Report of The

LAKE ERIE YELLOW PERCH TASK GROUP

March 1989

Members:

Roger Kenyon   - Pennsylvania Fish Commission (Chairman)
Don Einhouse   - New York Department of Environmental Conservation
Mike Rawson   - Ohio Department of Natural Resources
Sandra Orsatti   - Ontario Ministry of Natural Resources
Jerry Paine   - Ontario Ministry of Natural Resources
Bob Sutherland   - Ontario Ministry of Natural Resources
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 was charged with producing stock size estimates and recommending allowable harvests for 1989 in each of four management units (refer to Figure 1 for identification of these units). Agencies contributed summaries of harvest, fishing effort, age composition and relative abundance to the Task Group.

Fisheries Review

The reported harvest of yellow perch from Lake Erie in 1988 totaled 6,807 t (Table 1). The reported harvest was within the 1988 recommended allowable harvest except in Unit 2 where the reported harvest was 12% greater than recommended. The 1988 lakewide total harvest was 6% greater than in 1987 with each agency reporting harvest levels similar to 1987 (Table 2). Ontario accounted for 79% of the lakewide catch, Ohio 19%, Michigan 1%, Pennsylvania 1%, and New York <1%. Ontario and Pennsylvania reported their commercial fisheries were limited to internal agency quota allocations.

Fishing effort (km of gill net) was standardized by the catch rate observed in Ontario's gill net fishery. In 1988 the lakewide standard fishing effort decreased 26% from 1987. Significant decreases of 20-50% occurred in all units except Unit 3 where effort was similar to 1987 (Table 1). Fishing effort was less than the target effort level in all units. Target effort was defined as a 20% reduction from the 1981 effort level. The 1988 fishing effort was more than 50% below the target level in each unit and 85% below in Unit 4.

Catch rates (kg/km of gill net) increased in all units (Table 1). Catch rates have not been this high in Units 1 and 2 since 1980 and in Units 3 and 4 since 1970. The 1984 cohort predominated in the catch in all units contributing 51%, 60%, 85% and 86% to the number harvested in Units 1-4, respectively.

2

Stock Assessment

Age structured stock size was determined for each unit with two catch-at-age models. The CAGEAN model was selected to represent stock abundance because the estimates of cohort size for the most recent years are more reliable. Cohort analysis was used to provide continuity with previous modeling by the YPTG (see YPTG 1985). Although cohort analysis estimates are reliable for cohorts that have passed completely through the fishery, the reliability of estimates for recently recruited cohorts is poor and therefore are not used for stock projections. Both models employed a conservative estimate for natural mortality ($M=0.22$) and assumed that age-4 and older fish were fully vulnerable to exploitation.

Stock size estimates were totaled for age-2 and older and age-3 and older fish. Age-2 fish have varied in their percent composition in the harvest but have been only lightly exploited relative to fully vulnerable age groups. Therefore stock size totals of age-3 and older better represent the portion of the stock that is vulnerable to fishing.

CAGEAN indicated the 1988 stocks of age-2 and older fish were larger than predicted in Units 1 and 2 and lower than predicted in Units 3 and 4 (Table 3). In Unit 1, the estimated stock size was 113.6 million fish which was 29% higher than projected from last years assessment. The primary cause for the increase was larger than predicted recruitment from the strong 1986 cohort. In Unit 2, the estimated stock size was 65.4 million fish. Recruitment from the 1986 cohort was strong as expected. Estimates of the 1984 and 1985 cohorts were greater than predicted which resulted in a 26% increase in the stock size estimate. In Unit 3, the estimated stock size was 22.9 million fish which was 35% lower than last years projection. The estimate of the 1984 cohort was larger than expected but did not compensate for the apparent lack of recruitment from the 1986 cohort. In

3

Unit 4, the stock size estimate of 4.1 million fish was 76% less than the projection last year. The apparent lack of recruitment from the 1986 cohort the was the primary reason for the decrease although the estimated abundance of all cohorts was lower.

There is no explanation for the lack of recruitment from the 1986 cohort in Units 3 and 4. No significant increase in mesh size was reported for the Ontario gill net fishery which might have accounted for a change in catchability estimates. However, 1988 agency assessment surveys of adult yellow perch in Ontario and Pennsylvania indicated that the 1986 cohort comprised 25%-40% of the adult stock. Nonetheless, stock size estimates will be based upon the conservative assessment that the 1986 cohort is not strong in Units 3 and 4.

Projected Stock Size and Recommended Allowable Harvest in 1989

Stock size estimates from CAGEAN were projected to 1989 by simulating the effect of fishing and natural mortality on the 1988 estimated stock size. Recruitment of the 1987 cohort in 1989 was estimated from various agency trawling indices of age-0 and age-1 yellow perch. Recommended allowable harvests were subsequently calculated from the 1989 stock size. Mean age-specific catchability coefficients and target fishing effort levels to determine exploitation rates. Harvest in numbers at age was converted to harvest weight by using mean weight at age in the harvest. Allowable harvests were also calculated based on the fishing effort levels associated with maximum yield simulations described as MSY effort in the YPTG 1985 report. The LEC had stipulated that recommended allowable harvests be based on the MSY by the year 2000. However due to the success of management agency actions in reducing fishing effort, MSY fishing effort has already been reached in each unit except Unit 2 where MSY effort is only 18% greater than the 1988 observed level.

4

Projections of stock size for 1989 indicate significant declines in the number of age-2 and older in all units except Unit 4 where stock size will be slightly larger than last year (Table 4). The declines in stock size were primarily due to low estimates of recruitment for the 1987 cohort. In Unit 4, the 1987 cohort was strong enough to increase the stock size from 1988 levels. The 1987 cohort appears to be equivalent to the very weak 1983 cohort in Units 1 and 2 and about average in Units 3 and 4.

Estimates for age-3 and older stock size decreased from 1988 levels in all units except Unit 1. In Unit-1, the age-3 and older total increased 9% from 1988 to the highest level observed since 1980. In Unit 2, age-3 and older stock size decreased by 8% from 1988 but was still higher than most years since 1980. In Unit 3, the stock size of age-3 and older fish decreased by 60% but remained higher than most years since 1980. In Unit 4 the stock size of age-3 and older fish decreased by 48% to the lowest level since 1980.

The 1989 allowable harvests derived from exploitation at target fishing effort are 4,083 t, 2,609 t, 1315 t, and 258 t in Units 1-4 respectively. In Units 2-4 the harvests are similar to the 1988 reported harvest because the decline in stock size is offset by the relatively high target effort level. In Unit 1, the harvest is larger than observed in 1988 because of the increased catchability of the strong 1986 cohort as age-3 fish as well as the target effort level.

Fishing at target effort levels would result in exploitation rates for fully vulnerable age groups of 65%, 69%, 66%, and 85% in Units 1-4 respectively. Limiting effort to MSY levels would decrease exploitation rates of fully vulnerable age groups to 42%, 43%, 49%, and 83% in Units 1-4 respectively.

A summary of the 1989 recommended allowable harvests by agency was based on the relative percentage of water surface area within each unit (Table 5).

Recommended allowable harvests based on target effort and allowable harvests based on MSY effort are both presented for consideration.

Conclusions and Recommendations

High yellow perch catches and catch rates in 1988 indicated the continued presence of the strong 1984 cohort and recruitment of a strong 1986 cohort in Units 1 and 2. Predicted recruitment from the 1987 cohort is expected to be very poor in Units 1 and 2 and below recent average levels in Units 3 and 4. CAGEAN assessment in Units 2-4 indicated lower stock sizes in 1989 would support harvest at 1988 levels only with a return to relatively high target effort levels. In Unit 1, the 1989 harvest would be considerably higher than in 1988 even without an increase in effort.

A continuation of the lower exploitation rates associated with reduced fishing effort observed in recent years should be considered rather than an intensification of exploitation rates associated with a return to target effort levels. It is recommended that an analysis of exploitation strategy associated with a move to long-term maximum or optimum harvests be conducted by 1990.

Table 1. Catch and effort summaries for Lake Erie yellow perch by management unit, 1980-88.

Year	Unit 1	Unit 2	Unit 3	Unit 4	All Units
Catch (t)					
1980	3,323	4,052	708	387	8,470
1981	2,138	2,387	739	441	5,705
1982	2,001	2,518	768	334	5,621
1983	701	1,724	555	216	3,196
1984	1,846	2,495	542	467	5,320
1985	1,845	2,435	456	216	4,952
1986	2,217	2,578	1,191	163	6,149
1987	2,185	2,856	1,080	289	6,410
1988	2,367	2,729	1,448	263	6,807
1988 RAH[a]	3,322	2,432	2,184	577	8,515
1960-88[b]	2,486	3,467	1,384	490	7,759
Standard Effort[c] (kms x 10³)					
1980	39.4	34.6	22.8	16.8	113.6
1981	44.4	42.5	24.4	23.7	135.1
1982	55.6	49.5	21.0	19.3	145.3
1983	26.7	53.8	19.7	15.8	116.0
1984	41.7	51.6	16.5	24.7	134.4
1985	23.9	39.4	13.5	12.6	89.4
1986	34.2	34.4	15.0	11.6	95.1
1987	25.5	23.7	7.9	5.4	62.5
1988	16.6	18.8	8.3	2.8	46.5
Target[d]	35.5	34.0	19.5	19.0	108.0
1960-88	29.4	34.0	18.9	14.6	94.9
Catch Rates (kgs/km)					
1980	84.3	117.2	31.0	23.0	74.5
1981	48.2	56.1	30.2	18.6	42.2
1982	36.0	50.9	36.6	17.3	38.7
1983	26.3	32.1	28.1	13.6	27.5
1984	43.6	48.4	32.9	18.9	39.6
1985	71.3	63.9	30.5	16.0	54.1
1986	64.9	74.9	79.6	14.1	64.6
1987	85.7	120.5	136.7	53.5	102.6
1988	142.6	145.2	174.5	93.9	146.4
1960-88	96.5	110.6	80.5	38.4	90.7

[a]1988 recommended allowable harvest (RAH) based on 1988 CAGEAN projections and target fishing effort.

[b]Long-term observed values from 1960-88 except in Unit 4 which includes 1964-88.

[c]Standard effort is calculated in terms of Ontario small mesh gill nets (see YPTG report, 1985).

[d]Target effort is 20% less than the effort observed in 1981.

Table 2. Summary of total catch[*] of yellow perch by management unit and agency, Lake Erie 1980-88.

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
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
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
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

[*]Catch is in tonnes. Values in parentheses represent each agencies' percentage of management unit catch.

Table 3. Yellow perch stock size estimates (millions) derived from CAGEAN model by management
unit, Lake Erie 1980-1988.

UNIT	AGE	1980	1981	1982	1983	1984	1985	1986	1987	1988
						YEAR				
1	2	20.5	18.8	26.9	23.7	42.1	7.4	69.8	38.0	47.8
	3	47.8	15.8	14.3	19.1	18.1	32.6	5.8	54.1	29.8
	4	5.6	25.1	7.4	4.0	9.2	9.8	19.9	3.2	32.4
	5	3.0	1.5	4.8	0.4	0.8	2.6	3.7	5.6	1.1
	6	0.5	0.9	0.5	0.3	0.1	0.3	1.1	1.4	2.5
	Total (+2)[a]	77.4	62.1	53.9	47.5	70.3	52.7	100.3	102.3	113.6
	Total (+3)[b]	56.9	43.3	27.0	23.0	28.2	45.3	30.5	64.3	65.8
2	2	12.1	21.0	39.7	26.8	28.1	4.1	79.6	17.0	29.0
	3	30.2	5.8	8.9	26.0	18.6	18.4	2.7	52.2	12.2
	4	2.3	6.8	1.0	2.7	10.3	5.8	6.0	0.8	23.8
	5	0.7	0.2	0.4	0.1	0.6	1.4	0.8	0.8	0.2
	6	0.1	0.1	0.0	0.1	0.0	0.1	0.2	0.1	0.2
	Total (+2)	45.4	33.9	50.0	55.7	57.6	29.8	89.3	70.9	65.4
	Total (+3)	33.3	12.9	10.3	28.9	29.5	25.7	9.7	53.9	36.4
3	2	4.0	5.2	8.1	4.9	5.4	1.0	49.0	3.1	0.6
	3	4.1	2.0	2.1	4.3	2.9	3.3	0.7	33.8	2.3
	4	0.5	1.2	0.4	0.4	1.2	0.9	1.3	0.3	19.8
	5	0.2	0.1	0.1	0.1	0.1	0.3	0.3	0.5	0.2
	6	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0
	Total (+2)	8.8	8.5	10.7	9.7	9.6	5.5	51.4	37.9	22.9
	Total (+3)	4.8	3.3	2.6	4.8	4.2	4.5	2.4	34.8	22.3
4	2	4.4	4.1	3.7	3.8	3.3	1.5	8.3	0.8	0.3
	3	3.6	2.8	2.4	2.7	2.8	2.4	1.1	6.2	0.6
	4	0.5	1.6	1.0	1.0	1.2	0.9	1.1	0.5	3.1
	5	0.2	0.1	0.3	0.2	0.2	0.1	0.2	0.2	0.1
	6	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
	Total (+2)	8.7	8.7	7.4	7.8	7.5	4.9	10.7	7.7	4.1
	Total (+3)	4.3	4.6	3.7	4.0	4.2	3.4	2.4	6.9	3.8

[a] Total of age-2 perch and older.

[b] Total of age-3 perch and older.

Table 4. Recommended allowable harvest of yellow perch in numbers and weight based on CAGEAN projections of 1989 stock sizes and target fishing effort.

Unit	Age	Stock Number (x 10⁶)	Stock Weight (t)	Catch Number (x 10⁶)	Catch Weight (t)	Exploit Rate (u)	Catch Weight at Age (g)	Stock Weight at Age (g)
1	2	5.54	188	0.31	27	0.06	88	34
	3	37.18	2,454	12.71	1,309	0.34	103	66
	4	18.89	1,530	12.31	1,379	0.65	112	81
	5	14.01	1,401	9.13	1,169	0.65	128	100
	6	0.49	64	0.32	51	0.65	160	131
	7	1.09	329	0.71	148	0.65	209	302
	Total (+2)	77.20	5,967	35.49	4,083	0.49	115	77
	Total (+3)	71.66	5,778	35.18	4,056	0.49	115	81
2	2	3.05	137	0.42	44	0.14	105	45
	3	20.83	1,646	9.84	1,132	0.47	115	79
	4	5.97	615	4.11	518	0.69	126	103
	5	7.58	1,001	5.21	886	0.69	170	132
	6	0.07	14	0.05	10	0.69	198	197
	7	0.08	27	0.06	20	0.69	338	332
	Total (+2)	37.58	3,439	19.69	2,609	0.52	133	92
	Total (+3)	34.53	3,301	19.27	2,565	0.56	133	96
3	2	5.06	258	1.27	154	0.25	121	51
	3	0.36	41	0.22	28	0.60	128	113
	4	0.95	132	0.62	99	0.66	160	139
	5	7.46	1,537	4.89	1,022	0.66	209	206
	6	0.06	15	0.04	12	0.66	306	243
	7	0.00	0	0.00	0	0.66	368	444
	Total (+2)	13.89	1,982	7.04	1,315	0.51	187	143
	Total (+3)	8.83	1,724	5.77	1,162	0.65	201	195
4	2	2.97	128	0.40	42	0.14	105	43
	3	0.21	18	0.12	13	0.59	109	88
	4	0.37	42	0.32	38	0.85	119	113
	5	1.33	192	1.14	157	0.85	138	144
	6	0.05	9	0.04	7	0.85	176	187
	7	0.00	0	0.00	0	0.85	300	240
	Total (+2)	4.93	389	2.02	258	0.41	127	79
	Total (+3)	1.96	261	1.62	216	0.83	133	133

Table 5. Agency distribution of 1989 recommended allowable harvest based on water surface area within management units.

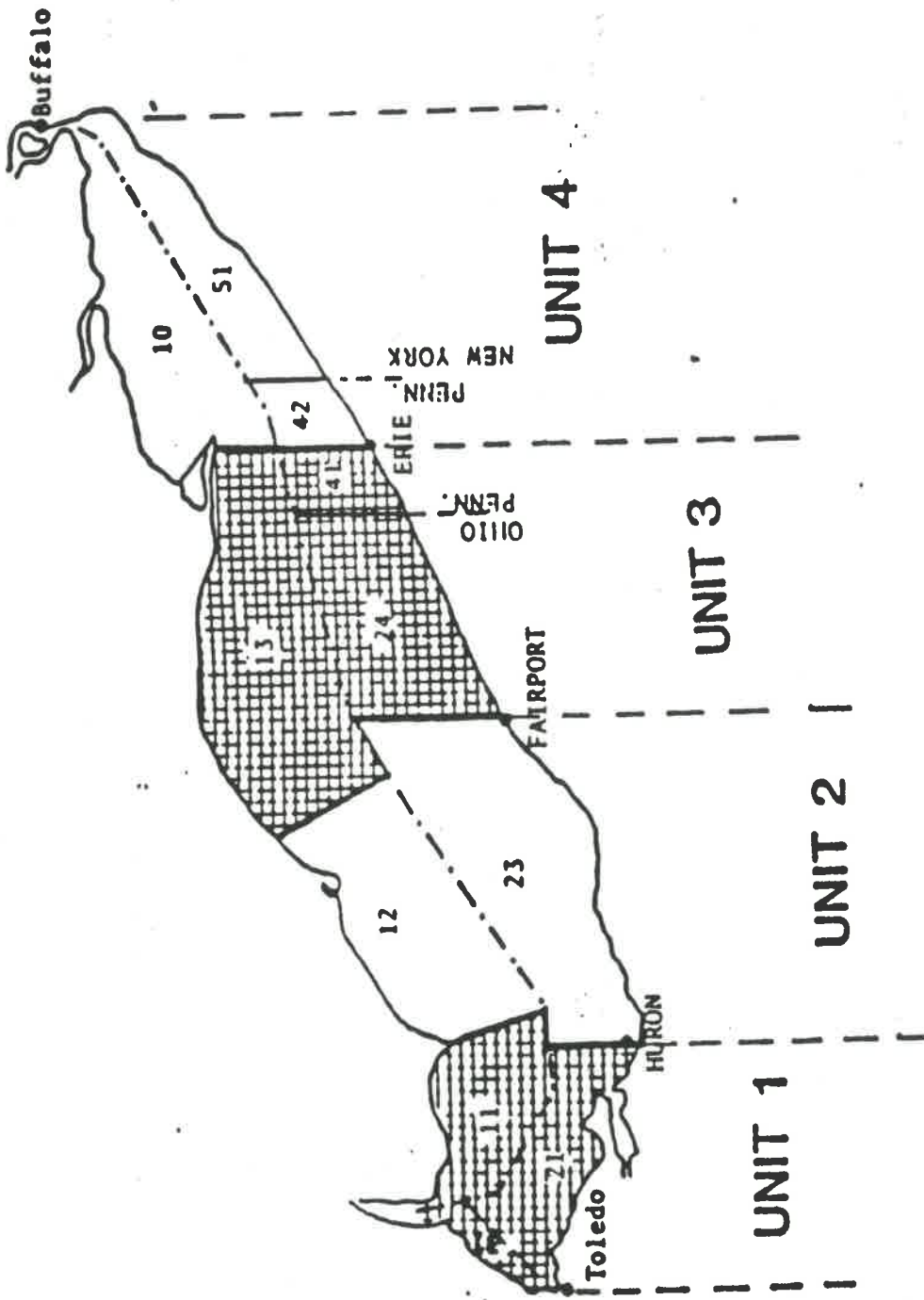| Agency	Unit	Water Area %	Recommended Allowable Harvest (t)	(lbs x 10³)	MSY Allowable Harvest (t)	(lbs x 10³)
Ontario	1	42.3	1,727	3,808	1,073	2,365
	2	42.5	1,109	2,445	660	1,455
	3	56.1	738	1,626	542	1,195
	4	55.2	142	314	115	254
	Total		3,716	8,193	2,390	5,269
Ohio	1	49.6	2,025	4,465	1,258	2,773
	2	57.5	1,501	3,309	893	1,969
	3	31.9	419	925	308	679
	Total		3,945	8,698	2,459	5,421
Pennsylvania	3	11.9	156	345	115	253
	4	17.2	44	98	36	79
	Total		201	443	151	333
Michigan	1	8.1	331	729	205	453
New York	4	27.6	71	157	58	127

Figure 1. Geographical boundaries of management units for yellow perch task group.