Bilge water emissions in the Baltic Sea

Results from BONUS ZEB
Bilge water

- From machinery spaces, leaking pipes, weather deck, never from cargo and separated from ballast
- Discharge allowed if ship is ‘en route’ and oil content is less than 15 ppm
- On board treatment obligatory
- Composition varies between ships and on the same ship
- Baltic Sea is a Particularly Sensitive Sea Area (PSSA); special area in MARPOL Annex I
Modelling of concentrations of bilge water oil in shipping lanes

Field concentrations of oil were estimated from:

- Measured oil concentration in treated bilge water (average 7 ships)
- Estimate total volumes discharged from single ships, produce emission factors
- Geographical distribution of discharge, from the STEAM model (average values for winter/spring and summer/autumn)
- Modelling from discharge rates and literature data on half-life for oil (a slow and a fast scenario, each with slower half-life in winter than in summer)
- The discharged water was presumed to be mixed down to 12m depth and no horizontal distribution was included.
Chemical content in treated bilge water from 7 ships

Oil content in bilge water from each of the ships:

<table>
<thead>
<tr>
<th>Oil index (mg·L⁻¹)</th>
<th>Ship A</th>
<th>Ship B</th>
<th>Ship C</th>
<th>Ship D</th>
<th>Ship E</th>
<th>Ship F</th>
<th>Ship G</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0</td>
<td>1.1</td>
<td>5.5</td>
<td>3.8</td>
<td>69.3</td>
<td>5.0</td>
<td>0.4</td>
<td>12.3</td>
</tr>
</tbody>
</table>
In one ship PAH, dominated by naphthalene, made up 10% of the oil content.
Modelled with STEAM by Finnish Meteorological Institute 2016
Study areas for risk assessment

Two regions with intense shipping were selected; the Hanö Bight (A, C), and the Gulf of Finland (B, D).
Modelling of concentrations of bilge water oil in shipping lanes

<table>
<thead>
<tr>
<th>Scenario A: slow oil half-life</th>
<th>Scenario B: rapid oil half-life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter/spring</td>
<td>Summer/autumn</td>
</tr>
<tr>
<td>60 days</td>
<td>20 days</td>
</tr>
</tbody>
</table>

- The model gives a peak in oil concentration at the end of winter/spring.
- Range of a few nanograms per litre
Toxicity of bilge water oil

Estimated concentrations of bilge water oil compared to oil concentrations shown to cause reduced fertility in zooplankton and harmful effects on cod larvae:

- **Slow degradation scenario:**
  Estimated concentrations were 0.1-0.05‰ of literature data on toxic concentrations.

- **Rapid degradation scenario:**
  Estimated concentrations were 0.01 – 0.03‰ of literature data on toxic concentrations.


Uncertainties

- Assumptions, e.g. small continuous discharge
- Amounts produced on different ships
- Test fluids and meters
- Representative samples?
  - example: 1 ship of 8000 kW spending 1 year in the Baltic Sea and discharge untreated bilge water of 100 ppm will release 35 kg of oil. Should all ships do that the total amount of discharged oil would be 50 tonnes
- ...

...
Risk of bilge water to Baltic marine ecosystems

Estimated concentrations of oil and metals from bilge water in the Baltic Sea area are low compared to concentrations with documented toxic effect to marine biota.

However, available toxicity data are generally based on short term exposure. Information on effects caused by small but chronically elevated pollutants concentrations from bilge water discharge and other activities related to shipping is very limited.
Thank you!

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Read more:


– Tiselius and Magnusson, 2016, Toxicity of treated bilge water to plankton: effects on copepod feeding, reproduction and mortality and on Microtox assays, Marine Pollution bulletin