State of the Science Workshop November 18

Joint Nature Conservation Committee

Lessons learned in Europe: the effects of offshore wind development on marine mammals

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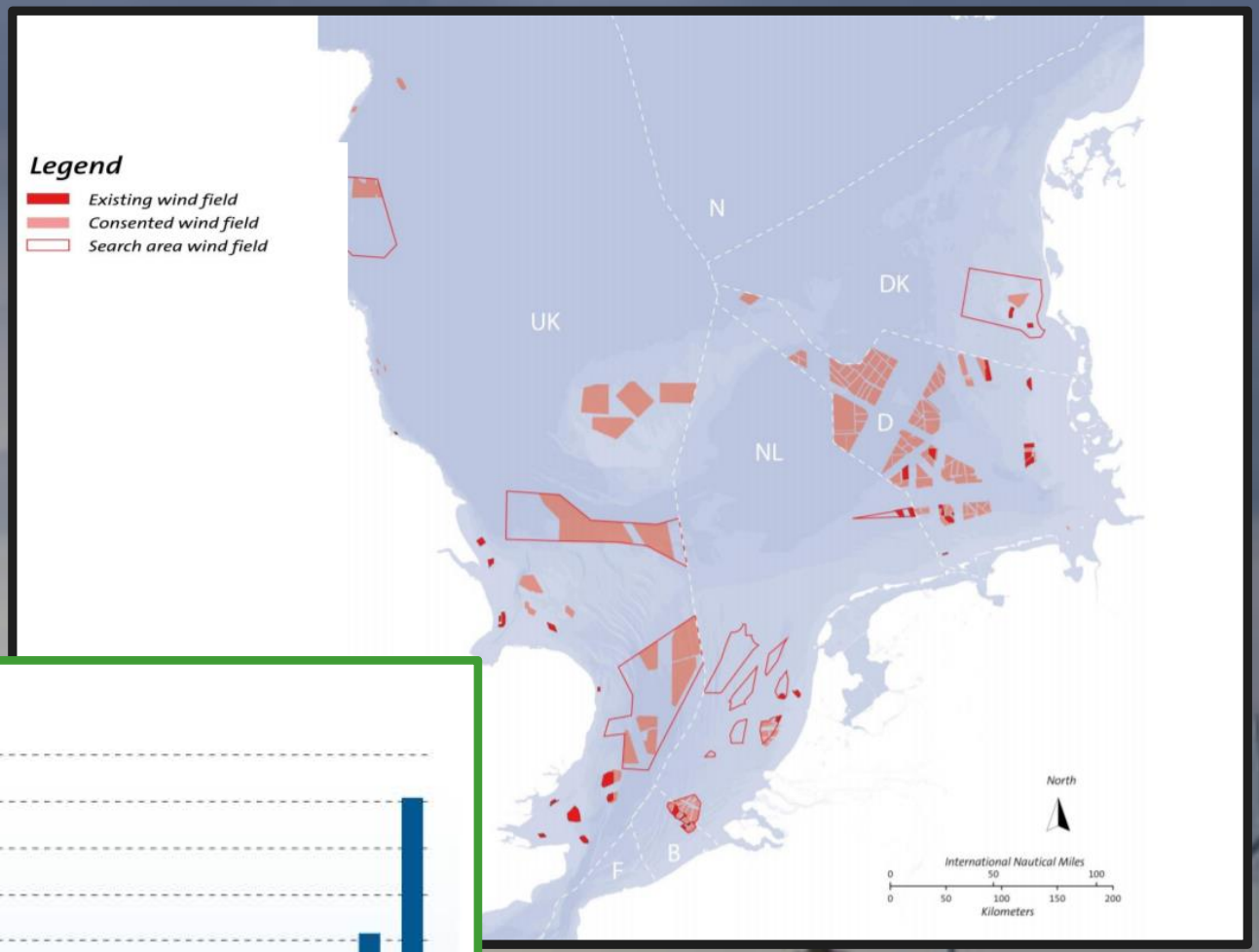
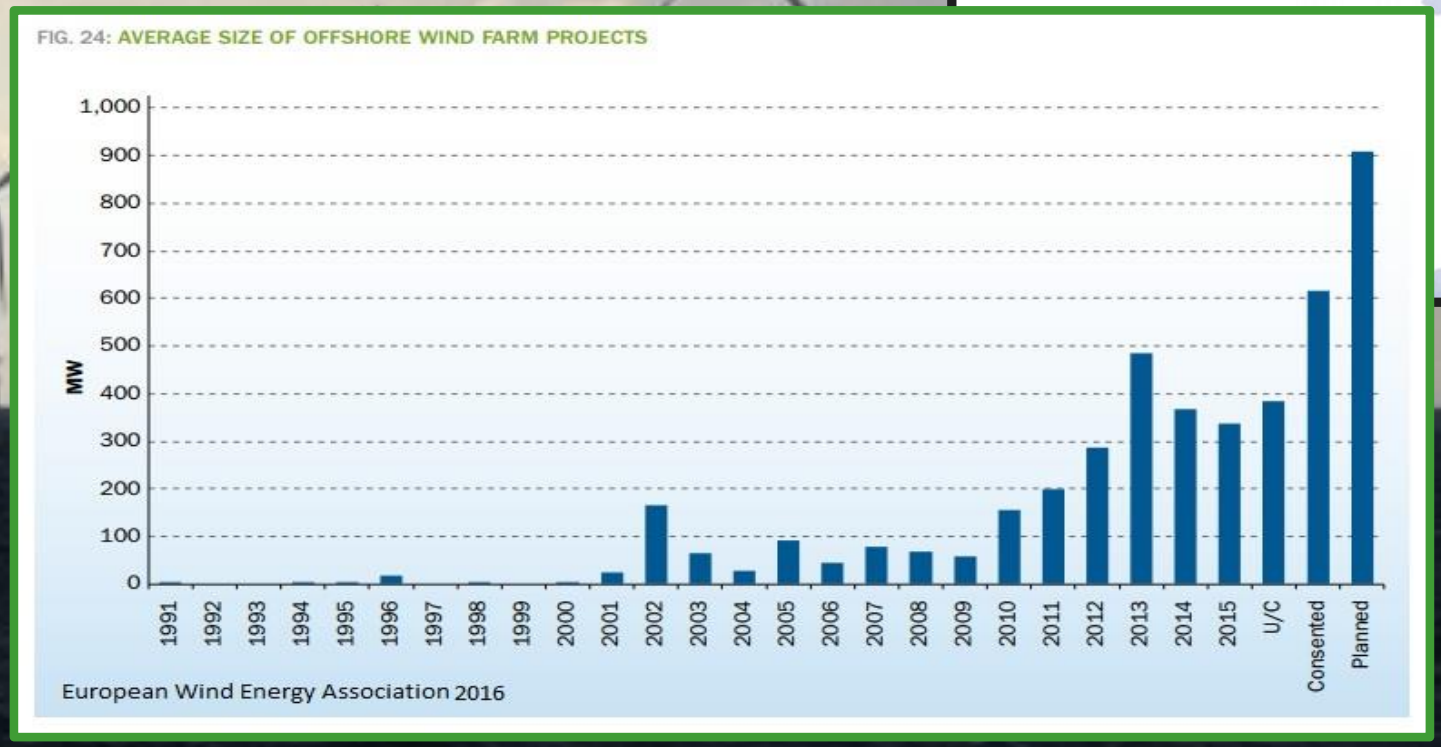
> 80% of global Offshore Wind Energy is in Europe





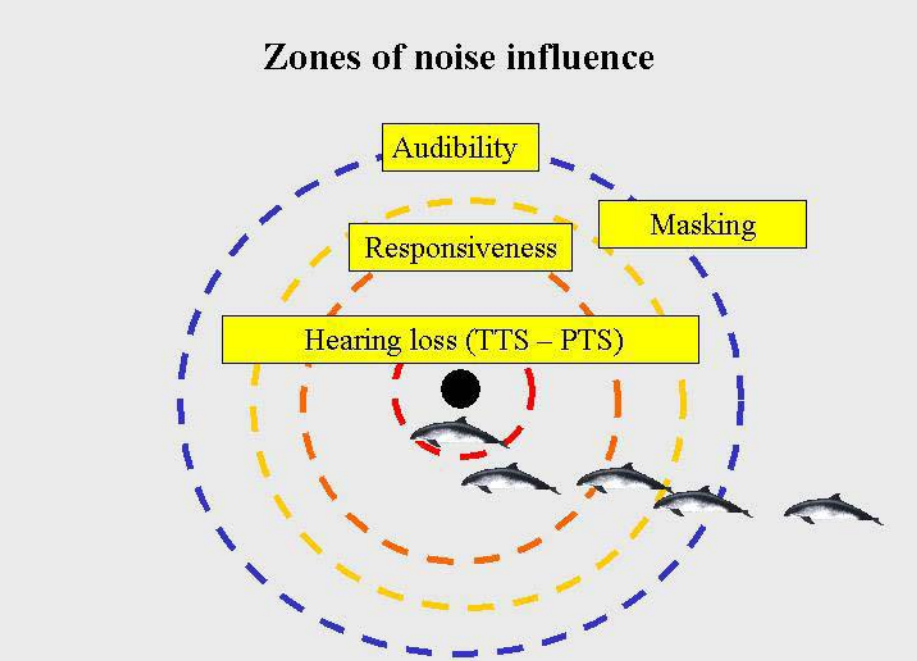
All cetaceans are protected from killing, injury and disturbance

Habitats Directive
Article 12

Marine mammals use sound for a variety of functions

- Finding food
- Navigation
- Predator detection
- Communication (Mating, Social)

Human made sounds can affect them in several ways



After Richardson et al 1995

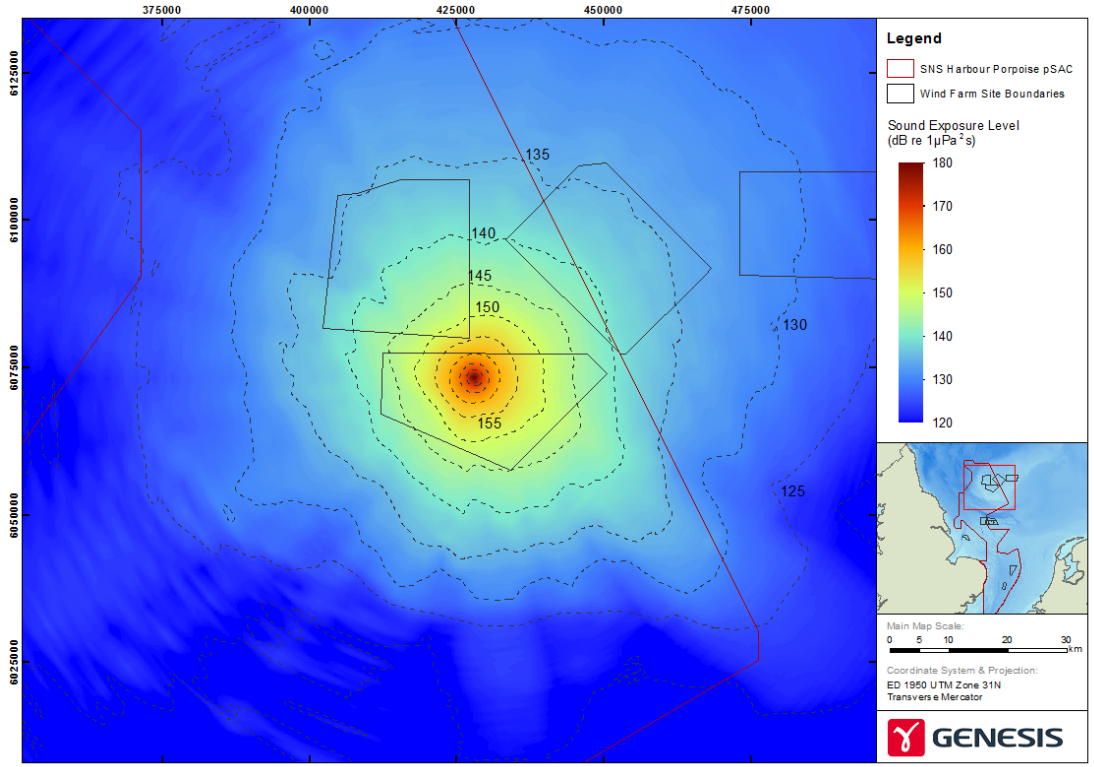
Direct effects of offshore wind development on marine mammals

- Pre-installation: high resolution geophysical surveys and vessel noise, unexploded ordnance

- During installation: vessel noise, ADD noise, **piling noise** from installation of turbine foundations

- Operation: operational noise from turbines
  (see https://www2.gov.scot/Resource/0043/00433960.pdf)

Risk of hearing damage and disturbance from piling noise



Risk of hearing damage

-Onset of Permanent Threshold Shift-

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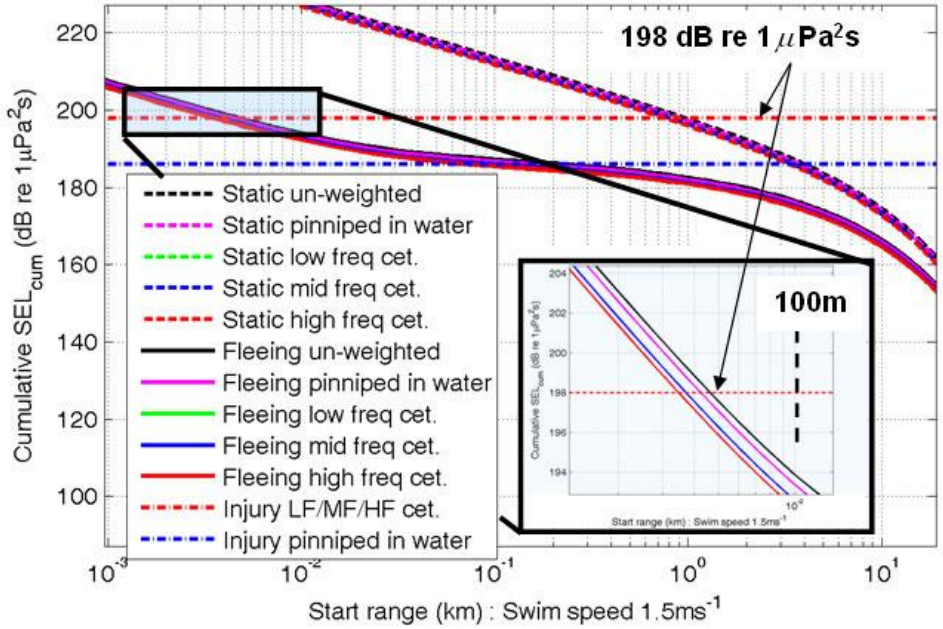
- Key parameter: cumulative Sound Exposure Level (weighted)
- Assumed harbour porpoise swims away from the sound source at 1.5 m/s
- NMFS 2018 thresholds/functions for the onset of Permanent Threshold Shift

- Injury risk to porpoise within 1-2km from piling
- Some Acoustic Deterrent Devices* effective at deterring animals at those distances

*Up coming JNCC guide to ADDs



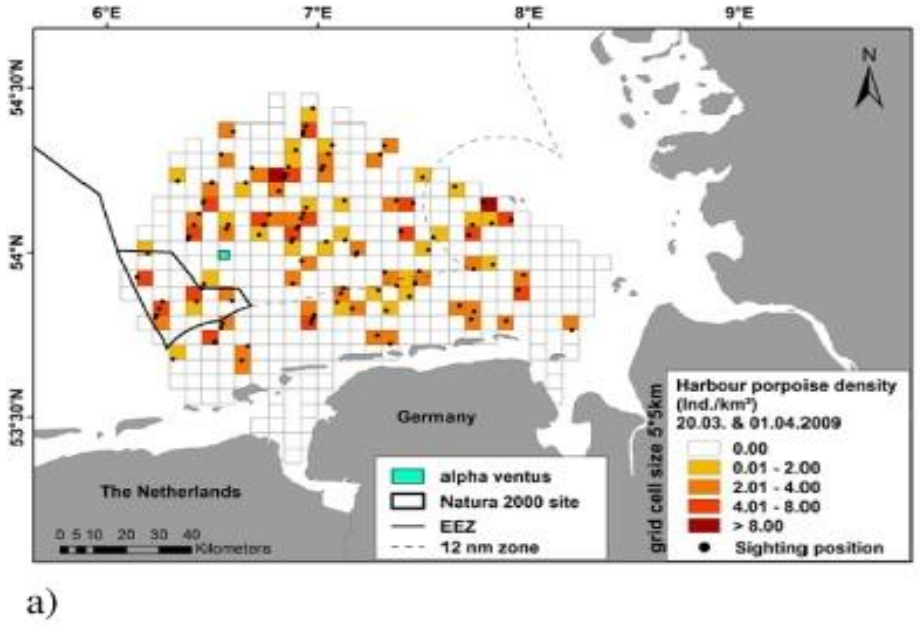
Lepper et al 2012

Risk of injury to seals

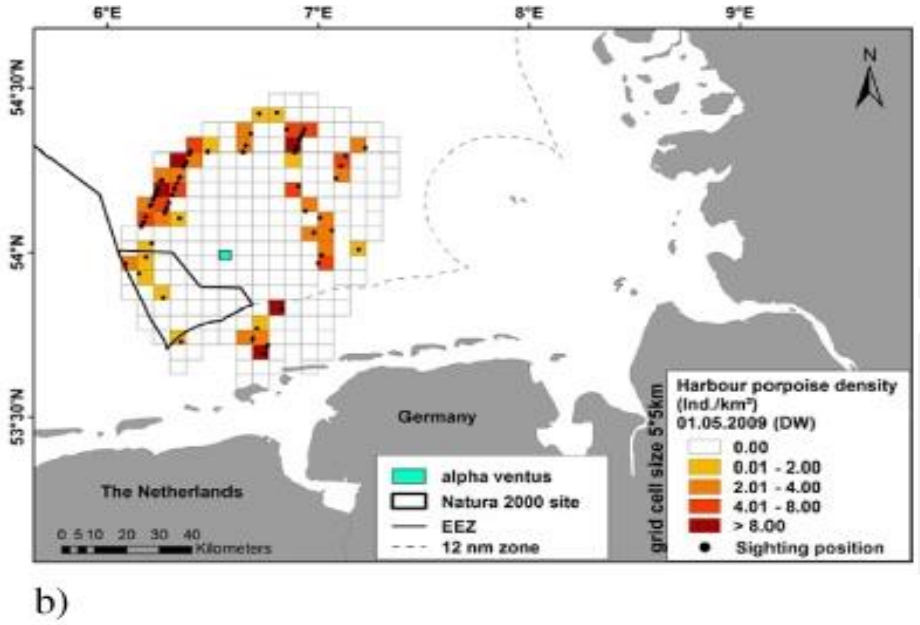
Hastie et al. 2015. Journal Applied Ecology. predicted that half of the tagged seals received sound levels from pile driving that exceeded auditory damage thresholds for pinnipeds.

Different conclusions may occur with different thresholds, i.e. not been compared to new NOAA thresholds for example

Risk of disturbance/ displacement



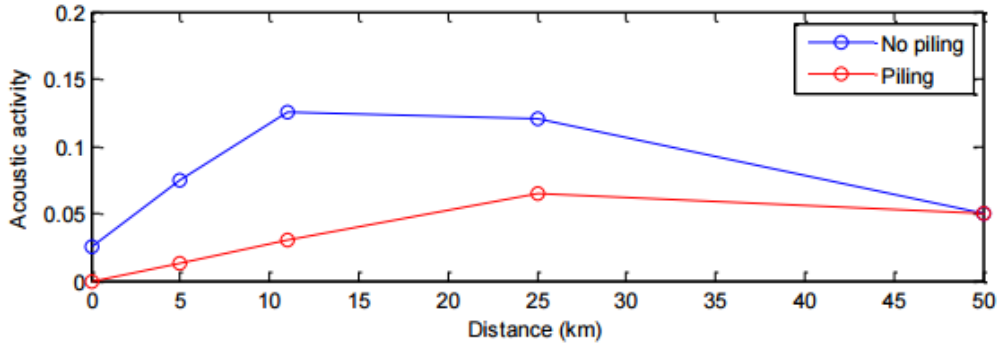
a)



b)

- Strong avoidance response within 20km of piling

- Return time is relatively short - within a day



Michael Dähne et al 2013 Environ. Res. Lett.

Review of studies in Germany

Effects of offshore pile driving on harbour porpoise abundance in the German Bight

Assessment of Noise Effects

Final Report

Miriam J. Brandt, Anne-Cécile Dragon, Ansgar Diederichs, Alexander Schubert, Vladislav Kosarev, Georg Nehls
Veronika Wahl, Andreas Michalik, Alexander Braasch, Claus Hinz, Christian Ketzer, Dieter Todeskino
Marco Gauger, Martin Laczny, Werner Piper

Husum, June 2016
Prepared for Offshore Forum Windenergie

- Median noise levels during noise mitigated piling ~ about 10 dB lower than those during unmitigated piling. But high variability

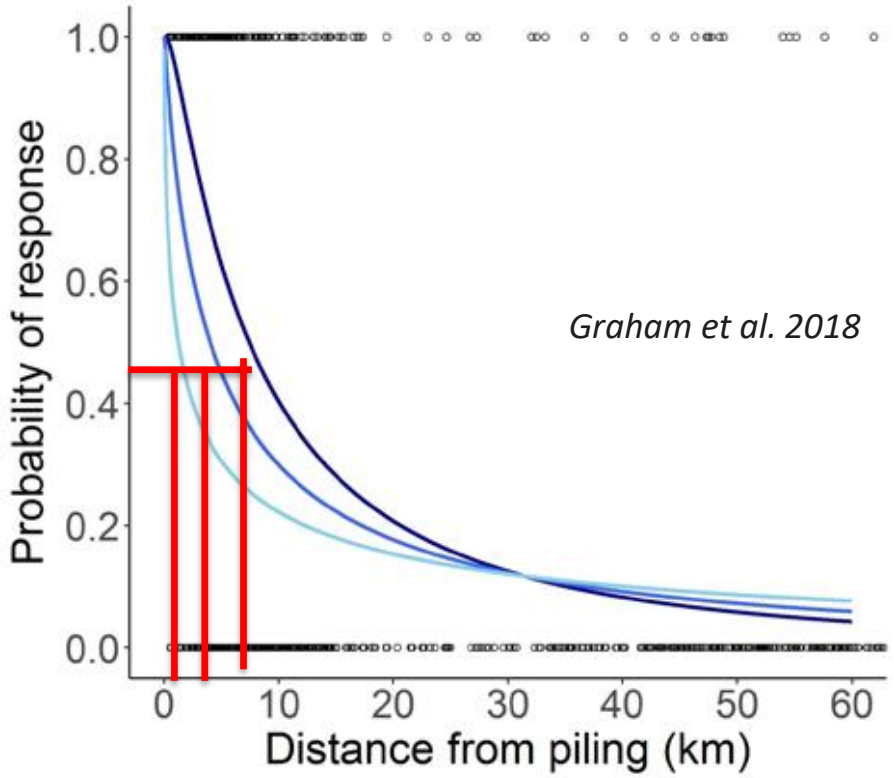
- Decline in porpoise detections was found at noise levels above 143 dB SEL, but not all porpoises left the noise impacted area at that noise level

- Seal scarer/ADD has a further reaching effect than piling with noise mitigation

- Decline in porpoise detections within 5km, 24h before piling – likely related to vessel activities

- Some evidence of habituation to piling at one of the wind farms

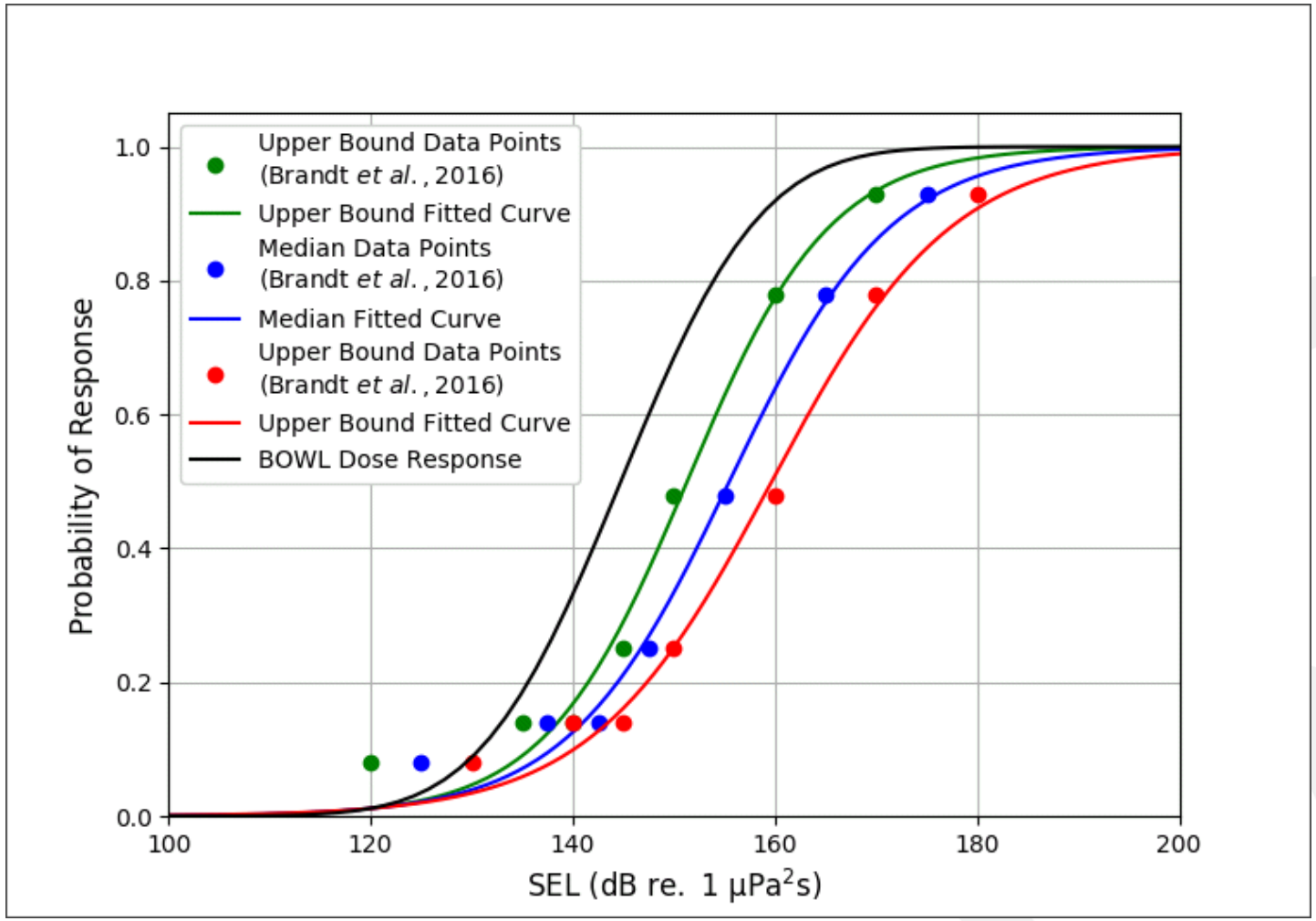
Strategic Regional Construction Marine Mammal Monitoring Programme (Moray Firth, Scotland)



Graham et al. 2018

- 50% probability of harbour porpoise response within 7.4km from piling
- This range is reduced during construction period to within 1.3km

Estimating disturbance ranges- received sound level response curves-

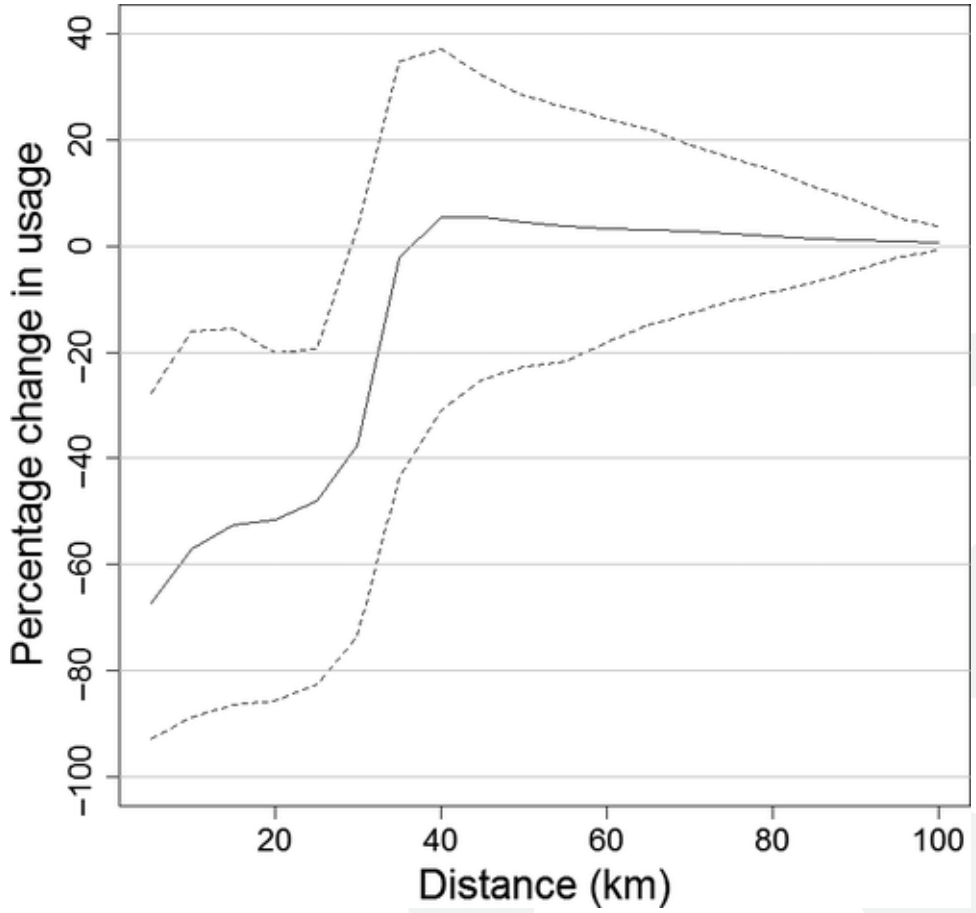


Source: BEIS RoC , 2018

https://www.gov.uk/government/consultations/southern-north-sea-review-of-consents-draft-habitats-regulations-assessment-hra

Harbour seals in The Wash, UK

Russel et al 2016.
Journal of Applied Ecology



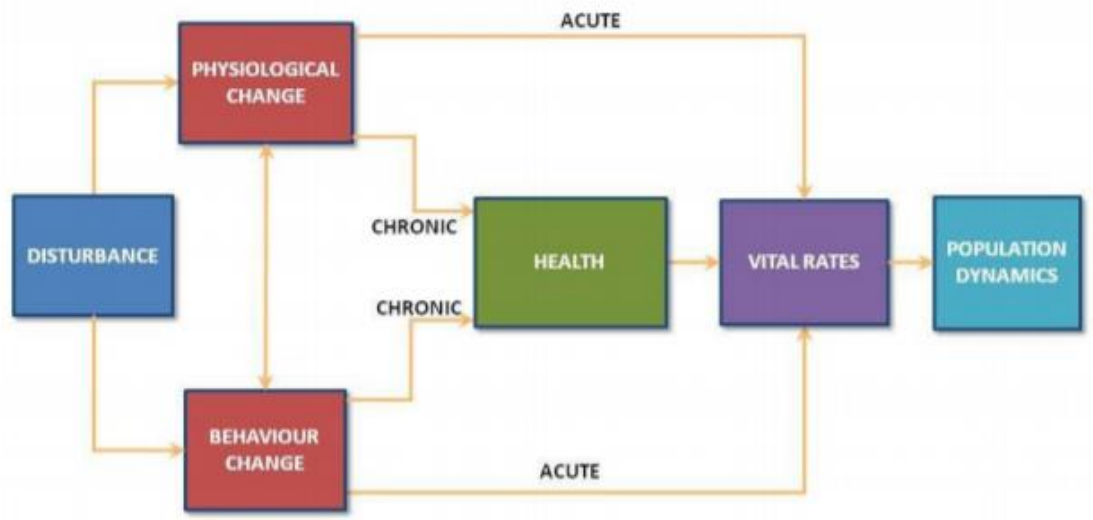
- During piling, seal abundance was significantly reduced up to 25 km from the piling activity
- Within 2 hours of cessation of pile driving seal abundance and distribution as before

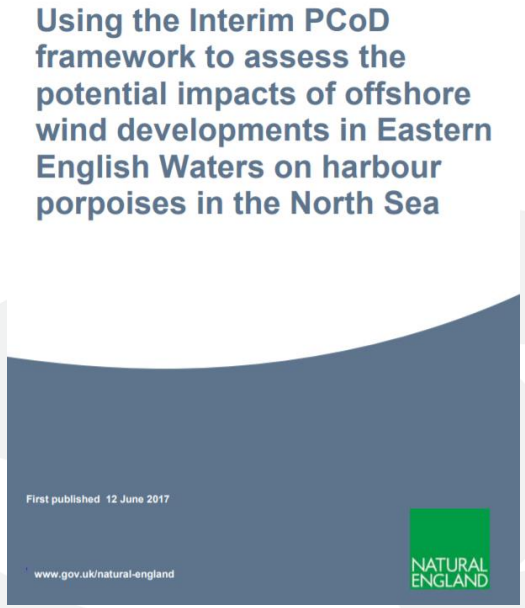
Bubble curtains as mitigation for pile driving

‘Operation of the Big Bubble curtain 2 reduced the potential area of disturbance by pile driving for harbour porpoises **by 90%’.** *Nehls et al. 2016; Dhane et al 2017*

iPCoD

– interim Population Consequences of Disturbance model-



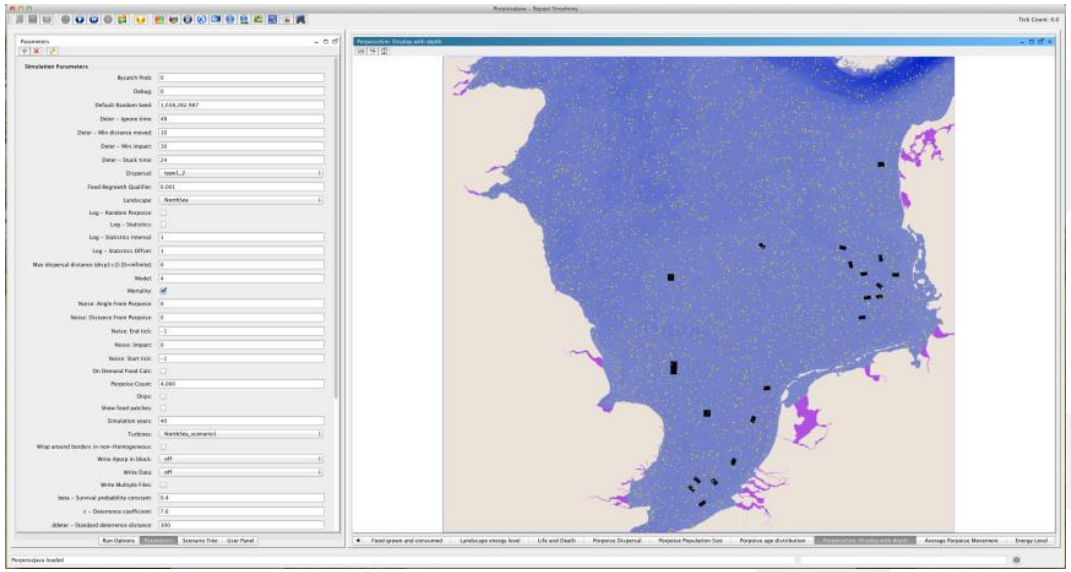


Booth et al 2017.

Expert elicitation: PTS onset and Disturbance effects on survival and reproduction

SMRU Consulting
understand • assess • mitigate

Disturbance Effects on the Harbour Porpoise Population in the North Sea



Spatially explicit modelling framework for predicting impacts of anthropogenic disturbances on marine populations based on their influence on animal movement and foraging

Nabe-Nielsen et al 2018. *Conservation Letters*

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Report 607

Guide to Population Models used in Marine Mammal Impact Assessment (2017)

Sparling, C.E., Thompson, D. & Booth, C.G.

This report is intended to be an accessible summary reference guide to marine mammal population modelling for statutory nature conservation body (SNCB) advisers and practitioners dealing with assessments of the potential impacts on marine mammal populations.

Introduction

The prediction of the population level consequences of impacts on marine mammals as a result of proposed marine developments is a crucial part of the impact assessment and decision making process. A variety of different population modelling approaches have been used in recent years to provide information for consenting decisions about the potential magnitude and significance of impacts. The range of models and approaches that have been adopted and presented in Environmental Statements and HRA reports are quite complex and the variety can be confusing to the non-specialist.

This guide first provides an overview of the main generic types of approaches used in population assessment/decision making (Section 2) before exploring a few specific examples in more detail in Section 3. Section 4 provides an overview of the main issues arising from this overview and examples and comments on recent developments and future directions. A glossary of terms is provided at the end of the guide.

Download

- Guide to Population Models used in Marine Mammal Impact Assessment (PDF, 1435 kb)

You will need the free Adobe Acrobat Reader to view this document.

ISSN 0963-8901

Please cite as: Sparling, C.E., Thompson, D. & Booth, C.G., (2017), Guide to Population Models used in Marine Mammal Impact Assessment. JNCC Report 607. ISSN 0963-8901

SMRU Consulting
understand • assess • mitigate

http://jncc.defra.gov.uk/page-7446

Future research

- Behavioural responses to piling from different species
- Effects on health – more subtle effects
- Foraging success/body condition/energy budgets
- Individual based studies of reproduction and survival/long term time series

WOZEP
DUTCH GOVERNMENTAL OFFSHORE WIND ECOLOGICAL PROGRAMME

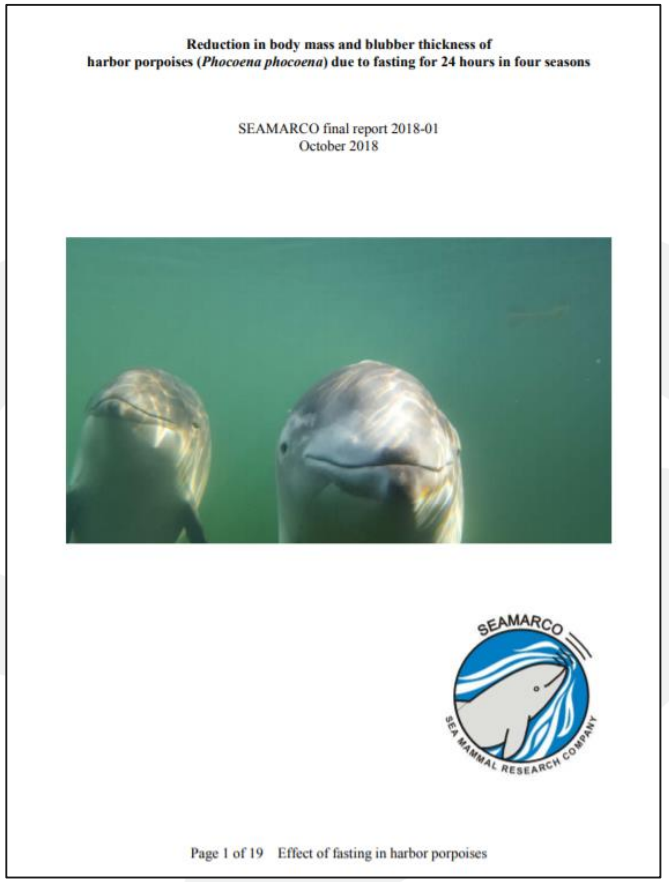
Rijkswaterstaat
Ministry of Infrastructure and the Environment

RWS UNCLASSIFIED

Offshore wind energy ecological programme (Wozep)

Monitoring and research programme 2017-2021

Date 24 november 2016
Status Final



Ron Kastelein's work

Summary

- Pile driving is the main source of effect, but general vessel construction noise has an effect before piling starts
- Injury risk for species usually within 1-2km and can usually be mitigated using variety of techniques
- Harbour porpoise and seals displaced in a gradient fashion away from the noise source ~ 7- 20km- but usually return to the area relatively quickly
- Population consequences of disturbance on species is unknown- most assessment approaches use expert opinion- need monitoring data to validate models- decrease uncertainty

Thank you for listening!

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Potential further reading

- ORJIP (Offshore Renewables Joint Industry Programme); https://www.carbontrust.com/offshore-wind/orjip/

- iPcoD; http://publications.naturalengland.org.uk/publication/4813967957950464 and http://jncc.defra.gov.uk/page-7469

- DEPONS; http://bios.au.dk/om-instituttet/organisation/havpattedyrforskning/projekter/depons/ and https://dce2.au.dk/pub/SR186.pdf

- Marine Scotland Regional Advisory Groups;
  - Moray Firth Regional Advisory Group (MFRAG);
    https://www2.gov.scot/Topics/marine/Licensing/marine/scoping/mfrag
  - Forth and Tay Regional Advisory Group (FTRAG)
    https://www2.gov.scot/Topics/marine/Licensing/marine/scoping/ftrag

- Industry evidence programme - offshore wind;
  https://www.researchgate.net/profile/Rufus_Howard/publication/325902224_Industry_Evidence_Programme_Offshore_Wind_Farms-Pilot_Industry_Evidence_Base/links/5b2b9793aca272821e461b11/Industry-Evidence-Programme-Offshore-Wind-Farms-Pilot-Industry-Evidence-Base.pdf