

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

March 1992

Members:

Sandra Orsatti	-	Ontario Ministry of Natural Resources (Chair)
Don Einhouse	-	New York Department of Environmental Conservation
Mike Rawson	-	Ohio Department of Natural Resources
Pauline Dietz	-	Ontario Ministry of Natural Resources
Roger Kenyon	-	Pennsylvania Fish Commission
Ken Muth	-	United States Fish and Wildlife Service

Presented to:

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

The Yellow Perch Task Group (YPTG) was charged with describing yellow perch stock status, producing population size estimates and recommending allowable harvest (RAH) for 1992 in each of four management units (Figure 1). These charges are summarized in the current report. In 1991, the task group was also charged with a the review of methodologies including exploitation policies. This work was continued in 1992 as background material for the estimation of population size and recommended allowable harvest levels. A joint report with the Statistics and Modelling Task Group will be released later this year that details the methodology review.

Fisheries Review

The reported harvest of yellow perch from Lake Erie in 1991 totalled 2,759 tonnes (6.1 million pounds) (Table 1), which was 37% less than the 1990 harvest. All agencies reported declines in perch catches in 1991. The largest reductions were in Michigan (-59%) and Ontario (-41%) waters, which were followed by New York (-35%), Ohio (-23%) and Pennsylvania (-18%). Ontario harvested 69% of the lakewide reported catch, while Ohio accounted for 27%, and Michigan, Pennsylvania and New York caught the remaining 4%.

In 1991, the recommended allowable harvest level was 3.5 million pounds lakewide. Based on current information, the revised recommendation for 1991 was 4.8 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 (1976-1991) in harvest, fishing effort and catch rate are described in Figures 2, 3 and 4 by Unit and gear type. Commercial gillnet effort in 1991 declined in Unit 1 (-26%), increased by 10% in Unit 2, and remained approximately the same in Units 3 (-1%) and 4 (-2%), as compared to 1990. Trapnet effort increased in Units 1 (+15%) and 2 (+4%), and declined in Units 3 (-39%) and 4 (-6%). Sport fish effort in Unit 1 declined in 1991 (-12%) due to a large reduction in sport effort in Michigan waters (-74%). However, sport fish effort in Ohio waters of Unit 1 increased (+50%). Sport fish effort increased 13% in Unit 2, 71% in Unit 3 and declined 10% in Unit 4. Catch rates from the commercial gillnet and trap net fisheries declined in all management units in 1991 compared to 1990

levels. Catch rates from the sport fisheries, increased in Units 1 and 2, and declined in Units 3 and 4. Catch rates in 1991 were at levels similar to or lower than catch rates observed in the early 1980's, which was prior to the entry of the 1984 year class into the fisheries.

The 1988 and 1989 year classes of yellow perch were the largest components of the 1991 harvest in Units 1, 2 and 3 (Table 4). In Unit 4, the 1986, 1987 and 1988 year classes made the strongest contribution to the harvest (Table 4). The 1986 year class was a strong contributor to the gillnet and trapnet fisheries in the first half of the year. The 1989 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 1991 Population Size - To estimate the 1991 population size, a three gear (gillnet, trapnet and sport harvest and effort) version of the CAGEAN model was used. The three gear version allows factors such as catchabilities and selectivities to be configured by gear. Estimates of population size were done using a natural mortality rate of 0.4 ($M=0.4$).

In all Units, the current CAGEAN estimate of the 1991 population size, was larger than the population size projected last year (Table 5). CAGEAN estimates of the 1989 year class (age-2) were higher than what had been projected last year in all Units. In Unit 1, the abundance of age-3 and older fish were over-estimated, whereas in Units 2, 3, and 4, age-3 and older fish abundance were underestimated using last year's population projection.

Results from CAGEAN indicated that the 1989 year class was very abundant as 2 year old fish in 1991. However, there have been no other indications that this is the case. Results from Index fishing surveys show that the 1989 year class is more abundant than older aged fish in the population, but have not indicated that the 1989 year class is strong relative to the other year classes. Results from Ontario's fall index fishing survey done in cooperation with the commercial fishing industry in all 4 management units were used to estimate the abundance of the 1989 year class, and an 'adjusted' 1991 population size estimate of age-2 and older fish was produced (Table 5). The ratio of geometric mean catch rates of the 1988 and 1989 year classes in 1990 and 1991, respectively, from the index nets, and the CAGEAN

estimate of the 1988 year class as age-2 were used to estimate the size of the 1989 year class as age-2 fish in 1991, i.e. $Abundance_{1989} \text{ (millions of fish)} = Abundance_{1988} \times (Index_{1989} / Index_{1988})$. It was felt that CAGEAN's estimate of the 1988 year class as age-2 fish would be more reliable than its estimate of the 1989 year class as age-2 fish because there were 2 years of harvest information for the 1988 cohort and only 1 year of information for the 1989 year class. It was believed that results from the partnership index fishing surveys conducted in Ontario waters is currently the most representative index information because of its broad coverage, standardized methods and large sample sizes.

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. Results associated with age-3 and older fish are believed to be more representative of what is available as the fishable stock. Age-2 fish do contribute to the harvest, as can be seen in 1991, but a cohort contributes in a more significant manner at age-3 and older fish when it is more vulnerable to the gear.

Stock size estimates of age-3 and older fish declined in all management units in 1991 compared to 1990 (Table 6, Figure 5). Stock size estimates in 1991 were at levels prior to the 1984 year class in Units 2, 3 and 4. In Unit 1, stock size estimates in 1991 were at the lowest level in a period dating back to 1976. In terms of biomass of fish, 1991 estimates were lower than 1990 in all units (Figure 6). The 1991 population consisted primarily of age-2 fish in units 1, 2 and 3. In Unit 4, 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 43%, 46%, 33% and 62% respectively, in Units 1 through 4 (Table 6, Figure 7). These were higher than those estimated for 1990. Survival rates have improved since the early 1980's. The corollary is that exploitation rates have been lower recently than in the early 1980's (Table 6, Figure 8). Exploitation rates in 1991 by management unit, for age-3 and older fish were 30%, 26%, 42% and 6% respectively.

Recruitment - The methods used in last year's report 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).

There has been poor to fair recruitment of yellow perch in all Units subsequent to the 1986 year class (Figure 9). The 1987 and 1988 year classes were poor. Based on index fishing results, the 1989 and 1990 year class appears to be fair (Figure 10). The 1991 year class appears to be poorer in strength than the previous 2 year classes based on index trawling.

1992 Population Size Projection - Stock size estimates for 1992 (age-3 and older) were projected from the adjusted 1991 population size estimates and age specific survival rates in 1991. Recruitment of the 1990 year class in 1992 (age-2 fish) was estimated from various agency trawling indices of age-0 and age-1 yellow perch.

Projections of stock size for 1992 indicate a slight increase in the abundance of age-2 and older fish in Units 1 and 2 (Table 9, for unadjusted population sizes see Appendix A). However, stock size estimates continue to decline in Units 3 and 4. Estimates of age-3 and older fish in 1992 were 95%, 154% and 4% Units greater than the estimate of 1991 abundance in Units 1, 2 and 3, respectively. In Unit 4, the number of age-3 and older fish declined 25% in 1992. Population size estimates in Unit 1 for 1992 remain at low levels relative to other years in a time series dating back to 1976. Units 2, 3, and 4 population sizes in numbers have returned or are returning to 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 and age-3 fish, and the group of fish age-6 and older were modelled as still being relatively abundant.

Biomass of age-3 and older fish may be the most representative indicator of fishable stock in 1992 (Table 9). There was a 37% increase in the biomass of age-3 and older fish in Unit 1 in 1992 compared to 1991. In Unit 2, the increase was 34%. In Units 3 and 4, the biomass of fish declined 39% and 19%, respectively. Biomass was generated from the number of fish estimated by CAGEAN

multiplied by the mean weight-at-age from index fishing data that were used to generate growth curves for yield per recruit modelling.

Yield per Recruit - Optimum fishing mortality, F_{opt} , is a instantaneous fishing mortality rate at which the yield per recruit into the fishery is optimized. The yield per recruit model's basic assumption is that the desired harvest strategy is to optimize the return in weight per recruit (fish). The growth rate of fish versus its natural mortality rate determines when and at what harvest rate, fish will be harvested to optimize harvest. For temperate waters, a modification of F_{opt} has been recommended, $F_{0.1}$. $F_{0.1}$ corresponds to 10% of the rate of increase of yield per recruit that can be obtained by increasing the instantaneous fishing mortality rate (F) at low levels of fishing mortality.

The yield per recruit model requires information about: the age at which fish are recruited to the fishery, that age at which fish are fully vulnerable, growth characteristics (von Bertalanffy growth equation parameters) and natural mortality. Growth parameter estimation was updated using a dataset consisting of weight-at-age information from recent years of index fishing. For the purposes of modelling yellow perch, the age of first vulnerability was considered to be age-3 (i.e. age-3 and older are representative of the fishable stock) and the age of full vulnerability, 3.5 years old. In practice, the vulnerability of 2 year old fish in the catch are recognized in applying the results of the yield per recruit model (see scaling of $F_{0.1}$ later in this section). The model assumes that all fish older than the age at which fish are full vulnerability are also fully vulnerable to the gear (i.e. the selectivity curve increases with age and then flattens). This assumption is valid for trapnet and sport fisheries (Figure 11). However, it does not take into account the dome shaped selectivity curve for gillnets (age-4 is peak vulnerability in recent years, Figure 11). As a result, the $F_{0.1}$ value generated from yield per recruit modelling is not applied to each age equally, because ages are not equally vulnerable to the gear. The more vulnerable age groups may experience levels of fishing above $F_{0.1}$ and those less vulnerable below $F_{0.1}$.

The 1992 harvest estimates consisting 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. Harvest in weight is the

product of the age specific harvest in number of fish multiplied by the mean weight in the harvest (5 year average, 1987 - 1991). The harvest estimate is the sum of the harvest for age-2 and older fish (Table 10, Appendix B, C and D). The following steps were used for scaled $F_{0.1}$:

1. F_{age} is the sum of $F_{0.1}$ for ages 3 to 6 (fishable stock) divided by the sum of the selectivity coefficients for ages 2 to 6, multiplied by the age specific selectivity coefficient.
2. F_{age} is converted to an exploitation rate for a given age.
3. The stock size estimate in numbers for a given age is multiplied by the age specific exploitation rate to generate a harvest in numbers for a given age.
4. The harvest in weight at a given age is the product of the mean weight in the harvest of that age multiplied by the harvest in numbers for that age.
5. The harvest estimate in weight is the sum of the age specific harvests for ages 2 to 6.

Recommended Allowable Harvest

Three harvest scenarios were generated for 1992 (Table 11). The first was using the unadjusted estimates of population size and a scaled $F_{0.1}$ exploitation strategy; the second was to use the adjusted 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 1991. The recommended allowable harvest levels are the values from the second scenario; adjusted population size and a scaled $F_{0.1}$ exploitation strategy. The minimum and maximum values presented for 1992 are based on the coefficient of variation determined from the CAGEAN population estimates.

Recommendations and Conclusion

For 1991, a lakewide harvest of 3.5 million pounds was recommended. This reflected the serious concerns of the task group about yellow perch abundance. In what were essentially unlimited fisheries in 1991, the lakewide harvest was 6.1 million pounds. In Units 2 through 4, last year's projection of the 1991 population size was an underestimate relative to this year's information. However, if one uses the current description of the 1991 population size based on including 1991 harvest information and the $F_{0.1}$ strategy, the recommended harvest level would have been 4.8 million pounds (Table 12,

Appendix D). Both last year's lakewide recommendation of 3.5 million pounds and the actual harvest were within the lower and upper bounds of the range surrounding the revised recommendation for 1991.

For 1992, improvements in the amount of fishable stock size (age-3 and older) in western Lake Erie (Units 1 and 2) compared to 1991 have been estimated. However, these improvements do not approach the population levels observed in the late 1980's. Stock size in terms of biomass continues to decline in eastern Lake Erie (Units 3 and 4). We are recommending a harvest level using the adjusted 1992 population estimate and the $F_{0.1}$ exploitation strategy. The midpoint (and the RAH) level is 6.1 million pounds lakewide. This is an increase from the 1991 revised RAH of 4.8 million pounds, and reflects the subtle increase in lakewide biomass of age-3 and older fish (7% increase). The relative size of the RAHs compared among management units reflects recent harvest patterns with the largest harvest and RAH coming from Unit 2.

The yield-per-recruit modelling assumes that the selectivity curve reaches a peak vulnerability which is maintained for all older ages. The task group has attempted to adjust for that assumption by scaling the $F_{0.1}$ values generated from yield per recruit modelling by age specific selectivity. It is recommended that alternative exploitation models be explored in the upcoming year that allow for selectivity of the gear to be incorporated within the model.

The task group continues to urge agencies to adopt a standard index assessment program that includes yellow perch. Inputs from index fishing, such as growth and total mortality rates are critical to the modelling exercises. With several years of assessment data, index fishing results can be used directly in the CAGEAN population estimation exercise as an input to calibrate harvest information.

Table 1. Summary of total catch^a of yellow perch by management unit and agency, Lake Erie 1980 - 91.

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	
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	
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	
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	

^aCatch is in metric tonnes.

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

Table 2. Lake Erie 1991 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 1991 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	0.355	0.192	0.294	-0.061	-17.2	0.102	52.8
	Ohio	0.416	0.226	0.309	-0.107	-25.7	0.083	36.9
	Michigan	0.068	0.037	0.043	-0.025	-36.7	0.006	16.7
	TOTAL	0.839	0.455	0.646	-0.193	-23.0	0.191	42.0
2	Ontario	0.213	0.416	0.985	0.772	362.6	0.569	136.7
	Ohio	0.288	0.563	0.310	0.022	7.6	-0.253	-44.9
	TOTAL	0.501	0.979	1.295	0.794	158.5	0.316	32.3
3	Ontario	0.107	0.293	0.550	0.443	415.1	0.257	87.5
	Ohio	0.061	0.167	0.115	0.054	89.7	-0.052	-30.9
	Pennsylvania	0.023	0.062	0.069	0.046	205.2	0.007	11.1
	TOTAL	0.190	0.522	0.734	0.544	286.3	0.212	40.6
4	Ontario	0.038	0.109	0.073	0.035	91.7	-0.036	-33.2
	Pennsylvania	0.012	0.034	0.000	-0.012	-100.0	-0.034	-100.0
	New York	0.020	0.059	0.011	-0.009	-46.1	-0.048	-81.2
	TOTAL	0.070	0.202	0.084	0.014	19.4	-0.118	-58.4
TOTAL	Ontario	0.713	1.011	1.902	1.189	166.9	0.891	88.1
	Ohio	0.765	0.955	0.734	-0.031	-4.0	-0.221	-23.2
	Michigan	0.068	0.037	0.043	-0.025	-36.7	0.006	16.7
	Pennsylvania	0.034	0.096	0.069	0.035	100.1	-0.027	-28.3
	New York	0.020	0.059	0.011	-0.009	-46.1	-0.048	-81.2
ALL UNITS		1.600	2.158	2.759	1.159	72.4	0.601	27.9

Note: A positive difference indicates that harvest was greater than RAH

Table 3a. Catch and effort summaries for Lake Erie yellow perch fisheries in Management Unit 1, 1981 - 91.

	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	--
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	--
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	--

^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 - 91.

	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	--
	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	--
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	--

^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 in Management Unit 3, 1981 - 91.

	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	--
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	--
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	--

^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 in Management Unit 4, 1981 - 91.

	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
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
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

^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, 1991.
 Note: 1985 represents age 6 and older fish.

YEAR CLASS	UNIT 1		UNIT 2		UNIT 3		UNIT 4	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Gillnets								
1990	.004	0.2						
1989	.886	35.3	4.859	58.9	1.130	24.6	.014	2.19
1988	.598	23.9	1.514	18.4	1.050	22.9	.162	25.4
1987	.263	10.5	.797	9.7	.944	20.6	.120	18.8
1986	.622	24.8	.809	9.8	.505	11.0	.269	42.2
1985+	.134	5.4	.269	3.3	.958	20.9	.073	11.4
TOTAL	2.507		8.248		4.587		0.638	
Trapnets								
1990								
1989	.011	2.4	.029	3.9	.020	4.8	.001	2.9
1988	.027	5.9	.040	5.4	.094	22.7	.004	11.4
1987	.044	9.7	.036	4.9	.042	10.2	.008	22.9
1986	.230	50.5	.343	46.7	.114	27.6	.011	31.4
1985+	.143	31.4	.287	39.0	.143	34.6	.011	31.4
TOTAL	.455		.735		.413		.035	
Angling								
1990	.012	0.5	.064	6.3				
1989	.501	22.5	.475	46.5	.027	22.3	.001	6.7
1988	.828	37.2	.235	23.0	.019	15.7	.002	13.3
1987	.249	11.2	.041	4.0	.008	6.6	.001	6.7
1986	.317	14.3	.118	11.6	.033	27.3	.003	20.0
1985+	.317	14.3	.088	8.6	.034	28.1	.008	53.3
TOTAL	2.224		1.021		0.121		0.015	
All Gear								
1990	0.016	0.3	0.064	0.6	0.000	0.0	0.000	0.0
1989	1.398	27.0	5.363	53.6	1.177	23.0	0.016	2.3
1988	1.453	28.0	1.789	17.9	1.163	22.7	0.168	24.4
1987	0.556	10.7	0.874	8.7	0.994	19.4	0.129	18.8
1986	1.169	22.5	1.270	12.7	0.652	12.7	0.283	41.1
1985	0.594	11.5	0.644	6.4	1.135	22.2	0.092	13.4
TOTAL	5.186		10.004		5.121		0.688	

Table 5. Comparison of the 1991 yellow perch stock size projection (based on 1990 harvest data) to the CAGEAN estimate of 1991 population size and to the adjusted estimate of stock size (1989 year class estimated using index fishing results).

UNIT	AGE	NUMBERS OF FISH (MILLIONS)			DIFFERENCE - CAGEAN		DIFFERENCE - ADJUSTED	
		1991	1991	1991	NUMBER	PERCENT	NUMBER	PERCENT
		STOCK PROJECTION	CAGEAN ESTIMATE	ADJUSTED				
1	2	21.99	54.00	26.08	-32.01	-146	-4.09	-19
	3	6.29	5.10	5.12	1.19	19	1.17	19
	4	0.91	0.80	0.76	0.11	12	0.15	16
	5	4.61	2.60	2.57	2.01	44	2.04	44
	6+	3.34	2.60	2.63	0.74	22	0.71	21
	2+OLDER	37.14	65.10	37.16	-27.96	-75	-0.02	-0
	3+OLDER	15.15	11.10	11.09	4.05	27	4.06	27
2	2	18.65	78.40	58.73	-59.75	-320	-40.08	-215
	3	4.69	6.70	6.73	-2.01	-43	-2.04	-43
	4	0.51	1.00	1.00	-0.49	-96	-0.49	-97
	5	1.98	3.00	2.99	-1.02	-52	-1.01	-51
	6+	1.65	6.70	6.66	-5.05	-306	-5.01	-303
	2+OLDER	27.48	95.80	76.11	-68.32	-249	-48.63	-177
	3+OLDER	8.83	17.40	17.38	-8.57	-97	-8.55	-97
3	2	6.68	19.60	10.47	-12.92	-193	-3.79	-57
	3	0.71	1.90	1.86	-1.19	-168	-1.15	-162
	4	0.34	0.80	0.82	-0.46	-135	-0.48	-140
	5	0.55	1.00	1.01	-0.45	-82	-0.46	-83
	6+	1.11	5.70	5.67	-4.59	-414	-4.56	-410
	2+OLDER	9.39	29.00	19.82	-19.61	-209	-10.43	-111
	3+OLDER	2.71	9.40	9.35	-6.69	-247	-6.64	-245
4	2	2.73	2.70	1.40	0.03	1	1.33	49
	3	0.57	1.40	1.42	-0.83	-146	-0.85	-149
	4	0.25	0.70	0.72	-0.45	-180	-0.46	-186
	5	0.37	1.80	1.84	-1.43	-386	-1.47	-396
	6+	0.43	3.70	3.68	-3.27	-760	-3.24	-755
	2+OLDER	4.35	10.30	9.09	-5.95	-137	-4.74	-109
	3+OLDER	1.62	7.60	7.65	-5.98	-369	-6.02	-372

Table 6. Lake Erie yellow perch population size and parameters estimated using 3-GEAR CAGEAN ($M=0.4$). NUMBER is stock size in millions of fish, BIOMASS is stock size in millions of kilograms, 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	1976	53.762	2.502	0.53	0.18	19.861	1.587	0.35	0.41
	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	45.730	2.487			21.608	1.836			
2	1976	41.021	2.629	0.44	0.29	14.469	1.593	0.29	0.48
	1977	48.188	3.063	0.42	0.31	18.101	1.889	0.27	0.50
	1978	37.467	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	64.749	6.356			44.081	5.550			
3	1976	19.410	1.142	0.37	0.37	6.225	0.680	0.23	0.56
	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	19.407	1.819			9.659	1.478			
4	1976	7.698	0.417	0.42	0.32	4.624	0.330	0.33	0.43
	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	8.066	1.188			5.724	1.122			

Table 7. Yellow perch stock size (millions of fish) at the start of the year, estimated from CAGEAN for the years 1980–1991. 1991 age 2 values have been adjusted. The 1992 population size has been generated from 1991 population estimates and from regressions based on index trawling.

UNIT	AGE	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	
1	2	30.248	25.158	40.983	40.696	76.078	11.634	91.811	45.355	34.994	2.730	7.984	26.075	24.122	
	3	63.966	19.327	15.582	23.144	26.125	49.282	7.599	58.807	29.366	22.685	1.760	5.117	16.844	
	4	6.264	29.819	7.426	4.260	12.043	13.074	26.264	3.474	14.804	29.336	14.804	10.820	0.764	2.533
	5	3.239	1.622	5.175	0.626	1.401	4.216	5.204	7.402	1.153	9.851	9.851	4.210	2.571	0.246
	6+	0.445	0.976	0.510	0.493	0.390	0.686	2.052	2.367	3.571	2.034	3.692	3.692	2.633	1.985
	2 AND OLDER	104.162	76.902	69.676	69.219	116.037	78.892	132.930	117.405	98.420	98.420	52.104	28.466	37.160	45.730
2	3 AND OLDER	73.914	51.744	28.693	28.523	39.959	67.258	41.119	72.050	63.426	49.374	20.482	11.085	21.608	
	2	16.000	31.077	60.325	33.865	45.891	6.537	167.075	37.131	52.961	4.229	11.180	58.732	20.668	
	3	34.271	7.030	11.922	30.807	19.374	27.353	3.889	98.972	23.478	33.880	2.643	6.730	36.103	
	4	2.596	6.748	0.936	3.592	12.961	7.254	10.023	1.378	49.400	12.385	15.871	1.003	2.866	
	5	0.849	0.243	0.339	0.166	1.112	2.499	1.335	1.720	0.491	19.786	3.810	2.989	0.242	
	6+	0.173	0.103	0.031	0.058	0.070	0.426	1.107	1.088	1.492	1.184	9.609	6.654	4.870	
3	2 AND OLDER	53.869	45.201	73.553	68.488	79.408	44.069	183.429	140.289	127.822	71.464	43.113	76.108	64.749	
	3 AND OLDER	37.869	14.124	13.228	34.623	33.517	37.532	16.354	103.158	74.861	67.235	31.933	17.376	44.081	
	2	4.738	5.706	11.440	7.094	11.639	2.745	128.042	18.100	10.544	2.988	2.914	10.468	9.748	
	3	5.493	2.198	2.283	5.171	3.302	7.384	1.753	83.134	11.988	6.953	1.950	1.861	6.544	
	4	0.600	1.556	0.442	0.601	1.492	1.333	3.126	0.875	50.084	6.906	3.675	0.817	0.637	
	5	0.298	0.129	0.215	0.082	0.138	0.381	0.380	1.197	0.472	24.413	2.764	1.006	0.156	
6+	0.022	0.045	0.018	0.028	0.020	0.054	0.164	0.253	0.829	0.701	11.158	5.666	2.322		
4	2 AND OLDER	11.151	9.634	14.398	12.976	16.591	11.897	133.465	103.559	73.917	41.961	22.461	19.818	19.407	
	3 AND OLDER	6.413	3.928	2.958	5.882	4.952	9.152	5.423	85.459	63.373	38.973	19.547	9.350	9.659	
	2	7.138	6.329	4.924	6.676	7.012	5.199	27.981	6.730	8.294	1.774	2.134	1.442	2.342	
	3	4.962	3.873	3.174	2.824	3.983	4.483	3.421	18.334	4.464	5.531	0.005	1.418	0.960	
	4	0.673	1.775	1.096	1.338	1.339	1.507	2.403	1.744	10.829	2.812	3.435	0.715	0.880	
	5	0.228	0.172	0.318	0.361	0.528	0.259	0.621	0.884	0.885	6.325	0.002	1.836	0.404	
6+	12.773	11.977	9.194	10.838	12.334	11.189	33.805	26.808	23.587	10.117	5.574494	3.575	4.182		
2 AND OLDER	2 AND OLDER	25.774	24.126	18.706	22.037	25.196	22.637	68.231	54.500	48.059	26.559	11.151	8.986	8.768	
	3 AND OLDER	18.636	17.797	13.782	15.361	18.184	17.438	40.250	47.770	39.765	24.785	9.017	7.544	6.426	

Table 8. Estimates of yellow perch abundance (number of age -2 recruits) for the 1990 and 1991 year classes derived from agency trawl indices (M = 0.40)

Agency	Area	Season	Group	1990 Year Class			1991 Year Class		
				Mean Estimate	95% Confidence Limits		Mean Estimate	95% Confidence Limits	
					Lower	Upper		Lower	Upper
Management Unit 1									
Ont.	11	Summer	YOY	35,858,816	29,124,782	44,149,846	18,972,479	16,189,930	22,233,262
Ohio	21	Summer	YOY	14,038,302	9,800,069	20,109,442	14,200,674	9,960,123	20,246,652
Ohio	21	Fall	YOY	40,216,986	35,032,964	46,168,117	13,012,227	8,433,311	20,077,292
Ohio	21	Fall	YRL	6,749,642	3,931,769	11,587,066	---	---	---
USFW	21	Summer	YOY	27,560,661	24,532,271	30,962,892	18,665,734	14,177,971	24,574,012
USFW	21	Summer	YRL	24,121,159	20,624,701	28,210,364	---	---	---
USFW	21	Fall	YOY	71,128,595	48,496,394	104,322,748	73,876,106	49,510,731	110,232,243
USFW	21	Fall	YRL	16,957,148	12,930,508	22,237,709	---	---	---
			Weighted	24,121,553	18,410,923	31,602,658	20,869,879	15,533,310	28,040,998
Management Unit 2									
Ohio	23	Fall	YOY	58,014,295	41,607,875	80,889,938	27,009,521	25,108,073	29,054,967
Ohio	23	Fall	YRL	18,244,970	16,734,784	19,891,439	---	---	---
Ont.	11	Summer	YOY	29,618,212	23,403,590	37,483,073	14,680,050	12,223,856	17,629,779
Ohio	21	Summer	YOY	10,394,631	7,241,942	14,919,804	10,522,222	7,367,581	15,027,614
Ohio	21	Fall	YOY	31,762,598	27,280,971	36,980,452	9,590,657	6,017,606	15,285,267
Ohio	21	Fall	YRL	5,909,076	3,099,651	11,264,875	---	---	---
USFW	21	Summer	YRL	17,908,750	14,891,483	21,537,367	---	---	---
USFW	21	Fall	YOY	58,171,145	37,561,870	90,088,223	60,563,321	38,343,669	95,658,967
USFW	21	Fall	YRL	12,706,192	9,735,602	16,583,189	---	---	---
			Weighted	20,667,779	15,599,324	27,381,917	17,360,146	13,314,516	22,635,902

continued....

Table 8. (cont'd)

Agency	Area	Season	Group	1990 Year Class			1991 Year Class		
				95% Confidence Limits		Mean Estimate	95% Confidence Limits		Mean Estimate
				Lower	Upper		Lower	Upper	
Management Unit 3									
Ohio	24	Fall	YRL	13,772,715	11,041,815	17,179,030	---	---	---
Ont.	11	Summer	YOY	10,675,906	5,960,709	19,121,043	4,865,111	2,906,906	8,142,436
Ont.	11	Summer	YRL	12,465,807	7,254,990	21,419,237	---	---	---
USFW	21	Fall	YRL	3,507,451	2,491,760	4,937,156	---	---	---
			Weighted	9,748,369	6,434,072	14,768,614	4,865,124	2,906,715	8,143,016
Management Unit 4									
Ont.	16	Fall	YOY	2,050,717	1,580,576	2,660,701	1,259,090	725,996	2,183,632
Ont.	16	Fall	YRL	888,598	443,255	1,781,382	---	---	---
Ont.	11	Summer	YRL	4,174,061	3,010,751	5,786,858	---	---	---
Ohio	21	Summer	YOY	1,836,184	1,328,153	2,538,541	1,854,267	1,346,743	2,553,052
Ohio	21	Fall	YOY	4,850,052	4,322,308	5,442,233	1,879,281	1,371,616	2,574,845
Ohio	21	Fall	YRL	1,282,857	802,189	2,051,537	---	---	---
USFW	21	Fall	YOY	7,619,338	5,505,180	10,545,397	7,872,608	5,604,610	11,058,390
USFW	21	Fall	YRL	2,202,933	1,708,455	2,840,527	---	---	---
			Weighted	2,341,713	1,630,367	3,363,702	2,235,038	1,513,867	3,299,758

Table 9. Projection of the 1992 Lake Erie yellow perch population size. Stock size estimates in 1992 are derived from CAGEAN and index trawling regressions. The estimates of the 1989 year class have been adjusted by Ontario partnership index fishing results. Stock size in numbers is in millions of fish.

UNIT	AGE	1991 PARAMETERS										1992 PARAMETERS										BIOMASS	
		STOCK SIZE (NUMBERS)					MORTALITY RATES					SURV RATE (S)	STOCK SIZE (NUMBERS)					POP. WEIGHT (kg)	MILLIONS OF KGS				
		MEAN	SE	MIN	MAX	(F)	(Z)	(A)	(u)	MEAN	MIN		MAX	1991	1992								
1	2	26.075	6.414	19.661	32.489	0.037	0.437	0.354	0.030	0.646	24.122	18.411	31.603	0.027	0.704	0.651							
	3	5.117	1.259	3.858	6.376	0.303	0.703	0.505	0.218	0.495	16.844	12.700	20.987	0.065	0.333	1.085							
	4	0.764	0.188	0.576	0.952	0.735	1.135	0.679	0.439	0.321	2.533	1.910	3.157	0.092	0.070	0.233							
	5	2.571	0.632	1.939	3.203	0.727	1.127	0.676	0.436	0.324	0.246	0.185	0.306	0.119	0.306	0.029							
	6	2.633	0.648	1.985	3.281	0.427	0.827	0.563	0.291	0.437	1.985	1.496	2.473	0.241	0.635	0.478							
	2+	37.160	9.141	28.019	46.301	0.142	0.542	0.4185	0.1098	0.5815	45.729	34.703	58.526		2.047	2.487							
3+	11.085	2.727	8.358	13.812	0.445	0.845	0.5703	0.3002	0.4297	21.607	16.292	26.923		1.343	1.835								
2	2	58.732	17.443	41.289	76.175	0.087	0.487	0.386	0.069	0.614	20.668	15.599	27.382	0.039	2.291	0.806							
	3	6.730	1.999	4.731	8.729	0.454	0.854	0.574	0.305	0.426	36.089	25.370	46.807	0.086	0.579	3.104							
	4	1.003	0.298	0.705	1.301	1.023	1.423	0.759	0.546	0.241	2.865	2.014	3.716	0.135	0.135	0.387							
	5	2.989	0.888	2.101	3.877	0.533	0.933	0.607	0.347	0.393	0.242	0.170	0.314	0.233	0.696	0.056							
	6	6.655	1.977	4.678	8.632	0.189	0.589	0.445	0.143	0.555	4.869	3.423	6.314	0.411	2.735	2.001							
	2+	76.109	22.604	53.505	98.713	0.147	0.547	0.4210	0.1129	0.5790	64.732	46.576	84.533		6.436	6.354							
3+	17.377	5.161	12.216	22.538	0.379	0.779	0.5410	0.2632	0.4590	44.064	30.977	57.151		4.146	5.548								
3	2	10.468	6.584	3.884	17.052	0.070	0.470	0.375	0.056	0.625	9.748	6.434	14.769	0.035	0.366	0.341							
	3	1.861	1.171	0.690	3.032	0.672	1.072	0.658	0.412	0.342	6.543	2.427	10.658	0.084	0.156	0.550							
	4	0.817	0.514	0.303	1.331	1.255	1.655	0.809	0.613	0.191	0.637	0.236	1.038	0.132	0.108	0.084							
	5	1.006	0.633	0.373	1.639	0.889	1.289	0.724	0.500	0.276	0.156	0.058	0.254	0.187	0.188	0.029							
	6	5.666	3.564	2.102	9.230	0.619	1.019	0.639	0.388	0.361	2.322	0.862	3.783	0.351	1.989	0.815							
	2+	19.818	12.466	7.352	32.284	0.319	0.719	0.5127	0.2274	0.4873	19.406	10.017	30.502		2.807	1.819							
3+	9.350	5.881	3.469	15.231	0.699	1.099	0.6668	0.4241	0.3332	9.658	3.583	15.733		2.441	1.478								
4	2	1.442	0.597	0.845	2.039	0.006	0.406	0.334	0.005	0.666	2.342	1.630	3.364	0.028	0.040	0.066							
	3	1.418	0.587	0.831	2.005	0.077	0.477	0.379	0.061	0.621	0.960	0.563	1.358	0.054	0.077	0.052							
	4	0.715	0.296	0.419	1.011	0.170	0.570	0.435	0.130	0.565	0.880	0.516	1.245	0.096	0.069	0.084							
	5	1.836	0.760	1.076	2.597	0.132	0.532	0.412	0.102	0.588	0.404	0.237	0.571	0.141	0.259	0.057							
	6	3.675	1.522	2.154	5.197	0.026	0.426	0.347	0.021	0.653	3.479	2.039	4.920	0.267	0.981	0.929							
	2+	9.087	3.762	5.325	12.848	0.062	0.462	0.3700	0.0497	0.6300	8.066	4.984	11.458		1.426	1.188							
3+	7.645	2.790	4.480	10.809	0.073	0.473	0.3769	0.0581	0.6231	5.724	3.354	8.094		1.385	1.122								

Table 10. Recommended allowable harvest (RAH) of Lake Erie yellow perch for 1992. 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 is in millions of fish. Catch in weight (RAH) is in millions of kilograms.

UNIT	AGE	STOCK SIZE (NUMBERS)				EXPLOITATION RATE				CATCH (Millions of Fish)				HARVEST CATCH (Millions of kg) - RAH			
		MEAN	MIN	MAX	F(OPT)	s(age)	F	u	MEAN	MIN	MAX	WEIGHT (kg)	MEAN	MIN	MAX		
1	2	24.122	18.411	31.603	0.000	0.050	0.030	0.024	0.590	0.450	0.773	0.091	0.054	0.041	0.070		
	3	16.844	12.700	20.987	0.453	0.412	0.246	0.181	3.056	2.304	3.807	0.108	0.330	0.249	0.411		
	4	2.533	1.910	3.157	0.453	1.000	0.597	0.378	0.958	0.722	1.193	0.126	0.121	0.091	0.150		
	5	0.246	0.185	0.306	0.453	0.989	0.591	0.375	0.092	0.069	0.115	0.146	0.013	0.010	0.017		
	6	1.985	1.496	2.473	0.453	0.581	0.347	0.245	0.485	0.366	0.605	0.185	0.090	0.068	0.112		
	TOTAL (3+)	45.729	34.703	58.526	1.812	3.033	0.137	0.113	5.181	3.912	6.493	0.117	0.608	0.459	0.760		
2	2	20.668	15.599	27.382	0.000	0.085	0.073	0.058	1.196	0.903	1.585	0.109	0.130	0.098	0.173		
	3	36.089	25.370	46.807	0.477	0.444	0.379	0.263	9.500	6.678	12.321	0.121	1.149	0.808	1.491		
	4	2.865	2.014	3.716	0.477	1.000	0.854	0.487	1.394	0.980	1.808	0.139	0.194	0.136	0.251		
	5	0.242	0.170	0.314	0.477	0.521	0.445	0.300	0.073	0.051	0.094	0.173	0.013	0.009	0.016		
	6	4.869	3.423	6.314	0.477	0.185	0.158	0.121	0.589	0.414	0.763	0.212	0.125	0.088	0.162		
	TOTAL (3+)	64.732	46.576	84.533	1.908	2.235	0.239	0.197	12.751	9.026	16.572	0.126	1.611	1.139	2.093		
3	2	9.748	6.434	14.769	0.000	0.056	0.042	0.034	0.329	0.217	0.499	0.112	0.037	0.024	0.056		
	3	6.543	2.427	10.658	0.523	0.535	0.401	0.276	1.805	0.670	2.941	0.122	0.220	0.082	0.359		
	4	0.637	0.236	1.038	0.523	1.000	0.749	0.445	0.284	0.105	0.462	0.146	0.041	0.015	0.067		
	5	0.156	0.058	0.254	0.523	0.708	0.531	0.345	0.054	0.020	0.088	0.174	0.009	0.003	0.015		
	6	2.322	0.862	3.783	0.523	0.493	0.369	0.258	0.599	0.222	0.975	0.210	0.126	0.047	0.205		
	TOTAL (3+)	19.406	10.017	30.502	2.092	2.793	0.192	0.158	3.071	1.234	4.965	0.141	0.434	0.172	0.702		
4	2	9.658	3.583	15.733	2.092	0.038	0.435	0.284	2.742	1.017	4.466	0.145	0.397	0.147	0.646		
	2	2.342	1.630	3.364	0.000	0.038	0.025	0.020	0.047	0.033	0.068	0.105	0.005	0.003	0.007		
	3	0.960	0.563	1.358	0.398	0.452	0.298	0.214	0.206	0.121	0.291	0.106	0.022	0.013	0.031		
	4	0.880	0.516	1.245	0.398	1.000	0.659	0.407	0.358	0.210	0.506	0.120	0.043	0.025	0.061		
	5	0.404	0.237	0.571	0.398	0.773	0.510	0.335	0.135	0.079	0.191	0.137	0.019	0.011	0.026		
	6	3.479	2.039	4.920	0.398	0.153	0.101	0.079	0.275	0.161	0.389	0.150	0.041	0.024	0.058		
TOTAL (3+)	8.066	4.984	11.458	1.592	2.415	0.154	0.127	1.022	0.604	1.446	0.127	0.130	0.076	0.183			
		5.724	3.354	8.094	1.592		0.247	0.974	0.571	1.378	0.128	0.125	0.073	0.176			

Table 11. Lake Erie yellow perch harvest scenarios for 1992. Three 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	0.961	0.725	1.201	2,119,005	1,598,625	2,648,205	0.13	0.13	0.20
2	1.997	1.411	2.594	4,403,385	3,111,255	5,719,770	0.21	0.21	0.26
3	0.625	0.243	1.014	1,378,125	535,815	2,235,870	0.19	0.19	0.28
4	0.028	0.018	0.038	61,740	39,690	83,790	0.14	0.14	0.18
TOTAL	3.611	2.397	4.847	7,962,255	5,285,385	10,687,635			
ADJUSTED POPULATION ESTIMATE – F(0.1) EXPLOITATION STRATEGY – RECOMMENDED ALLOWABLE HARVEST									
1	0.608	0.459	0.760	1,340,640	1,012,095	1,675,800	0.11	0.11	0.21
2	1.611	1.139	2.093	3,552,255	2,511,495	4,615,065	0.20	0.20	0.26
3	0.434	0.172	0.702	956,970	379,260	1,547,910	0.16	0.16	0.28
4	0.130	0.076	0.183	286,650	167,580	403,515	0.13	0.13	0.17
TOTAL	2.783	1.846	3.738	6,136,515	4,070,430	8,242,290			
ADJUSTED POPULATION ESTIMATE – F(1991 EFFORT)									
1	0.724	0.547	0.907	1,596,420	1,206,135	1,999,935	0.14	0.14	0.25
2	1.867	1.321	2.426	4,116,735	2,912,805	5,349,330	0.23	0.23	0.30
3	0.650	0.259	1.052	1,433,250	571,095	2,319,660	0.24	0.24	0.42
4	0.038	0.022	0.054	83,790	48,510	119,070	0.04	0.04	0.05
TOTAL	3.279	2.149	4.439	7,230,195	4,738,545	9,787,995			

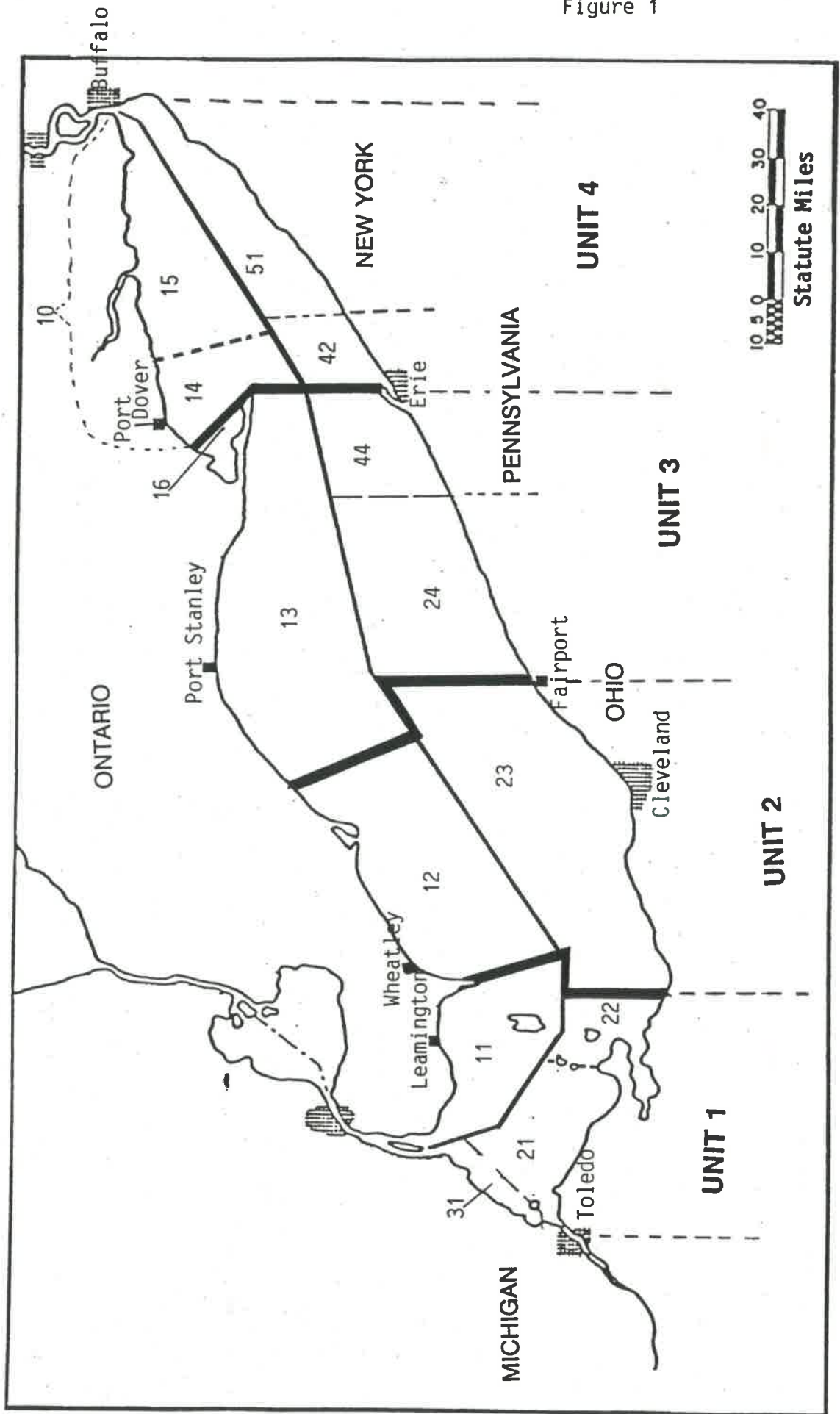
Table 12. Lake Erie yellow perch recommended allowable harvest for 1991 using current information, as compared to actual 1991 harvest and the 1991 recommendation.

UNIT	YIELD MILLIONS KGS			YIELD POUNDS			1991 RAH		1991 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	0.455	0.343	0.566	1,003,275	756,315	1,248,030	0.839	1,849,995	0.646	1,424,430
2	0.979	0.688	1.269	2,158,695	1,517,040	2,798,145	0.501	1,104,705	1.295	2,855,475
3	0.522	0.194	0.851	1,151,010	427,770	1,876,455	0.190	418,950	0.734	1,618,470
4	0.198	0.116	0.280	436,590	255,760	617,400	0.069	152,145	0.084	185,220
TOTAL	2.154	1.341	2.966	4,749,570	2,956,905	6,540,030	1.599	3,525,795	2.759	6,083,595

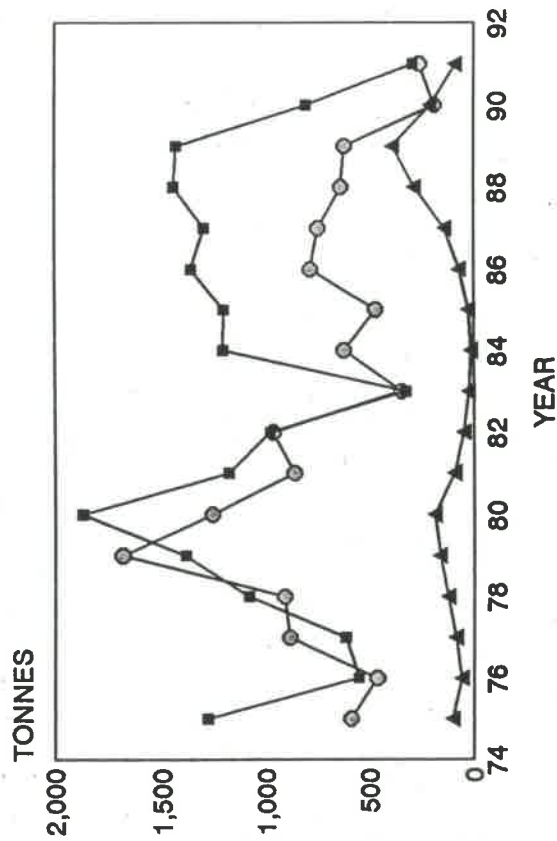
Figures

- 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 1975-1991).
- Figure 3. Trends in Lake Erie yellow perch effort by gear (gillnet, trapnet and angling) within a management unit (period 1975-1991).
- Figure 4. Trends in Lake Erie yellow perch catch rate by gear (gillnet, trapnet and angling) within a management unit (period 1975-1991).
- 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 1989 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 1989 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 1989 year class estimate has been adjusted by Ontario partnership index fishing results. The 1990 and 1991 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 (1984-1991). 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

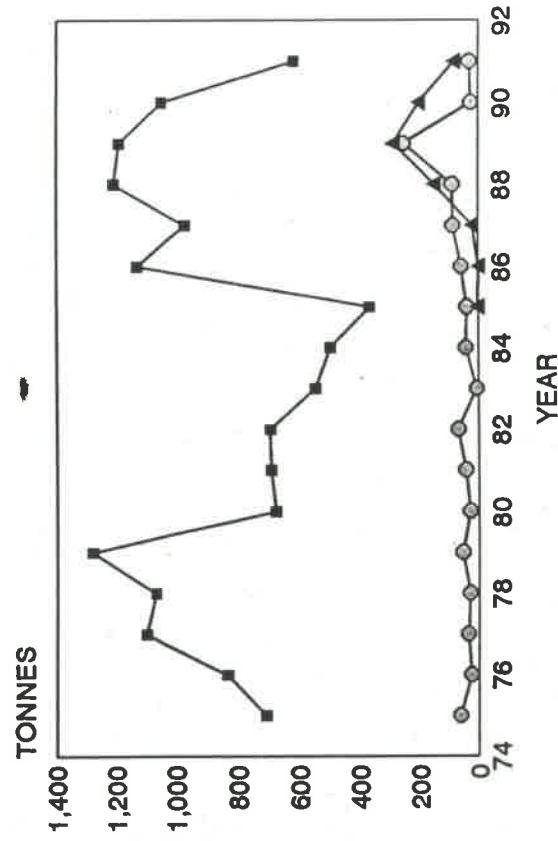


MANAGEMENT UNIT 1 HARVEST



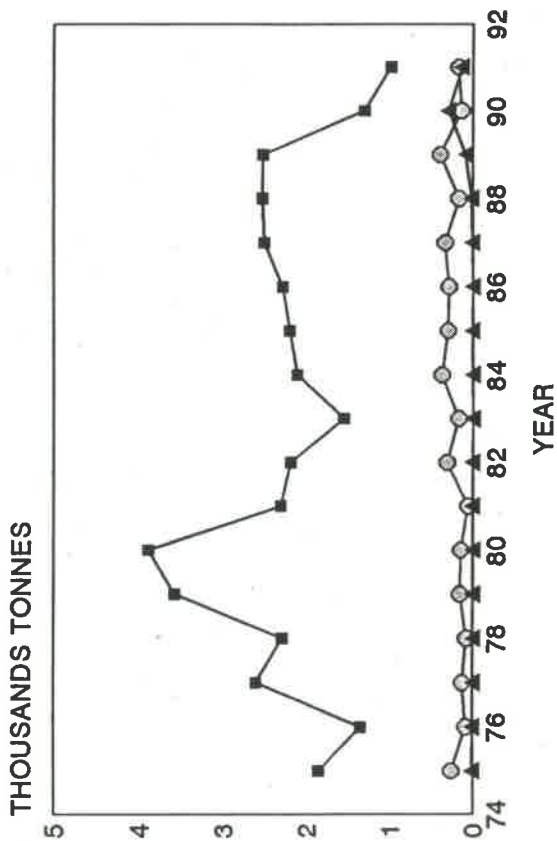
■ GILLNET ▲ TRAPNET ◊ SPORT

MANAGEMENT UNIT 3 HARVEST



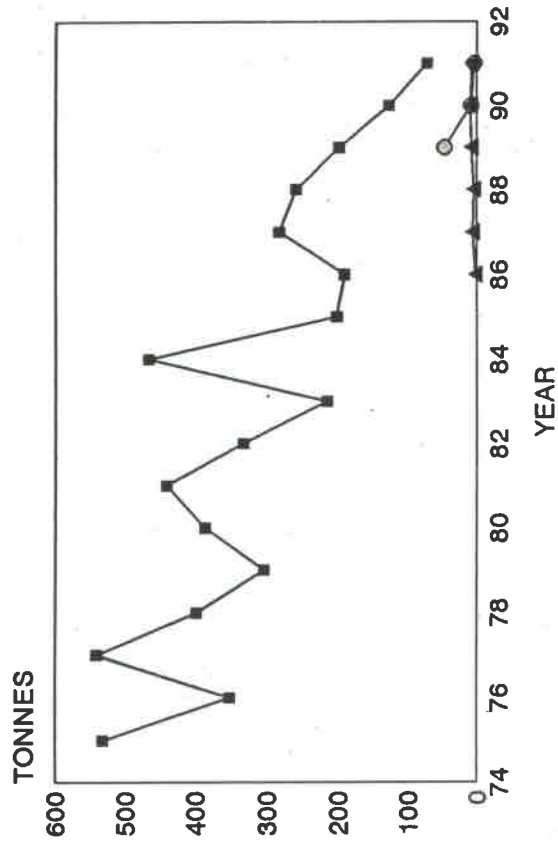
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MANAGEMENT UNIT 2 HARVEST



■ GILLNET ▲ TRAPNET ◊ SPORT

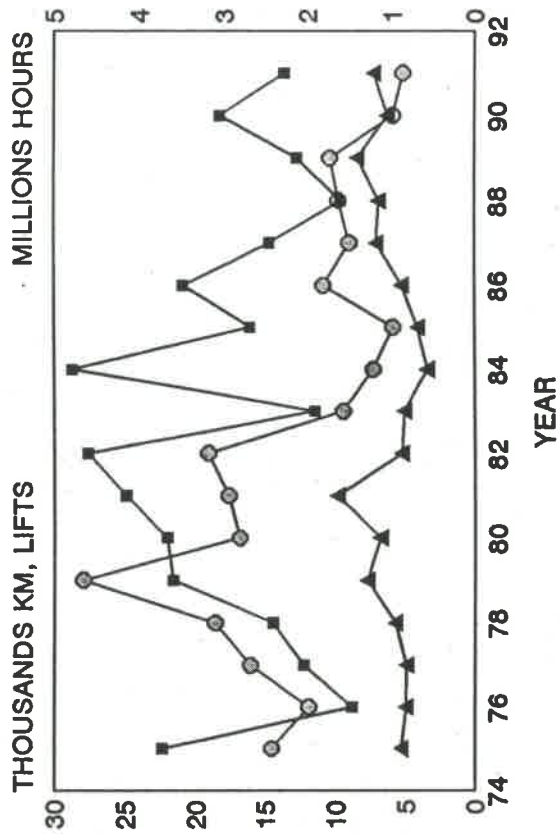
MANAGEMENT UNIT 4 HARVEST



■ GILLNET ▲ TRAPNET ◊ SPORT

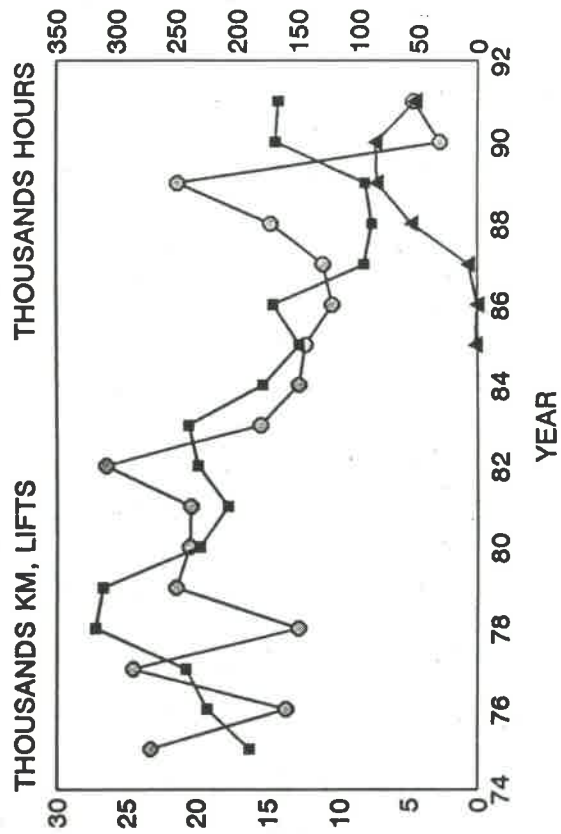
Figure 2

MANAGEMENT UNIT 1 EFFORT



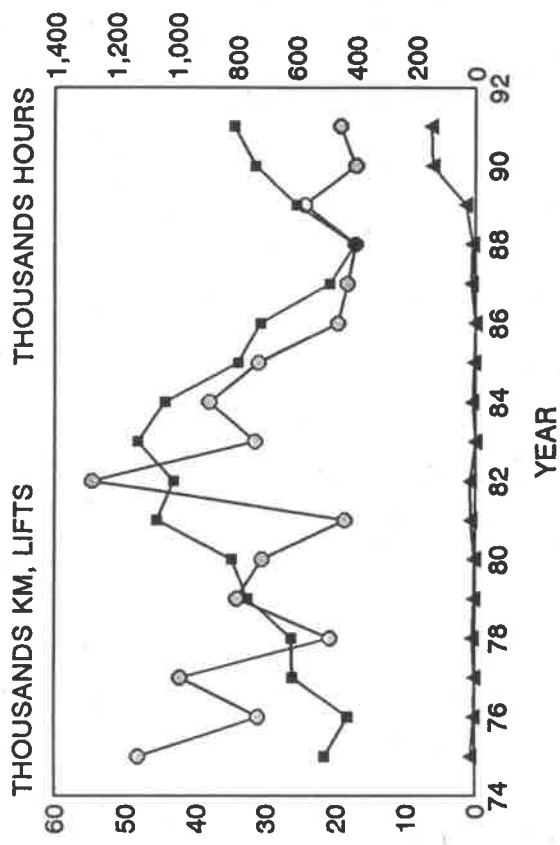
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MANAGEMENT UNIT 3 EFFORT



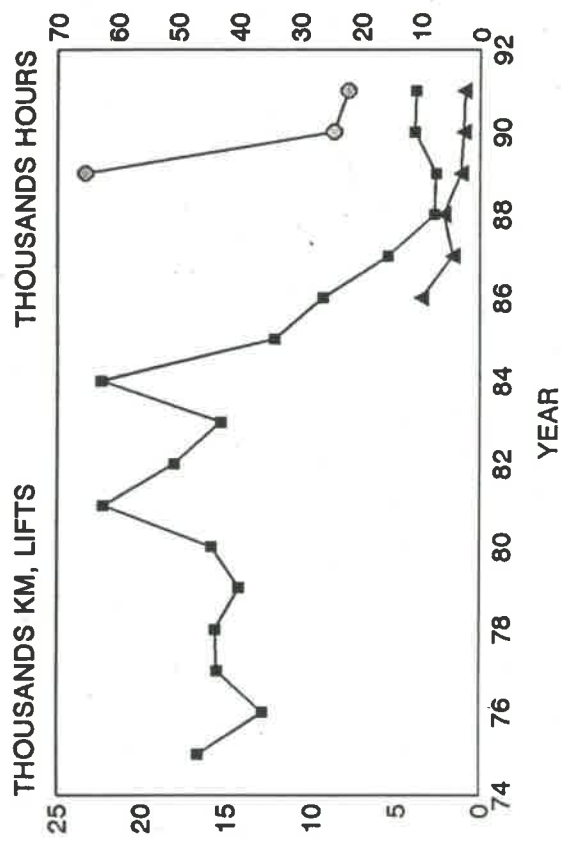
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MANAGEMENT UNIT 2 EFFORT



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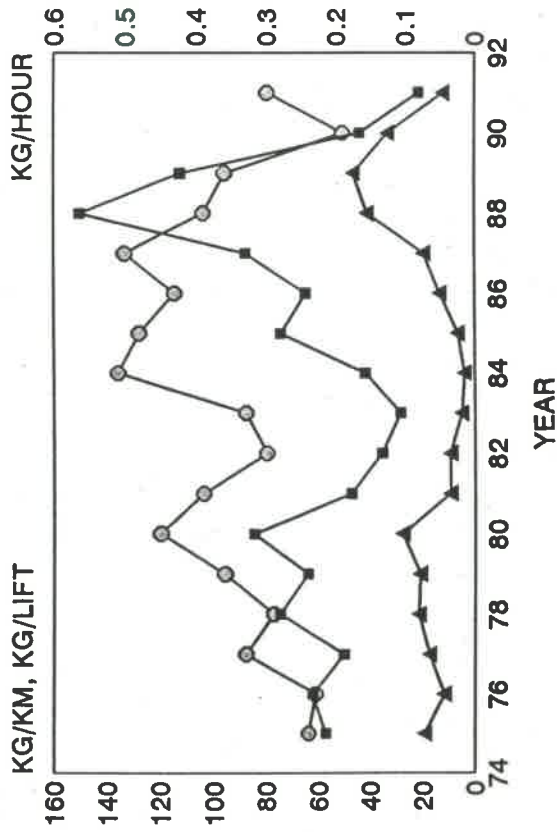
MANAGEMENT UNIT 4 EFFORT



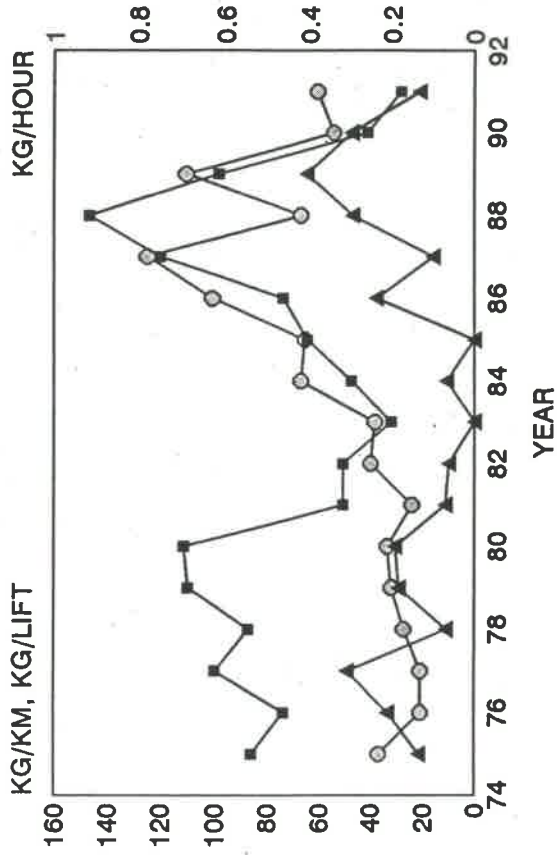
■ GILLNET ▲ TRAPNET ◆ SPORT

Figure 3

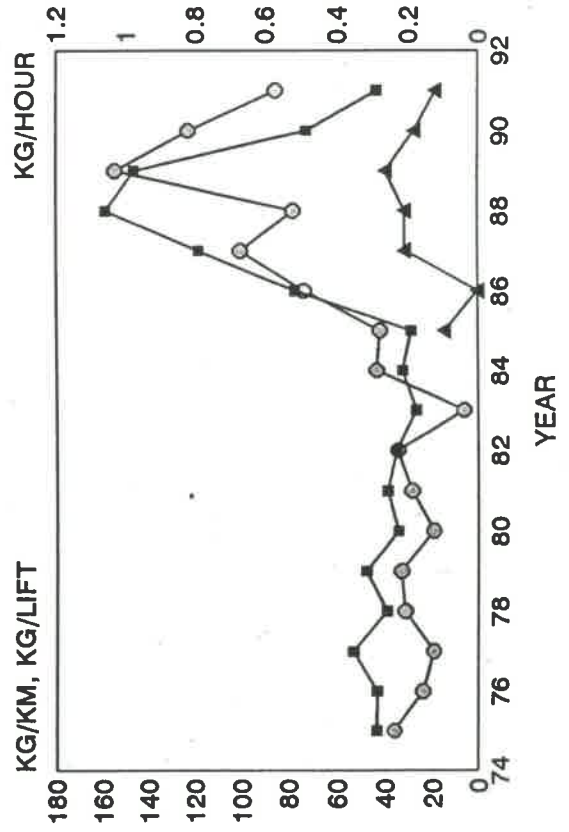
MANAGEMENT UNIT 1 CUE



MANAGEMENT UNIT 2 CUE



MANAGEMENT UNIT 3 CUE



MANAGEMENT UNIT 4 CUE

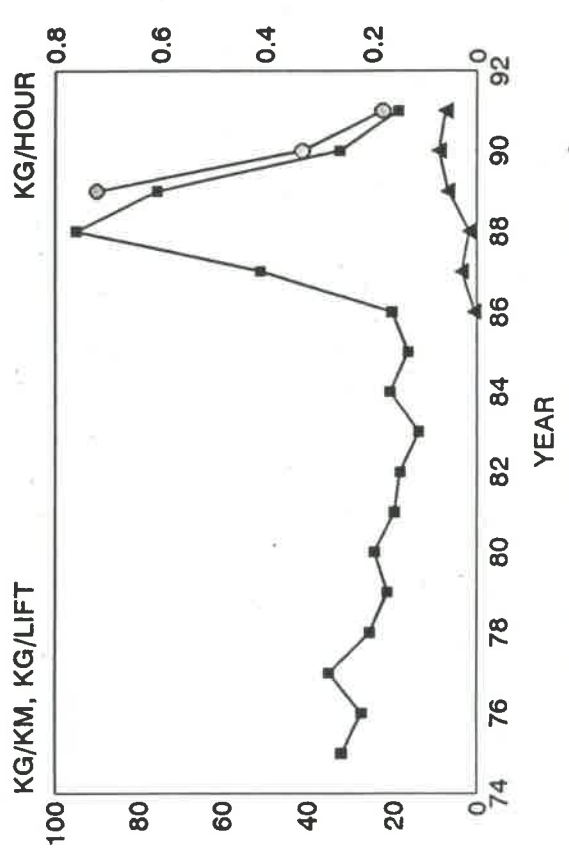
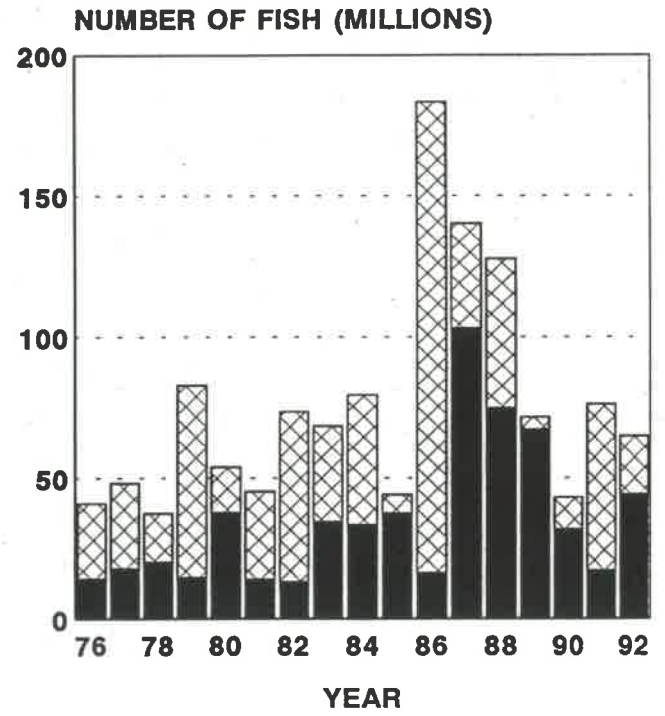
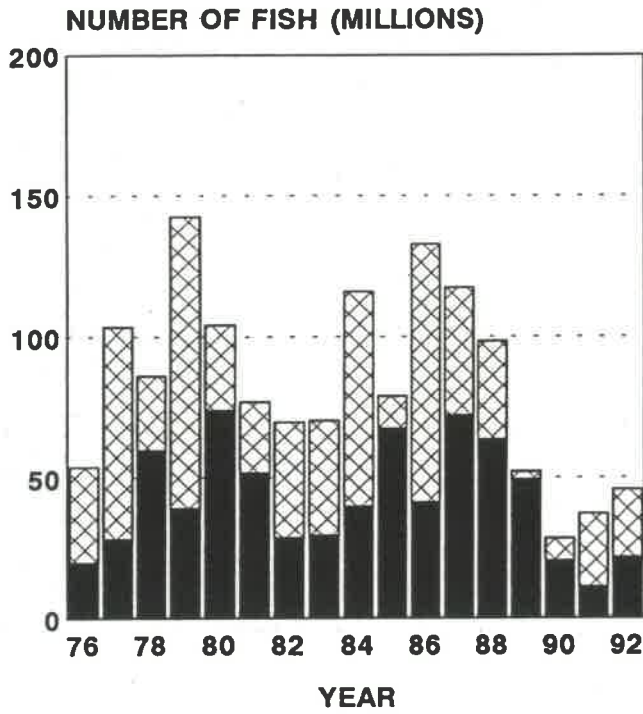


Figure 4

**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 1**

**YELLOW PERCH POPULATION ESTIMATE
MANAGEMENT UNIT 2**



**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 3**

**YELLOW PERCH POPULATION ESTIMATE
MANAGEMENT UNIT 4**

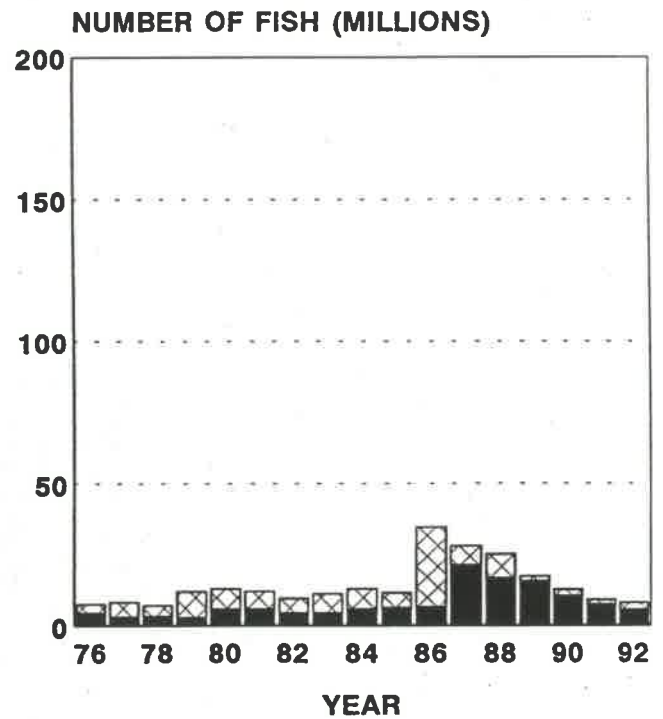
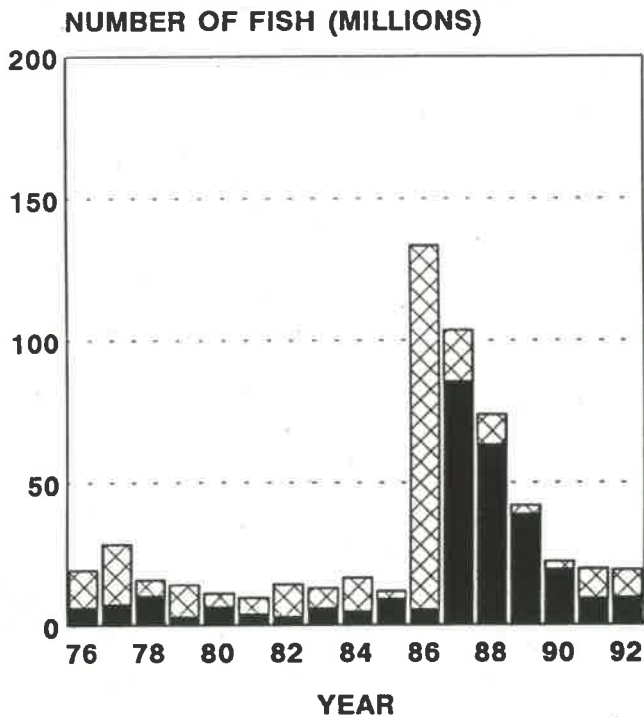
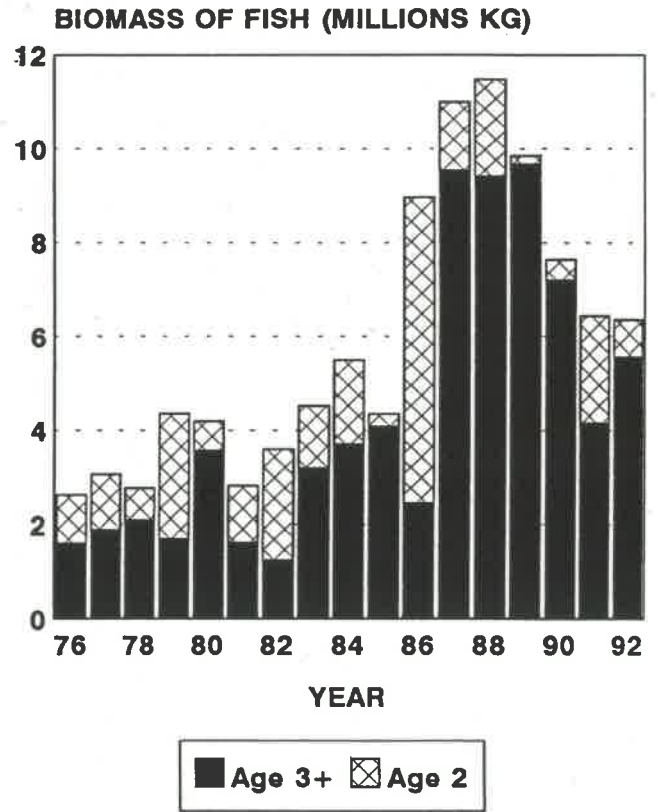
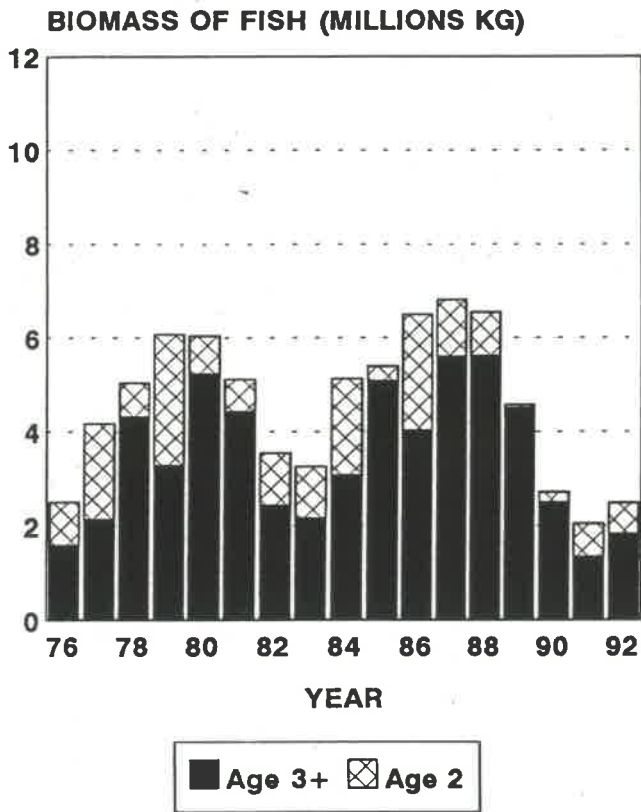


Figure 6

**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 1**

**YELLOW PERCH POPULATION ESTIMATE
MANAGEMENT UNIT 2**



**YELLOW PERCH POPULATION ESTIMATES
MANAGEMENT UNIT 3**

**YELLOW PERCH POPULATION ESTIMATE
MANAGEMENT UNIT 4**

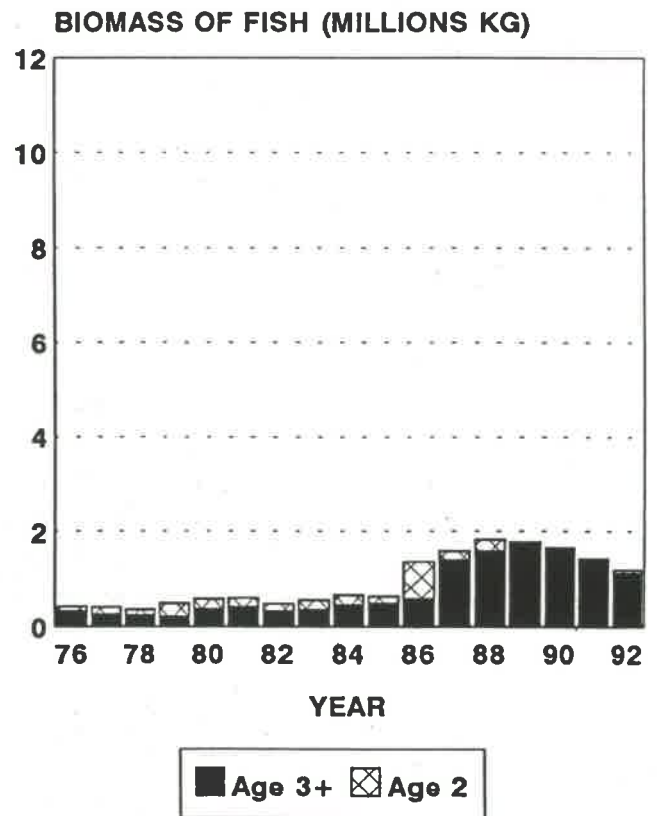
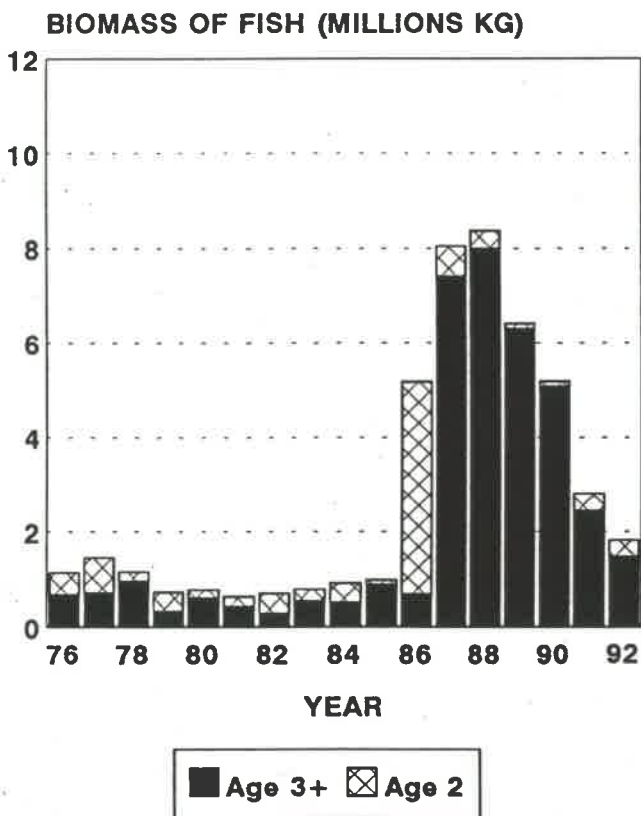
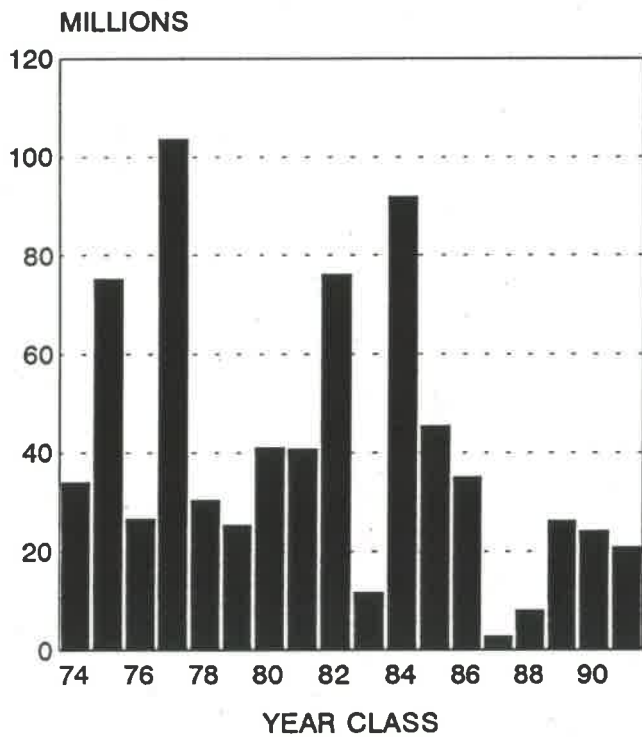


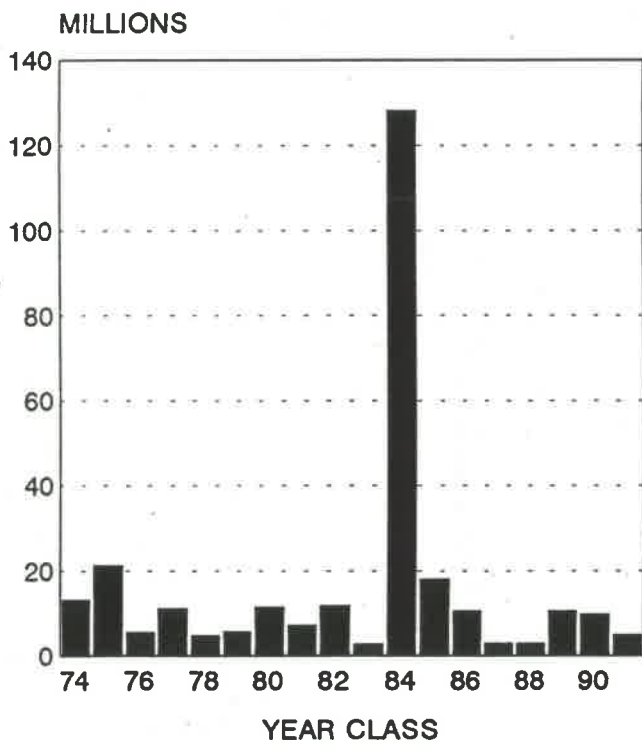
Figure 7

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



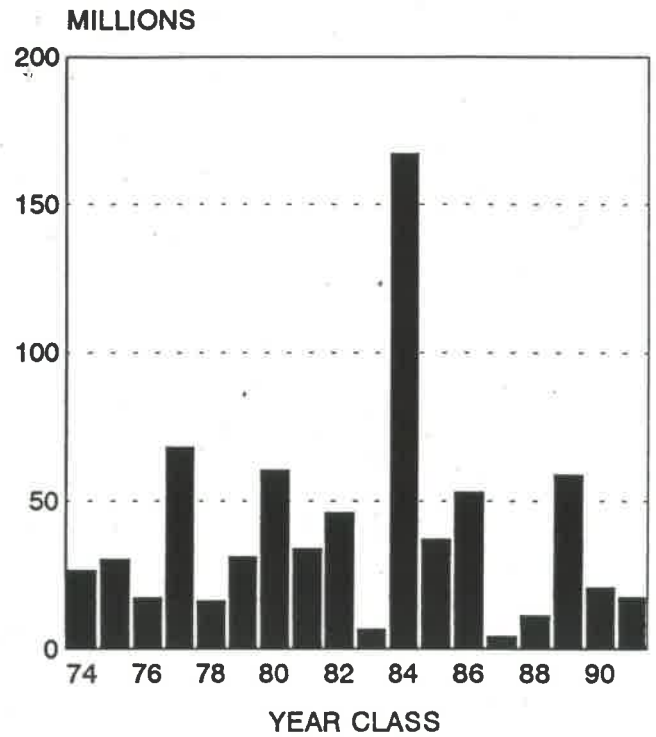
1990, 1991 FROM REGRESSIONS
1989 VALUE HAS BEEN SCALED

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



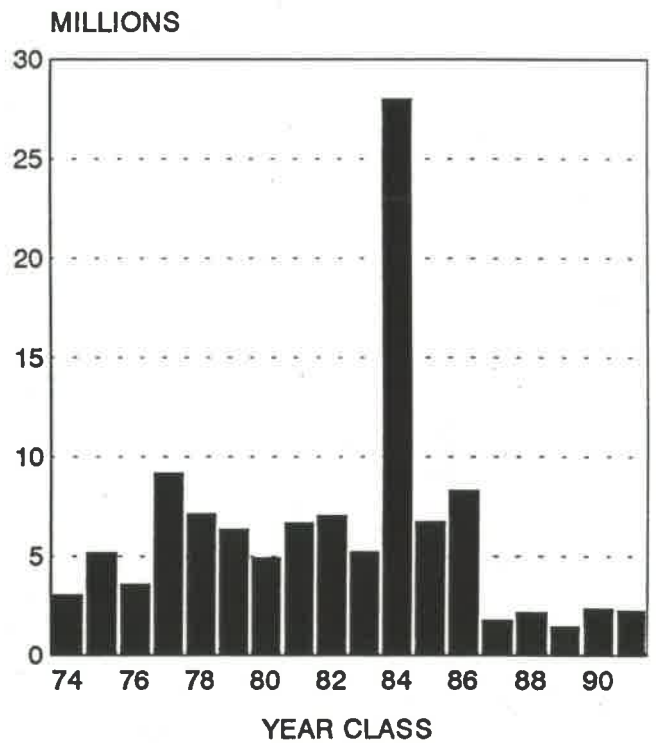
1990, 1991 FROM REGRESSIONS
1989 VALUE HAS BEEN SCALED

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



1990, 1991 FROM REGRESSIONS
1989 VALUE HAS BEEN SCALED

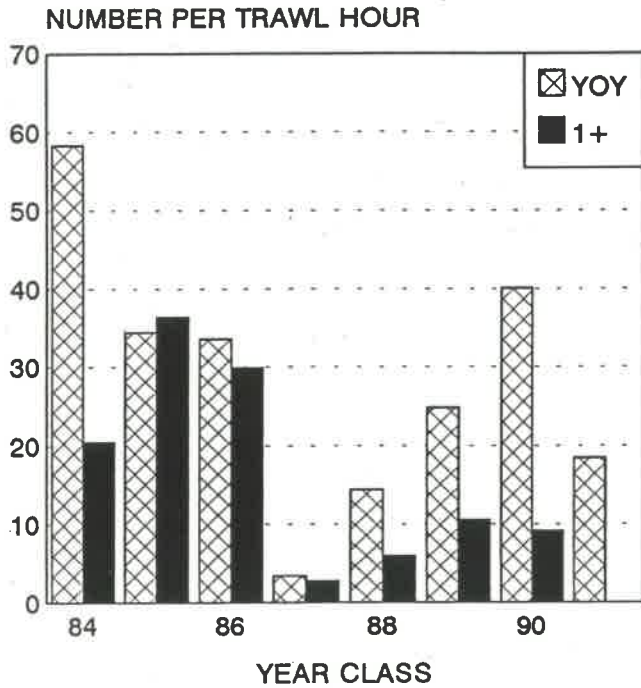
**CAGEAN AGE 2 POPULATION ESTIMATES
MANAGEMENT UNIT 4**



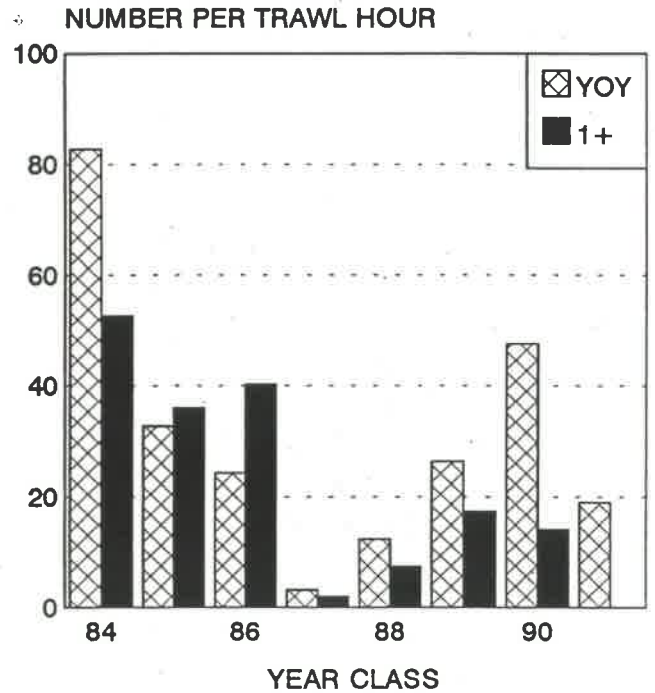
1990, 1991 FROM REGRESSIONS
1989 VALUE HAS BEEN SCALED

Figure 8

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



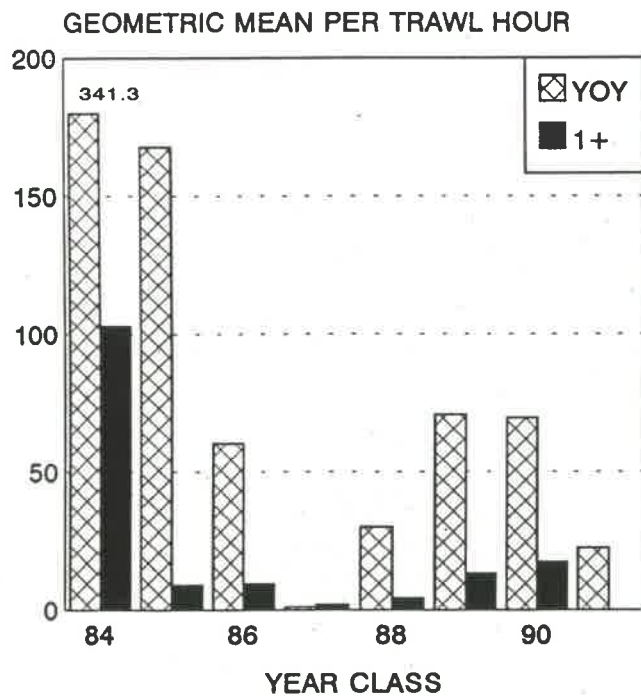
**YOY AND 1+ YELLOW PERCH
INTERAGENCY INDEX TRAWL VALUES
MANAGEMENT UNIT 2**



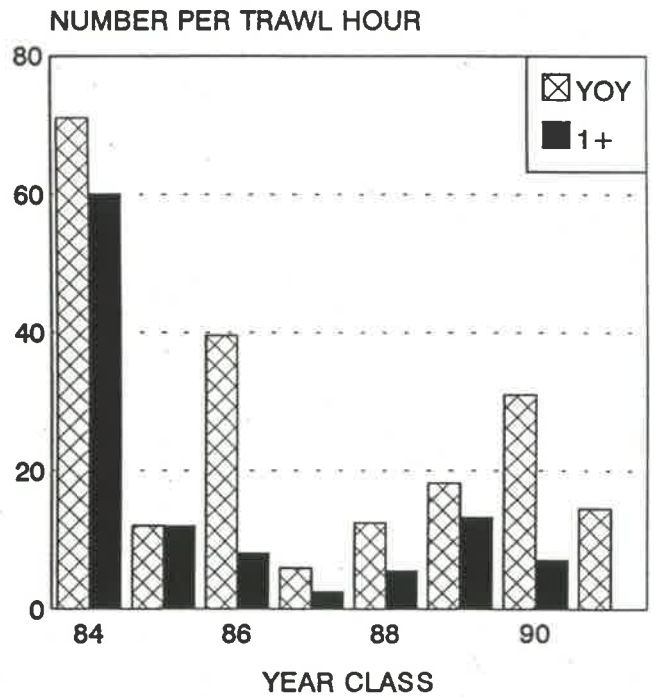
COMBINED INDEX TRAWL VALUES WEIGHTED BY R-SQUARED
GEOMETRIC MEAN

COMBINED INTERAGENCY TRAWL VALUES WEIGHTED BY R-SQUARED
GEOMETRIC MEAN

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



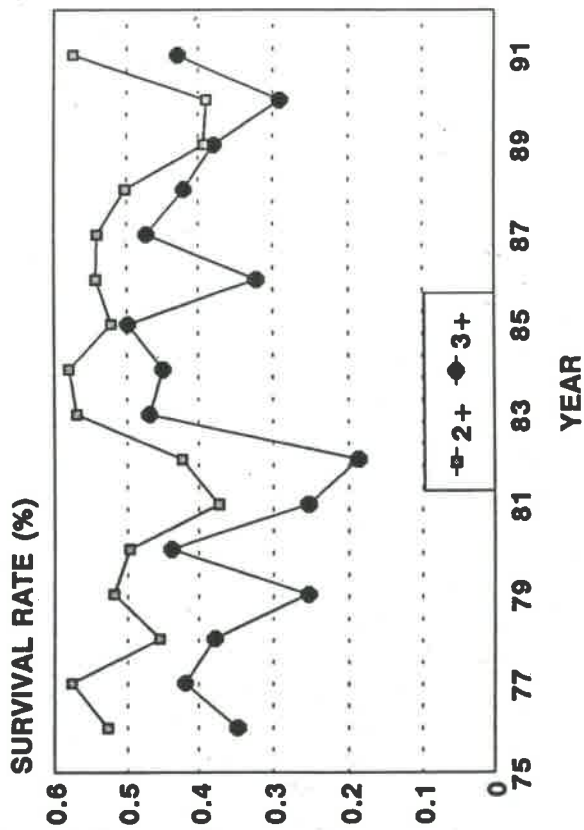
**YOY AND 1+ YELLOW PERCH
INTERAGENCY INDEX TRAWL VALUES
MANAGEMENT UNIT 4**



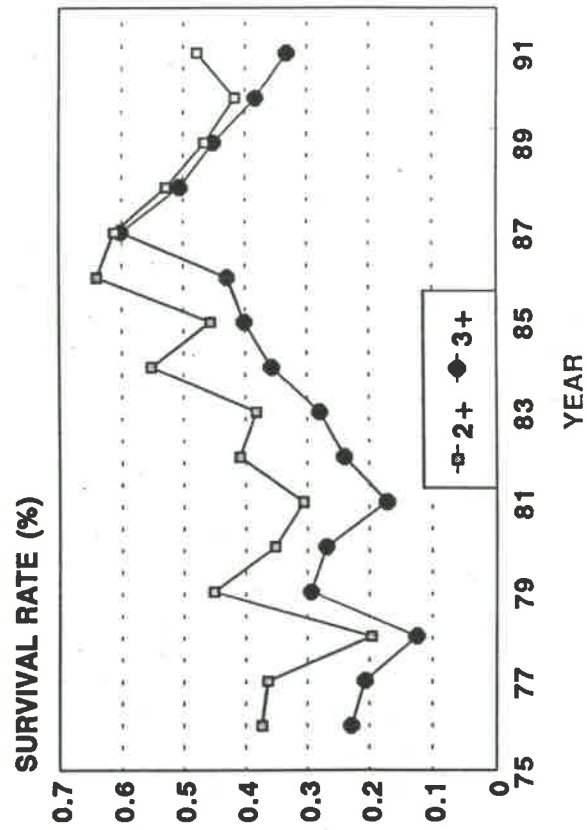
COMBINED INDEX TRAWL VALUES WEIGHTED BY R-SQUARED
GEOMETRIC MEAN

COMBINED INDEX TRAWL VALUES WEIGHTED BY R-SQUARED
GEOMETRIC MEAN

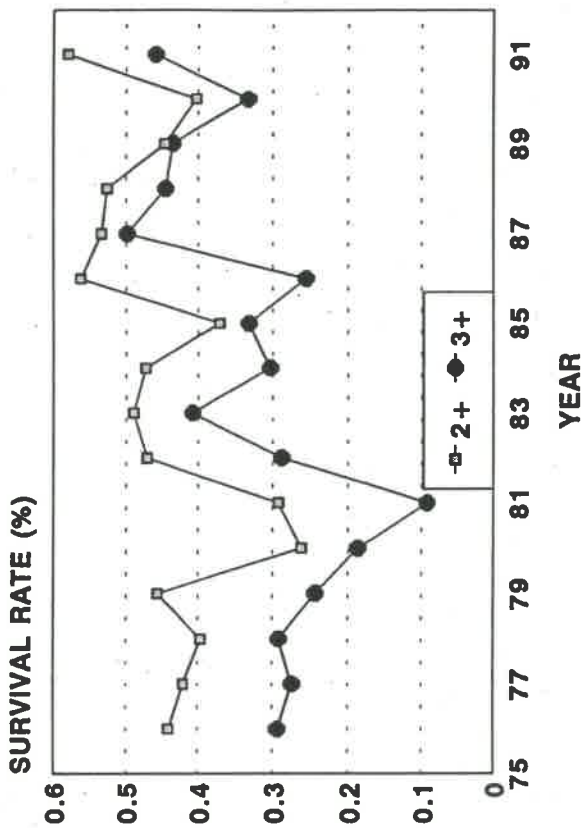
YELLOW PERCH SURVIVAL RATES MANAGEMENT UNIT 1



YELLOW PERCH SURVIVAL RATES MANAGEMENT UNIT 3



YELLOW PERCH SURVIVAL RATES MANAGEMENT UNIT 2



YELLOW PERCH SURVIVAL RATES MANAGEMENT UNIT 4

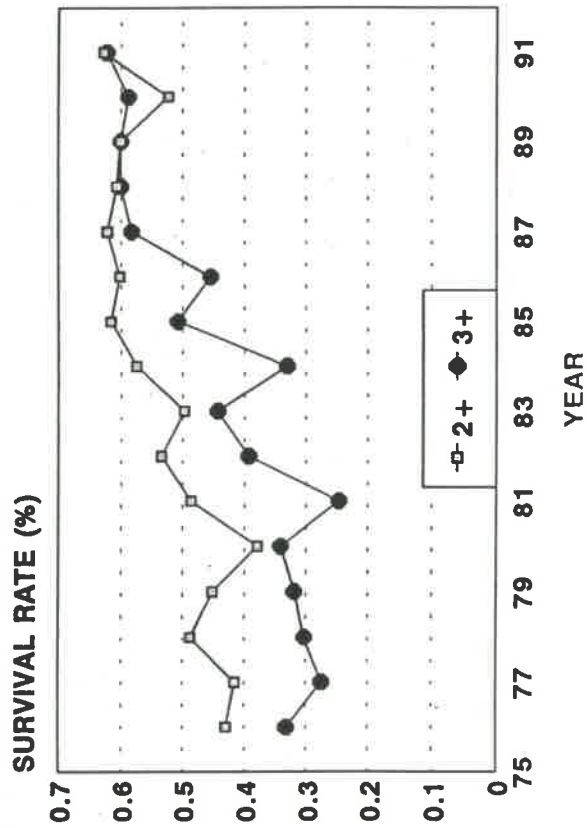
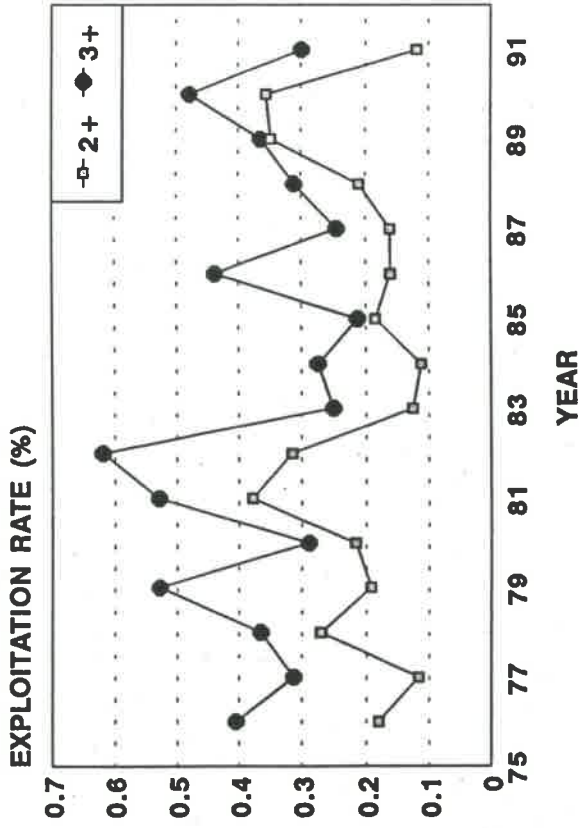
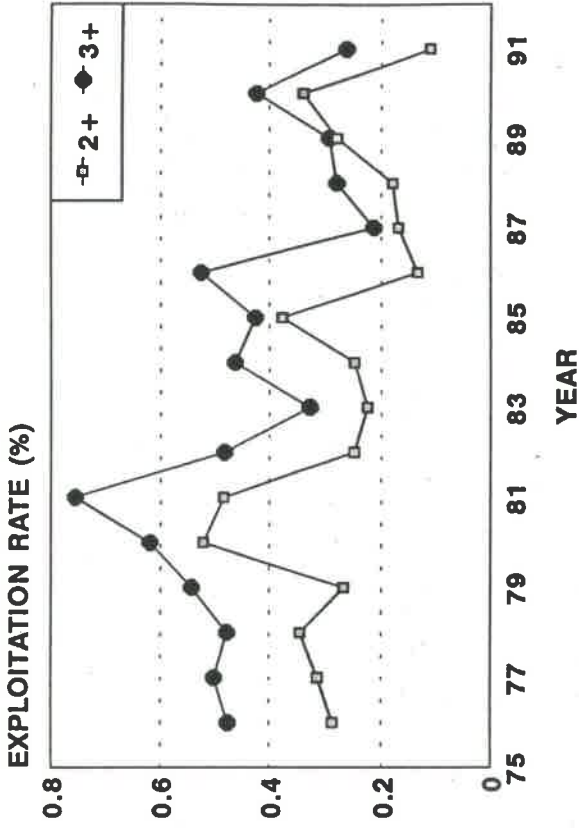


Figure 9

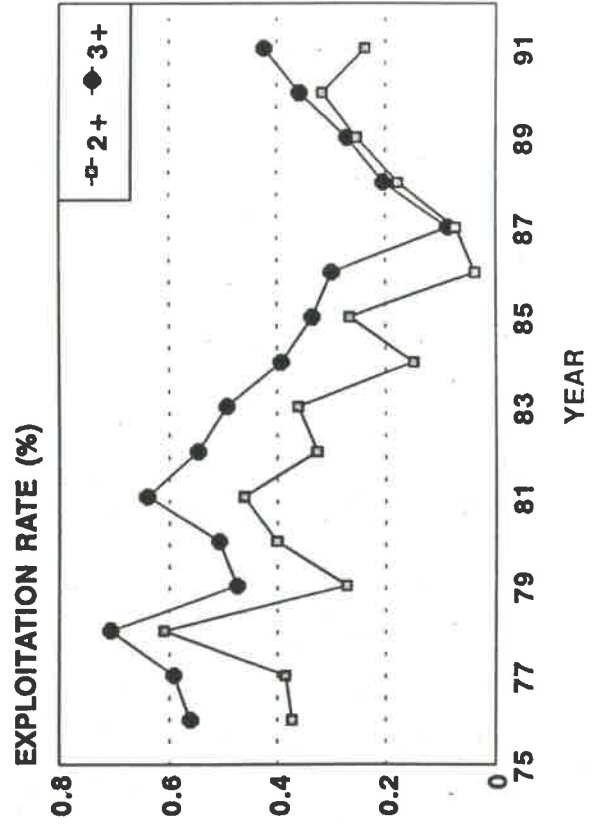
**YELLOW PERCH EXPLOITATION RATES
MANAGEMENT UNIT 1**



**YELLOW PERCH EXPLOITATION RATES
MANAGEMENT UNIT 2**



**YELLOW PERCH EXPLOITATION RATES
MANAGEMENT UNIT 3**



**YELLOW PERCH EXPLOITATION RATES
MANAGEMENT UNIT 4**

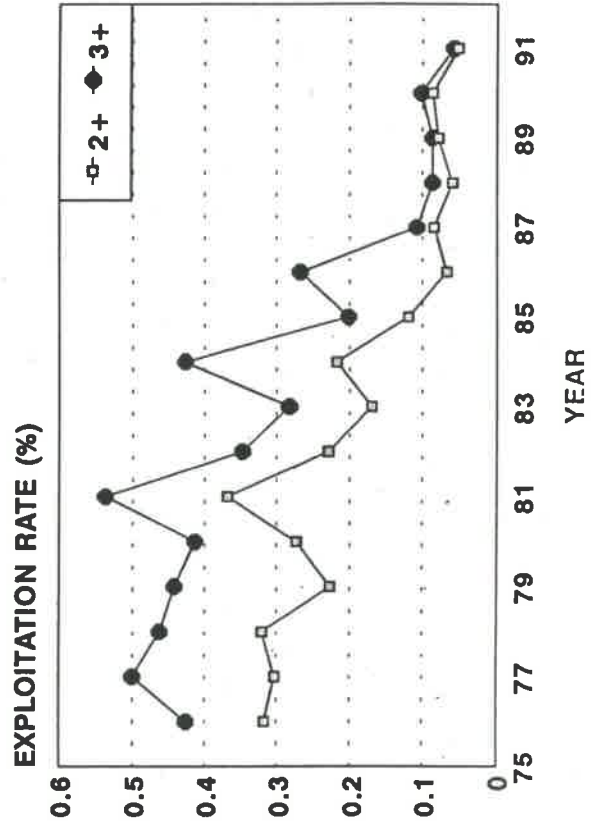
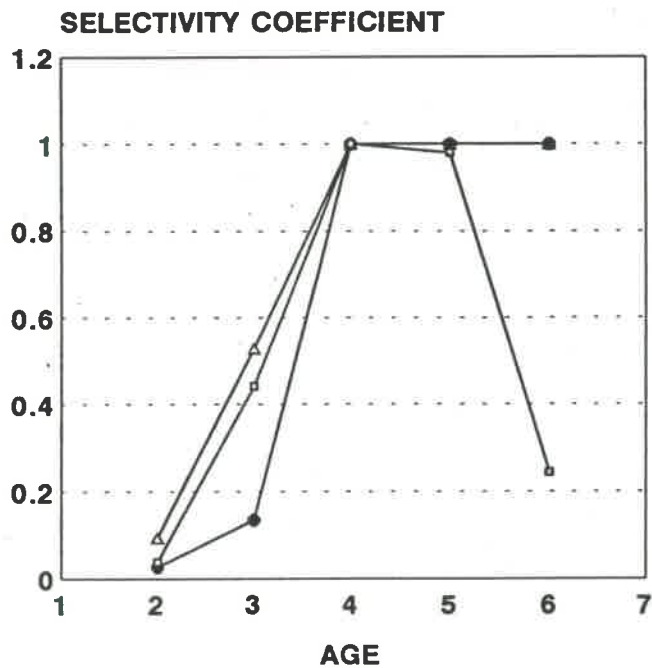


Figure 10

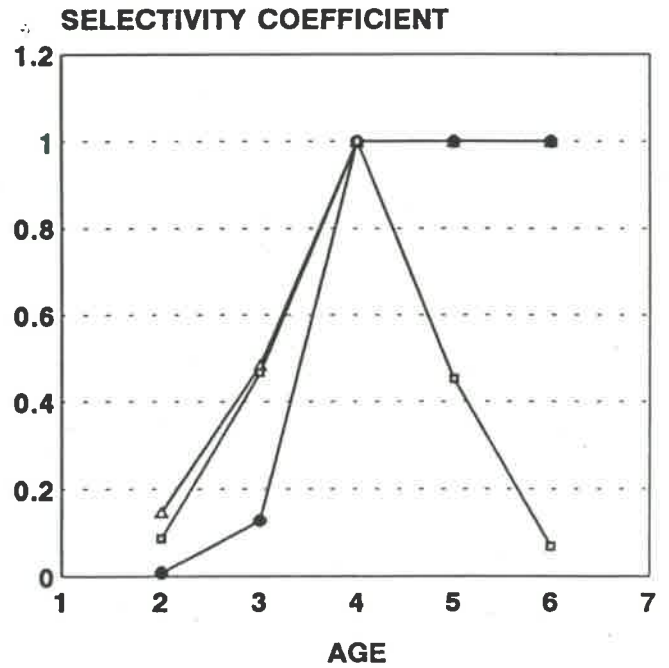
Figure 11

MANAGEMENT UNIT 1 SELECTIVITY COEFFICIENTS BY GEAR



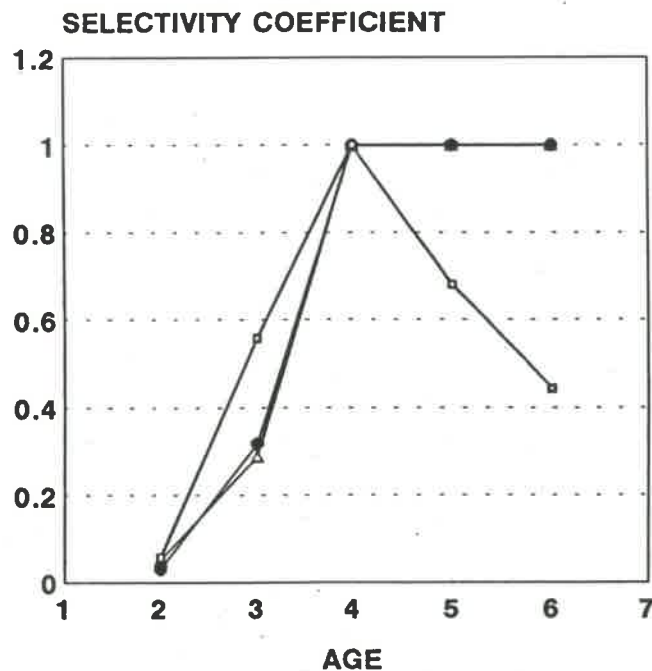
□ GILLNET ● TRAPNET ▲ ANGLING

MANAGEMENT UNIT 2 SELECTIVITY COEFFICIENTS BY GEAR



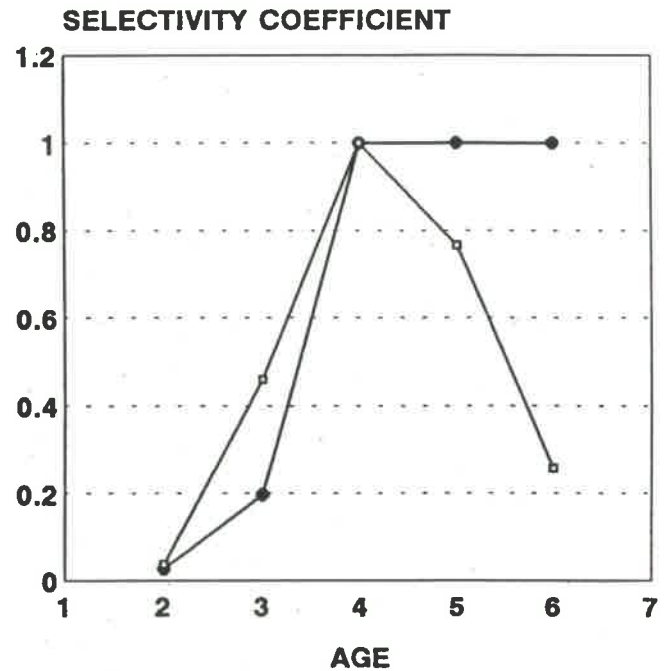
□ GILLNET ● TRAPNET ▲ ANGLING

MANAGEMENT UNIT 3 SELECTIVITY COEFFICIENTS BY GEAR



□ GILLNET ● TRAPNET ▲ ANGLING

MANAGEMENT UNIT 4 SELECTIVITY COEFFICIENTS BY GEAR



□ GILLNET ● TRAPNET

Appendix A. Projection of the 1992 Lake Erie yellow perch population size. Stock size estimates in 1992 are derived from CAGEAN and index trawling regressions. Stock size in numbers is in millions of fish.

		1991 PARAMETERS										1992 PARAMETERS										BIOMASS	
UNIT	AGE	STOCK SIZE (NUMBERS)					MORTALITY RATES					SURV RATE (S)	STOCK SIZE (NUMBERS)					POP. WEIGHT (kg)	MILLIONS OF KGS				
		MEAN	SE	MIN	MAX	(F)	(Z)	(A)	(u)	MEAN	MIN		MAX	1991	1992								
1	2	54.001	13.284	40.717	67.285	0.037	0.437	0.354	0.030	0.646	0.646	18.411	31.603	0.027	1.458	0.651							
	3	5.117	1.259	3.858	6.376	0.303	0.703	0.505	0.218	0.495	0.495	26.302	43.464	0.065	0.333	2.267							
	4	0.764	0.188	0.576	0.952	0.735	1.135	0.679	0.439	0.321	0.321	1.910	3.157	0.092	0.070	0.233							
	5	2.571	0.632	1.939	3.203	0.727	1.127	0.676	0.436	0.324	0.324	0.185	0.306	0.119	0.306	0.029							
	6	2.633	0.648	1.985	3.281	0.427	0.827	0.563	0.291	0.437	0.437	1.496	2.473	0.241	0.635	0.478							
	TOTAL (3+)		65.086	16.011	49.075	81.097	0.096	0.496	0.3909	0.0755	0.6091	0.6091	48.305	81.003		2.801	3.659						
2	2	78.468	23.305	55.163	101.773	0.087	0.487	0.386	0.069	0.614	0.614	15.599	27.382	0.039	3.060	0.806							
	3	6.730	1.999	4.731	8.729	0.454	0.854	0.574	0.305	0.426	0.426	33.896	62.536	0.086	0.579	4.147							
	4	1.003	0.298	0.705	1.301	1.023	1.423	0.759	0.546	0.241	0.241	2.014	3.716	0.135	0.135	0.387							
	5	2.989	0.888	2.101	3.877	0.533	0.933	0.607	0.347	0.393	0.393	0.170	0.314	0.233	0.696	0.056							
	6	6.655	1.977	4.678	8.632	0.189	0.589	0.445	0.143	0.555	0.555	3.423	6.314	0.411	2.735	2.001							
	TOTAL (3+)		95.845	28.466	67.379	124.311	0.134	0.534	0.4137	0.1038	0.5863	0.5863	55.101	100.262		7.206	7.397						
3	2	19.571	12.310	7.261	31.881	0.070	0.470	0.375	0.056	0.625	0.625	6.434	14.769	0.035	0.685	0.341							
	3	1.861	1.171	0.690	3.032	0.672	1.072	0.658	0.412	0.342	0.342	4.538	19.926	0.084	0.156	1.027							
	4	0.817	0.514	0.303	1.331	1.255	1.655	0.809	0.613	0.191	0.191	0.236	1.038	0.132	0.108	0.084							
	5	1.006	0.633	0.373	1.639	0.889	1.289	0.724	0.500	0.276	0.276	0.058	0.254	0.187	0.188	0.029							
	6	5.666	3.564	2.102	9.230	0.619	1.019	0.639	0.388	0.361	0.361	0.862	3.783	0.351	1.989	0.815							
	TOTAL (3+)		28.921	18.191	10.730	47.112	0.234	0.634	0.4693	0.1730	0.5307	0.5307	12.128	39.770		3.126	2.297						
4	2	2.687	1.112	1.575	3.799	0.006	0.406	0.334	0.005	0.666	0.666	1.630	3.364	0.028	0.075	0.066							
	3	1.418	0.587	0.831	2.005	0.077	0.477	0.379	0.061	0.621	0.621	1.790	2.532	0.054	0.077	0.097							
	4	0.715	0.296	0.419	1.011	0.170	0.570	0.434	0.130	0.566	0.566	0.880	1.244	0.096	0.069	0.084							
	5	1.836	0.760	1.076	2.596	0.132	0.532	0.413	0.102	0.587	0.587	0.404	0.572	0.141	0.259	0.057							
	6	3.675	1.521	2.154	5.196	0.026	0.426	0.347	0.021	0.653	0.653	3.479	4.919	0.267	0.981	0.929							
	TOTAL (3+)		10.331	4.277	6.054	14.608	0.055	0.455	0.3656	0.0443	0.6344	0.6344	8.896	12.631		1.461	1.233						
TOTAL (3+)		7.644	3.165	4.479	10.809	0.073	0.473	0.3769	0.0582	0.6231	0.6231	6.554	9.267		1.385	1.167							

Appendix B. Estimated harvest of Lake Erie yellow perch for 1992. The exploitation rate is derived from optimal yield policy and the stock size estimates are from CAGEAN (unadjusted). Stock size and catch in numbers is in millions of fish. Catch in weight is in millions of kilograms.

UNIT	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	u	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	2	24.122	18.411	31.603	0.000	0.050	0.030	0.024	0.590	0.450	0.773	0.091	0.054	0.041	0.070	0.070	0.070
	3	34.883	26.302	43.464	0.453	0.412	0.246	0.181	6.328	4.772	7.885	0.108	0.683	0.515	0.852	0.852	0.852
	4	2.533	1.910	3.157	0.453	1.000	0.597	0.378	0.958	0.722	1.193	0.126	0.121	0.091	0.150	0.150	0.150
	5	0.246	0.185	0.306	0.453	0.989	0.591	0.375	0.092	0.069	0.115	0.146	0.010	0.010	0.017	0.017	0.017
	6	1.985	1.496	2.473	0.453	0.581	0.347	0.245	0.485	0.366	0.605	0.185	0.090	0.068	0.112	0.112	0.112
	TOTAL (3+)	63.769	48.305	81.003	1.812	3.033	0.161	0.133	8.453	6.379	10.571	0.114	0.961	0.725	1.201	1.201	1.201
2	2	20.668	15.599	27.382	0.000	0.085	0.073	0.058	1.196	0.903	1.585	0.109	0.130	0.098	0.173	0.173	0.173
	3	48.216	33.896	62.536	0.477	0.444	0.379	0.263	12.692	8.922	16.462	0.121	1.536	1.080	1.992	1.992	1.992
	4	2.865	2.014	3.716	0.477	1.000	0.854	0.487	1.394	0.980	1.808	0.139	0.194	0.136	0.251	0.251	0.251
	5	0.242	0.170	0.314	0.477	0.521	0.445	0.300	0.073	0.051	0.094	0.173	0.013	0.009	0.016	0.016	0.016
	6	4.869	3.423	6.314	0.477	0.185	0.158	0.121	0.589	0.414	0.763	0.212	0.125	0.088	0.162	0.162	0.162
	TOTAL (3+)	76.859	55.101	100.262	1.908	2.235	0.252	0.207	15.943	11.270	20.712	0.125	1.997	1.411	2.594	2.594	2.594
3	2	9.748	6.434	14.769	0.000	0.056	0.042	0.034	0.329	0.217	0.499	0.112	0.037	0.024	0.056	0.056	0.056
	3	12.232	4.538	19.926	0.523	0.535	0.401	0.276	3.375	1.252	5.499	0.122	0.412	0.153	0.671	0.671	0.671
	4	0.637	0.236	1.038	0.523	1.000	0.749	0.445	0.284	0.105	0.462	0.146	0.041	0.015	0.067	0.067	0.067
	5	0.156	0.058	0.254	0.523	0.708	0.531	0.345	0.054	0.020	0.088	0.174	0.009	0.003	0.015	0.015	0.015
	6	2.322	0.862	3.783	0.523	0.493	0.369	0.258	0.599	0.222	0.975	0.210	0.126	0.047	0.205	0.205	0.205
	TOTAL (3+)	25.095	12.128	39.770	2.092	2.793	0.224	0.185	4.641	1.817	7.522	0.135	0.625	0.243	1.014	1.014	1.014
4	2	2.342	1.630	3.364	0.000	0.035	0.023	0.019	0.044	0.031	0.064	0.105	0.003	0.002	0.005	0.005	0.005
	3	1.790	1.049	2.532	0.398	0.453	0.298	0.215	0.384	0.225	0.543	0.106	0.007	0.004	0.009	0.009	0.009
	4	0.880	0.516	1.244	0.398	1.000	0.658	0.406	0.358	0.210	0.506	0.120	0.009	0.005	0.012	0.012	0.012
	5	0.404	0.237	0.572	0.398	0.776	0.511	0.336	0.136	0.080	0.192	0.137	0.003	0.002	0.004	0.004	0.004
	6	3.479	2.039	4.919	0.398	0.153	0.101	0.079	0.276	0.162	0.390	0.150	0.007	0.004	0.009	0.009	0.009
	TOTAL (3+)	8.896	5.470	12.631	1.592	2.418	0.163	0.135	1.198	0.707	1.694	0.122	0.028	0.018	0.038	0.038	0.038
		6.554	3.840	9.267	1.592		0.255	0.176	1.153	0.676	1.631	0.124	0.025	0.016	0.034	0.034	0.034

Appendix C. Estimated harvest of Lake Erie yellow perch for 1992. The exploitation rate use is equal to the effort in 1991 and the stock size estimates are derived from adjusted CAGEAN outputs. Stock size and catch in numbers is in millions of fish. Catch in weight is in millions of kilograms.

UNIT	AGE	STOCK SIZE (NUMBERS)			EXPLOITATION RATE			CATCH (Millions of Fish)			HARVEST WEIGHT (kg)			CATCH (Millions of kg)		
		MEAN	MIN	MAX	F(max)	s(age)	F	u	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN
1	2	24.122	18.411	31.603	0.735	0.050	0.037	0.030	0.723	0.552	0.947	0.091	0.050	0.066	0.050	0.086
	3	16.844	12.700	20.987	0.735	0.412	0.303	0.218	3.665	2.764	4.567	0.108	0.298	0.396	0.298	0.493
	4	2.533	1.910	3.157	0.735	1.000	0.735	0.439	1.113	0.839	1.387	0.126	0.106	0.140	0.106	0.175
	5	0.246	0.185	0.306	0.735	0.989	0.727	0.436	0.107	0.081	0.133	0.146	0.012	0.016	0.012	0.019
	6	1.985	1.496	2.473	0.735	0.581	0.427	0.291	0.577	0.435	0.718	0.185	0.080	0.107	0.080	0.133
	TOTAL (3+)	45.729	34.703	58.526			0.226	0.135	6.185	4.670	7.753	0.117	0.547	0.724	0.547	0.907
2	2	20.668	15.599	27.382	1.023	0.085	0.087	0.069	1.423	1.074	1.886	0.109	0.117	0.155	0.117	0.206
	3	36.089	25.370	46.807	1.023	0.444	0.454	0.305	11.016	7.744	14.288	0.121	0.937	1.333	0.937	1.729
	4	2.865	2.014	3.716	1.023	1.000	1.023	0.546	1.563	1.099	2.027	0.139	0.153	0.217	0.153	0.282
	5	0.242	0.170	0.314	1.023	0.521	0.533	0.346	0.084	0.059	0.109	0.173	0.010	0.014	0.010	0.019
	6	4.869	3.423	6.314	1.023	0.185	0.189	0.143	0.695	0.489	0.902	0.212	0.104	0.147	0.104	0.191
	TOTAL (3+)	64.732	46.576	84.533			0.428	0.228	14.782	10.465	19.211	0.126	1.321	1.867	1.321	2.426
3	2	9.748	6.434	14.769	1.255	0.056	0.070	0.056	0.544	0.359	0.825	0.112	0.040	0.061	0.040	0.092
	3	6.543	2.427	10.658	1.255	0.555	0.672	0.412	2.697	1.001	4.393	0.122	0.122	0.329	0.122	0.536
	4	0.637	0.236	1.038	1.255	1.000	1.255	0.613	0.391	0.145	0.637	0.146	0.021	0.057	0.021	0.093
	5	0.156	0.058	0.254	1.255	0.708	0.899	0.500	0.078	0.029	0.127	0.174	0.005	0.014	0.005	0.022
	6	2.322	0.862	3.783	1.255	0.493	0.619	0.388	0.901	0.334	1.468	0.210	0.070	0.189	0.070	0.308
	TOTAL (3+)	19.406	10.017	30.502			0.486	0.238	4.612	1.868	7.450	0.141	0.259	0.650	0.259	1.052
4	2	2.342	1.630	3.364	0.170	0.038	0.006	0.005	0.012	0.009	0.018	0.105	0.001	0.001	0.001	0.002
	3	0.960	0.563	1.358	0.170	0.452	0.077	0.061	0.059	0.034	0.083	0.106	0.004	0.006	0.004	0.009
	4	0.880	0.516	1.245	0.170	1.000	0.170	0.130	0.114	0.067	0.162	0.120	0.008	0.014	0.008	0.019
	5	0.404	0.237	0.571	0.170	0.773	0.132	0.102	0.041	0.024	0.058	0.137	0.003	0.006	0.003	0.008
	6	3.479	2.039	4.920	0.170	0.153	0.026	0.021	0.074	0.043	0.104	0.150	0.006	0.011	0.006	0.016
	TOTAL (3+)	8.066	4.984	11.458			0.049	0.037	0.300	0.177	0.425	0.126	0.022	0.038	0.022	0.054
		5.724	3.354	8.094			0.066	0.050	0.288	0.169	0.407	0.127	0.037	0.037	0.021	0.052

Appendix D. Estimated harvest of Lake Erie yellow perch for 1991 using current information. The exploitation rate is derived from optimal yield policy and the stock size estimates are from adjusted CAGEAN outputs. Stock size and catch in numbers is in millions of fish. Catch in weight is in millions of kilograms.

UNIT	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	u	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX
1	2	26.075	19.661	32.489	0.000	0.050	0.030	0.024	0.637	0.481	0.794	0.091	0.044	0.058	0.044	0.072	0.072
	3	5.117	3.858	6.376	0.453	0.412	0.246	0.181	0.928	0.700	1.157	0.108	0.076	0.100	0.076	0.125	0.125
	4	0.764	0.576	0.952	0.453	1.000	0.597	0.378	0.289	0.218	0.360	0.126	0.027	0.036	0.027	0.045	0.045
	5	2.571	1.939	3.203	0.453	0.989	0.591	0.375	0.964	0.727	1.201	0.146	0.106	0.141	0.106	0.175	0.175
	6	2.633	1.985	3.281	0.453	0.581	0.347	0.245	0.644	0.485	0.802	0.185	0.090	0.119	0.090	0.148	0.148
	TOTAL (3+)	37.160	28.019	46.301	1.812	3.033	0.113	0.093	3.462	2.611	4.314	0.131	0.343	0.455	0.343	0.566	0.566
2	2	58.732	41.289	76.175	0.000	0.085	0.073	0.058	3.399	2.389	4.408	0.109	0.260	0.370	0.260	0.480	0.480
	3	6.730	4.731	8.729	0.477	0.444	0.379	0.263	1.772	1.245	2.298	0.121	0.151	0.214	0.151	0.278	0.278
	4	1.003	0.705	1.301	0.477	1.000	0.854	0.487	0.488	0.343	0.633	0.139	0.048	0.068	0.048	0.088	0.088
	5	2.989	2.101	3.877	0.477	0.521	0.445	0.300	0.898	0.631	1.164	0.173	0.109	0.155	0.109	0.201	0.201
	6	6.655	4.678	8.632	0.477	0.165	0.158	0.121	0.805	0.566	1.044	0.212	0.120	0.171	0.120	0.221	0.221
	TOTAL (3+)	76.109	53.505	98.713	1.908	2.235	0.117	0.097	7.361	5.175	9.547	0.133	0.688	0.979	0.688	1.269	1.269
3	2	10.468	3.884	17.052	0.000	0.056	0.042	0.034	0.354	0.131	0.576	0.112	0.015	0.040	0.015	0.065	0.065
	3	1.861	0.690	3.032	0.523	0.535	0.401	0.276	0.514	0.191	0.837	0.122	0.023	0.063	0.023	0.102	0.102
	4	0.817	0.303	1.331	0.523	1.000	0.749	0.445	0.364	0.135	0.593	0.146	0.020	0.053	0.020	0.087	0.087
	5	1.006	0.373	1.639	0.523	0.708	0.531	0.345	0.347	0.129	0.566	0.174	0.022	0.060	0.022	0.098	0.098
	6	5.666	2.102	9.230	0.523	0.493	0.369	0.258	1.460	0.542	2.379	0.210	0.114	0.307	0.114	0.500	0.500
	TOTAL (3+)	19.818	7.352	32.284	2.092	2.793	0.166	0.153	3.039	1.127	4.950	0.172	0.194	0.522	0.194	0.851	0.851
4	2	1.442	0.845	2.039	0.000	0.038	0.025	0.020	0.029	0.017	0.041	0.105	0.002	0.003	0.002	0.004	0.004
	3	1.418	0.831	2.005	0.398	0.452	0.298	0.214	0.304	0.178	0.430	0.106	0.019	0.032	0.019	0.046	0.046
	4	0.715	0.419	1.011	0.398	1.000	0.659	0.407	0.291	0.170	0.411	0.120	0.020	0.035	0.020	0.049	0.049
	5	1.836	1.076	2.597	0.398	0.773	0.510	0.335	0.614	0.360	0.869	0.137	0.049	0.084	0.049	0.119	0.119
	6	3.675	2.154	5.197	0.398	0.153	0.101	0.079	0.291	0.170	0.411	0.150	0.026	0.044	0.026	0.062	0.062
	TOTAL (3+)	9.087	5.325	12.848	1.592	2.415	0.204	0.168	1.529	0.896	2.162	0.129	0.116	0.198	0.116	0.280	0.280
		7.645	4.480	10.809	1.592		0.285	0.196	1.500	0.879	2.121	0.130	0.114	0.195	0.114	0.276	0.276