

ML 2009-6a “Ballast Water Sampling Method Development and Treatment Technology” (MPCA)

Completion Date: 06/30/2011* (*See note on “Final Report” below)

Appropriation Language - \$300,000 is from the trust fund and \$66,000 is from the Great Lakes protection account to the commissioner of the Pollution Control Agency in cooperation with the Department of Natural Resources to conduct monitoring for aquatic invasive species in ballast water discharges to Minnesota waters of Lake Superior and to test the effectiveness of ballast water treatment systems.

Project Manager – Rebecca Walters, MPCA, (Also significant involvement by Jeff Stollenwerk, PCA, and Allegra Cangelosi, Principal Investigator Northeast Midwest Institute (NEWMI))

Project Overview - Ballast water – water carried in tanks on ships to help provide stability and aid steering – is likely the single greatest source for introduction of non-native and invasive aquatic species. Ballast water is collected in one body of water and discharged into another body of water, usually large distances apart. Options exist for treating ballast water prior to discharge in order to prevent these introductions, but they have not been tested in freshwater environments such as the Great Lakes. Through this appropriation, the Minnesota Pollution Control Agency, the Minnesota Department of Natural Resources and the Northeast Midwest Institute are cooperating to conduct monitoring for aquatic invasive species in ballast water discharge in Lake Superior, test the effectiveness of ballast water treatment options in a freshwater environment, and accelerate installation of treatment options that prove effective.

Project Summary - Safe and effective shipboard treatment of ballast water is regarded as the best solution to address ballast water as a pathway for the introduction of invasive species. Three ballast treatment systems have received International Maritime Organization (IMO) approval relative to effectiveness and environmental soundness, however, these systems remain largely untested relative to fresh water performance. Moreover, the best technical means of monitoring the effect of treatments installed on ships relative to a given benchmark has yet to be fully developed, trialed, and customized to Great Lakes ships. In addition to assessing treatment effectiveness onboard ships, credible monitoring information is essential to understanding the relative contributions of vessel fleets to the introduction and spread of invasive species. This project will advance protection of Minnesota’s water resources with respect to ship-mediated introductions of invasive species through: a) fresh water testing in Lake Superior of at least two ballast treatment systems that have received International Maritime Organization approval, and b) developing, to the extent necessary, and trialing scientifically credible and operationally feasible ballast water monitoring/sampling mechanisms and procedures for purposes of measuring discharge quality against a treatment performance benchmark. The work will also result in the collection and analysis of information on the contents of ballast discharge associated with a range of ships to assist in further developing the state's environmental and natural resources policies. The project will contribute to environmental protection in the state and region by fully outfitting twelve ships that visit Duluth Harbor for effective and efficient discharge monitoring.

Summary of Results:

- The two different inline sampling devices were installed and trialed on twelve ships. These installation required preliminary ship visits, a brief report with computational fluid analysis, and development of detailed installation guidelines.
- A guidebook is being produced on methods for getting and recording categorical data on ballast biological constituents of subject ships for effective ship discharge monitoring.

Final Report - Getting ships to participate and the time it took to install devices and then do the testing took longer than anticipated so an time extension was given for the final report that will be provided by the end of 2011. Work on the project including work on the final report being done after June 30, 2011 and before the end of 2011 is being covered by other funds.

ML 2009-6b “Emergency Delivery System Development for Disinfecting Ballast Water”

Completion Date: 06/30/2012* (*See note on “Final Report” below)

Appropriation Language - \$125,000 is from the trust fund to the commissioner of the Pollution Control Agency for an agreement with the United States Geologic Survey to test the viability of treating ballast water through tank access ports or air vents as a means to prevent the spread of invasive species.

Project Manager - Scott Smith, United States Geological Service (USGS)

Project Overview - Ballast water – water carried in tanks on ships to help provide stability and aid steering – is likely the single greatest source for introduction of non-native and invasive aquatic species. Ballast water is collected in one body of water and discharged into another body of water, usually large distances apart. At least one new invasive species is found in the Great Lakes every year, with Lake Superior being particularly at risk. Scientists from the U.S. Geological Survey will test methods of decontaminating ballast water on board a working ship with an emphasis on techniques that can be used in emergencies such as a grounded ship.

Project Summary - This project is Phase III of an overall effort to produce an Emergency Response Guide to Handling Ballast Water to Control Non-Indigenous Species. Phase I (\$25,000) was funded by NOAA and resulted in a study plan entitled “Mixing Biocides into Ships’ Ballast Water: Efficiency of Novel Methods.” Phase II (\$185,000) was funded by the Great Lakes Fisheries Trust and studied in-line injection, bulk dye dosing, perforated hose dosing and passive mixing methods, such as ship’s motion.

Similar to Phase II, this proposal (Phase III) involves preparation of ballast tank mixing and sampling equipment, field work on a working ship to trial promising ballast mixing methods, and analysis/report. The active methods to be studied in Phase III are venture eductors and air lifts. The outcome will be the incorporation of these methods (if determined to be effective and practical) into a best practices guide for treating the ballast water of ships either:

- Arriving in port with high risk ballast water
- Leaving a port that contains ballast known to be high risk for the destination port, or
- Grounded and laden with high risk, untreated ballast water.

Summary of Results - The logistics, planning and equipment preparation were completed by May 15, 2010. The field deployment and onboard testing activities, including breakdown, were completed on May 23, 2010. The remaining work for this project, Result 3 Data Analysis and Report, is currently underway.

- **Result 1:** The three groups: educator team, air lift team, and sampling team, responsible for set-up and execution of the on ship testing completed preparations for the on ship trials in a timely fashion. Planning took place during weekly teleconferences where each of the three teams gave status updates. Communication with the ship’s owner was ongoing during the planning process and their comments/concerns were answered and communicated to the teams.
- **Result 2:** The remainder of the equipment and consumables were delivered to the ship with the crew. The ships grocery supplier was utilized to help with transferring equipment to the ship during cargo loading at Two Harbors, MN. The teams boarded the vessel with all equipment on 15 May 2010.
- **Result 3:** All shipboard data has been collected and a draft Project Report and Field Guide Update has been submitted to USGS by the Contractor. The draft Report and Field guide are under review by our USGS research team. The final products will be submitted to the USGS peer review process for additional review and refinement.

Final Report - Expected to be ready in late 2011.

ML 2010-6d “Bioacoustic Traps for Management of Round Goby”

Completion Date: 06/30/2013

Appropriation Language - \$175,000 is from the trust fund to the Board of Regents of the University of Minnesota to evaluate bioacoustic technology specific to invasive round goby in Lake Superior as a method for early detection and population reduction. This appropriation is available until June 30, 2013, by which time the project must be completed and final products delivered.

Project Manager – Dr. Allen Mensinger, U of MN – Duluth

Project Overview - The round goby is an invasive fish that is rapidly spreading throughout the Great Lakes. One reason for its rapid expansion is that round goby outcompetes native fish through its ability to spawn throughout the spring and summer in contrast to native fish, which only spawn once a year. Interrupting this reproductive cycle in some way could be used to help halt further expansion of round goby and control existing populations. Scientists from the University of Minnesota - Duluth are using this appropriation to develop and test a method for trapping these fish using sounds that mimic those that male gobies use to attract females to the nest.

Project Summary - First a sound library of the fish's calls to determine the correct calls to use will be developed. Then these sounds and different trap designs will be tested in a laboratory setting to optimize attraction and capture efficiency. Finally, bioacoustic traps will be deployed in the Duluth - Superior Harbor to test their efficacy under field conditions. The technology could be used as an early warning system to alert fishery managers of new goby investigations, to block the spread of the goby at key check points, and potentially to eradicate new or small populations of the invasive fish.

Result Status as of June 2011 –

To increase our call library several large fish tanks were established in the spring of 2011. Artificial habits were added to the tanks and recently captured male and female round gobies were added to the tanks in May of 2011. Several fish successfully spawned and the sound generated by these records has been recorded and is currently awaiting analysis. Hydrophones have been placed since May 2011 in the Duluth Superior harbor and hundreds of hours of sound files have been recorded and are currently being analyzing to determine if goby sounds are present. It is anticipate that the data will be analyzed by December 31, 2011. We will finish the data analysis by the overall end date of the project. Additionally, the coast guard station location has provided excellent access to the goby population.

2011-6a “Improved Detection of Harmful Microbes in Ballast Water”

Completion Date: 06/30/2014

Appropriation Language - \$125,000 the first year and \$125,000 the second year are from the trust fund to the Board of Regents of the University of Minnesota for the University of Minnesota Duluth to identify and analyze potentially harmful bacteria transported into Lake Superior through ship ballast water discharge. This appropriation is available until June 30, 2014, by which time the project must be completed and final products delivered.

Project Manager - Dr. Randall Hicks, U of MN - Duluth

Project Summary - While the Great Lakes face many threats, the presence of invasive species threatens not only Lake Superior but also Minnesota’s people and coastal economies. The transport of organisms in the ballast water of ships is of global concern. The appearance of the fish virus Viral Hemorrhagic Septicemia (VHS) in the Great Lakes and the recent discovery of its DNA in parts of Lake Superior have led many to recognize that some microbes transported in the ballast water of commercial ships may be harmful invasive species, just like invasive species of plants and animals that threaten our natural resources. Our team will examine freshwater (‘Lakers’) and ocean-going (‘Salties’) commercial ships to identify harmful bacteria that are being transported in ballast water and discharged into Lake Superior. We will use state-of-the-art DNA sequencing techniques to identify harmful bacteria we should be most concerned about. The methods employed have the potential to detect rare microbes before they become common inhabitants in Lake Superior and nearby watersheds. Lastly, we will rank the most potentially harmful bacteria transported to the Duluth-Superior Harbor in the ballast water of commercial ships, which should be useful for developing guidelines for the microbiological safety of ballast water in the future.

Result Status - The project began in July/August 2011.

Completion date - June 30, 2014.