

**Report of the
LAKE ERIE YELLOW PERCH TASK GROUP**

March 1993

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Presented to:

**Standing Technical Committee of the Lake Erie Committee
Great Lakes Fishery Commission**

The Yellow Perch Task Group (YPTG) was charged with describing the status of yellow perch, producing population size estimates and recommending allowable harvest (RAH) for 1993 in each of the four Lake Erie management units (Figure 1). The results of these charges are presented in this report. The task group was also charged with two additional tasks: a review of factors affecting recruitment of yellow perch into the fisheries, and the completion of the Joint YPTG/Statistics and Modelling Task Group (SAM) report, documenting the procedures used to develop a recommended allowable harvest. Work was done on both of the additional charges in 1992 and reports will be completed in 1993.

Fisheries Review

The reported harvest of yellow perch from Lake Erie in 1992 totalled 2,617 tonnes (5.8 million pounds) (Table 1), which was 5% less than the 1991 harvest. Perch catches declined in all agencies except Ontario, which showed a slight overall increase of 8%. Pennsylvania harvest showed the greatest decline (-49%), followed by Ohio (-33%), Michigan (-30%) and New York (-18%). Ontario harvested 78% of the lakewide reported catch, while Ohio harvest accounted for 19%, and Michigan, Pennsylvania and New York caught the remaining 3%.

The recommended allowable harvest level for 1992 was 6.1 million pounds lakewide. Based on current information, the revised recommendation for 1992 was 7.7 million pounds (Described later in this report). Reported harvest relative to these recommendations is summarized in Table 2.

Harvest, fishing effort, and catch rate are summarized by Unit, year, agency, and gear type in Tables 3a-d. The trends over time (1975-1992) in harvest, fishing effort and catch rate are described in Figures 2, 3 and 4 by Unit and gear type. Commercial gillnet harvest increased in Units 1 (+6%) and 2 (+16%), and decreased in Units 3 (-7%) and 4 (-29%), compared to 1991 harvest. Harvest from commercial trapnets was down in all units. The greatest decrease in trapnet harvest was in the central basin of Lake Erie, Units 2 (-52%) and 3 (-45%), followed by Units 1 (-37%) and 4 (-29%). Sport harvest decreased in Units 1 (-40%) and 2 (-7%), increased in Unit 3 (+23%) and stayed the same in Unit 4.

Commercial gillnet effort in 1992 declined in Units 1 (-32%), and 4 (-29%), stayed the same in Unit 2 (+2%), and increased in Unit 3 (+11%), as compared to 1991. Trapnet effort decreased in all units. Unit 4 showed the greatest decrease (-31%), followed by Units 2 (-27%), 3 (-26%), and 1 (-6%).

Sport fish effort declined in Units 1 (-46%) and 2 (-25%) in 1992 but increased substantially in Units 3 (+56%) and 4 (+137%).

Catch rates for commercial gillnet fisheries increased in Units 1 (+57%) and 2 (+14%) but continued to decrease in Units 3 (-20%) and 4 (-18%), compared to 1991 levels. Commercial trapnet catch rates decreased in all Units (Unit 1: -33%, Unit 2: -34%, Unit 3: -26%) except Unit 4, which remained approximately the same as that of 1991 (+4%). Catch rates from the sport fisheries increased in Units 1 (+8%) and 2 (+24%), and declined in Units 3 (-21%) and 4 (-56%). Catch rates in 1992 remained at levels similar to or lower than catch rates observed in the early 1980's, prior to the entry of the 1984 year class into the fisheries.

The 1992 harvest of yellow perch was comprised mainly of the 1989 and 1990 year classes in Units 1, 2 and 3. Unit 4 is the only management unit in which the 1986, 1987 and 1988 year classes make up a major portion of the fishery (Table 4). The 1989 year class was a strong contributor to the gillnet and trapnet fisheries throughout the year in all units except Unit 4. The 1990 year class began contributing to the fisheries in the second half of the year in Units 1, 2 and 3.

Stock Assessment

Catch-at-Age-Analysis (CAGEAN) and the Estimation of 1992 Population

A three gear (gillnet, trapnet and sport harvest and effort) version of the CAGEAN model was used to estimate the 1992 population size. The three gear version allows factors such as catchabilities and selectivities to be gear specific. Population size estimates were based on a natural mortality rate of 0.4 ($M=0.4$).

In all units except Unit 4, the current CAGEAN estimate of the 1992 population size was larger than the population size projected last year (Table 5). CAGEAN estimates of both the 1989 (age 3) and 1990 year classes (age 2) were higher than those which had been projected last year in Units 1, 2 and 3, but lower than projected in Unit 4. The abundance of age 3 and older fish was underestimated in all units except Unit 4, in which abundance was overestimated for all age groups.

Results from CAGEAN and the Ontario partnership index fishing surveys agree that the 1990 year class was very abundant as 2 year old fish in 1992. Age 2 fish were the most abundant cohort in Units 1, 2 and 3. The 1989 year class is not as strong as that of 1990 but continues to be more abundant than older aged fish in the population.

Since age 2 yellow perch are not fully recruited to the gillnet, trapnet and sport fishing gears, results from Ontario's fall partnership index fishing surveys were used to estimate the abundance of the 1990 year class as age 2 fish, and an 'adjusted' 1992 population size estimate of age 2 and older fish was produced (Table 5). The adjustment was made in the following way. For each management unit, the ratio of geometric mean catch rates of the 1989 and 1990 year classes as 2-year-old fish in 1991 and 1992, respectively, from the partnership index nets, and the CAGEAN estimate of the 1989 year class as age 2 were used to estimate the abundance of the 1990 year class as age 2 fish in 1992, i.e.

$Abundance_{1990}$ (millions of fish) = $Abundance_{1989} \times (Index_{1990} / Index_{1989})$. Because the 1989 year class has 2 year's worth of harvest data associated with it by 1992, CAGEAN will be able to provide a more reliable estimate of the 1989 year class as age 2 fish than it would for the 1990 year class, with only one year of harvest data available in 1992. The partnership index fishing surveys, done in cooperation with the Ontario commercial fishing industry, are considered to provide the most representative index information currently available due to the broad coverage of the surveys, standardized methods and large sample sizes.

In conjunction with the adjustment of age 2 stock size estimates, it was believed that a concomitant adjustment of the CAGEAN-derived F (instantaneous fishing mortality) value was required for each of the 4 management units. In order to scale the age 2 F, the rate of exploitation (u) was estimated using the ratio of the actual number of age 2 fish harvested in 1992 to the adjusted age 2 stock size. It was assumed that the actual total mortality rate (A), calculated from the CAGEAN estimates, would not change significantly, and could be used without adjustment. The expectation of natural death (v) can be calculated ($v = A - u$), and using the instantaneous natural mortality rate of 0.4, F was calculated as follows: $F = (M*u)/v$. (Ricker, 1975). This adjustment of age 2 specific F rates

does not have a significant effect on the overall population stock size estimate, i.e. less than 1% decrease in the yield using the F adjustment. Appendix E compares the results of age 2 F adjusted method with the results of the age 2 F from CAGEAN, used previously by the YPTG, in tabular form. Appendix F shows the estimated harvest of yellow perch for 1992 using the adjusted age 2 F method.

Population size, in numbers and biomass, and population parameters such as survival and exploitation rates are presented for two stock size estimates; one that consists of age 2 and older fish, and one that consists of age 3 and older fish (Table 6). Because of the relatively low exploitation rate on age 2 fish related to their low vulnerability to the gear, the yield from age 2 fish is low relative to their total abundance in the population. Results associated with age 3 and older fish are believed to be more representative of the available fishable stock. Age 2 fish do contribute to the harvest, as illustrated in 1992, but a cohort contributes more significantly at age 3 and older, when it is more vulnerable to the gear.

In 1992, stock size estimates of age 3 and older fish increased in all management units, except Unit 4, as compared to 1991 (Table 6, Figure 5). Stock size estimates for Units 2, 3, and 4 were at levels typical of the early 1980's, prior to the 1984 year class. Stock size estimates for Unit 1 in 1992 were better than those of 1991 but still lower than typical historical levels. Biomass estimates for age 3 and older fish in 1992 were lower than 1991 in all units, except Unit 1. (Figure 6). The 1992 population consisted primarily of age 2 fish in units 1, 2 and 3. Unit 4 was the only unit in which the age 6 and older fish made up the largest component of the population estimate (Figure 7).

Survival rates for age 3 and older fish were higher in all Units in 1992, as compared to 1991. Survival rates for Units 1 to 4 are 56%, 52%, 44% and 64%, respectively (Table 6, Figure 7). Exploitation rates have decreased as survival rates have improved. Age 3 and older fish in 1992 experienced exploitation rates of 14%, 19%, 28%, and 4%, respectively, down in all units as compared to 1991.

Recruitment

The same methods used in the last two year's reports were used to estimate age 2 population size from index trawling values. This method includes: an expanded data series (more years and more

trawling projects), the use of geometric mean index values (number per trawl-hour), regressing CAGEAN age 2 population size estimates of age 2 abundance (Table 8).

Since 1986, there has been poor to fair recruitment of yellow perch in all Units (Figure 9). Two years of poor year class strength in 1987 and 1988 were followed by two fair year classes, 1989 and 1990. The index gillnetting results indicate that the 1990 year class is stronger than anticipated. Index young-of-the-year (YOY) and yearling trawling suggested that the 1991 year class will be poorer than the previous 2 years and the 1992 year classes will be better than 1991. Based on the index gillnetting results, the 1991 year class is greater than the 1989 year class in Unit 1, similar in Unit 2, and less in Units 3 and 4.

1993 Population Size Projection

Stock size estimates for 1993 (age 3 and older) were projected from the adjusted 1992 population size estimates and age specific survival rates in 1992. Recruitment of the 1991 year class in 1993 (age 2 fish) was estimated from various agency trawling indices of age 0 and age 1 yellow perch (Figure 8).

Projections of stock size for 1993 indicate a decline in the abundance of age 2 and older fish in all units (Table 9, for unadjusted population sizes see Appendix A). However, estimates of age 3 and older fish in 1993 were higher in Units 1 (+56%), 2 (+61%) and 3 (+58%) than in 1992. In Unit 4, the number of age 3 and older fish continued to decline (-24%) in 1992. Although Unit 1 population abundance remains slightly lower than historical levels, most of the Units appear to have returned to population size levels seen prior to the entry of the 1984 year class. The composition of the populations projected in all management units consist primarily of age 2, 3 and 4-year-old fish, but with fewer 2-year-olds than in 1992 and few fish older than 5.

Biomass of age 3 and older fish is probably the most representative indicator of fishable stock available in 1993 (Table 9). In the 1993 projection, there was a 67% increase in the biomass of age 3 and older fish in Unit 1, a 69% increase in Unit 2, and a 57% increase in Unit 3, as compared to 1992. Unit 4 showed a 25% decrease in biomass between 1992 and 1993. Biomass was generated from the

number of fish estimated by CAGEAN (for 1992) and the yield-per-recruit model (for 1993), multiplied by the mean weight-at-age from the 1992 Ontario partnership index fishing survey data. The 1992 index values are considered to provide the best estimation of biomass in the current population.

Yield per Recruit

The yield per recruit model used to determine a recommended harvest in 1993 is the same as that used in 1992. The basic assumption of the yield per recruit model is that the desired harvest strategy is to optimize the return in weight per recruit. The optimum harvest rate F_{opt} is determined by growth rate versus natural mortality rate. For temperate waters, F_{opt} is modified to $F_{0.1}$, which corresponds to 10% of the rate of increase in yield per recruit which can be obtained by increasing F (fishing mortality) at low levels of fishing. A full description of the model inputs, as well as the steps required to determine a scaled $F_{0.1}$, are given in last year's report (YPTG, 1992).

The 1993 harvest estimates of age 2 and older fish is the sum of the estimates of harvest from each age, derived from scaling $F_{0.1}$ by the selectivity at that age. Catch in weight is calculated by multiplying the age specific catch in millions of fish by the mean weight in the harvest (5 year average, 1988 - 1992). The harvest estimate is the sum of the harvest for age 2 and older fish (Table 10, Appendix B, C and D).

Recommended Allowable Harvest

Four harvest scenarios were generated for 1993 (Table 11). The first 3 are the same as those presented for 1992. The first was using the unadjusted CAGEAN estimates of population size and a scaled $F_{0.1}$ exploitation strategy; the second was to use the adjusted CAGEAN population size estimate and a scaled $F_{0.1}$ exploitation strategy; and the third was to use the adjusted population size and the same level of fishing effort as in 1992.

The fourth scenario, presented for the first time this year, was based on the use of the 1992 harvest and Ontario partnership index fishing results, with the products adjusted in accord with an optimum exploitation strategy (Table 13a,13b). The fall index gillnetting conducted in the Ontario waters of each management unit provides a source of information on relative biomass of yellow perch present

in each management unit. The gillnet mesh sizes (ranging from 1.25" - 5.00") encompass the range of fish sizes available to the fisheries as well as smaller fish which are not yet recruited to the fisheries. Yellow perch caught in mesh sizes of 1.75" and greater in the fall are used as an indicator of the availability of yellow perch which will represent the fishable stock the following year. Knowing the number of yellow perch caught in a standard amount of fishing effort and their lengths, a length/weight regression was used to estimate the weight of perch caught and this value was used as an index of fishable biomass of the stock in the upcoming fishing year (1993).

Assuming that the biomass indicator calculated is directly proportional to fishable stock and that fishing effort is constant from one year to the next, two successive years of index data, coupled with recent harvest weight, can be used to project harvest in the upcoming year. Given that the effort used to harvest yellow perch in the most recent harvest year may be different than the effort needed to optimize harvest, a second calculation is required. A harvest projection is made assuming that effort (fishing mortality rate) does not change in the upcoming year. The ratio of the projected harvest at $F_{0.1}$ to the projected harvest, using the previous year's fishing effort, provides a factor which can be used to adjust the harvest projection, which was based on the index fishing biomass change.

Recommendations and Conclusions

A lakewide harvest of 6.1 million pounds of yellow perch was recommended in 1992 and the harvest was virtually the same at 5.8 million pounds. Using the current 1992 information, the recommended allowable harvest would have been 7.7 million pounds (Table 12, Appendix D). Last year's recommended allowable harvest and actual harvest were within the range associated with the revised recommendation for 1992.

In 1993, the fishable stock size (age 3 and older) has continued to improve, but not to the population levels experienced in the late 1980's. Stock size in numbers and biomass continue to decline in Unit 4. We are recommending a harvest level within the range presented in the adjusted CAGEAN 1993 population estimate and the $F_{0.1}$ exploitation strategy. The midpoint level is 10.9 million pounds, ranging from 7.2 to 14.7 million pounds.

Because of the importance of the inputs from the index fishing program, the YPTG continues to urge agencies to adopt a standard index assessment program which includes yellow perch. As the data series grows, the index fishing results can be used directly in the CAGEAN population estimation exercise as an input to calibrate harvest information.

References

RICKER, W.E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. Bulletin of Fisheries Research Board of Canada, Bull. 191. 382 p.

YELLOW PERCH TASK GROUP. 1992. Report of the Yellow Perch Task Group. Presented to the Standing Technical Committee (LEC). Great Lakes Fish Comm. 42 p.

Table 1.

Summary of total catch^a of yellow perch by management unit and agency, Lake Erie 1980 - 92.

Unit	Year	Ontario		Ohio		Michigan		Pennsylvania		New York		TOTAL
		Catch	(%)	Catch	(%)	Catch	(%)	Catch	(%)	Catch	(%)	
1	1980	1,873	(56)	1,326	(41)	74	(02)	--	--	--	--	3,323
	1981	1,180	(55)	924	(43)	34	(02)	--	--	--	--	2,138
	1982	983	(49)	972	(49)	46	(02)	--	--	--	--	2,001
	1983	326	(47)	358	(51)	17	(02)	--	--	--	--	701
	1984	1,208	(65)	608	(33)	30	(02)	--	--	--	--	1,846
	1985	1,347	(73)	476	(26)	22	(01)	--	--	--	--	1,845
	1986	1,360	(61)	775	(35)	82	(04)	--	--	--	--	2,217
	1987	1,298	(59)	785	(36)	102	(05)	--	--	--	--	2,185
	1988	1,445	(61)	846	(36)	76	(03)	--	--	--	--	2,367
	1989	1,432	(59)	862	(35)	151	(06)	--	--	--	--	2,445
	1990	808	(67)	296	(24)	105	(09)	--	--	--	--	1,209
	1991	294	(46)	309	(48)	43	(07)	--	--	--	--	646
1992	312	(59)	184	(35)	30	(06)	--	--	--	--	526	
2	1980	2,877	(71)	1,175	(29)	--	--	--	--	--	--	4,052
	1981	1,603	(67)	784	(33)	--	--	--	--	--	--	2,387
	1982	2,162	(86)	356	(14)	--	--	--	--	--	--	2,518
	1983	1,466	(85)	258	(15)	--	--	--	--	--	--	1,724
	1984	2,117	(85)	378	(15)	--	--	--	--	--	--	2,495
	1985	2,127	(87)	308	(13)	--	--	--	--	--	--	2,435
	1986	2,289	(89)	289	(11)	--	--	--	--	--	--	2,578
	1987	2,512	(88)	344	(12)	--	--	--	--	--	--	2,856
	1988	2,538	(93)	191	(07)	--	--	--	--	--	--	2,729
	1989	2,530	(84)	486	(16)	--	--	--	--	--	--	3,016
	1990	1,303	(75)	432	(25)	--	--	--	--	--	--	1,735
	1991	985	(76)	310	(24)	--	--	--	--	--	--	1,295
1992	1,144	(83)	227	(17)	--	--	--	--	--	--	1,371	
3	1980	478	(68)	144	(20)	--	--	86	(12)	--	--	708
	1981	505	(68)	131	(18)	--	--	103	(14)	--	--	739
	1982	615	(80)	89	(12)	--	--	64	(08)	--	--	768
	1983	519	(94)	21	(04)	--	--	15	(03)	--	--	555
	1984	466	(86)	44	(08)	--	--	32	(06)	--	--	542
	1985	370	(81)	43	(09)	--	--	43	(09)	--	--	456
	1986	1,101	(92)	60	(05)	--	--	30	(03)	--	--	1,191
	1987	908	(84)	108	(10)	--	--	64	(06)	--	--	1,080
	1988	1,128	(78)	239	(17)	--	--	81	(06)	--	--	1,448
	1989	1,095	(63)	544	(31)	--	--	96	(06)	--	--	1,735
	1990	965	(76)	229	(18)	--	--	84	(06)	--	--	1,278
	1991	550	(75)	115	(16)	--	--	69	(09)	--	--	734
1992	540	(82)	84	(13)	--	--	35	(05)	--	--	659	
4	1980	303	(78)	--	--	--	--	42	(11)	42	(11)	387
	1981	355	(80)	--	--	--	--	33	(07)	53	(12)	441
	1982	253	(76)	--	--	--	--	29	(09)	52	(16)	334
	1983	175	(81)	--	--	--	--	13	(06)	28	(13)	216
	1984	365	(78)	--	--	--	--	35	(07)	67	(14)	467
	1985	190	(75)	--	--	--	--	14	(05)	51	(20)	255
	1986	143	(88)	--	--	--	--	16	(11)	2	(01)	161
	1987	260	(90)	--	--	--	--	23	(08)	6	(02)	289
	1988	258	(98)	--	--	--	--	1	(<1)	4	(02)	263
	1989	199	(78)	--	--	--	--	0	(00)	55	(22)	254
	1990	128	(88)	--	--	--	--	0	(00)	17	(12)	145
	1991	73	(87)	--	--	--	--	0	(00)	11	(13)	84
1992	52	(85)	--	--	--	--	0	(00)	9	(15)	61	

^aCatch is in metric tonnes.

Values in parentheses represent each agency's percentage of management unit catch.

Table 2. Lake Erie 1992 recommended allowable harvest (RAH) levels and reported harvest of yellow perch by management unit and by agency, using surface area as the allocation formula. Two 1992 RAH levels are shown; those based on last year's information (ORIGINAL) and those based on current information (UPDATE) in 1992. RAH, harvest and difference between the two values are reported in millions kilograms.

UNIT	AGENCY	RAH -- MILLIONS KG		HARVEST MILLIONS KG	DIFF. -- ORIGINAL		DIFF. -- UPDATE	
		ORIGINAL	UPDATE		KG x 10**6	%	KG X 10**6	%
1	Ontario			0.312				
	Ohio			0.184				
	Michigan			0.030				
	TOTAL	0.608	0.754	0.526	-0.082	-13.5	-0.228	-30.2
2	Ontario			1.144				
	Ohio			0.227				
	TOTAL	1.611	1.869	1.371	-0.240	-14.9	-0.498	-26.6
3	Ontario			0.540				
	Ohio			0.084				
	Pennsylvania			0.035				
	TOTAL	0.434	0.616	0.659	0.225	51.8	0.043	7.0
4	Ontario			0.052				
	Pennsylvania			0.000				
	New York			0.009				
	TOTAL	0.130	0.265	0.061	-0.069	-53.1	-0.204	-77.0

Table 3a. Catch and effort summaries for Lake Erie yellow perch fisheries in Management Unit 1, 1981 - 92.

	Year	Ohio		Michigan	Ontario	
		Trap	Sport	Sport	Gill Net	Sport
CATCH (tonnes)	1981	93	831	34	1180	-- ^a
	1982	50	922	46	983	--
	1983	26	332	17	327	--
	1984	14	594	30	1208	--
	1985	27	449	23	1206	--
	1986	71	704	82	1361	--
	1987	139	646	102	1298	--
	1988	284	562	76	1445	--
	1989	392	470	151	1432	--
	1990	210	86	105	808	--
	1991	89	220	43	294	--
	1992	56	128	30	312	--
EFFORT ^b	1981	9,830	2,676,326	271,000	24,908	--
	1982	5,272	3,036,979	151,900	27,627	--
	1983	5,086	1,498,289	74,914	11,456	--
	1984	3,451	1,159,599	57,980	28,746	--
	1985	4,141	935,645	46,782	16,139	--
	1986	5,279	1,404,286	404,514	20,909	--
	1987	7,078	1,046,115	452,460	14,730	--
	1988	6,900	1,153,182	494,158	9,616	--
	1989	8,418	1,028,551	696,973	12,716	--
	1990	6,299	350,000	634,255	18,305	--
	1991	7,259	700,719	164,517	13,629	--
	1992	6,795	350,433	120,979	9,221	--
CATCH RATES ^c	1981	9.46	0.31	0.13	47.37	--
	1982	9.48	0.30	0.30	35.58	--
	1983	5.11	0.22	0.23	28.54	--
	1984	4.06	0.51	0.52	42.02	--
	1985	6.52	0.48	0.49	74.73	--
	1986	13.45	0.50	0.20	65.09	--
	1987	19.64	0.62	0.23	88.12	--
	1988	41.16	0.49	0.15	150.27	--
	1989	46.57	0.46	0.22	112.61	--
	1990	33.34	0.26	0.17	44.14	--
	1991	12.26	0.31	0.26	21.57	--
	1992	8.24	0.37	0.25	33.84	--

^a Not measured.

^b Sport effort in angler-hours; gill net effort in km; trap net effort in lifts.

^c Sport (kg/hour), gill net (kg/km), trap net (kgs/lift).

Table 3b. Catch and effort summaries for Lake Erie yellow perch fisheries in Management Unit 2, 1981 - 92.

	Year	Ohio			Ontario	
		Gill Net	Trap Net	Sport	Gill Net	Sport
CATCH (tonnes)	1981	711	8	65	1,603	-- ^a
	1982	34	8	314	2,162	--
	1983	82	0	176	1,466	--
	1984	0	5	373	2,117	--
	1985	0	8	300	2,208	--
	1986	0	0	289	2,290	--
	1987	0	10	334	2,512	--
	1988	0	21	170	2,538	--
	1989	0	91	395	2,530	--
	1990	0	295	137	1,303	--
	1991	0	137	173	985	--
	1992	0	66	161	1,144	--
	EFFORT ^b	1981	17,810	713	437,816	27,782
1982		1,400	801	1,277,417	41,868	--
1983		3,632	0	739,325	44,692	--
1984		0	466	894,109	44,524	--
1985		0	212	728,763	34,187	--
1986		0	0	461,273	30,920	--
1987		0	630	429,239	20,940	--
1988		0	448	402,180	17,315	--
1989		0	1,403	572,612	25,679	--
1990		0	6,238	400,676	31,613	--
1991		0	6,480	452,277	34,739	--
1992		0	4,753	340,917	35,348	--
CATCH RATE ^c		1981	39.92	11.22	0.15	57.70
	1982	24.29	9.99	0.25	51.64	--
	1983	22.58	0	0.24	32.80	--
	1984	--	10.73	0.42	47.55	--
	1985	--	37.74	0.41	64.59	--
	1986	--	0	0.63	74.06	--
	1987	--	15.87	0.78	119.96	--
	1988	--	46.88	0.42	146.58	--
	1989	--	64.86	0.69	98.52	--
	1990	--	47.29	0.34	41.22	--
	1991	--	21.14	0.38	28.35	--
	1992	--	13.89	0.47	32.36	--

^a Not measured.

^b Sport effort in angler-hours; gill net effort in km; trap net effort in lifts.

^c Sport (kg/hour), gill net (kgs/km), trap net (kgs/lift).

Table 3c. Catch and effort summaries for Lake Erie yellow perch fisheries in Management Unit 3, 1981 - 92.

	Year	Ohio			Ontario		Pennsylvania	
		Gill Net	Trap Net	Sport	Gill Net	Sport	Gill Net	Sport
CATCH (tonnes)	1981	86	0	45	505	-- ^a	103	-- ^a
	1982	18	0	71	615	--	64	--
	1983	14	0	7	519	--	15	--
	1984	0	0	44	466	--	32	--
	1985	0	2	41	325	--	43	--
	1986	0	0	60	1,101	--	30	--
	1987	0	21	87	908	--	64	--
	1988	0	150	89	1,128	--	81	--
	1989	0	288	256	1,095	--	96	--
	1990	0	203	26	965	--	84	--
	1991	0	84	31	550	--	69	--
	1992	0	46	38	540	--	35	--
EFFORT ^b	1981	2,377	0	237,691	12,685	--	2,735	--
	1982	710	0	308,826	16,438	--	2,737	--
	1983	802	0	181,030	18,199	--	1,521	--
	1984	0	0	149,602	14,153	--	1,197	--
	1985	0	136	144,309	10,635	--	2,175	--
	1986	0	0	122,007	12,440	--	2,185	--
	1987	0	668	129,316	6,667	--	1,538	--
	1988	0	4,781	172,490	6,203	--	1,418	--
	1989	0	7,281	248,530	7,098	--	1,037	--
	1990	0	7,376	31,881	12,472	--	1,978	--
	1991	0	4,516	54,607	12,247	--	2,018	--
	1992	0	3,361	84,445	14,540	--	1,321	--
CATCH RATE ^c	1981	36.18	0	0.19	39.81	--	37.66	--
	1982	25.35	0	0.23	37.41	--	23.38	--
	1983	17.46	0	0.04	28.52	--	9.86	--
	1984	--	0	0.29	32.93	--	26.73	--
	1985	--	14.71	0.28	30.56	--	19.77	--
	1986	--	0	0.49	88.50	--	13.73	--
	1987	--	31.44	0.67	136.19	--	41.61	--
	1988	--	31.37	0.52	181.85	--	57.12	--
	1989	--	39.56	1.03	154.27	--	92.57	--
	1990	--	27.52	0.82	77.37	--	42.47	--
	1991	--	18.60	0.57	44.91	--	34.19	--
	1992	--	13.69	0.45	37.14	--	26.50	--

^a Not measured.

^b Sport effort in angler-hours; gill net effort in km; trap net effort in lifts.

^c Sport (kg/hour), gill net (kgs/km), trap net (kgs/lift).

Table 3d. Catch and effort summaries for Lake Erie yellow perch fisheries in Management Unit 4, 1981 - 92.

	Year	Ontario		Pennsylvania		New York		
		Gill Net	Sport	Gill Net	Sport	Gill Net	Trap Net	Sport
CATCH (tonnes)	1981	355	-- ^a	33	--	53	0	--
	1982	253	--	29	--	52	0	--
	1983	175	--	13	--	28	0	--
	1984	365	--	35	--	67	0	--
	1985	137	--	14	--	51	0	--
	1986	143	--	48	--	0	2	--
	1987	260	--	23	--	0	6	--
	1988	258	--	1	--	0	4	--
	1989	199	--	0	--	0	8	47
	1990	128	--	0	--	0	9	8
	1991	73	--	0	--	0	7	4
	1992	52	--	0	--	0	5	4
EFFORT ^b	1981	19,130	--	1,070	--	2,072	0	--
	1982	14,637	--	1,195	--	2,235	0	--
	1983	12,832	--	1,329	--	1,160	0	--
	1984	19,368	--	1,211	--	1,826	0	--
	1985	8,582	--	486	--	3,133	0	--
	1986	8,797	--	569	--	0	3,513	--
	1987	4,908	--	632	--	0	1,602	--
	1988	2,719	--	8	--	0	2,132	--
	1989	2,628	--	0	--	0	1,136	65,370
	1990	3,924	--	0	--	0	981	24,463
	1991	3,859	--	0	--	0	918	22,090
	1992	3,351	--	0	--	0	632	52,398
CATCH RATE ^c	1981	18.56	--	30.84	--	25.58	0	--
	1982	17.28	--	24.27	--	23.27	0	--
	1983	13.64	--	9.78	--	24.14	0	--
	1984	18.85	--	28.90	--	36.69	0	--
	1985	15.96	--	28.81	--	16.28	0	--
	1986	16.26	--	84.36	--	--	0.57	--
	1987	52.97	--	36.39	--	--	3.75	--
	1988	94.89	--	125.00	--	--	1.88	--
	1989	75.72	--	0	--	--	7.04	0.72
	1990	32.62	--	0	--	--	9.17	0.33
	1991	18.92	--	0	--	--	7.63	0.18
	1992	15.52	--	0	--	--	7.91	0.08

^a Not measured.

^b Sport effort in angler-hours; gill net effort in km; trapnet effort in lifts.

^c Sport (kg/hour), gill net (kgs/km), trap net (kgs/lift).

Table 4. Harvest of yellow perch (millions of fish) from Lake Erie by management unit, 1992.
 Note: 1986 represents age 6 and older fish.

YEAR CLASS	UNIT 1		UNIT 2		UNIT 3		UNIT 4	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Gillnets								
1991			.004	0.03	.001	0.02	0	0
1990	.915	32.1	4.454	43.1	.832	18.4	0	0
1989	1.622	57.0	5.478	53.0	2.911	64.5	.022	20.0
1988	.219	7.7	.310	3.0	.397	8.8	.046	41.2
1987	.050	1.8	.044	0.4	.172	3.8	.035	31.2
1986+	.041	1.4	.038	0.4	.958	20.9	.073	11.4
TOTAL	2.847		10.327		4.515		0.111	
Trapnets								
1991								
1990	.028	8.7	.016	4.5	.001	0.5	.0004	1.7
1989	.147	45.2	.145	39.7	.066	30.4	.002	9.2
1988	.054	16.8	.069	18.8	.049	22.3	.004	20.0
1987	.021	6.4	.025	6.9	.043	19.6	.003	13.6
1986+	.074	22.9	.110	30.2	.060	27.2	.012	55.5
TOTAL	.324		.366		.219		.022	
Angling								
1991	.019	1.5	.006	0.6				
1990	.516	37.8	.443	45.2	.031	20.1	0	0
1989	.505	36.9	.349	35.7	.055	35.1	.0003	2.5
1988	.204	14.9	.055	5.6	.012	7.7	.001	4.8
1987	.017	1.3	.015	1.6	.012	7.6	.002	15.6
1986+	.105	7.7	.111	11.3	.046	29.6	.009	77.1
TOTAL	1.368		0.979		0.156		0.011	
All Gear								
1991	0.019	0.4	0.009	0.1	0.001	0.02	0.000	0.0
1990	1.460	32.2	4.912	42.1	0.865	17.7	0.0003	0.3
1989	2.274	50.1	5.972	51.2	3.033	62.0	0.025	17.0
1988	0.467	10.3	0.434	3.7	0.458	9.4	0.051	35.1
1987	0.088	1.9	0.085	0.7	0.226	4.6	0.040	27.3
1986	0.221	4.9	0.259	2.2	0.308	6.3	0.029	20.3
TOTAL	4.540		11.672		4.890		0.145	

Table 5. Comparison of the 1992 yellow perch stock size projection (based on the 1991 harvest data) to the CAGEAN estimate of 1992 population size and to the adjusted estimate of stock size (1990 year class adjusted using Ontario Partnership Index fishing results).

UNIT	AGE	NUMBERS OF FISH (MILLIONS)			DIFFERENCE - CAGEAN		DIFFERENCE - ADJUSTED	
		1992 STOCK PROJECTION	1992 CAGEAN ESTIMATE	1992 ADJUSTED	NUMBER	PERCENT	NUMBER	PERCENT
1	2	26.08	97.10	38.78	-71.02	-272	-12.70	-49
	3	5.12	21.38	21.38	-16.26	-318	-16.26	-318
	4	0.76	1.79	1.79	-1.03	-136	-1.03	-136
	5	2.57	0.19	0.19	2.38	93	2.38	93
	6+	2.63	1.34	1.34	1.29	49	1.29	49
	2+OLDER	37.16	121.79	63.48	-84.63	-228	-26.32	-71
	3+OLDER	11.09	24.69	24.69	-13.60	-123	-13.60	-123
2	2	58.73	113.30	66.04	-54.57	-93	-7.31	-12
	3	6.73	32.40	32.40	-25.67	-381	-25.67	-381
	4	1.00	1.56	1.56	-0.56	-56	-0.56	-56
	5	2.99	0.15	0.15	2.84	95	2.84	95
	6+	6.66	2.82	2.82	3.84	58	3.84	58
	2+OLDER	76.11	150.23	102.97	-74.12	-97	-26.86	-35
	3+OLDER	17.38	36.93	36.93	-19.55	-112	-19.55	-112
3	2	10.47	25.22	28.69	-14.75	-141	-18.22	-174
	3	1.86	13.87	13.87	-12.01	-646	-12.01	-646
	4	0.82	0.90	0.90	-0.08	-10	-0.08	-10
	5	1.01	0.23	0.23	0.78	77	0.78	77
	6+	5.67	1.30	1.30	4.37	77	4.37	77
	2+OLDER	19.82	41.52	45.00	-21.70	-109	-25.18	-127
	3+OLDER	9.35	16.30	16.30	-6.95	-74	-6.95	-74
4	2	1.40	0.06	1.01	1.34	96	0.39	28
	3	1.42	0.94	0.94	0.48	34	0.48	34
	4	0.72	0.69	0.69	0.03	4	0.03	4
	5	1.84	0.40	0.40	1.44	78	1.44	78
	6+	3.68	3.42	3.42	0.26	7	0.26	7
	2+OLDER	9.09	5.52	6.46	3.57	39	2.63	29
	3+OLDER	7.65	5.45	5.45	2.20	29	2.20	29

Table 6. Lake Erie yellow perch population size and parameters estimated using 3-GEAR CAGEAN ($M=0.4$)(ADJUSTED VALUES). NUMBER is stock size in millions of fish. BIOMASS is stock size in millions of kilograms (1992 weight-at-age values from Ontario Partnership Index Gillnetting). S is annual survival rate and u is annual exploitation rate. Results are presented for populations consisting of age 2 and older fish, and age 3 and older fish.

UNIT	YEAR	AGE 2 AND OLDER				AGE 3 AND OLDER			
		NUMBER	BIOMASS	S	u	NUMBER	BIOMASS	S	u
1	1977	103.447	4.165	0.58	0.12	28.300	2.136	0.42	0.31
	1978	86.183	5.036	0.45	0.27	59.632	4.319	0.38	0.37
	1979	142.670	6.075	0.52	0.19	39.188	3.281	0.25	0.53
	1980	104.161	6.043	0.50	0.22	73.913	5.227	0.44	0.29
	1981	76.902	5.107	0.37	0.38	51.743	4.428	0.25	0.53
	1982	69.676	3.541	0.42	0.32	28.693	2.435	0.19	0.62
	1983	70.217	3.253	0.57	0.13	29.522	2.154	0.47	0.25
	1984	116.036	5.121	0.58	0.11	39.959	3.067	0.45	0.27
	1985	78.892	5.387	0.52	0.19	67.258	5.073	0.50	0.21
	1986	132.930	6.503	0.54	0.16	41.119	4.024	0.32	0.44
	1987	117.406	6.818	0.54	0.16	72.051	5.593	0.47	0.25
	1988	98.420	6.550	0.50	0.21	63.426	5.606	0.42	0.31
	1989	52.103	4.573	0.39	0.35	49.374	4.499	0.38	0.36
	1990	28.466	2.716	0.39	0.36	20.482	2.501	0.29	0.48
	1991	37.160	2.047	0.58	0.11	11.085	1.343	0.43	0.30
	1992	63.475	3.627	0.61	0.08	24.694	1.999	0.56	0.14
	1993	53.871	3.984			38.552	3.341		
2	1977	48.188	3.063	0.42	0.31	18.101	1.889	0.27	0.50
	1978	37.487	2.767	0.40	0.34	20.279	2.096	0.29	0.48
	1979	83.005	4.355	0.46	0.27	14.860	1.698	0.24	0.54
	1980	53.888	4.191	0.26	0.52	37.888	3.567	0.19	0.62
	1981	45.200	2.826	0.29	0.48	14.123	1.614	0.09	0.76
	1982	73.553	3.596	0.47	0.25	13.228	1.243	0.29	0.48
	1983	68.488	4.517	0.49	0.23	34.622	3.197	0.41	0.33
	1984	79.408	5.494	0.47	0.25	33.517	3.704	0.30	0.46
	1985	44.068	4.344	0.37	0.38	37.531	4.089	0.33	0.43
	1986	183.429	8.969	0.56	0.13	16.354	2.453	0.26	0.53
	1987	140.290	10.994	0.53	0.17	103.159	9.546	0.50	0.21
	1988	127.823	11.481	0.53	0.18	74.861	9.416	0.45	0.28
	1989	71.464	9.847	0.45	0.28	67.235	9.683	0.44	0.29
	1990	43.114	7.643	0.40	0.34	31.934	7.207	0.33	0.42
	1991	76.109	6.436	0.57	0.11	17.376	4.146	0.46	0.26
	1992	102.969	6.802	0.58	0.11	36.928	3.764	0.52	0.19
	1993	72.175	6.955			59.518	6.373		
3	1977	28.495	1.456	0.36	0.39	7.250	0.713	0.21	0.59
	1978	15.893	1.155	0.20	0.61	10.372	0.962	0.12	0.71
	1979	14.218	0.721	0.45	0.27	3.121	0.333	0.29	0.47
	1980	11.151	0.770	0.35	0.40	6.413	0.604	0.27	0.51
	1981	9.634	0.630	0.31	0.46	3.928	0.430	0.17	0.64
	1982	14.398	0.697	0.41	0.33	2.958	0.297	0.24	0.55
	1983	12.975	0.787	0.38	0.36	5.882	0.539	0.28	0.49
	1984	16.591	0.914	0.55	0.15	4.952	0.507	0.36	0.39
	1985	11.898	0.983	0.46	0.27	9.152	0.886	0.40	0.34
	1986	133.464	5.170	0.64	0.04	5.422	0.688	0.43	0.30
	1987	103.558	8.045	0.61	0.07	85.459	7.411	0.60	0.09
	1988	73.916	8.366	0.53	0.18	63.372	7.997	0.51	0.20
	1989	41.961	6.412	0.47	0.25	38.973	6.307	0.45	0.27
	1990	22.462	5.184	0.42	0.32	19.548	5.082	0.38	0.36
	1991	19.817	2.807	0.49	0.23	9.349	2.441	0.33	0.42
	1992	44.995	2.784	0.57	0.12	16.304	1.665	0.44	0.28
	1993	30.287	2.785			25.773	2.609		
4	1977	8.380	0.407	0.43	0.30	3.215	0.262	0.28	0.50
	1978	7.174	0.354	0.42	0.32	3.597	0.254	0.30	0.46
	1979	12.133	0.479	0.49	0.23	2.979	0.223	0.32	0.44
	1980	13.050	0.577	0.45	0.27	5.913	0.377	0.34	0.41
	1981	12.221	0.597	0.38	0.37	5.892	0.420	0.25	0.54
	1982	9.555	0.470	0.49	0.23	4.631	0.332	0.39	0.35
	1983	11.318	0.544	0.53	0.17	4.642	0.357	0.44	0.28
	1984	13.051	0.657	0.50	0.22	6.039	0.461	0.33	0.43
	1985	11.681	0.629	0.57	0.12	6.482	0.483	0.51	0.20
	1986	34.689	1.361	0.62	0.07	6.708	0.578	0.45	0.27
	1987	28.113	1.582	0.60	0.08	21.383	1.394	0.58	0.11
	1988	25.217	1.826	0.62	0.06	16.923	1.594	0.60	0.09
	1989	17.460	1.785	0.61	0.08	15.686	1.735	0.60	0.09
	1990	12.728	1.655	0.60	0.09	10.594	1.595	0.59	0.10
	1991	9.087	1.426	0.63	0.05	7.645	1.385	0.62	0.06
	1992	6.458	0.992	0.64	0.04	5.451	0.961	0.64	0.04
	1993	6.032	0.778			4.145	0.720		

Table 7. Yellow perch stock size (millions of fish) at the start of the year, estimated from CAGEAN for the years 1980-92. Age 2 values for 1992 have been adjusted. The 1993 population size has been generated from 1992 population estimates and from regressions based on index trawling.

UNIT	AGE	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	
1	2	29,830	25,170	40,990	41,023	76,622	11,462	89,772	42,739	32,866	2,931	6,223	33,576	38,781	15,319	
	3	63,498	19,055	15,598	24,174	26,375	49,634	7,485	57,444	27,641	21,270	1,821	3,953	21,381	24,802	
	4	6,183	29,520	7,373	4,302	12,193	13,392	26,718	3,460	3,460	28,801	13,938	10,101	1,748	1,787	12,207
	5	3,348	1,675	5,451	0,667	1,472	4,283	5,335	7,414	1,127	1,127	9,392	3,792	2,012	0,189	0,766
	6+	0,435	0,985	0,517	0,499	0,410	0,721	2,090	2,384	3,515	1,976	1,976	3,395	2,171	1,337	0,777
	2 AND OLDER	103,294	76,405	69,929	70,665	117,072	79,492	131,400	113,441	93,950	49,407	25,322	42,460	63,475	53,871	
3 AND OLDER	73,464	51,235	28,939	29,642	40,450	68,030	41,628	70,702	61,084	46,576	19,099	8,884	24,694	38,552		
2	2	16,460	31,339	59,644	33,077	44,963	6,158	157,149	30,247	49,045	4,697	7,512	54,806	66,041	12,657	
	3	33,962	7,140	11,938	30,278	18,831	26,756	3,634	92,195	18,981	31,185	2,907	4,350	32,400	40,378	
	4	2,477	6,265	0,898	0,347	12,423	7,110	9,583	1,254	44,720	9,790	14,107	0,922	1,555	16,855	
	5	0,831	0,240	0,346	0,161	1,075	2,485	1,278	1,603	1,842	17,257	2,890	1,842	0,153	0,583	
	6+	0,179	0,105	0,033	0,059	0,070	0,377	0,958	0,914	1,254	0,979	7,469	4,606	2,820	1,701	
	2 AND OLDER	53,909	45,089	72,859	63,922	77,362	42,886	172,602	126,213	114,425	63,908	34,825	66,526	102,969	72,174	
3 AND OLDER	37,449	13,750	13,215	30,845	32,399	36,728	15,453	95,966	65,380	59,211	27,313	11,720	36,928	59,517		
3	2	4,848	5,724	11,223	6,958	9,044	2,564	121,750	15,708	10,454	4,039	3,612	21,735	28,691	4,514	
	3	5,644	2,115	2,082	4,934	2,847	4,701	1,646	79,313	10,287	6,916	2,652	2,334	13,874	18,534	
	4	0,639	1,637	0,432	0,603	1,279	1,150	2,052	0,818	47,437	5,945	3,717	1,163	0,902	6,394	
	5	0,285	0,118	0,178	0,074	0,098	0,377	0,305	0,711	0,421	22,027	2,267	0,968	0,233	0,285	
	6+	0,053	0,984	0,047	0,053	0,038	0,050	0,111	0,149	0,442	0,418	8,322	3,571	1,295	0,580	
	2 AND OLDER	11,469	10,578	13,962	12,622	13,306	8,842	125,864	96,699	69,041	69,041	39,345	20,570	29,771	44,995	
3 AND OLDER	6,621	4,854	2,739	5,664	4,262	6,278	4,114	80,991	58,587	58,587	35,306	16,958	8,036	16,304		
4	2	7,366	6,606	5,079	7,015	7,562	5,582	28,998	6,666	6,927	1,848	1,711	1,416	1,007	1,887	
	3	5,197	3,986	3,400	2,975	4,216	4,843	3,674	18,993	4,419	4,616	1,229	1,134	0,940	0,675	
	4	0,695	1,907	1,271	1,559	1,467	1,739	2,672	1,931	11,350	2,787	2,864	0,737	0,691	0,604	
	5	0,228	0,166	0,358	0,444	0,617	0,345	0,766	1,057	1,001	6,662	1,579	1,505	0,402	0,423	
	6+	0,064	0,085	0,062	0,163	0,263	0,336	0,379	0,581	0,961	1,239	4,738	3,909	3,418	2,444	
	2 AND OLDER	13,550	12,750	10,170	12,156	14,125	12,845	36,489	29,228	24,658	17,152	12,121	8,701	6,458	6,093	
3 AND OLDER	6,184	6,144	5,091	5,141	6,563	7,263	7,491	22,562	17,731	15,304	10,410	7,285	5,451	4,146		

Table 8. Estimates of yellow perch abundance (number of age -2 recruits) for the 1991 and 1992 year classes derived from agency trawl indices (M = 0.40)

		1991 Year Class				1992 Year Class			
Agency	Area	Season	Group	Mean Estimate	95% Confidence Limits		Mean Estimate	95% Confidence Limits	
					Lower	Upper		Lower	Upper
Management Unit 1									
Ont.	11	Summer	YOY	18,972,479	16,189,930	22,233,262	12,454,593	9,024,918	17,187,621
Ohio	21	Summer	YOY	14,200,674	9,960,123	20,246,652	---	---	---
Ohio	21	Fall	YOY	13,012,227	8,433,311	20,077,292	22,175,530	18,254,095	26,939,388
Ohio	21	Fall	YRL	9,172,313	5,932,759	14,180,807	---	---	---
USFW	21	Summer	YOY	18,665,734	14,177,971	24,574,012	15,976,029	11,300,980	22,585,078
USFW	21	Summer	YRL	5,960,113	2,723,967	13,040,885	---	---	---
USFW	21	Fall	YOY	73,876,106	49,510,731	110,232,243	250,783,356	95,334,279	659,702,808
USFW	21	Fall	YRL	16,957,148	12,930,508	22,237,709	---	---	---
			Weighted	15,319,406	10,456,442	22,445,742	26,293,885	17,126,016	40,369,480
Management Unit 2									
Ohio	23	Fall	YOY	27,009,521	25,108,073	29,054,967	---	---	---
Ont.	11	Summer	YOY	14,680,050	12,223,856	17,629,779	9,228,435	6,448,770	13,206,240
Ohio	21	Summer	YOY	10,522,222	7,367,581	15,027,614	---	---	---
Ohio	21	Fall	YOY	9,590,657	6,017,606	15,285,267	16,886,077	13,664,339	20,867,427
Ohio	21	Fall	YRL	7,847,456	4,661,743	13,210,202	---	---	---
USFW	21	Summer	YRL	4,061,651	1,670,945	9,872,859	---	---	---
USFW	21	Fall	YOY	60,563,321	38,343,669	95,658,967	221,536,961	73,883,494	664,270,497
USFW	21	Fall	YRL	8,232,498	5,361,745	12,640,291	---	---	---
			Weighted	12,656,902	8,759,333	18,289,650	20,106,256	12,570,941	32,160,530

continued....

Table 8. (cont'd)

Agency	Area	Season	Group	1991 Year Class			1992 Year Class		
				95% Confidence Limits		Mean Estimate	95% Confidence Limits		Mean Estimate
				Lower	Upper		Lower	Upper	
Management Unit 3									
Ont.	11	Summer	YOY	4,865,111	2,906,906	8,142,436	2,893,276	1,343,112	6,232,574
Ont.	11	Summer	YRL	7,170,601	5,081,922	10,117,731	---	---	---
USFW	21	Fall	YRL	2,213,753	1,283,627	3,817,858	---	---	---
			Weighted	4,514,212	2,843,413	7,167,236	2,893,308	1,343,039	6,233,052
Management Unit 4									
Ont.	16	Fall	YOY	1,259,090	725,996	2,183,632	3,008,644	2,613,759	3,463,188
Ont.	16	Fall	YRL	1,012,365	543,236	1,886,625	---	---	---
Ont.	11	Summer	YRL	2,872,807	2,443,886	3,377,006	---	---	---
Ohio	21	Summer	YOY	1,854,267	1,346,743	2,553,052	---	---	---
Ohio	21	Fall	YOY	1,879,281	1,371,616	2,574,845	2,941,117	2,590,859	3,338,726
Ohio	21	Fall	YRL	1,605,587	1,104,055	2,334,948	---	---	---
USFW	21	Fall	YOY	7,872,608	5,604,610	11,058,390	22,598,634	9,886,690	51,655,126
USFW	21	Fall	YRL	1,548,040	1,027,460	2,333,381	---	---	---
			Weighted	1,886,946	1,273,731	2,795,384	5,187,996	3,752,266	7,172,506

Table 9. Projection of the 1993 Lake Erie yellow perch population size. Stock size estimates are derived from CAGEAN and index trawling regressions. The estimates of the 1990 year class have been adjusted by Ontario partnership Index fishing results. Stock size (numbers) is in millions of fish.

AGE	1992 PARAMETERS										1993 PARAMETERS									
	STOCK SIZE (NUMBERS)					MORTALITY RATES					SURV RATE (S)	STOCK SIZE (NUMBERS)					POP. WEIGHT (kg)			
	MEAN	SE	MIN	MAX	(F)	(Z)	(A)	(u)	MEAN	MIN		MAX	1992	1993						
UNIT 1																				
2	38.781	8.780	30.001	47.561	0.047	0.447	0.360	0.038	0.640	15.319	10.456	22.446	0.042	1.629	0.643					
3	21.381	4.841	16.540	26.222	0.161	0.561	0.429	0.123	0.571	24.802	19.187	30.417	0.073	1.561	1.811					
4	1.787	0.405	1.382	2.192	0.448	0.848	0.572	0.302	0.428	12.207	9.443	14.971	0.106	0.189	1.294					
5	0.189	0.043	0.146	0.232	0.448	0.848	0.572	0.302	0.428	0.766	0.592	0.939	0.140	0.026	0.107					
6	1.337	0.303	1.034	1.640	0.253	0.653	0.479	0.185	0.521	0.777	0.601	0.953	0.166	0.222	0.129					
TOTAL (3+)	63.475	14.371	49.104	77.846	0.099	0.499	0.3926	0.0777	0.6074	53.871	40.280	69.726	3.627	3.984	3.341					
UNIT 2																				
2	66.041	23.268	42.773	89.309	0.092	0.492	0.389	0.073	0.611	12.657	8.759	18.290	0.046	3.038	0.582					
3	32.400	11.415	20.985	43.815	0.254	0.654	0.480	0.186	0.520	40.378	26.151	54.604	0.079	2.560	3.190					
4	1.555	0.548	1.007	2.103	0.580	0.980	0.625	0.370	0.375	16.855	10.917	22.793	0.146	0.227	2.461					
5	0.153	0.054	0.099	0.207	0.375	0.775	0.539	0.261	0.461	0.583	0.378	0.789	0.270	0.041	0.158					
6	2.820	0.993	1.827	3.813	0.148	0.548	0.422	0.114	0.578	1.701	1.102	2.301	0.332	0.936	0.565					
TOTAL (3+)	102.969	36.276	66.693	139.245	0.148	0.548	0.4220	0.1141	0.5780	72.175	47.307	98.777	6.802	6.955	6.373					
UNIT 3																				
2	28.691	12.544	16.147	41.235	0.037	0.437	0.354	0.030	0.646	4.514	2.843	7.167	0.039	1.119	0.176					
3	13.874	6.066	7.808	19.940	0.375	0.775	0.539	0.261	0.461	18.534	10.431	26.636	0.084	1.165	1.557					
4	0.902	0.394	0.508	1.296	0.823	1.223	0.706	0.475	0.294	6.394	3.598	9.189	0.133	0.120	0.850					
5	0.233	0.102	0.131	0.335	0.894	1.294	0.726	0.501	0.274	0.265	0.149	0.382	0.200	0.047	0.053					
6	1.295	0.566	0.729	1.861	0.520	0.920	0.602	0.340	0.398	0.580	0.326	0.833	0.257	0.333	0.149					
TOTAL (3+)	44.995	19.672	25.323	64.667	0.157	0.557	0.4272	0.1205	0.5728	30.287	17.348	44.207	2.784	2.785	2.609					
UNIT 4																				
2	1.007	0.507	0.500	1.514	0.000	0.400	0.330	0.000	0.670	1.887	1.273	2.795	0.031	0.031	0.058					
3	0.940	0.473	0.467	1.413	0.042	0.442	0.357	0.034	0.643	0.675	0.335	1.014	0.052	0.049	0.035					
4	0.691	0.348	0.343	1.039	0.092	0.492	0.389	0.073	0.611	0.604	0.300	0.908	0.104	0.072	0.063					
5	0.402	0.202	0.200	0.604	0.071	0.471	0.376	0.057	0.624	0.423	0.210	0.635	0.159	0.064	0.067					
6	3.418	1.720	1.698	5.138	0.044	0.444	0.359	0.036	0.641	2.444	1.214	3.673	0.227	0.776	0.555					
TOTAL (3+)	6.458	3.250	3.208	9.708	0.043	0.443	0.3581	0.0350	0.6419	6.032	3.332	9.026	0.992	0.992	0.778					
	5.451	2.743	2.708	8.194	0.052	0.452	0.3633	0.0415	0.6367	4.145	2.059	6.231	0.961	0.961	0.720					

Table 10. Recommended allowable harvest (RAH) of Lake Erie yellow perch for 1993. The exploitation rate is derived from optimal yield policy and the stock size estimates are derived from adjusted CAGEAN outputs. Stock size and catch in numbers are in millions of fish. Catch in weight (RAH) is in millions of kilograms.

AGE	STOCK SIZE (NUMBERS)			EXPLOITATION RATE			CATCH (Millions of Fish)			HARVEST WEIGHT (kg)			CATCH (Millions of kg) - RAH			
	MEAN	MIN	MAX	F(OPT)	s(age)	F	u	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
UNIT 1																
2	15.319	10.456	22.446	0.000	0.105	0.063	0.050	0.771	0.526	1.129	0.100	0.077	0.053	0.113		
3	24.802	19.187	30.417	0.453	0.359	0.215	0.160	3.977	3.076	4.877	0.114	0.453	0.351	0.556		
4	12.207	9.443	14.971	0.453	1.000	0.598	0.379	4.621	3.575	5.667	0.127	0.587	0.454	0.720		
5	0.766	0.592	0.939	0.453	1.000	0.598	0.379	0.290	0.224	0.355	0.157	0.046	0.035	0.056		
6	0.777	0.601	0.953	0.453	0.564	0.338	0.239	0.186	0.144	0.228	0.222	0.041	0.032	0.051		
TOTAL (3+)	53.871	40.280	69.726	1.812	3.028	0.222	0.183	9.844	7.545	12.256	0.122	1.204	0.924	1.495		
	38.552	29.824	47.280	1.812		0.350	0.235	9.073	7.019	11.127	0.124	1.127	0.872	1.382		
UNIT 2																
2	12.657	8.759	18.290	0.000	0.159	0.121	0.094	1.195	0.827	1.727	0.109	0.130	0.090	0.188		
3	40.378	26.153	54.603	0.477	0.437	0.334	0.237	9.552	6.187	12.918	0.126	1.204	0.780	1.628		
4	16.855	10.917	22.793	0.477	1.000	0.764	0.452	7.611	4.929	10.292	0.150	1.142	0.739	1.544		
5	0.583	0.378	0.789	0.477	0.647	0.494	0.327	0.191	0.123	0.258	0.197	0.038	0.024	0.051		
6	1.701	1.102	2.301	0.477	0.255	0.195	0.147	0.250	0.162	0.337	0.260	0.065	0.042	0.088		
TOTAL (3+)	72.175	47.309	98.776	1.908	2.497	0.316	0.260	18.798	12.229	25.532	0.137	2.578	1.675	3.498		
	59.518	38.550	80.486	1.908		0.444	0.296	17.603	11.401	23.805	0.139	2.448	1.585	3.310		
UNIT 3																
2	4.514	2.843	7.167	0.000	0.045	0.029	0.024	0.107	0.068	0.170	0.110	0.012	0.007	0.019		
3	18.534	10.431	26.636	0.523	0.455	0.296	0.213	3.952	2.224	5.679	0.127	0.502	0.282	0.721		
4	6.394	3.598	9.189	0.523	1.000	0.650	0.402	2.573	1.448	3.698	0.151	0.389	0.219	0.558		
5	0.265	0.149	0.382	0.523	1.086	0.706	0.427	0.113	0.064	0.163	0.195	0.022	0.012	0.032		
6	0.580	0.326	0.833	0.523	0.632	0.411	0.281	0.163	0.092	0.235	0.250	0.041	0.023	0.059		
TOTAL (3+)	30.287	17.348	44.207	2.092	3.218	0.277	0.228	6.909	3.895	9.945	0.140	0.965	0.544	1.389		
	25.773	14.505	37.040	2.092		0.404	0.264	6.801	3.828	9.775	0.140	0.953	0.537	1.370		
UNIT 4																
2	1.887	1.273	2.795	0.000	0.004	0.003	0.002	0.004	0.003	0.006	0.111	0.000	0.000	0.001		
3	0.675	0.335	1.014	0.398	0.454	0.267	0.195	0.131	0.065	0.197	0.120	0.016	0.008	0.024		
4	0.604	0.300	0.908	0.398	1.000	0.588	0.373	0.226	0.112	0.339	0.130	0.029	0.015	0.044		
5	0.423	0.210	0.635	0.398	0.771	0.453	0.305	0.129	0.064	0.194	0.161	0.021	0.010	0.031		
6	2.444	1.214	3.673	0.398	0.479	0.281	0.204	0.499	0.248	0.750	0.271	0.135	0.067	0.203		
TOTAL (3+)	6.032	3.332	9.026	1.592	2.708	0.199	0.164	0.989	0.492	1.486	0.204	0.201	0.100	0.303		
	4.145	2.059	6.231	1.592		0.345	0.238	0.985	0.489	1.480	0.204	0.201	0.100	0.302		

Table 11. Lake Erie yellow perch harvest scenarios for 1993. Four scenarios are presented. The recommended harvest levels are the second option; an adjusted estimate of population size and the scaled F(0.1) exploitation strategy

UNIT	YIELD MILLIONS KGS			YIELD POUNDS			EXPLOITATION RATES		
	MEAN	MIN	MAX	MEAN	MIN	MAX	2+OLDER	3+OLDER	3+OLDER
UNADJUSTED POPULATION ESTIMATE - F(0.1) EXPLOITATION STRATEGY									
1	1.906	1.471	2.345	4,202,730	3,243,555	5,170,725	0.17	0.20	0.20
2	3.552	2.304	4.810	7,832,160	5,080,320	10,606,050	0.25	0.28	0.28
3	0.906	0.510	1.303	1,997,730	1,124,550	2,873,115	0.23	0.27	0.27
4	0.116	0.059	0.175	255,780	130,095	385,875	0.12	0.17	0.17
TOTAL	6.480	4.344	8.633	14,288,400	9,576,520	19,035,765			
ADJUSTED POPULATION ESTIMATE - F(0.1) EXPLOITATION STRATEGY - RECOMMENDED ALLOWABLE HARVEST									
1	1.204	0.924	1.495	2,654,820	2,037,420	3,296,475	0.18	0.24	0.24
2	2.578	1.675	3.498	5,684,490	3,693,375	7,713,090	0.26	0.30	0.30
3	0.965	0.544	1.389	2,127,825	1,199,520	3,062,745	0.23	0.26	0.26
4	0.201	0.100	0.303	443,205	220,500	668,115	0.16	0.24	0.24
TOTAL	4.948	3.243	6.685	10,910,340	7,150,815	14,740,425			
ADJUSTED POPULATION ESTIMATE - F(1992 EFFORT)									
1	0.942	0.723	1.169	2,077,110	1,594,215	2,577,645	0.14	0.18	0.18
2	2.062	1.340	2.798	4,546,710	2,954,700	6,169,590	0.21	0.24	0.24
3	1.162	0.655	1.673	2,562,210	1,444,275	3,688,965	0.28	0.32	0.32
4	0.036	0.018	0.054	79,380	39,690	119,070	0.03	0.04	0.04
TOTAL	4.202	2.736	5.694	9,265,410	6,032,880	12,555,270			
INDEX ADJUSTED TO F(OPT)									
1	1.312			2,892,960					
2	1.956			4,312,980					
3	0.635			1,400,175					
4	0.23			507,150					
TOTAL	4.133			9,113,265					

Table 12. Lake Erie yellow perch recommended allowable harvest for 1992 using current information, as compared to actual 1992 harvest and the 1992 recommendation.

UNIT	YIELD MILLIONS KGS			YIELD POUNDS			1992 RAH			1992 HARVEST		
	MEAN	MIN	MAX	MEAN	MIN	MAX	KG x 10**6	POUNDS		KG x 10**6	POUNDS	
ADJUSTED POPULATION ESTIMATE - F(0.1) EXPLOITATION STRATEGY - RECOMMENDED ALLOWABLE HARVEST												
1	0.754	0.583	0.925	1,662,570	1,285,515	2,039,625	0.608	1,340,640		0.526	1,159,830	
2	1.869	1.211	2.528	4,121,145	2,670,255	5,574,240	1.611	3,552,255		1.371	3,023,055	
3	0.616	0.347	0.885	1,358,280	765,135	1,951,425	0.434	956,970		0.659	1,453,095	
4	0.265	0.131	0.398	584,325	288,855	877,590	0.130	286,650		0.061	134,505	
TOTAL	3.504	2.272	4.736	7,726,320	5,009,760	10,442,880	2.783	6,136,515		2.617	5,770,485	

Table 13a.

Lake Erie harvest projection (millions of kilograms) using 1992 harvest, Ontario Partnership index fishing results and an adjustment for optimal yield

MANAGEMENT UNIT	A INDEX WEIGHT 1991 (KG)	B INDEX WEIGHT 1992(KG)	C HARVEST 1992 (MILLION KG)	D PROJECTED HARVEST 1993 FROM INDEX (MILLION KG)
1	94.919	185.254	0.526	1.027
2	210.043	239.634	1.371	1.564
3	186.236	216.005	0.659	0.764
4	39.030	26.387	0.061	0.041
TOTAL			2.617	3.396

PROJECTED HARVEST 1993 FROM INDEX D= B*C/A

MANAGEMENT UNIT	A PROJECTED HARVEST 1993 CAGEAN+Fopt (MILLION KG)	B PROJECTED HARVEST 1993 FROM INDEX (MILLION KG)	C PROJECTED HARVEST 1993 CAGEAN AND 1992 EFFORT (MILLION KG)	D PROJECTED HARVEST 1993 INDEX ADJUSTED TO Fopt (MILLION KG)
1	1.204	1.027	0.942	1.312
2	2.578	1.564	2.062	1.956
3	0.965	0.764	1.162	0.635
4	0.201	0.041	0.036	0.230
TOTAL	4.948	3.396	4.202	4.133

PROJECTED HARVEST 1993 D= A*B/C

Table 13b.

Lake Erie harvest projection (millions of pounds) using 1992 harvest, Ontario Partnership index fishing results and an adjustment for optimal yield

MANAGEMENT UNIT	A INDEX WEIGHT 1991 (LBS)	B INDEX WEIGHT 1992(LBS)	C HARVEST 1992 (MILLION LBS)	D PROJECTED HARVEST 1993 FROM INDEX (MILLION LBS)
1	209.296	408.485	1.160	2.264
2	463.145	528.393	3.023	3.449
3	410.650	476.291	1.453	1.685
4	86.061	58.183	0.135	0.091
TOTAL			5.770	7.489

PROJECTED HARVEST 1993 FROM INDEX D= B*C/A

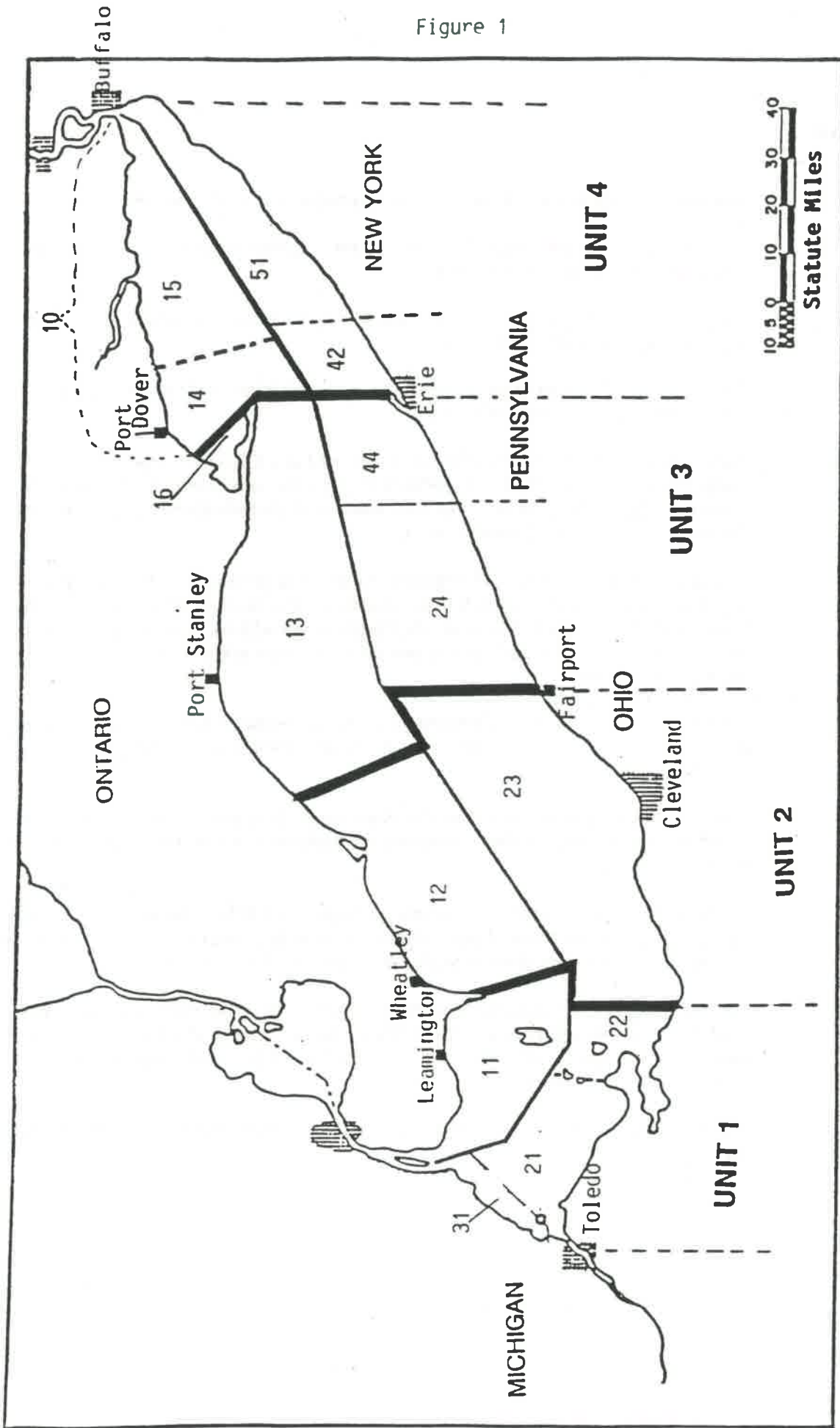
MANAGEMENT UNIT	A PROJECTED HARVEST 1993 CAGEAN+Fopt (MILLION LBS)	B PROJECTED HARVEST 1993 FROM INDEX (MILLION LBS)	C PROJECTED HARVEST 1993 CAGEAN AND 1992 EFFORT (MILLION LBS)	D PROJECTED HARVEST 1993 INDEX ADJUSTED TO Fopt (MILLION LBS)
1	2.655	2.264	2.077	2.893
2	5.684	3.449	4.547	4.312
3	2.128	1.685	2.562	1.400
4	0.443	0.091	0.079	0.508
TOTAL	10.910	7.489	9.265	9.113

PROJECTED HARVEST 1993 D= A*B/C

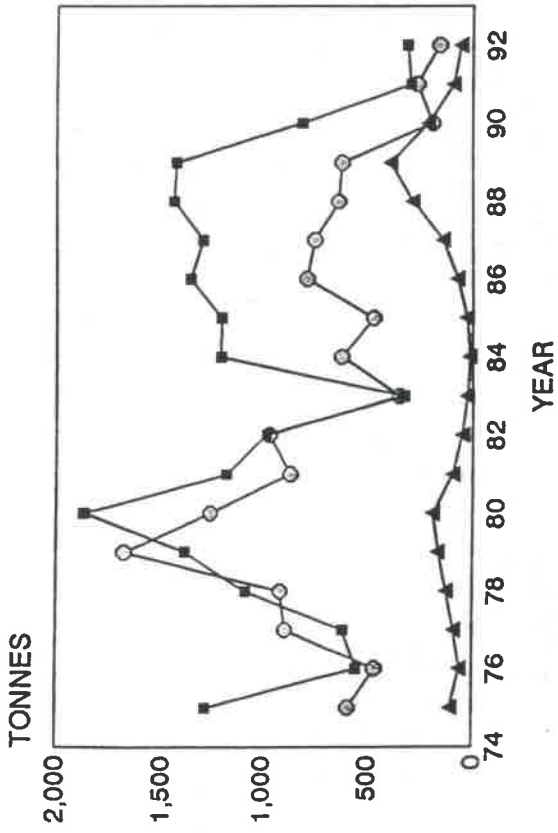
Figures

- Figure 1. Map of Lake Erie describing yellow perch management unit boundaries.
- Figure 2. Trends in Lake Erie yellow perch harvest by gear (gillnet, trapnet and angling) within a management unit (period 1975-1992).
- Figure 3. Trends in Lake Erie yellow perch effort by gear (gillnet, trapnet and angling) within a management unit (period 1975-1992).
- Figure 4. Trends in Lake Erie yellow perch catch rate by gear (gillnet, trapnet and angling) within a management unit (period 1975-1992).
- Figure 5. Trends in numeric abundance (millions of fish) of Lake Erie yellow perch by management unit. Age 3 and older fish and age 2 fish are indicated. Estimates of abundance are from CAGEAN. The 1990 year class abundance has been adjusted by Ontario partnership index fishing results.
- Figure 6. Trends in biomass (millions of kilograms) of Lake Erie yellow perch by management unit. Age 3 and older fish and age 2 fish are indicated. Estimates of biomass are derived from CAGEAN estimates of numeric abundance and weight-at-age information from index fishing. The 1990 year class abundance has been adjusted by Ontario partnership index fishing results.
- Figure 7. Trends in survival rate of Lake Erie yellow perch by management unit. Age 3 and older fish and age 2 and older populations are indicated. Estimates of survival rate are from CAGEAN.
- Figure 8. Trends in exploitation rate of Lake Erie yellow perch by management unit. Age 3 and older fish and age 2 and older populations are indicated. Estimates of exploitation rate are from CAGEAN.
- Figure 9. Trends in the abundance of age 2 yellow perch by Lake Erie management unit. The 1990 year class estimate has been adjusted by Ontario partnership index fishing results. The 1991 and 1992 year class estimates are based on index trawling values.
- Figure 10. Young-of-the-year and yearling index trawling geometric mean catch rates for yellow perch for each management unit (1984-1992). Values presented are combined agency values from significant regressions with CAGEAN age 2 estimates weighted by the R-squared from the regression.
- Figure 11. Age specific selectivity coefficients by gear (gillnet, trapnet, angling) for Lake Erie yellow perch by management unit.

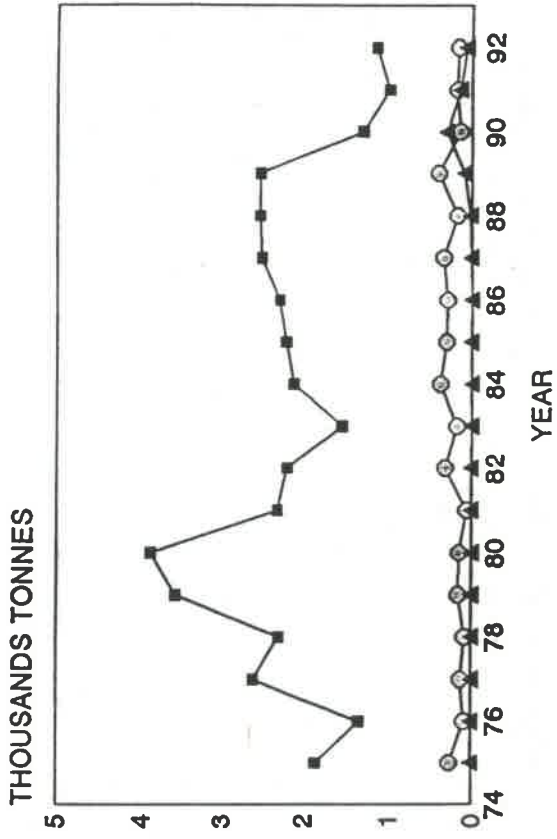
Figure 1



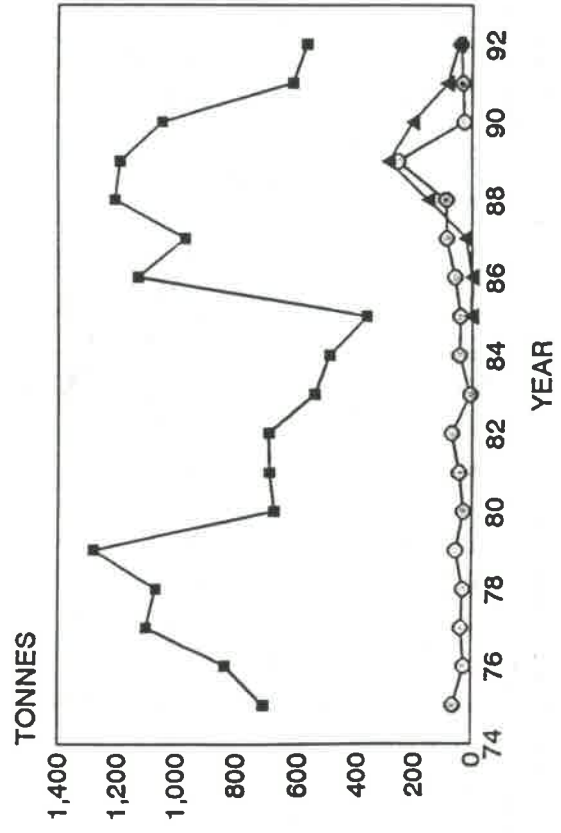
MANAGEMENT UNIT 1 HARVEST



MANAGEMENT UNIT 2 HARVEST



MANAGEMENT UNIT 3 HARVEST



MANAGEMENT UNIT 4 HARVEST

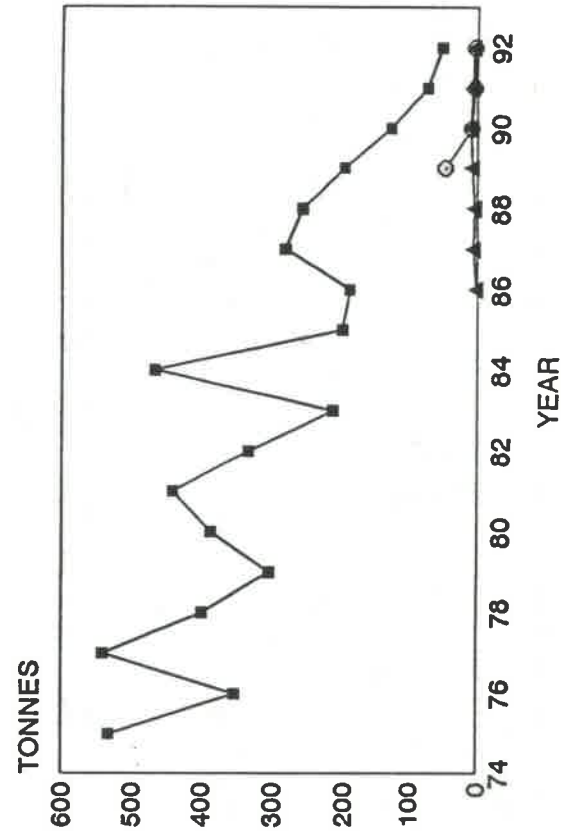
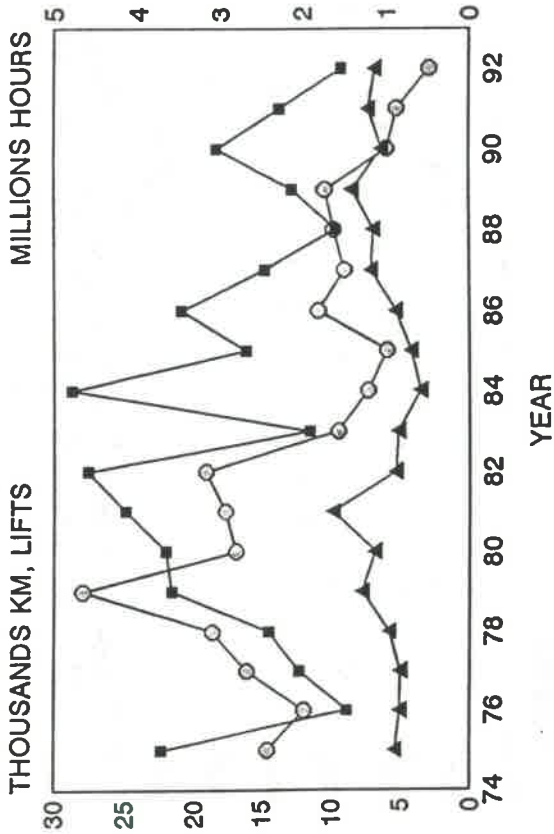


Figure 2

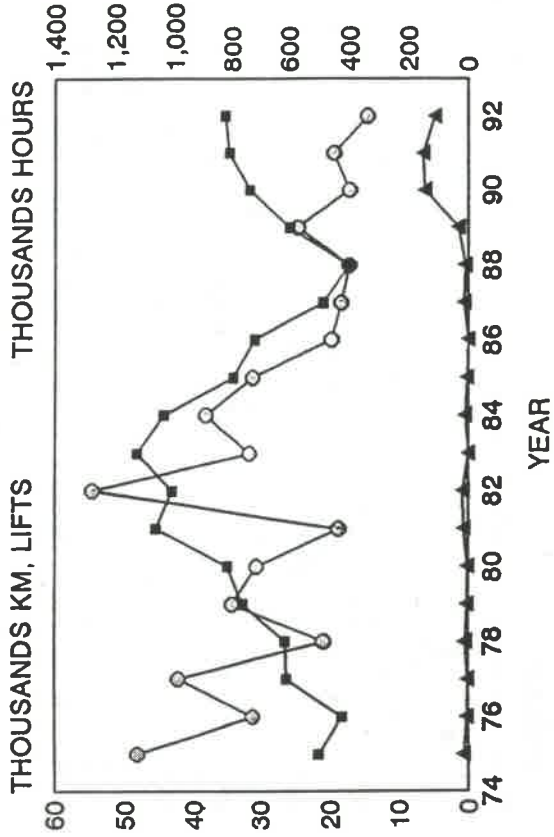
Figure 3

MANAGEMENT UNIT 1 EFFORT



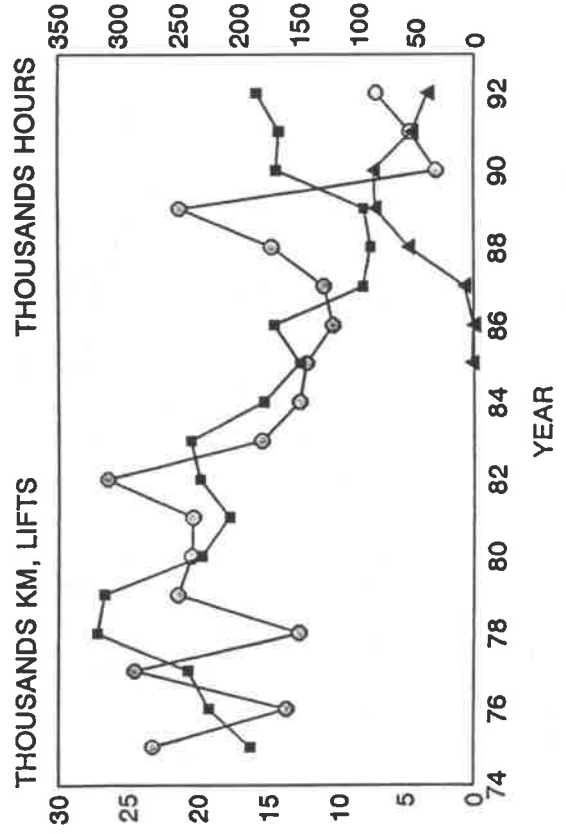
■ GILLNET ▲ TRAPNET ○ SPORT

MANAGEMENT UNIT 2 EFFORT



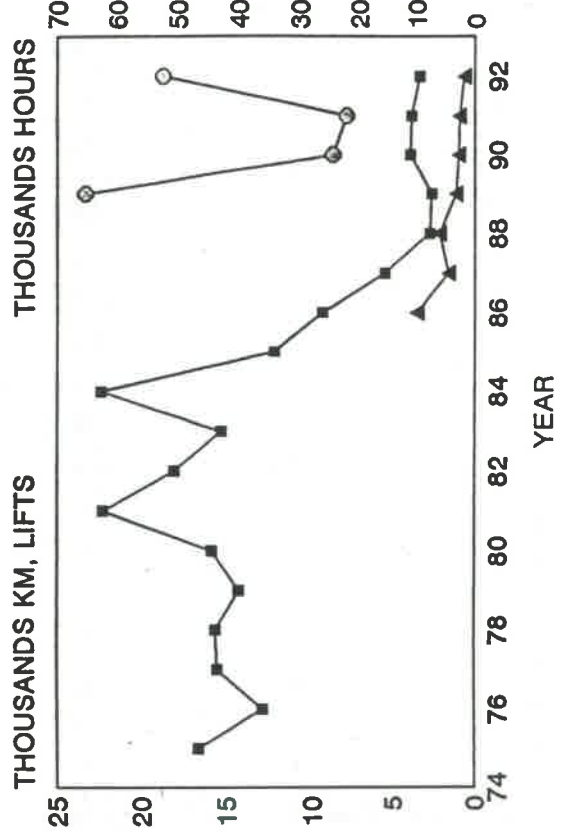
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MANAGEMENT UNIT 3 EFFORT



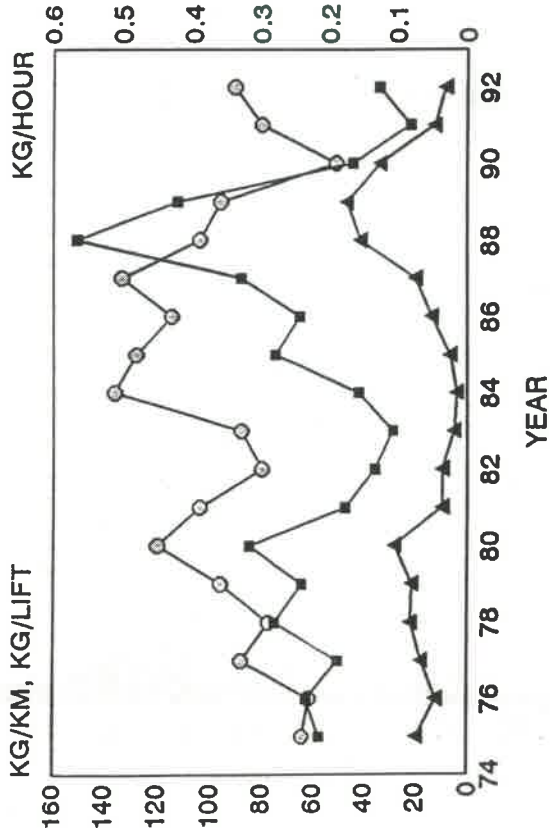
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MANAGEMENT UNIT 4 EFFORT



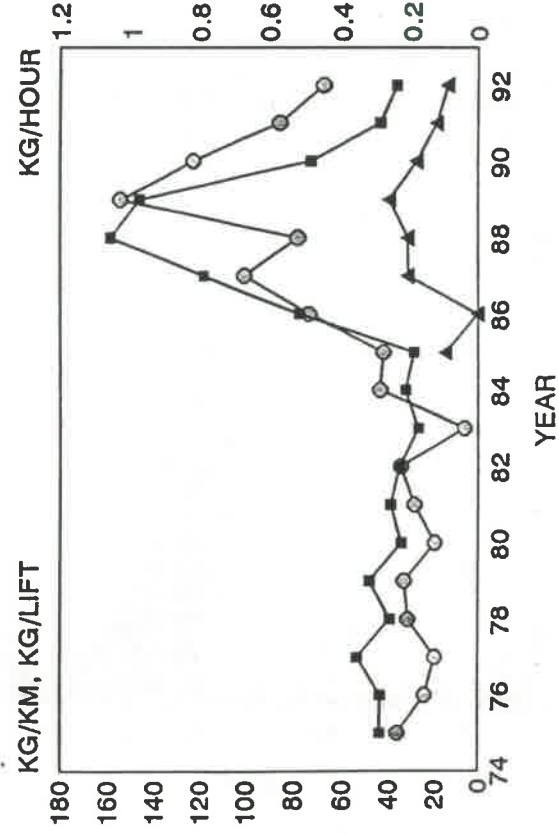
■ GILLNET ▲ TRAPNET ○ SPORT

MANAGEMENT UNIT 1 CUE



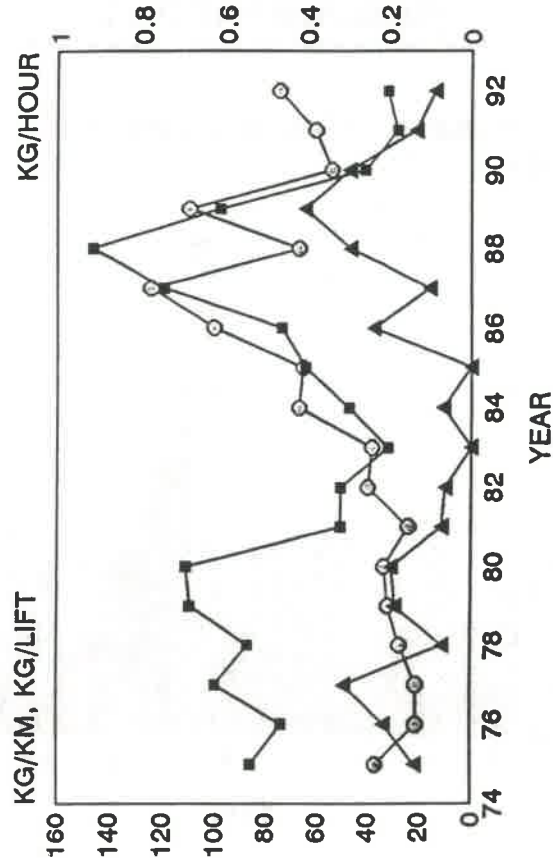
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MANAGEMENT UNIT 3 CUE



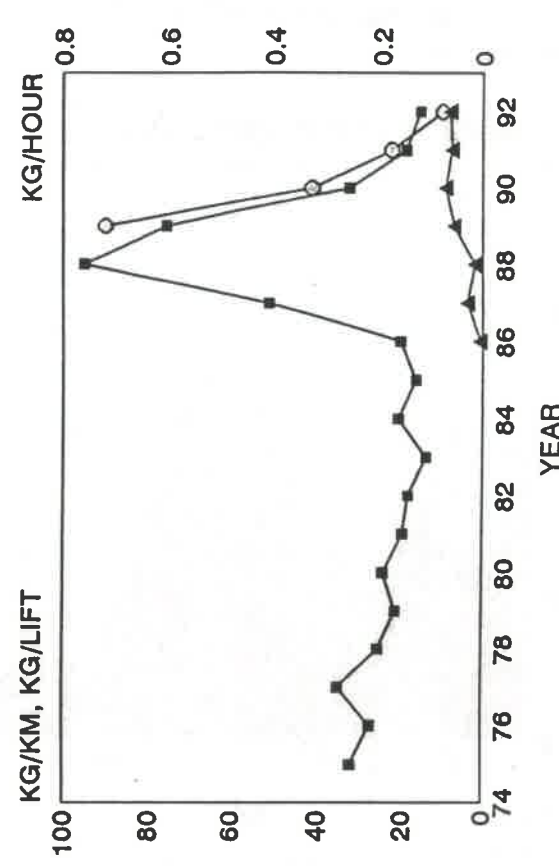
■ GILLNET ▲ TRAPNET ○ SPORT

MANAGEMENT UNIT 2 CUE



■ GILLNET ▲ TRAPNET ○ SPORT

MANAGEMENT UNIT 4 CUE



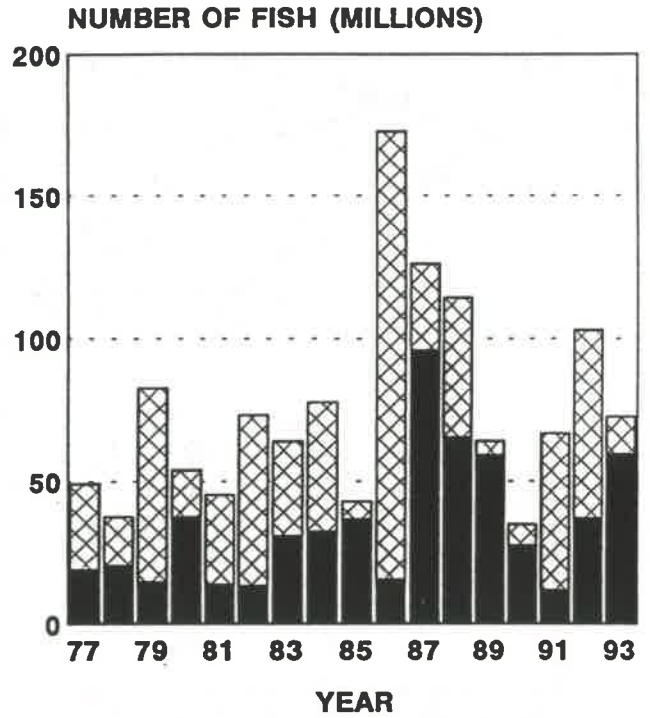
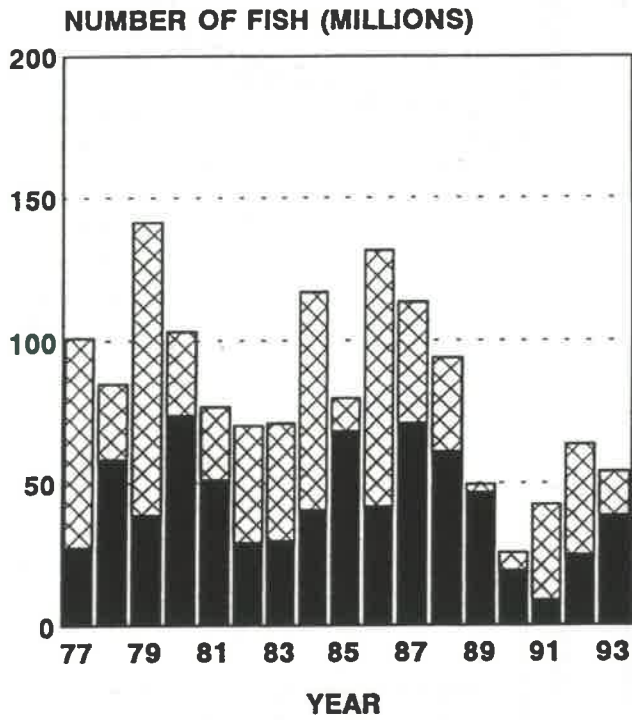
■ GILLNET ▲ TRAPNET ○ SPORT

Figure 4

Figure 5

**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 1**

**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 2**

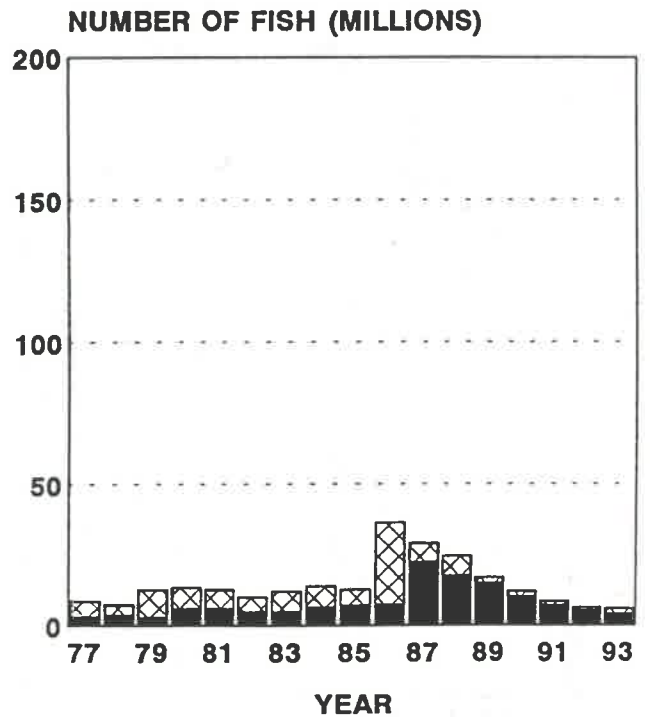
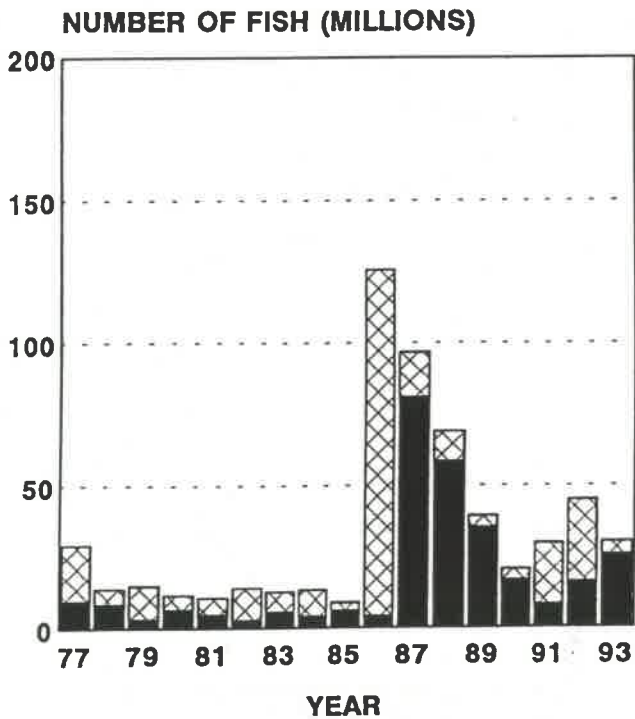


■ Age 3+ ☒ Age 2

■ Age 3+ ☒ Age 2

**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 3**

**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 4**



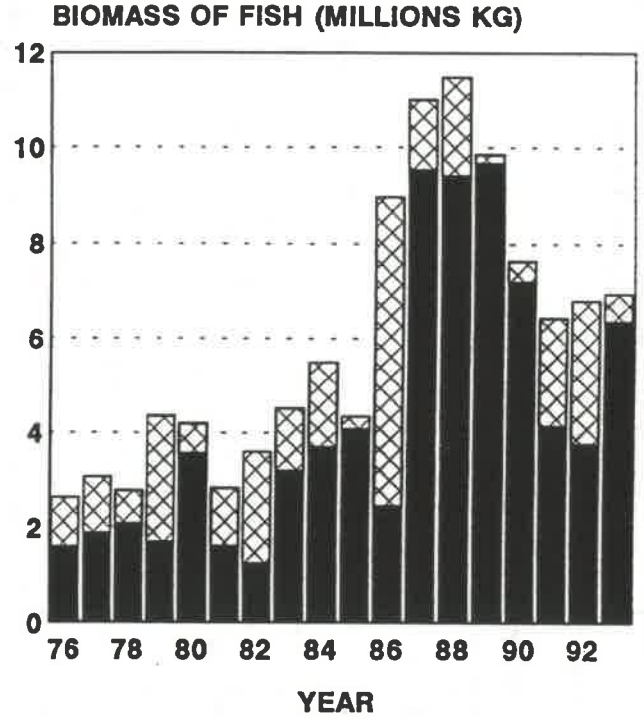
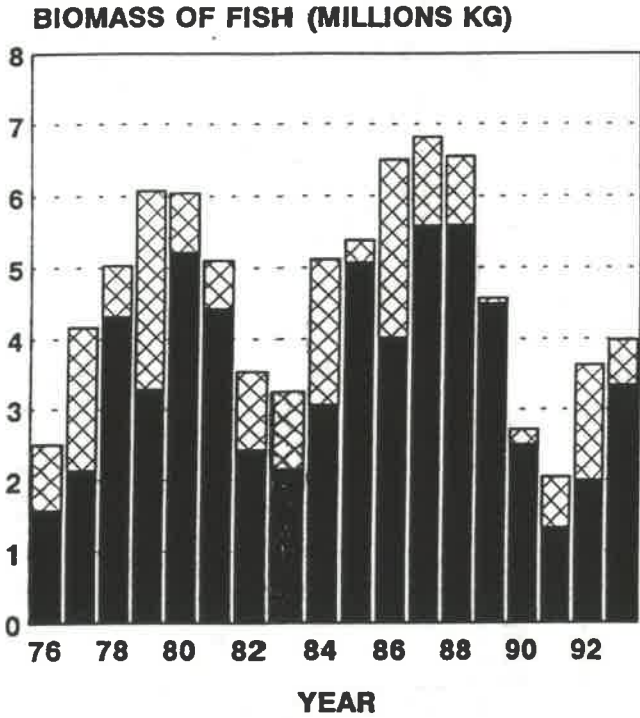
■ Age 3+ ☒ Age 2

■ Age 3+ ☒ Age 2

Figure 6

**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 1**

**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 2**



**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 3**

**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 4**

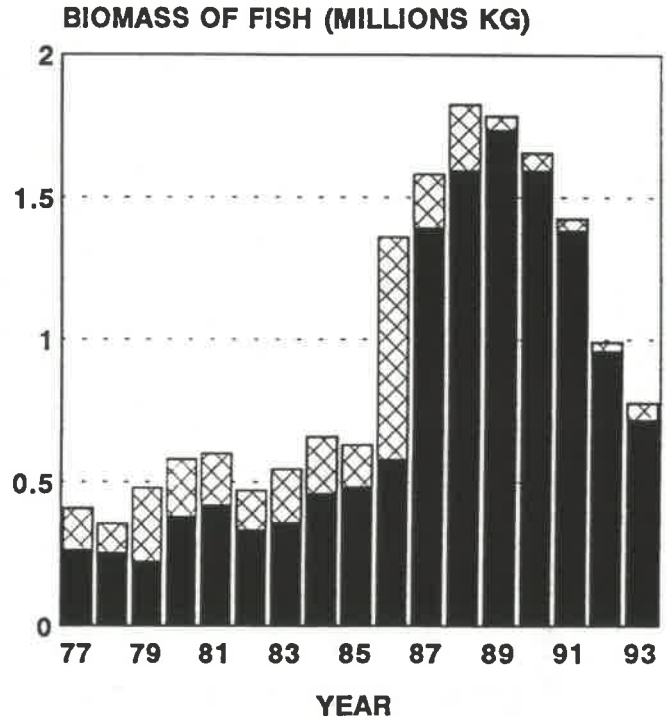
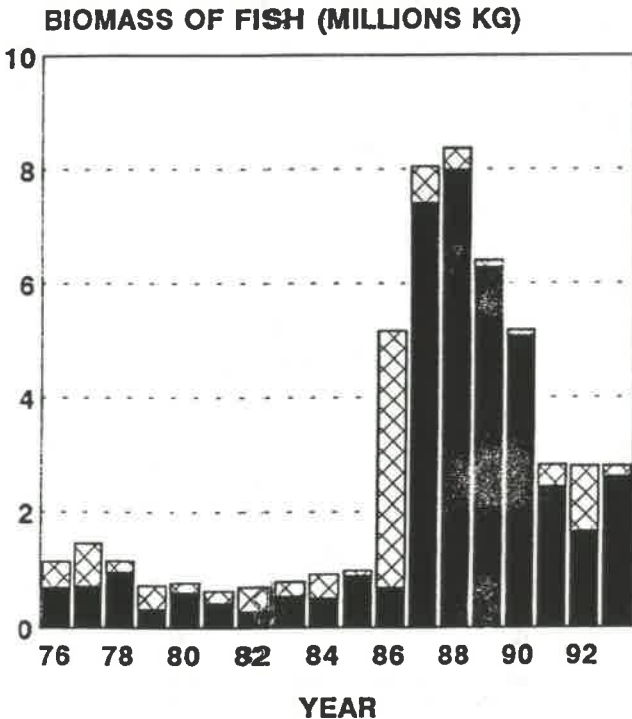
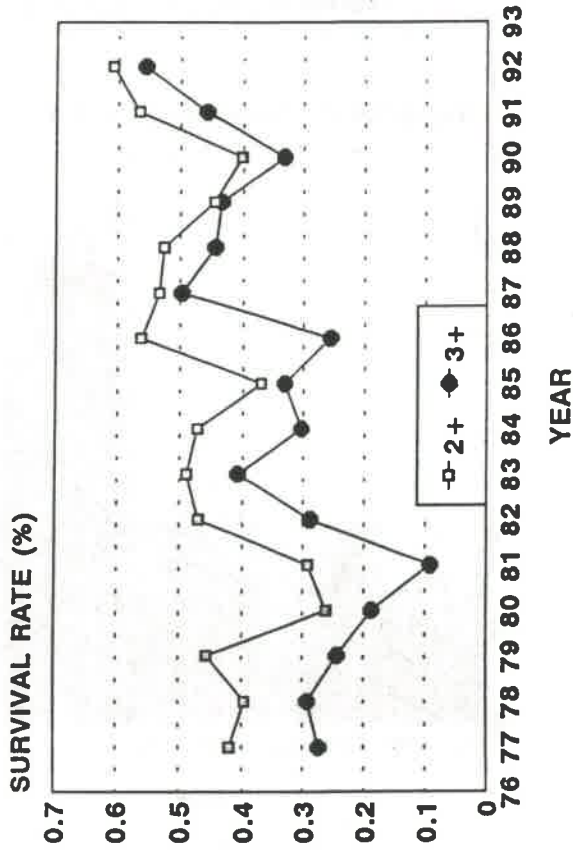
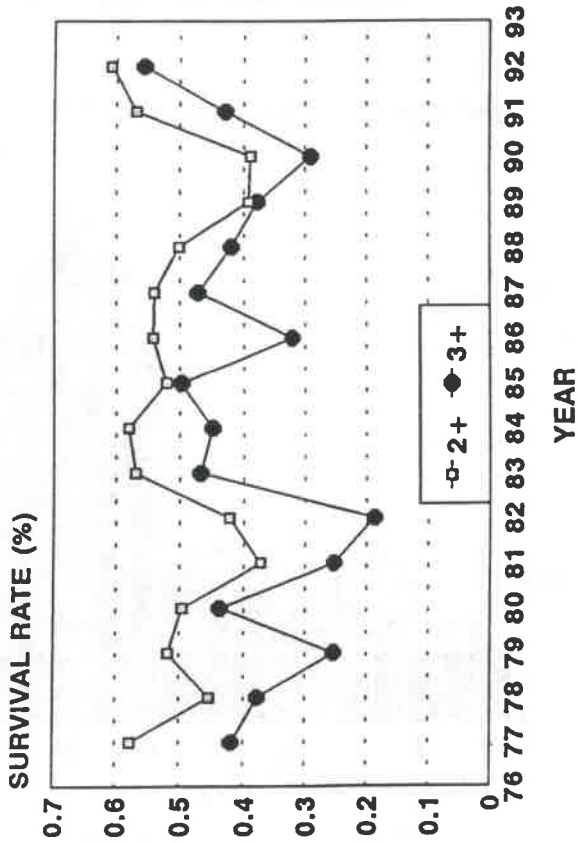


Figure 7

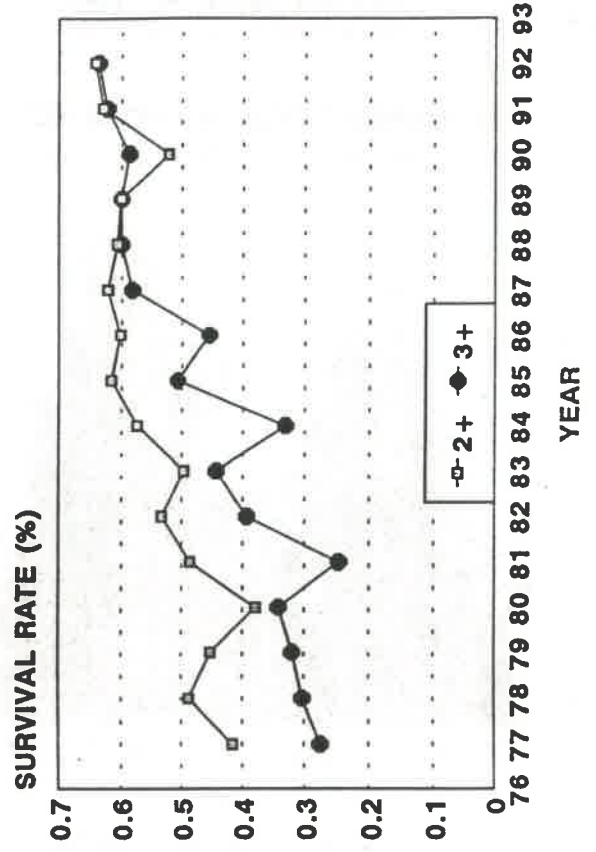
YELLOW PERCH SURVIVAL RATES MANAGEMENT UNIT 2



YELLOW PERCH SURVIVAL RATES MANAGEMENT UNIT 1



YELLOW PERCH SURVIVAL RATES MANAGEMENT UNIT 4



YELLOW PERCH SURVIVAL RATES MANAGEMENT UNIT 3

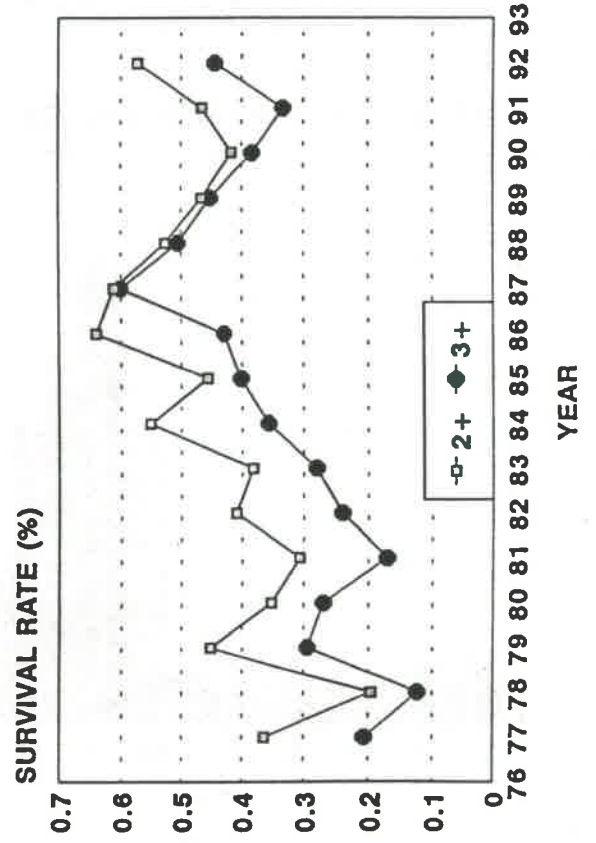
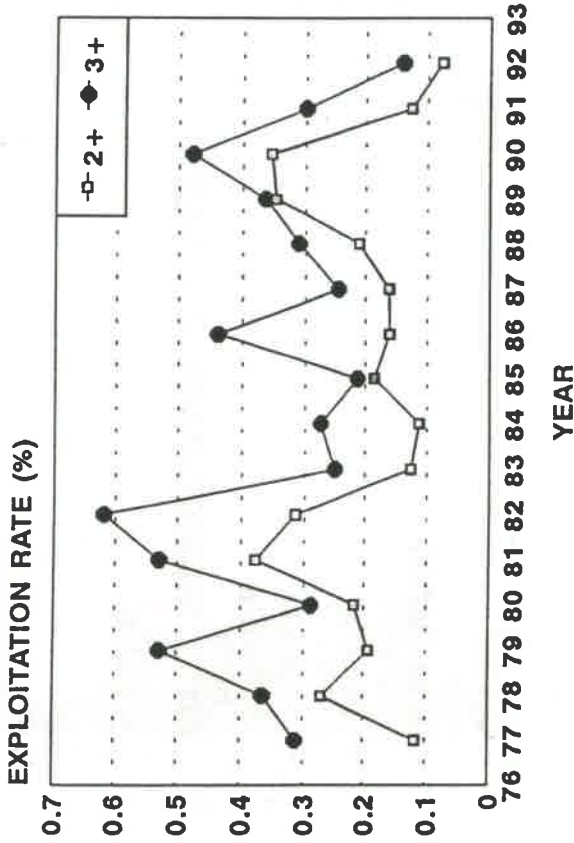
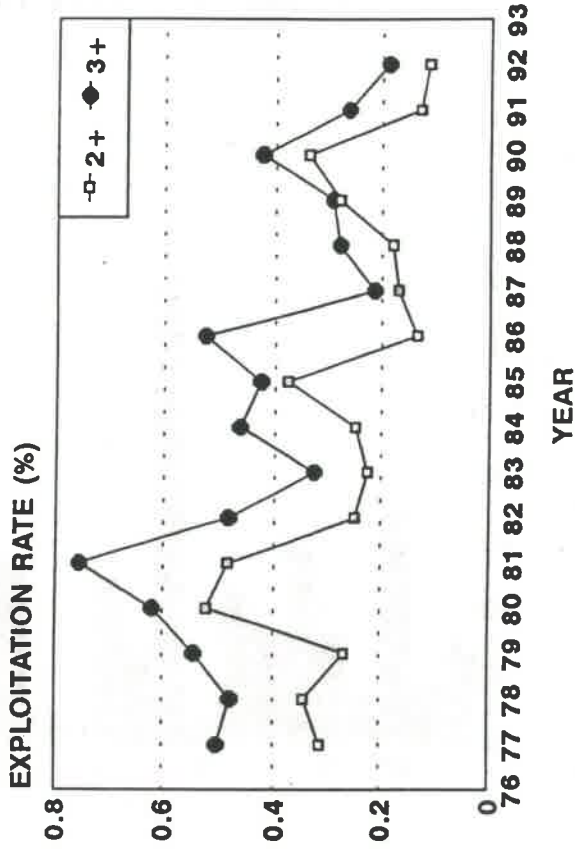


Figure 8

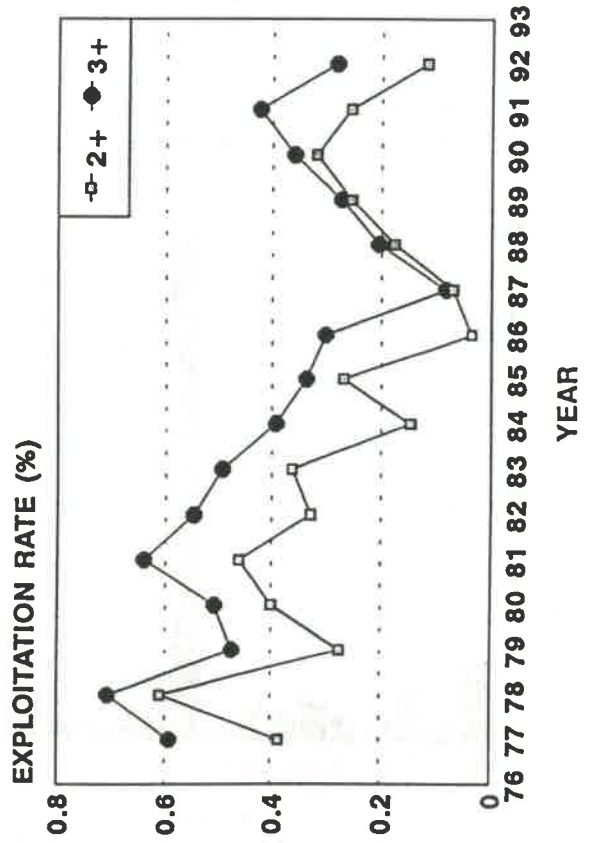
YELLOW PERCH EXPLOITATION RATES MANAGEMENT UNIT 1



YELLOW PERCH EXPLOITATION RATES MANAGEMENT UNIT 2



YELLOW PERCH EXPLOITATION RATES MANAGEMENT UNIT 3



YELLOW PERCH EXPLOITATION RATES MANAGEMENT UNIT 4

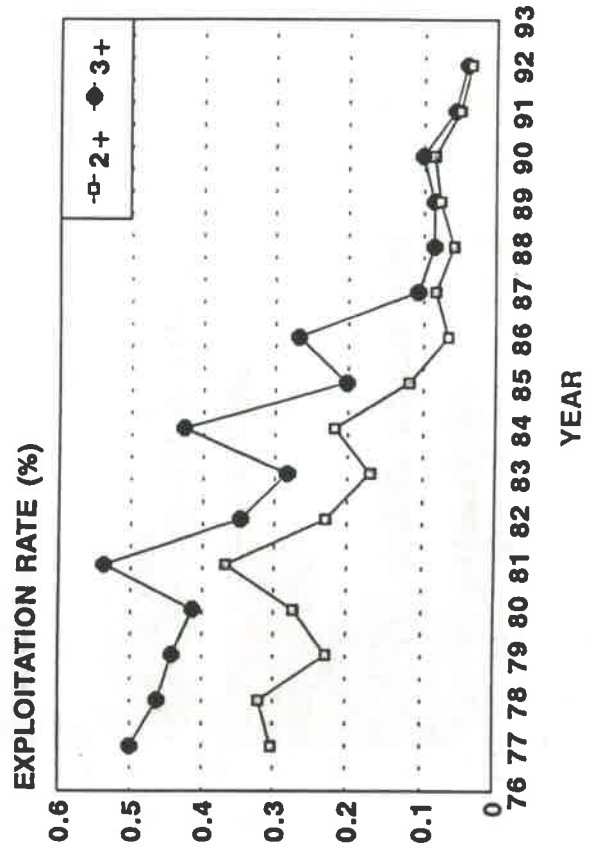
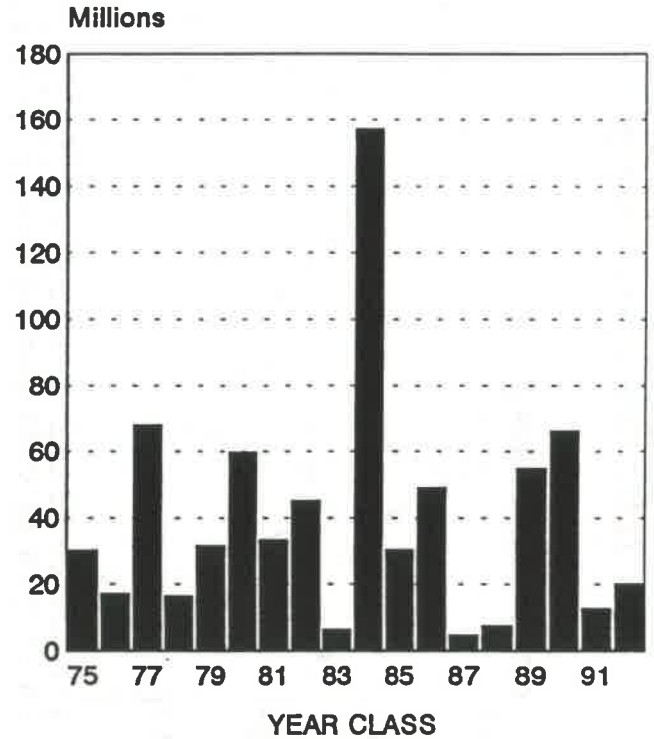
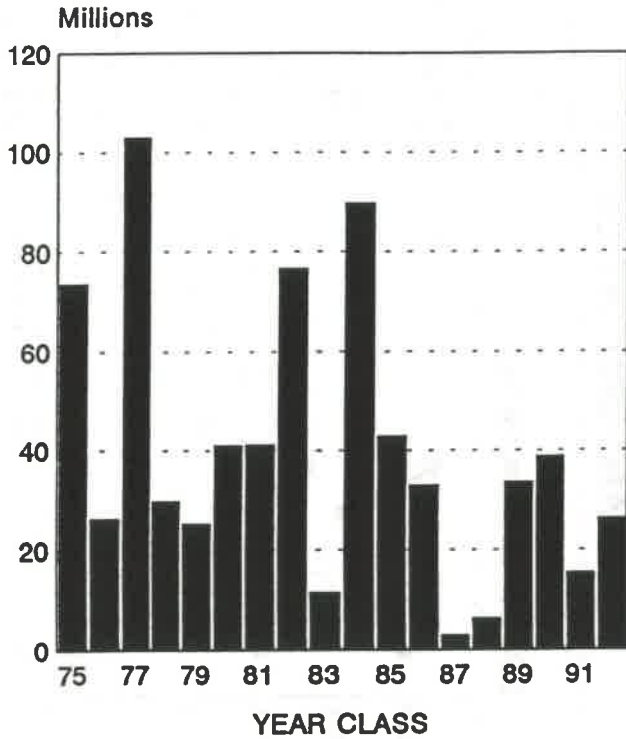


Figure 9

**CAGEAN AGE 2 POPULATION ESTIMATES
MANAGEMENT UNIT 1**

**CAGEAN AGE 2 POPULATION ESTIMATES
MANAGEMENT UNIT 2**

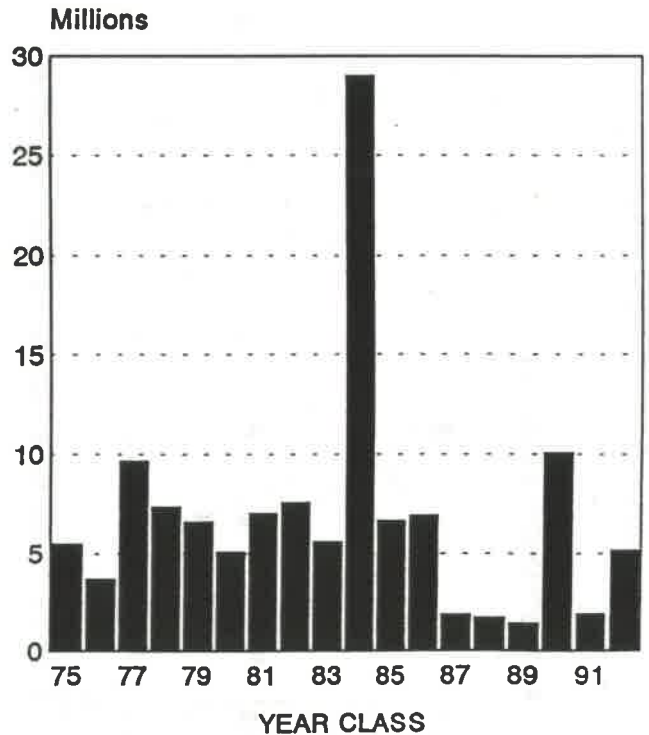
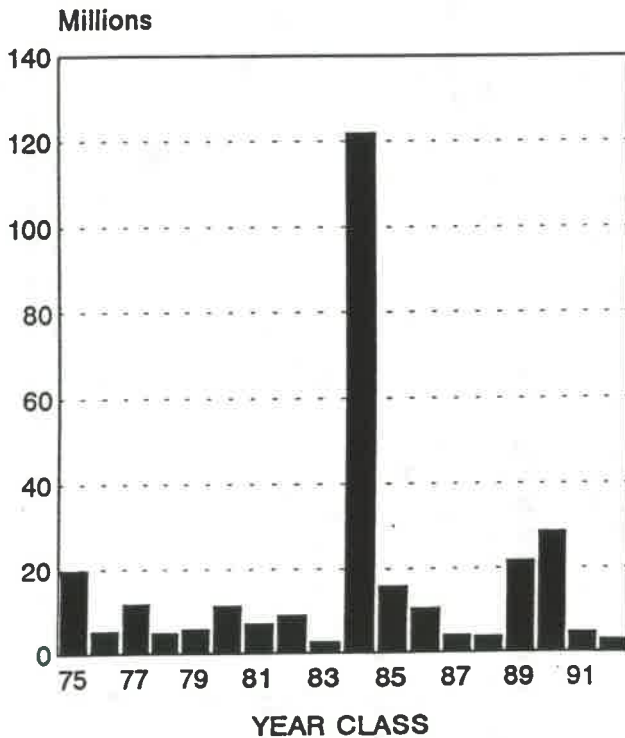


1991, 1992 FROM REGRESSIONS
1990 VALUE HAS BEEN SCALED

1991, 1992 FROM REGRESSIONS
1990 VALUE HAS BEEN SCALED

**CAGEAN AGE 2 POPULATION ESTIMATES
MANAGEMENT UNIT 3**

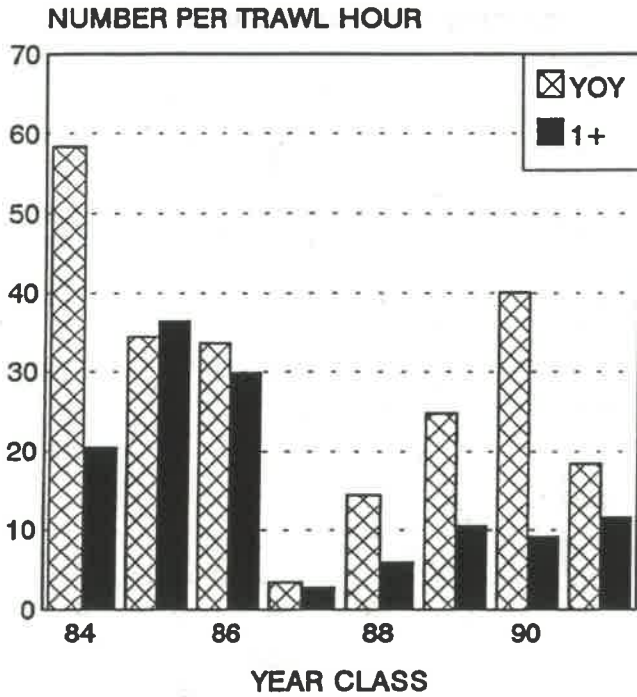
**CAGEAN AGE 2 POPULATION ESTIMATES
MANAGEMENT UNIT 4**



1991, 1992 FROM REGRESSIONS
1990 VALUE HAS BEEN SCALED

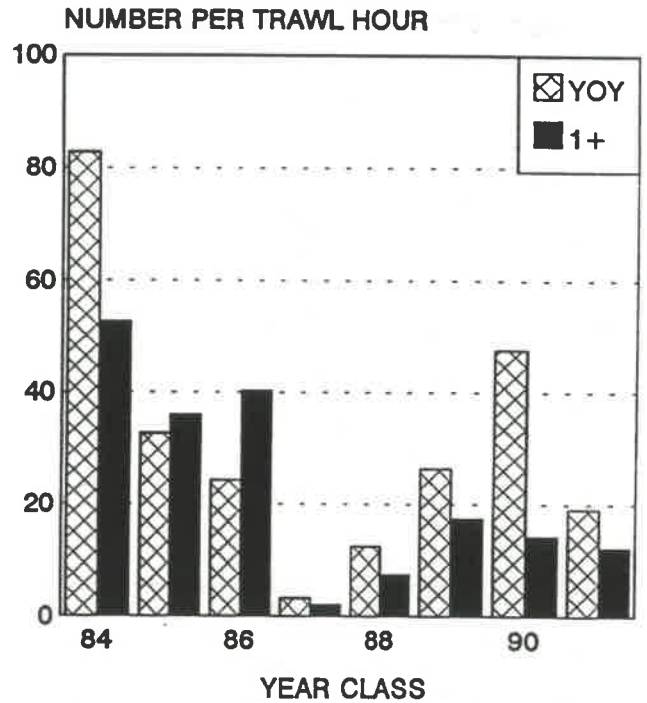
1991, 1992 FROM REGRESSIONS
1990 VALUE HAS BEEN SCALED

**YOY AND YEARLING YELLOW PERCH
INTERAGENCY INDEX TRAWL VALUES
MANAGEMENT UNIT 1**



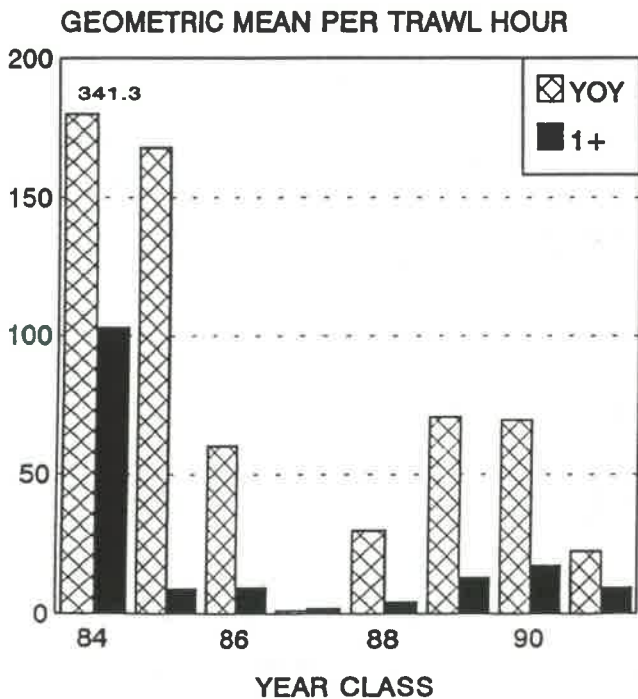
COMBINED INDEX TRAWL VALUES WEIGHTED BY R-SQUARED GEOMETRIC MEAN

**YOY AND 1+ YELLOW PERCH
INTERAGENCY INDEX TRAWL VALUES
MANAGEMENT UNIT 2**



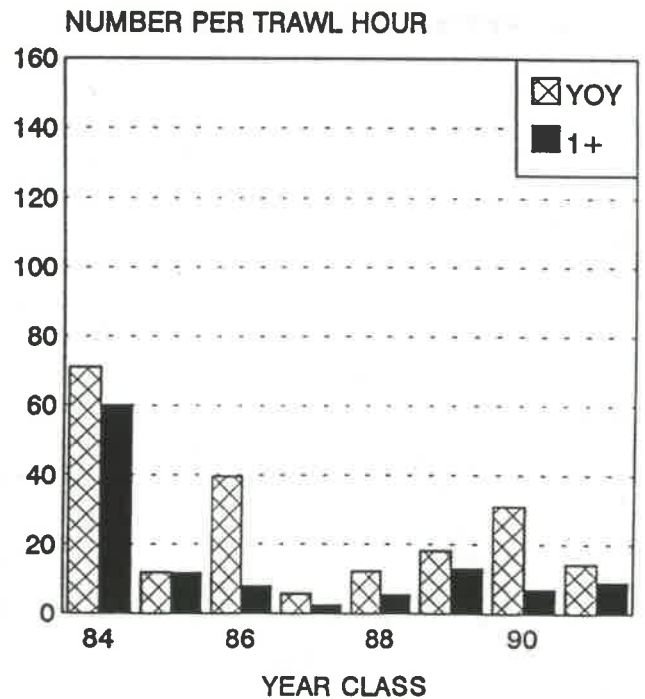
COMBINED INTERAGENCY TRAWL VALUES WEIGHTED BY R-SQUARED GEOMETRIC MEAN

**YOY AND 1+ YELLOW PERCH
INTERAGENCY INDEX TRAWL VALUES
MANAGEMENT UNIT 3**



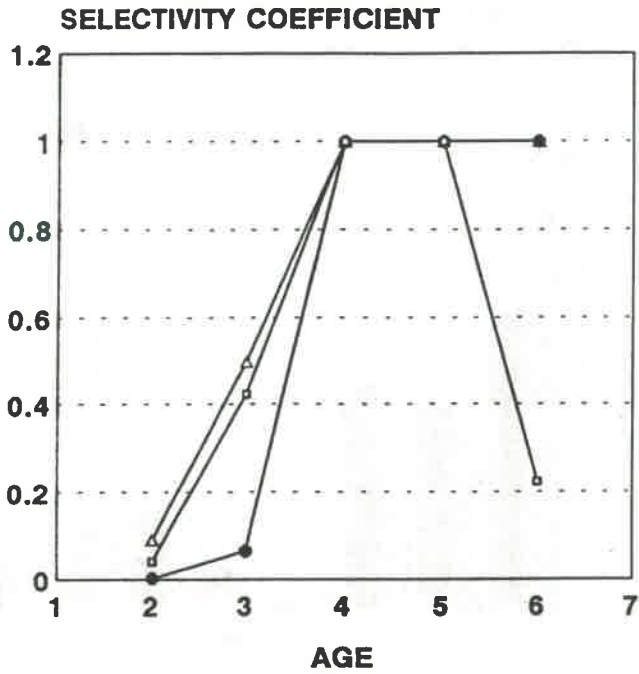
COMBINED INDEX TRAWL VALUES WEIGHTED BY R-SQUARED GEOMETRIC MEAN

**YOY AND 1+ YELLOW PERCH
INTERAGENCY INDEX TRAWL VALUES
MANAGEMENT UNIT 4**



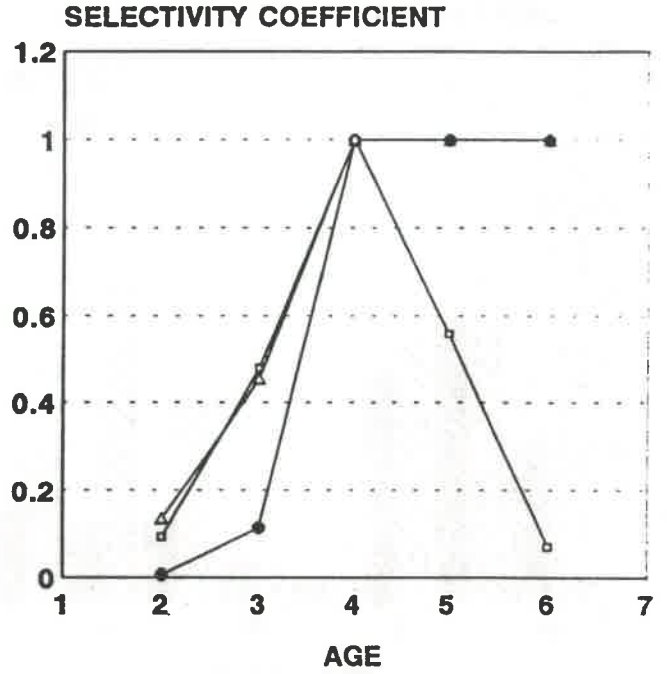
COMBINED INDEX TRAWL VALUES WEIGHTED BY R-SQUARED GEOMETRIC MEAN

**MANAGEMENT UNIT 1
SELECTIVITY COEFFICIENTS
BY GEAR**



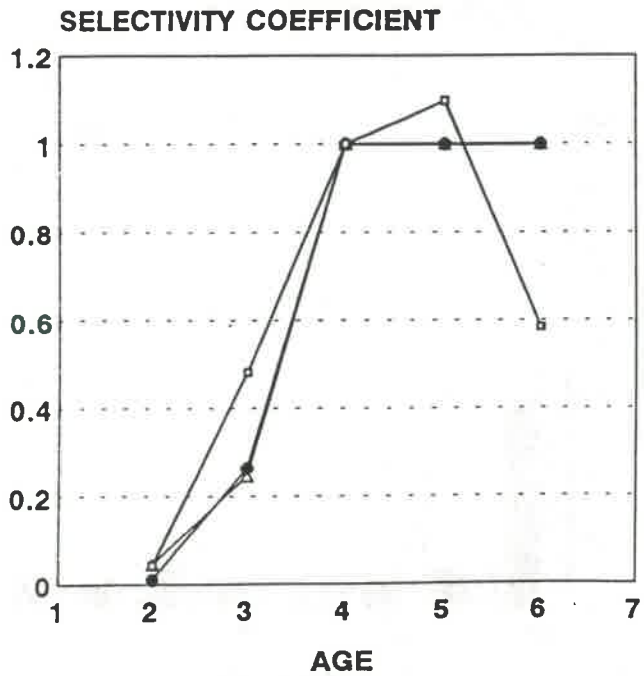
□ GILLNET ♦ TRAPNET △ ANGLING

**MANAGEMENT UNIT 2
SELECTIVITY COEFFICIENTS
BY GEAR**



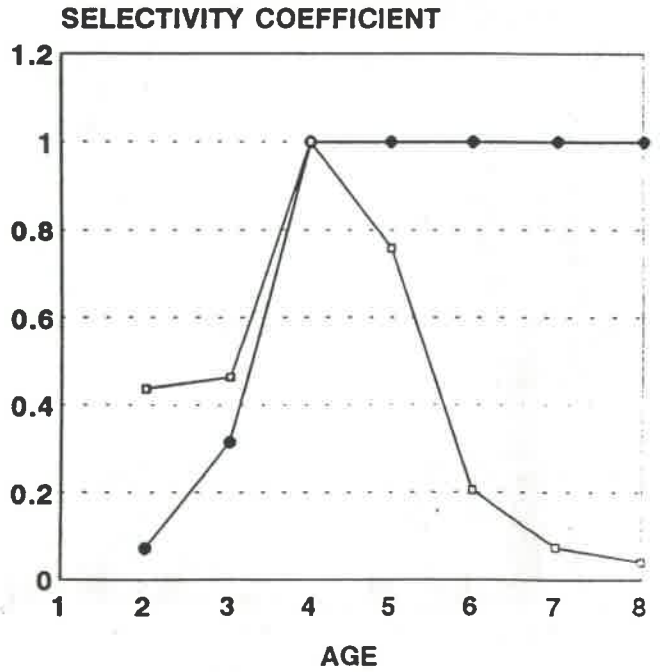
□ GILLNET ♦ TRAPNET △ ANGLING

**MANAGEMENT UNIT 3
SELECTIVITY COEFFICIENTS
BY GEAR**



□ GILLNET ♦ TRAPNET △ ANGLING

**MANAGEMENT UNIT 4
SELECTIVITY COEFFICIENTS
BY GEAR**



□ GILLNET ♦ TRAPNET

Appendix A. Projection of the 1993 Lake Erie yellow perch population size. Stock size estimates are derived from CAGEAN and index trawling regressions. Stock size in numbers is in millions of fish. Biomass is in millions of kilograms.

1992 PARAMETERS										1993 PARAMETERS														
STOCK SIZE (NUMBERS)					MORTALITY RATES					SURV RATE					STOCK SIZE (NUMBERS)					POP. WEIGHT (kg)				
AGE	MEAN	SE	MIN	MAX	(F)	(Z)	(A)	(u)	(S)	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	1992	1993				
UNIT 1																								
2	97.097	21.983	75.114	119.080	0.019	0.419	0.342	0.016	0.658	15.319	10.456	22.446	0.042	4.078	0.643									
3	21.381	4.841	16.540	26.222	0.161	0.561	0.429	0.123	0.571	63.848	49.393	78.304	0.073	1.561	4.661									
4	1.787	0.405	1.382	2.192	0.448	0.848	0.572	0.302	0.428	12.207	9.443	14.871	0.106	0.189	1.294									
5	0.189	0.043	0.146	0.232	0.448	0.848	0.572	0.302	0.428	0.766	0.592	0.939	0.140	0.026	0.107									
6	1.337	0.303	1.034	1.640	0.253	0.653	0.479	0.185	0.521	0.777	0.601	0.953	0.166	0.222	0.129									
TOTAL	121.791	27.573	94.218	149.364	0.051	0.451	0.3629	0.0409	0.6371	92.917	70.486	117.612	0.046	6.077	6.834									
(3+)	24.694	5.591	19.103	30.285	0.186	0.586	0.4432	0.1404	0.5568	77.598	60.030	95.166	0.079	1.999	6.191									
UNIT 2																								
2	113.301	39.916	73.385	153.217	0.051	0.451	0.363	0.041	0.637	12.656	8.759	18.290	0.046	5.212	0.582									
3	32.399	11.414	20.985	43.813	0.254	0.654	0.480	0.186	0.520	72.201	46.764	97.637	0.079	2.560	5.704									
4	1.555	0.548	1.007	2.103	0.590	0.980	0.625	0.370	0.375	16.855	10.917	22.793	0.146	0.227	2.461									
5	0.153	0.054	0.099	0.207	0.375	0.775	0.539	0.261	0.461	0.583	0.378	0.789	0.270	0.041	0.158									
6	2.820	0.993	1.827	3.813	0.148	0.548	0.422	0.114	0.578	1.701	1.102	2.301	0.332	0.936	0.565									
TOTAL	150.228	52.925	97.303	203.153	0.098	0.498	0.3920	0.0769	0.6080	103.996	67.920	141.809	0.046	8.976	9.469									
(3+)	36.927	13.009	23.918	49.936	0.257	0.657	0.4817	0.1885	0.5183	91.340	59.161	123.519	0.079	3.764	8.887									
UNIT 3																								
2	25.215	11.024	14.191	36.239	0.034	0.434	0.352	0.027	0.648	4.514	2.843	7.167	0.039	0.983	0.176									
3	13.874	6.066	7.808	19.940	0.375	0.775	0.539	0.261	0.461	16.340	9.196	23.484	0.084	1.165	1.373									
4	0.902	0.394	0.508	1.296	0.823	1.223	0.706	0.475	0.294	6.394	3.598	9.189	0.133	0.120	0.850									
5	0.233	0.102	0.131	0.335	0.894	1.294	0.726	0.501	0.274	0.265	0.149	0.382	0.200	0.047	0.053									
6	1.295	0.566	0.729	1.861	0.520	0.920	0.602	0.340	0.398	0.580	0.326	0.833	0.257	0.333	0.149									
TOTAL	41.519	18.152	23.367	59.671	0.166	0.566	0.4321	0.1266	0.5679	28.093	16.114	41.055	0.039	2.648	2.601									
(3+)	16.304	7.128	9.176	23.432	0.412	0.812	0.5560	0.2821	0.4440	23.579	13.271	33.888	0.084	1.665	2.425									
UNIT 4																								
2	0.064	0.032	0.032	0.096	0.004	0.404	0.332	0.003	0.668	1.887	1.273	2.795	0.031	0.002	0.058									
3	0.940	0.473	0.467	1.413	0.042	0.442	0.357	0.034	0.643	0.043	0.021	0.064	0.052	0.049	0.002									
4	0.691	0.348	0.343	1.039	0.092	0.492	0.389	0.073	0.611	0.604	0.300	0.908	0.104	0.072	0.063									
5	0.402	0.202	0.200	0.604	0.071	0.471	0.376	0.057	0.624	0.423	0.210	0.635	0.159	0.064	0.067									
6	3.418	1.720	1.698	5.138	0.015	0.415	0.339	0.012	0.661	2.509	1.246	3.771	0.227	0.776	0.570									
TOTAL	5.515	2.775	2.740	8.290	0.033	0.433	0.3511	0.0264	0.6489	5.465	3.051	8.174	0.031	0.963	0.760									
(3+)	5.451	2.743	2.708	8.194	0.033	0.433	0.3514	0.0267	0.6486	3.578	1.778	5.379	0.052	0.961	0.702									

Appendix B. Estimated harvest of Lake Erie yellow perch for 1993. The exploitation rate is derived from optimal yield policy and the stock size estimates are from CAGEAN (unadjusted). Stock size and catch in numbers are in millions of fish. Catch in weight is in millions of kilograms.

AGE	STOCK SIZE (NUMBERS)				EXPLOITATION RATE				CATCH (Millions of Fish)				CATCH (Millions of Kg)			
	MEAN	MIN	MAX	F(OPT)	s(age)	F	U	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
UNIT 1																
5	15.319	10.456	22.446	0.000	0.043	0.026	0.021	0.327	0.223	0.479	0.100	0.033	0.022	0.048		
3	63.848	49.393	78.304	0.453	0.359	0.219	0.163	10.431	8.069	12.792	0.114	1.189	0.920	1.458		
4	12.207	9.443	14.971	0.453	1.000	0.611	0.384	4.693	3.630	5.755	0.127	0.596	0.461	0.731		
5	0.766	0.592	0.939	0.453	1.000	0.611	0.384	0.294	0.228	0.361	0.157	0.046	0.036	0.057		
6	0.777	0.601	0.953	0.453	0.564	0.345	0.243	0.189	0.146	0.232	0.222	0.042	0.032	0.051		
TOTAL	92.917	70.486	117.612	1.812	2.966	0.208	0.171	15.934	12.297	19.619	0.120	1.906	1.471	2.345		
(3+)	77.598	60.030	95.166	1.812		0.299	0.201	15.607	12.074	18.140	0.120	1.873	1.449	2.297		
UNIT 2																
2	12.656	8.759	18.290	0.000	0.087	0.069	0.055	0.693	0.480	1.002	0.110	0.076	0.053	0.110		
3	72.201	46.764	97.637	0.477	0.437	0.344	0.242	17.508	11.340	23.676	0.126	2.206	1.429	2.983		
4	16.855	10.917	22.793	0.477	1.000	0.787	0.461	7.763	5.028	10.498	0.150	1.164	0.754	1.575		
5	0.583	0.378	0.789	0.477	0.647	0.509	0.334	0.195	0.126	0.264	0.197	0.038	0.025	0.052		
6	1.701	1.102	2.301	0.477	0.255	0.200	0.151	0.256	0.166	0.346	0.260	0.067	0.043	0.090		
TOTAL	103.996	67.920	141.809	1.908	2.425	0.308	0.254	26.416	17.140	35.786	0.134	3.552	2.304	4.810		
(3+)	91.340	59.161	123.519	1.908		0.423	0.282	25.722	16.660	34.784	0.135	3.476	2.251	4.700		
UNIT 3																
2	4.514	2.843	7.167	0.000	0.041	0.027	0.022	0.098	0.062	0.156	0.110	0.011	0.007	0.017		
3	16.340	9.196	23.484	0.523	0.455	0.296	0.213	3.488	1.963	5.012	0.127	0.443	0.249	0.637		
4	6.394	3.598	9.189	0.523	1.000	0.651	0.403	2.575	1.449	3.701	0.151	0.389	0.219	0.559		
5	0.285	0.149	0.382	0.523	1.086	0.707	0.427	0.113	0.064	0.163	0.195	0.022	0.012	0.032		
6	0.580	0.326	0.833	0.523	0.632	0.411	0.282	0.163	0.092	0.235	0.250	0.041	0.023	0.059		
TOTAL	28.093	16.114	41.055	2.092	3.214	0.278	0.229	6.438	3.630	9.268	0.141	0.906	0.510	1.303		
(3+)	23.579	13.271	33.888	2.092		0.412	0.269	6.340	3.568	9.112	0.141	0.895	0.504	1.286		
UNIT 4																
2	1.887	1.273	2.795	0.000	0.046	0.030	0.024	0.046	0.031	0.068	0.111	0.005	0.003	0.008		
3	0.043	0.021	0.064	0.398	0.454	0.297	0.214	0.009	0.005	0.014	0.120	0.001	0.001	0.002		
4	0.604	0.300	0.908	0.398	1.000	0.655	0.405	0.245	0.122	0.368	0.130	0.032	0.016	0.048		
5	0.423	0.210	0.635	0.398	0.771	0.505	0.332	0.140	0.070	0.211	0.161	0.023	0.011	0.034		
6	2.509	1.246	3.771	0.398	0.160	0.104	0.082	0.206	0.102	0.309	0.271	0.056	0.028	0.084		
TOTAL	5.465	3.051	8.174	1.592	2.430	0.143	0.118	0.646	0.329	0.970	0.180	0.116	0.059	0.175		
(3+)	3.578	1.778	5.379	1.592		0.243	0.168	0.600	0.298	0.902	0.185	0.111	0.055	0.167		

Appendix C. Estimated harvest of Lake Erie yellow perch for 1993. The exploitation rate used is equal to the effort in 1992 and the stock size estimates are derived from adjusted CAGEAN outputs. Stock size and catch in numbers are in millions of fish. Catch in weight is in millions of kilograms.

AGE	STOCK SIZE (NUMBERS)			EXPLOITATION RATE			CATCH (Millions of fish)			HARVEST WEIGHT (kg)			CATCH (Millions of kilograms)			
	MEAN	MIN	MAX	F(max)	s(age)	F	u	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
UNIT 1																
2	15.319	10.456	22.446	0.448	0.105	0.047	0.038	0.581	0.396	0.851	0.100	0.058	0.040	0.085		
3	24.802	19.187	30.417	0.448	0.359	0.161	0.123	3.047	2.957	3.737	0.114	0.347	0.269	0.426		
4	12.207	9.443	14.971	0.448	1.000	0.448	0.302	3.684	2.850	4.518	0.127	0.468	0.362	0.574		
5	0.766	0.592	0.939	0.448	1.000	0.448	0.302	0.231	0.179	0.283	0.157	0.036	0.028	0.044		
6	0.777	0.601	0.953	0.448	0.564	0.253	0.185	0.144	0.112	0.177	0.222	0.032	0.025	0.039		
TOTAL (3+)	53.871	40.280	69.726			0.212	0.143	7.687	5.894	9.566	0.122	0.942	0.723	1.169		
	38.552	29.824	47.280			0.273	0.184	7.106	5.497	8.715	0.124	0.884	0.683	1.084		
UNIT 2																
2	12.657	8.759	18.290	0.580	0.159	0.092	0.073	0.920	0.636	1.329	0.109	0.100	0.069	0.145		
3	40.378	26.153	54.603	0.580	0.437	0.254	0.186	7.515	4.867	10.162	0.126	0.947	0.613	1.280		
4	16.855	10.917	22.793	0.580	1.000	0.580	0.370	6.233	4.037	8.429	0.150	0.935	0.606	1.264		
5	0.583	0.378	0.789	0.580	0.615	0.375	0.261	0.152	0.089	0.206	0.197	0.030	0.019	0.041		
6	1.703	1.103	2.302	0.580	0.255	0.148	0.114	0.194	0.125	0.262	0.260	0.050	0.033	0.068		
TOTAL (3+)	72.176	47.309	98.777			0.326	0.208	15.014	9.765	20.388	0.137	2.062	1.340	2.798		
	59.519	38.550	80.487			0.371	0.237	14.094	9.129	19.059	0.139	1.962	1.271	2.653		
UNIT 3																
2	4.514	2.843	7.167	0.894	0.045	0.037	0.030	0.135	0.085	0.215	0.110	0.015	0.009	0.024		
3	18.534	10.431	26.636	0.894	0.455	0.375	0.261	4.833	2.720	6.946	0.127	0.614	0.345	0.882		
4	6.394	3.598	9.189	0.894	1.000	0.823	0.475	3.036	1.709	4.364	0.151	0.458	0.258	0.659		
5	0.265	0.149	0.382	0.894	1.086	0.894	0.501	0.133	0.075	0.191	0.195	0.026	0.015	0.037		
6	0.580	0.326	0.833	0.894	0.632	0.520	0.340	0.197	0.111	0.283	0.250	0.049	0.028	0.071		
TOTAL (3+)	30.287	17.348	44.207			0.491	0.275	8.335	4.700	12.000	0.139	1.162	0.655	1.673		
	25.773	14.505	37.040			0.567	0.318	8.200	4.615	11.785	0.140	1.148	0.646	1.649		
UNIT 4																
2	1.887	1.273	2.795	0.092	0.004	0.000	0.000	0.001	0.000	0.001	0.111	0.000	0.000	0.000		
3	0.675	0.335	1.014	0.092	0.454	0.042	0.034	0.023	0.011	0.034	0.120	0.003	0.001	0.004		
4	0.604	0.300	0.908	0.092	1.000	0.092	0.073	0.044	0.022	0.066	0.130	0.006	0.003	0.009		
5	0.423	0.210	0.635	0.092	0.771	0.071	0.057	0.024	0.012	0.036	0.161	0.004	0.002	0.006		
6	2.444	1.214	3.673	0.092	0.479	0.044	0.036	0.087	0.043	0.131	0.271	0.024	0.012	0.035		
TOTAL (3+)	6.032	3.332	9.026			0.037	0.029	0.178	0.089	0.267	0.202	0.036	0.018	0.054		
	4.145	2.059	6.231			0.054	0.043	0.177	0.088	0.267	0.202	0.036	0.018	0.054		

Appendix D. Estimated harvest of Lake Erie yellow perch for 1992 using current information. The exploitation rate is derived from optimal yield policy and the stock size estimates are from adjusted CAGEAN outputs. Stock size catch in numbers is in millions of fish. Catch in weight is in millions of kilograms.

AGE	STOCK SIZE (NUMBERS)			EXPLOITATION RATE			CATCH (Millions of Fish)			HARVEST WEIGHT (kg)			CATCH (Millions of kg)		
	MEAN	MIN	MAX	F(OPT)	s(age)	F	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
UNIT 1															
2	38.781	30.001	47.561	0.000	0.105	0.063	0.050	1.951	1.509	2.392	0.100	0.195	0.151	0.239	
3	21.381	16.540	26.222	0.453	0.359	0.215	0.160	3.431	2.654	4.208	0.114	0.391	0.303	0.480	
4	1.787	1.382	2.192	0.453	1.000	0.598	0.379	0.676	0.523	0.830	0.127	0.086	0.066	0.105	
5	0.189	0.146	0.232	0.453	1.000	0.598	0.379	0.072	0.055	0.088	0.157	0.011	0.009	0.014	
6	1.337	1.034	1.640	0.453	0.564	0.338	0.239	0.319	0.247	0.392	0.222	0.071	0.055	0.087	
TOTAL (3+)	63.475	49.103	77.847	1.812	3.028	0.123	0.102	6.449	4.989	7.909	0.117	0.754	0.583	0.925	
	24.694	19.102	30.286	1.812		0.271	0.182	4.498	3.479	5.517	0.124	0.559	0.433	0.686	
UNIT 2															
2	66.041	42.773	89.309	0.000	0.159	0.121	0.095	6.250	4.048	8.452	0.109	0.681	0.441	0.921	
3	32.400	20.985	43.815	0.477	0.437	0.334	0.236	7.663	4.963	10.362	0.126	0.965	0.625	1.306	
4	1.555	1.007	2.103	0.477	1.000	0.764	0.451	0.702	0.455	0.949	0.150	0.105	0.068	0.142	
5	0.153	0.099	0.207	0.477	0.647	0.494	0.327	0.050	0.032	0.068	0.197	0.010	0.006	0.013	
6	2.820	1.827	3.813	0.477	0.255	0.195	0.147	0.414	0.268	0.560	0.260	0.108	0.070	0.146	
TOTAL (3+)	102.969	66.691	139.247	1.908	2.498	0.178	0.146	15.078	9.766	20.391	0.124	1.869	1.211	2.528	
	36.928	23.918	49.938	1.908		0.359	0.239	8.828	5.718	11.939	0.135	1.188	0.770	1.607	
UNIT 3															
2	28.691	16.147	41.235	0.000	0.045	0.029	0.024	0.682	0.384	0.981	0.110	0.075	0.042	0.108	
3	13.874	7.808	19.940	0.523	0.455	0.296	0.213	2.957	1.664	4.250	0.127	0.376	0.211	0.540	
4	0.902	0.508	1.296	0.523	1.000	0.650	0.402	0.363	0.204	0.522	0.151	0.055	0.031	0.079	
5	0.233	0.131	0.335	0.523	1.086	0.706	0.427	0.100	0.056	0.143	0.195	0.019	0.011	0.028	
6	1.295	0.729	1.861	0.523	0.632	0.411	0.281	0.365	0.205	0.524	0.250	0.091	0.051	0.131	
TOTAL (3+)	44.995	25.323	64.667	2.092	3.218	0.120	0.099	4.466	2.514	6.419	0.138	0.616	0.347	0.885	
	16.304	9.176	23.432	2.092		0.355	0.232	3.784	2.130	5.438	0.143	0.541	0.304	0.777	
UNIT 4															
2	1.007	0.500	1.514	0.000	0.004	0.002	0.002	0.002	0.001	0.003	0.111	0.000	0.000	0.000	
3	0.940	0.467	1.413	0.398	0.454	0.267	0.195	0.183	0.091	0.275	0.120	0.022	0.011	0.033	
4	0.691	0.343	1.039	0.398	1.000	0.588	0.374	0.258	0.128	0.388	0.130	0.034	0.017	0.050	
5	0.402	0.200	0.604	0.398	0.771	0.453	0.305	0.123	0.061	0.184	0.161	0.020	0.010	0.030	
6	3.418	1.698	5.138	0.398	0.479	0.282	0.204	0.698	0.347	1.049	0.271	0.189	0.094	0.284	
TOTAL (3+)	6.458	3.208	9.708	1.592	2.708	0.237	0.196	1.264	0.628	1.899	0.209	0.265	0.131	0.398	
	5.451	2.708	8.194	1.592		0.336	0.231	1.262	0.627	1.897	0.210	0.264	0.131	0.397	

Appendix E

Table 1a. A comparison between projected stock size adjusted by two methods: adjusting age-two stock numbers (present method), and adjusting age two stock numbers and fishing mortality rates. (from Table 9, YPTG 1983 report)

1982 Parameters	Instantaneous Fishing Mortality Rate			Instantaneous Total Mortality Rate			Actual Total Mortality Rate			Rate of Exploitation			Survival Rate		
	AGE	(F)	(F adj)	(Z)	(Z adj)	% Difference	(A)	(A adj)	% Difference	(u)	(u adj)	% Difference	(S)	(S adj)	% Difference
UNIT 1	2	0.019	0.047	0.419	0.447	6.83	0.342	0.360	5.28	0.016	0.038	141.86	0.858	0.640	2.74
	3	0.161	0.161	0.561	0.561	0.00	0.429	0.429	0.00	0.123	0.123	0.00	0.571	0.571	0.00
	4	0.448	0.448	0.848	0.848	0.00	0.572	0.572	0.00	0.302	0.302	0.00	0.428	0.428	0.00
	5	0.448	0.448	0.848	0.848	0.00	0.572	0.572	0.00	0.302	0.302	0.00	0.428	0.428	0.00
	6	0.253	0.253	0.853	0.853	0.00	0.479	0.479	0.00	0.185	0.185	0.00	0.521	0.521	0.00
	TOTAL	0.081	0.098	0.481	0.499	3.74	0.382	0.393	2.89	0.064	0.078	21.28	0.616	0.607	1.78
	(3+)	0.198	0.198	0.598	0.598	0.00	0.443	0.443	0.00	0.140	0.140	0.00	0.557	0.557	0.00
UNIT 2	2	0.051	0.092	0.451	0.482	8.19	0.363	0.388	7.12	0.041	0.073	78.38	0.637	0.611	4.08
	3	0.254	0.254	0.654	0.654	0.00	0.480	0.480	0.00	0.186	0.186	0.00	0.520	0.520	0.00
	4	0.590	0.590	0.980	0.980	0.00	0.625	0.625	0.00	0.370	0.370	0.00	0.375	0.375	0.00
	5	0.375	0.375	0.775	0.775	0.00	0.538	0.538	0.00	0.261	0.261	0.00	0.461	0.461	0.00
	6	0.148	0.148	0.548	0.548	0.00	0.422	0.422	0.00	0.114	0.114	0.00	0.578	0.578	0.00
	TOTAL	0.120	0.148	0.620	0.648	5.44	0.405	0.422	4.09	0.083	0.114	22.00	0.595	0.578	2.79
	(3+)	0.257	0.257	0.657	0.657	0.00	0.482	0.482	0.00	0.189	0.189	0.00	0.518	0.518	0.00
UNIT 3	2	0.034	0.037	0.434	0.437	0.74	0.352	0.354	0.59	0.027	0.030	9.31	0.648	0.648	0.32
	3	0.375	0.375	0.775	0.775	0.00	0.539	0.539	0.00	0.261	0.261	0.00	0.461	0.461	0.00
	4	0.823	0.823	1.223	1.223	0.00	0.706	0.706	0.00	0.475	0.475	0.00	0.294	0.294	0.00
	5	0.894	0.894	1.294	1.294	0.00	0.728	0.728	0.00	0.501	0.501	0.00	0.274	0.274	0.00
	6	0.520	0.520	0.920	0.920	0.00	0.602	0.602	0.00	0.340	0.340	0.00	0.396	0.396	0.00
	TOTAL	0.155	0.157	0.555	0.557	0.41	0.428	0.427	0.31	0.119	0.121	1.36	0.574	0.573	0.23
	(3+)	0.412	0.412	0.812	0.812	0.00	0.558	0.558	0.00	0.282	0.282	0.00	0.444	0.444	0.00
UNIT 4	2	0.004	0.004	0.404	0.404	0.94	0.3325	0.3289	0.78	0.0035	0.0003	90.48	0.6675	0.6701	0.38
	3	0.042	0.0417	0.417	0.417	0.00	0.3571	0.3571	0.00	0.0337	0.0337	0.00	0.6429	0.6429	0.00
	4	0.082	0.0819	0.4819	0.4819	0.00	0.3885	0.3885	0.00	0.0728	0.0728	0.00	0.6115	0.6115	0.00
	5	0.071	0.0709	0.4709	0.4709	0.00	0.3756	0.3756	0.00	0.0685	0.0685	0.00	0.6244	0.6244	0.00
	6	0.044	0.0440	0.4440	0.4440	0.00	0.3585	0.3585	0.00	0.0355	0.0355	0.00	0.6415	0.6415	0.00
	TOTAL	0.044	0.0434	0.444	0.4434	0.14	0.3585	0.3581	0.11	0.0355	0.0350	1.36	0.6415	0.6419	0.06
	(3+)	0.052	0.0515	0.4515	0.4515	0.00	0.3833	0.3833	0.00	0.0415	0.0415	0.00	0.6367	0.6367	0.00

Appendix E cont'd.

Table 1b. A comparison between projected stock size adjusted by two methods: adjusting age-two stock numbers (present method), and adjusting age two stock numbers and fishing mortality rates. (from Table 9, YPTG 1993 report)

1993 Parameters	Mean Stock Size (millions of fish)			Selectivity			Instantaneous Fishing Mortality Rate			Rate of Exploitation			Catch in Numbers (millions of fish)			Catch in kilograms (millions)			Projected Biomass (millions of kg)			
	AGE	Mean	Adjusted	% Differ	s(age)	s(age) adj	% Differ	F	F(adj)	% Differ	u	u(adj)	% Differ	Mean	Mean (adj)	% Differ	Mean	Mean (adj)	% Differ	Biomass	Biomass Adjusted	% Differ
UNIT 1	2	15.319	15.319	0.00	0.043	0.105	144.79	0.028	0.063	139.77	0.021	0.050	135.74	0.327	0.771	135.74	0.033	0.077	135.74	0.643	0.643	0.00
	3	25.501	24.802	2.74	0.359	0.359	0.00	0.219	0.215	2.05	0.163	0.160	1.85	4.166	3.977	4.54	0.475	0.453	4.54	1.862	1.811	2.74
	4	12.207	12.207	0.00	1.000	1.000	0.00	0.811	0.596	2.05	0.384	0.379	1.54	4.893	4.821	1.54	0.596	0.587	1.54	1.294	1.294	0.00
	5	0.768	0.768	0.00	1.000	1.000	0.00	0.611	0.598	0.00	0.384	0.379	1.54	0.284	0.280	1.54	0.048	0.048	1.54	0.107	0.107	0.00
	6	0.777	0.777	0.00	0.584	0.584	0.00	0.345	0.336	2.05	0.243	0.238	1.75	0.189	0.186	1.75	0.042	0.041	1.75	0.129	0.129	0.00
TOTAL		54.570	53.871	1.28	2.868	3.028	2.08	0.215	0.222	3.13	0.177	0.183	3.13	9.869	9.844	1.80	1.192	1.204	1.02	4.035	3.984	1.28
(3+)		39.251	38.552	1.78				0.354	0.350	1.12	0.238	0.235	1.12	9.342	9.073	2.88	1.159	1.127	2.78	3.392	3.341	1.50
UNIT 2	2	12.857	12.857	0.00	0.087	0.159	81.82	0.069	0.121	78.82	0.055	0.094	72.41	0.693	1.195	72.41	0.076	0.131	72.41	0.582	0.582	0.00
	3	42.084	40.378	4.08	0.437	0.437	0.00	0.344	0.334	2.86	0.242	0.237	2.44	10.205	9.552	6.39	1.286	1.204	6.39	3.325	3.190	4.08
	4	18.955	18.955	0.00	1.000	1.000	0.00	0.787	0.784	2.86	0.481	0.452	1.97	7.764	7.811	1.97	1.165	1.142	1.97	2.481	2.481	0.00
	5	0.583	0.583	0.00	0.847	0.847	0.00	0.509	0.484	2.86	0.334	0.327	2.25	0.185	0.191	2.25	0.038	0.038	2.25	0.158	0.158	0.00
	6	1.701	1.701	0.00	0.255	0.255	0.00	0.200	0.195	2.86	0.151	0.147	2.81	0.258	0.250	2.81	0.087	0.085	2.81	0.565	0.565	0.00
TOTAL		73.881	72.175	2.31	2.425	2.487	2.84	0.314	0.318	0.88	0.259	0.280	0.88	18.113	18.786	1.85	2.632	2.679	2.00	7.090	6.955	1.90
(3+)		61.224	59.518	2.78				0.452	0.444	1.89	0.301	0.286	1.89	18.420	17.903	4.43	2.855	2.448	4.22	6.508	6.373	2.07
UNIT 3	2	4.514	4.514	0.00	0.041	0.045	9.47	0.027	0.028	9.34	0.022	0.024	9.21	0.098	0.107	9.21	0.011	0.012	9.21	0.178	0.178	0.00
	3	18.593	18.534	0.32	0.455	0.455	0.00	0.298	0.296	0.12	0.213	0.213	0.10	3.988	3.952	0.42	0.904	0.902	0.42	1.562	1.557	0.32
	4	6.384	6.384	0.00	1.000	1.000	0.00	0.651	0.650	0.12	0.403	0.402	0.06	2.975	2.973	0.09	0.369	0.369	0.09	0.850	0.850	0.00
	5	0.265	0.265	0.00	1.068	1.068	0.00	0.707	0.706	0.12	0.427	0.427	0.06	0.113	0.113	0.06	0.022	0.022	0.06	0.053	0.053	0.00
	6	0.580	0.580	0.00	0.632	0.632	0.00	0.411	0.411	0.12	0.282	0.281	0.10	0.183	0.183	0.10	0.041	0.041	0.10	0.149	0.149	0.00
TOTAL		30.346	30.287	0.20	3.214	3.218	0.12	0.277	0.277	0.05	0.228	0.228	0.05	6.919	6.909	0.15	0.897	0.895	0.16	2.790	2.785	0.18
(3+)		25.832	25.773	0.23				0.404	0.404	0.05	0.264	0.264	0.05	6.821	6.801	0.28	0.956	0.953	0.27	2.814	2.809	0.19
UNIT 4	2	1.887	1.887	0.00	0.046	0.004	90.48	0.028	0.003	90.33	0.022	0.002	90.22	0.041	0.004	90.22	0.005	0.000	90.22	0.058	0.058	0.00
	3	8.872	8.875	0.38	0.454	0.454	0.00	0.263	0.267	1.53	0.192	0.195	1.35	0.129	0.131	1.73	0.018	0.018	1.73	0.035	0.035	0.38
	4	0.604	0.604	0.00	1.000	1.000	0.00	0.578	0.588	1.53	0.389	0.373	1.15	0.223	0.226	1.15	0.029	0.029	1.15	0.063	0.063	0.00
	5	0.423	0.423	0.00	0.771	0.771	0.00	0.447	0.453	1.53	0.301	0.305	1.23	0.127	0.129	1.23	0.020	0.021	1.23	0.067	0.067	0.00
	6	2.444	2.444	0.00	0.479	0.479	0.00	0.277	0.281	1.53	0.201	0.204	1.34	0.482	0.489	1.34	0.133	0.135	1.34	0.555	0.555	0.00
TOTAL		6.030	6.032	0.04	2.750	2.708	1.50	0.204	0.198	2.39	0.168	0.164	2.39	1.012	0.989	2.34	0.203	0.201	0.71	0.778	0.778	0.02
(3+)		4.143	4.145	0.08				0.340	0.345	1.27	0.235	0.238	1.27	0.972	0.985	1.33	0.198	0.201	1.33	0.720	0.720	0.02

Appendix F. Estimated harvest of Lake Erie yellow perch for 1992 using adjusted age 2 F values.

1992 PARAMETERS															
STOCK SIZE (NUMBERS)				EXPLOITATION RATE				CATCH (Millions of Fish)				HARVEST WEIGHT (kg)			
AGE	MEAN	MIN	MAX	F(OPT)	s(age)	F	U	MEAN	MIN	MAX	MEAN	MIN	MAX		
UNIT 1															
2	24.122	18.411	31.603	0.000	0.091	0.054	0.043	1.042	0.795	1.365	0.091	0.095	0.072	0.124	
3	16.346	12.325	20.367	0.453	0.412	0.243	0.179	2.930	2.209	3.651	0.108	0.316	0.239	0.394	
4	2.533	1.910	3.157	0.453	1.000	0.590	0.374	0.948	0.715	1.182	0.126	0.119	0.090	0.149	
5	0.246	0.185	0.308	0.453	0.989	0.583	0.371	0.091	0.069	0.114	0.146	0.013	0.010	0.017	
6	1.985	1.496	2.473	0.453	0.581	0.343	0.242	0.480	0.362	0.598	0.185	0.089	0.067	0.111	
TOTAL (3+)	45.231	34.328	57.905	1.812	3.073	0.147	0.121	5.492	4.150	6.909	0.115	0.633	0.478	0.795	
	21.109	15.917	26.302	1.812		0.313	0.211	4.450	3.355	5.544	0.121	0.538	0.406	0.670	
UNIT 2															
2	20.668	15.599	27.382	0.000	0.112	0.095	0.075	1.546	1.167	2.048	0.109	0.169	0.127	0.223	
3	35.092	24.670	45.515	0.477	0.444	0.374	0.261	9.144	6.428	11.860	0.121	1.106	0.778	1.435	
4	2.865	2.014	3.716	0.477	1.000	0.844	0.483	1.383	0.972	1.794	0.139	0.192	0.135	0.249	
5	0.242	0.170	0.314	0.477	0.521	0.439	0.297	0.072	0.051	0.093	0.173	0.012	0.009	0.016	
6	4.869	3.423	6.314	0.477	0.185	0.156	0.120	0.582	0.409	0.755	0.212	0.123	0.087	0.160	
TOTAL (3+)	63.736	45.876	83.241	1.908	2.262	0.242	0.200	12.727	9.027	16.550	0.126	1.603	1.136	2.084	
	43.068	30.277	55.859	1.908		0.390	0.260	11.181	7.860	14.502	0.128	1.434	1.008	1.861	
UNIT 3															
2	9.748	6.434	14.769	0.000	0.112	0.082	0.065	0.634	0.418	0.960	0.112	0.071	0.047	0.108	
3	6.100	2.263	9.937	0.523	0.535	0.393	0.271	1.656	0.614	2.698	0.122	0.202	0.075	0.329	
4	0.637	0.236	1.038	0.523	1.000	0.734	0.439	0.280	0.104	0.456	0.146	0.041	0.015	0.067	
5	0.156	0.058	0.254	0.523	0.708	0.520	0.340	0.053	0.020	0.086	0.174	0.009	0.003	0.015	
6	2.322	0.862	3.783	0.523	0.493	0.362	0.253	0.589	0.218	0.959	0.210	0.124	0.046	0.201	
TOTAL (3+)	18.964	9.853	29.781	2.092	2.849	0.205	0.169	3.211	1.375	5.159	0.139	0.447	0.186	0.720	
	9.216	3.419	15.012	2.092		0.428	0.280	2.578	0.956	4.199	0.146	0.376	0.139	0.612	
UNIT 4															
2	2.342	1.630	3.364	0.000	0.076	0.050	0.040	0.093	0.065	0.134	0.105	0.010	0.007	0.014	
3	0.954	0.559	1.349	0.398	0.452	0.293	0.211	0.202	0.118	0.285	0.106	0.021	0.013	0.030	
4	0.880	0.516	1.245	0.398	1.000	0.649	0.402	0.354	0.207	0.500	0.120	0.042	0.025	0.060	
5	0.404	0.237	0.571	0.398	0.773	0.501	0.330	0.134	0.078	0.189	0.137	0.018	0.011	0.026	
6	3.479	2.039	4.920	0.398	0.153	0.089	0.078	0.271	0.159	0.383	0.150	0.041	0.024	0.058	
TOTAL (3+)	8.060	4.981	11.449	1.592	2.454	0.159	0.131	1.054	0.628	1.492	0.126	0.133	0.079	0.188	
	5.718	3.351	8.085	1.592		0.244	0.168	0.960	0.563	1.358	0.128	0.123	0.072	0.174	

"Appendix"

Derivation of Optimal F policy options prepared as exploitation strategies for Lake Erie yellow perch harvest management.

Optimum fishing mortality (F_{opt}) is used to calculate an optional yield for each Management Unit. $F_{0.1}$ is arbitrarily defined as that level of fishing mortality beyond which the instantaneous rate of change in yield per recruit is less than 10% of the rate produced by an instantaneous fishing mortality rate of zero. Derivation of the F_{opt} option recommended by the YPTG for use in computing yield may be needed and is provided below.

The optional exploitation strategy implies the fishable perch stock (ages 2 - 6) is fished at a rate $F_{0.1}$ across all age groups as depicted schematically in Figure 2. In reality, all age groups are subject to selectively different rates induced by gear selectivity, behavior, changes in distribution etc. Since catch allocations cannot be specified by age, the level of fishing mortality applied to a specific age group is not controlled. Therefore, those more vulnerable age groups may experience levels of fishing above $F_{0.1}$ and those less vulnerable below $F_{0.1}$ (Figure 1).

Using Management Unit 1 as an example (Figure 1) F_{opt} is the optimal yield fishing rate adjusted by age and $F_{0.1}$ equals 0.517. By adjusting $F_{0.1}$ to represent age-group vulnerability and selectivity, such that $F_{opt} (A+B)$ equals $F_{opt} (A+C)$ schematically in Figure 1, perch yields are allocated by a more realistic method, consistent with the actual practice within the fishery.