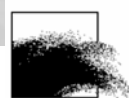


To Sea, or not to see

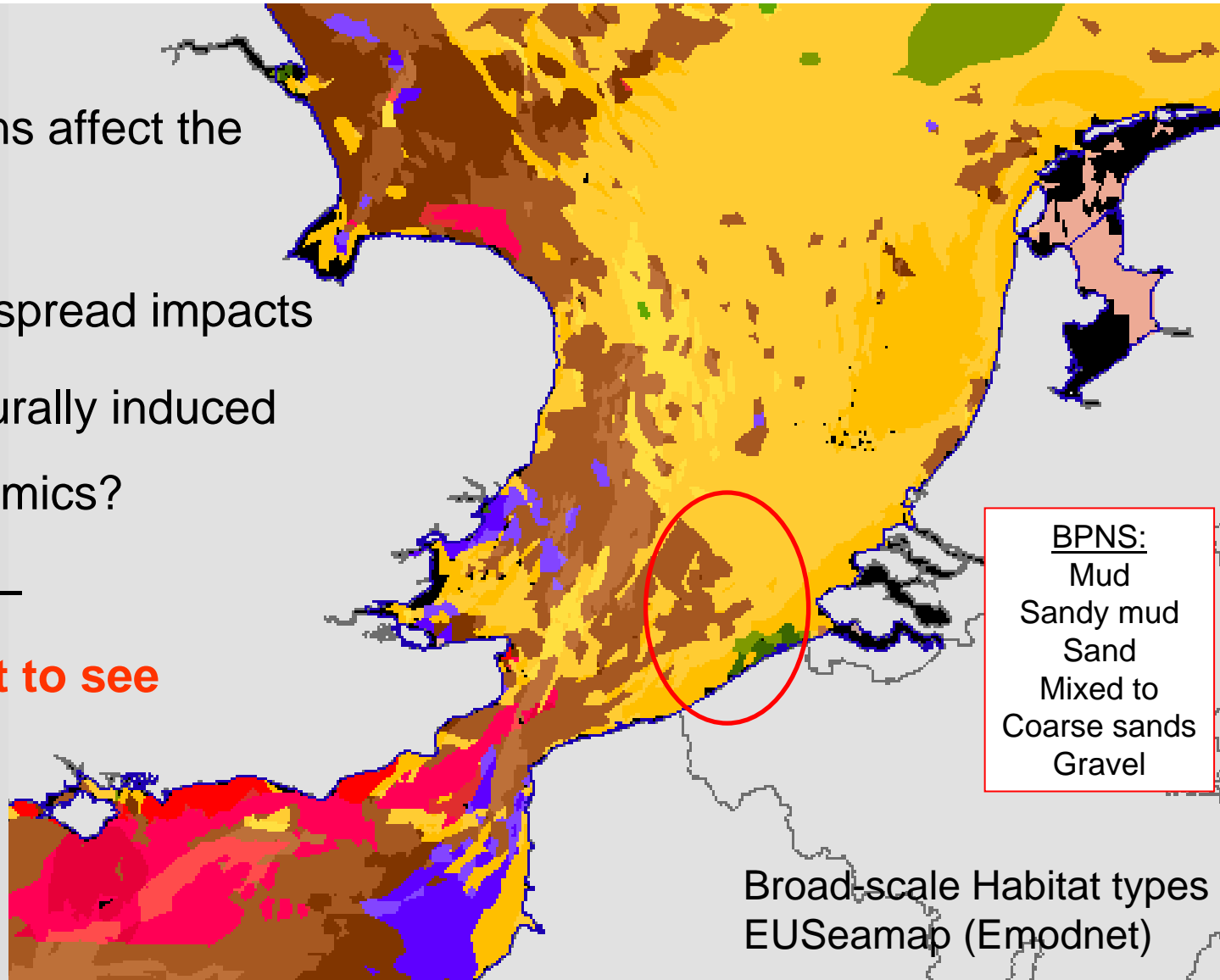
Vera Van Lancker

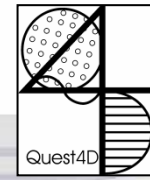


Key questions

- How do humans affect the seafloor?
- Local vs wide-spread impacts
- Human vs naturally induced sediment dynamics?
- Ways forward –

To Sea, or not to see

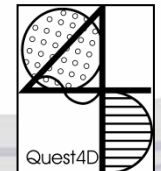




Main pressure types

following EMSFD terminology

1. **Smothering:** covering the natural seabed habitat with a layer of material that might be expected to disperse (e.g. disposal of dredged material);
 2. **Sealing:** permanent structures, fixed on the seabed (e.g. infrastructure works; measuring piles; cables and pipelines; wind turbines; and wrecks);
 3. **Abrasion:** scouring and ploughing the seabed (e.g. benthic fishing using trawl gear; burying activity during cable and pipeline laying; wind turbine scour + maintenance of navigation channels);
 4. **Extraction:** exploitation by removal of seabed resources (e.g. aggregate extraction)
-
- ➔ Pressures at different scales
 - ➔ Footprint of disturbance \ll Habitat type (mud vs sand vs gravel)
 - ➔ **What about Seafloor Integrity? (EMSFD)**
 - ➔ Safeguarding structure and function of ecosystems
 - ➔ Benthic ecosystems should not be adversely affected



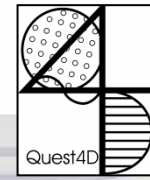
UK Study of Foden et al. 2011, MEPS

Pressure	Human activity	Confidence	Footprints per habitat					Footprints on UK seabed		
			Sand	Gravel	Muddy sand	Reef	Mud	Per activity	Per pressure (overlapping activities merged)	
Smothering	Dredge material disposal	2	3	110.8	89.6	61.0	21.9	0.2	283.5	346.01
				<i>0.06</i>	<i>0.22</i>	<i>0.26</i>	<i>0.43</i>	<i>0.01</i>	<i>0.11</i>	<i>0.14</i>
	Cuttings from well heads and platforms	2		52.6	6.2	3.6	0.03	0.1	62.6	
				<i>0.03</i>	<i>0.02</i>	<i>0.02</i>	<i><0.01</i>	<i>0.05</i>	<i>0.02</i>	
	Smothering per habitat (overlapping activities merged)			163.4	95.8	64.5	21.9	0.34		
Obstruction	Oil and gas platforms	2		0.8	<0.1	<0.1	0.0	0.0	0.8	21.1
				<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i>0.00</i>	<i>0.00</i>	<i><0.01</i>	<i><0.01</i>
	Well heads	2		4.2	0.5	0.3	<0.1	<0.1	5.0	
				<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	
	Oil and gas pipelines	1		3.1	0.7	0.2	0.0	<0.1	4.0	
				<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i>0.00</i>	<i><0.01</i>	<i><0.01</i>	
	Submarine cables	1		0.2	<0.1	<0.1	<0.1	0.0	0.3	
				<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i>0.00</i>	<i><0.01</i>	
	Wind turbines	1		0.1	0.1	0.1	0.0	0.0	0.2	
				<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i>0.0</i>	<i>0.00</i>	<i><0.01</i>	
	Wrecks	2		6.7	3.4	1.7	0.4	0.1	12.4	
				<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	
	Obstruction per habitat (overlapping activities merged)			14.4	4.4	1.9	0.4	0.1		
Abrasion	Benthic fishing	1	2-3	93946.2	19893.4	18088.2	647.3	1324.7	133899.7	133909.59
				<i>50.56</i>	<i>49.68</i>	<i>76.25</i>	<i>12.73</i>	<i>71.89</i>	<i>52.2</i>	<i>52.20</i>
	Wind farm scour pits	2		0.6	0.6	0.5	0.0	0.0	1.7	
				<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i>0.00</i>	<i>0.00</i>	<i><0.01</i>	
	Submarine cable burial	2		12.3	4.2	1.4	0.0	0.1	18.0	
				<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i>0.00</i>	<i><0.01</i>	<i><0.01</i>	
	Abrasion per habitat (overlapping activities merged)			93952.3	19896.8	18089.3	647.3	1323.9		
Extraction	Aggregate extraction	3	1	51.9	92.4	1.9	0.0	0.0	146.3	146.3
				<i>0.03</i>	<i>0.23</i>	<i><0.01</i>	<i>0.00</i>	<i>0.00</i>	<i>0.05</i>	<i>0.05</i>
Footprint of all pressures, per habitat				94182.0	20089.5	18157.6	669.6	1324.3		
				<i>50.69</i>	<i>50.17</i>	<i>76.54</i>	<i>13.17</i>	<i>71.87</i>		

Not incl.
Harbour
infrastructure works

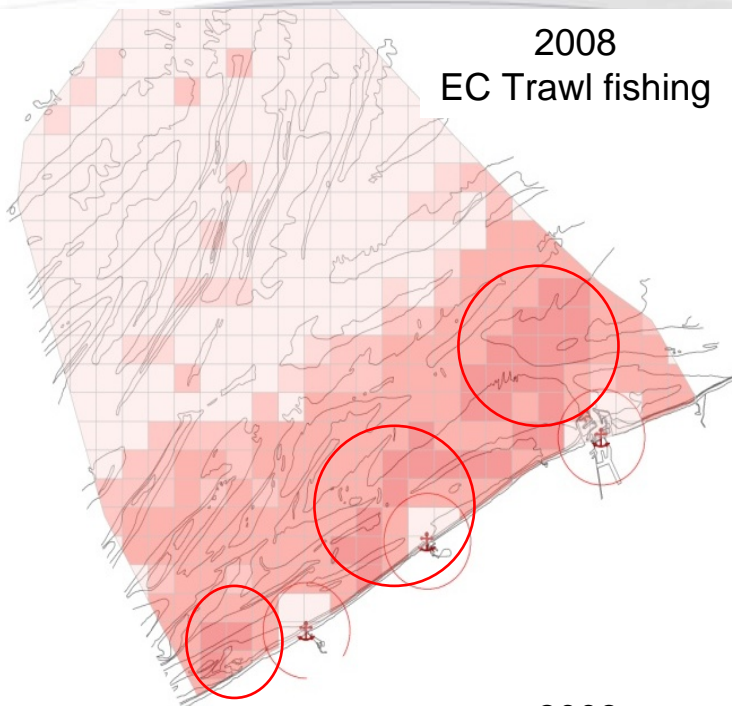


Data is now in place for Belgian waters

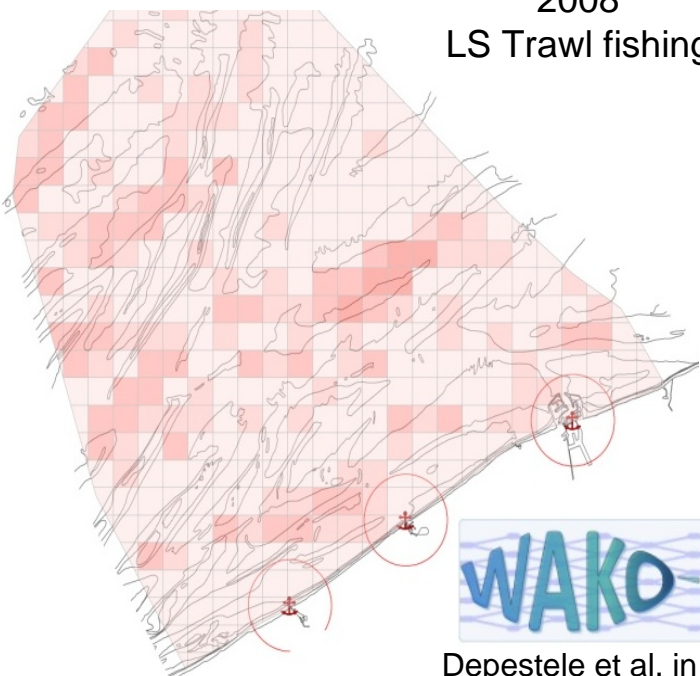


Fisheries

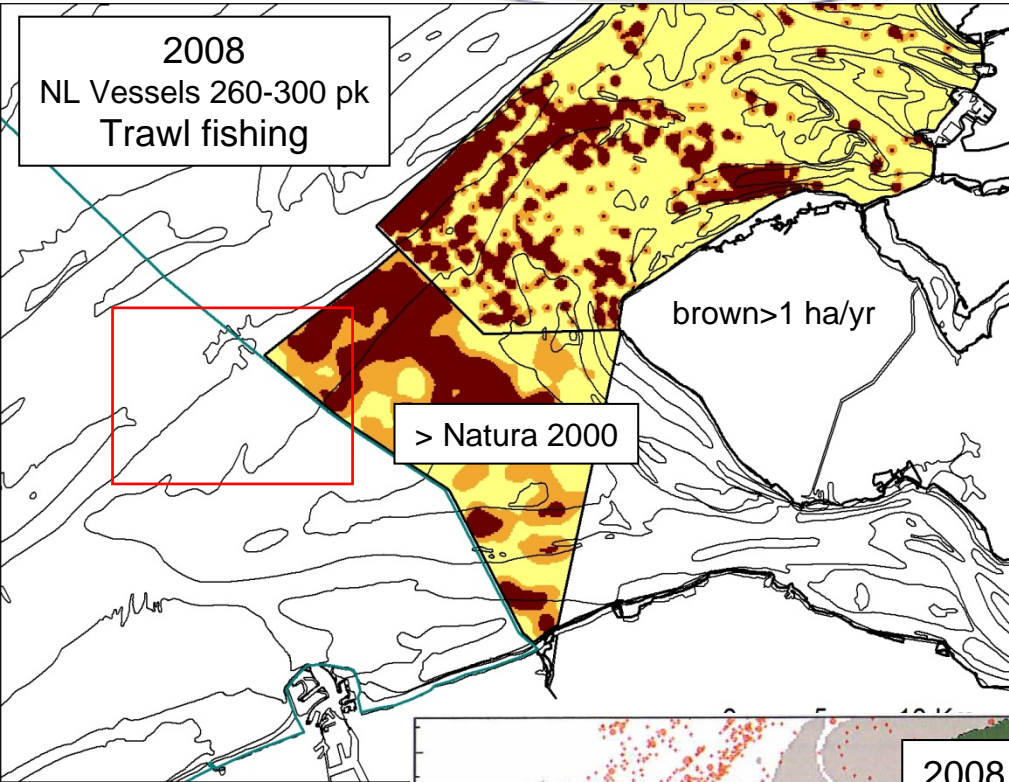
2008
EC Trawl fishing



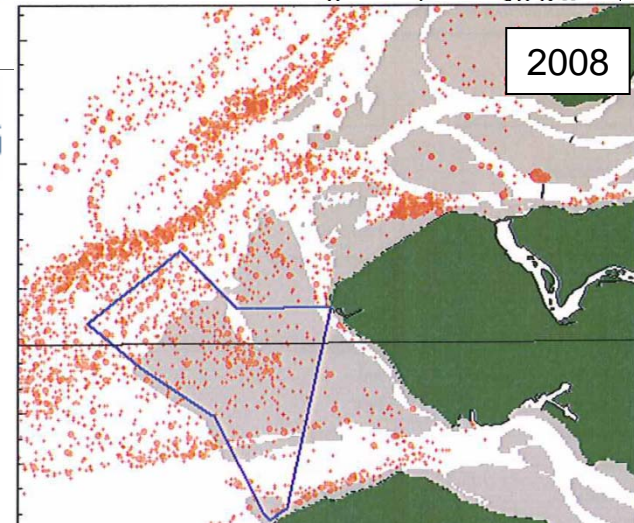
2008
LS Trawl fishing



Depestele et al. in prep.



Bierman et al. 2009



Seafloor integrity?

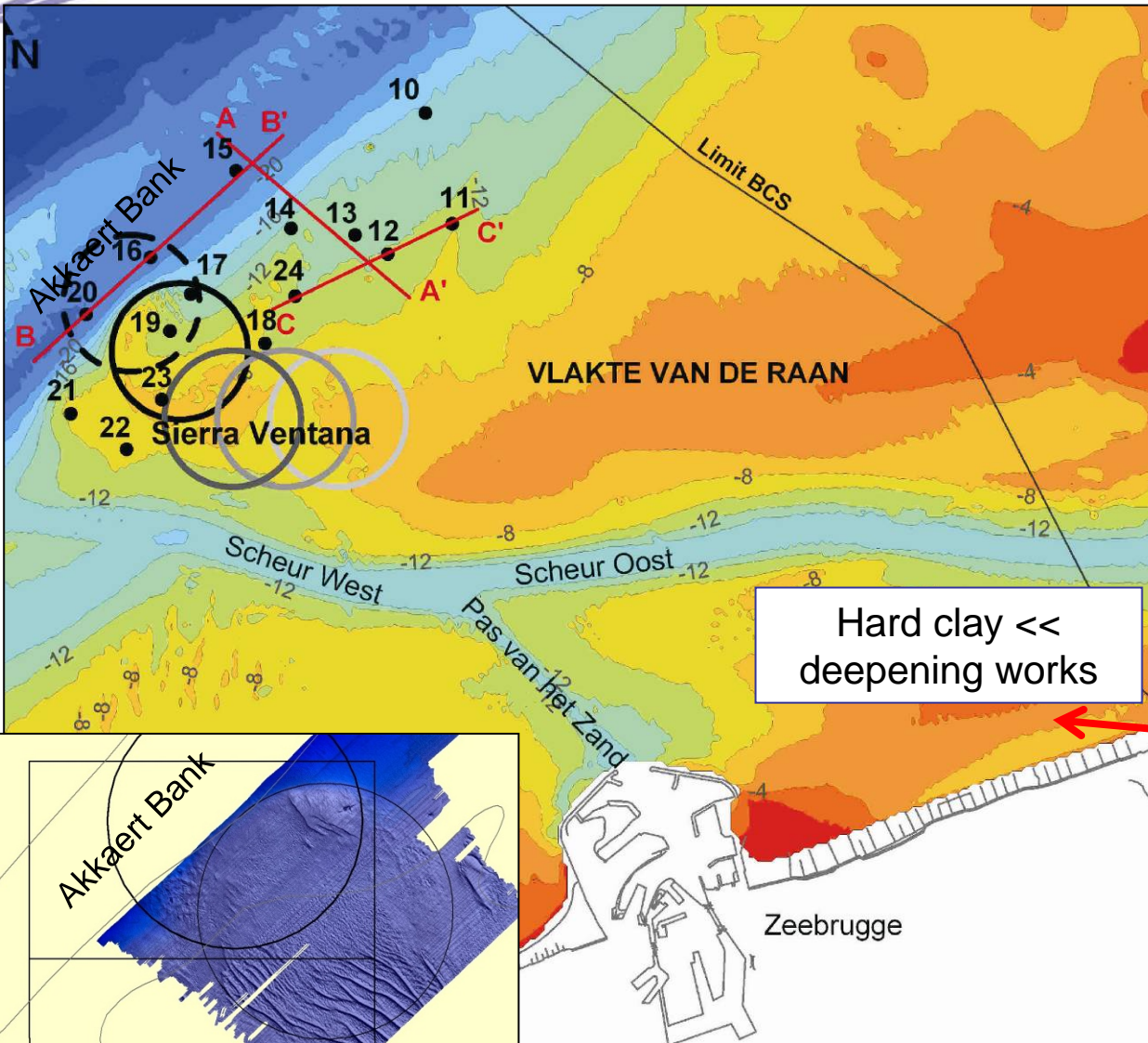
- Habitat quality?
- How does trawling affect the benthos?
- Release of fines in the water column?

ABRASION

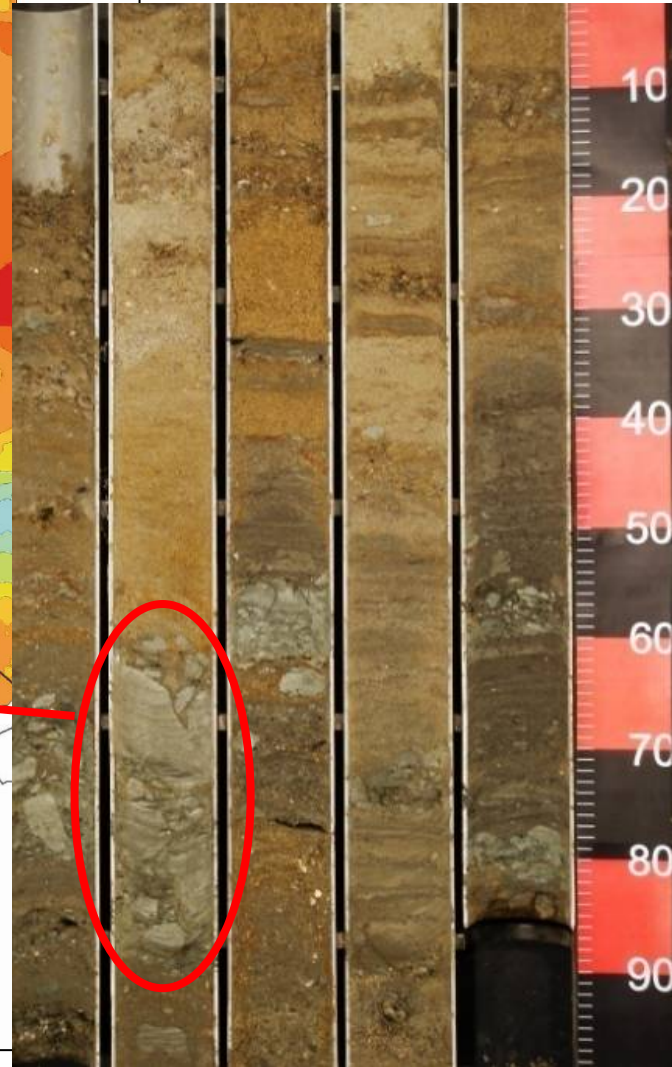
Ploughed seafloors!!
Impact dependent
on habitat type
Impact is widespread

□ 30m

Disposal of dredged material



Vibrocore



Disposal of sand-mud / clay mixtures

Sedimentation along disposal grounds

1 Analysis bathymetry data

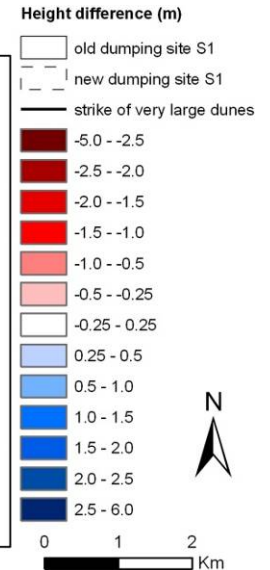
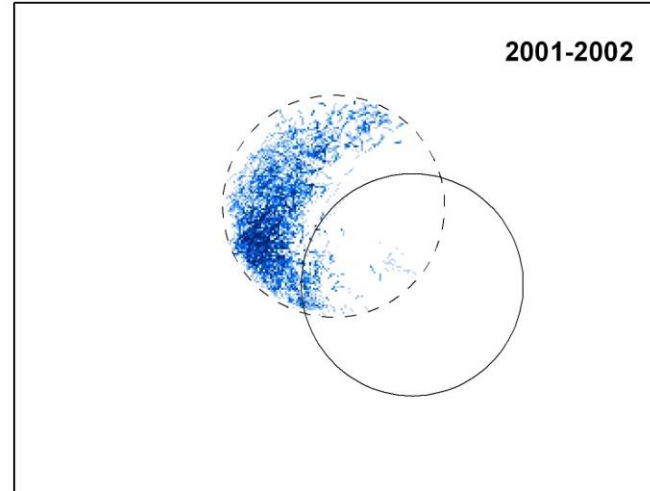
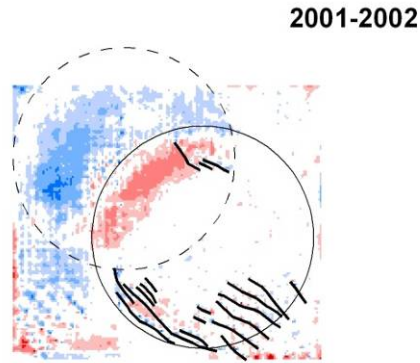
2

Analysis disposal data

Short term

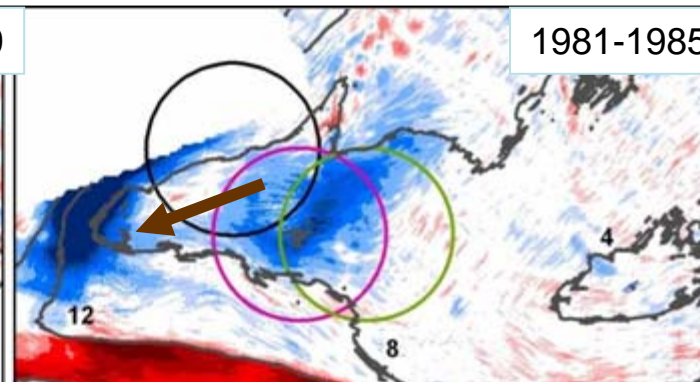
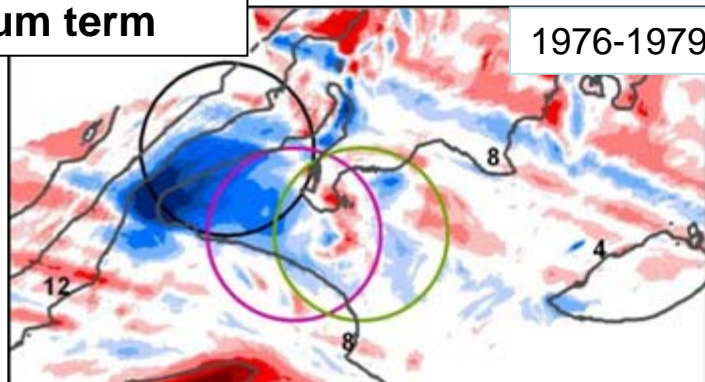
SMOTHERING

Near field: lethal for some species
Far field: beneficial??



Data compiled from the Flemish Authorities, Agency for Maritime and Coastal Services, Maritime Access.

Medium term

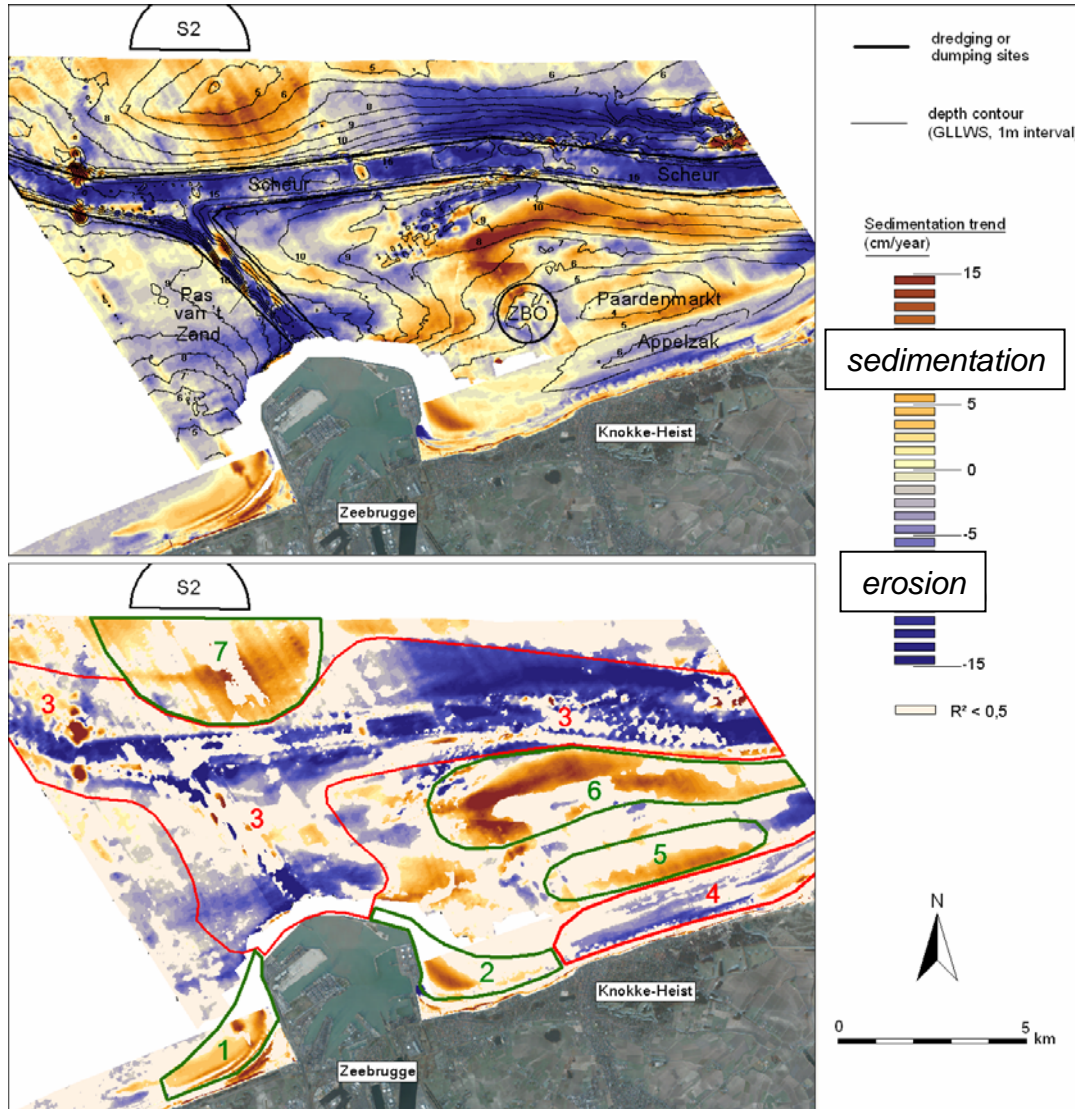


3 Analysis vibrocores:
• top 25-50 cm variable composition
• natural & anthropogenic

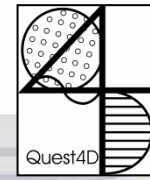
Regional sedimentation, outside the borders of the designated zones

blue: sedimentation
red: erosion

Infrastructure works s.l.



**SEALING
SMOTHERING
ABRASION**



Human vs naturally induced sediment dynamics?

- Data are now available to assess relative importances on BPNS level
- In France, area of 'La Grande Vasière' (Bourillet *et al.* 2006):
 - Scraped seafloors < Fishing: each m² is scraped 6-10 times/yr → 180 to 380 Mt/yr of fine sediments are remobilised
 - Still, remobilisation is controlled FIRST by storms, then by fisheries (remobilisation by fisheries is only 10-30% of storm action)



Importance of natural-variability assessment

Q4D: provision of long-term modelling data,
based on coupled current-wave models
+ quasi-permanent seabed observations from in-situ tripods

Natural variability >> Sediment dynamics!

VLISSINGEN
NL

ZEEBRUGGE
BE

BUITENDELTA

Delta front

DISPOSAL
GROUND

Understanding changes
Importance of
-morphological setting
-sediment processes
-habitat types



Data SIO, NOAA, U.S. Navy, NGA, GEBCO

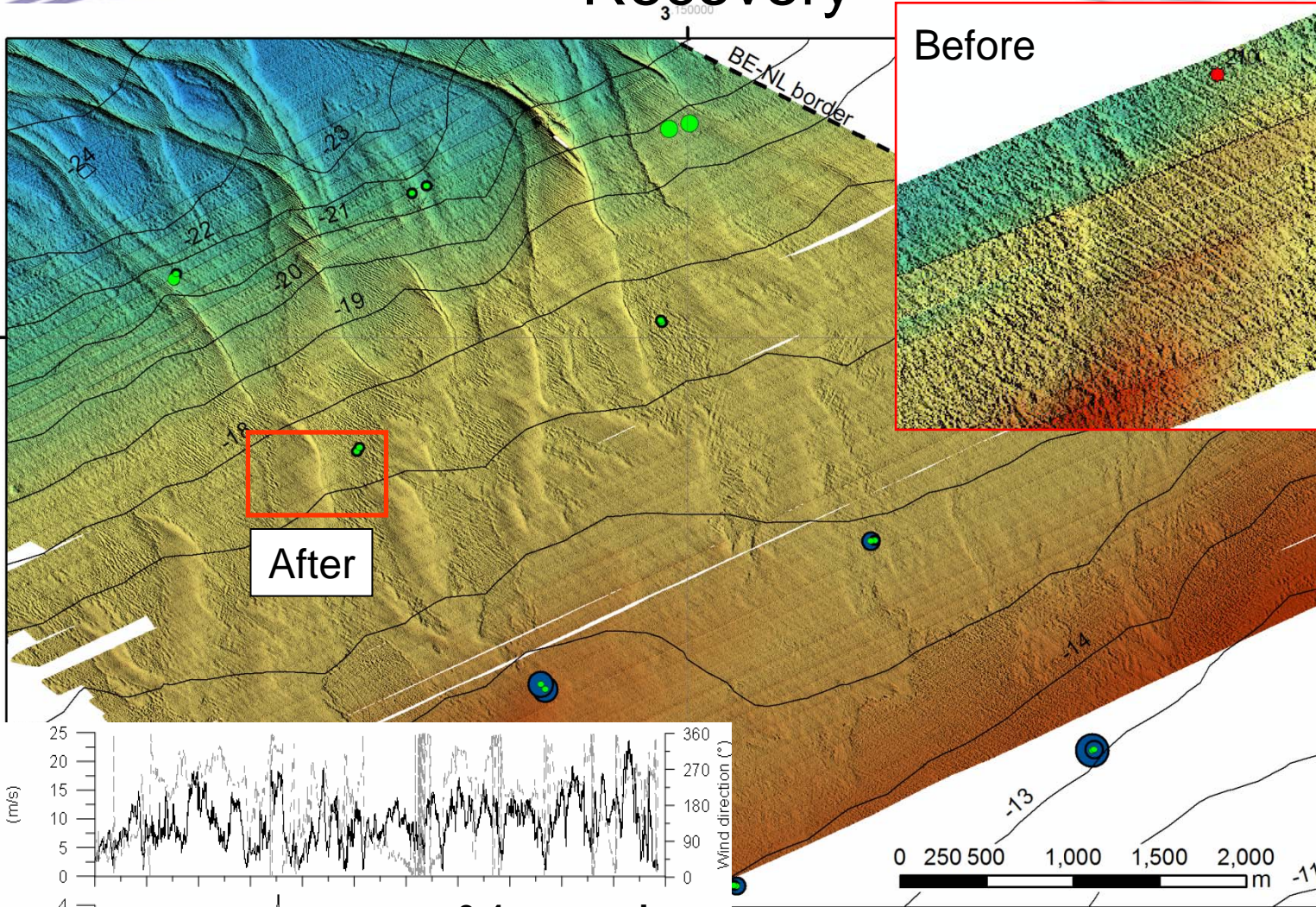
Imagery Date: 4/8/2007
51°30'

Google

Bathymetrie © Deltares 2011

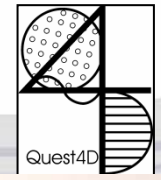
Nederlandse Hydrografische Dienst & Rijkswaterstaat Dienst Noordzee

Recovery



3-4m waves!

Same area AFTER a storm
Deposition of a sand layer



To Sea, or not to see

- For characterising human disturbance
 - Vessel monitoring systems: Spatial extent of human activities **and intensity**
 - a.o. Aggregate extraction; disposal of dredged material; fishing intensity
 - Desktop studies
- Still, for assessing (=seeing) impacts, data needed on
 - Spatial coverage >> local vs widespread effects?
 - Temporal coverage >> natural variability (+extreme events) >> recovery rates
- Above all, assessment needed on **environmental status**: Good vs Not Good (>>EMSFD)
- Understanding the change is important to advise future projects and plans (**without seeing NO vision! NO Policy**)



Seabed-mapping programmes
Sea-going observations /
measurements
>> Integrated Monitoring

Next series of
talks!
+Monitoring
Debate PM
+Debate
EMSFD

Acknowledgments

- Flemish Authorities, Maritime Services/Maritime Entrance for providing hydro-meteorological data, as well as dredging-intensity data
- Data processing Isabelle Du Four, Rindert Janssens
- Fishing-intensity data: Jochen Depestele (ILVO), Stijn Bierman (IMARES, NL)

• A warm thank you to my sea-going buddies Reinhilde van den Branden, Rindert Janssens, Emiel Vereecken and students during several training campaigns

- RV Belgica Officers and Crew

