Assessment of Salmonine Populations and Their Prey in Michigan Waters of Lake Michigan

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Background

Pacific salmon (Chinook Salmon, Coho Salmon and Steelhead) populations in Lake Michigan support extremely popular and economically valuable recreational fisheries. In 2011, the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation found that nearly 40 percent of all fishing in the State of Michigan occurred in the Great Lakes and that these fisheries contributed nearly $1 billion dollars to local economies. Salmonids (trout and salmon) are in high demand in the recreational fishery and are intensively managed using regular adjustments to stocking and harvest; so it is important to have knowledge of the underlying factors driving changes in distribution, abundance, and recruitment. These factors include: interactions with other species; mortality rates; diet preferences; the amount of natural reproduction; and the amount and composition of forage. Fishing mortality is controlled through regulations but to implement meaningful regulations, we need to know a great deal more about salmon populations in Lake Michigan. This study, which is an ongoing, systematic assessment of our Pacific salmon populations, provides us with an opportunity to be proactive rather than reactive in our management of these species.

The objectives of this project are to assess the health and status of Chinook Salmon, Coho Salmon and Steelhead stocks in Lake Michigan, by: (1) evaluating the relative abundance, distribution, and biological characteristics (growth, mortality, diet composition, and clinical indicators of disease) of both hatchery and naturally reproduced salmon populations; (2) evaluating the abundance, biomass, and distribution of important prey fish from acoustic and midwater trawl surveys; (3) relating the variation in prey levels to Chinook Salmon, Coho Salmon, and Steelhead growth, abundance, recruitment, and survival; (4) assessing the relative influence of lake productivity (called bottom-up) and predator based (called top-down) control on fluctuations in predator-prey interactions in Lake Michigan; and (5) evaluating habitat characteristics and chemical (isotope) signatures of naturally produced salmon and steelhead smolts to improve tributary habitat management and estimates of natural reproduction. This project is the only long-term Great Lakes survey designed to collectively evaluate salmonines and their prey. The study monitors ongoing changes in Chinook Salmon, Coho Salmon, and Steelhead populations, as well as changes in forage fish populations, and provides these critical data to Great Lakes fisheries managers.

Key study results

- During 2015, more than 2,300 Chinook and Coho Salmon samples were collected from fishing tournaments along the Michigan shoreline of Lake Michigan from St. Joseph to Charlevoix. Complete biological data—including information on age and growth, mark prevalence (using oxytetracycline (OTC – chemical marks), fin clips, and coded wire tags), incidence of disease, diet, and Sea Lamprey wounding—were recorded for all salmonines collected. The collection of samples was coordinated through multi-agency committees (Lake Michigan Technical Committee (LMTC) Salmonid Working Group and Planktivore Working Group), participation on grant-funded studies, as well as collaborative research with universities and other fisheries agencies (e.g., United States Fish and Wildlife Service). Results from these collections are used extensively in management of the Lake Michigan salmonid fishery with details are at http://www.michigan.gov/dnr/0,4570,7-153-10364_52259-323650--,00.html.
- The 2015 acoustic survey to estimate forage fish abundance was completed as planned (28 transects completed lakewide) by the research vessels the USGS "Sturgeon", the USFWS

"Baird", and Fisheries Division's "Steelhead". This was an increase of effort from the previous three years. Fisheries Division completed 11 acoustic transects from St. Joseph to Cross Village. In addition to acoustic data collection, we also sampled prey fish with midwater trawls and mysids with vertical plankton nets (Photo 1). Detailed forage fish results for 2014 surveys were reported to the Lake Michigan Committee in March 2015—details are at http://www.glfc.org/lakecom/common_docs/Compiled%20Reports%20from%20USGS%202015.pdf

Photo 1. Processing samples during the lakewide hydroacoustic (forage) survey.

Preliminary results from 2015 surveys suggest that the 2015 Alewife year class (age 0) is more abundant than in 2013 and 2014 but it is likely below the long-term average. Abundance of age-0 Alewife has historically been a good predictor of abundance at age-1 the following year. In addition, adult Alewife were sparsely distributed, and far fewer were caught in 2015 than in 2014, which is consistent with forecasts of lower Alewife biomass in 2015. Young Bloater were observed on most transects, which has never been observed in a Lake Michigan acoustic survey. Based on this observation, the 2015 Bloater year class is likely above average in abundance.

- Age-0 and 1 Steelhead were collected in June-August from spatially diverse tributaries to Lake Michigan in Michigan and Wisconsin. A total of 46 different locations in the Lake Michigan basin were sampled from 2013 to 2015, providing comprehensive spatial coverage of watersheds that potentially contribute wild Steelhead to the lake fishery (Photo 2). Sampling represents a collaborative effort between Central Michigan University, the Wisconsin Department of Natural Resources, and Fisheries Division. In addition, we have collaborated with researchers at Michigan State University with the collection of Chinook Salmon fingerlings from lakes Huron and Michigan for isotope signature analysis. Analyses conducted to date indicate strong differentiation among Steelhead populations from different regions of the lakes.

Photo 2. Collecting Age-0 and Age-1 steelhead from the Jordan River for otolith microchemistry analysis.

Additional details on this study can be found at http://www.michigan.gov/dnr/0,4570,7-153-10364_52259_19056-333302--,00.html.