
Name of Organization: NOAA/GLERL

Type of Organization: Federal Agency

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Project Title: Assessment of ANS Invasion Risk from NOBOB Vessels

Project Category: Exotic Species

Rank by Organization (if applicable): 0

Total Funding Requested (\$): 130,400 **Project Duration:** 2 Years

Abstract:

Invasive nuisance species are considered a major threat to global biological diversity, second only to habitat degradation and loss. Successful invaders often out-compete native organisms and substantially modify ecosystems to the detriment of biodiversity and sustainable use. Vessels carrying and discharging ballast water have been identified as a major pathway for aquatic nonindigenous species invasions in the Great Lakes region and elsewhere. However, more than half the vessels entering the Great Lakes every year report "no ballast on board" (NOBOB) and are not subject to serious scrutiny or ballast water management regulations. NOBOB vessels pose a potentially significant risk as vectors of nonindigenous aquatic nuisance species introductions to the Great Lakes. Live organisms in the residual water and sediment of "empty" ballast tanks may be discharged when these tanks are used to move the vessel within the Great Lakes to take-on new cargo. For the Great Lakes, and elsewhere, it is increasingly evident that we lack the necessary data to 1) understand and assess the risk of invasions associated with NOBOB vessels, and 2) make sound, scientifically-based management decisions that will prevent or minimize the risk of invasions associated with NOBOB vessels. Detailed information is needed on the organisms that are alive in the residual water and sediments of NOBOB vessels arriving in the Great Lakes, as well as the viability of these organisms and their capacity to invade. These data are essential to both assess invasion risks associated with NOBOB vessels and to adequately guide development of treatments that are now being advanced. This project will 1) sample and characterize the biological community and 2) test for the presence of resting stages, in residual ballast water and sediments in NOBOB vessels entering the Great Lakes.

Geographic Areas Affected by the Project

States:

- | | |
|---|--|
| <input checked="" type="checkbox"/> Illinois | <input checked="" type="checkbox"/> New York |
| <input checked="" type="checkbox"/> Indiana | <input checked="" type="checkbox"/> Pennsylvania |
| <input checked="" type="checkbox"/> Michigan | <input checked="" type="checkbox"/> Wisconsin |
| <input checked="" type="checkbox"/> Minnesota | <input checked="" type="checkbox"/> Ohio |

Lakes:

- | | |
|-----------------------------------|---|
| <input type="checkbox"/> Superior | <input type="checkbox"/> Erie |
| <input type="checkbox"/> Huron | <input type="checkbox"/> Ontario |
| <input type="checkbox"/> Michigan | <input checked="" type="checkbox"/> All Lakes |

Geographic Initiatives:

- | | | | | |
|--|----------------------------------|-------------------------------------|--------------------------------------|---|
| <input type="checkbox"/> Greater Chicago | <input type="checkbox"/> NE Ohio | <input type="checkbox"/> NW Indiana | <input type="checkbox"/> SE Michigan | <input type="checkbox"/> Lake St. Clair |
|--|----------------------------------|-------------------------------------|--------------------------------------|---|

Primary Affected Area of Concern: Not Applicable

Other Affected Areas of Concern:

For Habitat Projects Only:

Primary Affected Biodiversity Investment Area: Not Applicable

Other Affected Biodiversity Investment Areas:

Problem Statement:

Invasive nuisance species are considered a major threat to global biological diversity, second only to habitat degradation and loss. Successful invaders often out-compete native organisms and substantially modify ecosystems to the detriment of biodiversity, and beneficial and sustainable use. Vessels carrying and discharging ballast water have been identified as a major pathway for aquatic nonindigenous species invasions in the Great Lakes region and elsewhere. As a result, regulations requiring seawater exchange of ballast water were established in the 1990s to prevent or minimize discharges of untreated ballast water and reduce the risk associated with nonindigenous species contained therein. However, more than half (estimates range from 52% to >95%) of the vessels entering the Great Lakes every year report "no ballast on board" (NOBOB).

NOBOB vessels are not subject to the mandatory seawater exchange requirements applied to vessels "in ballast" when entering the Great Lakes, yet their ballast tanks are often not truly empty, but contain residual water and sediment that can include a large number and diverse array of living organisms. A 1991 study reported residual ballast water in Great Lakes NOBOB vessels ranging from 59 to 468 metric tons per vessel. A more recent (1996) study documented numerous live biota in the residual water and sediments of NOBOB vessels entering the Great Lakes, and concluded: "The general belief that NOBOB vessels harbor significant pockets of potential invaders was confirmed by this study." However, there is relatively little information available regarding the live biota, or the possible presence and viability of dormant or resting stages (spores, cysts, resting eggs and ephippia) that may exist in either the water or sediment of NOBOB vessels. Dormant stages are formed as a natural defense mechanism when organisms encounter adverse conditions, and may remain dormant for years before reemerging or hatching when exposed to better conditions.

While the studies previously referenced did document the presence of live organisms, their data appear to be based mainly on water (and some sediment) samples obtained through sounding tubes. Since ballast tanks are quite extensive in a lateral direction and may contain numerous small indentations and compartments that can act as sediment traps, samples obtained through sounding tubes may not be fully representative of organisms living in the sediments.

A NOBOB vessel may off-load existing cargo and take-on local water as ballast at one Great Lakes port before traveling to another. At the next port, in order to take-on new cargo, it discharges the local ballast water from the previous port, and very possibly, nonindigenous organisms stirred up from the ballast residual water and sediment it entered with. This represents a potential pathway for invasive organisms, but it bypasses and is unaffected by currently mandatory ballast water exchange requirements. Thus, NOBOB vessels pose a potentially significant risk as vectors of nonindigenous aquatic nuisance species introductions to the Great Lakes ecosystem.

For the Great Lakes, and elsewhere, it is increasingly evident that we lack the necessary data 1) to understand and assess the risk of invasions associated with NOBOB vessels, and 2) to make sound, scientifically-based management

decisions that will prevent or minimize the risk of invasions associated with NOBOB vessels. In order to determine if treatment strategies are required, and if so, possible treatment options, for NOBOB vessels' ballast tanks, further identification and assessments of ballast-tank organisms and their dormant stages is needed, including the viability of these organisms and their capacity to invade. These data are essential to both assess invasion risks associated with NOBOB vessels and to adequately guide development of treatments that are now being advanced.

Proposed Work Outcome:

We propose to sample and characterize the living biological community and test for the presence of dormant or resting stages in residual ballast water and sediments sampled from NOBOB vessels entering the Great Lakes.

A team of specially trained and experienced scientists/technicians will board selected NOBOB vessels and access their "empty" ballast tank(s) for direct sampling. Indirect sampling through sounding tubes or other access routes will only be used when direct entry is not plausible, or to supplement direct sampling. Samples will be collected following standard water and sediment sampling protocols when possible, but will be adapted as necessary. Ambient conditions of ballast tank water (salinity, temperature, oxygen content) will be surveyed. Samples will be returned to the laboratory to be characterized/analyzed for the presence and identification of living organisms. In order to test for the presence of dormant or resting stages, sediment samples will be frozen (-20°C) and then exposed to hatching conditions in controlled environment chambers (20°C sterilized lake water, high light). Information will be collected on the history of ballast water/sediments and recent ports of call for each sample vessel.

At the end of this project we expect to provide the following deliverables:

1. taxonomic identification/characterization of the biota found living in residual sediment and water at the bottom of selected NOBOB ballast tanks of vessels entering the Great Lakes;
2. an assessment of the presence and significance of dormant stages/phases in the residual water and sediment in these tanks.

These results will provide detailed information relevant to assessing the risk posed by NOBOB vessels as potential vectors for ANS invasions in the Great Lakes. The information and knowledge gained will assist in the design of treatment technologies and development of standards for treatment.

Project Milestones:	Dates:
Project Start (receipt of funds)	09/2000
Assemble and train field teams	10/2000
Initiate field sampling on NOBOB vessels	11/2000
Complete fieldwork	09/2001
Complete analyses and experiments	02/2002
Final report to EPA	05/2002
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Project Addresses Environmental Justice

If So, Description of How:

Project Addresses Education/Outreach

If So, Description of How:

Project Budget:

	Federal Share Requested (\$)	Applicant's Share (\$)
Personnel:	55,000	25,000
Fringe:	14,000	6,400
Travel:	19,000	1,000
Equipment:	1,000	0
Supplies:	9,000	0
Contracts:	5,500	0
Construction:	0	0
Other:	0	0
Total Direct Costs:	103,500	32,400
Indirect Costs:	26,900	6,800
Total:	130,400	39,200
Projected Income:	0	0

Funding by Other Organizations (Names, Amounts, Description of Commitments):

No other organizations have committed funding for the work proposed herein. This EPA-GLNPO project is a component of a multi-agency coordinated program we are organizing, although the success of this EPA-GLNPO project does not depend on success in funding the other activities in the proposed program.

The multi-agency program is being developed around five key activities:

- 1) establish a Great Lakes vessel tracking database similar to and linked with that used at the National Ballast Water Information Clearinghouse established under NISA 1996;
- 2) sample and characterize the biological community in residual ballast water and sediments in NOBOB vessels entering the Great Lakes;
- 3) conduct lab and field experiments to determine the presence of resting stages in ballast tank residual water and sediments and to determine if emergence of resting stages occurs when an "empty" ballast tank (containing residual sediment and water) is filled with water;
- 4) conduct field experiments to test the effectiveness of the "swish and spit" approach as a management tool to reduce the ANS invasion risk associated with NOBOB vessels; and
- 5) conduct field experiments with vessels containing brackish-to-fresh ballast water, with emphasis on ballast water originating from European ports, to test the effectiveness of ballast water exchange in reducing or eliminating the potential for alien species introductions to the Great Lakes.

A preproposal for funding for the vessel tracking database (item 1 above) has been submitted to the Michigan Great Lakes Protection Fund Year 2000 RFP; the present (EPA-GLNPO) preproposal falls under items 2 and 3 above). The U.S. Coast Guard and NOAA have both expressed interest in participating in (providing funding for) the program as described above, pending additional program documentation to be submitted by mid-April.

Description of Collaboration/Community Based Support:

Our goal is to form an interagency program between NOAA, USEPA, and the US Coast Guard, and possibly the State of Michigan. A program coordination/advisory committee with a representative from each funding agency and the Principal Investigators will be established. The Principal Investigators are Dr. David Reid (NOAA/GLERL), Dr. Hugh MacIsaac (University of Windsor, Canada), and Dr. Gregory Ruiz (Smithsonian Environmental Research Center, Edgewater, Maryland). Ms. Allegra Cangelosi of the NE-MW Institute (Washington, DC) will also participate in an advisory capacity for program design and policy considerations, and will sit on the program coordination/advisory committee. In addition, the U.S. Great Lakes Shipping Association and the Shipping Federation of Canada have expressed interest in providing assistance with accessing vessels. The U.S. Coast Guard Ninth District (Cleveland, OH) and MSD-Messena, NY, have also indicated a willingness to assist us with vessel access and related information.