

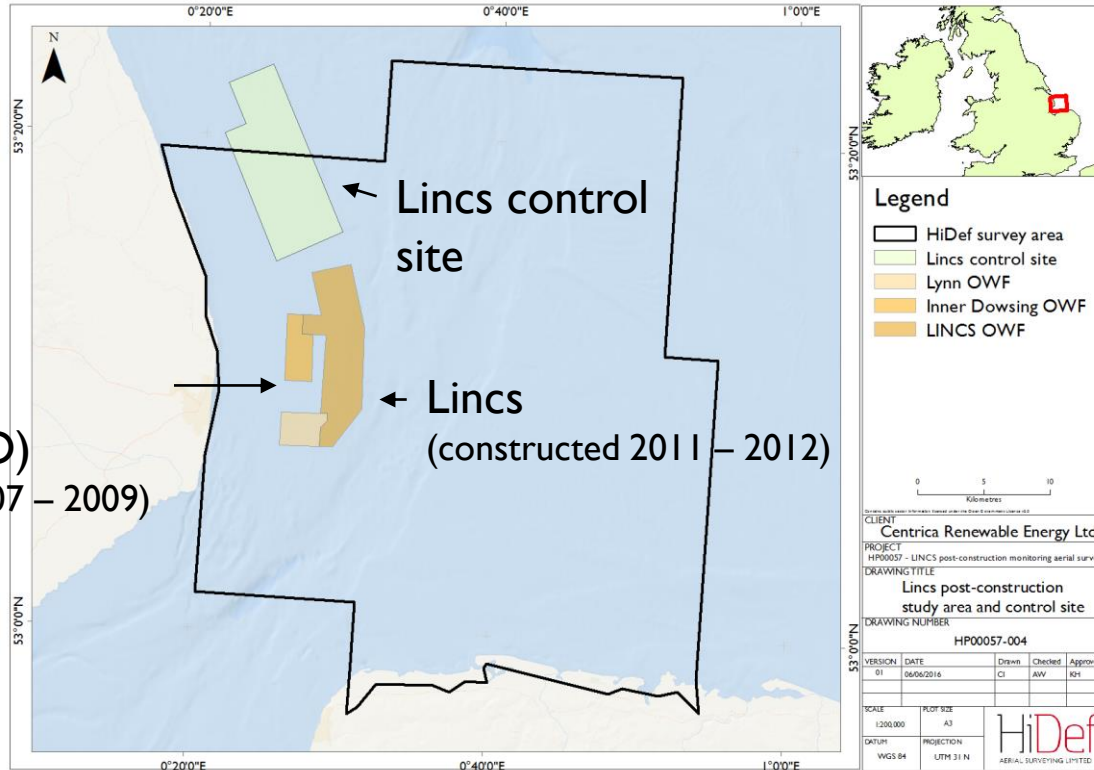
BioConsult diver workshop

Operational effects of Lincs and LID
wind farms on red-throated divers in
the Greater Wash

24 – 25 November 2016

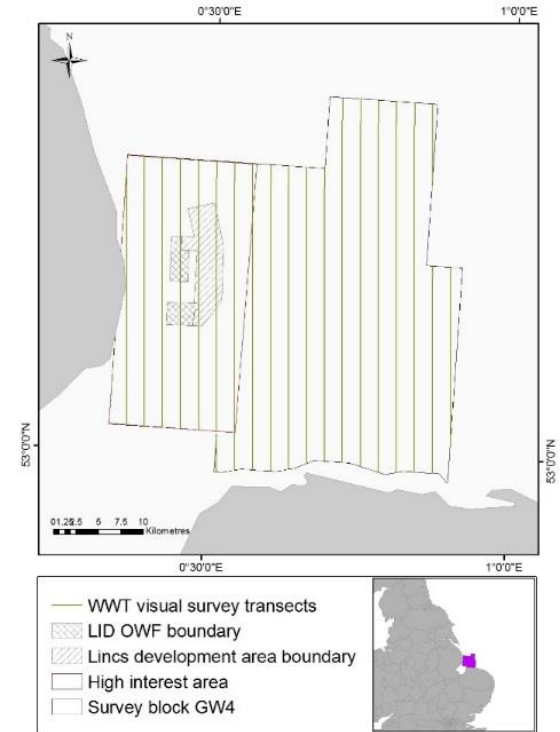
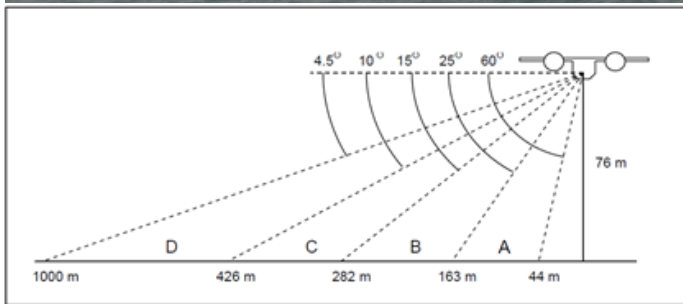
Background

Lynn & Inner
Dowsing (LID)
(constructed 2007 – 2009)



Survey data

November
2003 to
March 2010

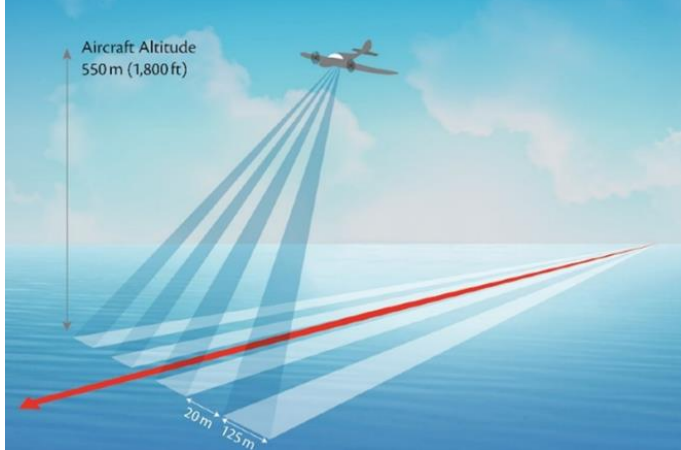


Survey data

2003 to 2012



Survey data



January 2010 to
March 2016

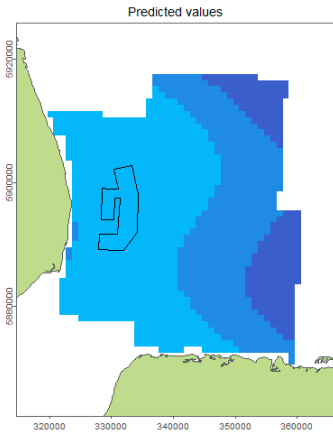
Data analysis

- Used spatially explicit density surface modelling approach to generate predictive grids for 9 receptor species / species groups;
- Used the ‘Complex Region Spatial Smoother’ (CReSS) spatial modelling method (Scott-Hayward *et al.* 2014¹) and targeted smoothing capabilities using ‘Spatially Adaptive Local Smoothing Algorithm’ (SALSA - Walker *et al.* 2009²). Generalized Estimating Equations used to control spatio-temporal autocorrelation in residuals;
- These tools are available in the MRSea package in R:
<http://creem2.st-andrews.ac.uk/software/> ; and
- Depth and month as factors but no information on turbine locations.

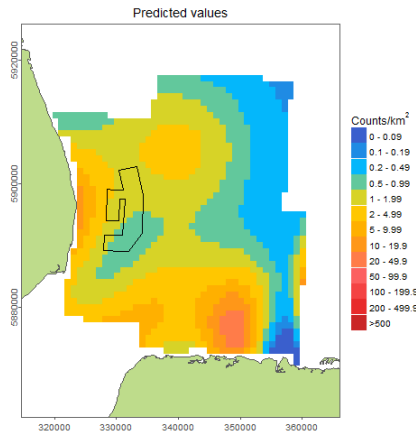
1 Scott Hayward *et al.* 2014. Journal of Computational and Graphical Statistics. 23: 340-360.

2 Walker *et al.* 2009. Journal of Statistical Computation and Simulation 81: 179-191.

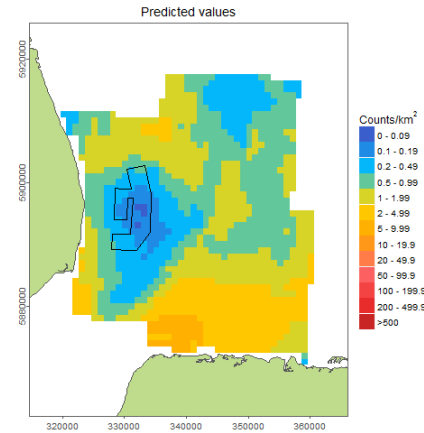
All divers ¹



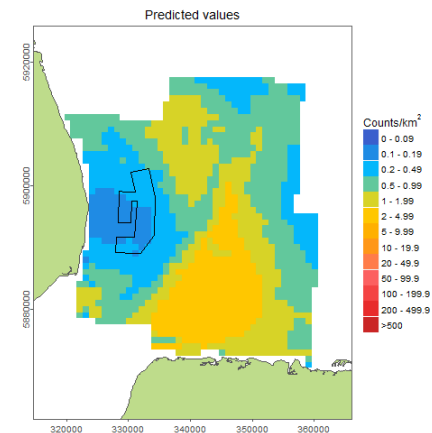
Phase 1:
Baseline



Phase 2:
Construction



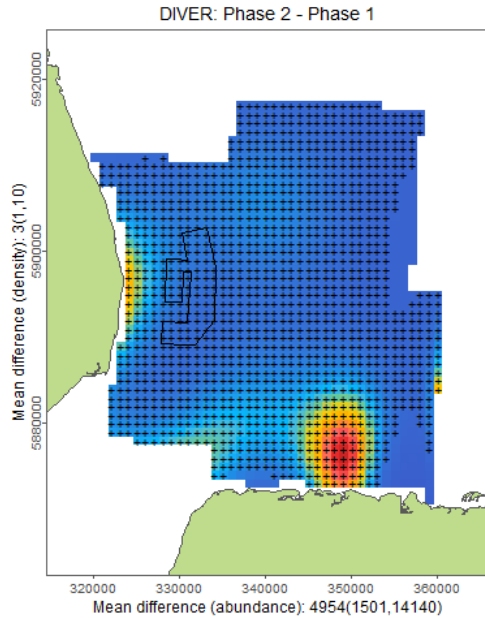
Phase 3:
Year 1 operation



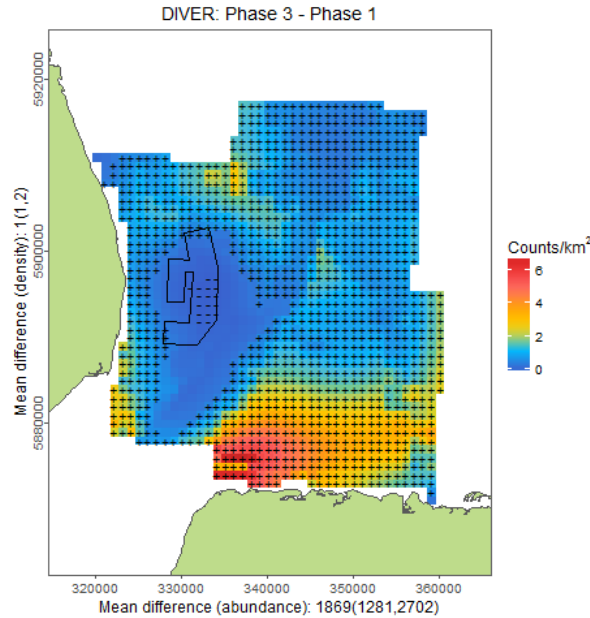
Phase 4:
Year 2 operation

¹ Over 99% of divers were red-throated divers *Gavia stellata*

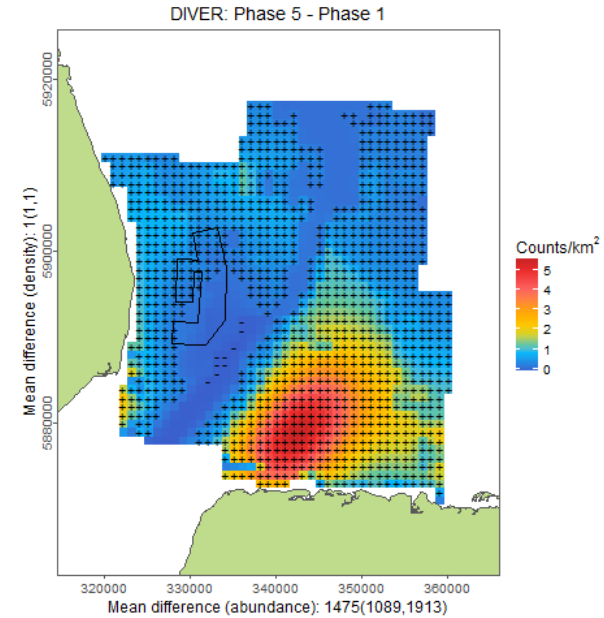
All divers



Construction - baseline



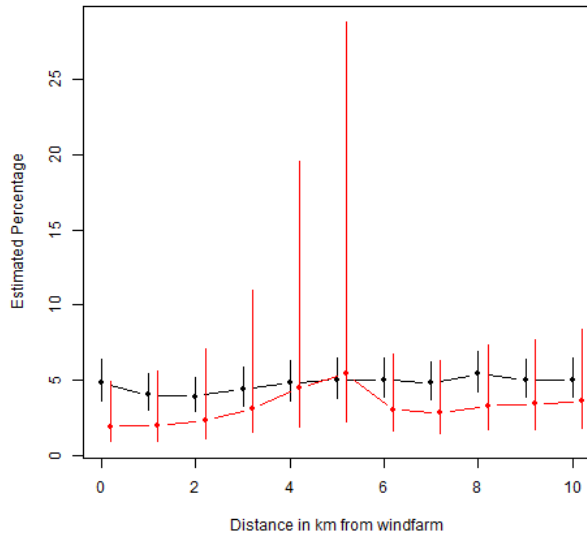
Year 1 operational – baseline



Year 2 operational – baseline

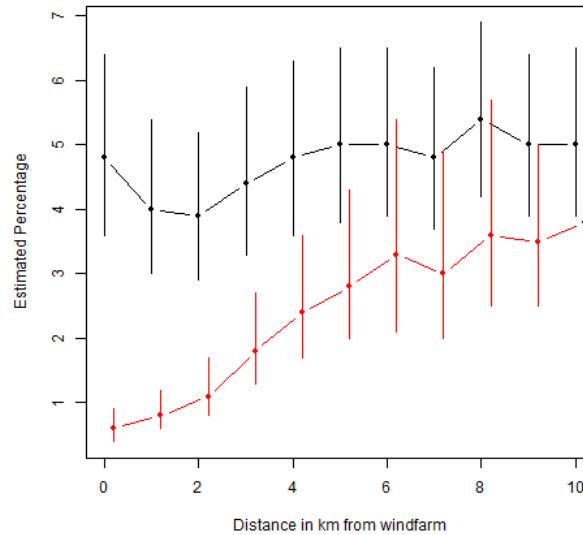
All divers

Phase 1 (black) vs Phase 2 (red)



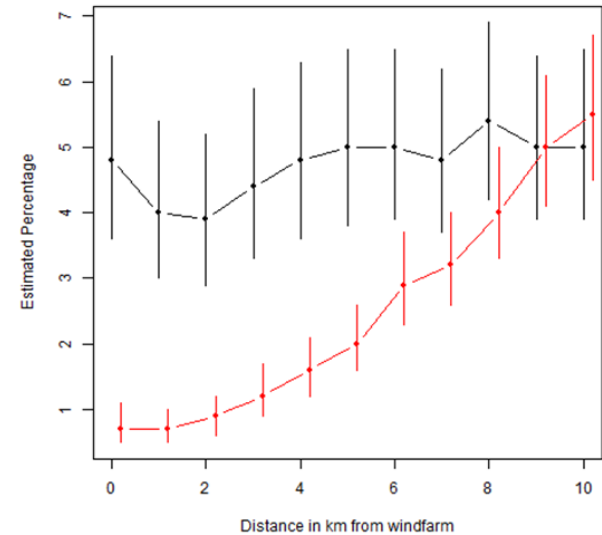
Construction v baseline
No displacement

Phase 1 (black) vs Phase 3 (red)



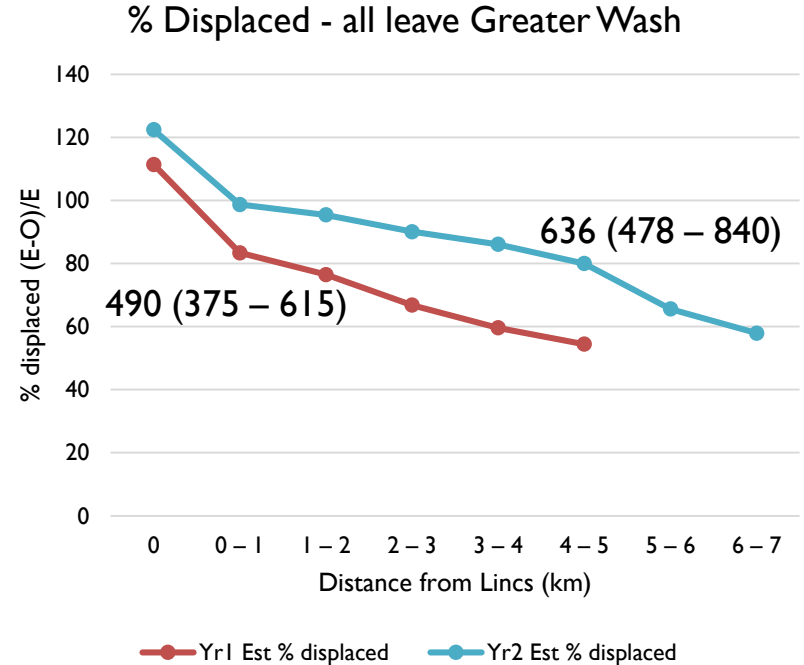
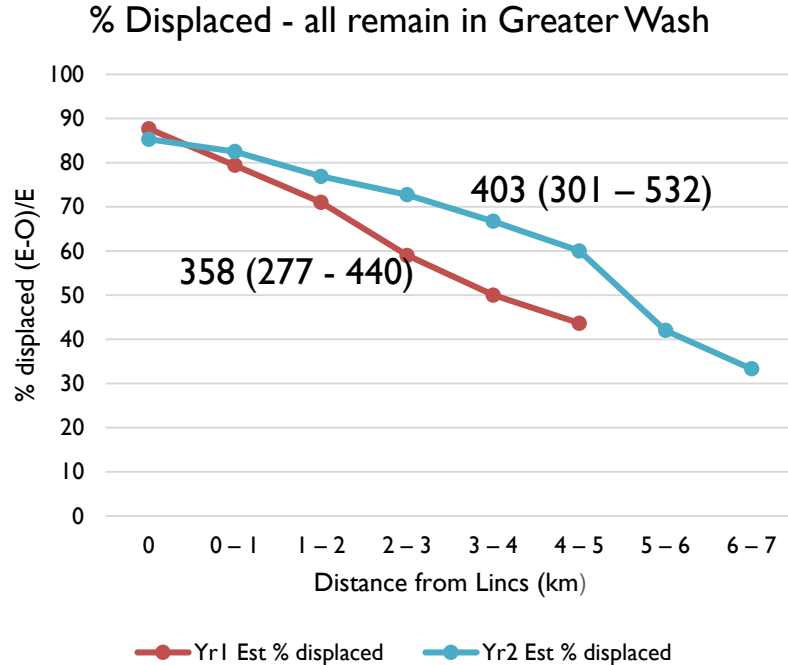
Year 1 operational v baseline
Displacement at 5km

Phase 1 (black) vs Phase 4 (red)



Year 2 operational v baseline
Displacement at 7km

All divers



Assumption: that divers would have had the same overall distribution pattern in Greater Wash in post-construction phase as in pre-construction phase.

Summary

- Displacement effects detected for all divers by location of regions with positive and negative change;
- Displacement effects for all divers (= rtd): detectable at 5–7 km from Lincs (depending on the year); and
- Possibly 358–636 divers displaced (depending on year and calculation method).

Thanks

- To you for your interest
- Centrica Energy for funding
- Staff at HiDef Aerial Surveying Ltd and DMP Statistical Solutions Ltd

HiDef Aerial Surveying Ltd

Bio Consult SH

HiDef
AERIAL SURVEYING LIMITED

Andy Webb
Chief Scientist

Phoenix Court, Earl Street
Cleator Moor, Cumbria, CA25 5AU
Tel: +44 1224 040 436
Mob: +44 7850 766 491
andy.webb@hidesurveying.co.uk
www.hidesurveying.co.uk