STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-81-R-4

Study No.: 725 **Title:** Fisheries assessments in large, inland lakes of Michigan.

Period Covered: October 1, 2002 to September 30, 2003

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 2003 was the third 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 Bond Falls Flowage (Ontonagon County), North Manistique Lake (Luce County), Big Manistique Lake (Luce and Mackinac Counties), and South Manistique Lake (Mackinac County). We tagged 8,882 walleye, 255 northern pike, 187 smallmouth bass, and 11 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. Some analysis was completed for lakes surveyed in 2002, however, that work has been put on hold because of the priority of finishing 2001 reports. Data for 2003 have been entered and error-checked, and summaries have been provided to managers. Planning was initiated for 2004 lakes to be surveyed.

Findings: Jobs 1 through 8 were scheduled for 2002-03, and progress is reported below.

Job 1. Title: 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 next five years. Preliminary lists were developed by each Basin Team, but the final choices require a meeting of all Basin team leaders and creel program personnel which has yet to take place. Lakes to be sampled in 2004 are: Peavy Pond (Iron County), Grand Lake (Presque Isle County), and Long Lake (Presque Isle and Alpena Counties). Elk lake (Antrim, Grand Traverse, Kalkaska Counties) will likely be sampled in 2005 to coincide with a stocking evaluation of steelhead.

Target species for population estimates in coolwater lakes are walleye, northern pike, smallmouth bass, and muskellunge. We have had good success collecting enough walleye for reliable population estimates in all cases and for northern pike in some cases. We have decided to tag smallmouth bass and muskellunge in lakes where abundance is high enough to at least attempt abundance and exploitation estimates. We have estimates of angler exploitation on smallmouth bass for 2 lakes sampled in 2002 (North Lake Leelanau and South Lake Leelanau) and will have estimates for at least one lake (Big Manistique) sampled in 2003. We have decided not to set exact tagging goals. While we generally shoot for 10% of a population, we rarely know with certainty the size of population in advance; thus, 10% of a guestimate has little utility. Additionally, our estimates of population size will always be better the more fish we tag. Therefore, we will allocate a certain amount of resources (time, personnel, money) to spend on each netting effort, and we will tag fish until a point of diminishing returns of new, unmarked fish (primarily walleye).

It has been decided that all lakes surveyed as part of this large lakes study will also be surveyed using standard 'Status and trends' protocol in the summer. This coordinated effort with the statewide resource inventory program will provide a comprehensive evaluation of the aquatic resources in each large lake.

Job 2. Title: <u>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.</u>–We drafted a 'Duties distribution' list that identifies the duties of each person directly related to this study (Appendix 1). This allocation of duties has significantly improved the coordination and oversight of the large spring tagging operation.

Four lakes were surveyed in 2003: Bond Falls Flowage (Ontonagon County), North Manistique Lake (Luce County), Big Manistique Lake (Luce and Mackinac Counties), and South Manistique Lake (Mackinac County). 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 is housed in an Access database with queries in place to extract data for estimates of exploitation, catch per unit effort, movement, etc.

Job 3. Title: <u>Manage tag-recovery operation, including establishing a payment system for reward tags.</u>–Tag returns were collected from various sources (angler-mailed, internet return, creel clerk, phone-in) and entered into the Access database. Queries have been developed that validate tag numbers for each return. Additionally, possession of tag was verified before payment vouchers were generated. The database automatically generated letters to anglers and payment vouchers. Payments for reward tags are usually sent to anglers 1-2 months following arrival in our office.

Job 4. Title: <u>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.</u>–Ratios of marked-to-unmarked fish observed in the creel have been tallied for all 5 lakes surveyed in 2001. Information for lakes creel surveyed in 2002 has been summarized, but not finalized yet (see Study 646 Progress Report). Creel surveys for lakes surveyed in 2003 are still in progress.

Job 5. Title: <u>Oversee laboratory processing and aging of spine, fin ray, or scale samples.</u>–We established a protocol where images of all structures are recorded with a digital camera and stored in Joint Photographic Experts Group (.jpg) format using Image-Pro® software or a similar set-up. A computer filing system was developed to organize, store, and retrieve images.

Ages were determined by inspecting digital images of spine or fin-ray sections on a computer screen. We age approximately 15 fish per sex per in group. Two technicians independently age walleye. Ages for walleye are considered correct when results of both technicians agree. Samples in dispute are aged by a third technician. Disputed ages are considered correct when the third technician agrees with one of the first two. Samples are discarded if three technicians disagree on age.

A final age has been identified for all samples collected in 2001. Samples collected in 2002 have been aged by two readers and await the comparison of assigned ages and final age determination. Assignments have been made and aging has begun on samples collected in 2003.

Job 6. Title: 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. Most analyses are complete and the report writing process has begun. One report (Houghton Lake) is completed in a first draft form that has been submitted to reviewers. Writing of the three other reports for lakes surveyed in 2001 has begun. Survey data was 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 first drafts of 2001 reports and establishing the form for reporting in general. Abundance estimates from recaptures during the netting operation were made for 2002 lakes, but are not reported here due to our policy of not releasing 'preliminary' numbers. Final annual exploitation rates were calculated for lakes surveyed in 2001 and preliminary rates for 2002 (Table 3). Walleye exploitation has ranged from 3 - 30% 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 2003 surveys was sent to fisheries managers June 23, 2003 (Tables 1 and 2). 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. 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.

Job 8. Title: 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.

Prepared by: Patrick A. Hanchin
Date: September 30, 2003

Table 1.–Summary of effort, number of fish tagged, and age structures collected in 2003.

	Lake			
	North Manistique	Big Manistique	South Manistique	Bond Falls Flowage
Effort				
Fyke-net lifts	50	98	60	195
Trap-net lifts	28	93	82	0
Electrofishing runs	0	0	2	13
Walleye				
Total tagged	392	3,380	2,809	2,301
(R + NR)	(212 + 180)	(1506 + 1874)	(975 + 1834)	(1,017 + 1,284)
Sub-legals clipped	1	274	973	1,964
Spine samples	228	547	425	391
Northern pike				
Total tagged	15	99	34	107
(R + NR)	(8 + 7)	(47 + 52)	(11 +23)	(56 + 51)
Sub-legals clipped	2	103	231	708
Fin ray samples	17	195	145	426
Smallmouth bass				
Total tagged	0	140	46	1
(R + NR)		(57 + 83)	(12 + 34)	(1 + 0)
Sub-legals clipped	6	73	7	15
Spine samples	1	206	36	2
Muskellunge				
Total tagged (NR)	0	0	11	0
Sub-legals clipped	0	0	3	0
Fin ray samples	0	0	10	0

Table 2.–Total catch (including recaptures) for lakes surveyed in 2003.

Species	Lake			
	North Manistique	Big Manistique	South Manistique	Bond Falls Flowage
Brook trout	0	17	0	0
Black bullhead	0	0	10	0
Black crappie	0	0	0	101
Bluegill	1	9	145	3
Brown bullhead	0	53	15	1
White sucker	1,263	4,612	581	218
Lake herring	0	14	0	0
Largemouth bass	0	2	54	0
Muskellunge	0	0	19	0
Mudpuppy	0	8	3	0
Northern pike	17	214	277	966
Pumpkinseed	0	5	25	14
Rainbow trout	0	0	42	0
Redhorse spp.	8	215	15	0
Rock bass	88	262	170	511
Shorthead redhorse	0	130	0	0
Silver redhorse	0	74	1	0
Smallmouth bass	9	221	60	36
Walleye	447	4,690	4,852	5,618
Yellow perch	10	982	1,011	20

Table 3.–Annual exploitation of walleye for lakes surveyed in 2001 and 2002.

		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	29.7	81.3
	Michigamme	29.3	29.5	64.7
	Crooked	14.7	58.3	100
	Pickerel	13.2	11.4	64.2
	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

[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

Large Lakes Study Distribution of Duties

Gerald Casey - Has supervisory oversight of field staff (Management team directive)

- Determine number of crews and nets needed (joint with local tech supervisor)
  - Assign 3-person crews and crew leaders
    - Crew leaders preferably work the entire duration for continuity
    - Leaders responsible for: boat equipment, data, crew oversight
    - Ensure each boat has tub, bucket, dip net, esocid sock, length board
  - Solicit workers and assign work schedules (schedule 5 weeks, Tues - Tues)
  - Coordinate and stage boats and nets needed for each lake
- Secure lodging (joint with local tech supervisor)
  - Lodging on lake is preferable
  - Short commute (30 min)
  - Restaurants available within short drive
  - One person per room preferable
  - Telephone available at lodging
  - Designated 'headquarters' room or cabin
  - Set-up payment method
  - Estimated cost must be approved by Jan
- Determine start date (with local tech supervisor; we will shoot for ice-out)
- Dedicated third reader for aging structures (with Hanchin and Schelb)

Jan Fenske

- Quality control of data recording during tagging
- Aging assignments and location of Image Analysis systems
- Budget oversight

Patrick Hanchin

- Organize kick-off meeting (may be unnecessary in the future)
- Distribute study protocol and oversee data collection
- Create tag return forms, notice placards, and informational memo
- Determine when to pull nets (utilizing advice from crew leaders)
- Oversee data entry (with short term worker), error-checking, and maintain database
- Transfer data to Fish Collection System
- Provide tagging summary and updates
- Dedicated third reader for aging structures (with Casey and Schelb)
- Data analysis and report writing (co-author with Rick Clark and Roger Lockwood)
- Present results (preliminary or final) to local organizations

Chris Schelb

- Inventory tags and distribute tags and tagging boards
- Maintain and distribute tagging paraphernalia (pliers, snips, etc.)
- Order envelopes and distribute pre-loaded inch-group boxes
- Print and distribute Rite-in-rain data sheets and cover sheets
- Distribute tag return forms and notice placards
- Dedicated third reader for aging structures (with Casey and Hanchin)

Cathy Sullivan

- Tag return entry (along with short-term worker)
- Process payment vouchers for reward tags
- Send tag return letters to anglers

Alan Sutton

- Provide length, tag number, and fin clip information from creel survey to Hanchin
- Provide harvest summaries to Hanchin for use in analysis

Local technician supervisor

- Joint determination of number of nets and crews needed (with Casey)
- Aid in selecting and securing lodging (with Casey)
- Monitor ice conditions and determine start date (with Casey)
- Set up locations (bait shops and resorts) to distribute tag return forms and notice placards
- Determine if local informational release is necessary (Hanchin will provide memo)
- Set up gas account if necessary
- Mail tag return forms from creel clerk, bait shops, etc. to Charlevoix
- Provide summary of tagged fish collected in summer status and trends survey

Local management unit biologist

- Edit draft of special report
- Write status of the fishery report