STUDY PERFORMANCE REPORT

State: Michigan   **Project No.:** F-80-R-6

Study No.: 230722   **Title:** Implications of lakeshore development for fishery resources in Michigan

Period Covered: October 1, 2004 to September 30, 2005

Study Objectives: Develop models integrating information from the literature and from new data collections to predict the response of fish populations and communities to lakeshore development.

Summary: In this project, I have continued to review the literature and develop a modeling framework for linking the effects of shoreline development on fish population dynamics. The literature review I've conducted to date has identified several gaps, in response to which I've developed a collaborative field study proposal to address these gaps. Data from the resource inventory program are still being audited, but preliminary programs for the analysis of these data have been developed. I have also worked with R. Lockwood and K. Wehrly in the development of a technical report covering sample size requirements and analysis of shoreline habitat data from the resource inventory program.

Findings: Jobs 2, 3, 4, and 5 were scheduled for 2004-05, and progress is reported below.

Job 2. Title: Continue model development.–A conceptual model for largemouth bass in lakes was developed (Figure 1), forming the basis for future modeling efforts.

Job 3. Title: Develop research agenda.–Based on the field research agenda developed in 2003-2004, I have worked with Dr. Mary Bremigan and Dr. Kim Scribner to develop a project addressing some of the critical data gaps identified. This project was not funded, but we will continue to seek a support for this project within the Fisheries Division or through extramural funding sources.

Job 4. Title: Analyze data from resource inventory program.–Data from the resource inventory program require additional manipulation and auditing before final analyses can be completed. I met with Kevin Wehrly to discuss data analysis strategies, and developed SAS-based programs for the analysis of these data (provided as attachments to this year's Study 721 report).

I assisted Kevin Wehrly and Roger Lockwood in the production of Technical Report 2005-3 for Study 230712 discussing the appropriate analysis of shoreline habitat data from the resource inventory program (Lockwood et al. 2005).

Job 5. Title: Prepare annual report and communicate results.–No work was done on this job during the current year except for preparing this report.

References:

Lockwood, R. N, K. Wehrly, and D. B. Hayes. 2005. Sample sizes for inland lake habitat and lakeshore development metrics. Michigan Department of Natural Resources, Fisheries Technical Report. Ann Arbor.

Prepared by: Daniel Hayes
Dated: September 30, 2005

Figure 1. Conceptual model of the relationship between largemouth bass population
 dynamics and lake habitat condition.

Mature adults
   -fecundity dependent on size/age distribution
   -maturation schedule based on size of fish a prior year's growth rate
   -sex ratio dependent on sex-specific mortality rates

Spawning and Nesting
   -spawning sites selected based on substrate and depth
   -spawning timing based on water temperature
   -egg development based on temperature
   -larval growth dependent on temperature
   -larval survival dependent on growth
   -adult survival rate dependent on intensity of catch/release fishing during
     spawning, as well as constant natural mortality rate during spawning
   -weight loss of adults during spawning dependent on duration of larval period

Age-0 (after leaving nest to spring of following year)
   -literature not clear on habitat preferences
  -growth dependent on temperature (following bioenergetics equations)
  -survival dependent on growth, amount of cover (including macrophytes and
    woody material)

Juvenile and Adult Stage (age 1+)
   -able to actively seek and maintain location in preferred habitat conditions
   -preference based on temperature, oxygen, vegetation, substrate, overhead
cover,
    and fish density
   -survival determined by natural mortality and fishing mortality. Fishing
mortality
    modified by vegetation density
   -growth dependent on productivity index, temperature (following bioenergetics
    equations)