SIZE MATTERS

INTRODUCTION

30 MW in 2009

2000 MW in 2020

Need to value impact at different scales
INTRODUCTION

- Seabird attraction and collision risk
- Invasive species
- Artificial reef effect
SIZE MATTERS

SEABIRD ATTRACTION AND COLLISION RISK

• significant attraction of large gulls to wind farms ⇒ increased collision risk
• collisions estimated through model calculations (Band, 2012) based on visual and radar flux data:
  visual - high resolution, species specific, but only daytime
  radar - continuous but not species specific
• 2,4 collisions of gulls / turbine / year at the Bligh Bank
• 132 collisions / year @ Bligh Bank wind farm
• threshold of 5% additional mortality per year is not exceeded for any population

⇒ No impact @ population level
SEABIRD ATTRACTION AND COLLISION RISK

- target of 43 GW offshore wind in the European Union (EWEA, 2013)
SEABIRD ATTRACTION AND COLLISION RISK

• target of 43 GW offshore wind in the European Union (EWREA, 2013)
• equivalent to > 14 000 3 MW turbines (cfr. Bligh Bank)
• extrapolated additional mortality for 10 000 turbines exceeds threshold (5% additional mortality) for both lesser (14.6%) and great black-backed gull (7.3%)
INVASIVE SPECIES

- offshore artificial hard substrata are rapidly colonised
- non-indigenous species (NIS) dominate the intertidal zone
- including both introduced (6) and range expanding (2) species
- minor differences between foundations, larger differences between foundation type and wind farm
- all NIS previously known from buoys, vessels other substrata in the area
INVASIVE SPECIES

- more NIS likely as colonisation continues and more substrata become available
- strategic positioning of NIS increasing the risk of becoming invasive species (e.g. Pacific Oyster competing with the blue mussel)
- specific to areas of soft sediment environment (Southern North Sea)
- stepstone effect (between windfarms)
ARTIFICIAL REEF EFFECT

- Rapid colonization of artificial hard substrate
- Attraction of high numbers of fish
- Possible foraging opportunities for birds and marine mammals
- Organic enrichment of nearby soft sediment substrate
- Increase in local biomass and species richness
ARTIFICIAL REEF EFFECT

- Changes in species richness pre- and post-construction
- Increase in hard substrate associated fish species from 2 to 8 species

**Species richness - Benthos**

- hard substrate associated species
- soft sediment associated species

<table>
<thead>
<tr>
<th></th>
<th>pre-construction</th>
<th>post-construction</th>
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<tbody>
<tr>
<td>hard substrate</td>
<td>10</td>
<td>100</td>
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<tr>
<td>soft sediment</td>
<td>81</td>
<td>164</td>
</tr>
</tbody>
</table>
ARTIFICIAL REEF EFFECT

- Changes in biomass pre- and post-construction

- 4000fold increase in autumn biomass at turbine footprint
SIZE MATTERS

Autumn epifouling biomass of three foundation types

- **GBF**
  - Intertidal zone: 500 kg AFDW
  - Submerged foundation: 500 kg AFDW
  - Scour protection: 2000 kg AFDW

- **Jacket**
  - Intertidal zone: 50 kg AFDW
  - Submerged foundation: 400 kg AFDW
  - Scour protection: 450 kg AFDW

- **Monopile**
  - Intertidal zone: 200 kg AFDW
  - Submerged foundation: 250 kg AFDW
  - Scour protection: 450 kg AFDW
ARTIFICIAL REEF EFFECT

- Four ‘new’ species for the Belgian part of the North Sea (BPNS)
- 14-fold increase in autumn biomass at the level of wind farm
- Entire energy zone developed (~530 turbines) → maximal increase of autumn biomass by 3% for BPNS (similar to the impact of wrecks)
FUTURE RESEARCH

Before we can think big…

• Define scientifically sound thresholds (at North Sea scale)
• Require cross-windfarm/cross-sectoral international cooperation
• Evaluate impacts at the appropriate level / in the right context
• Address knowledge gaps on cumulative impacts
• Monitor existing wind farms to anticipate/mitigate future impacts
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Any Questions?