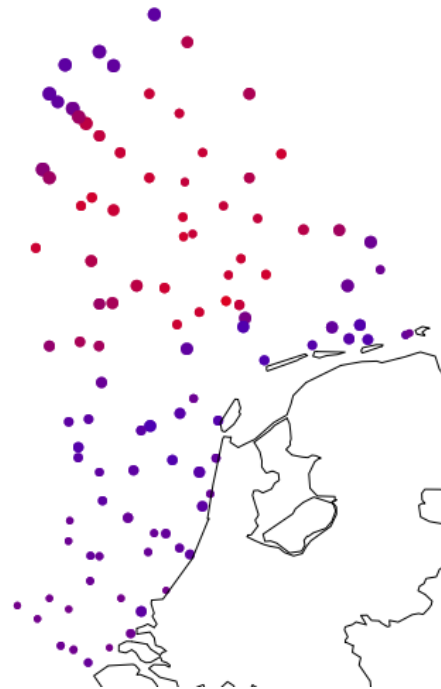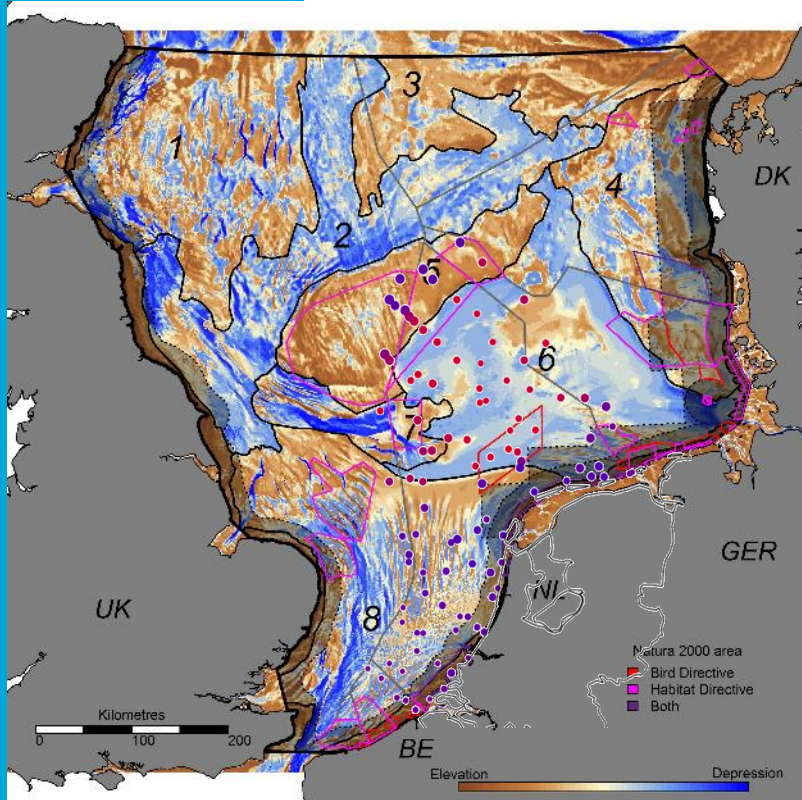# Long-term dynamics in benthic biodiversity

Peter M.J. Herman

Deltares/TUDelft

What we learn from long-term data

- Patterns of density, biomass, diversity in the North Sea landscape
- How to optimally protect diversity?
- How does diversity change?
- How to manage benthic biodiversity?

TU Delft

Community composition

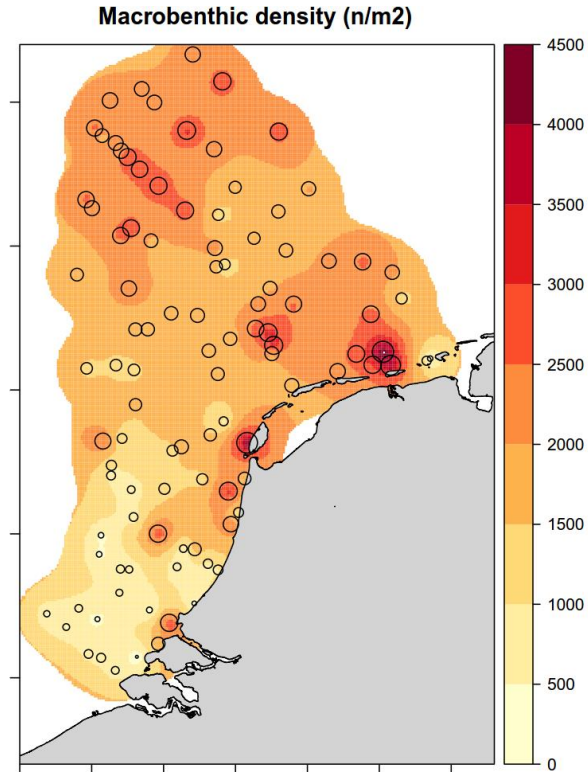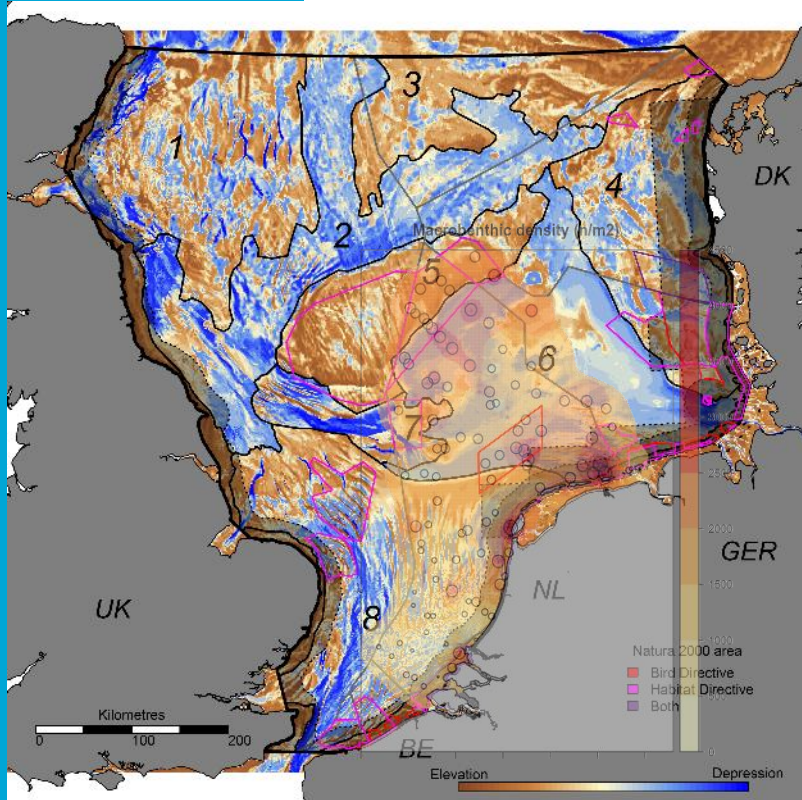
Deep (red) vs. Shallow (blue)

Deep group: sand (large) vs. mud (small)

Shallow group: current (small) vs. waves (large)

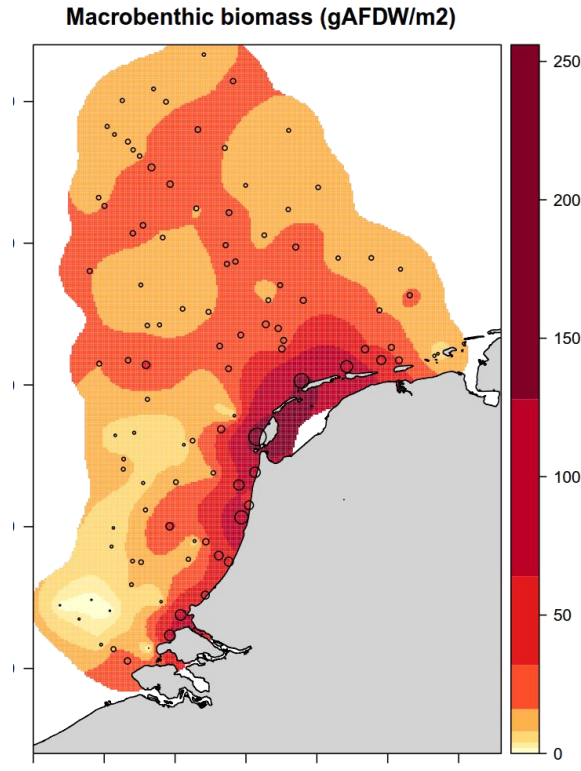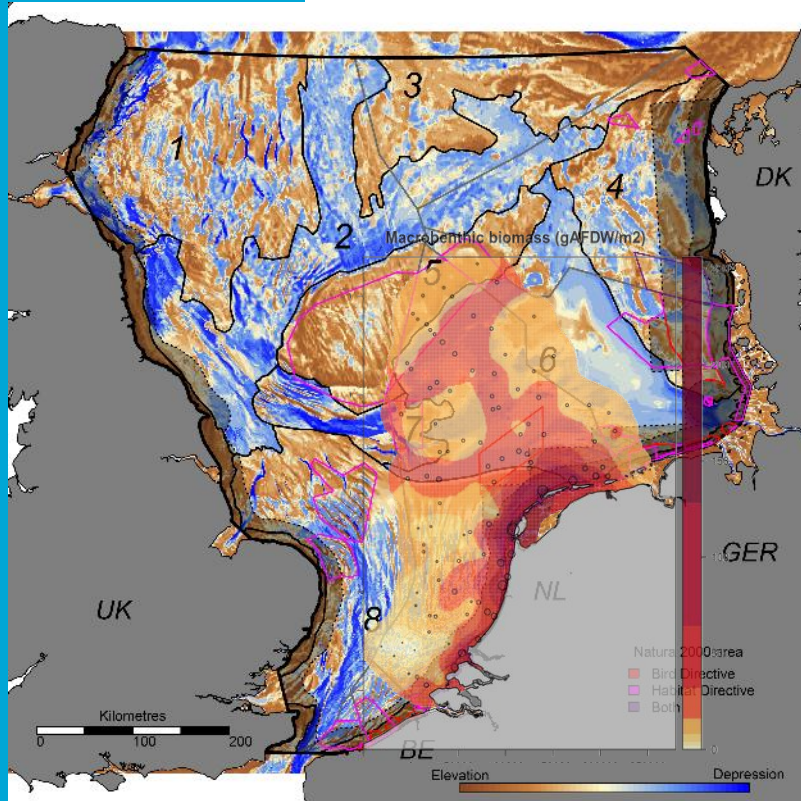Lanscape map: Van der Reijden et al. 2018. PLOS One
Data: Rijkswaterstaat MWTL

TUDelft

Density (number per m^2)

Sand wave area poor. Rest homogeneous

Remarkably small differences

Biomass (gAFDW m^{-2})

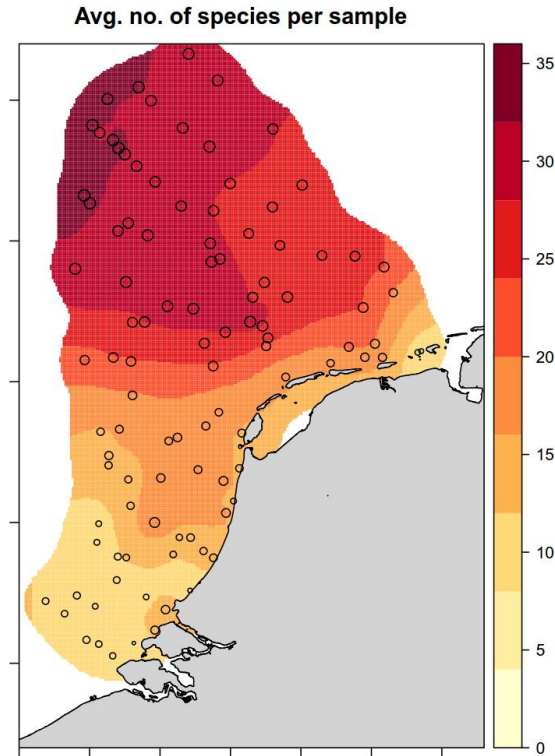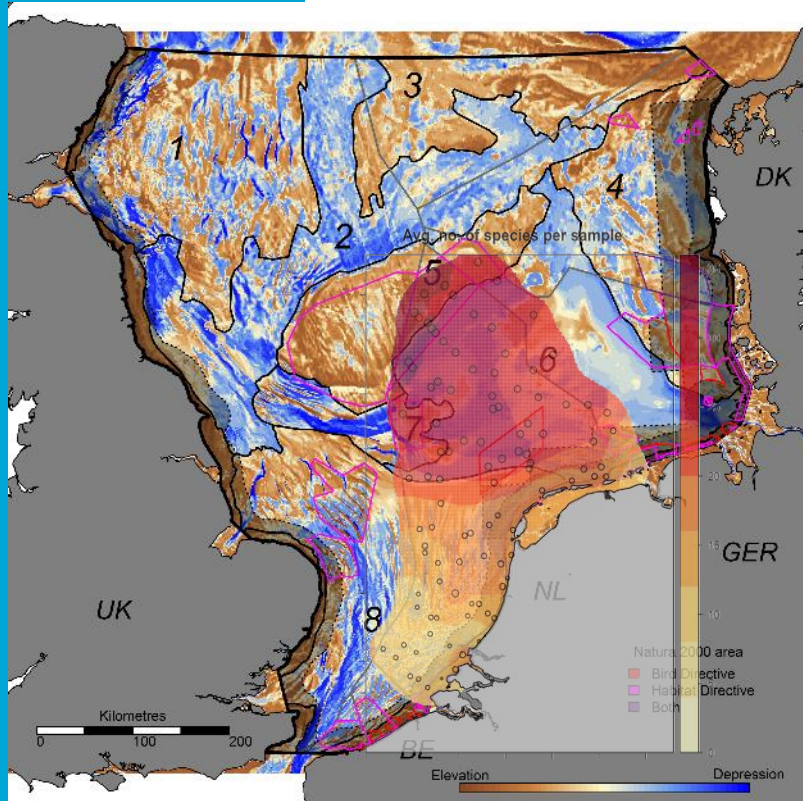Macrobenthic biomass (gAFDW/m2)

High at the coast (production) and at fronts (vertical flux)

Landscape detail missing at this resolution

Van der Reijden et al. 2018. PLOS One

29 november 2019

5

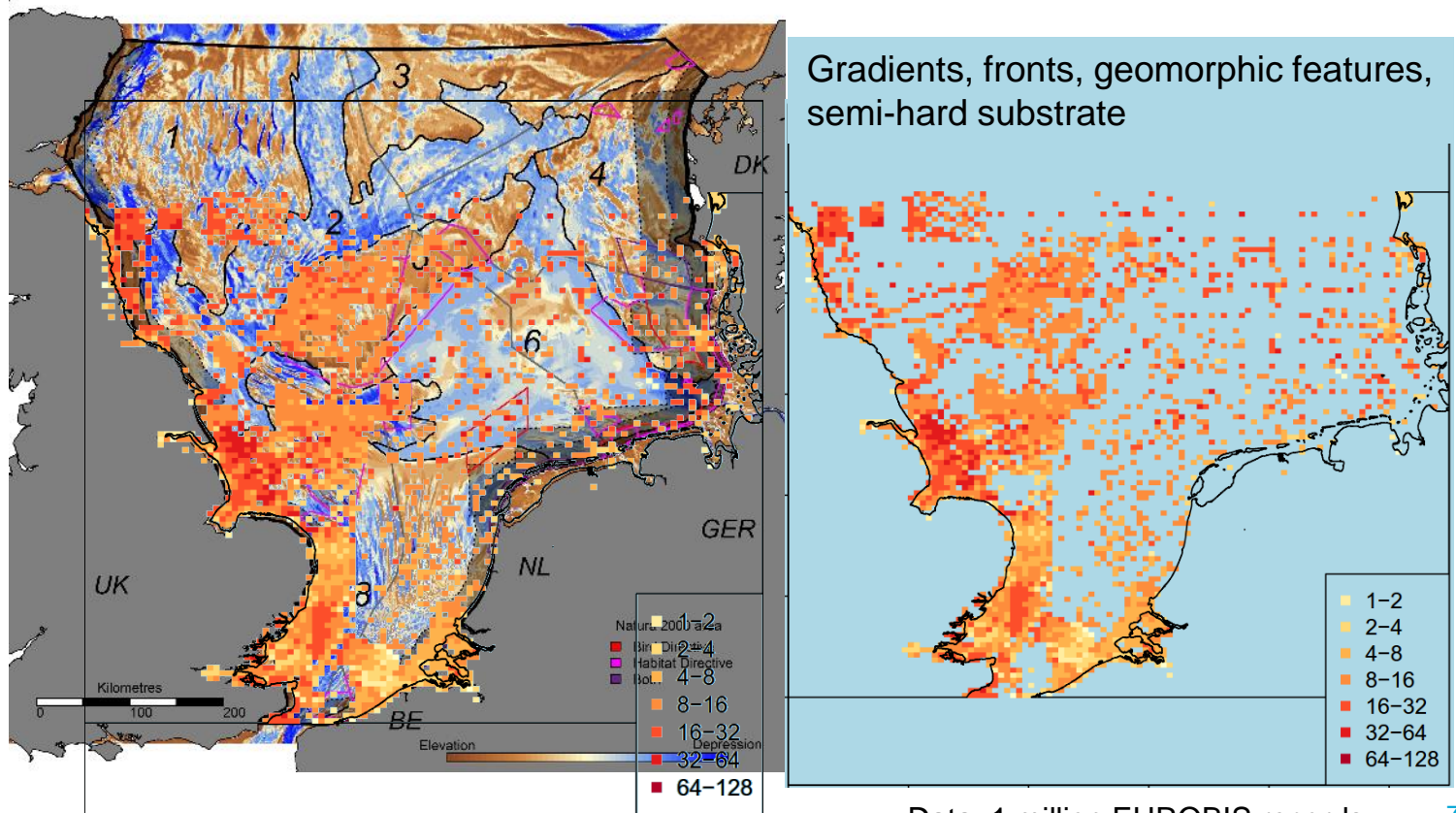# Number of taxa per sample

Avg. no. of species per sample

N-S gradient

Doggerbank (shallow, dynamic) much richer than coast

Inverse productivity-richness gradient

Diversity EMODNET database

Gradients, fronts, geomorphic features, semi-hard substrate

Data: 1 million EUROBIS records
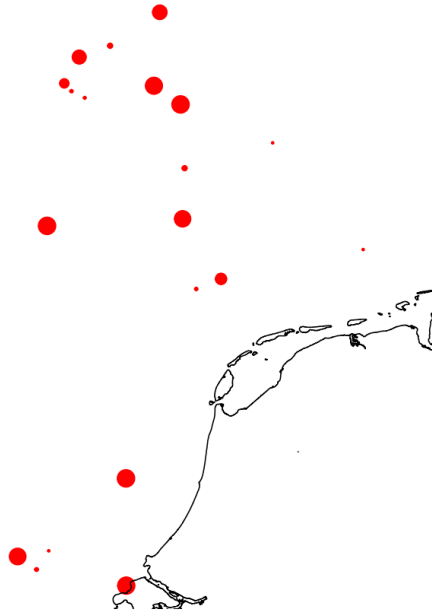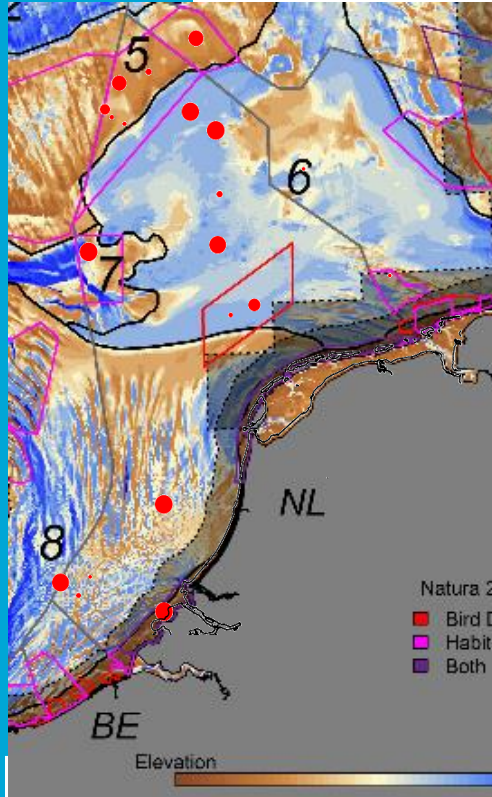
7

Where is the core of the diversity?

- 103 monitoring stations ~ 1% of surface per station

- If you can protect 10% of the surface, what would you chose?

    -> which combination of 11 stations yields most species?

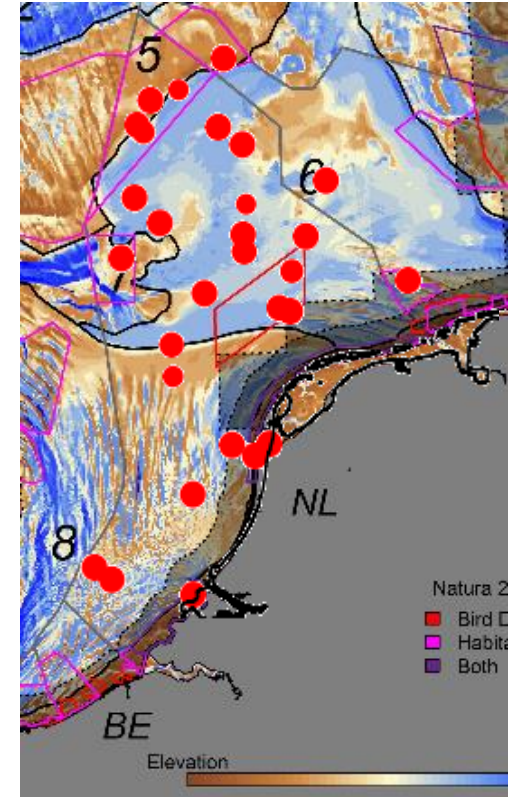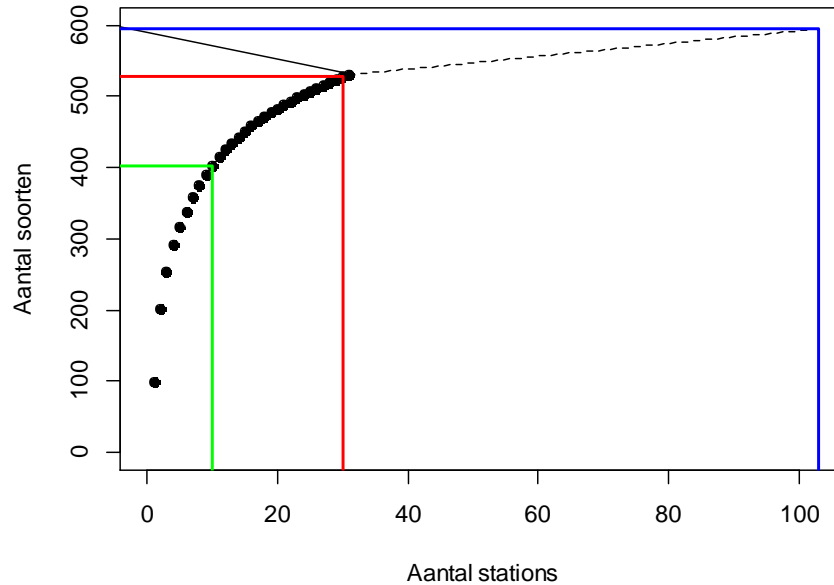# 11 stations with (together) maximal no. of species

Search starts at each of the stations, agglomerates so as to achieve max species

Graph gives relative representation of stations in 30 best solutions
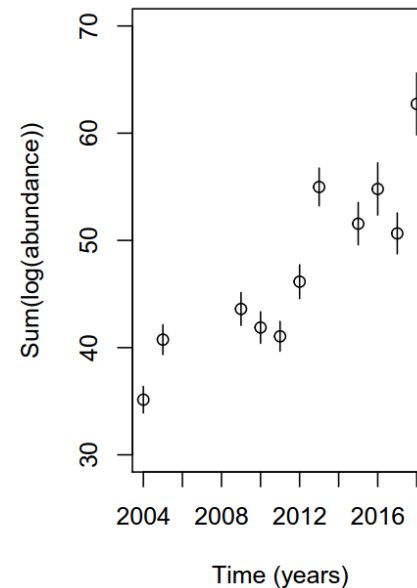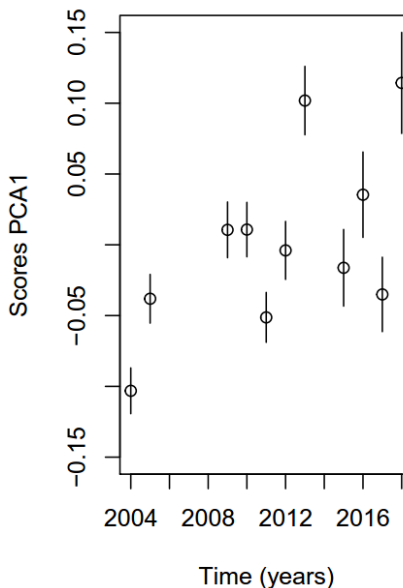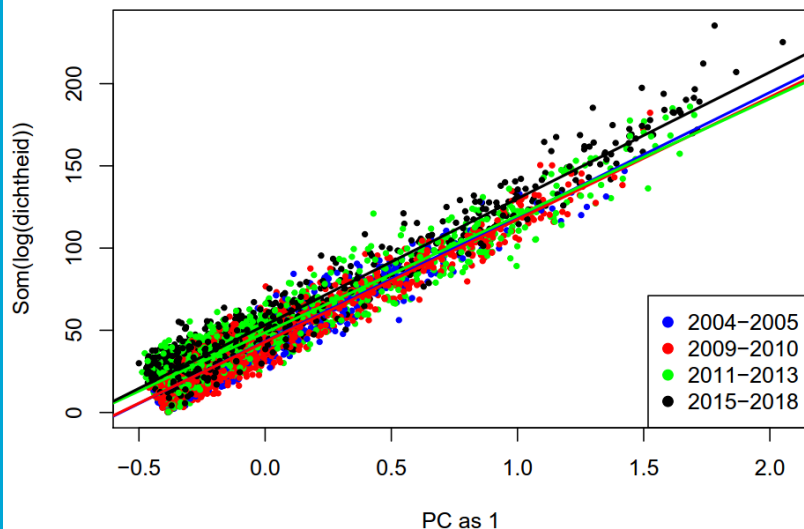
11/103 stations: 420/596 spp

Same stations return: FF, OG, DB, CB, Sand Banks, Coast
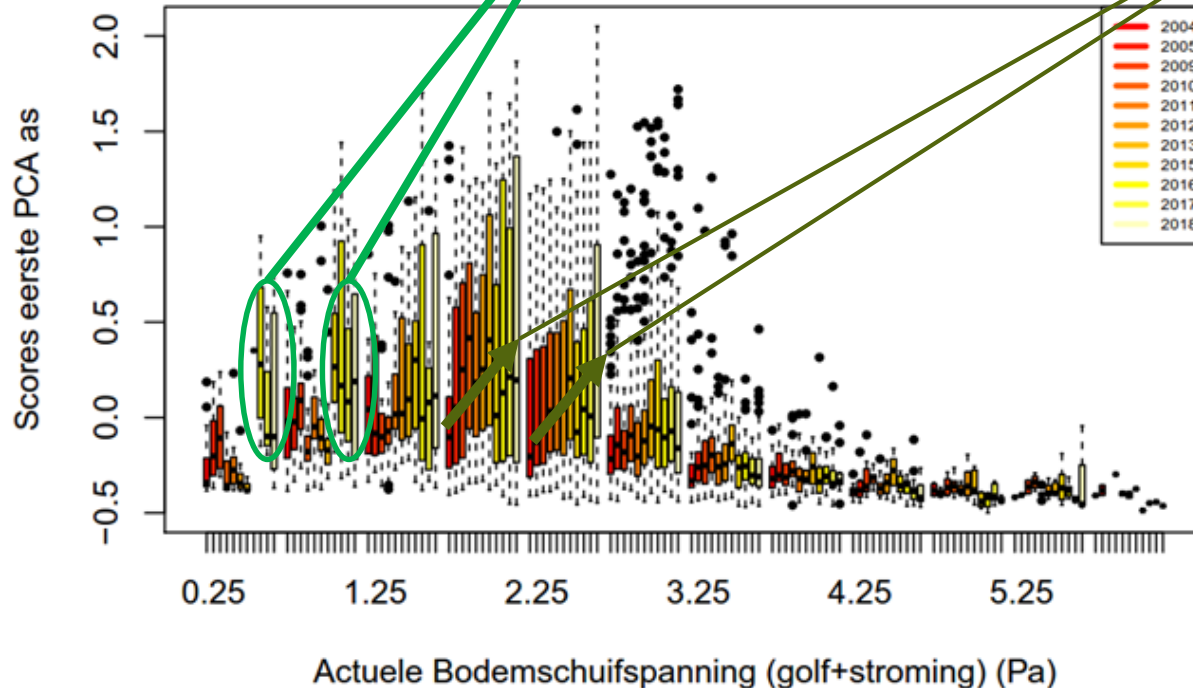
How much to protect?

PMR-NCV monitoring Voordelta

Totale dichtheid (log−transformed) vs. PC as 1

Morfologic changes + « autonomous »

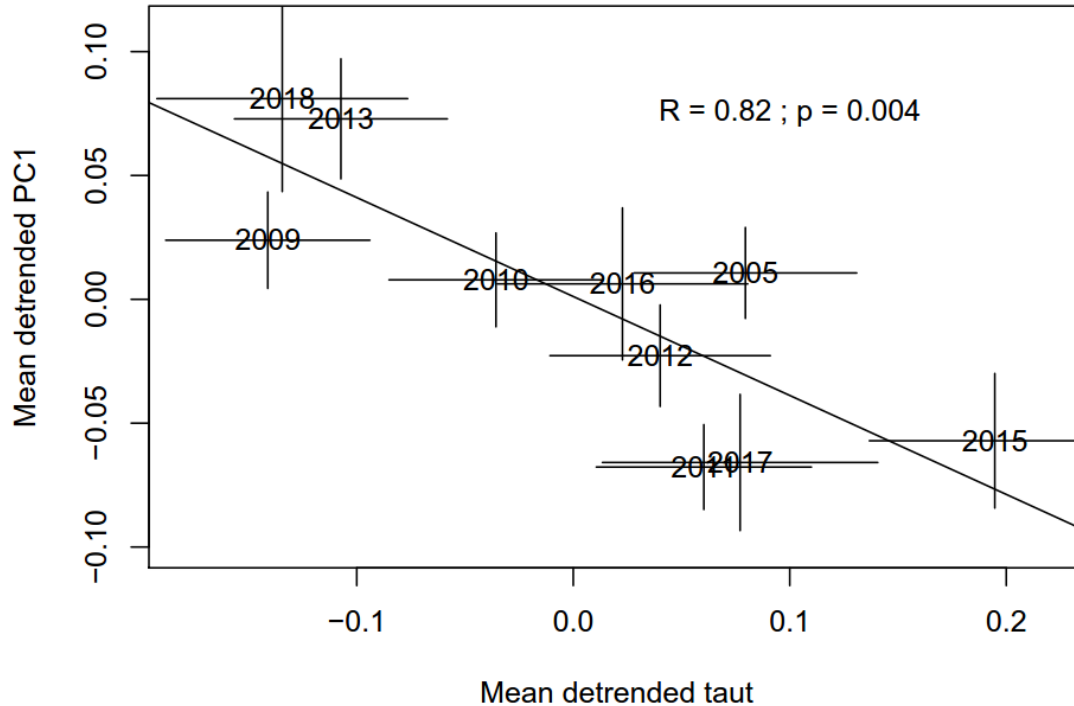
PC 1 vs. totale bodemschuifspanning

Divergence calmer and rougher areas caused by Maasvlakte II

Increased diversity and biomass of shellfish

-> disappearance beam trawling?
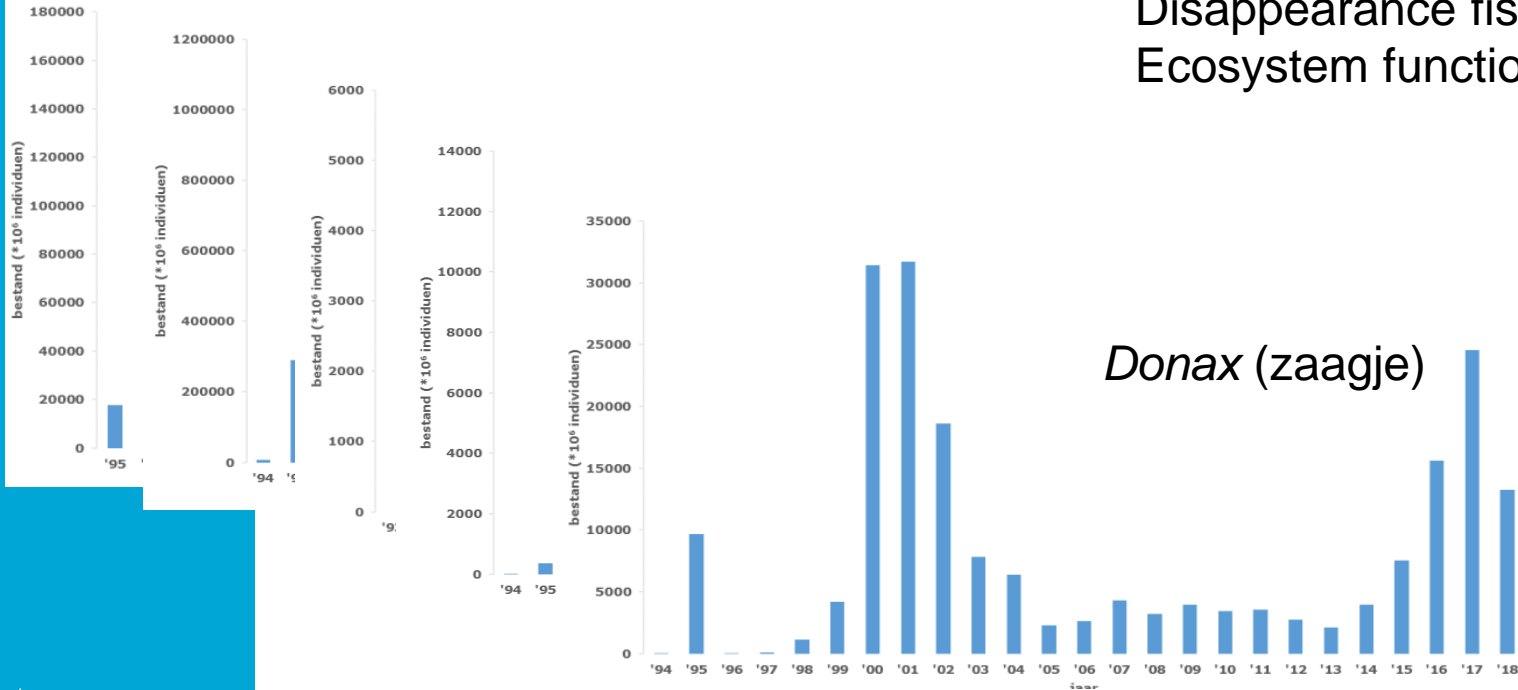
Year-to-year variability

Variation in bottom shear stress -> mainly due to waves (weather)

No explanation for long-term trend

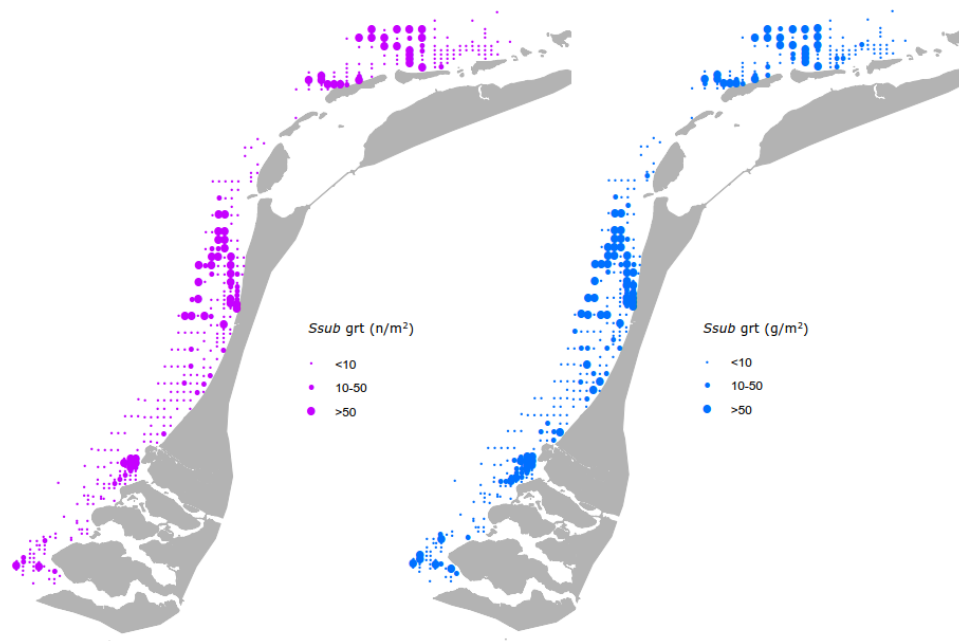# But what explains come-back of shellfish in the Dutch coast?

Disappearance fisheries?
Ecosystem functioning?

Donax (zaagje)
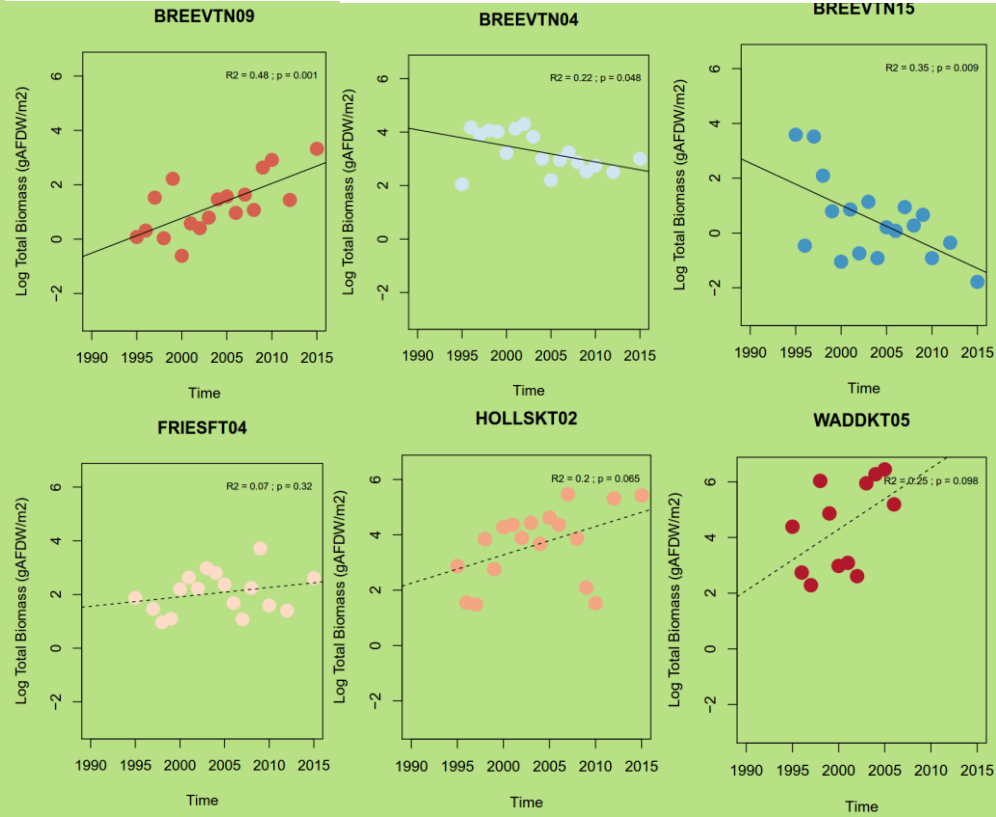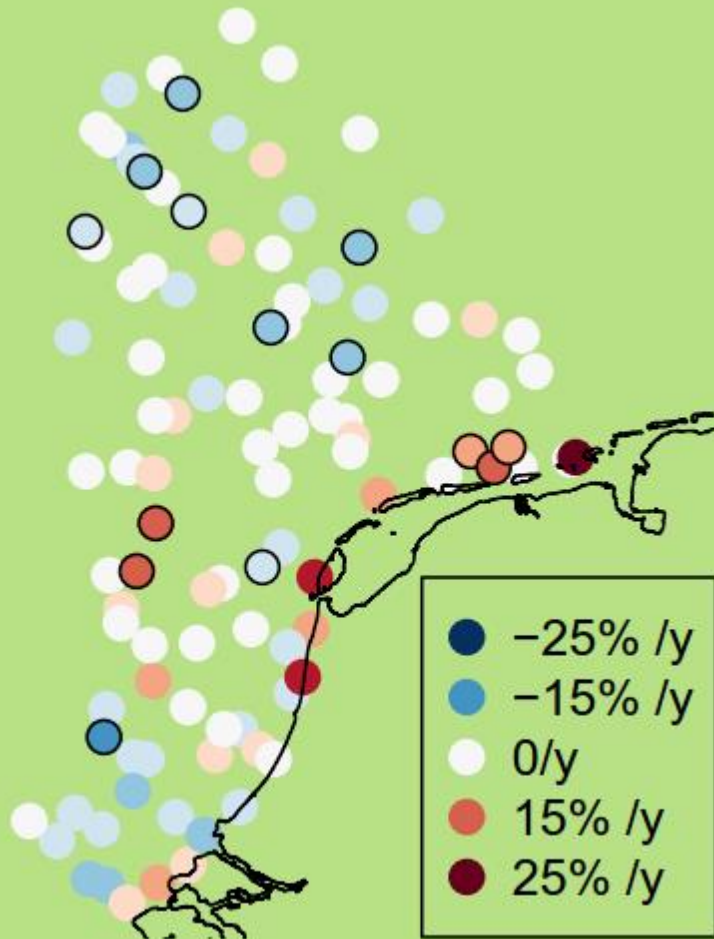
Karin Troost (WMR)

Not uniform in space

Spisula biomass in the big recent recruitment

Ssub grt (n/m²)
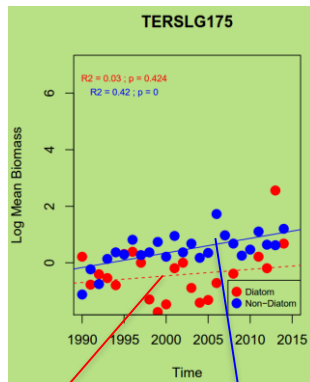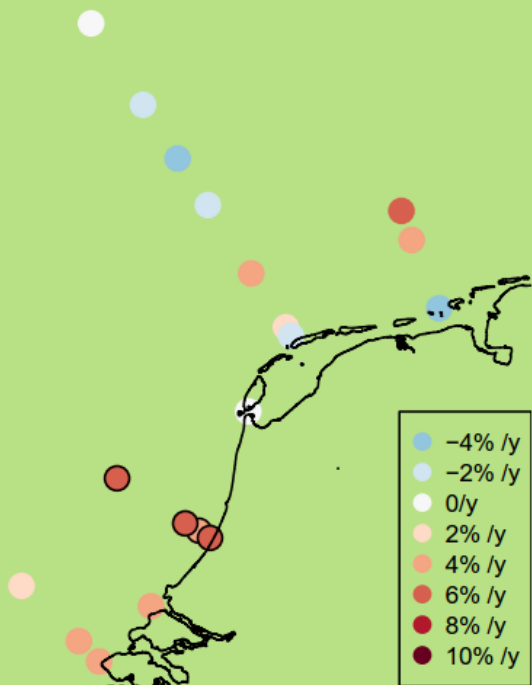
- <10
- 10-50
- >50

Ssub grt (g/m²)

- <10
- 10-50
- >50

Figuur 9. De dichtheid van de halfgeknotte strandschelp (Ssub) groot (> 19mm) in aantal per m² (links) en biomassa in gram versgewicht m² (rechts) in 2017.
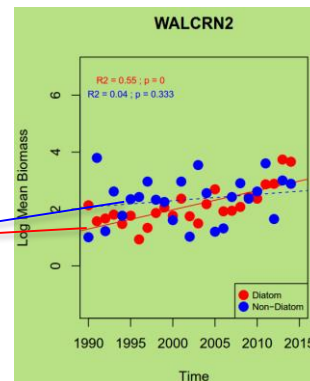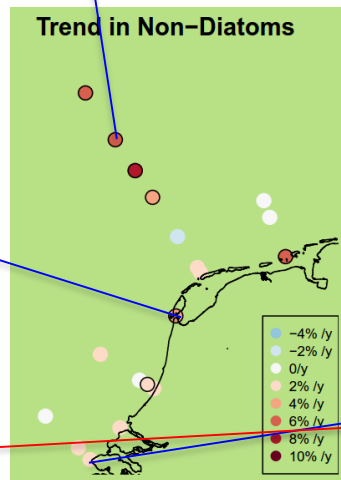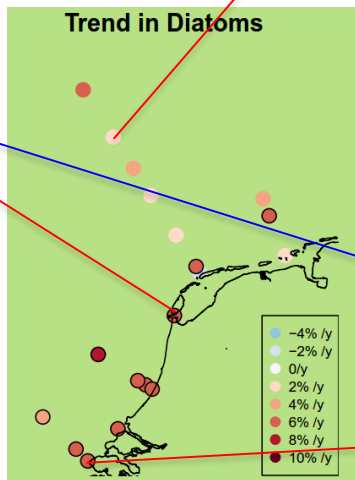
Troost et al. 2017 WMR report

Temporal trend in biomass benthos

Phytoplankton composition

Trend in Ratio D/n−D

TERSLG175

Trend in Diatoms

Trend in Non−Diatoms

WALCRN2

Si/N and Si/P ratios

Rijnsdorp et al.

Tau low   Tau high   Sensitivity

Ecol. Appl. 2018
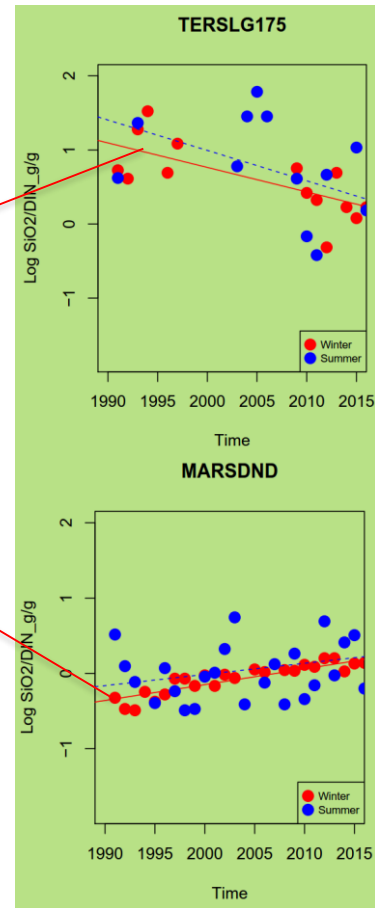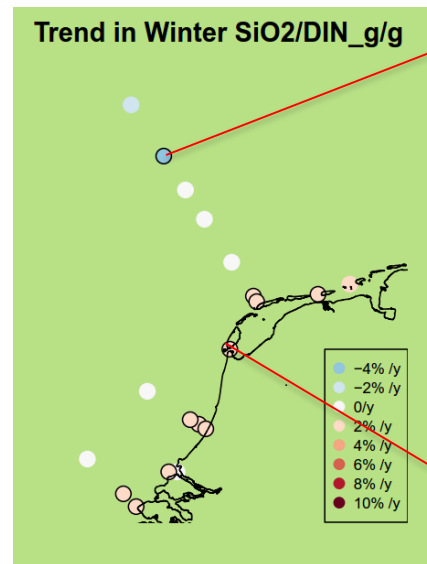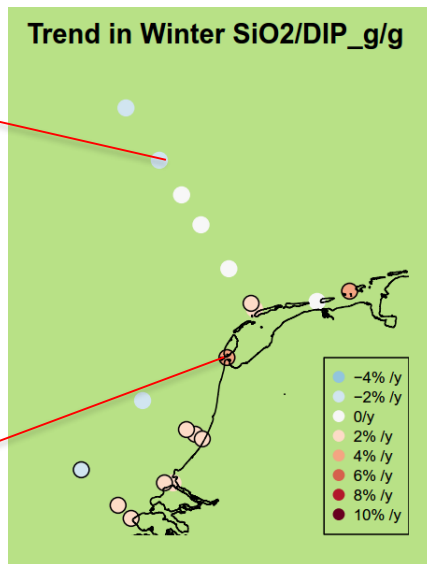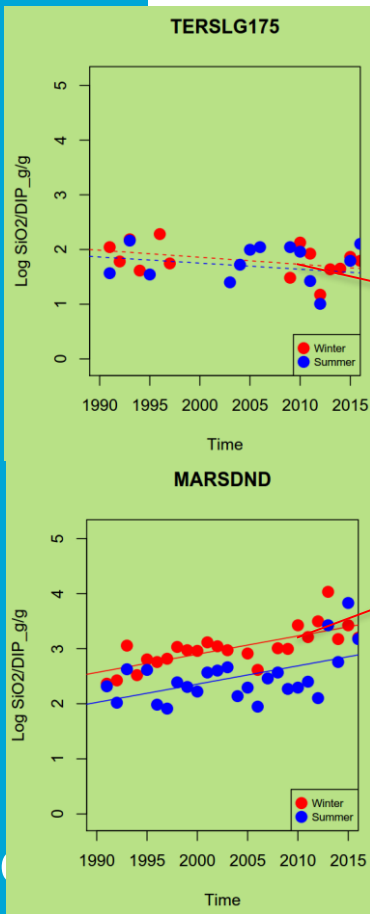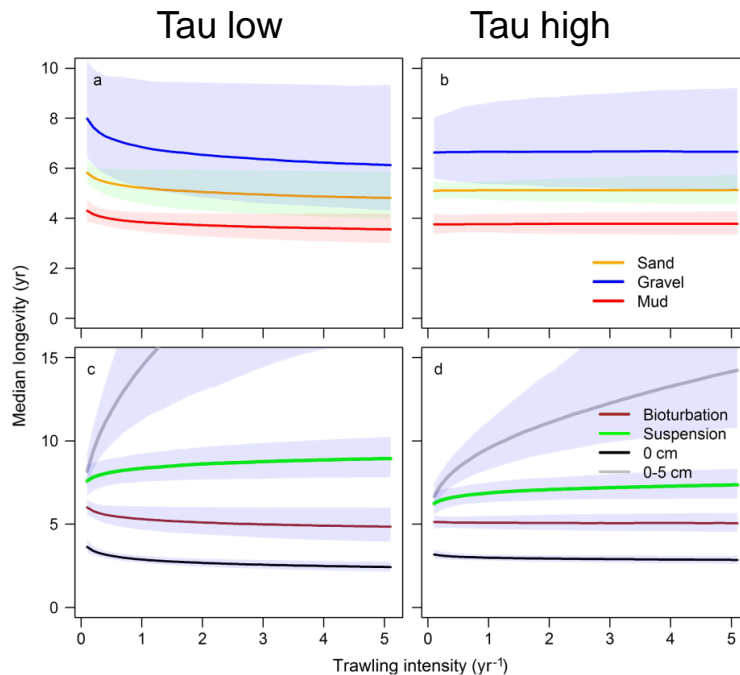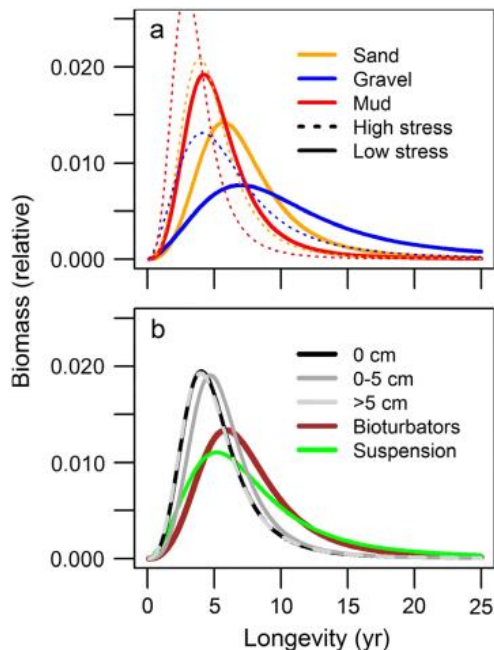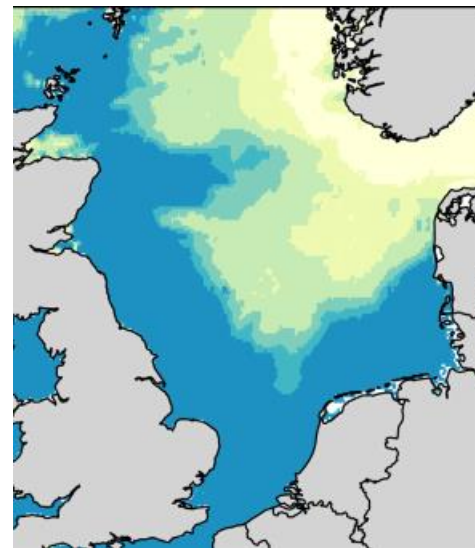
BISI evaluation Oyster Grounds
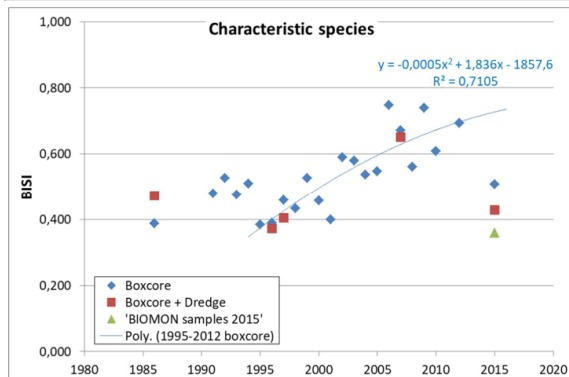
MWTL monitoring

Trait-based
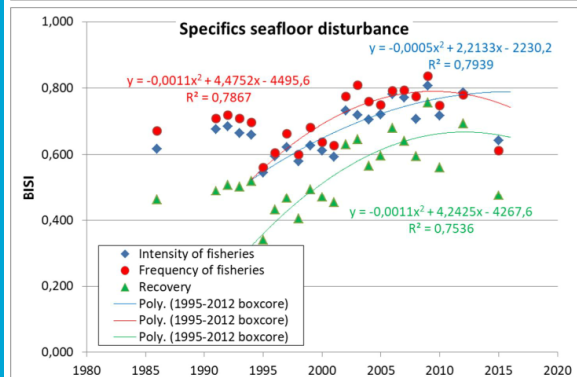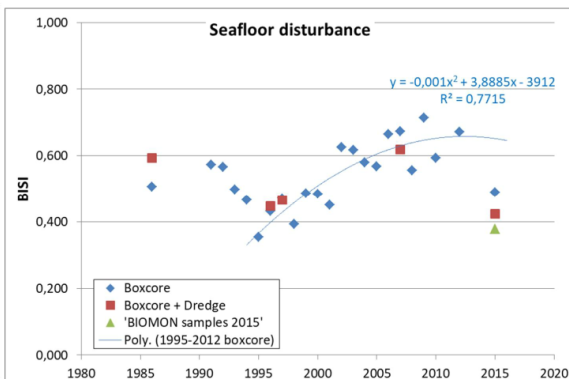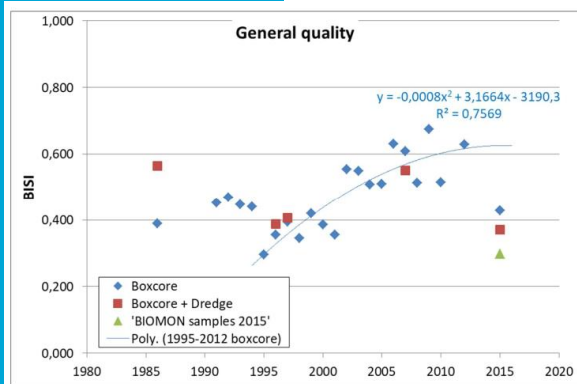
Specific indicator species
for different stress factors

Wijnhoven et al. 2018

Functional or disturbance???

- NOT mutually exclusive !
- Closer spatial analysis needed
- No answer without protected areas
- Sustained monitoring
- Better functional analysis (incl. food quality)

Conclusions

- Benthos responds to a seascape that is:
  - Hydrodynamic
  - Morphodynamic
  - Disturbance – related
  - Food web – related
- Management requires better understanding of relations
- Protection ('reference areas') essential
- Chemical and physical changes matter!

TUDelft