Great Lakes Protection Fund
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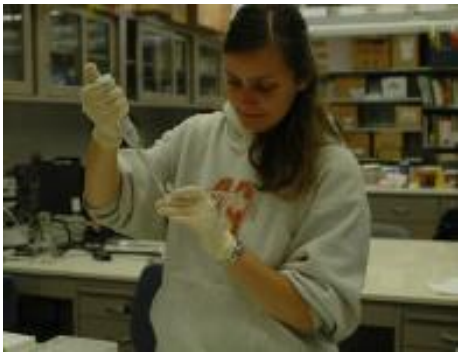
Funded Project

Developing and Applying a Portable Real-Time Genetic Probe for Detecting Aquatic Invasive Species in Ships Ballast

Project No.	867
Timeline	2007 – 2011
Award Amount	$805,000
Team Leader	David Lodge, University of Notre Dame, lodge.1@nd.edu



Lab tech preparing samples

This project produced a novel genetic detection technology for the “next set” of invasive species in the Great Lakes. The project team, led by experts in the fields of invasive species biology, molecular ecology, and nanotechnology, partnered with Canadian and U.S. agencies to build a new, portable, monitoring and analytical tool to detect invaders in real time using genetic probes and laser technology. The team built species-specific probes for four potentially invasive species (Chinese mitten crab, killer shrimp, golden mussel and predatory water flea), one for zebra mussels, and one for quagga mussels. Their ship-scale, laboratory-independent, completely portable detection platform, provides results in minutes and could save our region from the next zebra mussel.

The team’s genetic-based portable detection platform evolved during the project duration. Early on, the team tested two different methods of detection: a fluorescent bead-based microfluidic platform and a carbon nanotube (CNT) microfluidic platform. Both tools showed promise but both had drawbacks for application in large-scale surveillance programs. As the team became aware of the limitations, they sought out better technologies. The final detection system selected by the team, Laser Transmission Spectroscopy (LTS), uses laser based detection capabilities that can make extremely accurate measurements in minutes. The potential of this simpler and more portable platform was much greater than the two earlier platforms.

The team’s discoveries on this project translated to real-world applications. The team was contracted by the U.S. Army Corps of Engineer (USACE) to use eDNA technology (derived from the team’s work) and apply it to the high-profile Asian carp situation in the Chicago waterway system. As part of this effort, the team trained USACE and U.S. Fish and Wildlife Service (USFWS) personnel in eDNA methods, and both agencies are now using eDNA. The team also collaborated with the USFWS on expanding eDNA applications to many species throughout the Great Lakes.

The team formed a ballast water advisory group that met several times throughout the project and was comprised of representatives from: Fisheries and Oceans Canada, Transport Canada, USCG, USEPA, NOAA, Great Lakes Commission, Northeast-Midwest Institute, Shipping Federation of Canada, USFWS, and USFS. The states of Indiana, Michigan, Ohio, Wisconsin, and New York were also involved in these meetings. The team was also invited by a collective of shipping industry representatives to engage more fully with them.