
SGS Global Marine Services

# Commissioning Testing of Ballast Water Management Systems: Shipboard Results and Lessons Learned

Pacific Ballast Water Group Meeting

Dr. Lisa Drake | 06 APR 2021

# Agenda


01 Overview of commissioning guidance

02 Findings and recommendations from commissioning testing

03 Questions

# International Maritime Organization (IMO): BWMS Commissioning Testing Guidance

- Approved at MEPC 73 (BWM.2/Circ.70)
- Two samples, intake (ambient) and discharge, taken according to IMO Guidelines G2 (→ comparision)
- At least indicative analysis for all Regulation D-2 parameters
- Including self-monitoring parameters and system design limitation (SDL) parameters of the BWMS; BWMS approved under the 2008 G8 Guidelines were installed until Oct 2020 and not required to report any SDL parameters in the type approval

IMO INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT
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BWM.2/Circ.70
1 November 2018

**INTERNATIONAL CONVENTION FOR THE CONTROL AND MANAGEMENT OF SHIPS' BALLAST WATER AND SEDIMENTS, 2004**

**Guidance for the commissioning testing of ballast water management systems**

1 The Marine Environment Protection Committee (MEPC), at its seventy-third session (22 to 26 October 2018), approved *Guidance for the commissioning testing of ballast water management systems*, as set out in the annex.

2 Member Governments and international organizations are invited to bring the annexed Guidance to the attention of all parties concerned.

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Parallels to type approval testing—representative samples needed

# BWM.2/Circ.70 BWMS Commissioning Testing Guidance

- Approved at MEPC 75 (BWM.2/Circ.70/Rev.1)
- **One sample should be collected** (discharge)
- **Indicative analysis for D-2 parameters in largest size class (≥10 to 50 µm; ≥50 µm)**
- **Including self-monitoring parameters** and **system design limitation** parameters of the BWMS – **but minimum holding time will still be required before discharge (= no big change in the testing plans)**
- **Mandatory after June 2022**

The details on the implementation of BWM.2/Circ.70/Rev.1 depend on the flag State

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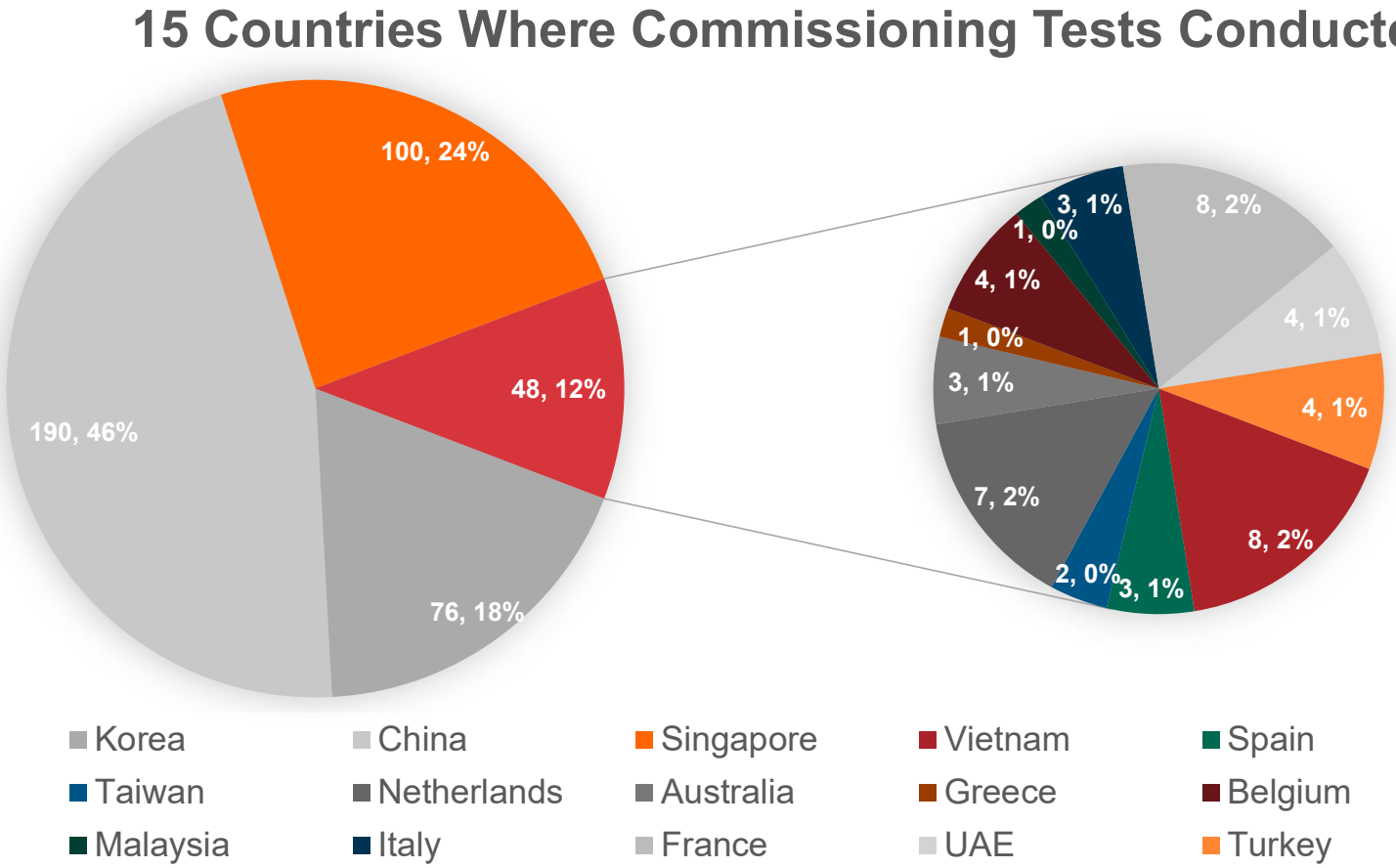
# Lessons from **414** tested BWMS from **26** manufacturers (29 March 2021)



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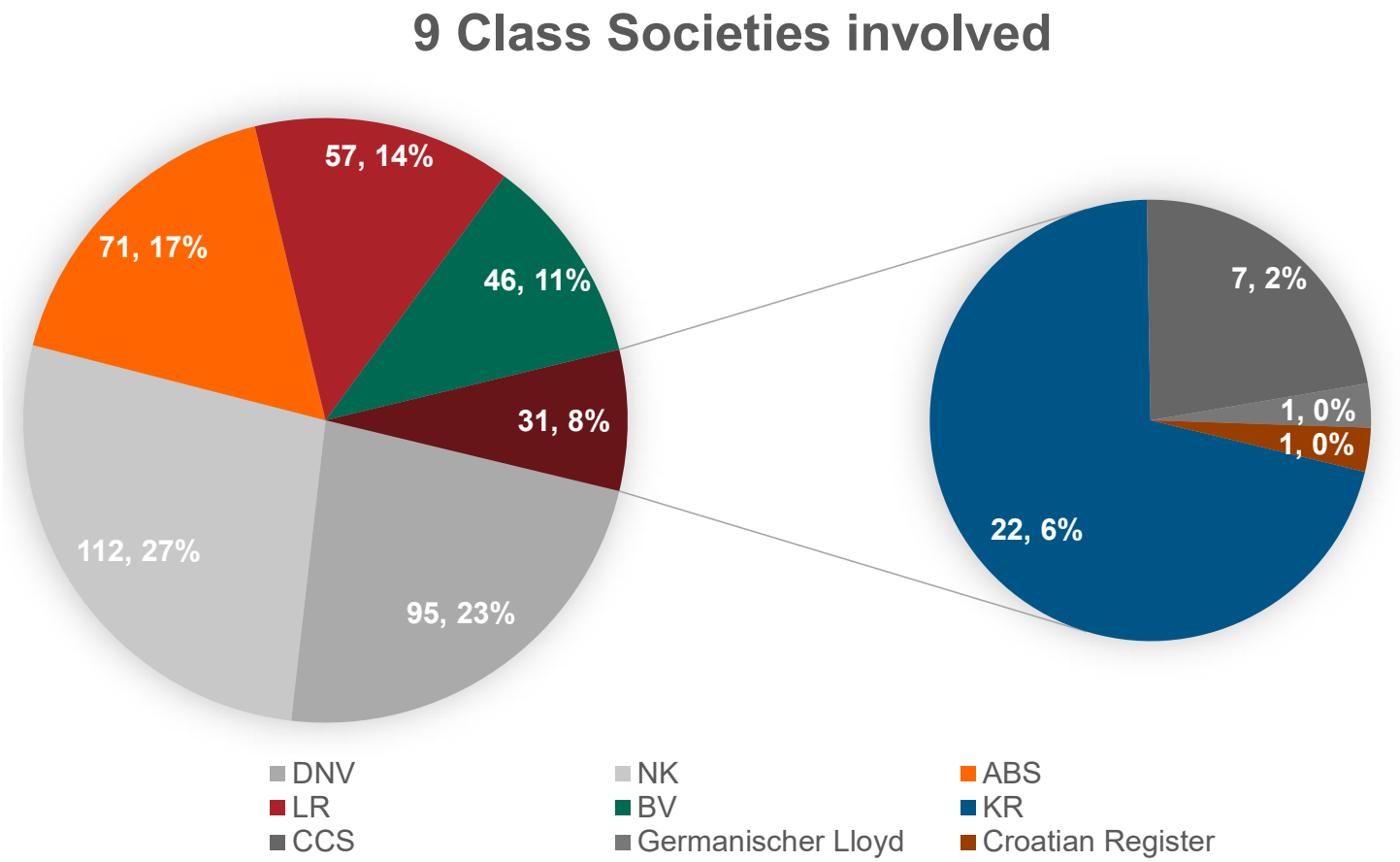

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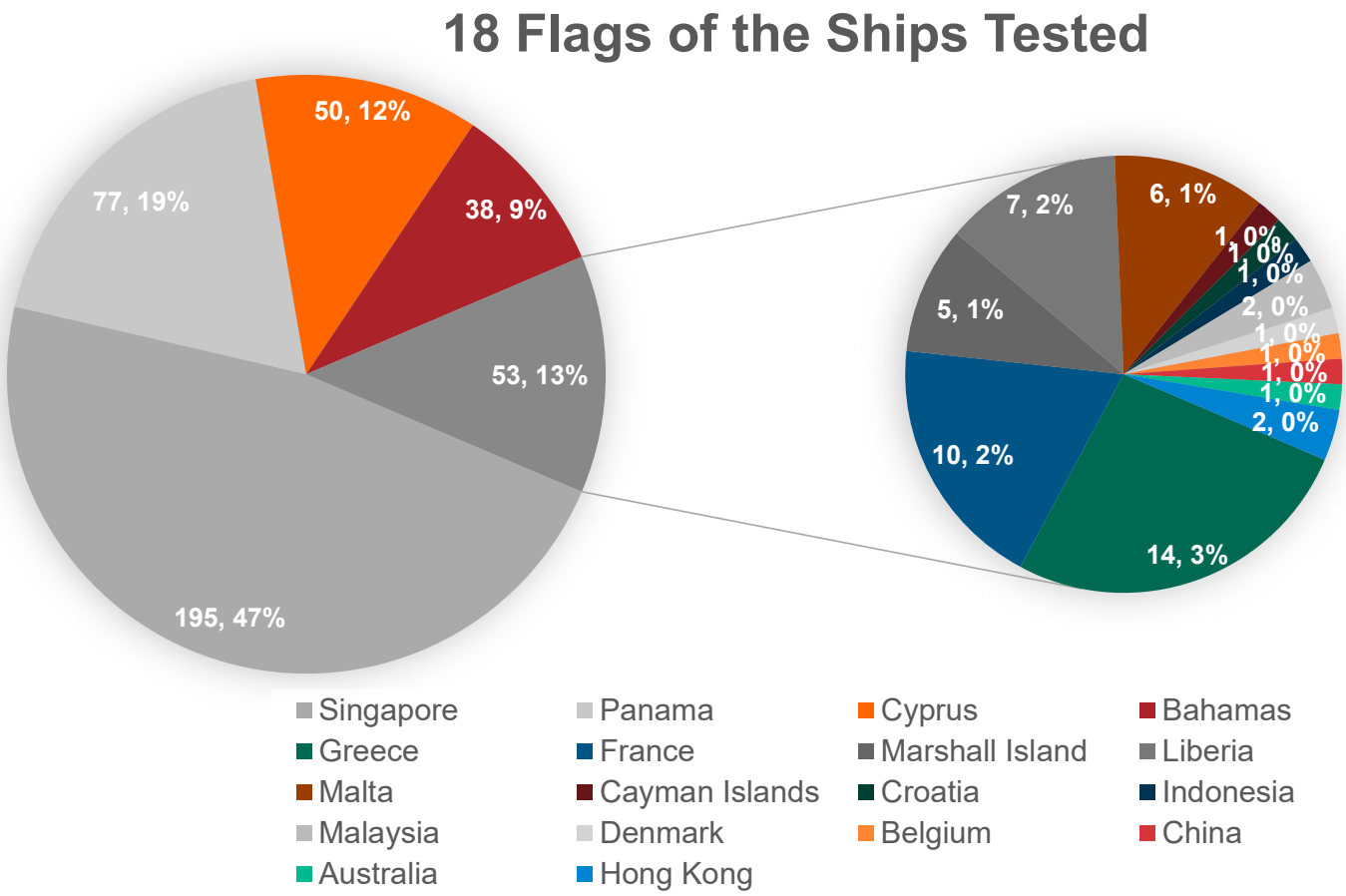


# General observations from Commissioning…

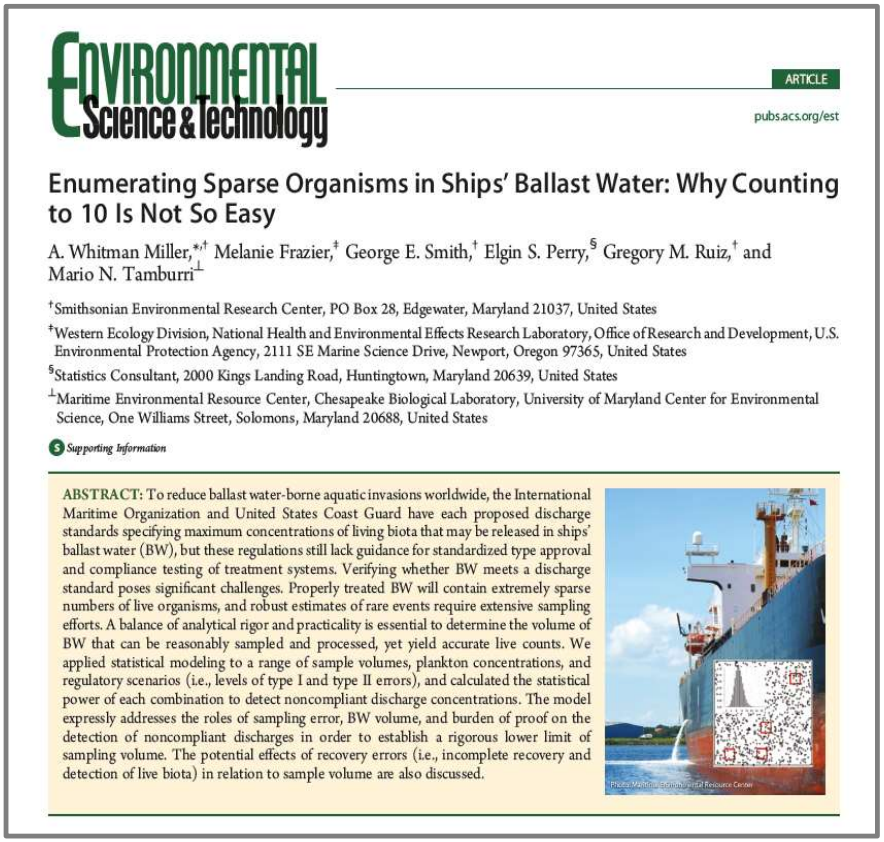
- 5 hours (smoothest tests) to 30 hours of work (1 to 3 BWMS installed with operational issues)
- Separate days (holding time, sometimes)
- 100 kg of equipment (drive or launch transfer)
- 3 inspectors (+crew)
- Laboratory testing (standard equipment)
- ***Just* D-2 sampling (discharge only)** = 3-4 h onboard (MEPC 75/INF.11)




# Presence of Class and Manufacturer during Commissioning

- Class were present to witness the tests in ~**65%** of the cases (February 2020) – They are now present in **52%** of the cases (March 2021)
- Manufacturer were present in **45%** of the cases (February 2020) – They are now present in **67%** of the tests (March 2021)

# Discharge sampling – Representative sampling



Environmental Science & Technology

ARTICLE

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## Enumerating Sparse Organisms in Ships' Ballast Water: Why Counting to 10 Is Not So Easy

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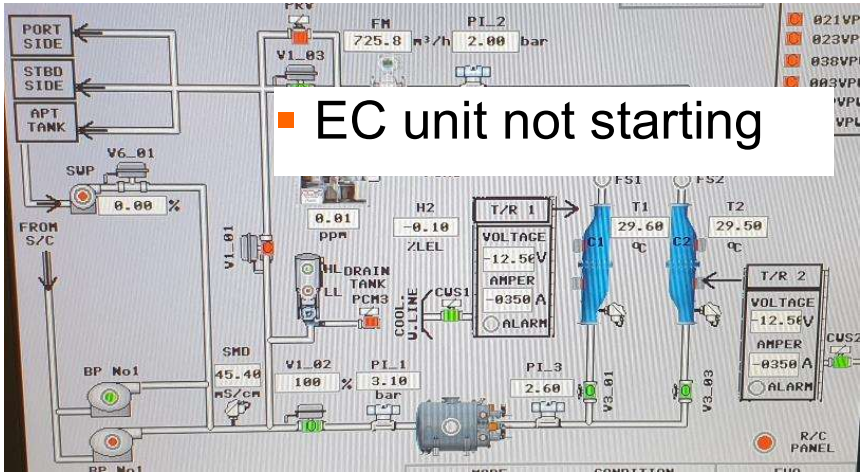
Supporting Information

**ABSTRACT:** To reduce ballast water-borne aquatic invasions worldwide, the International Maritime Organization and United States Coast Guard have each proposed discharge standards specifying maximum concentrations of living biota that may be released in ships' ballast water (BW), but these regulations still lack guidance for standardized type approval and compliance testing of treatment systems. Verifying whether BW meets a discharge standard poses significant challenges. Properly treated BW will contain extremely sparse numbers of live organisms, and robust estimates of rare events require extensive sampling efforts. A balance of analytical rigor and practicality is essential to determine the volume of BW that can be reasonably sampled and processed, yet yield accurate live counts. We applied statistical modeling to a range of sample volumes, plankton concentrations, and regulatory scenarios (i.e., levels of type I and type II errors), and calculated the statistical power of each combination to detect noncompliant discharge concentrations. The model expressly addresses the roles of sampling error, BW volume, and burden of proof on the detection of noncompliant discharges in order to establish a rigorous lower limit of sampling volume. The potential effects of recovery errors (i.e., incomplete recovery and detection of live biota) in relation to sample volume are also discussed.

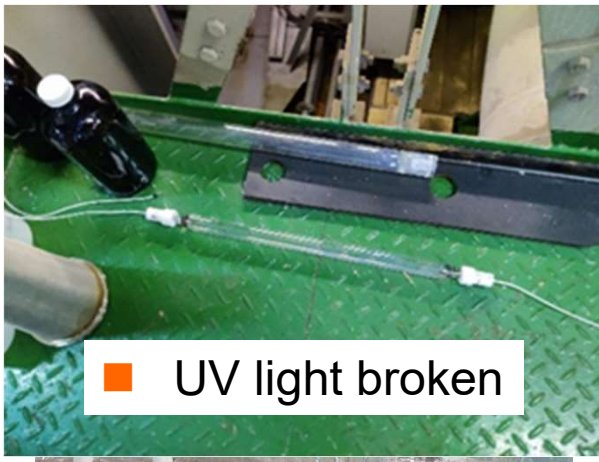
- Representative sample (3 $m^3$ according to the BWMS Code) is a goal for SGS because of:
  - Statistical robustness
  - Allows detailed analyses without having to re-sample if required (1 $m^3$ for indicative analysis, 1 $m^3$ for detailed analyses, if needed)
    - Saves money to the ship-owners
- In a few cases, it is not possible because of:
  - Sample probe size (too small) not allowing to sample fast enough
  - Time (schedule of the vessel)

# Plenty of Issues to Address

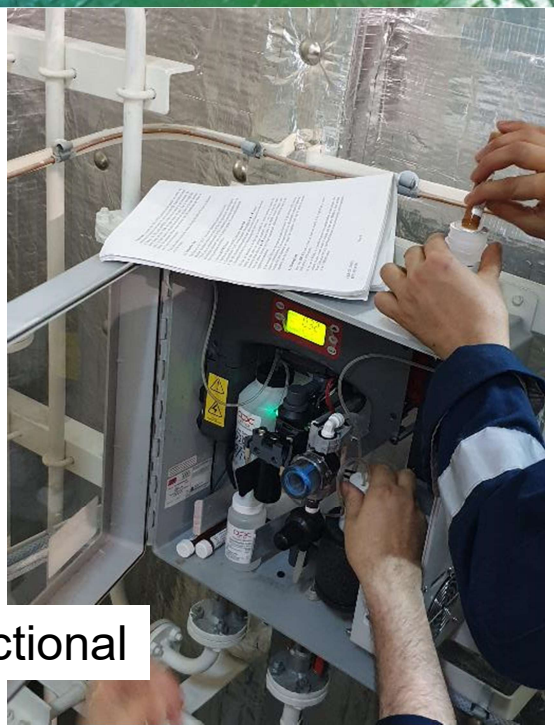

- Strainer clogged with fish school




- EC unit not starting



- UV light broken

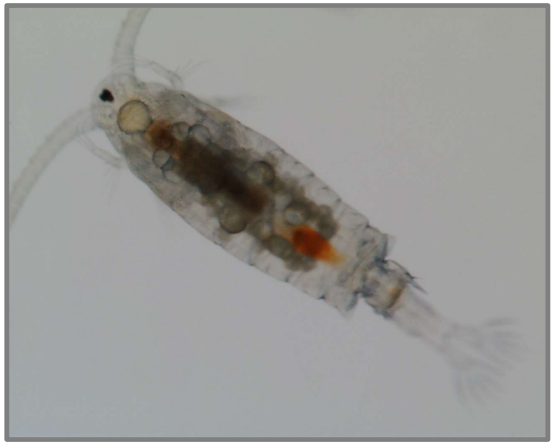


- TRO meter not functional

- Very low UV-transmittance due to sediment load (a few cases only thanks to good planning – low tide is worst…)

# Intake Sampling – Educational Aspects

- Comparision of inlet vs. discharge helps to evaluate treatment efficacy (reduction of concentration of organisms)
- The crew is given a chance to see some of the organisms that are removed, killed, or rendered harmless—this is the objective of the Convention...



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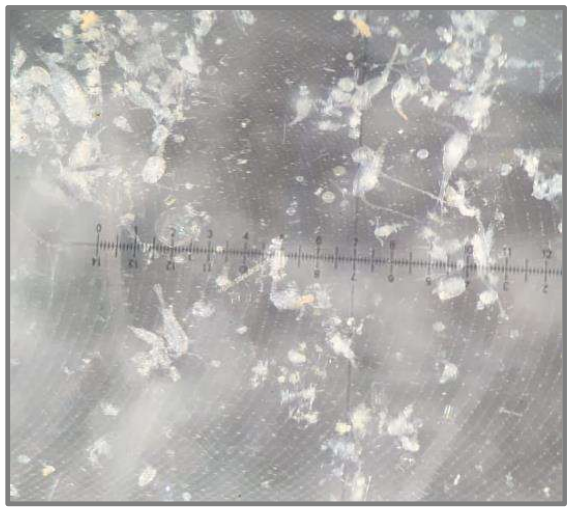
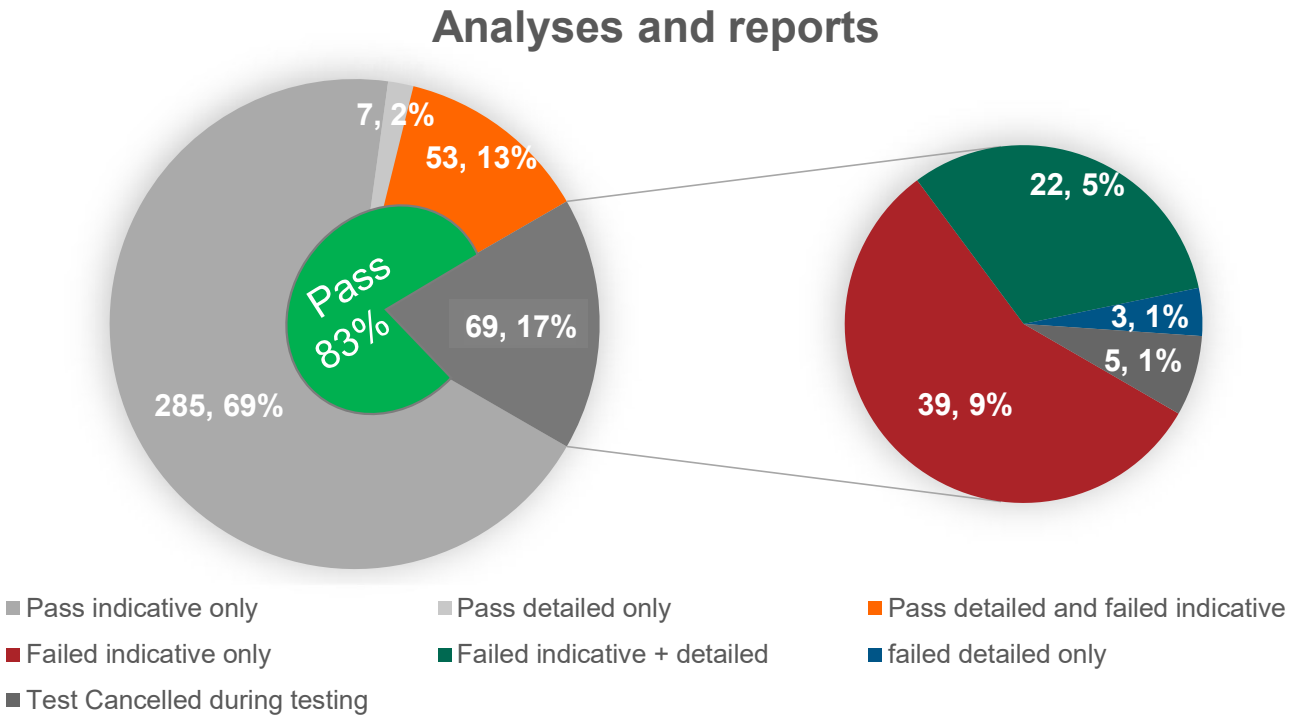
- Identification of organisms in the inlet and dicharge can help to find origin of failures
  - Types of organisms found in discharge can support explanations for failure, e.g., harpacticoid (bottom-dwelling) copepods are often found in tanks that have not been cleaned, while calanoid copepods are mainly found in treated water for which the filter may be damaged



# Results of Testing




- Detailed analyses offered to verify (or refute) adenosine triphosphate (ATP) results in case of failure; detailed analyses prevail over indicative analyses
- Non-compliances are overwhelmingly found in the largest size fraction (≥50 µm)

- Only 1% of tests failed on bacteria *without* failing as well on ≥50 µm organisms
- In nearly all cases, compliance occurred with <10 µm and ≥10 to 50 µm (5% and 2% failures rates) – when failure occurred, it was usually found in the ≥50 µm size class

# Lessons Learned—Improvement!

| | |
|---|---|
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| Proportion of Tests with Manufacturers | 67% |
| Proportion of Test with Class | 52% |

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| Proportion of Tests with Manufacturers | 67% |
| Proportion of Test with Class | 52% |
| Proportion of Installation failing commissioning (D-2) | 17% |
| Proportion Fail (≥50 µm - Indicative) | 29% |
| Proportion Fail (10-50 µm - Indicative) | 2% |
| Proportion Fail (<10 µm - Indicative) | 5% |
| Proportion of indicative Fail saved by detailed analyses (pass) | 71% |

Over time, has decreased from 24%

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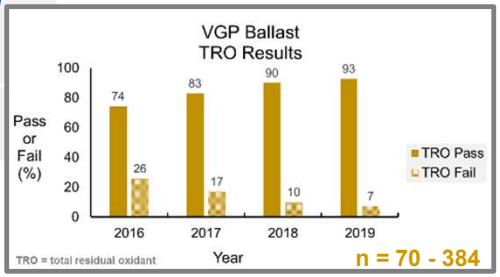
| Proportion of indicative Fail saved by detailed analyses (pass) | 71% |
| Proportion total residual oxidant (TRO) failure (neutralization issues from BWMS using active substances) | 9% |
| Test Cancelled during testing – BWMS not functional | 1% |

Similar to results from testing for EPA Vessel General Permit (VGP)



# Conclusions

- Detailed sampling and analysis can be completed with no undue delay to vessels
  - ~5 h for commissioning testing; 3-4 h for D-2 testing
    - Most of the time is to collect a representative sample
  - Informs the discussion and premise for PSC inspections
- Commissioning results show a failure rate decreasing over time to 17%
  - Nearly all failures are in the largest size class
  - Neither bacteria nor the ≥ 10 and <50 µm size class are good proxies for failures
- Analysis of the largest size class (≥50 µm) is needed to tell the full story
- Detailed analysis of the largest size class (≥50 µm) is needed to tell the full story: it refutes indicative results in 71% of cases
- Therefore, the best indicator of compliance with the D-2 standard would be to take a sample for the largest size class and a binocular microscope onboard

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WHEN YOU NEED TO BE SURE