

Final Report

Feasibility of Rehabilitating and Supplementing Fisheries by Stocking Lake Whitefish in the Upper Great Lakes

Project number: 2018.1822

PROJECT ABSTRACT

Feasibility of Rehabilitating and Supplementing Fisheries by Stocking Lake Whitefish in the Upper Great Lakes

Lake Whitefish (*Coregonus clupeaformis*) have been highly valued by commercial fishers in the Great Lakes for more than a century, but these stocks have declined substantially in Lakes Huron, Michigan, and Erie over the past 15 years. Fishery yields have declined due to reductions in stock abundance, fishing effort, and fishing conditions. Weight at age declines have also occurred, but these declines had largely already taken place when the fishery was producing peak yields, before yields declined. Herein, we considered the feasibility of augmenting fishery yields in Lakes Huron and Lakes Michigan through stocking of hatchery-reared Lake Whitefish. We consider the potential to increase yield through stocking fish at the summer fingerling (~2g), fall fingerling (>15g), and yearling stages. We used estimates of costs associated with various stocking scenarios based on construction costs associated with developing a coregonine rearing facility at the Jordan River National Fish Hatchery, and estimates of production to various stages based on the Ontario Ministry of Natural Resources and Forestry's protocol for Lake Whitefish stocking for Lake Simcoe. Through a review of primary and secondary scientific literature, we estimated survival of hatchery fish stocked at various stages and calculated eventual recruitment to the fishery; we then expanded these estimates to yield enhancement based on yield per recruit calculations that were parameterized based on 1836 treaty-ceded waters stock assessments. Our results suggest that stocking Lake Whitefish as summer fingerlings is not recommended because the enhanced production of this earlier stage is not nearly sufficient to make up for what is likely to be much lower survival. Stocking that emphasizes fall fingerlings or yearlings are more viable alternatives given anticipated survival. That said, the return that might be expected from a stocking program, given best estimates of survival of fall fingerling or yearling fish, would be difficult to justify on purely economic grounds. For example, the expected cost to produce one pound of additional yield on Lake Michigan is about \$8, exceeding current prices fishermen receive for Lake Whitefish by a considerable amount. Lake-wide declines from peak fishery yields for Lakes Huron and Michigan are approximately 2,200 and 1,250 metric tons. Within 1836 treaty-ceded waters, declines in yield have been about 700 and 900 metric tons. We estimated the magnitude of hatchery operations and associated costs with enhancing yields by amounts equal to half the 1836 treaty water losses to the full lake-wide losses. Costs to produce the lowest levels of yield enhancement were substantial. For example, we estimated that to produce the lowest level of yield enhancement considered for Lake Michigan, it would be necessary to stock 21.2 million summer fingerlings and 24.4 million fall fingerlings, or 13.3 million spring yearlings under the most plausible levels of survival. Such operations would have annual long-term costs of \$12 million to \$14 million USD, and would require facilities on the order of 10 times those that will be in place for coregonine rearing at the Jordan River National Fish Hatchery. Survival of stocked fish is highly uncertain and alternative but not totally implausible values can lead to substantially different results from stocking.

Final Narrative Report

Project Title: Feasibility of Rehabilitating and Supplementing Fisheries by Stocking Lake Whitefish in the Upper Great Lakes

Grantee: Quantitative Fisheries Center, Michigan State University

Project Team: James R. Bence, Travis O. Brenden, Emily M. Liljestrand (Michigan State University)

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Grant Amount: \$19,999.84

Start and End Dates: 2/14/2019 to 5/31/2019

Key Search Words: Lake Whitefish, stocking, hatchery, survival, Lake Michigan, Lake Huron

Background/Overview

1. *Briefly summarize the project description as outlined in the original proposal.*

We proposed to synthesize available information in a desktop study to evaluate the feasibility of stocking Lake Whitefish to rehabilitate or supplement fisheries in the Great Lakes. This involved determination of likely numbers that would need to be stocked at different stages to have substantial benefits and the resources required to produce those numbers of fish to stock.

2. *Briefly summarize any significant changes to the work performed in comparison to the plan of work originally proposed and funded. If changes were made, describe how they affected your ability to achieve the intended outcomes for the work.*

There were no significant deviations in the work that was proposed and performed. One minor deviation from what had been proposed was that we did not evaluate the possibility of stocking Lake Whitefish fry as a management option. We did not consider this a viable option given the multitude of studies that have found stocking of fry to have no measurable effect on fishery harvest.

Outcomes

3. *To what extent and how (if at all) did this research project advance scientific knowledge of the issue?*

Questions concerning the feasibility of stocking Lake Whitefish to augment wild populations and enhance/rehabilitate fisheries have been posed since the turn of the 20th century. Todd (1986) provided a comprehensive review of the feasibility of stocking Lake Whitefish in the Great Lakes; however, Todd (1986) only evaluated the feasibility of stocking Lake Whitefish fry because at that time culturing Lake Whitefish to later life stages was not routine. Todd (1986) noted that stocking fingerling or older Lake Whitefish might be a more feasible management action, although the realized benefits would still depend on survival rates of those stocked life stages. This project addressed the feasibility of whether stocking fingerling or older Lake Whitefish could offset declines in yield that Lake Whitefish fisheries in Lakes Huron and

Michigan have experienced. Through literature review of primary and secondary scientific publications, we identified plausible survival rates for Lake Whitefish life stages. Through expert elicitation, we estimated costs associated with culturing Lake Whitefish to later life stages. Existing Lake Whitefish stock assessment provided us with the means necessary to calculate anticipated yield per recruit for Lake Huron and Michigan. These three pieces of information combined could directly address the costs:benefits of different Lake Whitefish stocking policies.

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?*

Emily Liljestrand, a PhD graduate research assistant at Michigan State University, was a participant on this project. Her main responsibilities on the project were to develop an R script and excel spreadsheet that could take stocking number, survival rate, and yield per recruit input to determine expected fishery yield from a particular stocking policy. Emily also coordinated and participated in the remote meetings held with the working group of hatchery experts to pinpoint costs associated with culturing Lake Whitefish to different life stages.

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?*

As part of this project, we interacted with hatchery experts from the Ontario Ministry of Natural Resources and Forestry, Michigan Department of Natural Resources, U.S. Fish and Wildlife Services, and Bay Mills Indian Community experienced in culturing fish in the Great Lakes region. While the project investigators had interacted with some of these experts on previous projects, the interactions between investigators and the hatchery experts were novel as they were focused on understanding detailed methodologies and costs associated with methodologies in culturing Lake Whitefish to different life stages. None of the project investigators previously had much experience in hatchery operations in the Great Lakes region; the opportunity to interact with these hatchery experts was quite eye-opening as to the details that would go into culturing Lake Whitefish in large numbers.

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 finding 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?*

Our findings provide estimates of anticipated costs of stocking Lake Whitefish in Lakes Michigan and Huron to recover yield that has been lost stemming from declines in recruitment levels. There is uncertainty in cost associated with what survival rates might be for stocked Lake Whitefish, our evaluations account for this uncertainty and the desired level of yield that might want to be restored.

7. *Considering the above or other factors not listed, what do you consider to be the most important benefits or outcomes of the project?*

In addition to providing anticipated costs of stocking Lake Whitefish to recover yield that has been lost due to declining recruitment, the other important outcome of this project is that it demonstrates how readily-available information can be compiled in a straightforward way to address cost:benefit questions regarding stocking as a potential fishery management action.

Related Efforts

8. *Was this project a stand-alone 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?*

This was a stand-alone effort.

9. *Has there been any spin-off work or follow-up work related to this project? Did the work inspire subsequent, related research involving you or others?*

To date there has not been any spin-off or follow-up work related to this project.

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.*

No publications, presentations, websites, or other forms of dissemination of project findings have been carried out. We prepared a white paper (see #12 below) as part of this study and intend to revise this and publish it as a QFC Technical Report and make this publically available through FigShare.

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 the 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.)*

As part of this project, we interacted with hatchery experts from the Ontario Ministry of Natural Resources and Forestry, Michigan Department of Natural Resources, U.S. Fish and Wildlife Services, and Bay Mills Indian Community experienced in culturing fish in the Great Lakes region. We interacted with these hatchery experts primarily to determine costs associated with culturing Lake Whitefish to different life stages, but we also sought their opinion as to whether survival rates that were identified from literature review seemed appropriate for Lake Whitefish and whether the results from our evaluations made biological sense.

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 six months, unless notified that more time is needed.)*

Attached to this report is a white paper entitled “Feasibility of Rehabilitating and Supplementing Fisheries by Stocking Lake Whitefish in the Upper Great Lakes” that describes the methods, results, and discussion of our evaluations. We anticipate that we will update this white paper once the working group of hatchery experts and the GLFT Science Advisory Team (SAT) have had an opportunity to look over the paper and ask follow-up questions. Once the report is finalized, we will publish this report as an MSU Quantitative Fisheries Center Technical Report that will be made publicly available through FigShare. We suggest that the GLFT restrict access

to the white paper until we have had a chance to respond to questions from the working group and GLFT SAT. We expect that period will be less than two months.

13. Manuscripts: Grantees submitting one or more publications or pending publications in lieu of a stand-alone 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.

Not applicable.

14. Compilation reports. Grantees working on several related sub-projects under a single grant may submit a series of sub-project 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.

Not applicable.

Discussion

See discussion in the referenced white paper submitted as an additional document with this report.