STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-81-R-6

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

Period Covered: October 1, 2004 to September 30, 2005

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 2005 was the fifth year of this study (formerly Study 691) involving extensive fish collection and marking in the spring, followed by a year-long creel survey to estimate angler harvest and population size. We surveyed Lake Gogebic (Gogebic and Ontonagon Counties), and Black Lake (Cheboygan and Presque Isle Counties). Due to budget constraints, we did not survey Elk Lake or Indian Lake, as was scheduled for 2005. We tagged 6,678 walleye, 550 northern pike, and 164 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 and report writing for lakes surveyed in 2001 and 2002. At the requests of managers, some analysis was completed for lakes surveyed in 2003. However, reports will be completed on a chronological basis; that is, finishing one year's data before starting on another year. Data for 2005 have 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 forgoing surveys of lakes in 2005.

Findings: Jobs 1–8 were scheduled for 2004-05, and progress is reported below.

Job 1. Title: Select lakes to be sampled for the next 5 years.–We communicated with Basin teams for selecting 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. Lakes to be sampled in 2006 are: Lake Charlevoix (Charlevoix County), and Lake Michigamme (Marquette County). The original list in its entirety is attached as Appendix 1.

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, we may in the future simply collect biological data on this species.

Job 2. Title: Organize and oversee annual netting/tagging operation for selected lakes.–Two lakes were surveyed in 2005: Lake Gogebic (Gogebic and Ontonagon Counties), and Black Lake (Cheboygan and Presque Isle Counties). 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 represented in Table 2. All data is housed in a Microsoft Access

database, with queries in place to extract data for estimates of exploitation, catch per unit effort, movement, etc.

Job 3. Title: Manage tag-recovery operation, including establishing a payment system for reward tags.–Tag returns are collected from various sources (angler-mailed, internet return, creel clerk, phone-in) and are entered into the Access database. Queries have been 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 1-2 months following arrival in our office. At present, we have approximately 7,000 tag returns in our database from approximately 4.5 years of study.

Job 4. Title: Coordinate with creel survey Study 230646 to get ratio of marked-to-unmarked target fish for population estimate and estimated total harvest of all species.–Ratios of marked-to-unmarked fish observed in the creel have been tallied for lakes surveyed through 2003 (see Study 646 Progress Report). Creel surveys for lakes surveyed in 2005 are still in progress.

Job 5. Title: Oversee laboratory processing and aging of spine, fin ray, or scale samples.–We established a protocol where digital images of all structures are taken using 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 2003. Samples collected in 2004 have been aged by at least one reader and in most cases by two readers. Assignments have been made and aging has begun on samples collected in 2005.

Job 6. Title: Conduct analysis of field data.–Significant progress has been made on analysis of 2002 survey data. Draft reports have been completed for two lakes (Muskegon and Leelanau), and the third (Cisco Chain) is underway. Reports for all lakes surveyed in 2001 are complete. Survey data through 2005 was made available in a raw form to managers via the statewide database (Fish Collection System) for housing and querying fish survey data.

Analyses of 2003 data have been completed to a large extent, and I expect that draft reports will be completed this winter. Preliminary abundance estimates from recaptures during the netting operation were made for 2005 lakes, but are not reported here due to our policy of not publishing 'preliminary' numbers. Final annual exploitation rates have been calculated for lakes surveyed in through 2002, and preliminary rates for 2003 and 2004 (Table 3). Walleye exploitation has ranged from 3 - 35%, which is within the range observed for similar lakes. The reporting rate of non-reward tags has ranged from 64 - 100% (Table 3). This rate is calculated relative to the reporting rate of reward tags and assumes near 100% reporting of reward tags. In the future, we may have to examine the costs and benefits of our tagging operation if we are not getting good compliance of angler tag returns.

The tagging summary for 2005 surveys was sent out to all fisheries managers (Tables 1 and 2), and updates regarding angler exploitation were sent to managers throughout the year.

Job 7. Title: Use regression analysis to examine relationship between walleye population size and lake size.–We fit a model of adult walleye abundance to lake area for the seven lakes that had final population estimates (Table 4). We used an approach similar to the Wisconsin DNR (Hansen 1989) where lake area is used to predict walleye abundance in lakes with no population estimates. A log-log regression explained 80% of the variation in legal-size walleye abundance ($F = 20.6$, $df = 6$, $P = 0.006$). The only intent of this exercise was to examine the model fit; it has

little utility thus far as a predictive model. Additional abundance estimates will be added to the model as they become available.

Job 8. Title: Write annual report.–This performance report fulfills obligations for an annual study report. Additionally, results for individual lakes are being incorporated into MDNR Special Reports. The following Special Reports for Large Lakes have been completed in fiscal year 2004-05:

Hanchin, P. A., R. D. Clark, Jr., R. N. Lockwood, and T. A. Cwalinski. In press. The fish community and fishery of Burt Lake, Cheboygan County, Michigan in 2001 with emphasis on walleyes and northern pike. Michigan Department of Natural Resources, Fisheries Special Report 36, Ann Arbor.

Hanchin, P. A., R. D. Clark, Jr., R. N. Lockwood, and N. A. Godby, Jr. 2005. The fish community and fishery of Crooked and Pickerel lakes, Emmet County, Michigan with emphasis on walleyes and northern pike. Michigan Department of Natural Resources, Fisheries Special Report 34, Ann Arbor.

Hanchin, P. A., R. D. Clark, Jr., and R. N. Lockwood. 2005. The fish community and fishery of Michigamme Reservoir, Iron County, Michigan with emphasis on walleyes and northern pike. Michigan Department of Natural Resources, Fisheries Special Report 33, Ann Arbor.

In addition to the three reports listed above, Special Report 30 for Houghton Lake was completed and submitted previously as results for F-80-R-4, Study 709 Final Report (Clark et al. 2004).

Literature Cited:

Clark, R. D., P. A. Hanchin, and R. N. Lockwood. 2004. The fish community and fishery of Houghton Lake, Roscommon County, Michigan with emphasis on walleyes and northern pike. Michigan Department of Natural Resources, Fisheries Special Report 30, Ann Arbor.

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.

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Table 1.–Summary of effort, number of fish tagged, and age structures collected in 2005. Numbers of reward (R) and non-reward (NR) tags are in parentheses.

	Lake	
	Black Lake (10,113 acres)	Lake Gogebic (13,127 acres)
Effort		
Fyke-net lifts	171	425
Trap-net lifts	282	0
Electrofishing runs	4	0
Walleye		
Total tagged	990	5,688
(R + NR)	(643 + 347)	(2,782 + 2,906)
Sub-legals clipped	5	8,753
Northern pike		
Total tagged	345	205
(R + NR)	(163 + 182)	(81 + 124)
Sub-legals clipped	744	913
Smallmouth bass		
Total tagged	104	60
(R + NR)	(53 + 51)	(17 + 43)
Sub-legals clipped	4	67
Muskellunge		
Total tagged	0	0
(R + NR)		
Sub-legals clipped	1	0
Yellow perch		
Total clipped (≥ 10”)	x	425

Table 2.–Total catch by species from spring 2005 survey (includes recaps).

Species	Black Lake	Lake Gogebic
BCR	3	6
BLB	73	1
BLG	7	
BOW	90	
BRB	152	1
BUR		2
CRC		1
CSH		3
CWS	313	3558
GAR	2	
GOS		1
GRR	188	
LHR	2	1
LMB	8	
LNG	16	
MUS	1	
NOP	1308	1296
PSF	31	48
RKB	937	373
SHR	3	
SIR	564	
SMB	116	130
STN	1	
WAE	1057	18189
YEP	110	1152
YLB	10	

Table 3.–Annual exploitation of walleye for lakes surveyed through 2004.

Species	Lake	Annual exploitation rate (%) based on: reward tag returns	Annual exploitation rate (%) based on: harvest/abundance[1]	Reporting rate (%) of non-reward tags
Walleye	Houghton	10.6	27.3	81.3
	Michigamme	29.3	22.3	64.7
	Crooked-Pickerel	16.3	29.3	100
	Burt	8.0	23.0	92.2
	Cisco chain[1]	16.9	–	88.6
	North Leelanau	14.6	34.1	100
	South Leelanau	16.1	34.1	82.5
	Muskegon	3.5	4.8	71.5
	Bond Falls Flowage[1]	35.4	–	72.5
	North Manistique[1]	7.5	–	94.2
	Big Manistique[1]	10.8	12.5	74.5
	South Manistique[1]	31.8	62.4	80.0
	Grand Lake[1]	6.9	–	–
	Long Lake[1]	7.6	–	–
	Peavy Pond[1]	18.2	–	–

[1] Preliminary estimates
[2] Single-census estimate of abundance

Table 4.–Analysis of modeled legal walleye abundance data.

SUMMARY OUTPUT

Regression statistics	
Multiple R	0.897228
R Square	0.805018
Adjusted R Square	0.766021
Standard Error	0.412633
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.514868	3.514868	20.64336	0.006148984
Residual	5	0.851332	0.170266		
Total	6	4.3662			

Appendix 1.–Large lakes to be surveyed through 2010. Plans are subject to change.

Year	Lake name	County	Management unit
2006	Lake Michigamme	Marquette	Northern Lake Michigan
	Lake Charlevoix	Charlevoix	Central Lake Michigan
2007	Portage/Torch Lakes	Houghton	Western Lake Superior
	Walloon Lake	Charlevoix	Central Lake Michigan
	Houghton Lake	Roscommon	Central Lake Michigan
	Long Lake	Grand Traverse	Central Lake Michigan
2008	Chicagon/Hagerman/Stanley	Iron	Northern Lake Michigan
	Glen Lake	Leelanau	Central Lake Michigan
	Mullett Lake	Cheboygan	Northern Lake Huron
	Milakokia/Millecoquins	Mackinac	Northern Lake Michigan
2009	Lac La Belle/Gratiot	Keweenaw	Western Lake Superior
	Torch Lake	Antrim	Central Lake Michigan
	Cadillac/Mitchell Lakes	Wexford	Central Lake Michigan
	Brevoort Lake	Mackinac	Northern Lake Michigan
2010	Lake Independence	Marquette	Western Lake Superior
	Higgins Lake	Roscommon	Central Lake Michigan
	Intermediate/Bellaire Lakes	Antrim	Central Lake Michigan
	Burt Lake	Cheboygan	Northern Lake Huron