Knowledge-based status assessment of benthic habitats: challenges and opportunities

CARAMBHA – Cumulative impact assessment of marine benthic habitats

AquaBiota
- part of the NIRAS Group

CARAMBHA

Cumulative impact assessment of marine benthic habitats

AquaBiota Water Research: Antonia Nyström Sandman
Stockholm University: Clare Bradshaw
SGU: Oscar Törnqvist
Hafok: Mats Blomqvist
SLUA: Mattias Sköld
SYKE: Samuli Korpinen

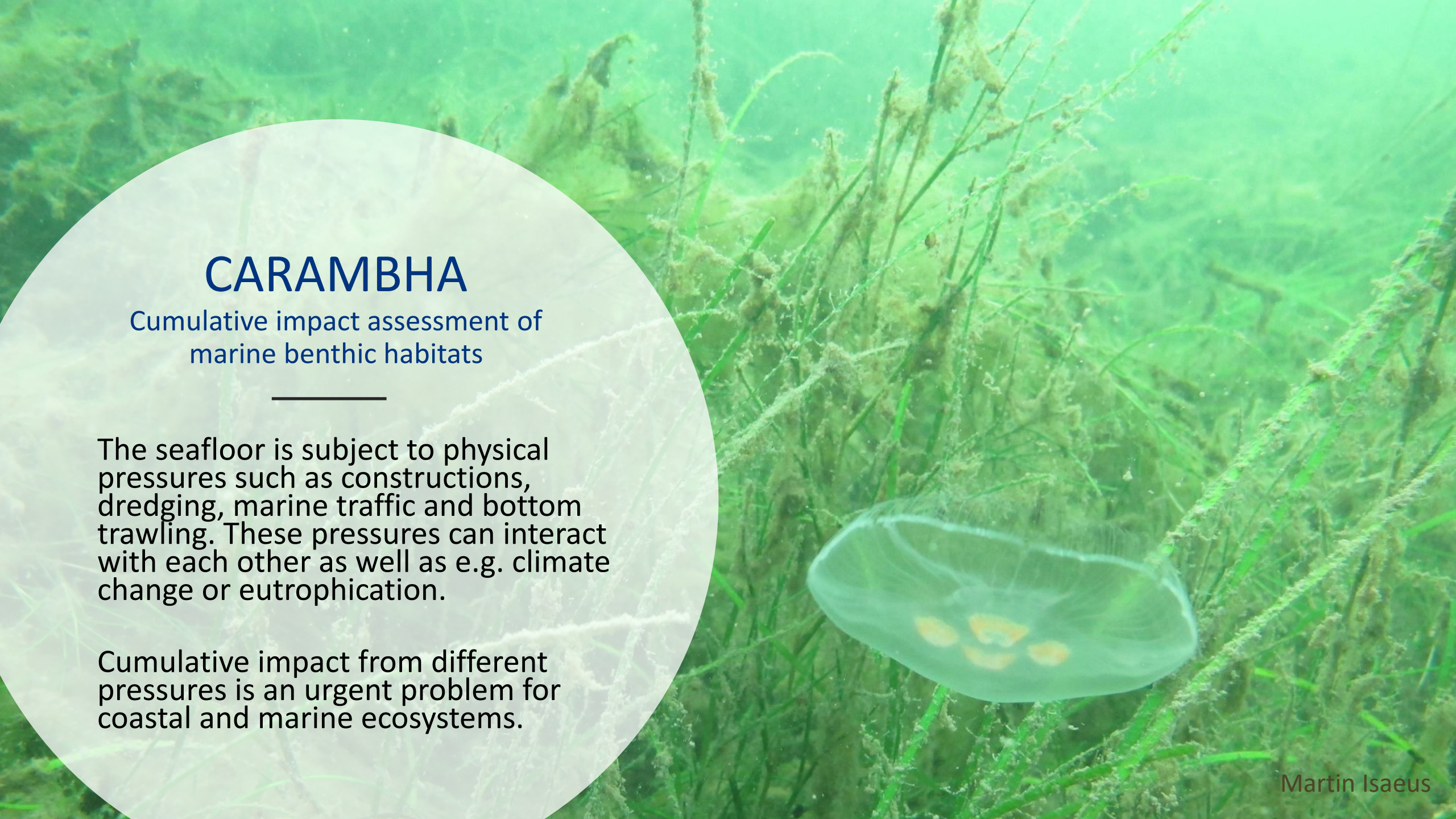
AquaBiota - part of the NIRAS Group
Stockholms universitet
SGU Sveriges geologiska undersökning
Hafok AB
SLU
SYKE
och Havs Vatten myndigheten
NATURVÅRDSVERKET

CARAMBHA

Cumulative impact assessment of marine benthic habitats

The seafloor is subject to physical pressures such as constructions, dredging, marine traffic and bottom trawling. These pressures can interact with each other as well as e.g. climate change or eutrophication.

Cumulative impact from different pressures is an urgent problem for coastal and marine ecosystems.



Martin Isaeus

COMMISSION DECISION (EU) 2017/848

of 17 May 2017

laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised methods for monitoring and assessment, and repealing Decision 2010/477/EU

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) ([1]), and in particular Articles 9(3) and 11(4) thereof,

Whereas:

MSFD Descriptor 6

- Seafloor integrity is one of 11 descriptors used in the Marine Strategy Framework Directive to assess environmental status.
- According to the MSFD, seafloor integrity (D6) is to be assessed as the proportion of each broad habitat type adversely affected by anthropogenic pressures.

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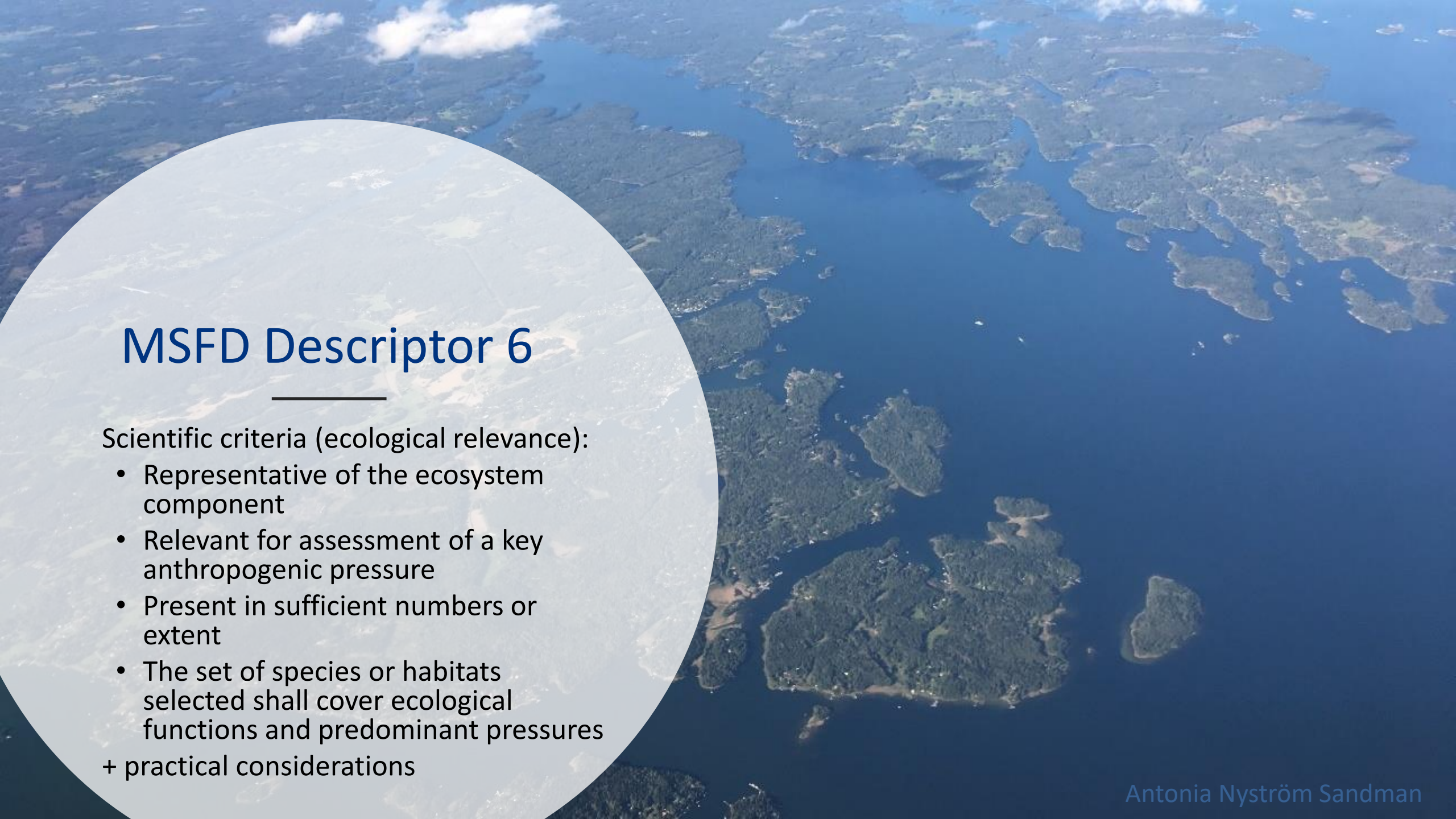


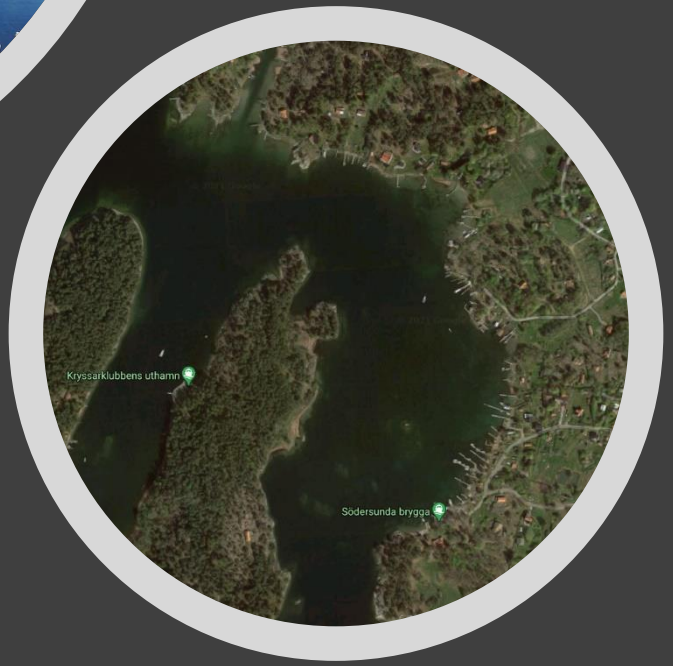
MSFD Descriptor 6

Scientific criteria (ecological relevance):

- Representative of the ecosystem component
- Relevant for assessment of a key anthropogenic pressure
- Present in sufficient numbers or extent
- The set of species or habitats selected shall cover ecological functions and predominant pressures

+ practical considerations

Antonia Nyström Sandman



What is good status (of benthic habitats)?

…and how do we measure it?

- Status assessment
- Risk based assessment
- Integration

Status assessment

Biological indicators

- typical species composition
- relative abundance
- absence of particularly sensitive or fragile species
- absence of species providing a key function
- size structure of species
- …

Antonia Nyström Sandman

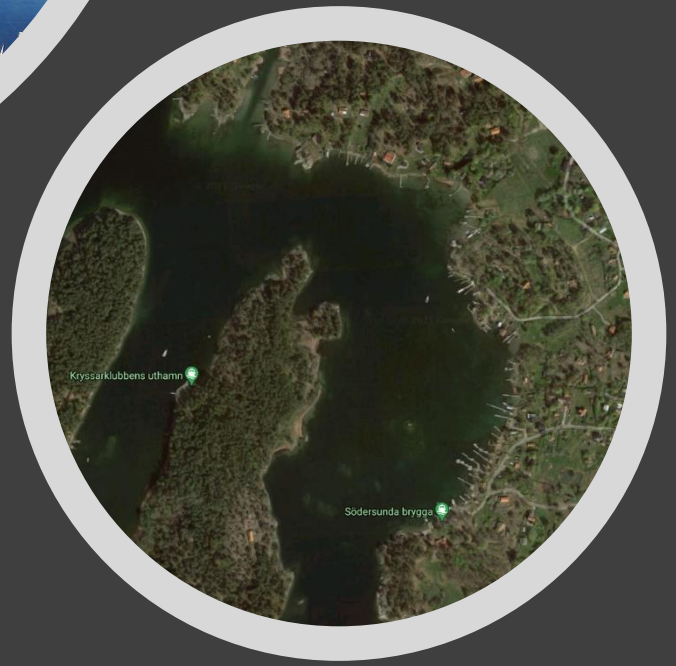
Risk based assessment

- Pressure maps

- Species (or biotope) maps
- Sensitivity matrix

Pressure + sensitivity → impact

E.g. BSII, CumI etc



What is good status (of benthic habitats)?

…and how do we measure it?

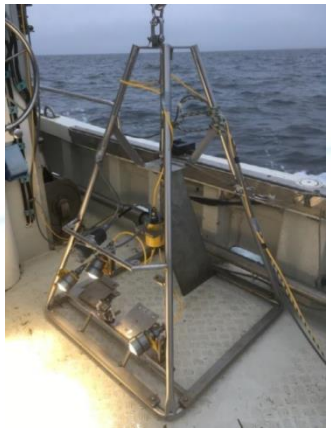
Sampling in disturbance gradients

- Benthic fauna in trawling gradient
- Vegetation and benthic fauna in coastal areas

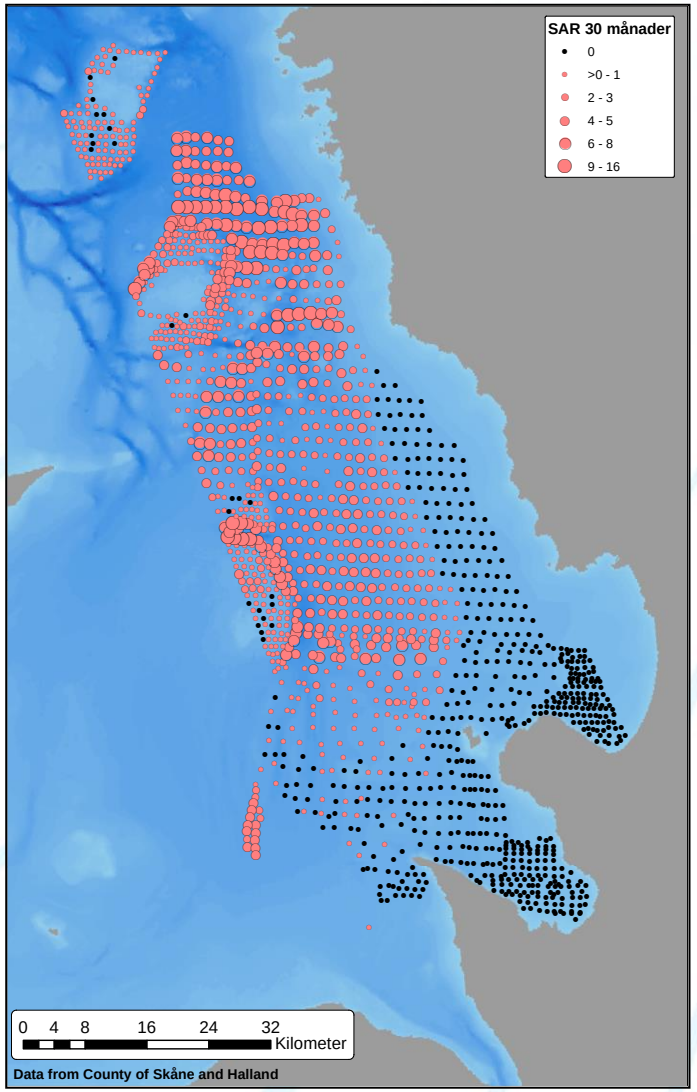
Threshold values for adverse effects

Some challenges…

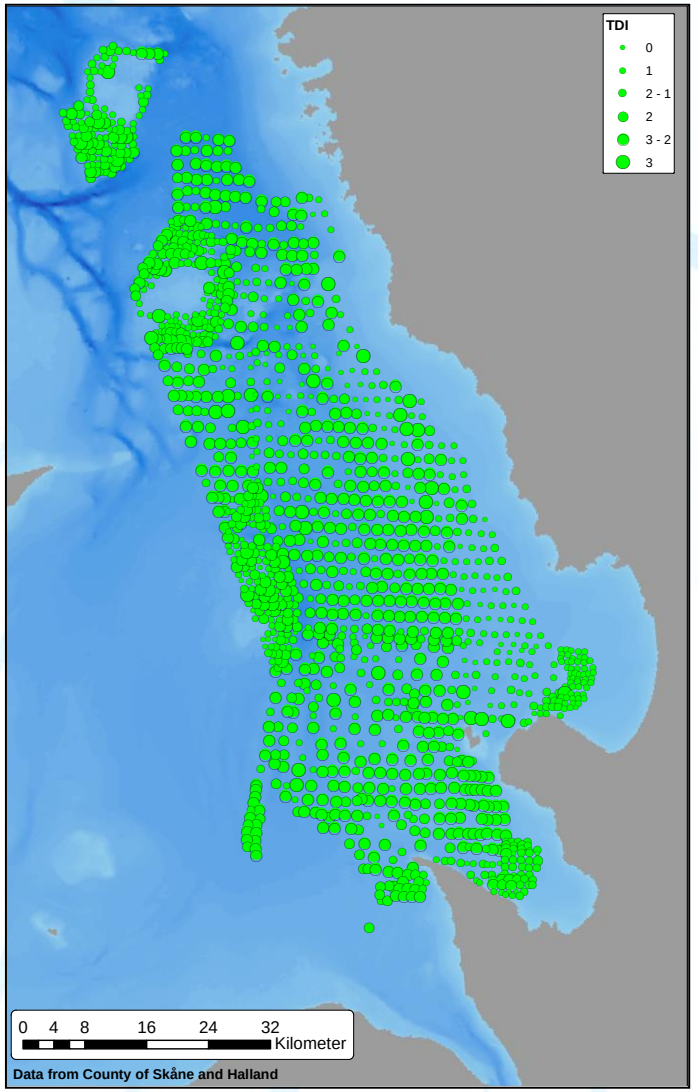
Dropvideo



Trawling intensity



TDI Trawl Distubance Indicator



… and some possibilities

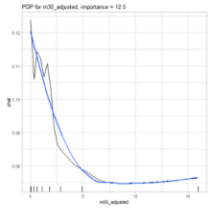
Spatial limit for adverse effects

Step 1 & 2:

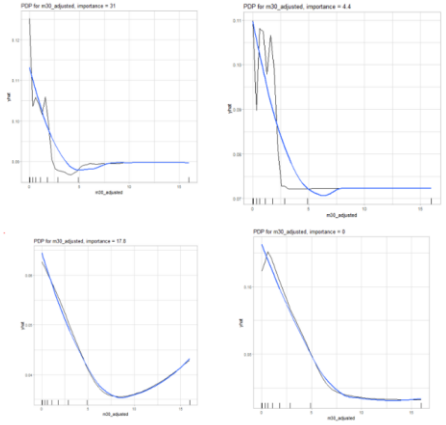
- Modeling of abundance or cover, including the pressures as predictors in the model
- Contrafactual modeling

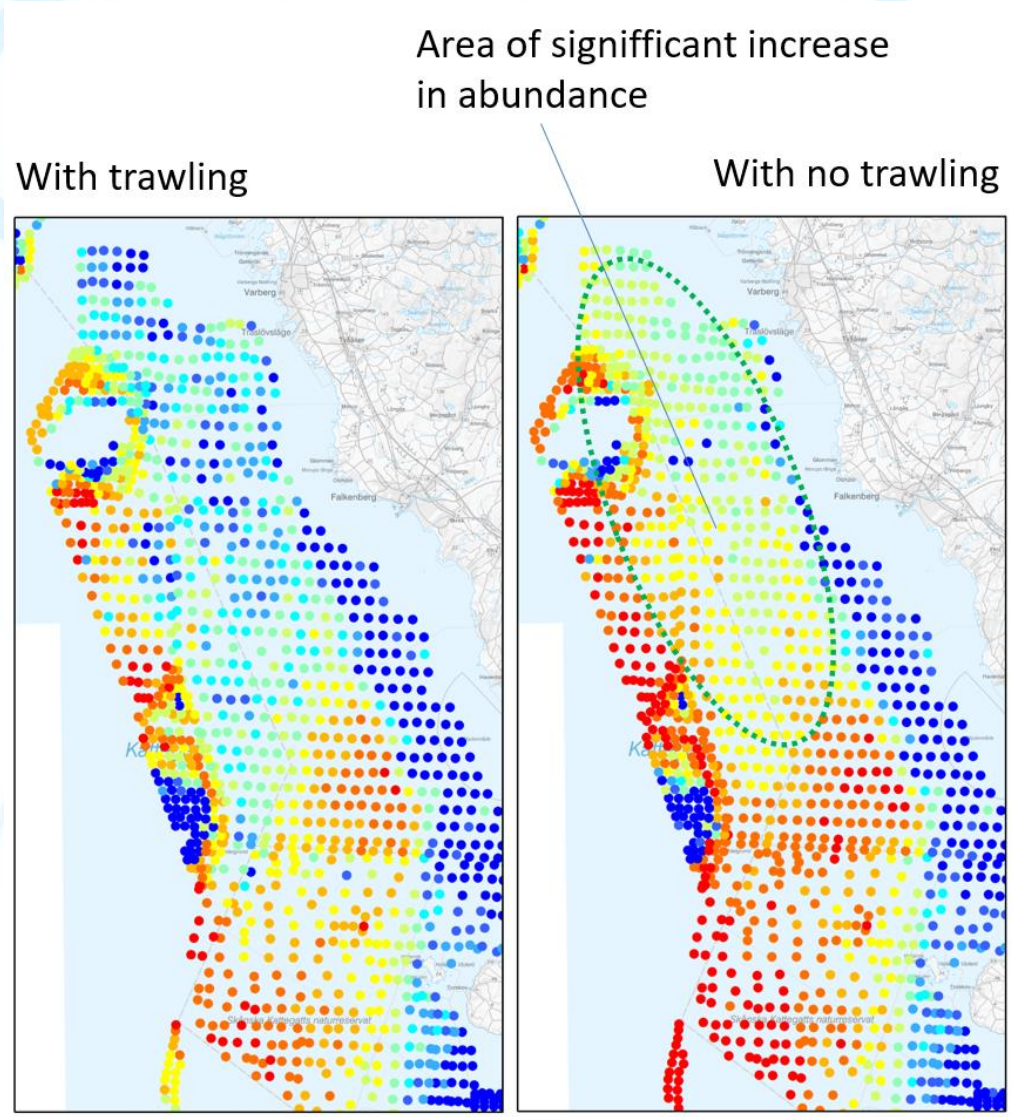
1. Partial dependency

All models, as well as ensemble averages, show increased negative impact from trawling on abundance



Ensemble average





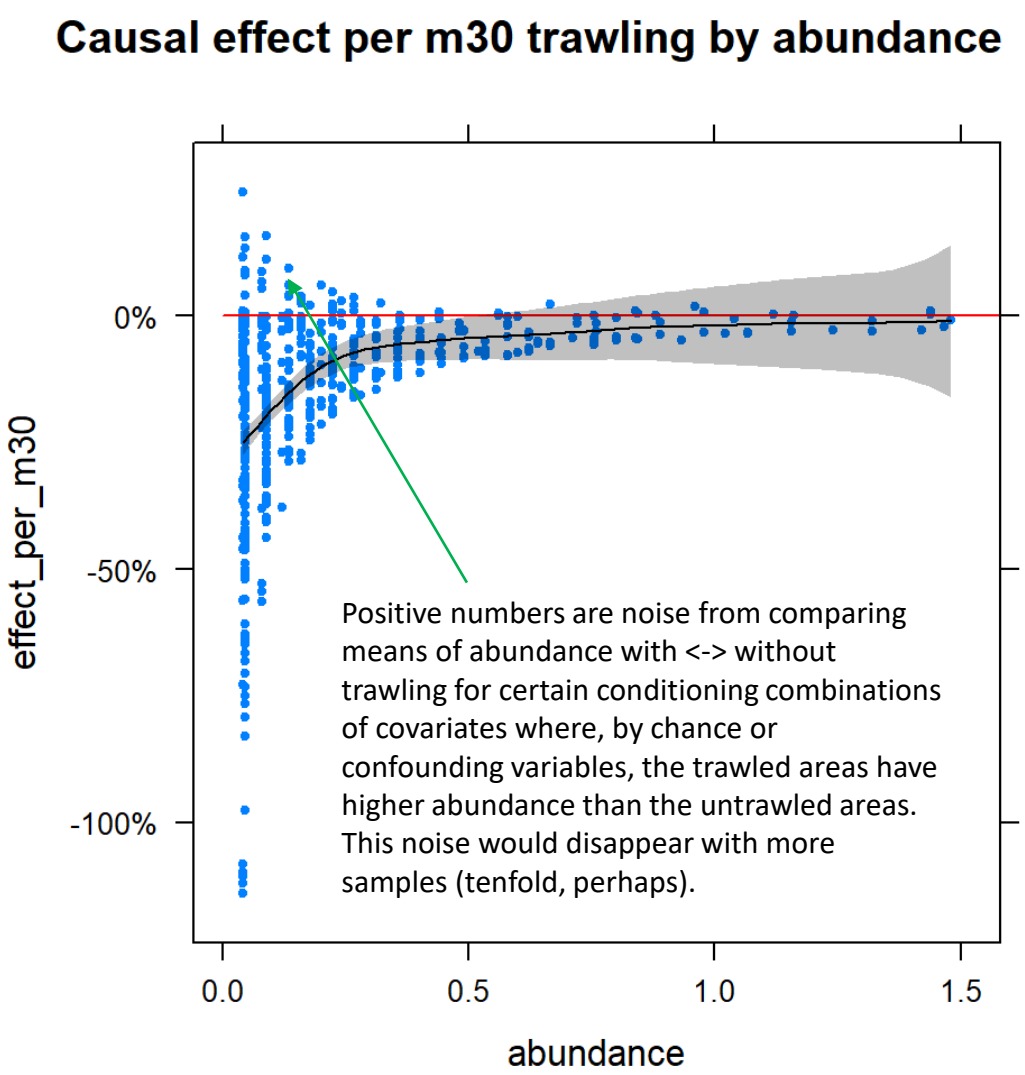
… and some possibilities

Spatial limit for adverse effects

Step 3:

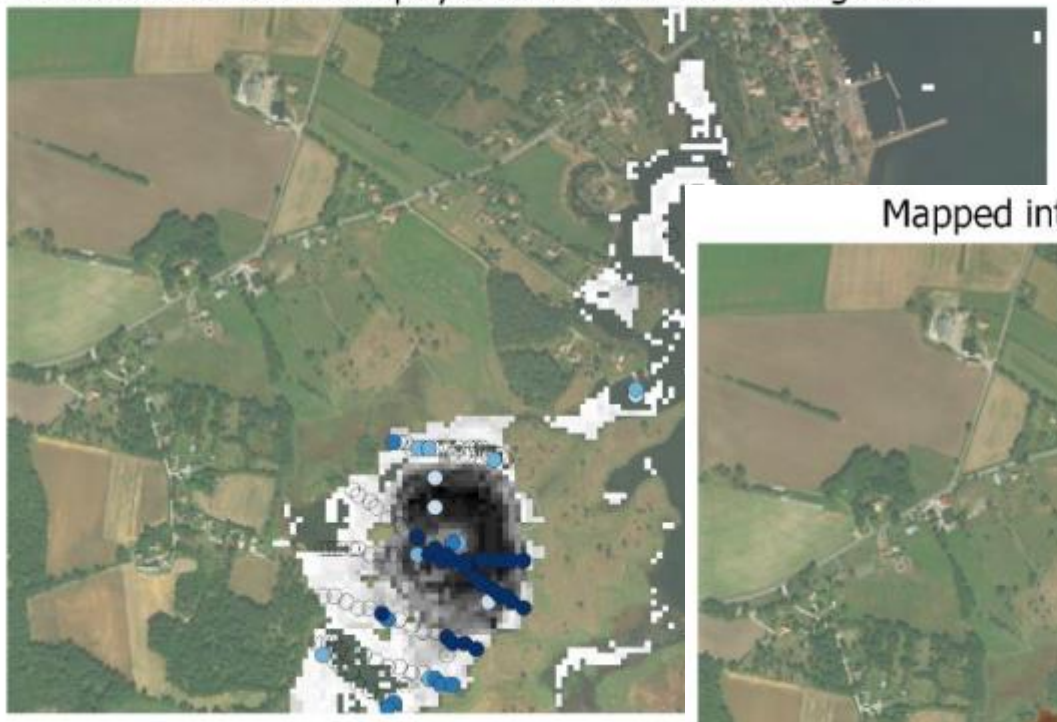
- Analysis of causal inference
  - In what types of environments are species affected?
  - At what degree of pressure is the effect visible?

To the right, the previous picture is corroborated; in areas with lower abundance, < c.a. 0.5 ind/m^2, there is a **significant** negative effect of trawling, here expressed in percentage points per effective m30 (fully covering trawl sweep).



… and some possibilities

Predicted current Charophyte cover and monitoring data



Mapped intensity of physical disturbance

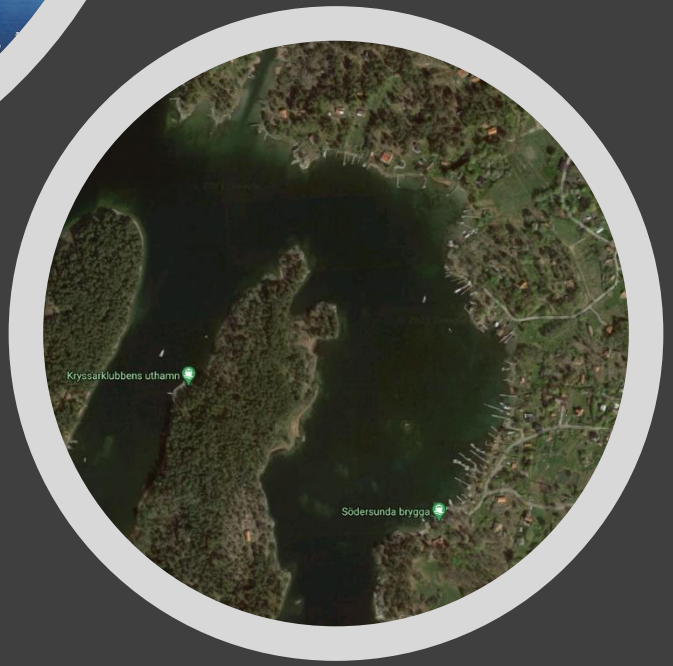
Scenario model change (physical

Modelled charophyte cover (%)
1
91

Total cover of Charophytes in raw data (%)
0
1
1-10
10-50
>50

Mapped physical disturbance
1
2
3
4
5

Scenario, change in cover (%)
4
10
20
30



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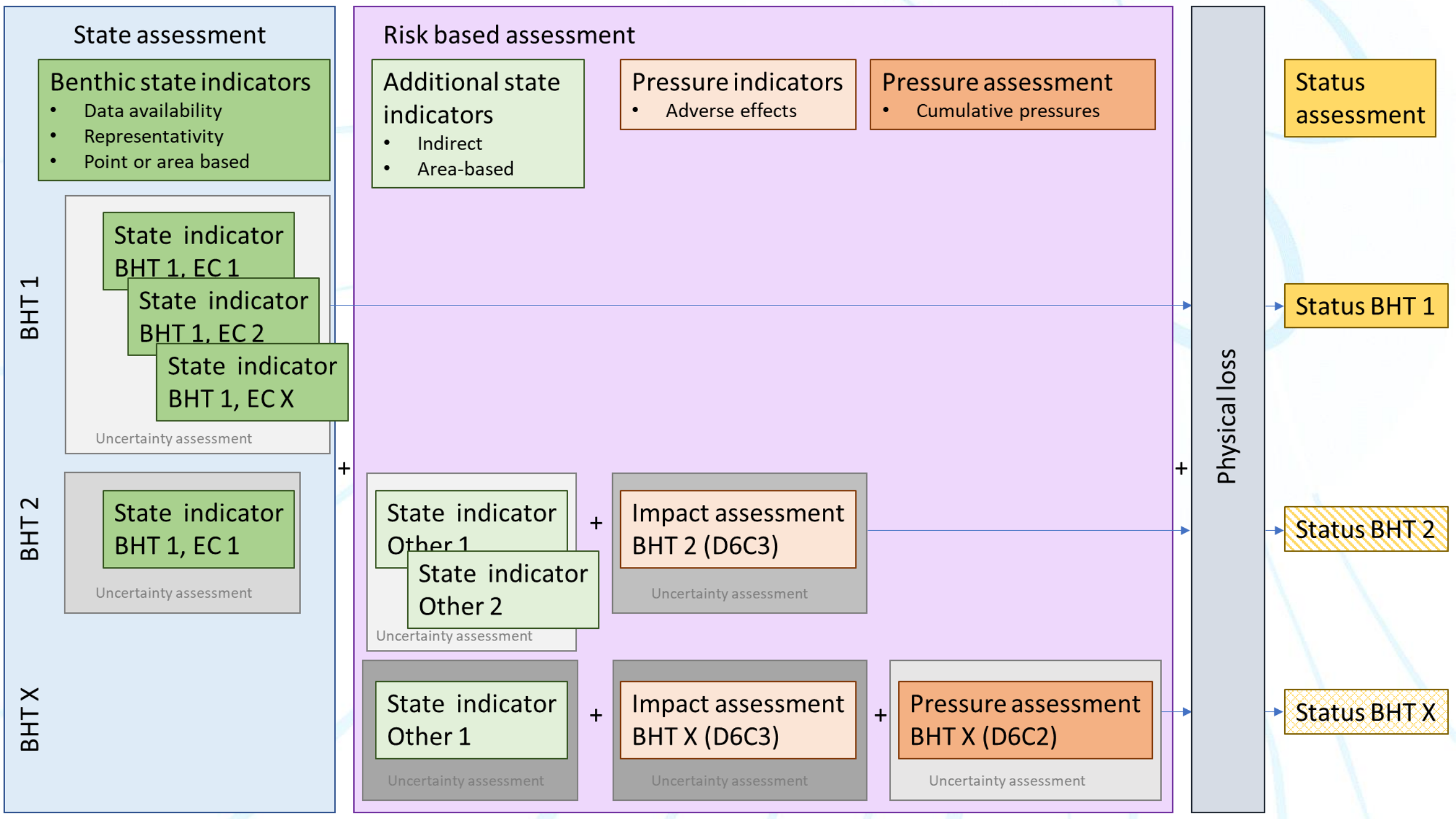

State assessment
Benthic state indicators
Data availability
Representativity
Point or area based
Risk based assessment
Additional state indicators
Indirect
Area-based
Pressure indicators
Adverse effects
Pressure assessment
Cumulative pressures
Status assessment
BHT 1
State indicator BHT 1, EC 1
State indicator BHT 1, EC 2
State indicator BHT 1, EC X
Uncertainty assessment
Status BHT 1
+
BHT 2
State indicator BHT 1, EC 1
Uncertainty assessment
State indicator Other 1
State indicator Other 2
Uncertainty assessment
+
Impact assessment BHT 2 (D6C3)
Uncertainty assessment
+
Physical loss
Status BHT 2
BHT X
State indicator Other 1
Uncertainty assessment
+
Impact assessment BHT X (D6C3)
Uncertainty assessment
+
Pressure assessment BHT X (D6C2)
Uncertainty assessment
Status BHT X

State assessment

Benthic state indicators
- Data availability
- Representativity
- Point or area based

BHT 1

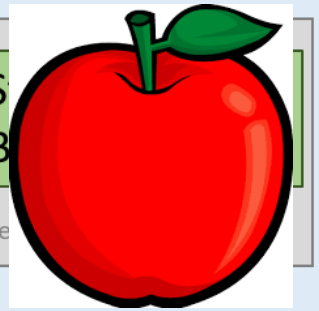
State indicator BHT 1, EC 1

State indicator BHT 1, EC 2

State indicator BHT 1, EC X

Uncertainty assessment

BHT 2



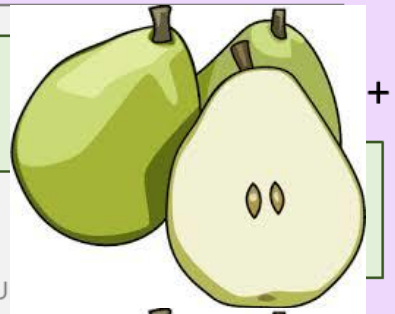
BHT X

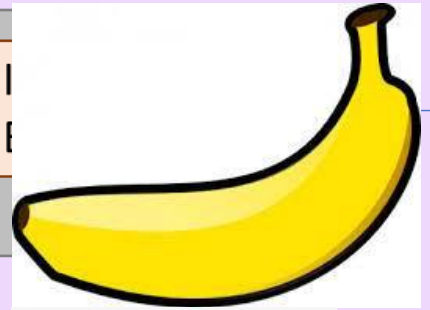
Risk based assessment

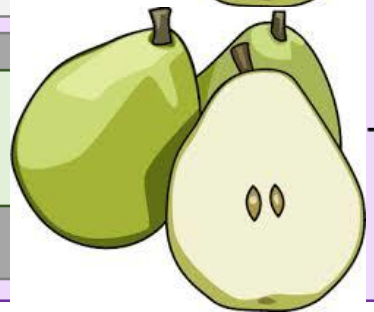
Additional state indicators
- Indirect
- Area-based

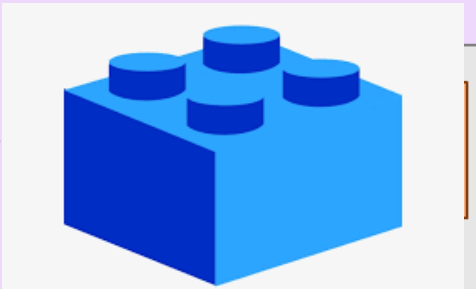
Pressure indicators
- Adverse effects

Pressure assessment
- Cumulative pressures









al loss

Status assessment

Status BHT 1

Γ X

THANK YOU FOR LISTENING

https://www.aquabiota.se/en/projects/carambha-cumulative-impact-assessment-of-marine-benthic-habitats/

Martin Isaeus