The (Dutch) North Sea- Carbon content and policy implications

North Sea Days 2023

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The North Sea- Biodiversity: MSFD seabed habitat types

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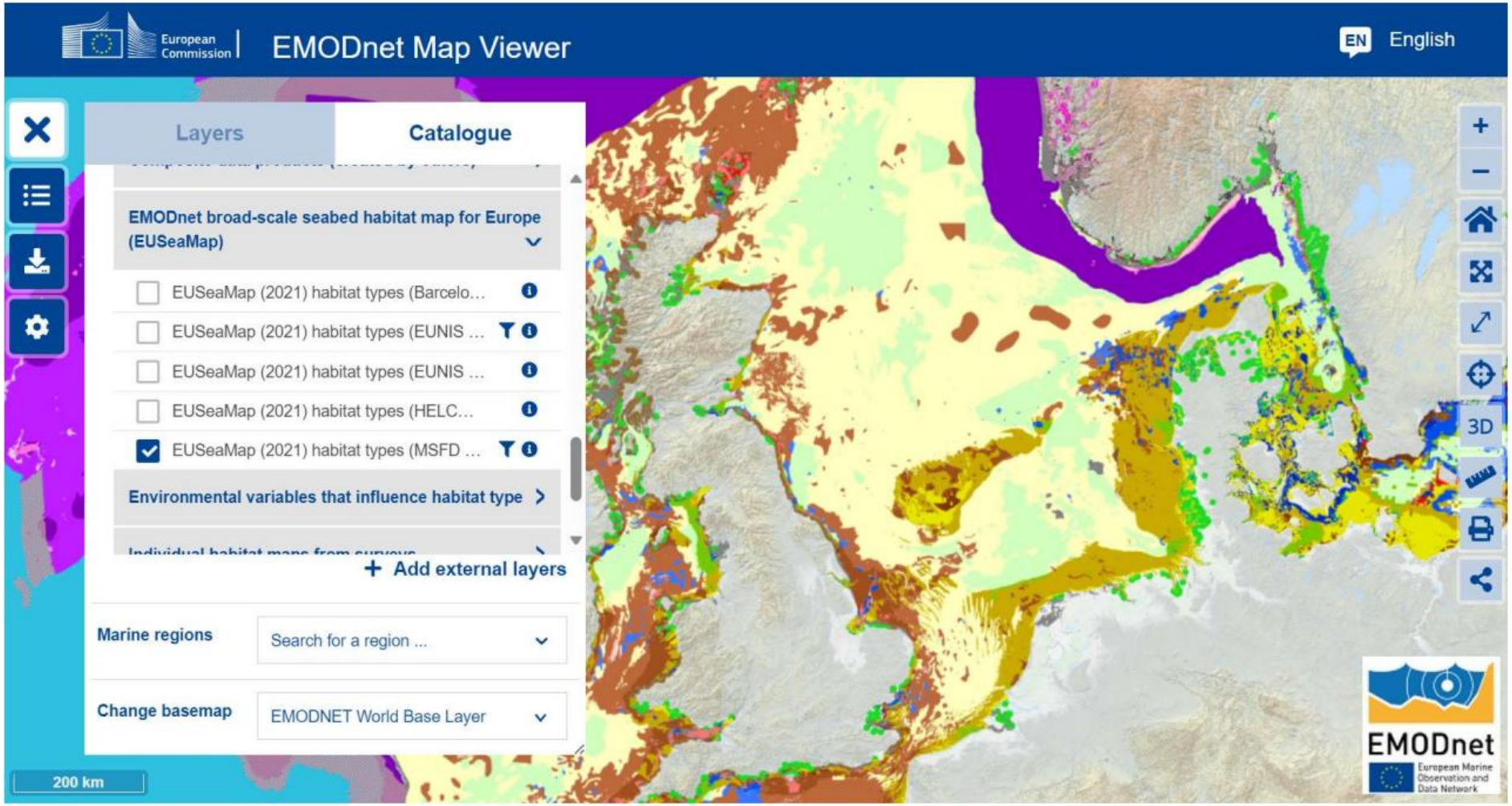

The North Sea: Carbon content

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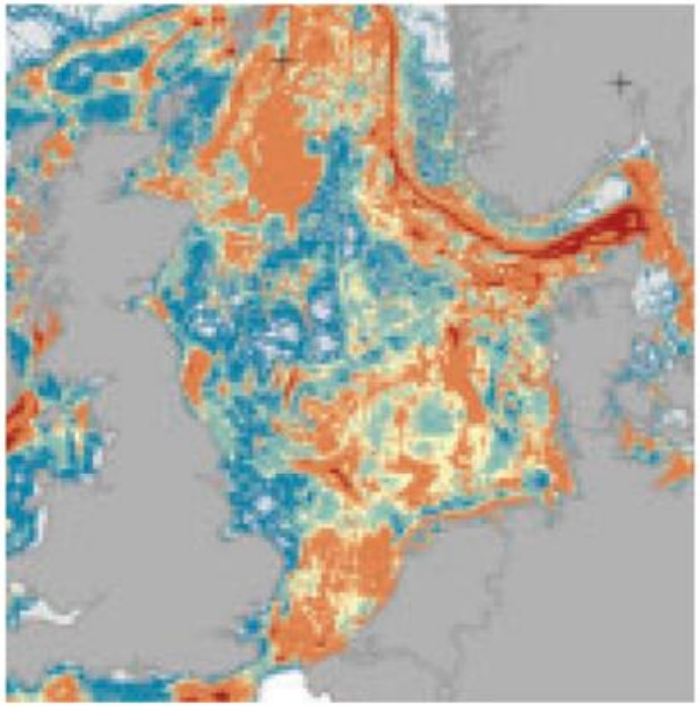
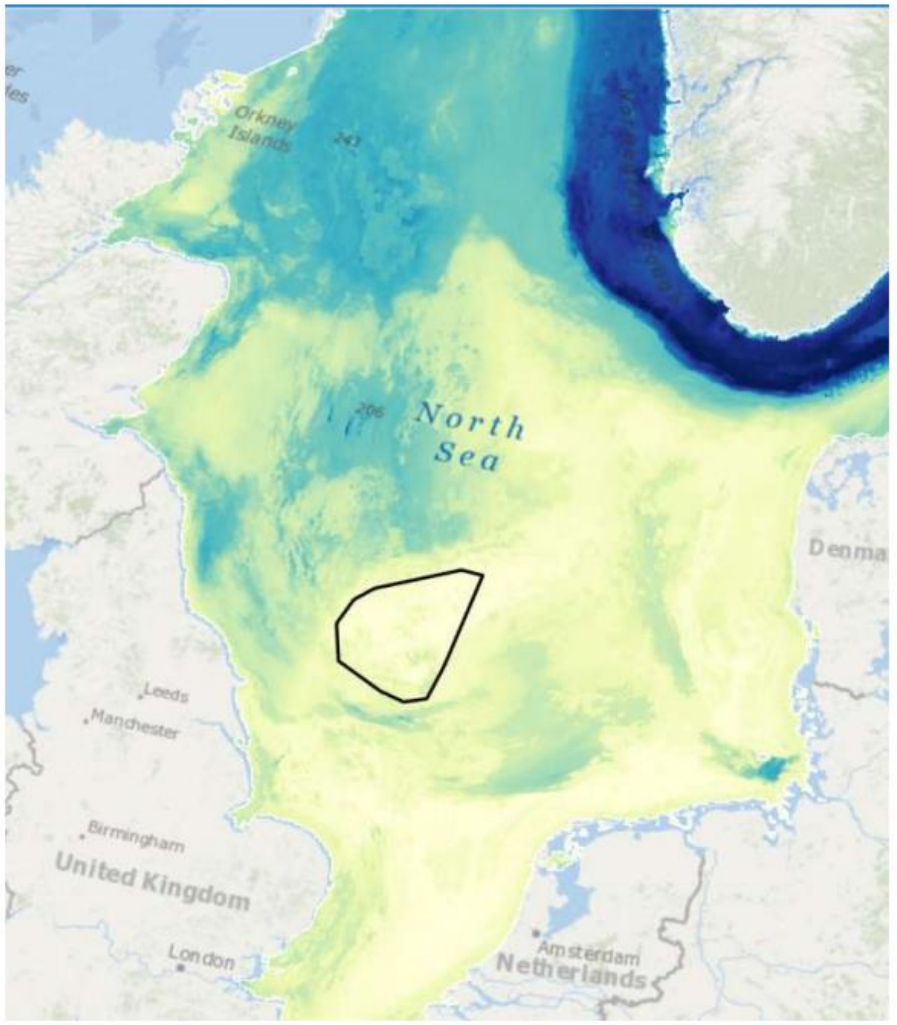
Highest trawl intesity

versus highest C-content



Eigaard et al. 2017



Diesing et al. 2021

The seafloor's potential for carbon storage: source or sink?

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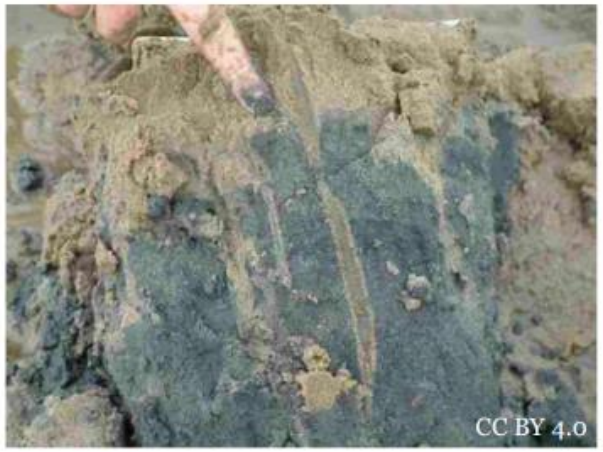
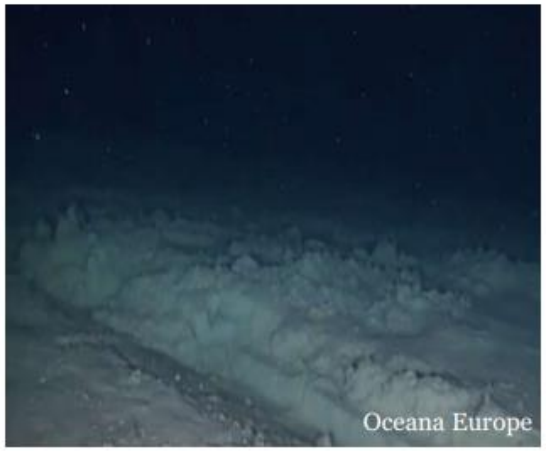
- **Source:** the degradation of organic matter is enhanced due to high levels of oxygenation which leads to aerobic microbial mineralisation. Organic carbon and nutrients are recycled fast and return into the system.
  >> coarse sediments, high levels of infaunal activity (bioturbation/bioirrigation) and/or high levels of physical disturbance (natural/anthropogenic)





The seafloor's potential for carbon storage: source or sink?

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- **Sink:** the degradation of organic matter is reduced due to low sedimentary oxygenation. Organic matter is accumulated and stays on the seafloor.
  >> fine sediments, low levels of infaunal activity & physical disturbance and/or epibenthic cover (makrophytes, seagrass, reef structures) reducing current velocity, leading to better sedimentation and reduced porewater flow

Consequences of the physical disturbance

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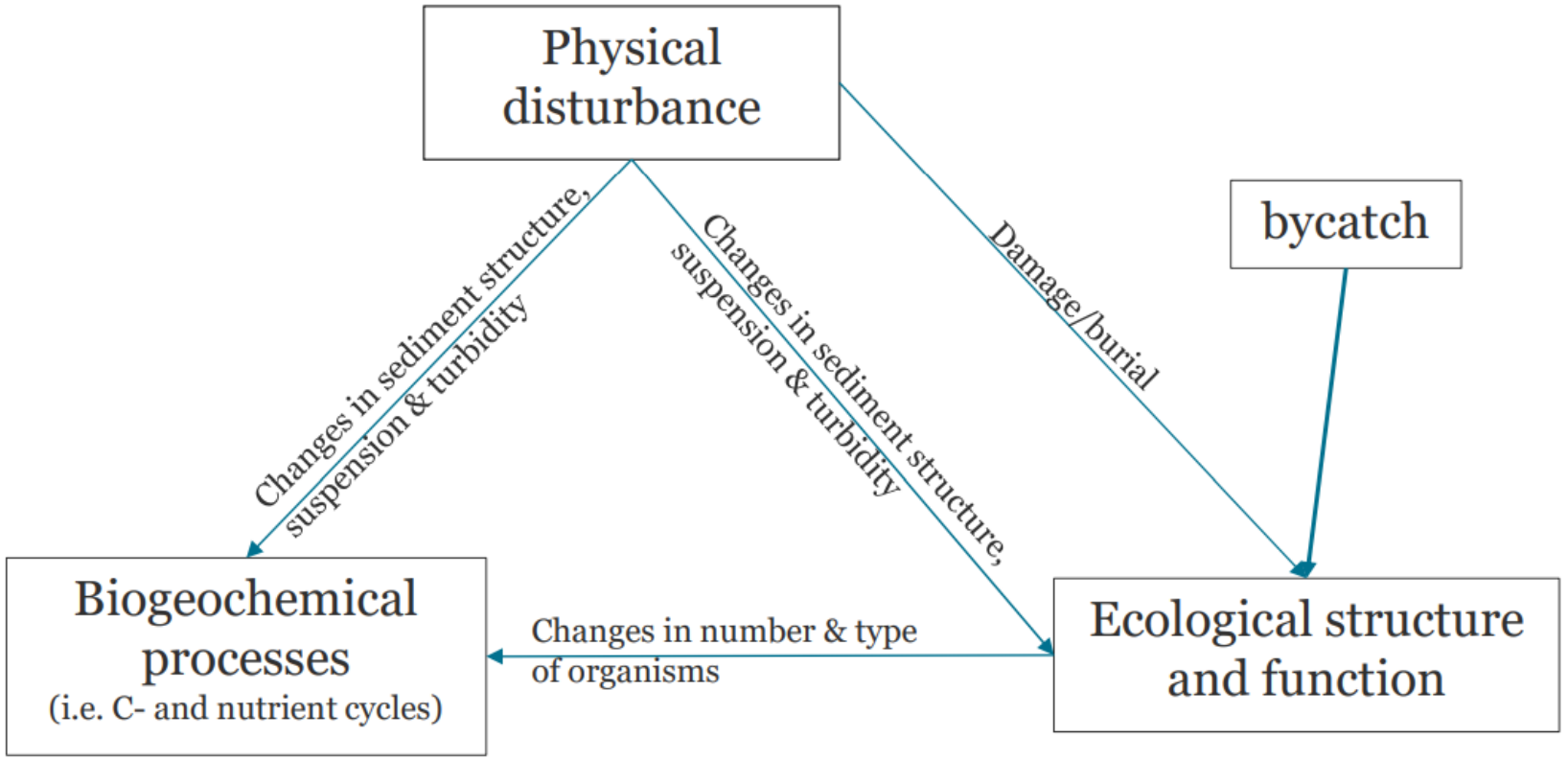

Carbon & nutrient cycles

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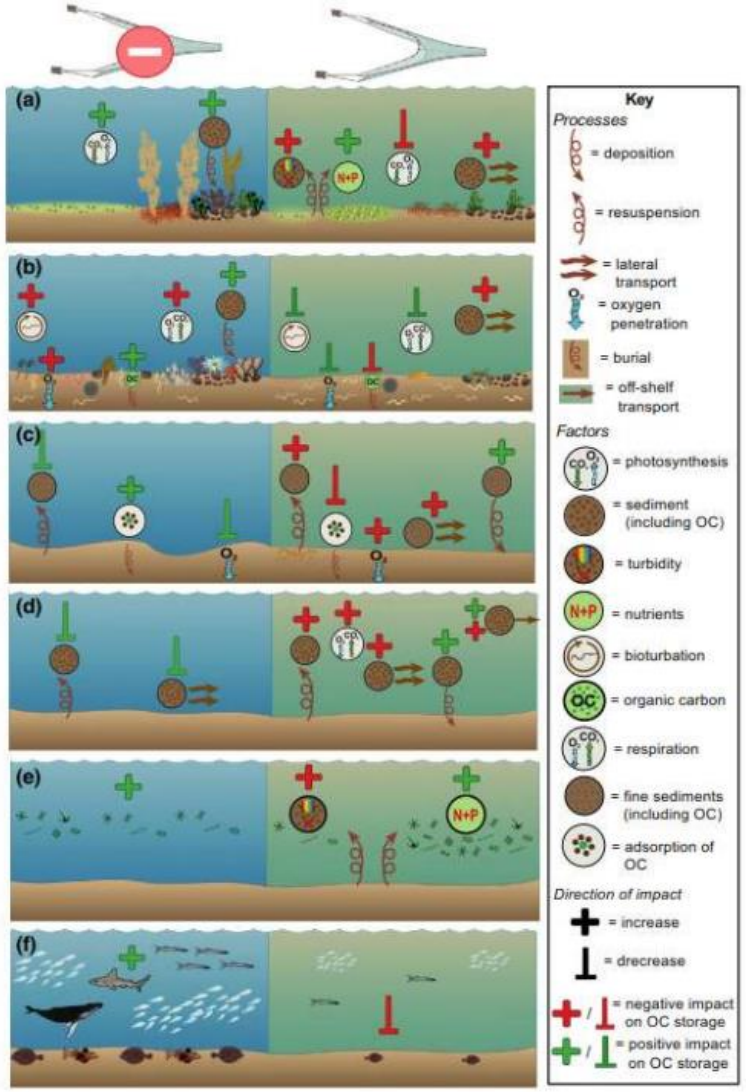
- Sediment-Resupension: sediment plume contains i.a. C, N, P, Fe and Mn
- Dissolved nutrients: NH_4, NO_2, NO_3

  >> natural nutrient cycles are disrupted
- Mineralisation in the water column increases >> Oxygen consumption in the water column increases
- Pollutants are resuspended
- restoration of natural biogeochemical equilibrium in the sediment can take weeks to months

Epstein et al. 2021: The impact of mobile demersal fishing on carbon storage in seabed sediments



Organic Carbon in the Dutch North Sea

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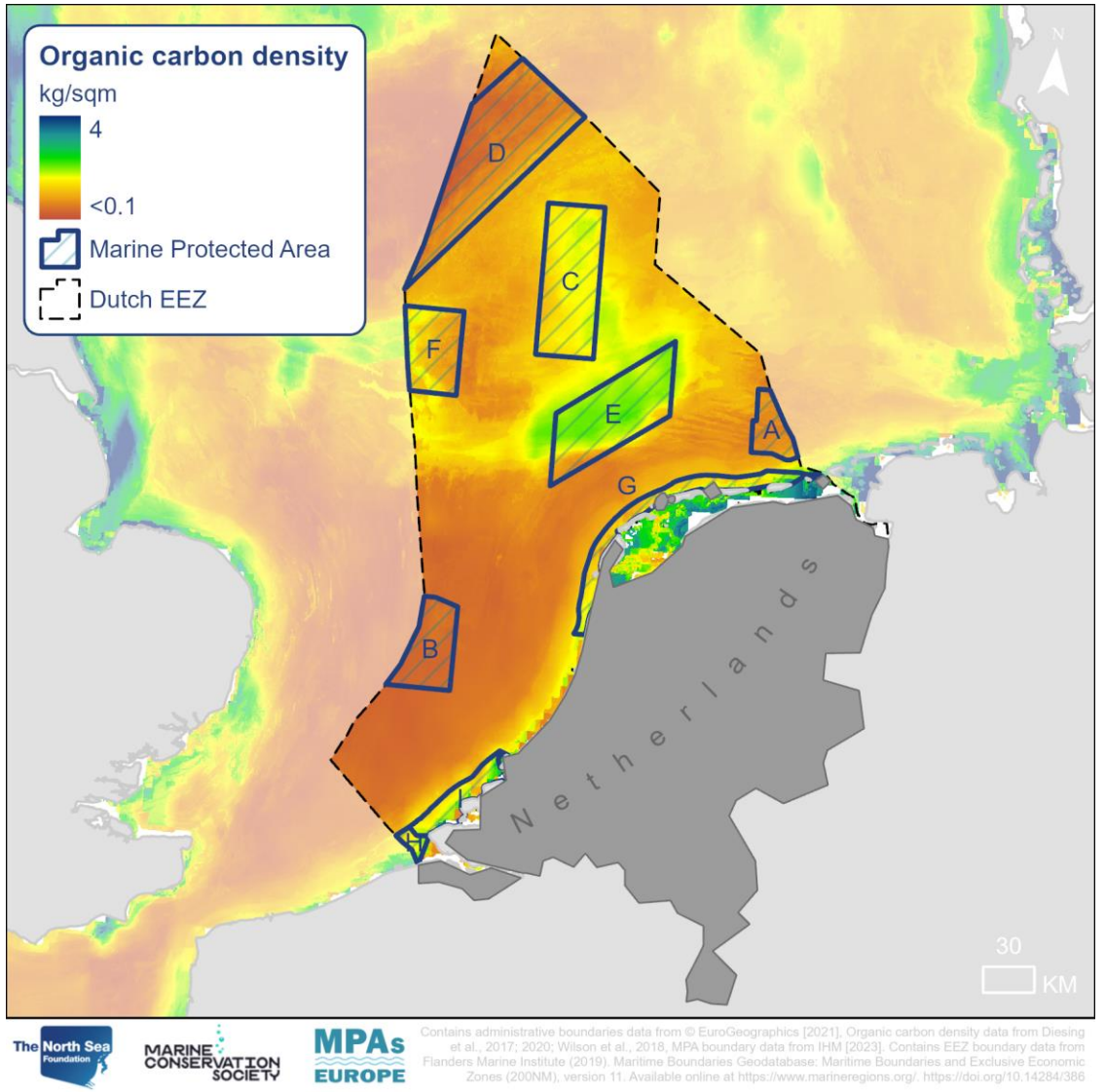
- The ocean is our largest carbon sink, absorbing more than a quarter of all human CO2 emissions.
- Our Dutch North Sea also stores organic carbon. The density of organic carbon is 11% higher in MPAs than outside
- These areas are estimated to store around 20.5 million tonnes of CO2 in seabed sediments, representing about 42% of the greenhouse gas emissions of Dutch industry in 2022



Policy implications?

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- Blue carbon is still underutilised in efforts to combat climate change

Potential actions?

- Invest in research and monitoring of marine ecosystems and blue carbon storage in Dutch waters to better understand their potential and the impact of human activities
- Implement strict protection measures for marine habitat areas to minimise disturbances and promote blue carbon storage
- Incorporate blue carbon storage into national climate policy and greenhouse gas emissions reporting to recognise its contribution to climate change.

Bedankt! Vragen/opmerkingen?

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Physical disturbance

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- Elevated seafloor structures (biogenic and other such as sand ripples) are flattened
- Trawl doors leave groves in seafloor: 2.5cm – approx. 20cm depth
- Sediment mixing leads to change in physical characteristics: porosity, grain size, permeability, water content as well as chemical properties (redox, pH,...)
- Sediment plumes: up to 500m in length and 10m height after 2h, visible for 3-4 days in > 1km distance
- Sediment cohesion at the seafloor decreases leading to easier future „erosion“, i.e. loss of fine(r) sediment fractions
- Extent of these effects depends on water depth and sediment type/mud content
- Largest effect: in water depths where resuspension is usually low, i.e. large depth/high mud content

Zooming in: bottom-trawling intensity

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- % of the sea floor trawled during a year, was estimated at 63% (0-200m depth) and 31% (200-1000m depth) North Sea wide.
- For the Dutch part of the North Sea this is 81%.
- 90% of the effort occurring in less than 50% of the footprint. In these core fishing grounds, the bulk of the landings is taken.

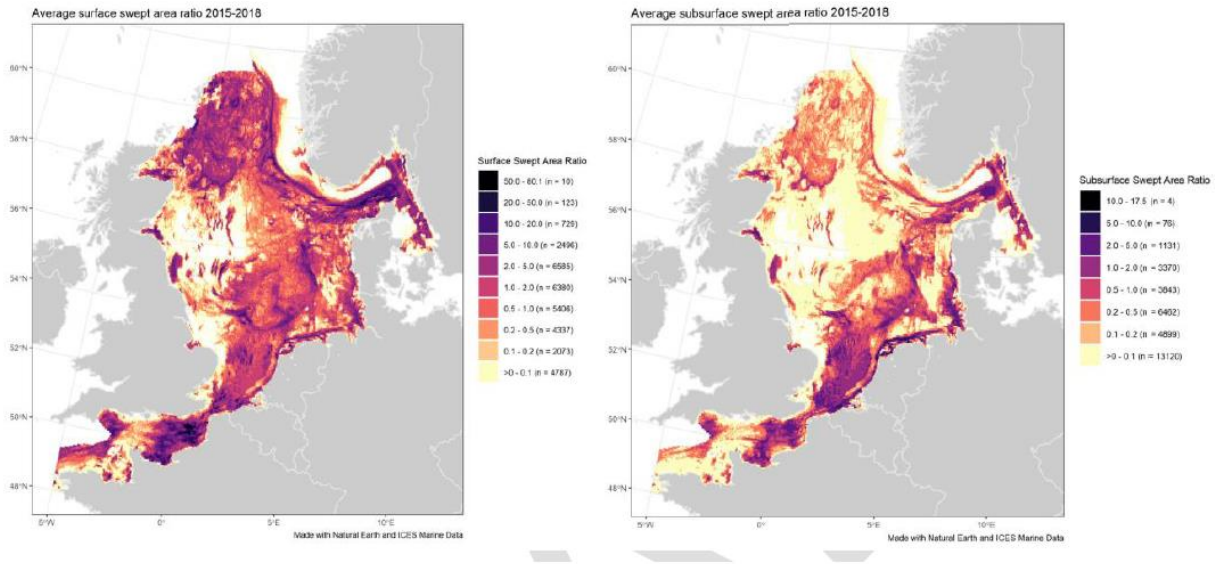
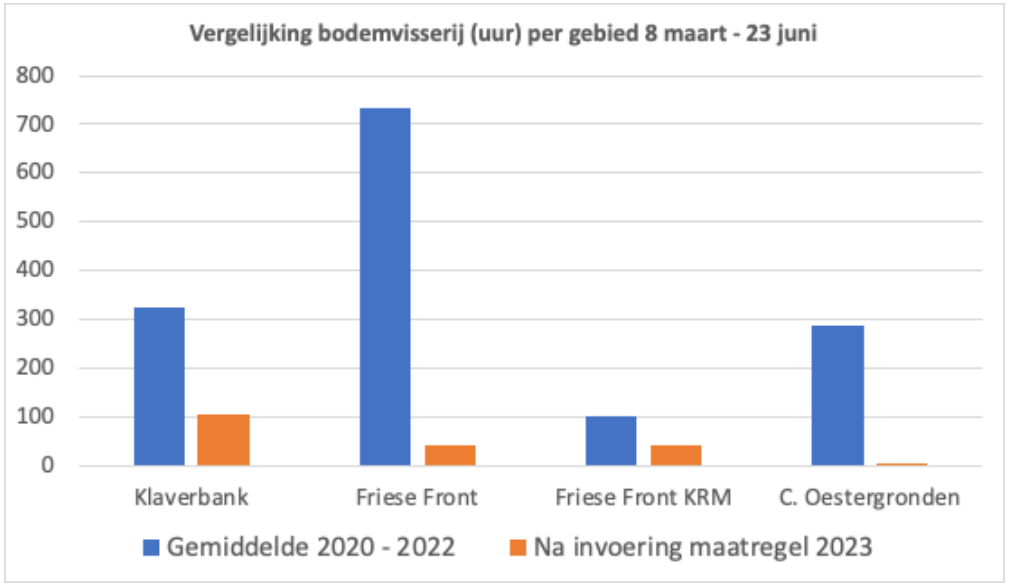


Figure 4 Average annual surface (left) and subsurface (right) disturbance by bottom contacting towed gear (Bottom otter trawls, beam trawls, dredges, and demersal seines) in the Greater North Sea during 2015–2018, expressed as average swept area ratios (SAR). Source: ICES (2020)



- The average bottom fishing intensity is 2X higher inside MPAs than outside them

- Since 8 March 2023, fishing measures have been in place in three designated nature reserves. The result has been a 78.5% reduction in fishing activities.

Extra slides/info

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