



Rijkswaterstaat  
*Ministerie van Infrastructuur en Milieu*

# Dealing with cumulative effects of offshore windfarms on marine ecology

Applying first results in consenting process for  
offshore wind in Dutch North Sea

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Based on research by:

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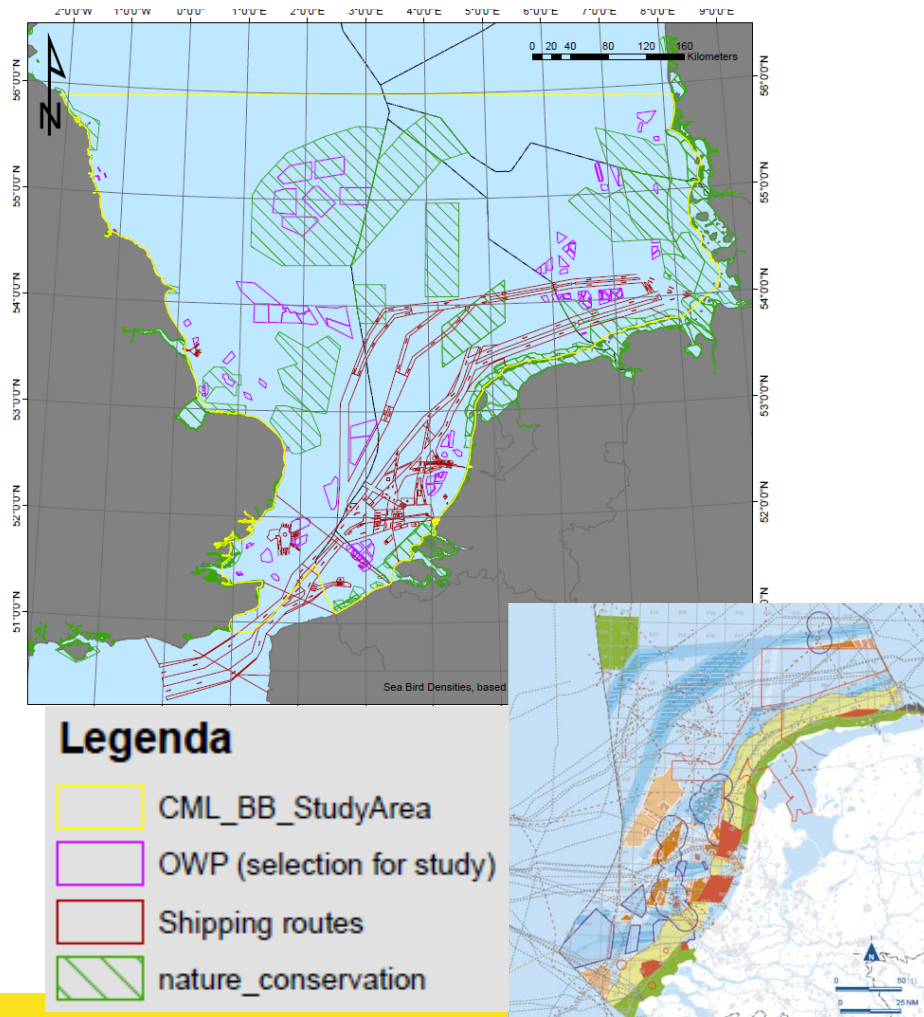
## Why a framework for assessing cumulative effects?

Plans for OWF until 2023 in entire Southern North Sea area:

- 10 large (350 MW) and 5 smaller OWF in NL (total 4450 MW)
- OWF in neighbouring countries, up to c. 8000 turbines

Leading to potentially unacceptable cumulative effects on (marine) wildlife (harbour porpoise, seals, birds, bats)

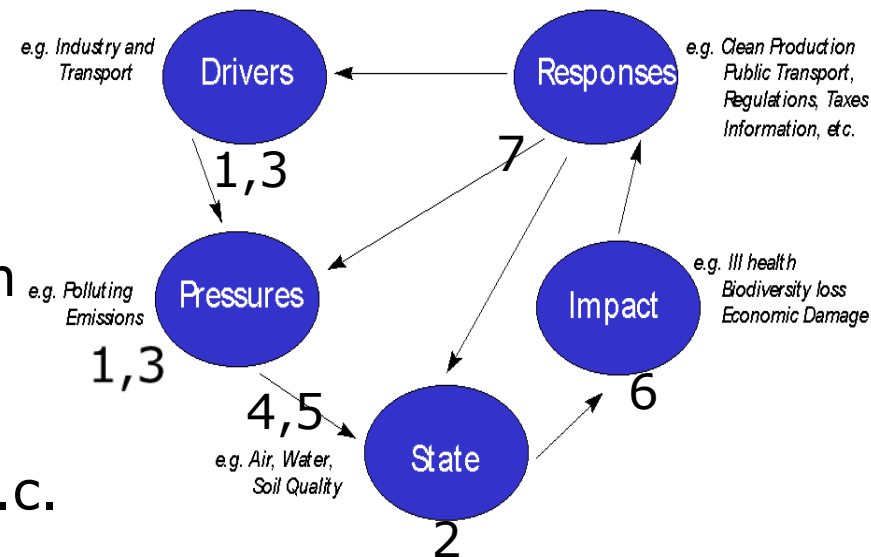
Concern for (legal) consequences for nature conservation (EU guidelines)





## A stepwise approach, based on DPSIR framework

1. 'pressures' from 'driver' offshore wind farms
2. 'state' potentially affected species groups
3. other 'drivers' & 'pressures' affecting same species groups
4. cumulative effect 'pressures' on 'state' relevant species groups
5. cumulative effect significant?
6. effect on ecosystem services (i.c. biodiversity on scale S North Sea)
7. (if needed) 'response' measures (mitigate/compensate)





## Steps 1 and 2: pressures by offshore wind farms - potentially vulnerable species groups

Over entire Southern North Sea

- Construction wind farms:
    - underwater noise production by pile driving
  - Operational wind farms
    - presence of OWF
    - rotation of wind turbine rotor blades
- displacing harbour porpoise → effect on vital rates
  - habitat loss certain seabirds
  - barrier effects for coastal birds moving to and from sea
  - collision risks all birds (Band 2012) and bats



## Step 3: other 'drivers' and 'pressures' for relevant species



- Underwater noise: several sources; additional: (gillnet) fisheries (*not yet quantified*)
- Disturbance by main shipping routes (*included*); additional: fisheries, (oil) pollution, sand extraction, etc. (*not yet quantified*)
- Land-based wind farms & any other threats within distribution area (*not yet quantified, easily underestimated*)
- Largely unknown as yet (*not yet considered*)



## Steps 4, 5 and 6: assessing cumulative effects

Choice for Potential Biological Removal (PBR) as maximum acceptable impact, allows for scanty population data



- **PBR exceeded by unmitigated noise pile driving** (cumulation with other noise sources)
- PBR unlikely exceeded by habitat loss at least until 2023
- Barrier effects unlikely
- **PBR exceeded for 3 *Larus* gulls** (with 3-4 MW turbines in Dutch waters)
- 40-60% PBR in some species (waders, swans)
- **significant effects not excluded** (huge knowledge gaps)



## Step 7: operational mitigation of impacts for new OWF

For porpoise (and seals):

- Technical means of noise reduction by pile driving
- Consider legal threshold value for noise



For bats:

- Stop turbines during low wind periods in late summer and autumn → bats



For (all) birds:

- Larger (10MW) turbines: less piling, less turbines, wider corridors
- No OWF at less than 10 NM from Dutch coast



All birds and mammals



Coastal birds and 'land'birds



## Remaining knowledge gaps to be addressed vs. possible mitigation

### Ecological findings, urgent:

- Bats: poss. significant effects

### Ecological findings, longer-term :

- Seabirds: no significant habitat loss till 2023

- Migrating 'land'birds: maximum 40-60% PBR in scarce species

### Considerations for policy-making:

- Take up bat research at sea and desk study on population trends

- No urgency; precautionary mitigation? And what could that be?

- Investigate future (> 2023) impact habitat loss on seabirds

- No OWF < 10 NM

- Standstill during 'now-casted' mass migration at rotor height

- More insight in other pressures





## Ambitions for the future (2017-2023 and further...)

- Coordination with neighbouring countries (North Sea wide): governance, piling agenda, maintenance, monitoring & research, Natura 2000
- Include Marine Strategy Framework Directive indicators
- Extend framework to more activities (fisheries, oil and gas production, shipping, sand-extraction, land-based threats...)
- Investigate options for adaptive management (e.g. for time windows beyond 2023)
- ...



## Points for further discussion...

1. Expensive research vs. effective preventive mitigation
2. PBR sufficient as tool for assessing effects?
3. Need for '*worst case*' scenarios in applying precautionary principle?
4. Possible forgotten aspects and future options for mutual learning internationally

More information, see [www.noordzeeloket.nl](http://www.noordzeeloket.nl)