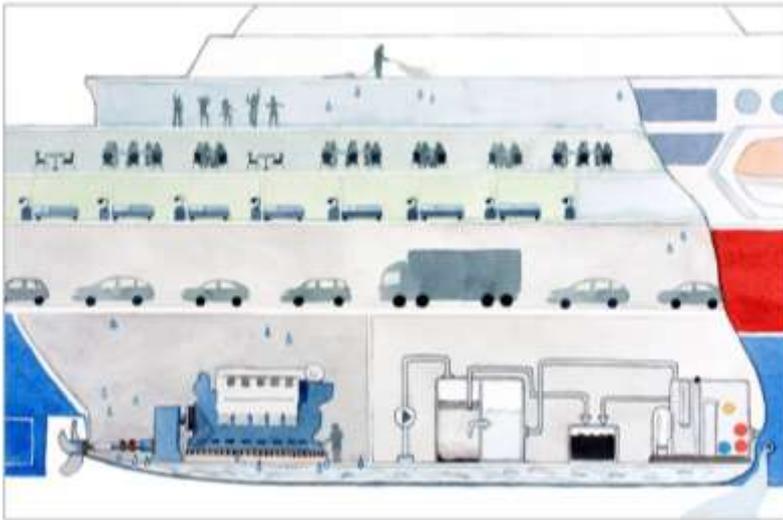


Bilge water emissions in the Baltic Sea

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 Particular Sensitive Sea Area (PSSA); special area in MARPOL Annex I

Modelling of concentrations of bilge water oil in shipping lanes

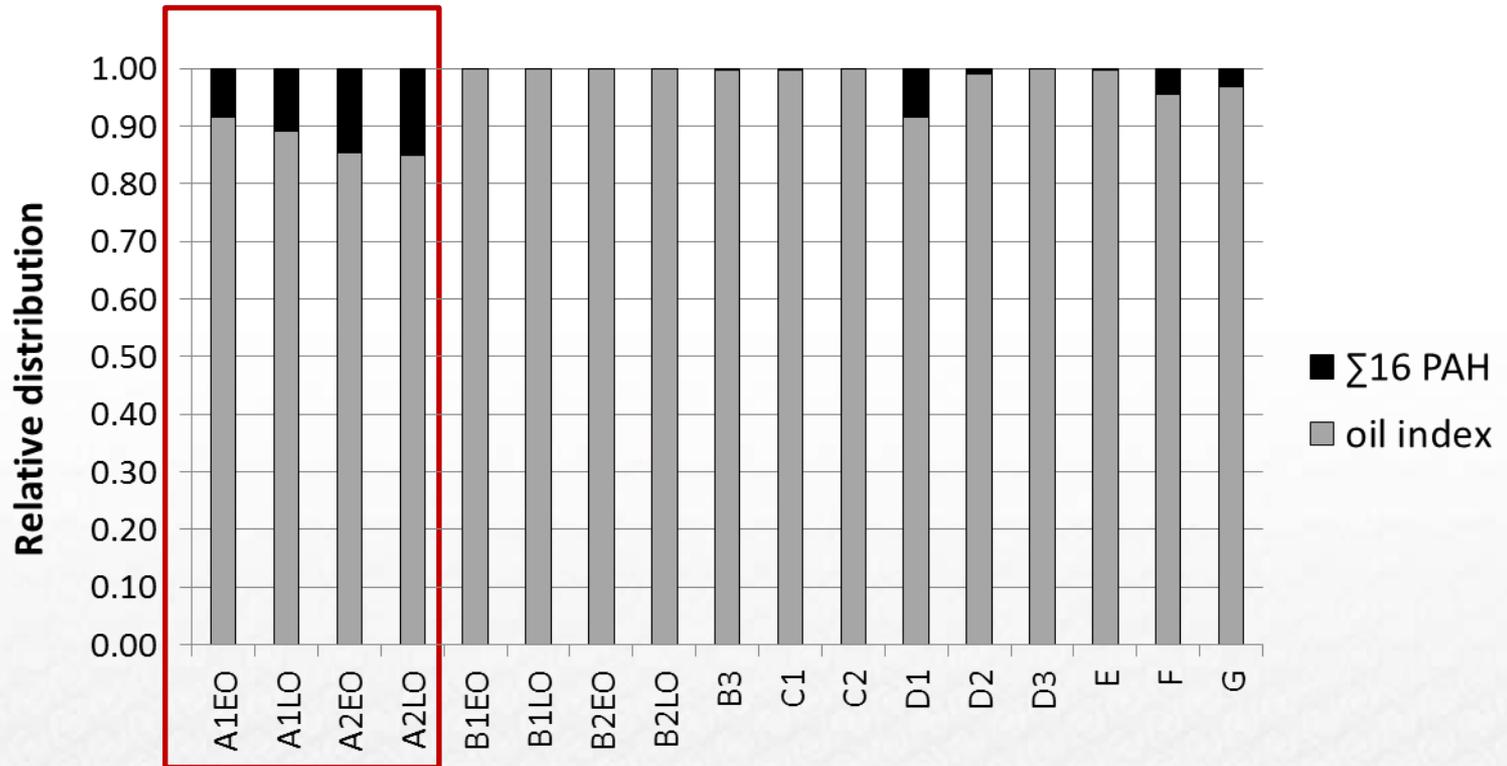
- ➔ Field concentrations of oil were estimated from:
 - Measured oil concentration in treated bilge water (average 7 ships)
 - Estimate total volumes discharged from single ships, produce emission factors
 - Geographical distribution of discharge, from the STEAM model (*average values for winter/spring 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

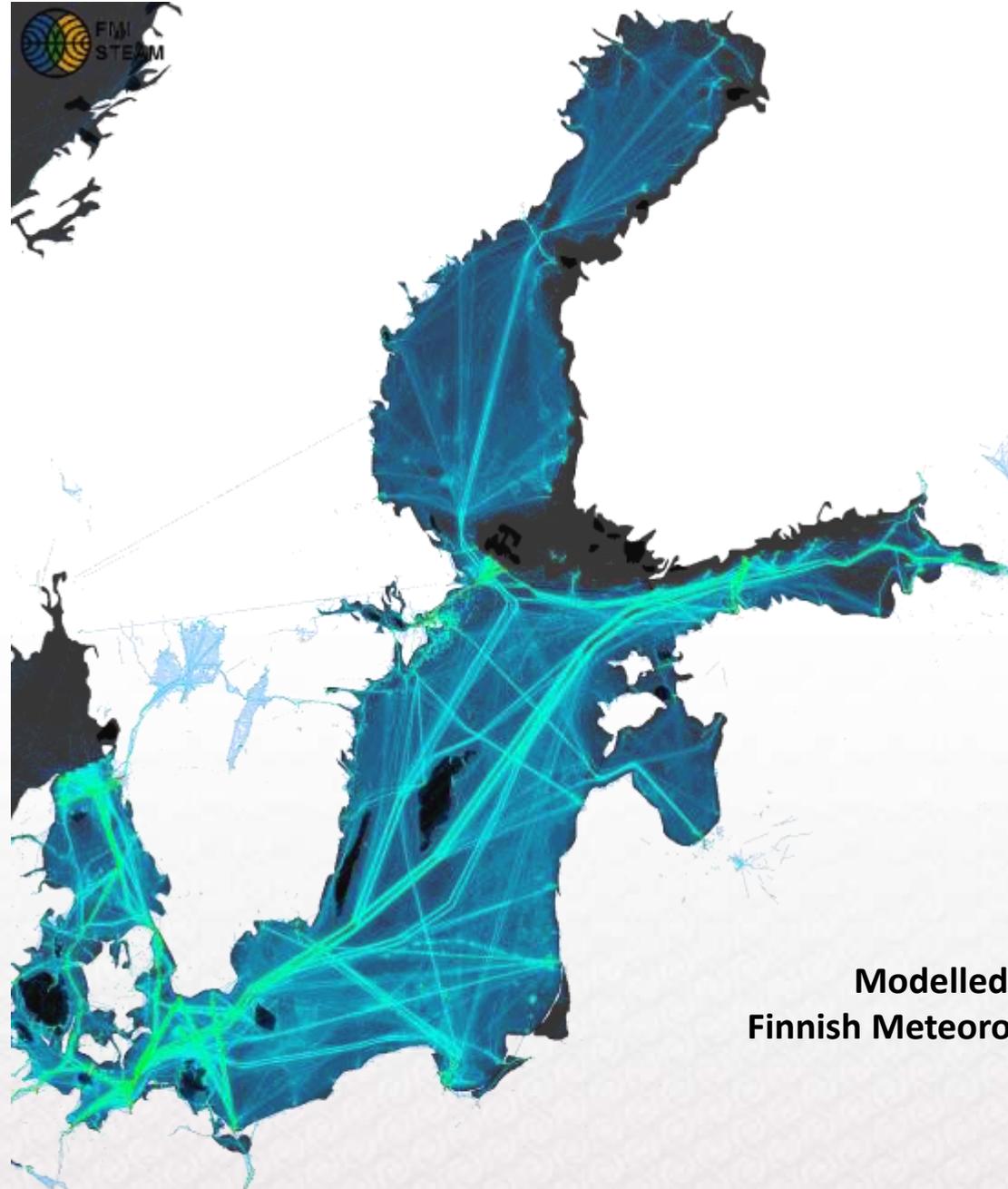
Oil content in bilge water from each of the ships:

	Ship A	Ship B	Ship C	Ship D	Ship E	Ship F	Ship G	Mean
Oil index (mg·L ⁻¹)	1.0	1.1	5.5	3.8	69.3	5.0	0.4	12.3

PAH content in relation to total oil content in treated bilge water



- ➔ In one ship PAH, dominated by naphthalene, made up 10% of the oil content



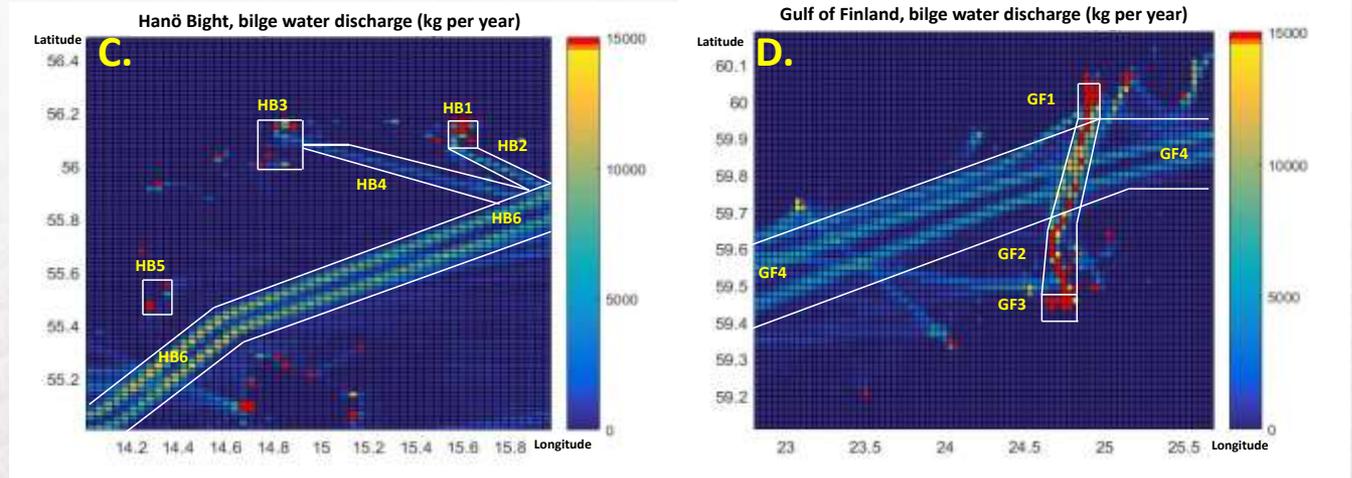
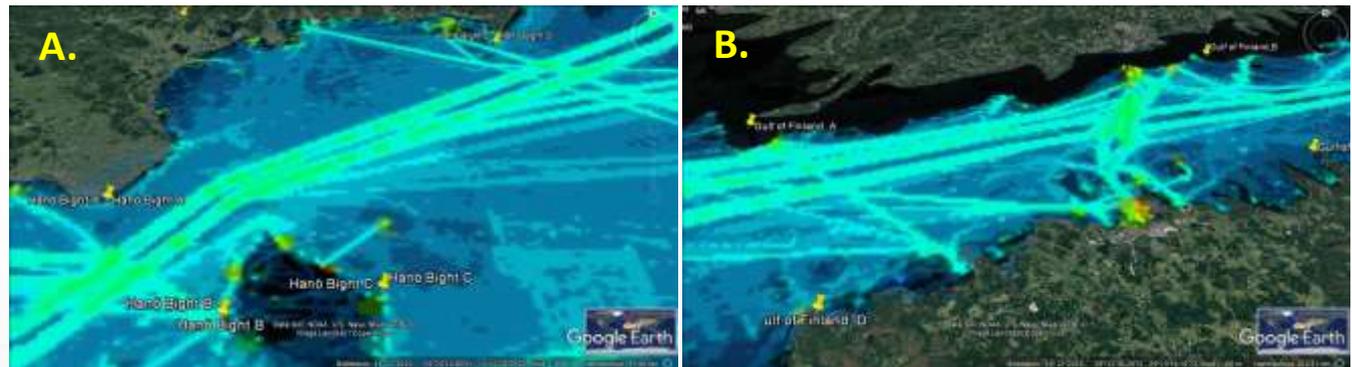
Modelled with STEAM by
Finnish Meteorological Institute
2016

Bilge water discharge [l/cell] Cell area at center: 0.99km²



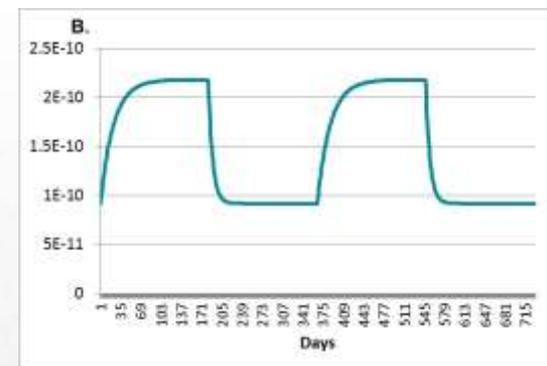
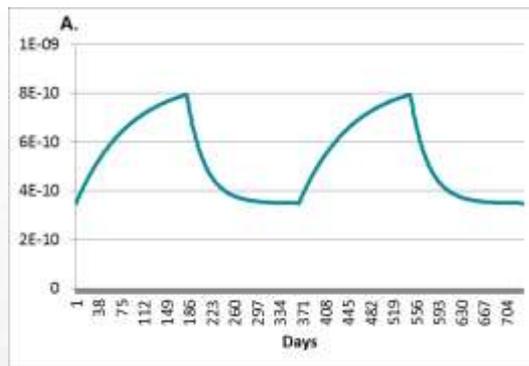
Study areas for risk assessment

- ➔ 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

Scenario A: slow oil half-life		Scenario B: rapid oil half-life	
Winter/spring	Summer/autumn	Winter/spring	Summer/autumn
60 days	20 days	15 days	5 days



- ➔ 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.



Cowles, T.J., Remillard, J.F., 1983
Mar. Biol. 78, 45–51.



Nahrgang, J., Dubourg, P., et al. 2016
Environ. Pollut. 218, 605–614.

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:

- Kerstin Magnusson, Jukka-Pekka Jalkanen, Lasse Johansson, Vytautas Smailys, Paul Telemo, Hulda Winnes, **Risk assessment of bilge water discharges in two Baltic shipping lanes**, Marine Pollution Bulletin, Article in press.
- 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

