ABSTRACT

Climate-Induced Changes to Fisheries Habitat in Lake Michigan: An Integrated Assessment

While it is becoming clear that the Great Lakes will likely experience significant warming due to climate change, the potential effects of this warming and other climatic features on fisheries resources in Lake Michigan are not well understood. Given that Great Lakes fish stocks support numerous economically important sport and commercial fisheries, elucidating and adapting to future climate-driven changes in Great Lakes fish habitat is vitally important. Presently, management of Great Lakes fisheries can be characterized as primarily reactionary and focused on short-term processes. However, a different paradigm may be necessary if fisheries managers and resource users are to proactively prepare for the consequences of climate change. Effective management within such a long-term perspective may necessitate not only evaluation of human dimensions of fisheries management, but also the development and application of innovative, forward-looking investigative methods which can be effectively communicated to a diverse management audience.

Interestingly, most analyses of likely future climatic impacts on adult fishes in the upper Great Lakes suggest that many ichthyofauna will benefit from warmer conditions. The upper Great Lakes, including Lake Michigan, are deep, cool water bodies with limited suitable thermal habitat, and thus these analyses have suggested that warmer climates will increase the net volume of suitable thermal habitat and thereby positively impact adult life stages of most fish species. We suggest that such analyses are insufficient because impacts of future climate may differ among life stages and will undoubtedly differentially impact spatio-temporally distinct fish populations. For example, climate change impacts on nearshore physical and chemical processes and resulting spatio-temporal overlap between young and adult fish and suitable habitat can have huge impacts on population production.

We will use an Integrated Assessment (IA) framework to accomplish our **three overarching objectives: 1) evaluate cross-institutional knowledge gaps and structures that facilitate or impede proactive management of Lake Michigan fisheries in the face of climate change, 2) project how future climates are likely to affect nearshore Lake Michigan fisheries habitat and 3) effectively communicate potential climate-induced impacts on fisheries habitat to relevant stakeholders.** In order to properly manage fisheries in the face of climate change, it is vital to understand what drives management of Lake Michigan. First, we will conduct iterative webbased surveys of managers and resource users throughout the region to better understand knowledge gaps and factors that might inhibit adaptive change. Second, we will quantify thermal habitat using existing circulation models and down-scaled climate models, and we will use output from these models to quantify spatio-temporal bioenergetics-based growth rate potential (an index of habitat quality) for ecologically and economically important fish species. Finally, we will disseminate findings from this research to a broad audience using pre-assessed communication tools. Thereby, we will provide managers and users with information and decision support to adapt fisheries management and fishing expectations in response to a changing climate.