Marine biodiversity and human wellbeing in Denmark's changing environment

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WORLD MARITIME UNIVERSITY


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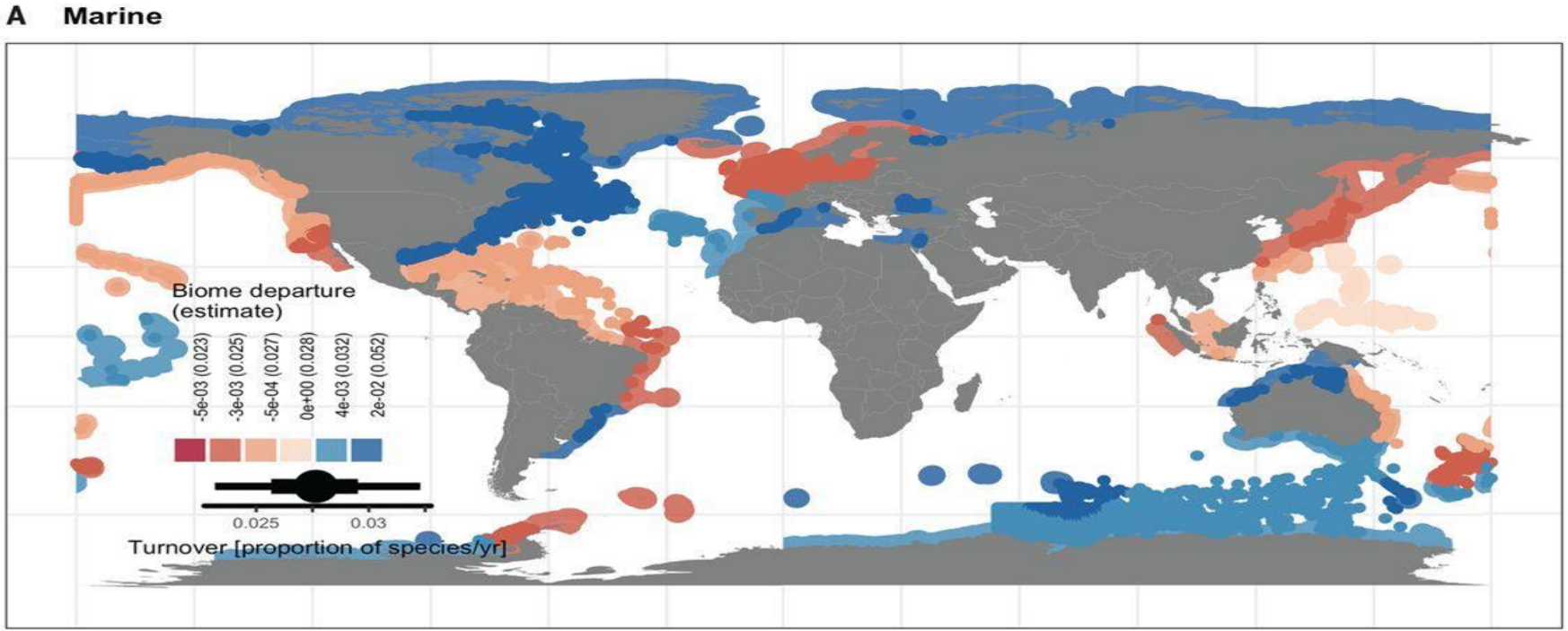
INTERNATIONAL MARITIME ORGANIZATION

Global news: Reshuffling of species in ecosystems.



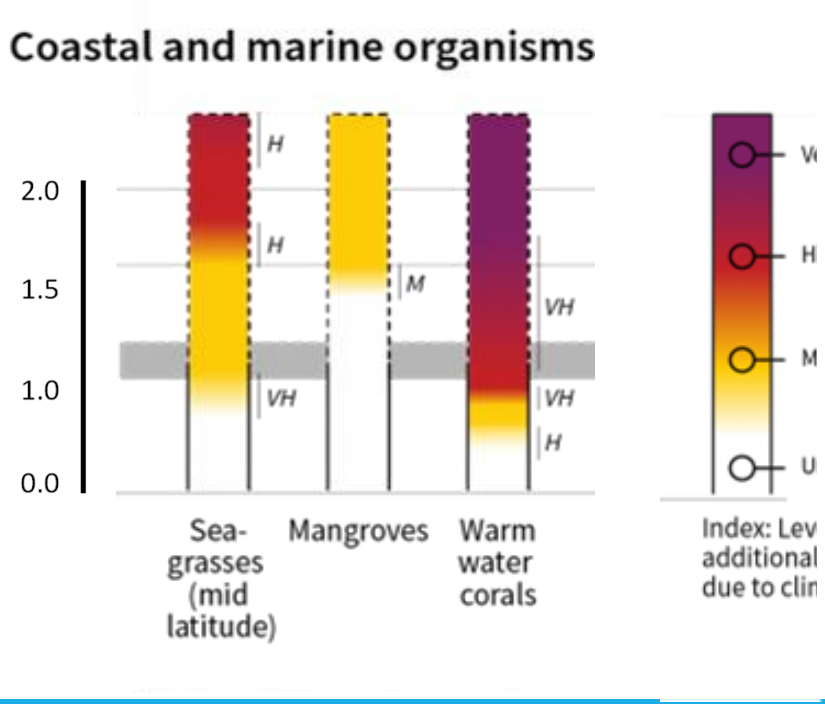
Blue, reshuffling faster than the global average
Red, reshuffling slower than global average

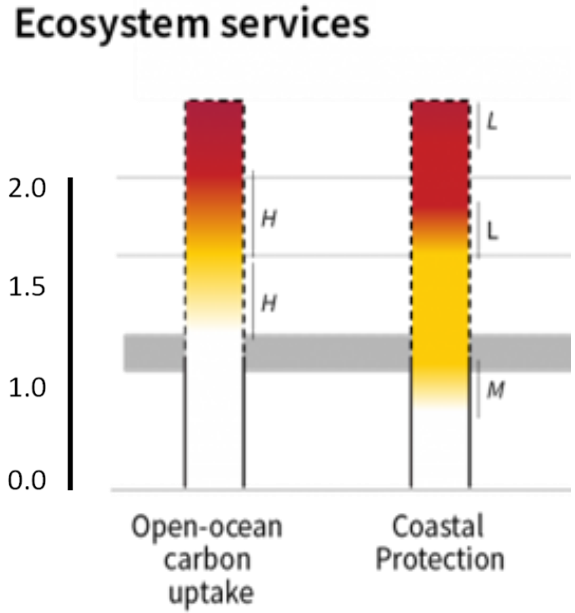
over 50,000 time series from 239 time series datasets from around the World

Shane A. Blowes et al. Science 2019;366:339-345

Science AAAS

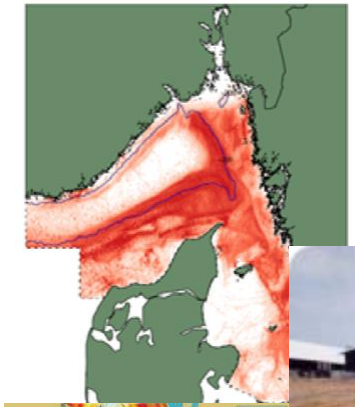
Global news:
IPCC 2018: Risks with 1.5 C vs 2 C

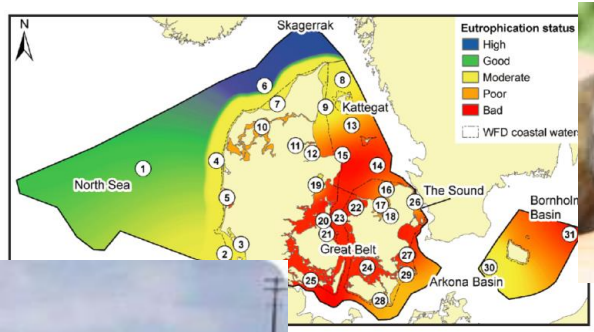


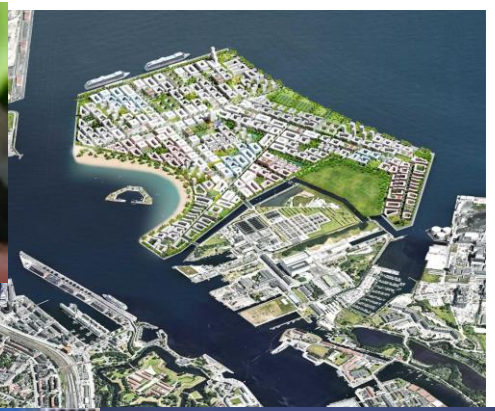


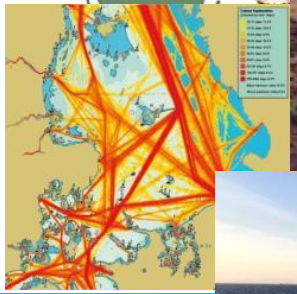
What has the Danish marine environment done for us?

What have we done for the Danish marine environment?









Cocktail

1960’s-1980’s cocktail

Nutrient loadings & hypoxia
Bottom trawling
Illegal fishing
Overfishing
Underwater noise
Oils spills
Contaminants
Coastal development
Marine debris
etc.

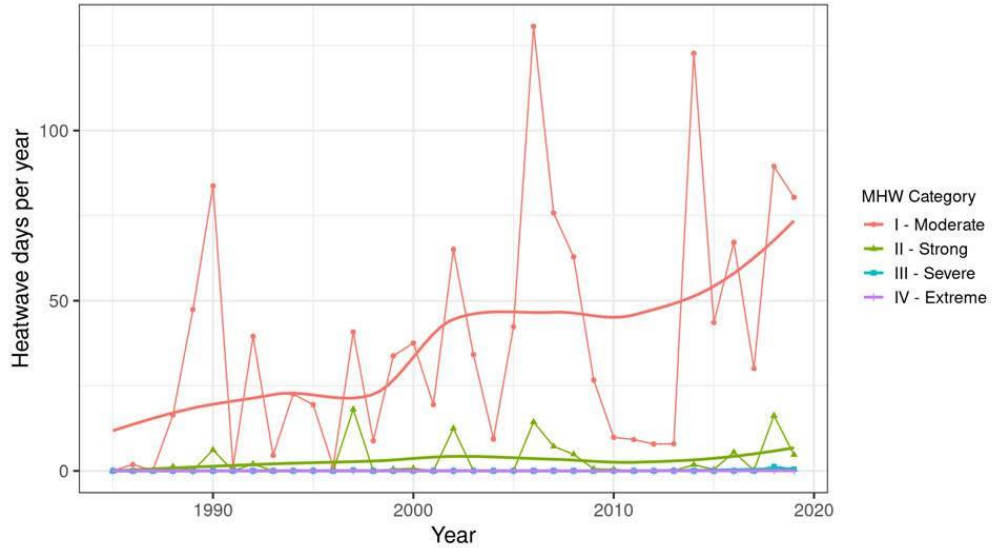
Today, different levels of the same (some lower, some higher)

+ Climate change
+ Ocean acidification
+ BLUE GROWTH

So even harder for our ecosystems and biodiversity to cope

imagine the glass is our marine environment

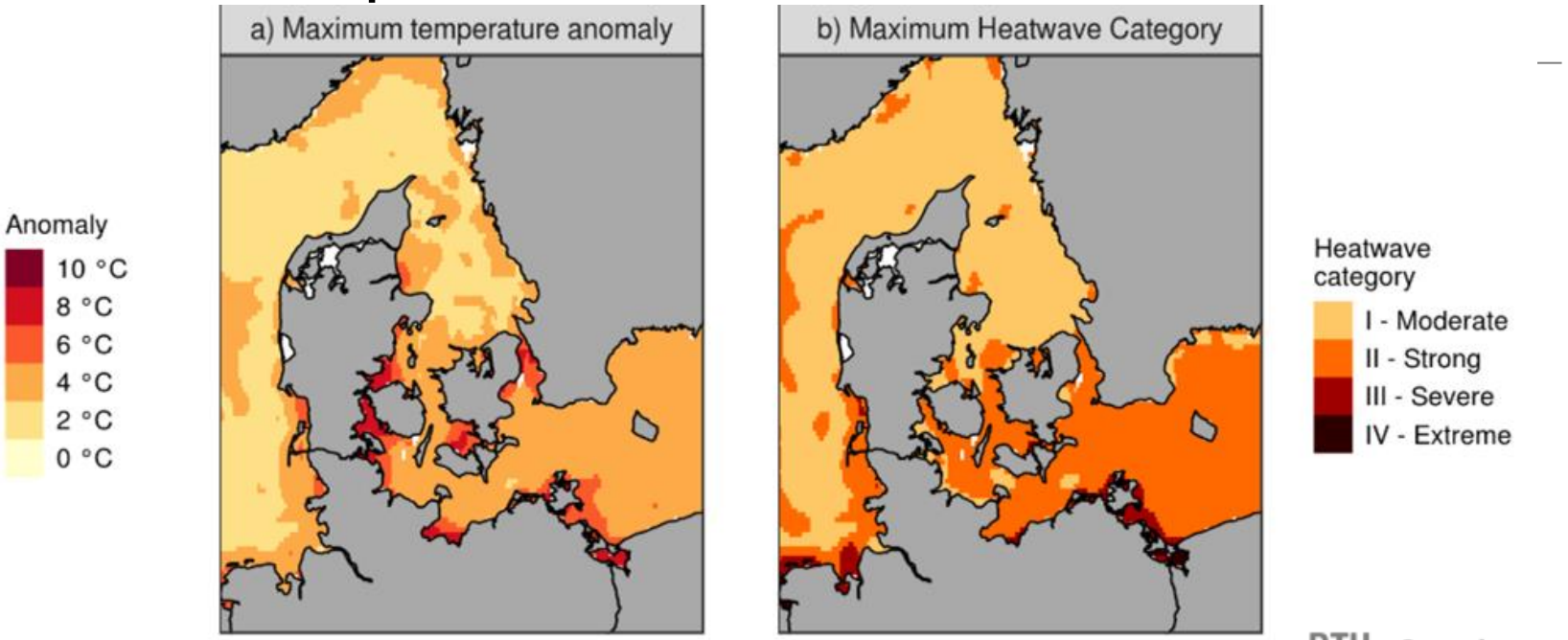
Danish marine climate is changing- Increase in number of marine heat wave (MHW) days per year



The trend is 1.4 MHW days per year per year from 1985-2019. Based on SST surface measurements from satellite around Denmark on a 4km grid. (Payne, DTU AQUA)

DTU Danmarks Tekniske Universitet

Warmer Denmark
Extreme temperatures over the last 12 months



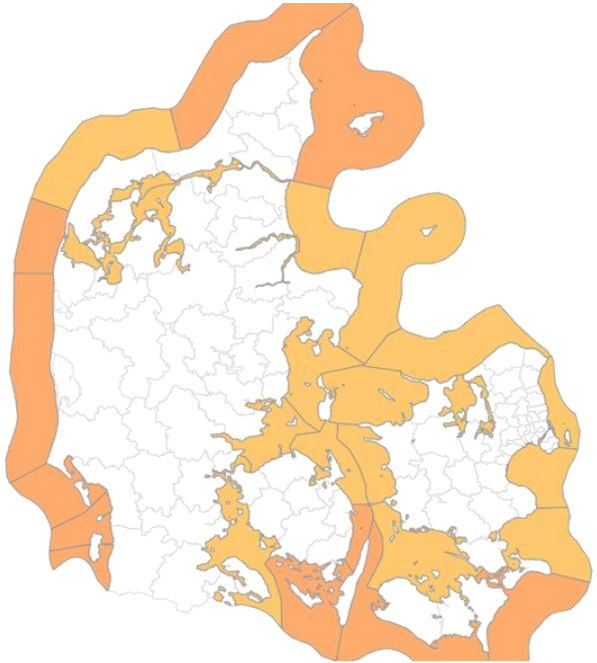
Current Marine Heatwave status based on ocean temperature data for Sun 20 Oct 2019.

DTU Danmarks Tekniske Universitet

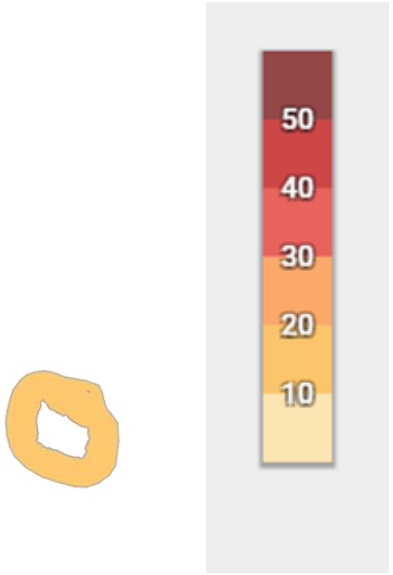
Climate change Forecast DMI

2041-2070

RCP8.5



Ændring i vandstand og stormflod i cm ...
i forhold til referenceperioden 1981-2010

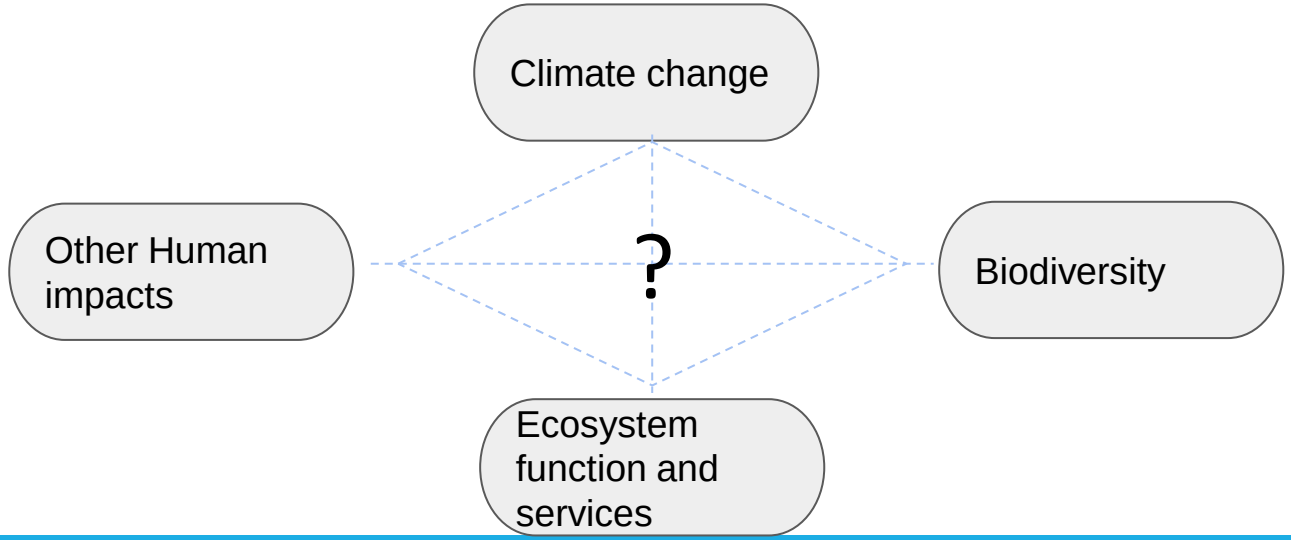


DMI

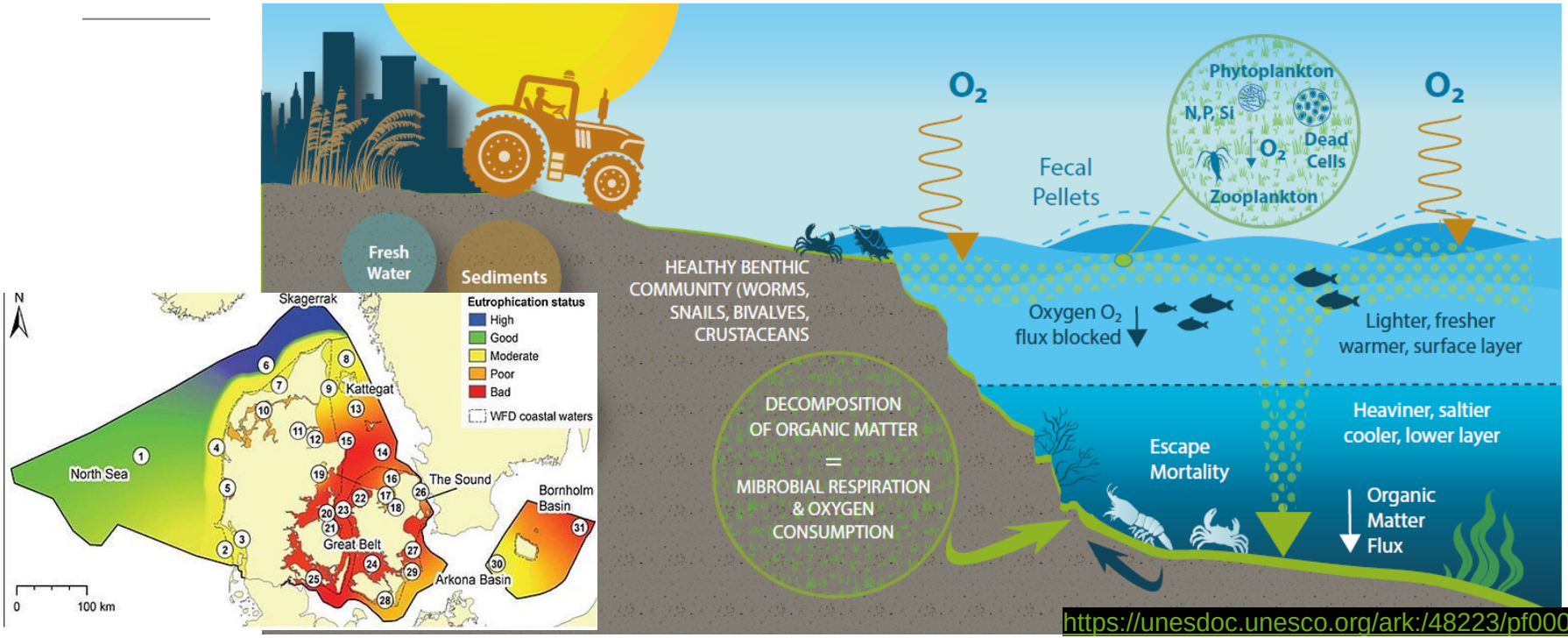
KLIMAATLAS

How does marine biodiversity link to climate change, human activities and ecosystem services in Denmark?

Even though this scientific journey is in many ways just beginning, the science is already clear on some points

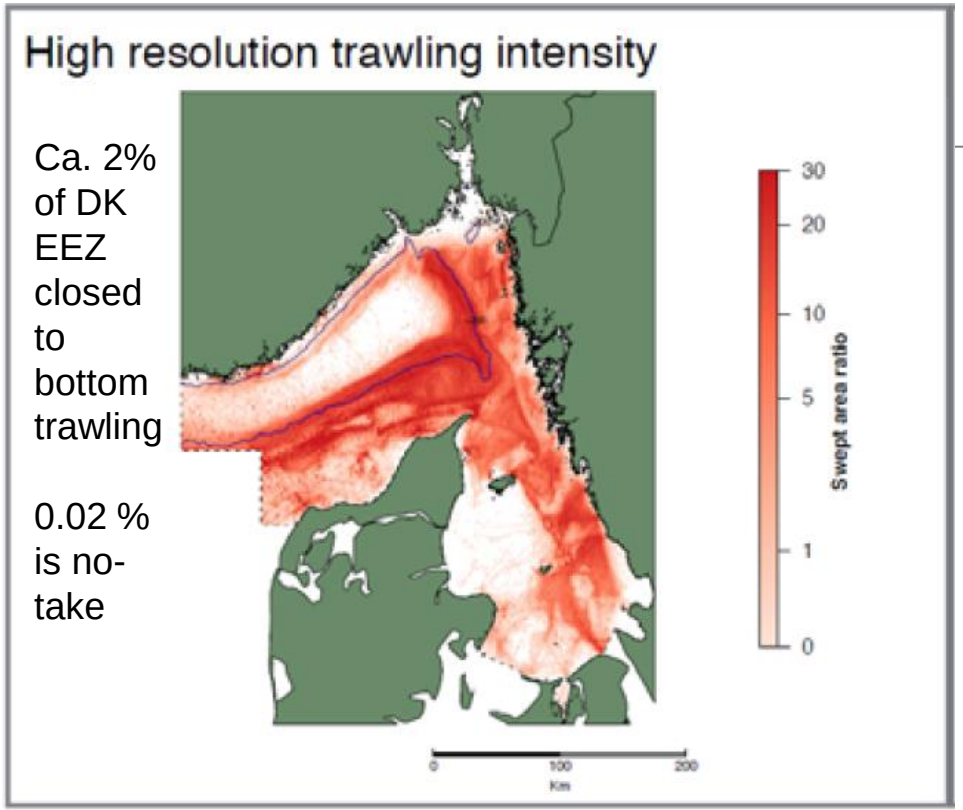


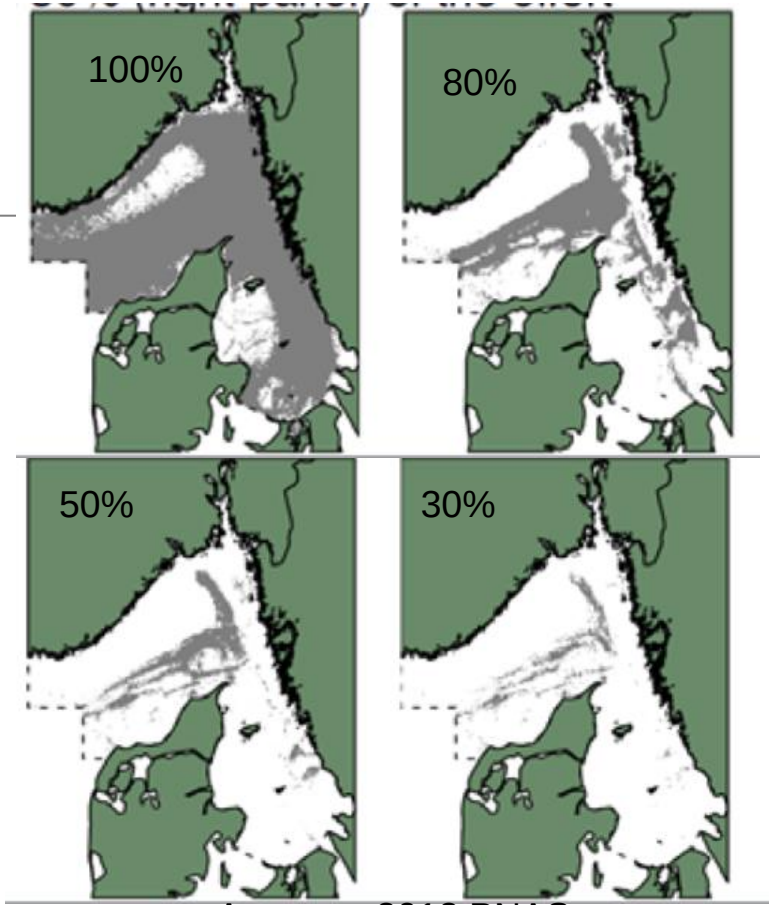
The Ocean is losing its breath: Climate change and anthropogenic nutrients reduce marine oxygen levels (Breitburg et al 2018, Science)



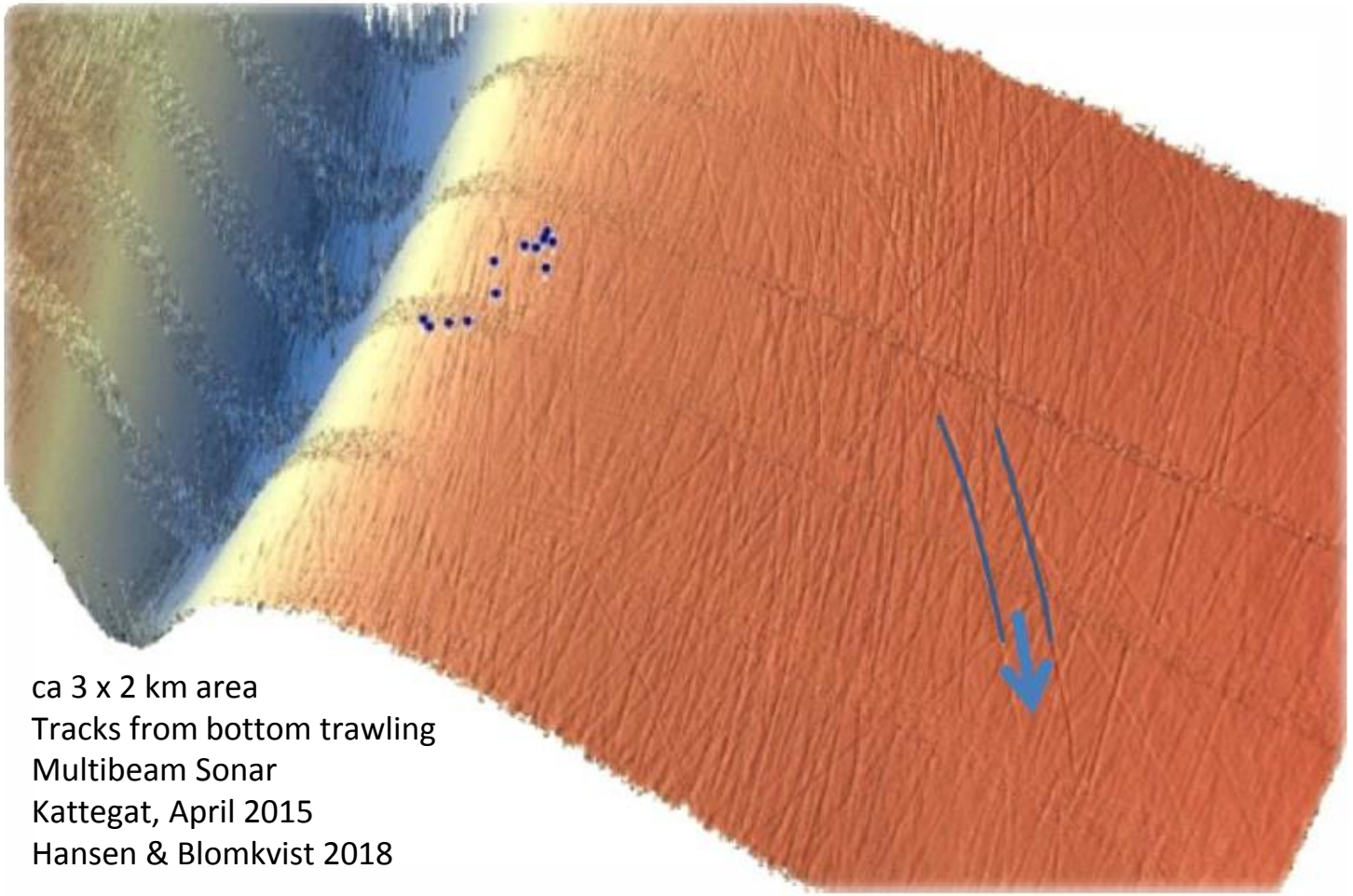
https://unesdoc.unesco.org/ark:/48223/pf0000265196

Miljøstyrelsen, 2014: Danmarks Havstrategi, Basisanalysen



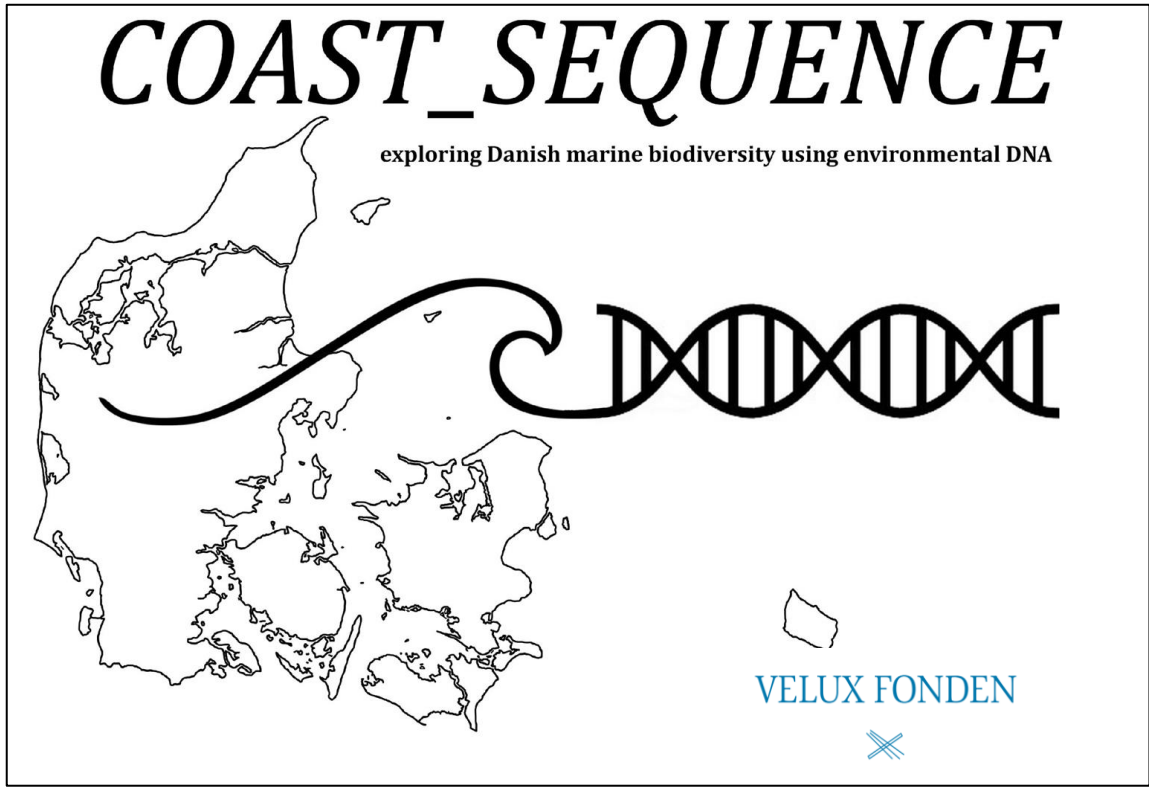


Amorosa 2018 PNAS



ca 3 x 2 km area
Tracks from bottom trawling
Multibeam Sonar
Kattegat, April 2015
Hansen & Blomkvist 2018

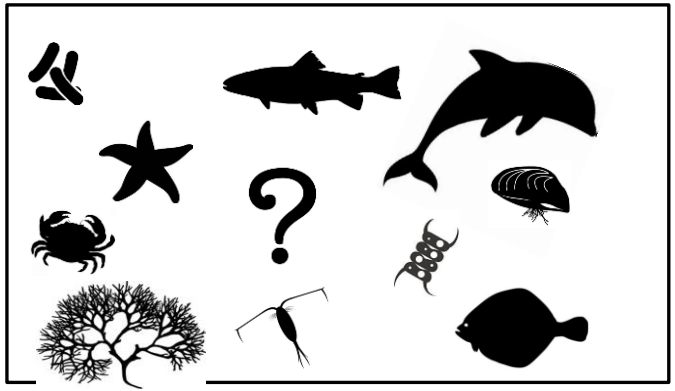
A new scientific journey begins:



What's out there?
Why is it there?

AARHUS UNIVERSITY
NATURAL HISTORY MUSEUM OF DENMARK
UNIVERSITY OF COPENHAGEN
WORLD MARITIME UNIVERSITY

From microbes to mammals



Extensive sampling in 2 seasons 2019

Stratified sampling

Water and sediment

33 clusters – 280 sites

- Rock piers
- Eel grass
- Sand bottom
- Environmental variables
  (temp, pH, nutrients, etc.)

Citizen Science (havblitz.dk)

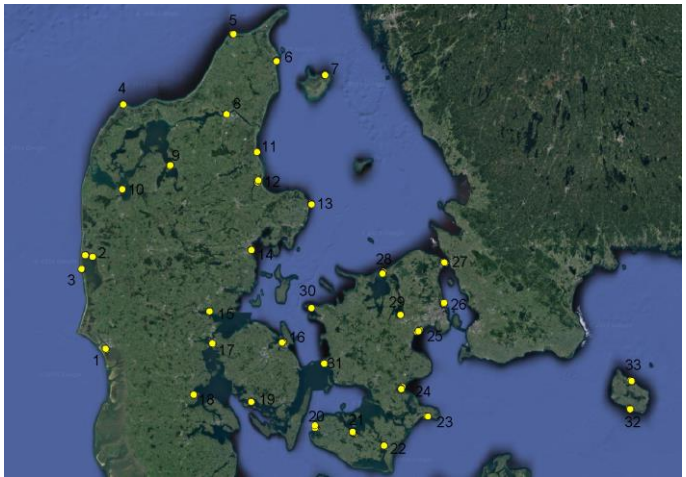
Water

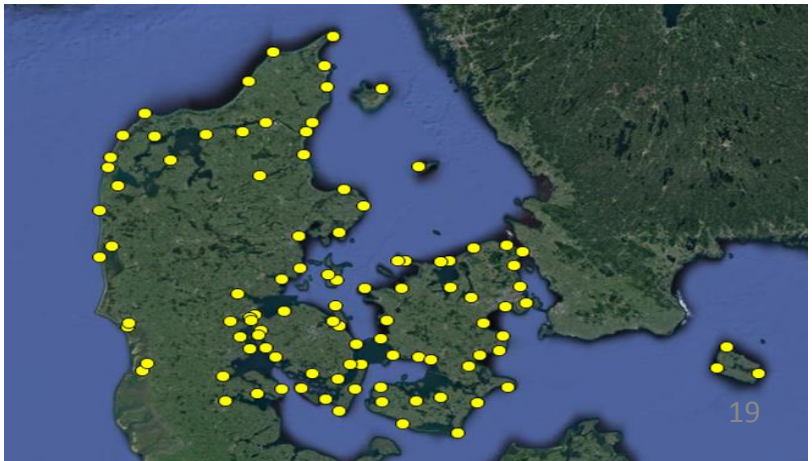
100 sites

- Rock piers

Danmarks Naturfredningsforening

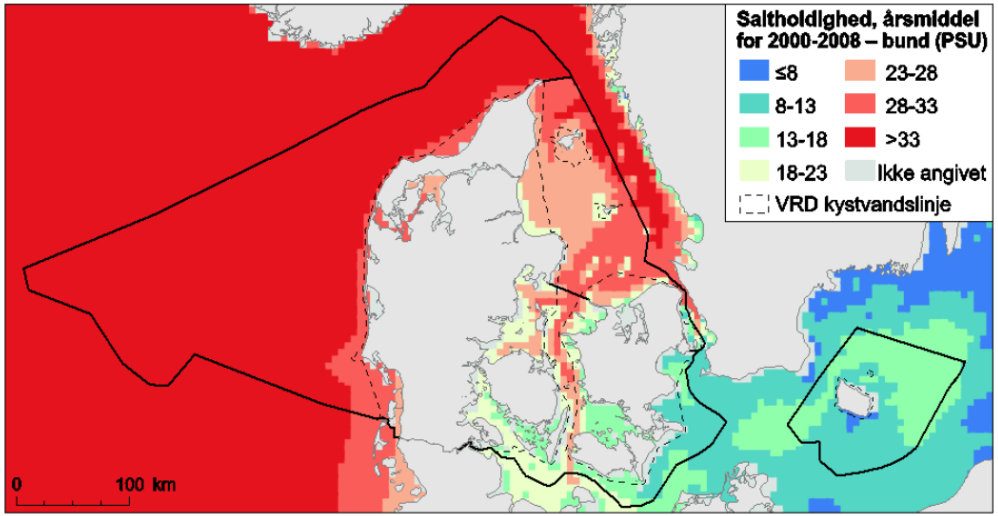
With thanks to Danmarks Naturfredningsforening





Overall aim:

Exploring which factors determine the distribution of coastal Danish marine biodiversity across the tree of life



Where to from here? We must

- **Decarbonize**
- **Proactively prepare Danish society for the future we know we will have**
    - **Increased marine heat waves, temperatures and pressures on the marine environment**
    - **Diversity of other human impacts**
- **Weaken the cocktail of impacts with ecosystem based approaches to management**
    - **Prevent anthropogenic nutrients from reaching coastal waters to reduce eutrophication driven deoxygenation**
    - **Curtail bottom trawling**
    - **Create well-managed and effective no-take Marine protected areas 30%**
    - **We must eliminate and prevent marine debris (e.g. ghost nets)**

Where to from here? We must

- **Implement Zoning with Marine spatial planning (MSP) (need more stakeholders and transdisciplinary science to support this than ever before)**
- **Set aside places to monitor change- reference areas. Helps us to understand, what is under DK control?**

Global challenges

- **Denmark is connected to the rest of the World**
- **What happens in the rest of the World has an impact on Denmark, its trade, industry and ecosystem services too (sea food, etc)**
- **We need to build capacity, (not just in Denmark but everywhere) to innovate solutions to climate change and impacts of human activities**

We must also respond to the crisis of mistrust in scientific consensus

- How can we inoculate Danish society (adults and children) from the spread of misinformation about climate change, biodiversity and ecosystem services?
- Who has access to scientific communication? Who is addressing scientific communication for e.g. children & youth (2030 voters) in real time?
- Note: Lack of trust in science might impact funding for science

Skål!

T.K. Soerensen, P. Mariani,B. MacKenzie, A. Christiansen, M. Payne, P. F. Thomsen, M. Rudd, J. H. Andersen, A. Polejack, P.R. Moeller

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