GREAT LAKES FISHERY COMMISSION

2004 Project Completion Report[1]

Lake Huron Case Study and Cross Lake Comparisons of Top Predators

by:

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Completion Report to Great Lakes Fishery Commission

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Abstract

Synthetic research was coordinated, led, and conducted leading to two manuscripts as part of the Salmonind Communities of Oligotrophic Lakes (SCOL-2) process. In this process we participated in SCOL-2 workshops and provided input on other manuscripts that were prepared as part of SCOL-2. The first manuscript provides a synthetic and integrative overview regarding changes in the Lake Huron fish community and ecosystem since 1970. Emphasis is put on stressors to the system and a prognosis for the future. This paper has been submitted to the Canadian Journal of Fisheries and Aquatic Sciences, received generally favorable reviews, and is now (July 2004) being revised for resubmission. The second manuscript considers the impact of top down effects by salmonine predators and differences among the lakes. The paper emphasizes that top down effects vary and that current top down influences of top predators may not match historical top down influences prior to the collapse of lake trout and other top predators stocks. This manuscript was submitted to Mike Hansen, Guest Editor for the SCOL-2 papers for the Canadian Journal of Fisheries and Aquatic Sciences and he is now reviewing it.

Summary of Activities and Manuscript Contents

Synthetic research was coordinated, led, and conducted leading to two manuscripts as part of the Salmonind Communities of Oligotrophic Lakes (SCOL-2) process. In this process we participated in SCOL-2 workshops and provided input on other manuscripts that were prepared as part of SCOL-2.

Norine Dobiesz, postdoctoral associate took the lead in the task of organizing, reviewing and synthesizing materials that had previously been developed for the Lake Huron Case Study paper for SCOL-2 by David McLeish at OMNR. This process led to the preparation of a manuscript, which after several rounds of internal review by co-authors was submitted to the Canadian Journal of Fisheries and Aquatic Sciences. Generally favorable reviews have been received and the manuscript is being revised for resubmission as of July 2004. This paper is 56 manuscript pages in length with an additional 9 figures:

Dobiesz, N.E. D.A. McLeish, R.L. Eshenroder, J.R. Bence, L.C. Mohr, B.A. Henderson, M.P. Ebener, T.F. Nalepa, A.P. Woldt, J.E. Johnson, R.L. Argyle, and J.C. Makarewicz Ecology of the Lake Huron Fish Community 1970-1999.

A summary of the content of this manuscript follows: In this paper we reviewed the status of the Lake Huron fish community between 1970 and 1999 and explored the effects of key stressors. Offshore waters have changed little in terms of nutrient enrichment while phosphorus levels have declined in inner Saginaw Bay. Introduced mussels, *Dreissena* spp., proliferated and may have caused a decline in *Diporeia* in outer Saginaw Bay. *Bythotrephes,* now common in the lake, may be responsible for a compositional shift of zooplankton from bosminids to daphnids. Sea lampreys (*Petromyzon marinus*) remain prevalent, but intensive control efforts on the St. Marys River in the late 1990s may reduce the impacts of their predation on salmonines. Over-fishing is less of a problem than in the past except for lake trout (*Salvelinus namaycush*), planted for rehabilitation purposes, and for *Coregonus hoyi*, which is sensitive to fishing when its cyclic recruitment is low. Massive stocking programs have increased the abundance of top predators, but lake trout have been rehabilitated in only one area. Successful lake trout rehabilitation may both require and cause reduction in pelagic prey fish densities, and this could lead to more limited Pacific salmon fisheries.

Jim Bence with assistance from Norine Dobiesz took the lead in comparing top down effects of salmonine predators across the Great Lakes. With the assistance of co-authors a manuscript was prepared and submitted to the Guest Editor for SCOL-2 papers, Mike Hansen and as of July 2004 this manuscript is being evaluated by the Guest Editor.

This manuscript is 41 manuscript pages (including one appendix) with an additional eight figures:

Bence, J.R., N.E. Dobiesz, C. Madenjian, R. Argyle, R. Barbiero, J. Bowby, R. Claramunt, R. O'Gorman, and T. Shaner. Open-water salmonine predators and top down effects in the Great Lakes

A summary of the content of the manuscript follows: Concerns about an imbalance between top piscivore abundance and prey fish productivity have played an important role in scientific study and management of the Great Lakes. Here we argue that the top down effects of salmonine piscivores are likely quite different among the lakes. Chinook salmon have grown substantially faster and alewife were substantially denser in Lake Ontario than the other lakes. These results suggest less intense top down effects in Lake Ontario even though top predators reached as high or higher a density in that lake as in lakes Michigan and Huron. High densities of alewife in Lake Ontario combined with their restriction to the epilimnion in that lake have likely led to greater effects of planktivory in that lake. Larger sizes of zooplankton are scarcer in Lake Ontario than lakes Michigan and Huron even though total zooplankton biomass density is higher. Compensatory mechanisms have limited top down cascade effects at the whole trophic level in lakes Michigan, Huron and Ontario. For example, although salmonine predators have greatly reduced the abundance of older alewife, high levels of alewife recruitment have been sustained. These young alewife make up much of the biomass and contribute most of the planktivory. While planktivory has played a role in determining size structure in zooplankton communities, total phosphorus still predicts total zooplankton biomass density well, indicating that smaller zooplankton have compensated for declines in larger species. Top down effects of salmonines on the fish communities in lakes Michigan, Huron and Ontario are likely less intense than prior to lake trout collapses in those lakes or currently in Lake Superior.