6+	3.493	2.375	4.611	0.464	0.943	0.437	0.296	1.035	0.704	1.366	0.232	0.241	0.164	0.317	0.530	0.361	0.700
	Total	36.750	24.817	48.684				0.194	7.145	4.836	9.453	0.174	1.240	0.841	1.640	2.735	1.853	3.616
	(3+)	14.083	9.576	18.590				0.298	4.197	2.854	5.540	0.206	0.864	0.588	1.141	1.906	1.296	2.516

Table 2.2. Lake Erie yellow perch recommended allowable harvest (RAH) estimates for 2003. Estimates are based on the F(opt) fishing strategy and the ADMB CSI model. See text for the MU 4 exception to the RAH strategy. Values are rounded to nearest thousand.

Yield (Millions of Pounds)

	RAH		
	Min.	Mean	Max.
Unit 1	1.609	2.443	3.278
Unit 2	2.849	3.970	5.092
Unit 3	1.853	2.735	3.616
Unit 4	special strategy : Y / R not applied		
Total $_{(1-3)}$	**6.311**	**9.148**	**11.986**

Yield (Millions of Kilograms)

	RAH		
	Min.	Mean	Max.
Unit 1	0.730	1.108	1.487
Unit 2	1.292	1.800	2.309
Unit 3	0.840	1.240	1.640
Unit 4	special strategy : Y / R not applied		
Total $_{(1-3)}$	**2.862**	**4.148**	**5.436**

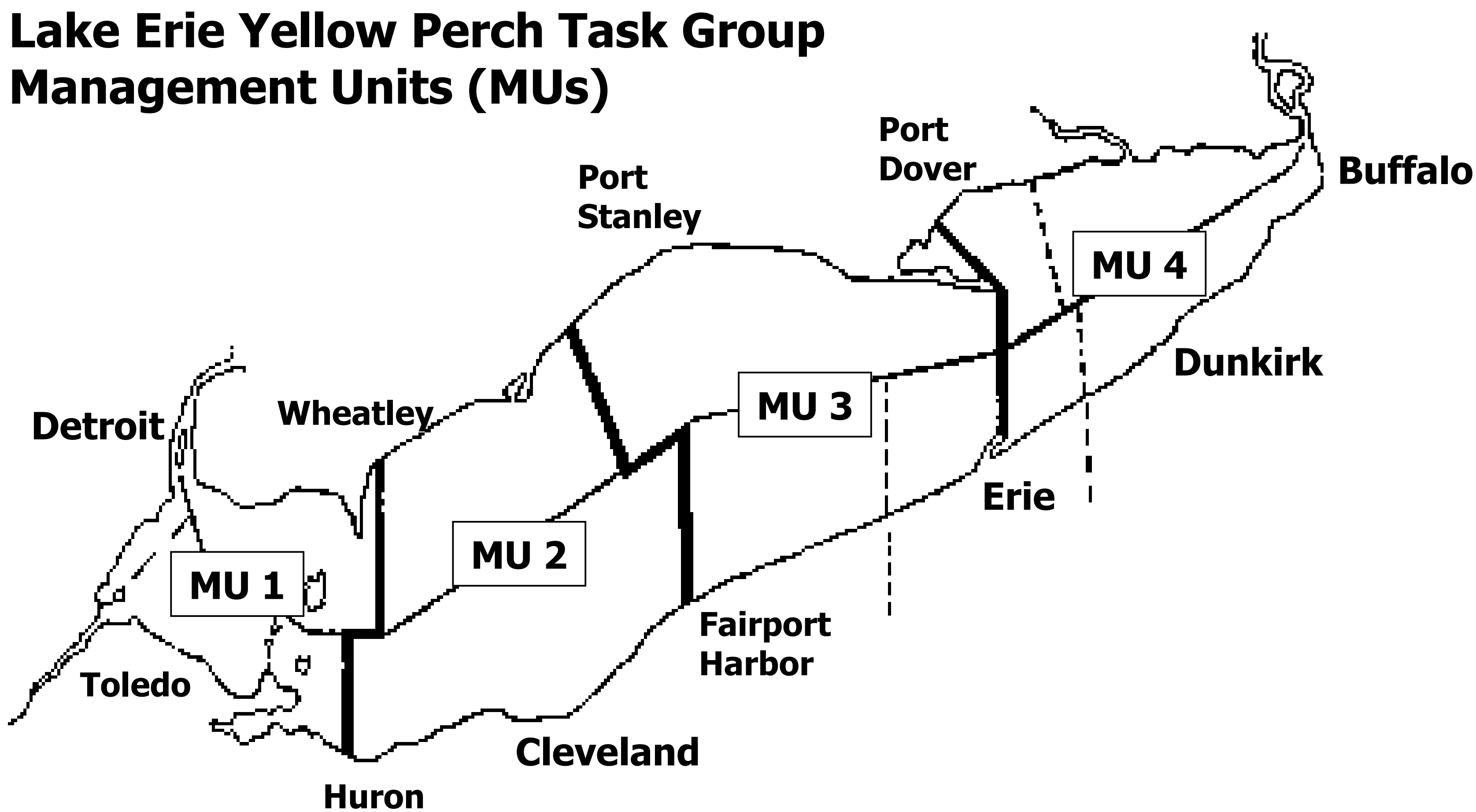

Figure 1.1. The Yellow Perch Task Group management units (MUs) of Lake Erie.

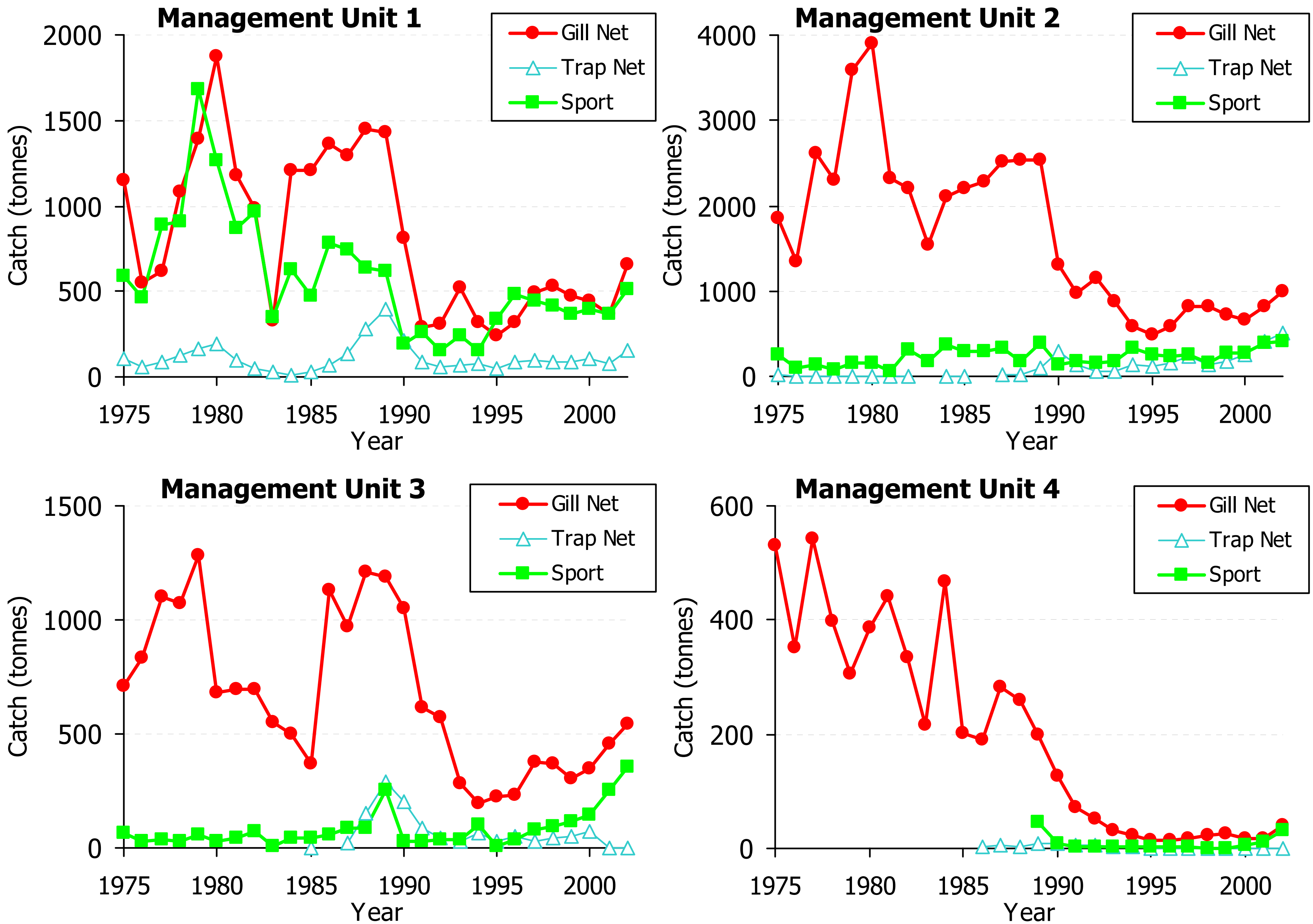

Figure 1.2. Lake Erie yellow perch harvest by management unit and gear type.

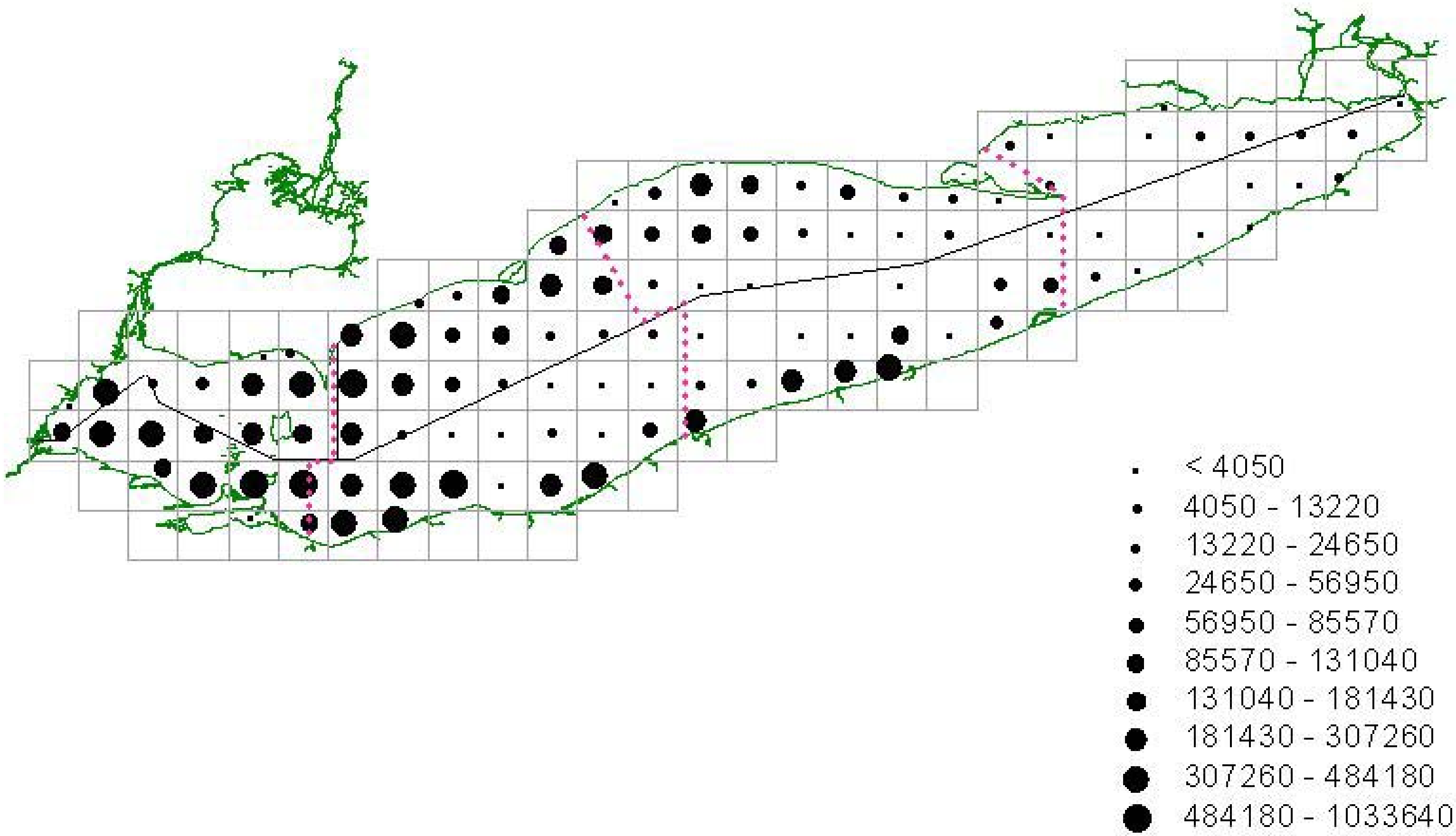

Figure 1.3. Spatial distribution of yellow perch harvest (lbs) in 2002 by 10-minute grid. Grids overlap two management units along boundaries.

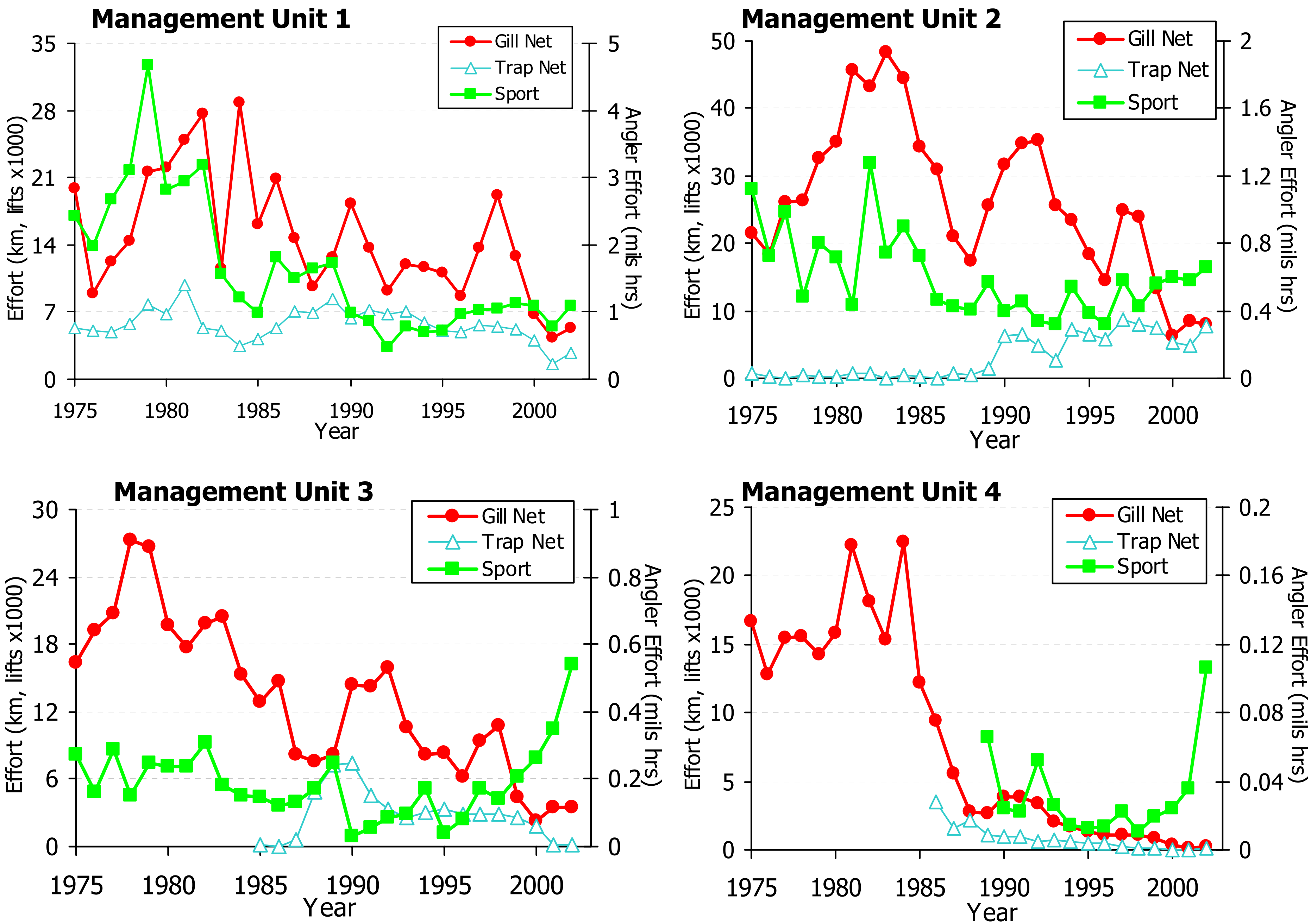

Figure 1.4. Lake Erie yellow perch effort by management unit and gear type. Note: 2001 and 2002 gill net effort presented contains both small and large mesh.

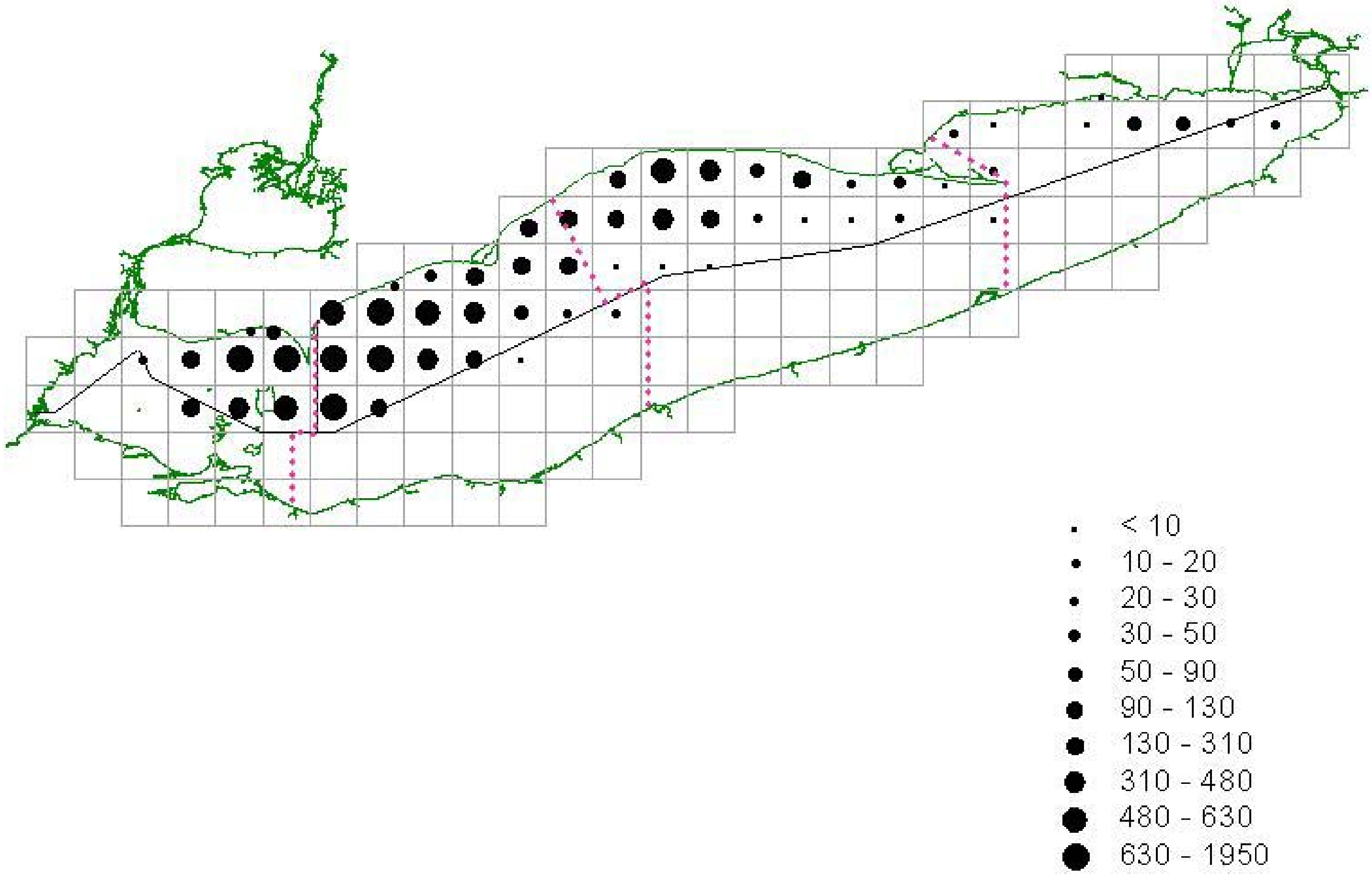

Figure 1.5. Spatial distribution of yellow perch gill net effort (km) in 2002 by 10-minute grid.

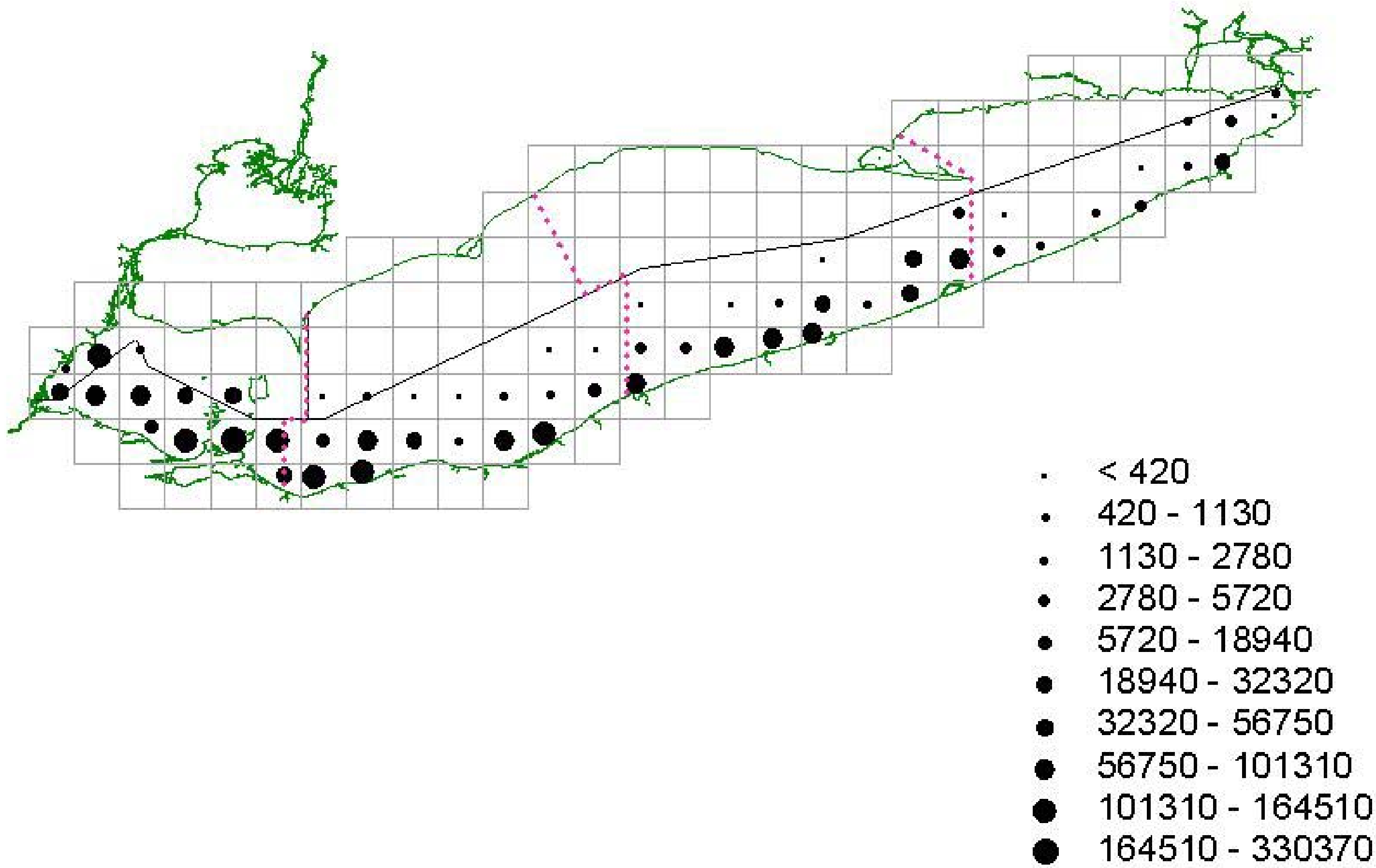

Figure 1.6. Spatial distribution of yellow perch sport angling effort (angler hours) in 2002 by 10-minute grid.

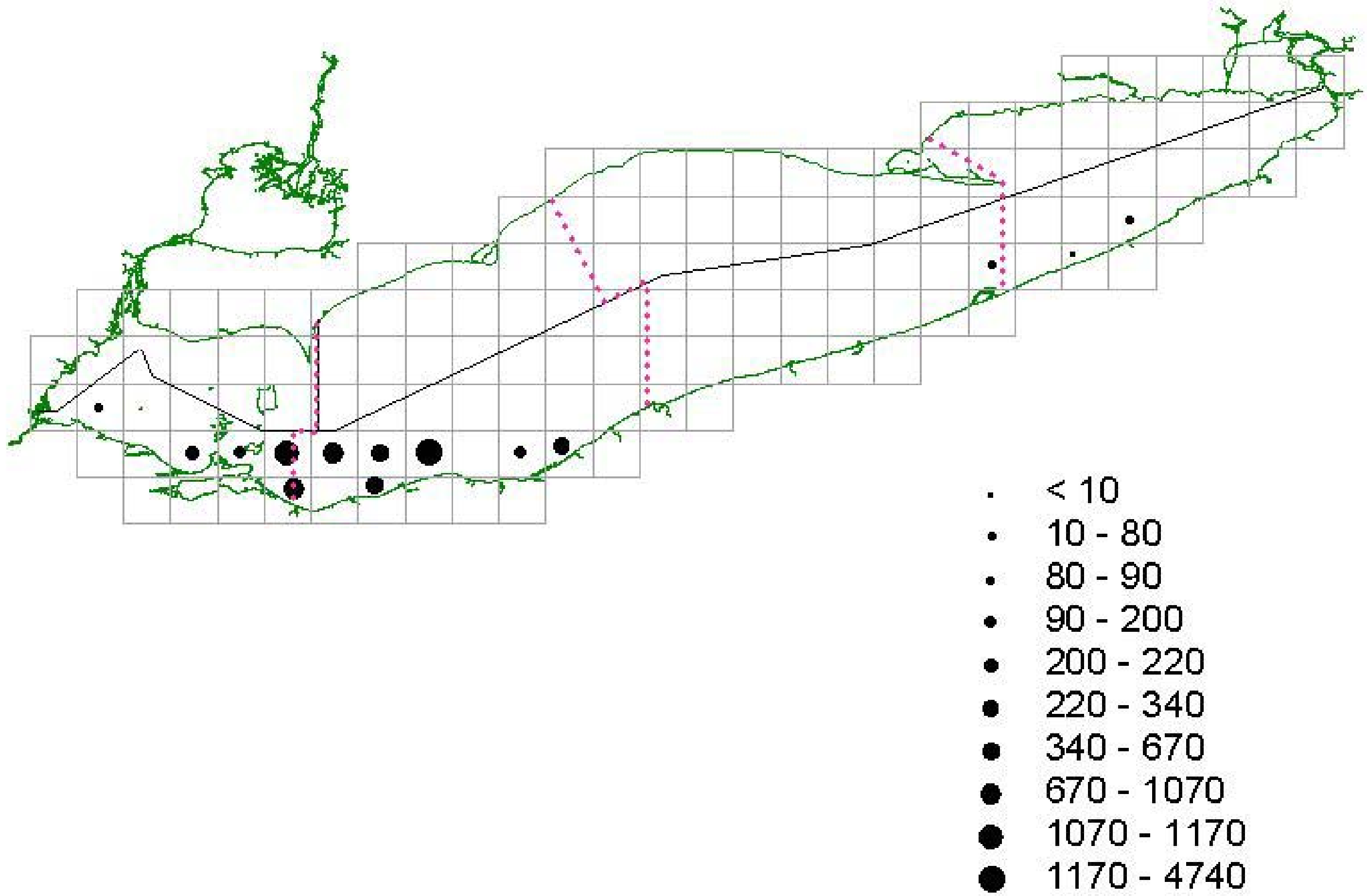

Figure 1.7. Spatial distribution of yellow perch trap net effort (lifts) in 2002 by 10-minute grid.

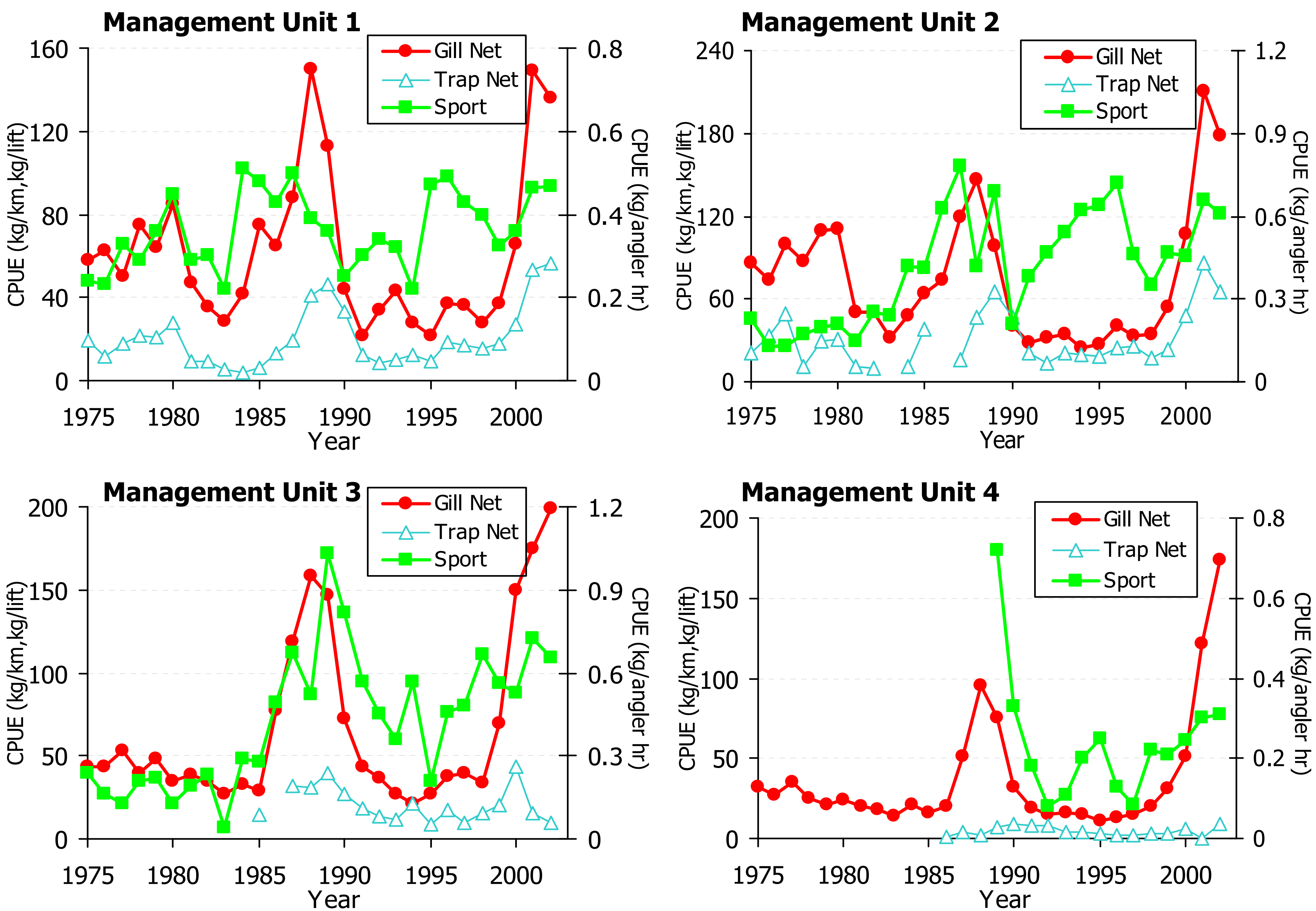

Figure 1.8. Lake Erie yellow perch catch per unit effort (CPUE) by management unit and gear type. Note: 2001 and 2002 gill net CPUE is for small mesh only.

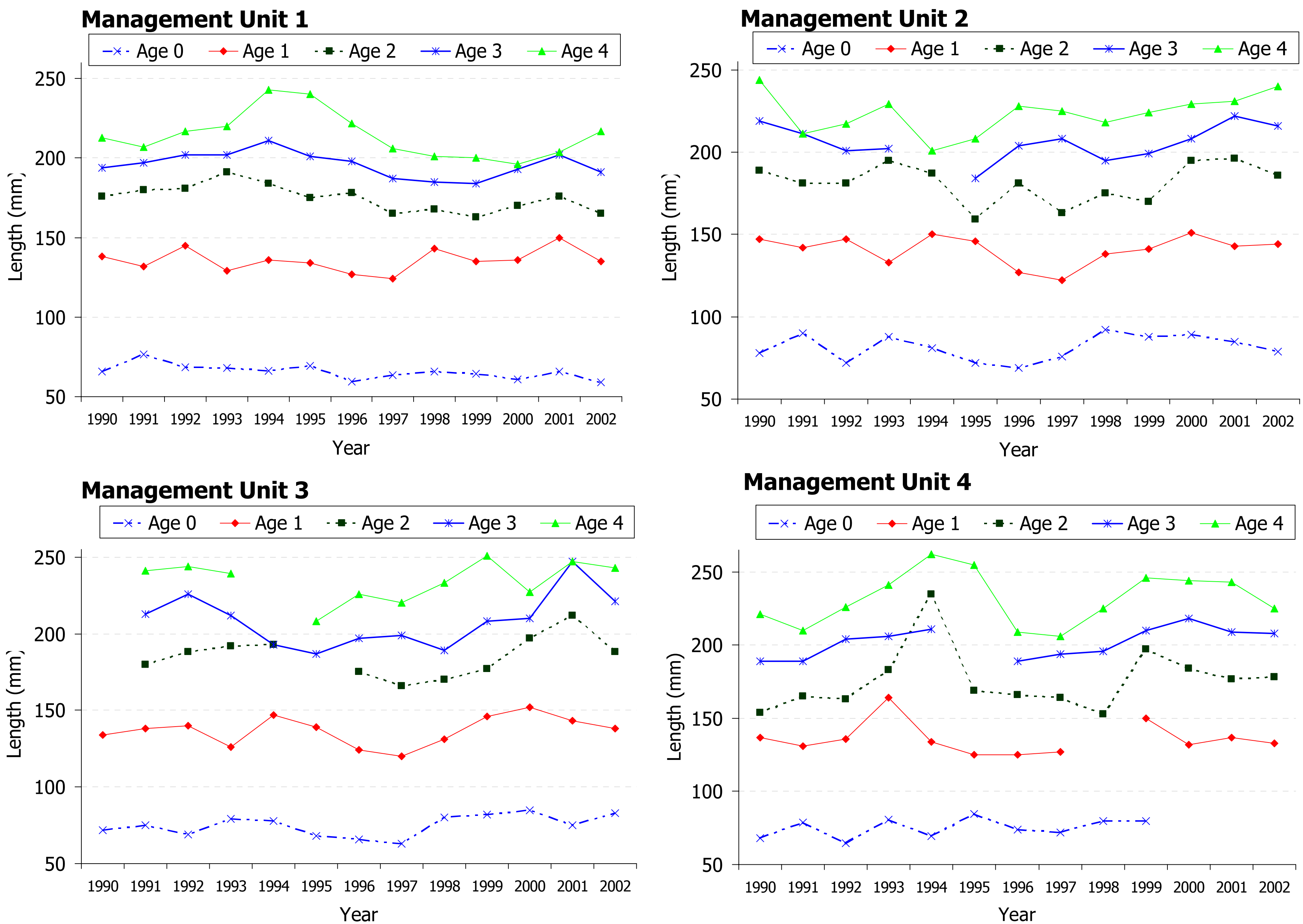

Figure 1.9. Yellow perch length-at-age from October interagency experimental samples for ages 0, 1, 2, and 4 by management unit.

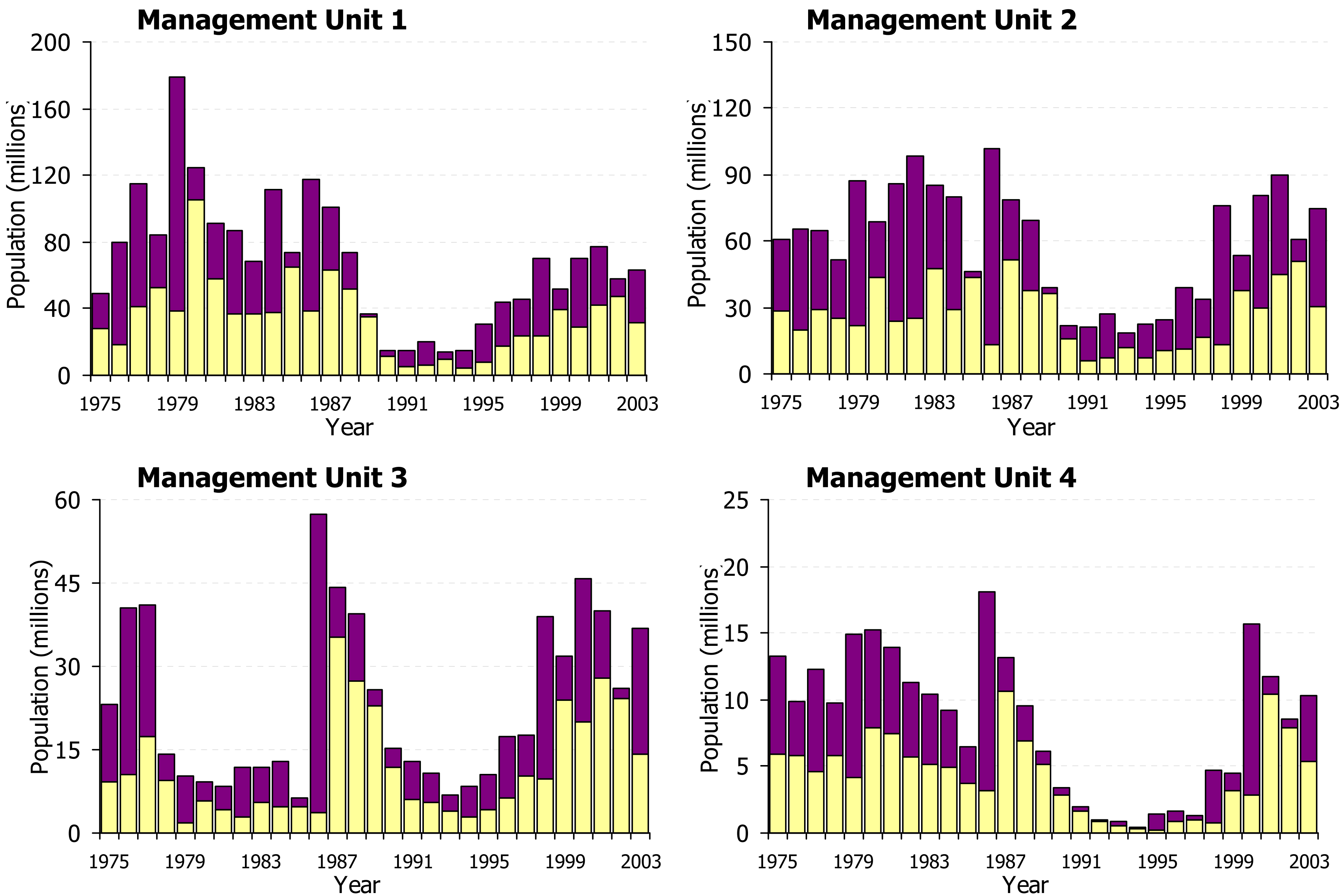

Figure 1.10. Lake Erie yellow perch population estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 2003 are from ADMB CSI Catch-Age and parametric regressions for age 2.

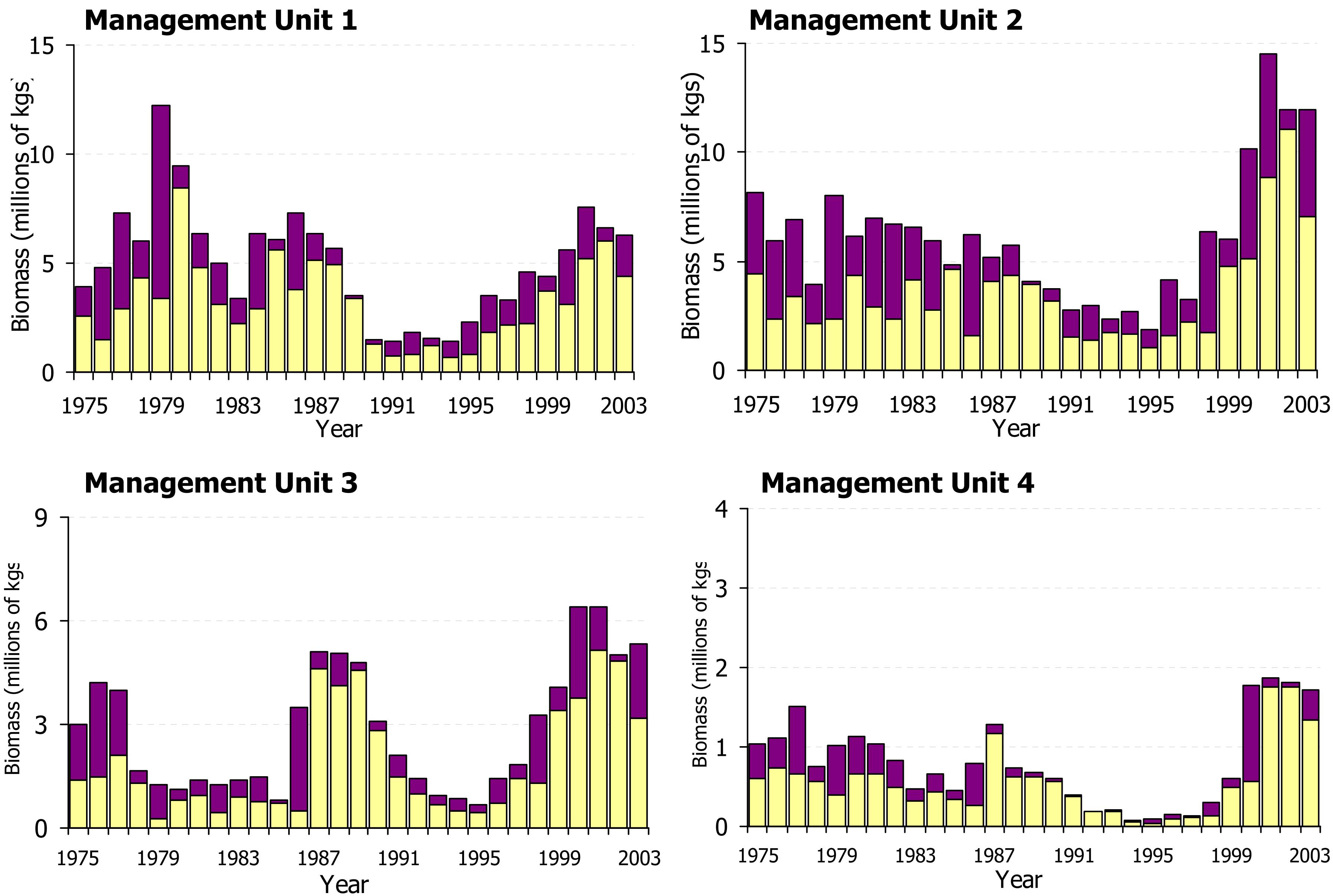

Figure 1.11. Lake Erie yellow perch biomass estimates by management unit for age 2 (dark bars) and ages 3+ (light bars). Estimates for 2002 are from ADMB CSI Catch-Age and parametric regressions for age 2.

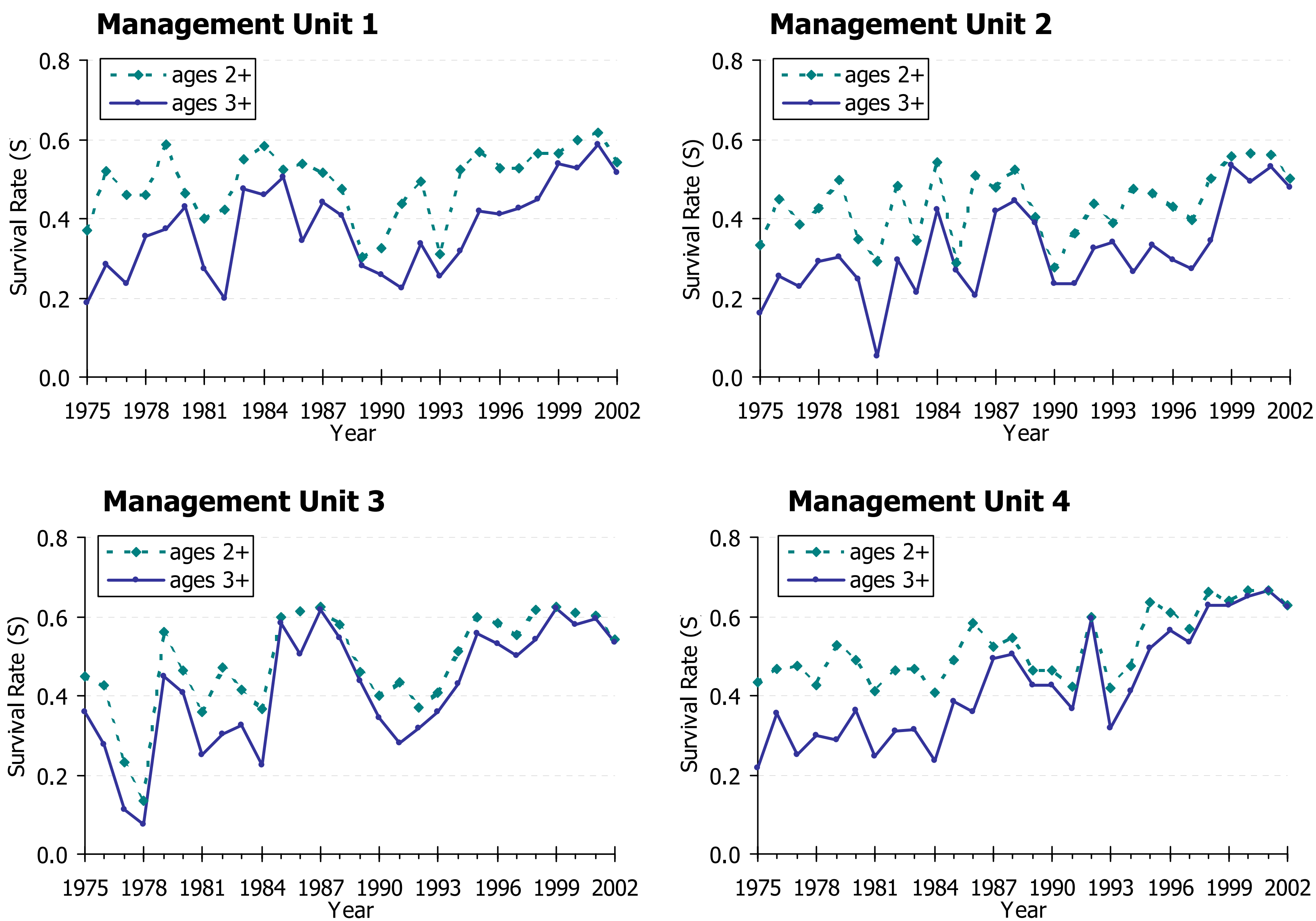

Figure 1.12. Lake Erie yellow perch survival rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from ADMB CSI Catch-Age model.

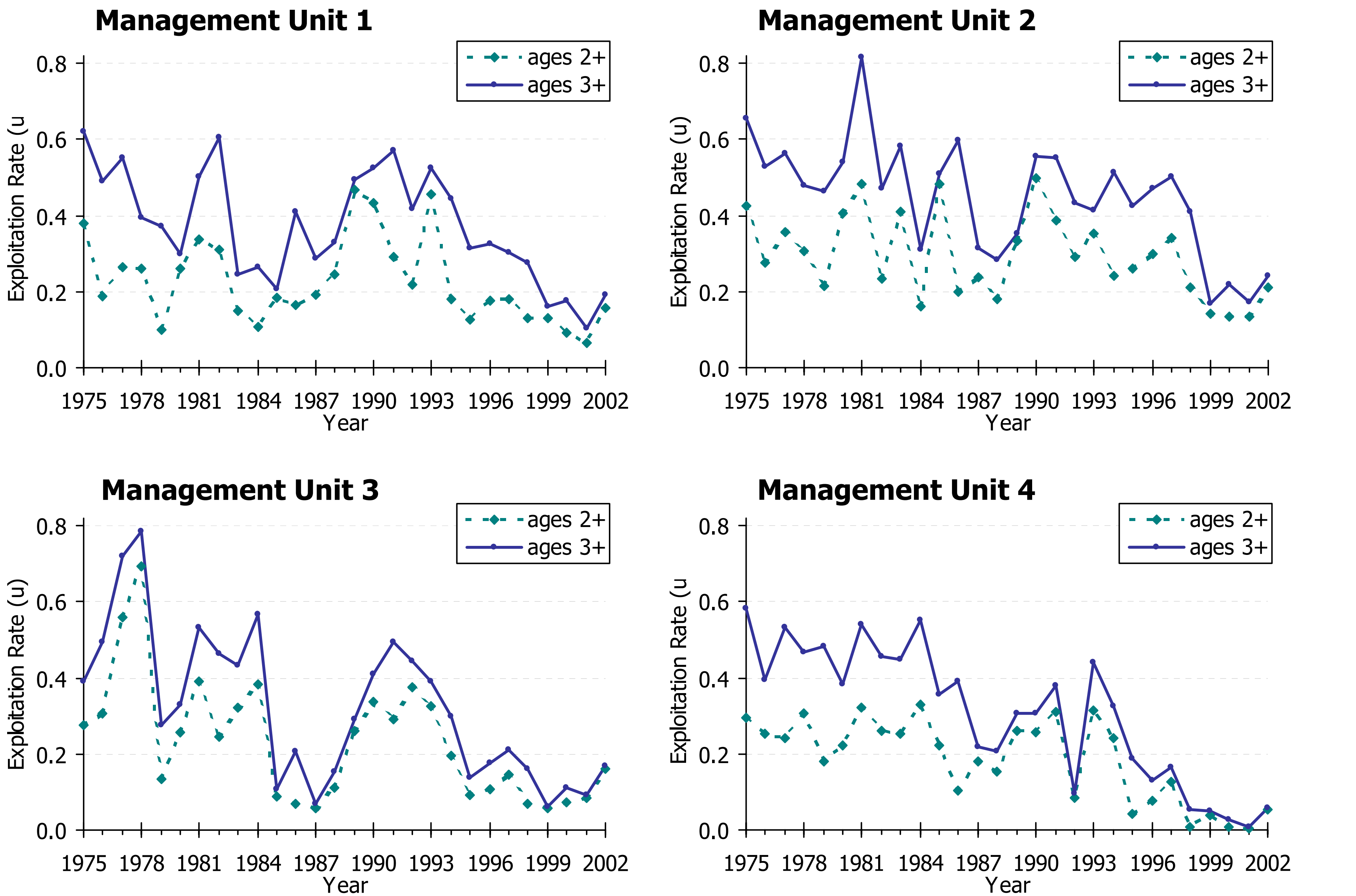

Figure 1.13. Lake Erie yellow perch exploitation rates by management unit for ages 2+ (dashed line) and ages 3+ (solid line). Estimates are derived from ADMB CSI Catch-Age model.

Appendix Table A-1. Agency trawl regression indices found statistically significant for projecting estimates of age 2 yellow perch 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.
OHS11G	0.8957	0.8471	52.7	44.642	0.0802	36.189	53.095
OHF20A	0.8433	0.1609	321.8	51.778	0.0231	36.910	66.645
OHF10A	0.8016	0.0868	262.9	22.820	0.0120	16.510	29.129
OHF11G	0.8014	1.1023	63.8	70.327	0.1829	46.989	93.665
BOHF21A	0.7787	0.1503	134.4	20.200	0.0253	13.400	27.001
USS11G	0.7458	1.6007	20.1	32.174	0.2592	21.754	42.594
USF11A	0.7381	0.6733	38.2	25.720	0.1112	17.224	34.216
USF10G	0.6997	0.2619	16.8	4.400	0.0476	2.801	5.999
ONTS10A	0.6990	0.0168	998.0	16.766	0.0031	10.579	22.954
OHS20G	0.5991	0.9918	40.7	40.366	0.2705	18.348	62.385
OHS10G	0.5807	0.1085	144.0	15.624	0.0256	8.251	22.997
			mean	**31.347**		**20.814**	**41.880**

Management Unit 2

Index	R-SQUARE	Slope	Index Value	Age-2 estimate	SE of slope	Lower Age 2 CI.	Upper Age 2 CI.
OHF20A	0.9325	0.2047	321.8	65.872	0.0184	54.030	77.715
OHF31A	0.9074	0.4721	134.9	63.686	0.0477	50.817	76.556
BOHF21A	0.8602	0.1918	134.4	25.778	0.0244	19.219	32.337
OHS11G	0.8470	1.0143	52.7	53.454	0.1196	40.848	66.059
BOHF30G	0.8435	1.8069	34.8	62.880	0.2594	44.826	80.934
OHF10A	0.7911	0.1062	262.9	27.920	0.0151	19.980	35.860
USS11G	0.7562	1.9846	20.1	39.890	0.3125	27.328	52.453
USF10G	0.7547	0.3349	16.8	5.626	0.0530	3.846	7.407
OHF11G	0.7338	1.2764	63.8	81.434	0.2563	48.730	114.138
BOHS20G	0.7278	1.6338	40.7	66.496	0.3330	39.389	93.602
ONTS10A	0.7166	0.0210	998.0	20.958	0.0037	13.573	28.343
USF11A	0.6961	0.8051	38.2	30.755	0.1475	19.486	42.024
OHS30G	0.6497	1.4431	38.5	55.559	0.3746	26.715	84.404
OHS10G	0.6422	0.1405	144.0	20.232	0.0291	11.851	28.613
			mean	**44.324**		**30.046**	**58.603**

Management Unit 3

Index	R-SQUARE	Slope	Index Value	Age-2 estimate	SE of slope	Lower Age 2 CI.	Upper Age 2 CI.
BOHF20G	0.9233	0.3297	69.9	23.046	0.0317	18.614	27.478
OHF31A	0.9091	0.2058	134.9	27.762	0.0206	22.205	33.320
BOHF30G	0.8571	0.7927	34.8	27.586	0.1079	20.076	35.096
BOHF21A	0.8199	0.0812	134.4	10.913	0.0124	7.580	14.246
BOHS20G	0.7592	0.7262	40.7	29.556	0.1363	18.462	40.651
OHS30G	0.6810	0.6397	38.5	24.628	0.1548	12.709	36.548
NYF41A	0.6349	0.4743	32.0	15.178	0.1272	7.037	23.318
			mean	**22.667**		**15.240**	**30.094**

Management Unit 4

Index	R-SQUARE	Slope	Index Value	Age-2 estimate	SE of slope	Lower Age 2 CI.	Upper Age 2 CI.
NYF41A	0.8042	0.1630	32.0	5.216	0.0284	3.398	7.034
ILP41G	0.6503	0.4773	9.6	4.582	0.0971	2.718	6.446
BOHF31A	0.5812	0.0520	132.6	6.895	0.0140	3.182	10.608
ILP40G	0.5412	0.0166	169.7	2.817	0.0042	1.392	4.243
			mean	**4.878**		**2.673**	**7.083**

Appendix Table A-2. Geometric index values from lakewide trawl surveys.

Year	ONTS10G	OHS10G	OHS11G	OHF10G	OHF11G	USS10G	USS11G	USF10G	USF11G	ONOHP10G	OHS20G	OHS21G	OHF20G	OHF21G	BOHS20G	BOHS21G	BOHF20G	BOHF21G
1980	-	10.5	0.0	69.0	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	-	3.0	7.9	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1982	49.4	30.0	13.8	31.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1983	1.4	2.0	0.0	2.2	-	4.0	16.0	2.8	17.5	-	-	-	-	-	-	-	-	-
1984	118.5	16.3	0.3	5.3	-	7.1	1.9	10.9	2.9	-	-	-	-	-	-	-	-	-
1985	36.0	7.0	0.0	3.9	-	6.5	8.4	28.8	12.8	-	-	-	-	-	-	-	-	-
1986	56.5	155.8	0.0	7.6	-	141.7	34.1	8.8	22.7	-	-	-	-	-	-	-	-	-
1987	0.5	4.3	31.6	4.1	-	1.4	17.3	4.3	12.3	3.9	-	-	-	-	-	-	-	-
1988	88.6	17.1	2.3	3.6	-	43.3	3.6	1.0	0.1	45.4	-	-	-	-	-	-	-	-
1989	127.0	20.4	2.9	18.8	-	32.6	8.1	20.0	1.0	61.9	-	-	-	-	-	-	-	-
1990	111.5	42.8	9.6	54.1	-	29.2	6.7	59.2	2.0	81.0	1.0	28.4	19.2	55.2	0.4	24.0	24.6	55.1
1991	41.3	20.1	10.8	14.4	0.2	16.9	17.1	63.4	4.9	33.6	1.9	28.5	4.3	57.2	1.4	28.1	4.9	66.6
1992	27.4	12.2	2.0	10.2	0.2	4.3	0.1	17.3	0.3	23.1	15.0	6.7	8.7	11.7	15.0	6.7	9.1	12.4
1993	80.2	86.8	6.6	24.0	0.2	28.8	0.9	17.3	0.2	107.5	4.0	24.3	9.4	28.7	4.0	24.3	9.9	25.2
1994	243.2	64.6	18.2	35.6	22.7	419.9	8.0	78.7	36.1	148.5	6.5	2.8	20.0	6.8	6.5	2.8	21.1	6.7
1995	51.9	26.3	46.4	30.6	0.1	475.2	23.1	9.3	4.4	51.1	0.8	20.0	2.9	45.8	0.8	20.0	2.7	35.8
1996	679.0	575.2	32.7	262.1	32.1	10633.1	5.3	228.7	3.9	649.2	61.0	2.7	95.0	5.4	47.8	2.7	94.5	4.9
1997	11.4	10.8	45.3	5.9	42.9	18.3	27.1	5.6	9.0	15.0	3.5	855.1	2.1	42.2	5.7	762.4	2.1	40.1
1998	112.4	71.8	2.8	104.4	6.8	74.4	3.8	100.9	6.4	100.5	16.9	1.8	70.4	3.1	12.9	2.0	70.4	3.1
1999	171.0	102.8	27.8	79.4	31.2	943.4	12.7	50.2	14.7	148.3	10.6	14.1	47.6	48.3	11.3	11.6	44.1	56.8
2000	16.3	44.0	46.1	13.3	19.5	11.1	5.4	4.9	9.0	32.3	0.3	27.8	5.6	39.2	0.3	34.2	5.5	45.7
2001	243.5	144.0	9.5	128.5	5.7	22.2	1.1	16.8	0.6	202.4	40.7	2.6	52.1	5.2	40.7	2.6	69.9	6.2
2002	10.3	8.2	52.7	9.0	63.8	1.4	20.1	3.5	10.5	12.1	0.3	181.4	1.2	20.8	0.3	181.4	0.9	21.4

Year	OHS30G	OHS31G	OHF30G	OHF31G	BOHS30G	BOHS31G	BOHF30G	BOHF31G	PAF30G	PAF31G	ILP40G	ILP41G	OLP40G	OLP41G	NYF40G	NYF41G
1980	-	-	-	-	-	-	-	-	-	-	77.5	69.0	11.8	25.7	-	-
1981	-	-	-	-	-	-	-	-	23.0	-	357.4	29.9	21.6	1.7	-	-
1982	-	-	-	-	-	-	-	-	26.0	-	229.5	16.0	7.9	4.1	-	-
1983	-	-	-	-	-	-	-	-	0.5	-	25.6	-	0.0	0.0	-	-
1984	-	-	-	-	-	-	-	-	385.0	-	414.8	16.0	57.0	1.4	-	-
1985	-	-	-	-	-	-	-	-	4.0	-	6.0	32.7	0.7	5.6	-	-
1986	-	-	-	-	-	-	-	-	125.0	-	465.4	3.8	38.5	0.3	-	-
1987	-	-	-	-	-	-	-	-	25.0	-	0.7	2.6	1.1	10.8	-	-
1988	-	-	-	-	-	-	-	-	40.0	-	73.4	0.8	47.3	0.4	-	-
1989	-	-	-	-	-	-	-	-	0.5	-	70.0	6.4	18.0	6.8	-	-
1990	0.3	5.3	6.9	15.8	0.4	4.6	6.8	13.7	3.0	-	27.2	8.9	8.2	3.4	-	-
1991	2.0	6.3	0.9	18.7	1.6	12.6	0.9	13.3	5.0	-	8.0	2.8	2.0	0.5	-	-
1992	11.4	2.5	20.4	3.6	23.5	1.5	17.1	3.1	50.0	-	46.5	3.3	6.1	1.4	4.4	1.8
1993	6.6	4.7	13.8	12.6	6.1	4.1	12.2	10.6	38.0	-	19.2	5.8	6.2	1.2	54.9	2.1
1994	3.0	1.6	9.5	1.5	4.0	1.6	8.3	1.4	172.0	-	13.2	3.8	26.4	3.3	12.8	2.6
1995	4.5	9.2	11.6	35.1	4.5	9.2	10.9	36.3	20.0	-	1.2	5.4	2.4	10.4	4.9	9.6
1996	53.4	1.2	76.7	3.2	50.0	1.1	39.9	2.4	214.8	-	12.6	1.5	36.8	1.2	24.1	0.2
1997	-	-	2.0	7.5	-	-	1.8	5.5	0.0	-	3.1	1.6	2.6	4.5	0.1	1.5
1998	7.9	1.2	21.8	1.1	7.9	1.2	18.3	1.1	0.2	-	383.3	3.6	14.3	0.7	0.6	0.1
1999	11.0	22.2	12.0	22.2	11.0	22.2	11.8	21.9	15.0	9.0	5.1	17.6	0.6	8.8	5.6	3.9
2000	0.0	22.3	0.8	6.9	0.0	21.5	0.8	5.8	14.4	1.8	0.7	0.8	2.6	1.1	5.3	1.9
2001	38.5	5.3	35.0	0.5	38.5	5.3	34.8	0.4	35.8	1.5	169.7	1.6	26.1	0.5	112.3	13.8
2002	0.9	82.2	1.4	9.7	0.8	113.3	1.3	132.6	20.8	28.3	1.5	9.6	0.2	5.1	3.3	10.0

Appendix Table A-3. Arithmetic index values from lakewide trawl surveys.

Year	ONTS10A	OHS10A	OHS11A	OHF10A	OHF11A	USS10A	USS11A	USF10A	USF11A	ONOHP10A	OHS20A	OHS21A	OHF20A	OHF21A	BOHS20A	BOHS21A	BOHF20A	BOHF21A
1980	-	122.0	0.0	663.7	191.0	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	-	29.5	56.0	110.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1982	965.6	359.1	124.3	854.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1983	3.3	30.5	0.0	5.8	-	19.8	59.2	15.0	43.3	-	-	-	-	-	-	-	-	-
1984	3020.8	138.3	0.8	110.0	-	28.5	5.8	46.4	11.8	-	-	-	-	-	-	-	-	-
1985	521.9	26.1	0.0	39.0	-	42.0	34.0	71.4	27.2	-	-	-	-	-	-	-	-	-
1986	1754.5	1143.7	0.0	61.5	-	1295.0	162.3	63.7	76.3	-	-	-	-	-	-	-	-	-
1987	0.7	20.0	104.4	18.0	-	5.0	41.0	12.8	61.2	10.8	-	-	-	-	-	-	-	-
1988	328.7	145.9	12.6	35.0	-	129.0	10.3	5.8	0.3	224.5	-	-	-	-	-	-	-	-
1989	788.4	107.2	15.7	113.5	-	149.8	15.7	34.2	3.3	447.9	-	-	-	-	-	-	-	-
1990	739.9	145.5	26.4	330.0	-	81.0	22.2	176.2	6.3	458.8	3.7	152.5	108.8	59.9	1.7	158.5	121.5	59.5
1991	111.4	139.3	34.1	61.8	0.6	185.2	35.0	210.8	18.0	125.4	10.7	95.7	27.0	120.8	8.4	91.9	29.5	128.3
1992	271.7	65.4	12.9	91.5	1.0	21.0	0.5	75.3	2.5	164.4	16.4	19.2	92.1	34.7	16.4	19.2	99.0	36.7
1993	766.9	1261.0	19.6	274.5	4.8	321.7	6.0	137.7	0.5	1052.5	104.0	72.5	23.9	92.7	104.0	72.5	25.3	86.9
1994	887.7	526.5	78.2	289.4	97.4	4281.8	40.3	162.0	57.8	702.5	144.2	12.3	155.7	26.9	144.2	12.3	165.6	26.1
1995	1337.8	348.0	167.8	81.6	0.2	2866.6	223.4	27.5	20.0	815.4	8.7	278.7	8.0	180.4	8.7	278.7	7.5	161.6
1996	3309.9	3284.9	105.5	644.2	121.5	11444.0	13.2	737.2	9.2	3296.2	2721.8	31.6	347.0	35.0	2411.0	28.6	343.7	33.7
1997	109.9	58.2	175.4	37.2	156.9	293.7	85.3	39.3	51.0	81.2	79.0	1848.0	24.2	402.1	116.3	1590.0	25.4	394.0
1998	285.4	195.4	7.4	281.7	23.3	138.7	11.0	246.2	19.4	236.0	641.1	7.2	199.7	7.4	561.6	8.1	199.7	7.4
1999	816.0	299.3	96.8	180.2	70.6	1234.8	29.2	176.5	28.8	534.2	85.7	52.9	172.1	113.8	93.8	47.8	157.5	123.8
2000	75.4	180.8	112.0	39.7	46.8	115.8	23.8	42.2	30.8	126.4	1.7	236.1	50.5	155.6	2.0	271.4	49.9	162.0
2001	998.0	361.6	18.8	262.9	14.3	63.5	3.3	57.3	2.8	703.3	854.0	21.0	321.8	14.6	854.0	21.0	365.1	15.5
2002	23.7	51.4	90.0	43.4	127.1	8.7	37.7	25.2	38.2	36.5	0.8	520.9	10.3	125.2	0.8	520.9	8.1	134.4

Year	OHS30A	OHS31A	OHF30A	OHF31A	BOHS30A	BOHS31A	BOHF30A	BOHF31A	PAF30A	PAF31A	ILP40A	ILP41A	OLP40A	OLP41A	NYF40A	NYF41A
1980	-	-	-	-	-	-	-	-	-	-	191.0	207.5	38.1	59.7	-	-
1981	-	-	-	-	-	-	-	-	-	-	607.2	98.9	109.8	5.3	-	-
1982	-	-	-	-	-	-	-	-	-	-	840.2	142.3	54.4	18.7	-	-
1983	-	-	-	-	-	-	-	-	-	-	142.6	-	-	-	-	-
1984	-	-	-	-	-	-	-	-	-	-	1167.9	73.7	275.7	7.6	-	-
1985	-	-	-	-	-	-	-	-	-	-	24.6	138.7	3.6	71.3	-	-
1986	-	-	-	-	-	-	-	-	-	-	1324.5	41.2	122.8	0.9	-	-
1987	-	-	-	-	-	-	-	-	-	-	2.8	30.0	2.6	206.4	-	-
1988	-	-	-	-	-	-	-	-	-	-	269.5	3.6	476.1	0.7	-	-
1989	-	-	-	-	-	-	-	-	-	-	359.4	66.9	201.7	37.8	-	-
1990	1.9	22.7	52.5	33.6	2.7	20.9	55.2	29.9	-	-	181.6	31.6	36.4	12.6	-	-
1991	11.3	166.2	3.2	48.0	10.8	306.8	3.2	39.7	-	-	106.2	25.7	10.5	1.1	-	-
1992	45.5	10.4	68.2	7.8	60.1	7.0	58.6	7.8	-	-	428.4	24.3	39.6	7.9	23.0	5.0
1993	96.9	34.7	38.3	29.4	91.1	32.6	34.3	26.8	-	-	180.7	15.4	24.5	3.8	222.4	6.2
1994	176.7	33.5	35.0	9.8	224.1	33.2	33.2	9.3	-	-	67.0	22.9	114.6	12.7	102.9	18.7
1995	69.1	61.2	26.7	87.5	69.1	61.2	25.4	89.4	-	-	3.5	42.6	5.6	27.9	12.0	30.9
1996	5214.4	8.8	330.1	9.9	5160.4	8.5	265.8	8.6	-	-	48.6	5.5	167.0	2.7	232.1	0.7
1997	-	-	7.9	129.4	-	-	7.1	115.2	-	-	18.8	6.5	14.1	38.2	0.4	12.4
1998	751.3	8.5	105.6	3.0	751.3	8.5	100.5	3.0	32.5	-	1054.3	17.2	130.8	1.4	2.7	0.4
1999	122.3	173.3	60.1	110.7	122.3	173.3	60.3	112.4	30.6	47.4	23.8	104.4	1.9	41.9	73.3	62.3
2000	0.0	231.3	2.7	54.4	0.0	248.4	2.5	50.2	31.2	4.2	2.1	3.1	9.8	3.1	46.8	14.1
2001	3500.8	27.8	36.0	1.0	3500.8	27.8	36.0	1.0	177.0	4.3	483.2	5.3	54.1	1.1	207.5	24.4
2002	4.5	2044.1	8.4	134.9	3.8	2139.6	7.8	132.6	26.5	48.8	6.8	36.5	0.4	11.8	19.2	32.0

Appendix Legend. Lakewide trawl index series names and codes used in the Appendix.

Geometric Means	
ONTS10G	Ontario Management Unit 1 summer age 0 geometric
OHS10G	Ohio Management Unit 1 summer age 0 geometric
OHS11G	Ohio Management Unit 1 summer age 1 geometric
OHF10G	Ohio Management Unit 1 fall age 0 geometric
OHF11G	Ohio Management Unit 1 fall age 1 geometric
USS10G	USGS Management Unit 1 summer age 0 geometric
USS11G	USGS Management Unit 1 summer age 1 geometric
USF10G	USGS Management Unit 1 fall age 0 geometric
USF11G	USGS Management Unit 1 fall age 1 geometric
ONOHP10G	Ontario/Ohio Management Unit 1 summer age 0 geometric
OHS20G	Ohio Management Unit 2 summer age 0 geometric
OHS21G	Ohio Management Unit 2 summer age 1 geometric
OHF20G	Ohio Management Unit 2 fall age 0 geometric
OHF21G	Ohio Management Unit 2 fall age 1 geometric
BOHS20G	Ohio Management Unit 2 summer age 0 geometric (blocked by depth strata)
BOHS21G	Ohio Management Unit 2 summer age 1 geometric (blocked by depth strata)
BOHF20G	Ohio Management Unit 2 fall age 0 geometric (blocked by depth strata)
BOHF21G	Ohio Management Unit 2 fall age 1 geometric (blocked by depth strata)
OHS30G	Ohio Management Unit 3 summer age 0 geometric
OHS31G	Ohio Management Unit 3 summer age 1 geometric
OHF30G	Ohio Management Unit 3 fall age 0 geometric
OHF31G	Ohio Management Unit 3 fall age 1 geometric
BOHS30G	Ohio Management Unit 3 summer age 0 geometric (blocked by depth strata)
BOHS31G	Ohio Management Unit 3 summer age 1 geometric (blocked by depth strata)
BOHF30G	Ohio Management Unit 3 fall age 0 geometric (blocked by depth strata)
BOHF31G	Ohio Management Unit 3 fall age 1 geometric (blocked by depth strata)
PAF30G	Pennsylvania Management Unit 3 fall age 0 geometric
PAF31G	Pennsylvania Management Unit 3 fall age 1 geometric
ILP40G	Inner Long Point Bay Management Unit 4 age 0 geometric
ILP41G	Inner Long Point Bay Management Unit 4 age 1 geometric
OLP40G	Outer Long Point Bay Management Unit 4 age 0 geometric
OLP41G	Outer Long Point Bay Management Unit 4 age 1 geometric
NYF40G	New York Management Unit 4 fall age 0 geometric
NYF41G	New York Management Unit 4 fall age 1 geometric

(continued)

Appendix Legend (continued)

Arithmetic Means	
ONTS10A	Ontario Management Unit 1 summer age 0 arithmetic
OHS10A	Ohio Management Unit 1 summer age 0 arithmetic
OHS11A	Ohio Management Unit 1 summer age 1 arithmetic
OHF10A	Ohio Management Unit 1 fall age 0 arithmetic
OHF11A	Ohio Management Unit 1 fall age 1 arithmetic
USS10A	USGS Management Unit 1 summer age 0 arithmetic
USS11A	USGS Management Unit 1 summer age 1 arithmetic
USF10A	USGS Management Unit 1 fall age 0 arithmetic
USF11A	USGS Management Unit 1 fall age 1 arithmetic
ONOHP10A	Ontario/Ohio Management Unit 1 summer age 0 arithmetic
OHS20A	Ohio Management Unit 2 summer age 0 arithmetic
OHS21A	Ohio Management Unit 2 summer age 1 arithmetic
OHF20A	Ohio Management Unit 2 fall age 0 arithmetic
OHF21A	Ohio Management Unit 2 fall age 1 arithmetic
BOHS20A	Ohio Management Unit 2 summer age 0 arithmetic (blocked by depth strata)
BOHS21A	Ohio Management Unit 2 summer age 1 arithmetic (blocked by depth strata)
BOHF20A	Ohio Management Unit 2 fall age 0 arithmetic (blocked by depth strata)
BOHF21A	Ohio Management Unit 2 fall age 1 arithmetic (blocked by depth strata)
OHS30A	Ohio Management Unit 3 summer age 0 arithmetic
OHS31A	Ohio Management Unit 3 summer age 1 arithmetic
OHF30A	Ohio Management Unit 3 fall age 0 arithmetic
OHF31A	Ohio Management Unit 3 fall age 1 arithmetic
BOHS30A	Ohio Management Unit 3 summer age 0 arithmetic (blocked by depth strata)
BOHS31A	Ohio Management Unit 3 summer age 1 arithmetic (blocked by depth strata)
BOHF30A	Ohio Management Unit 3 fall age 0 arithmetic (blocked by depth strata)
BOHF31A	Ohio Management Unit 3 fall age 1 arithmetic (blocked by depth strata)
PAF30A	Pennsylvania Management Unit 3 fall age 0 arithmetic
PAF31A	Pennsylvania Management Unit 3 fall age 1 arithmetic
ILP40A	Inner Long Point Bay Management Unit 4 age 0 arithmetic
ILP41A	Inner Long Point Bay Management Unit 4 age 1 arithmetic
OLP40A	Outer Long Point Bay Management Unit 4 age 0 arithmetic
OLP41A	Outer Long Point Bay Management Unit 4 age 1 arithmetic
NYF40A	New York Management Unit 4 fall age 0 arithmetic
NYF41A	New York Management Unit 4 fall age 1 arithmetic

Appendix Table B-1. Management Unit 1 yellow perch biological references from simulations and projected population size in 2004 and 2005 at fishing rates F= 0.0 to 3.0. Biological reference points include mean spawner biomass as a fraction of an unfished population, mean survival of age 2+ and 3+ fish, and the probability of attaining low population levels observed in 1993 for ages 2+ and 3+. The projected harvest for 2003 that is approximately equal to the Fopt RAH is in bold, with a double border.

Simulation					Future Projections at Different Fishing Rates					
% Spawner Biomass (Of Unfished)	Survival 2+	Survival 3+	Prob %. 1993 2+	Prob. % 1993 3+	F	Harvest (lbs x 10^6) 2003	Harvest (lbs x 10^6) 2004	Population 2+ (millions) 2004	Population 3+ (millions) 2004	Population 3+ (millions) 2005
100	67%	67%	0	0	0.00	0.0	0.0	43.5	42.2	29.1
88	64%	63%	0	0	0.10	0.6	0.6	42.0	40.7	26.7
79	62%	60%	0	0	0.20	1.1	1.1	40.6	39.3	24.5
71	60%	57%	0	0	0.30	1.6	1.5	39.3	38.0	22.5
65	58%	54%	0	0	0.40	2.1	1.9	38.1	36.8	20.8
60	57%	52%	0	0	0.50	**2.6**	2.2	36.9	35.6	19.2
55	55%	49%	1	0	0.60	3.0	2.5	35.9	34.5	17.8
51	54%	47%	2	0	0.70	3.4	2.7	34.8	33.5	16.6
48	53%	45%	3	0	0.80	3.8	2.9	33.9	32.5	15.4
45	52%	43%	3	0	0.90	4.1	3.0	33.0	31.6	14.4
43	51%	42%	4	0	1.00	4.5	3.1	32.1	30.8	13.5
40	50%	40%	7	1	1.10	4.8	3.2	31.3	30.0	12.6
38	49%	38%	10	2	1.20	5.1	3.3	30.5	29.2	11.8
36	48%	37%	11	3	1.30	5.4	3.4	29.8	28.5	11.1
35	47%	36%	13	6	1.40	5.6	3.5	29.1	27.8	10.5
33	47%	34%	14	9	1.50	5.9	3.5	28.5	27.2	9.9
27	43%	29%	24	21	2.00	7.0	3.7	25.7	24.4	7.6
19	39%	21%	45	52	3.00	8.6	3.7	21.8	20.5	4.8

Note: Projected harvest in pounds is directly comparable to RAH. F values in this table are not directly comparable to RAH F_{opt} due to selectivity.

Parameters in Computations

Age	s(age)	Weight (kg)
2	0.069	0.105
3	0.367	0.127
4	0.697	0.144
5	0.755	0.148
6	0.806	0.174

2003 Stock Size (numbers x 10^6)

Age	Mean	Min.	Max.
2	31.347	20.814	41.880
3	6.993	4.601	9.384
4	12.981	8.541	17.420
5	7.876	5.183	10.570
6+	3.685	2.425	4.945
(2+)	62.882	41.564	84.200
(3+)	31.535	20.750	42.320

2004 Age 2 Recruits (x 10^6)
1.321

Appendix Table B-2. Management Unit 2 yellow perch biological references from simulations and projected population size in 2004 and 2005 at fishing rates F= 0.0 to 3.0. Biological reference points include mean spawner biomass as a fraction of an unfished population, mean survival of age 2+ and 3+ fish, and the probability of attaining low population levels observed in 1993 for ages 2+ and 3+. The projected harvest for 2003 that is approximately equal to the Fopt RAH is in bold, with a double border.

Simulation					Future Projections at Different Fishing Rates					
% Spawner Biomass (Of Unfished)	Survival 2+	Survival 3+	Prob %. 1993 2+	Prob. % 1993 3+	F	Harvest (lbs x 10^6) 2003	Harvest (lbs x 10^6) 2004	Population 2+ (millions) 2004	Population 3+ (millions) 2004	Population 3+ (millions) 2005
100	67%	67%	0	0	0.00	0.0	0.0	51.8	50.1	34.7
91	64%	62%	0	0	0.10	0.9	1.0	49.8	48.1	31.1
83	61%	58%	0	0	0.20	1.7	1.9	47.9	46.2	28.0
77	58%	55%	1	0	0.30	2.5	2.6	46.1	44.4	25.2
71	56%	51%	1	0	0.40	3.2	3.2	44.4	42.7	22.7
67	54%	48%	3	0	0.50	**3.9**	3.6	42.9	41.2	20.5
62	52%	45%	7	3	0.60	4.5	4.1	41.4	39.7	18.6
59	50%	43%	13	3	0.70	5.1	4.4	40.0	38.3	16.9
56	48%	40%	16	7	0.80	5.7	4.7	38.7	37.0	15.3
53	47%	38%	20	16	0.90	6.3	4.9	37.5	35.7	14.0
50	45%	36%	26	25	1.00	6.8	5.1	36.3	34.6	12.7
47	44%	34%	30	37	1.10	7.2	5.2	35.2	33.5	11.6
45	43%	32%	37	45	1.20	7.7	5.3	34.2	32.4	10.6
42	42%	30%	46	50	1.30	8.1	5.4	33.2	31.5	9.7
40	40%	29%	48	56	1.40	8.5	5.5	32.2	30.5	8.9
38	39%	27%	50	65	1.50	8.9	5.5	31.4	29.6	8.2
27	34%	20%	68	85	2.00	10.6	5.5	27.6	25.8	5.5
15	23%	11%	91	100	3.00	13.0	5.1	22.1	20.4	2.7

Note: Projected harvest in pounds is directly comparable to RAH. F values in this table are not directly comparable to RAH F_{opt} due to selectivity.

Parameters in Computations

Age	s(age)	Weight (kg)
2	0.159	0.125
3	0.626	0.143
4	0.839	0.159
5	0.839	0.182
6	0.852	0.232

2003 Stock Size (numbers x 10^6)

Age	Mean	Min.	Max.
2	44.324	30.046	58.603
3	6.282	4.561	8.004
4	13.711	9.955	17.468
5	7.386	5.362	9.409
6+	3.042	2.209	3.876
(2+)	74.746	52.132	97.360
(3+)	30.422	22.086	38.757

2004 Age 2 Recruits (x 10^6)
1.710

Appendix Table B-3. Management Unit 3 yellow perch biological references from simulations and projected population size in 2004 and 2005 at fishing rates F= 0.0 to 3.0. Biological reference points include mean spawner biomass as a fraction of an unfished population, mean survival of age 2+ and 3+ fish, and the probability of attaining low population levels observed in 1993 for ages 2+ and 3+. The projected harvest for 2003 that is approximately equal to the Fopt RAH is in bold, with a double border.

Simulation					Future Projections at Different Fishing Rates					
% Spawner Biomass (Of Unfished)	Survival 2+	Survival 3+	Prob %. 1993 2+	Prob. % 1993 3+	F	Harvest (lbs x 10^6) 2003	Harvest (lbs x 10^6) 2004	Population 2+ (millions) 2004	Population 3+ (millions) 2004	Population 3+ (millions) 2005
100	67%	67%	0	0	0.00	0.0	0.0	25.2	24.6	16.9
91	64%	63%	0	0	0.10	0.5	0.5	24.0	23.5	15.2
84	61%	59%	0	0	0.20	1.1	0.9	22.9	22.4	13.6
78	58%	56%	0	0	0.30	1.6	1.2	21.9	21.3	12.3
72	56%	53%	0	0	0.40	2.0	1.5	20.9	20.4	11.1
68	54%	50%	1	0	0.50	**2.5**	1.7	20.0	19.4	10.0
64	52%	48%	2	0	0.60	2.9	1.9	19.1	18.6	9.0
60	50%	46%	3	3	0.70	3.3	2.0	18.3	17.7	8.2
57	49%	43%	4	3	0.80	3.6	2.2	17.5	17.0	7.4
54	47%	41%	5	5	0.90	4.0	2.3	16.7	16.2	6.7
51	46%	39%	7	7	1.00	4.3	2.3	16.0	15.5	6.1
49	44%	38%	13	16	1.10	4.6	2.4	15.4	14.8	5.5
47	43%	36%	19	22	1.20	4.9	2.4	14.7	14.2	5.0
44	42%	34%	21	32	1.30	5.2	2.4	14.1	13.6	4.6
42	41%	33%	30	47	1.40	5.5	2.4	13.6	13.0	4.2
40	40%	32%	34	54	1.50	5.7	2.4	13.0	12.5	3.8
31	34%	26%	55	85	2.00	6.8	2.3	10.7	10.2	2.4
18	26%	17%	88	98	3.00	8.4	1.9	7.4	6.9	1.1

Note: Projected harvest in pounds is directly comparable to RAH. F values in this table are not directly comparable to RAH F_{opt} due to selectivity.

Parameters in Computations

Age	s(age)	Weight (kg)
2	0.317	0.128
3	0.510	0.160
4	0.790	0.184
5	0.795	0.213
6	0.745	0.232

2003 Stock Size (numbers x 10^6)

Age	Mean	Min.	Max.
2	22.667	15.240	30.094
3	1.133	0.771	1.496
4	4.303	2.926	5.680
5	5.154	3.504	6.803
6+	3.493	2.375	4.611
(2+)	36.750	24.817	48.684
(3+)	14.083	9.576	18.590

2004 Age 2 Recruits (x 10^6)
0.530

Appendix Table B-4. Management Unit 4 yellow perch biological references from simulations and projected population size in 2004 and 2005 at fishing rates F= 0.0 to 3.0. Biological reference points include mean spawner biomass as a fraction of an unfished population, mean survival of age 2+ and 3+ fish, and the probability of attaining low population levels observed in 1994 for ages 2+ and 3+.

Simulation					Future Projections at Different Fishing Rates					
% Spawner Biomass (Of Unfished)	Survival 2+	Survival 3+	Prob %. 1993 2+	Prob. % 1993 3+	F	Harvest (lbs x 10^6) 2003	Harvest (lbs x 10^6) 2004	Population 2+ (millions) 2004	Population 3+ (millions) 2004	Population 3+ (millions) 2005
100	67%	67%	0	0	0.00	0.00	0.00	6.91	6.89	4.63
88	64%	63%	0	0	0.10	0.15	0.12	6.66	6.64	4.26
79	62%	60%	0	0	0.20	0.28	0.22	6.43	6.41	3.92
72	60%	57%	0	0	0.30	0.41	0.30	6.22	6.20	3.63
66	58%	54%	0	0	0.40	0.52	0.37	6.02	6.00	3.38
61	57%	52%	0	0	0.50	0.63	0.42	5.84	5.81	3.15
56	55%	49%	1	0	0.60	0.74	0.47	5.66	5.64	2.95
53	54%	47%	2	1	0.70	0.83	0.50	5.50	5.48	2.77
50	53%	45%	2	2	0.80	0.92	0.53	5.36	5.33	2.62
47	52%	43%	3	2	0.90	1.01	0.55	5.22	5.19	2.47
45	51%	42%	3	2	1.00	1.09	0.57	5.09	5.06	2.35
42	50%	40%	6	4	1.10	1.16	0.59	4.97	4.94	2.23
40	49%	39%	9	11	1.20	1.23	0.60	4.86	4.83	2.13
39	49%	38%	10	13	1.30	1.29	0.61	4.75	4.73	2.04
37	48%	36%	13	14	1.40	1.35	0.61	4.66	4.63	1.95
36	47%	35%	16	17	1.50	1.41	0.62	4.57	4.54	1.88
30	45%	30%	17	24	2.00	1.64	0.62	4.20	4.18	1.57
23	40%	23%	27	58	3.00	1.94	0.62	3.76	3.73	1.19

Parameters in Computations

Age	s(age)	Weight (kg)
2	0.006	0.132
3	0.213	0.153
4	0.676	0.192
5	0.767	0.220
6	0.774	0.228

2003 Stock Size (numbers x 10^6)

Age	Mean	Min.	Max.
2	4.878	2.673	7.083
3	0.509	0.308	0.709
4	0.606	0.367	0.844
5	3.520	2.133	4.907
6+	0.763	0.462	1.064
(2+)	10.275	5.943	14.606
(3+)	5.397	3.271	7.524

2004 Age 2 Recruits (x 10^6)
0.025