

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-81-R-1

Study No.: 484

Title: Population dynamics of yellow perch stocks in Michigan waters of Lake Michigan.

Period Covered: October 1, 1999 to September 30, 2000

Study Objectives: (1) To summarize pertinent existing data from state, federal, commercial, sport, university, and private sources; (2) to conduct assessment netting to establish baseline data and determine whether lack of recruitment and declining yellow perch numbers are problems in Michigan waters; (3) to determine whether factors of fish health might be affecting abundance or recruitment of yellow perch; (4) to reestablish a program of biological data collection for sport-caught yellow perch; (5) to investigate discreteness among yellow perch populations in Lake Michigan; and (6) to develop information and mathematical models from these data that will allow managers to predict, with some predetermined level of certainty, the outcome of various yellow perch management strategies.

Summary: Gill-net assessments were conducted at six eastern Lake Michigan ports (Charlevoix, Arcadia, Grand Haven, Saugatuck, South Haven, and St. Joseph) in April and May, 2000. Catch-per-unit-effort at the four southern Lake Michigan ports ranged from 25 to 375 yellow perch per 1,000 feet of gill net per 24 h, and averaged 169 fish per net night for the four southernmost ports, combined. Yellow perch catch rates were highest at South Haven and St. Joseph, and were typically higher in deep (60-70 feet) net sets when compared with shallow (30-40 feet) sets at the Lake Michigan ports we sampled.

Trawling was conducted in July and August at Pentwater, Grand Haven, and South Haven. Based on collection of age-0 yellow perch, the 2000 year class was the second strongest sampled during this study, but was still significantly less abundant than the 1998 year class. Significant numbers of adult yellow perch from the relatively strong 1998 year class are still being collected in summer trawl samples. Other species collected in trawl samples included spottail shiner (the most abundant fish in trawl samples in all years) and round gobies. Round gobies were first collected in survey samples at Grand Haven in 1997 (0.5 fish per trawl hour); catch rates increased in 1998 (3.0 fish/h) and again in 1999 (69.0 fish/h).

Tagging of yellow perch was conducted during spring 1997-99, in coordination with other Lake Michigan management agencies through the Great Lakes Fishery Commission (GLFC) Yellow Perch Task Group. Yellow perch tagged by Michigan Department of Natural Resources (MDNR) personnel (approximately 3,000 per year) were released near Bridgman, St. Joseph, and Onkama. In 2000, recaptures of tagged perch were obtained from southern Lake Michigan assessment netting and from angler returns. In addition, tissue samples from assessment-caught fish were provided to the University of Minnesota for a study using microsatellite DNA markers to further address the issue of stock discreteness in Lake Michigan yellow perch populations.

Job 1. Title: Review literature and summarize existing data.

Findings: *Michigan Department of Natural Resources Assessment Netting*—Yellow perch were collected in MDNR assessment netting throughout Lake Michigan between 1968-86. From 300-3,000 yellow perch were collected and aged per year. These data are currently being summarized, along with information on alewife abundance in these same assessments (see Job 2). Results of these analyses will be presented in future reports.

Literature Review—A review of yellow perch literature has been conducted, focusing on the following subjects; yellow perch disease, sampling techniques, interactions with alewife, reproduction and early life history, population fluctuations, age and growth, regulations, stock assessment, foraging, and energetics. This review is ongoing and will be used in planning and completing other jobs within this study.

Job 2. Title: Conduct standardized assessment sampling.

Findings: *Spring Assessment Netting*—Gill-net assessments were conducted at six eastern Lake Michigan ports (Charlevoix, Arcadia, Grand Haven, Saugatuck, South Haven, and St. Joseph) in April and May, 2000. Three to six nets (each net 1,000 feet long, 1.5 to 3.5" stretched nylon mesh, 0.5" intervals) were fished overnight at each port. In addition, yellow perch were collected near Ludington, Michigan as part of a study of the barrier net at the Ludington Pumped Storage Hydroelectric Project. Subsamples of fish from MDNR assessments and from the Ludington study were returned to the Charlevoix Great Lakes Station for analysis of age and growth, fecundity, body composition (percent water, gonadosomatic index), and diet.

Catch-per-unit-effort at the four southern Lake Michigan ports (Grand Haven, Saugatuck, South Haven, and St. Joseph) ranged from 25 to 374 yellow perch per 1,000 feet of gill net per 24 h, and averaged 169 fish per net night for the four ports, combined (Table 1). Yellow perch catch rates were highest at South Haven and St. Joseph, and were typically higher in deep (60-70 feet) net sets when compared with shallow (30-40 feet) sets at the Lake Michigan ports we sampled.

Additional species collected in yellow perch assessment nets include alewife, rainbow smelt, spottail shiner, lake trout, brown trout, chinook salmon, whitefish (lake and round), sucker (white and longnose), and round goby. Of these, alewife probably have the greatest potential to influence yellow perch populations (Brandt et al. 1987; GLFC 1996). Analysis of data on alewife and other species collected in spring assessment netting is ongoing.

Summer Trawl Assessments—Trawling was conducted in July and August, 2000 at Pentwater, Grand Haven, and South Haven. Samples consisted of 12, 10-minute trawls at each port during each month. Six trawls were conducted prior to sunset and six were conducted after dark. Based on collection of age 0 yellow perch in August / September, the 2000 year class was the second most abundant (during the time period covered by this study), but still significantly less abundant than the 1998 year class (Table 2). Significant numbers of adult yellow perch from the relatively strong 1998 year class are still being collected in summer trawl samples.

Other species collected in trawl samples included spottail shiner, alewife, rainbow smelt, and johnny darter. Spottail shiners were the most abundant fish in trawl samples at southern Lake Michigan ports in all years. Through our trawl assessments, we have also been able to document the range extension and establishment of round gobies in eastern Lake Michigan at Grand Haven. Round gobies were first collected in survey samples at Grand Haven in 1997 (0.5 fish per trawl

hour); catch rates increased in 1998 (3.0 fish/h) and again in 1999 (69.0 fish/h). Additional analysis of data on species other than yellow perch is ongoing and will be presented in future reports.

Job 3. Title: Investigate the potential impacts of disease on yellow perch populations.

Findings: Yellow perch, alewife, rainbow smelt, bloater chubs, and round goby from gillnet and trawl assessment samples were provided to researchers conducting a study on early mortality syndrome (EMS) and thiamin deficiency in Great Lakes fish. Additional yellow perch samples were provided to various Lake Michigan researchers involved in GLFC Yellow Perch Task Group early life history studies (Makauskas and Clapp 2000).

Job 4. Title: Collect and analyze biological data from sport-caught yellow perch.

Findings: *Yellow Perch Catch*—Yellow perch recreational catch information for the period 1985-99 were summarized in coordination with Studies 427 and 462. Lake Michigan (Michigan waters only) yellow perch catch declined from 3.2 million fish in 1988 to 0.4 million fish in 1998. In 1999, yellow perch catch increased to about 0.8 million fish. Catch of yellow perch varied significantly across ports; for example, catch was highest at St. Joseph (greater than 600,000 yellow perch) and Grand Haven (greater than 200,000 fish) in 1985 and 1987, respectively, whereas catch peaked at South Haven in 1994 (approximately 1.5 million yellow perch; Table 3). Recreational catch statistics generally parallel fishery-independent assessments of adult yellow perch in southern Lake Michigan (Table 1 and Table 3).

Biological data collection—Yellow perch length and age data were collected in 1985-92 as part of the Lake Michigan creel survey program (Study 427). Beginning in 1996, data were again collected from the recreational creel at four sites for which fisheries-independent assessment data are available. In 1997, this data collection program was expanded to include all standard creel sites between New Buffalo and Grand Traverse Bay. In 1999, only limited data were collected at two sites (South Haven and Holland/Saugatuck), but in 2000, data collection again included all standard creel sites between New Buffalo and Grand Traverse Bay. At a given site, data were collected from up to 100 angler-caught yellow perch per month. Length and sex were determined for each fish.

Average total length of yellow perch in the recreational catch was approximately 9.5 inches across all years sampled (Table 4). Age composition of the recreational catch will be determined in the future, using a length-age key based on gillnet assessment samples.

Job 5. Title: Investigate discreteness of yellow perch populations in Lake Michigan.

Findings: *Tagging study*—Tagging of yellow perch was conducted during spring 1997-99, in coordination with other Lake Michigan management agencies through the GLFC Yellow Perch Task Group. Yellow perch tagged by MDNR personnel (approximately 3,000 per year) were released in Michigan waters near Bridgman, St. Joseph, and Onkama (Table 5). In 2000, recaptures of tagged perch were obtained from southern Lake Michigan assessment netting and from voluntary angler returns. Analysis of tag return data from throughout Lake Michigan is ongoing, and will provide much needed information on fish movements, growth, exploitation rates, and mixing of stocks.

Physiological parameters—Physiological parameters have often been used as measures of discreteness of fish populations (Ihssen et al. 1981). As part of our spring assessment sampling, we examined various physiological and biological parameters (percent water, gonadosomatic index, growth rate, and diet) for differences among populations (ports). This initial examination showed no apparent differences in these parameters among perch populations at southern Lake Michigan ports. Analyses of fecundity and diet of yellow perch collected in spring assessment netting are still being conducted. In the future, we will examine correlations between yellow perch reproductive success and these various physiological parameters using data collected over a number of years.

Genetic study—Tissue samples from assessment-caught fish were provided to the University of Minnesota for a study using microsatellite DNA markers to further address the issue of stock discreteness in Lake Michigan yellow perch populations.

Job 6. Title: Develop information and mathematical models related to yellow perch management strategies.

Findings: Successful modeling of Lake Michigan yellow perch populations will require collection of information on length, weight, age, sex, maturity, egg production, diet, movement, harvest rates, and predation. These data are currently being collected in Jobs 1-5 (see above). Initial modeling efforts will be aimed at investigating predictability of yellow perch population fluctuations (see Job 1), the influence of commercial and recreational harvest on yellow perch populations, and estimating population parameters through development of an age-structured population model. Results of these efforts will be presented in future reports, and will be coordinated with ongoing modeling work being conducted by the GLFC Lake Michigan Yellow Perch Task Group.

Job 7. Title: Evaluate results, write reports, and develop future study plans for Michigan waters of Lake Michigan south of the 45th parallel.

Findings: Results of yellow perch research were summarized for this progress report, as well as for summaries to various MDNR and external committees. Presentations were given at the Michigan State University, Fisheries Extension Workshops in St. Joseph and Grand Haven. A poster describing the expansion of round gobies in Lake Michigan (see Job 2) was presented at the 1999 International Association of Great Lakes Research meeting in Cleveland, Ohio. An article based on this poster was submitted to the Journal of Great Lakes Research (Clapp et al. 2000), and is in the process of being revised for publication. A report describing the work of the GLFC Lake Michigan Yellow Perch Task Group (Makauskas and Clapp 2000) was completed for the GLFC annual meeting in Ann Arbor, and a draft publication describing the Lake Michigan inshore fish community was completed (Clapp et al. 2001), based on a presentation made at the same meeting. Great Lakes Fish and Wildlife Restoration Act funding was obtained (in cooperation with Jim Bence of the Michigan State University unit of the Partnership for Ecosystem Research and Management - PERM) to begin yellow perch modeling work on Lake Michigan.

Literature Cited:

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- Makauskas, D. and D.F. Clapp. 2000. Status of Yellow Perch in Lake Michigan and Yellow Perch Task Group Progress Report. Great Lakes Fishery Commission, Lake Michigan Technical Committee, Annual Meeting Minutes.

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Table 1.—Average assessment gillnet catch (fish / 1,000' of gillnet / 24 hours) of yellow perch at eastern Lake Michigan ports, 1996-2000. Three to six nets were set at each port in each year. Two standard errors are shown in parentheses.

Sample year	Port						
	Charlevoix	Arcadia	Grand Haven	Saugatuck	South Haven	St. Joseph	Combined
1996	---	---	315 (326)	20 (4)	338 (584)	33 (14)	177 (168)
1997	---	---	155 (104)	59 (62)	153 (200)	25 (10)	94 (61)
1998	---	---	158 (238)	35 (50)	86 (74)	17 (15)	74 (64)
1999	---	---	20 (15)	19 (19)	58 (36)	84 (42)	41 (18)
2000	14 (6)	14 (11)	25 (13)	38 (11)	374 (179)	264 (160)	169 (86)

Table 2.—Yellow perch catch-per-unit-effort (number per trawl hour) at four Lake Michigan ports (Muskegon, Grand Haven, South Haven, and St. Joseph), 1996-2000; values are for samples from the four ports combined. Age class determinations are based on length frequency analysis. Samples were not collected at St. Joseph in September 1996, at St. Joseph in 2000, at Muskegon in July 1997, or at Muskegon after 1997.

Year	Age 0			Adult (Age 1 and older)		
	July	August / September		July	August / September	
		July	September		Combined	July
1996	0	2	1	138	17	84
1997	2	2	2	31	3	15
1998	7	218	163	4	9	8
1999	7	5	6	95	339	190
2000	0	8	4	72	43	56

Table 3.—Yellow perch recreational catch at four southern Lake Michigan ports, 1985-99. Estimates of charter catch were not obtained prior to 1990. Creel estimates were not obtained at Holland and South Haven in 1989-91.

Sample year	Port							
	Grand Haven		Holland/Saugatuck		South Haven		St. Joseph	
	Creel	Charter	Creel	Charter	Creel	Charter	Creel	Charter
1985	110,084	---	105,398	---	292,225	---	664,671	---
1986	79,972	---	27,382	---	307,847	---	590,044	---
1987	213,199	---	126,910	---	313,800	---	448,285	---
1988	156,496	---	119,128	---	618,933	---	575,937	---
1989	121,713	---	---	---	---	---	313,084	---
1990	74,151	1,755	---	74	---	2,107	348,313	16,099
1991	133,783	154	---	2	---	39,870	253,873	6,076
1992	58,126	791	47,610	12	348,138	19,906	430,828	8,293
1993	78,364	1,532	62,585	176	732,128	40,452	384,416	17,822
1994	119,106	1,344	63,588	504	1,414,005	48,756	152,108	11,232
1995	11,490	363	68,882	85	981,999	92,074	74,063	3,528
1996	75,553	608	40,704	0	148,115	35,372	64,113	2,327
1997	84,774	304	16,899	0	209,663	41,771	11,891	800
1998	23,554	79	8,249	39	121,798	25,503	13,369	383
1999	34,562	360	10,495	202	290,001	39,534	70,393	1,492

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Table 4.—Average total length (inches) of yellow perch in recreational catch, 1996-99. Data are presented for boat and shore angling modes; fish caught by charter anglers at South Haven are presented separately. Values in parentheses are two standard errors.

Port	Year							
	1996		1997		1998		1999	
	Boat	Shore	Boat	Shore	Boat	Shore	Boat	Shore
Arcadia – Onekema	-----	-----	10.2 (0.4)	-----	11.9 (1.0)	-----	-----	-----
Elk Rapids	-----	-----	-----	9.3 (0.4)	-----	7.2 (0.3)	-----	-----
Grand Traverse Bay	-----	-----	8.2 (0.2)	7.0 (0.2)	7.8 (0.4)	7.3 (0.7)	-----	-----
Grand Haven –								
Muskegon	10.1 (0.2)	9.4 (0.2)	10.4 (0.2)	9.5 (0.2)	9.8 (0.2)	8.4 (0.2)	-----	-----
Holland - Saugatuck	9.4 (0.4)	9.6 (0.2)	10.3 (0.2)	9.4 (0.4)	11.0 (0.7)	-----	9.2 (0.3)	-----
South Haven	9.3 (0.2)	10.2 (0.4)	9.3 (0.2)	10.4 (1.4)	9.8 (0.4)	-----	9.3 (0.2)	-----
South Haven (Charter)	9.3 (0.2)	-----	8.7 (0.2)	-----	-----	-----	-----	-----
St. Joseph - New Buffalo	9.8 (0.2)	9.8 (0.2)	10.2 (0.2)	10.2 (0.4)	9.3 (0.2)	8.9 (0.2)	-----	-----
Combined	9.7 (0.2)	9.7 (0.2)	9.9 (0.2)	9.2 (0.2)	9.5 (0.1)	8.4 (0.2)	9.3 (0.2)	-----

Table 5.—Cumulative number of tagged and recaptured yellow perch, 1996-99 (data from Makaukas and Clapp 2000; and John Dettmers, Illinois Natural History Survey, personal communication).

Location	Tagging year			
	1996	1997	1998	1999
Illinois	13,462	8,482	4,902	6,274
Indiana	0	2,950	620	3,246
Michigan	0	3,292	3,369	2,594
Grand Traverse Bay	0	32	0	0
Green Bay	0	1,844	2,314	3,026
Wisconsin	0	5,153	1,318	3,142
Total tagged	13,462	21,753	12,523	18,282
Total recaptures	1,350	1,573	695	516