Seafloor disturbance – the approach in Belgium

NWWAC Horizontal Group
Tuesday 05 July
Ghent

Tuesday July 5th

Hans Polet

Estimation of seafloor impact

- **Various approaches/indicators to estimate benthic state & impact**
  - None of the approaches is wrong, all have their advantages/disadvantages
  - They use specific characteristics of the benthic community
    - Abundance and/or biomass
    - Diversity measures
    - Species composition
    - Group of certain sensitive or tolerant species
- Two major types:
  - Indicators evaluating the benthic state (**quality**)
  - Indicators evaluating the **risk** of decreasing the benthic state

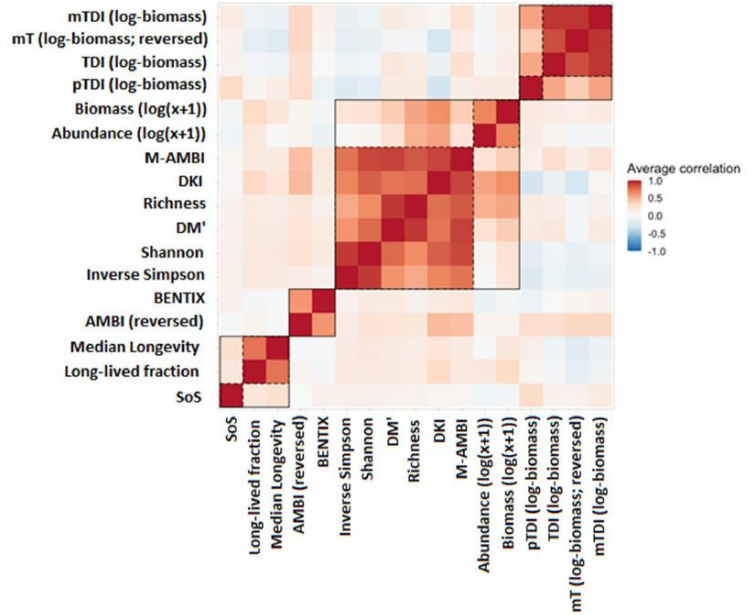
- Aim: To find an appropriate approach to evaluate/manage sea bottom impact for specific fishery (e.g. Belgian fishery)

Multiple indicator approaches to evaluate benthic state (quality)

4 families of indicators

- Based on species life history characteristics (longevity)
- Diversity based indicator
- Indicators classifying species in relation to euthrophication (AMBI types)
- Indicators classifying species in relation to fishery (TDI types)

Correlation of those indicators



Multiple indicator approaches to estimate risk of disturbance

OSPAR approach (BH3)

- Based on information from MarLin
- Habitat sensitivity determined based on literature and categorized in three classes: low, medium, high.
- Qualitative approach

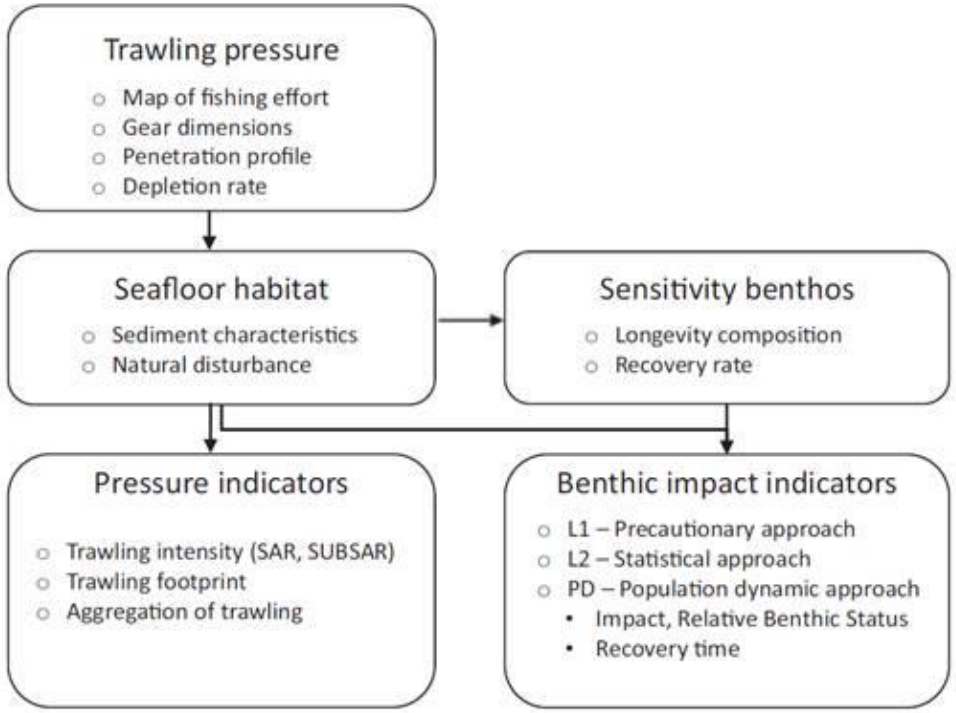
ICES WGFBIT approach, based on EU benthis indicators

- Based on EU Benthis project indicator: Relative benthic status.
- It determines sensitivity of habitats based on longevity of benthic community (higher sensitivity in areas with longer living species).
- Quantitative approach

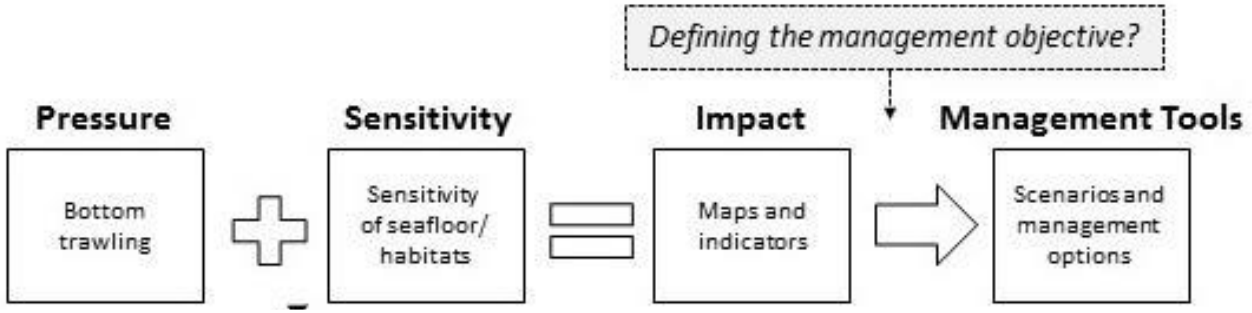
- A new indicator for 'Visserij verduurzaamt'

  → Most suited approach for the moment: OSPAR BH3 methodology

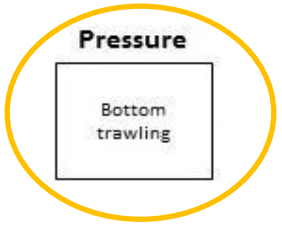
Indicators for seafloor disturbance



(Rijnsdorp et al. 2020)



(ICES 2017)



Indicators for seafloor disturbance
Pressure indicator

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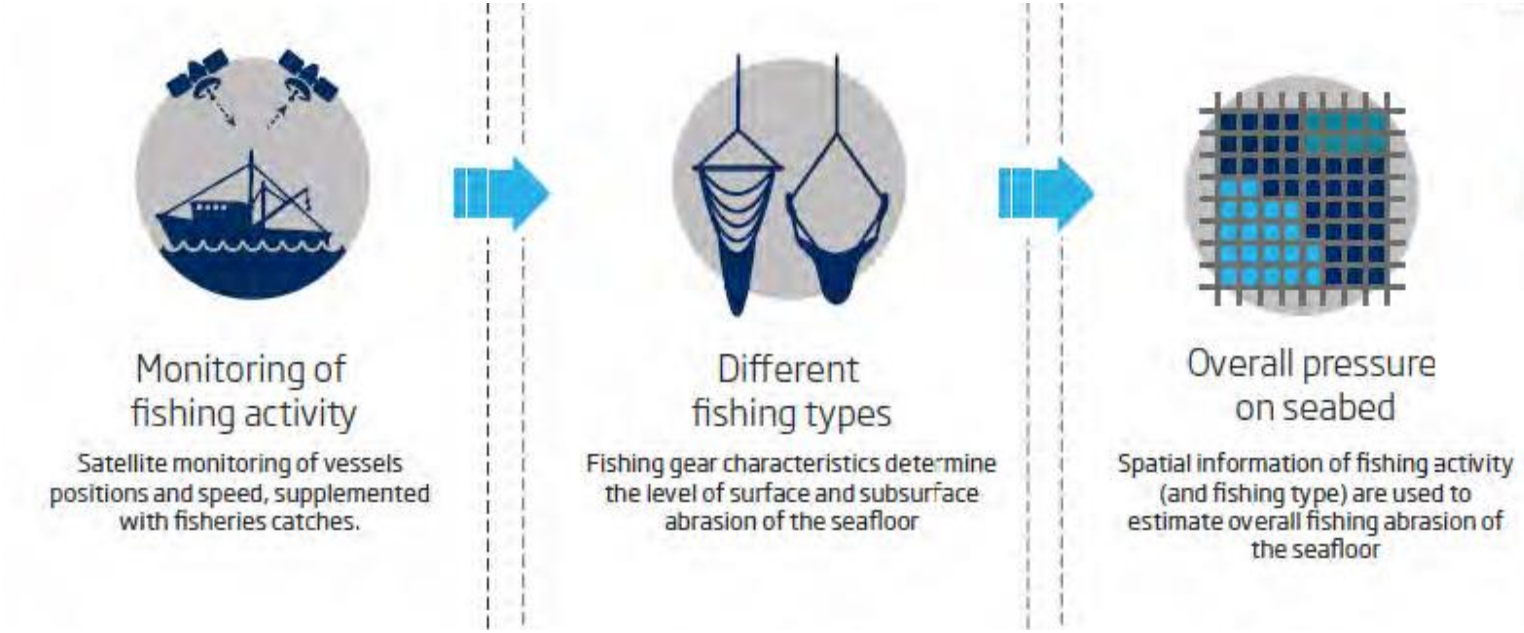
- Part I: Swept Area Ratio (SAR)

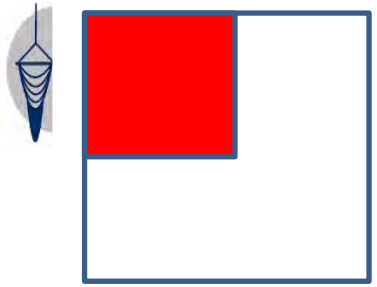


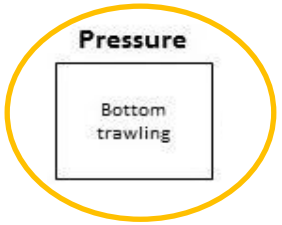
Benthis

SAR = hours fished x average fishing speed x gear width ***per grid cel***

SAR = 0.25 25% of the surface fished

SAR = 2 200% of the surface fished





Indicators for seafloor disturbance
Pressure indicator

- **Part II:** Disturbance level (depletion rate)

Depletion rates *(the fraction of benthic fauna killed or removed in the trawl path by a single trawl pass) depend on the gear penetration depth of the different métiers (Rijnsdorp et al. 2020)*

- **Part III:** Pressure

PRESSURE = SAR x depletion rate

Per vessel
Per trip
Per fishing gear (métier level 5)
Per grid cell

VV ***Benthis*** ***Benthis***

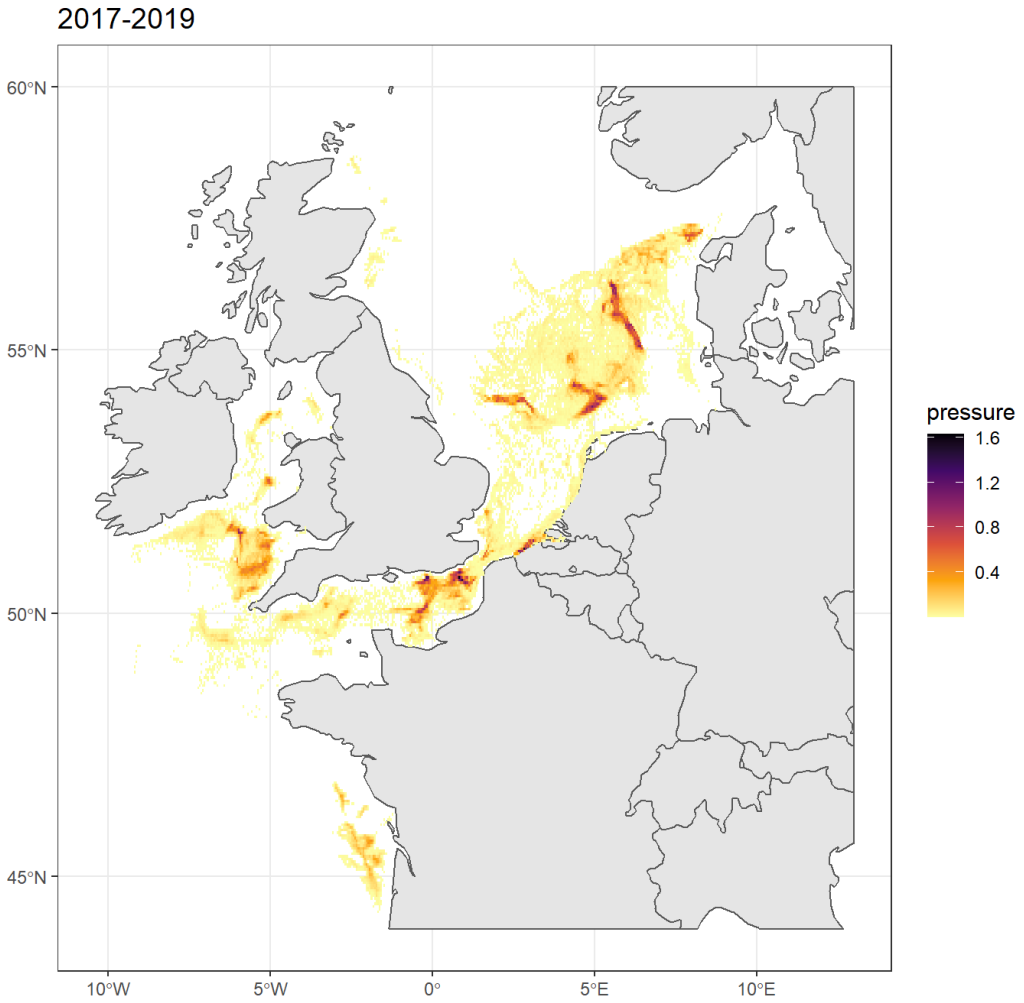
met5	pene_cm	Depletion rate
DRB_MOL	5.47	0.2
OTB_CRU	3.091587	0.1
SDN_DEF	1.804391	0.009
SSC_DEF	1.880698	0.016
TBB_CRU	1.694282	0.06
TBB_DEF	2.72	0.14
OTB_MCD	3.091587	0.1
OTB_DEF	2.650785	0.074
TBW_DEF	2.653334	0.1358063

(Benthis)

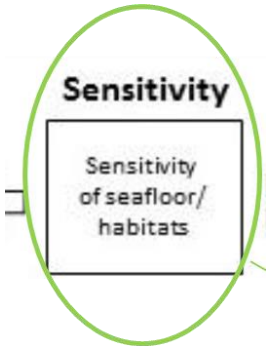
Pressure

Bottom trawling

Result of pressure
Belgian fleet 2017-2019



Pressure = hours fished x average fishing speed x gear width x depletion rate *per gridcel*



Measuring sensitivity for physical disturbance

OSPAR BH3 approach

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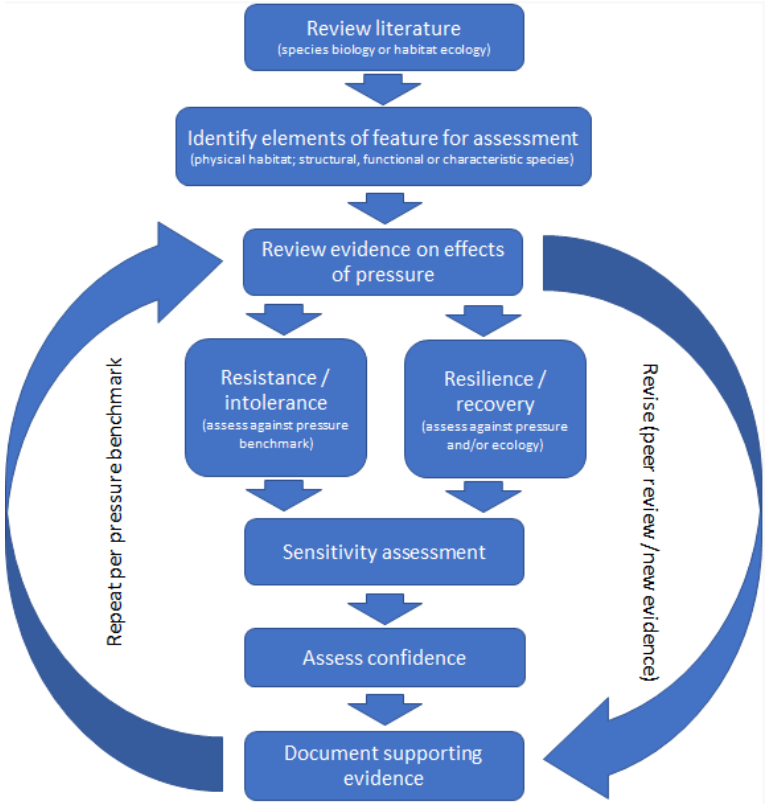
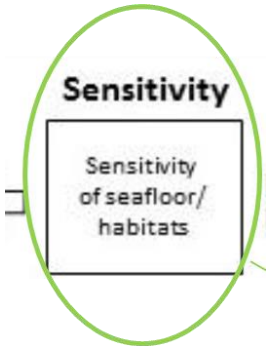
The sensitivity assessment is execute following the Marine Evidence based Sensitivity Assessment (MarESA) approach (Tyler-Walters et al. (2018). https://www.marlin.ac.uk/sensitivity/sensitivity_rationale



"a species (population) is defined as ***very sensitive*** when it is ***easily adversely affected by human activity*** (e.g. low resistance) and ***recovery is only achieved after a prolonged period***, *if at all* (e.g. low resilience or recoverability)" (OSPAR, 2008; Laffoley *et al.*, 2000).



Measuring sensitivity for physical disturbance

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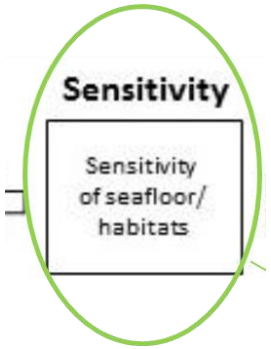
Sensitivity assessment done for pressure:

Abrasion/disturbance at the surface of the substratum

ICG-C Pressure	Benchmark	Pressure description
Abrasion/disturbance at the surface of the substratum	**Benthic species /habitats** Damage to surface features (e.g. species and physical structures within the habitat)	Physical disturbance or abrasion at the surface of the substratum in sedimentary or rocky habitats. The effects are relevant to epiflora and epifauna living on the surface of the substratum. In intertidal and sublittoral fringe habitats, surface abrasion is likely to result from recreational access and trampling (inc. climbing) by human or livestock, vehicular access, moorings (ropes, chains), activities that increase scour and grounding of vessels (deliberate or accidental). In the sublittoral, surface abrasion is likely to result from pots or creels, cables and chains associated with fixed gears and moorings, anchoring of recreational vessels, objects placed on the seabed such as the legs of jack-up barges, and harvesting of seaweeds (e.g. kelps) or other intertidal species (trampling) or of epifaunal species (e.g. oysters). In sublittoral habitats, passing bottom gear (e.g. rock hopper gear) may also cause surface abrasion to epifaunal and epifloral communities, including epifaunal biogenic reef communities. Activities associated with surface abrasion can cover relatively large spatial areas e.g. bottom trawls or bio-prospecting or be relatively localized activities e.g. seaweed harvesting, recreation, potting, and aquaculture.
Penetration and/or disturbance of the substratum below the surface	**Benthic species /habitats** Damage to sub-surface features (e.g. species and physical structures within the habitat)	Physical disturbance of sediments where there is limited or no loss of substratum from the system. This pressure is associated with activities such as anchoring, taking of sediment/geological cores, cone penetration tests, cable burial (ploughing or jetting), propeller wash from vessels, certain fishing activities, e.g. scallop dredging, beam trawling. Agitation dredging, where sediments are deliberately disturbed by and by gravity & hydraulic dredging where sediments are deliberately disturbed and moved by currents could also be associated with this pressure type. Compression of sediments, e.g. from the legs of a jack-up barge could also fit into this pressure type. Abrasion relates to the damage of the sea bed surface layers (typically up to 50 cm depth). Activities associated with abrasion can cover relatively large spatial areas and include fishing with towed demersal trawls (fish & shellfish); bio-prospecting such as harvesting of biogenic features such as maerl beds where, after extraction, conditions for recolonization remain suitable or relatively localised activities including seaweed harvesting, recreation, potting, aquaculture. Change from gravel to silt substrata would adversely affect herring spawning grounds. Loss, removal or modification of the substratum is not included within this pressure (see the physical loss pressure theme). Penetration and damage to the soft rock substrata are considered, however, penetration into hard bedrock is deemed unlikely.



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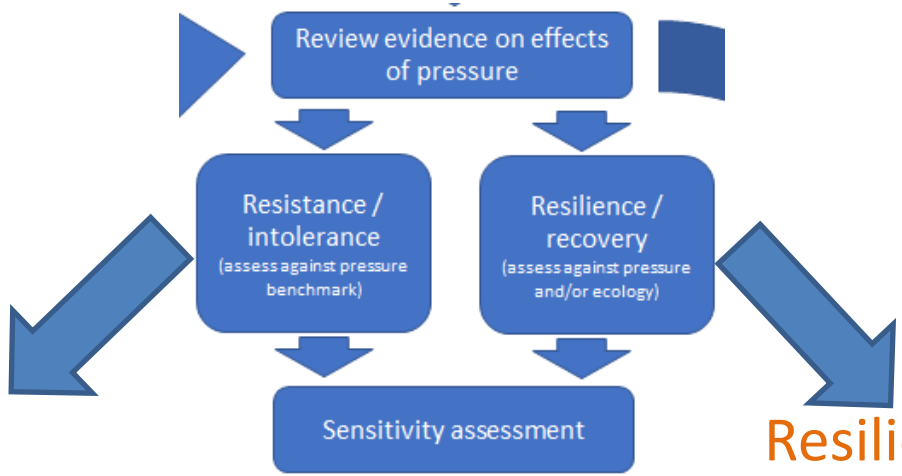


Resistance

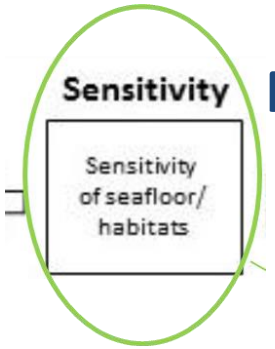
= Tolerance against a pressure

Resistance	Description
None	Key functional, structural, characterizing species severely decline and/or physicochemical parameters are also affected e.g. removal of habitats causing a change in habitats type. A severe decline/reduction relates to the loss of 75% of the extent, density or abundance of the selected species or habitat component e.g. loss of 75% substratum (where this can be sensibly applied).
Low	Significant mortality of key and characterizing species with some effects on the physicochemical character of habitat. A significant decline/reduction relates to the loss of 25-75% of the extent, density, or abundance of the selected species or habitat component e.g. loss of 25-75% of the substratum.
Medium	Some mortality of species (can be significant where these are not keystone structural/functional and characterizing species) without change to habitats relates to the loss <25% of the species or habitat component.
High	No significant effects on the physicochemical character of habitat and no effect on population viability of key/characterizing species but may affect feeding, respiration and reproduction rates.

Resilience

= Recovery potential

Resilience	Description
Very Low	Negligible or prolonged recovery possible; at least 25 years to recover structure and function
Low	Full recovery within 10-25 years
Medium	Full recovery within 2-10 years
High	Full recovery within 2 years



Measuring sensitivity for physical disturbance

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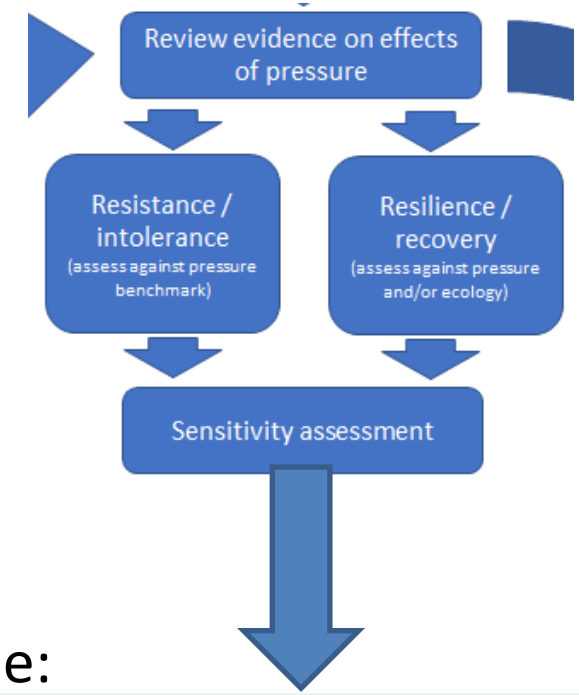


Resistance

= Tolerance against a pressure

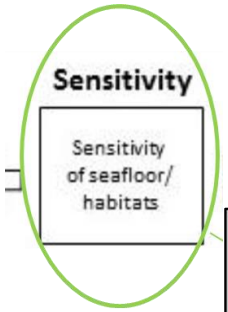
Resilience

= Recovery potential

Sensitivity score table:

	Resistance			
Resilience	**None**	**Low**	**Medium**	**High**
Very Low	High	High	Medium	Low
Low	High	High	Medium	Low
Medium	Medium	Medium	Medium	Low
High	Medium	Low	Low	Not sensitive

For example: A habitat with no resistance and a low or very low resilience will be classified as high sensitive



Result measuring sensitivity for physical disturbance

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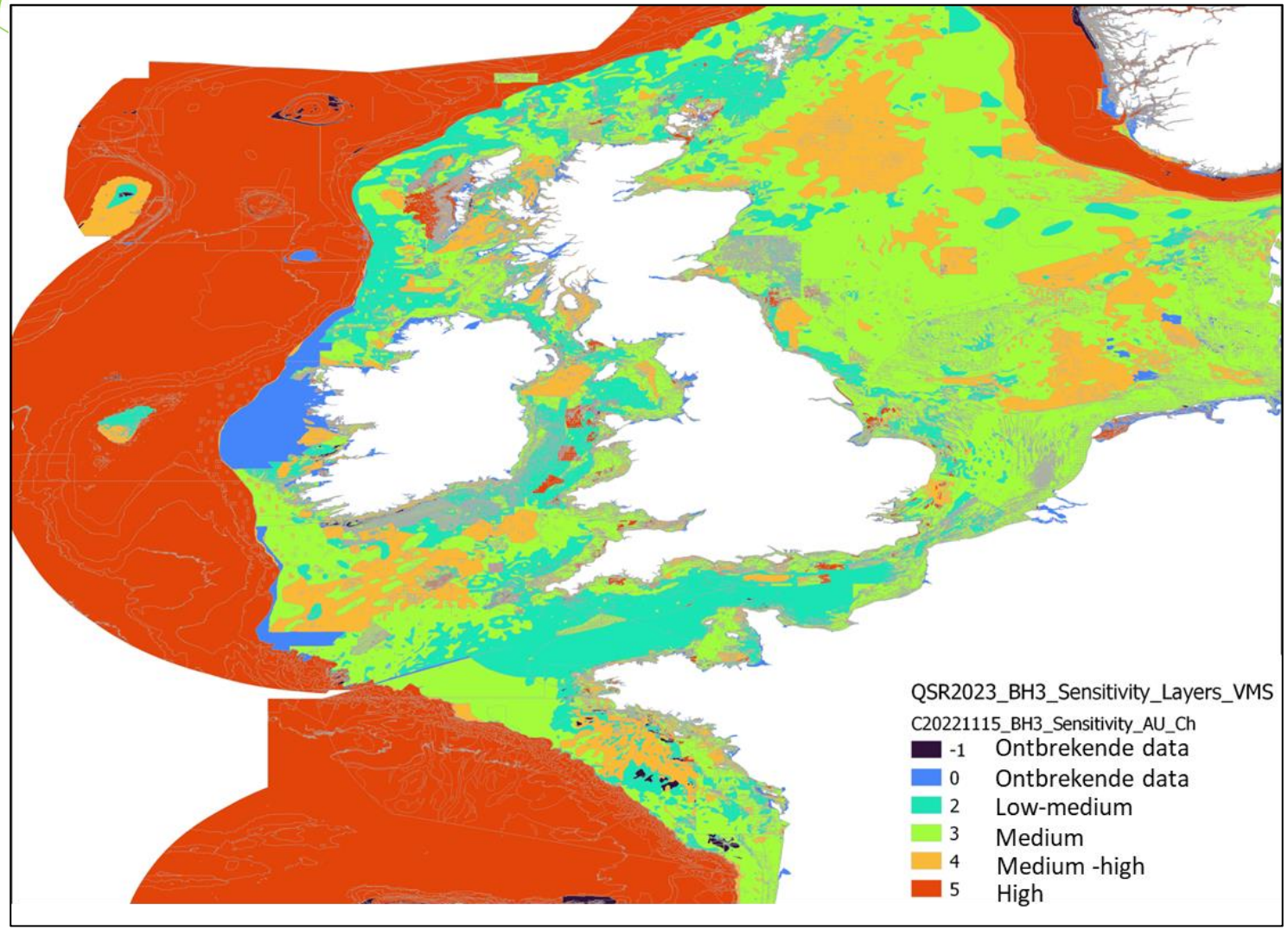
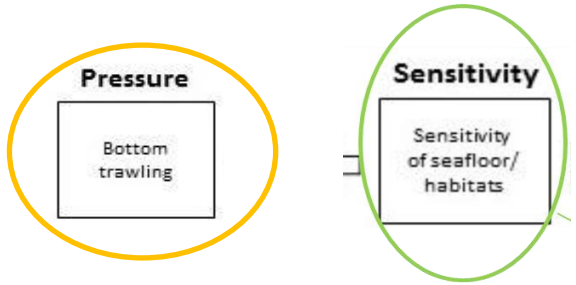


Sensitivity of habitats in accordance to OSPAR BH3

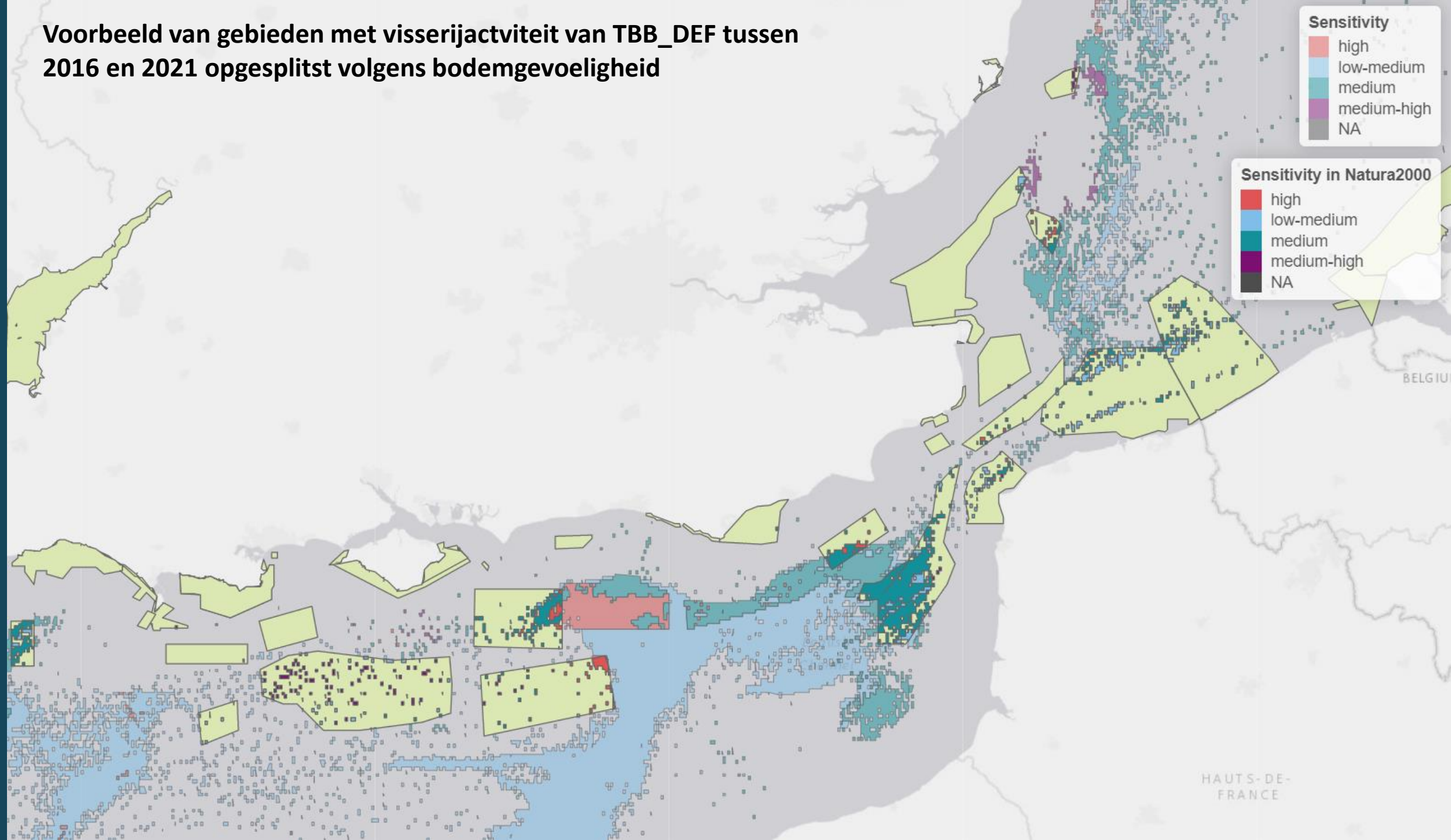
Fishing disturbance monitoring indicator



∑ SA fishing gear x depletion rate $_{\text{per gear group}}$ per sensitivity class

- SA fishing gear : Swept area= total width of the fishing gear * towing speed * number of fishing hours Calculated per vessel per sensitivity per gear group.
- Depletion rate : differs according to the gear group (Table 1-1) (per gear group)
- Sensitivity classes (-1 & 0 = missing data, 1= low, 2= low-medium, 3= medium, 4= medium-high, 5=high)

Voorbeeld van gebieden met visserijactviteit van TBB_DEF tussen 2016 en 2021 opgesplitst volgens bodemgevoeligheid



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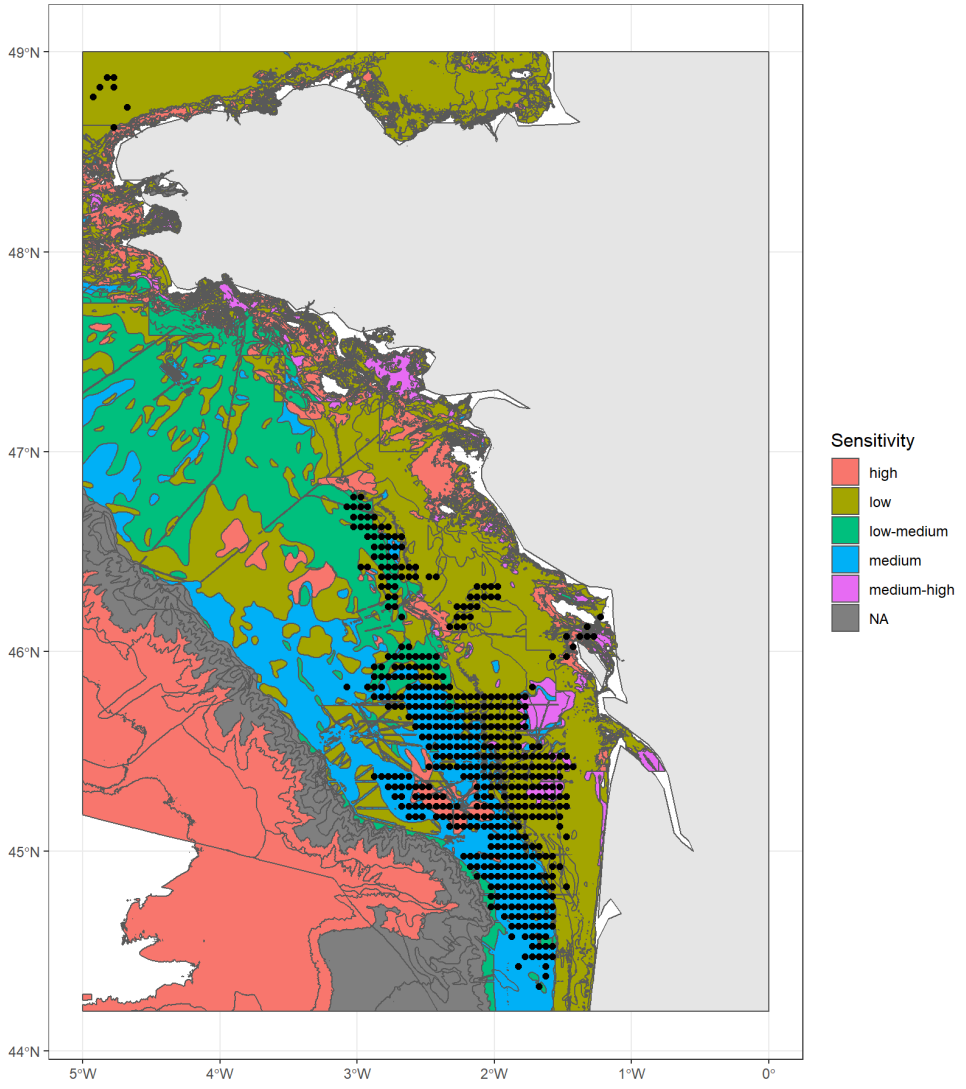
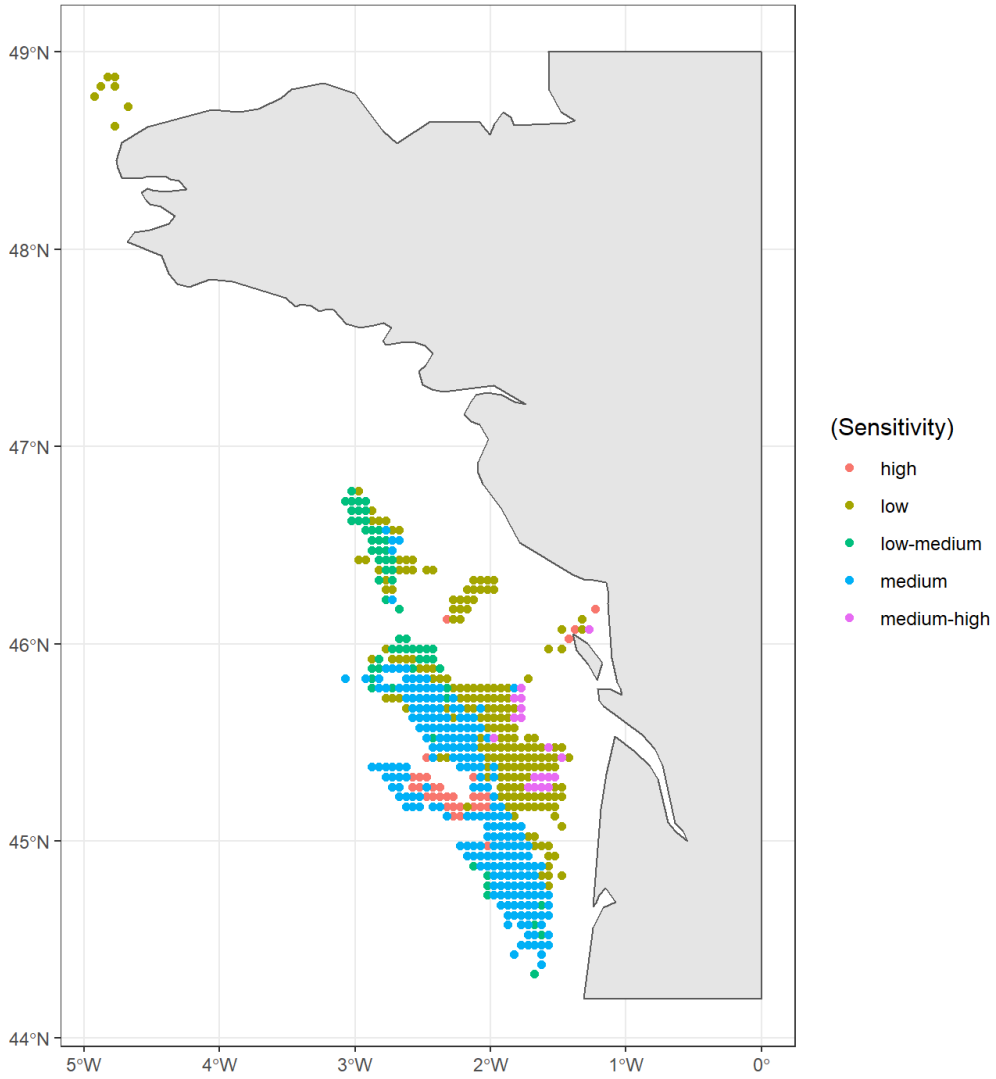
Results 2017, 2018, 2019





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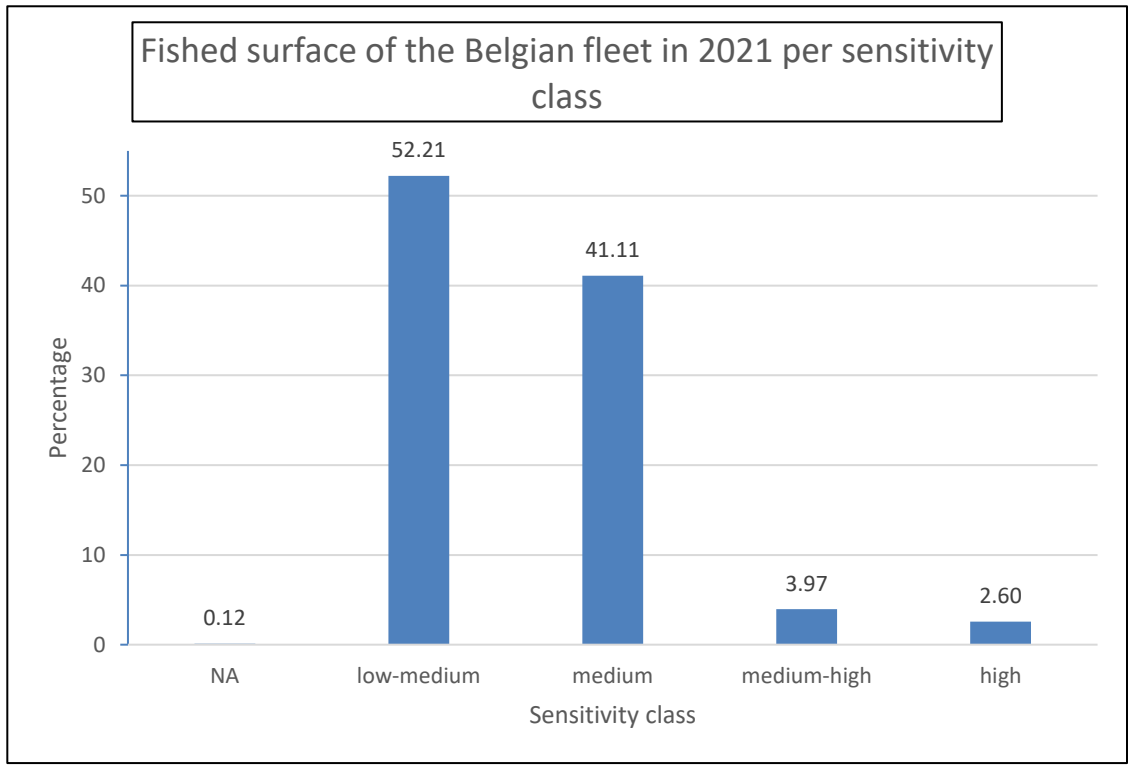
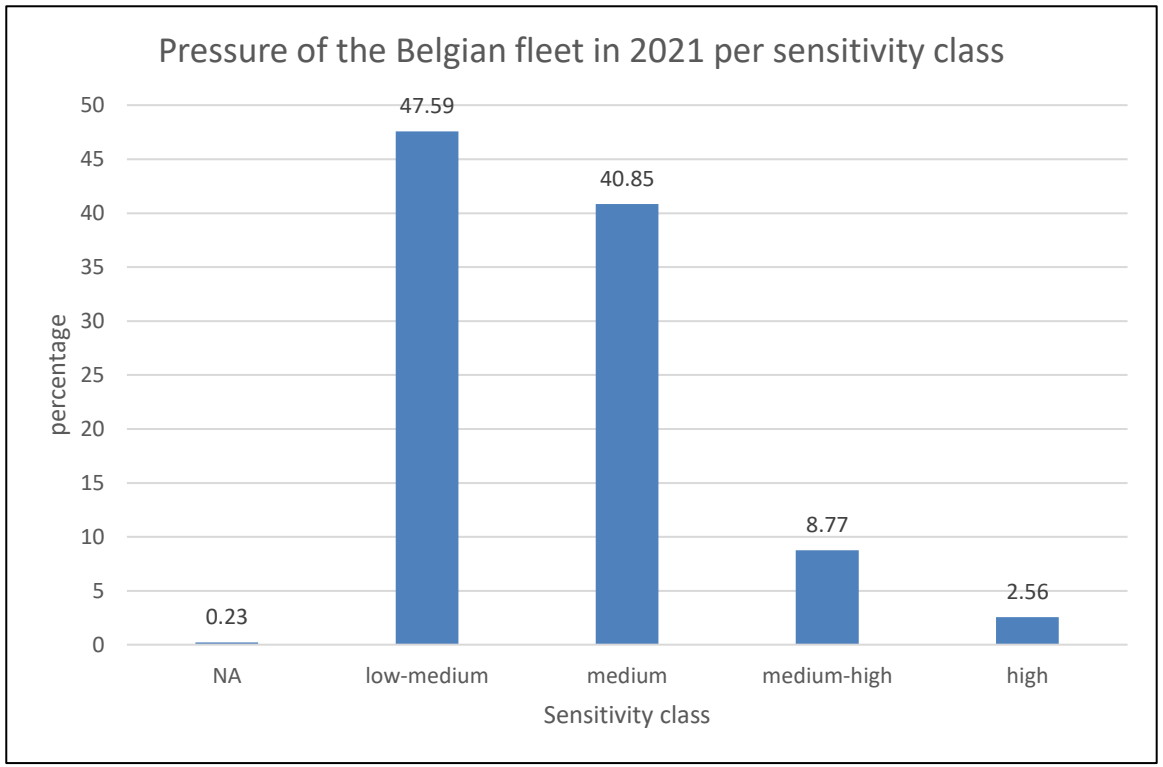
Results for 2021

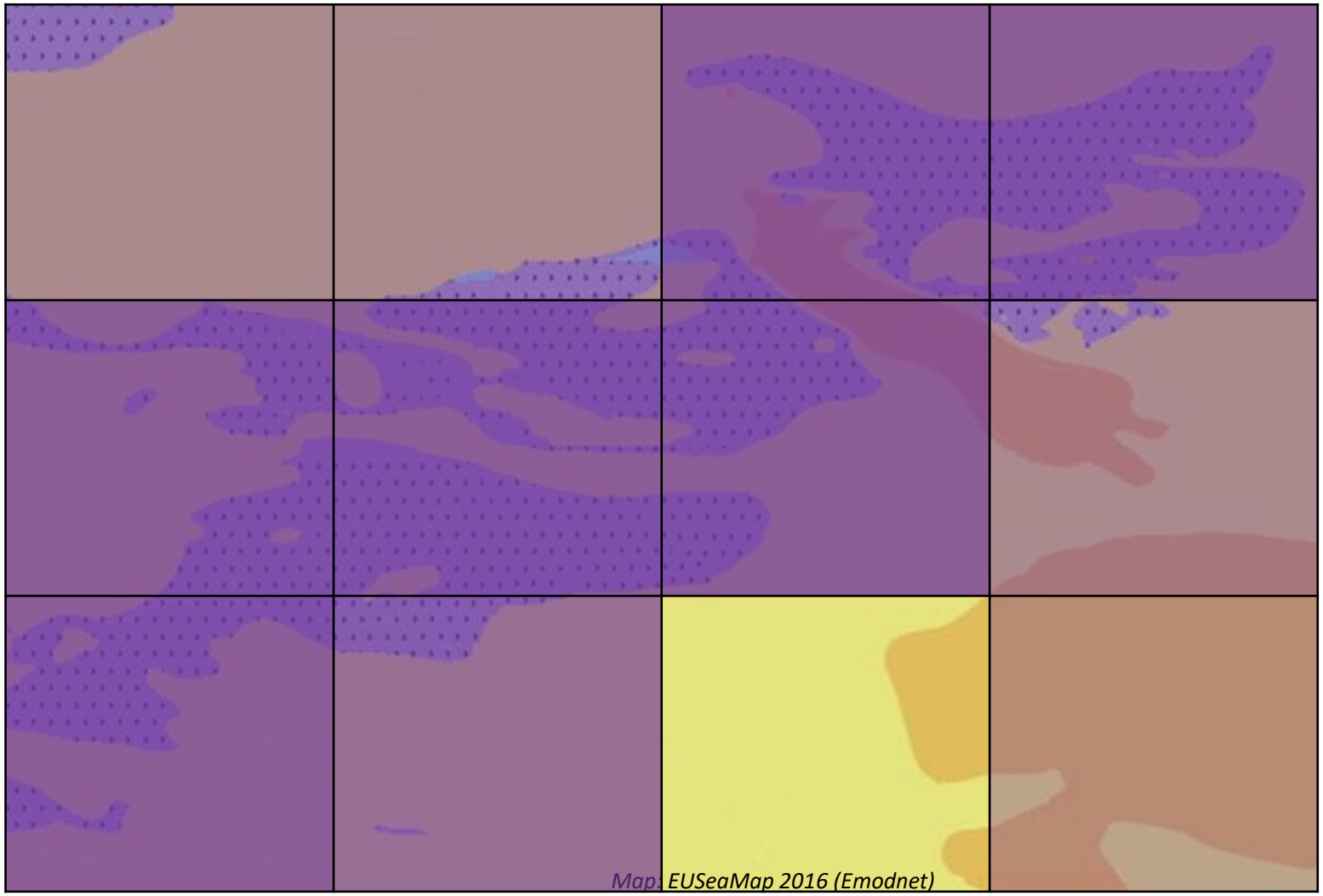




Seafloor disturbance by Belgian beam trawlers – one case

Map: EUSeaMap 2016 (Emodnet)

Seafloor disturbance by Belgian beam trawlers – one case



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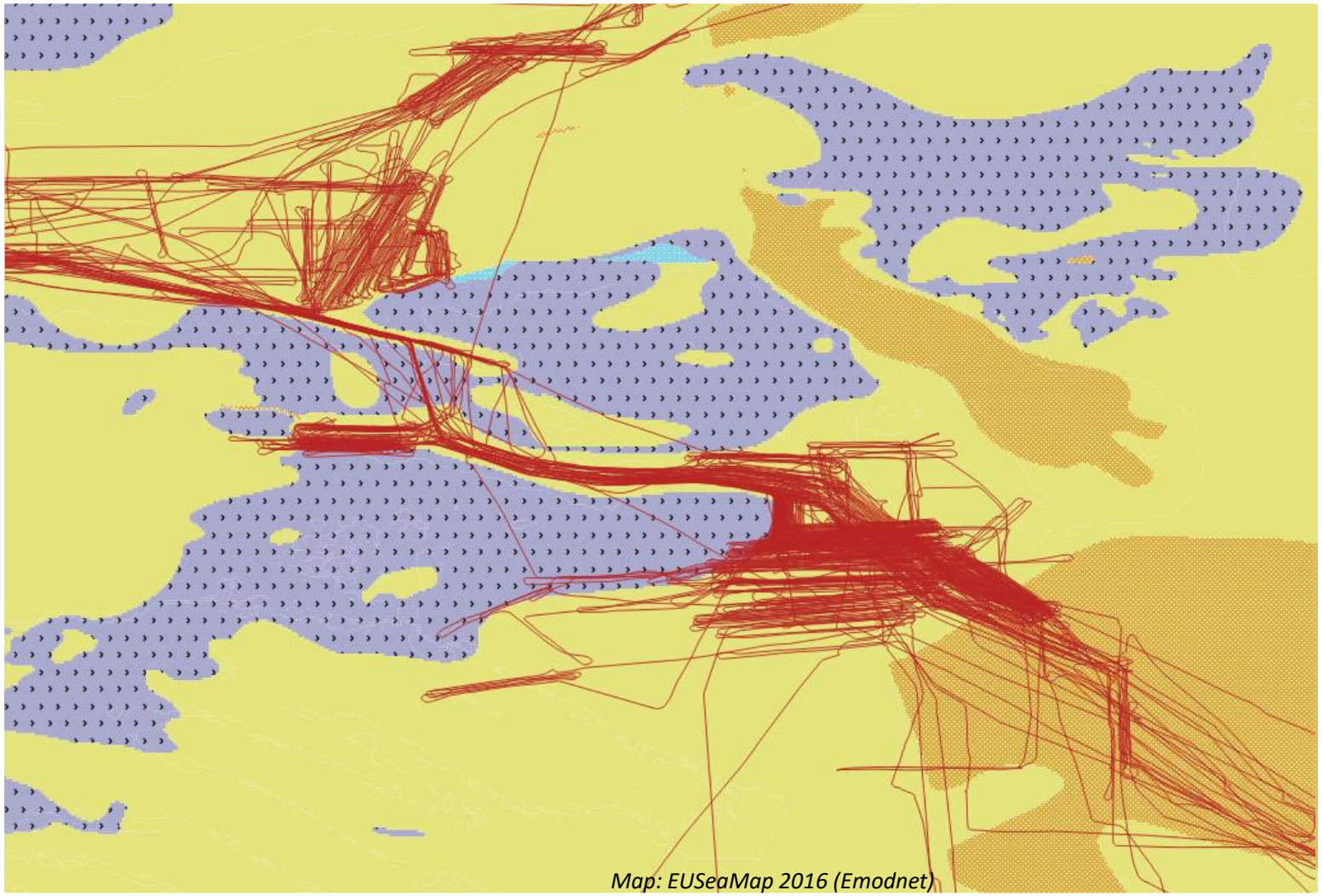
Seafloor disturbance by Belgian beam trawlers – one case



Map: EUSeaMap 2016 (Emodnet)

Coarse sediment
Sandy mud to muddy sand
Mixed sedimen
Sand

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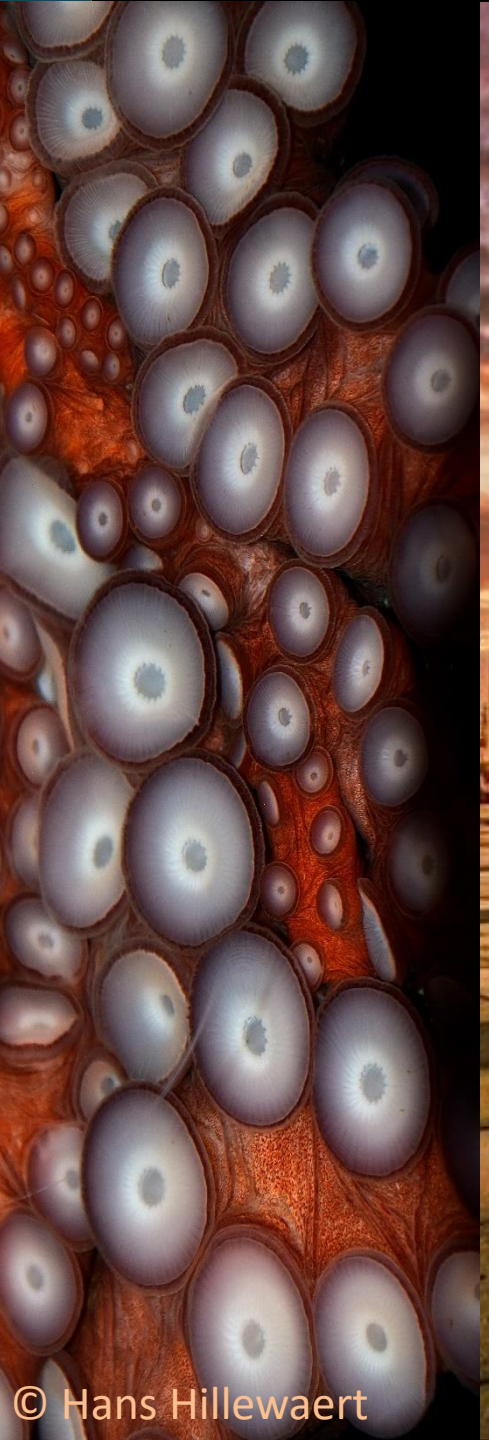
Conclusions

- Work in progress
- Several indicators exist and are further being developed
- Indicators based on best knowledge, but best knowledge is not always good
- Great progress and practical methods available to be used



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Thank you

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