

State of Science Workshop on Wildlife and
Offshore Wind Energy Development
Ecosystem Perspectives

**From observing structural effects to
understanding functional effects of offshore
wind energy development.**

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and

Colleagues from the Belgian offshore wind farm monitoring program, FaCE-It and PERSUADE projects, ICES Working Group on Marine Benthos and Renewable Energy Developments, and ICES Benthos Ecology Working Group

Objectives and outline

1. Offshore wind farms do impact the environment
2. Spatial scale matters
3. Ecosystem functioning matters
4. Pertinent operational questions to be selected
5. Well-designed monitoring programmes and research needed

We already know a lot from ecological monitoring...
...yet focused on local and structural impacts.

If we are however asked

- on how much offshore wind farms alter the wider marine ecosystem, and
- whether these changes are acceptable,

we often cannot come up with an answer...

When assessing offshore wind farm impacts... spatial scale matters.

Single windmill

Single wind farm

Multiple wind farms

← **Current monitoring programs** →

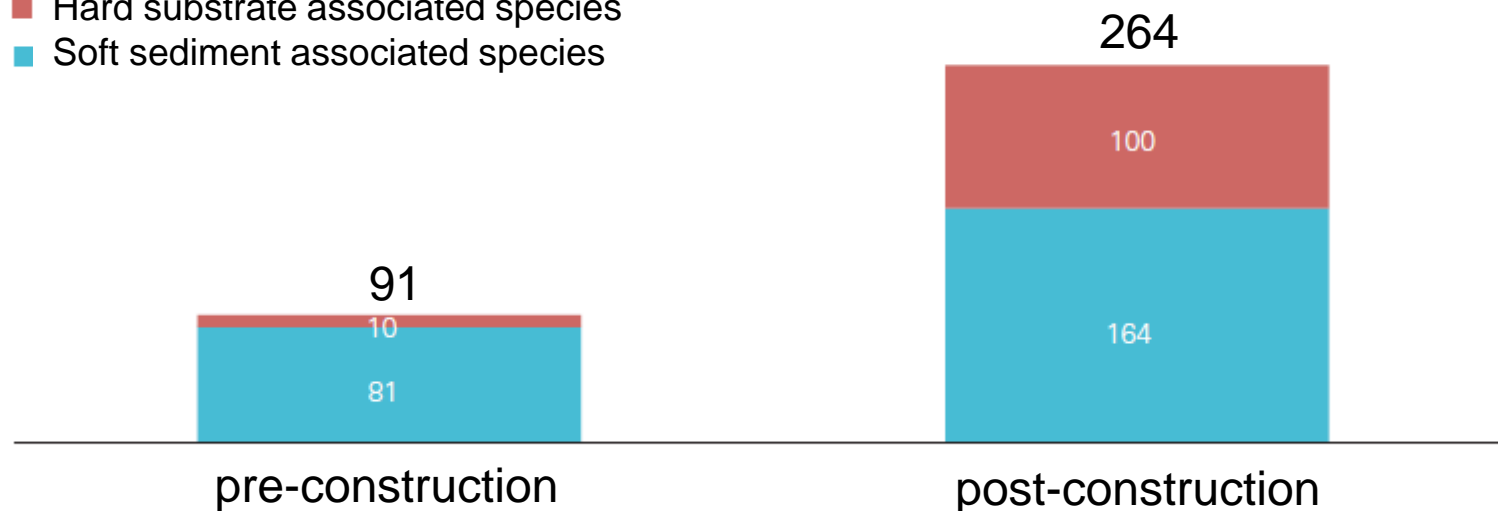
← **Here's where we want to be** →

Spatial scale matters...

Example: benthic species richness in Belgian wind farms

Species richness - benthos

- Hard substrate associated species
- Soft sediment associated species



Wind farm scale:
+ 190%

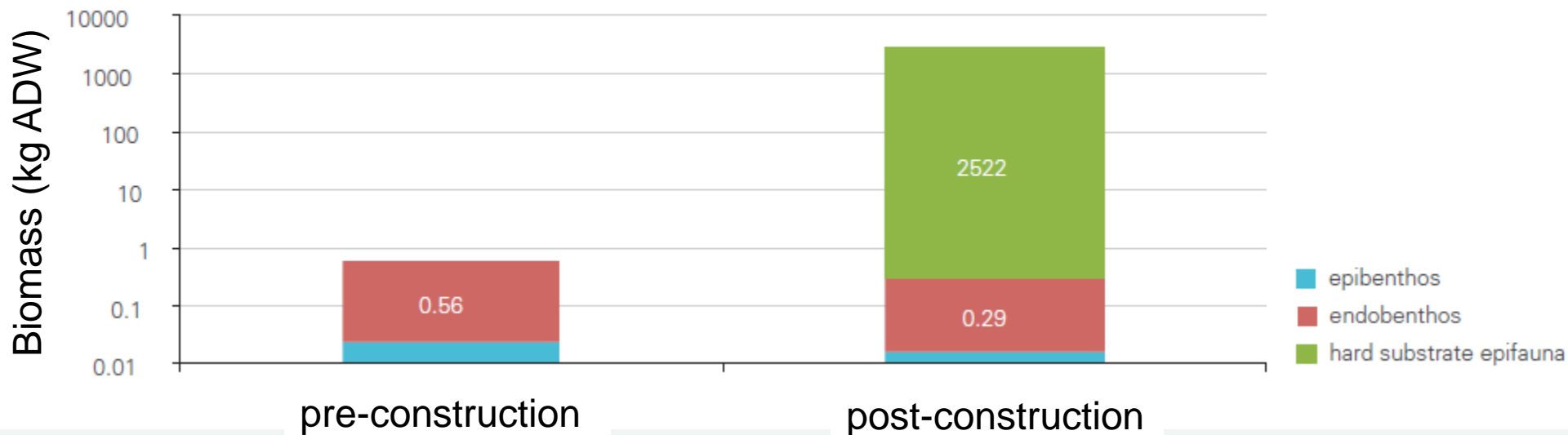


Belgian part of the
North Sea:
+ 0%

Spatial scale matters...

Example: macrofauna biomass in Belgian wind farms

Single windmill biomass



Single windmill scale:
x 4000



Wind farm scale:
x 14



Belgian part of the
North Sea:
X 1,03

Spatial scale matters...

Then, how to best assess impacts?

Uncertainty in valuing impacts

*“Offshore wind farms do change the local environment. Importantly, these changes are across all ecosystem components and some can be regarded as (**potentially**) negative, e.g. ... and some (**potentially**) positive, ...”*

Lindeboom et al., 2015, Hydrobiologia

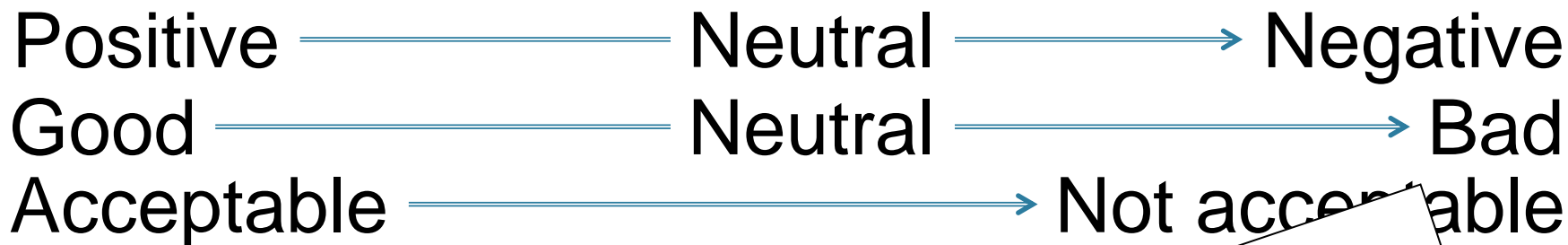
Positive or negative?

Good or bad?

Acceptable or unacceptable?

Spatial scale matters

Example: Offshore wind farms as “species richness” hotspots



Offshore industry

Policy makers

Marine managers

eNGOs

Scientists

THE VIEWPOINT OF THE OFFSHORE INDUSTRY
THE VIEWPOINT OF THE POLICY MAKERS
THE VIEWPOINT OF THE MARINE MANAGERS
THE VIEWPOINT OF THE eNGOs
THE VIEWPOINT OF THE SCIENTISTS

There is no right or wrong
Value judgement of a non-issue: so what?

Scientists

eNGOs ?

Scientists

Spatial scale and, ecosystem processes and functioning...

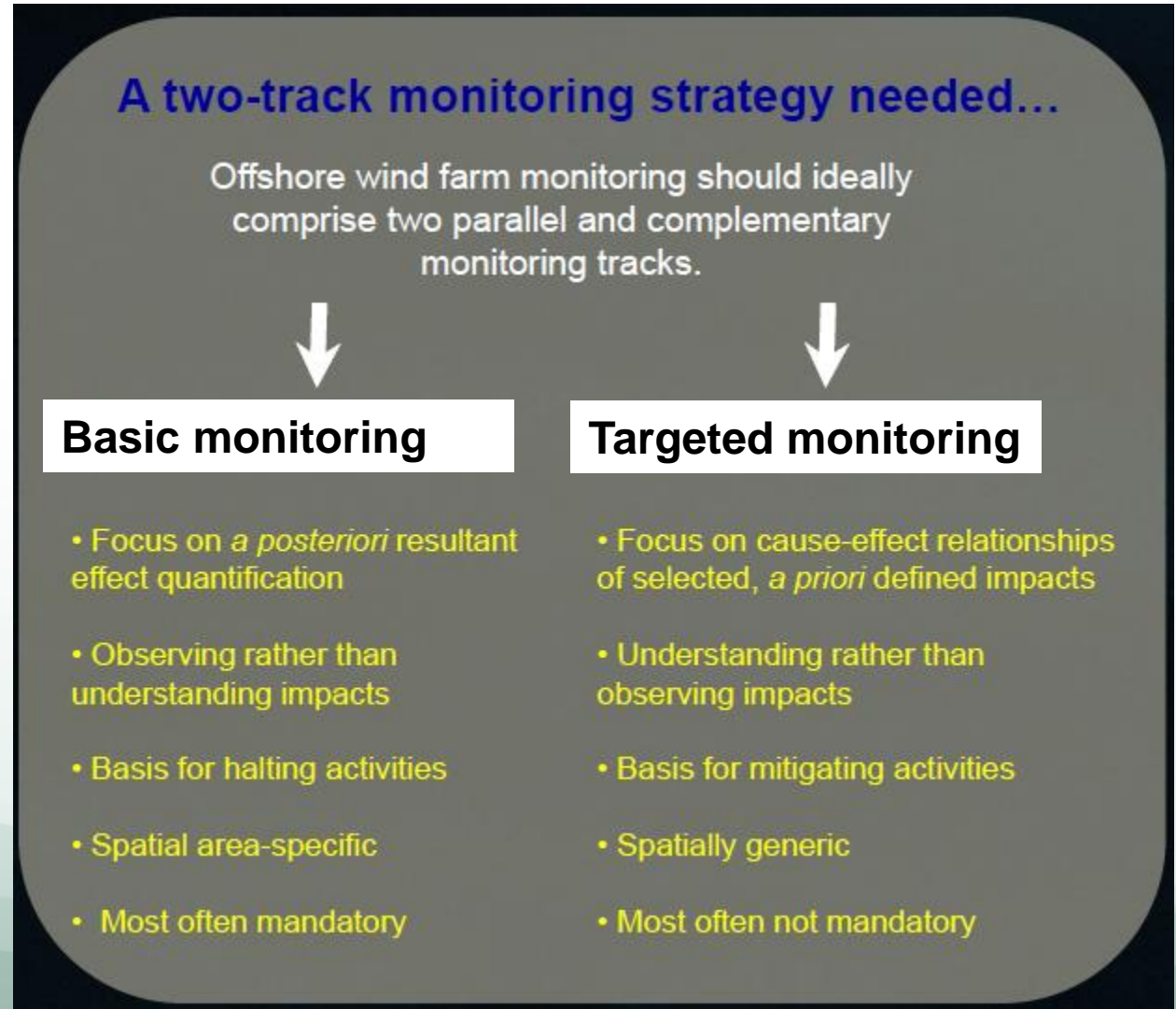
Touching upon goods and services provided by the sea.

A possible way forward: WinMon.BE model...

Basic and targeted monitoring

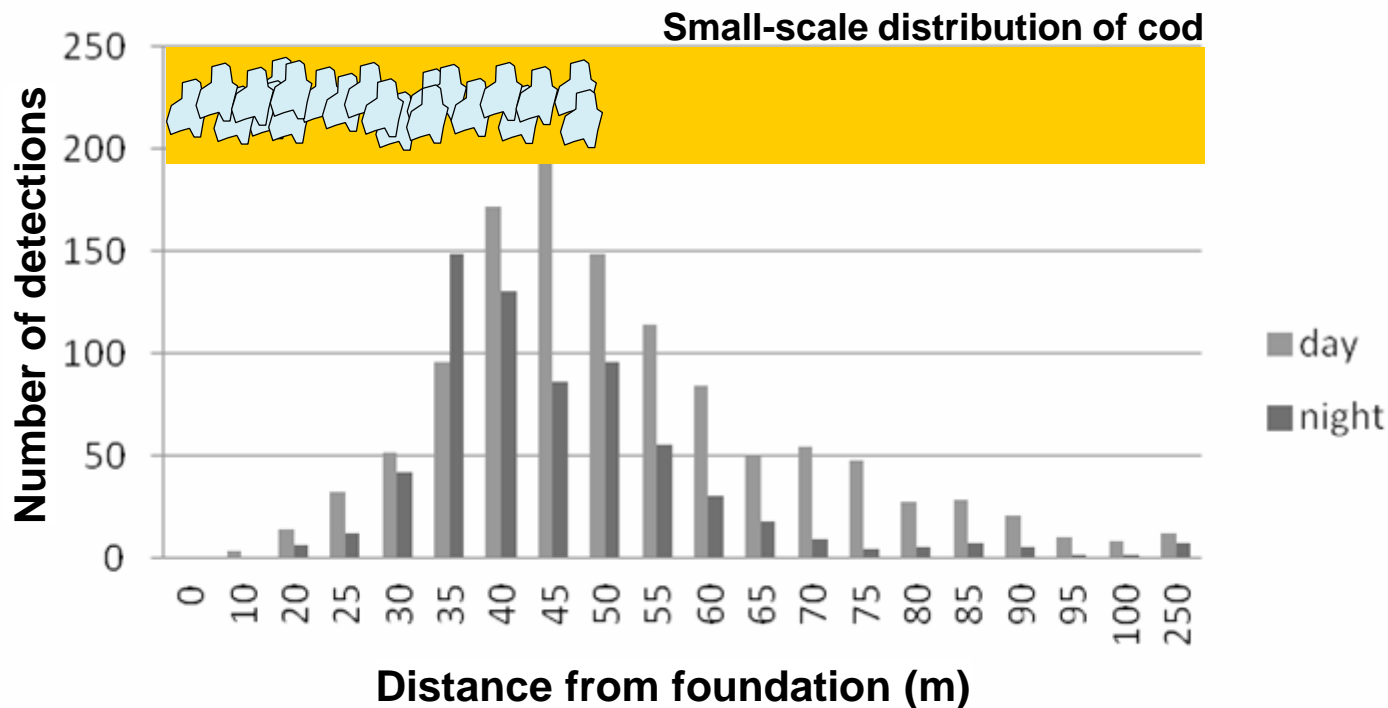
The challenges

1. Combine *in situ* BACI and gradient design data collection, *in situ* experiments and lab experiments
2. Selection of most pertinent operational questions.
3. Smart and well-considered data collection needed.



Challenge 1: Flexible research designs

Using monitoring funding from offshore wind industry



Fish densities

- up to 29.000 individuals of pouting per wind turbine...

Stomach content analysis and fitness consequences

- Hard substrate epifauna is an important food source for pouting...

Challenge 1: Flexible research designs

Using regular funding for research



Functional biodiversity in a Changing sedimentary Environment: Implications for biogeochemistry and food webs in a managerial setting.

Focus:

- Effects of fining and hardening on biogeochemical cycles and food webs

Research designs:

- Field campaigns and lab experiments, modelling

ExPERimental approaches towards Future Sustainable Use of North Sea Artificial HarD SubstratEs

Focus:

- Effects of offshore wind farms on biogeochemistry and food webs...
- ...under changing climate and multi-use conditions

Research designs:

- Lab experiments and modelling

Challenge 1: Flexible research designs

Example 1: enhanced filtering capacities

Jassa herdmani filtering

- $0.0055125 \text{ l ind}^{-1} \text{ h}^{-1}$
- $55.125 \text{ l m}^{-2} \text{ h}^{-1}$
- $1,323 \text{ l m}^{-2} \text{ day}^{-1}$
 - Only females feed
 - 50 % is female
 - 500 m² is inhabited on a GBF turbine
- 330,750 l per turbine per day

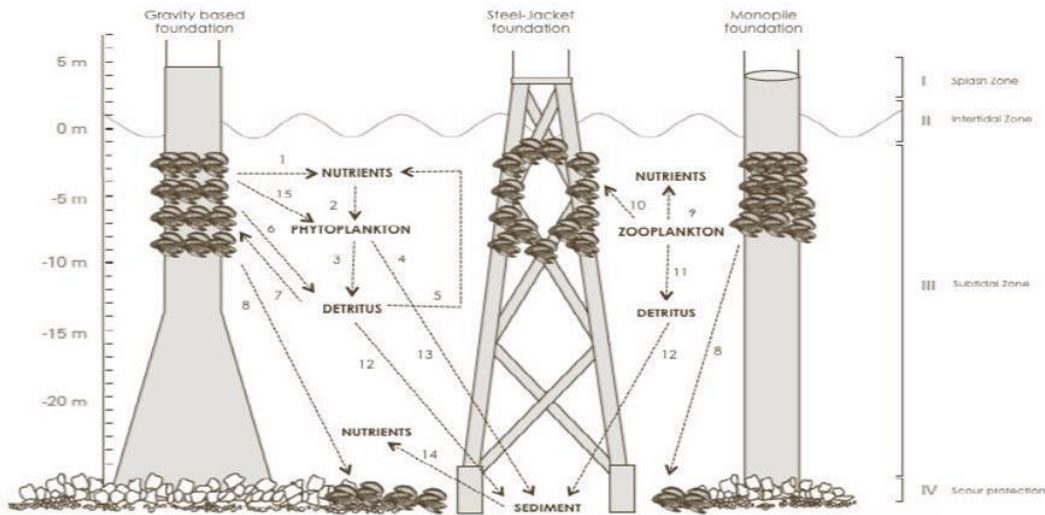
Artificial Hard Substrate Garden



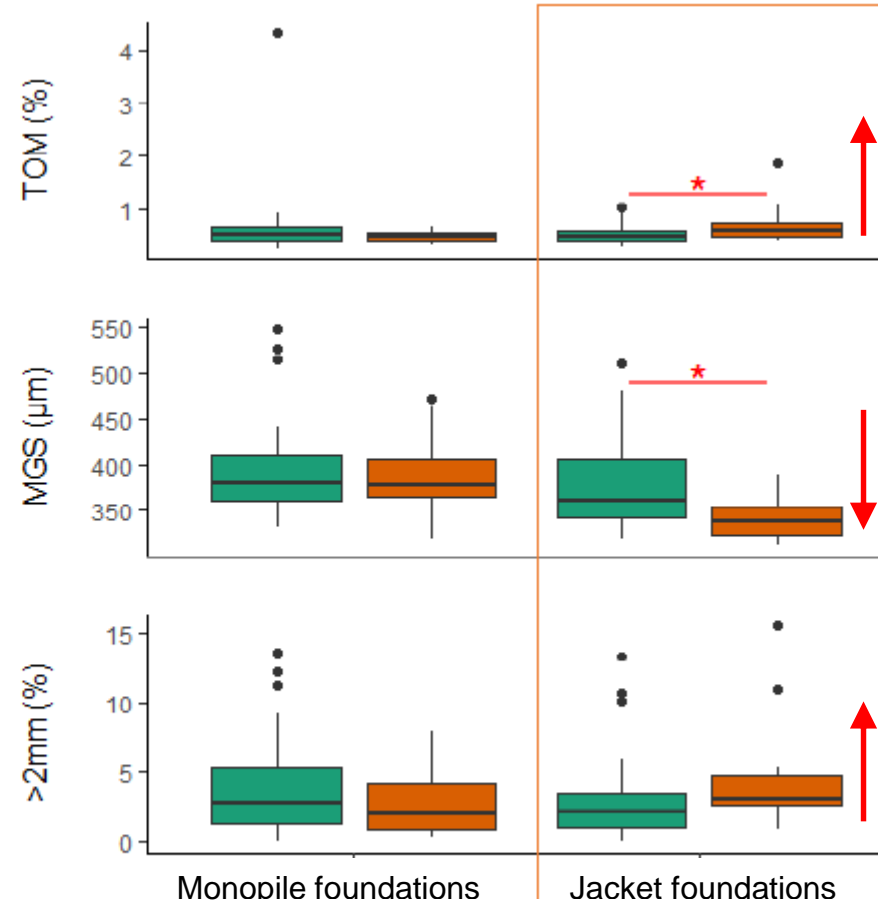
Challenge 1: Flexible research designs

Example 2: Sediment fining and enrichment

De Luca Peña, 2016

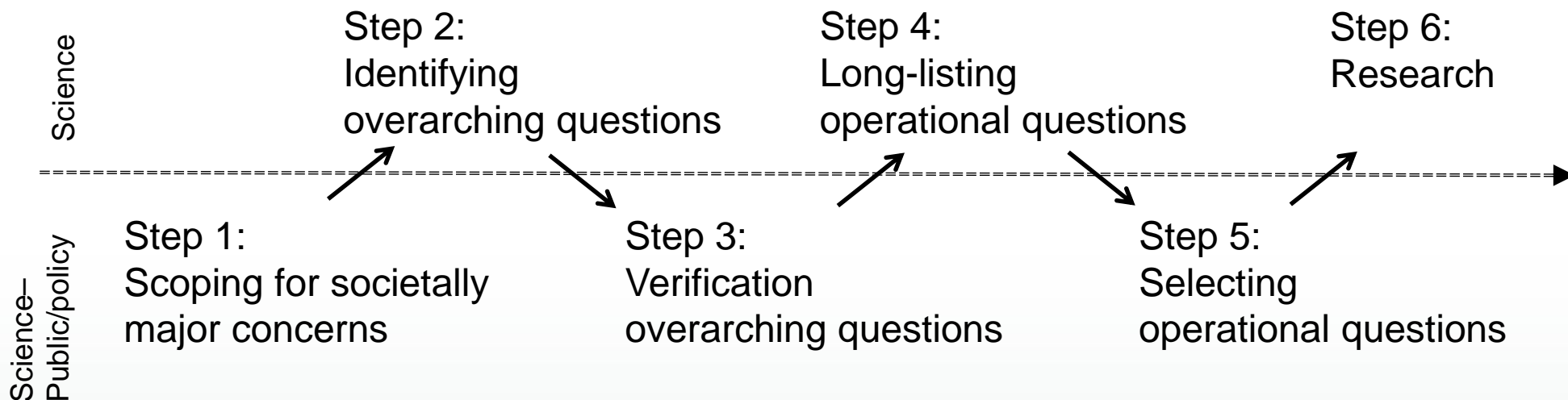


Fining and organic enrichment



Lefaible et al., 2018

Challenge 2: Selecting pertinent operational questions Science – Public/policy interface



Example: Wind farms in marine protected areas?

Negotiation process (February 2018-July 2018)

- Public: eNGOs + Belgian Offshore Platform
- Policy: Federal Ministry for the North Sea
- Science: Royal Belgian Institute of Natural Sciences



Research programme:

- € +500,000
- 2019-2022
- Incl. nature-inclusive building

Challenge 2: Selecting pertinent operational questions Science – Public/policy interface

Major/public concern:

- What are the effects of offshore wind farms that compromise reaching conservation objectives for a given MPA?
- ...

Overarching questions:

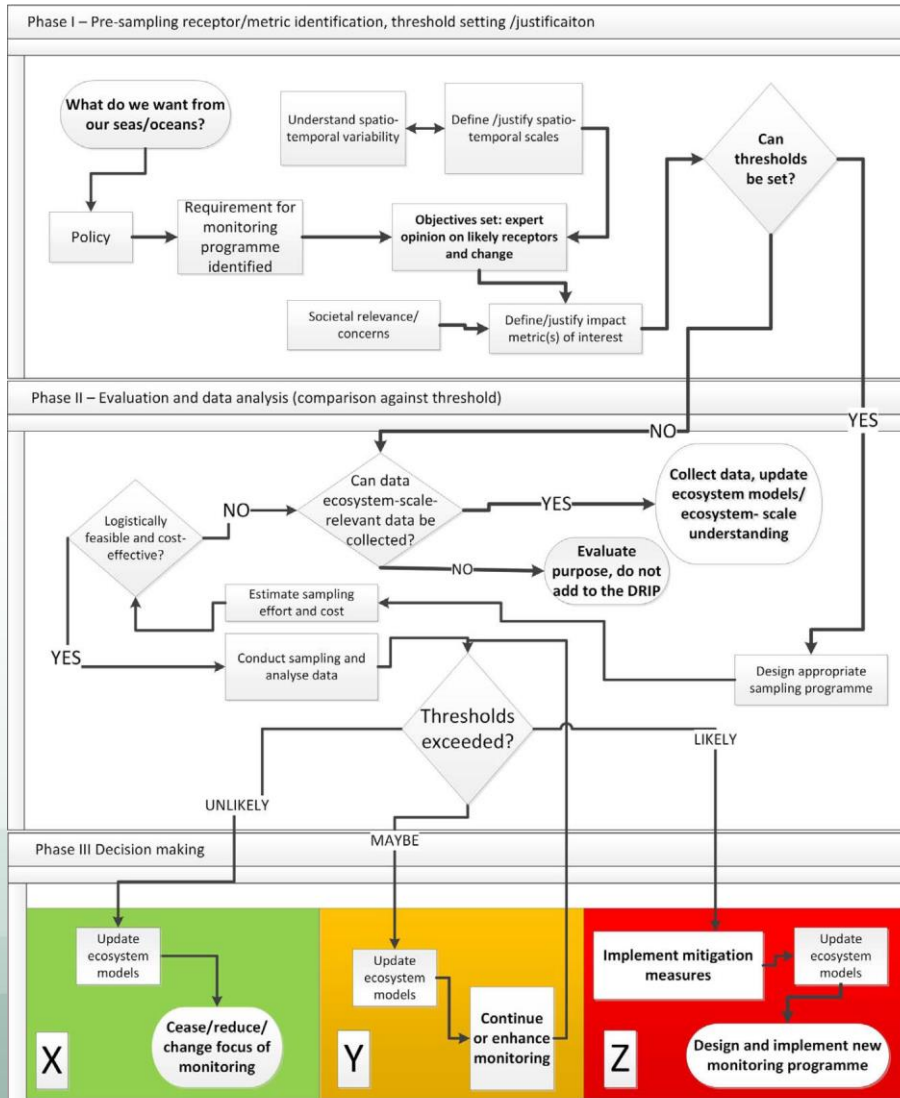
- Effects on long-lived benthic organisms of gravel/boulder beds?
- ...

Operational questions:

- What is the spatial extent and magnitude of siltation of gravel/boulder beds because of offshore wind farms?
- What is the sensitivity of gravel/boulder bed fauna to siltation?
- ...

Challenge 3: Smart and well-considered data collection

“Turning off the DRIP”



Data rich, information poor

- Many monitoring programmes => data-rich
- Poorly designed monitoring programmes => information-poor



- Carefully consider the selected operational research questions
- Tackle only those for which a reliable research scheme can be developed and executed

In conclusion

1. Offshore wind farms do impact the environment (negative and positive?)
2. Spatial scale matters (beyond locally observed effects)
3. Ecosystem functioning matters (aside ecosystem structure)
4. Pertinent operational questions to be selected (consultative process)
5. Well-designed monitoring programmes and research needed (turning off DRIP)

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MEMOIRS

on the Marine Environment

SCIENTIFIC REPORTS SERIES

ENVIRONMENTAL IMPACTS
OF OFFSHORE WIND FARMS
IN THE BELGIAN PART OF THE NORTH SEA

**ASSESSING AND MANAGING
EFFECT SPHERES OF INFLUENCE**

Edited by
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Robin Brabant
Bob Rumes
Laurence Vigin

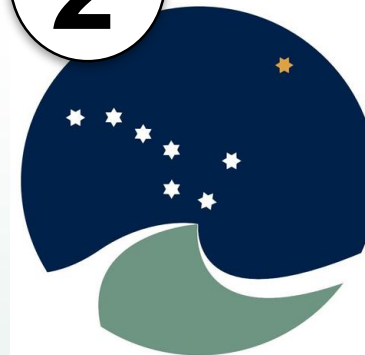
museum 



TWO OFFERS AND THANK YOU

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ICES

CIEM

**ICES Working Group on Marine Benthos
and Renewable Energy Developments**

[https://odnature.naturalsciences.be/
downloads/mumm/windfarms/winm
on_report_2018_final.pdf](https://odnature.naturalsciences.be/downloads/mumm/windfarms/winm_on_report_2018_final.pdf)

Next meeting: 12-15 February 2019,
Brussels (Belgium)