# Forecasting Spatial Distributions of Salmonines in Lake Michigan

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## Overview

The development of real-time web-accessible tools such as the MSU Coastwatch system have provided sport fishing stakeholders with an improved means of locating suitable surface temperature zones in which to locate target species. However, as useful as this system is, it is limited to a single dimension. Advancements in computer modeling, more robust hydrodynamic models with improved resolution of remote sensing capabilities have resulted in some thermal mapping of the Great Lakes, presented in two or three dimensions. Low resolution, 3-D thermal mapping of the GL already have been developed.

The use of spatially explicit models in the Great Lakes has provided valuable insight on localized fish growth potential in pelagic habitats. Because these growth zones are highly correlated with actual fish distribution and temperatures, a unique opportunity exists to combine these tools to provide an innovative predictive framework for recreational anglers and assessment biologists in locating target fish species.

## Objective

Increase number of fish stocks managed at sustainable levels.

## Proposed Work

We propose to achieve the following objectives:

- Develop/ refine existing 3-D thermal models in a higher resolution format for the Great Lakes.
- Integrate these revised thermal maps with spatial models developed for identifying preferred growth zones of fish pelagic fish habitat.
- Develop a high resolution system of real-time fish distribution maps from the integration of thermal maps and spatial fish models that is user friendly and accessible on the internet for GL anglers, biologists

GLOS/GLSGN will coordinate extension outreach of the project that includes educating stakeholders and fisheries managers about the project, solicit boat anglers to volunteer their services to ground truth the pilot system, conduct outreach on the results of the project, facilitate the development of a user friendly website to obtain information, conduct outreach on using the website and provide user comments on the system back to other investigators.

**Scientific Rationale**

Results will improve our knowledge of physical factors influencing behavior, movement and distribution of top piscivores in Lake Michigan. In future, we aim to improve model forecasts of salmonine spatial distributions by adding predictions of planktivore distributions.

**Governmental/Societal Relevance**

Discussions between U.B. and GLERL scientists and NYSG have suggested that the integration of multi-dimensional, thermal imaging systems in the Great Lakes with spatial modeling is not only possible but may be accomplished within a short time frame. Moreover, it could be developed at a high-enough resolution or scale to be useful for anglers and fisheries assessment biologists in locating target species in real-time (nowcasts) and forecasts. This system would also allow the data to be archived. U.B and GLERL scientists in conjunction with NYSG are proposing to develop this system for Lake Ontario as a pilot project for developing a system Great Lakes wide (as part of GLOS, the Great Lakes Observation System). This will be coordinated with the Great Lakes Sea Grant Network.

We believe that this project meets the criteria of fisheries management, sport fishing promotion and extension outreach under the GLOS priorities. The anticipated benefits of the project to fisheries management would include: an improved understanding of fish distribution patterns of predatory species in the lake, how these patterns are influenced by biophysical processes, increased fishing participation by stakeholders, increased angler success and increased economic revenues to GL coastal communities from increased angler participation. Stakeholders would benefit from an improved ability to locate target species, increased angler success, and reduced expenditures in locating fish.

**Relevance to Ecosystem Forecasting**

Results of this study will provide daily and weekly forecasts of salmonine distributions across time and depth.