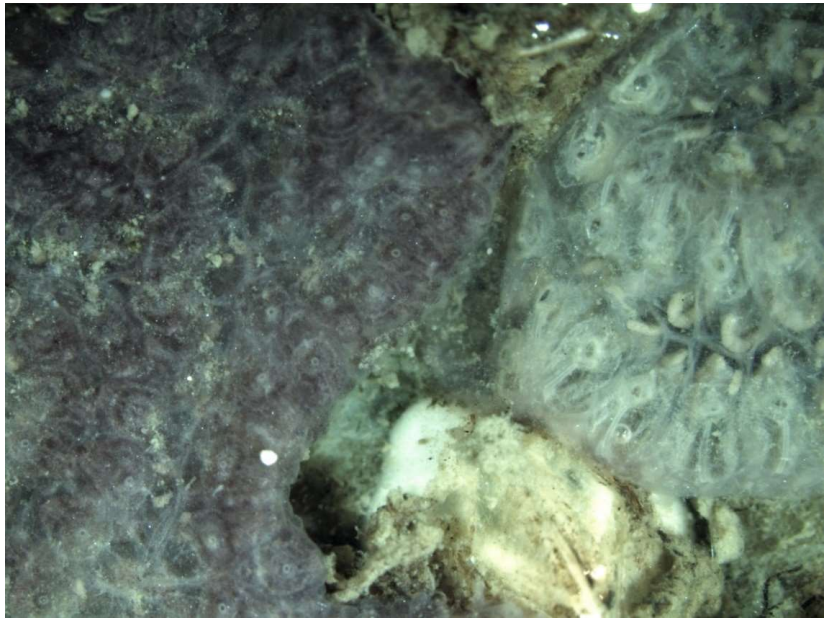
Marine IAS: Pathways, trends, impacts, and future perspectives with emphasis on Danish seas

Botrylloides violaceus (Ascidian)



Bugulina stolonifera (Porifera)

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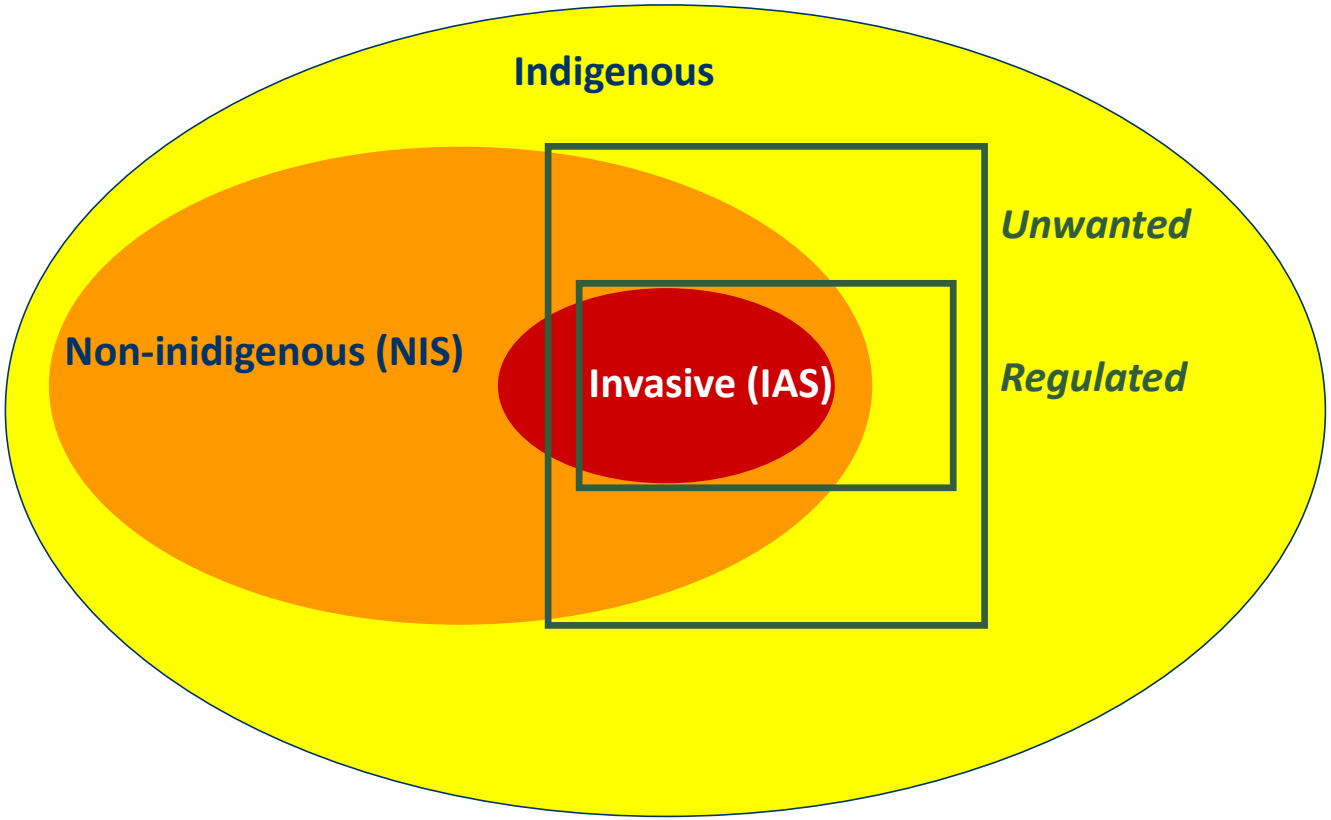
Invasive aquatic species (IAS) – definitions



- An IAS is a freshwater or marine organism that has spread or been introduced beyond its native range and is either causing harm or has the potential to cause harm.
- These species are not native to an ecosystem and their introduction causes or is likely to cause economic or environmental harm or harm to human health

Why worry about IAS?

Eutrophication

Climate changes

Fishery

Marine environment
- Biodiversity
- Water quality
- Ecosystem services

Litter

Habitat destruction

Invasive species

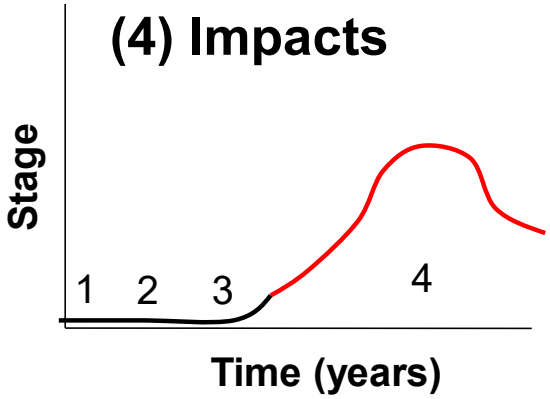
Introduction of IAS

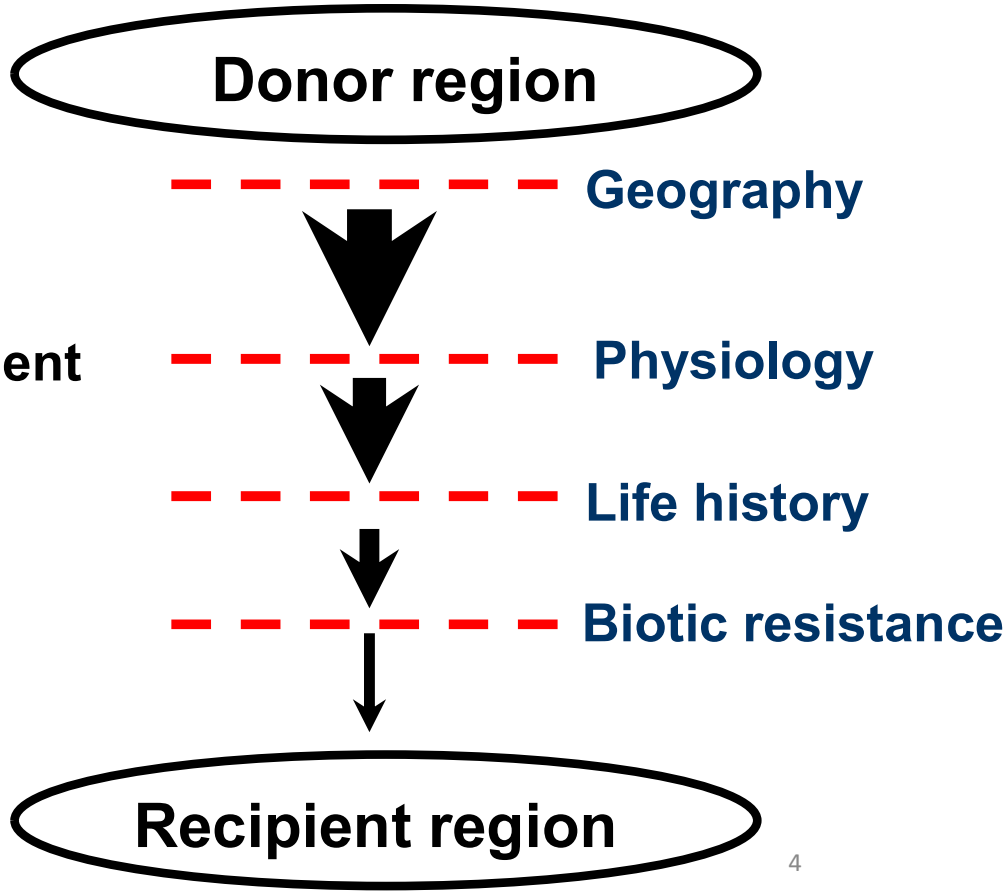
(1) Collection, transport, release

(2) Survival and establishment

(3) Spread

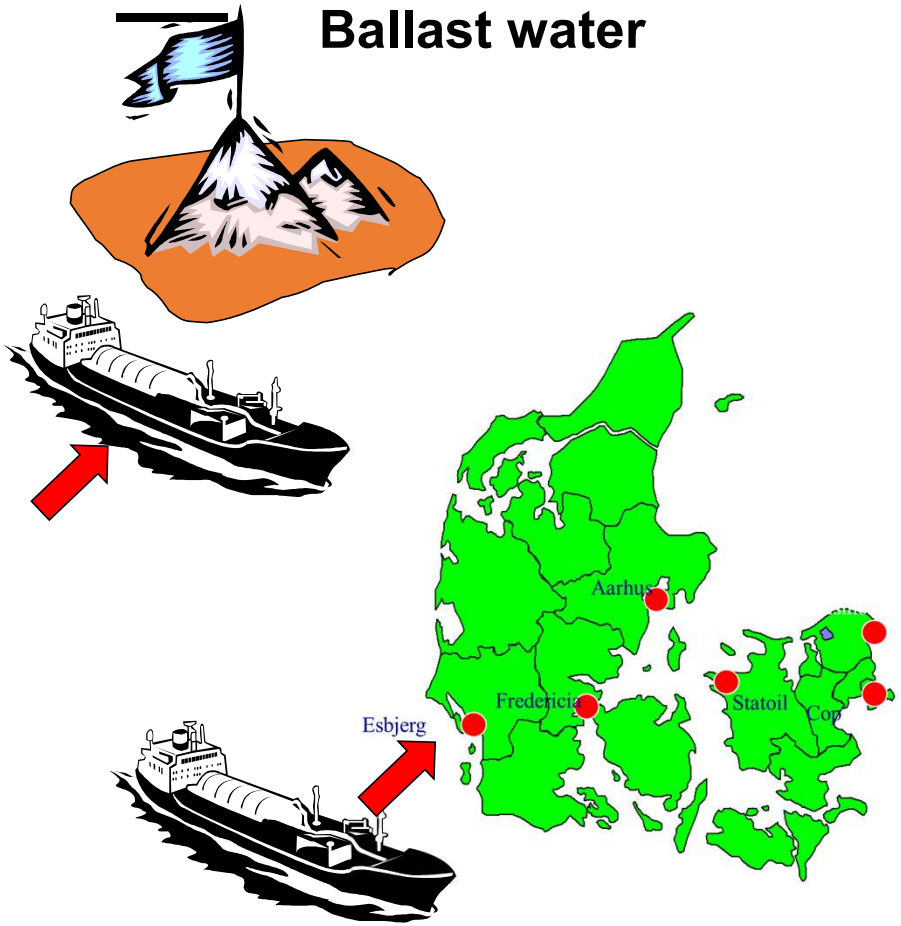
(4) Impacts





Pathways

Ballast water



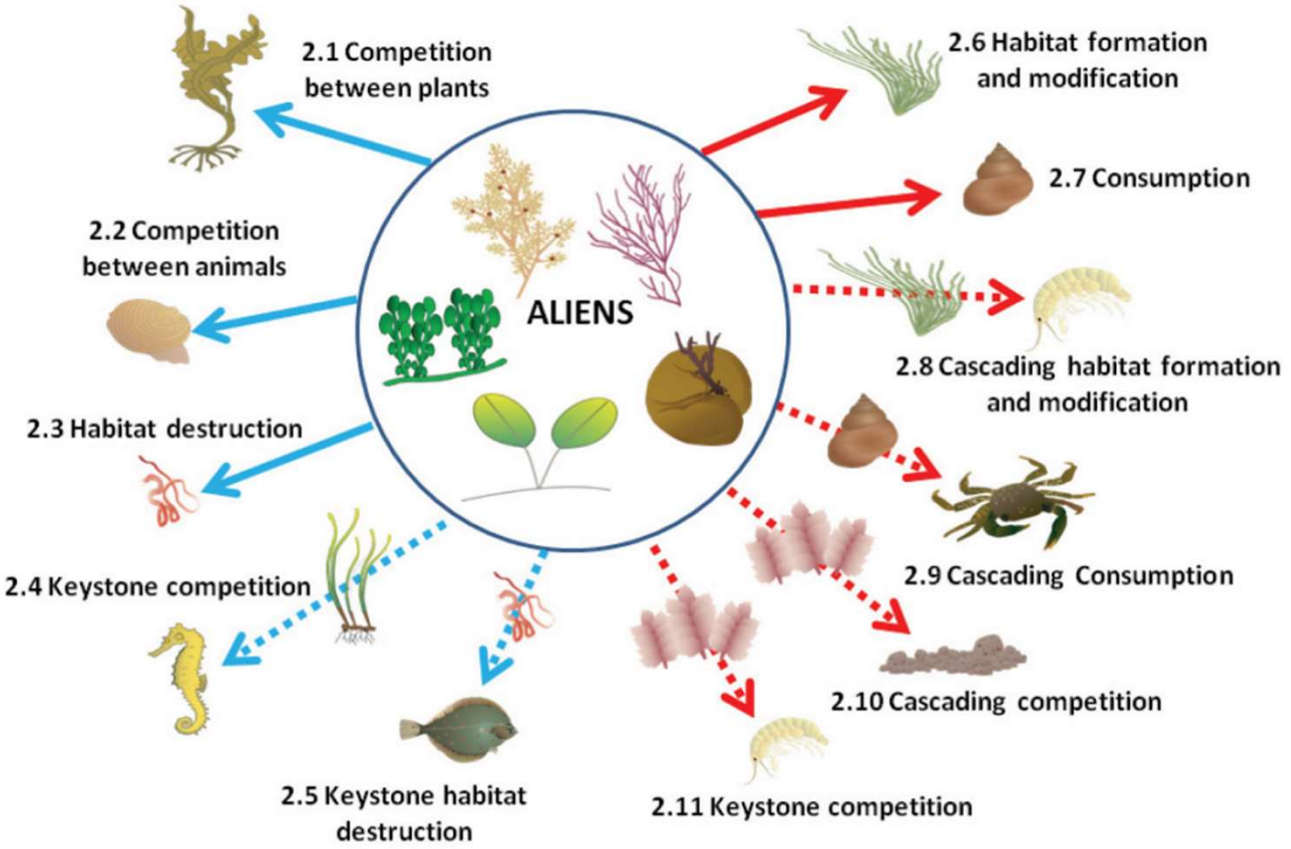
Stepping stones

Leasure boats

Fouling

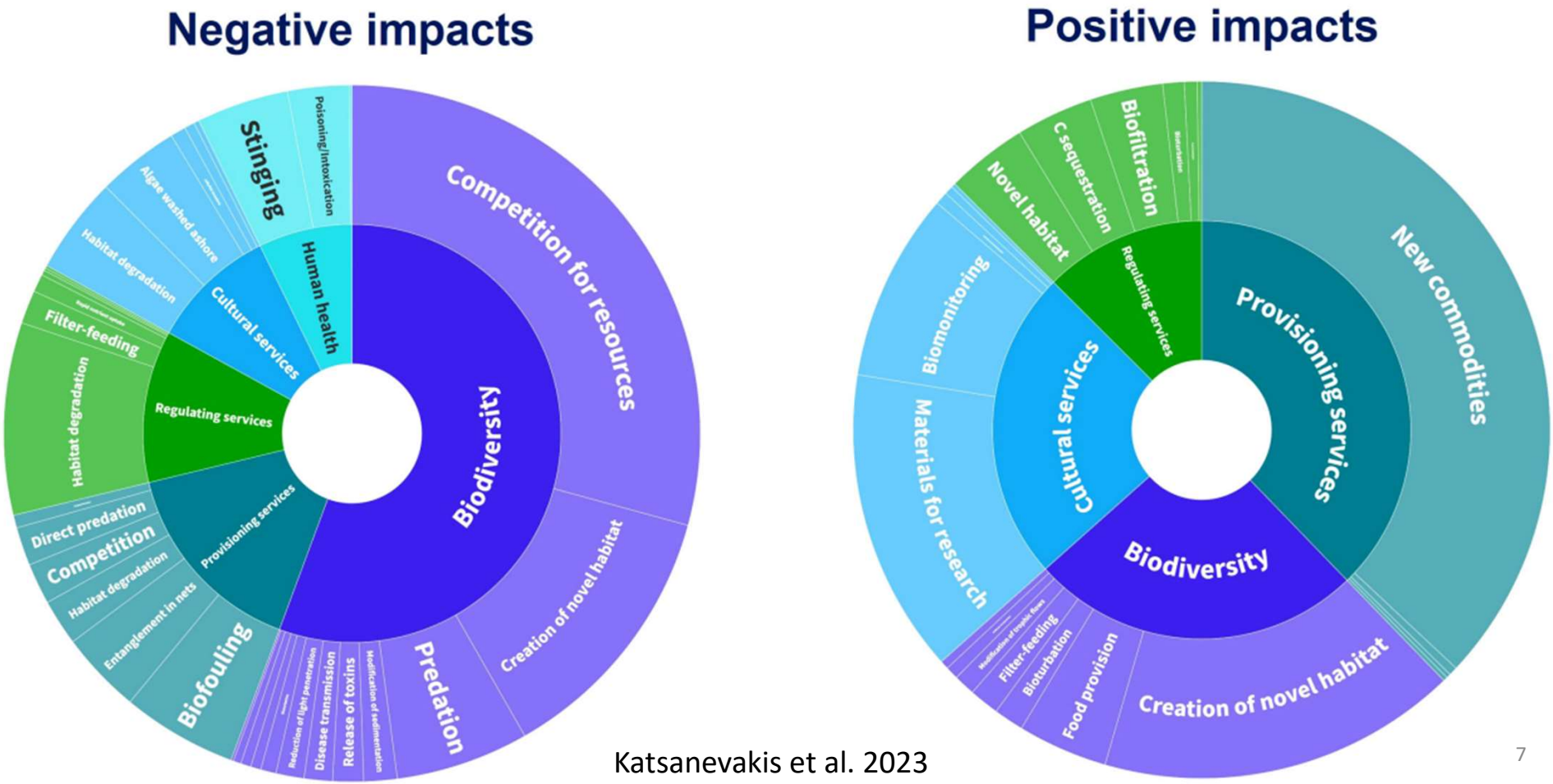
Release

Impacts of IAS – many interactions



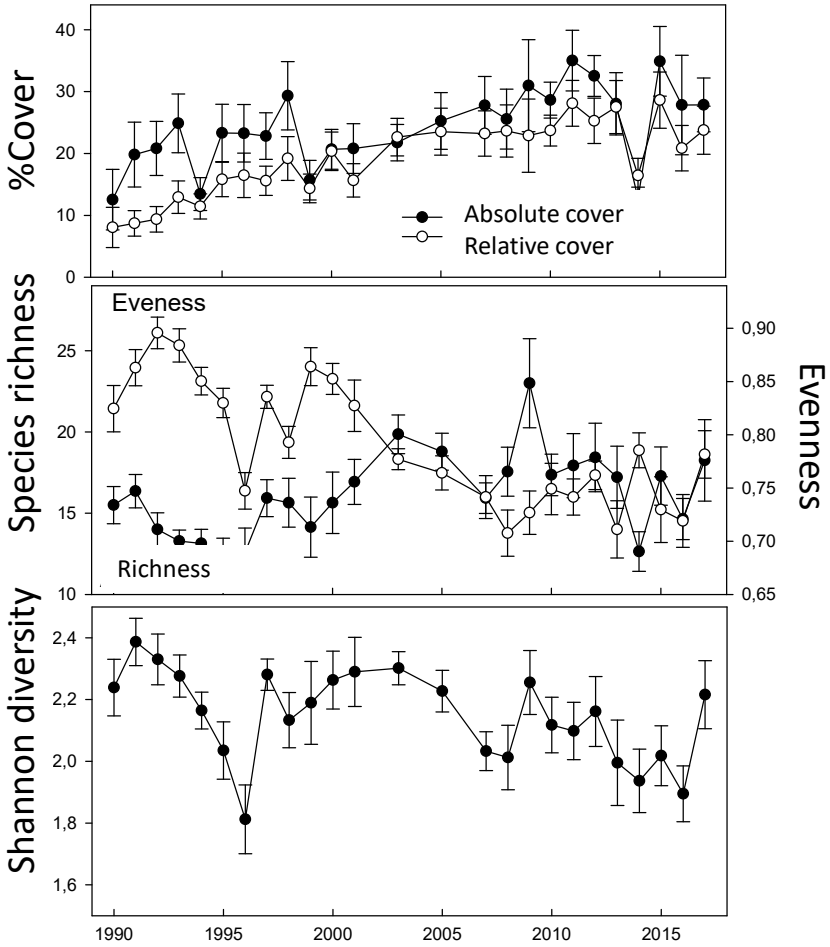
Thomsen et al.- (2013), Ecological Interactions between Marine Plants and Alien Species

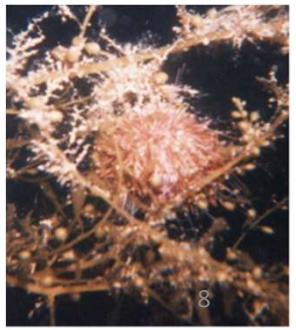
Impacts of IAS – negative and positive



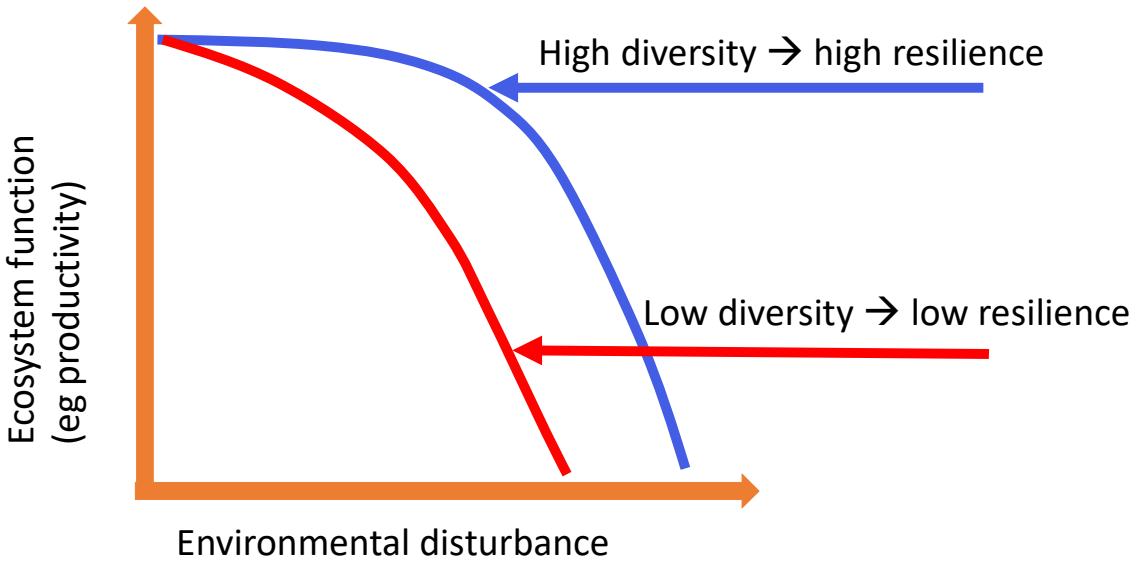
Katsanevakis et al. 2023

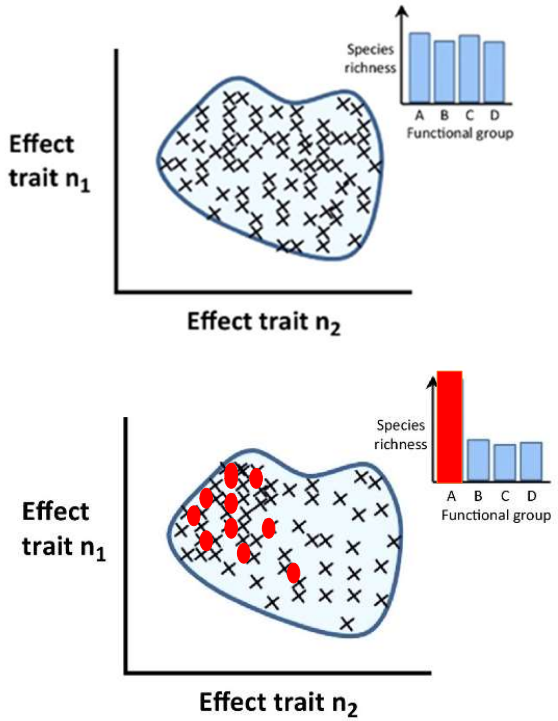
Impacts of an IAS – *Sargassum muticum*





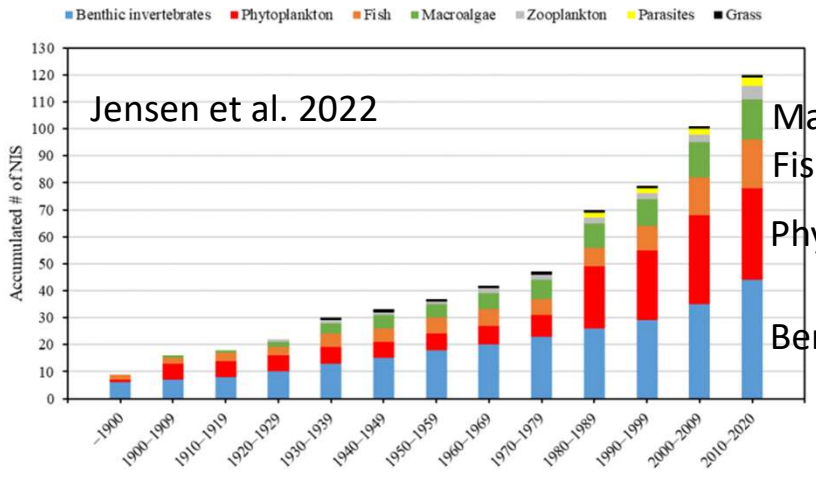
Impacts of IAS → reduced resilience → functions





Oliver et al. 2015. TREE

Rates of NIS introduction into Danish Seas



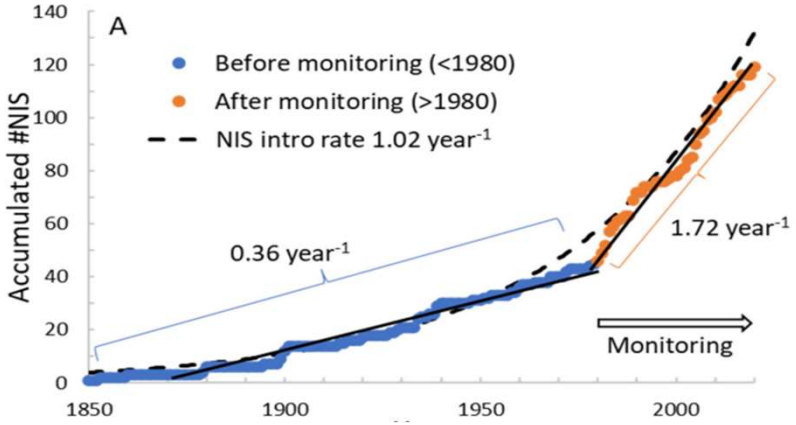
Jensen et al. 2022

Macroalgae

Fish

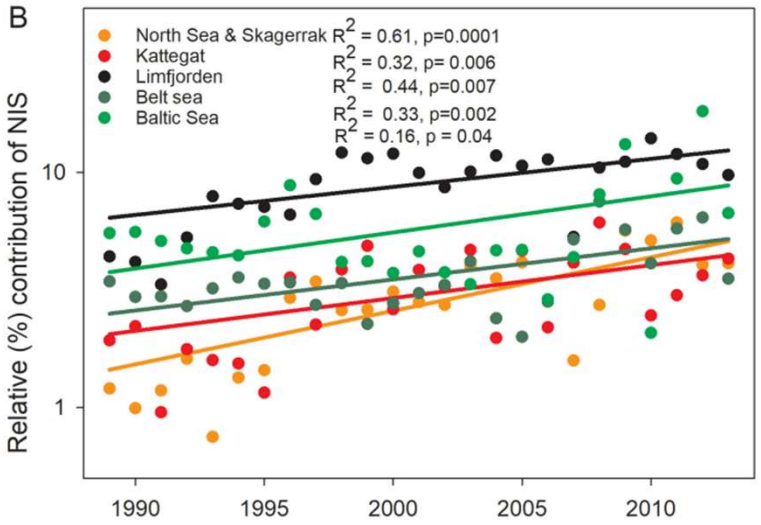
Phytoplankton

Benthic inv



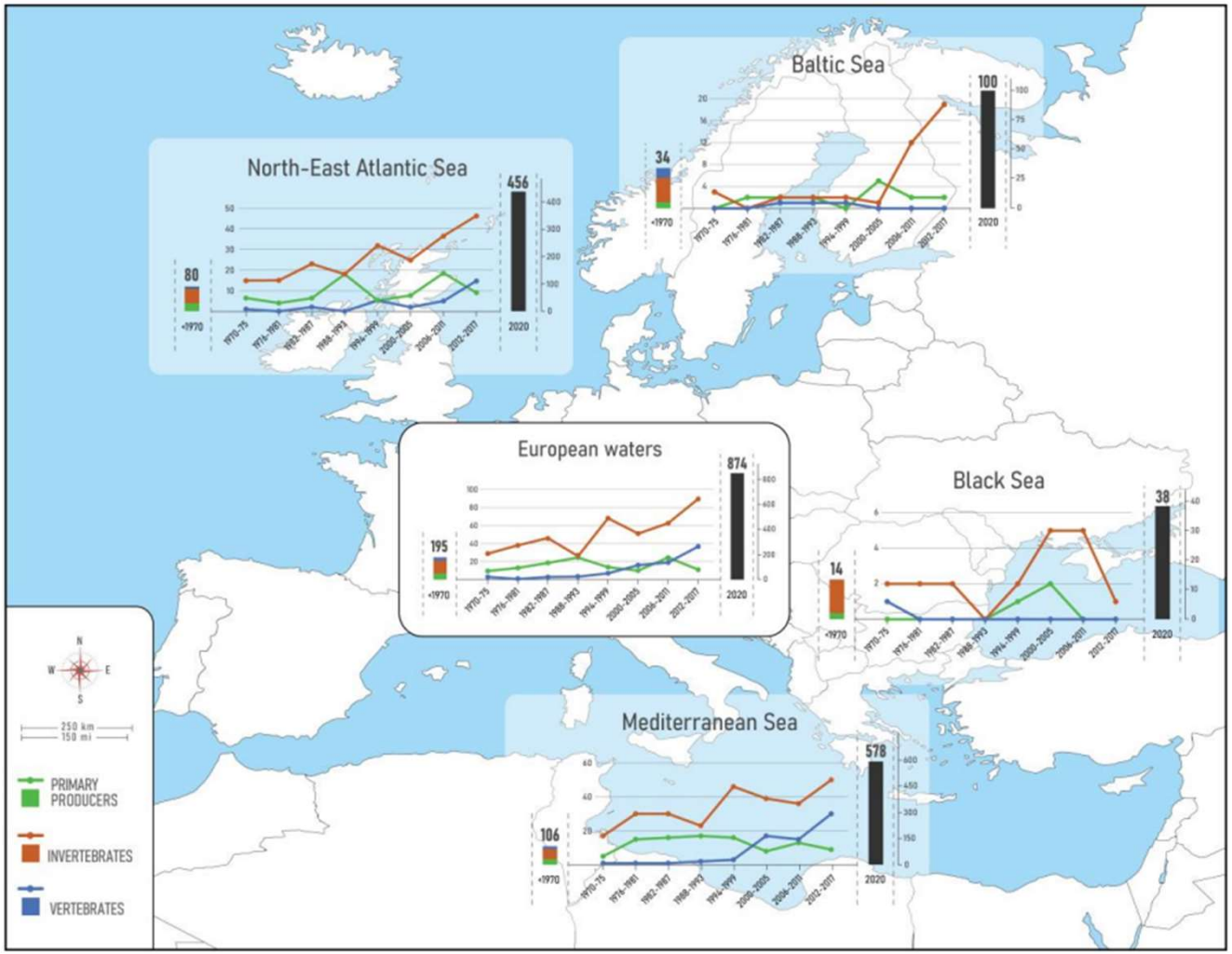
Stæhr & Jakobsen 2023

Benthic invertebrates



Staehr et al. 2020

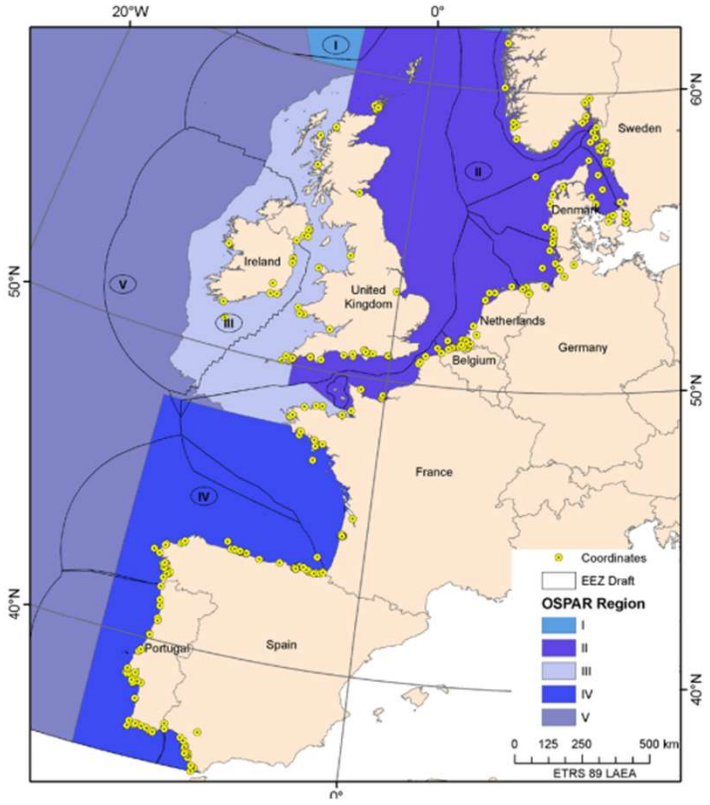
Introduction of NIS into European Seas

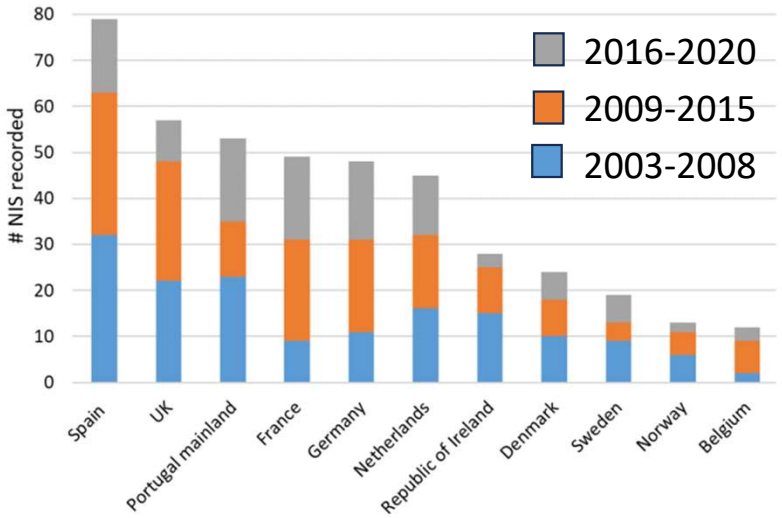


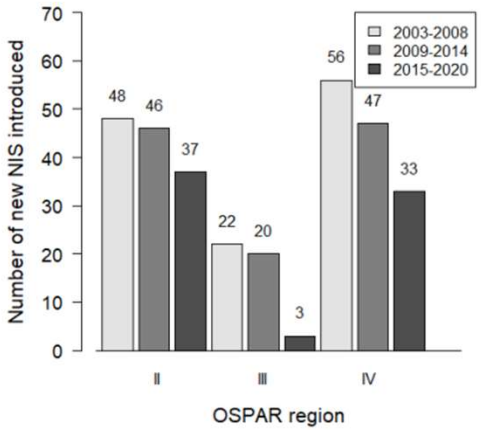
- 874 NIS in totarl (year 2020)
- Most NIS are invertebrates
- Excluding parasites and phytoplankton
- Effects of time delays in latest report

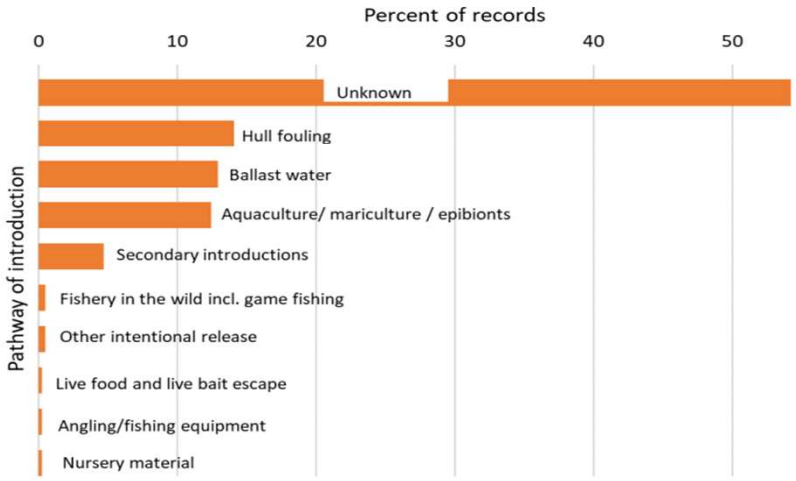
Zenetos et al. 2022

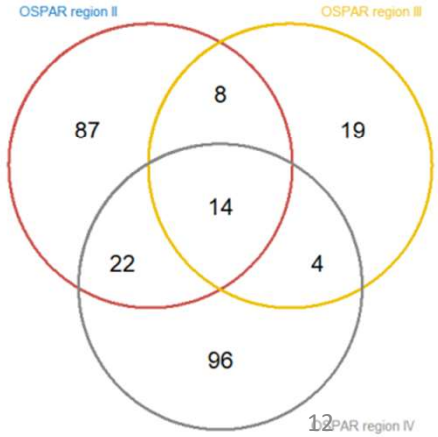
Recent introduction of NIS into OSPAR seas











Management / mitigation of IAS

- "Eliminate, minimize, reduce and or mitigate the impacts of IAS"
- "To prevent, reduce and control pollution of the marine environment resulting from IAS"

<u>Prevention of new introductions through enforcement of regional and global rules and management</u>

Monitoring is an essential part of management

Monitoring

Management

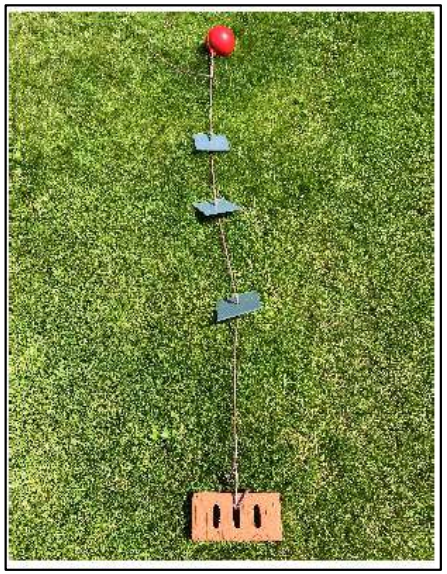
Reporting and assessments

Legislation

- Early detection of new IAS → warning & erradiation
- Changes in distribution and numbers → Impact
- Assessment of status → adjustment of management

Monitoring methods

Settlement plates

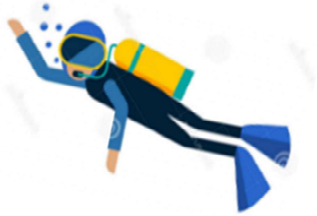


Sediment samples

Scrapings

Frames

Diving



Water samples

Knowledge gaps related to IAS

1. How to measure impacts?

- Experts judgements, bio-pollution indicators, trends in species, modelling. Requires good data

2. How to best monitor?

- eDNA, conventional**,** cost-efficiency

3. How to improve certainty of pathways of introduction and dispersal?

- Requires repeated observations and modelling

4. What drives rates of introduction and impact?

- Effects of climate change and other stressors and preconditions

5. Mitigation through Marine protection and restoration?

Questions?