

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-81-R-7

Study No.: 230712

Title: Status and trends of inland lakes: methods development, program oversight, and ecological assessment

Period Covered: October 1, 2005 to September 30, 2006

Study Objectives:

1. To oversee the implementation of the status and trends program for inland lakes.
2. To summarize and maintain data collected as part of the status and trends of inland lakes.
3. To evaluate statewide stocking programs in inland lakes.
4. To evaluate the status and trends of inland lakes.

Summary: Evaluations of sampling methods for estimated mean length and length frequencies were completed. The technical report evaluating precision of shoreline methods was rewritten to include analysis of among-observer precision and the amount of time required to conduct shoreline surveys. This re-write has been submitted for publication to the North American Journal of Fisheries Management. Data collected during the netting experiments conducted in 2005 and status and trends fish survey data were analyzed to evaluate the influence of net type and survey design on catch statistics. Data from netting experiments designed to evaluate the effects of mesh size and throat opening diameter on size selectivity and escapement of fish were also analyzed. Two workshops were held to train Management Unit survey crews how to assess lake habitat and shoreline development, and to collect zooplankton and limnological samples. A Fisheries Division Policy (attached) was written and approved by the Management Team in August 2006. Fish Collection System was error checked and gear type, gear effort, species identification, age and growth, and chemistry data entry errors were corrected for survey years 2002-05. Initial status and trends summaries were developed for number of lakes surveyed, species richness, catch rates, length frequencies, age and growth, and water chemistry.

Findings: Jobs 1, 2, 3, 4, and 6 were scheduled for 2005-06, and progress is reported below.

Job 1. Title: Determine appropriate quantitative sampling methods.—The number of fish to measure and at what resolution (inch group vs. tenth of inch) to measure to obtain accurate estimates of mean length and length frequency was evaluated for multiple species. Based on data on 11 species, measuring 30 individuals to the inch group resulted in an error rate of 15% or less. In this case, percent error is the percentage of means within ± 0.1 inches of the true mean. These data suggest that measuring fish to the inch group will result in acceptable estimates of mean size for most species when at least 30 individuals are measured. When fewer than 30 individuals of a species are captured, measurements should be made to the 0.1 of an inch. All length measures collected for age and growth purposes should be taken to 0.1 of an inch to obtain unbiased estimates of mean length at age.

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Data collected during the netting experiments conducted in 2005 were analyzed. To evaluate the effect of random vs. non-random net placement, we set nets at random locations and then moved them to new random locations over the course of the survey. To simulate the practice of setting nets in the best locations to maximize the number of fish caught, we calculated the mean CPUE for the 3 locations that had the highest catch rates. We then compared this CPUE to the mean catch rate based on random net sets, computed from all net lifts during the survey. In Joslin Lake, mean CPUE at the best locations was 158.2 while CPUE based on random net placement was 99.8. This result suggests that setting nets to maximize the number of fish caught (the traditional practice among Management Units) results in biased estimates of CPUE. We recommend that future netting surveys use random net placement to ensure that representative samples are collected from a lake.

Catch comparisons from fyke and trap nets of varying mesh size revealed that mesh size had a significant effect on estimates of mean length and length frequency. Based on data from the netting experiments conducted in 2005, we found that a 0.5 inch difference in stretch mesh size resulted in a 1.0 inch difference in estimates of population mean length for bluegill *Lepomis macrochirus* and redear sunfish *L. microlophus*. A similar result was found in the netting data collected by management units during status and trends surveys. No difference in estimates of mean length was found between fyke and trap nets of similar mesh size. Based on data collected during status and trends surveys, we found that fyke nets and trap nets had similar catch rates for most species. However, trap nets had significantly higher CPUE for bluegill and fyke nets had significantly higher CPUE for yellow perch *Perca flavescens*. Collectively, these results indicate that there is a need to standardize mesh size and net type across the Division to ensure that data are comparable statewide.

A second netting experiment designed to measure escapement rates was completed in October 2005. For the first part of this experiment, bluegills of varying length were stocked into the pots of small (1.0 inch) and large (1.5 inch) stretch-mesh fyke nets and the opening of these nets were sewn shut. This enabled us to estimate the escapement rates attributable to mesh size as a function of fish size. Escapement rates of bluegill ranging from 1 to 5 inches decreased with increasing fish size in both mesh sizes. However, escapement rates were significantly higher in large mesh fyke nets for all size classes of bluegill (Table 1).

In the second part of the experiment, throat sizes were fixed at 6, 8, and 10 inches. Three small mesh fyke nets and three large mesh fyke nets of varying throat size were placed in 2 ponds. Nets of similar mesh size were placed in the same pond. Nets were emptied after 24 hours and all fish captured were measured and fin clipped and then returned to the nets. The nets were emptied again after another 24 hours and fish were again measured and fin clipped. The experiment was repeated 2 more times using 2 new ponds for each 2 day trial. We could not detect an effect of throat size on escapement rates due to high rates of movement both in and out of nets. This suggests that fish regularly move in and out of nets during surveys and that calculating catch per effort using net nights may not be appropriate. We recommend that the number of nights that a net is fished be standardized to one and that the number of lifts be used to calculate catch per unit effort.

Job 2. Title: Train field personnel in new sampling methods.—Two workshops were held to train Management Unit survey crews how to assess lake habitat and shoreline development, and to collect zooplankton and limnological samples.

Job 3. Title: Write Fishery Division policy and procedures for sampling methods.—A Fisheries Division Policy was written and approved by the Management Team in August 2006.

Job 4. Title: Evaluate the status and trends of inland lakes.— Fish Collection System was error checked and gear type, gear effort, species identification, age and growth, and chemistry errors were corrected for survey years 2002-05. The net inventory database was revised and reformatted to account for the influence of mesh size on catch data. Summary statistics for the status and trends of inland lakes were produced in collaboration with Daniel Hayes at Michigan State University. Programs were written in SAS for summarizing the following information by gear type, lake size and basin: number of lakes surveyed, species richness, catch rates, length frequencies, age and growth, and water chemistry. Initial summaries were presented at each of the four watershed basin team summer meetings and at the fall biologist conference.


Job 6. Title: Write annual performance report.—This annual progress report was prepared as scheduled.

Prepared by: Kevin E. Wehrly

Date: September 30, 2006

Table 1.—Mean percent escapement of bluegill by inch group for small and large mesh nets.

Inch Group	Percent escapement	
	Small mesh	Large mesh
1	100	100
2	50	100
3	23	80
4	7	20
5	0	8

Fisheries Division  Policy & Procedure	Program: Field Operation	
	Chapter: Resource Management	Date Approved: 10/26/06
	Responsible Program: Field Operations	
Title: Conducting Status and Trends Surveys	Number: 02.02.018	

REFERENCES

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<http://www.michigan.gov/wildlifeconservationstrategy>
- Hayes, D., E. Baker, R. Bednarz, D. Borgeson, JR., J. Braunscheidel, J. Breck, M. Bremigan, A. Harrington, R. Hay, R. Lockwood, A. Nuhfer, J. Schneider, P. Seelbach, J. Waybrant, and T. Zorn. 2003. Developing a standardized sampling program: the Michigan experience. Fisheries 28(7):18-25.
- Schneider, James C. (ed.) 2000. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.
- Michigan Department of Natural Resources Fisheries Division Fish Collection System program.
- Michigan Department of Natural Resources. Forest, Mineral and Fire Management. 2006. Draft 2006 State Forest Management Plan.

POLICY

Fisheries Division Management Units are responsible for allocating a minimum of 40 percent of their annual survey effort to Status and Trends sampling of lakes and streams. Effort is to be distributed approximately equal between lakes and streams. Standardized procedures documented in the Manual of Fisheries Survey Methods II must be used.

EXPLANATION

The Status and Trends program is an inventory effort designed to provide information to address local, regional, and statewide management and conservation needs on inland lakes and streams. The ability to effectively monitor status and trends of fish populations and aquatic resource habitat is dependent upon comparable data collected from representative waters using standardized methods. The program was designed by the Resource Inventory Planning Committee and was implemented statewide in 2002. The major components of the program involve standardization of sampling gear, a statistical basis for site selection, and an expansion of traditional game fish surveys to include information on non-game fishes, habitat, and human development. Status and Trends information are used to assess the current status of inland lakes and streams, and to document change through time as well as provide comparisons among similar types of water bodies. This inventory program provides a monitoring framework to meet other Statewide programs such as those outlined in Michigan's Wildlife Conservation Strategy, the Statewide Forest Management Plan, and eco-regional planning documents. Furthermore, the Program enables Fisheries Division to better address Statewide questions such as the effects of riparian development, impacts of invasive species, and effects of changing regulations while providing management biologists with a robust set of ecological data on specific waters from which to make local management decisions.

PROCEDURE

All lakes and select valley segments of streams to be surveyed are determined from a stratified random design to ensure that samples are collected from spatially and ecologically representative water bodies. Lakes that are randomly selected for sampling are stratified by size and management unit. Randomly selected streams are stratified by size, temperature class, and management unit. High-quality trout and smallmouth bass streams to be surveyed for long-term trend monitoring are determined from a permanent list stratified by size, Great Lakes access, and management unit. These fixed sites are sampled in a three-year on-off rotation to provide broader geographic coverage throughout the state.

The primary modules for sampling lakes are fish surveys, limnology, zooplankton, residential lakeshore development. The primary modules for sampling streams are fish, water temperature, instream habitat, and riparian surveys. Data for each module are collected during every survey for randomly selected lakes and streams. For fixed stream sites, trout or smallmouth bass surveys are conducted during each year of the three-year sampling rotation; data on the entire fish community including non-game species are

Title:

Conducting Status and Trends Surveys

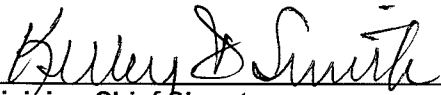
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collected during year two of the three-year rotation. Habitat surveys at fixed sites occur in year one of the three-year rotation. All data collected for the Status and Trends Program will be entered into the Fish Collection System when the survey is completed.

Discretionary surveys can be completed within the remaining 60 percent time allocation to recognize social and economic considerations for management. Units are encouraged to extend the Status and Trends protocol to these surveys also.

Fisheries Management Biologists are responsible for writing status of the fishery reports for individual waterbodies. The Research Section is responsible for reporting on statewide status and trends of all waterbodies.



Division Chief Signature

October 26, 2006