STUDY PERFORMANCE REPORT

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

Study No.: 712 **Title:** Resource inventory support for inland lakes

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

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: Protocols were developed for new status and trends field procedures for measuring lake profiles, for collecting water samples for nutrient and chlorophyll analyses, and for collecting zooplankton samples to determine size structure and composition of the zooplankton community. A comparison of methods for estimating shoreline development was initiated. The number of houses around a lake was determined from aerial photos and from field surveys for a set of study lakes in Southeast Michigan. Initial results indicated that development estimates based on aerial photos tend to underestimate the number of dwellings on a lake, especially as the percentage of the lake that is developed increases. Zooplankton samples were also collected from these study lakes to determine the influence of depth and spatial location on estimates of species composition and size structure of the zooplankton community. Guidelines for the number of lakes to be sampled each year were developed. Based on the amount of survey effort from the 2002 field season, each management unit should expect to sample from 3 to 5 status and trends lakes per year. This means that 24 to 40 status and trends lakes will be sampled statewide annually. Feedback from Management Unit personnel on the 2002 sampling season was summarized and issues, concerns, and questions raised were addressed. Two fish identification training sessions were organized and presented. Laboratory methods for processing zooplankton samples using an image analysis system were also developed. Relational databases were constructed from data collected during the 2002 field season for use in evaluating methods and for characterizing the status and trends of Michigan's inland lakes

Findings: Jobs 1, 2, and 5 were scheduled for 2002-03, and progress is reported below.

Job 1. Title: Develop sampling protocols, train field personnel, and develop sample processing procedures for fish and limnological measures collected from inland lakes.–Field protocols were developed for measuring physiochemical profiles (dissolved oxygen, temperature, pH, conductivity), collecting water samples for alkalinity and nutrient analyses, collecting and filtering water samples for determining chlorophyll a concentration, and collecting samples for use in characterizing species composition and size structure of the zooplankton community. Methods were based on information in the literature and were adapted from existing Michigan Department of Environmental Quality procedures and from the MDNR Manual of Fisheries Survey Methods. A "cheat sheet" providing condensed instructions for using Fish Division's new YSI water quality probes was also written and distributed to the Management Units. For budgetary reasons, Fisheries Division was unable to acquire handheld computers (iPAQ) prior to the 2003 field season for use in data capture. Consequently, fish and limnological (includes profiles, water samples, and zooplankton) data sheets were developed and distributed.

Macrophyte sampling and characterization of shoreline development by Management Unit personnel was postponed for the 2003 sampling season because defensible methods were lacking. Estimates of macrophytes and submerged trees in the littoral zone and shoreline development data (number of houses, number of docks, % shoreline armored) were collected from 6 inland lakes in Southwest Michigan for use in methods development. Aerial photographs of the same 6 lakes, as well as lakes that had shoreline development data collected in 2002 were obtained from the State of Michigan's Spatial Data Library. These maps were uploaded into Arcview, and estimates of total number of houses and housing density (number of houses/kilometer) were calculated. The number of houses estimated using aerial photographs will be compared with on the ground counts to determine the feasibility of using aerial photographs to assess shoreline development. Initial results indicated that development estimates based on aerial photos tend to underestimate the number of dwellings on a lake, especially as the percentage of the lake that is developed increases. This discrepancy results from the relatively low resolution of the aerial photographs. In addition, low resolution makes it difficult to characterize other aspects of shoreline development including number of docks and percent of the shoreline that is armored.

To address questions regarding current zooplankton sampling methods, zooplankton were collected from the same set of 6 lakes where shoreline development data were collected. Current methods based on the MDNR Manual of Fisheries Survey Methods require the collection of at least 4 samples from each lake using vertical tows starting from a depth equal to the critical depth (where dissolved oxygen is less than 0.5 ppm). An important question raised by management unit personnel is where to take samples from a lake when there is no critical depth. To help address this question, samples were collected at the same depth from various locations around the lake and from a variety of depths at the same locations. Zooplankton from these samples have been identified and measured. Data have been entered and are ready to be analyzed.

To develop guidelines for the number of lakes that management units should sample each year, survey effort from lakes sampled in 2002 was evaluated. Management units were provided with a spreadsheet on which to record all surveys conducted, the purpose of each survey, the number of person days required, the number of trips taken to each water body, types of gear used, number of net nights, and the number of aging structures collected. This information not only provided a means to estimate effort, but also served as a quality control measure to ensure that field crews were following the protocols. The Resource Inventory Planning Committee recommended that 45% of sampling effort be spent on status and trends surveys, 40% on management evaluations, and 15% on surveys conducted at the discretion of management unit personnel. Prior to the 2002 sampling season, however, the amount of time required to survey a lake using status and trends protocols was underestimated. Lakes surveyed using status and trend protocols require more person days than any other survey type (Figure 1). Surveys on large lakes can take up to 35-40 person days to complete. This underestimate resulted in half of the management units putting over 70% of their sampling effort into status and trends surveys (Figure 2). To help management units develop work plans consistent with the Resource Inventory Planning Committee guidelines, 20% of the range (200 to 300 person days) of total survey effort by management units was calculated. This resulted in an expected range from 40 to 60 person days. In 2002, the median amount of effort needed to complete status and trend surveys on small (10-99 acre), medium (100-999), and large lakes (1000 and greater) was 11, 15, and 29 person days respectively. Based on these data, the number of lakes that a management unit should plan to sample in a year ranges from 3 to 5. Thus, the number of lakes to be sampled statewide for the status and trends program will range from 24 to 40. For comparison, 41 status and trends lakes were sampled in 2002.

These guidelines were presented to Management Unit personnel and to the Fisheries Division Management Team.

Management personnel were asked to submit feedback on their experiences using the new status and trends protocols during the 2002 sampling season. This feedback process provided the opportunity to learn what aspects of the protocols were difficult to understand and to determine what issues survey crews and biologists had with the status and trends program. Over 10 pages of comments, questions, and concerns were organized into categories and responses to each category were presented to Management Unit personnel. The majority of issues raised involved how status and trends data will be used, how it will help us manage fisheries resources, and how it will be entered and summarized. A large number of responses questioned specifics of new procedures for zooplankton sampling, water chemistry sampling, assessing shoreline development, and netting. In general, there was consensus among Management Unit personnel that there is a need for more training and more detailed protocols. Most respondents also indicated that status and trend surveys were taking up too much of their sampling time. Many of these issues have been addressed or are continuing to be addressed. For example, the work planning guidelines discussed above illustrated that too many status and trends lakes were sampled by most Management Units in 2002. Consequently, managers were instructed to scale back the number of lakes to be sampled in 2003.

Two training workshops were organized and presented to Management Unit biologists and technicians. These 1.5 day-long workshops were designed to train field personnel in the identification of non-game fishes. The workshops developed a fish identification strategy that includes knowing the most common species, knowing what species occur in your region, validating with several characteristics, and preserving specimens that cannot be identified in the field. Reference materials that included a list of common and scientific names, species lists by management unit, distribution maps, and an identification guide to the non-game fishes of Michigan authored by Dr. Gerald Smith (University of Michigan) were prepared and presented to representatives from each management unit.

Laboratory methods for identifying zooplankton and measuring zooplankton lengths using image analysis systems were developed. Power analysis was performed using PASS software to determine the number of individuals from each of 4 samples that needed to be measured. Results of these analyses indicated that at least 50 individuals from each sample must be measured to detect a 0.1 mm difference in average length with 90% power at the 5% level of significance. Cumulative taxa richness curves indicated that the presence of most taxa in a lake could be detected by identifying a minimum of 200 individuals from each of 4 samples taken from the lake. These analyses also indicated that much of the variance in zooplankton size and composition can be attributed to spatial variation within a lake. Therefore, collection of at least 4, spatially-distributed samples (and in some cases more) is required to adequately characterize the size distribution and taxonomic composition of the zooplankton community. Standard operating procedures were written as a quality control measure for processing zooplankton samples.

Job 2. Title: Develop and maintain databases of inland lake samples.–With the help of data base specialists in Lansing, the Fish Collection System was modified to accept new data sources including GPS coordinates, lake profiles, water quality data, zooplankton data, and shoreline development information.

Relational data bases were developed at the Institute for Fisheries Research for lakes sampled during the 2002 field season. These databases were constructed for use in evaluating methods and for characterizing the status and trends of Michigan's inland lakes. Databases were created using Access for the following information: Lake location, zooplankton lengths and taxa, water chemistry, physiochemical profiles, vegetation, shoreline development, fish growth rates by species, catch data by gear and net lift, and historical and current stocking rates.

Job 5. Title: Write reports.–This annual progress report was prepared as scheduled.

Prepared by: Kevin E. Wehrly
Date: September 30, 2003

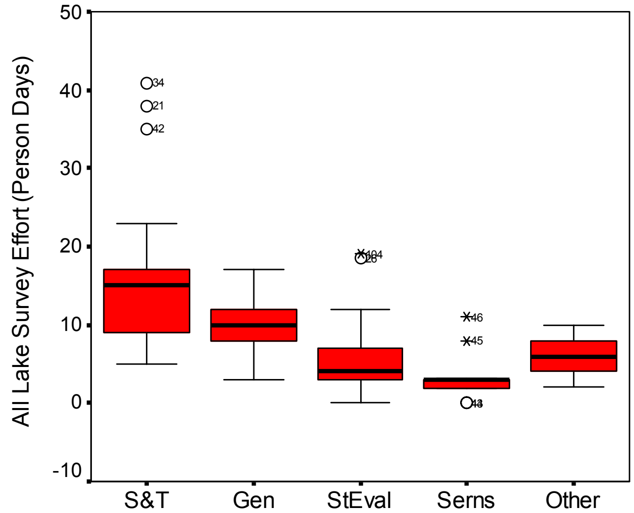

Figure 1.–Box plots of the amount of effort in person days required to complete different types of lake surveys during the 2002 sampling season. S&T = Status and trends, Gen = General surveys, StEval = Stocking evaluations, Serns = Serns electrofishing index, Other = collection of fish for contaminant analysis, sampling with DEQ, and sampling associated with research projects.

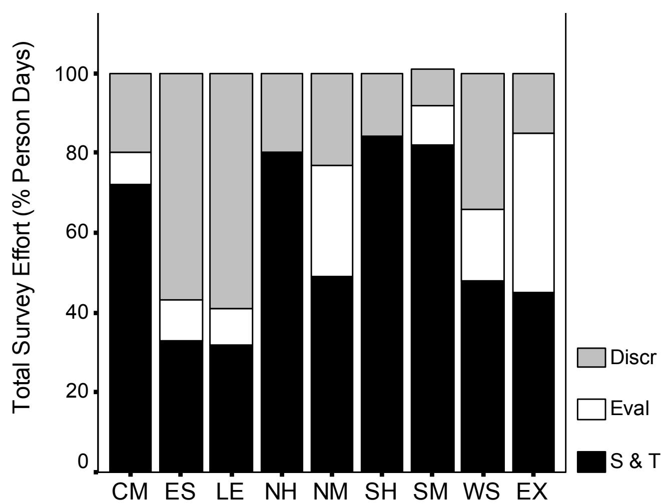

Figure 2.–Percentage of survey effort spent on status and trends (S&T), management evaluations (Eval), and discretionary sampling (Discr) by each management unit during the 2002 sampling season. CM = Central Lake Michigan, ES= Eastern Lake Superior, LE = Lake Erie, NH = Northern Lake Huron, SH = Southern Lake Huron, SM = Southern Lake Michigan, WS = Western Lake Superior, and EX = the expected distribution of effort based on the Resource Inventory Planning Committee's recommendations.