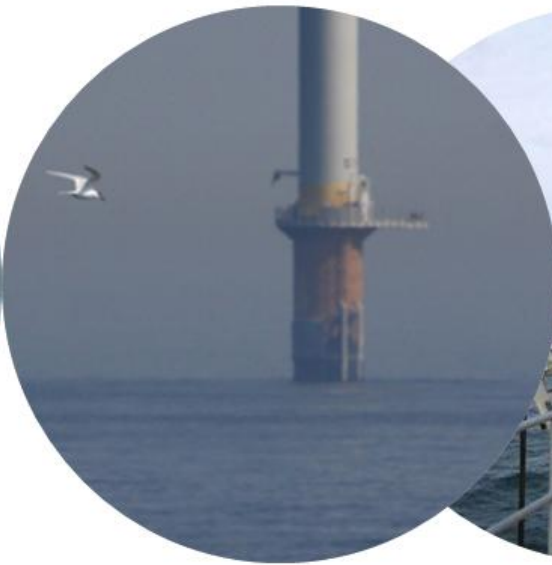
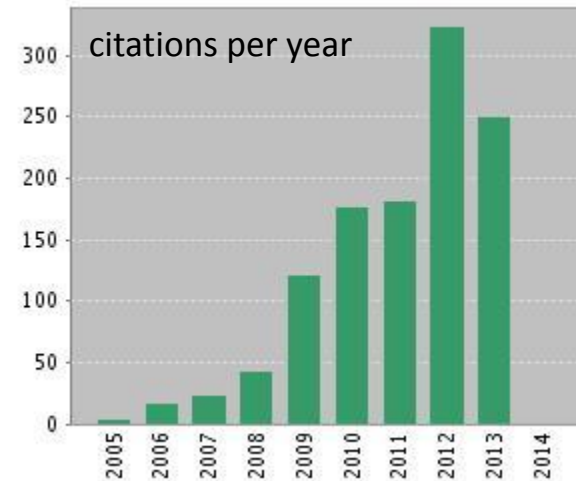
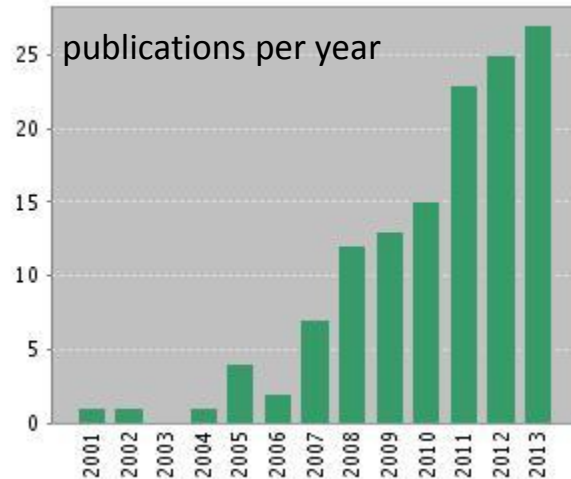


Review/evaluation of Belgium monitoring programme and suggestions for the future

Han Lindeboom, Jennifer Dannheim, Andrew Gill and Dan Wilhelmsson



Where were we (scientifically) when this programme started ?



Offshore wind related ecological publications;
(source ISI web of knowledge)

Danish, Dutch, British, German and Belgium research

What have we learned from this 6 years of research ?

The overriding lesson is that OWFs change the local environment

OWFs are a new habitat in the open North Sea

They have (potential) negative and positive effects

Major impacts from:

- Noise produced in the building phase

- New hard substratum

- Moving rotor blades

- Noise in the production phase

- Exclusion of fisheries



The results from the Belgian monitoring, which is currently one of the best programmes, in general confirm the expected/suggested nature and magnitude of impacts

Caveat in research programme: relatively small number of turbine structures

How does this fit into our vision upon wind farms at sea (ecology)

- Long term habitat change by epifouling communities
- Artificial reef effects
- Recovery of benthos and fish after trawling cessation
- Effects on birds , avoidance, indifference, attraction, collisions
- Effects on sea mammals (and fish), avoidance, indifference, attraction

Separation in positive and negative changes,
the OWF sector can champion the good and mitigate the bad.



What does the outcome mean for future monitoring ?

For a valid ecological-based monitoring programme there must be consideration of all elements, from which priority elements must be selected

Targeted and basic monitoring studies

Adaptive monitoring

Clarity in the selection of parameters to quantify

Natural variability background

Effect scale and importance



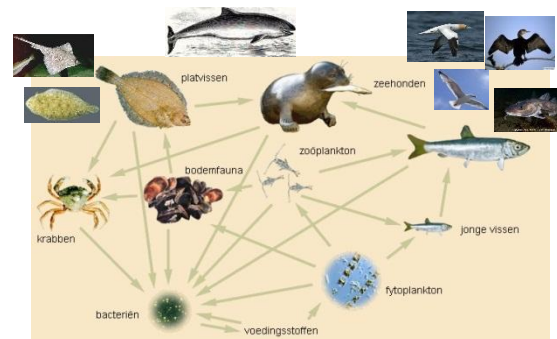
Suggestions for future research programmes on wind at sea (general)

Make more clear how negative and positive environmental effects are assessed

More integrated approach on ecosystem and seascape scales

baseline data on state, sensitive species, habitat, migration routes of birds, fishes and sea mammals

Levels of uncertainty surrounding some ecological questions need more attention
confidence assessments will add to the level of understanding



Suggestions for future research programmes on wind at sea (specific)

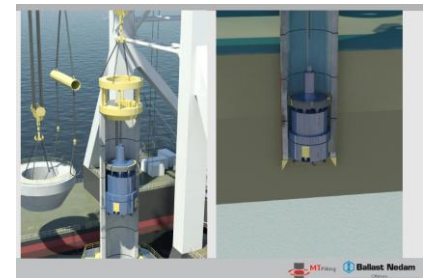
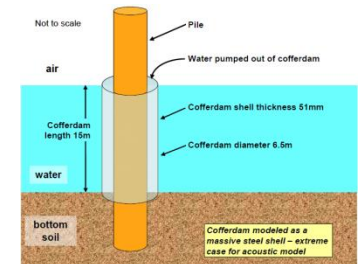
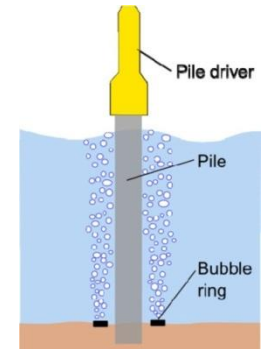
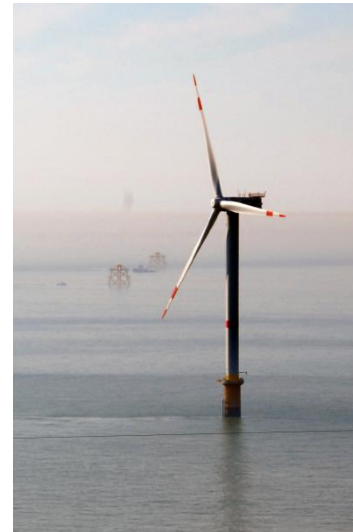
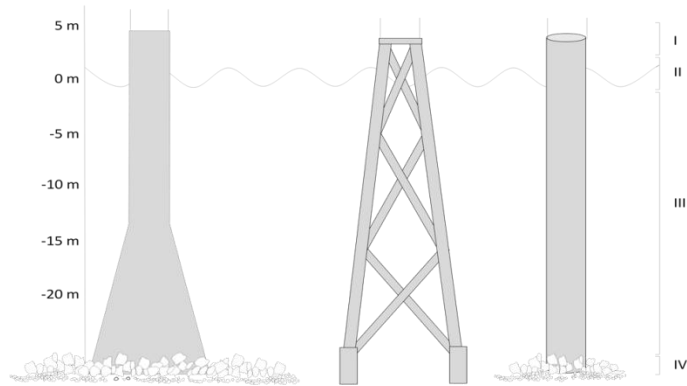
Noise

Building phase

Operational phase (low level noise)



Noise during the building phase



Suggestions for future research programmes on wind at sea (specific)

Noise

Building phase

Operational phase (low level noise)



Electromagnetic fields (?)

Sediments and morphodynamics

Bird collisions estimates are from modelling > more data needed

What is impact on population level

Lesser and great black-backed gull

Bats?

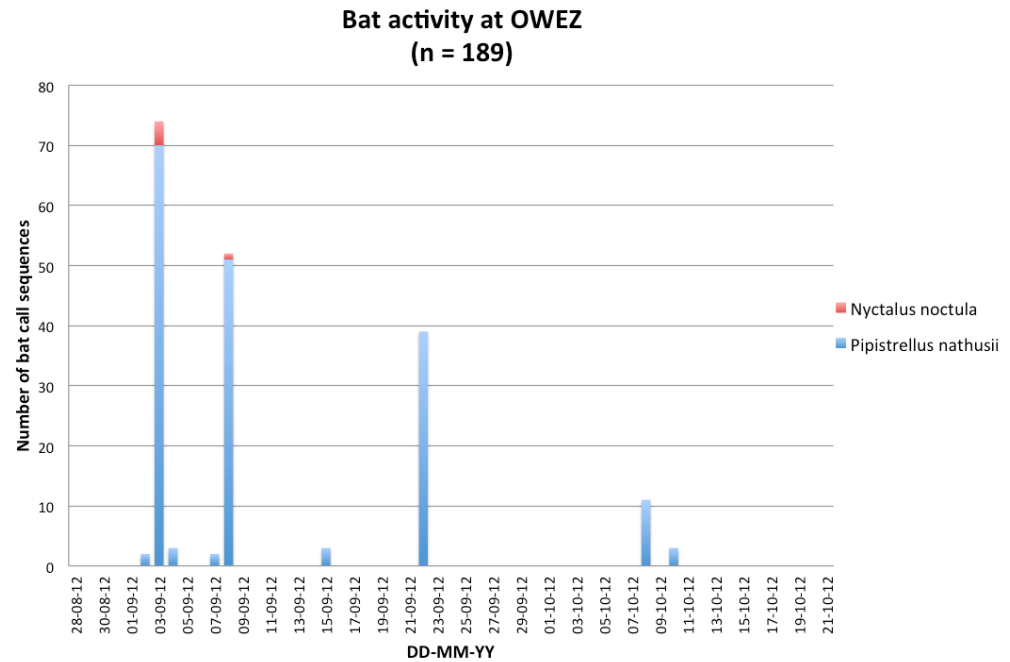


Pilot study Bat activity in the dutch offshore wind farm OWEZ and PAWP

Bob Jonge Poerink, Sander Lagerveld, Hans Verdaat
IMARES & the Fieldwork Company



Nathusius' pipistrelle Pipistrellus nathusii (photo: Klaus Bogon)



Suggestions for future research programmes on wind at sea (specific)

Noise

Building phase

Operational phase (low level noise)



Electromagnetic fields (?)

Sediments and morphodynamics

Bird collisions estimates are from modelling > more data needed

What is impact on population level

Lesser and great black-backed gull



Bats!

Stepping stone for invasive species?

Fish in OWFs, attraction – production?

Barrier for birds (Gannets, auks, sea ducks) or sea mammals (harbour porpoise, seals)

Suggestions for future research programmes on wind at sea (general)

Benefits of fisheries closure

Elasmobranchs and big fish





Oostende fishmarket, Belgium, early 20th century

Karl van Ginderdeuren

Suggestions for future research programmes on wind at sea (general)

Benefits of fisheries closure

Elasmobranchs and big fish



Multiple use of sea areas will come higher on the agenda:
OWF might be ideal for protein production in open sea,
e.g. mussels, oysters, crabs, lobsters and fish

Economic and social acceptance



Suggestions for future research programmes on wind at sea (general)

Adaptive spatial planning and configurations of wind farms

There is a manifold of OWF cause-effect relationships, a need to answer open scientific questions and to share “investigation work load” ;
This calls for International cooperation, exchange of knowledge, results and data

Scientists, industry and administrators should strive for international exchange of data and allow open access to these data.

Not only address aspects called for by legislation but also use ecological criteria to set objectives; science should not just follow politics



Integrated Adaptive Management in Offshore Wind Farms

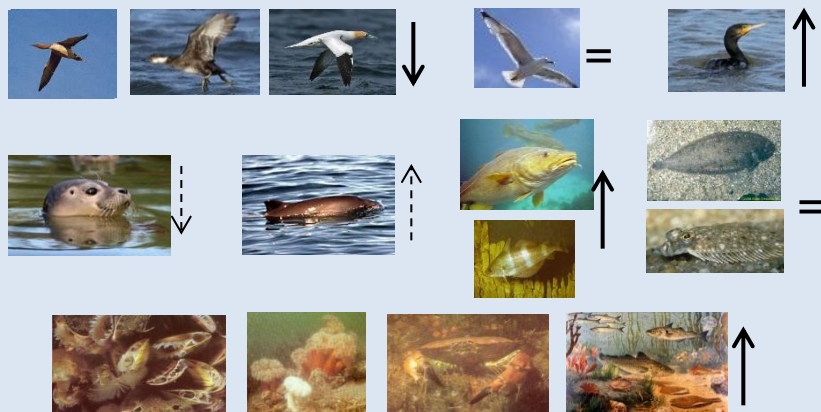
Climate



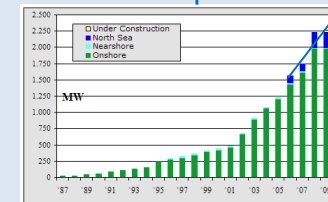
Food web



Biodiversity



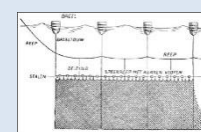
development



A-selective fisheries



trawling



gill net

Selective fisheries



angling



long line



trap

Aquaculture



algae



oysters



mussels

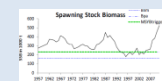


lobsters



fish

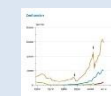
Monitoring !



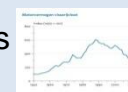
fish



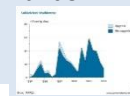
birds



mammals



users



benthos

Thank you!

Jennifer Dannheim,
Andrew Gill and
Dan Wilhelmsson





Success



Future research in offshore wind farms in the Belgian part of the North Sea

