Update on Great Lakes Ballast Water Research and Development Plan

Great Lakes Panel on Aquatic Nuisance Species – Spring 2024 Meeting

Christine Polkinghorne – 26 June 2024

Research Program Manager

R&D Plan Collaborators

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UNIVERSITY of WISCONSIN Superior

Lake Superior Research Institute LSRI Est. 1967

AMI Consulting Engineers P.A.

Great Lakes RESTORATION

U.S. Department of Transportation Maritime Administration

EPA United States Environmental Protection Agency

Natural Resources Research Institute
University of Minnesota Duluth
Driven to Discover

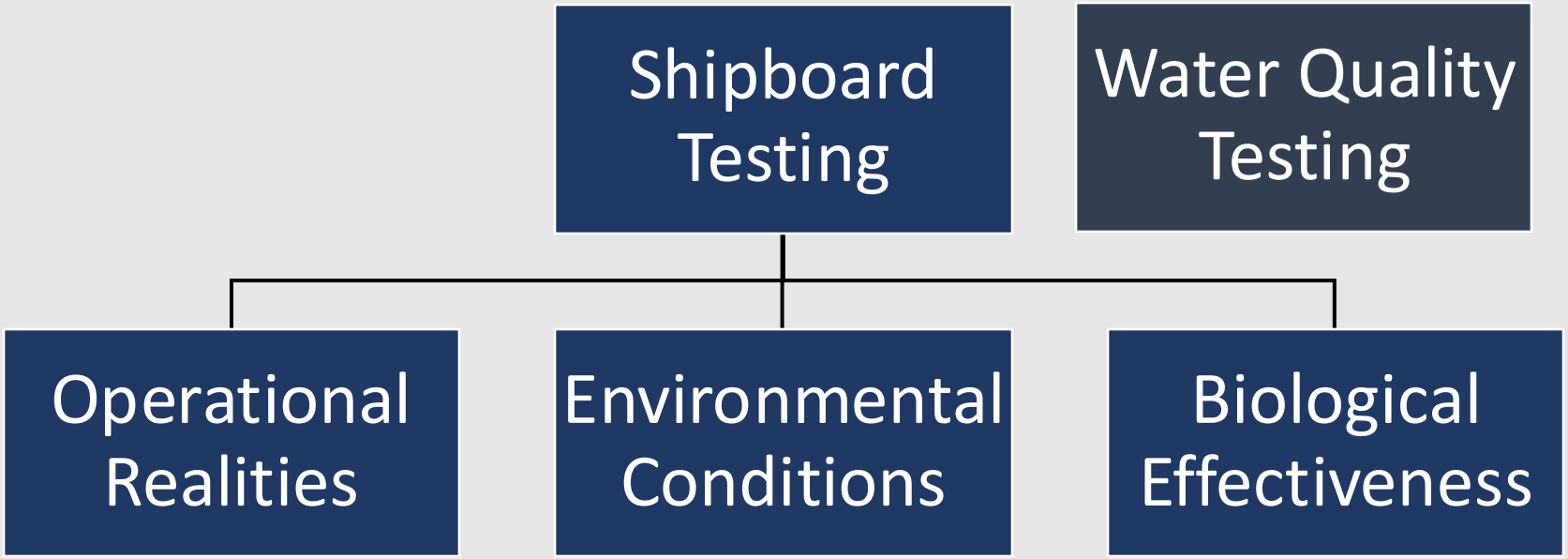
Research and Development Plan

Purpose: Determine whether existing USCG type-approved BWMS can treat Great Lakes ballast water effectively to meet current discharge standard, either using existing methods or adapted methods adjusted to reflect the different environmental conditions of the Great Lakes and operational realities of Laker vessels.

Outcome of Stakeholder Comments R&D plan v. 5 to v. 6

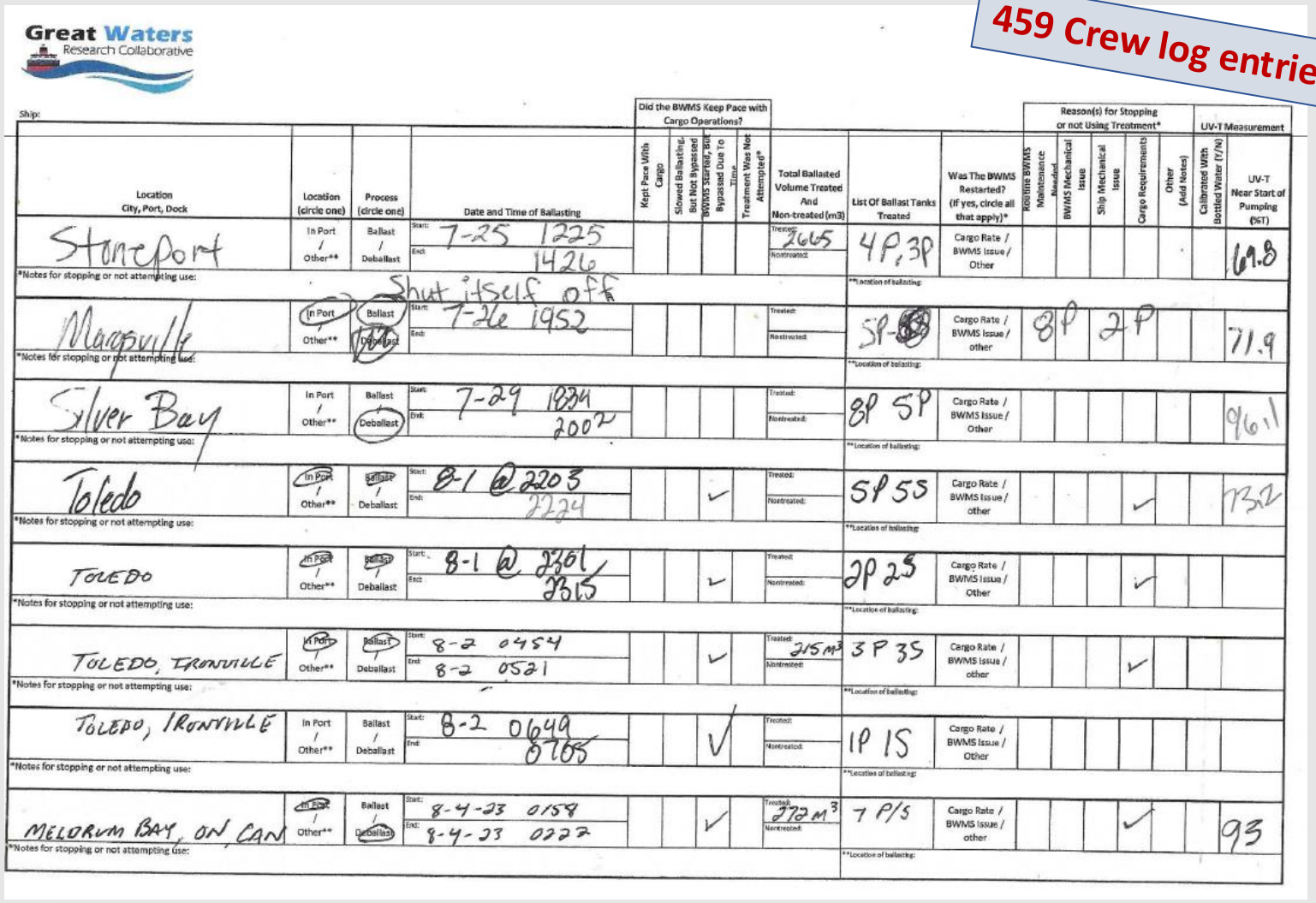
Research Area	Project Description
RA1: Identification of Methods/Alternatives and Assessment of Cost for Great Lakes Ballast Water Management	
1-1	Determining Operational Characteristics of Great Lakes Vessels
1-2	Land-Based BWMS Evaluation
1-3	**Shipboard BWMS Evaluation**
1-4	Ballast Water Filter Performance
1-5	Feasibility Study of Reception Facility Treatment
RA2: Toward Development of Great Lakes Relevant BWMS Testing Protocol	
2-1	**Characterize BWMS Challenge Conditions**
2-2	Protocol Freshwater Revision and Validation
RA3: Assessing the Risk of Aquatic Nuisance Species Transfer from Ballast Water Discharge	
3-1	Quantifying ANS Transfer
3-2	Determining Impact of ANS Reduction

R&D Plan v. 6 Purpose: Determine whether existing USCG type-approved BWMS can treat Great Lakes ballast water effectively to meet current discharge standard, either using existing methods or adapted methods adjusted to reflect the different environmental conditions of the Great Lakes and operational realities of Laker vessels.



Shipboard Operational Realities and Environmental Conditions

459 Crew log entries in 2023



Great Waters Research Collaborative

Ship:

Location City, Port, Dock	Location (circle one)	Process (circle one)	Date and Time of Ballasting	Did the BWMS Keep Pace with Cargo Operations? Kept Pace With Cargo	Slowed Ballasting, But Not Bypassed	BWMS Started, but Bypassed Due To Time	Treatment Was Not Attempted*	Total Ballasted Volume Treated And Non-treated (m3)	List Of Ballast Tanks Treated	Was The BWMS Restarted? (If yes, circle all that apply)*	Reason(s) for Stopping or not Using Treatment* Routine BWMS Maintenance Needed	BWMS Mechanical Issue	Ship Mechanical Issue	Cargo Requirements	Other (Add Notes)	UV-T Measurement Calibrated With Bottled Water (Y/N)	UV-T Near Start of Pumping (%T)
Stoneport	In Port / Other**	Ballast / Deballast	Start: 7-25 1225 End: 1426					Treated: 2665 Nontreated:	4P, 3P	Cargo Rate / BWMS Issue / Other							69.8
*Notes for stopping or not attempting use: Shut itself off									**Location of ballasting:								
Marysville	In Port / Other**	Ballast / Deballast	Start: 7-26 1952 End:					Treated: Nontreated:	5P-6S	Cargo Rate / BWMS Issue / other	8P		2P				71.9
*Notes for stopping or not attempting use:									**Location of ballasting:								
Silver Bay	In Port / Other**	Ballast / Deballast	Start: 7-29 1834 End: 2002					Treated: Nontreated:	8P 5P	Cargo Rate / BWMS Issue / Other							96.1
*Notes for stopping or not attempting use:									**Location of ballasting:								
Toledo	In Port / Other**	Ballast / Deballast	Start: 8-1 @ 2203 End: 2224			✓		Treated: Nontreated:	5P 5S	Cargo Rate / BWMS Issue / other				✓			73.2
*Notes for stopping or not attempting use:									**Location of ballasting:								
TOLEDO	In Port / Other**	Ballast / Deballast	Start: 8-1 @ 2301 End: 2315			✓		Treated: Nontreated:	2P 2S	Cargo Rate / BWMS Issue / Other				✓			
*Notes for stopping or not attempting use:									**Location of ballasting:								
TOLEDO, IRONVILLE	In Port / Other**	Ballast / Deballast	Start: 8-2 0454 End: 8-2 0521			✓		Treated: 215 m³ Nontreated:	3P 3S	Cargo Rate / BWMS Issue / other				✓			
*Notes for stopping or not attempting use:									**Location of ballasting:								
TOLEDO, IRONVILLE	In Port / Other**	Ballast / Deballast	Start: 8-2 0649 End: 0705			✓		Treated: Nontreated:	1P 1S	Cargo Rate / BWMS Issue / Other							
*Notes for stopping or not attempting use:									**Location of ballasting:								
MELORUM BAY, ON, CAN	In Port / Other**	Ballast / Deballast	Start: 8-4-23 0158 End: 8-4-23 0222			✓		Treated: 272 m³ Nontreated:	7 P/S	Cargo Rate / BWMS Issue / other				✓			93
*Notes for stopping or not attempting use:									**Location of ballasting:								

Shipboard Operational Realities and Environmental Conditions

132 DESMI Autolog files from 2023

Report Generated
11/1/2022 3:58:22 AM

BWMS Operation Report

DESMI

IMO No.: 1304610 Vessel Name: Michigan Trader

System Operation mode: De-Ballast USCG Compliance

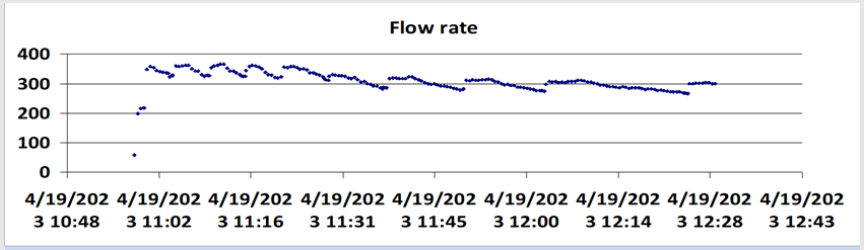
System Started: 11/1/2022 2:24:00 AM At GPS Position: N/A , N/A
System Stopped: 11/1/2022 3:58:22 AM At GPS Position: N/A , N/A
Operation ended: Treatment successful

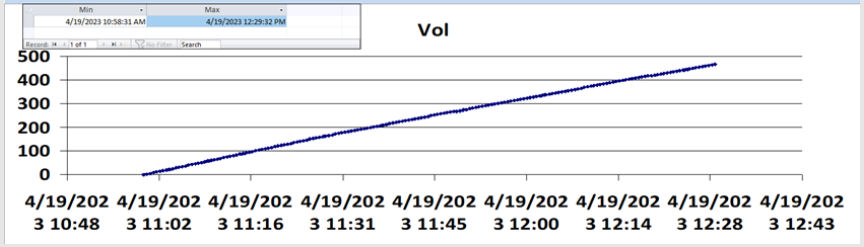
Total treated volume: 1573 m³
Total Lamp power consumption: 340.2 kWh

Process Data

Lamp Current for this operation	Average Current 200.7 A	Maximum Current 201.5 A	Minimum Current 200.1 A
Lamp Power for this operation	Average Power 216.2 kW	Maximum Power 217.0 kW	Minimum Power 215.7 kW
Flowrate for this operation	Average Flowrate 1000 m³/h	Maximum Flowrate 1097 m³/h	Minimum Flowrate 1 m³/h
Inlet Pressure for this operation	Average Pressure 0.4 bar	Maximum Pressure 1.1 bar	Minimum Pressure 0.3 bar
Outlet Pressure for this operation	Average Pressure 0.4 bar	Maximum Pressure 1.0 bar	Minimum Pressure 0.3 bar
Diff. Pressure for this operation	Average Pressure 0.030 bar	Maximum Pressure 0.040 bar	Minimum Pressure 0.000 bar
UVI for this operation	Average UVI 541 W/m2	Maximum UVI 676 W/m2	Minimum UVI 323 W/m2
UV-unit Temperature for this operation	Average Temp. +12.4 °C	Maximum Temp. +23.3 °C	Minimum Temp. +12.0 °C

210 BIO-SEA B Autolog files from 2023

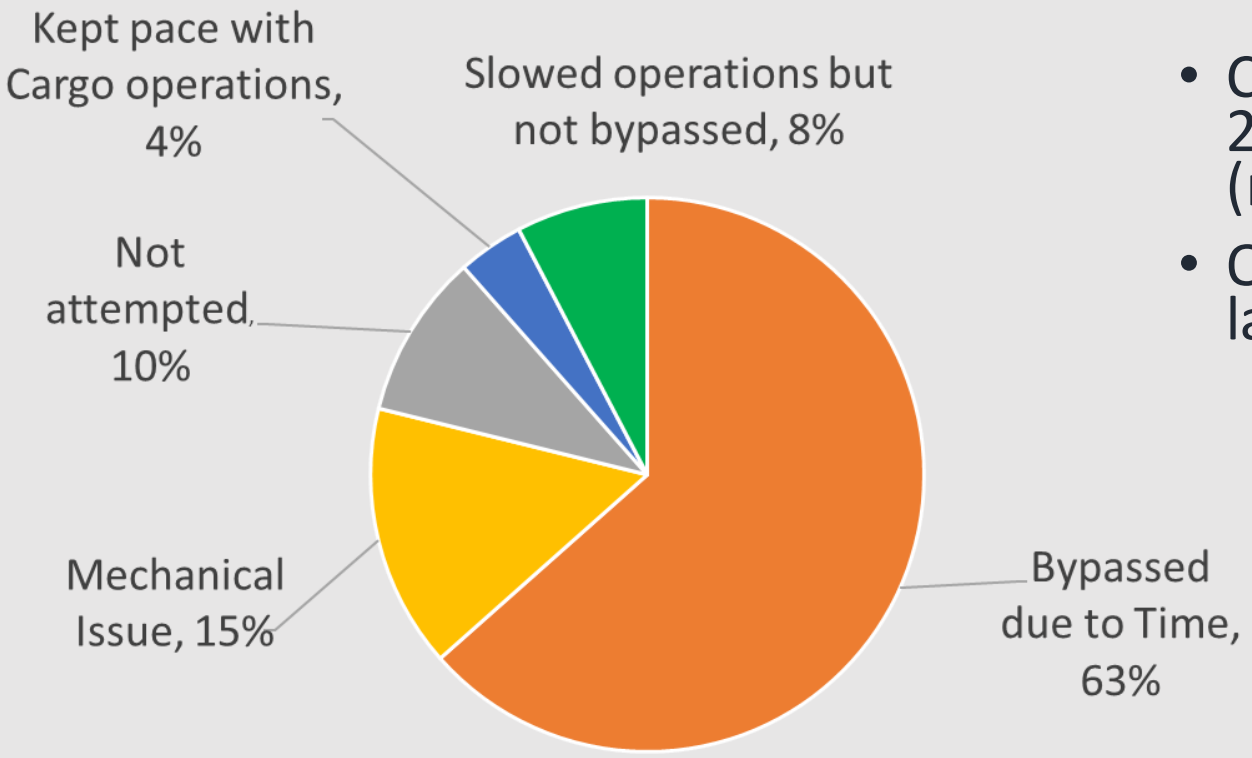




AvgOfValue	MaxOfValue	MinOfValue	Variable	MinOfTimeString	MaxOfTimeString
308.276626683417	365.5382	57.94271	FT1	4/19/2023 10:58:31 AM	4/19/2023 12:29:32 PM
907.131203703704	1255.99	897.21	UV1.1	4/19/2023 10:59:57 AM	4/19/2023 12:29:02 PM
902.487777777777	1001.73	899.06	UV2.1	4/19/2023 10:59:57 AM	4/19/2023 12:29:02 PM
912.418611111111	1598.44	898.72	UV2.2	4/19/2023 10:59:57 AM	4/19/2023 12:29:02 PM
900.000100000001	900.0001	900.0001	UVOrder	4/19/2023 10:58:31 AM	4/19/2023 12:29:02 PM
237.350408472143	466.1085	0.06054084	Vol	4/19/2023 10:59:57 AM	4/19/2023 12:29:32 PM
43869.3524137931	44129.11	43666.8	VolTot	4/19/2023 10:58:31 AM	4/19/2023 12:28:02 PM

Shipboard Operational Realities and Environmental Conditions

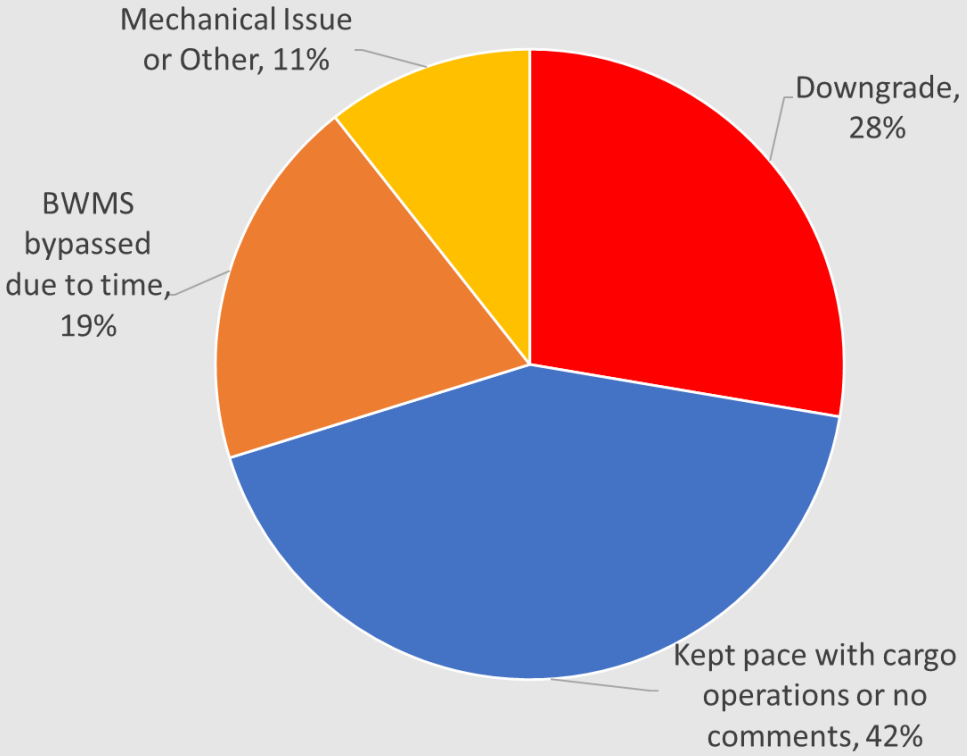
DESMI Compact Clean System Performance



- Crew Logs from 2023 Shipping Season (n=52)
- Only ballast events that lasted >10 minutes

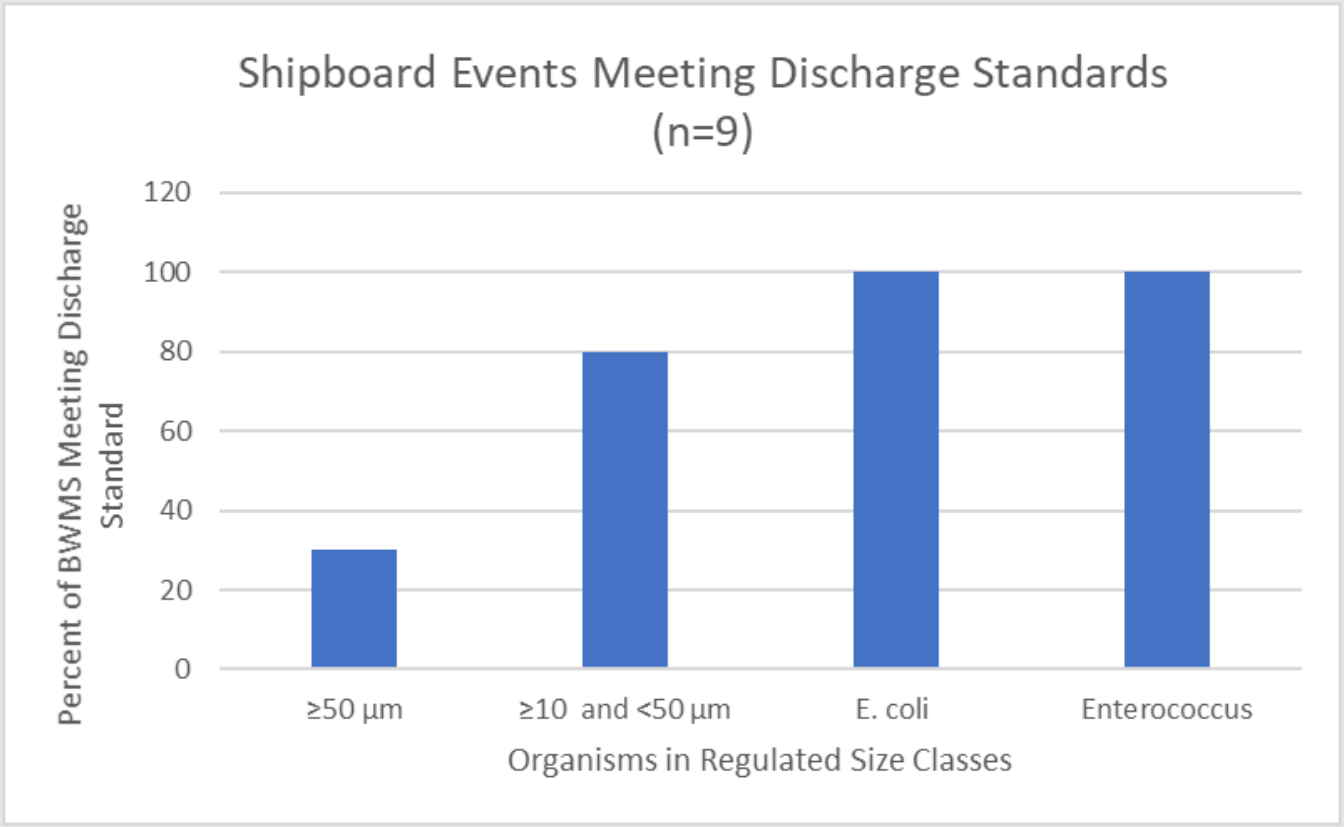
Shipboard Operational Realities and Environmental Conditions

BIO-SEA B System Performance



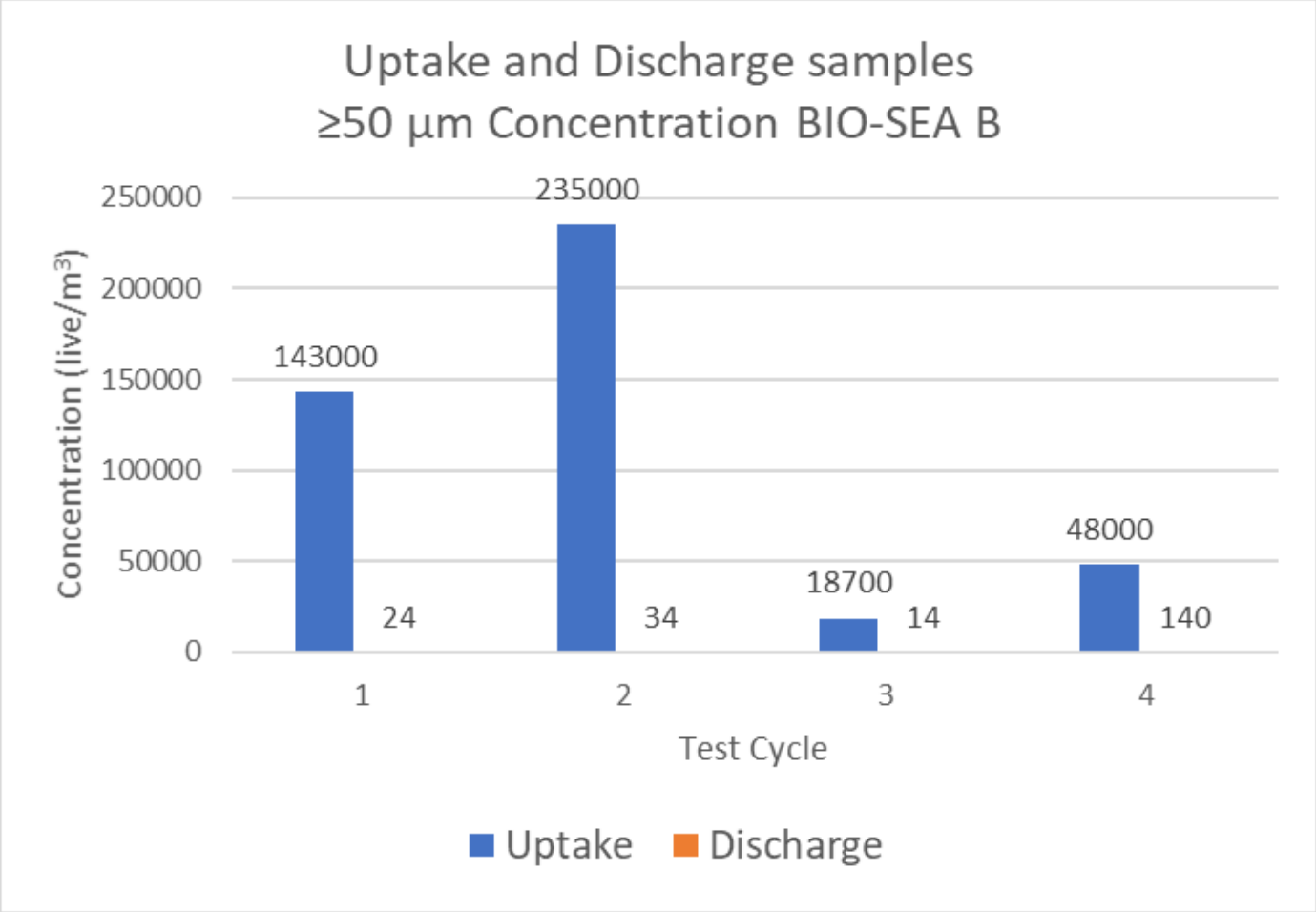
- Crew Logs from 2023 Shipping Season (n=94)
- Only ballast events that lasted >10 minutes

R&D Plan Shipboard Biological Effectiveness for Paired Uptake and Discharge Events 2022-2023



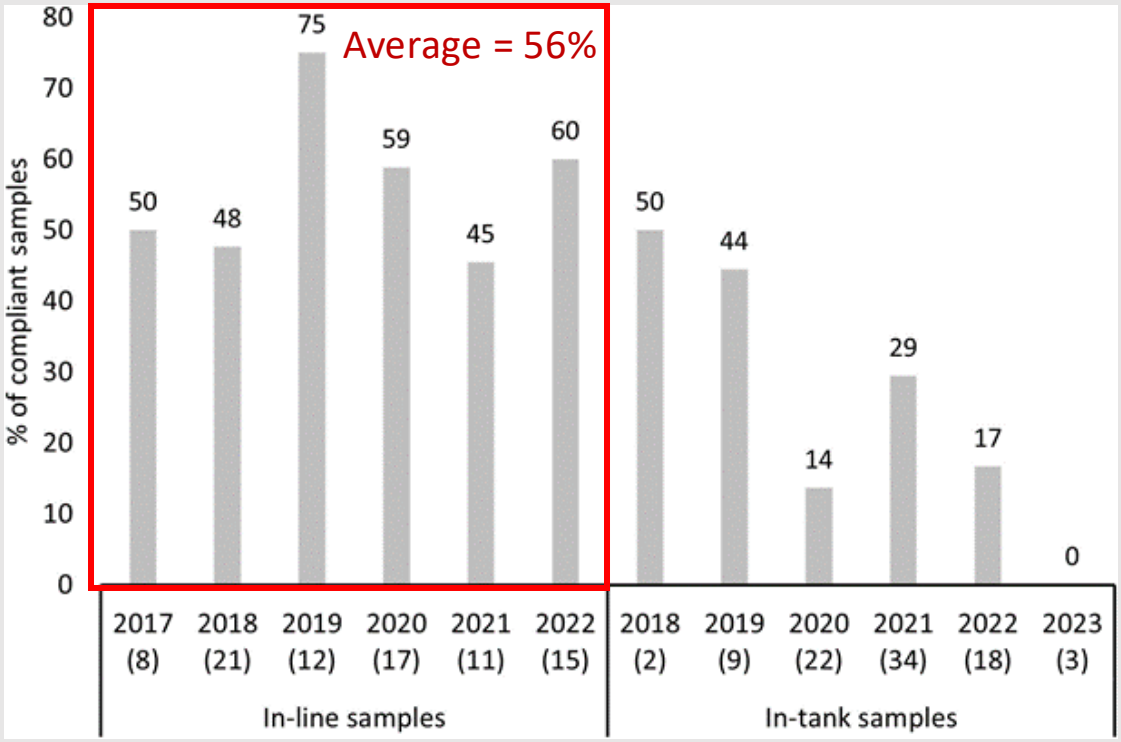
UV Treatment – DESMI Compact Clean, Bio-UV BIO-SEA B, AlfaLaval Pure Ballast
Chlorination – TeamTec Senza

Biological Effectiveness of BIO-SEA B BWMS on ≥ 50 µm size class



Assessment of BWMS Compliance to D-2 Discharge Standard (n=228)

R&D Plan Shipboard Biological Effectiveness Average = 30%



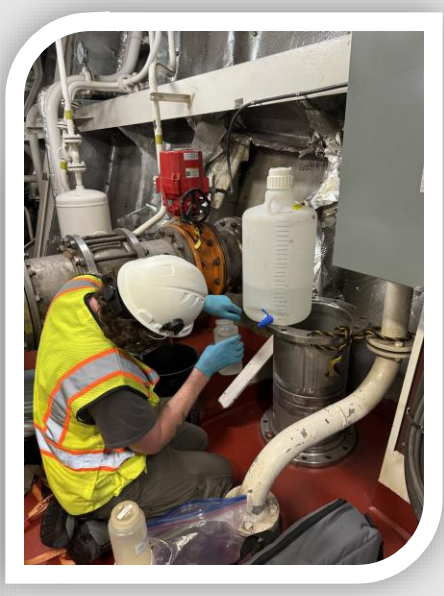
Percentage of compliant in-tank and in-line samples during compliance testing by year (D-2 standard, ≥50 µm –sized organisms). Number of samples each year is provided in brackets.

Outinen, O. et. al., 2024

R&D plan 2023-2024 Reports

- Great Lakes Ballast Water Research and Development Plan v. 6
- Evaluating a Most Probable Number Method for Assessing the Viability of Great Lakes Protists
- Shore-based Evaluation of the Effectiveness of the Bawat Ballast Water Management System Mk2 Mobile Treatment Unit
- Toward Development of a Great Lakes Relevant BWMS Testing Protocol: Use of Stains to Assess Viability of Resting Stages
- Toward Development of a Great Lakes Relevant BWMS Testing Protocol: Assessment of Environmental Acceptability of Treated Ballast Water Upon Discharge
- Bench-scale Tests of the Newman Zone OS Ballast Water Deoxygenation Treatment
- Land-based Evaluation of the Effectiveness of the Optimarin DN100 and DN150 Ballast Systems in the Great Lakes
- Fanberg, L. et al., “Presence zooplankton, eggs, and resting stages in ballast water samples from the Laurentian Great Lakes.” Vol.50, Issue 1, February 2024. https://doi.org/10.1016/j.jglr.2023.102275
- Evaluating a most probable number method for assessing the viability of Laurentian Great Lakes protists – under review JGLR
- Mesocosm manuscript – under internal review

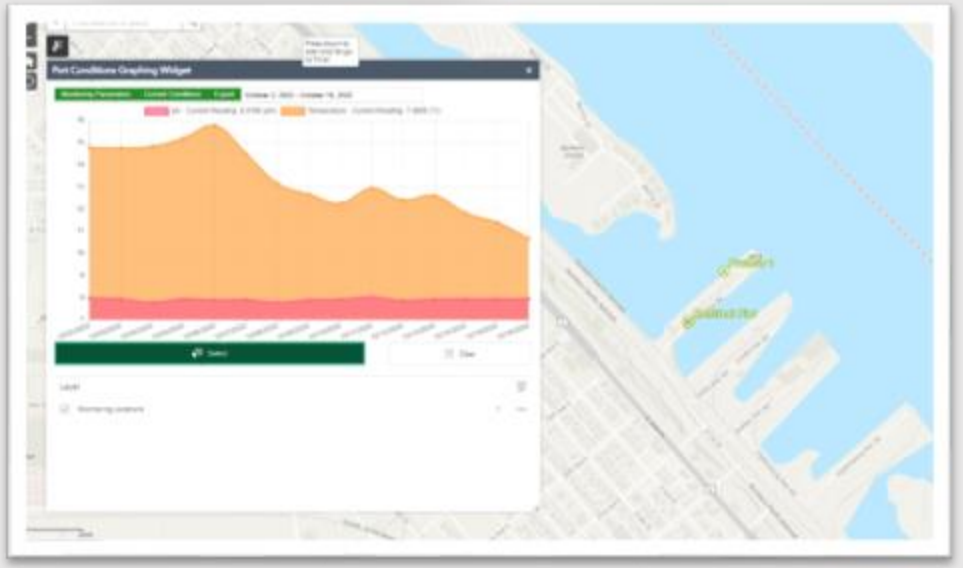
What's next in 2024?



Complete Ballast Water Filter Performance

15 ship visits

- VTB Michigan Trader –UV
- Interlake Pere Marquette – UV
- Interlake Pathfinder – 40 and 50 µm filters
- Algoma Mariner - chlorination
- Algoma Algoluna - UV



Port water quality condition sampling to address challenge condition question

- 25 ports with highest uptake volumes
- Continue to develop interactive database

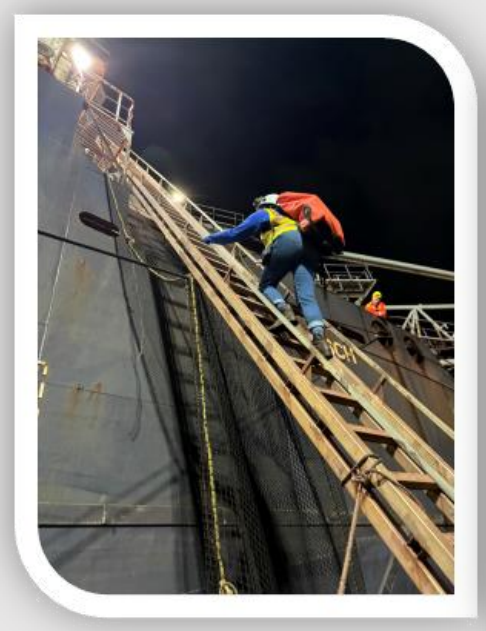
What's next? (continued)

2025 – all pending receipt of GLRI funds

Photo courtesy of Interlake-Steamship

Addition of M/V Mark W. Barker to current ship sampling roster

Continuation of Shipboard and Port Water Quality testing



Thank You for your Support

U.S. Department
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Maritime Administration

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