RESEARCH FINAL REPORT GUIDELINES

PROJECT ABSTRACT

Title: An online tool for evaluating habitat conditions and fish populations in streams throughout Michigan.

Abstract Body: Sharing information is key to successful management of common resources. Michigan Department of Natural Resources (MDNR) Fisheries Division biologists collaboratively manage fish communities and habitats in the Great Lakes, inland lakes, and streams with various agencies, tribal governments, and the public. In 2002, the Michigan Department of Natural Resources (MDNR) Fisheries Division initiated a statewide Status and Trends Program (STP) to assess fish populations and aquatic habitat in Michigan rivers. A key component of the STP is an inventory of stream reaches throughout Michigan using a stratified-random sampling design and standardized survey methods (Wills et al. 2008).

Summaries of data from these surveys and other surveys done using the STP Random Site can be used to characterize stream fish communities in various types of streams throughout Michigan. In addition, each STP random site survey involves assessment of riparian and instream habitat conditions, enabling characterization of key aspects of stream habitat including, substrate conditions, woody habitat, stream depth and width, streambank stability, and riparian corridor vegetation. Thus, descriptions of fish and habitat conditions specific to each type of stream (e.g., medium-sized, high-gradient, coldwater streams in northeastern Lower Peninsula) are possible when these data are linked to an ecological classification framework, such as Michigan's Valley Segment Ecological Classification (Seelbach et al. 2006; Zorn et al. 2008). Such descriptions are useful to fishery managers and practitioners of habitat restoration.

The pieces of information needed for defining such benchmarks exist in MDNR databases for the entire state of Michigan. What was needed was a web-based tool to serve these data in a user-friendly manner that would benefit citizens and fishery managers. However, developing such a tool is technologically challenging, and had not been accomplished due to many years of State agency restructuring, budget cutbacks, and high-priority technology infrastructure upgrades that left little, if any, remaining funds available to develop such a project. Therefore, funding was obtained from the Great Lakes Fishery Trust to contract the expertise needed for assembling these pieces into an online decision support tool.

We developed an online tool, the Stream Evaluator, for characterizing benchmark conditions of fish assemblage composition, species abundance, and habitat conditions for each stream type in Michigan. To develop the Stream Evaluator tool, we provided data from MDNR Fisheries

Division's centralized database and worked with software developers at Michigan State University's Remote Sensing and Geographic Information Systems center. Michigan Department of Technology Management and Budget staff coordinated software development efforts and migrated the Stream Evaluator to State of Michigan servers where it permanently resides. The tool enables users (e.g., the public, managers, and anglers) to compare fish populations and habitat conditions of stream reaches they are interested in with statistically-based summaries (at the local, region, or state-wide scale) from waters that share similar hydrological and physical attributes. The graph and data-based comparisons between individual survey data and benchmark values computed from other standardized surveys throughout Michigan enables users to readily assess individual stream reaches in the appropriate biophysical context. Benchmark data also enables characterization of fish and habitat conditions in all stream types in Michigan. The Stream Evaluator will be updated annually with the latest data from MDNR Fisheries Division survey database conducted using MDNR Status and Trends Random Sites protocols. The Stream Evaluator is available at the following URL: http://www.mcgi.state.mi.us/smdt/

FINAL NARRATIVE REPORT GUIDELINES

- **Project Title:** An online tool for evaluating habitat conditions and fish populations in streams throughout Michigan (Project 2015.1531)
- **Grantee Organization:** Michigan Department of Natural Resources, Fisheries Division.
- **Project Team:** Troy Zorn, Jan-Michael Hessenauer, Todd Wills, and Danielle Forsyth Kilijanczyk (MDNR Fisheries Division); Ed Bissell and Justin Booth (Michigan State University, Remote Sensing and Geographic Information Systems); Anila Francis (Michigan Department of Technology Management and Budget); Henry Quinlan (United States Fish and Wildlife Service); Brett Fessell (Grand Traverse Band of Ottawa and Chippewa Indians). (Please list all members of the project team who should be credited with contributions to the work, including name and institutional affiliation.)
- **Contact Person:** Dr. Troy Zorn, Michigan DNR Fisheries Division, Marquette Fisheries Research Station, zornt@michigan.gov
- **Grant Amount:** $71,245
- **Start and End Dates:** 1-1-2016 and 10-31-2018
- **Key Search Words** (stream, habitat, fish, stream width, depth, wood, substrate, bank stability, riparian, growth, length-at-age, species abundance, trout, smallmouth bass)

Background/Overview

1. Briefly summarize the project description as outlined in the original proposal.
    a. We worked with Michigan State University (MSU) and Michigan Department of Technology, Management, and Budget (DTMB) collaborators to develop the Stream Evaluator, an online tool to facilitate sharing of data on habitat conditions and fish populations in Michigan streams obtained from surveys conducted using standardized field methods (Status and Trends Random Sites Protocols). The Stream Evaluator enables users to select a stream reach, view habitat, fish species occurrence and abundance, and more detailed information on abundance and growth of game fishes. Then, the user can specify a set of similar streams for comparison, and the tool enables graphical and numeric comparisons of values for each survey parameter against average values calculated from the set of streams chosen for comparison. With summaries from a geographically and

ecologically-relevant set of benchmark streams, the Stream Evaluator allows users to determine which aspects of stream habitat and fish populations are below, meeting, or exceeding conditions typically observed streams chosen for comparison.

2. Briefly summarize any significant changes to the work performed in comparison to the originally proposed and funded plan of work. If changes were made, describe how they affected your ability to achieve the intended outcomes for the work.
    a. This project ran behind schedule due to causes which were unanticipated prior to when funding was received. They included personnel changes within MDNR Fisheries Division (promotion of co-PI Wills and hiring/training of Hessenauer, his replacement), Fisheries database issues that were discovered shortly after the project began and then mid-way through the project, and the use of a new, much more involved, and time-consuming process for moving the project to State of Michigan servers. These delays led to a later than expected online release of the Stream Evaluator and prevented us from capturing information on tool use for this report.

Outcomes

Please characterize key outcomes of the project related to *knowledge*, *training*, *relationships*, and *practice*. Not all projects will have outcomes of all types.

3. To what extent and how (if at all) did this research project advance scientific knowledge of the issue?
    a. The Stream Evaluator is broadly increasing all users' knowledge of the STP random sites survey program and field protocols. The tool will highlight the value of data from standardized surveys and help further the use of STP Random Sites survey protocols. Data from the tool will provide users with the appropriate context for interpreting stream habitat and fish data collected on individual surveys, and will enable users to quantitatively understand how geographic region and key stream attributes (e.g., size, July mean temperature, channel gradient, etc.) shape fish communities and stream habitat conditions. The data will enable fishery managers to predict what might be expected in streams that will be surveyed, or to estimate what may have been lost when resources are damaged by human activities. It allows fishery managers to obtain region- and water-type specific benchmarks for game fish populations, such as fish abundance by size group or length-at-age. Such information will provide empirical support for management decisions, thus encouraging more informed and better management of stream habitats and fishes. Properly serving these data is enlightening biologists, anglers, interest groups, and the public about the diversity of streams throughout Michigan. The Stream Evaluator was released online during MDNR Fisheries Division's field sampling season, but we have already given several presentations on the tool. Further promotion of the Stream Evaluator will occur in the coming months to raise awareness of it and train individuals in how to use it.
4. To what extent and how (if at all) did this project contribute to the education and advancement of graduate or undergraduate students focused on Great Lakes fishery issues?
    a. The work was undertaken by professionals and was not part of a student project.
5. To what extent and how (if at all) did this work help you or others on your team build new relationships with others in the research or management communities?

a. By making this information widely available, we are strengthening relationships among partners and publics that MDNR Fisheries Division interacts with. Access to these data may foster additional data-sharing and catalyze further efforts by interest groups, other agencies, and non-profits to use these standardized protocols on surveys so that information can be added to MDNR's database for inclusion in the Stream Evaluator. For example, STP Random Site Protocols were used on over 20 grant-funded surveys in tributaries in the Manistee River system associated with Michigan's Arctic Grayling Initiative. These data will be included in the Stream Evaluator's next annual data refresh. The utility and power of the tool will only increase as additional partners provide data to MDNR from surveys conducted using Random Site Protocols. In summary, by providing a common decision-making platform this Tool will provide a bridge for MDNR to partner with others on surveys and making decisions from surveys.

6. To what extent and how (if at all) do the findings have action implications for fishery managers? If the research has direct management implications, do you have any knowledge of use of the findings by managers? If the research does *not* have direct management implications at this stage, to what extent did the research advance the process of identifying management responses to critical issues?
    a. It is our desire that anglers, non-profits, other agencies, tribes etc. make accessing the Stream Evaluator a standard practice when examining habitat or fish survey data or conditions on any stream in Michigan. Public access to standardized survey data summaries and benchmark information for comparison provides MDNR Fisheries Division biologists with knowledge that was previously unavailable and will save them considerable time in summarizing and providing such data to address inquiries from the public, interest groups, and other agencies. We are working with our biologists and interest groups to encourage their constituents and the public to make it a standard practice to look to MDNR's online tools, the Fish Population Trend Viewer and the Stream Evaluator for up-to-date information on stream fish population trends and survey expectations for streams in their area before asking the biologist for this information. Michigan DNR fishery managers are routinely accessing this information as needed in their daily work.
7. Considering the above or other factors not listed, what do you consider to be the most important benefits or outcomes of the project?
    a. The ability to interpret data from individual surveys in the proper context and to compare on stream to a set of comparable streams represent major advancements for those who manage stream habitats and fish populations in Michigan. There are a number of important benefits or outcomes from the project: 1) information from this important inventory program is being shared widely and in the most useful formats; 2) sharing this information helps fulfill the 2007 Inland Consent Decree mandate and MDNR's desire to share these data with the tribes, agencies, universities, and public; 3) the Tool provides a common information base that will be useful to many parties, including fishery managers, anglers, non-profits, and interested publics; 4) the project will be maintained and data kept up to date at minimal cost; 5) personal requests to MDNR biologists for graphs and data summaries of this information should decline over time, saving MDNR personnel time and costs; 6) a process and platform for future data delivery efforts was created.

Related Efforts

8. Was this project a standalone effort, or was there a broader effort beyond the part funded by the GLFT? Have other funders been involved, either during the time of your GLFT grant or subsequently?
    a. This was a standalone effort, though MDNR provided funding to complete this project.
9. Has there been any spinoff work or follow-up work related to this project? Did this work inspire subsequent, related research involving you or others?
    a. This work was a spinoff of the Stream Fish Population Trend Viewer project, which was largely funded by the GLFT. Follow-up effort is planned to assess use of the Trend Viewer and Stream Evaluator tools, and we are working to enable Google Analytics for the websites to quantify use. Zorn will be using the Stream Evaluator to characterize trout and salmon populations in different stream types and regions Michigan (with vs. without Great Lakes access), a priority Action Item identified in Michigan's management plan for inland trout (Zorn et al. 2018). Last week, trout population trend data for several Au Sable River tributaries and adjacent streams were examined using the Trend Viewer were to determine if recent declines in a portion of the North Branch Au Sable River were more likely due to site-scale conditions as opposed to regional (climatic) processes. Uses for tools like these will continue to arise, and the utility of the tools in addressing management questions will improve over time as each tool's set of data grows.

Communication/Publication of Findings

10. List publications, presentations, websites, and other forms of formal dissemination of the project deliverables, tools, or results, including those that are *planned* or *in process.*
    a. The Stream Evaluator is published and available online at: http://www.mcgi.state.mi.us/smdt/
    b. Written publication: Zorn, T., T. Wills, J. Hessenauer, E. Bissell, J. Lenz, A. DePottey, D. Kilijanczyk, and A. Francis. 2017. Using statewide survey data to support local-scale management of Michigan trout streams. Pates 147-152 *in* R. Carline, editor. Proceedings of Wild Trout XII Symposium. West Yellowstone, Montana. *We are also planning to submit a similar article for publication in the AFS publication, Fisheries.*
    c. This project was presented at numerous venues by Zorn, and can be referenced as "T. Zorn, J. Hessenauer, D. Forsyth-Kilijanczyk, T. Wills, J. Lenz, E. Bissell, A. DePottey, F. Anila, H. Quinlan, B. Fessell. Using statewide survey data to support local-scale management in Michigan streams". Presentations were given at the following venues:
        - Upper Peninsula joint MDNR-MDEQ Aquatic Resources Meeting, Marquette, MI, January 2017, *planned for January 2019*
        - MDNR Fisheries Division Trout Committee meeting, December 2017
        - MDNR Coldwater Resources Steering Committee meeting, Gaylord MI April 2017 and 2018
        - Wild Trout XII, West Yellowstone, MT, September 2017
        - Michigan DNR Fisheries Division, Resource Inventory Team meeting, Gaylord, MI, January 2018

- Michigan DNR Fisheries Division, Lake Michigan Basin Team meeting, Manistique, MI, September 2018
- Michigan DNR Fisheries Division, Lake Michigan Basin Team meeting, Marquette, MI, September 2018
- Midwest Fish and Wildlife Conference, Milwaukee, WI, January 2018
- *Planned:* MDNR Fisheries Division Biologist meeting, Gaylord, December 2018
- *Planned:* Annual meeting of the Michigan Chapter of the American Fisheries Society, Gaylord, MI, March 2019

d. *News releases planned:* This project will also be presented via a MDNR press release, which may lead to several newspaper articles. Similar information (and a link to the site) will also posted to listserves of the American Fisheries Society's Michigan Chapter and Northcentral Division, and the Great Lakes Information Network listserve.

11. Please characterize your efforts to share the findings of this research with state, federal, Tribal, and interjurisdictional (e.g., Great Lakes Fishery Commission) agencies charged with management responsibilities for the Great Lakes fishery. If other audiences were priority for this research, please characterize your outreach efforts to those audiences as well. (Please note: You may wish to consult midterm reports in which specific audiences for the findings, and means of outreach to these audiences, were identified.)
    a. *Planned:* MDNR, USFS, KBIC, USFWS interagency meeting, December 2018, Kenton, MI.
    b. The Stream Evaluator will be shared with the other groups as opportunities arise in the coming months.
12. Please identify technical reports and materials attached to this report by name and indicate for each whether you are requesting that GLFT restrict access to the materials while you seek publication. (Please note that the maximum amount of time during which GLFT will restrict access to the results of funded research is 18 months, unless notified that more time is needed.)
    a. The project is published online and publicly available.
13. Manuscripts. Grantees submitting one or more publications or pending publications in lieu of a standalone technical report must submit a cover memo that confirms that all aspects of the funded research are incorporated in the published work, and in cases of multiple publications, identifies or crosswalks the grant-funded objectives to the published article containing results.
    a. Not applicable.
14. Compilation reports. Grantees working on several related subprojects under a single grant may submit a series of subproject reports rather than a single, integrated report. However, grantees must submit a cover sheet or introduction that outlines and crosswalks grant objectives with the location of the results in the compilation document.
    a. Not applicable.

Discussion

Development of the Stream Evaluator was the most important outcome of this project. Making this information available to state, tribal, and federal fishery managers, as well as university and non-profit collaborators, anglers, and the public, will undoubtedly foster a better understanding of the diversity of habitat conditions and fish populations in Michigan streams. Hopefully, this work will stimulate similar data sharing efforts and collaboration with other entities. Great Lakes fishery

managers working on stream-spawning species will benefit from having ready access to abundance information for various Michigan rivers, for use in addressing larger-scale (e.g., Great Lake basin) ecological issues. Biologists working on Michigan rivers, watershed groups, local tackle shops, anglers, and interested citizens will all benefit from data on species abundance and habitat conditions and a new ability to set more realistic goals and expectations for fish habitat conditions or fish abundance.

Development of a long-term mechanism for maintaining the project and keeping it fresh with the most recent data is also an important, long-term outcome of the project. We have a documented procedure for refreshing project data and ensuring correct linkages among data tables and will be implementing it in Spring 2019. Successfully executing the updates is key to the long-term utility and viability of decision support tools like the Fish Population Trend Viewer and Stream Evaluator. We will work to ensure the application works seamlessly after each update.

Initial use of the Stream Evaluator confirmed the importance of using geographic and ecological attributes in selection of streams for comparisons. For example, use of "stream gradient class" as a selection criterion enables users to see distinct differences between lower and higher gradient streams, with the generally having increased proportions of gravel and coarser substrates, and often less embeddedness of gravels. This allows managers concerned about a specific stream, to compare it with others having comparable gradient and get a more realistic set of expectations for what realistic expectations might be for substrate conditions, were habitat rehabilitation efforts undertaken. We will be obtaining feedback from users of this tool, and making adjustments as needed during the annual data refresh process.

This project could not have been accomplished without our collaborators. Programmers at Michigan State University impressed us with their ability to tailor the project to our specifications and make adjustments as the project came together. Project staff at Michigan DTMB have done an admirable job conforming the project to State of Michigan servers, and working through technical glitches that have arisen.

Obtaining information on website traffic would be useful for better understanding the number and types of people using the Stream Evaluator and Fish Population Trend Viewer. These data are not yet available, given the recent release of the website and ongoing work to publicize it. We are presently setting up Google Analytics based tracking so use can be assessed during the next year.