

Great Lakes and St. Lawrence Ballast Water Workshop

November 16-17, 2016 | Detroit, Michigan

Workshop Proceedings



ACKNOWLEDGEMENTS

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The Great Lakes Commission appreciates the support of the Ballast Water Task Force that identified challenges and opportunities to advancing ballast water management in the Great Lakes region and provided valuable input on development of the workshop agenda to ensure that it would meet the needs of the broad stakeholder community.

The Great Lakes Commission thanks the workshop presenters and participants for their many contributions to this effort. The workshop was a success because of their active engagement, constructive comments, and thoughtful discussion.

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OVERVIEW

The Great Lakes Commission and partners held a workshop on the status of preventing aquatic invasive species introduction and spread through ballast water discharge in the Great Lakes and St. Lawrence River region. Over the last decade, government agencies, industry, and independent groups have made considerable progress on ballast water management to prevent the introduction and spread of aquatic invasive species. Today, there is less risk of new invasive species being introduced in the Great Lakes and St. Lawrence River region than ever before. While this is good progress, several moving pieces and questions remain to be resolved on this issue to ensure our regional resources are protected. The workshop was intended to provide an opportunity for the Great Lakes and St. Lawrence community – including representatives of federal, state and provincial agencies, industry, ports, research facilities, environmental groups, and other key stakeholders – to come together, share information, and develop a common base of understanding of contemporary conditions, and associated challenges and opportunities, of ballast water management in the Great Lakes and St. Lawrence River region. The workshop included presentations and discussion on the current regulatory framework (including federal legislative action), the status of treatment technology, the state of the science, and stakeholder perspectives on ballast water management in the U.S. and Canada.

AGENDA

Workshop Objectives

Provide an opportunity for the Great Lakes and St. Lawrence community – including representatives of federal, state and provincial agencies, industry, ports, research facilities, environmental groups, and other key stakeholders – to

- Network and share information,
- Develop a common understanding of the current state of ballast water management across the Great Lakes-St. Lawrence River region,
- Identify scientific, technology, management, and policy gaps, needs, and opportunities to advance ballast water management collaboratively,
- Develop preliminary findings to shape next steps in regional policy and scientific inquiry,
- Assess opportunities to define and advance priorities for ballast water management in the Great Lakes-St. Lawrence River region.

Wednesday, November 16

9:30 a.m. Welcome Remarks, Agenda Review and Workshop Objectives

Tim Eder, Executive Director, Great Lakes Commission

9:40 a.m. Ballast Water Management and the Great Lakes-St. Lawrence Resources

Jon Allan, Director, Michigan Office of the Great Lakes

10:00 a.m. International and Domestic Ballast Water Rules and Regulations: Status and Future Outlook

Objective: Understand the status and outlook for ballast water policy and regulations, and identify opportunities for continuing to harmonize regulatory approaches

(10:00 a.m.) Debbie Duckworth, CGHQ Office of Environmental Standards and Lorne Thomas, U.S. Coast Guard

(10:15 a.m.) Josh Emerson, U.S. Environmental Protection Agency

(10:30 a.m.) Colin Henein, Transport Canada

(10:45 a.m.) Questions and Discussion

- *How will federal agencies continue to work together on policy approaches across agencies and binationally?*

11:00 a.m. Break

Continued: International and Domestic Ballast Water Rules and Regulations: Status and Future Outlook

(11:15 a.m.) Sarah LeSage, Michigan Department of Environmental Quality

(11:30 a.m.) Jeff Stollenwerk, Minnesota Pollution Control Agency

(11:45 a.m.) Susan Eichelkraut, Wisconsin Department of Natural Resources

(12:00 p.m.) Questions and Discussion

- *What opportunities exist for states to continue to work toward harmonization of policy approaches?*

12:15 p.m. Lunch

1:15 p.m. Treatment System Approval, Availability and Outlook

Objective: Understand the status and outlook for treatment systems and identify needs and potential opportunities that still remain for implementing treatment systems that will protect the Great Lakes-St. Lawrence system

(1:15 p.m.) Debbie Duckworth, CGHQ Office of Environmental Standards and Lorne Thomas, U.S. Coast Guard

- Status and outlook of type approval process

(1:30 p.m.) Matt TenEyck, Great Ships Initiative

- Test facility experiences and outlook
- Feasibility / effectiveness of treatments systems for the GLSL

(1:45 p.m.) Gary Croot, President, IMESA, Inc.

- Vendor experiences and outlook for treatment development

(2:00 p.m.) Ed Pfau, Senior Scientist, and Travis Smith, Senior Engineer, Hull and Associates

- Feasibility considerations of shoreside ballast water management for Lakers

(2:15 p.m.) Questions and Discussion

- *What are the outstanding challenges and potential opportunities to overcome those challenges to advance implementation of effective treatment or management solutions?*

2:45 p.m. Break

3:00 p.m. Private Sector Efforts to Mitigate Risk

Objective: Understand the status and outlook for treatment systems and identify needs and potential opportunities that still remain for implementing treatment systems that will protect the Great Lakes-St. Lawrence system

(3:00 p.m.) Marc Gagnon, Fednav

(3:15 p.m.) Tom Rayburn, Lake Carriers Association

(3:30 p.m.) Nick Leak, Chamber of Marine Commerce

(3:45 p.m.) Pierre Pelletreau, American Steamship Company

(4:00 p.m.) Questions and Discussion

- *What are the outstanding challenges and potential opportunities to overcome those challenges to advance implementation of effective technology or management solutions?*

4:30 p.m. Update on Commercial Vessel Incidental Discharge Act

Objective: Understand the outlook for and implications of proposed legislation that could impact U.S. policies and regulatory framework

(4:30 p.m.) Matt McKenna, Director of the Great Lakes Washington Program, Northeast-Midwest Institute

(4:50 p.m.) Questions and Discussion

5:00 p.m. Conclude Day 1

5:30 p.m. Reception at Port Detroit - 130 Atwater St, Detroit, MI 48207

Sponsors:
Great Lakes Fishery Trust
Detroit Wayne County Port Authority
Great Lakes Fishery Commission
Fednav

Thursday, November 17

8:30 a.m. Agenda Review and Recap of Day 1

Tim Eder, Great Lakes Commission

8:40 a.m. Ballast Water Management Simulation Presentation

Objective: Illustrate how rules and regulations would be applied under different scenarios of ships traveling into and through the Great Lakes-St. Lawrence River system in order to inform discussions about remaining policy gaps and needs

Erika Jensen, Great Lakes Commission

Questions and Discussion

9:00 a.m. Protecting the Natural Resources of the Great Lakes-St. Lawrence Region

Objective: Understand perspectives regarding the importance of reducing risk of AIS introduction and spread in the Great Lakes-St. Lawrence

(9:00 a.m.) Jeff Tyson, Great Lakes Fishery Commission

(9:10 a.m.) Molly Flanagan, Alliance for the Great Lakes

(9:20 a.m.) Questions and Discussion

- 9:30 a.m. Assessing Risk and Measuring Prevention/Response Effectiveness**
Objective: Understand the current state of knowledge and efforts to better understand risk in order to inform discussions of needs to address outstanding risks
(9:30 a.m.) Matt TenEyck, Great Ships Initiative
- Environmental response: How clean is clean?
 - Risk/Release Analysis
- (9:50 a.m.) Sarah Bailey, Department of Fisheries and Oceans Canada
- Canadian National Risk Assessment
- (10:10 a.m.) Questions and Discussion
- *What questions remain about residual risk?*
- 10:20 a.m. Break**
- 10:40 a.m. Panel: Moving Forward on Ballast Water Management in the Great Lakes-St. Lawrence Region**
Objective: Building on information and discussion over the last 1.5 days, refine and continue to identify scientific, technology, management, and policy gaps, needs and opportunities to inform next steps in regional policy and scientific inquiry
Moderator: Jon Allan
Panelists:
- Molly Flanagan, Alliance for the Great Lakes
 - Marc Gagnon, Fednav
 - Tom Rayburn, Lake Carriers Association
 - Jeff Stollenwerk, Minnesota Pollution Control Agency
 - Lorne Thomas, U.S. Coast Guard
- 12:00 p.m. Closing Remarks, Next Steps, and Adjournment**

PRESENTATION SUMMARIES

(For more information, refer to the workshop presentations posted online)

Wednesday, November 16

Welcome Remarks, Agenda Review and Workshop Objectives

Tim Eder, Executive Director, Great Lakes Commission (GLC)

Eder welcomed the workshop participants and thanked them for attending. He followed with thanks to the workshop's co-sponsors: the Great Lakes Fishery Trust, the Great Lakes Fishery Commission, the Northeast-Midwest Institute, Fednav, and the Detroit Port Authority. Eder positioned the workshop as an opportunity for stakeholders with different perspectives to come together to discuss a complex issue with far-reaching implications, and highlighted the importance of ensuring both ecological integrity and sustainable marine commerce within the region. He further noted that while this forum may not be the venue to define policy steps forward, the GLC will develop a set of preliminary findings based on the outcomes of this workshop, and participants should be encouraged to embrace any common ground that emerges. He outlined the primary objectives of the workshop: to share information and assess opportunities for collaborative work between the various perspectives represented.

Ballast Water Management and the Great Lakes-St. Lawrence Resources

Jon Allan, Director, Michigan Office of the Great Lakes

Allan began by reflecting on humanity's historical success at managing life, but modern struggle to eliminate harmful organisms from ballast water in a controlled fashion without collateral damage. He noted that managing ballast water requires technical and laboratory processes to meet the social expectation of what life should exist in specific areas, with serious consequences if that life is not systematically managed. He expressed support for healthy maritime commerce in the region, but cautioned that maritime shipping is more than a free flow of goods back and forth, as it may also introduce a flow of life into the region. Allan emphasized that ballast water treatment is an issue that the region has been working on for thirty years, and would likely work on for another thirty years, as new technology and innovation emerges to address treatment standards. He concluded by reminding attendees that we would be developing a clearer understanding of current regulations, as well as what our next steps together might be.

International and Domestic Ballast Water Rules and Regulations: Status and Future Outlook

Objective: Understand the status and outlook for ballast water policy and regulations, and identify opportunities for continuing to harmonize regulatory approaches

- Debbie Duckworth, CGHQ Office of Environmental Standards, and Lorne Thomas, U.S. Coast Guard (USCG)

Duckworth provided an overview of the USCG's online resources, noting that any documents developed by USCG are posted online as they are finalized. Significant general updates can be found on the USCG Marine Commons blog, while inspection updates are included in the Navigation and Vessel Inspection Circulars. She also noted that the USCG Marine Safety Info Bulletins address common industry questions and provide clarification for regulations. Duckworth discussed the February 2016 update to the ballast water Recordkeeping and Reporting Rule, explaining that the update provides a clarifier that all vessels going to a U.S. port, including both lakera and salties, must submit a ballast water report. She said that the online reporting system provides many benefits to both ships and the USCG, with the biggest one being that the electronic submission is editable, so reports can be corrected after being submitted. Duckworth reviewed the outcome of the May 2016 Regulation Practicability Review and tips for submitting an online application for a ballast water management system (BWMS) Temporary Compliance Extension. She also outlined the conditions for use of an alternate management system (AMS), and clarified that temporary compliance extensions and AMS use can be used in conjunction so that AMS installation extends the exemption date by a further five years. She then gave a brief overview of USCG compliance and enforcement procedures, pointing out that the USCG is involved in ongoing research and development of test kits to develop standardized sampling methods aboard vessels. Duckworth concluded by identifying some of the next steps for USCG's ballast water management program and provided contact information for inquiries.

- Josh Emerson, U.S. Environmental Protection Agency (USEPA)

Emerson discussed the USEPA vessel general permit (VGP), the current iteration of which has been in effect since 2013 and will be rewritten soon to provide for the next permit version, which will likely be active in December 2018. He reviewed the process for writing the new VGP framework: the VGP program has a five-year rewrite structure, and a draft of the 2018 permit will be available for public review a year in advance of its publication deadline. Following release of the draft, USEPA must accept and respond to all public comment, while working closely with Transport Canada, USCG, and each state's 401 certification process. Emerson described the impact of a recent court decision on the drafting process for the 2018 VGP. The Second Circuit Court of Appeals ruled that the USEPA acted "arbitrarily and capriciously" in the 2013 VGP, and pointed out that the 2013 VGP lacked an adequate explanation for the decision to implement International Maritime Organization (IMO) D-2 discharge standards as the VGP discharge standards, and did not fully consider the applicability of on-shore treatment as a method of ballast water management. Emerson assured that both of these issues will be fully addressed in the 2018 VGP. He concluded by acknowledging that there are a lot of unknowns about the Vessel Incidental Discharge Act (VIDA) and so rather than try to predict what Congress will do with the bill, USEPA will continue to work on the VGP and its associated ballast water management program.

- Colin Henein, Transport Canada

Henein presented a narrative overview of Transport Canada's ballast water management program, specifically noting that Canada is a party to the IMO Convention for the Control and Management of Ships' Ballast Water and Sediments (IMO Convention), which will enter into force on September 8, 2017. He relayed four of the recent developments of the IMO Marine Environment Protection Committee. Regarding type approval guidelines for BWMSs, Henein explained that recent revisions to the IMO G8 guidelines (the guidelines by which party states may approve BWMSs) will improve the relevance of type approval testing to Great Lakes conditions. This includes short- as well as long-term voyages in freshwater environments, and assessment of BWMSs in 0-40°C for marine and brackish systems, and 2-40°C for freshwater systems. Henein discussed IMO's transition strategy, highlighting that IMO will integrate an Experience-Building Phase into the IMO Convention's implementation which will involve a period of data gathering and analysis to determine if a BWMS are performing to the D-2 standard without penalizing vessels that are doing their best to comply. This means IMO has agreed in principle not to penalize ship owners if a ballast water discharge exceeds the permitted standard, provided an approved BWMS is installed, used, and maintained according to the manufacturer's instructions, and that the BWMS self-monitoring system indicates that it is working properly. Ships may still be required to take an action to protect the environment.

Henein then shifted Transport Canada's work to bring the IMO Convention into force in Canada. He clarified that while Canada has ratified the IMO Convention, it cannot be enforced without being written into Canada's regulations. It is unlikely that Canada's implementing regulations will be finalized before the IMO Convention enters into force. He noted that Transport Canada produced a discussion paper in 2012 outlining a proposed regulatory approach to implementing the IMO Convention, and while that paper is now dated, it allowed Canada to address real considerations with implementation. Henein said that while Canadian officials are working through the process of amending the regulations, Transport Canada will continue to apply its existing regulations, including the joint inspection with the USCG and the Canadian and U.S. St. Lawrence Seaway Corporations of overseas ships as they enter and leave the St. Lawrence Seaway. Henein stressed the importance of consistency in international, Canadian and U.S. approaches to ballast water regulations, acknowledging that ships can only install one BWMS, and that the BWMS needs to work in a variety of conditions and be widely accepted by all jurisdictions. Following a question from the audience, Henein clarified the amendment process for Canadian legal code as it applies to enforcing the IMO Convention. Henein concluded, saying that Transport Canada will work closely with industry, U.S., and international colleagues to take advantage of the IMO Convention transition phase to develop fair and meaningful recommendations to inform develop of the amendments.

Questions and Discussion

During questions and discussion, the following points were made and/or clarified:

- Biology is extremely complex on a microscopic level, and USCG is to considering the biology and chemistry of ballast water when developing test kits, but they need industry support to determine the best solution. USCG is conducting research to develop a compliance monitoring tool. There are several levels of compliance that inspections assess: ensuring that shipboard technology is working properly, and shipboard sampling of ballast water to identify any "gross" exceedance of the discharge standard. The challenge is trying to discern if the level has been grossly exceeded (e.g. 12 organisms present vs. 9).

- USCG does not have discrete data regarding the number of ships that have applied for extensions and have installed an AMS. The presence of an AMS, as well as the type and manufacturer, is included on inspection forms, and AMS installation dates are included in extension applications, but that data has yet to be extrapolated.
- AMS systems are not always tested in all salinities, and are often limited to marine or brackish environments. Those AMSs cannot be used in the Great Lakes, and vessels using these devices would need an extension letter in addition to the AMS to traverse and do business in the Great Lakes region.
- During the IMO Convention transition phase, contingency measures will be put into place if ballast water is not being effectively treated by a BWMS, but discussions about how those measures will be managed are just beginning. Many countries already have their own contingency measures in place for untreated ballast water.
- In the transition to U.S. type-approved ballast systems, the USCG will not have a discrete transition phase (as IMO will), but will be focused on sampling techniques to identify effectiveness and to ensure BWMS are meeting the discharge standard.
- The IMO Experience-Building Phase is not a decision to avoid enforcement of the D-2 standard; enforcement is part of the convention and can't be changed. During this phase there will not be a penalty for ships that miss the D-2 standard if they've installed and used a system appropriately, but a different action may be taken (e.g., contingency measures). IMO is not indicating that during this transition phase there will be no enforcement of standards, but that penalties allowed in the Convention will not be used as enforcement measures.
- It is unknown at this time if USCG, USEPA, and Transport Canada will coordinate their penalties for ships with untreated or improperly treated ballast water following enforcement of IMO.
- Canadian regulations currently allow four options for ballast water management: mid-ocean ballast water exchange/saltwater flushing, ballast water treatment, retention on board, or discharge to shore. Therefore, any ships using a BWMS to manage ballast water will still be able to access Canadian waters after the Convention enters into force and prior to amendments to Canada's regulations.
- In Canada, if a ship uses a BWMS, there is not currently an additional requirement for mid-ocean ballast water exchange/saltwater flushing. It is an open question as to whether Canada would require both treatment and mid-ocean ballast water exchange/saltwater flushing in the future, as proposed in the 2012 discussion paper.
- Under USCG regulations, AMS use is equivalent to mid-ocean ballast water exchange/saltwater flushing and are considered equivalent in treatment. Ships with an installed and properly functioning AMS are not required to also conduct mid-ocean ballast water exchange/saltwater flushing.

Continued: International and Domestic Ballast Water Rules and Regulations: Status and Future Outlook

Objective: Understand the status and outlook for ballast water policy and regulations, and identify opportunities for continuing to harmonize regulatory approaches

- Sarah LeSage, Michigan Department of Environmental Quality

LeSage presented a brief history of Michigan's ballast water permit program, highlighting that the permit only applies to ocean-going vessels, and requires treatment of ballast water discharged in Michigan waters by one of four designated methods. The current permit does not set a discharge standard. LeSage discussed the metrics of program participation; approximately 350 certificates of coverage have been issued since 2007, with 106 currently in effect. She noted that almost all vessels have applied for coverage as certified "no discharge" vessels, and that no applications have been received yet for individual vessel permits. She explained that of the vessels that are not certified as "no discharge" vessels, three new build vessels have applied for coverage with chlorine treatment, and one for coverage for a UV system. Michigan does not implement a ballast water inspection program, but relies on paperwork to support the five-year rotation of the permit. She said that regulators are currently evaluating if Michigan still needs to execute a ballast water permit program, but given that ballast water treatment is not currently occurring across the Great Lakes region, it will likely be reissued by the January 2017 deadline. LeSage concluded by saying that Michigan is working to encourage USCG type approvals, and is looking into opportunities to incorporate reporting requirements and treatment systems consistent with USCG requirements.

- Jeff Stollenwerk, Minnesota Pollution Control Agency

Stollenwerk began by describing the initiation of Minnesota's ballast water management program, which was largely influenced by a lawsuit against the USEPA on the need for ballast water discharges to be authorized by permits under the Clean Water Act. He clarified that Minnesota supports federal regulation of ballast water and will continue to do so, and complimented the federal agencies on their progress to that end. He discussed the progress that Minnesota's program

has made in condensing regulations and writing them to largely concur with USCG and USEPA VGP requirements for consistency's sake. Stollenwerk highlighted Minnesota's position that lakers are a higher priority vector for spreading invasive species into Minnesota waters than ocean-going vessels, as ocean-going vessels frequently have exchanged ballast multiple times before they reach Minnesota ports. To address this position, the 2013 Minnesota permit issued a ballast water treatment requirement for lakers set to begin in 2018; however, exemptions will be granted if vessels can demonstrate that a BWMS that effectively treats discharges in freshwater systems is not available by that time, and if they also conduct an annual review of available BWMSs. He then outlined Minnesota's VGP certification process: the state largely concurred with the performance standards presented in the permit, but were concerned with other aspects. Minnesota added monitoring requirements for vessels exempted from treatment to their VGP certification, based on the understanding that the Clean Water Act requires monitoring if pollutants are discharged, a factor that was not addressed in the 2013 VGP. That certification was challenged, but upheld in Minnesota state court. Stollenwerk ended by reaffirming Minnesota's stance in favor of federal regulation that will be adequately protective of Minnesota waters, noting specifically that the state will oppose the Vessel Incidental Discharge Act (VIDA) because it limits states' rights to protect water quality under the Clean Water Act. Moving forward, Minnesota will continue to work on their next state permit and participate in other ballast water management partnerships.

- Susan Eichelkraut, Wisconsin Department of Natural Resources

Eichelkraut introduced herself as the interim coordinator of Wisconsin's ballast water program and described the conception of Wisconsin's program, which began in 2010 with a discharge standard 100 times more stringent than the IMO D-2 standard. Following a feasibility study that determined existing systems could not meet this standard, the permit was modified in 2012, reverting to the IMO D-2 standard. She reviewed Wisconsin's current ballast water general permit, which utilizes the IMO D-2 discharge standard and includes a requirement for lakers to meet the discharge standard by their first dry docking after March 30, 2018. This condition is currently being contested in court and is not resolved. Eichelkraut also discussed Wisconsin's VGP certification, which requires a state ballast water permit and state inspections for all vessels covered under the VGP, and retains mid-ocean ballast water exchange/saltwater flushing as a requirement to enter Wisconsin waters even after a BWMS has been installed aboard a ship. She highlighted state inspections as a successful and important aspect of Wisconsin's ballast water management program, as it ensures that captains have read and understood their ballast water management plans and allows state inspectors to engage in education and outreach to a vessel's captain and crew. Finally, she outlined Wisconsin's path forward to work with industry and other regulatory agency to better define and update the state program.

Questions and Discussion

During questions and discussion, the following points were made and/or clarified:

- Michigan's VGP certification is reflective of its permit requirement but has more requirements (e.g., monitoring) that are not on the permit. When reissuing the state ballast water permit, permit section staff review the state's VGP certification to determine if any gaps need to be filled by the permit.
- High risk water sources are defined in Wisconsin's state code, and regulators are currently reviewing if Sturgeon Bay should be labelled as high risk. However, high risk water sources haven't been defined in terms of uptake, and the state permit only has jurisdiction for discharges in Wisconsin, not for high risk uptakes discharged elsewhere.
- The presenters each clarified state authorities regulating aquatic invasive species (AIS):
 - The basis for Minnesota's ballast water permit and VGP certification is water quality standards, but other broader water quality authorities include AIS. It has been established that AIS can act as a pollutant, as the definition of a pollutant is very broad, and this gives Minnesota's Pollution Control Agency adequate legal basis to regulate AIS as a pollutant.
 - Wisconsin's VGP certification specifically prohibits discharging exotic/invasive species in ballast water; a separate state code (NR40) is used to address other activities such as specifically prohibiting transporting AIS in bilge water, bait buckets, or boat trailers. This code is not applied to shipping but applies to other (e.g. recreational) boaters.
 - Michigan's permit is authorized under Part 31 of Michigan's Natural Resources and Environmental Protection Act which specifically mentions AIS in statute. AIS are not mentioned in Part 4/8 Rules promulgated pursuant to that act, but they are not at odds. This has come up as a broader issue for the AIS program, as the program occasionally doesn't have the proper regulatory authority for some AIS activities.

- Developing a water quality standard for AIS is challenging and is a relatively new subject. USEPA is working to further its knowledge and ability to establish numeric criteria for AIS that can be utilized in permitting activities.
- The presenters each clarified how their state regulations differentiated (or not) between invasive and non-indigenous species:
 - Michigan does not make a distinction between invasive vs. non-indigenous species when regulating ballast water, but does make that distinction when evaluating species to determine if they should be included as prohibited/restricted species under state code. The prohibited and restricted species list are more directly targeted to organisms in trade. The federal National Invasive Species Act criteria of economic, environmental, or public health harm is used for those evaluations.
 - Minnesota regulates ballast water through the Minnesota Pollution Control Agency and uses the IMO D-2 standard as the basis of the regulation, regardless of whether species are invasive or non-indigenous.
 - Wisconsin water quality certification specifies non-indigenous species, defined as species considered high risk or invasive in Wisconsin waters.
- Byproducts may be produced by a BWMS, such as with chlorination, and regulations regarding these byproducts are not well publicized and may not be consistent between states. For example, chlorine is regulated per USEPA standards, and some states have leniency for short-term chlorine discharges. It was unknown if other byproducts have similar leniency. BWMS administrators often know what these byproducts are, but don't know the state requirements to provide that information. Ship owners don't want to be in non-compliance for these regulations, and if they don't know what reporting or discharge standards are for their byproducts, they are less likely to use the system in order to avoid a compliance discharge issue.
- There was group interest in developing a mapping tool to display discharge standards throughout the basin.

Treatment System Approval, Availability and Outlook

- Debbie Duckworth, CGHQ Office of Environmental Standards and Lorne Thomas, U.S. Coast Guard

Duckworth began by reviewing the online resources discussed in her previous presentation. She outlined the process for achieving USCG type approval for a BWMS, as well as the process for utilizing third party independent laboratories. Duckworth highlighted the two testing mechanisms used for verification of technology: land-based testing and ship-board testing. The protocols for both mechanisms were developed under USEPA's Environmental Technology Verification (ETV) Program and are used jointly; land-based testing confirms that the technology operates as described, and ship-board testing is designed to test the endurance and safety of the technology at sea. Duckworth noted that it has been a learning process for the USCG to work with independent labs for BWMS testing, but that USCG is committed to responding to lessons learned to ensure consistent testing and adherence to best management practices. She reviewed the current status of BWMSs undergoing testing for USCG type approval and USCG research and development of sampling procedures that will increase efficiency and consistency of independent lab testing and improve operating procedures.

- Matt TenEyck, Great Ships Initiative

TenEyck noted that much of the content covered in his presentation is documented in the briefing paper developed by Great Ships Initiative (GSI) for this workshop and provided to participants, and that the briefing paper contained details of data gathered by the lab. He reviewed the BWMS certification testing framework, breaking it down into two parts: testing the mechanical integrity of the BWMS, and testing the biological efficacy of the technology. For biological efficacy testing, up to twenty consecutive valid trials may be conducted, and successful testing requires five valid and successful land-based trials with varying salinities, and five valid and successful ship-board trials with varying real-world conditions. He explained that these trials require a minimum standard to be met that may not reflect real-world or Great Lakes-specific conditions. He then expanded upon salinity definitions that are used by the USCG and IMO, noting that within the Great Lakes, the western portion of Lake Superior is very fresh water and as a ship moves westward and through the St. Lawrence Seaway, the water becomes saltwater by USCG standards. This means that BWMSs utilized by ships in the Great Lakes must be effective in both very fresh and saltwater. TenEyck further described the challenge of finding adequate uptake waters for freshwater system testing, as freshwater systems do not always have the minimum number of 10+ micron-sized organisms necessary to conduct a valid trial, nor do they have a wide variety of organisms with a minimum diameter of 50 microns (to meet testing condition requirements). TenEyck discussed the status of BWMS evaluations and approval, stating that a major roadblock to certifying freshwater systems is the limited availability of information covering operating contingencies of a given BWMS. He concluded with the message that not all internationally approved BWMSs

have been tested for freshwater efficacy, and that testing facilities may manipulate their testing conditions by manually adding salt or species assemblages to meet minimum testing conditions.

- Gary Croot, President, IMESA, Inc.

Croot reflected on the many challenges associated with the development of BWMSs for the Great Lakes environment. The cold water environment is a major challenge, as well as the need to operate BWMSs in a short period of time, frequently under 24 hours for many laker voyages. While similar conditions exist in northern European and Asian ports, the combination of conditions in the Great Lakes means that vendors will be unlikely to target the Great Lakes environment when developing new technology. He estimated that 65-85,000 installations of BWMSs will occur over the next several years and less than 500 will be for vessels that traverse the Great Lakes. Subsequently, BWMSs will likely not be designed for the specific combination of environmental factors present in the Great Lakes and may not work as effectively as ship owners and regulators expect them to. He also noted the lack of “piggy-backing” with current systems; rather than utilizing 2-3 types of treatment, many systems utilize filtration with one other form of primary treatment. He cited concerns with independent labs not applying testing frameworks consistently due to differences in interpretation of protocols. For example, different labs may test BWMSs under different ambient conditions and, as a result, one BWMS may pass testing at one lab, and fail the same tests at a different lab. He highlighted the fact that vendors and ship owners want a BWMS that consistently meets the discharge standards in the widest range of conditions possible. This is because the testing conditions for type approval may be different from the waters in which a BWMS operates, impacting the technology’s ability to meet the discharge standard reliably. Croot was optimistic about the probability that a BWMS will be type approved by the USCG for operation in the United States, and praised the Norwegian independent lab DNV-GL for achieving testing status for both USCG minimum standards and the IMO G8 standard, which means the lab will not have to test BWMSs individually for the two standards.

- Ed Pfau, Senior Scientist, and Travis Smith, Senior Engineer, Hull and Associates

Pfau commended the day’s speakers for their excellent synopsis of the background of ballast water management in the U.S. He explained that Hull and Associates is working with the Lake Carrier’s Association (LCA) to study the feasibility of shoreside treatment in response to the Second Court of Appeals ruling on the 2013 USEPA VGP. The feasibility study considers several different forms of treatment, including the construction of a dedicated treatment facility, utilizing existing publicly owned water treatment facilities, and mobile shoreside treatment options, as well as the feasibility of utilizing potable water as a ballast water source. Pfau reviewed the general approach to the project and how the research team chose the ports that would serve as the “model sites” during the review. Smith then reviewed the approach to evaluating the engineering feasibility of shoreside treatment in the selected ports. He noted that the flow rate in particular was a very important component of this analysis, as flow rate must be examined on two different levels: the instantaneous flow rate necessary for the loading and unloading of cargo, and the daily maximum flow rate from all vessels docking at a port. Smith highlighted the preliminary findings of the study, including some of the potential advantages and challenges of shoreside treatment. Smith concluded by discussing the next phase of research, and noting that he expects a report of the findings to be available in late 2016 or early 2017.

Questions and Discussion

During questions and discussion, the following points were made and/or clarified:

- USCG will likely interpret independent lab tests as successful or not based on the outcomes of testing and the current numeric organism standard.
- For ships that travel between northern ports, it is impractical to conduct challenge water testing between November and March because it is highly unlikely that cold northern waters will contain the concentration of organisms necessary for a challenge water trial.
- The current focus of the shoreside treatment feasibility study is on-shore technology, and availability of publicly owned wastewater treatment and public water supply facilities. The next phase will focus on infrastructure requirements. A parallel study conducted by Choice Ballast and Netsco is examining the on-board component for transferring ballast water or accepting potable water.
- Ship owners retain regulatory responsibility under USCG, which operates on a sort of “good faith system.” If a type-approved BWMS is working properly but not meeting the discharge standard, USCG does not have a defined penalty at this time. Shipboard conventions put the onus on a rigorous type approval to demonstrate that a piece of equipment will meet minimum standards consistently. The IMO perspective is that if vessels only have a

responsibility to meet discharge standards without specified technology, port states would have to sample every ship to ensure compliance. Type approval of BWMSs streamlines this process, and the signature of a country to a type approval signifies that they have investigated the system and it is capable of treating ballast water to the discharge standard. No one can ensure BWMSs treat effectively all the time, but type approval accelerates the inspections procedure at port because inspectors know that the ship has a system that has been investigated.

- IMO will be requiring manufacturers to self-report the water quality parameters required for a BWMS to work properly. This is a mechanism for manufacturers to report design limitations or where a BWMS can perform. Under G8 standards there will be a public report including all of this collected data and the type approval process, and it will be available through IMO for the general public. The intention is to provide more transparency in BWMSs in a form of communication that is directly available to system purchasers who may identify how a BWMS was assessed and where it works.
- Assuming shoreside treatment is feasible, a facility could serve dual functionality for treating ballast from ships with a failed BWMS. If the ballast water is saltwater, that would be a compounding factor, but feasibility is more about the predictive capacity for effective shoreside treatment. The Hull and Associates study is primarily focused on screening facilities to determine if they can receive water (volume and plumbing); some facilities appear on paper to have that capacity but the storage needed for instantaneous unloading is high to buffer the flow rate.
- UV treatment systems are the most prevalent for using flow control to control contact time and intensity. Different manufacturers rate their systems differently, but this data will be available to vendors under both IMO and USCG standards. It will be a matter of vendors identifying the amount of water treated under challenge conditions, and if it was under backwash. Water has low UV transitivity, requiring slower flow rates for longer contact times.
- If you are a shipowner who is highly dependent on maximizing discharge rate at all times, slowed flow rates are not appropriate for your ship. There is no perfect system out there, but as a shipowner you must decide the most critical components. If a ship has to discharge at a particular rate, then you need to choose a system that may be over sized and add additional pumps; if you have to backwash 20% of flow rate, you won't be able to discharge at your vessel's maximum flow rate and so would need to increase pump capabilities. If you need to change flow rate based on UV transitivity, then that technology is not a good choice for ships that have to utilize a high capacity of flow rate. For ships that it is critical to shift ballast quickly, they will need to take a hard look at the technology they use. Some ships typically pump very hard, and will need to take a hard look at plumbing and pumping capacity if they want to meet discharge standards and continue high flow rate.
- USCG has a hands on approach in regards to flow rate; the intention is clear that USCG is trying to create an even playing field for assessment. It is safe to say that there was an assumption that technology would be developed in response to the unique conditions of the Great Lakes, and USCG was optimistic that it would be developed faster. If industry will be affected by how fast ships will be able to load and unload cargo, it may be unavoidable for the near future depending on what BWMSs receive type approval.

Private Sector Efforts to Mitigate Risk

- Marc Gagnon, Fednav

Gagnon discussed the Fednav decision to order BWMSs for ships currently under construction, given that it would be more cost-effective to fit a BWMS to a new build than to retrofit a vessel after construction. He then reviewed the history of Fednav as an organization as well as their fleet. He emphasized the need for harmonization in regulations throughout the Great Lakes, and pointed out that the IMO has type approved 69 BWMSs, while USCG has type approved zero. Gagnon discussed Fednav's history of testing aboard their fleet, and the success that Fednav has had with a chlorination BWMS. He clarified that a shipowner is not the only factor in deciding which BWMS may be installed on a vessel, but that the shipyard will present BWMS options that they are capable of fitting to vessels. Gagnon stated that Fednav is moving toward implementation of BWMSs on all vessels; the current discharge standards are challenging but they can be met. He noted that many vessels in the global shipping community have a BWMS installed but that few are utilized, and he stated that Fednav takes pride in the fact that their BWMSs are constantly in use. He questioned how many BWMSs will be type-approved by USCG before extensions are removed, as one or two systems will likely not work on every type of vessel operating within the Great Lakes. He concluded by acknowledging the major financial crisis affecting the global shipping industry, and that while pre-emptively fitting new ships with BWMSs is a solution for Fednav, it is a calculated risk that cannot be taken by every shipowner.

- Tom Rayburn, Lake Carriers Association

Rayburn began by identified several challenges for lakers when addressing risk of invasive species spread. First, he noted that the quality of data in the Great Lakes basin showing how and where organisms moved through the lakes, and what drives the success and failure of establishment is often lacking. Second, he said that in many cases, regulators and industry personnel are not working together to scope the problem of moving invasive species and developing solutions and that often they meet an impasse and retreat, rather than working cooperatively. Third, he stated that he was unsure if the community fully understood what protective measures are possible with policy, technology, remediation, regulation, and defining success. He outlined several challenges to implementing shoreside treatment as a viable ballast water treatment option. With shoreside treatment, it is less clear how long shipowners are responsible for ballast, who would face repercussions if the ballast water was not treated on-board and improperly treated at a public treatment facility, and how responsibility can be traced to an individual ship after ballast water from different ships has been mixed during the process. Other challenges relate to infrastructure, with a limited number of federally managed commercial docks in the Great Lakes, and the feasibility of offloading ballast through a single connection point on a dock.

Rayburn then spoke about the partnerships that LCA is part of to expedite BWMS technology research and development, including Minnesota Pollution Control Agency (PCA), GSI, the Chamber of Marine Commerce, Choice Ballast, and Netsco. One of these partnership efforts is focused on identifying the requirements to retrofit ships with BWMSs, to receive potable water as ballast, and to install systems that would pump ballast water off the ship and to a water treatment facility. Several considerations in this study were not previously accounted for by the USCG, including that often, laker hulls are old but BWMS technology is modern, that there may be multiple ballast water systems on lakers (requiring separate BWMSs for each on-board system if they are not integrated with each other), and that flow rate is an important deciding factor when installing a BWMS, as loading and unloading time are crucial to making a profit from shipping. He also described the structural issues that must be considered in tandem with BWMS installation, namely that a BWMS would require space that was previously utilized for cargo, that power must be diverted to power the BWMS, and that laker tanks and pipes are often bare steel that have not been coated to handle chlorine. A structural feasibility study is currently underway through a partnership with the U.S. Maritime Administration (MARAD), the Minnesota PCA, and the GSI. It will examine the feasibility of BWMSs across different types of lakers, the feasibility of BWMSs that use filtration, and BWMSs that are economically achievable for the LCA fleet. LCA is also involved in a sampling study with GSI: ten LCA vessels have sampling mechanisms installed, with GSI providing the sampling technology and taking samples from the intake lines during cargo offloading, ambient testing during transit, and monitoring when ballast is discharged.

- Nick Leak, Chamber of Marine Commerce

Leak provided an overview of the Chamber of Marine Commerce (CBC), informing attendees that the Canadian Shipowners Association had merged with the CBC and that all ballast water efforts are being coordinated through an organization-wide ballast water research and technology evaluation project. He stated that the CBC believed that ballast water risk has not been sufficiently defined to develop optimal solutions, and that shipowners and vendors want to ensure that BWMSs are treating target species and not causing indirect environmental effects. To achieve this goal, CBC has partnered with several environmental agencies to participate in research and update models and work plans. He discussed a tool that the National Research Center has developed to compare BWMS data to vessel route regulations, utilizing 35 different sets of criteria and user defined parameters, and comparing those results to regulatory requirements, type approval test results, environmental and safety requirements, and system costs. The output of the tool will recommend a variety of different systems, rather than identifying one “best” BWMS. Testing of the tool would begin in December 2016, and the final product will be delivered in January 2017. Leak said that its developers would like to incorporate water quality and chemistry because Great Lakes conditions are not conducive to the operation of certain types of technology, machinery, and equipment. CBC is also involved in mobile treatment system research, the goal of which is to develop a hybrid system that will perform in the Great Lakes. The first trial for this mobile “ballast responder” system had to be cancelled almost immediately because there were not enough organisms of a certain size to conduct a challenge water trial. He concluded by saying the CBC is committed to continued research with the ballast responder system with the U.S. National Park Service (NPS), that CBC will revisit trials of other technology, including UV treatment and filtration, and that CBC will continue to collaborate with partners to work together to develop effective and efficient technology.

- Pierre Pelletreau, American Steamship Company

Pelletreau provided an overview of American Steamship Company (ACS), a subsidiary of GATX, and stated that as an active member of the shipping industry, ACS is happy to support research and development towards a viable solution that is both environmentally conscious and economically sustainable. ACS has been active in ballast water management research efforts since 2008, and have incorporated four of the 17 ships in their fleet into this effort. He stressed that the only way to make progress is by collaborating with a diverse group of partners. ACS's partners include the U.S. Geological Survey, USCG, NPS, the Moss Landing Marine Lab, Environmental Research Services, MARAD, The Glosten Associates, and the U.S. Army Corps of Engineers. Pelletreau said that ACS was driven to act, despite being an operating company without a team of scientists and manufacturers, after realizing the many challenges facing the shipping industry when it comes to ballast water management. He noted several challenges associated with the laker fleet, including high ballast capacity and flow rates, turbidity in uptake water and shallow ports, short transit times, the variety of vessel constructions and ballast systems, and a vessel structure that is designed for the non-corrosive environment of the freshwater Great Lakes. Further, each ship is a custom build and utilized for different purposes, rather than multiple copies of the same design, which makes it more difficult to retrofit these vessels with a BWMS. He also noted the BWMS market challenges, as laker vessels represent 0.15% of the global merchant fleet, but utilize a flow rate that is five times higher than the global median. The other set of challenges he noted were environmental in nature, as the Great Lakes are a freshwater system with large fluctuations in seasonal and spatial temperature variations and there are gaps in the knowledge of Great Lakes aquatic species type composition and regional concentration.

Pelletreau identified one of the biggest challenges for BWMSs as the ability to effectively treat ballast water species and mitigate impacts to the ambient environment when it is discharged. The research that ASC has been conducting utilizes a pH altering technique. ACS decided to explore the possibility of pH alteration because it is effective in freshwater, non-corrosive to steel, possesses relatively quick reaction times, and turbidity is not an important factor of efficacy. The research that ACS has been involved in over the past eight years began on a small scale and then grew into higher financial risk and exposure. ACS started by investigating the applicability of pH alteration in a scale model tank before moving to a full size ballast tank for a full suite of trials. ACS has also undertaken sampling activities to better describe the Great Lakes' aquatic community so partners can better define the treatment goal and identify measures of success. Further, engineers at ACS have been developing a conceptual design of what a full ship installation of a pH altering BWMS would entail, all while engaging in regulatory dialogue to ensure that progress and findings are being shared with the pertinent agencies. He said that further exploration and research into the species types and regional concentration in the Great Lakes is necessary and that it may not be economically viable to retrofit all ships with the type of technology they are exploring. Pelletreau ended by pointing to the future of ACS's research including further sampling, literature reviews, and efficacy trials.

Questions and Discussion

During questions and discussion, the following points were made and/or clarified:

- The pH scale is logarithmic and difficult to manipulate with consumables, meaning that the target for pH levels can be a moving target. Altering pH is also significantly affected by temperature, and there is a wide variability in the volume of consumables necessary depending on the temperature of the water.
- The greatest area of opportunity for collaboration between industry and agency representatives is in field sampling. These sampling efforts can focus on what species are present in the Great Lakes, what their effect is in certain areas, what their effects would be in new areas where they could be transported and introduced, what concentrations they could be transported in, and what it takes to kill them.
- Other areas for collaboration include the characterization of risk. Some work has been done with the Department of Fisheries and Oceans Canada (DFO) risk assessment, but that paper was focused on relative risk. What is the actual risk, and how can it be better quantified and better defined to help come up with solutions? Answering these questions will drive decisions about what treatments are used.

Update on Commercial Vessel Incidental Discharge Act

Matt McKenna, Director of the Great Lakes Washington Program, Northeast-Midwest Institute

The proposed U.S. federal legislation, the Vessel Incidental Discharge Act (VIDA) (S. 373 and H.R. 980), establishes a single federal ballast water management standard, specifying standards issued by the USCG in 2012 as the baseline. These standards would preempt existing state standards and USEPA's ballast water permit under the Clean Water Act. A state could adopt more stringent ballast water standards if the USCG determines that compliance with the state standard is

achievable and is consistent with obligations under relevant international agreements. USCG would be required to adopt more stringent ballast water standards within eight years, but could establish lower or higher revised performance standards with respect to classes of vessels, if appropriate. Manufacturers of ballast water treatment technology could only sell, deliver or import technology that has been certified by the USCG.

The Senate Commerce Committee approved VIDA on February 26, 2015 with amendments clarifying the Great Lakes and St. Lawrence Seaway as a geographically limited area; codifying USEPA's VGP requirement that vessels entering the Great Lakes through the St. Lawrence River, after operating outside of the Exclusive Economic Zone, conduct saltwater flushing of all ballast water tanks onboard prior to entry; and modifying the proposed process by which a state can petition for more stringent ballast water standards. The House of Representatives bill was referred to the Transportation and Infrastructure Committee. Several potential vehicles have been considered as a mechanism for passing VIDA, including USCG and the Maritime Administration (MARAD) authorization bills. During a markup of the annual National Defense Authorization Act (NDAA), Rep. Duncan Hunter offered VIDA (H.R.980) as an amendment and it was accepted by a voice vote. The Senate's version of the NDAA (S. 2943) does not include a ballast water title. Later, the House Transportation and Infrastructure Committee and Senate Commerce Committee staff began circulating a discussion draft of a ballast water title to be considered by the NDAA Conference Committee.¹ The newest language includes a provision that requires any ship entering the Great Lakes through the St. Lawrence Seaway, after operating outside of the Exclusive Economic Zone, to conduct a complete ballast water exchange in an area that is 200 nautical miles or more from any shore. This language is similar to what was included in the Senate's amendments in 2015.

Questions and Discussion

During questions and discussion, the following points were made and/or clarified:

- USCG rules are the baseline for new standard under VIDA, any amendments to VIDA would take existing USEPA rules and codify them into law under VIDA. The discussion draft bill language differs a little bit from current USCG rules but it wouldn't require USCG to change their rules.
- State involvement with ballast water management as proposed in VIDA would likely involve USCG giving the governors opportunities to provide input when revising standards in the future.
- VIDA lays out a 10-year program review cycle (as opposed to the USEPA's current 5-year cycle for their VGP).

Thursday, November 17

Agenda Review and Recap of Day 1

Tim Eder, Great Lakes Commission

Eder welcome participants back to the second day of the workshop and thanked John Loftus and the Port of Detroit for hosting the reception the previous evening. Eder provided a background on the Great Lakes Fishery Trust and thanked them for their support and sponsorship of the workshop. He reiterated that if there are clear areas of consensus, the GLC will consider them and that the GLC is always open to recommendations for collaboration and communication on this issue. Eder stated that the GLC had convened a state and provincial task force to help guide the development and planning of the workshop, and that they will be reconvened following the conclusion of the workshop to debrief and provide advice and guidance about next steps. The GLC will also produce a workshop proceedings document.

Ballast Water Management Simulation Presentation

Erika Jensen, Great Lakes Commission

Jensen presented a GIS-based story map documenting the route of a Fednav ship traveling from Europe to and through the Great Lakes – St. Lawrence system and the regulations triggered by the route and the ship's activities. The presentation story map is based off an actual vessel and actual route. The ship, Federal Champlain, is fitted with a BallastAce treatment system. It originates in Høyanger, Norway, and ends its trip through the Great Lakes – St. Lawrence system in Thunder Bay, Ontario. The story map can be viewed online at <http://arcg.is/2jmUsCt>.

¹ VIDA was not passed as part of the final NDAA agreement during the 2016 session of Congress.

Questions and Discussion

During questions and discussion, the following points were made and/or clarified:

- If vessel is going anywhere in Canada other than the Great Lakes, vessels with BWMSs are not required to conduct mid-ocean ballast water exchange.
- Vessels must conduct mid-ocean ballast water exchange to enter the St. Lawrence Seaway, and the Weather Service advises vessels about inclement weather so that they can conduct the exchange in safe conditions.
- Michigan DEQ does not have a monitoring requirement at this time because the agency's permit does not currently set numeric discharge standards. Vessels operating in Michigan waters must also comply with best management practices set up by the St. Lawrence Seaway.
- Environment Canada oversees discharge of byproducts that are not live organisms.
- During a ballast water exchange, filtered water is drawn into the tank and backwash is going back into the environment where it originated. If plumbing is installed correctly, backwash presents no harm of transporting organisms. Standard operation is to flush the backwash line to ensure it is free of any organisms.
- When entering the St. Lawrence Seaway, if a vessel cannot conduct ballast water exchange or if the contents of a tank doesn't meet the standard, the Ballast Water Working Group would require the vessel to retain ballast in the tank and would re-inspect the tanks on the way out of the system to ensure that the composition of the water in the ballast tanks is the same, indicating that the ballast has been kept on board.
- Operating under a ballast water retention order does not significantly impact operations of the vessel, as it only effects one of 20 tanks in the case of the Federal Champlain.
- The NPS is currently investigating ports of origin to determine how closely waters match to Great Lakes conditions.

Protecting the Natural Resources of the Great Lakes-St. Lawrence Region

- Jeff Tyson, Great Lakes Fishery Commission

Tyson began by emphasizing the importance of robust and vibrant fisheries across the Great Lakes region and their continuing state of change due to changing environmental conditions and invasive species. He highlighted the negative impact of the sea lamprey invasion on lake trout populations and the resulting ecosystem instability as an example of the devastating effects that invasive species can have. He also pointed to the relationship between chinook salmon, alewife, water flea, and zebra mussels as a more recent example of the fragile balance between native fish populations, invasive species populations, and human interaction. Tyson noted that the introduction of the round goby in the early 1990s, which preys on zebra mussels, coincided with a decline in overall catch rates that has been linked to goby-zebra mussel interaction. Since 2004, catch rate has decreased so much that Ohio DNR closed the fishing season during the smallmouth bass spawning season. Tyson stated that prevention is key for managing invasive species. The fish community and ecosystems in the Great Lakes are young, unstable, and vulnerable to new introductions. He stressed that for fishery stakeholders, knowing that the seasonal date range and catch rates for species are stable is necessary to schedule fishing trips and maintain business. He ended with a review of the Great Lakes Fishery Commission's ballast water policy brief, which is currently being drafted.

- Molly Flanagan, Alliance for the Great Lakes

Flanagan acknowledged the comparison between chemical and biological pollution, but noted that chemicals tend to dissipate after time and the water column will re-regulate. This is not the case for invasive species, making prevention critical. She reviewed specific environmental impacts of zebra mussels before moving on to broader impacts of all AIS. Flanagan also drew attention to the economic impacts of invasive species throughout the Great Lakes region and various industries. She shifted her focus to discussion of VIDA, reiterating that the USCG plays a critical role in ballast water management, and adding that the role of USEPA is critical because of the agency's experience setting water quality standards and understanding impacts on environmental health. She said the Alliance for the Great Lakes does not support VIDA primarily because it exempts the regulation of discharges under the USEPA's Clean Water Act. Flanagan ended her remarks encouraging collaboration and challenging the workshop participants to think about solutions to accelerate and incentivize the installation of BWMSs aboard vessels.

Questions and Discussion

During questions and discussion, the following points were made and/or clarified:

- The Great Lakes Fishery Commission's ballast water policy brief draft is close to being completed.

Assessing Risk and Measuring Prevention/Response Effectiveness

- Matt TenEyck, Great Ships Initiative

TenEyck explained the premise of the risk-release relationship (e.g., how invasion risk varies as the number of organisms introduced changes) and described the history of GSI's work exploring the feasibility of determining the risk-release relationship for a given Great Lakes harbor, and the feasibility of existing tools to facilitate setting a realistic discharge standard. TenEyck noted that a small number of introduced organisms has the potential to cause an invasion, but that it takes a significant amount of time and funding to conduct field surveys to identify organisms in the water column that could be transported. TenEyck presented the results of the field surveys, and specified that eDNA screening is an easy to use, inexpensive tool that, when the target organism(s) are known, helps responders and managers concentrate their rapid response efforts. eDNA testing cannot show everything that is present in the water column, but it can indicate to field staff if the species they are scanning for is present through eDNA detection. He also discussed the challenges revealed by the field survey results. Mapping opportunity for transport is less feasible, as the data required to produce high quality maps is often not available. TenEyck then reviewed the second phase of GSI's risk-release relationship research, which involved creating 22 mesocosms within cubic meter tanks to determine growth and survival of test organisms (spiny water flea and the diatom *Melosira*) over a short period of time in a variety of water quality conditions. TenEyck highlighted that even at one organism per cubic meter, there was net growth, indicating that the introduction of one organism could lead to an invasion. He ended by stating that mesocosms can collect large volumes of data relevant for modelling shape of invasion curve in short time, but that short trials potentially don't capture the full life cycle, major demographic changes, or random deaths.

- Sarah Bailey, Department of Fisheries and Oceans Canada

Bailey began by outlining the purpose and general objectives of the Department of Fisheries and Oceans Canada (DFO) relative risk assessment for the shipping industry. The purpose of the risk assessment was to estimate the current risk posed under existing ballast water exchange regulations and how that risk will change in the future under IMO. The assessment considered 11 different types of shipping pathways across Canada. Bailey then reviewed the framework and methodology behind the risk assessment. Relative risk was identified through the determination of ecoregions that each of the ships travelled from (shipping pathways connected to source ports known to have a high number of high risk species were ranked as high risk). Bailey said a possible approach could have been to produce one risk assessment for each pathway and prioritize routes that were higher risk; however, there is no existing accepted baseline pathway standard against which to compare the results of individual pathway risk assessments, and so assessment results can only be compared to each other. Therefore, Bailey and her team could only report on relative risk. She clarified that in the results for lakers, current risk is high if only zooplankton are considered, but low if only phytoplankton are considered. Bailey concluded by emphasizing the need for better data, acknowledging that the data used as the basis for this risk assessment is now dated, but also that some shipping pathways need better data in order to better characterize risk.

Questions and Discussion

During questions and discussion, the following points were made and/or clarified:

- The difference in results for laker relative risk in the DFO risk assessment between zooplankton and phytoplankton is based on data collected during sampling. There were increased densities of populations or frequency of finding for zooplankton than phytoplankton. There were also fewer samples with good phytoplankton data, but the international pathway sampling provided good data for both organisms, supporting the conclusion that ships arriving in Canada more often have zooplankton AIS than phytoplankton AIS.
- The information included in the DFO risk assessment will help Canada prioritize focus and efforts on pathways and ballast management and which pathways need more work. Transport Canada is responsible for setting standards and inspections/enforcement with respect to ballast water, but there is no science mandate at Transport Canada. Therefore, the DFO risk assessment includes formal science advice which carries a lot of weight and informs Transport Canada's work to decrease the risks.

- In response to a question on how DFO's work might inform any request for exemptions by Great Lakes ships, it was clarified that DFO's risk assessment is one of the highest quality data sources that Transport Canada has to examine the risk posed by ships. The IMO Convention requires a risk assessment before exemptions are granted. The methods of the DFO risk assessment could be used to evaluate exemptions, but one point that differs is that this risk assessment is on a pathway basis, evaluating all ships within broad classifications, while the exemptions from IMO are for individual or a small number of ships in specific geographic areas. It could be possible for ships moving between Windsor and Detroit to apply for an IMO for exemption, and this pathway hasn't been investigated closely by the risk assessment because that data is lost in all other laker data. The DFO risk assessment could be used as an example, but more work would likely be needed to make decisions about specific ships.
- Economic impacts could be integrated more fully into the risk assessment methodology, DFO would just have to modify how impacts are integrated and considered.

Panel: Moving Forward on Ballast Water Management in the Great Lakes-St. Lawrence Region

Moderator: Jon Allan

Panelists: Molly Flanagan, Alliance for the Great Lakes; Marc Gagnon, Fednav; Tom Rayburn, Lake Carriers Association; Jeff Stollenwerk, Minnesota Pollution Control Agency; Lorne Thomas, U.S. Coast Guard; Colin Henein, Transport Canada

Allan moderated a panel discussion to identify scientific, technology, management, and policy gaps, needs, and opportunities to inform next steps in regional policy and scientific inquiry related to ballast water management. During the discussion the following questions, perspectives, and viewpoints were shared:

- There is an effort to move forward together with similar goals and fair and practical regulations that are environmentally protective, but there are still difficult questions to answer and until ships install BWMSs, the region is still at risk.
- Efforts should be better coordinated and money better aligned to achieve protection and compliance.
- The risk of interlake spread has been eye opening, but the proper regulatory approach is not clear; alternatives are a broad approach or a "surgical" approach with detailed risk assessments region to region and boat to boat.
- Complete understanding of species composition in the Great Lakes is not realistic in the short-term.
- A lot of resources could be spent investigating specific species compositions, or the focus can be on treating ballast water effectively, recognizing that risk exists.
- Ballast water moves species into and around the region, and resources should be focused on moving beyond ballast water exchange to treating ballast water.
- It is important to recognize that there is risk, and although it may not need to be down to the species level, we need to understand enough about the species composition of an area to know that focus is appropriately assigned.
- At some point, focus needs to transition from understanding the risk to taking action to mitigate the risk. For example, there was a time in history that untreated sewage was flushed directly into water bodies with severe impacts; the Clean Water Act established there were human health and environmental risks to this practice and nationally decided discharge standards of wastewater. It was unknown at that time what the improvement would be and how much risk would be lowered, but there was enough science to move forward. Regulating authorities can't know everything that discharge standards will accomplish, but it makes sense to transition from scientists helping understand the risk to engineers developing solutions.
- Early adopters of BWMS technology have taken a risk. In the case of Fednav, it made more sense to lock in a manufacturer to install systems when vessels were being built rather than retrofit at a later time. Treatments systems are less expensive now, and some in the industry anticipates they will become more expensive once they are type-approved.
- History shows how slow progress is on ballast water management: the IMO ballast water convention was adopted in 2004, but not fully ratified until 2016. Many thought there would be USCG type-approved BWMSs by now, but there are none.
- The world of ballast water management currently centers on the IMO standard, and it would be very difficult to change that standard now. Given this, is USEPA's expertise as critical now that this standard (which will increase over time) is in place?
- The review and consultation mechanisms provided by USEPA process ensures that standards are being reviewed by actual risk to the environment rather than what technology can achieve and that state input is fully considered.

- Many of the regulations discussed at this workshop were set in the past; from today's perspective, were those good decisions?
- Cost to fit BWMSs is an element that underlies a lot of discussions but isn't being directly addressed.
- If there is uncertainty about consistent performance of a BWMS and that is preventing forward movement, what can be done about that from a regulatory side?
- The Clean Water Act gives states the ability to set standards above and beyond the federal standard, and states have proposed regulations that impinge upon marine commerce.
- It is difficult to grasp the feasibility of retrofitting ships, and what owners are facing isn't economically beneficial.
- The conversation about feasibility should have less to do with economics because there isn't technology that is effective. The first step is to contribute to collaborative efforts.
- BWMSs are not off the shelf solutions and must be tailored to each ship.
- USEPA has more experience with environmental impacts and focuses on meeting environmental standards; this doesn't trump vessel safety concerns, but exemplifies why a relationship between USCG and USEPA makes sense.
- From a ship owner's perspective, VIDA brings a lot of clarity, and while ship owners respect states' right to protect their waters, VIDA provides the certainty needed to begin installing BWMSs and taking action.
- By having USEPA regulate ballast water, interested parties have the ability to file suit calling for USEPA to enact stricter standards, which could have a cascading effect. If standard more stringent than IMO is set as a result, it could have a major impact on the shipping industry.
- VIDA would establish an exemption for one industry and begin regulating it differently from other industries that discharge pollutants, which could have wide-ranging ramifications.
- Currently, before releasing a notice of proposed rule-making, a USCG proposal must undergo interagency consultation. If USCG and USEPA disagree, there is a process for resolving disputes.
 - For example, the initial notice of proposed rule-making for the current USCG rule included two standards. The proposed rule went through public comment, was evaluated in conjunction with USEPA, and the agencies came to a mutual conclusion under an arbitration process.
 - If VIDA passes, it doesn't mean USEPA is out of the picture, and the USCG is by administrative order required to consult with affected agencies.
- Fednav is not monitoring their installed BWMSs for performance evaluation. Monitoring was discussed internally, and it was decided to use BWMSs, even though they are not yet required to, in order to help train crews, see how the systems work, and discover any operational issues to discuss with the manufacturer.
 - Fednav is currently in the process of training, and monitoring and sampling are outside of realm of possibility for crews.
 - Fednav vessels have always been open to scientists on board ships, but the vessel crew cannot sample ballast water themselves. This is an opportunity for collaboration with outside partners.
- Performance of BWMSs is examined by USCG for type approval, but performance in protecting the environment is outside of the agency's expertise.
 - Before doing inspections, USCG needs to determine the process for validating performance of a BWMS, as all subsequent inspections would fall on USCG.
- Agencies outside of both USCG and USEPA (e.g. U.S. Department of Agriculture) have expertise in invasive species and can be used as an asset when determining invasion risk. Invasion risk is not just concerned with organisms themselves, but also their impacts to coastlines, erosion, human health, and the stability of food webs.
- In terms of compliance, Transport Canada will want to ensure through inspections that a BWMS is approved, has been installed properly, is being used, and is working properly.
- DFO is currently developing compliance testing methods, which will include a pass/fail check for vessels achieving standards, but they are still working to determine what constitutes a pass and a fail.
- As we consider interlake transfer, it is evident that there is no way for lakers to finance a solution on their own. A ship by ship solution would resemble an investment that is comparable to the cost of a new fleet. The challenge moving forward will be finding those investment sources.
- NPS has invested in supporting laker technology development because there is a gap in commercial interest in solving issues specific to the Great Lakes.
- USCG and USEPA believe commerce will solve the technology issue, but if there is no impetus through regulation, then there is no guarantee that a technology developer will make their money back from investing in research. This dialogue won't be able to move forward until we have a common agenda to resolve the issue and secure funding.

Closing Remarks, Next Steps and Adjournment

Jon Allan and Tim Eder brought the workshop to a close, remarking that it is important to find common ground, that common ground exists, and the door for collaboration is open. They thanked the participants and recognized the amount of information shared and learned that the workshop. Participants were also encouraged to provide feedback on the workshop and suggestions for improvement. A proceedings document will be made available, along with speaker presentations as permission is granted.

PRESENTER BIOGRAPHIES

(Presented in alphabetical order)

Sarah Bailey is a Research Scientist with Fisheries and Oceans Canada, and Adjunct Professor at the Universities of Windsor and Toronto. Sarah has published >50 scientific papers, book chapters and technical reports about the risk and management of ship-mediated aquatic invasive species. Her research has played a key role in the development of national and international ballast water and biofouling regulations.

Gary Croot is founder and President of IMESA and has 30 years of experience in the fields of marine safety, environmental protection, and international regulatory compliance and enforcement. He retired from the U.S. Coast Guard in 2011 as Chief of the Environmental Standards Division where he developed a wide variety of environmental regulations including ballast water management, control of marine debris, and dry cargo residue. He was a founding member of the Great Lakes Ballast Water Collaborative.

Debbie Duckworth works for the Office of Environmental Standards at U.S. Coast Guard Headquarters. She is integrally involved in the AMS and Extension Approval within the Coast Guard's Ballast Water Management Program. Ms. Duckworth started her career as a marine biologist for the U.S. Navy and is also a licensed attorney and has worked for NOAA and the U.S. Marine Corps.

Susan Eichelkraut is with the Wisconsin Department of Natural Resources and has been the Lake Michigan Ballast Water Inspector for the Department since the program started in 2010. She is also serving as the interim ballast water program coordinator until vacancies are filled and Department realignment is complete.

Josh Emerson is a fellow with the U.S. Environmental Protection Agency HQ for the last 2 years working with the VGP team. Prior to that he was a research associate at Washington State University.

Molly Flanagan is Vice President for the Alliance for the Great Lakes. She has previous experience with The Joyce Foundation and the National Wildlife Federation.

Marc Gagnon is Director, Government Affairs and Regulatory Compliance at Fednav Limited, since 2008. Prior to that post, he was for 23 years Executive Director of the St. Lawrence Economic Development Council (SODES) as currently Chairman of the Board of Technopole Maritime du Québec serves on the boards of the St. Lawrence Ship-operators and Cargo Montreal, and is the Chair of the Canadian Chamber of Commerce Transportation Committee.

Colin Henein is a Policy Advisor with Transport Canada Marine Policy, working toward uniform implementation of practicable and protective ballast water requirements. Taking into account scientific, legal, technical and policy perspectives, Colin leads development of Canadian regulatory options for ballast water management, represents Canada in ballast water discussions at the International Maritime Organization and leads federal interdepartmental efforts towards compatibility of Canadian, U.S. and international ballast water requirements.

Nick Leak is President and Owner of KAJN Professional Services, Inc., and an engineer with the Chamber of Marine Commerce. He is the Project Manager for the Ballast Water Research & Technical Evaluation project. Pierre Pelletreau, is Vice President of Engineering at American Steamship Company. He has been with ASC for 20 years.

Sarah LeSage is an Aquatic Biologist Specialist with the Michigan Department of Environmental Quality and is the Aquatic Invasive Species Program Coordinator for the state of Michigan. Sarah has served in this capacity since 2010 where she organizes statewide interdepartmental efforts to prevent, detect, and control aquatic invasive species.

Matthew McKenna is Director of the Great Lakes Washington Program for the Northeast-Midwest Institute. He has previously worked as a governmental policy specialist in the private sector and as a congressional legislative aide.

Ed Pfau is a Senior Scientist at Hull and Associates. He has more than 25 years' experience in environmental toxicology, aquatic biology and limnology. He prepares and reviews human health and ecological risk assessments for brownfields, Superfund sites, and beneficial use evaluations.

Thomas Rayburn is the Director of Environmental and Regulatory Affairs for the Lake Carriers' Association. Rayburn has 26 years' experience in environmental, engineering, and emergency management fields. He has worked for national consulting firms, regional partnerships, and U.S. Coast Guard.

Travis Smith is a Chemical Engineer for Hull & Associates, Inc. with 12 years of experience in environmental engineering and consulting. His primary project responsibilities include water and wastewater technology evaluations, treatment system design, and treatment system optimizations.

Jeff Stollenwerk is the Industrial Water Section Manager for the Minnesota Pollution Control Agency. He leads the implementation of state and federal water quality regulations for a variety of industrial sectors across the state of Minnesota. Jeff has over 25 years of work experience with environmental regulations and has been active in the Ballast Water Collaborative since its inception.

Matt TenEyck is Director of the University of Wisconsin's Superior's Lake Superior Research Institute. He has worked cooperatively with colleagues from Northeast Midwest Institute and the University of Wisconsin-Superior on the testing of ballast water treatment systems at the bench scale level and to serving as one of the principal investigators on a multi-year project attempting to understand the mechanisms behind aquatic invasions.

Lorne Thomas is a retired CAPT USCG now serving as External Affairs Officer for the U. S. Coast Guard Ninth Coast Guard District, Cleveland, Ohio since 2010. He is responsible for direct oversight and execution of the Ninth District's public, Congressional, international, and tribal liaison programs and the District Commander's strategic messaging, communications and governmental engagement.

Jeff Tyson recently joined the Great Lakes Fishery Commission where he works to build consensus between Great Lakes' state, provincial, tribal, and federal stakeholders. Previously he spent 23 years with the Ohio Department of Natural Resources Wildlife Division for over 20 years, most recently as Lake Erie Fish Management Program Director.

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