Report of the

LAKE ERIE YELLOW PERCH TASK GROUP

March 1992

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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 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 that 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. $Abundance_{1989}$ (millions of fish) = $Abundance_{1988}$ X ($Index_{1989}$ / $Index_{1988}$). 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 Berntanlanffy 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 Catch	(%)	Ohio Catch	(%)	Michigan Catch	(%)	Pennsylvania Catch	(%)	New York Catch	(%)	TOTAL
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

[a]Catch 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).