Report of the

LAKE ERIE YELLOW PERCH TASK GROUP

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Presented to:

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

The Yellow Perch Task Group (YPTG) was charged with describing the status of yellow perch, producing population size estimates and recommending allowable harvest (RAH) for 1994 in each of the four Lake Erie management units (Figure 1). The results of these charges are presented in this report. The task group was also charged with the completion of the Joint YPTG/Statistics and Modelling Task Group (SAM) report, documenting the procedures used to develop a recommended allowable harvest. Work was done on this additional charge in 1993, however, it is incomplete.

Fisheries Review

The reported harvest of yellow perch from Lake Erie in 1993 totalled 2,327 tonnes (5.13 million pounds) (Table 1), which was 11% less than the 1992 harvest. Perch catches declined for Ontario, Pennsylvania, and New York. Pennsylvania harvest showed the greatest decline (-69%), followed by New York (-33%), and Ontario (-14%). Increases for Ohio (+12%) and Michigan (+87%) were 26 and 16 tonnes, respectively. Ontario harvested 73% of the lakewide reported catch, while Ohio harvest accounted for 24%, and Michigan, Pennsylvania and New York caught the remaining 3%.

The allowable harvest level recommended by the YPTG for 1993 was 10.9 million pounds lakewide. The Lake Erie Committee supported a lakewide allocation of 10 million pounds.

Harvest, fishing effort, and catch rate are summarized by Unit, year, agency, and gear type in Tables 2a-d. The trends over time (1975-1993) in harvest, fishing effort and catch rate are described in Figures 2, 3 and 4 by Unit and gear type. Commercial gillnet harvest increased only in Unit 1 (+66%) and declined in Units 2 (-23%) 3 (-50%) and 4 (-37%) compared to the 1992 harvest. Harvest from commercial trapnets was down in Units 3, 4 and increased slightly in Unit 1 (+29%). The greatest decrease in trapnet harvest was in the eastern basin of Lake Erie in Unit 4 (-40%) and in Unit 3 of the central basin (-33%). Sport harvest decreased in Units 3 (-8%) and 4 (-25%), and increased in Unit 1 (+56%) and 2 (+7%).

Commercial gillnet effort in 1993 declined in Units 2 (-28%), 3 (-23%) and 4 (-40%), and increased in Unit 1 (+30%), as compared to 1992. Trapnet effort also decreased in Units 2 (-46%) and 3 (-22%) while Units 4 (+20%) and 1 (+4%) exhibited modest increases. Sport fish effort declined in Units 2 (-6%) and 4 (-50%) in 1993 but increased 14% in Unit 3 and substantially in Unit 1 (+64%).

Catch rates for 1993 commercial gillnet fisheries increased from 1992 in Units 1 (+27%), 2 (+6%) and 4 (+64%) but continued to decrease in Unit 3 (-27%). Commercial trapnet catch rates increased in Units 1 (+23%) and 2 (+46%), and decreased slightly in Units 3 and 4. Catch rates from the sport fisheries have been stable the past few years in Unit 1, declined in Unit 3 (-20%) and increased in Units 2 (+15%) and 4 (+38%). Catch rates in 1993 generally remained at levels similar to or lower than catch rates observed in the early 1980's, prior to the entry of the prodigious 1984 year class into the fisheries.

The 1990 year class was a strong contributor throughout Units 1, 2, and 3 while older fish dominated the catches from Unit 4, especially for the trapnet and sport fisheries (Table 3).

Stock Assessment

Catch-at-Age-Analysis (CAGEAN) and the Estimation of 1993 Population

A three gear (gillnet, trapnet and sport harvest and effort) version of the CAGEAN model was used to estimate the 1993 population size. The three gear version allows factors such as catchabilities and selectivities to be gear specific. Population size estimates were based on a natural mortality rate of 0.4 (M=0.4).

The current CAGEAN estimate of the 1993 perch stock size was overestimated as projected in 1992 in Units 1, 2 and 3 by 7%, 20% and 14%, respectively. The 1992 projection for the 1993 stock size for Unit 4 underestimated the current stock size by 7 %.

Since age 2 yellow perch are not fully recruited to the gillnet, trapnet and sport fishing gears, results from Ontario's fall partnership index fishing surveys were used to estimate the abundance of the 1991 year class as age 2 fish, and an 'adjusted' 1993 population size estimate of age 2 and older fish was produced (Table 5). The adjustment was made in the following way. For each management unit, the ratio of geometric mean catch rates of the 1990 and 1991 year classes as 2-year-old fish in 1992 and 1993, respectively, from the partnership index nets, and the CAGEAN estimate of the 1990 year class as age 2 were used to estimate the abundance of the 1991 year class as age 2 fish in 1993, i.e. $Abundance_{1991}$ (millions of fish) = $Abundance_{1990}$ X ($Index_{1991}$ / $Index_{1990}$). Because the 1990 year class has 2 year's worth of harvest data associated with it by 1993, CAGEAN will be able to provide a more reliable estimate of the 1990 year class as age 2 fish than it would for the 1991 year class, with only one year of harvest data available in 1993. The partnership index fishing surveys, done in cooperation with the Ontario commercial fishing industry, are considered to provide the most representative index information currently available due to the broad coverage of the surveys, standardized methods and large sample sizes.

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 4). Because of the relatively low exploitation rate on age 2 fish related to their low vulnerability to the gear, the yield from age 2 fish is low relative to their total abundance in the population. Results associated with age 3 and older fish are believed to be more representative of the available fishable stock. Age 2 fish do contribute to the harvest, as illustrated in 1992, but a cohort contributes more significantly at age 3 and older, when it is more vulnerable to the gear.

In 1993, stock size estimates of age 3 and older fish increased in all management units, except Unit 4, as compared to 1992 (Table 4 , Figure 5). Stock size estimates for Units 2, 3, and 4 were at levels typical of the early 1980's, prior to the 1984 year class. Stock size estimates for Unit 1 in 1993 were better than those of 1991 and 1992 but still near historical low levels. Biomass estimates for age 3 and older fish in 1993 increased or remained near 1992 levels in all Units and the 1993 population consisted primarily of age 3 fish.

Unit 4 was the only unit in which the age 6 and older fish made up the largest component of the population estimate (Table 3).

Survival rates for age 3 and older perch declined in Units 2 and 4, continued to increase in Unit 3 and leveled off in Unit 1 (Figure 7).

Recruitment

The same methods used in the last three year's reports were used to estimate age 2 population size from index trawling values. This method includes: an expanded data series (more years and more trawling projects), the use of geometric mean index values (number per trawl-hour), regressing CAGEAN age 2 population size estimates of age 2 abundance (Table 16 and Figure 9).

Since 1986, recruitment of yellow perch has been considered fair to poor in all Units. The 1990 year class was initially underestimated by trawl indices based upon its estimated size at age 2 (Figure 10) and its shadow in 1993 catches (Table 3). The 1991 perch cohort is expected to be only a modest contributor to future perch stocks while the 1992 and 1993 year classes can be expected to elevate fishable stocks only in Units 1 and 2. Fishable perch stocks in Units 3 and 4 will remain at lower levels through the immediate future (Table and Figure 5).

1994 Population Size Projection

Stock size estimates for 1994 (age 3 and older) were projected from the adjusted 1993 population size estimates and age specific survival rates in 1993. Recruitment of the 1992 year class in 1994 (age 2 fish) was estimated from various agency trawling indices of age 0 and age 1 yellow perch (Table 16).

Projections of stock size for 1994 indicate a continued decline of age 2 and older perch in all Units. Serious reductions from 1992 levels of age 3 and older fish are expected in Units 2 (-51%), 3 (-53%) and 4 (-39%); Unit 1 will undergo a 25 % reduction (Table 4 and Figure 5). The Unit 4 perch stock will not only be at low levels but its numbers are expected to be composed of a large proportion of older fish, putting this population at further risk if enhanced recruitment isn't realized in the next few years.

Biomass of age 3 and older fish remains the most representative indicator of fishable stock available in 1994. In the 1994 projection, there are decreases of 7 % in Unit 1, 31 % in Unit 2, 41 % in Unit 3 and 31 % in Unit 4.

Yield per Recruit

The yield per recruit model used to determine a recommended harvest in 1994 is the same as that used in 1993. The basic assumption of the yield per recruit model is that the desired harvest strategy is to optimize the return in weight per recruit. The optimum harvest rate F_{opt}, is determined by growth rate versus natural mortality rate. For temperate waters, F_{opt} is modified to $F_{0.1}$, which corresponds to 10% of the rate of increase in yield per recruit which can be obtained by increasing F (fishing mortality) at low levels of fishing. A full description of the model inputs, as well as the steps required to determine a scaled $F_{0.1}$, are given in the YPTG report of 1992.

The 1994 harvest estimates of age 2 and older fish is the sum of the estimates of harvest from each age, derived from scaling $F_{0.1}$ by the selectivity at that age. Catch in weight is calculated by multiplying the age specific catch in millions of fish by the mean weight in the harvest (5 year average, 1989 - 1993). The harvest estimate is the sum of the harvest for age 2 and older fish (Tables 10 - 13).

Recommended Allowable Harvest

Five harvest scenarios were generated for 1994 (Table 6). Four are the same as those presented for 1993. One used the unadjusted CAGEAN estimates of population size and a scaled $F_{0.1}$ exploitation strategy; another was to use the adjusted CAGEAN population size estimate and a scaled $F_{0.1}$ exploitation strategy; another was to use the adjusted population size and the same level of fishing effort as in 1993; and another was based on the use of the 1993 harvest and the Ontario partnership index fishing results, with products adjusted in accord with an optimum exploitation policy. The fall index gillnetting conducted in the Ontario waters of each management unit provides a source of information on relative biomass of yellow perch present in each management unit. The gillnet mesh sizes (ranging from 1.25" - 5.00") encompass the range of fish sizes available to the fisheries as well as smaller fish which are not yet recruited to the fisheries. Yellow perch caught in mesh sizes of 1.75" and greater in the fall are used as an indicator of the availability of yellow perch which will represent the fishable stock the following year. The weight of yellow perch caught in a standard amount of fishing effort was used as an index of fishable biomass of the stock in the upcoming fishing year (1994).

Assuming that the biomass indicator calculated is directly proportional to fishable stock and allowing that fishing effort is constant from one year to the next, two successive years of index data, coupled with recent harvest weight, can be used to project harvest in the upcoming year. Given that the effort used to harvest yellow perch in the most recent harvest year may be different than the effort needed to optimize harvest, a second calculation is required. The source of information for this calculation is from harvest projections based on CAGEAN population estimates. One harvest projection is made allowing that effort (fishing mortality rate) does not change in the upcoming year. The second harvest projection uses the $F_{0.1}$ exploitation strategy. The ratio of the projected harvest at $F_{0.1}$ to the projected harvest using the previous year's fishing effort, provides a factor which can be used to adjust the index based harvest projection to a level which is consistent with the $F_{0.1}$ exploitation strategy (Tables 14, 15).

A fifth harvest scenario, presented for the first time this year, was based on using unadjusted CAGEAN estimates produced from running only ages 3-6 for Units 1 and 2 and ages 3-8 for Units 3 and 4, instead of including age 2 in the analyses (Tables 9, 11). CAGEAN Age 2 abundance was estimated assuming the following proportion: [CAGEAN (Age 2)/CAGEAN (Age 3)] = [Partnership (Age 2)/Partnership (Age 3)], which is similar set of calculations used to produce adjusted Age 2 populations in the second scenario above. We rationalize using ages 3+ CAGEAN runs due to the fact that age 2 fish are not fully recruited to the fishing gears and are presenting a high-biased estimate during the current year. This high estimate is carried forward to the following year as age 3, which receives heavy exploitation and becomes fully recruited to the fishing gears.

Partnership samples can provide us a better estimate of age 2 fish, as described above. To project age 2 fish for the following fishing year, we employed the same the regression formula used in the other population estimate procedures as explained in the YPTG report of 1992.

Recommendations and Conclusions

A lakewide harvest of 10 million pounds of yellow perch was adopted in 1993 and the harvest was 5.13 million pounds. Based on the performance of the fisheries in 1993, the abundance of yellow perch predicted for 1993 was greater than the actual abundance. In effect, the 1993 population estimates and subsequent harvest recommendations were overestimated.

If we were to recommend a total allowable harvest (RAH) in 1994 using the strategies employed in predicting the 1993 harvest, i.e. adjusted population estimate - F (0.1) exploitation strategy, the RAH would be 9.1 million pounds (min. 6.4 - max. 12.1) lakewide. Given that this method resulted in an over-estimate of yellow perch abundance for 1993, it is reasonable to view the current projection for 1994 with caution. Other scenarios which were based on CAGEAN population estimates resulted in mean harvest projections ranging from 7.8 to 12.2 million pounds. The one scenario which was in disagreement with the CAGEAN based estimates was that which was based on the Ontario partnership index fishery and the harvest projected using this information was 3.2 million pounds lakewide.

The Yellow Perch Task Group examined the results from the Ontario partnership index fishery and a concern emerged regarding the 1993 results. Specifically, the 1993 index fishing results may lead to an underestimate of the yellow perch stocks particularly in the central basin.

Given that the scenarios explored by the YPTG resulted in a range of projected harvest values, it is recommended that an intermediate position be adopted for 1994. A harvest level of 6 million pounds is suggested. This is less than the values determined using CAGEAN based approaches and greater than the value based on the Ontario partnership index fishing program. It also approximates the lower limits associated with CAGEAN based estimates. Further, it is recommended that the harvest be distributed amoung the management units in the same proportions as in 1993.

Changes which are occurring in the Lake Erie ecosystem are viewed as having a significant influence on the ability of the YPTG to perform its major task of advising the Lake Erie Committee about appropriate harvest levels for yellow perch. For example, population models of the type currently employed are best suited to situations which are relatively stable. Also, results from various fisheries be they commercial, sport or index are most useful if the behaviour of the target species is consistent. It is the view of the YPTG that time series moitoring of the resource continue and that effort continue to be devoted to understanding the changes which are occurring. Only in this way will we be in a position to optimize the use of the resource in the future and provide for its prudent conservation.

Because of the importance of the inputs from the index fishing program, the YPTG continues to urge agencies to adopt a standard index assessment program which includes yellow perch. As the data series grows,

the index fishing results can be used directly in the CAGEAN population estimation exercise as an input to calibrate harvest information.

References

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

Table 1. Summary of total catch[a] of yellow perch by management unit and agency, Lake Erie 1980 - 93.

Unit	Year	Ontario Catch	Ontario (%)	Ohio Catch	Ohio (%)	Michigan Catch	Michigan (%)	Pennsylvania Catch	Pennsylvania (%)	New York Catch	New York (%)	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
	1992	312	(59)	184	(35)	30	(06)	--	--	--	--	526
	1993	517	(62)	262	(31)	56	(07)	--	--	--	--	835
2	1980	2,877	(71)	1,175	(29)	--	--	--	--	--	--	4,052
	1981	1,603	(67)	784	(33)	--	--	--	--	--	--	2,387
	1982	2,162	(86)	356	(14)	--	--	--	--	--	--	2,518
	1983	1,466	(85)	258	(15)	--	--	--	--	--	--	1,724
	1984	2,117	(85)	378	(15)	--	--	--	--	--	--	2,495
	1985	2,127	(87)	308	(13)	--	--	--	--	--	--	2,435
	1986	2,289	(89)	289	(11)	--	--	--	--	--	--	2,578
	1987	2,512	(88)	344	(12)	--	--	--	--	--	--	2,856
	1988	2,538	(93)	191	(07)	--	--	--	--	--	--	2,729
	1989	2,530	(84)	486	(16)	--	--	--	--	--	--	3,016
	1990	1,303	(75)	432	(25)	--	--	--	--	--	--	1,735
	1991	985	(76)	310	(24)	--	--	--	--	--	--	1,295
	1992	1,144	(83)	227	(17)	--	--	--	--	--	--	1,371
	1993	877	(80)	224	(20)	--	--	--	--	--	--	1,101
3	1980	478	(68)	144	(20)	--	--	86	(12)	--	--	708
	1981	505	(68)	131	(18)	--	--	103	(14)	--	--	739
	1982	615	(80)	89	(12)	--	--	64	(08)	--	--	768
	1983	519	(94)	21	(04)	--	--	15	(03)	--	--	555
	1984	466	(86)	44	(08)	--	--	32	(06)	--	--	542
	1985	370	(81)	43	(09)	--	--	43	(09)	--	--	456
	1986	1,101	(92)	60	(05)	--	--	30	(03)	--	--	1,191
	1987	908	(84)	108	(10)	--	--	64	(06)	--	--	1,080
	1988	1,128	(78)	239	(17)	--	--	81	(06)	--	--	1,448
	1989	1,095	(63)	544	(31)	--	--	96	(06)	--	--	1,735
	1990	965	(76)	229	(18)	--	--	84	(06)	--	--	1,278
	1991	550	(75)	115	(16)	--	--	69	(09)	--	--	734
	1992	540	(82)	84	(13)	--	--	35	(05)	--	--	659
	1993	275	(78)	66	(19)	--	--	11	(03)	--	--	352
4	1980	303	(78)	--	--	--	--	42	(11)	42	(11)	387
	1981	355	(80)	--	--	--	--	33	(07)	53	(12)	441
	1982	253	(76)	--	--	--	--	29	(09)	52	(16)	334
	1983	175	(81)	--	--	--	--	13	(06)	28	(13)	216
	1984	365	(78)	--	--	--	--	35	(07)	67	(14)	467
	1985	190	(75)	--	--	--	--	14	(05)	51	(20)	255
	1986	143	(88)	--	--	--	--	16	(11)	2	(01)	161
	1987	260	(90)	--	--	--	--	23	(08)	6	(02)	289
	1988	258	(98)	--	--	--	--	1	(<1)	4	(02)	263
	1989	199	(78)	--	--	--	--	0	(00)	55	(22)	254
	1990	128	(88)	--	--	--	--	0	(00)	17	(12)	145
	1991	73	(87)	--	--	--	--	0	(00)	11	(13)	84
	1992	52	(85)	--	--	--	--	0	(00)	9	(15)	61
	1993	33	(85)	--	--	--	--	0	(00)	6	(15)	39

[a]Catch is in metric tonnes.
Values in parentheses represent each agency's percentage of management unit catch.

Table 2a. Catch and effort summaries for Lake Erie yellow perch fisheries in Management Unit 1, 1981 - 93.

	Year	Ohio		Michigan	Ontario	
		Trap	Sport	Sport	Gill Net	Sport
CATCH (tonnes)	1981	93	831	34	1180	--[a]
	1982	50	922	46	983	--
	1983	26	332	17	327	--
	1984	14	594	30	1208	--
	1985	27	449	23	1206	--
	1986	71	704	82	1361	--
	1987	139	646	102	1298	--
	1988	284	562	76	1445	--
	1989	392	470	151	1432	--
	1990	210	86	105	808	--
	1991	89	220	43	294	--
	1992	56	128	30	312	--
	1993	72	190	56	517	--
EFFORT[b]	1981	9,830	2,676,326	271,000	24,908	--
	1982	5,272	3,036,979	151,900	27,627	--
	1983	5,086	1,498,289	74,914	11,456	--
	1984	3,451	1,159,599	57,980	28,746	--
	1985	4,141	935,645	46,782	16,139	--
	1986	5,279	1,404,286	404,514	20,909	--
	1987	7,078	1,046,115	452,460	14,730	--
	1988	6,900	1,153,182	494,158	9,616	--
	1989	8,418	1,028,551	696,973	12,716	--
	1990	6,299	350,000	634,255	18,305	--
	1991	7,259	700,719	164,517	13,629	--
	1992	6,795	350,433	120,979	9,221	--
	1993	7,092	530,012	244,455	12,006	--
CATCH RATES[c]	1981	9.46	0.31	0.13	47.37	--
	1982	9.48	0.30	0.30	35.58	--
	1983	5.11	0.22	0.23	28.54	--
	1984	4.06	0.51	0.52	42.02	--
	1985	6.52	0.48	0.49	74.73	--
	1986	13.45	0.50	0.20	65.09	--
	1987	19.64	0.62	0.23	88.12	--
	1988	41.16	0.49	0.15	150.27	--
	1989	46.57	0.46	0.22	112.61	--
	1990	33.34	0.26	0.17	44.14	--
	1991	12.26	0.31	0.26	21.57	--
	1992	8.24	0.37	0.25	33.84	--
	1993	10.15	0.36	0.23	43.06	--

[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 2b. Catch and effort summaries for Lake Erie yellow perch fisheries in Management Unit 2, 1981 - 93.

	Year	Ohio			Ontario	
		Gill Net	Trap Net	Sport	Gill Net	Sport
CATCH (tonnes)	1981	711	8	65	1,603	--[a]
	1982	34	8	314	2,162	--
	1983	82	0	176	1,466	--
	1984	0	5	373	2,117	--
	1985	0	8	300	2,208	--
	1986	0	0	289	2,290	--
	1987	0	10	334	2,512	--
	1988	0	21	170	2,538	--
	1989	0	91	395	2,530	--
	1990	0	295	137	1,303	--
	1991	0	137	173	985	--
	1992	0	66	161	1,144	--
	1993	0	52	172	877	--
EFFORT[b]	1981	17,810	713	437,816	27,782	--
	1982	1,400	801	1,277,417	41,868	--
	1983	3,632	0	739,325	44,692	--
	1984	0	466	894,109	44,524	--
	1985	0	212	728,763	34,187	--
	1986	0	0	461,273	30,920	--
	1987	0	630	429,239	20,940	--
	1988	0	448	402,180	17,315	--
	1989	0	1,403	572,612	25,679	--
	1990	0	6,238	400,676	31,613	--
	1991	0	6,480	452,277	34,739	--
	1992	0	4,753	340,917	35,348	--
	1993	0	2558	320,891	25,569	--
CATCH RATE[c]	1981	39.92	11.22	0.15	57.70	--
	1982	24.29	9.99	0.25	51.64	--
	1983	22.58	0	0.24	32.80	--
	1984	--	10.73	0.42	47.55	--
	1985	--	37.74	0.41	64.59	--
	1986	--	0	0.63	74.06	--
	1987	--	15.87	0.78	119.96	--
	1988	--	46.88	0.42	146.58	--
	1989	--	64.86	0.69	98.52	--
	1990	--	47.29	0.34	41.22	--
	1991	--	21.14	0.38	28.35	--
	1992	--	13.89	0.47	32.36	--
	1993	--	20.33	0.54	34.30	--

[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 2c. Catch and effort summaries for Lake Erie yellow perch fisheries in Management Unit 3, 1981 - 93.

	Year	Ohio			Ontario		Pennsylvania	
		Gill Net	Trap Net	Sport	Gill Net	Sport	Gill Net	Sport
CATCH (tonnes)	1981	86	0	45	505	--[a]	103	--[a]
	1982	18	0	71	615	--	64	--
	1983	14	0	7	519	--	15	--
	1984	0	0	44	466	--	32	--
	1985	0	2	41	325	--	43	--
	1986	0	0	60	1,101	--	30	--
	1987	0	21	87	908	--	64	--
	1988	0	150	89	1,128	--	81	--
	1989	0	288	256	1,095	--	96	--
	1990	0	203	26	965	--	84	--
	1991	0	84	31	550	--	69	--
	1992	0	46	38	540	--	35	--
	1993	0	31	35	275	--	11	--
EFFORT[b]	1981	2,377	0	237,691	12,685	--	2,735	--
	1982	710	0	308,826	16,438	--	2,737	--
	1983	802	0	181,030	18,199	--	1,521	--
	1984	0	0	149,602	14,153	--	1,197	--
	1985	0	136	144,309	10,635	--	2,175	--
	1986	0	0	122,007	12,440	--	2,185	--
	1987	0	668	129,316	6,667	--	1,538	--
	1988	0	4,781	172,490	6,203	--	1,418	--
	1989	0	7,281	248,530	7,098	--	1,037	--
	1990	0	7,376	31,881	12,472	--	1,978	--
	1991	0	4,516	54,607	12,247	--	2,018	--
	1992	0	3,361	84,445	14,540	--	1,321	--
	1993	0	2,610	96,619	10,017	--	620	
CATCH RATE[c]	1981	36.18	0	0.19	39.81	--	37.66	--
	1982	25.35	0	0.23	37.41	--	23.38	--
	1983	17.46	0	0.04	28.52	--	9.86	--
	1984	--	0	0.29	32.93	--	26.73	--
	1985	--	14.71	0.28	30.56	--	19.77	--
	1986	--	0	0.49	88.50	--	13.73	--
	1987	--	31.44	0.67	136.19	--	41.61	--
	1988	--	31.37	0.52	181.85	--	57.12	--
	1989	--	39.56	1.03	154.27	--	92.57	--
	1990	--	27.52	0.82	77.37	--	42.47	--
	1991	--	18.60	0.57	44.91	--	34.19	--
	1992	--	13.69	0.45	37.14	--	26.50	--
	1993	--	11.88	0.36	27.45	--	17.74	--

[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 2d. Catch and effort summaries for Lake Erie yellow perch fisheries in Management Unit 4, 1981 - 93.

	Year	Ontario		Pennsylvania		New York		
		Gill Net	Sport	Gill Net	Sport	Gill Net	Trap Net	Sport
CATCH (tonnes)	1981	355	--[a]	33	--	53	0	--
	1982	253	--	29	--	52	0	--
	1983	175	--	13	--	28	0	--
	1984	365	--	35	--	67	0	--
	1985	137	--	14	--	51	0	--
	1986	143	--	48	--	0	2	--
	1987	260	--	23	--	0	6	--
	1988	258	--	1	--	0	4	--
	1989	199	--	0	--	0	8	47
	1990	128	--	0	--	0	9	8
	1991	73	--	0	--	0	7	4
	1992	52	--	0	--	0	5	4
	1993	33	--	0	--	0	3	3
EFFORT[b]	1981	19,130	--	1,070	--	2,072	0	--
	1982	14,637	--	1,195	--	2,235	0	--
	1983	12,832	--	1,329	--	1,160	0	--
	1984	19,368	--	1,211	--	1,826	0	--
	1985	8,582	--	486	--	3,133	0	--
	1986	8,797	--	569	--	0	3,513	--
	1987	4,908	--	632	--	0	1,602	--
	1988	2,719	--	8	--	0	2,132	--
	1989	2,628	--	0	--	0	1,136	65,370
	1990	3,924	--	0	--	0	981	24,463
	1991	3,859	--	0	--	0	918	22,090
	1992	3,351	--	0	--	0	632	52,398
	1993	2,008	--	0	--	0	761	26,297
CATCH RATE[c]	1981	18.56	--	30.84	--	25.58	0	--
	1982	17.28	--	24.27	--	23.27	0	--
	1983	13.64	--	9.78	--	24.14	0	--
	1984	18.85	--	28.90	--	36.69	0	--
	1985	15.96	--	28.81	--	16.28	0	--
	1986	16.26	--	84.36	--	--	0.57	--
	1987	52.97	--	36.39	--	--	3.75	--
	1988	94.89	--	125.00	--	--	1.88	--
	1989	75.72	--	0	--	--	7.04	0.72
	1990	32.62	--	0	--	--	9.17	0.33
	1991	18.92	--	0	--	--	7.63	0.18
	1992	15.52	--	0	--	--	7.91	0.08
	1993	16.43	--	0	--	--	3.94	0.11

[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 3. Harvest of yellow perch (millions of fish) from Lake Erie by management unit, 1993.
Note: 1987+ represents age 6 and older fish.

	UNIT 1		UNIT 2		UNIT 3		UNIT 4	
YEAR CLASS	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Gillnets								
1992								
1991	.573	17.3	.904	11.5	.216	9.6	.016	4.8
1990	2.102	63.6	5.299	67.2	1.079	48.1	.029	8.7
1989	.571	17.3	1.574	20.0	.751	33.5	.066	19.8
1988	.034	1.0	.067	0.8	.126	5.6	.052	15.6
1987+	.026	0.8	.039	0.5	.071	3.2	0.17	51.1
TOTAL	3.306		7.883		2.243		.333	
Trapnets								
1992								
1991					.012	6.5	.0004	2.9
1990	.124	36.2	.161	50.2	.115	61.8	.0006	4.3
1989	.127	37.0	.111	34.6	.036	19.4	.001	7.1
1988	.045	13.1	.018	5.6	.015	8.1	.002	14.3
1987+	.047	13.7	.031	9.7	.008	4.3	.010	71.4
TOTAL	.343		.321		.186		.014	
Angling								
1992	.016	0.8						
1991	.442	21.5	.181	16.2	.014	7.8	.0002	2.2
1990	1.243	60.5	.771	69.2	.098	54.7	.0009	10.0
1989	.289	14.1	.112	10.1	.026	14.5	.0003	3.3
1988	.043	2.1	.020	1.8	.011	6.1	.0007	7.8
1987+	.022	1.1	.030	2.7	.030	16.8	.007	77.8
TOTAL	2.055		1.114		.179		.009	
All Gear								
1992	.016	0.3						
1991	1.015	17.8	1.085	11.6	.242	18.7	.017	4.8
1990	3.469	60.8	6.231	66.9	1.292	49.5	.031	8.7
1989	.987	17.3	1.797	19.3	.813	31.2	.067	18.8
1988	.122	2.1	.105	1.1	.152	5.8	.055	15.4
1987+	.095	1.7	.100	1.1	.109	4.2	.187	52.4
TOTAL	5.704		9.318		2.608		.357	