How do cumulative effects of offshore wind farms scale with increasing exposure to seabird breeding colonies?

Christopher J Pollock, Deena Mobbs, Adam Butler, Oliver Leedham, Francis Daunt & Kate Searle
chrpol@ceh.ac.uk

UK Centre for Ecology & Hydrology

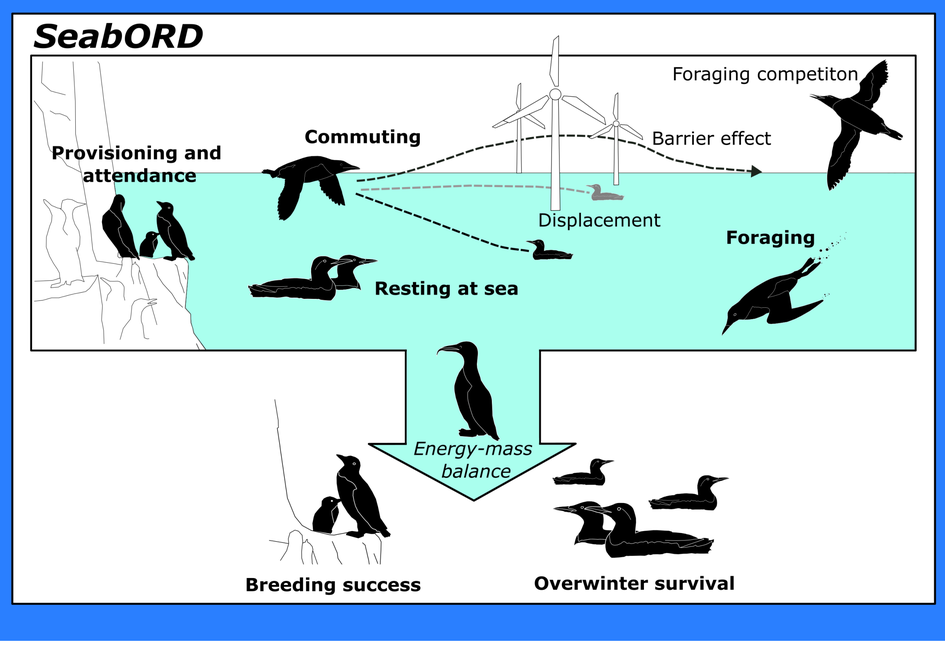
BioSS

Introduction

Offshore renewable developments (ORDs) may impact seabirds by causing them to fly farther to reach foraging grounds (**barrier effect**) or by excluding them from habitat (**displacement**).

Predicting these sublethal impacts at population level is complex as they are mediated through **altered behaviour** which may lead to abandoned **breeding attempts** or result in **decreases in adult condition**.

Furthermore, the proposed scale of ORD development requires an understanding of **cumulative effects**: the impact of multiple ORDs



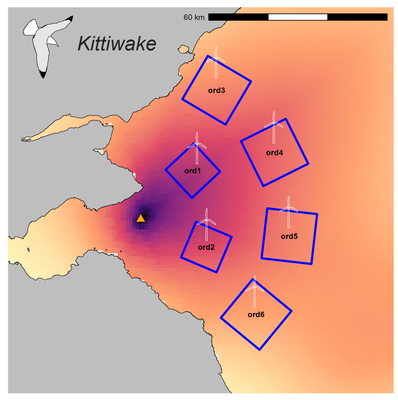
SeabORD is an **individual-based model** that predicts how these sublethal effects impact at population level by simulating the ecological processes driving individual responses.

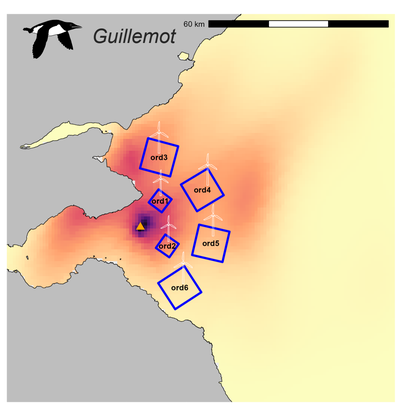
We predict the demographic consequences of multiple ORDs on Black legged kittiwakes (*Rissa tridactyla*) and Common guillemots (*Uria aalge*) from a population in the North Sea (Isle of May).

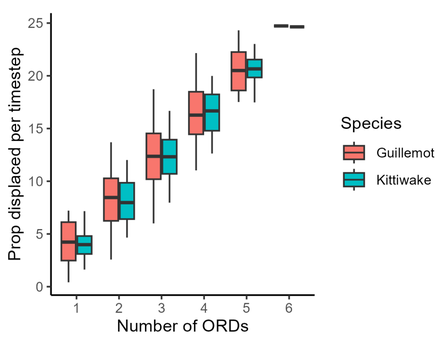
Inputs

1. Select species and corresponding bird distribution maps
2. Prey distribution maps and prey levels
3. ORD footprints and characteristics

1. Kittiwake/Guillemots from the Isle of May
2. Uniform prey distribution
3. Six footprints with all potential combinations from 1 up to 6 footprints (*N* combos = 63). Proportion of birds that experience displacement = 60%



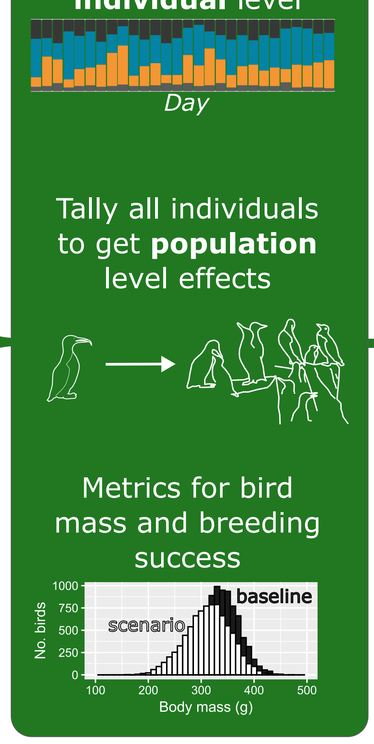




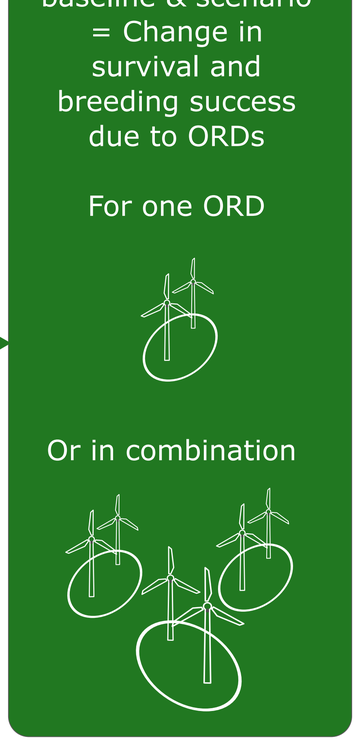
Different scenarios result in up to 25% birds being displaced per timestep

Simulate individuals

Outputs

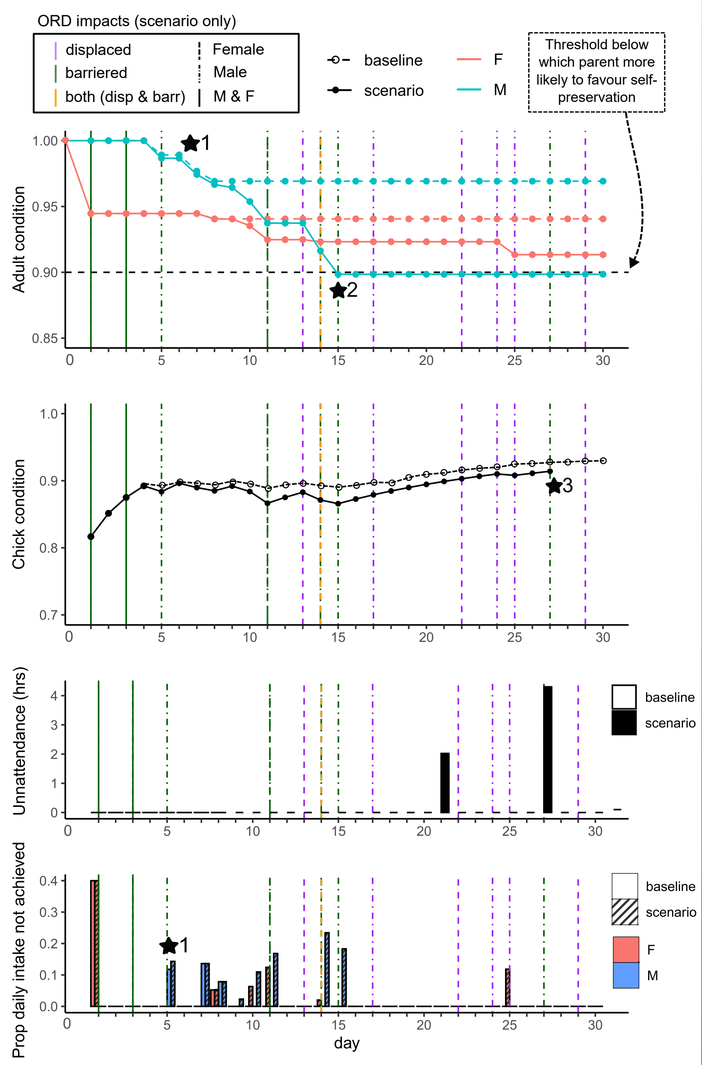


Application



Individual level

These plots tracks the condition of one matched (baseline & scenario) pair of breeding adults and their chick throughout a simulated breeeding season (30 days) highlighting the consequences of their interactions with ORDs

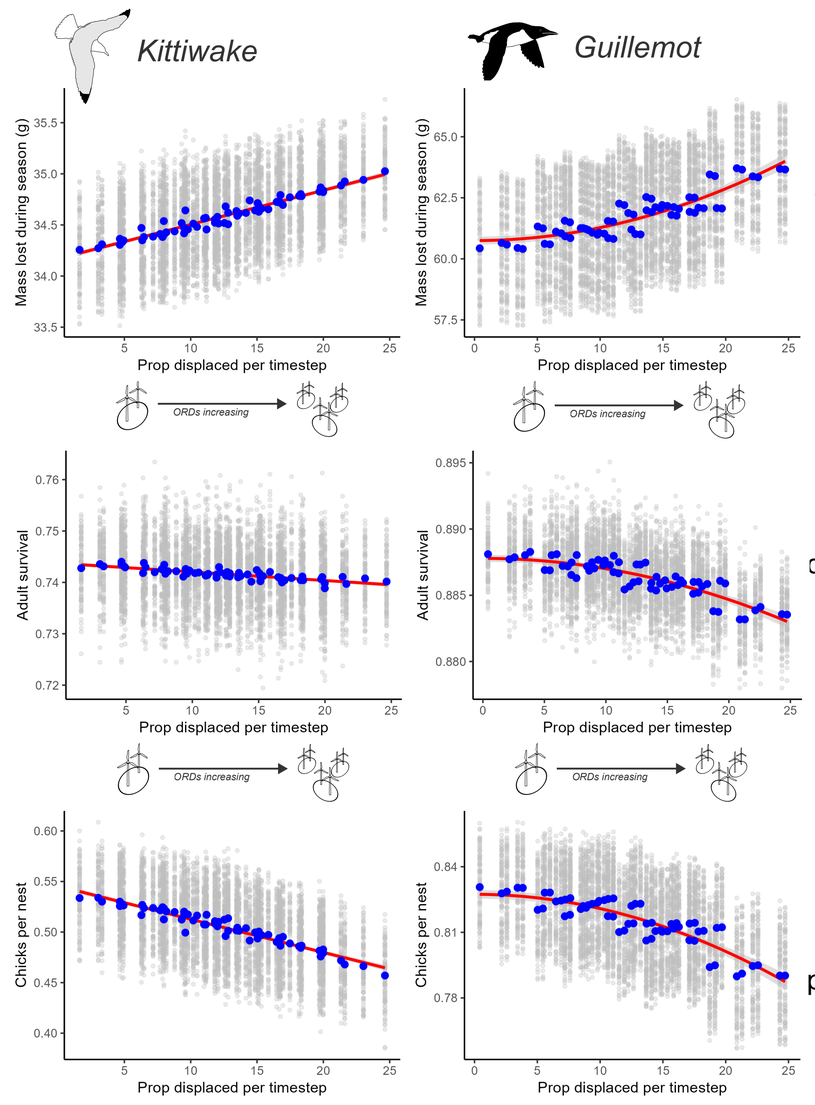


★1 Condition of barriered male begins to diverge from baseline male, due to achieving a lower daily intake

★2 Further divergence results in this male's condition falling below a behavioural threshold

★3 This results in the scenario chick dying due to being unattended for 4 hours on day 27, while the baseline chick survives

Population level



Scenario impacts on demographic rates (i.e. ORD only)

With increasing ORD interaction:

Adult mass loss over breeding season increases

Overwinter suvival decreases (a function of mass at the end of breeding season)

Breeding success decreases, showing greater declines than predicted for adult mass loss

Key takeaways:

- We predict that population level impacts on breeding success and adult survival scale positively with increasing exposure to cumulative ORDs, and that these processes may not be linear (see guillemot results), as currently assumed in the UK assessment process.
- This highlights the importance of using a mechanistic approach in assessing ORD impacts.

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PrePARED Predators + Prey Around Renewable Energy Developments

Offshore Wind Evidence + Change Programme

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enquiries@ceh.ac.uk
www.ceh.ac.uk