STUDY PERFORMANCE REPORT

State: Michigan

Study No.: 230725

Project No.: F-81-R-5

Title: Fisheries assessments in large, inland lakes of Michigan.

Period Covered: October 1, 2003 to September 30, 2004

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 2004 was the fourth 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 Peavy Pond (Iron County), Grand Lake (Presque Isle County), and Long Lake (Alpena and Presque Isle Counties). We tagged 2,882 walleye, 1,439 northern pike, 1,463 smallmouth bass, and 7 muskellunge. 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. At the requests of managers, some analysis was completed for lakes surveyed in 2002 and 2003. However, my plan is to tackle the report writing for this study on a chronological basis; that is, finishing one year's data before starting on another year. Data for 2004 have been entered and error-checked and summaries have been provided to managers. A list was finalized for lakes to be surveyed through 2010.

Findings: Jobs 1 through 8 were active this year, and progress is reported below.

Job 1. Select lakes to be sampled for the next 5 years. Identify target species for population estimates and establish tagging goals. Coordinate with statewide resource inventory and creel programs.–We attended Lakes Superior, Michigan and Huron Basin team meetings in order to give advice to 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 2005 are: Lake Gogebic (Ontonagon and Gogebic Counties), Black Lake (Cheboygan and Presque Isle Counties), and Indian Lake (Schoolcraft County). The 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. Organize and oversee annual netting/tagging operation for selected lakes. Tag, measure lengths, and collect spine, fin ray, or scale samples for target species. Identify and count all

fish handled. Measure length for a sub-sample of all non-target species. Maintain records of individual net locations and daily captures. Calculate catch-per-effort for all fish.–Three lakes were surveyed in 2004: Peavy Pond (Iron County), Grand Lake (Presque Isle County), and Long Lake (Alpena and Presque Isle Counties). A summary of the gear effort, number tagged, and age structures collected 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 are housed in an Access database with queries in place to extract data for estimates of exploitation, catch per unit effort, movement, etc.

Job 3. 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 over 5,500 tag returns in our database from approximately 3.5 years of study.

Job 4. Coordinate with creel survey study 646 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 in 2001 and 2002 (see Study 646 Progress Report). Creel surveys for lakes surveyed in 2004 are still in progress.

Job 5. 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 in 2001 and 2002. Samples collected in 2003 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 2004.

Job 6. Conduct analysis of field data. Assemble timely data summaries of netting operation to provide field managers and interested parties. Use mark-recapture methods to estimate population size of target species from: a) recaptures from netting operation; and b) recaptures from creel survey. Estimate exploitation rate of target species from: a) % tag returns; and b) ratio of estimated total harvest to estimated population size. Compare tag returns from reward and non-reward tags. Partition population into age groups based on results of Job 5. Analyze movement of target species between marking and recapture.–Significant progress has been made on analysis of 2001 survey data. Analyses are complete for all lakes and the report writing process is underway. We decided that for each large lake a Special Report will be written in the Fisheries Division publication series. Reports for Houghton Lake and Michigamme Reservoir are in press, and the draft report for Crooked and Pickerel Lakes is in review. A draft for Burt Lake, the final 2001 lake, is about one half complete. Survey data through 2004 were made available in a raw form to managers via the state-wide database (Fish Collection System) for housing and querying fish survey data.

Analyses of 2002 data have been completed to a large extent, but final estimates have not been made due to the priority of writing reports. Abundance estimates from recaptures during the netting operation were made for 2002 and 2003 lakes, but are not reported here due to our policy of not releasing ‘preliminary’ numbers. Final annual exploitation rates have been calculated for lakes surveyed in 2001 and 2002, and preliminary rates for 2003 (Table 3). Walleye exploitation has ranged from 3 - 32%, 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 2004 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. Use regression analysis to examine relationship between walleye population size and lake size. Compare results to Wisconsin regression.–We fit a model of adult walleye abundance to lake area for the five 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 93% of the variation in walleye abundance ($F = 40.1$, $df = 4$, $P = 0.008$). 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 finalized this winter, after which they will be added to the model.

Job 8. Write annual report.–This performance report fulfills obligations for an annual study report. In the future, results for individual lakes will be incorporated into MDNR Special Reports.

Literature Cited:

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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Date: September 14, 2004

Table 1.–Summary of effort, number of fish tagged, and age structures collected in 2004. Numbers of reward (R) and non-reward (NR) tags are in parentheses.

	Lake		
	Grand Lake	Long Lake	Peavy Pond
Effort			
Fyke-net lifts	293	228	399
Trap-net lifts	163	260	0
Electrofishing runs	0	1	54
Walleye			
Total tagged (R+NR)	1,135 (551 + 584)	641 (381 + 260)	1,106 (565 + 541)
Sub-legals clipped	1,514	105	983
Spine samples	421	368	572
Northern pike[1]			
Total tagged (R&NR)	100 (59 + 41)	117 (78 + 39)	1,222 (585 + 637)
Sub-legals clipped	103	230	1,107
Fin ray samples	169	311	630
Smallmouth bass			
Total tagged (R&NR)	760 (395 + 365)	671 (398 + 273)	32 (25 +7)
Sub-legals clipped	1,155	358	6
Spine samples	459	216	28
Muskellunge			
Total tagged (R&NR)	0	0	7 (1 + 6)
Sub-legals clipped	0	0	22
Fin ray samples	0	0	25

[1] All northern pike ≥ 18” were tagged in the Peavy system.

Table 2.–Total catch by species from spring 2004 survey (includes recaps).

Species	Grand Lake	Long Lake	Peavy System
Black bullhead	0	57	1
Black crappie	0	1	100
Bluegill	309	57	296
Bowfin	79	0	0
Brook trout	0	0	1
Brown bullhead	377	238	0
Burbot	0	0	27
Central mudminnow	0	0	3
Common carp	1	10	0
Common shiner	38	0	18
Creek chub	0	0	4
Golden shiner	0	0	18
Green sunfish	1	0	0
Largemouth bass	9	1	2
Longnose gar	15	0	0
Pumpkinseed	537	80	68
Mottled sculpin	0	0	2
Mudpuppy	14	2	0
Muskellunge	0	0	31
Northern pike	232	397	3310
Rainbow trout	0	1	0
Rock bass	2,451	2,243	587
Smallmouth bass	2,125	1,076	60
Tadpole madtom	0	0	963
Tiger musky	0	0	1
Walleye	3,295	837	2,509
White sucker	7,586	1,840	165
Whitefish	0	0	4
Yellow perch	3,848	831	4,670
Yellow bullhead	3	0	0

Table 3.–Annual exploitation of walleye for lakes surveyed through 2003.

		Annual exploitation rate (%)		
Species	Lake	Based on reward tag returns	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	8.8	29.3	92.2
	Cisco chain	16.0	–	88.6
	North Leelanau	13.0	–	100
	South Leelanau	15.4	–	82.5
	Muskegon	3.6	–	71.5
	Bond Falls Flowage	31.7	–	72.5
	North Manistique	7.1	–	94.2
	Big Manistique	8.2	–	74.5
	South Manistique	20.6	–	80.0

[1] Bi–census estimate of abundance

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

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.174508638	1.174508638	40.09636781	0.007964028
Residual	3	0.087876436	0.029292145		
Total	4	1.262385075			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.342234622	0.589883035	0.580173699	0.60250178
X Variable 1	0.987385122	0.155931574	6.332169282	0.007964028

Appendix 1.–Large lakes to be surveyed through 2010.

Year	Lake Name	County	Management Unit
2004	Peavy Pond	Iron	Northern Lake Michigan
	Grand Lake	Presque Isle	Northern Lake Huron
	Long Lake	Alpena	Northern Lake Huron
2005	Lake Gogebic	Ontonagon/Gogebic	Western Lake Superior
	Elk Lake	Antrim/Grand Traverse	Central Lake Michigan
	Black Lake	Cheboygan/Presque Isle	Northern Lake Huron
	Indian Lake	Schoolcraft	Northern Lake Michigan
2006	Lake Michigamme	Marquette	Northern Lake Michigan
	Lake Charlevoix	Charlevoix	Central Lake Michigan
	Lake Margrethe	Crawford	Central Lake Michigan
	Platte Lake	Benzie	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