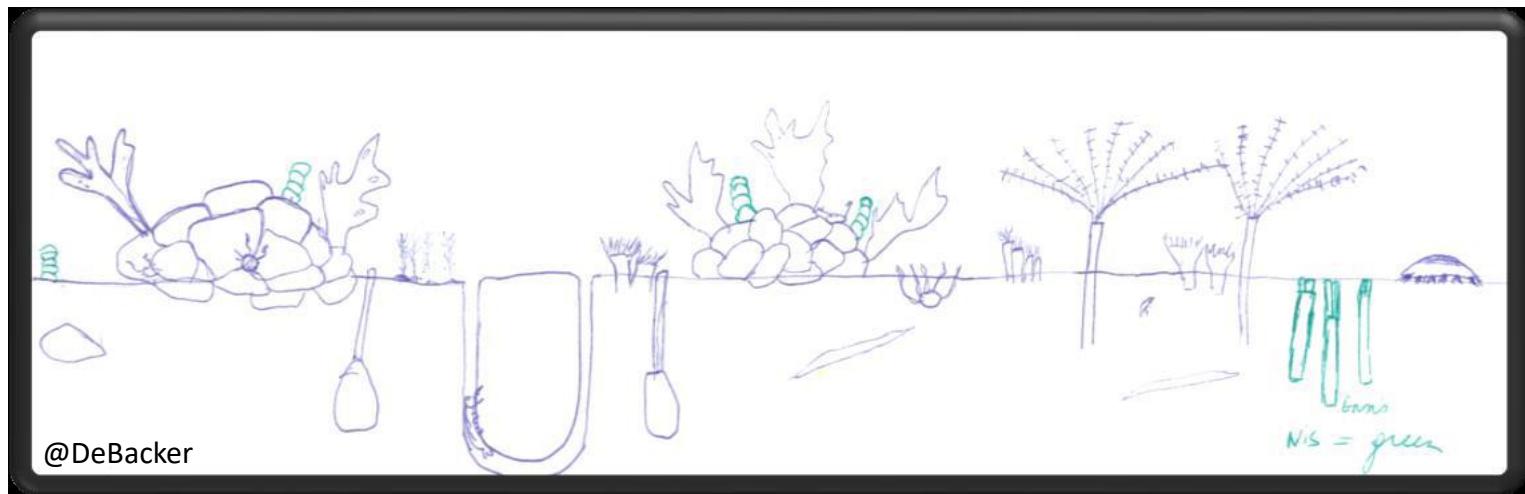


Reflection on benthic biodiversity for policy use!



Gert Van Hoey

Disclose symposium; Utrecht, 6/11/2019

Policy frameworks

Habitat Directive

Habitat type 110 and 1170

Focus on ecological important species = indicator species

Marine Strategy Directive

Biodiversity and seafloor integrity

Structure and function of seafloor

Water Framework Directive

Diversity in indicator algorithm

EQR=average (EQR species+ EQR density+ EQR similarity)

$$\left(\frac{1 - \frac{AMBI}{7} + \left(\frac{H'}{H_{max}} \right)}{2} \right) * \left(\frac{\left(1 - \frac{1}{N} \right) + \left(1 - \frac{1}{S} \right)}{2} \right)$$

$$(0.5 * \left(1 - \frac{AMBI}{7} \right) + \left(0.5 \frac{SN}{2.7} * \frac{N}{N+5} \right)) / NQIref$$

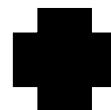
$$IQI_{ref} = \left(\left(0.38 * \left(\frac{1 - (AMBI/7)}{1 - (AMBI_{Ref}/7)} \right) \right) + \left(0.08 * \left(\frac{1 - \lambda'}{1 - \lambda'_{Ref}} \right) \right) + \left(0.54 * \left(\frac{S}{S_{Ref}} \right)^{0.1} \right) - 0.4 \right) / 0.6$$

Assessing
biodiversity is
challenging

Policy framework

Assessment criterium / descriptor

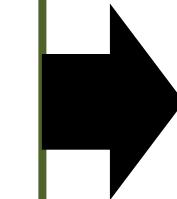
STEP 1:
Region/ Ecosystem/ habitats
Spatial assessment units



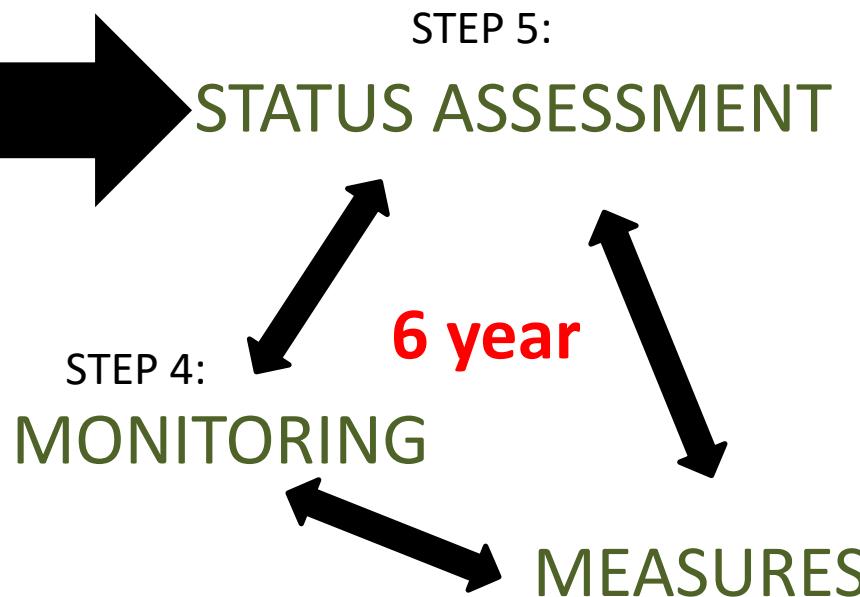
STEP 2:
Indicator selection



STEP 3:
Reference/baseline conditions
Target values



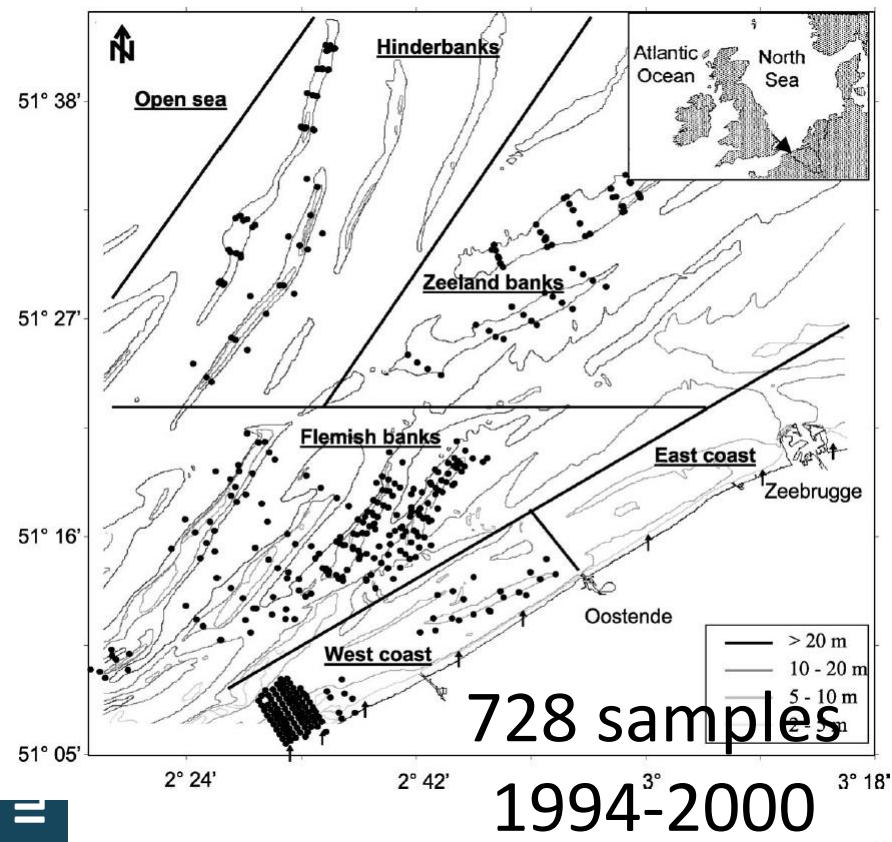
Directives procedure



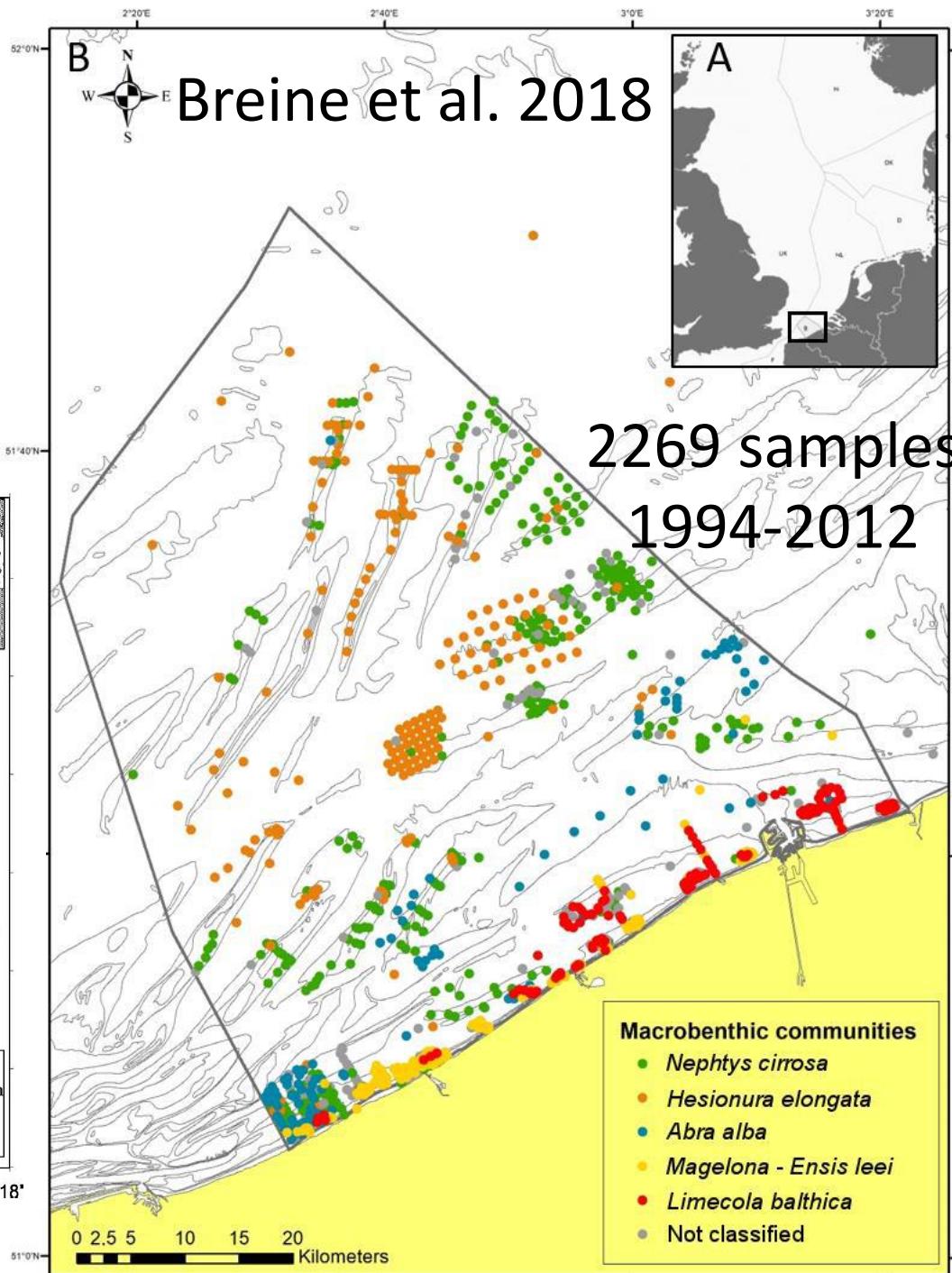
! DATA DEMANDING !

Benthic communities BPNS

Van Hoey et al. 2004

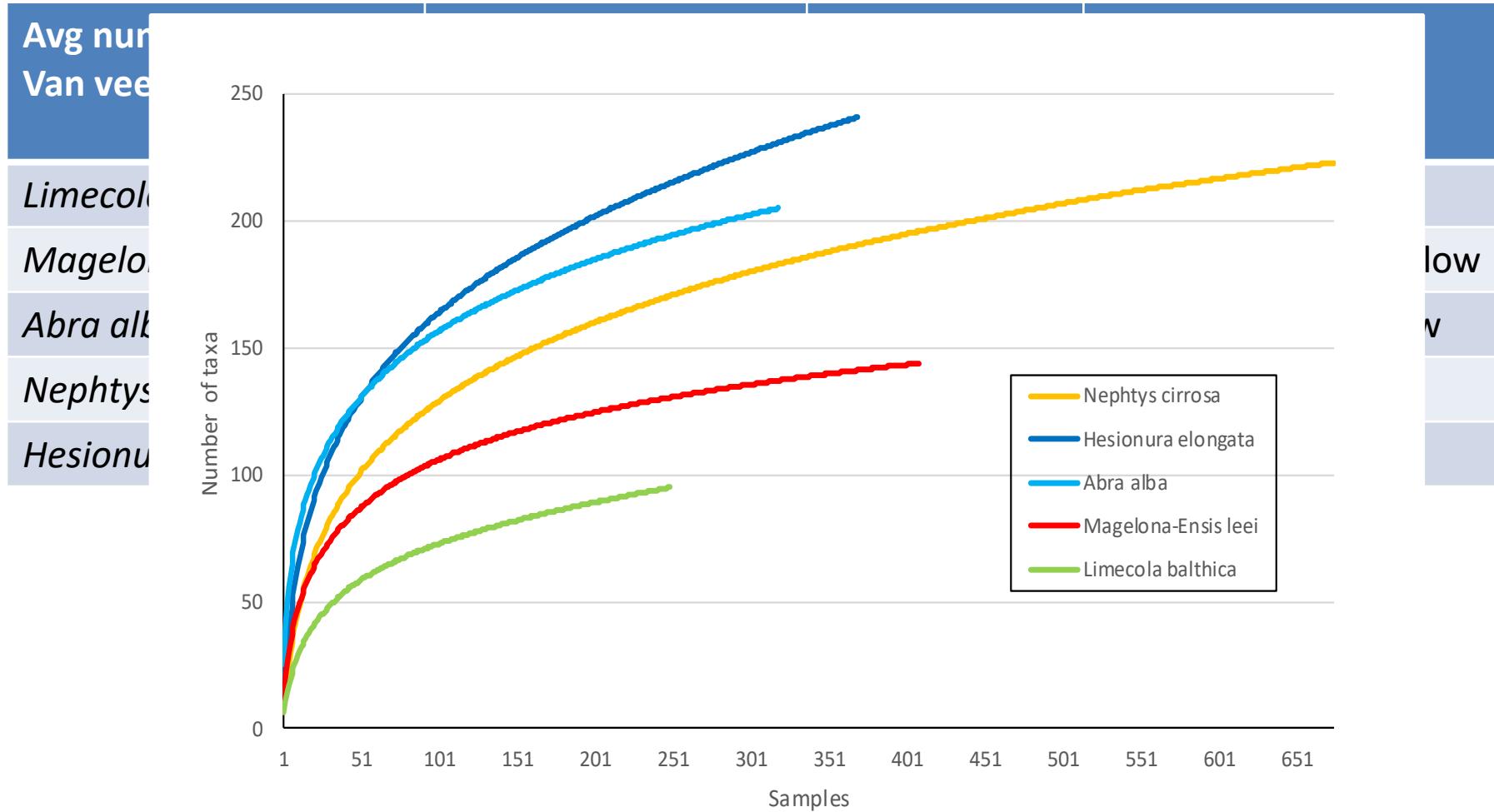


Breine et al. 2018



Benthic communities BPNS

Diversity



Benthic communities BPNS

Diversity

Avg number of taxa / Van veen	Van Hoey et al., 2004 728 samples	Breine et al., 2008 2269 samples	Physical habitat
<i>Limecola balthica</i>	/	6	Mud, shallow
<i>Magelona – Ensis leei</i>	/	12	Fine sand, very shallow
<i>Abra alba</i>	30	26	Fine sand, shallow
<i>Nephtys cirrosa</i>	7	9	Medium sand
<i>Hesionura elongata</i>	5	14	Coarse sand

period	Limecola	Abra	Nephtys	Hesionura	Total taxa	Total samples
<1986	60	157	91	172	222	661
1986-1993	49	106	23	92	153	197
1994-2004	83	246	155	218	319	2985
2005-2012	130	217	248	283	371	4592
Total taxa	151	291	278	330		ILVO +

Ugent data

Diversity and effort

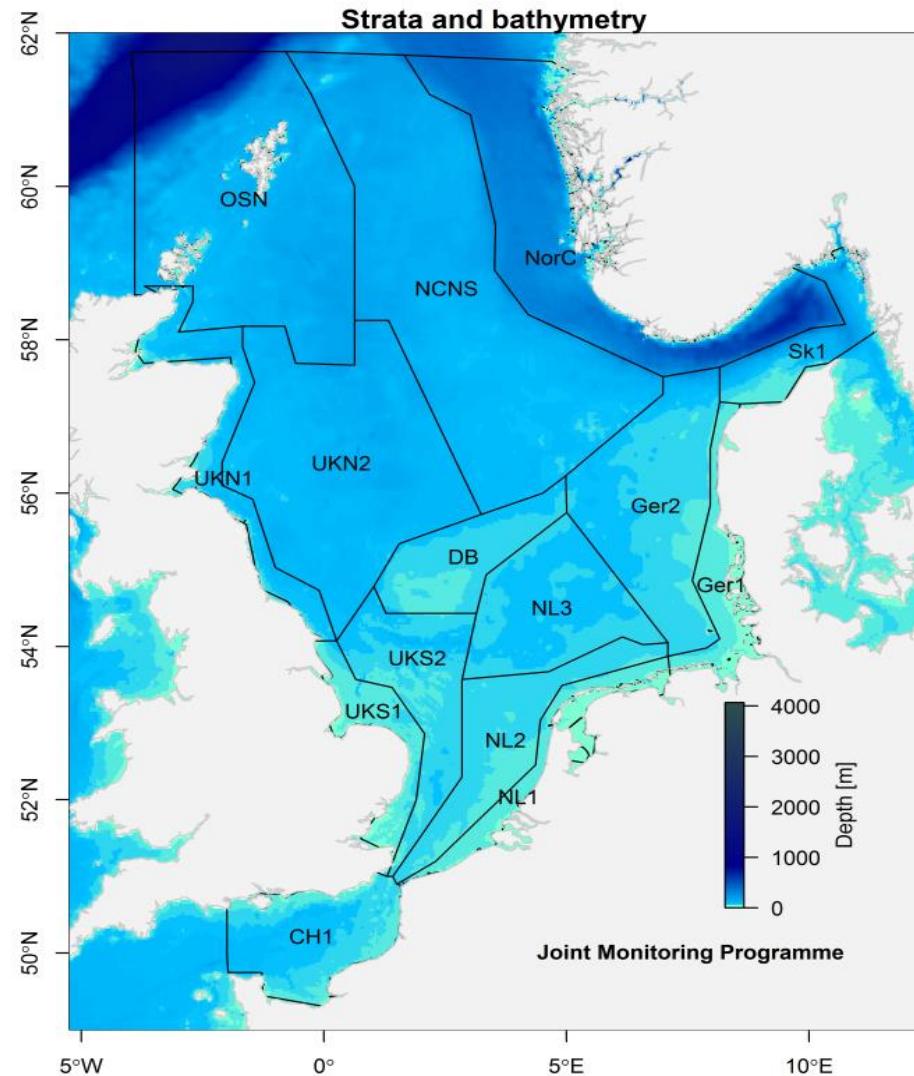
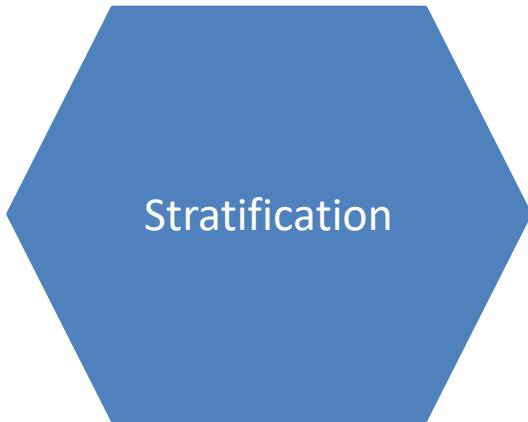
- Spatial distribution sampling
- Temporal window
- Taxonomic knowledge + standardization
- Sampling gear type

integrated, coordinated benthic monitoring strategy

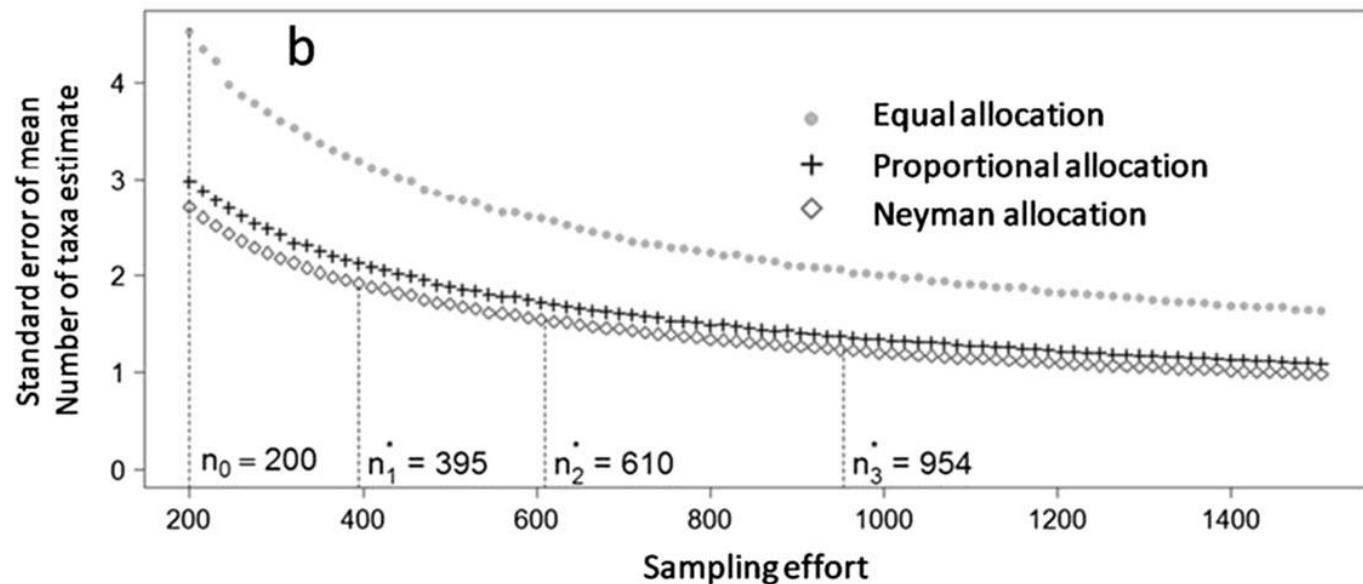
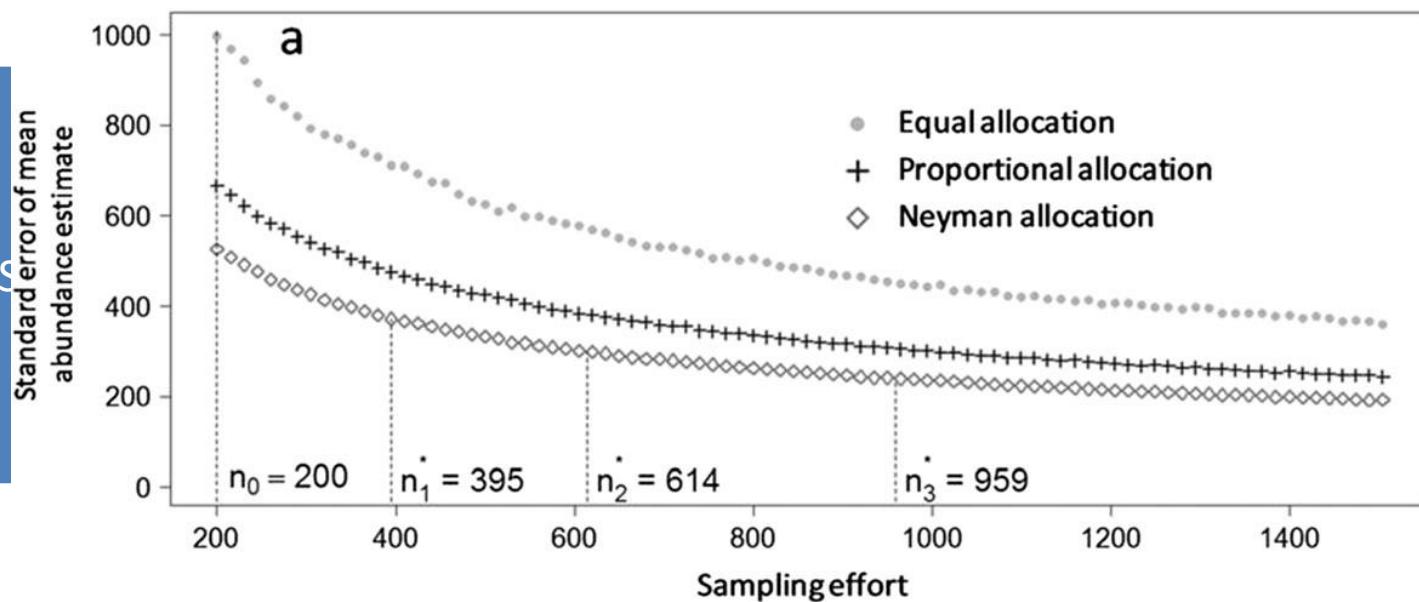
Monitoring

- The backbone of the status assessment
- Reduced monitoring budgets
- Cost effectiveness
- Integration across ecosystem components
- Regionally coordinated
- Ecosystem driven versus
human activity/pressure driven

Monitoring



Monitoring

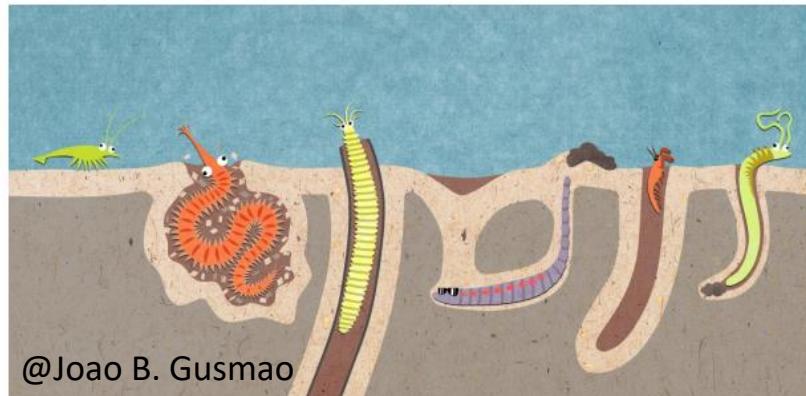


Monitoring

- Regional scale-based monitoring programmes shall depend on national initiatives.
 - Common dominator
 - Certain level of harmonization
- The critical point here is to agree on the minimum sampling scheme for region-wide assessments.
- It strengthens regional cooperation to fulfil multiple monitoring tasks, with a scientifically underpinned common approach.

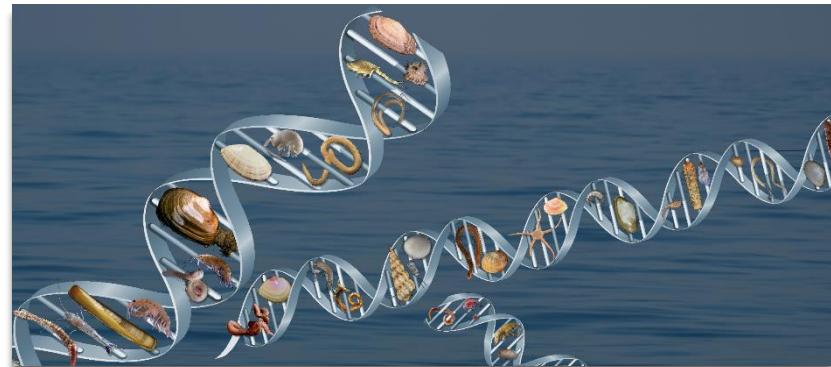
Other diversity issues

The assessment of functional diversity



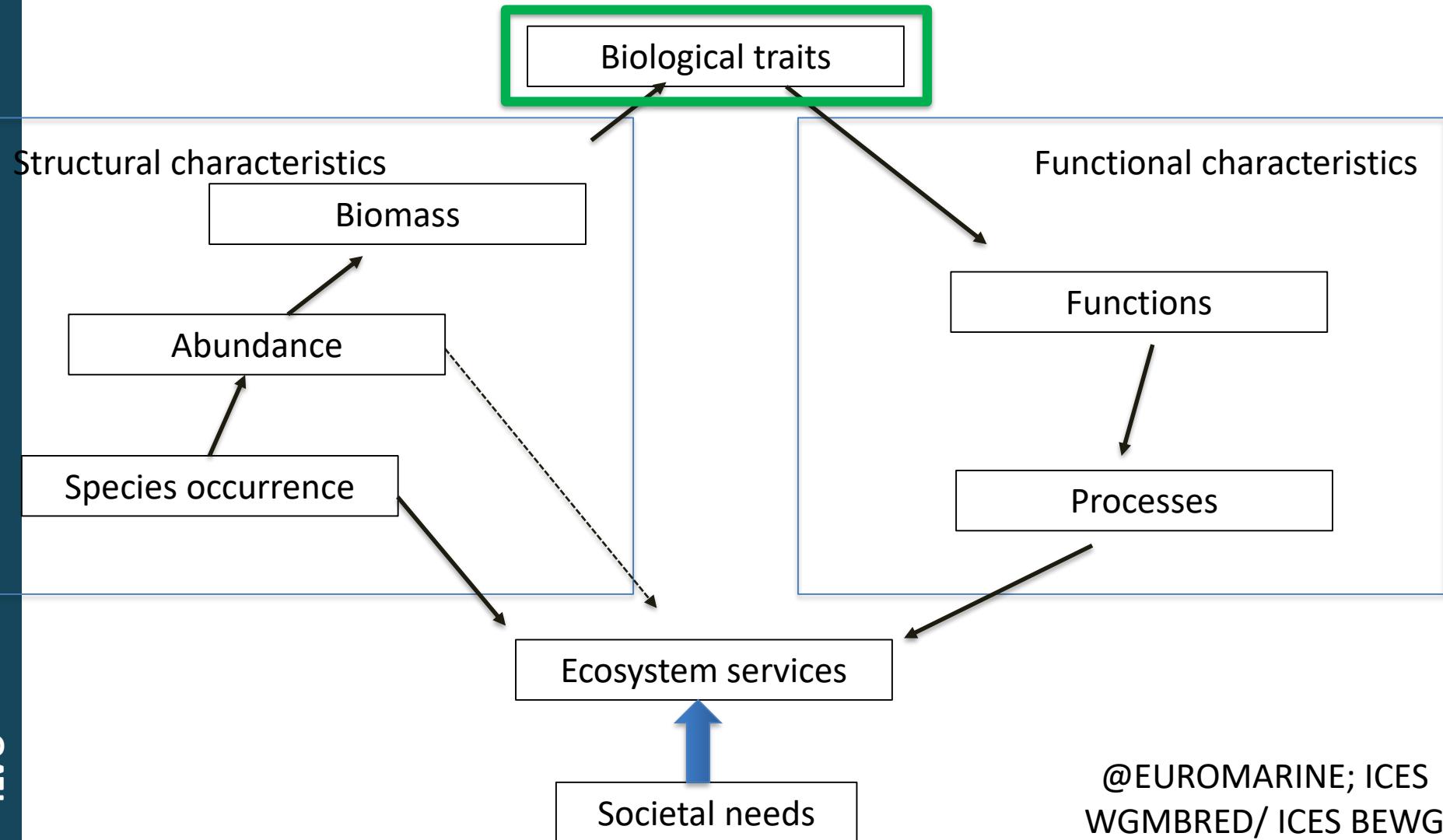
functional groups (Beauchard et al., 2017),
biological traits analysis (BTA),
indices for functional diversity

The use of DNA-based approaches



Functional diversity

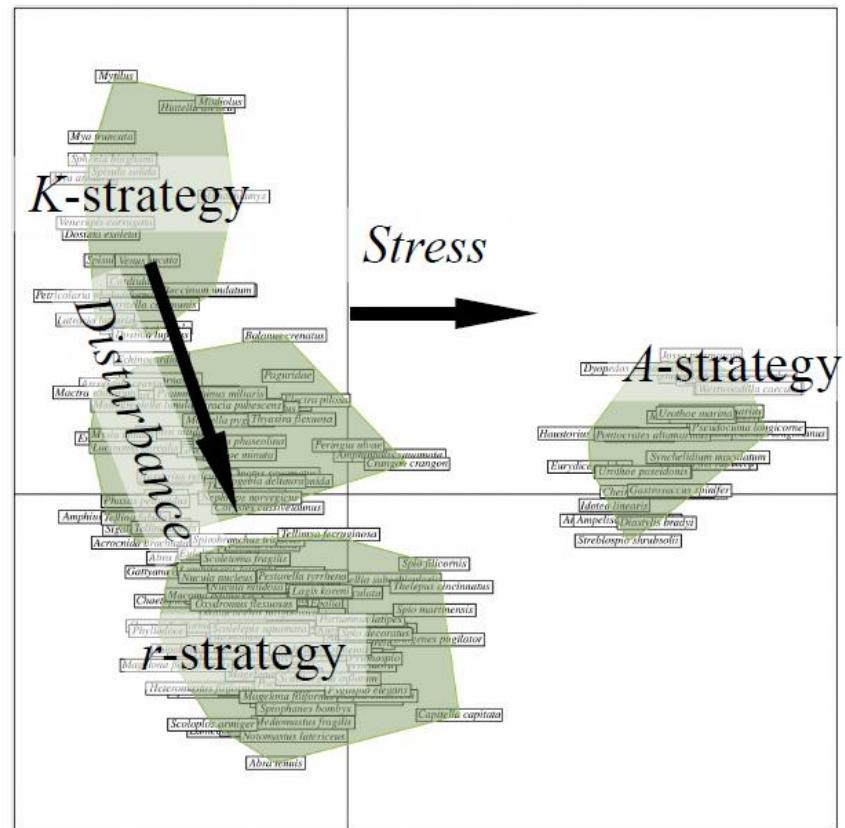
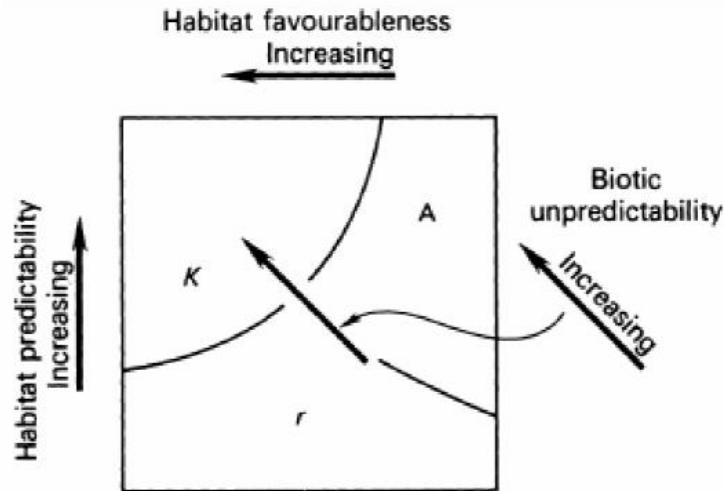
Parachute diagram: evaluation framework





Benthic functional types

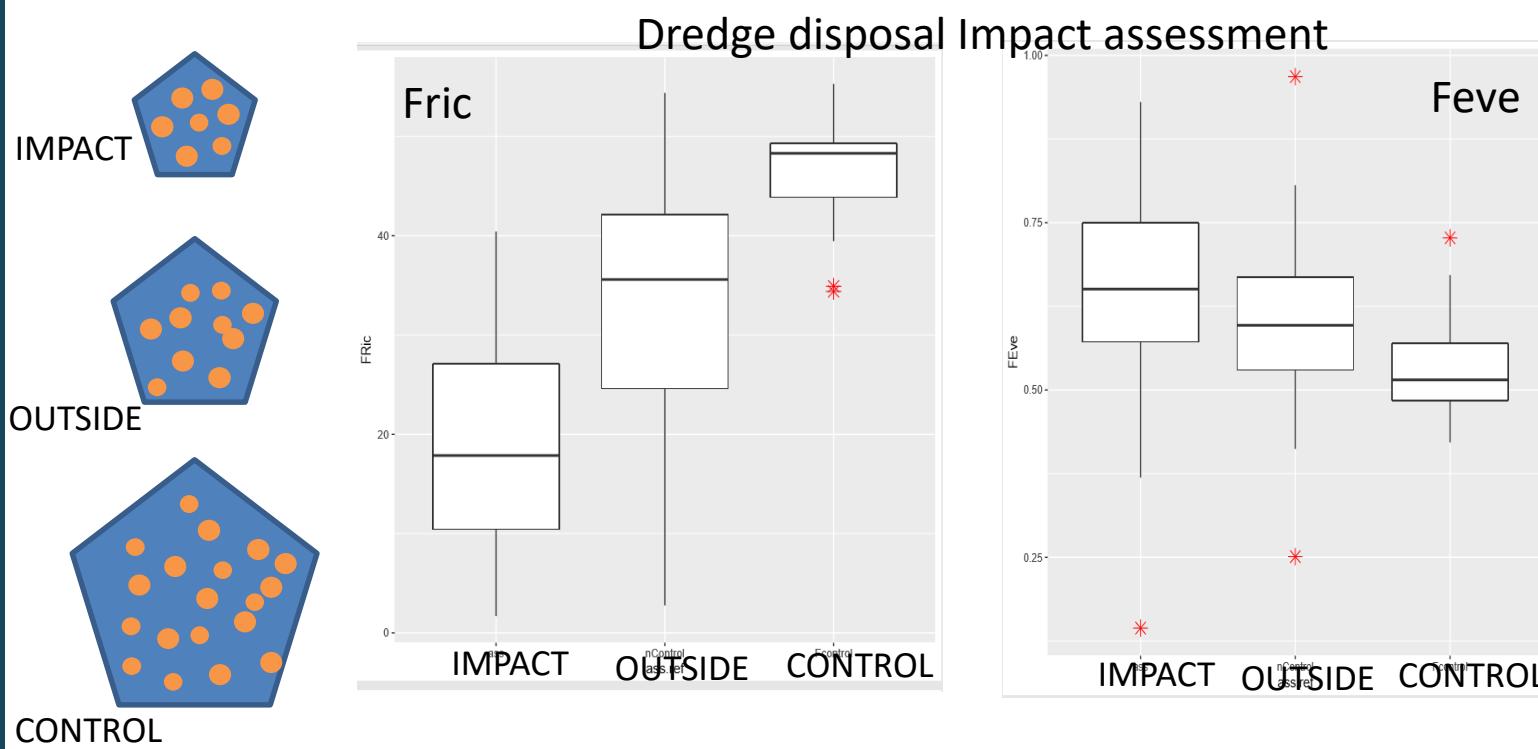
EWER



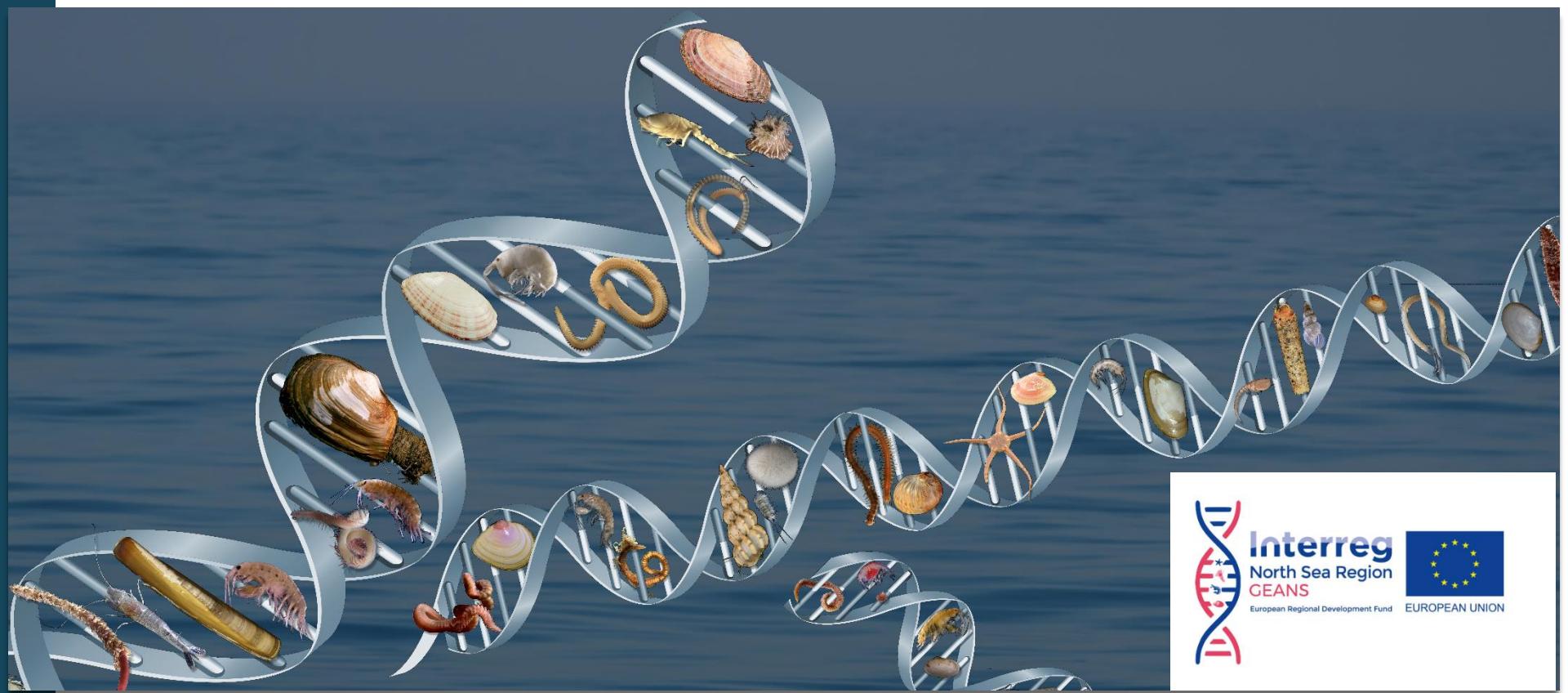
Functional diversity

Functional diversity indicators:

- Fric: Functional richness: the total extension of trait values
- Feve: Functional evenness: the regularity of the distribution of the species abundance in the functional trait space
- Fdiv: Functional divergence
- Fdis: Functional dispersion
- RaoQ: Rao's quadratic entropy (cf Simpson diversity)



DNA-based approaches



DNA-based approaches

Why?

Sustainable use and management of the North Sea = grand challenge!



⇒ Fast and accurate monitoring needed!

DNA-based approaches

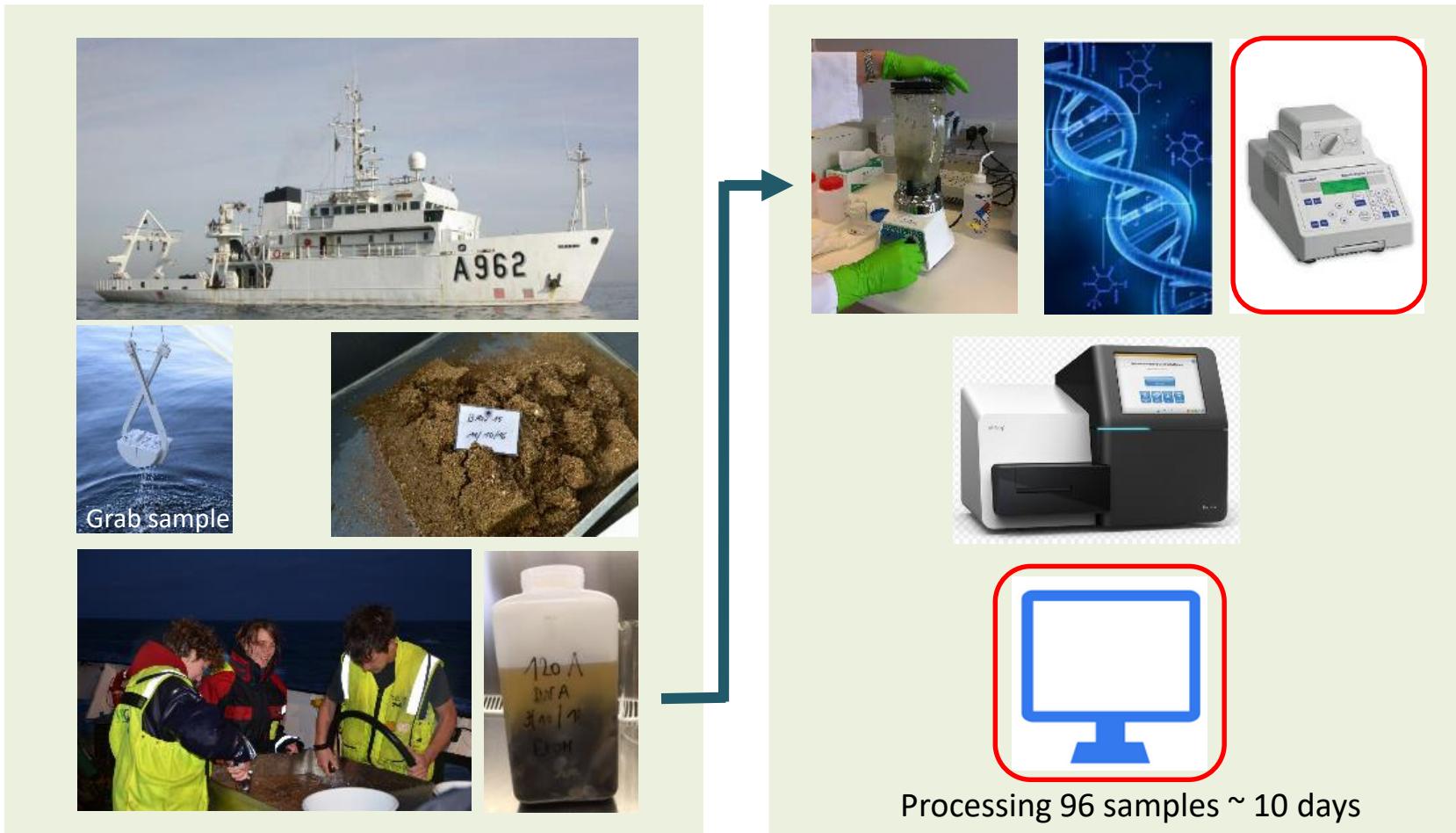
Current monitoring - morphology-based



Processing time 1 sample ~ up to 3 days

DNA-based approaches

The future!? - DNA-based analysis (metabarcoding)



DNA-based

Current obstacles for

- Link with traditional monitoring
- Reliable reference sequence
- Only relative abundance used
- Different approaches between application
 - Primer and barcode choice is not standardised
 - Lab protocols are not standardised
 - Sample used: bulk – ethanol –



The quality of the seafloor habitat is an important barometer for marine ecosystem health. In order to accurately measure that quality, GEANS will mainstream implementation of fast, accurate and cost-effective DNA-based assessments. This will enable national authorities to improve the management of human activities and protection of the marine environment across the North Sea Region in a transnational coherent way.

GEANS will conduct pilot studies concerning environmental impact assessments (renewable energy, aquaculture and sand extraction and suppletion), and concerning monitoring in relation to European directives (non-indigenous species and hard substrates). These pilots will be conducted in close cooperation with stakeholders.

Mariene ongewervelden van het Belgisch deel van de Noordzee
Invertébrés marins de la partie belge du mer du Nord



Thank you

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