STUDY PERFORMANCE REPORT

State: Michigan   **Project No.:**   F-81-R-8

Study No.: 230725   **Title:**   Fisheries assessments in large, inland
                                                                           lakes of Michigan.

Period Covered: October 1, 2006 to September 30, 2007

Study Objective: To develop and implement a program to assess fisheries in large, inland lakes of Michigan and to develop predictive models to estimate abundance and safe harvest levels in lakes where assessments have not been conducted.

Summary: Year 2007 was the seventh year of this study (formerly Study 230691) involving extensive fish collection and marking in the spring, followed by a year-long creel survey to estimate angler harvest and population size. Due to budget constraints, we did not survey Houghton Lake or Long Lake — lakes previously scheduled for surveys in 2007. We surveyed the Portage-Torch lakes system (Houghton County) and we tagged 4,776 walleye, 738 northern pike, and 76 smallmouth bass. All survey data were entered into the Microsoft Access database designed for storing catch and effort data and processing tag returns. Extensive work was done on analyses for lakes surveyed from 2003 to 2006. Data for 2007 has been entered and error-checked and summaries have been provided to managers. The list of lakes to be surveyed through 2010 has been modified due to budget constraints and because some lake surveys originally scheduled could not be conducted.

Findings: Jobs 1–7 and 9 were scheduled for 2006-07, and progress is reported below.

Job 1. Title: <u>Select lakes and identify target species.</u>–I communicated with Michigan Department of Natural Resources basin teams to select lakes to survey in the future. Preliminary lists were developed by each basin team, and final choices were made jointly by the principal investigator and basin team leaders. The final list was then coordinated with Statewide Angler Survey Program personnel and minor changes were made. Only the Elk/Skegemog Lake system in Antrim, Grand Traverse, and Kalkaska counties will be sampled in 2008. Due to the extensive changes made to the list of lakes to be surveyed through 2010, we now evaluate the list annually and plan for the next year only.

Target species for population estimates in coolwater lakes are walleye, northern pike, smallmouth bass, and muskellunge. We continue to have good success collecting enough walleye for reliable population estimates in all cases and for northern pike in some cases. We will continue to tag smallmouth bass at the manager's request in lakes where catch in the spring is high enough to make abundance and exploitation estimates. We have never tagged enough muskellunge for reliable estimates of abundance or exploitation. Hence, in the future we may simply collect biological data on this species.

Job 2. Title: <u>Oversee tagging.</u>–One lake system was surveyed in 2007 – the Portage-Torch lake system. A summary of the gear effort and number tagged by species is provided in Table 1. All fish were identified, counted, and a sub-sample was measured for length. Total catch is reported in Table 2. All data is housed in an Access database with queries in place to extract data for estimates of exploitation, catch per unit effort, and movement.

Job 3. Title: <u>Manage tag-recovery.</u>–Tag returns are collected from various sources (angler-mailed, internet return, creel clerk, and phone-in) and are entered into the Access database. Queries were developed that validate tag numbers for each return. Additionally, possession of tag is verified before payment vouchers are generated. The database automatically generates payment vouchers and letters to anglers. Responses to anglers are usually sent within 1–2 months after a return is reported to our office. To date, we have approximately 8,900 tag returns in our database from approximately 6.5 years of study.

Job 4. Title: <u>Coordinate with creel survey study.</u>–Ratios of marked-to-unmarked fish observed in the creel have been tallied for lakes surveyed through 2006 (see Study 230646 Progress Report). Data from creel surveys of lakes surveyed in 2007 are currently being processed.

Job 5. Title: <u>Oversee fish aging.</u>–We established a protocol to record digital images of all structures by means of Image-Pro® software. All images are archived on both hard disk and compact disk. A final age has been determined (approximately 15 fish per sex per in group) for all samples collected through 2006. Samples collected in 2007 have been sectioned and imaged, and aging has begun.

Job 6. Title: <u>Analyze field data.</u>– Due to the delay in getting reports written and published, analyses were completed for all lakes surveyed through 2006 and provided to managers. This was done so that managers would have the basic estimates they needed to make management decisions in a timely fashion. Raw survey data through 2007 was made available to managers via the statewide database (Fish Collection System) for housing and querying fish survey data. A tagging summary for the survey conducted in 2007 was also sent out to all fisheries managers (Tables 1 and 2), and updates on angler exploitation were sent to managers throughout the year.

Job 7. Title: <u>Develop walleye versus lake size regression.</u>–I fit a model of legal (≥15 in) walleye abundance to lake area for the seventeen lakes that had final population estimates (Table 3). I used an approach similar to that used by the Wisconsin DNR (Hansen 1989), where lake area is used to predict walleye abundance in lakes with no empirical population estimates. A log-log regression explained 62% of the variation in legal-size walleye abundance ($F = 24.4$; df = 16; $P = 0.0002$; Table 3). The intent of this exercise was to examine the model fit. It still has little utility thus far as a predictive model. Additional abundance estimates will be added to the model as they become available.

Job 9. Title: <u>Publish 5-year interim report.</u>– Significant progress has been made on final lake reports. The reports for the Muskegon Lake system and Lake Leelanau were published. Reports for South and Big Manistique lakes have been reviewed and are in press. Reports for the Cisco Chain, North Manistique Lake, Bond Falls Flowage, and Grand Lake are completed and awaiting final review by the division editor.

A decision was made to publish summaries based on five years of data in peer-review journals rather than through the Fisheries Division's Report series. One manuscript comparing multiple- and single-census methods for estimating walleye abundance was submitted to the North American Journal of Fisheries Management and is currently in review. Another manuscript comparing methods for estimating angler exploitation is being prepared and will also be submitted to a journal of the American Fisheries Society. Additionally, results for individual lakes are being published as MDNR Special Reports. The following Special Reports for Large Lakes have been completed in fiscal year 2006-07:

Hanchin, P. A., R. P. O'Neal, R. D. Clark, Jr., and R. N. Lockwood. 2007. The walleye population and fishery of the Muskegon Lake System, Muskegon and Newaygo counties, Michigan in 2002. Michigan Department of Natural Resources, Fisheries Special Report 40, Ann Arbor.

Hanchin, P. A., T. G. Kalish, Z. Su, and R. D. Clark, Jr. 2007. The fish community and fishery of Lake Leelanau, Leelanau County, Michigan with emphasis on walleyes, northern pike and smallmouth bass. Michigan Department of Natural Resources, Fisheries Special Report 42, Ann Arbor.

Hanchin, P. A., and D. R. Kramer. 2007. The fish community and fishery of Big Manistique Lake, Luce and Mackinac counties, Michigan in 2003–04 with emphasis on walleyes, northern pike, and smallmouth bass. Michigan Department of Natural Resources, Fisheries Special Report 43, Ann Arbor.

References:

Hansen, M. J. 1989. A walleye population model for setting harvest quotas. Wisconsin Department of Natural Resources, Bureau of Fisheries Management, Fish Management Report 143, Madison.

Prepared by: Patrick A. Hanchin
Date: September 30, 2007

Table 1.–Summary of effort and number of fish marked in 2007. Numbers of reward (R) and non-reward (NR) tags are in parentheses.

Effort	
Fyke-net lifts	443
Trap-net lifts	46
Electrofishing runs	1
¼-arc seine haul	1
Walleye	
Total tagged (R+NR)	4,776 (2,684 + 2,092)
Sub-legals clipped	136
Northern pike	
Total tagged (R+NR)	738 (285 + 453)
Sub-legals clipped	979
Smallmouth bass	
Total tagged (R+NR)	76 (46 + 30)
Sub-legals clipped	7

Table 2.–Total catch by species from spring 2007 survey of the Portage-Torch system (includes recaptures).

Species	N
Brown bullhead	15,402
Walleye	5,699
White sucker	5,297
Northern pike	1,965
Redhorse sucker spp.	1,958
Silver redhorse	1,229
Smelt	1,220
Yellow perch	944
Pumpkinseed	900
Trout perch	762
Rock bass	650
Black crappie	521
Golden shiner	469
Shorthead redhorse	143
Eurasian ruffe	103
Smallmouth bass	87
Longnose sucker	80
Common shiner	51
Round whitefish	46
Burbot	42
Rainbow trout	37
Bluegill	35
Spottail shiner	23
Sea lamprey	18
Mottled sculpin	16
Central mudminnow	15
Creek chub	13
Alewife	9
Lake herring	8
Black bullhead	8
Brook trout	8
Largemouth bass	7
Common carp	6
Coho salmon	4
Brown trout	3
Sturgeon	3
Bluntnose minnow	1
Silver lamprey	1

Table 3.–Analysis of modeled legal walleye abundance data. The dependent variable in the model is log (legal walleye abundance) and the independent variable is log [lake area (acres)].

Regression Statistics	
Multiple R	0.7871
R Square	0.6195
Adjusted R Square	0.5941
Standard Error	0.6047
Observations	17

ANOVA

	df	SS	MS	F	Significance F
Regression	1	8.9309	8.9309	24.4209	0.0002
Residual	15	5.4856	0.3657		
Total	16	14.4165			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.6172	1.7391	0.3549	0.7276	-3.0897	4.3240
X Variable 1	0.9807	0.1985	4.9417	0.0002	0.5577	1.4037