

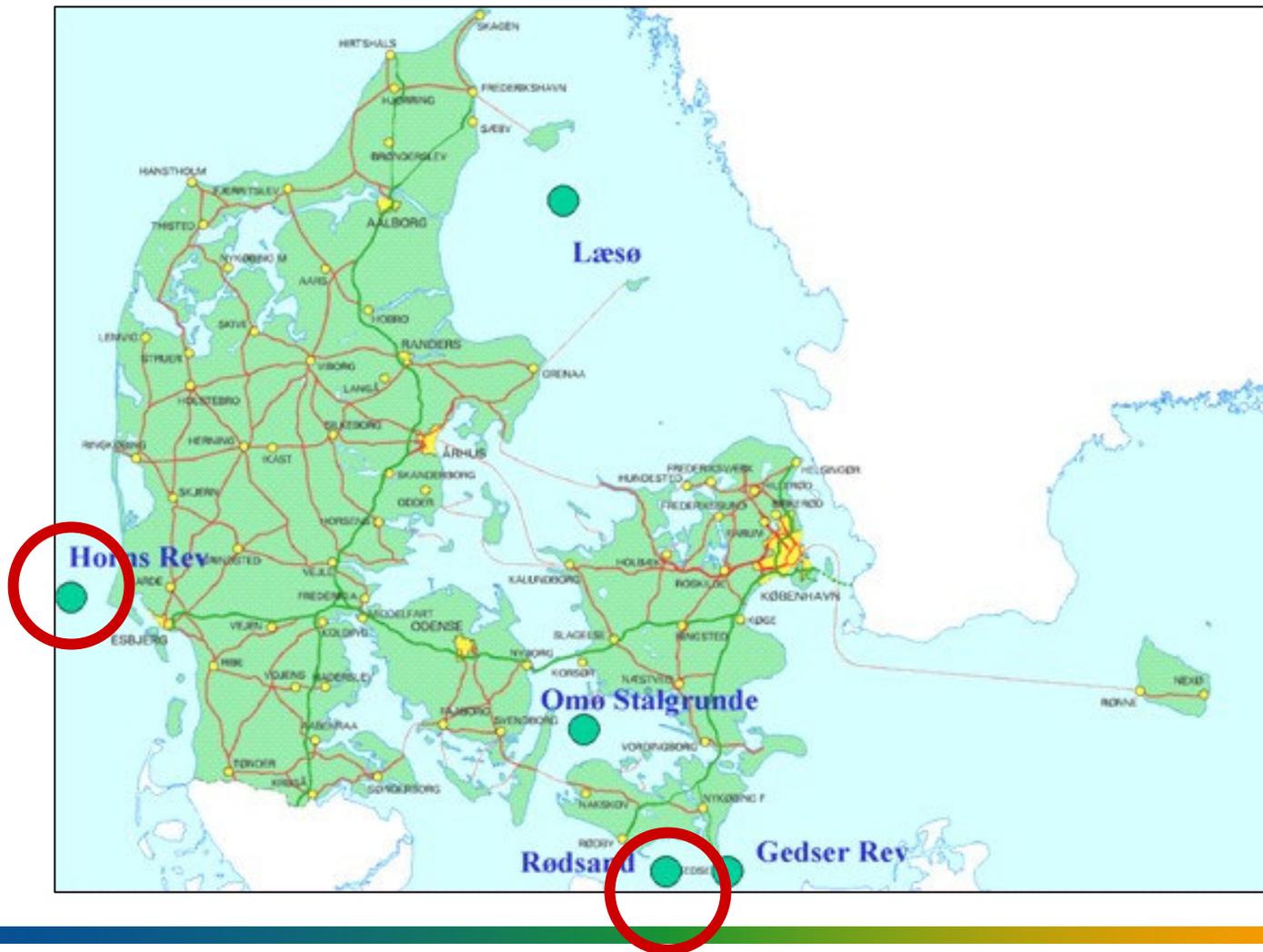
The environmental monitoring programme at Horns Rev and Nysted offshore wind farms

An overview

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Workshop on Offshore Wind Farms
Sigulda, 29-30 May 2008

Actions Plan for Offshore Wind Farms - 1997



The environmental monitoring programme

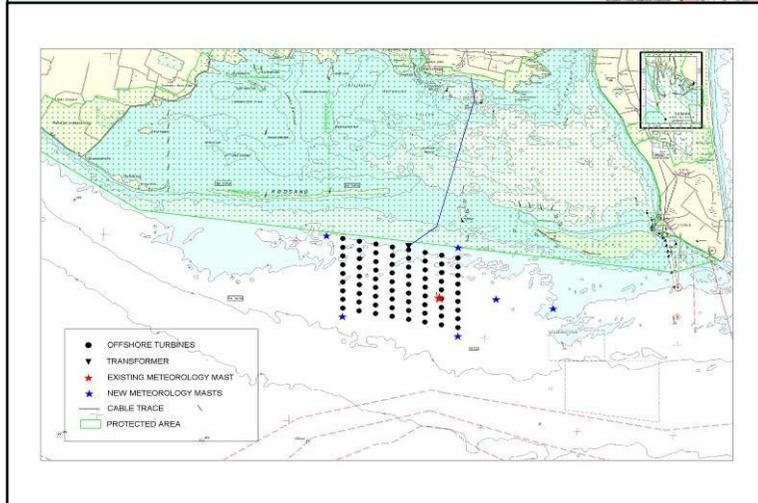
- Demonstration programme for large-scale offshore wind farms
- Horns Rev and Nysted wind farms
- Periode: 2001 – 2006 (1999 – 2006 incl. EIA pre-studies)
- Study setup: Before, during and after studies; impact and reference areas (BACI)
- Budget 11 mill EUR
- Financing: PSO (Energinet.dk)
- Programme management
 - Steering committee – The Environmental Group (ENS, SNS, Vattenfall, DONG)
 - International Advisory Panel of Experts on Marine Ecology (IAPEME)
 - NGO following group

Horns Rev and Nysted Offshore Wind Farm



Horns Rev (2002)

- Turbines: 80 Vestas V80, 2 MW
- Height to tip: 110 m
- Distance to coast 14 km
- Depth 7-14 m



Nysted (2003)

- Turbines: 72 Bonus, 2.3 MW
- Height to tip: 110 m
- Distance to coast 10 km
- Depth 6-10 m

Range of topics

- Hydrodynamic regimes and coastal morphology
- Benthic flora and fauna
- Fish
- Seals
- Harbour porpoise
- Birds
- Visual and socio-economical effects

Benthic flora and fauna - issues

- Introduction of hard substrates and spatial complexity (foundations, scour protection)
- Hydrodynamic effects on sediment and benthic fauna
- Effects of sea cable burial on benthic flora and fauna

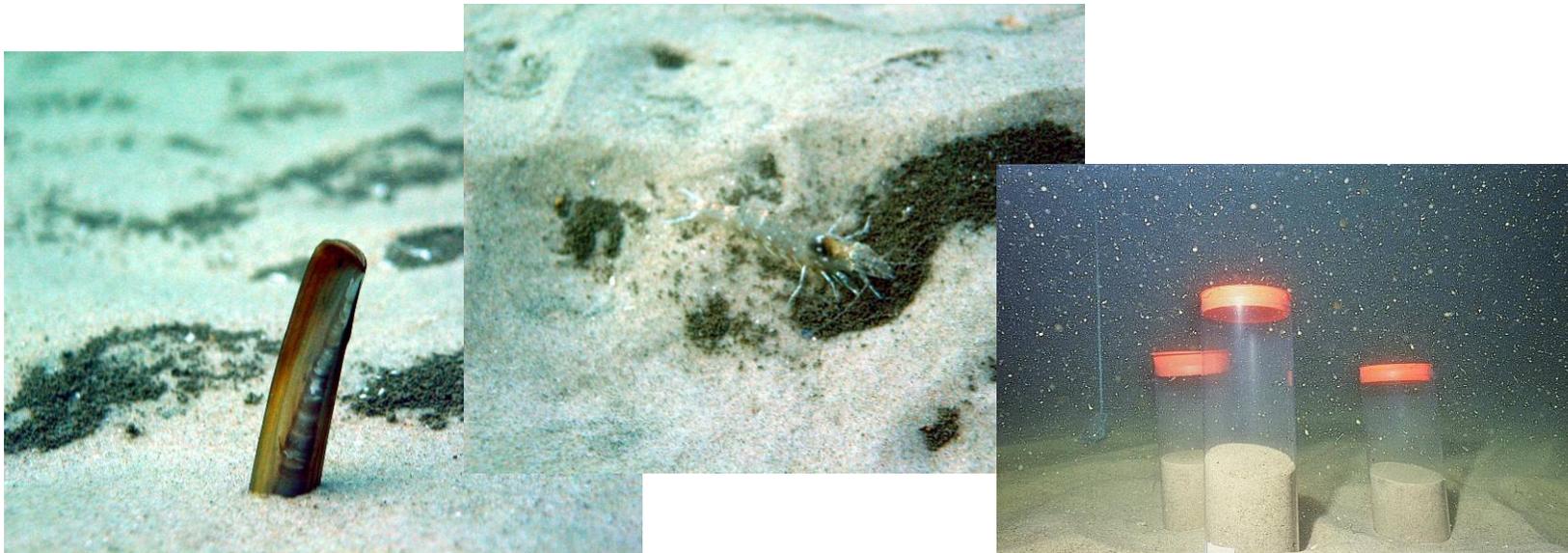
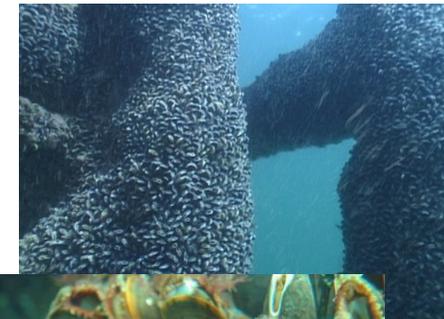
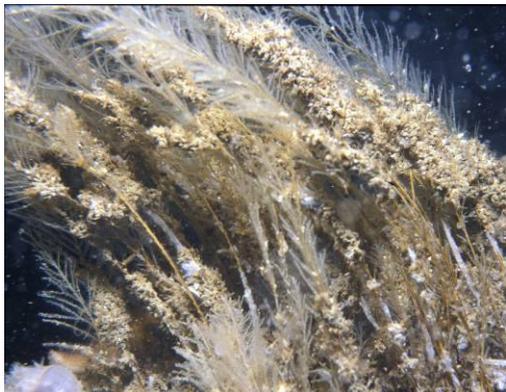


Foto: Maks Klastrup

Benthic flora and fauna - results

- Increased biomass (factor 50-150; <10%)
- Increased diversity (colonisation by prioritised species)
- Differences in hard bottom communities between sites (change, composition, succession)
- Infauna communities not markedly affected
- Local effects around sea cable, gradual recovery



Fotos: Maks Klastrup, Jens Christensen

Fish - issues

- "Park effect"
- Artificial reef effect
- Hydrodynamic effects on sandeel habitat
- Sea cable electromagnetic field effects



Fotos: Jens Christensen, Naturfocus



Fish - results

- No marked difference between wind farm and reference areas
- No marked artificial reef effect demonstrated
- Plenty of sandeel in the wind farm
- EMF effects apparently small, though no clear result



Fotos: Maks Klastrup, Jens Christensen

Marine mammals - issues

- Turbine underwater noise, boat traffic
- Changes in food availability
- Pile driving noise

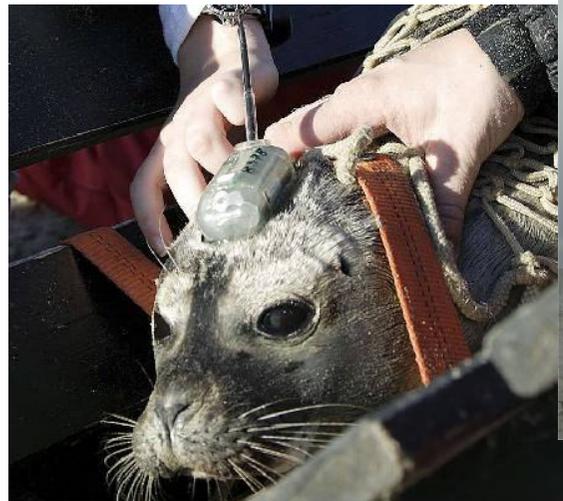


Foto: Svend Tougaard



Foto: Jonas Teilmann

Marine mammals - results

- Seals: No effects on overall presence (construction, operation)
- Harbour Porpoise
 - HR: No effect on overall presence (construction, operation)
 - N: post-construction decline – recovering (?)
- Both: Affected by pile driving



Foto: Svend Tougaard



Foto: Jonas Teilmann

Conclusion

"... confirm that, under the right conditions, even big wind farms pose low risk to birds, mammals and fish, even though there will be changes in the living conditions of some species by an increase in habitat heterogeneity"

The Environmental Group in the book *Danish offshore wind. Key environmental issues*

"The studies have shown that the Nysted and Horns Rev offshore wind farms have had very little impact on the environment, neither during their construction nor during their operational phases"

IAPEME in the book *Danish offshore wind. Key environmental issues*

Some important lessons

- Offshore environmental studies are difficult
 - Logistics
 - Many other factors than wind farms
- Effects on sediment, benthos, fish and marine mammals to be found at a small scale (operation)
- It may take some years for effects to stabilise
 - Gradual development of benthic communities
 - Habituation
- Bird surveys – without controlling confounding factors – may be difficult to interpret

To be continued

Follow-up programme decided

- Focus on remaining “important” issues, and international cooperation
- Priorities being discussed
- Same setup
- Budget ~1 mill EUR
- First study done and reported (Tony!)

Reporting

- International conference, November 2006
- Popular reporting
 - booklet
 - book: *Danish Offshore Wind – Key environmental issues**
ens.netboghandel.dk
- Technical reports
 - www.ens.dk/offshorewind
 - www.hornsrev.dk
 - www.nystedhavmoellepark.dk
- Scientific papers

*(<http://ens.netboghandel.dk/PUBL.asp?page=publ&objno=16288226>,
<http://www.ens.dk/graphics/Publikationer/Havvindmoeller/index.htm>)



Thanks for listening!

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