



AGIR pour la
BIODIVERSITÉ

Eolien et biodiversité

Séminaire
2017



21 et 22 novembre

Artigues-près-Bordeaux



MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE
ET SOLIDAIRE





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From effects to impacts: Analysing displacement of red-throated divers/*Plongeon* catmarin (*Gavia stellata*) from offshore windfarms in relation to wintering home ranges

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Ramūnas Žydelis, Stefan Heinänen, Julius Morkūnas & Petra Quillfeldt

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Cooperation between:



Georg Nehls
Claudia Burger
Monika Dorsch



Petra Quillfeldt
Birgit Kleinschmidt



Ramūnas Žydelis (now Ornitela)
Stefan Heinänen



KLAIPĖDA
UNIVERSITY

Julius Morkūnas

Project HELBIRD
(FTZ Büsum, Stefan Garthe)

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für Wirtschaft
und Energie



aufgrund eines Beschlusses
des Deutschen Bundestages

Project duration: 01.11.2014 – 31.10.2018

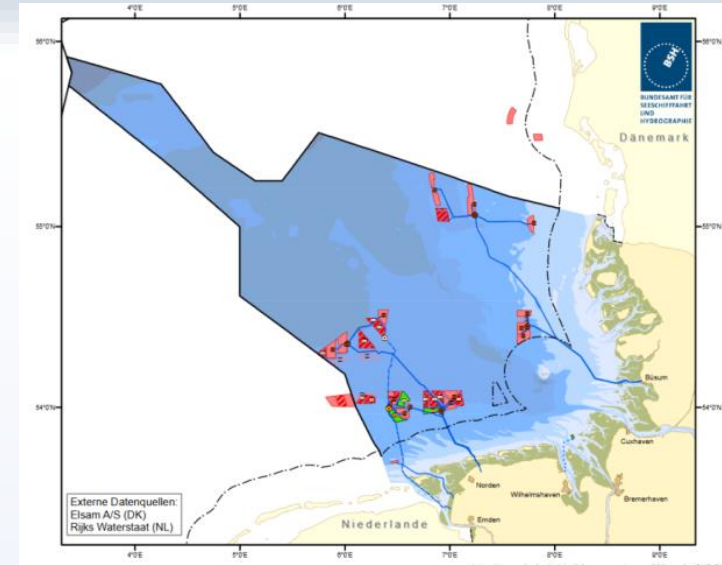
Background

- Red-throated divers/Plongeon catmarin
 - strictly protected holarctic migratory species
 - considered among the most sensitive species to displacement from wind farms



Background

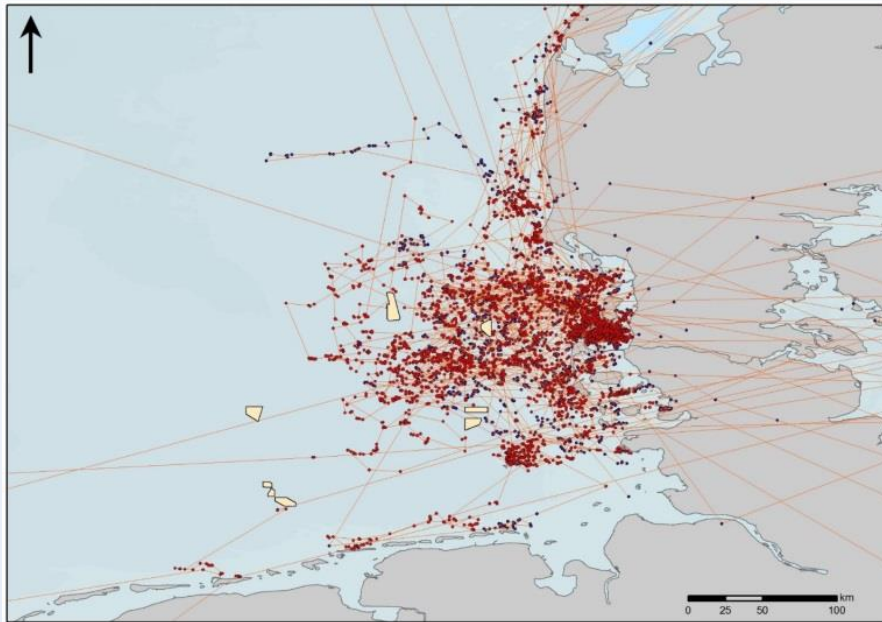
- Eastern German Bight is important as wintering site and for spring passage (18.3 % of the NW-European wintering population)
- Red-throated divers and offshore wind farms often seek similar habitats – relatively shallow offshore grounds with sand
- Area contains several OWFs → conflicts



Aim

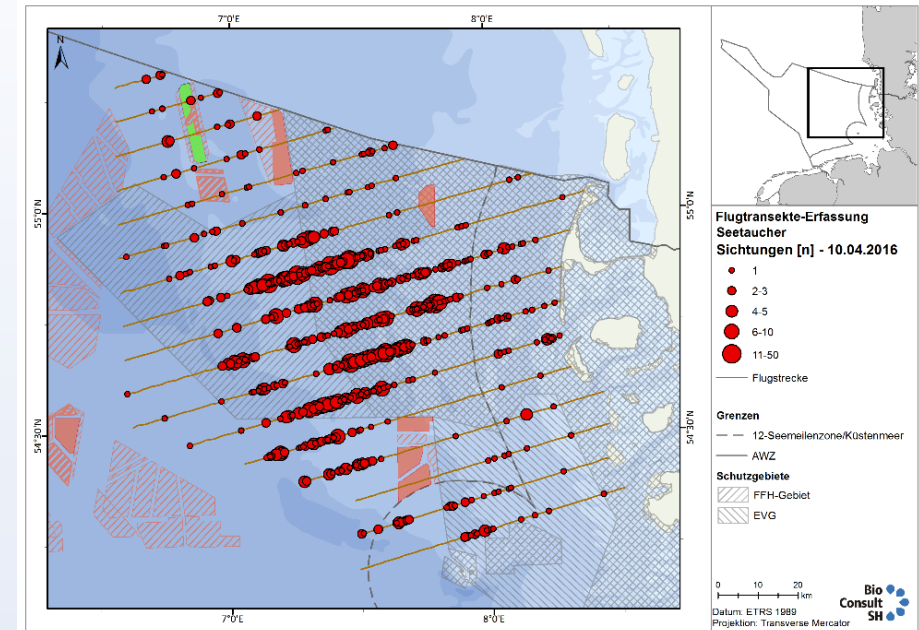
Evaluate wintering movements, Home ranges & displacement effects of red-throated divers/Plongeon catmarin in relation to offshore wind farms in the German Bight

Satellite telemetry data



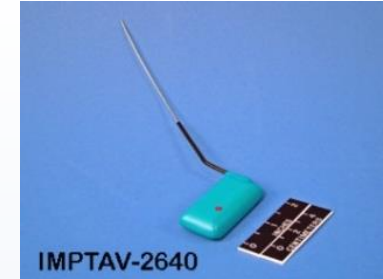
Digital survey data

HiDef
AERIAL SURVEYING LIMITED

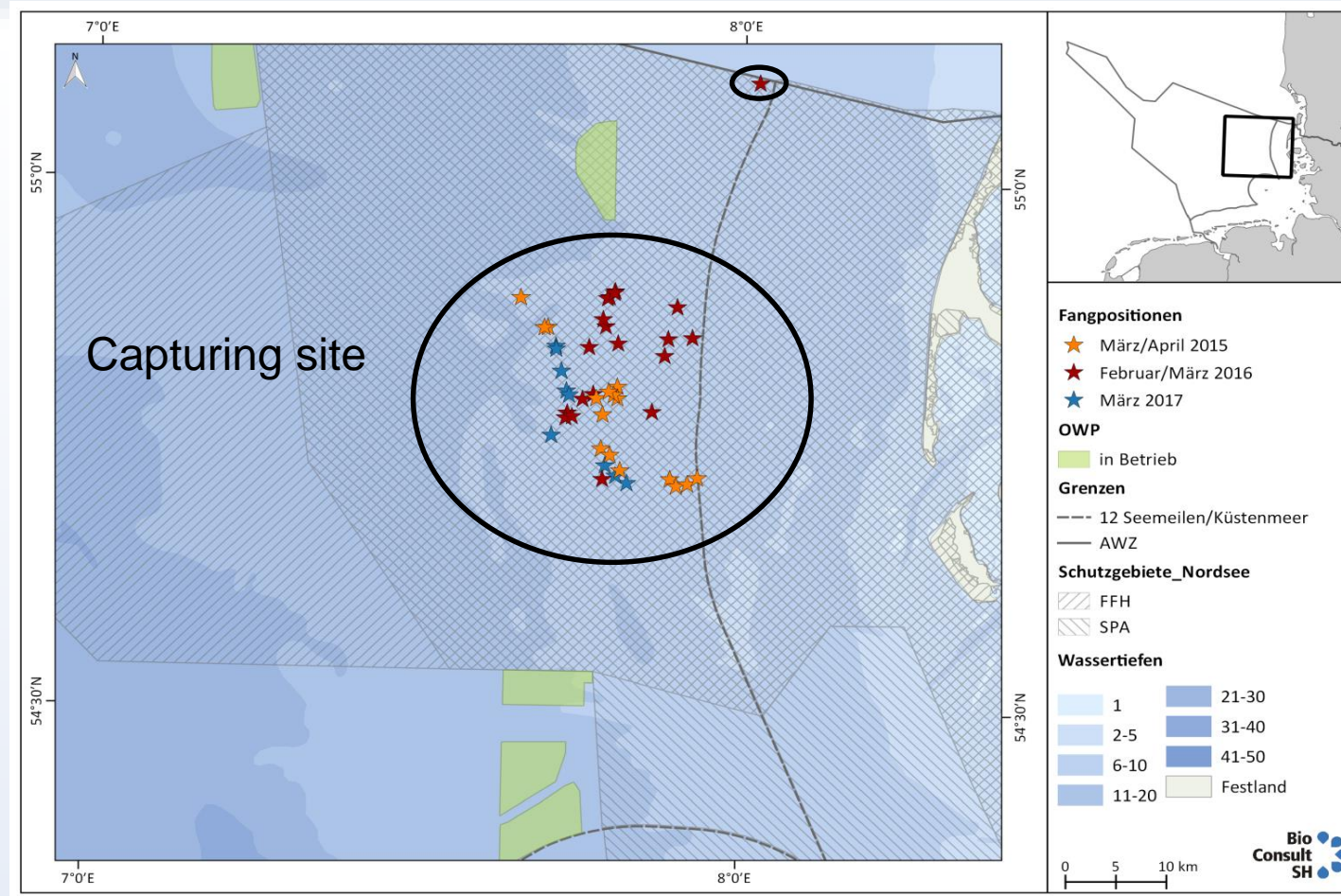


Method: Fieldwork

- Telemetry → Use implantable Argos transmitters
 - Catch wintering birds offshore in the North Sea
 - Implant transmitters
 - Release birds
 - Receive position data delivered by Argos system (3 hours/day)



Method: Fieldwork



Method: Data analysis

- Satellite telemetry
 - Year-round data on individual movements
 - Focus on wintering movements



- Two approaches
 - Home ranges & Daily movements in relation to OWFs
 - Distribution & abundance
 - Quantifying displacement effects

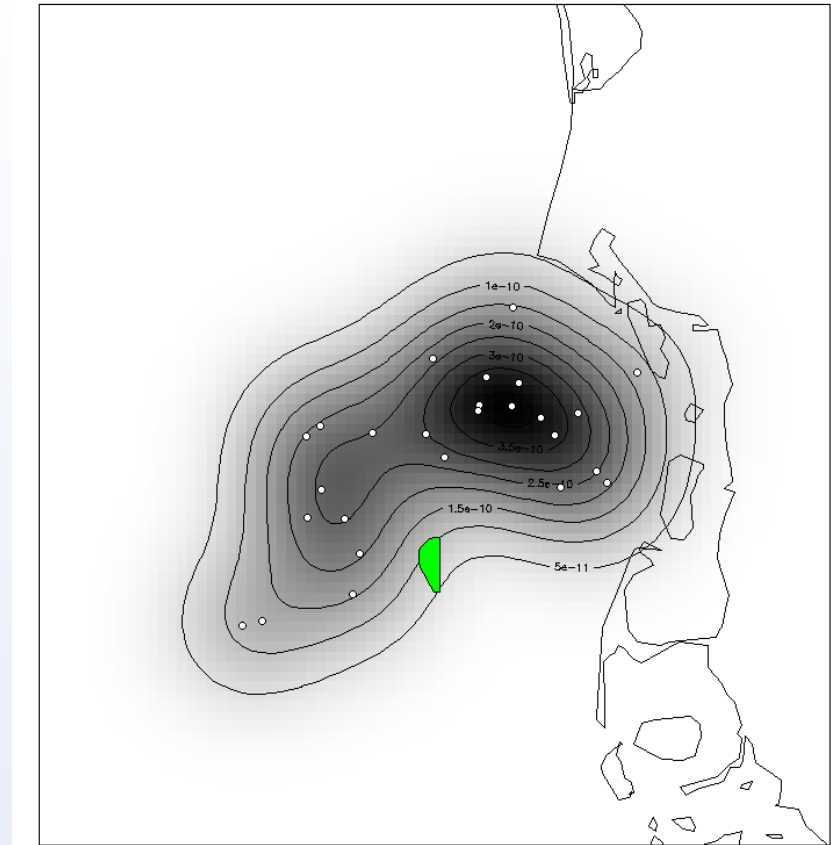
Method: Home ranges & Daily movements



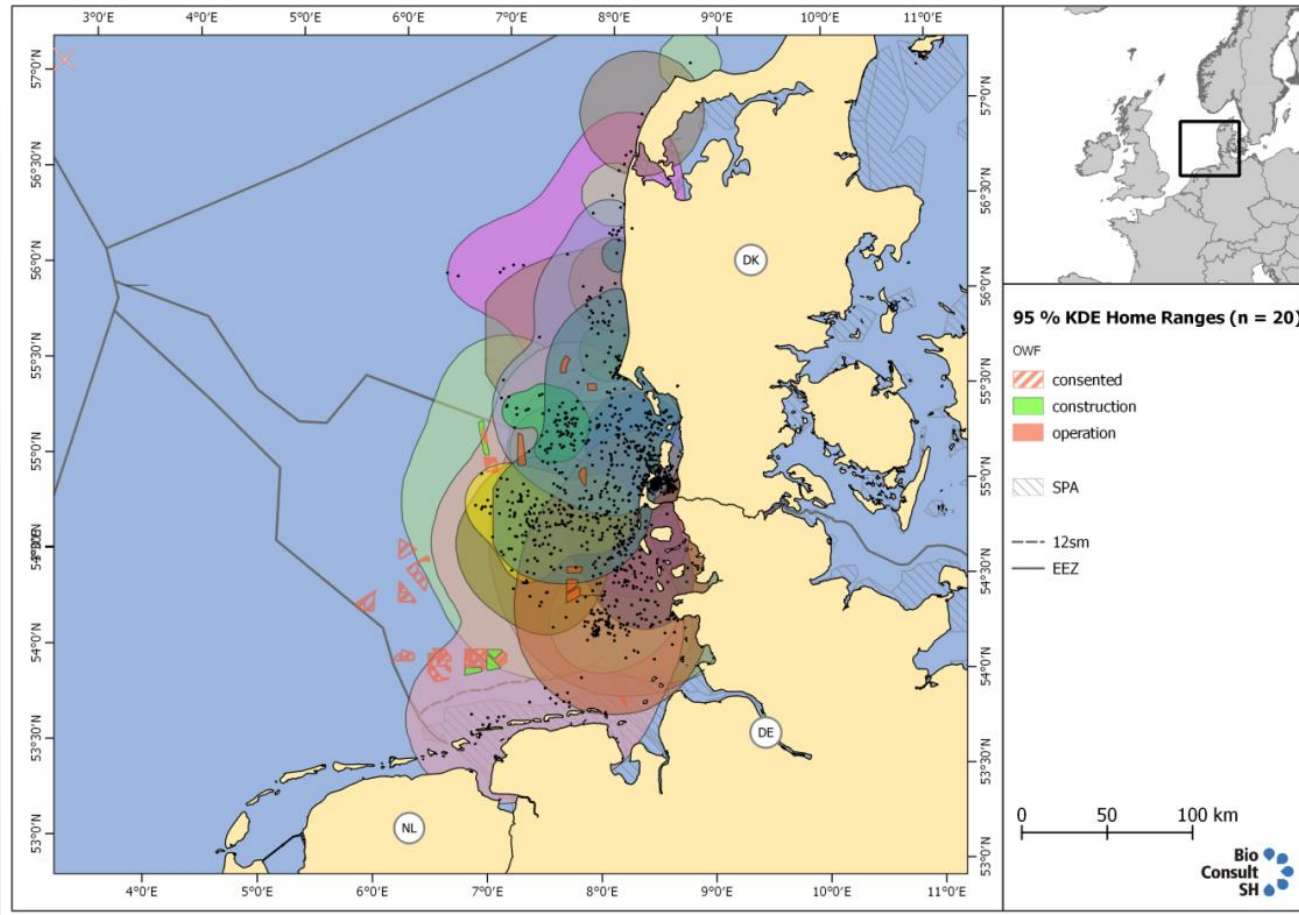
- Home range analysis
 - Area use relative to OWFs
- Relocation distances
 - Are daily movements affected by OWFs?
 - More disturbance might lead to greater relocation distances

Method: Winter home ranges

- Home range analysis
 - Data restricted to South-eastern North Sea
 - Min. 28 days in wintering area
 - 95 % and 50 % Kernel Density Estimates (KDE)
 - 20 home ranges of 18 Ind.

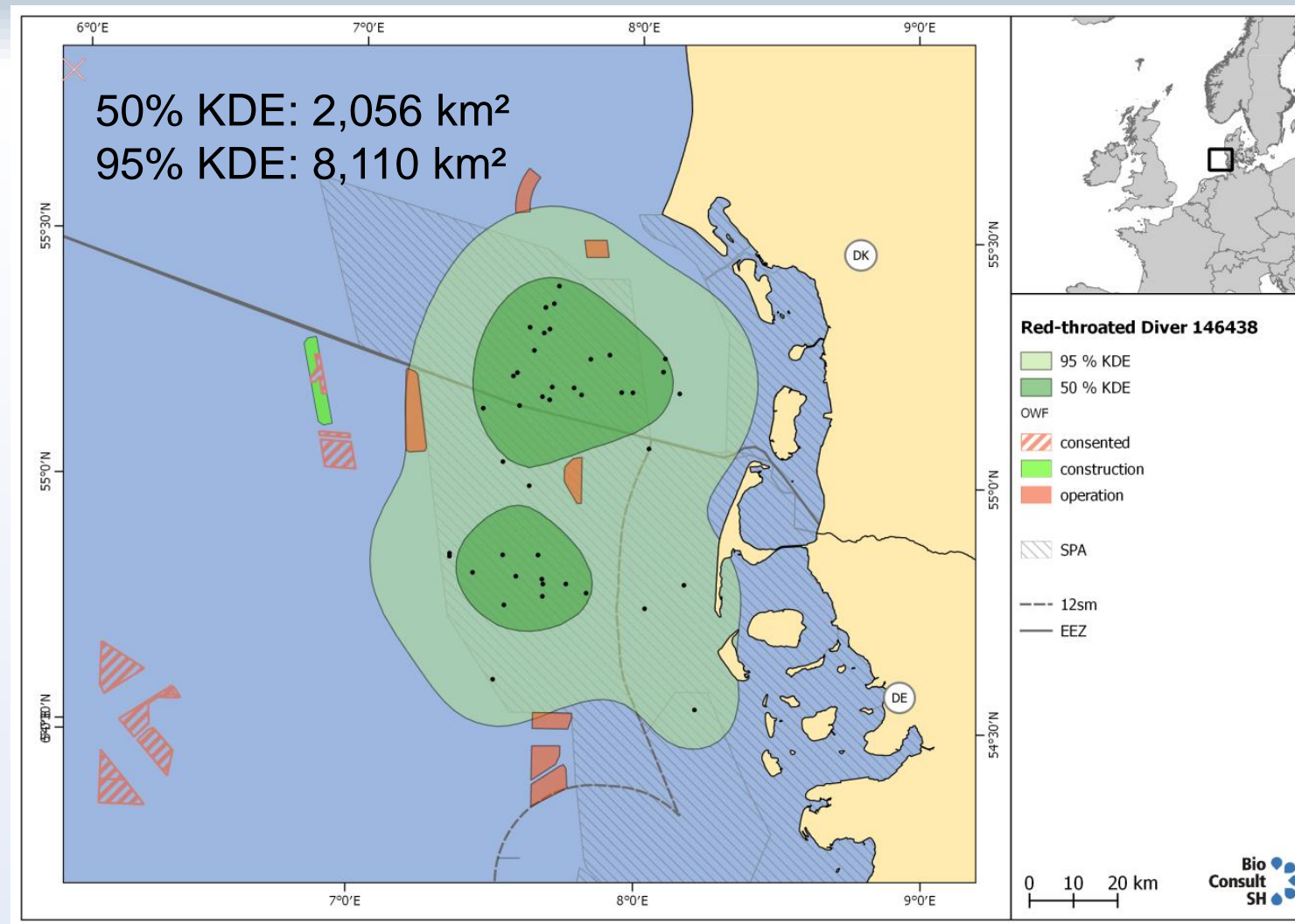


Results: Winter home ranges

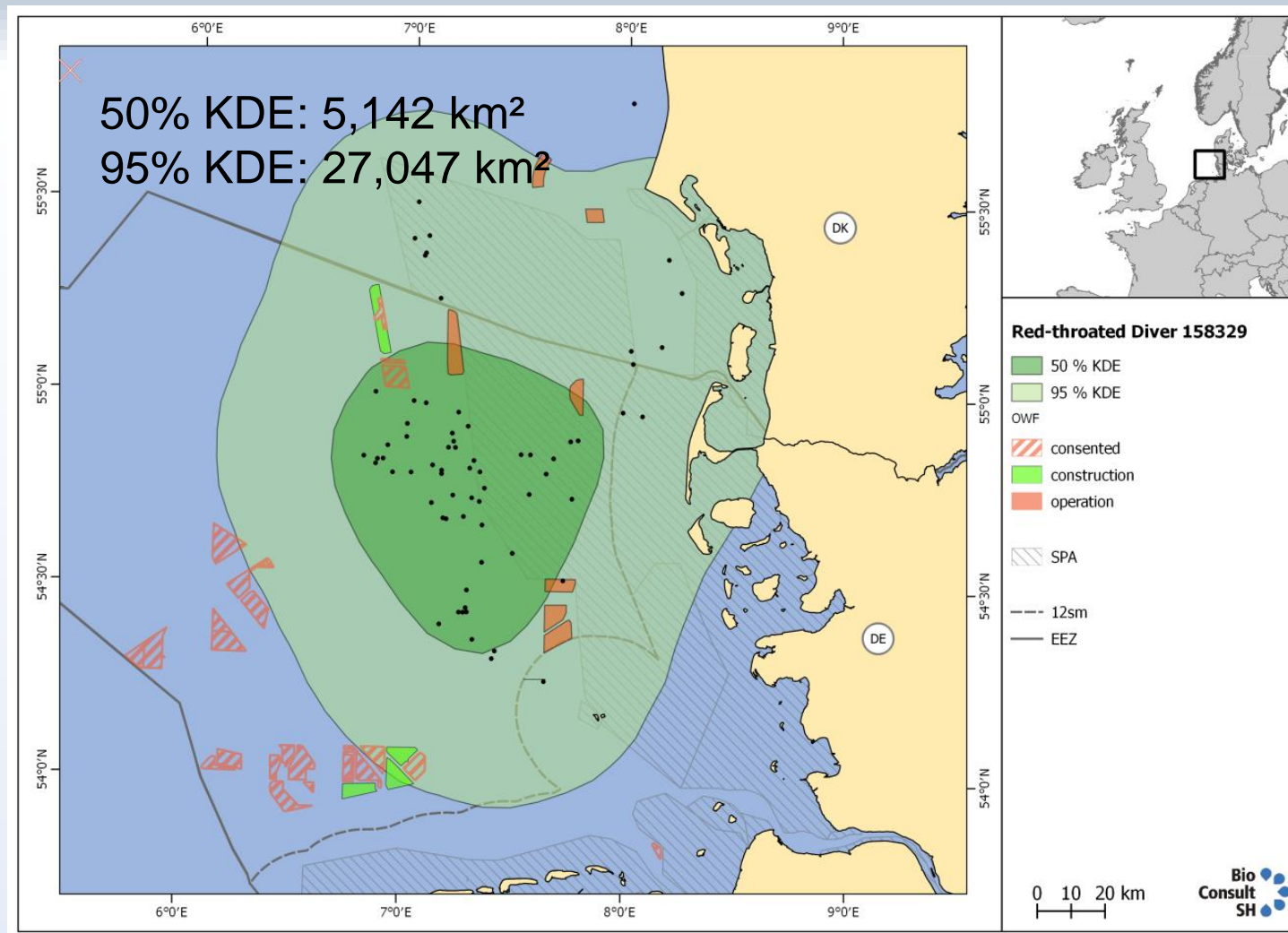


- 18 Individuals
- 95% KDE
 - Range: 1,022 to 28,288 km²
 - Average: 11,186 km²
- 50% KDE
 - Average: 2,659 km²

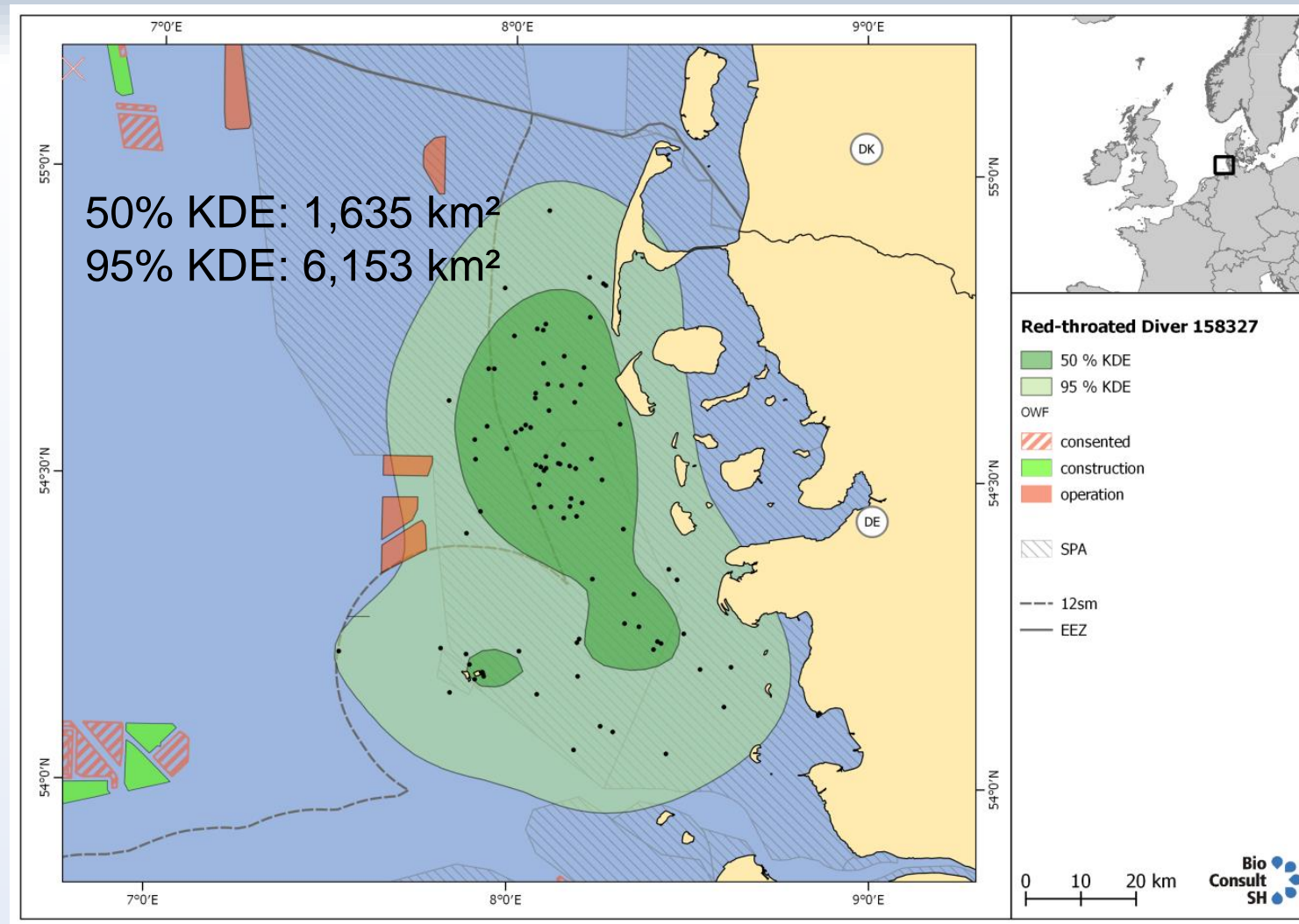
Results: Winter home ranges



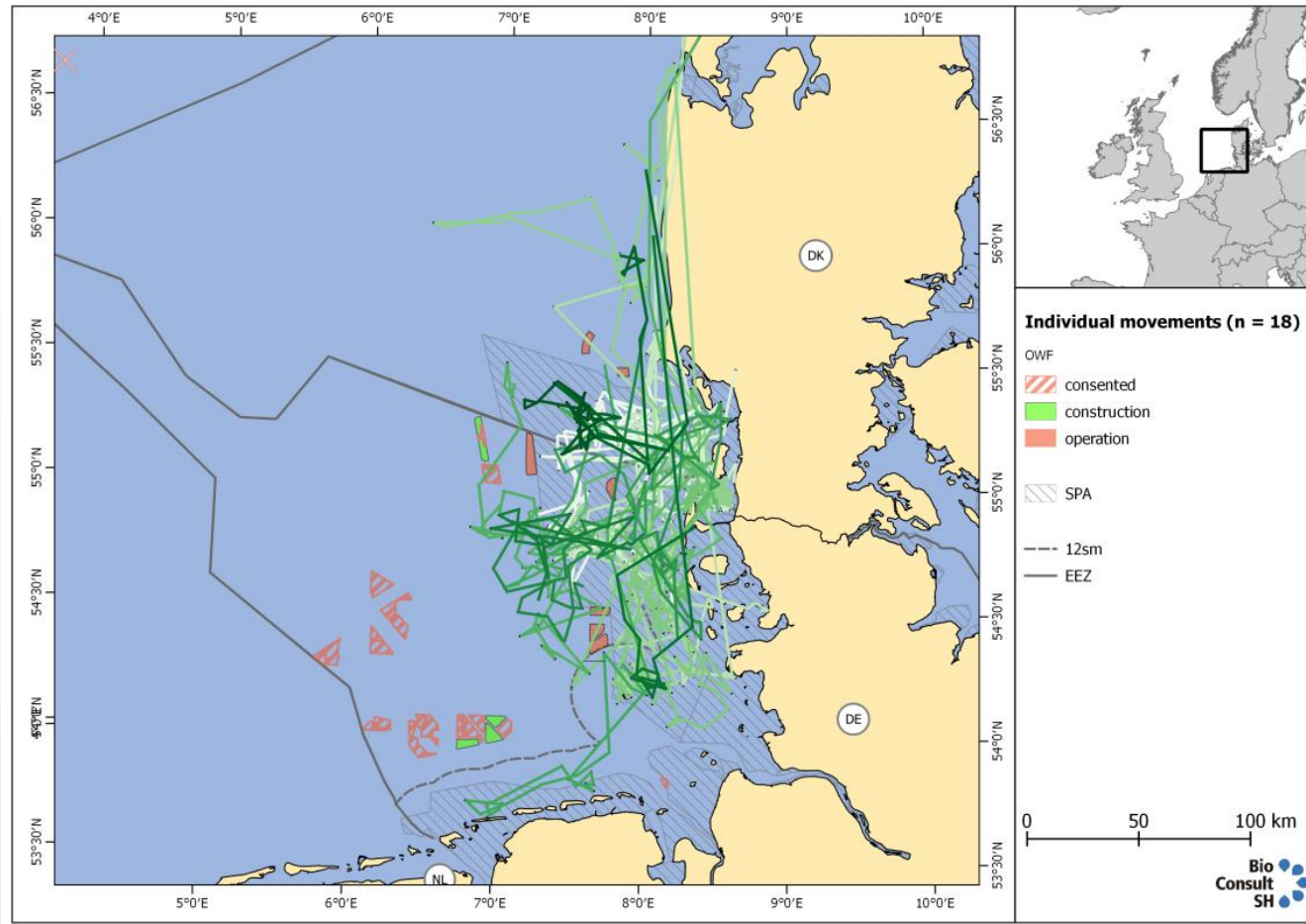
Results: Winter home ranges



Results: Winter home ranges

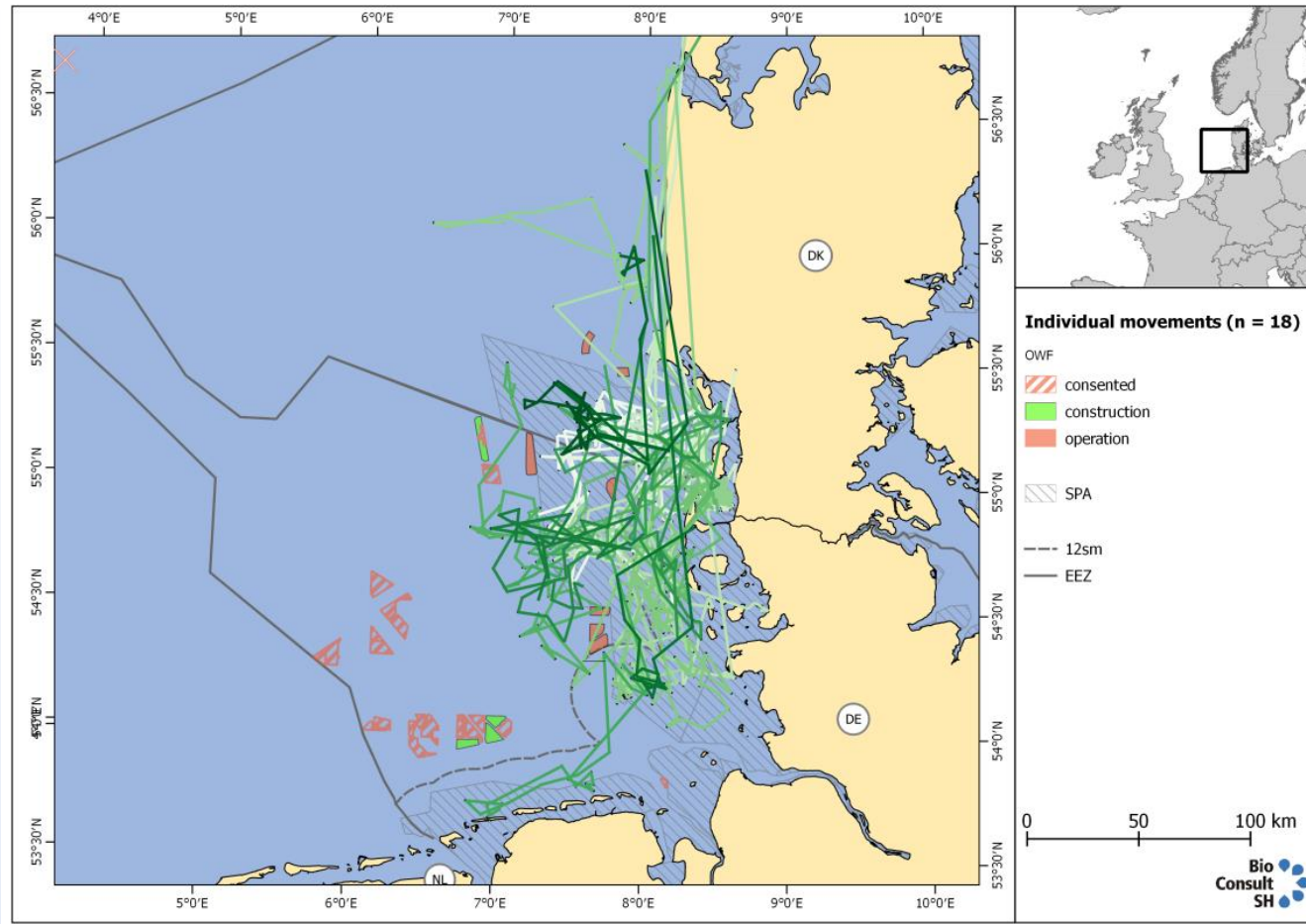


Method: Relocation distances



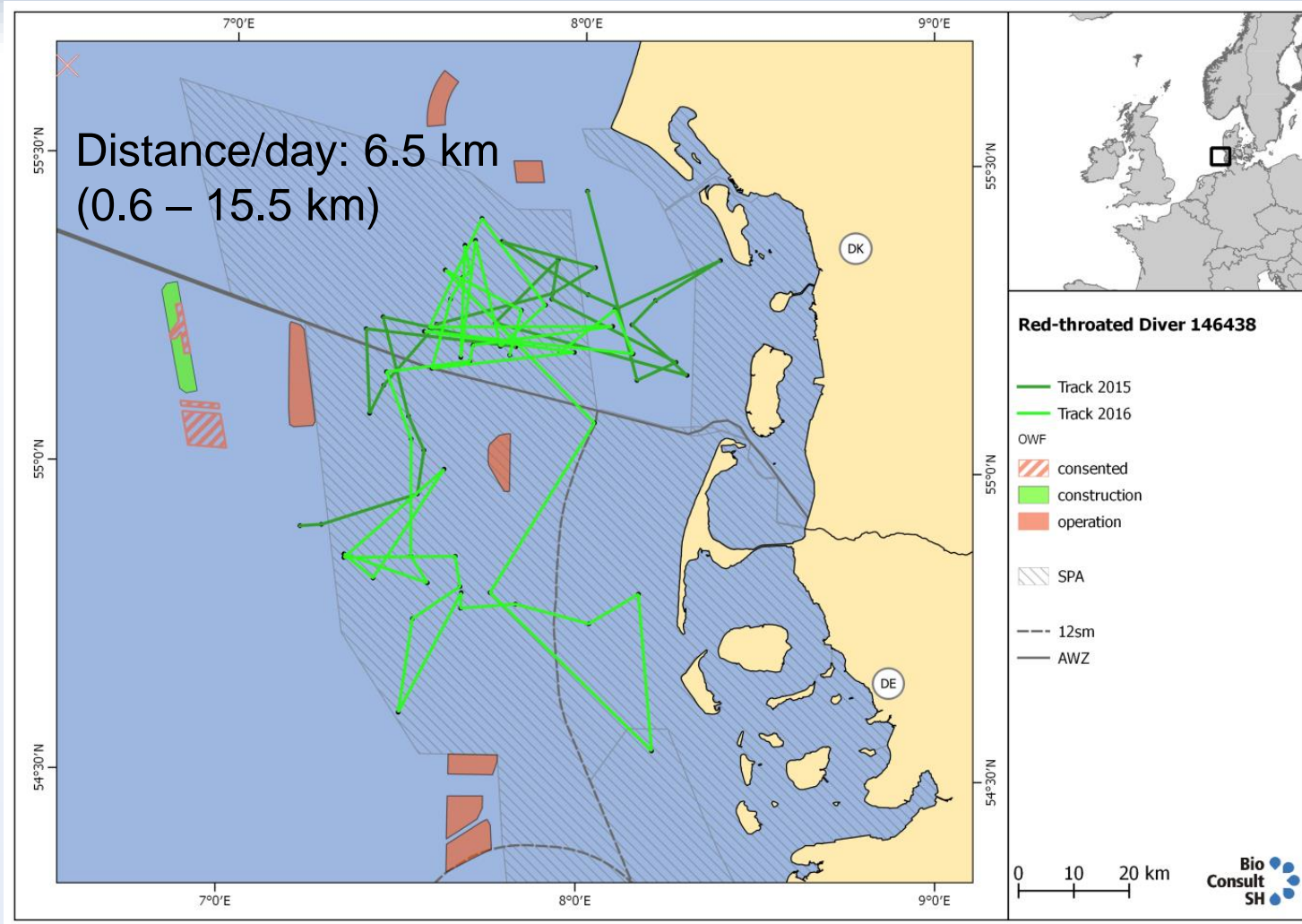
- Measure daily travel distance of individuals (best positions selected)
- Movements include direct (active) & indirect (drift by current & tides)
- ARGOS Positions are not 100% exact
- Connected points are an approximation (3 hours/day positions delivered)

Results: Relocation distances



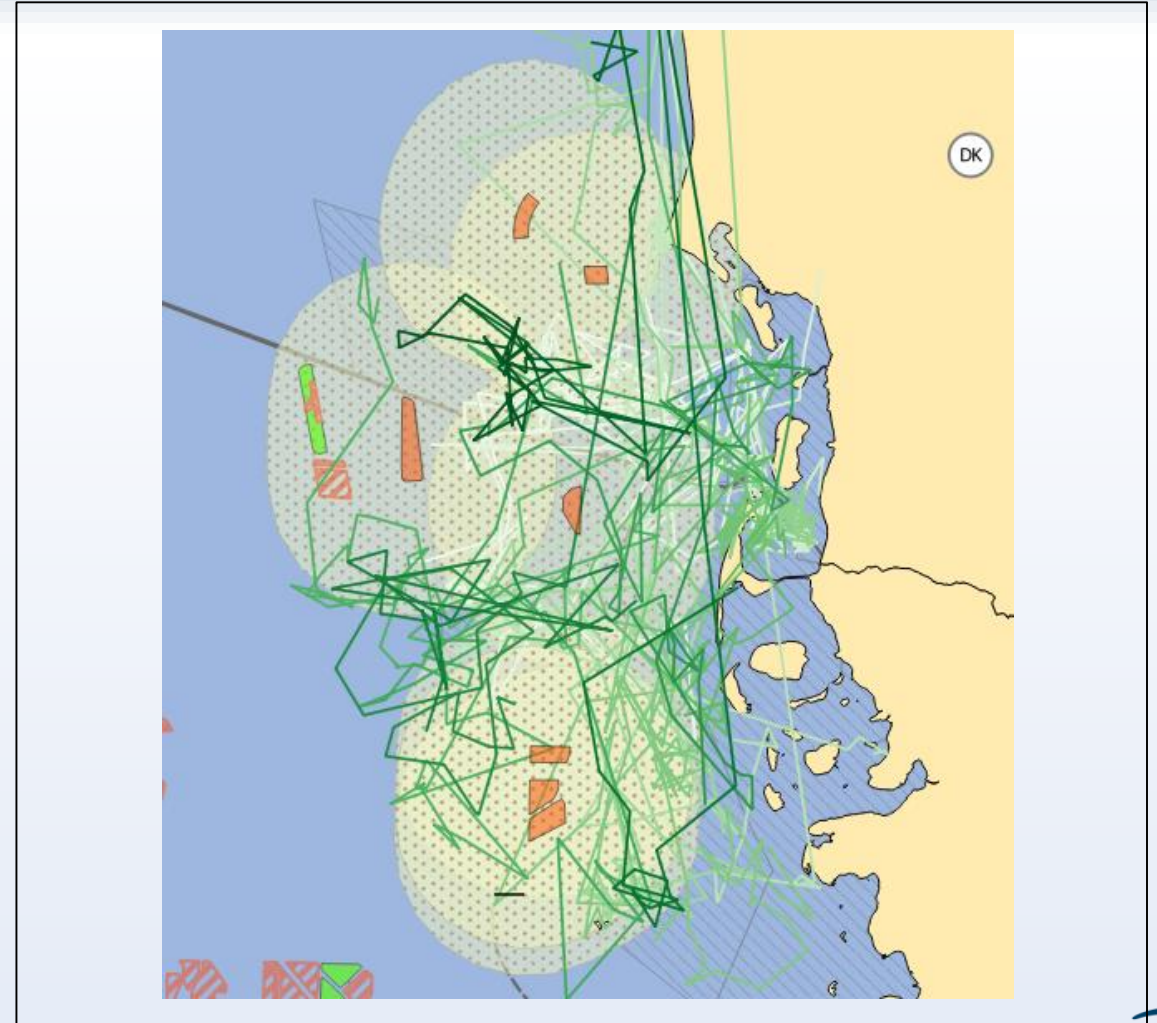
- 18 Individuals
- Average: 11.7 km per day
- Range: 0 – 125 km

Results: Relocation distances



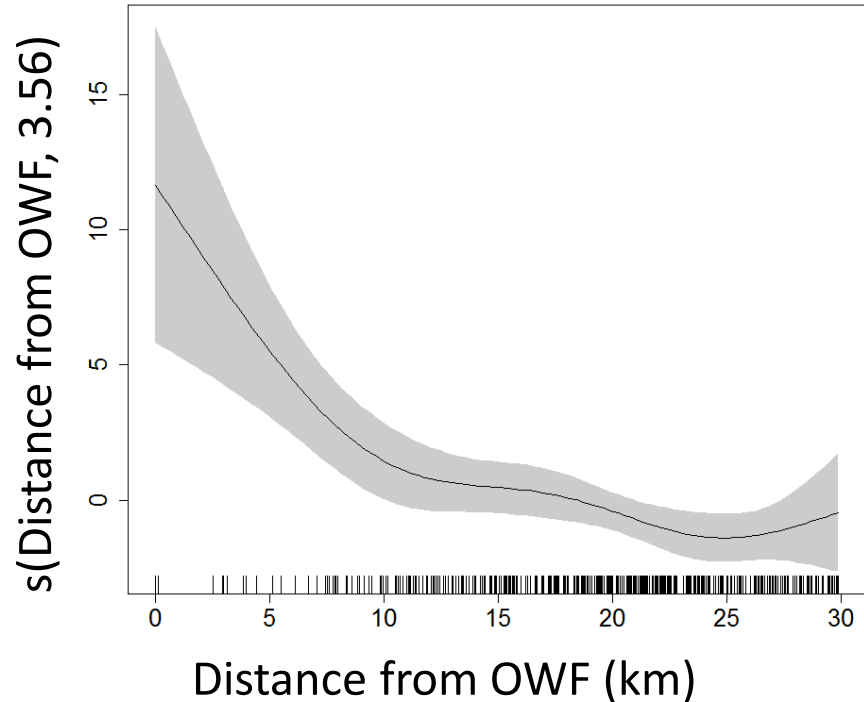
Method: Movement Analysis & OWFs

- Effect of OWFs on relocation distances
 - Daily relocation distances (< 30 km)
 - 30 km radius around OWFs
 - Coastal movements excluded (5 km buffer)
 - Analysis using GAMs
 - Controlling for individual differences, water depth



Results: Movement Analysis

Diver relocation distance

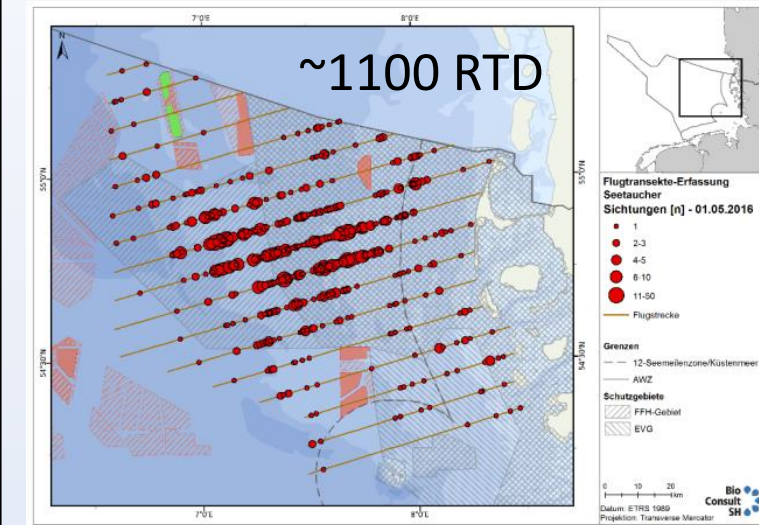
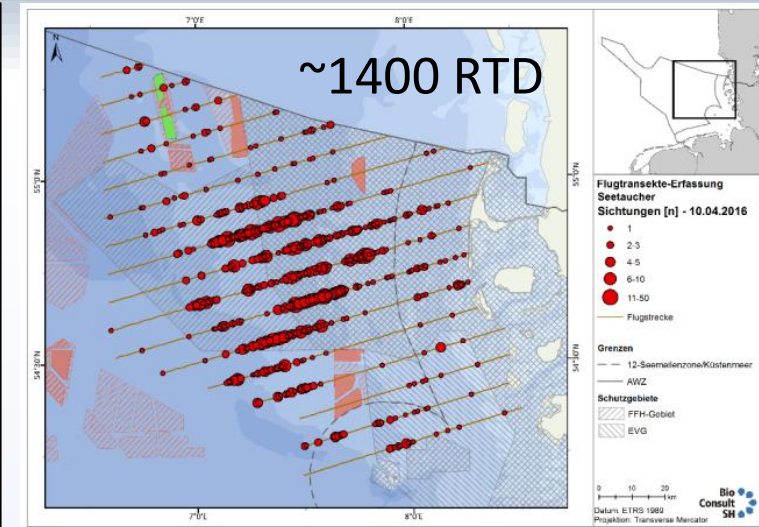


- $n = 418$ relocations
- Deviance explained: 17.2 %

- **GAM:** Relocation distances decrease with increasing distance from OWFs
- ID explains part of the variation
- Water depth not significant

Method: Distribution & displacement - survey data

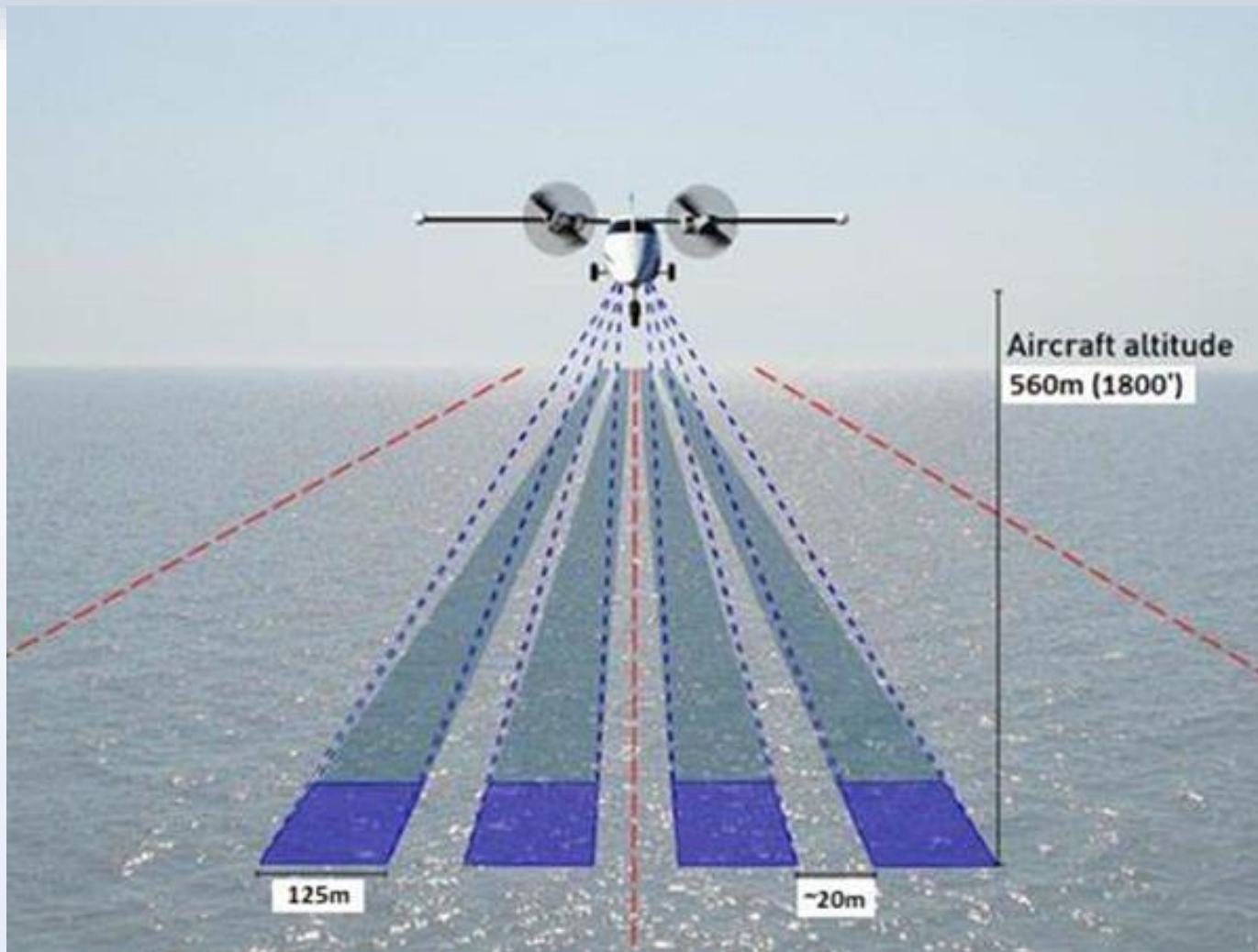
- Data from two HiDef digital surveys were used: 10 April 2016 and 1 May 2016
- Bird data converted into density (birds/km²) in 500 m segments
- Survey data associated with environmental data
- Two step Generalised additive mixed model
 - Binominal model
 - Positive density gamma



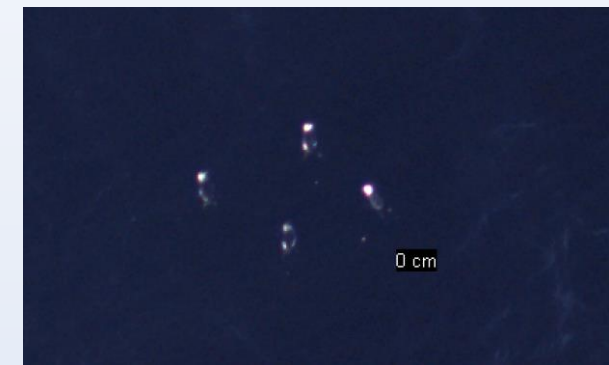
See
Heinänen et
al. in prep.

(S. Heinänen, DHI)

HiDef Aerial Digital Video Surveys



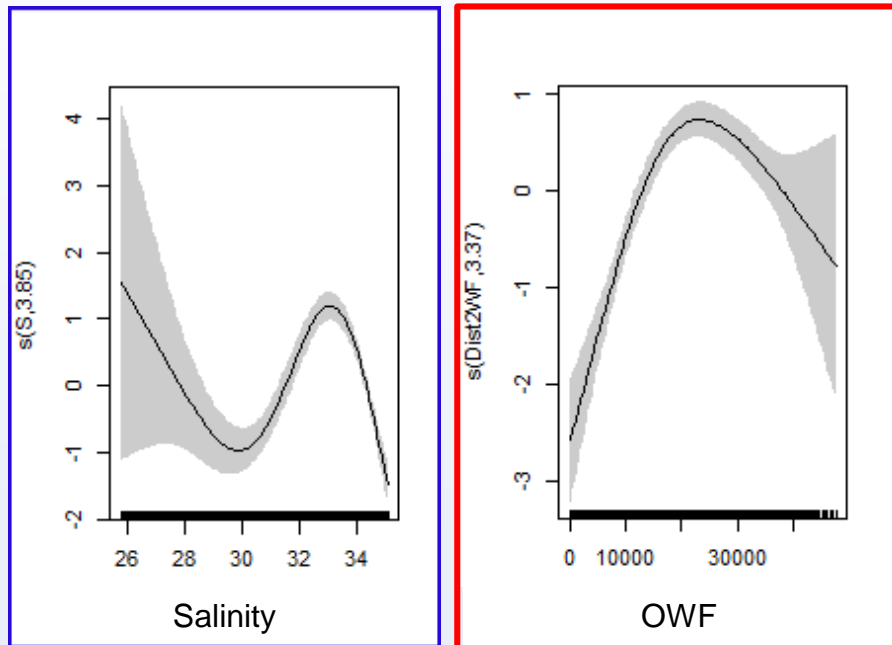
Red-throated diver/Plongeon catmarin
Black-throated diver/ Plongeon arctique



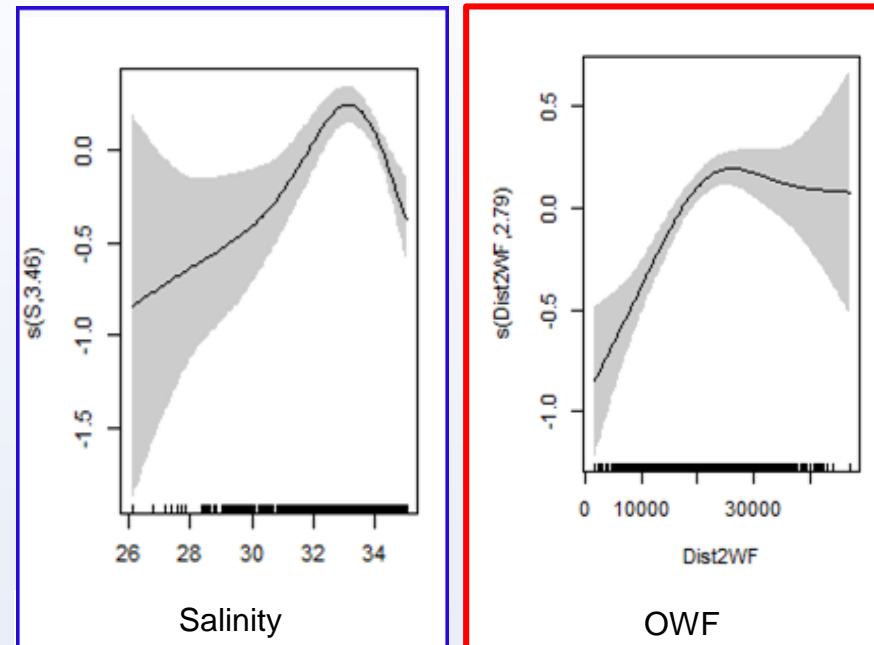
Model results – survey data

- Salinity strongest predictor variable, showing peak of suitable habitat at 32-34‰
- Distance to wind farms showed increasing habitat suitability & bird density up to 20 km

Presence/absence (binomial)



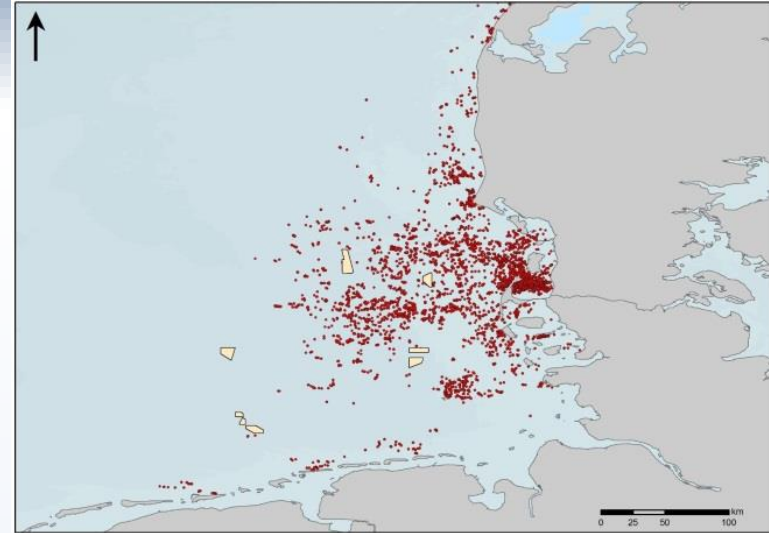
Positive density, birds/km² (gamma)



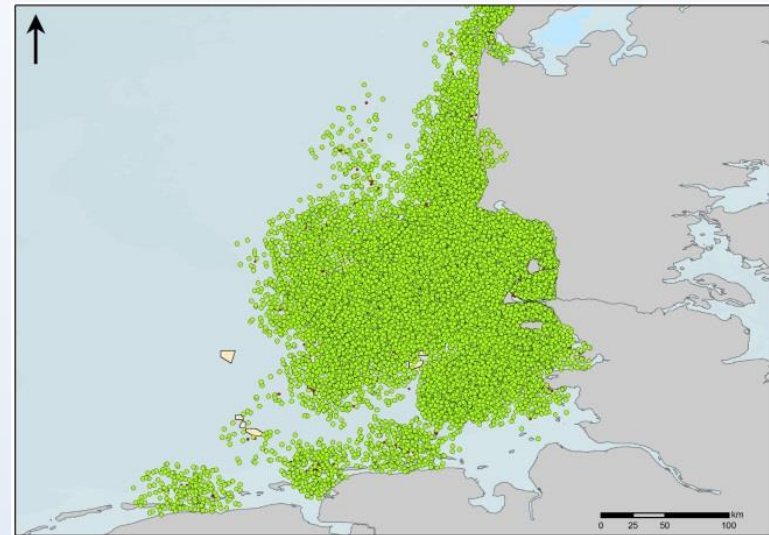
See Heinänen et al in prep.; S. Heinänen DHI

Method: Distribution & displacement – tracking data

- 28 tracked individuals
→ Period: between March 2015 – September 2016
- Filtering Argos data using Freitas filter (*argosfilter* package in *R*)
- Generating pseudo-absence positions (random pseudo-absence locations for each actual telemetry position)



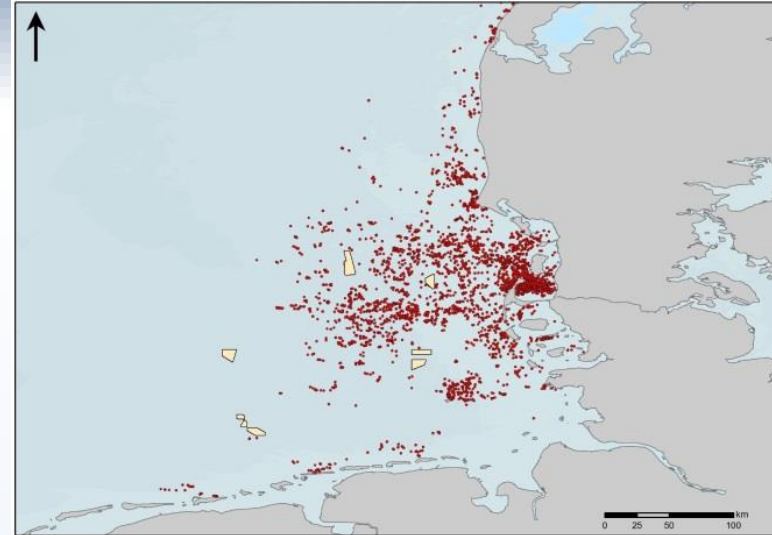
See Žydelis
et al in prep.



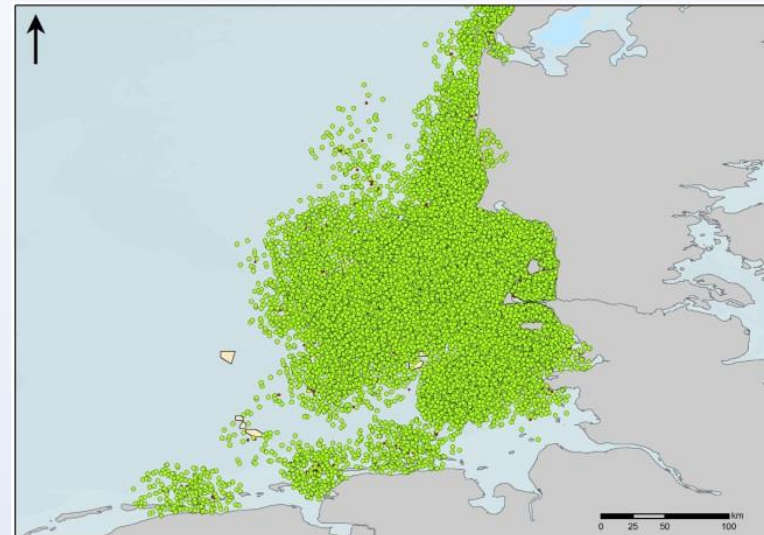
(R. Žydelis,
DHI/Ornitela)

Method – distribution & displacement – tracking data

- Associating all position data with environmental variables
- Applying generalized additive mixed modelling (*gamm4* package in *R*) by using individual bird as random effect



See Žydelis
et al in prep.

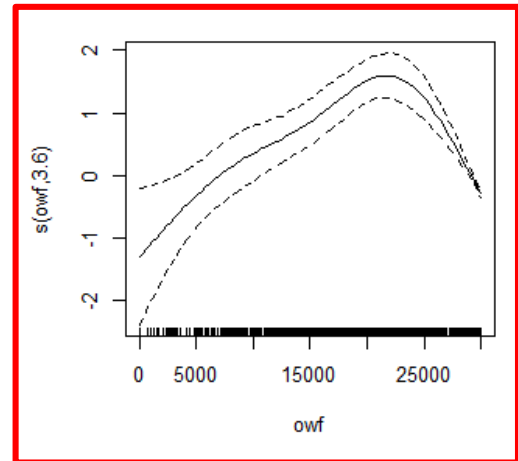
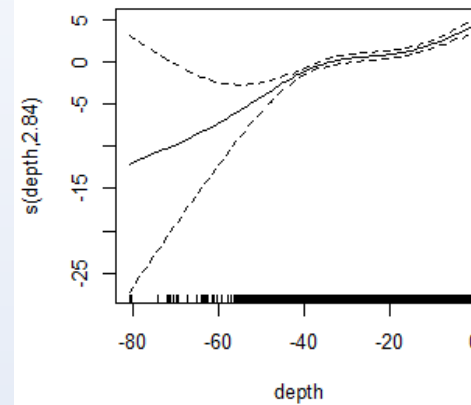
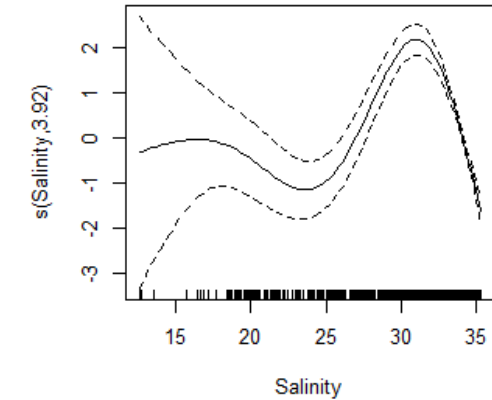
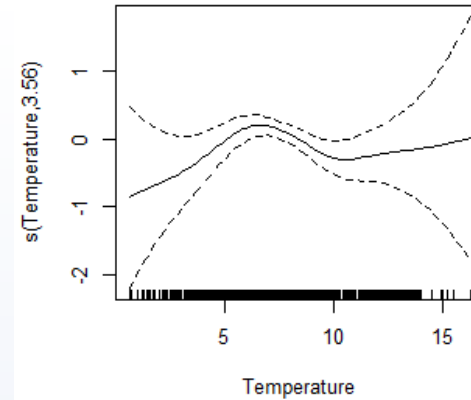


(R. Žydelis,
DHI/Ornitela)

Model results – tracking data

- Temperature, Salinity, Water depth and distance to OWF were significant **See Žydelis et al in prep.**
- Response curve shows increasing probability of suitable habitat up to 20 km from offshore wind farms

See Žydelis et al in prep.; R. Žydelis, DHI/Ornitela



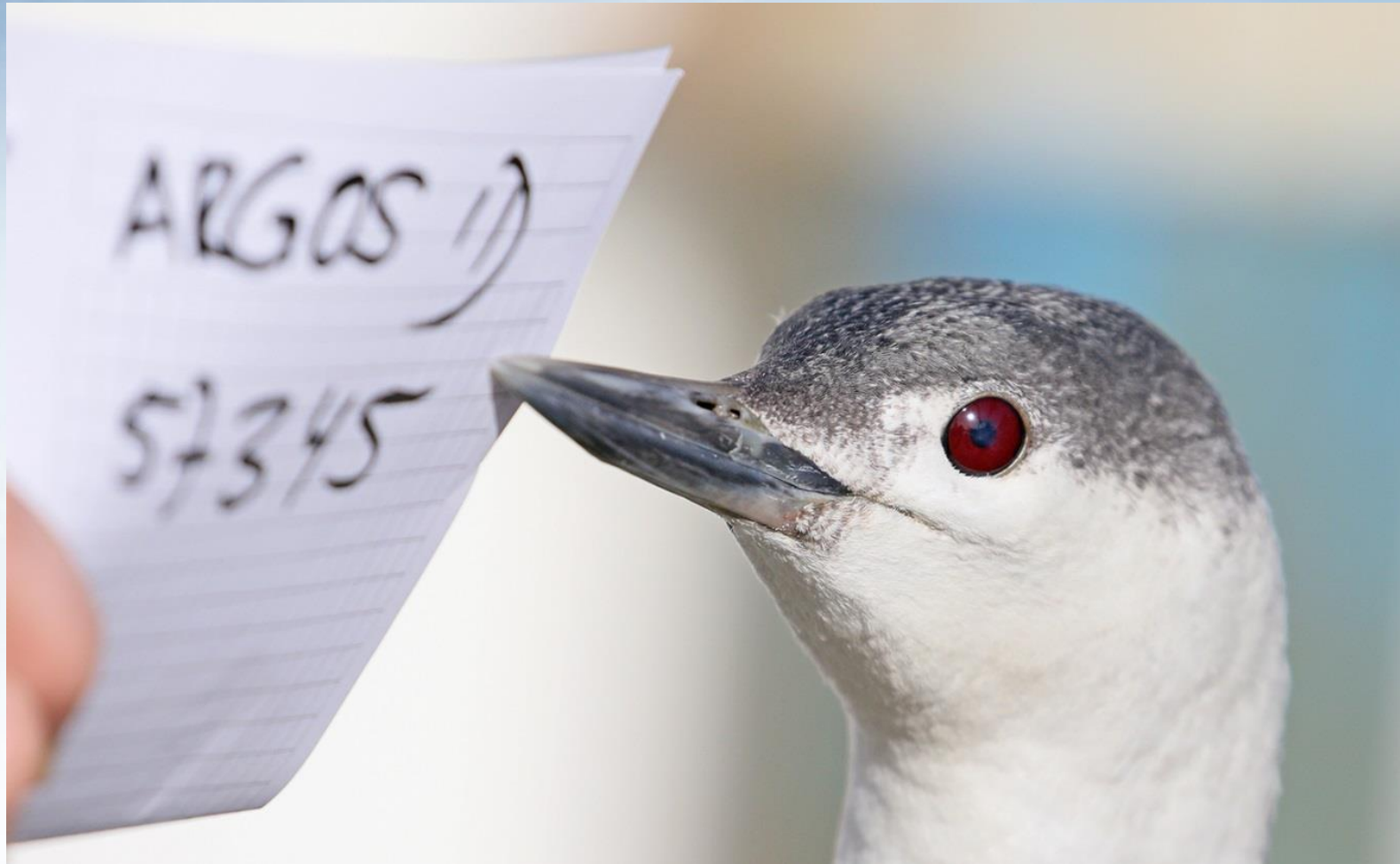
Discussion: Distribution patterns

- Two different datasets of different temporal scale (Survey & Tracking data)
→ Results were very similar
- In the German Bight red-throated divers aggregate on distinct frontal areas (Similar result by Skov & Prins 2001), most influential environmental parameters were salinity and water depth.
- Both models showed that divers clearly avoid being in the proximity of offshore wind farms

Discussion: Distribution patterns

- Red-throated divers in the German Bight show large wintering home ranges
- Effect of OWFs (or related factors, e.g. ships) on individual movements
 - Greater movements and displacement effects close to OWFs indicate disturbance → Fitness consequences?
 - Compare patterns to other wintering areas

Thank you!



www.Divertracking.com





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