

## The Coast Guard Tackles Non-Indigenous Species with Ballast Water Management

by Penny Herring and John Natale  
U.S. Coast Guard Research and Development Center

The Coast Guard has several facilities on Long Island Sound, consisting primarily of operational units which enforce maritime laws. The Coast Guard's only Research and Development Center, formerly located at the University of Connecticut's Avery Point Campus in Groton, and now in New London, has another purpose: developing a wide range of technologies to assist the service in carrying out its responsibilities. One of the Research and Development Center's important project areas is the control of non-indigenous species in ballast water.

Economically, non-indigenous species such as zebra mussels (see below) which most likely arrived in the U.S. in ballast water have caused billions of dollars in damage to water intake systems. Ecologically, non-indigenous species often compete with local populations for available food, disrupting the food chain, and in some cases result in catastrophic declines of native species.

So why is the Coast Guard interested in non-indigenous species? Two laws, the Non-indigenous Aquatic Nuisance Prevention & Control Act (NANPACA) of 1990 and the National Invasive Species Act (NISA) of 1996 directed the Coast Guard to reduce the number of unintentional introductions of non-indigenous species

without causing undue hardship to commercial shipping. Because an average of 130 million gallons of ballast water is discharged daily worldwide, the Coast Guard is working to eliminate non-indigenous species in ballast water.

The Research and Development Center's efforts to support the Coast Guard Headquarters Environmental Standards Group include research into both ballast water exchange and ballast water treatment. Ballast water exchange is the currently available practice for reducing the probability of discharging non-indigenous species. The Center's current effort on ballast water exchange is focusing on the development of an independent mechanism for verifying that an open ocean exchange has occurred.



Flow-through ballast water exchange.

U.S. Coast Guard



Cluster of zebra mussels.

Center for Great Lakes and Aquatic Sciences

Ballast water treatment is an alternative to exchange, but it is an entirely new field, with few treatment systems yet shown to be capable of reducing non-indigenous species concentrations to those specified in either the International Maritime Organization (IMO) Ballast Water Management Convention or California's Ballast Water Management Regulation – the only two published ballast water discharge standards currently in existence. Both standards include extremely low detection criteria

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### Inherent Difficulties with Testing BWT Systems

- Large Volumes
- High Flows
- Sample volumes are a small percentage of ballast water
- Analysis methods are at an extremely low limit of detection
- Obtaining representative samples without injury to organisms
- Distinguishing live from dead organisms

A full-scale test facility at the Naval Research Laboratory in Key West, FL (aerial view).

and are difficult to meet. During early efforts to learn about potential treatments, the Research and Development Center visited several developers who were testing equipment. Based upon these visits, the Research and Development Center and Coast Guard Headquarters decided to develop a testing procedure that would firmly and consistently test treatment systems at full operational scale.

Coast Guard Headquarter's discussion of the ballast water issue with staff from the Environmental Protection Agency (EPA)'s Environmental Technology Verification (ETV) Program resulted in a memo of understanding between the Coast Guard and the EPA to address test protocols and standards. Stakeholder and technical panels determined what the test protocol should encompass. While developing the initial protocol, it was rapidly determined that tests should be of full-scale operational systems, since scaling up from small prototypes to operational scales of hundreds to thousands of gallons often failed.

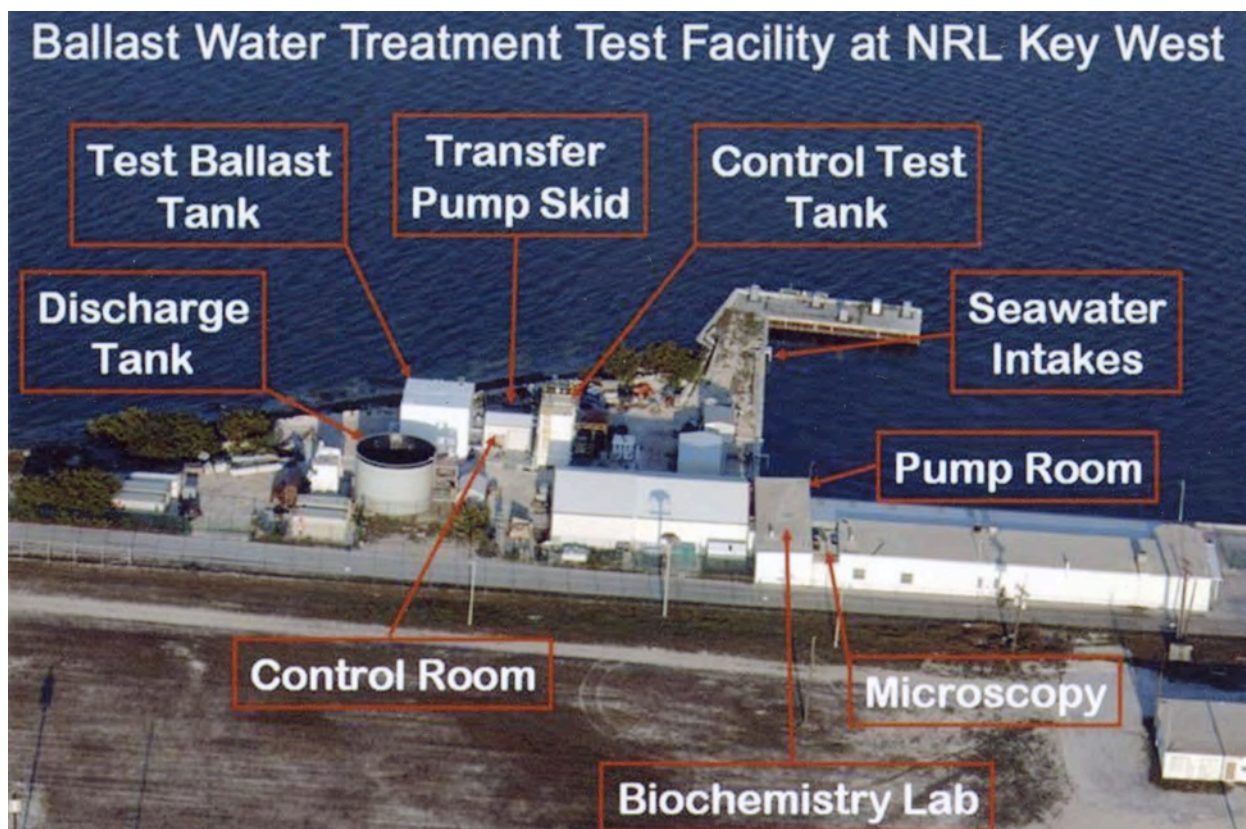
A "full-scale" flow rate of 1500 gallons per minute (gpm) (340 m<sup>3</sup>/hr) and a one hour run time were determined to be reasonable. That resulted in the need for a shore-based test facility capable of storing and treating 90,000 gallons of water. Responses to a Research and Development Center Broad Agency Announcement resulted in several potential sites, none of which fully met

all requirements. The Naval Research Laboratory (NRL) Center for Corrosion Science and Engineering stepped up to the plate, constructed a suitable storage tank and testing facility at the Marine Corrosion Facility in Key West, Florida, and has become a major player on the Ballast Water Treatment test team.

Numerous individual projects have been conducted to answer specific questions involved in testing ballast water treatment systems. Can filters remove organisms to meet the low discharge standard at 1500 gallons per minute? Can live standard test organisms be injected into 1500 gallons per minute flows without damaging the organisms? Do standard biological analysis methods work for very sparse concentrations of organisms? Can methods be automated for routine use? How are dissolved and particulate concentrations in test water best augmented without harming organisms? These are some of the things the Research and Development Center has considered in the development of new testing procedures.

So where are we now? It has taken the joint efforts of the U.S. Coast Guard, ETV Program, NRL engineers, consultants and a dedicated group of university researchers to reach the current status. The NRL test facility is fully operational and continues to be used by the Coast Guard and NRL to develop and improve

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Full-scale test facility at the Naval Research Laboratory in Key West, Florida (ground view).

testing methods. At least three new facilities for testing are under construction and will soon conduct calibration studies. These facilities have been significantly influenced by the work and products from the Coast Guard - NRL collaboration. An inclusive protocol, which describes in detail the process that must be followed during shore-based testing of full-scale treatment systems has been developed and beta-tested at NRL using an actual ballast water treatment system. This protocol, developed in tabletop discussions, has held up well, but the NRL's beta-testing program revealed areas of the protocol where modifications are needed. The protocol can nonetheless be a model as IMO and other countries develop similar test and approval requirements.

What's left to do? The ETV test protocol needs to be finalized and made public so all stakeholders (vendors, ship owners, regulators, environmental organizations, etc) will have a common and rigorous procedure for evaluating the performance of commercial ballast water treatment systems. As the in-depth shore-based testing is

finalized, the Research and Development Center's focus is shifting to shipboard tests for approval and related tests for compliance verification.

### About the Authors

John Natale is a Lieutenant Commander in the Coast Guard, and works at the USCG Research and Development Center in New London. He manages or provides technical support for R&D projects in the area of Marine Safety and Environmental Protection, and is a part-time Oceanography graduate student at the University of Connecticut.

Penny Herring has a Master's degree in Marine Ecology and participated in world-wide surveys for the Naval Oceanographic Office before returning to CT. She worked on Search & Rescue projects at the Research and Development Center before turning her attention to aquatic nuisance species. She has headed the Center's ANS program since 2001.