Asian Carp Studies at GLERL

Understanding the Impacts of an Invasive Species

Forecasting the effects of silver and bighead carp on food webs

A collaborative team of NOAA Great Lakes Environmental Research Laboratory (GLERL) scientists and their partners developed a model to identify potential effects of Asian carp on the food webs in Lake Erie and other Great Lakes. Food webs are the feeding interactions of aquatic life. Prior efforts to predict Asian carp effects on the Great Lakes focused on potential suitability of Great Lakes habitats for Asian carp spawning, establishment or growth, but had not investigated Asian carp effects on food webs and fisheries. This information is critical to assess potential control measures and management options. The models used by GLERL and CILER (Cooperative Institute for Limnology and Ecosystems Research) researchers simulate Asian carp population dynamics (growth and shrinkage over time, as controlled by birth, death and migration), ecosystem impacts, and food webs, and can help inform state and federal agencies working together to control the spread of Asian carp.

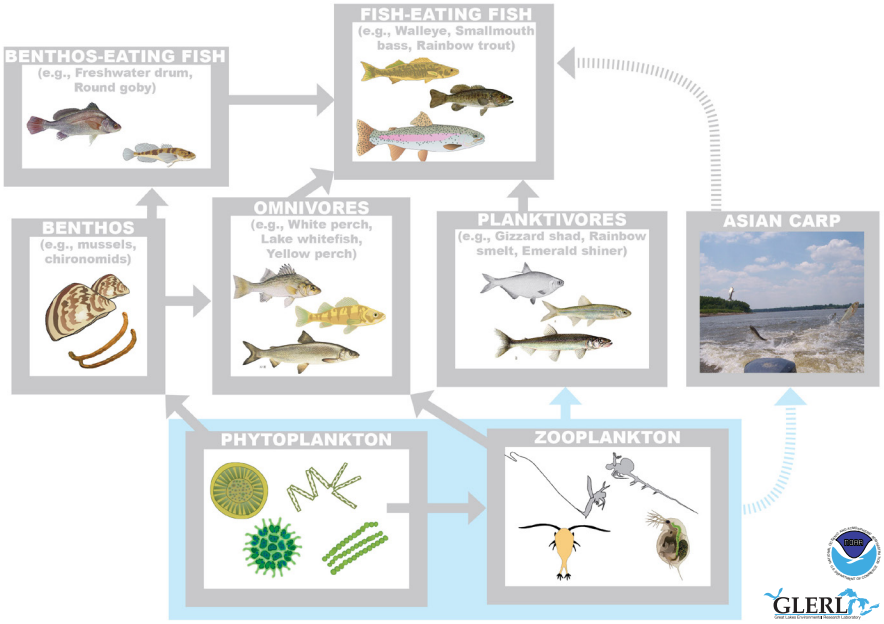
Lake Erie at risk

Lake Erie is at higher risk for Asian Carp invasion than the other Great Lakes because of its connectivity to watersheds where Asian carp occur, and the availability of spawning habitats and adequate food.

Simplified Lake Erie food web, modified to include Asian carp

If they successfully invade Lake Erie, Asian carp would likely affect the food web in two main ways:

- They would likely compete with native fish by eating their food (phytoplankton and zooplankton).
- Juvenile Asian carp would likely become food for fish-eating fish.



A coordinated effort

NOAA GLERL is a member of the Asian Carp Regional Coordinating Committee (ACRCC). The purpose of the ACRCC is to coordinate the planning and execution efforts of its members to prevent the introduction, establishment, and spread of Bighead, Black, Grass, and Silver Carp populations in the Great Lakes. The ACRCC, a collaborative team of Federal, state, provincial, and local agencies, provides oversight and coordination of multi-jurisdictional prevention activities through the development and implementation of an Asian Carp Control Strategy Framework. **For more information on the committee's guiding framework, goals, and current actions, visit www.asiancarp.us.**

Key findings

On average, model results suggested bighead and silver carp would affect Great Lakes food webs because of their competition with plankton-eating fishes, and by providing additional prey for fish that eat other fish. In Lake Erie, the model results indicated that bighead and silver carp would reach their peak biomass (weight of fish) within 20 years, and comprise nearly 34 percent, or one third, of the total fish biomass in the lake. Bighead and silver carp could cause declines in most fish species, including harvested species such as rainbow trout, white bass, white perch, walleye and rainbow smelt. However, a few species, including smallmouth bass, which could feed on young bighead and silver carp, may experience population increases of up to 16 percent from the added food source of these juvenile Asian carp.

In a few model simulations, bighead and silver carp reached a much higher population size in Lake Erie, similar to that observed in the Mississippi and Illinois Rivers, and had greater negative effects on the food web.

Information gained from studies at GLERL helps state and regional managers and policy makers understand the likelihood of Asian carp establishment and impact in the Great Lakes. The results are used by the ACRCC to inform current work on management and development of control technologies to keep Asian carp out of the Great Lakes.

Reference: ZHANG, H., E.S. RUTHERFORD, D.M. MASON, J.T. Breck, M.T. Wittman, R.M. Cooke, D.M. Lodge, J.D. Rothlisberger, X. Zhu, and T.B. Johnson. Forecasting the Impacts of Silver and Bighead Carp on the Lake Erie Food Web. *Transactions of the American Fisheries Society* 145(1):136-162 (DOI:10.1080/00028487.2015.1069211) (2016).

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