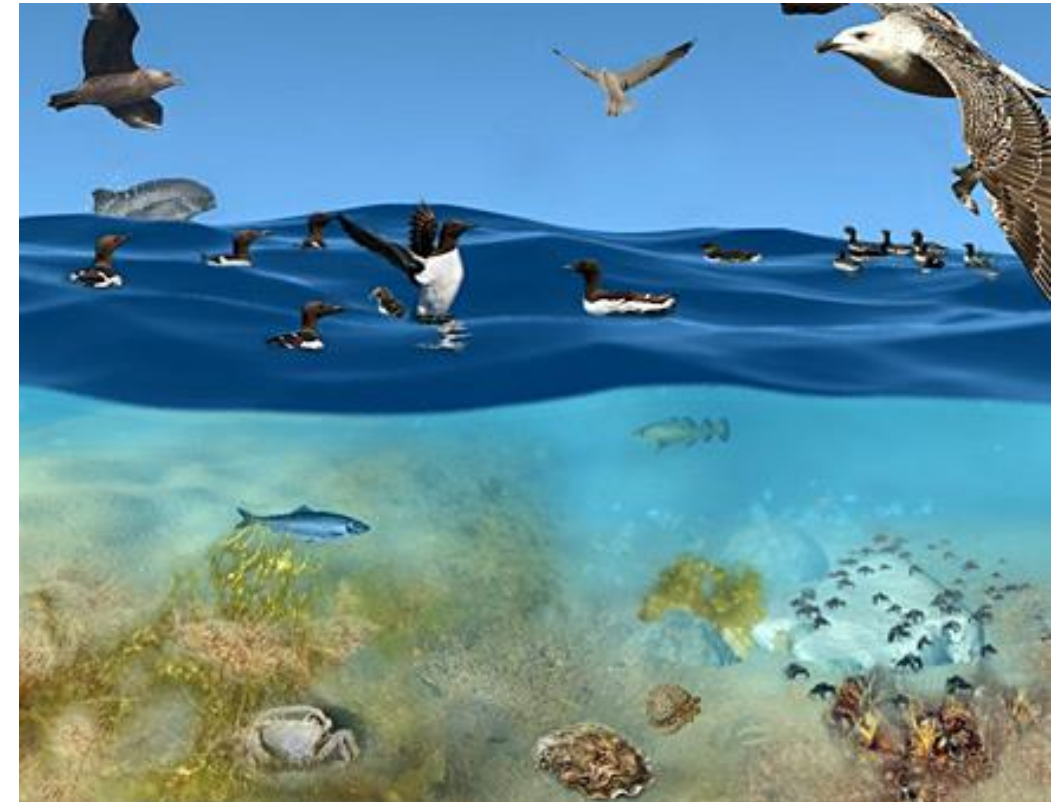
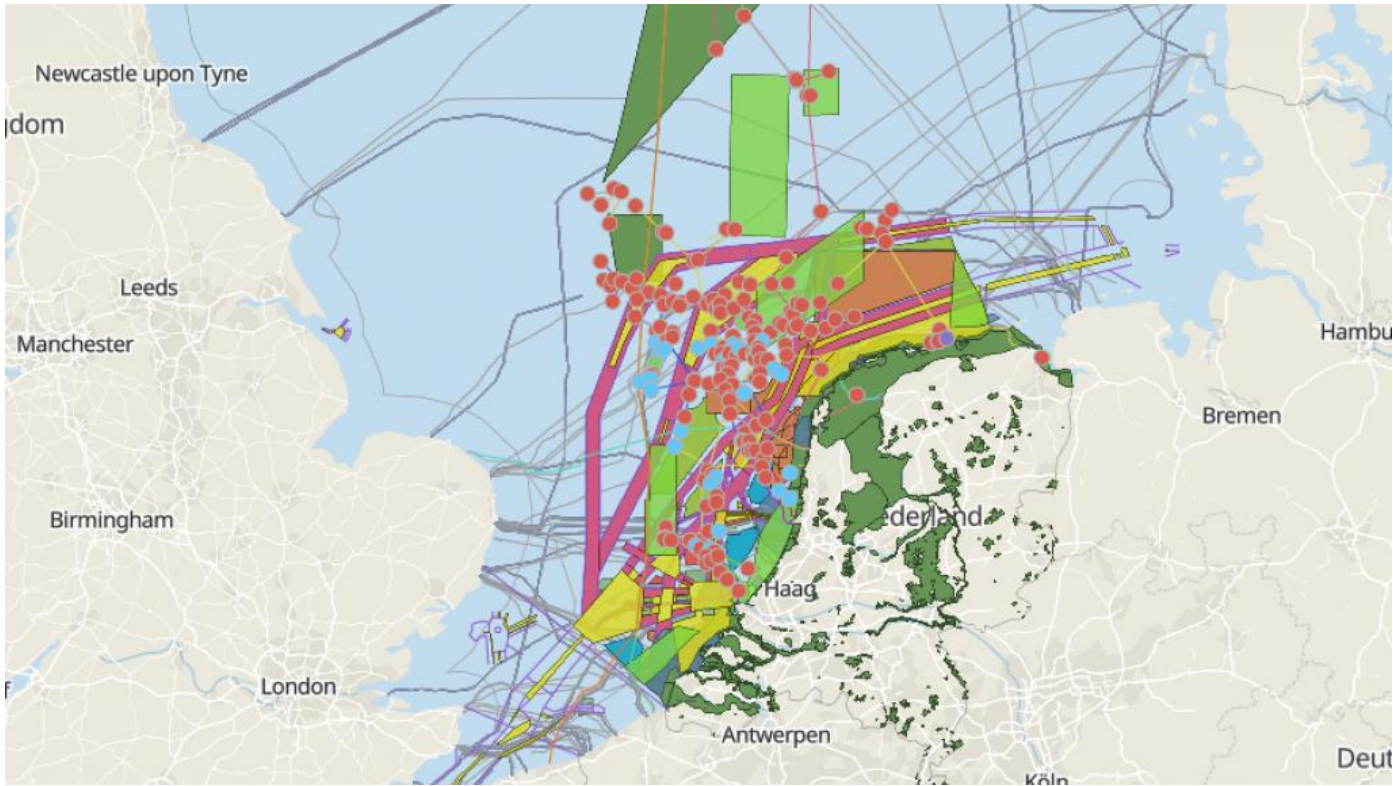
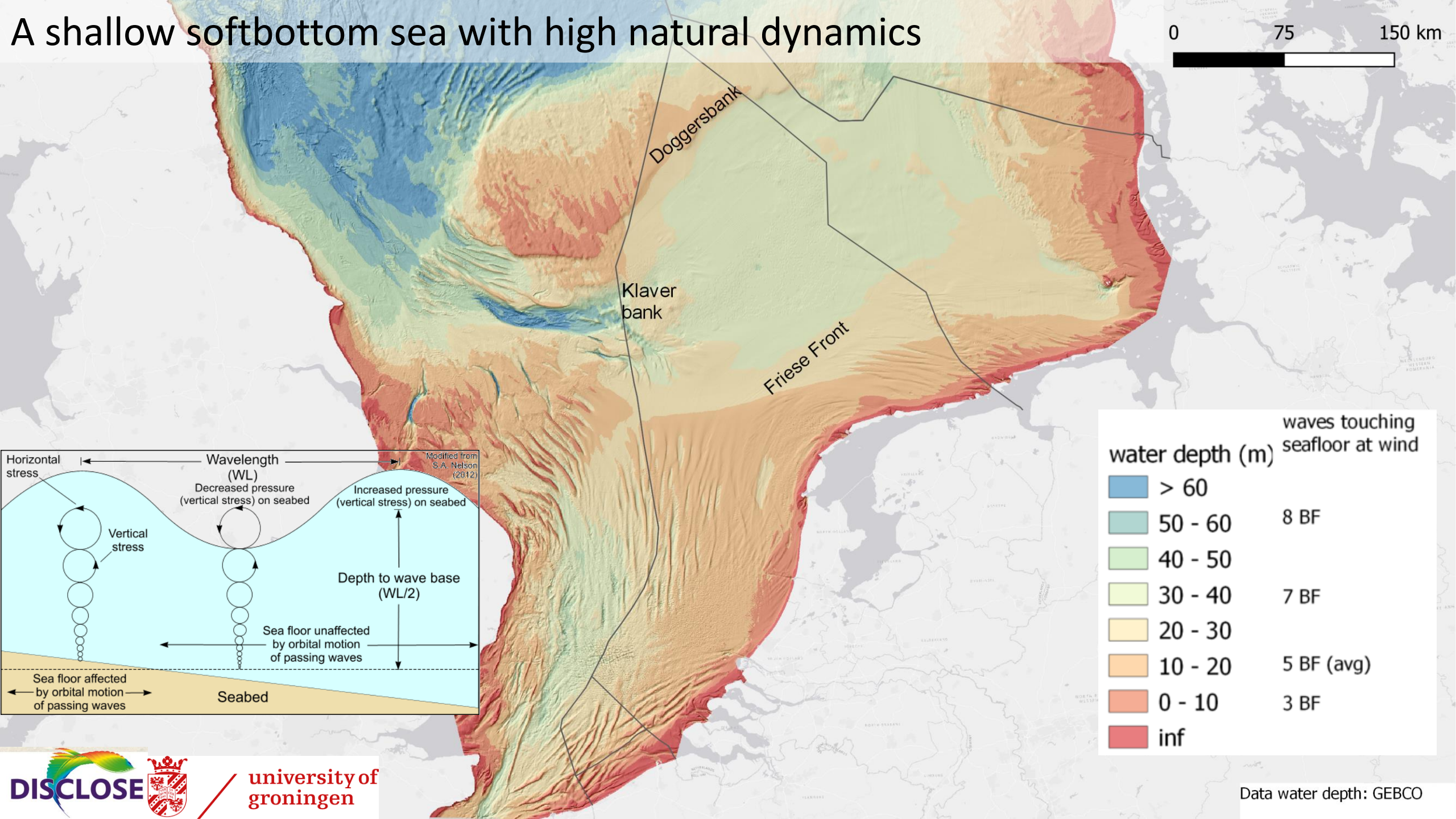


Natural and anthropogenic drivers of habitat resilience

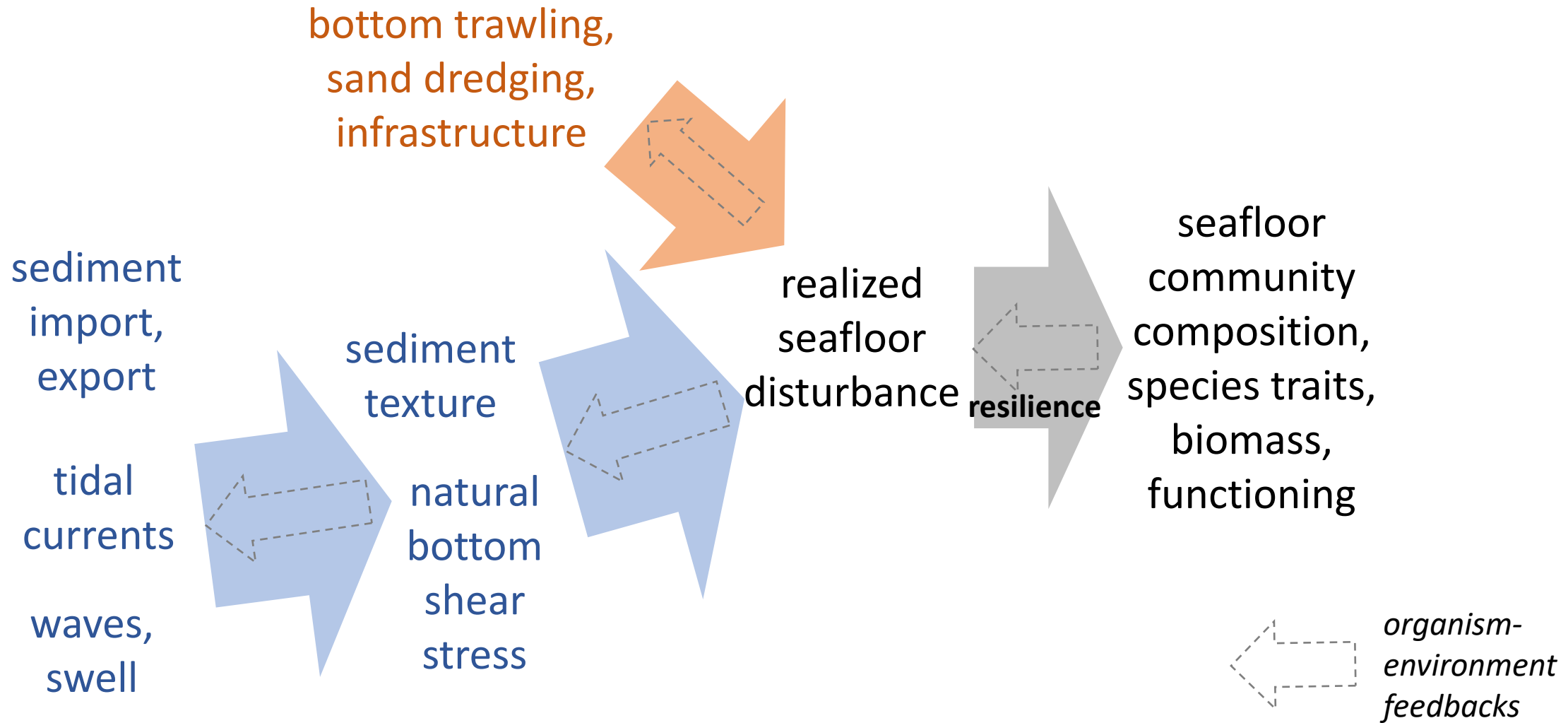
Han Olff

University of Groningen



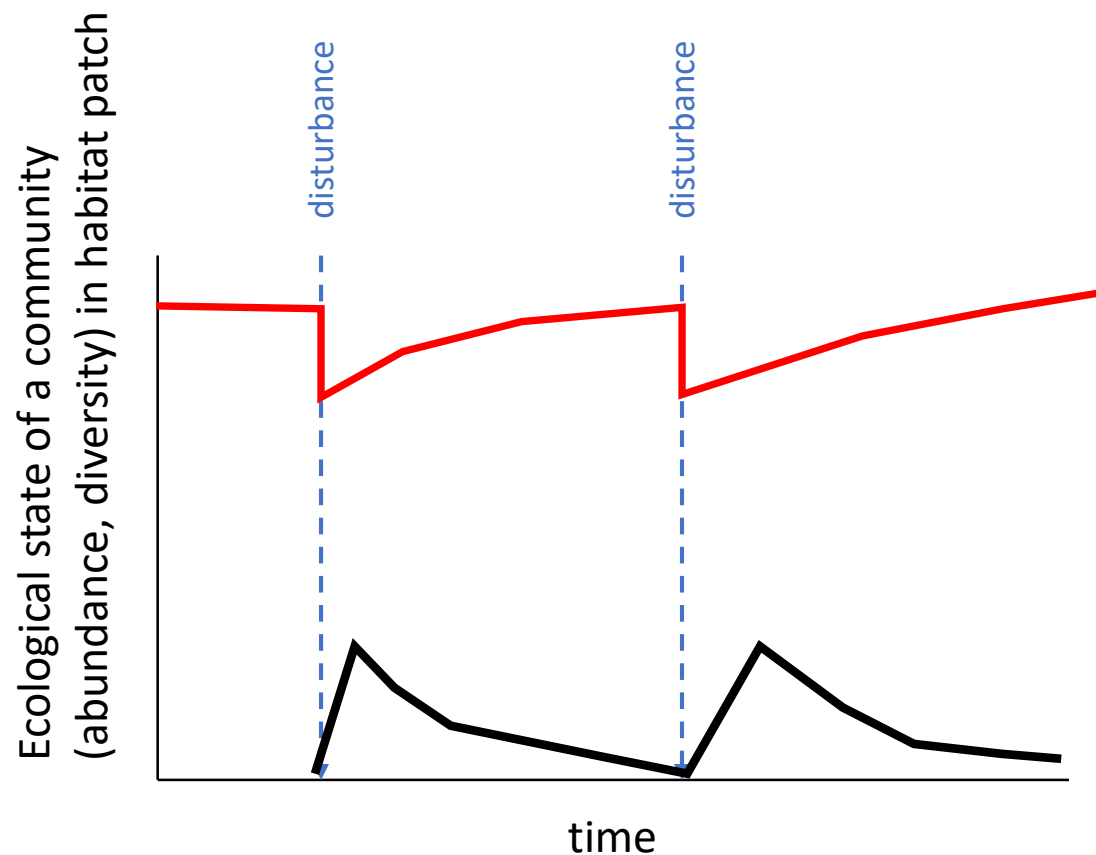


Natural and antropogenic driver of habitat resilience

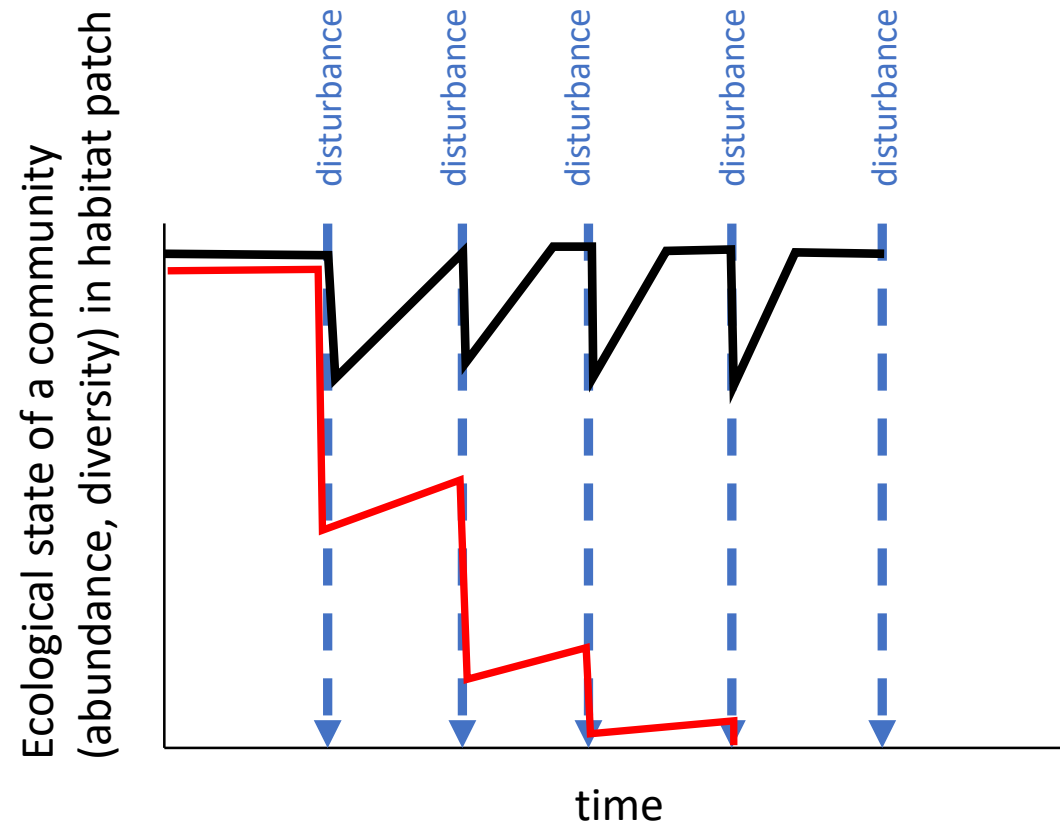


bathymetry

Low intensity & frequency of disturbance

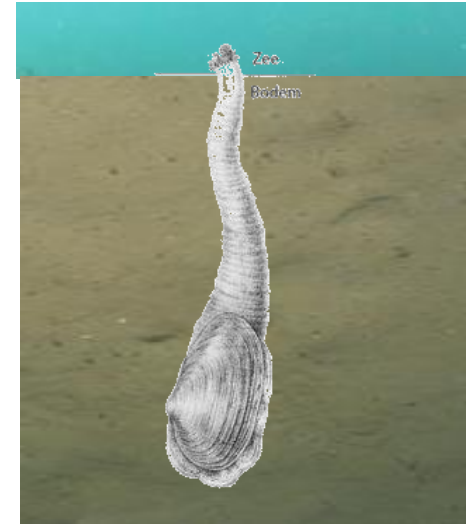


High intensity & frequency of disturbance

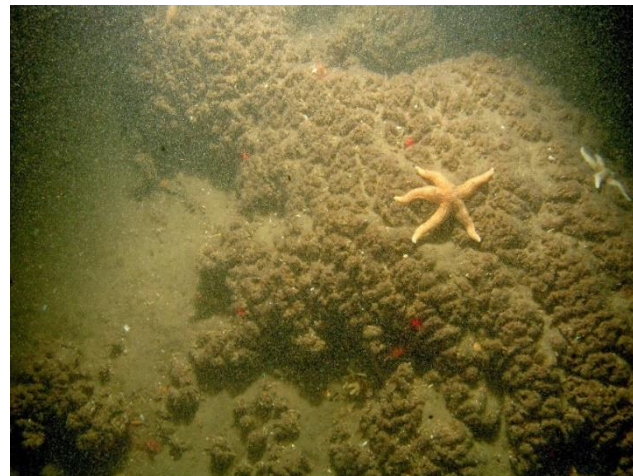
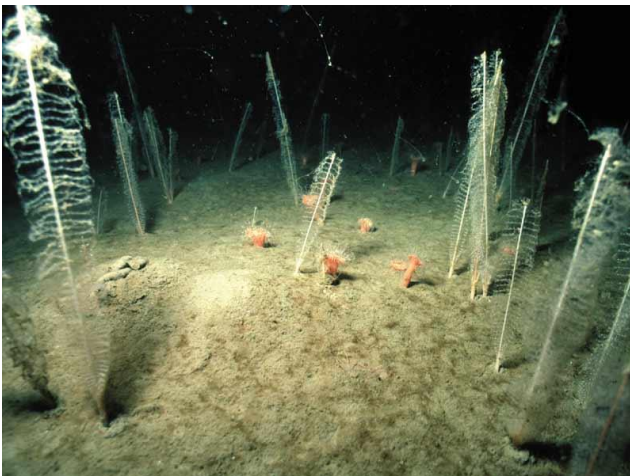


- Low resilience community
- High resilience community

High resilience communities of naturally unstable substrates?



Low resilience communities of naturally stable or biotically-stabilized substrates?



Natural and antropogenic driver of habitat resilience

bottom trawling,
sand dredging,
infrastructure

sediment
import,
export

tidal
currents

waves,
swell

bathymetry

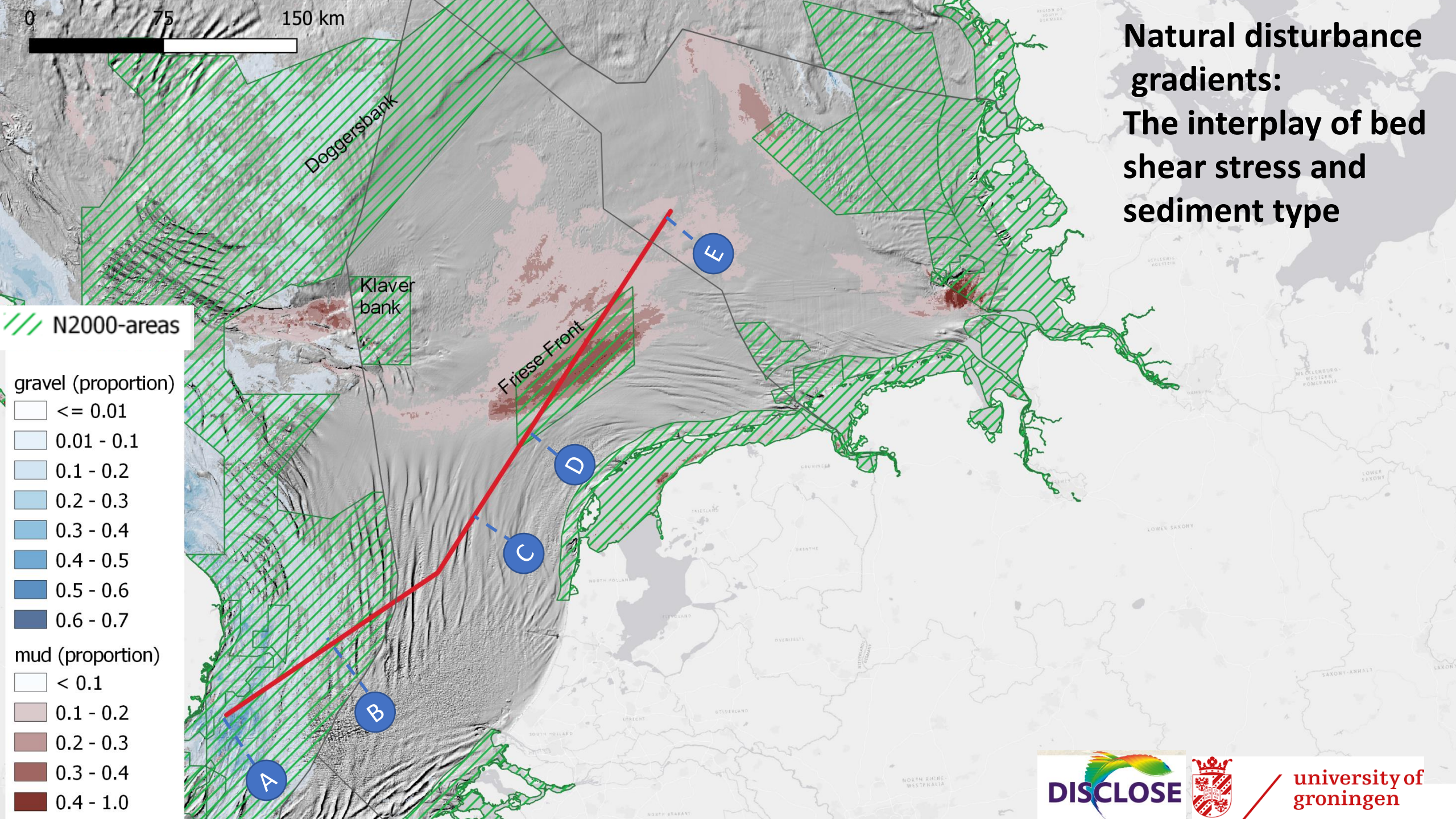
sediment
texture

natural
bottom
shear
stress

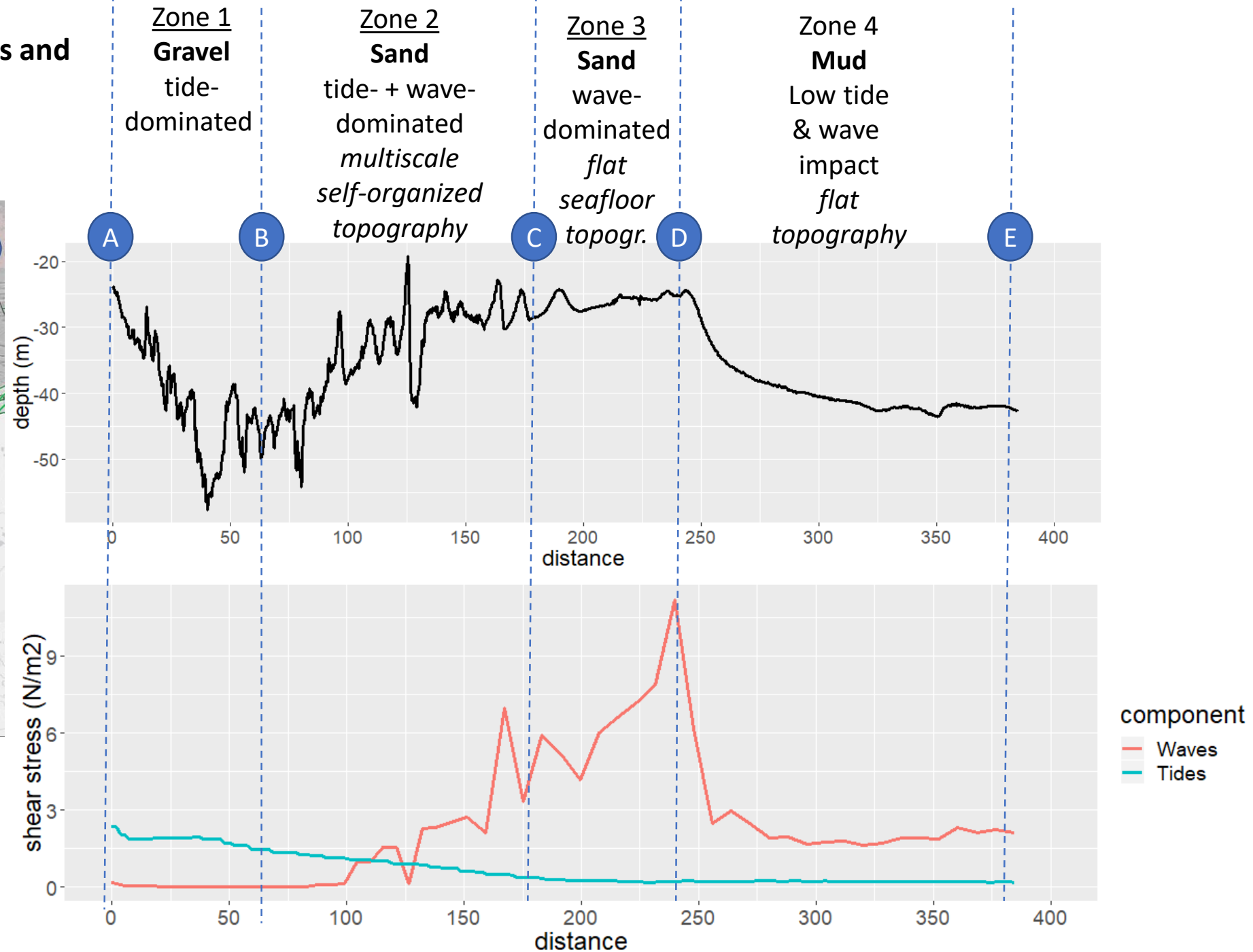
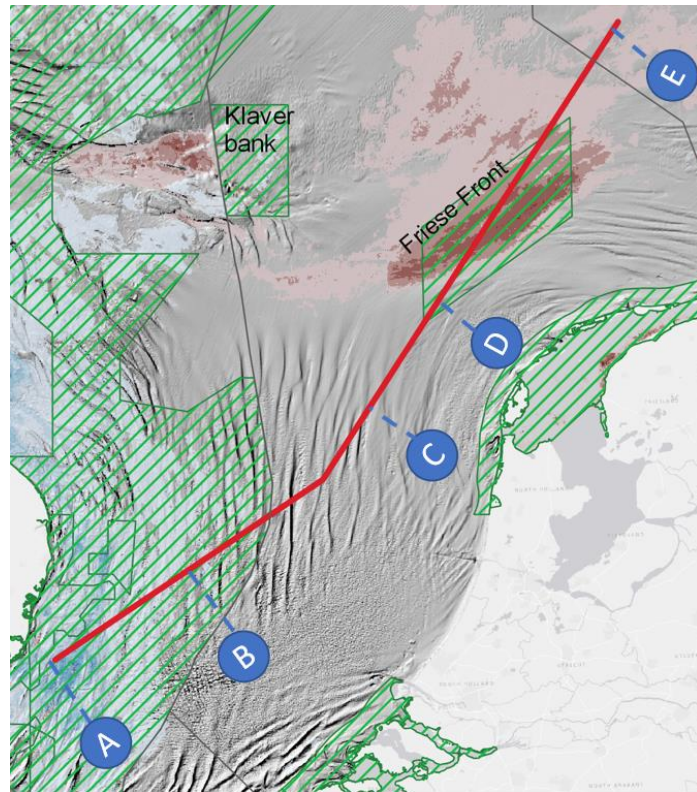
realized
seafloor
disturbance

resilience

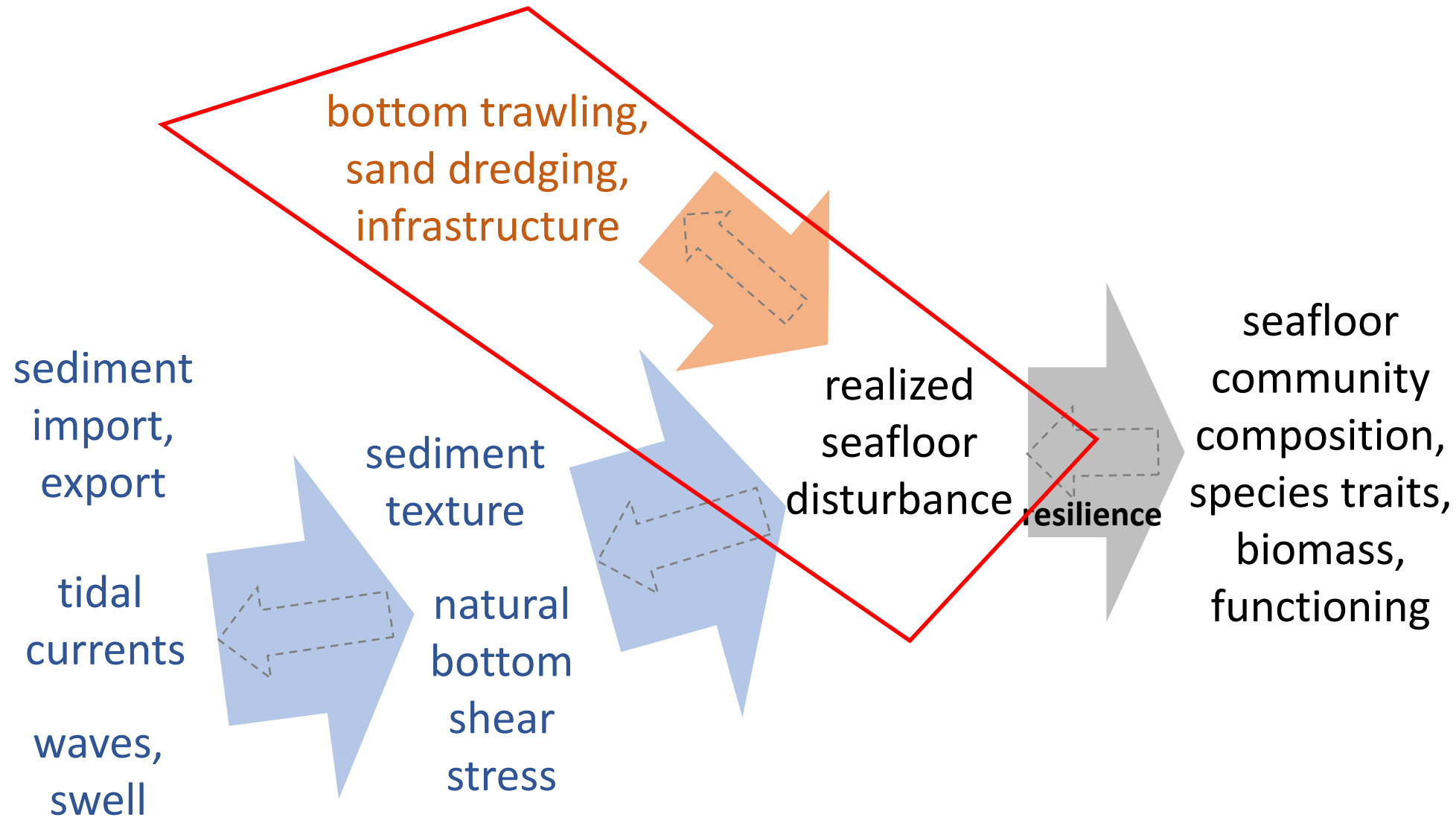
seafloor
community
composition,
species traits,
biomass,
functioning



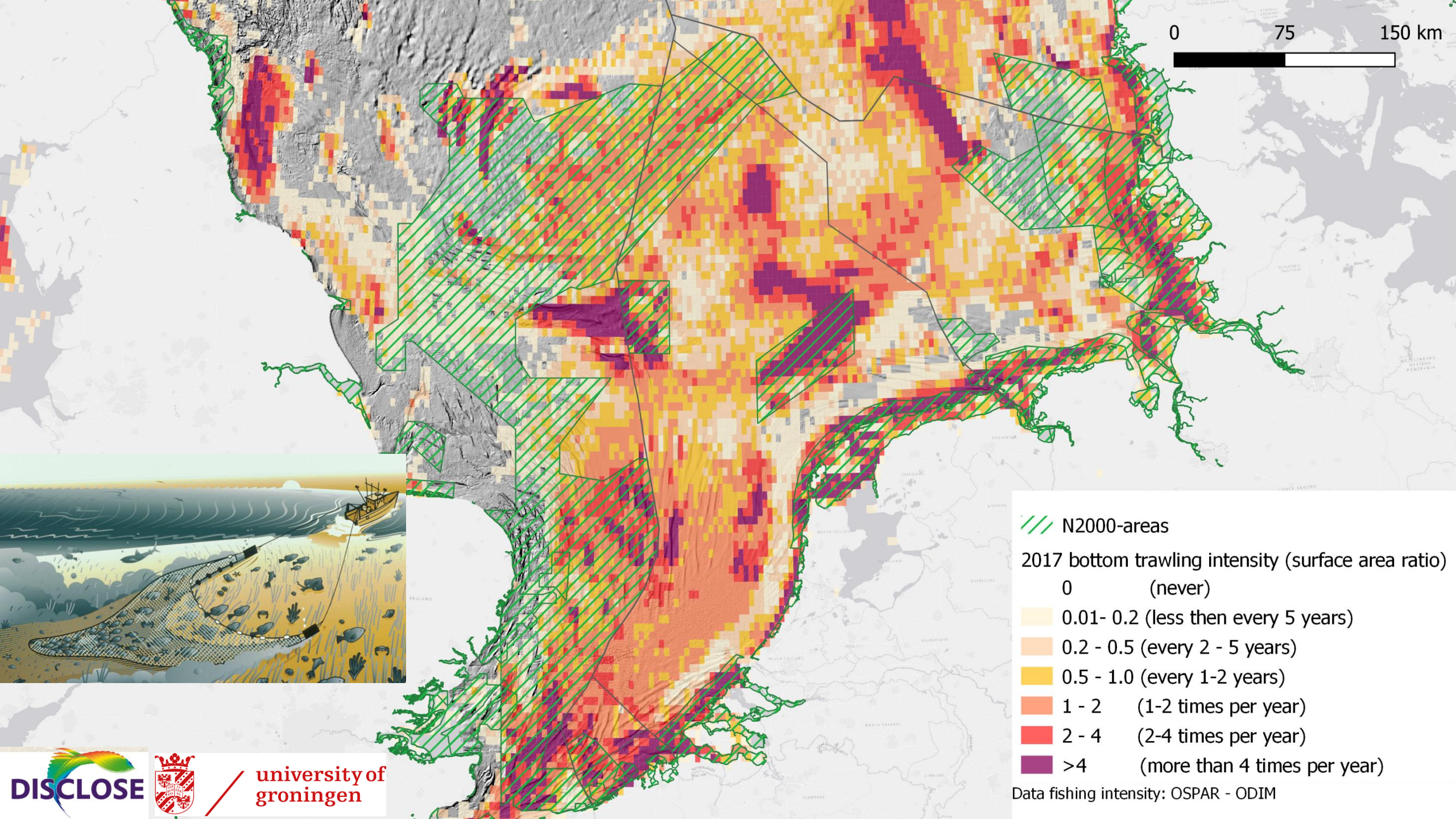
The interplay of bed shear stress and sediment type



Natural and antropogenic driver of habitat resilience

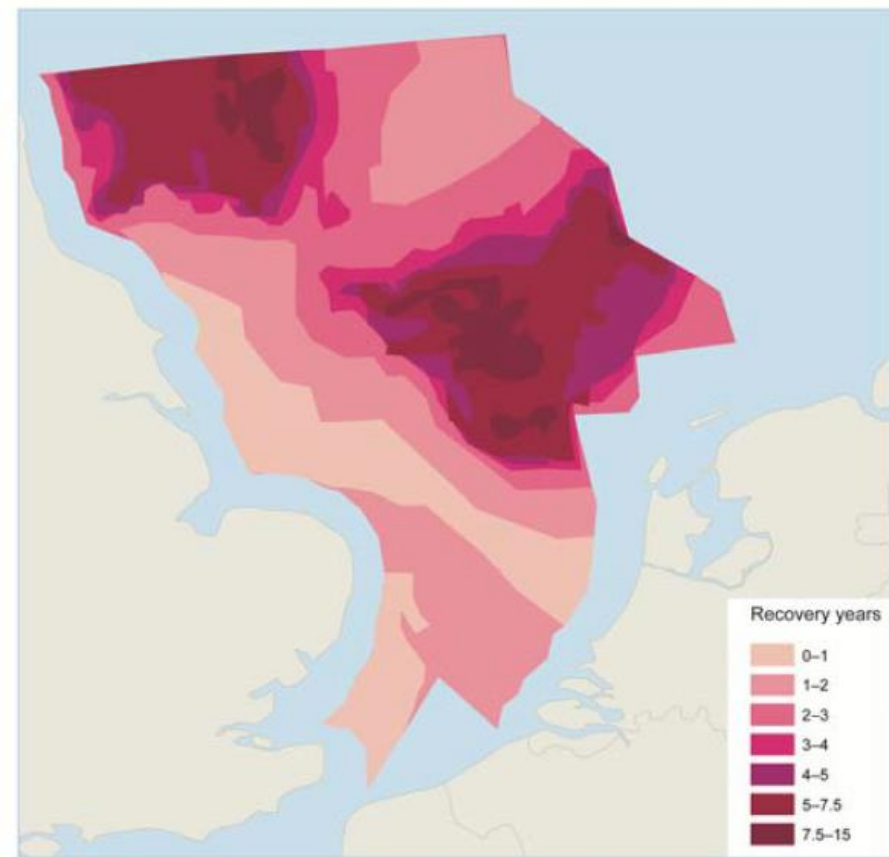


bathymetry

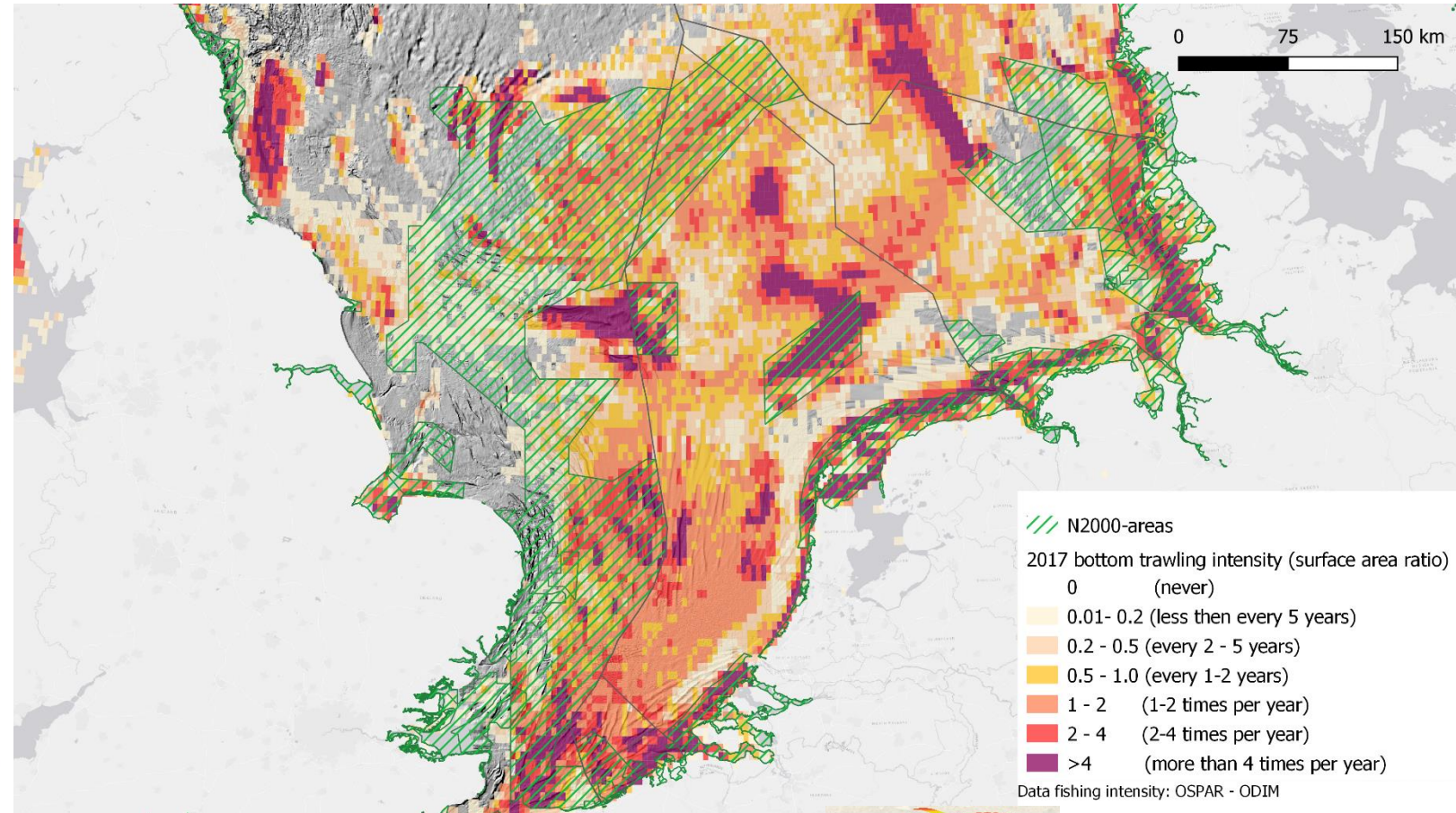


Risk of insufficient recovery time of seafloor communities

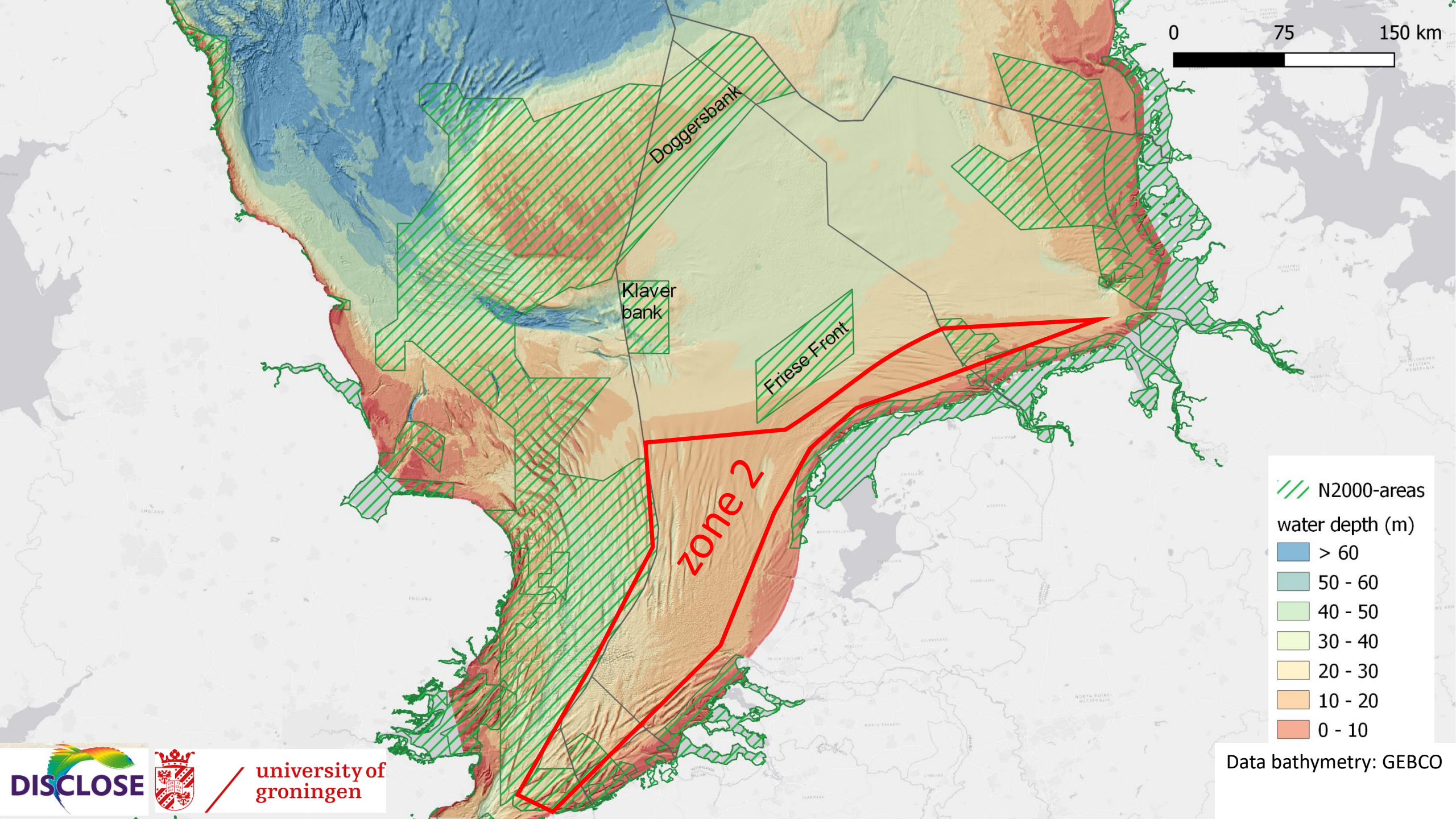
Estimated recovery time of seafloor communities to 90% productivity after 1 pass of beam trawl



Estimated return time of trawling



Hiddink et al. (2006) in ICES 2008



/// N2000-areas

water depth (m)

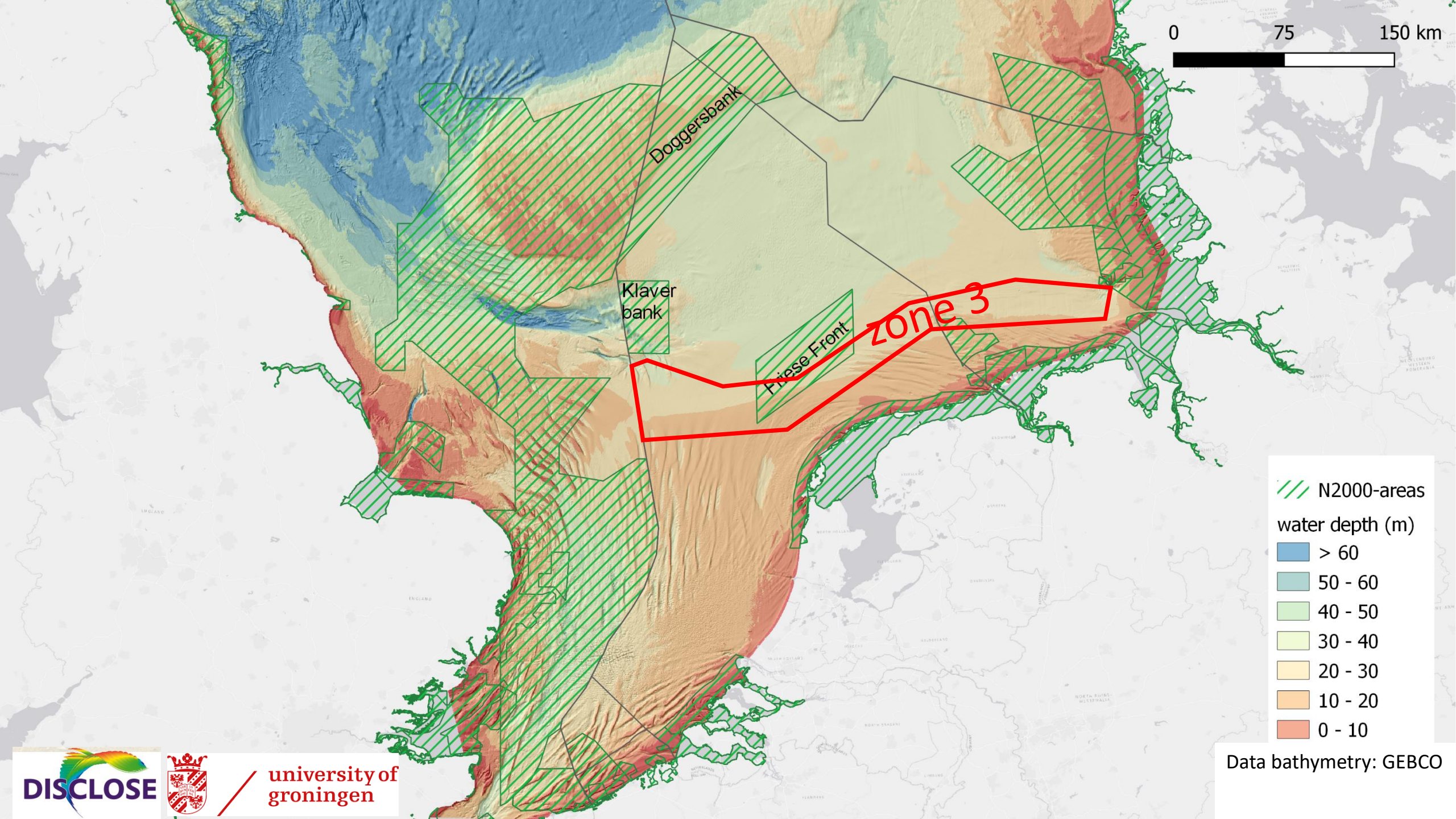
- > 60
- 50 - 60
- 40 - 50
- 30 - 40
- 20 - 30
- 10 - 20
- 0 - 10

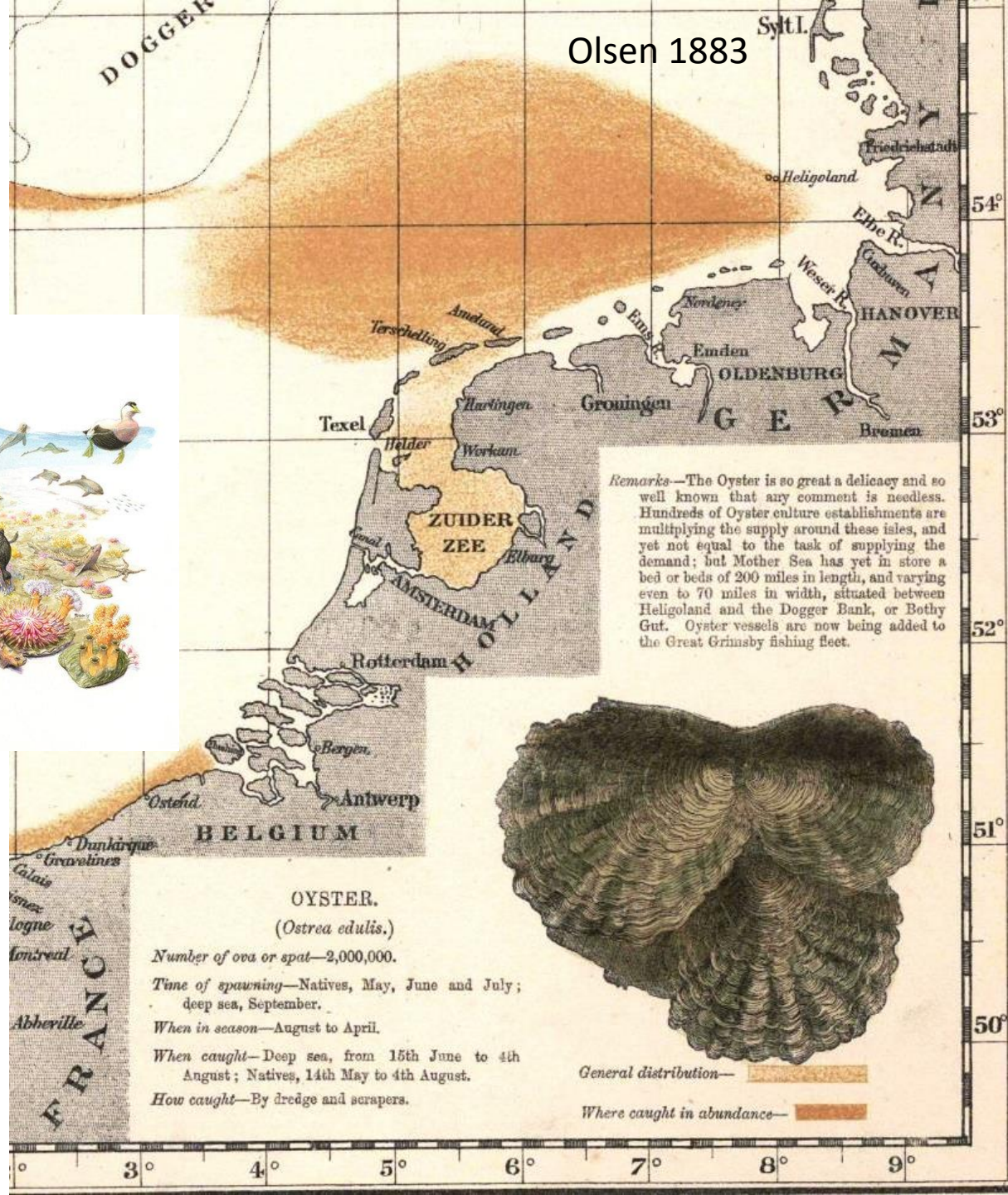
Data bathymetry: GEBCO



Borkumse Starren 2017 - Sten begroed met zwanenmonen

But also...





Moebius 1877

DIE
AUSTER
UND DIE
AUSTERNWIRTSCHAFT

VON

KARL MOEBIUS
PROFESSOR DER ZOOLOGIE IN KIEL.

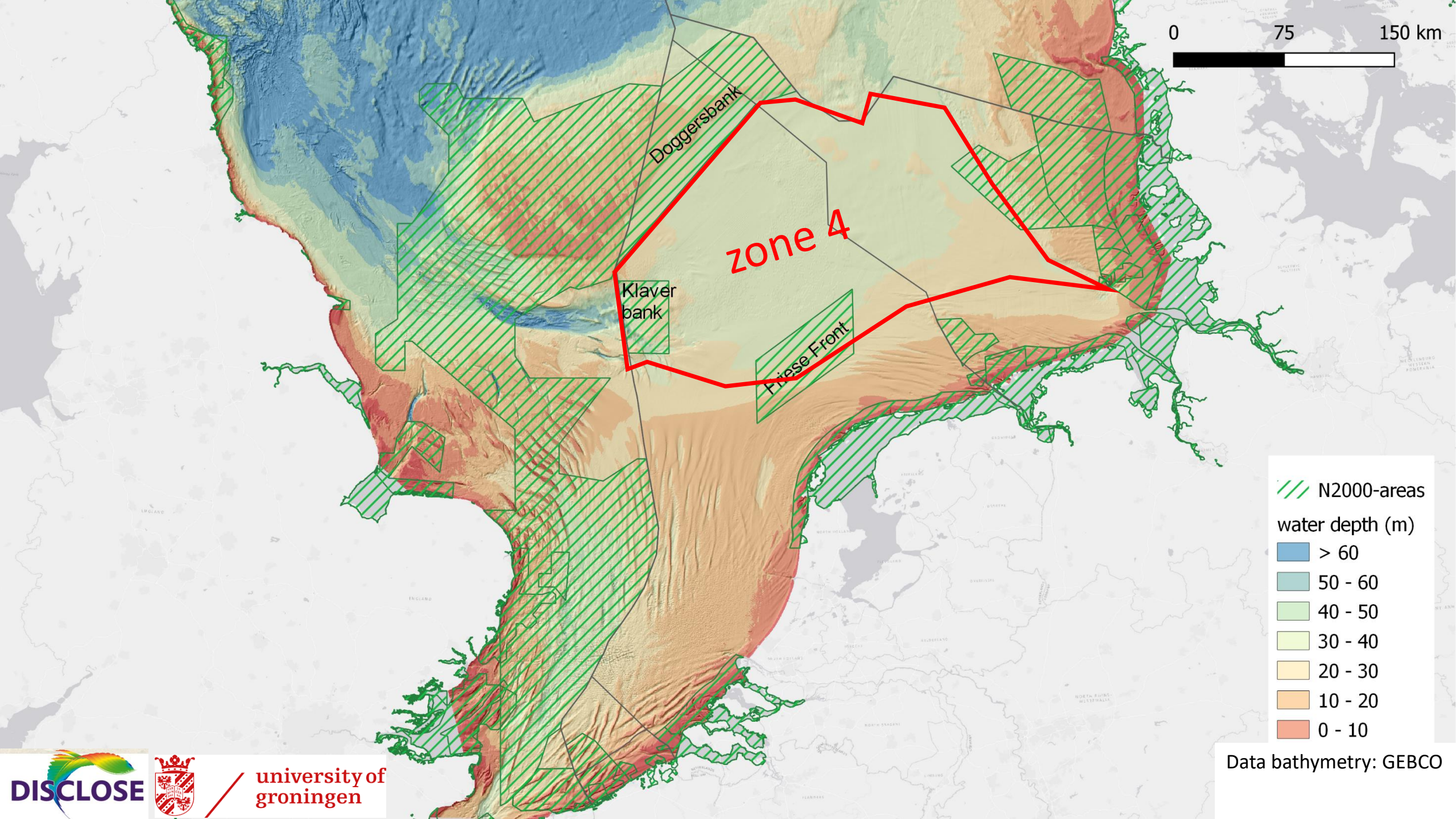


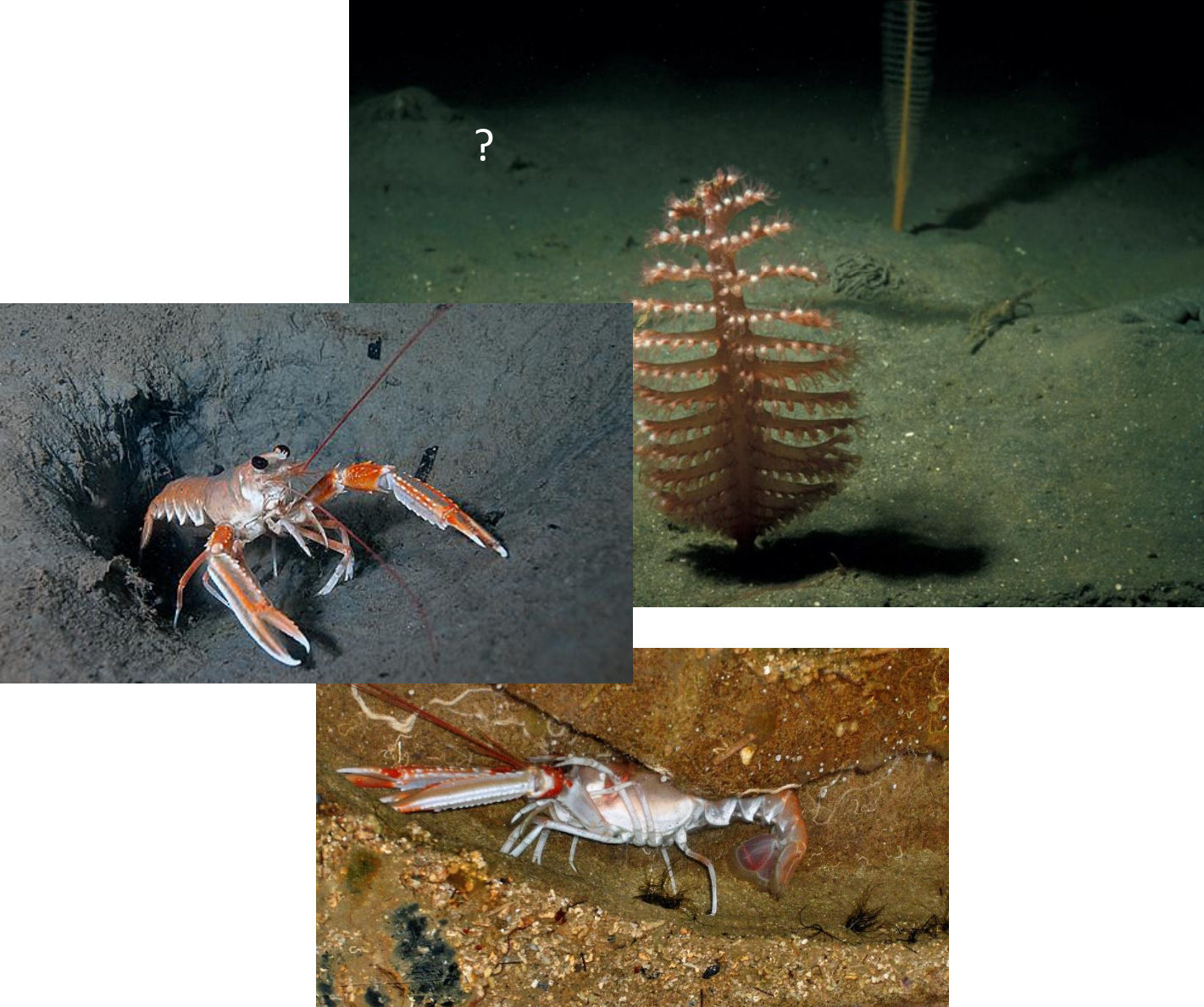
MIT EINER KARTE UND NEUN HOLZSCHNITTEN.

BERLIN.
VERLAG VON WIEGANDT, HEMPEL & PAREY.
1877.



university of
 groningen





OSPAR (2010)
Background Document for
Seapen and
Burrowing megafauna
communities

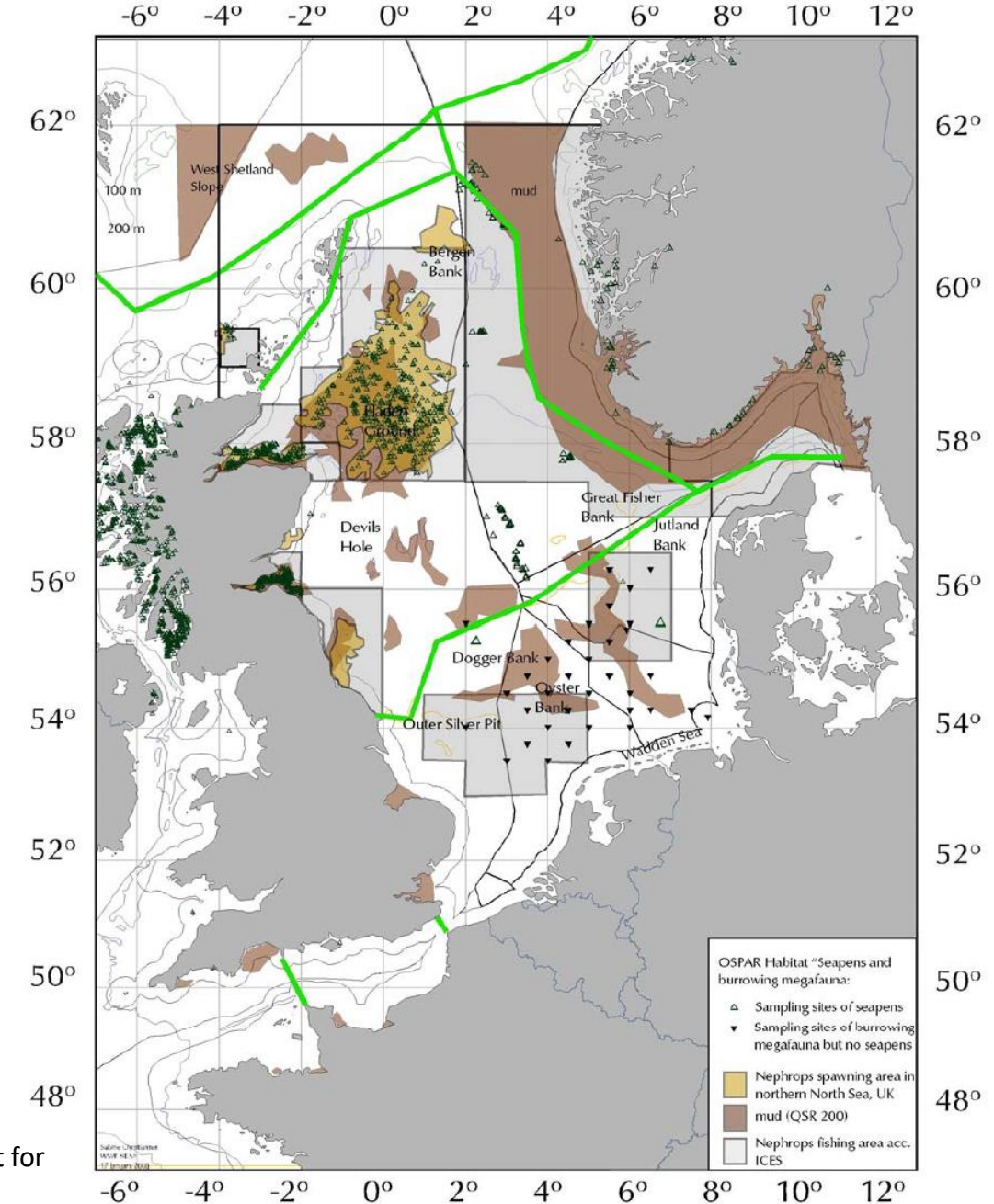
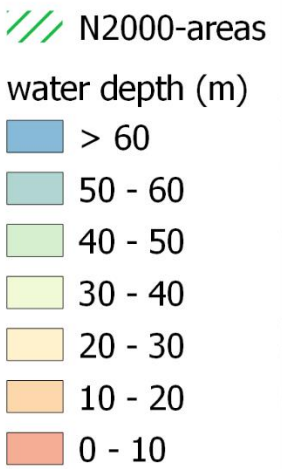
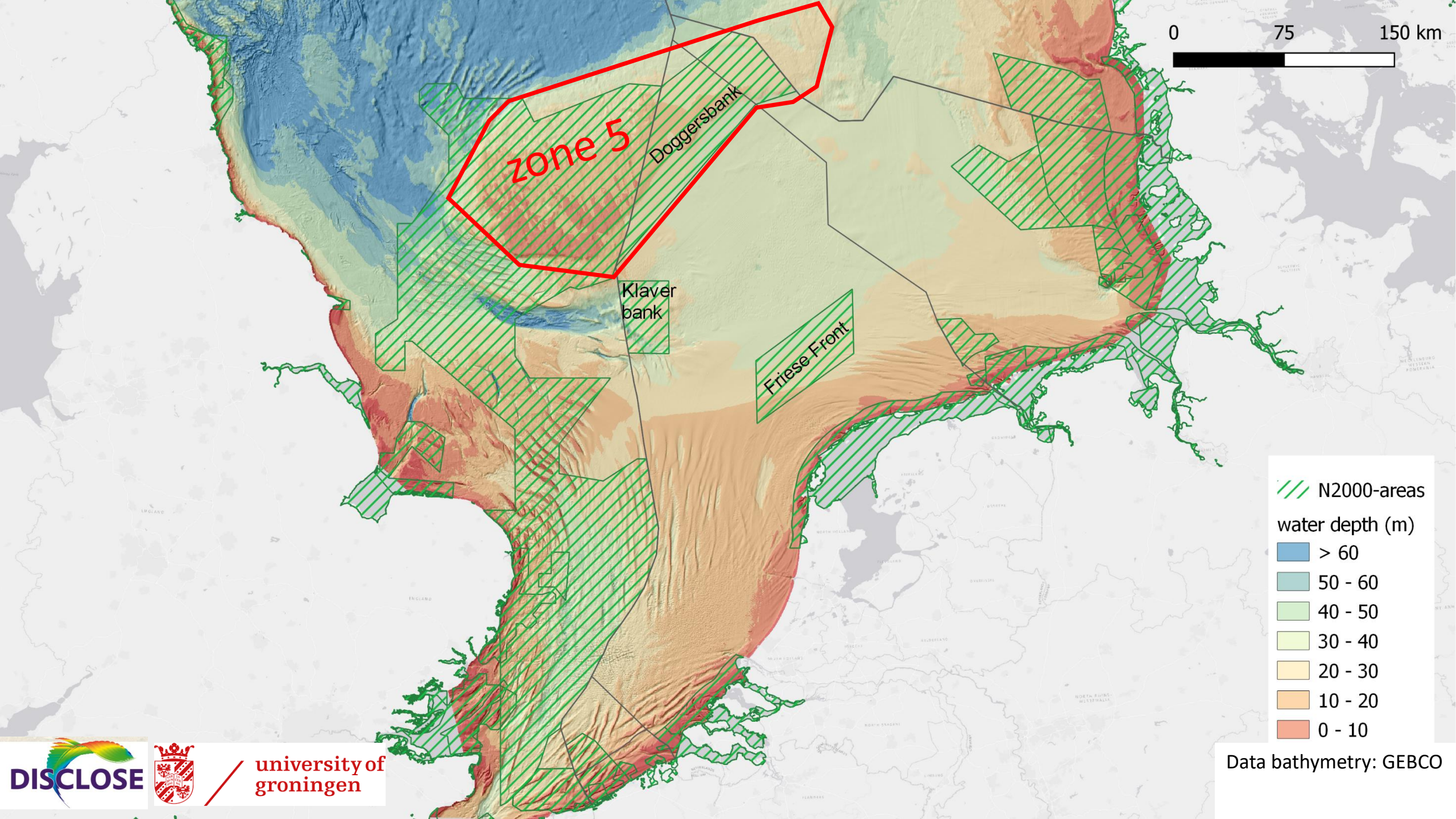
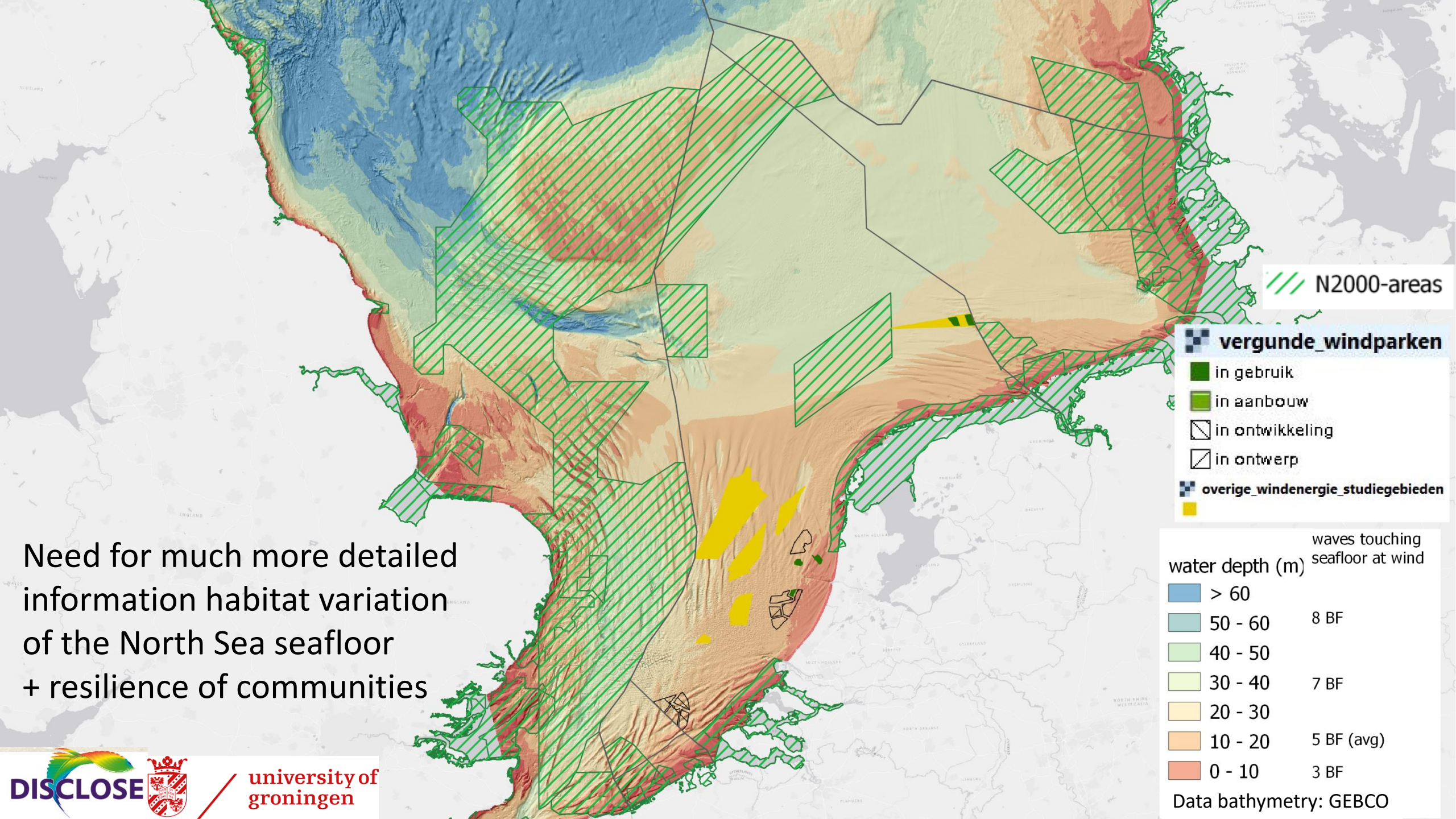



Figure 3: Sea-pen and burrowing megafauna habitat distribution in the North Sea (S.Christiansen, pers.comm).



Data bathymetry: GEBCO










/// N2000-areas

 vergunde windparken

-  in gebruik
-  in aanbouw
-  in ontwikkeling
-  in ontwerp

 overige windenergie studiegebieden

water depth (m)		waves touching seafloor at wind
	> 60	
	50 - 60	8 BF
	40 - 50	
	30 - 40	7 BF
	20 - 30	
	10 - 20	5 BF (avg)
	0 - 10	3 BF

Data bathymetry: GEBCO

Need for much more detailed
information habitat variation
of the North Sea seafloor
+ resilience of communities