

# AQUATIC INVASIVE SPECIES

## The Population Dynamics and Ecology of Zebra Mussels in Inland Lakes

### Final Report

#### **Objectives**

The primary objective of this project is to describe the population dynamics of zebra mussels in inland lakes. Reproductive output, larval abundance, recruitment and adult growth will be measured along with adult mussel density, size distribution and availability of suitable substrata within each study lake. Key environmental parameters will also be recorded, including depth, temperature, turbidity, conductivity, pH and chl a (as an index of phytoplankton productivity) within each study lake. Study lakes will be examined each year of this three year project and allow us to determine key biological and physical features that influence the success of zebra mussel populations following invasion of a lake, and allow us to predict potential post-invasion impacts on lake ecosystems.

#### **Summary of Progress**

Nine study lakes (seven in Michigan, one each in Indiana and Ohio) were examined during this three year project. Five of the lakes (Wawasee, IN; Vineyard, Clark, Loon and Silver, MI) were sampled each year, one (Eagle, MI) for two years, and three (Christiana and Elizabeth, MI; White Star Quarry, OH) for one year. Each lake was surveyed for the distribution and density of adult mussels; plankton samples and plankton traps assessed abundance of planktonic larvae; settling plates measured recruitment; and adult growth rates were measured. Water samples were collected for chl analyses; water temperature records collected using continuous recorders; dissolved oxygen depth profiles recorded; conductivity and pH measured at the surface for each study lake.

All sampling of study lakes has been completed at this time, although samples from the summer of 1997 are currently being analyzed (field experiments were recovered during late September and early October). Work completed at this time accomplishes the major goals and objectives of this project.

#### **Accomplishments**

All field work associated with this project has been completed. Several manuscripts dealing with the ecology of zebra mussels in inland lakes are in progress. Our results indicate that, in most cases, mussel populations can increase to nuisance levels within a few years of introduction. High density mussel populations can develop and be maintained on macrophytes, a substrate previously thought not suitable for sustaining nuisance level populations of zebra mussels. Furthermore, encrusted plants now appear to be a significant vector of inland spread of mussels. These results have been communicated to the general public via presentations at meetings and through Sea Grant outreach channels.

Population dynamics of zebra mussels vary among lakes, but the two life history stages (planktonic larvae and sessile benthic adults) respond differently across lakes. Lakes supporting fast adult growth rates do not show consistent high larval recruitment rates. This implies that optimal environmental requirements for larvae and adults are not identical, thus models predicting zebra mussel success across environmental gradients must incorporate the two life history stages in their analyses (to date these types of analyses have been restricted to adult stages).

#### **Benefits**

Project results have been incorporated in Sea Grant outreach activities, including workshop information, video conferences and zebra mussel fact sheets. This information has benefited lake-associated user and management groups.

## Narrative Report

All fieldwork described in the grant proposal has been completed in nine study lakes located in the Midwest (Indiana, Michigan and Ohio). Samples collected during the summer of 1997 are still in the process of being analyzed, a process which will be somewhat delayed by the relocation of one of the Principle Investigators (DWG) to the Ohio Sea Grant College Program, Ohio State University. The 1997 samples will be analyzed in Columbus, OH. Work completed to date is sufficient for several manuscripts, currently in progress, detailing (1) the connection between benthic adult and planktonic larval stages of zebra mussels, (2) the distribution of adult mussels with respect to depth and substrate within a complex lake, especially the role of macrophyte beds, and (3) the variation in growth rates of adult mussels with respect to location and depth within a lake. Future manuscripts will appear describing the interannual variation in population dynamics of mussels within a lake and the geographic variation in population dynamics among the study lakes.

The principle investigators are continuing this research with the assistance of local partners in two study lakes, thus we will be able to examine fluctuations of mussel population dynamics in inland lakes beyond the three year limit of this project.

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## Research Information

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- **Initiation Date:** September 1, 1994
- **Completion Date:** August 31, 1997
- **Affiliation:** The Ohio State University
  
- **Principal Investigator:** Ladd E. Johnson
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