

On scrubbers' impact on the marine environment

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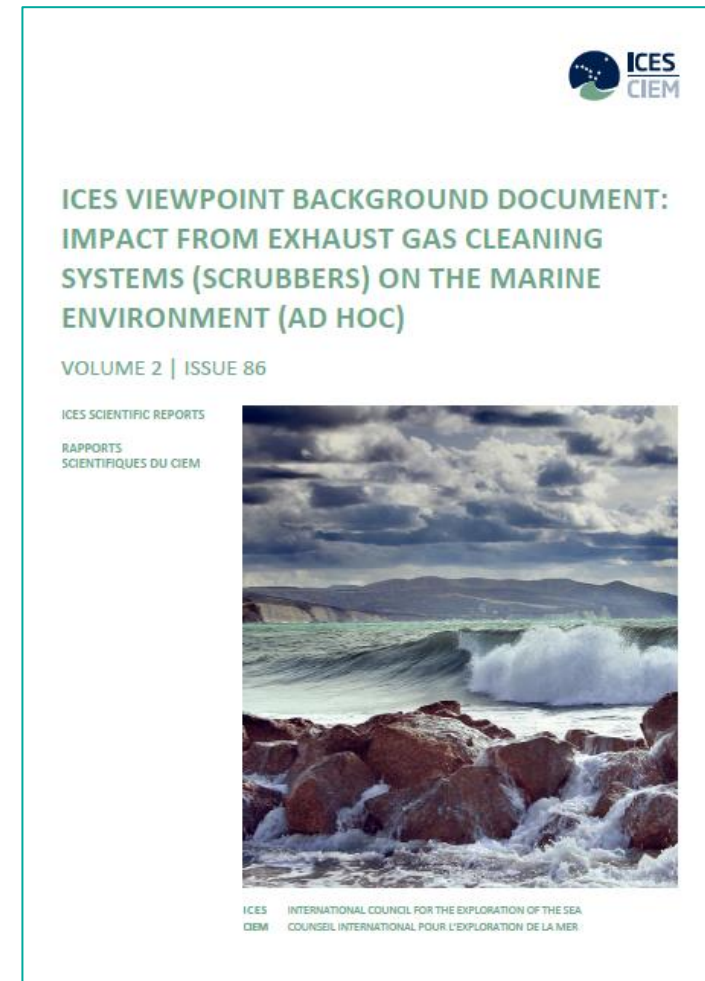
Maritime Environmental Science scrubber team:
Assoc prof. Erik Ytreberg, PhD student Anna Lunde Hermansson,
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Webinar

Scrubbers: A False Solution to the IMO's Sulphur Cap
Tuesday 6 December 2022

Acknowledgement

- ICES Viewpoint background document: Impact from exhaust gas cleaning systems (scrubbers) on the marine environment (Ad hoc)
- Evaluation, control and Mitigation of the EnviRonmental impacts of shippinG Emissions (EU H2020 EMERGE)



Take home message

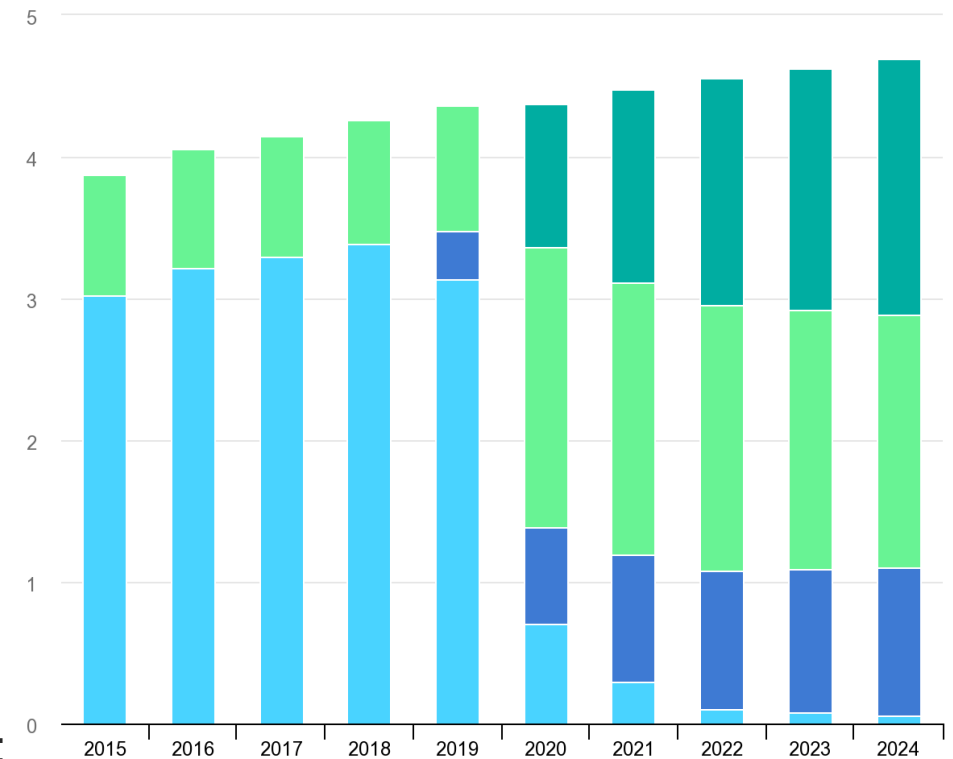
Background: Our oceans and the marine environment are under heavy pressure from anthropogenic activities

- Scrubbers account for a large share of contaminant, metals and organic compounds, input to the marine environment
- Scrubber water is highly toxic to marine organisms, also at very low concentration (0.001%)
- Scrubbers represent a technology that is possible to manage, to reduce negative impact on the marine environment

Scrubber stats in short

- Exhaust gas cleaning technology to reduce emissions to air allowing for continued use of fossil heavy fuel oil
- ~ 4500 ships globally
- ~ 25% of the global fleet fuel consumption
- Pay-back time for a scrubber installation depend on fuel price differences. Can be as low as 6 months (using online calculation tool at www.langtech.com).

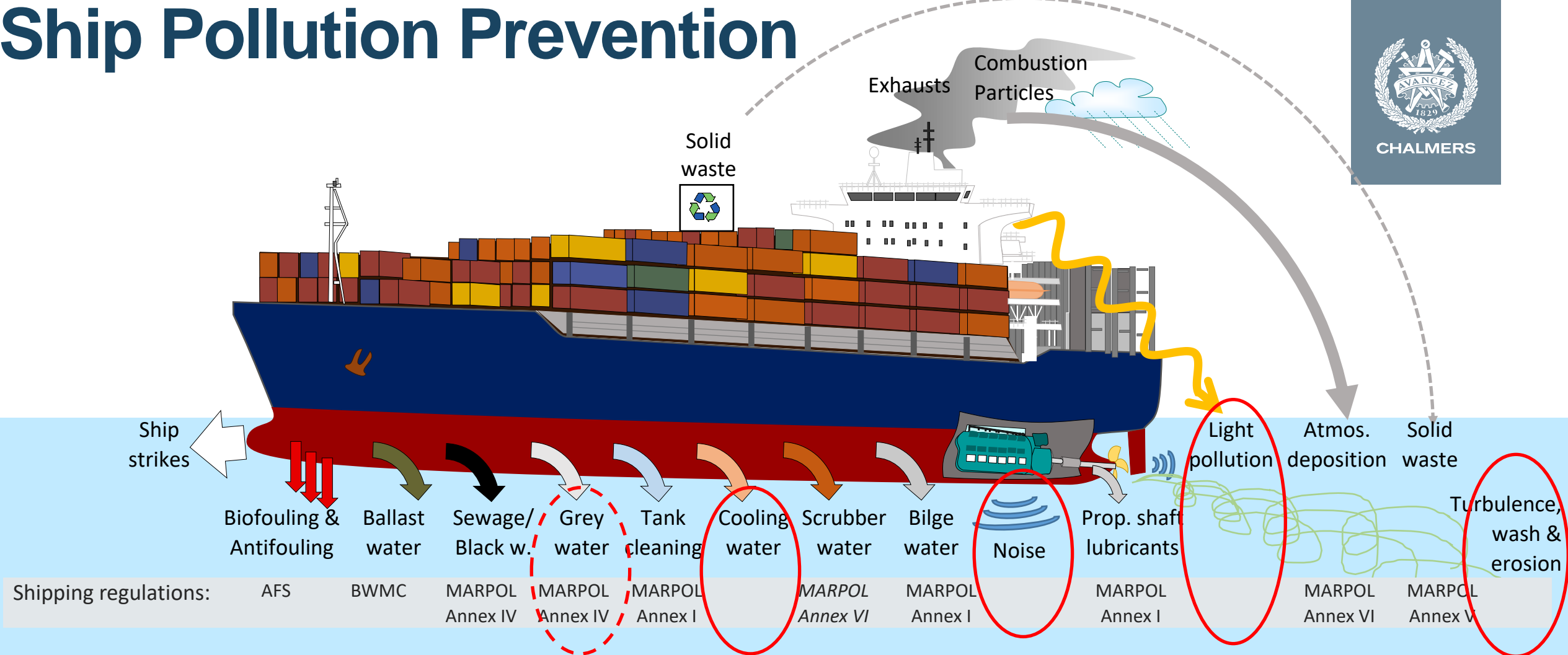
Marine bunkers product demand, 2015-2024



Source:

<https://www.iea.org/data-and-statistics/charts/marine-bunkers-product-demand-2015-2024>

Ship Pollution Prevention



- Regulations primarily through International Maritime Organization (IMO)
- Regulations target one onboard system at the time, some unregulated
- All regulations are not necessarily legally binding, e.g. guidelines

Marine environmental management

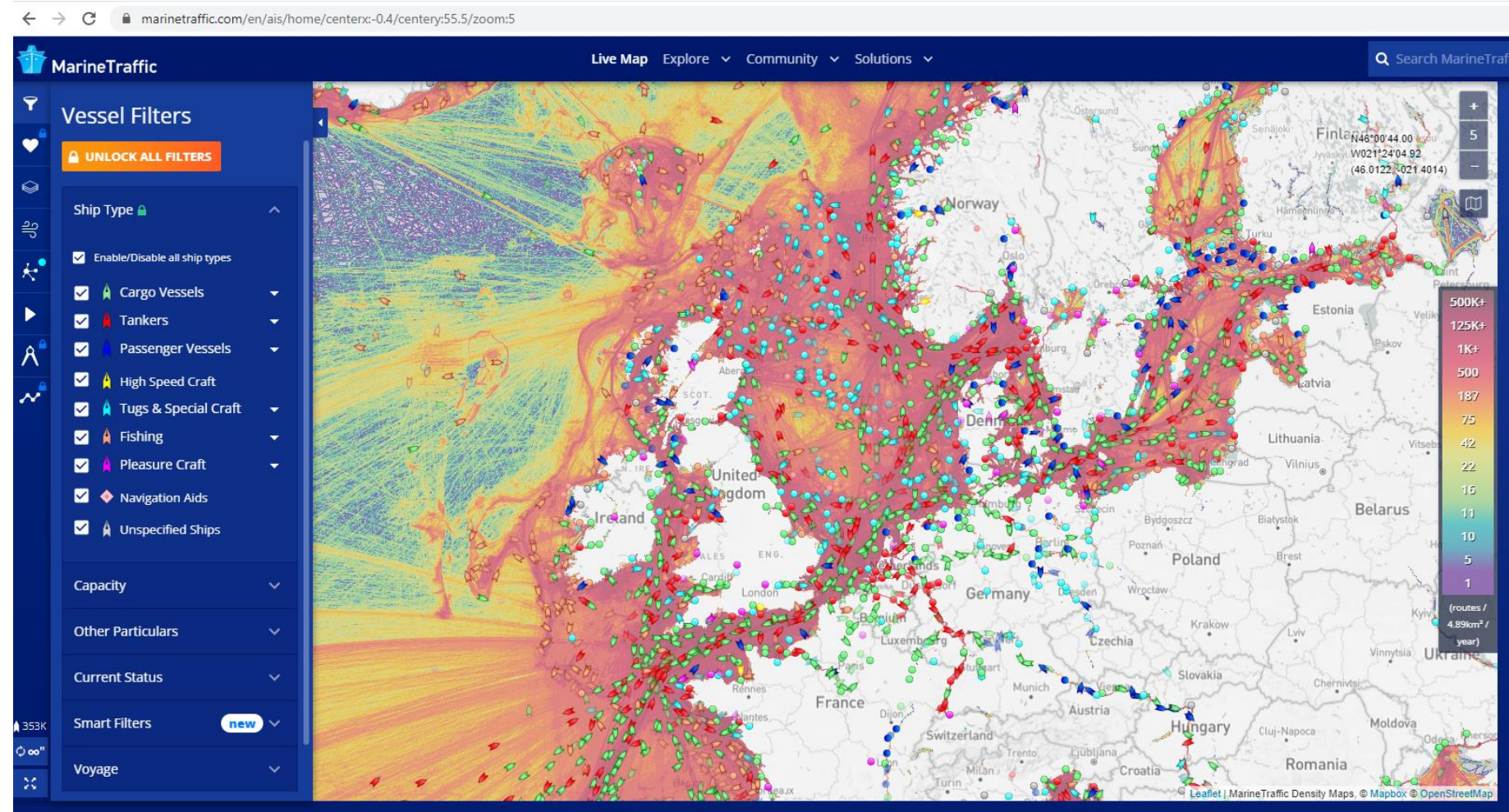


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Need to take into account all shipping-related pressures:

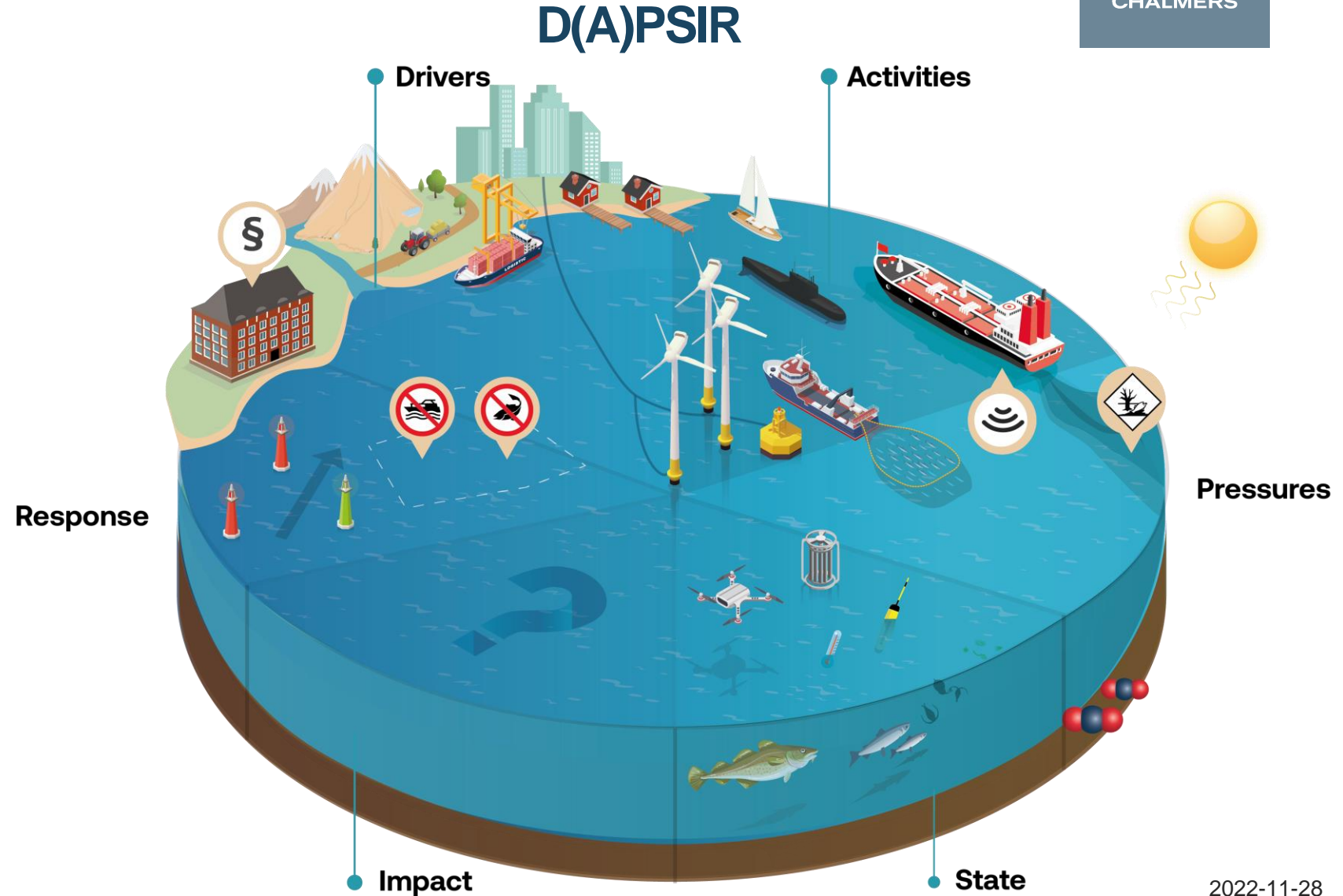
- all onboard systems
- all ships operating in the geographic area/water body of interest

Yet, most holistic marine assessment don't capture shipping pressures adequately!



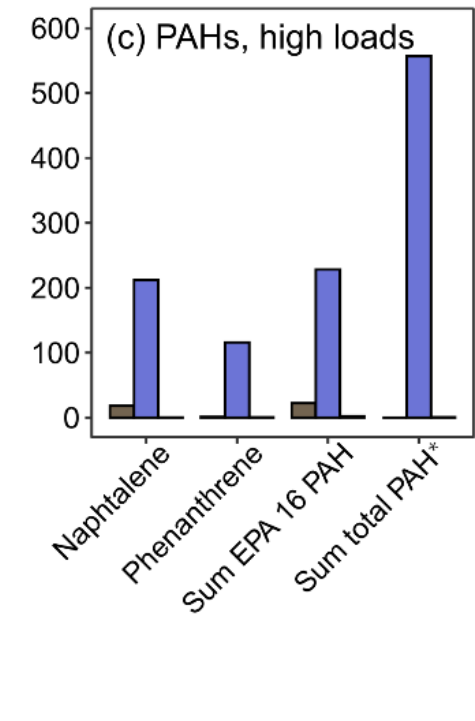
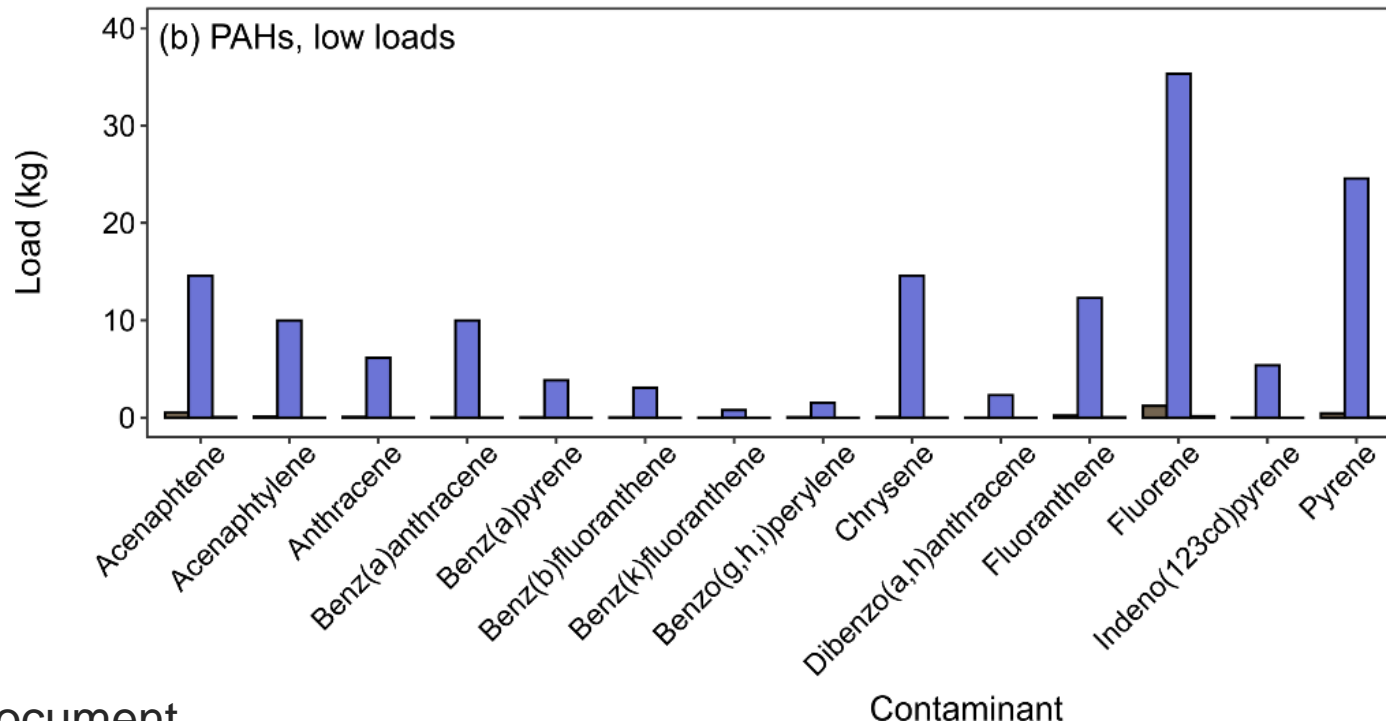
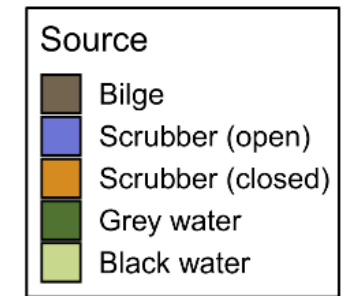
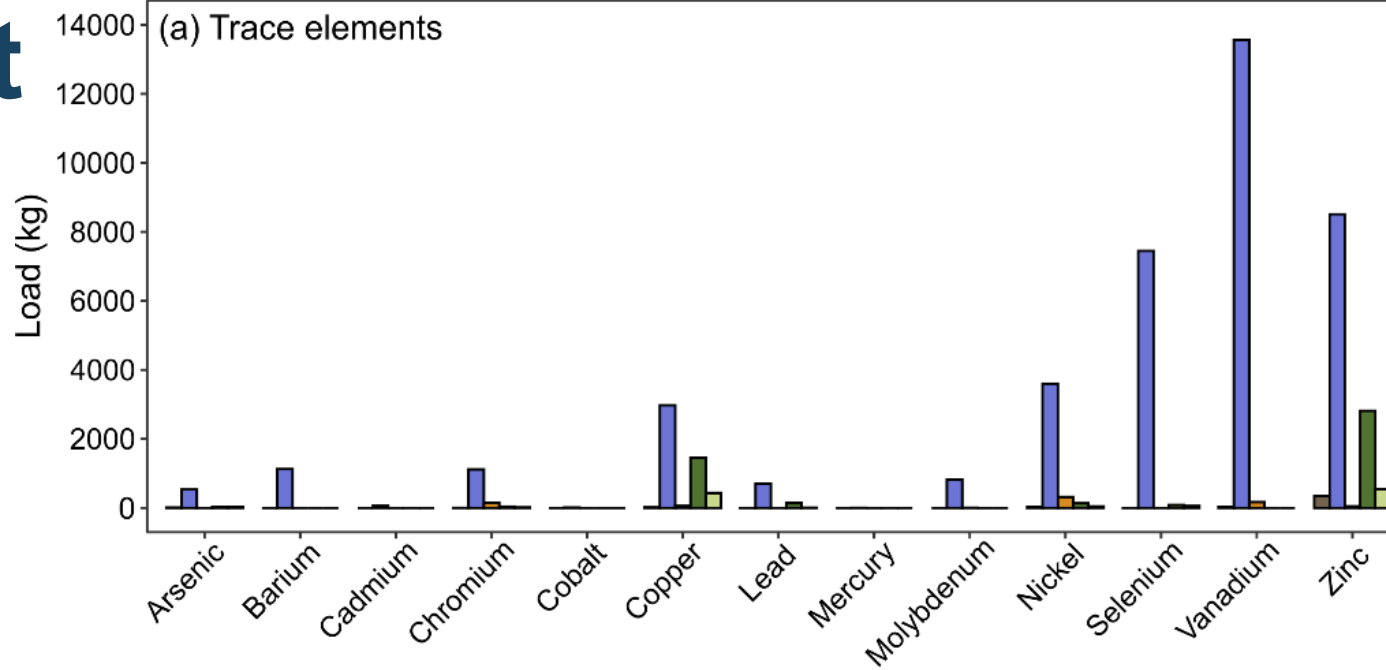
Marine environmental management

Needs to account for **all** human activities giving rise to pressures



Contaminant loads Baltic Sea 2018

- 99 ships with scrubbers
- Total >8000 ships
- Scrubbers dominate the loads compared to all other liquid waste streams from all ships in the area



Modelling the pressures of shipping

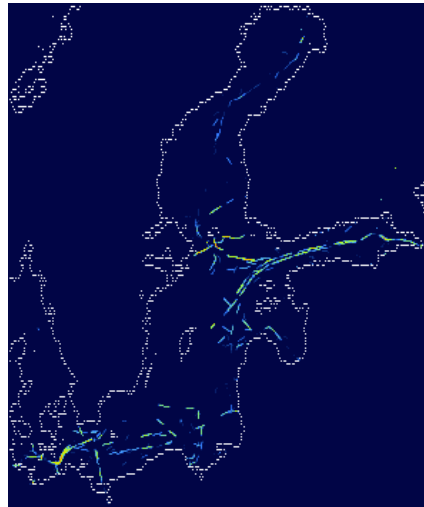
Ship types



Photos: Pixabay

Ship type discharge volumes or amounts:
 Bilge
 Ballast water
 Antifouling, etc.

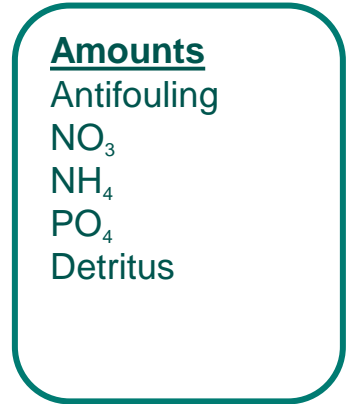
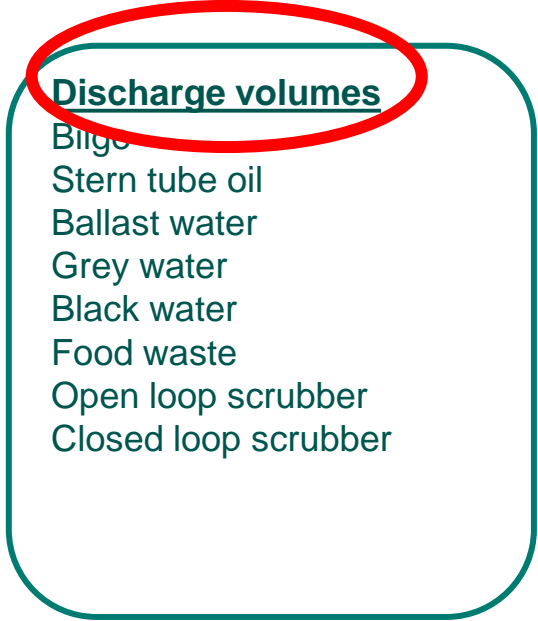
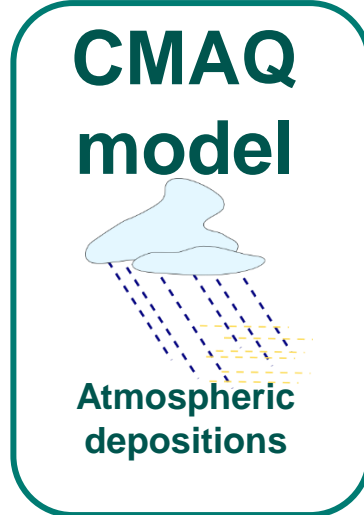
Activity (AIS) data



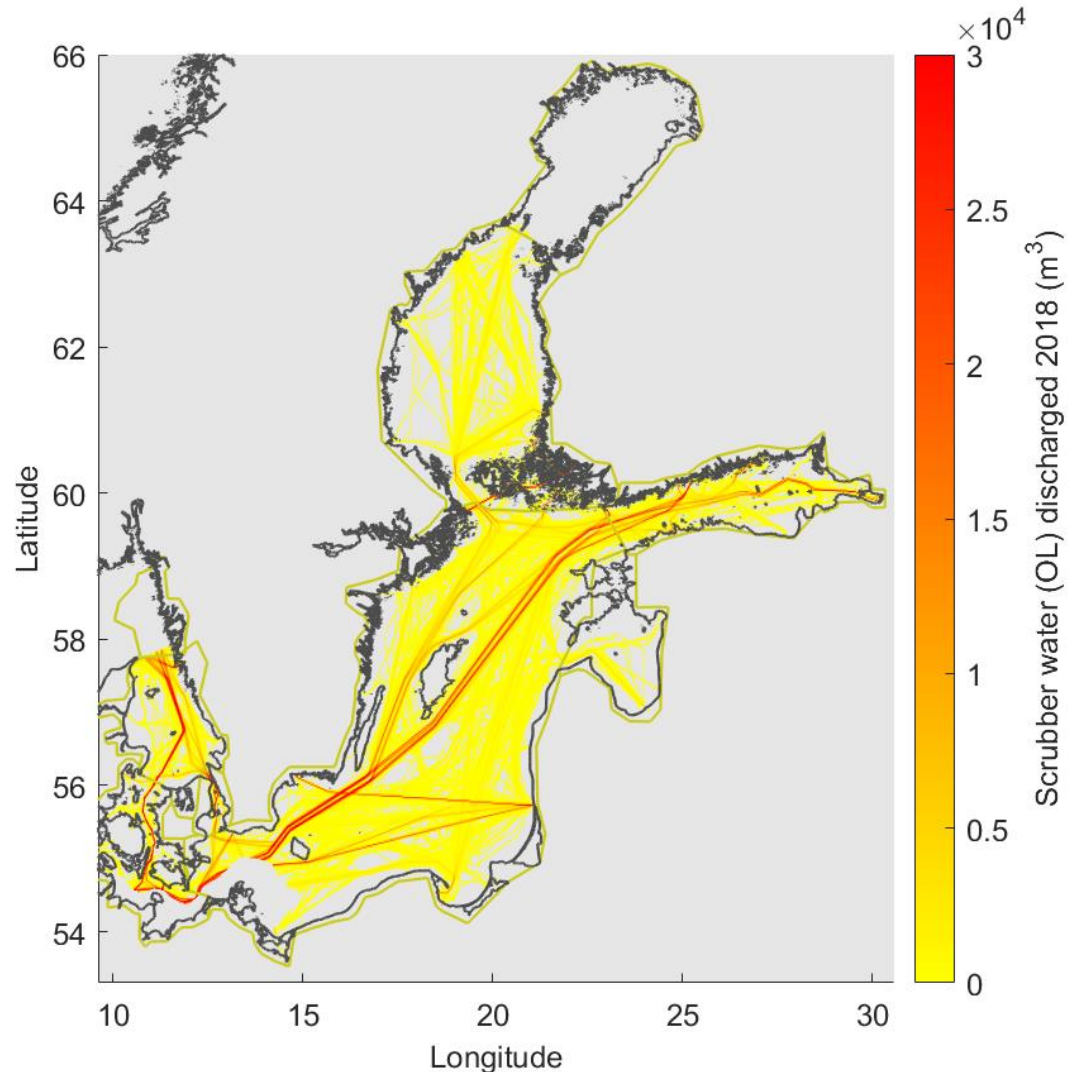
Year 2012



Air emissions



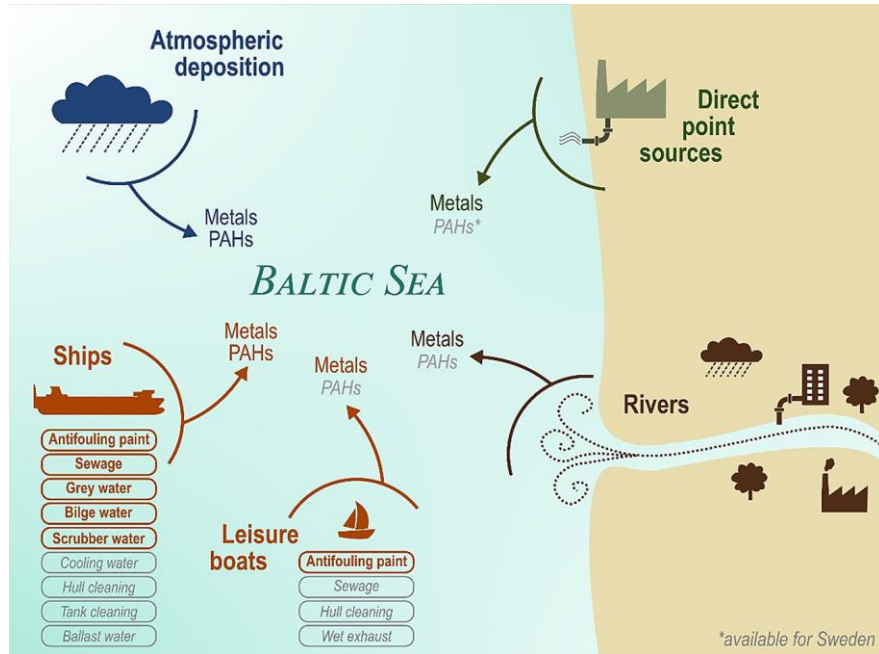
STEAM - Ship Traffic Emission Assessment Model



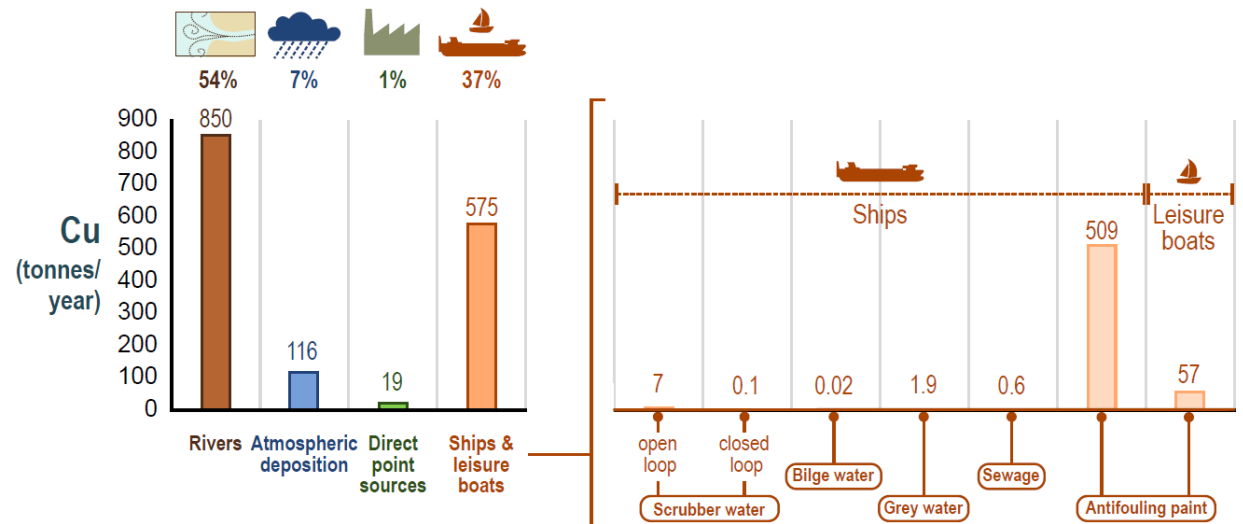
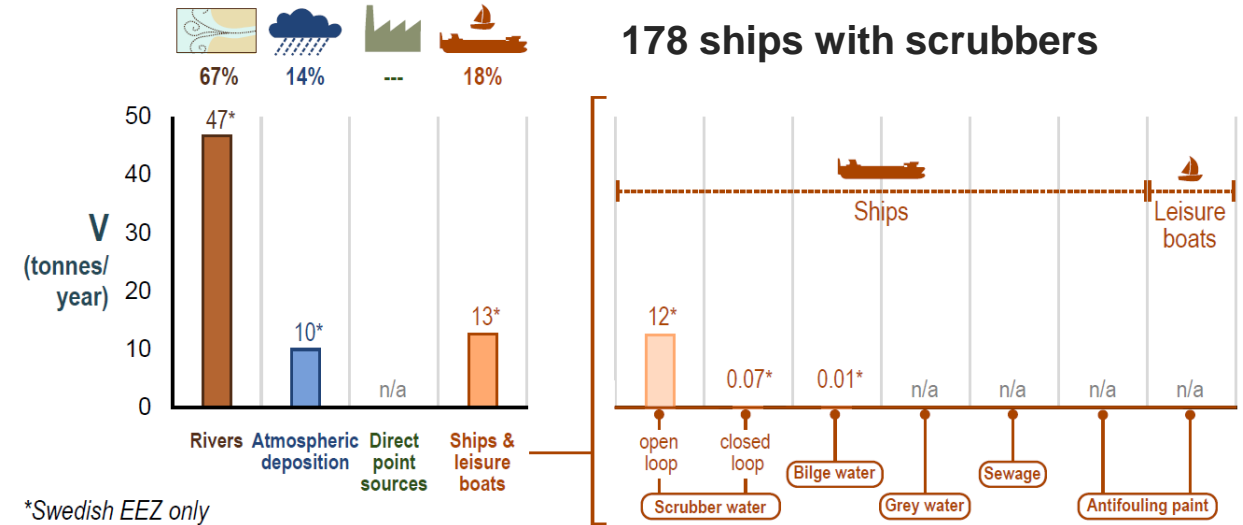
- Based on AIS data and IHS Markit
- Air and water emissions within grid cells
- Spatio-temporal resolution can be adjusted
- Intensity maps

Source: EMERGE Deliverable 5.1. and Jalkanen et al (2021). Ocean Science.

Comparison of contaminant load in the Baltic Sea



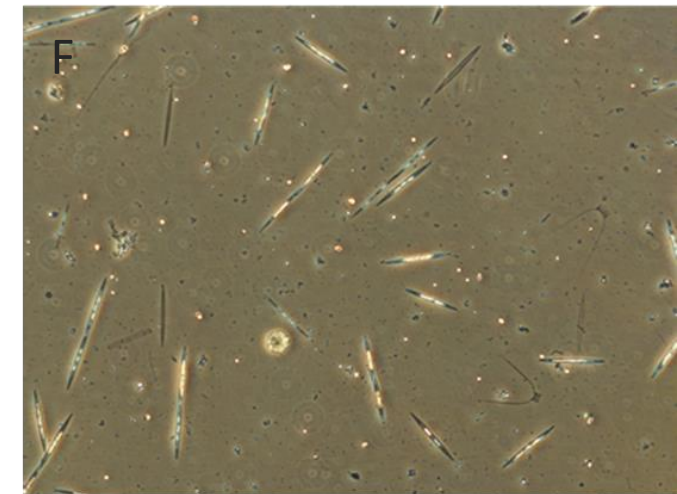
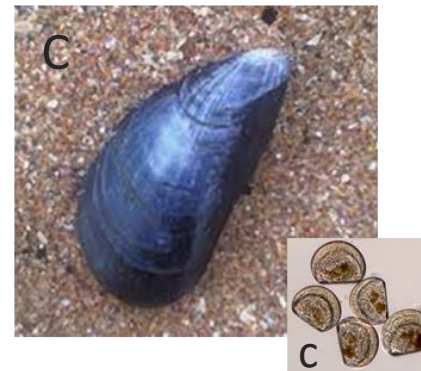
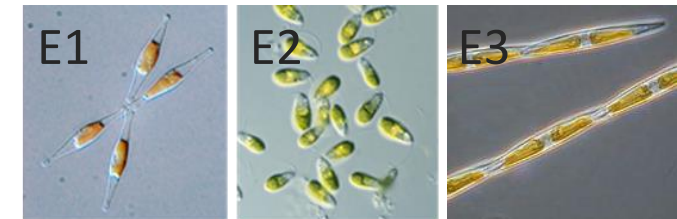
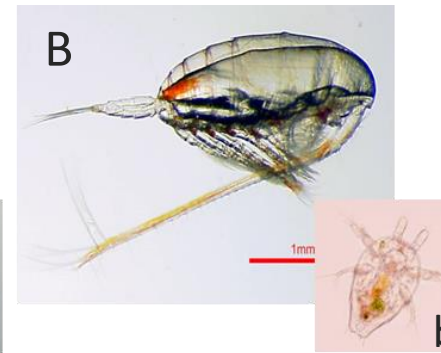
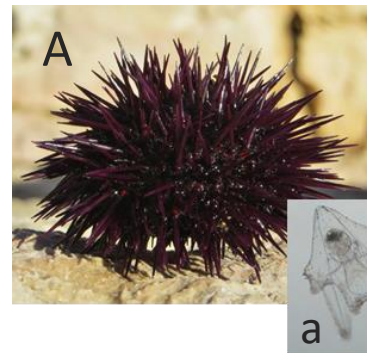
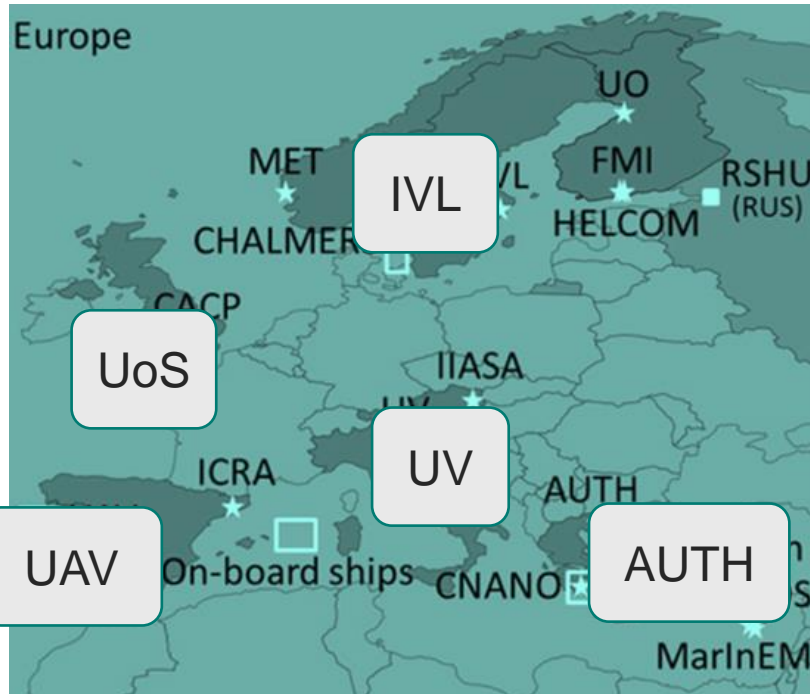
- Substantial contribution from ships (both metals and PAHs)
- Antifouling paints and open loop scrubber water contribute the most

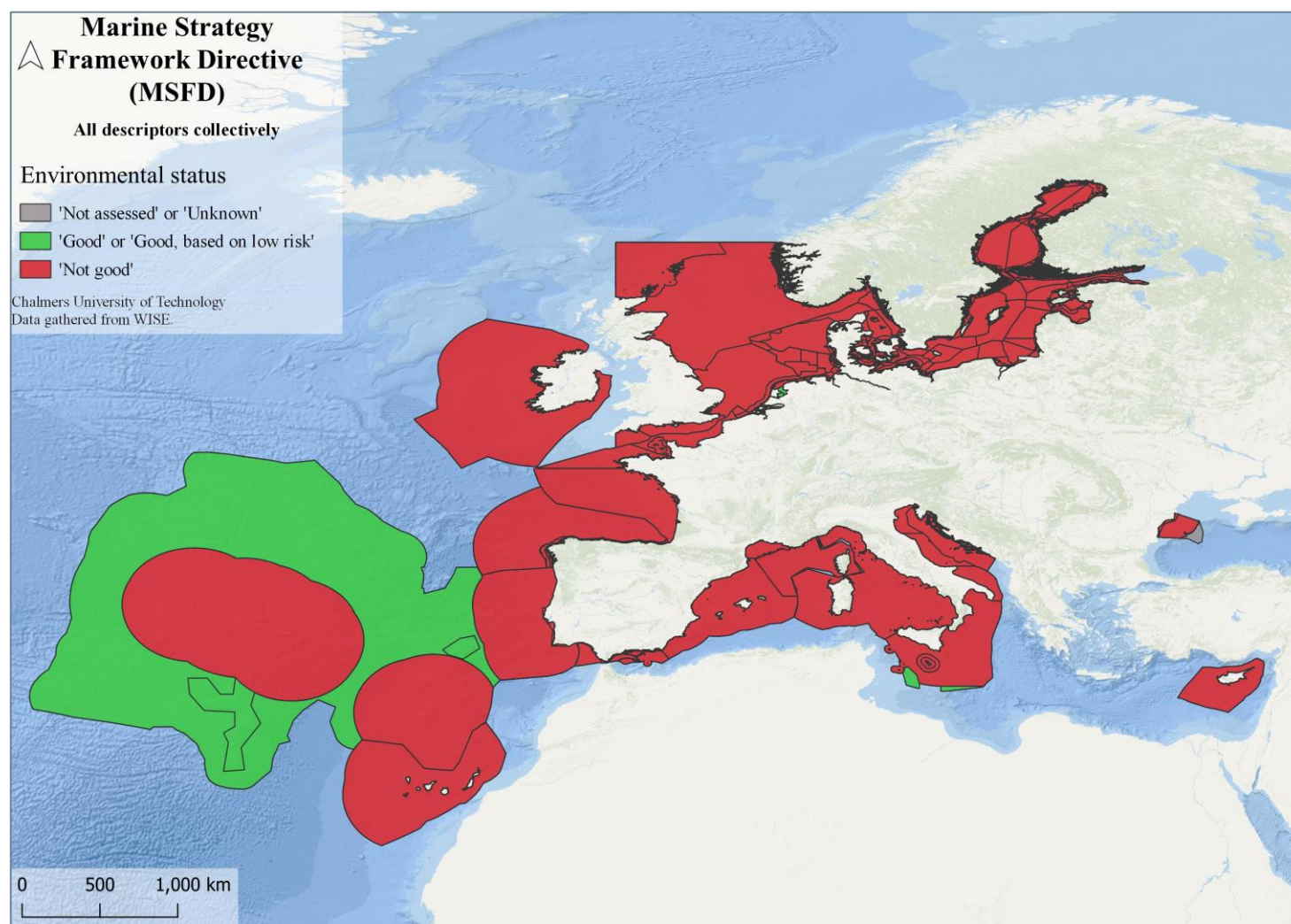


Ecotoxicological tests



- Scrubber water exposure in different concentrations (0.001%-40%)
- Different species and life stages (sea urchin, copepod, mussel and microalgae)
- Mesocosm studies – species distribution
- Effect at lowest tested concentration (0.001%) in developmental stages





7.4 The adoption of restrictions or a ban on discharge water from EGCSs should be considered in areas where any of the following indicative criteria are fulfilled:

- .1 environmental objectives in the areas are not met, e.g. good chemical status, good ecological status or good environmental status are not achieved under applicable legislation;

Conclusions

- Use of scrubbers implies continued use of fossil heavy fuel oil
- Scrubbers account for a large share of contaminant, metals and organic compounds, input to the marine environment
- Scrubber water is highly toxic to marine organisms, also at very low concentration (0.001%)
- Scrubbers represent a technology that is possible to manage, to reduce negative impact on the marine environment
- Discharge of scrubber water should be restricted



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Thank you for listening!

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Additional reading – emerging interest

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