

SUMMARY TITLE PAGE

**Invasive Species in the Great Lakes
– A Regional Scale Approach:**

Forecasting spread and bioeconomic impacts of aquatic invasive species from multiple pathways to improve management and policy in the Great Lakes

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Other subcontractors:

University of Michigan
Edward S. Rutherford, School of Natural Resources and Environment
Dmitry Beletsky, Cooperative Institute for Limnology and Ecosystem Research
University of Georgia
John M. Drake, Odum School of Ecology
University of Wyoming
David C. Finnoff, Department of Economics and Finance
University of Toledo
Jonathan Bossenbroek, Department of Environmental Sciences; Lake Erie Center Resources for the Future
Roger M. Cooke, Chauncey Starr Chair in Risk Analysis

Proposed budget

	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
U Notre Dame*	990,884	995,694	994,244	997,628	970,670	4,949,120

*All other institutions will be funded via subcontract to the University of Notre Dame

ABSTRACT/PROJECT SUMMARY

Forecasting spread and bioeconomic impacts of aquatic invasive species from multiple pathways to improve management and policy in the Great Lakes

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Total project cost: \$4,949,120

Budget period: Sept 2010-August 2015

Without forecasts of the arrival and bioeconomic impact of nonindigenous species, natural resource management cannot cost effectively respond to current invasions or prevent future invasions. In this project, investigators will combine scientific, economic, risk analysis, and management expertise to increase capabilities for forecasting both ecological and economic impact of current and future species invasions, quantify major uncertainties and ways to reduce uncertainty, and identify actions to improve cost effective management of invasive species in the Great Lakes (GL). There are six major goals of the project. **1)** To forecast the probability of establishment, researchers will draw on the literature and on-going studies, to identify which nonindigenous species are likely to be introduced into the GL via three major pathways: (a) shipping; (b) organisms in trade (pet, horticulture, aquaculture, biological supplies, live food, and live bait industries); and (c) canals, especially the Chicago Sanitary & Ship Canal. For each of these pathways, propagule pressure—the rate of introduction of individuals of these species into the GL—will be estimated from surveys of the literature and surveys of retail and consumer behavior, and the probability of establishment estimated. **2)** To forecast the potential habitat of species within the Great Lakes, investigators will use multiple ecological niche models, based on new GIS layers (produced by the project) of habitat and species distributions for all the GLs. **3)** To forecast the potential spread of invaders within the GL investigators will compare natural background dispersal (predicted by current models) to that predicted by oceanic ships, laker ships, and recreational boaters. **4)** To forecast ecological impacts, researchers will use two general approaches: (a) statistical and computational models based on species; and (b) food web modeling to develop quantitative scenarios of ecological impacts, with uncertainties specified via structured expert judgment. **5)** To forecast regional economic impact, researchers will link the food web models to a GL regional economic model (a computable general equilibrium model) to account for the feedbacks between ecological and economic systems, and quantitatively value ecosystem goods and services affected by invasive species. **6)** Finally, in collaboration with management partners throughout the project, investigators will use the linked ecological and economic models to evaluate alternative management strategies with holistic cost-benefit analyses that focus on preventing species introduction, early detection and rapid response (EDRR) efforts, slow-the-spread strategies, and integrated control options. For all analyses, robustness to model assumptions and uncertainty will be explicitly addressed using quantitative methods. Value of information analyses will identify priorities of future data collection that would reduce the uncertainty surrounding major management or policy decisions. The Ballast Water Advisory Panel, the Great Lakes Commission, and the Dispersal Barrier Advisory Panel will be the major vehicles by which mutual guidance between natural resource managers and the researchers will be maximized. While this project will focus on the GL, forecasting capabilities developed will be applicable to many other freshwater, marine, and terrestrial ecosystems.