

Fisheries Extension Enhancement

FOOD WEBS

Theme Scope: This theme focuses on issues relating to the food web supporting the fisheries of the Great Lakes. Indirect impacts of aquatic invasive species (AIS) mediated by food web interactions are included here, but not issues related to AIS prevention and control. Elements of this theme support efforts in the AIS, Contaminants, Management, and Restoration & Enhancement themes.

Regional Issues Addressed by this Theme

Great Lakes fisheries managers are seeking to understand how changes in the aquatic food web impact fish population by either providing or not providing an adequate food supply for larval fish. These results enable managers to predict strong or weak year classes based on the composition and density of zooplankton, allowing for fishing regulations that more closely mirror fish populations.

The tiny shrimp-like organism *Diporeia* was historically the dominant benthic invertebrate in most offshore areas of the Great Lakes. Since the mid-1980s, *Diporeia* have declined dramatically throughout the Great Lakes—from densities exceeding 15,000 per square meter to nonexistent in some areas. Since *Diporeia* normally make up about 70 % of the living biomass in a given area of a healthy lake bottom, their decline in



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the Great Lakes may spell hard times for a variety of fish species that depend heavily on them for food. Species of particular concern include commercial species such as lake whitefish as well as forage fishes such as alewife and smelt on which the recreationally valued predatory fishes (such as walleye and salmonids) depend.

A recent Sea Grant supported study points out that repeated introduction of non-native species has caused frequent restructuring of lake food webs and the demise of economically important fisheries. The addition of round gobies to the food web combined with the apparent elimination of mottled sculpins raises concerns about possible local extinctions and about changes in the food web that could affect other species. Despite their less visible presence in lakes, both native and exotic invertebrate predators are key components of aquatic food webs. Because they sit in the center of the web, between smaller plankton and fish, invertebrate predators have the potential to impact both upper and lower trophic levels. Unlike native species, the two exotic invertebrate predators, *Bythotrephes* and *Cercopagis*, prefer large zooplankton prey and may compete with larval and young fish for food.

Current Great Lakes Sea Grant Network Activities

Fisheries & Food Webs Educational Materials

With funding from the initial round of the National Sea Grant FEE Initiative, Michigan Sea Grant produced an updated and improved edition of the award-winning publication *The Life of the Lakes*. The 54-page book serves as a primer to



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Great Lakes fisheries and food webs for educators, anglers and anyone with an interest in the fishery and was used as the core element of the Great Lakes Fisheries Leadership Institute. The accompanying poster focuses on the food web. Ohio Sea Grant recently produced a 4-poster series on fish of Lake Erie. One poster of the series, titled "The Circle of Lake Life" focuses on food webs as pathways for energy and consumption. The information is also included in a brochure for kids.

Lake Ontario Forage Base Assessment

Recent changes in the Lake Ontario food web have resulted in changes in fish distribution and alteration of the trawling assessment. There has been increasing concern from sport fishing stakeholders and local legislators about the accuracy of the assessment program. In response to a request from New York Senator Maziarz and from stakeholder concerns, New York Sea Grant organized an external, objective review of the Lake Ontario Forage Fish Assessment Program with the cooperation of United States Geological Survey (USGS) and New York State Department of Environmental Conservation (NYSDEC). Four prominent scientists with expertise in the field of fisheries assessment were asked to conduct the review. The review process consisted of evaluating the assessment program in the context of review criteria developed by an advisory panel of Lake Ontario scientists and fisheries managers.

The basis of the review was a series of documents, developed by USGS and NYSDEC,

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and provided to the review panel, outlining the program's history, sampling design, analytic and modeling framework and data trends. The program received an overall positive review in terms of the reliability of the population trends of the major forage species in Lake Ontario, despite some recommendations for improvement made by the external review panel.

Since the prey fish assessment review, the agencies embarked on a total rebuild of the alewife assessment data base. In response to suggestions provided by the reviewers, the latest statistical procedures were used to examine the effect of changes in vessels and gear, the stratification scheme was changed, and rules for assumption of zero catches modified. Sampling was expanded to greater depths and further expansion is scheduled. Additional resources were provided to the USGS Lake Ontario Biological Station which funded additional sampling in spring 2004 and participation in an international workshop on survey analysis and design. Hydroacoustic sampling was also incorporated into the alewife assessment.

Lake Huron Regional Fisheries Workshops

The Lake Huron fishery is undergoing marked changes, largely as a result of many dramatic food-web changes occurring at all levels. During the spring of 2005, Michigan Sea Grant co-organized and facilitated a series of five regional workshops occurring across the length of Michigan's Lake Huron coastline. The goal of these workshops was to link researchers, managers, and stakeholders together in a venue where stakeholders can understand fishery changes they are experiencing, and more importantly, to engage in a dialogue with researchers and decision makers about these changes and the future of the lake's fishery. Nearly 400 fishery stakeholders participated, representing sport anglers, charter captains, commercial fishers, bait and tackle industry representatives, reporters, legislators and others. Results are being compiled and provided to the agency and stakeholder partners, and will be used throughout the decision making process relating to this topic.

Integration with National Goals

This theme supports national Sea Grant goals in the areas of Invasive Species, Coastal Communities, Fisheries, and Aquatic Science Literacy.

Fisheries extension enhancements within this theme will support national efforts to:

- Support the development of science-based Great Lakes policies
- Develop an ecosystem perspective in renewable resource management
- Understand ecological variability and its role in resource management practices
- Understand the ecological changes caused by invasive aquatic species
- Restore ecological conditions required by native species.

Priorities for Regional Action

Support food web research to enhance the fish management strategies from a whole-ecosystem perspective:

- Document changes in food web dynamics, including AIS induced changes
- Via an ecosystem approach, study the food web dynamics to gain a better understanding of certain elements of the food chain and the chemical and physical factors that significantly affect them
- Support research and development of models to enhance the understanding of fish production and recruitment dynamics

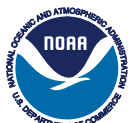
■ Identify food web factors necessary for rehabilitation of self-sustaining populations of native fish species

Provide information about predator-prey relationships and the impacts on commercial and recreational fishing.

Educate anglers and charter captains on food-web and ecosystem dynamics thereby empowering them to be informed participants in the debate over management and regulation of the fishery.

Additional Information

The Life of the Lakes: The Great Lakes Fishery & GLFLI Aquatic Science Curriculum
www.glerl.noaa.gov/seagrant/GLFLI/Notebook/Curriculum.html



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