Short-term behavioural responses of wintering waterbirds to marine activity*

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marinescotland

The Scottish Government

BTO
Looking out for birds

Project Background

- Increased exploitation of marine environment - renewables and aquaculture.
- pSPAs have been identified – including inshore wintering waterbirds.
- Any licenced activity which could affect features of an SPA → HRA .
- Need for evidence of how sensitive wintering waterbirds are to licensed marine activities.

Study area


Atlantic Ocean
The North Sound
Kettletoft
Rousay
Birsay
Mainland
Kirkwall
Stromness
Orphir
Ward Hill
Rackwick
Scapa Flow
Hoy
Lyness
Pentland Firth
Brough
John O'Groats
Thurso
Skirkly
Armadale
Melvich
Halkirk
Kelss
Bilbster
North Sea
NORWA
Bergen
Stavanger
Glasgow
UNITED KINGDOM
DENMARI
Dublin
Manchester
Birmingham
Cork
Cardiff
London
NETHERLANDS
Amsterdam
Dortmund
Düsseldorf
GERM
Celtic Sea
Plymouth
BELGIUM
Frankf
St Peter Port

Study species











Literature review - methods

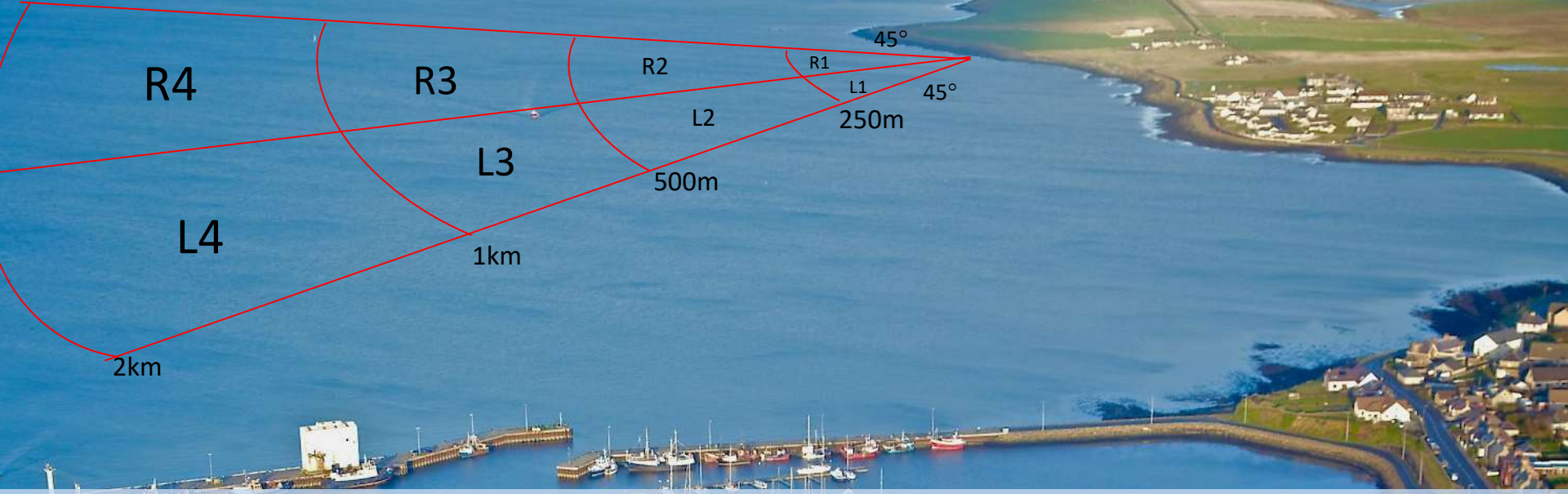
- Extensive search of literature for the full range of marine activities and all the pressures they exerted on wintering waterbirds.
- Identified the key parameters used to assess the species sensitivity to a pressure.
- Ranked the size of the magnitude of the impact for species affected and the quality of the evidence to support this.

Literature review – results and conclusions

- Disturbance, displacement and pollution - key pressures.
- Uncertainty when evidence based on expert opinion or reviews.
- Focus next phase of work – marine activity likely to lead to disturbance/displacement.
- Gap in knowledge – Common Goldeneye, Black-throated and Great Northern Divers, Slavonian Grebe and Black Guillemot.

Data collection – Marine traffic as a disturbance?

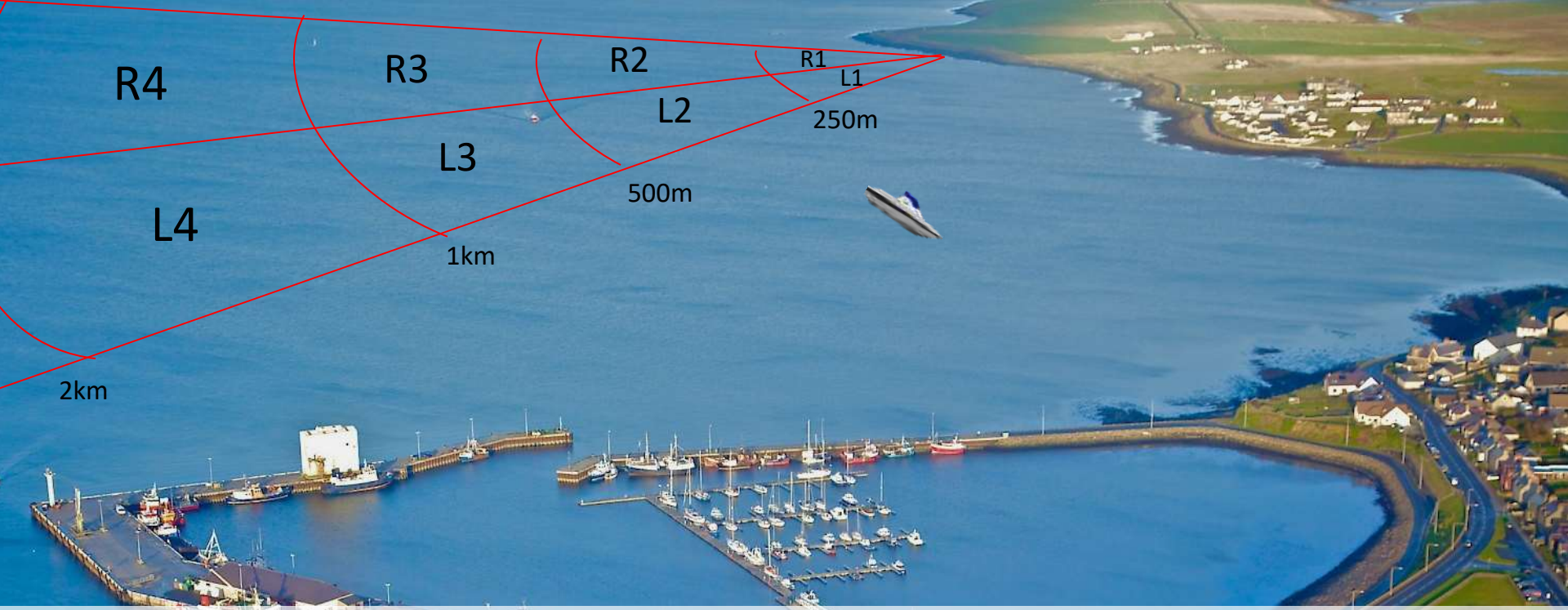
- One winter of fieldwork (2016/2017).
- Orkney marine environment **-** narrow enclosed channels, bays etc.
- Vantage point surveys VPs, focal flock-watches, and on-ferry surveys.
- Collected additional information – tide, sea state, wind speed, time of day etc.



VP surveys - methods

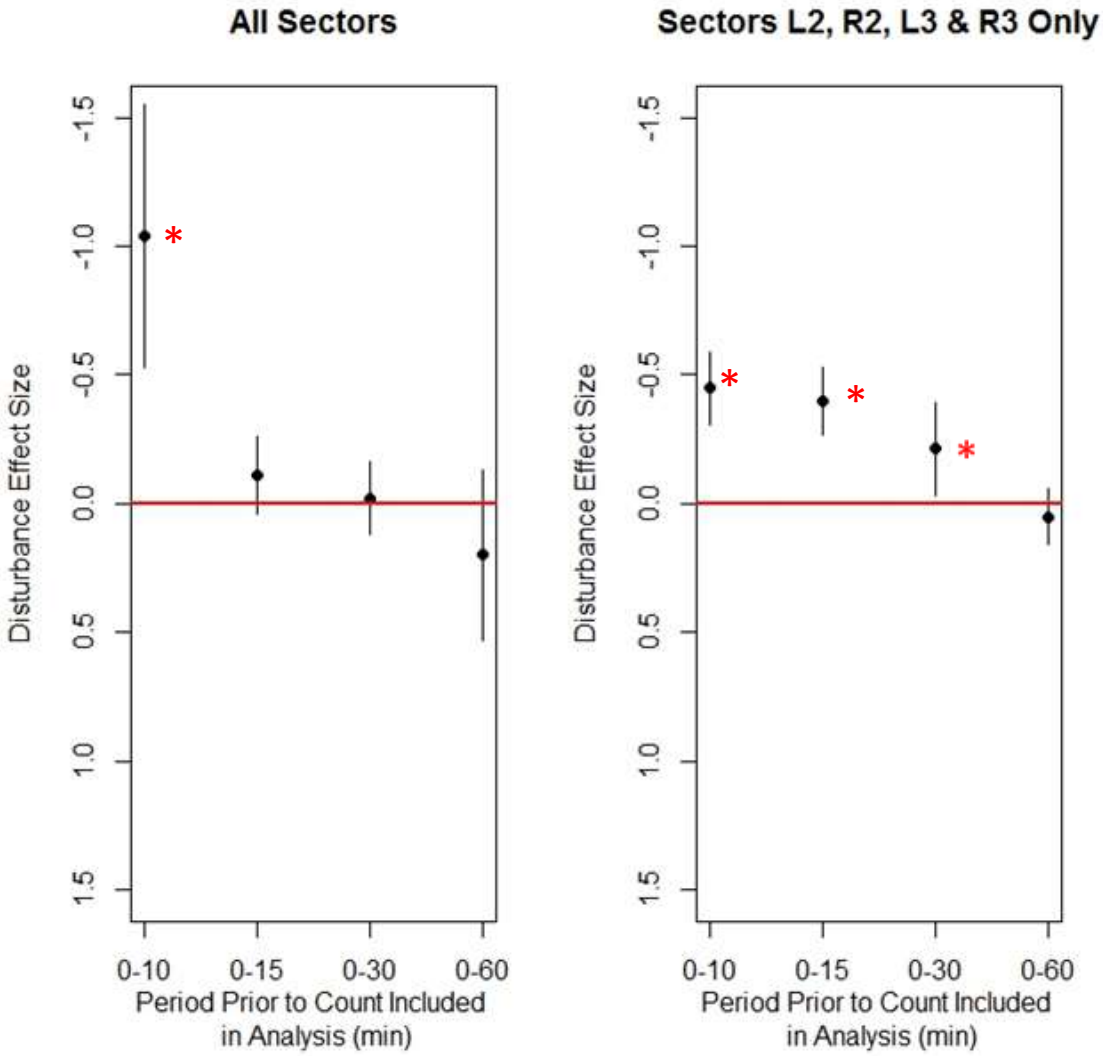
- 7 VPs - 90° arc divided into two, four distance bands = 8 sectors.
- Recording period:
  - Count 1 - number of target species per sector.
  - 1 hour recording marine traffic and bird flight activity .
  - Count 2 - number of target species per sector.
  - 1 hour recording marine traffic and bird flight activity.
  - Count 3 - number of target species per sector.


250m
500m
1km
2km



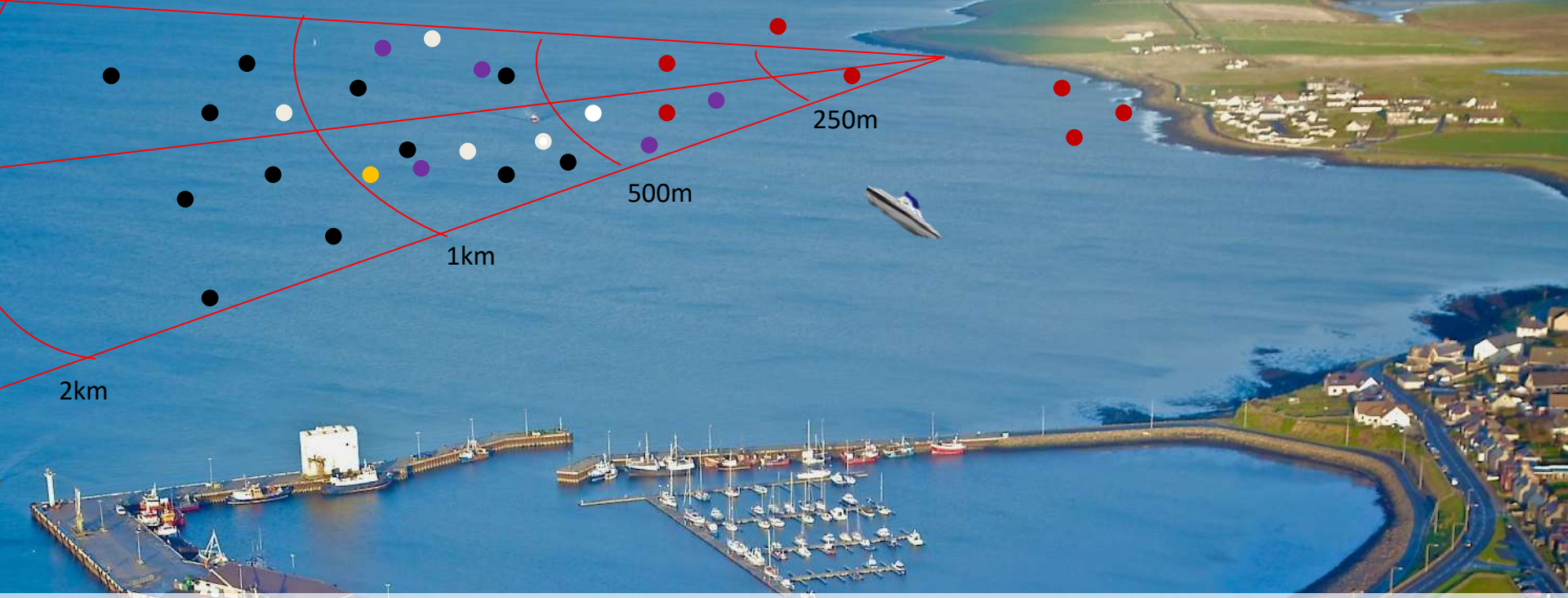
Vantage points - analyses

- GLMMs used to analyse the effect of environmental variables on the relative abundance of target species (site as random, sector nested within site).
- Four versions of the models for each species – effect of presence or absence of disturbance in the previous 10, 15, 30 and 60 mins.
- Repeated for all sectors combined and then sectors L2, L3, R2, R4



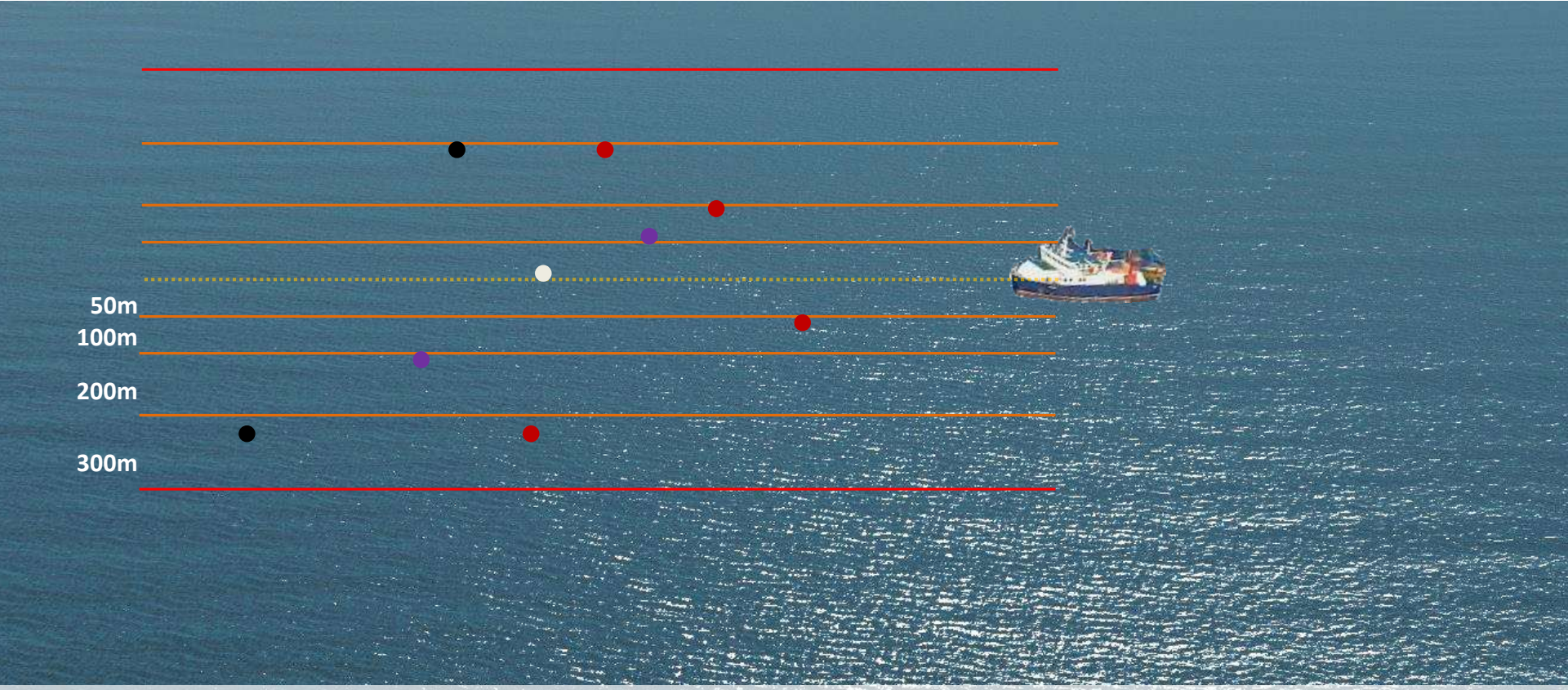
* Marine activity has a negative significant effect upon bird abundance

Importance of **time** and **spatia**l scale – varies by species.



Vantage points - Key results

- Great Northern Diver abundance reduced following marine traffic - **although flights very rarely recorded**
- Long-tailed Duck, Common eider and European Shag abundance also reduced following marine activity
- No effect on Black Guillemot detected
- Comparisons ***between species*** complicated by ecological gradient / sector size / sample size / detectability.

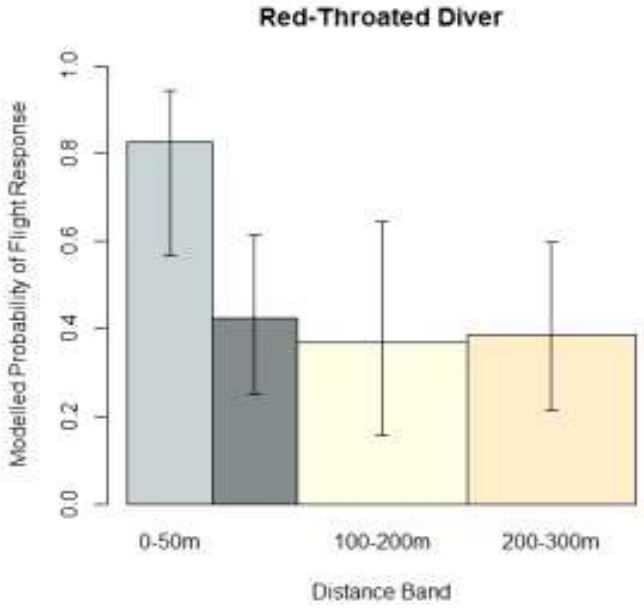


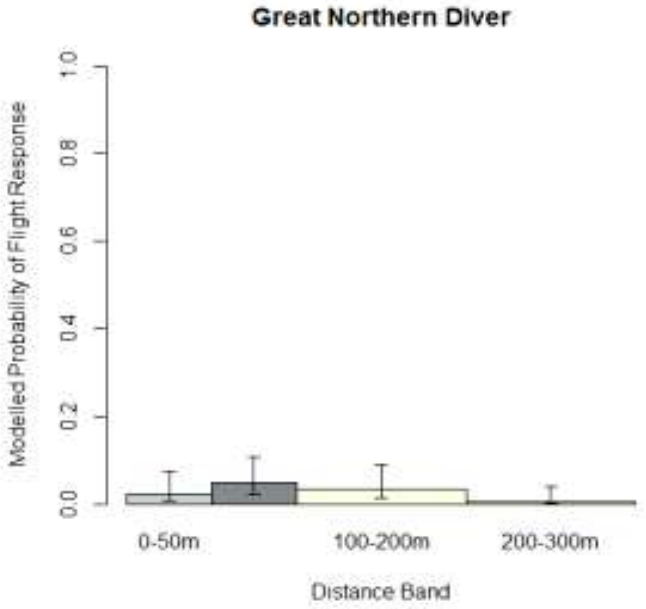
Ferry surveys

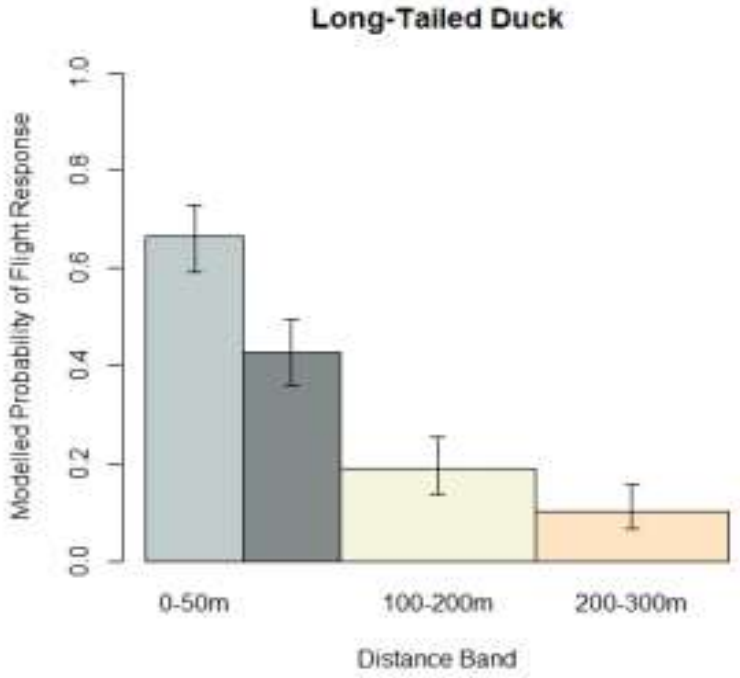
- Fieldworkers (in pairs) surveyed on three regular ferry routes between Islands
- Individual bird / flock recorded in distance band perpendicular to direction of travel
- Behaviour = '**flight**', '**evasive swim**', '**evasive dive**', or '**no response**'.

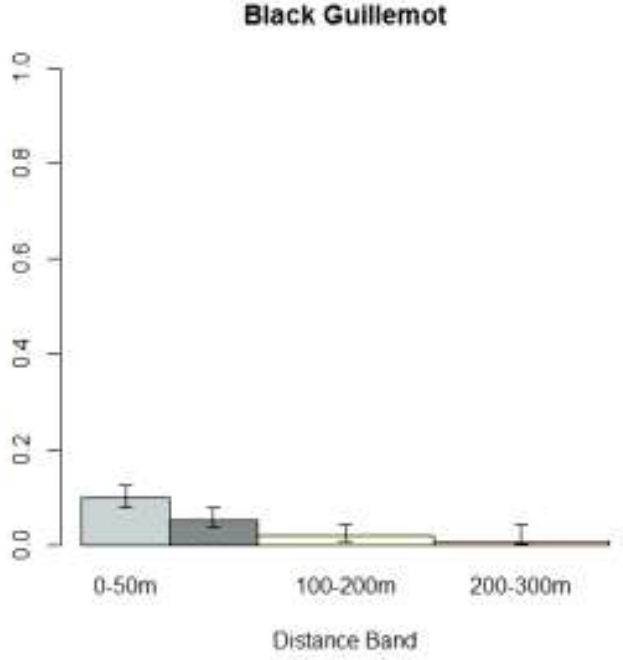
Classified into 'response' or flight for the analyses

Effect of distance band on flight response - examples









Summary of ferry results

Target Species	Overall response rate across all distance bands	Overall response rate in 200-300m distance band	Flight response rate in 200-300m distance band
Red-throated Diver			
Black-throated Diver			
Slavonian Grebe			
Red-breasted Merganser			
Long-tailed Duck			
Great Northern Diver			
Black Guillemot			
Common Eider			
Eurasian Shag			

Improved understanding of target species behaviour

Species	Reference	Risk
Red-throated diver	Schwemmer et al. 2011; Topping and Petersen 2011 (fly from boats more than 1000m away)	5
Black-throated diver	Schwemmer et al. 2011; Topping and Petersen 2011 (fly from boats more than 1000m away)	5
Great northern diver	Schwemmer et al. 2011; Topping and Petersen 2011 (fly from boats more than 1000m away)	5

Furness et al. 2013

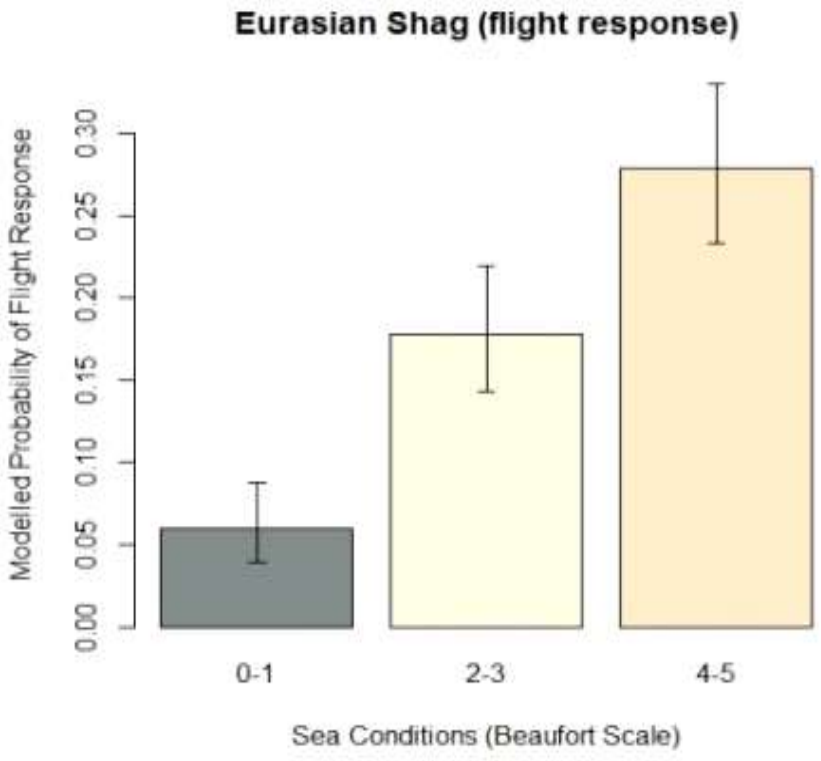
Previously no data on Black-throated and Great Northern Divers responses to marine traffic

However…..

Red-throated	Great northern / Black-throated
Most likely of all target species to take flight in response to vessels	Flights very rarely recorded in response to marine activity – usually swim out of path of vessel
Flight rate highest of all target species in 200-300m band	**But** *response* rates high and numbers significantly reduced in an area following marine activity (for GND)
Primary moult prior to arriving at wintering grounds	Full primary moult on wintering grounds

Sea state increases likelihood of flight

- Flight rates increased by 4-6 times in rougher seas for Common Eider, Black guillemot and European Shag
- Much weaker effect on Long-tailed Duck
- Great Northern Diver responses unaffected (still don't fly)



Comparative sensitivities of target species

medium sensitivity

low sensitivity

high sensitivity

very high sensitivity

What have we learnt from this project?

- Increased our understanding for the species: Black-throated and Great Northern Divers, Slavonian Grebe and Black Guillemot but not Common Goldeneye.

- Raised profile of Red-breasted Merganser – sometimes excluded from reviews when considering impacts of licenced marine activity.

- Flight is not only the response to marine activity.

- Careful extrapolating results from this project to birds on open sea and larger/faster vessels.

Questions for the future?

- Does a lack of response or a quick return to site mean birds are not sensitive to marine licenced activity → may indicate lack of alternate habitat?
- What are the costs to individuals birds of evasive action → increased energy costs and reduction in feeding (time and space), can they still meet daily energy demands?
- Long term exposure to marine activity → increased likelihood of mortality for birds affected?
- Can increases in marine activity result in changes to demographic rates → increase in over winter mortality rates?

Publication can be downloaded from Scottish Government's website:

*Jarrett, D. *et al*. (2018). Short-Term Behavioural Responses of Wintering Waterbirds to Marine Activity: Quantifying the Sensitivity of Waterbird Species during the Non-Breeding Season to Marine Activities in Orkney and the Western Isles. Scottish Marine and Freshwater Science Vol 7 No 9, 88pp. DOI: 10.7489/12096-1

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