

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-35-R-24

Study No.: 681

Title: Development of multi-lake management strategies for Michigan's inland lakes

Period Covered: April 1, 1998 to September 30, 1999

Study Objective: Develop a classification system for management of Michigan's inland lakes by determining how and why fish communities - and their response to management practices - vary among lakes (i.e., intersystem variability), along abiotic (e.g., longitudinal) and biotic (e.g., productivity) gradients, as well as across years (i.e., interannual variability).

Summary: Nancy Nate enrolled at Michigan State University as a PhD student in August, 1999. Her dissertation research, supported by this project, will address analysis of Fisheries Division historic data and classification of Michigan lakes. More generally, my field research in Ohio reservoirs and Michigan lakes continued. The Ohio reservoir work is evaluating the extent to which reservoir food web dynamics and nutrient cycling vary predictably along a reservoir productivity gradient. During the past year, data analysis efforts were focused on evaluating intersystem and interannual components of recruitment variability in reservoir fish assemblages. Research in Michigan lakes investigated the effects of chemical control of macrophytes on recruitment and production of littoral fishes. My participation in several Fisheries Division committees provided insight into how the findings of these research projects can be implemented to improve fisheries management in Michigan.

Job 1. Title: Assemble fish population assessment data.

Findings: Nancy Nate has been hired as a graduate research assistant and began working on the project in August. Nancy previously worked for the Wisconsin Department of Natural Resources on their statewide fisheries database and has a strong background in historical data analysis and database management.

In September, project objectives and potential collaborations were discussed with Drs. Jim Breck and Jim Schneider. We also met with Roger Parsons, Information Technology Analyst for the Fisheries Division, to discuss the Fish Collection System and the current status of the fish population assessment data. Data from 1980 to the present have been computerized. However, it will be several months before all records are available in the system. Assessment data collected prior to 1980 are available in paper files located at the Mason Building in Lansing or at the Institute for Fisheries Research in Ann Arbor. Nancy is currently in the process of obtaining permission to use the DNR network. This will allow direct access to the computerized historic data files. Pertinent literature relating to growth, recruitment, and mechanisms that shape fish populations is being assembled.

Job 2. Title: Assemble abiotic, biotic, and meteorological data.

Findings: Dr. Breck provided a file containing limnological data for approximately 700 Michigan lakes. These data were originally obtained from the Michigan Department of Environmental Quality Land and Water Management Division and are also available through the U.S. EPA STORET system. We have started to explore the spatial distribution of these lakes to determine if this subset would provide an appropriate starting point for linking with and modeling fisheries populations.

We have identified sources for geographic digital data through the DNR Spatial Information Resource Centee (SIRC) in Roscommon, Michigan. Digital data may be accessed through the DNR Intranet. Once access permission is granted, we will begin this phase of the project. Climatological data will be obtained from the National Climatological Data Center (NCDC).

Job 3. Title: Determine the extent of intersystem and interannual variability in fish population parameters.

Findings: For Nancy's Michigan lakes research, this analysis will begin after the historic data are assembled. I am also addressing this topic in the Ohio reservoir research. Last year I presented a seminar at Miami University, Ohio in which I analyzed historic data from Ohio. In so doing, I evaluated the extent to which gizzard shad (*Dorosoma cepedianum*) recruitment, and its subsequent effects on sport fish recruitment, vary predictably across reservoirs and across years. I am currently working on a manuscript that will summarize this analysis.

Job 6. Title: Participate in assessment and inventory committee.

Findings: I participated in the assessment and inventory committee by attending several meetings. In addition, I worked closely with the Inland Coldwater Regulations committee to complete the process of revising Michigan's inland coldwater regulations. In so doing, I am continuing to consider how we can develop a system for implementing and evaluating these changes to regulations, such that Fisheries Division fully (1) documents the system that we have created, and (2) assesses and refines the classification system in the future. For example, as we learn more about the relationship between physical habitat characteristics and fish growth rates from data gathered through the inventory and assessment process, we can then re-assess the guidelines used to assign water bodies to particular regulation classifications.

Job 7. Title: Expand research into related areas.

Findings: Specific to the Michigan lake classification research, Nancy has begun to review pertinent literature related to the ecological classification of lakes. A meeting to discuss classification issues with Dr. Paul Seelbach is pending. Our goal is to develop a lake classification system that will compliment the current stream classification system. Generally, we would like to consider lakes within the context of their landscape position and model fish populations on a broad regional scale within that structure.

More generally, during the past year I submitted several research proposals:

- January 1999. Recruitment variability in fishes: exploring patterns, processes, and implications for lake food webs. \$50,000. Michigan State University. Funding denied.

- February 1999. Assessing the effectiveness of artificial structures placed in impoundments along the Au Sable River (with Dan Hayes). \$160,000. Consumers Energy, Habitat Improvement Fund. Funding granted.
- March 1999. The effect of Sonar application on fish populations and aquatic plant growth in Michigan lakes. \$34,000. Aquatic Ecosystem Restoration Fund/Aquatic Plant Management Society. Funding granted.
- May 1999. Assessing lake integrity along land use gradients: a holistic framework for integrating landscape spatial patterns, humans and lakes (with Pat Soranno (lead author), Jack Liu, and Angela Mertig). \$900,000. Environmental Protection Agency (Pat Soranno lead author). Funding denied.

Overall, my ongoing research in Ohio reservoirs and Michigan lakes directly relates to the goals expressed in this project. In the Ohio reservoir research, we are evaluating the extent to which gizzard shad recruitment, and the subsequent effects of gizzard shad on sportfish and water quality, vary predictably across a reservoir productivity gradient. During summer 1999, we evaluated gizzard shad recruitment, sportfish recruitment, and water quality parameters in twelve reservoirs, ranging from mesotrophic to hypereutrophic. In addition, this project is evaluating the relative importance of watershed characteristics and gizzard shad populations in regulating reservoir nutrient dynamics. We are exploring the extent to which reservoir productivity can be used to classify reservoirs for management purposes. My collaborators on this project include Drs. Pat Soranno, Michigan State University, Mike Vanni and Bill Renwick, Miami University, Maria Gonzales, Wright State University, and Roy Stein, The Ohio State University. Roy Stein and I are co-advising a master's degree student on this project.

For Michigan lakes, we (collaborator Dr. Pat Soranno, Michigan State University and I) are evaluating the food web interactions among aquatic macrophytes, macroinvertebrates, bluegill, and largemouth bass. Specifically, the project is assessing whether chemical control of Eurasian watermilfoil, an exotic macrophyte, affects recruitment and production of littoral sport fishes. I am advising two master's degree students on this project.

Job 8. Title: Prepare annual reports and publications.

Findings: I currently have one manuscript in review and one manuscript in press:

Bremigan, M.T. and R.A. Stein. in review. Variability in larval gizzard shad recruitment across Ohio reservoirs: exploring causal mechanisms and implications for fisheries management. Submitted to Ecological Applications. 32 MS pages, 3 tables, 7 figures.

Bremigan, M. T. and R. A. Stein. in press. Larval gizzard shad success, juvenile effects, and reservoir productivity. Submitted to Transactions of the American Fisheries Society. 37 MS pages, 5 tables, 7 figures.

This study performance report was completed.

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