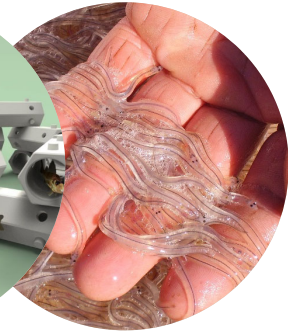
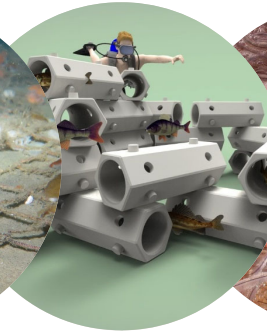
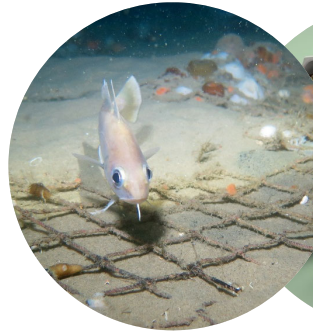


Is there a future for the North Sea of our grandparents?

Tinka Murk (Marine Animal Ecology, Wageningen University)

Noordzeedagen, Texel, 4-10-2018

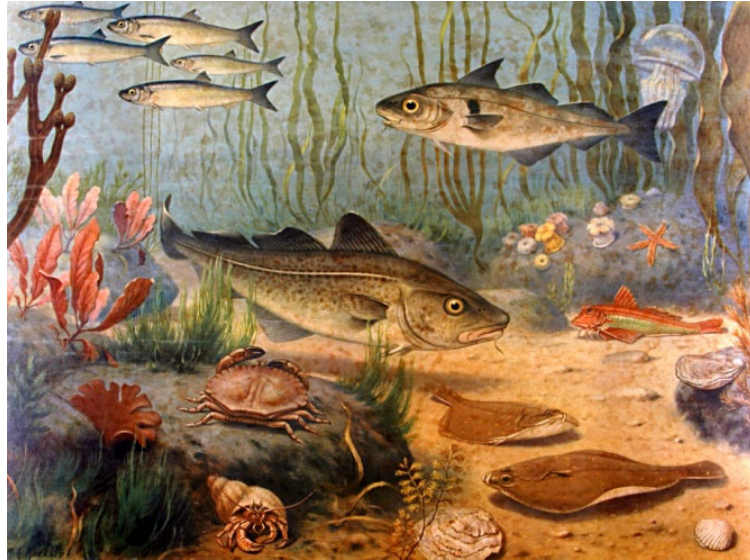


Our 'ambition' for the future North Sea (in 2030 => 2050)

- Robust
- Ecologically healthy
- Good environmental condition
- Productive
- Clean
- Healthy structure and functions
- Resilient
- Including long living, large toppredators
- Realise potential biodiversity and production



North Sea 3.0 (healthy, productive, resilient)



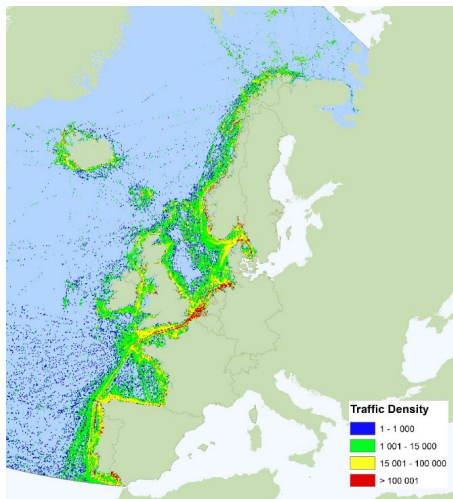
'In de Noordzee' (M.A. Koekoek, 1931)

Recipe for North Sea 3.0

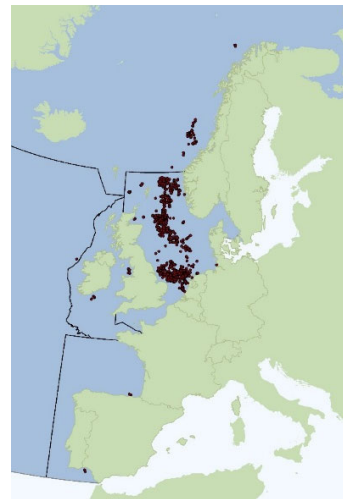
- Ensure necessary diversity of enough and good quality habitats
- Enable connectivity between habitats required to fulfil life cycles
- Support full food web functionality
- Ensure good environmental quality

Where are we now, in the year 2018 ? (1/2)

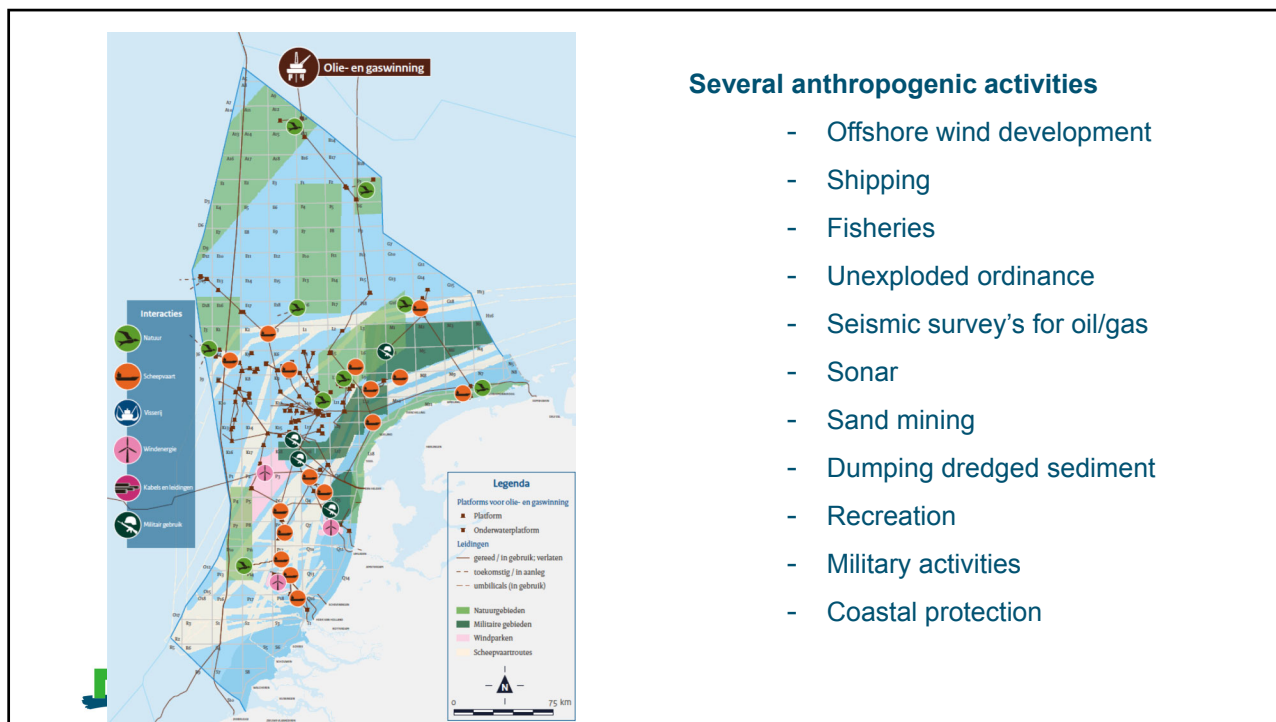
- North Sea 2.3 (Anthropocene)
- Populations of commercial fisheries species are regulated
- Contamination is strongly reduced
- Limited habitat diversity, large part seafloor is seriously degraded
- Large diversity of disrupting human activities
- Harvesting of food from sea mainly by hunters/gatherers
- Dedicated MPAs almost all still used, incl. fisheries
- Ambition for Blue Growth



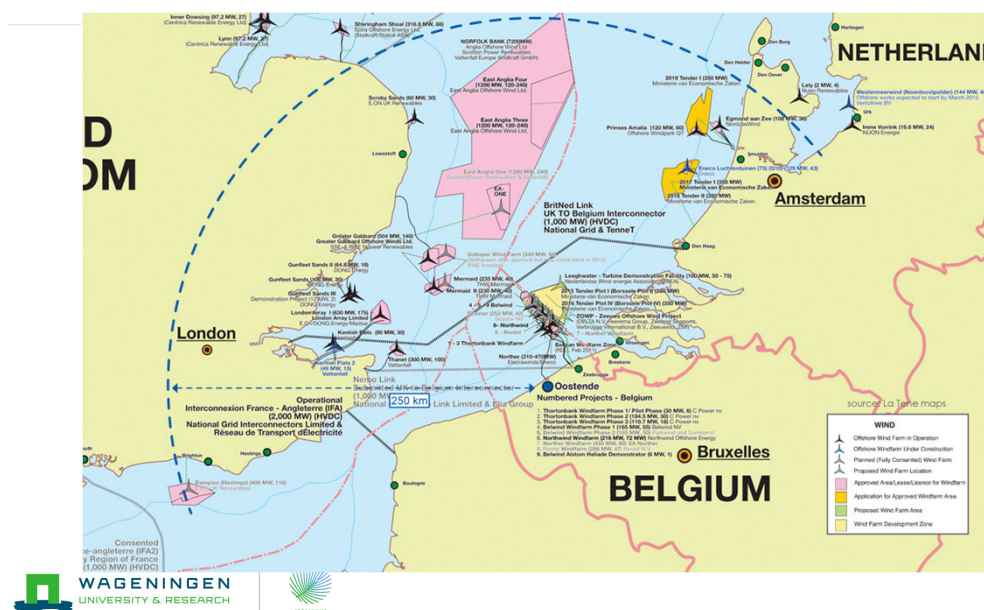
Intensity of shipping in OSPAR Maritime Area for 1 week period in February 2017 (Data Source: EMSA)



Oil and gas installations in the OSPAR maritime region (Data Source: OSPAR)



Offshore windfarms (realised & planned)





Blue growth:

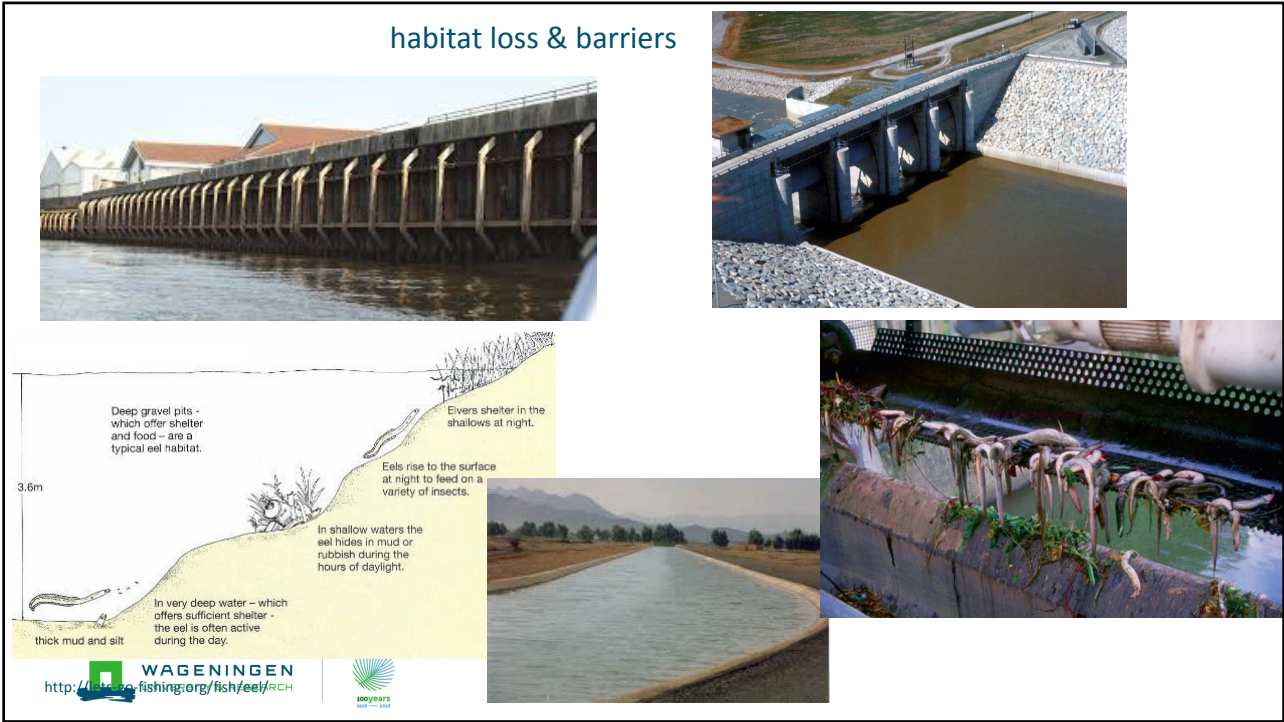
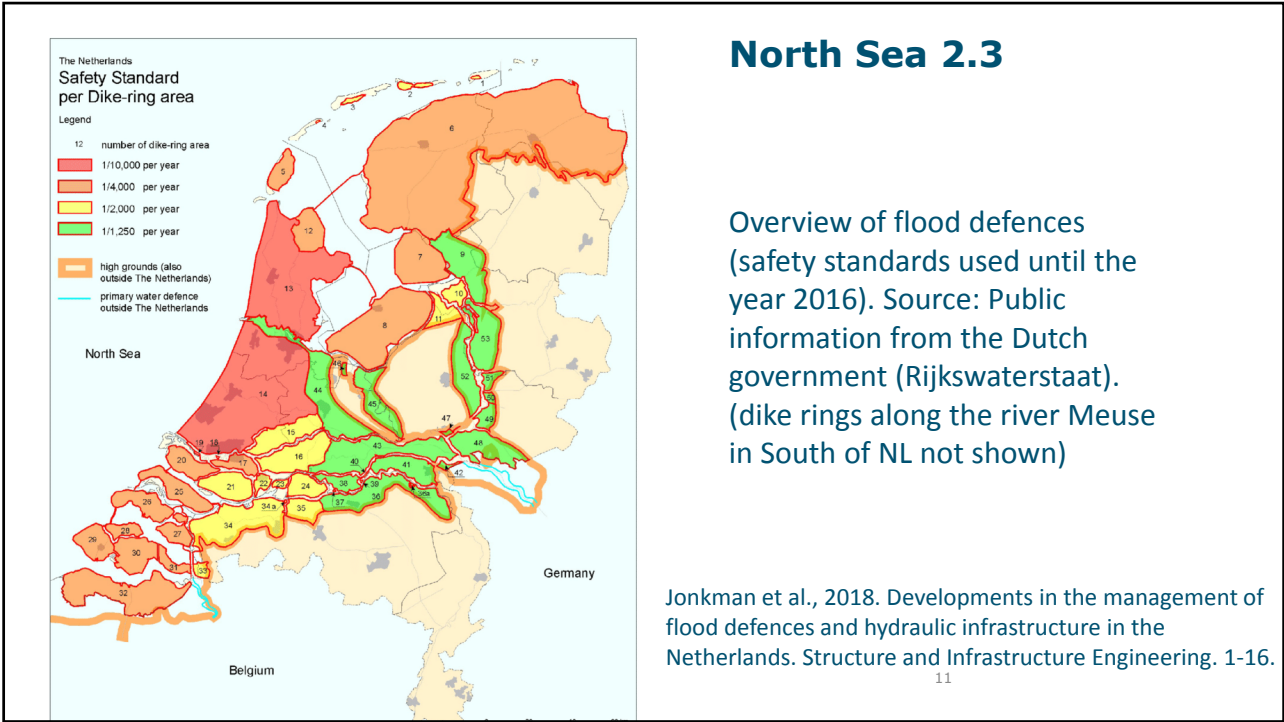
develop sectors that have a high potential for sustainable jobs and growth, such as:

- aquaculture
- coastal tourism
- marine biotechnology
- ocean energy
- seabed mining

ec.europa.eu/maritimeaffairs/policy/blue_growth_en ⁹

Where are we now, in the year 2018 ?(2/2)

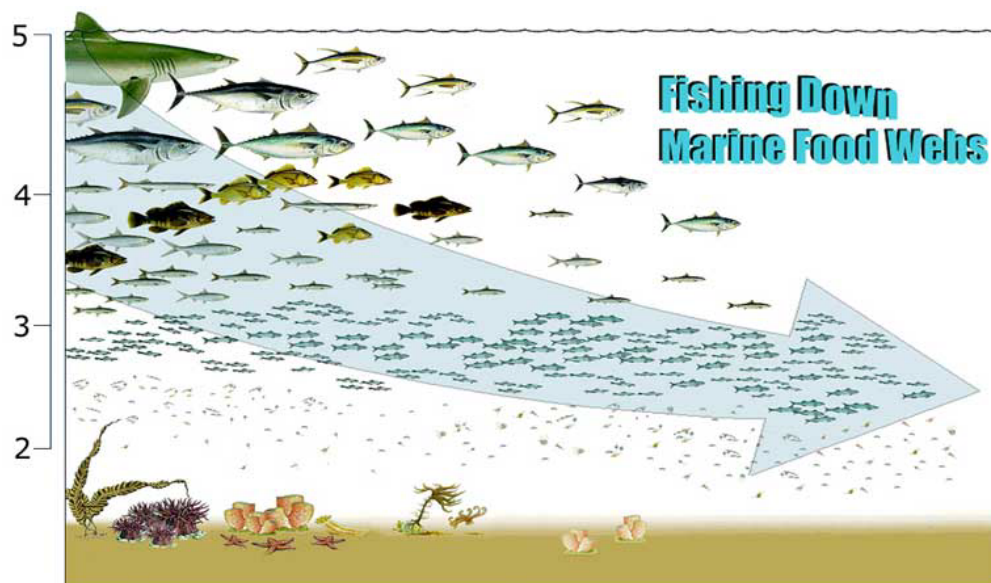
- Important migration routes blocked
- Estuarine habitats decimated and degraded

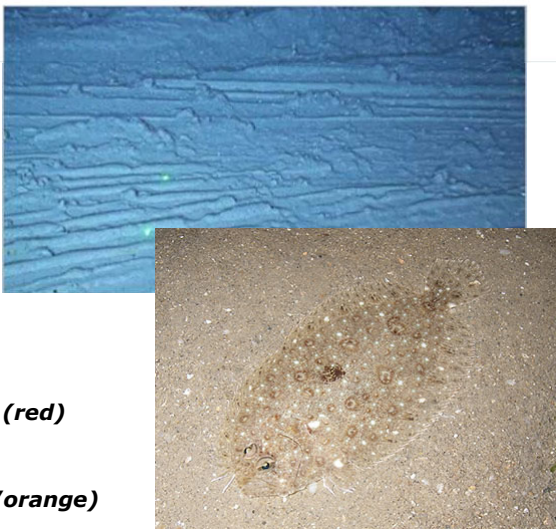


Where are we now, in the year 2018 ?(2/2)

- Important migration routes blocked
- Estuarine habitats decimated and degraded
- Long living marine top predators absent
- Large predators only reach fraction of their maximum size

Fishing down the marine food web

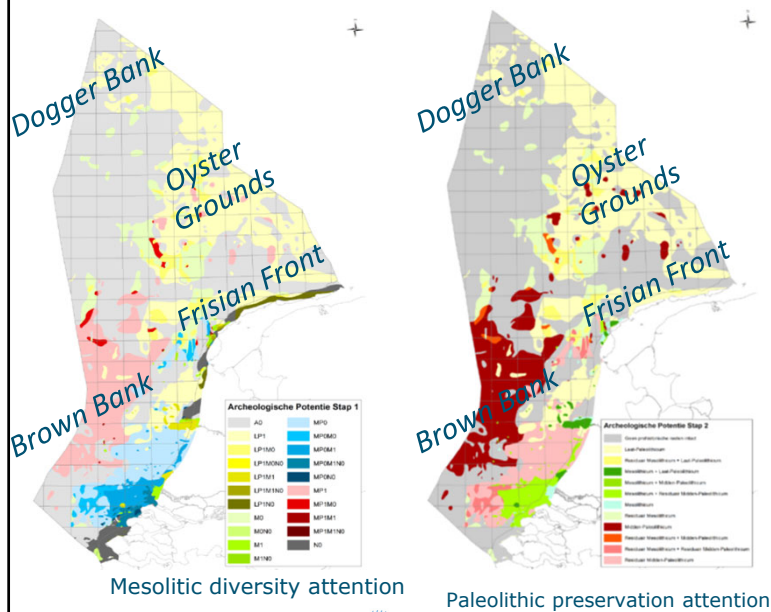


[illegible]

Keileem (red)

Zand
(yellow/orange)

Pebbles (black)



Mesolithic diversity attention

Paleolithic preservation attention

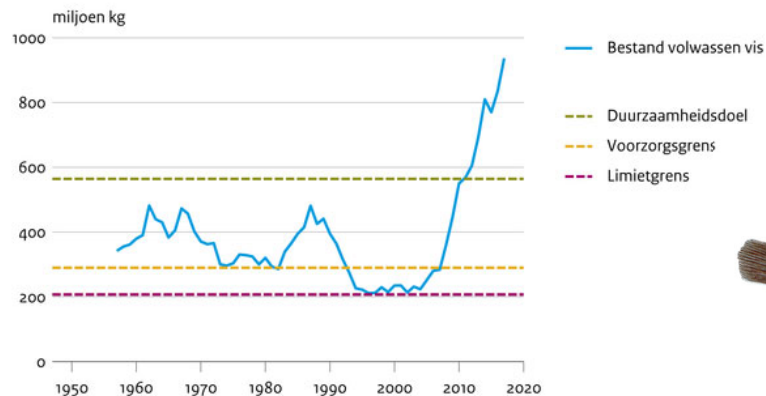


Deltares

Min. Economic Affairs

European plaice (*Pleuronectes platessa*) populations in the North Sea

Scholstand in Noordzee



Bron: ICES 2017

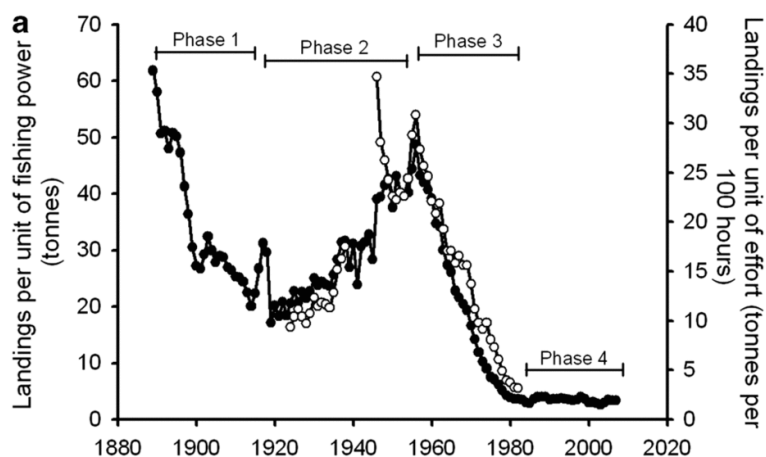
CBS/sep17
www.clo.nl/nl007318



www.clo.nl/indicatoren/nl0073-visbestanden-in-de-noordzee

17

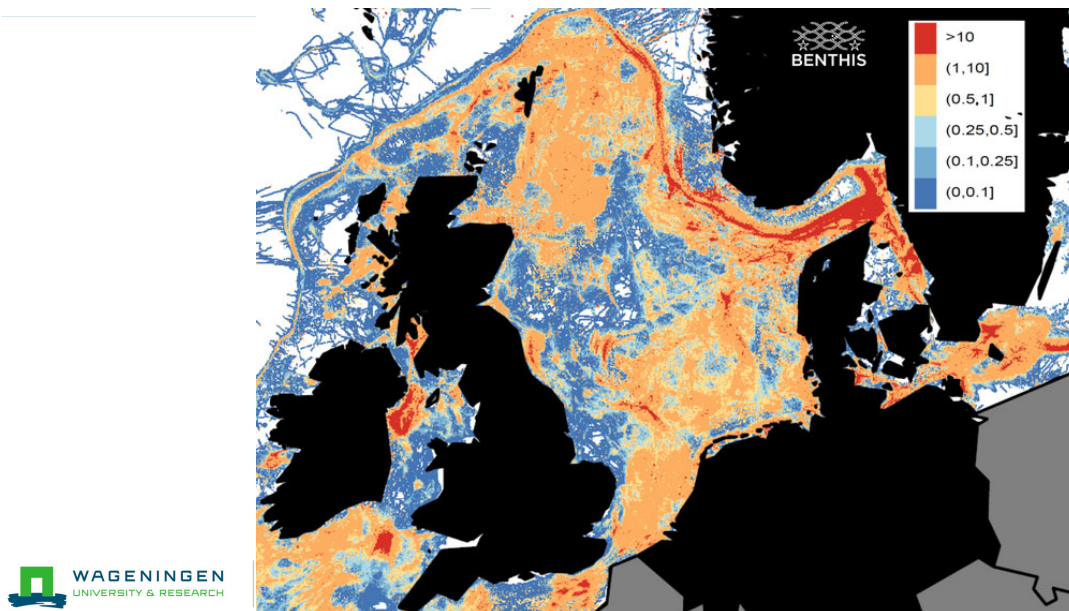
Landings of bottom-living fish per unit of fishing power of large British trawlers.



www.nature.com/articles/ncomms1013/figures/2

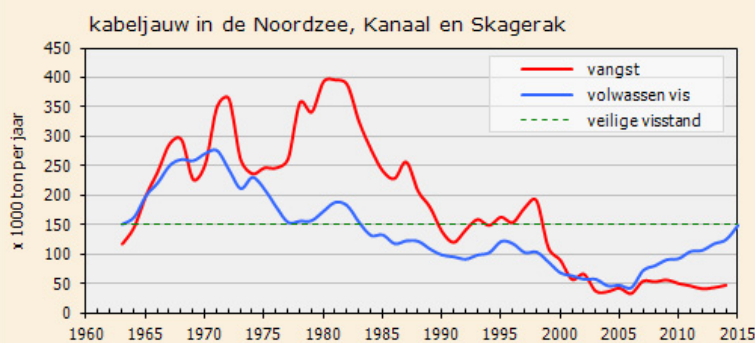
From: The effects of 118 years of industrial fishing on UK bottom trawl fisheries

Intensity seafloor damaging fisheries



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Cod populations in the North Sea

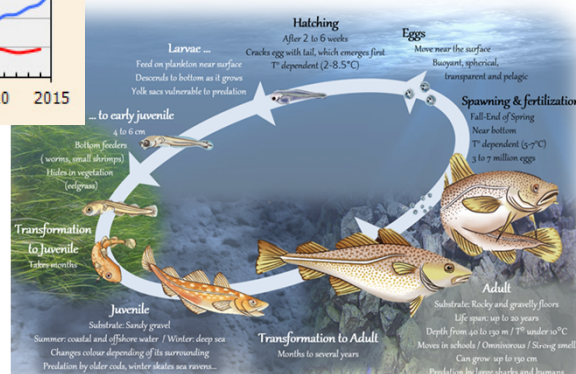


www.vliz.be/vleet/content-vleet.php?id=3892&language=0

ARKIVE
www.arkive.org



Atlantic Cod, *Gadus morhua* - Life cycle



Schipwrecks are most important reefs in North Sea 2.3



Fishermen, divers and eDNA:
you find mackerel and cod around reefs/wrecks
Structures have higher biodiversity & up to 500x
more biomass than sand



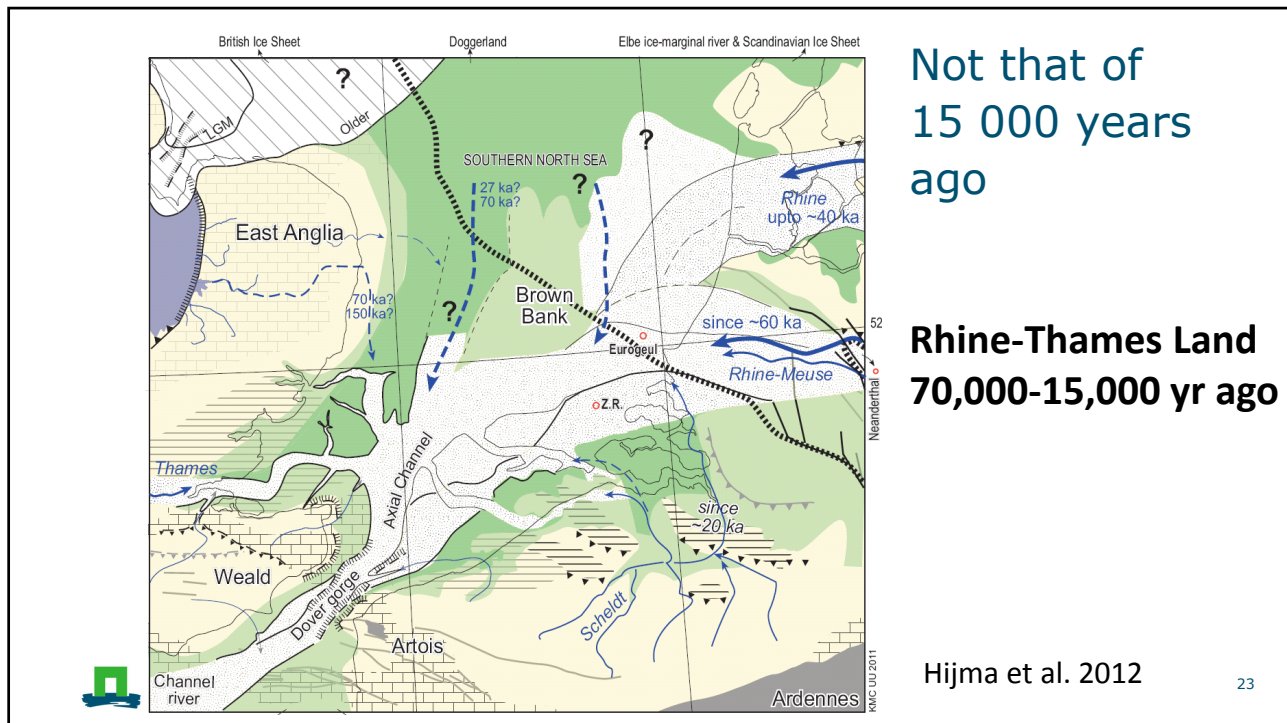
What if the reefs are gone in
100 years from now?



Colourful life on ship wrecks
Photo: Tinka Murk

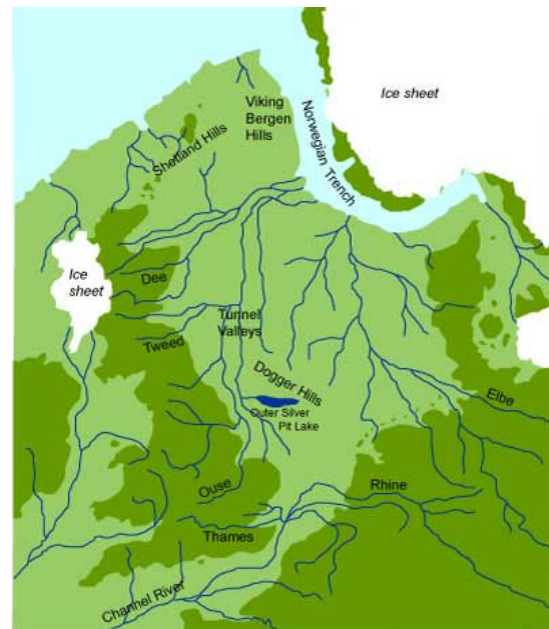
What baseline should we strive for?
What is the 'real' North Sea 1.0 ??





Not that of 9000 years ago

Doggerland inhabited by Doggerland people



Reconstruction of Doggerland, ca. 9,000 years ago
After: N. C. Flemming, The scope of Strategic Environmental Assessment of North Sea areas SEA3 and SEA2 in regard to prehistoric archaeological remains (London: Department of Trade and Industry, 2002);

24

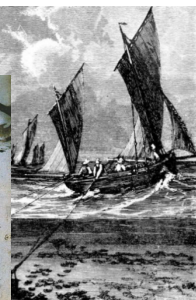
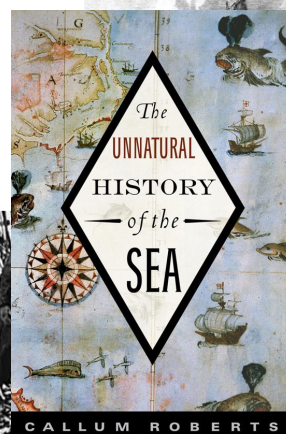
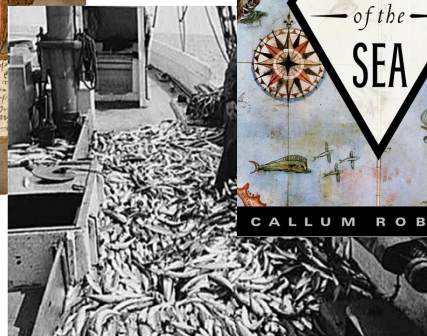
Is it the North Sea of 400 years ago?



Historical map of the Netherlands (1658) with De Zuyder Zee' (Johannes Janssonius)

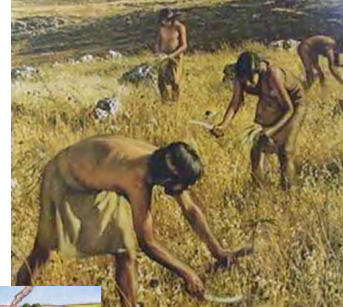
25

Already intensive human impact since 1000 yrs!



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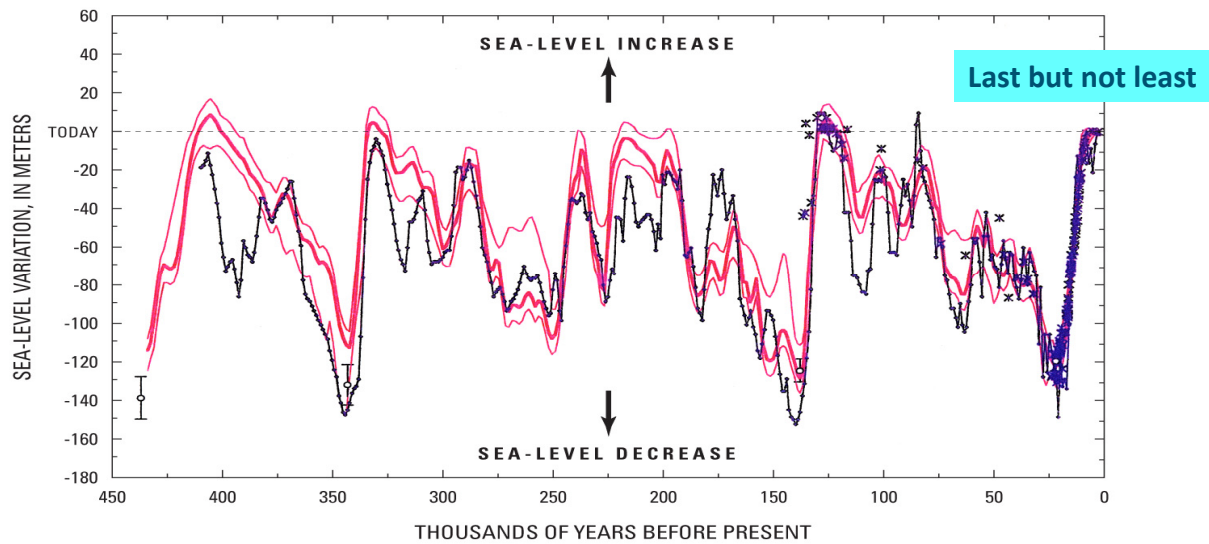
On land intensive human impact started much longer ago....



If we do not have a North Sea 1.0 reference,
what should we strive for?

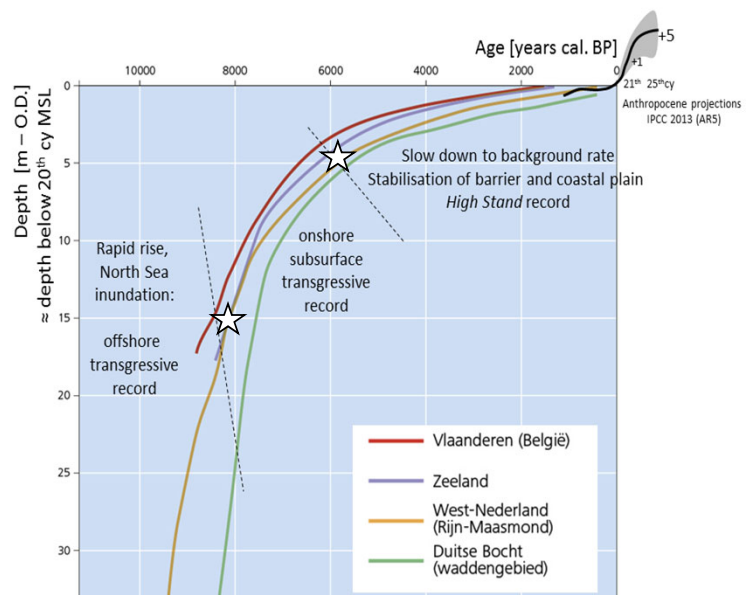
How do we go from North Sea 2.3 to
North Sea 3.0 as long as we do not know all
mechanisms?

To start with: Glacial cycles 'set the stage'

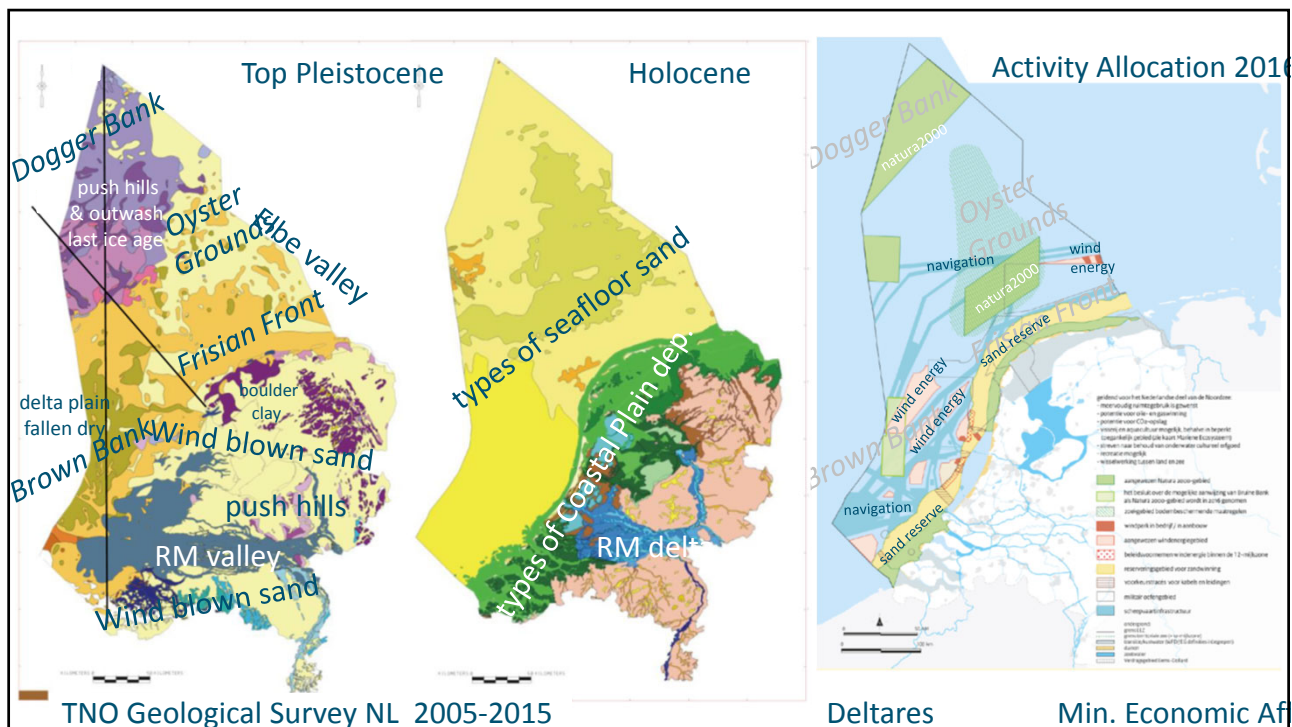


More in detail

Holocene sea level rise



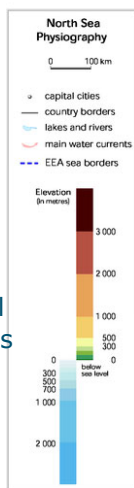
Stouthamer et al. 2015,
Annotation Kim Cohen



Ecosystems do not
mind national
borders....

Pay attention to international
gradients in abiotic conditions
(e.g. depth) and currents
when prioritizing ecologically
important areas

(pitfall: 'pragmatic MPAs')



How do we go from North Sea 2.3 to 3.0 ?

- Nature is what follows opportunities
- Also unwanted nature follows the opportunities that we (unintentionally) create (jellification, cyanobacterial matts, toxic algae blooms, overgrown coral reefs)
- We can learn from terrestrial developments (spatial planning, ownership, enforcement, nature inclusive design)
- Like on land: political choice whether certain lines of business can continue to do what they 'always did' and in the way 'they always did'.

On land this is much more visible and regularly leads to protests



We know the recipe for North Sea 3.0

- Ensure necessary diversity of enough and good quality habitats
- Enable connectivity between habitats required to fulfil life cycles
- Support full food web functionality
- Ensure good environmental quality



Healthy reef:

- Fisheries
- Tourism
- Biodiverse
- Coastal protection

Kisite Island, Kisite-Mpunguti
Marine Park & Reserve (2016)

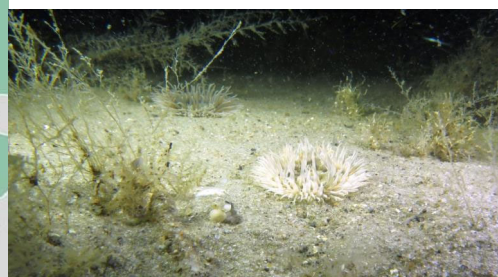
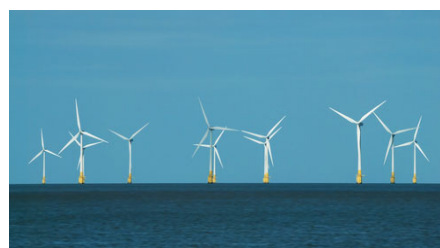
Degraded reef:
-Hardly fish
-No tourism
-Incomplete food web
-Coastal erosion



Provide hard substrate and housing

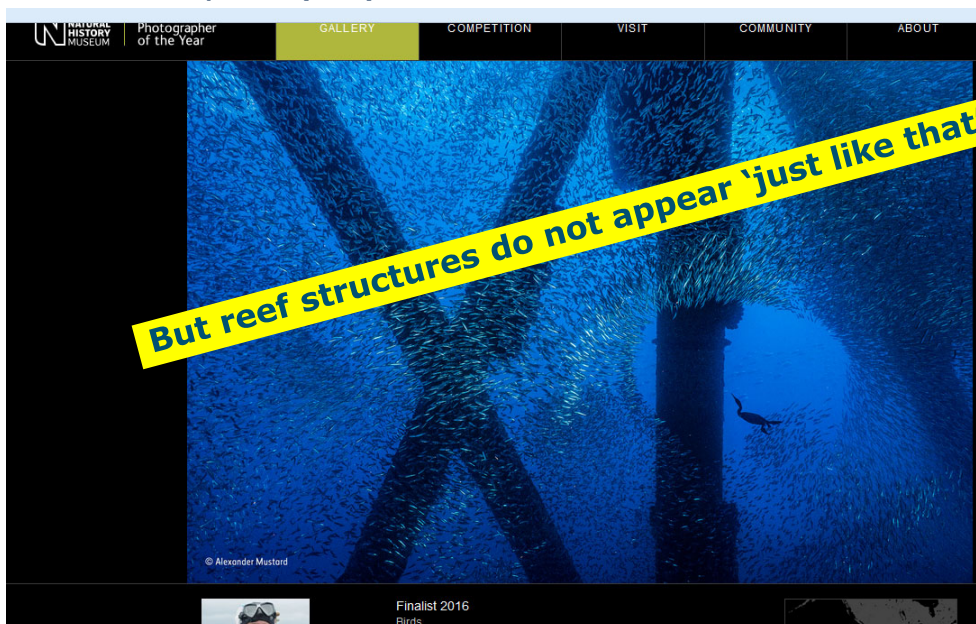


Offshore wind farm: some hard substrate and 'seafloor tranquillity'



'Living sand' Photo: Tinka Murk

More complex (3D) structures offer more habitat/shelter



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OWF habitat
enhancement for
important
North Sea species
(Fanny Koentjes)



WAGENINGEN
UNIVERSITY



(a) Atlantic cod

(b) Thornback ray (c) European lobster

(d) Brown crab

Learn from use by species of ship wreck structures



Drainage tubes
(eg. 20x100 cm)
for cod



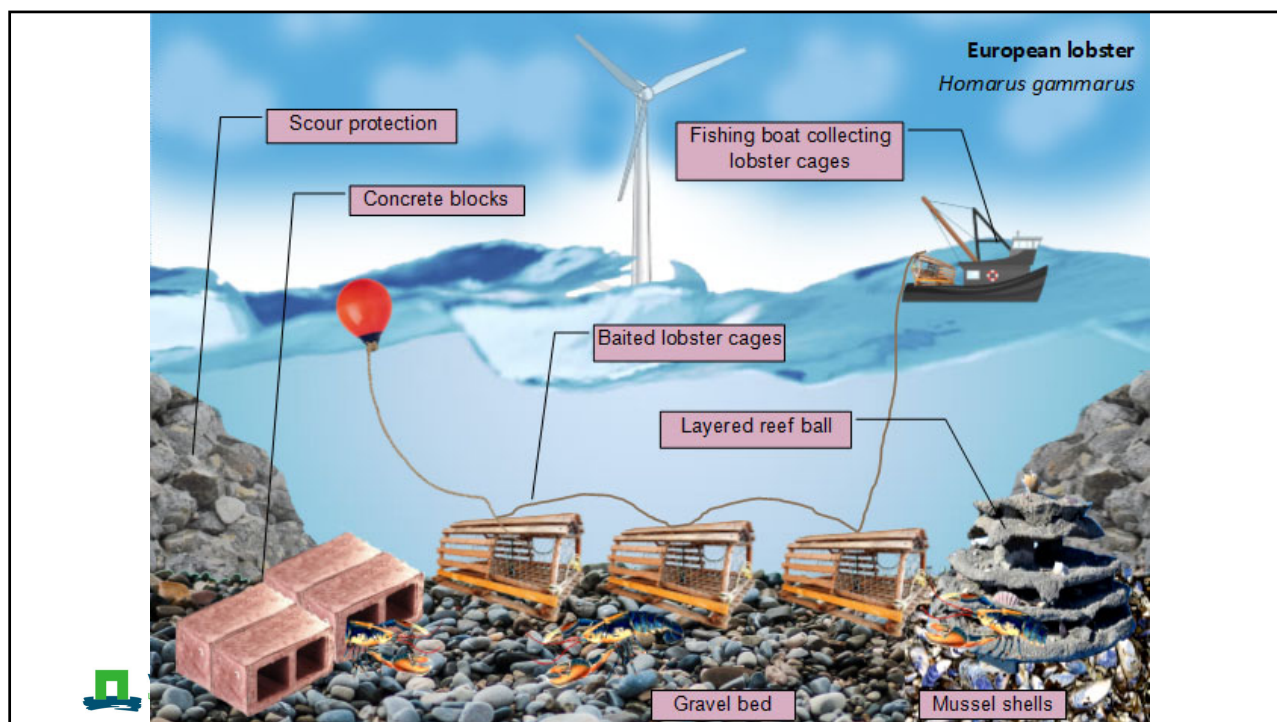
Flat hollow building blocks
or 'layered reefballs' for
lobster and young fish

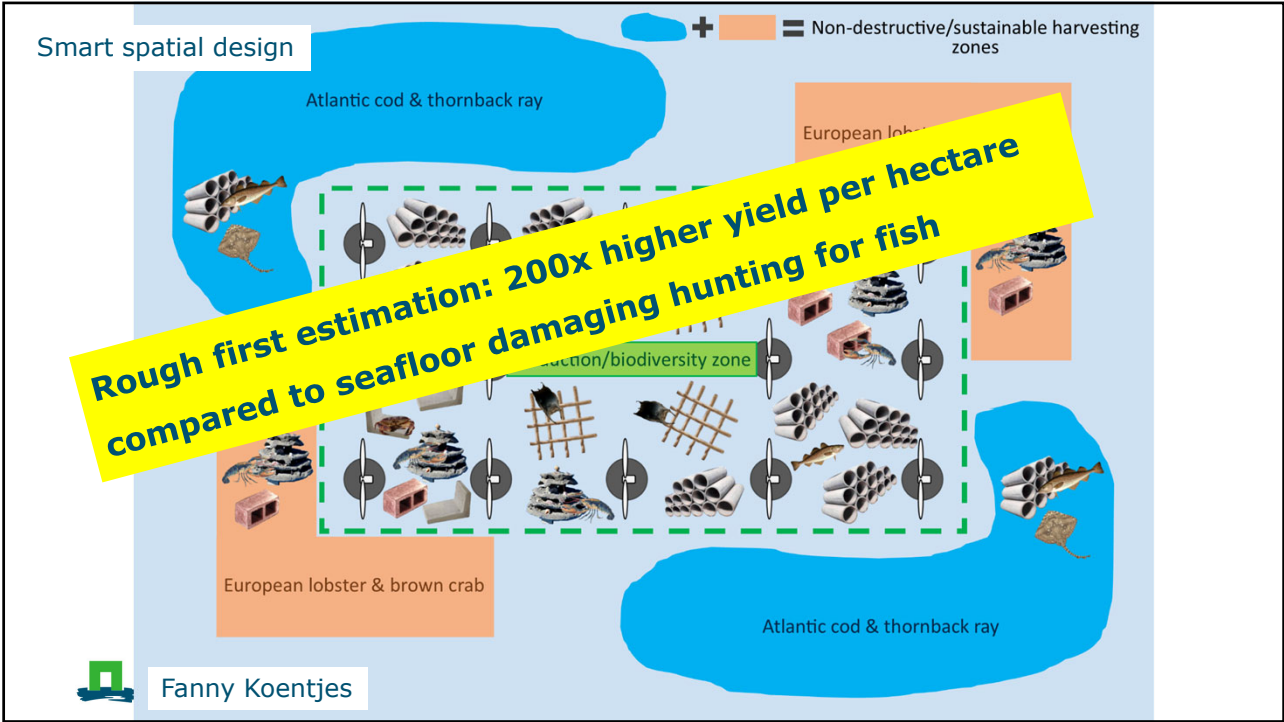
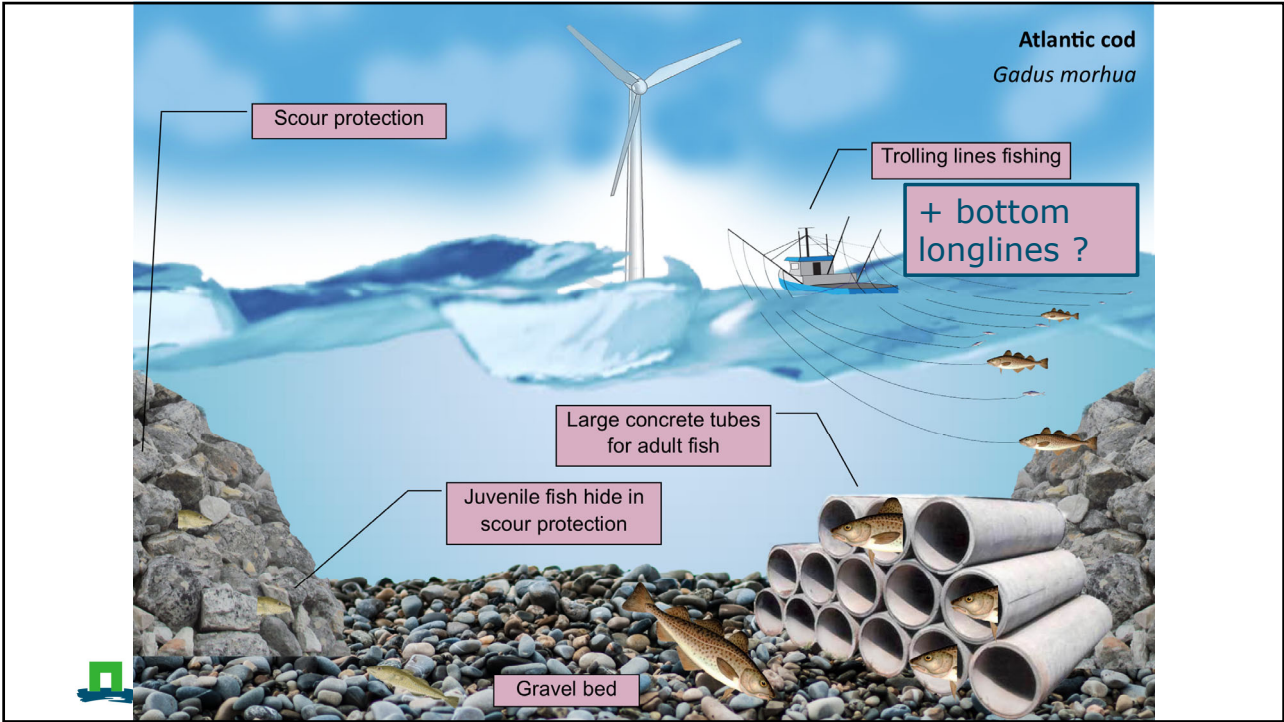


Concrete corner
stones for crab

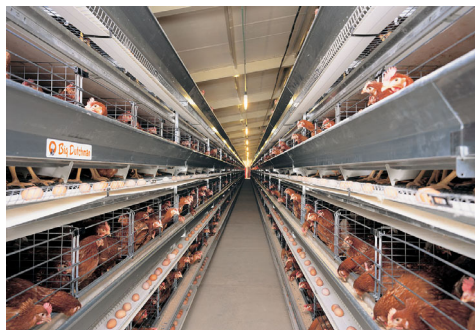


Substrate for recovery of shellfish reefs





Innovation involves trying, learning and adapting



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Also: do not forget to connect habitats !



And without
gillnets and
fykes in the
migration
routes; enforce!

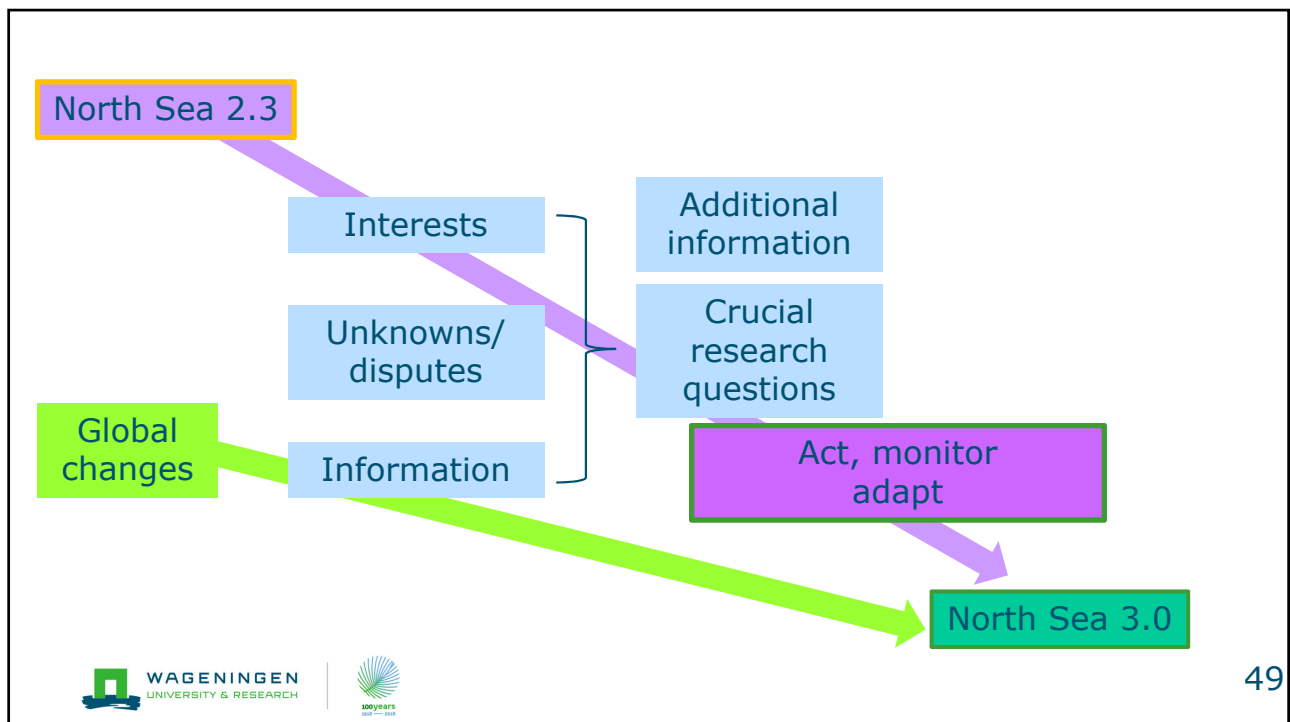


Seafloor damaging fisheries?

- Limit to max 75% of our North Sea area (Han Lindeboom)
- Never in MPAs
- No problem in sand mining areas (Maarten de Jong)
- Hardly problem in areas with high sea floor dynamics (Peter Herman, benthic research)
- Credit system (Jurgen Batsleer) based on habitat vulnerability
- Collaborate with innovative fishermen for more productive and sustainable alternatives (also allow/enable this research)

Developing insights and management

- The only certainty is that everything continuously changes, therefore functional targets and limits should be set
- Eco-inclusive, International marine spatial planning
- Optimised, eco-inclusive (multiple) uses
- MPAs based on ecology with 100% habitat protection, in an International ecological network, taking abiotic characteristics into account)
- Select a number of very different figurehead species and monitor their population development to find best approaches
- Focus research on understanding mechanisms behind (un)desired effects, and monitor over long time periods!



Is there a future for
the North Sea of our
grandparents?

Yes, as North Sea 3.0,
the North Sea of our
(grand-) children!

