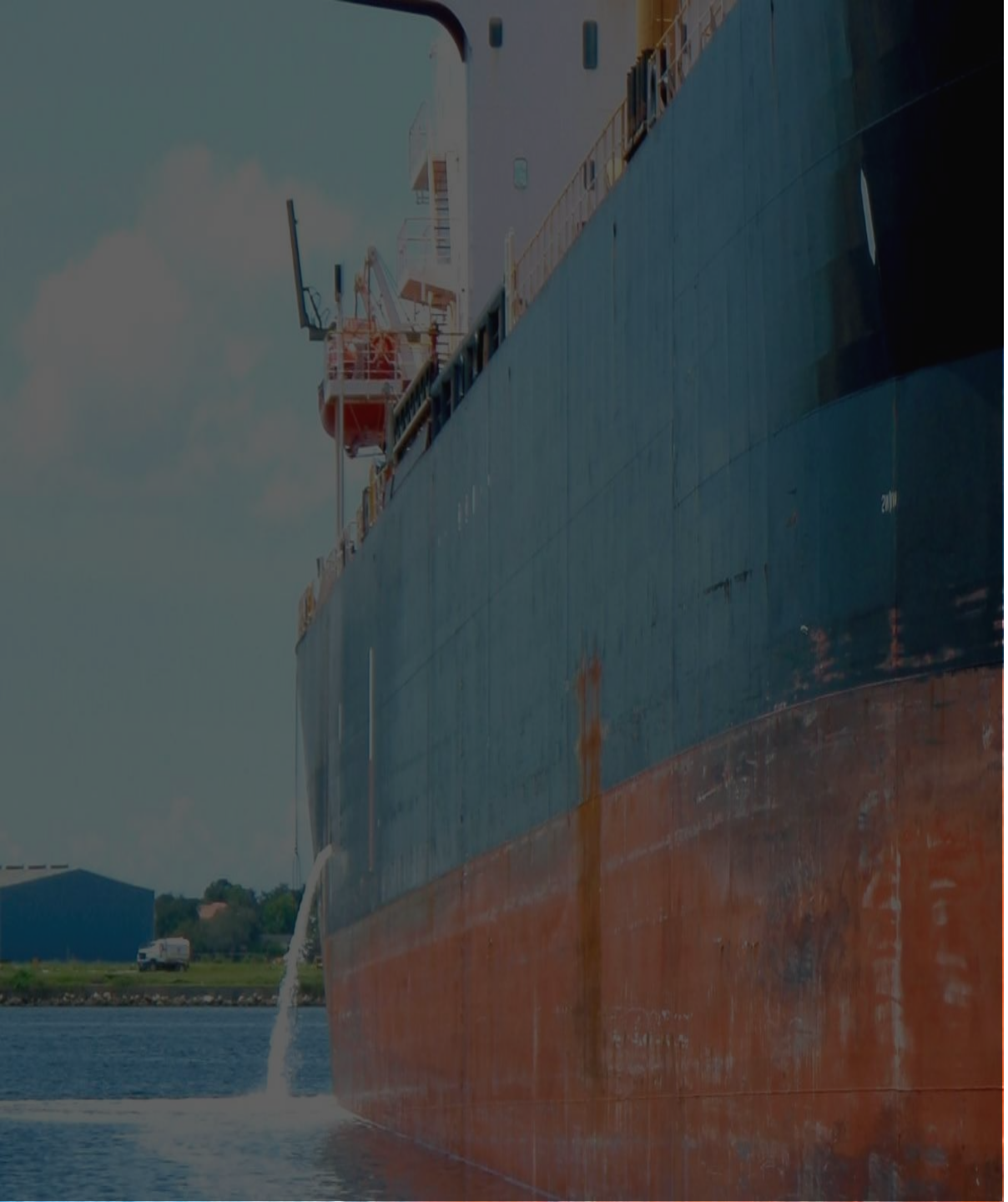
Reviewing a Year of BWMS Testing

Pacific Ballast Water Group Meeting | 2023

Stephen Loiacono, Scientific Program Manager
Golden Bear Research Center



IMO REQUIREMENT:
06 . 01 . 2022

Commissioning Testing - a mandatory requirement that forms part of the installation and commissioning survey of ballast water treatment systems, prior to certification.

Over **10,000** BWMS installations have been completed

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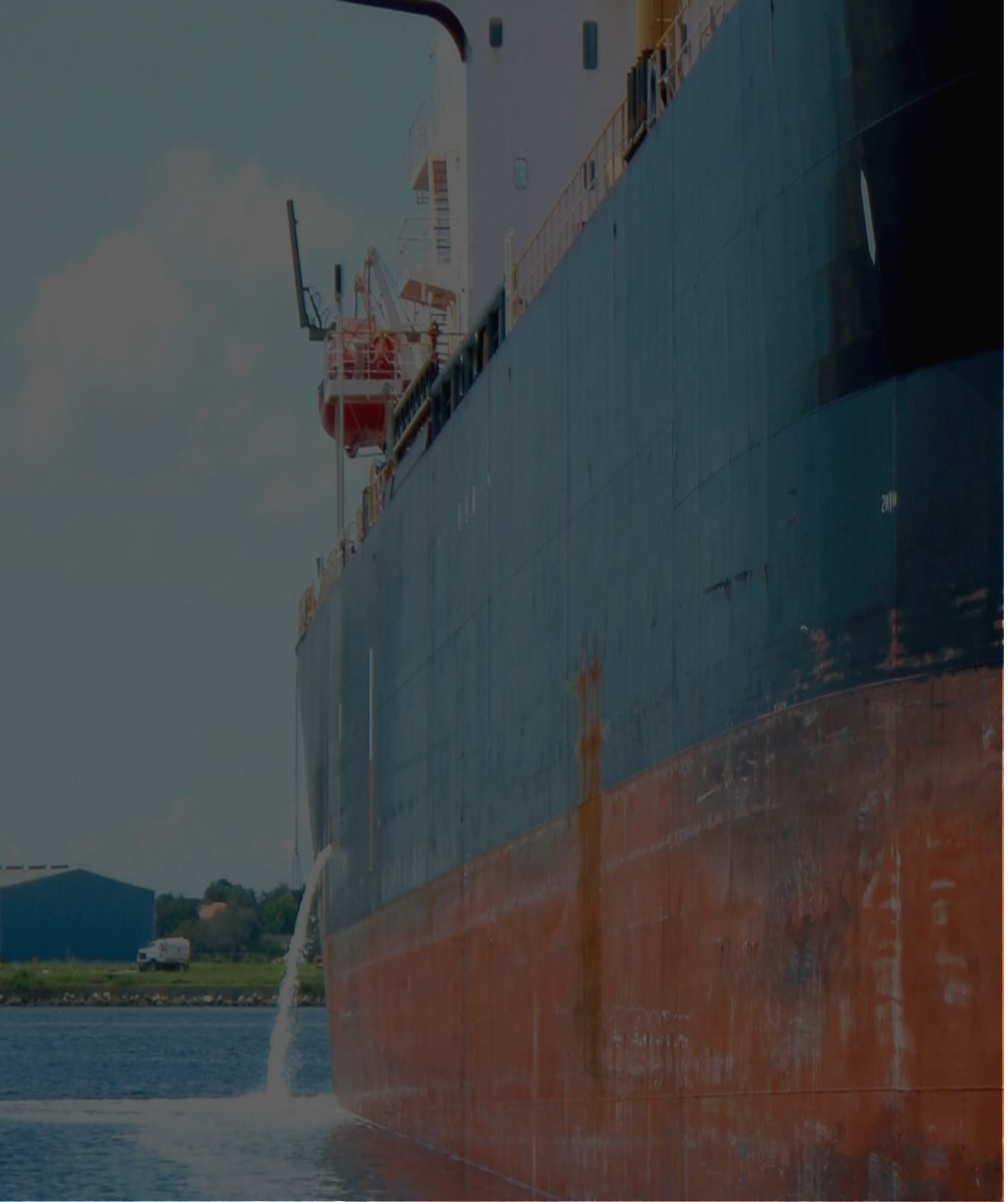

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- Completed 21 Commissioning Tests
  (USA, Canada, Caribbean, Europe)
- >70% UV Systems
  (Alpha Laval PureBallast most common)
- Detailed analysis for ≥50 µm size class organisms
- Indicative analysis for ≥10 µm and <50 µm size class organisms (Turner BCII)
- 5 of 21 tests failed (24% failure rate)
  4 of 5 failures were in ≥50 µm size class

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GLOBAL TESTNET - RESULTS

- Over **800 tests compiled** since 2017
- **~20%** of all tests failed to meet the D-2 Standard

Parameter	Type of Testing	
	Commissioning	Compliance
Total number of tests	704	134
Percentage of discharges failing to meet the D-2 Standard	20%	22%
Percentage of discharge exceeding TRO limits as set by GESAMP (G9 Guidelines)	6%	34%
Percentage of failed tests involving exceedance in the ≥50 µm size class	81%	93%
Percentage of failed tests involving exceedance in the ≥10 µm and <50 µm size class	8%	14%
Percentage of failed tests involving exceedance for *E. coli*	7%	0%
Percentage of failed tests involving exceedance for *Enterococci*	6%	0%
Percentage of failed tests involving exceedance for *V. cholerae*	0%	0%

GLOBAL TESTNET - RESULTS

- Over 800 tests compiled since 2017
- ~20% of all tests failed to meet the D-2 Standard
- Highest cause of failure:

  ≥50 µm size class organisms

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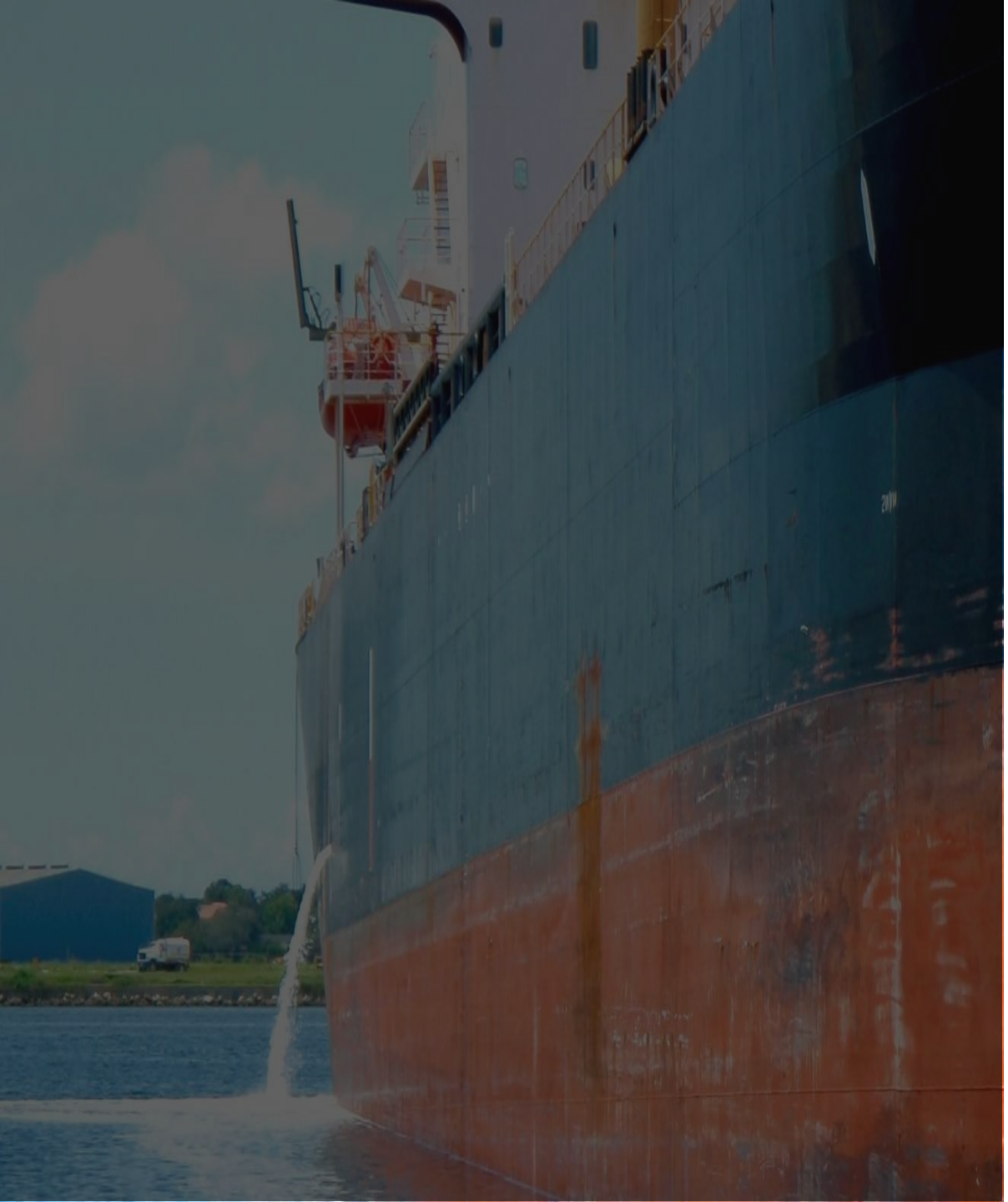
IF THE BWMS WORKS, WHY ARE THESE TESTS FAILING?

- Short Answer: **Human Error**
  - Crew forgot to close the sea chest
  - Pipes were not flushed properly
  - UV bulbs not cleaned
  - Crew discharged before Maximum Allowable Discharge Concentration was met (Bulk Chemical)
  - Contamination from leaky valves

IF THE BWMS WORKS, WHY ARE THESE TESTS FAILING?

- Conclusion: **A BWMS working perfectly will fail if the ship's crew make mistakes or ship has compromised equipment.**



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- 1 failure was reversed due to detailed analysis of ≥10 µm and <50 µm size class

- Environmentally, it's better to have a false positive than a false negative, but that comes at a price to the ship owner

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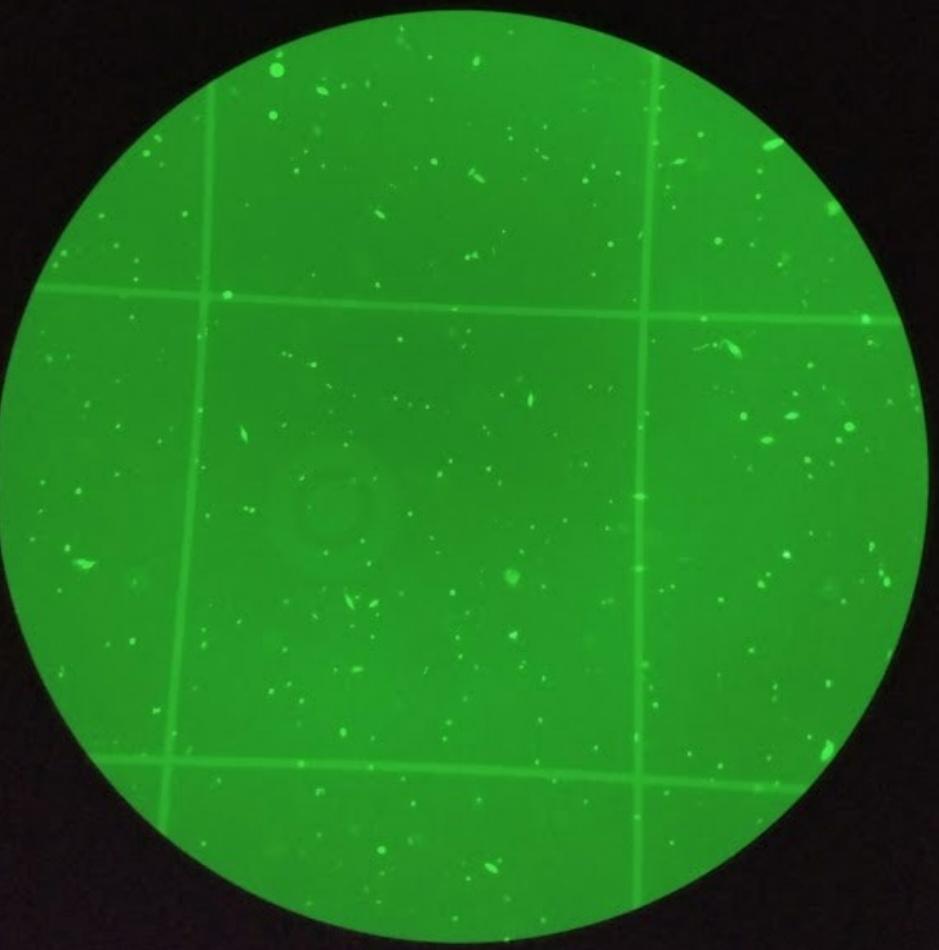
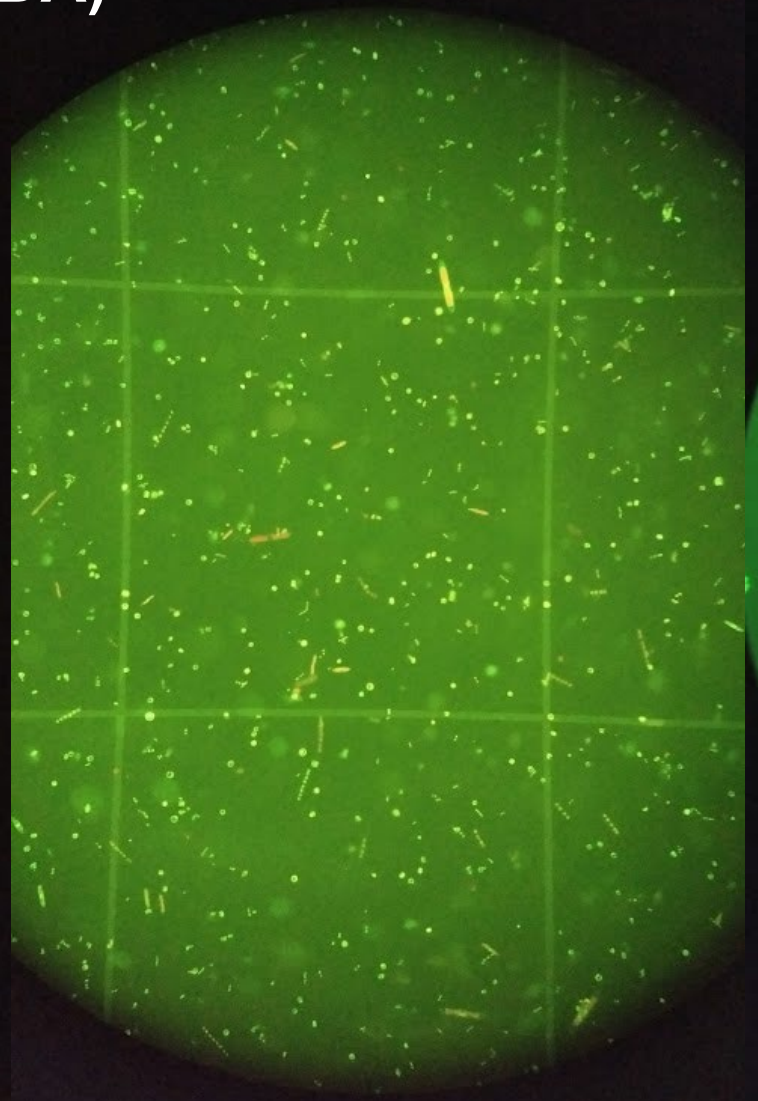
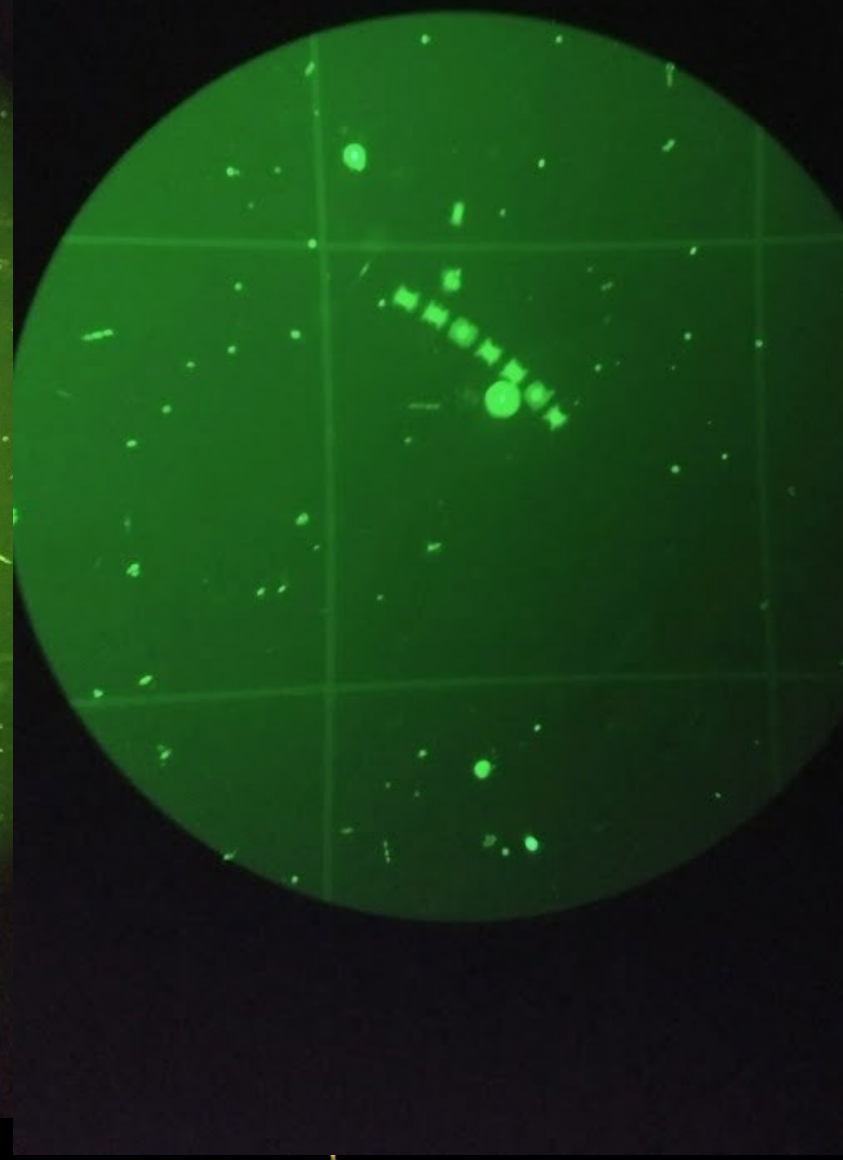
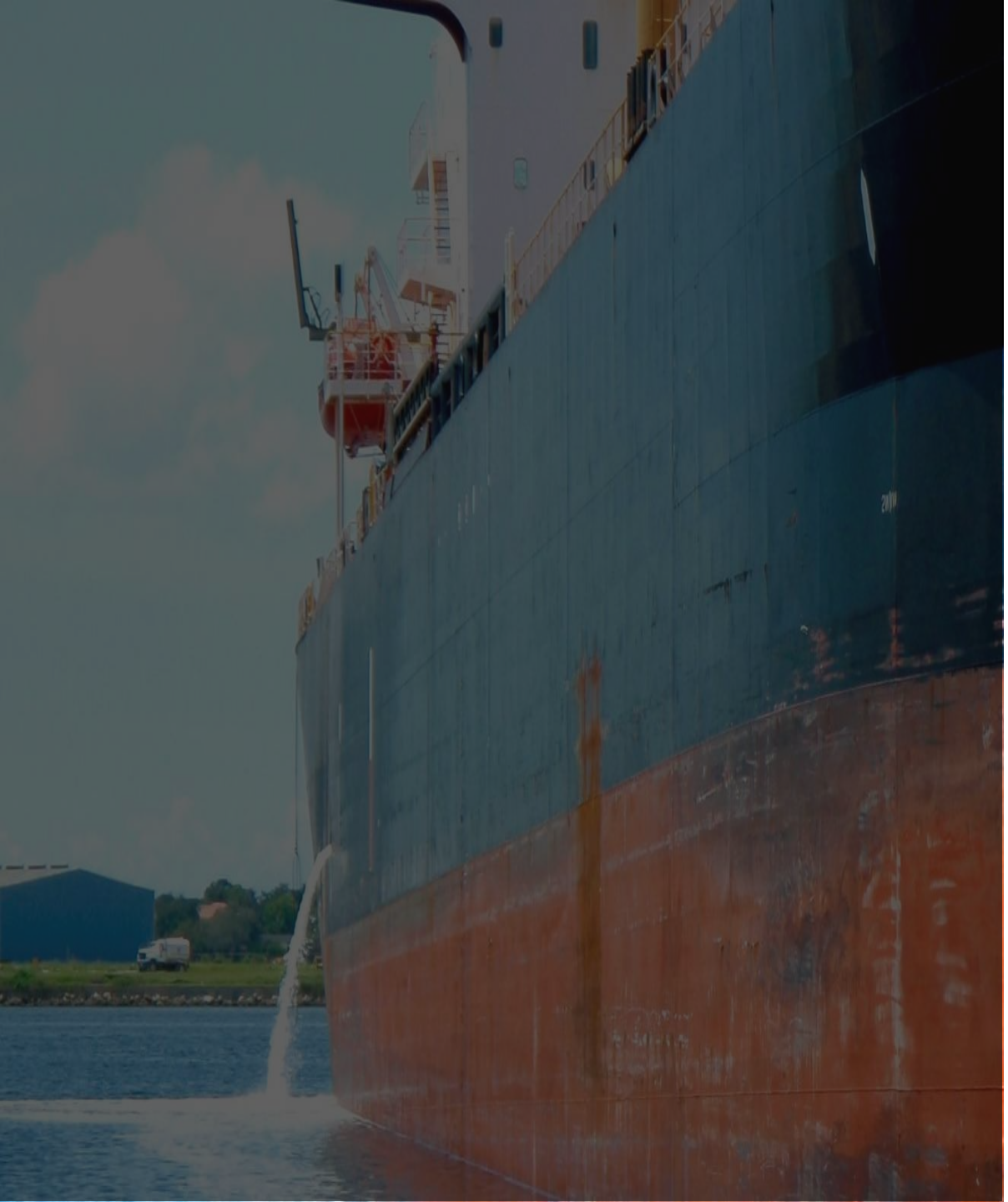
View through an Epifluorescent Microscope
(Dosed with FDA & CMFDA)







Gridlines are 18 microns thick



QUESTION:
HOW WELL DO THESE SYSTEMS WORK ONCE INSTALLED?

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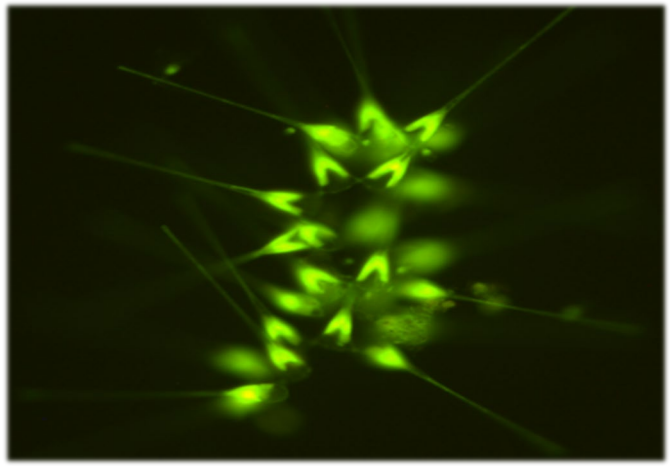
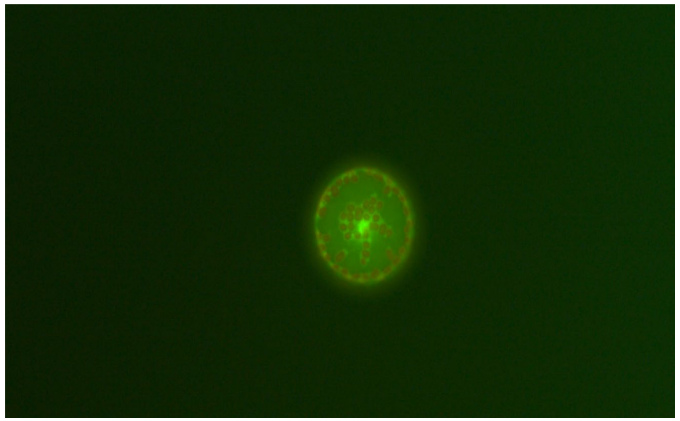
METHODS





- 10 SHIPS
- CONCENTRATE ≥1m^3 OF TREATED BALLAST WATER (IMO GUIDELINES)
- FULL DETAILED ANALYSIS:
    - ≥10 µM AND <50 µM ORGANISMS (EPIFLUORESCENT MICROSCOPE)
    - ≥50 µM ORGANISMS (STEREO MICROSCOPE)

RESULTS

Vessel	BWMS Model	BWMS Technology	Source Water Location	Live Organisms >50 um/m^3	Live Organisms 10-50 Average[a]	Live Organisms 10-50 SD
1	Alfa Laval PureBallast 3.1	Ultraviolet	Seattle, WA	1.8*	0.3	0.6
2	Alfa Laval PureBallast 3.1	Ultraviolet	Selby, CA	6.0	7.7	2.1
3	Sunrui BalClor BC 1500	Electrochlorination	Tampa, FL	0.7*	0.3*	0.0
4	Ecochlor Series 200	Chlorine Dioxide	Long Beach, CA	0.5*	0.3	0.6
5	Ecochlor ET-5700-5.0	Chlorine Dioxide	Long Beach, CA	1.0*	4.7	1.2
6	Alfa Laval 3.2 Compact Flex 500	Ultraviolet	Nova Scotia, Canada	1.0	0.3*	0.0
7[b]	Sunrui BC3000	Ultraviolet	Stockton, CA	1.0*	3.3	1.5
8	Desmi CompactClean 500	Ultraviolet	San Francico Bay, CA	1.0*	6	1.7
9[b]	MIURA CO. LTD HK-(E)R	Ultraviolet	Benicia, CA	4.0	0.3*	0.0
10[b]	1500 TYPE JFE BallastAce	Chlorine	Pacific (Open Ocean)	<1.0*	24.3	6.7

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All vessels passed in the >50 µm size class (7 out of 10 - No living organisms detected)

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1 fail in the ≥10 µm and <50 µm size class

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CONCLUSIONS

THESE SYSTEMS WORK VERY WELL

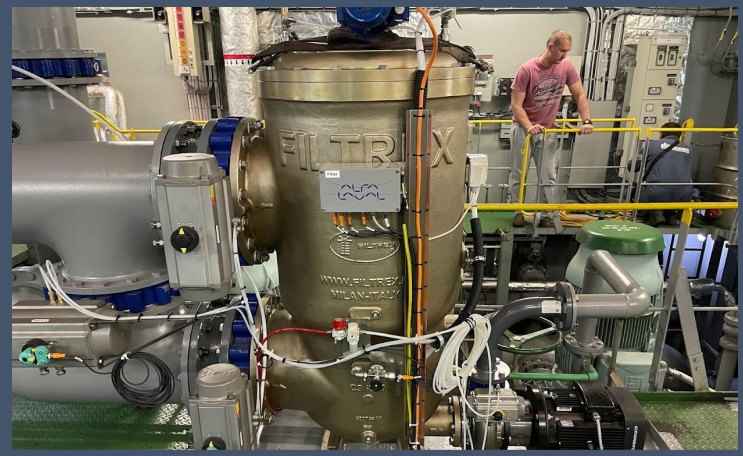
<u>IMPORTANT TO CONSIDER:</u>

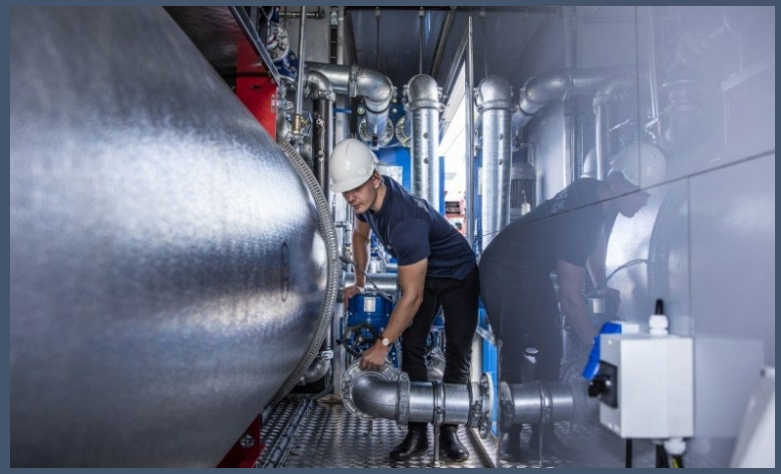
7 OF THE 10 SAMPLING EVENTS WERE COMMISSIONING TESTS.

- BALLAST TANKS WERE RECENTLY CLEANED

-CREW WERE RECENTLY TRAINED

<u>HOW WILL THESE SYSTEMS PERFORM IN 5 – 10 YEARS?</u>





Thank you

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