Ballast Water Management
Regulations and Challenges

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IMarEST, Ballast Water Experts Group
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The Issue – Aquatic Invasive Species in Ships’ BW

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The Issue

Transfer of invasive species by ships’ ballast water
The Issue

Studies show that the rate of introduction of invasive species associated with ships’ ballast water is rising faster and faster.

- Larger and faster ships
- Expansion of ports in new locations.

Increasing number of non-indigenous species in coastal regions

![Graph showing increasing number of invasions over time](chart)

Source: IMO GloBallast

[![Shrimp](shrimp.png)](shrimp.png)
[![Fish](fish.png)](fish.png)
[![Other marine life](other_marine_life.png)](other_marine_life.png)
[![Mitton Crab](mitton_crab.png)](mitton_crab.png)
Compare Impact Over Time

Oil Pollution vs Marine Bio-Invasions

Source: IMO GloBallast Program

Chart showing the impact of oil pollution and marine bio-invasions over time.
IMO BWM Convention

• In February 2004, IMO adopted the International Convention for the Control and Management of Ships’ Ballast Water and Sediments (BWMC).

• BWMC sets a framework for national governments to implement new legislation.

• Entry into force of this Convention → Needs 30 countries and 35% of World Gross Tonnage. Full ratification is expected in 2014. The BWMC comes into force 12 months later.

• Shipping companies that must comply with the convention are encouraged by IMO, ICS and others to begin now to install Type Approved Ballast Water Treatment Systems (BWTS) on their ships.
### Existing Vessels

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<tbody>
<tr>
<td>&lt; 1500 OR &gt; 5000</td>
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### New Vessels

<table>
<thead>
<tr>
<th>BW Cap. (m³)</th>
<th>BUILD YEAR</th>
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<tbody>
<tr>
<td>&gt; 5000</td>
<td>2009 - 2011</td>
</tr>
<tr>
<td>&gt; 5000 m³</td>
<td>2012 →</td>
</tr>
<tr>
<td>&lt; 5000 m³</td>
<td>2009 → *)</td>
</tr>
<tr>
<td>&lt; 5000 m³</td>
<td>2010 → **)</td>
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</table>

A = shall comply, NOT later than the first intermediate or renewal survey, whichever occurs first, after the anniversary date in the year of compliance with the D-2 standard.

*) MEPC.57 postponed requirement to second annual survey or latest by the end of 2011.

**) MEPC.59 recommends to Administrations to start fitting ships with BWMS technology.
There are now 38 contracting parties (only 30 are required), however they represent only 30.38% of the world’s tonnage. 35% is needed for the BWMC to enter into force.

Full ratification is expected during this year. The Convention will come into force 12 months after full ratification.

All new buildings with keels laid after the date the Convention comes into force must have a type approved system installed and operating when the ship is delivered.
Regional Enforcement

Some Countries have Implemented National Regulations Related to BWM Prior to the BWMC Coming Into Force:

- Australia
- Brazil
- Canada
- Norway
- Israel
- ROPME SEA AREA
- Ukraine
- USA – USCG and US EPA
  USA individual States, Great Lakes
Ballast Water Treatment Solutions

Two main technical approaches:

• A Chemical-based Solution using Active Substance.
  – Approval according to IMO Resolution MEPC 126(53). Basic and Final Approval according to (G9) and then testing and Type Approval according to (G8)

• A Chemical-Free System Solution using no Active Substance.
  – Basic and Final (G9) not required. Testing and Type Approval and according to (G8) and IMO Resolution MEPC 125(53)
Ballast Water Treatment Solutions
Most BWM Solutions include two stage process:

Stage 1) Physical Liquid-Solid Separation. To reduce sediment and remove larger organisms. (screen filter, disk filter) *Important to note that even chemical-based treatment options need this first stage, due to the organisms’ natural defenses!*

Stage 2) Disinfection. To kill or inactivate the smaller organisms:
  – **Physical** (UV, cavitation, deoxygenation, etc.)
  – **Chemical** (AOT, chlorine, Ozone, Chlorine Dioxide, etc.)
Ballast Water Treatment Solutions

During Ballasting

Typical Filtration and UV Disinfection Treatment System that works during both ballasting and de-ballasting operations.

During De-Ballast
BWM Challenges

- Enforcement & Compliance
- Selection, Installation, Operation & Technology
Compliance Testing Issues

- Certification (G8 performance) testing = 'blue-print' for compliance testing.
- Differences in worldwide interpretation of the BWM standard.
- Article 7 of the Convention states that survey and certification “shall not cause undue delay to the ship” as a result of the application of an extended survey.
- Therefore, compliance procedures must follow a recognizable common standard with an expected time scale.
Enforcement & Compliance

Port State Control Challenges

An estimated 70,000 Ships to be regulated.

<table>
<thead>
<tr>
<th>Sub Type</th>
<th>Count</th>
<th>Ballast Capacity of &lt;1500m³</th>
<th>Ballast Capacity of 1500-5000m³</th>
<th>Ballast Capacity of &gt;5000m³</th>
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<tbody>
<tr>
<td>Barges</td>
<td>574</td>
<td>0</td>
<td>0</td>
<td>574</td>
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<td>Bulk Carriers</td>
<td>8,110</td>
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<td>0</td>
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<td>Crude Oil Tanker</td>
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<tr>
<td>Chemical/Oil Products Tanker</td>
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<td>9,323</td>
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<tr>
<td>General Cargo Ship</td>
<td>18,187</td>
<td>0</td>
<td>16,535</td>
<td>1,652</td>
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<td>Fishing Vessels</td>
<td>8,001</td>
<td>7,970</td>
<td>30</td>
<td>1</td>
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<td>LNG Tanker</td>
<td>327</td>
<td>0</td>
<td>0</td>
<td>327</td>
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<tr>
<td>LPG Tanker</td>
<td>1,194</td>
<td>540</td>
<td>0</td>
<td>654</td>
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<td>OSVs</td>
<td>2,000</td>
<td>1,923</td>
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<td>77</td>
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<tr>
<td>Passenger (Cruise) Ship</td>
<td>515</td>
<td>0</td>
<td>479</td>
<td>36</td>
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<td>Passenger-Passenger/Cargo (Ro-Ro)</td>
<td>3,359</td>
<td>3,324</td>
<td>35</td>
<td>0</td>
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<tr>
<td>Passenger Ship</td>
<td>2,942</td>
<td>2,941</td>
<td>1</td>
<td>0</td>
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<tr>
<td>Refrigerated Cargo Ship</td>
<td>2,542</td>
<td>0</td>
<td>2,538</td>
<td>4</td>
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<tr>
<td>Ro-Ro Cargo Ship</td>
<td>1,873</td>
<td>0</td>
<td>1,700</td>
<td>173</td>
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<td>Livestock Carrier</td>
<td>101</td>
<td>0</td>
<td>90</td>
<td>11</td>
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<td>Vehicle Carrier</td>
<td>784</td>
<td>0</td>
<td>196</td>
<td>588</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>68,190</strong></td>
<td><strong>16,698</strong></td>
<td><strong>21,604</strong></td>
<td><strong>29,888</strong></td>
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</table>

Commercial vessels requiring on-board BWTS before 2020

(King et al. Preview of Global Ballast Water Treatment Markets)
Enforcement & Compliance

• **Logistical Challenges** - two examples:

  – **USA** has 49 major ports and hundreds of smaller ports, separated by hundreds or thousands of miles.

  – **Singapore** has a single port receiving > 70,000 commercial vessels/year = average >190 vessels per day. Average turnaround time for ships in Singapore is between 6-8 hours.

• **Sampling and Analytical Challenges.**

  – Large volume of water needed for statistically representative sample. Strict enforcement would require testing each ship each time it discharges ballast water.
A **Tiered approach** is recommended:

- A series of steps that increase the likelihood of detecting non-compliance, but still involve an increase in required resources and in logistical challenges.

- Such a strategy would identify the most obvious cases of non-compliance, based on the rationale that it is much easier and cheaper to detect clear non-compliance than it is to identify full compliance.

  - Self monitoring and reporting
  - Risk assessments
  - Inspections of operation and records
  - Occasional spot checks
  - Full testing only for historical offenders
BWM Challenges

Enforcement & Compliance
Selection, Installation, Operation & Technology
Equipment Selection Challenges

• Established technology supplier with strong financial position and commitment to the maritime market.

• Proven reliability on board ships.

• “High Value” test results and Type Approvals.

• Suitability for use with existing ballast pumps, piping and tank coatings.

• Design for Adaptability – Modular Components – Installation Flexibility
Installation Challenges

• Power Consumption of the BWMS?
• Available space for Equipment?
• What will be the optimal BW piping arrangement?
• Access to get the BWMS into the machinery space?
• Integrate the BWMS into the ballast control system?
• If chemicals are required, where will they be stored?
Installation Challenges

• How/where will systems be installed (i.e., dry dock, in water, during a voyage)?
• How long will installation take?
• How much manpower?
Installation Challenges

Retrofit Projects
Installation Challenges

Shipyards – New Build Projects

300m³/hr Hyde GUARDIAN system Installed on “Piana” a La Meridionale Ferry

Engineering, Planning & Installation by Brodosplit Shipyard.
Installation Challenges

**Shipyards – New Build Projects**

Retrofitting to tankers presents a much more difficult challenge and requires careful planning, increased modularity, and engineering flexibility.

2 x 2500 m3/hr Hyde GUARDIAN system
Installed on Suezmax Crude Oil Tanker
Engineering, Planning & Installation by Hyde and DSME.
BWM Challenges

Enforcement & Compliance
Selection, Installation, Operation & Technology
OPERATIONAL CHALLENGES

• What is the operating cost (OPEX) of the BWMS?

• Does the BWT affect vessel operation & turn-around time?

• Maintenance intervals and downtime?

• Any specialized training of crew and officers?

• Does the system operate in all water salinity?
  – Need to carry sea water or brine?

• If chemical, what safety and logistical considerations to purchase, transport, handle and store chemicals?

• How to ensure active substance is fully neutralized and no chemical is discharged?
Some Remaining Technological Challenges

- **Ballast tank stripping** Ensuring that all water discharged is treated to the highest degree possible.

- **System performance under extreme natural conditions**
  - Filter self cleaning under high sediment and biological loading.
  - Reliability of treatment system when water characteristics or environmental conditions reduce the effectiveness of a process (e.g., turbidity, sediment, temperature, salinity, UV transmission, high organism density, others)
  - *It’s best practice to avoid these conditions* or otherwise adjust vessel operation?
Remaining Technological Challenges

- **On-line monitoring of BWT**  BWT systems currently monitor engineering parameters. Need to consider future requirements for system performance discharge monitoring and reporting to Port State Control.

- **Supportability of BWT components** and software for the life of the vessel.

- **Logistics**  Consumables, on-board & emergency spares, on-site service support and 24 hour telephone support for troubleshooting.

- **Training**  High quality documentation and on-line training for crewmembers on proper operation, maintenance and routine repairs to the system if needed over the life of the vessel.
Remaining Technological Challenges

• Availability of qualified Marine Engineers/Microscopists
  – It is highly unlikely that BWMS suppliers have in-house capacity for the volume of engineering that is needed during the retrofit period. It is even more unlikely there are enough microscopists to check for compliance.
Challenges, challenges, challenges...