STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-80-R-8

Study No.: 230701 **Title:** Decision-support tools for managing fisheries of inland lakes

Period Covered: October 1, 2006 to September 30, 2007

Study Objective: To prepare reviews of the characteristics of Michigan's inland lakes and of fisheries management of selected species in inland lakes, and to develop decision-support tools to help manage fisheries on inland lakes. One critical set of tools to be developed is methods for allocating fish among multiple fisheries that occur in the same lake, given a safe harvest level. Another objective of this study is to develop tools that help fisheries managers compare the status and potential of specific lakes and fisheries.

Summary: Several activities occurred under Job 4 in the development of decision-support tools. Work continued on editing and linking database tables and geographic information system (GIS) files that will be used to build decision-support tools for natural resource managers. Data files and graphs for more than 4,000 temperature profiles from inland lakes were added to the Fish Collection System, the centralized database used extensively in Fisheries Division. Spatial and tabular information on lakes, rivers, and fish were contributed to a web-based application (Michigan Surface Water Information Management System, MiSWIMS) for presenting this information to the public and natural resource managers. Work continued on a database of lake attributes used to classify inland lakes, in collaboration with university faculty and graduate students. A manuscript on models for fish proximate composition and energy density was accepted for publication. Work continues on a model for fish population dynamics incorporating life history information, in order to better understand factors influencing age at maturity and timing of juvenile transitions between habitats. Job 5 is to prepare this progress report. Work began on Job 7, which is to develop and implement a GIS strategy for Fisheries Division. It is clear that there are a variety of GIS needs, skills, and available tools, and that a mixture of options will be needed to meet the needs of Fisheries Division.

Findings: Jobs 4, 5, and 7 were scheduled for 2006-07 as amended in 2006-07 and 2007-08, and progress is reported below.

Job 4. Title: Develop additional decision-support tools.–Development continued on several database tables and geographic information system (GIS) files that will be used to build decision-support tools for natural resource managers.

In the previous reporting period, I prepared summaries and graphs of historical temperature profiles to assist in determination of lake stratification. In this reporting period, I worked with a database person in Lansing to add this information to the Fish Collection System (FCS), the centralized database used by Fisheries Division. Field and research biologists and technicians now have electronic access to over 4,000 temperature profiles in both graphical and tabular format for inland lakes. These data were entered from limnology cards in the lake files at the Institute for Fisheries Research. Each graph shows temperature versus depth, the estimated top and bottom of the metalimnion (if present), the plane of the thermocline (if present) and a title containing the lake name, county, and the date of profile collection. Through the FCS each

temperature graph may be downloaded in jpg format for use in reports or presentations. An explanation of lake stratification and temperature profiles was also prepared and added to the FCS to provide additional information to users. Information on temperature is important for classifying lakes and for making decisions about fish stocking and other management actions.

During this reporting period, I worked with staff from the Department of Information Technology and the Department of Environmental Quality to develop and finalize the Michigan Surface Water Information Management System (MiSWIMS). This web application allows members of the public as well as employees of the Department of Natural Resources to use a web browser to find, map, and download a wide variety of spatial and tabular information about the surface waters of the state (http://www.michigan.gov/deq/0,1607,7-135-3313_3686_43375---,00.html).

Work is ongoing to add to a database of lake attributes and to classify Michigan lakes. I am focusing on lakes 5 acres and larger and using attributes that can be measured or estimated for all lakes using landscape variables. Collaborations are continuing with faculty and graduate students at Michigan State University as part of this process.

A manuscript describing new models for proximate body composition and energy density in fishes was accepted for publication in Transactions of the American Fisheries Society. These models will help in developing bioenergetics models with a more realistic treatment of starvation conditions as well as allocation of new biomass to growth in condition and length.

Work continues on a model to explain variation in timing of maturation among steelhead populations in Lake Michigan. In collaboration with researchers at the University of Michigan, an analytical solution has been obtained for calculating the optimal age at maturity for iteroparous species, including steelhead. The optimal age of maturity is most sensitive to juvenile (pre-maturation) survival rate and secondly to adult survival rate. Other variables in the model include von Bertalanffy growth coefficients for juveniles and adults, the fecundity-length exponent; and asymptotic length, to which optimal age of maturity is relatively insensitive. The goal of this modeling and analysis is to improve management decisions on stocking and fishing regulations.

Job 5. Title: Write progress report.–This progress report has been prepared.

Job 7. Title: Develop and implement a division GIS strategy.–Work began on the development of a strategy for effective use of geographic information system (GIS) technology in Fisheries Division. It is clear to me that there are many different GIS needs in the division, a wide range of GIS experience and skill among employees, and a wide range of GIS tools that can be used to match the needs and skills of division employees. A comprehensive GIS strategy will include several different approaches for using this technology to help natural resource managers and researchers.

A small number of Fisheries Division employees need the full power of ESRI ArcGIS software to do spatial analyses and to create and edit spatial data. Examples include research and management biologists preparing river assessments, and research biologists working on classification systems for rivers and lakes. This ArcGIS software is now being made available to certain division employees using floating licenses, presently coordinated at the department level. This allows efficient use of this expensive and complex software by several employees.

A large number of Fisheries Division employees can benefit from GIS information, but do not need the full power of ArcGIS. Less expensive and less complicated tools can probably meet their needs. One approach to providing some GIS capability includes use of one or more of the free “Explorer” applications available from ESRI (ArcGIS Explorer, ArcWeb Explorer, and

ArcExplorer) that allow users to view GIS data and do some simple GIS analyses (http://www.esri.com/software/arcexplorer/explorer.html). Another approach to providing some GIS capability is to add some spatial tools to the Fish Collection System (FCS). I obtained approval to work with staff in the Department of Information Technology in the coming year to add additional GIS capability to the FCS.

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