

# Golden Bear Research Center (GBRC) Update

Pacific Ballast Working Group

April 6, 2021

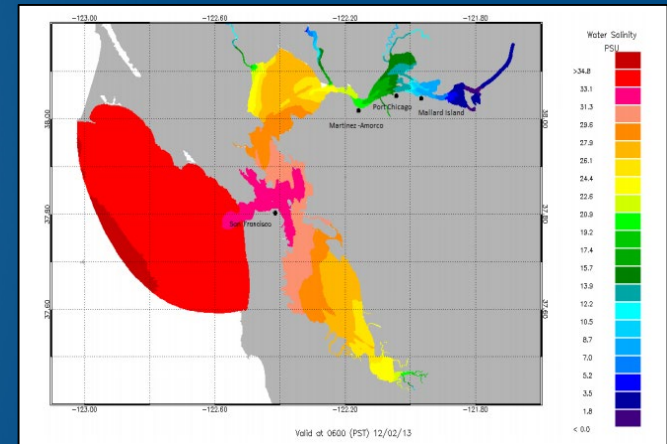
Christopher Brown

Director

Golden Bear Research Center

# Golden Bear Research Center: BWMS Land Based Testing Facility

**Objective: Provide an effective platform, for the research, development, testing and evaluation of technologies and practices that reduce marine vessel environmental impacts.**



# Golden Bear Research Center: BWMS Shipboard Based Testing Facility



## Previous Testing Locations:

Naples, Italy

Lisbon, Portugal

Azores

British Samoa

Puerto Rico

Singapore

Siam

Panama

Vancouver, Canada

Hawaii, USA



# GBRC BWMS Testing Update

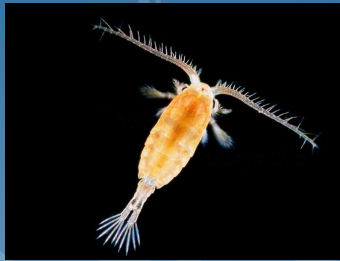


- USCG/IMO Type Approvals in 2020
  - Panasonic ATPS-BLUESys
  - Kurita BWMS
  - Ecochlor BWMS Code Approval
- One system pending with USCG
- Recently completed testing and in reporting phase for another system.



# Golden Bear Research Center: Commissioning Testing

Mobile Laboratory allows for detailed and indicative analysis.



Zooplankton  
( $\geq 50 \mu\text{m}$ )



Protists  
( $\geq 10 \mu\text{m}$  and  $< 50 \mu\text{m}$ )



# Golden Bear Research Center: Commissioning Testing

## Objective: Standardize/ Publish Methods for sample collection/analysis:

- Duration of Sample Collection: Continuous vs. Sequence
- Total Volume Sampled: 1 m<sup>3</sup> – 3 m<sup>3</sup>
- Organism Enumeration: Detailed vs. Indicative
- Analysis Time:
  - < 6 hr for ≥10 µm, <50 µm and ≥50 µm
  - <24 hr for Cholera, *E. coli*, and *Enterococcus*



## Contributing Testing Labs:

Ankron Water Services GmbH

DHI

Golden Bear Research Center

KOMERI (Korea Marine Equipment  
Research Institute)

MEA-nl

PML Applications

SGS



# Recent/Future Projects



- ISO TC8/WG12
  - TRO Monitor performance testing
  - Collection, handling, and analysis of ballast water samples
  - CMD verification testing
- Board of Directors/Steering Committee of Global TestNet
- Waste heat recovery technology
- Commissioning/compliance testing
- Decarbonization
- Sampling of discharging vessels in CA (CSLC)
- Compliance Sample Tool (Glosten/CSLC)
- BWE+BWT (CSLC)



Glosten



California  
STATE LANDS  
Commission



CAL MARITIME

# Compliance Sampling Rig



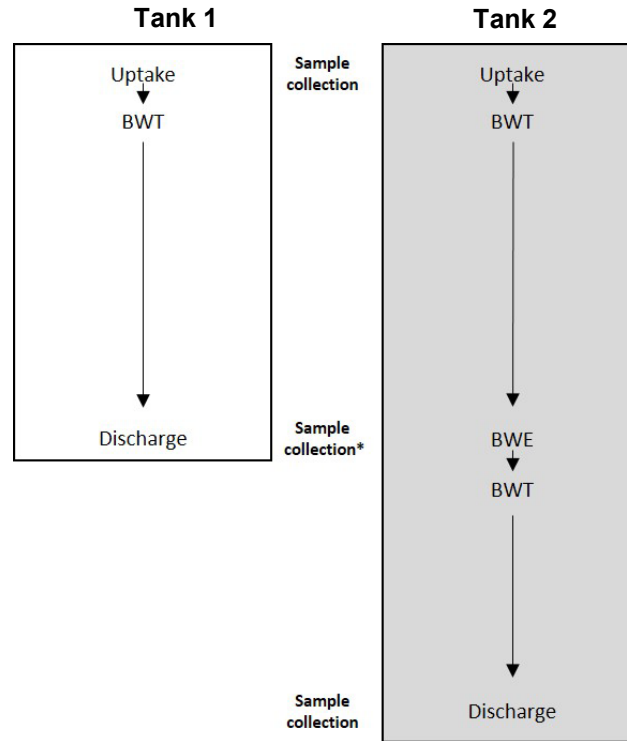


# *T.S. Golden Bear* Training Cruise BWE+BWT

- Water sourced in the Port of Long Beach, CA USA
- Treated via filtration and electrochlorination
- Sequential BWE performed ~150 NM off the coast of Mexico
- Exchanged water treated and discharged after the equivalent holding time
- Organism enumerations conducted as per shipboard type approval testing protocols



# *T.S. Golden Bear* Training Cruise BWE+BWT



## ***T.S. Golden Bear Training Cruise BWE+BWT***

Trial	Event	Organisms ≥50 µm/m <sup>3</sup>		Organisms ≥10 & <50 µm/mL		Enterococcus (MPN cells/ 100mL)		Heterotrophic Plate Count (CFU/mL)	
		mean	% change	mean	% change	mean	% change	mean	% change
BWT Alone	Uptake	4.8E+05	n/a	228	n/a	89	n/a	11767	n/a
	Treated Discharge	0.18	-99.9998	0.17	-99.6	1.3	-98.5	156	-98.7
BWT + BWE	Uptake	5.6E+05	n/a	266	n/a	333	n/a	8817	n/a
	BWE "Discharge"	0.22	-99.9998	0.17	-99.6	3.8	-98.9	1721	-80.5
	BWE Uptake	3,232	1.50E+06	160	1.60E+05	6.0	57.9	2321	34.9
	Treated Discharge	0.20	-99.97	0.17	-99.4	4.5	-25.0	725	-68.8



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# *T.S. Golden Bear* Training Cruise BWE+BWT

- While our study found no difference in the efficacy of BWT vs BWE+BWT, more studies are needed covering various salinities with different BWMS treatments
- A type-approved system that is correctly operated within its SDL should offer adequate protection from potential AIS introductions, especially in marine waters
- BWE+BWT can be a beneficial contingency measure when dealing with water quality challenges or BWMS performance issues
- Future regulations of BWE+BWT will need to weigh the potential increase in protection from AIS with vessel/crew safety considerations and the potential increase in emissions and energy/fuel consumption



# Thank you!

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