Red-throated Diver habitat use in the German North Sea based on telemetry data

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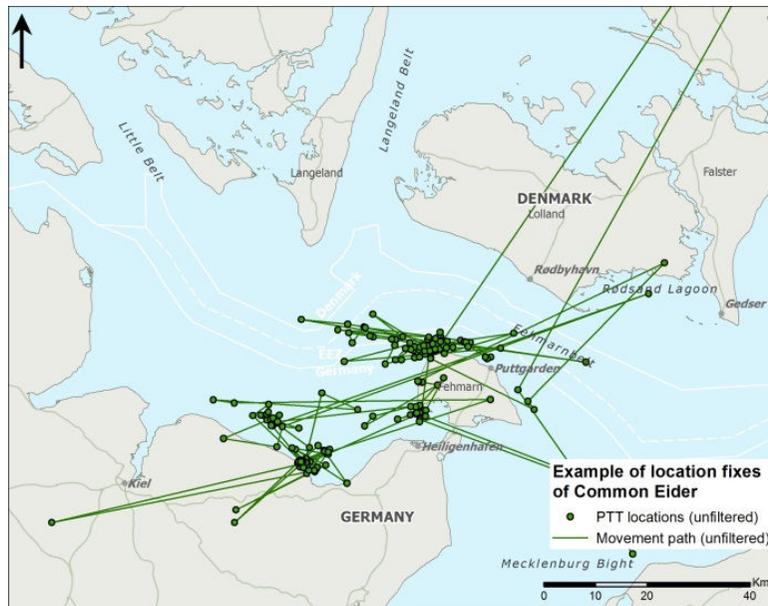
Objective of this talk

- Characterize habitat characteristics preferred by Red-throated Divers in the German Bight
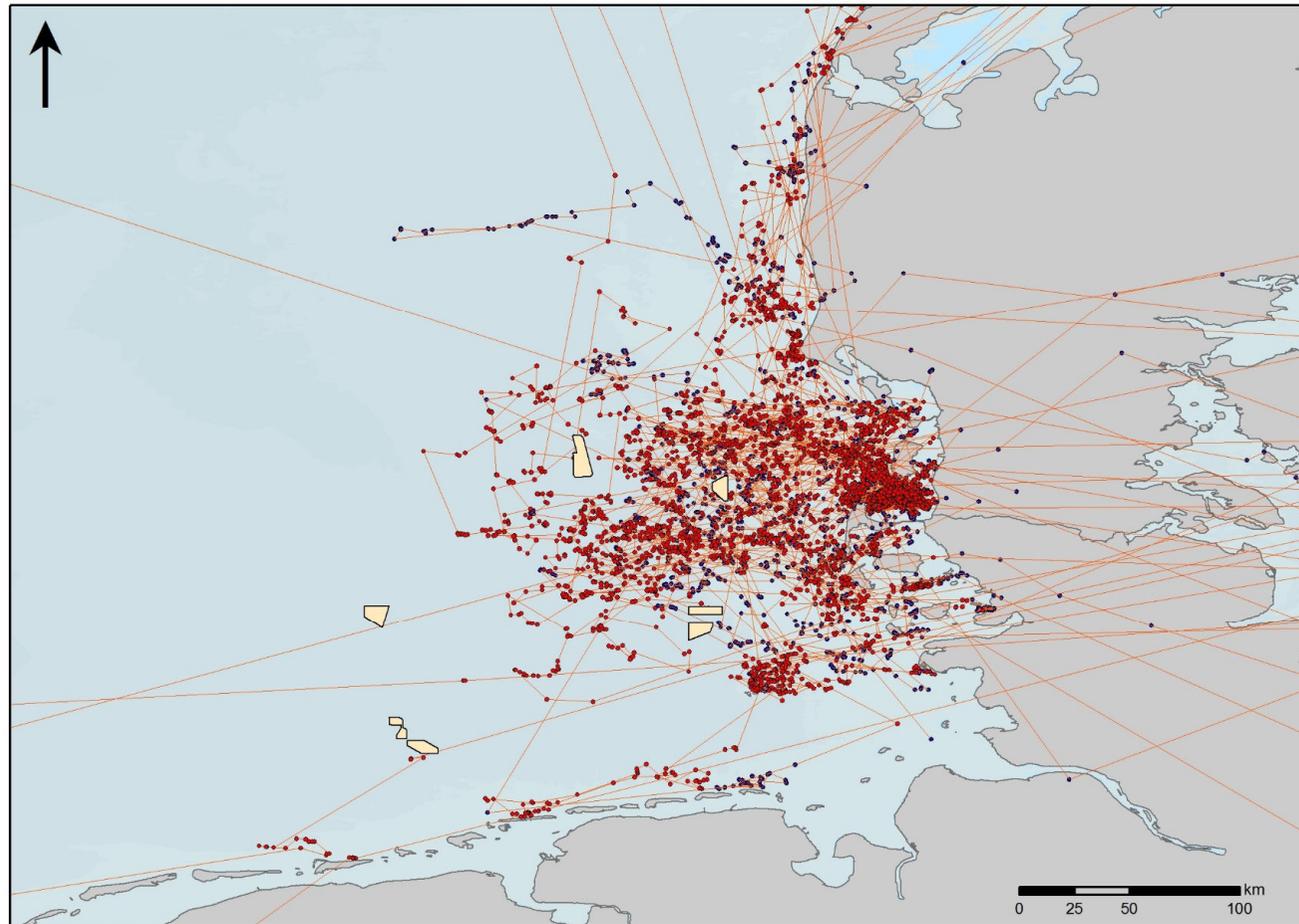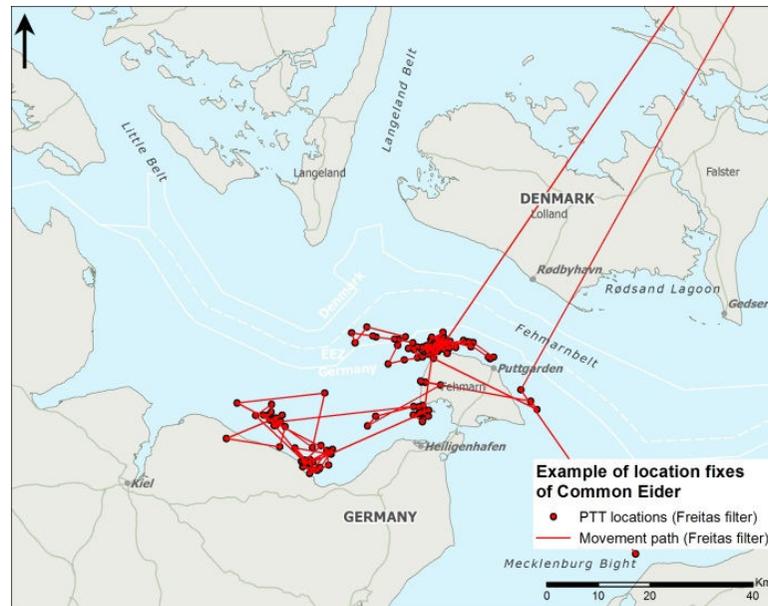
Methodological approach

1. Filtering Argos data using Freitas filter (*argosfilter* package in *R*)
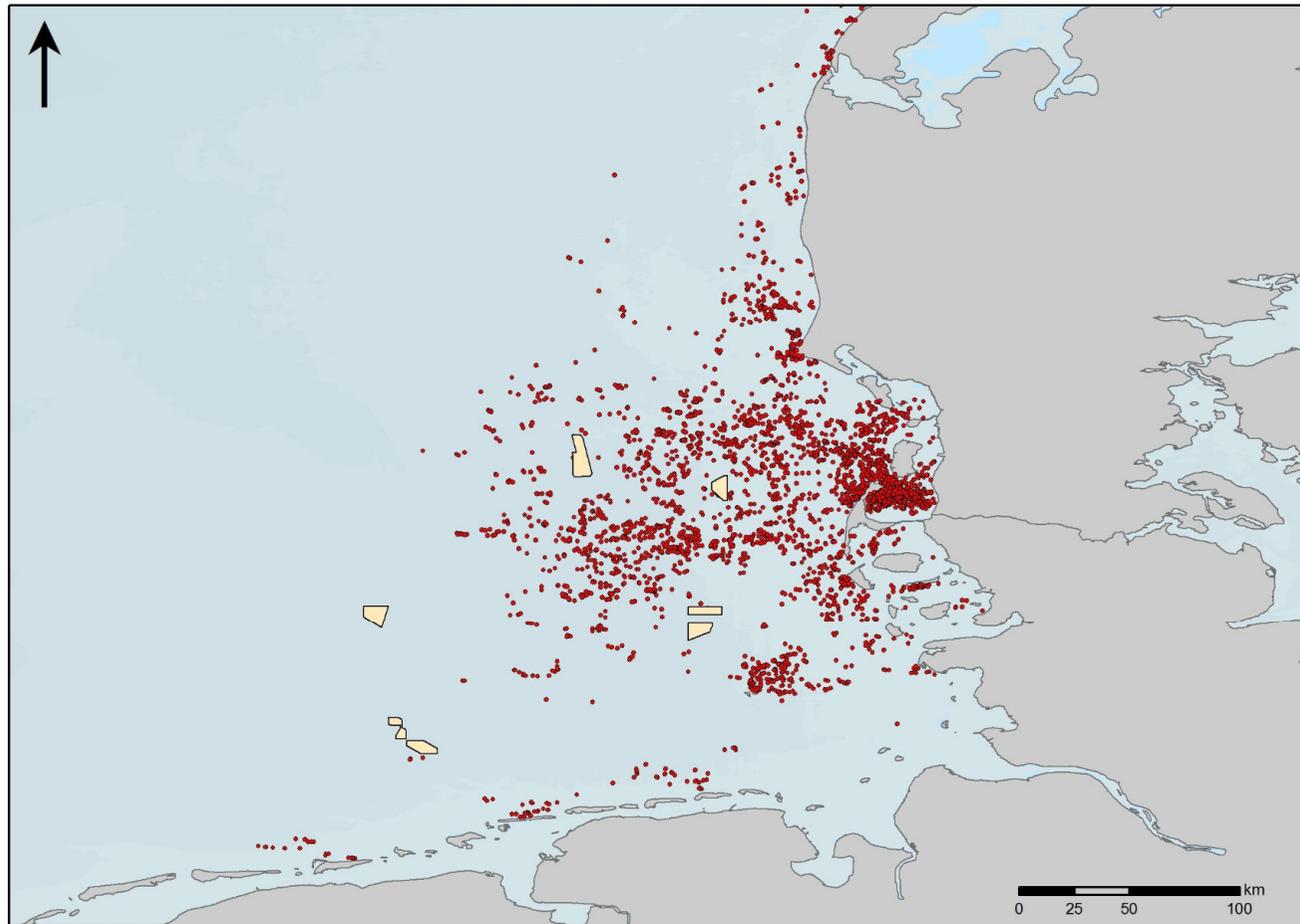
Unfiltered

Filtered

Methodological approach

2. Generating pseudo-absence positions (10 random pseudo-absence locations for each actual telemetry position within 20 km radius around it)
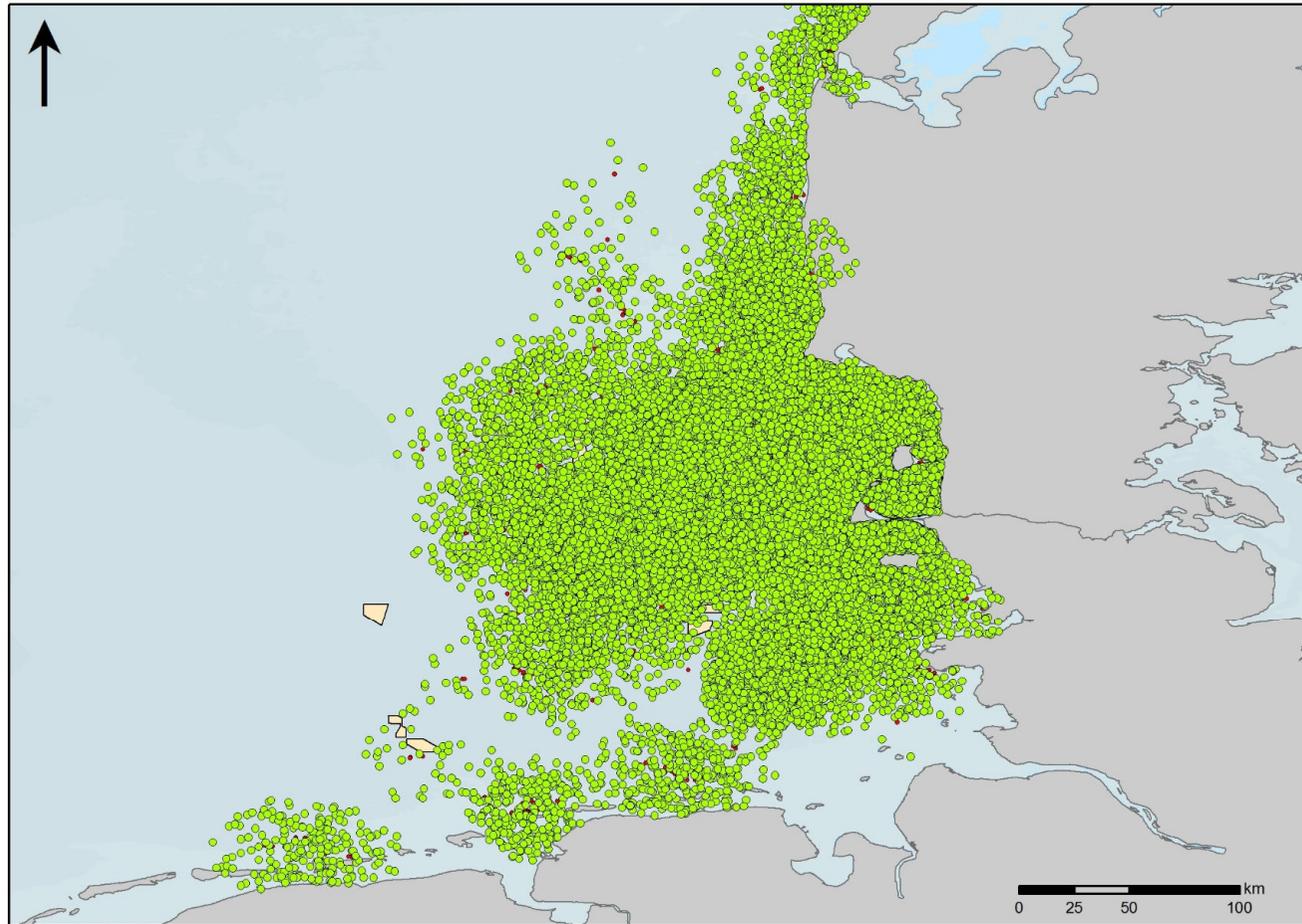
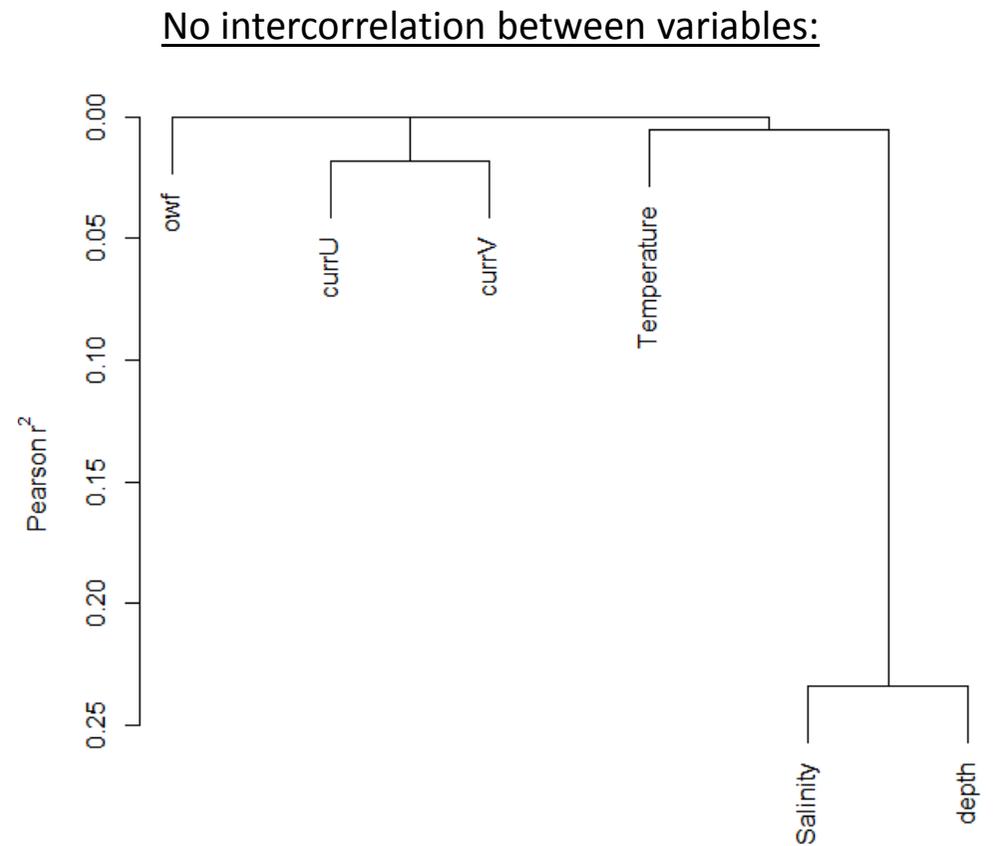# Methodological approach

2. Generating pseudo-absence positions (10 random pseudo-absence locations for each actual telemetry position within 20 km radius around it)

Methodological approach

3. Associating all position data with environmental variables:

- Water depth

- Distance to wind farms

- Current U velocity

- Current V velocity

- Salinity

- Water temperature

No intercorrelation between variables:

Methodological approach

4. Subsampling telemetry data by randomly drawing 1 position per bird per day

5. Subsampling pseudo-absence locations by randomly picking 2 locations for each telemetry position (models converged poorly with higher ratio of pseudo-absence locations involved due to too large sample size)

6. Applying generalized additive mixed modelling (*gamm4* package in *R*) by using individual bird as random effect

Results

- Current U and current V turned out being unimportant variables and were excluded from the model

- The remaining variables were significant

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Family: binomial
Link function: logit

Formula:
resp ~ s(Temperature, k = 10) + s(Salinity, k = 5) + s(depth,
    k = 5) + s(owf, k = 5)

Parametric coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -2.249      0.244   -9.22   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
                edf Ref.df  Chi.sq p-value
s(Temperature) 3.563  3.563    9.778  0.0331 *
s(Salinity)    3.922  3.922  196.825  <2e-16 ***
s(depth)       2.845  2.845  119.588  <2e-16 ***
s(owf)         3.602  3.602   94.052  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.553
glmer.ML = 1420.1  Scale est. = 1          n = 2520
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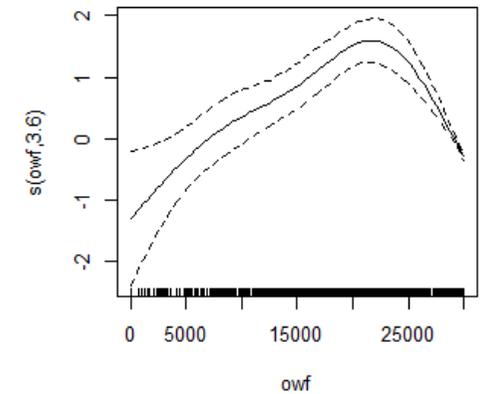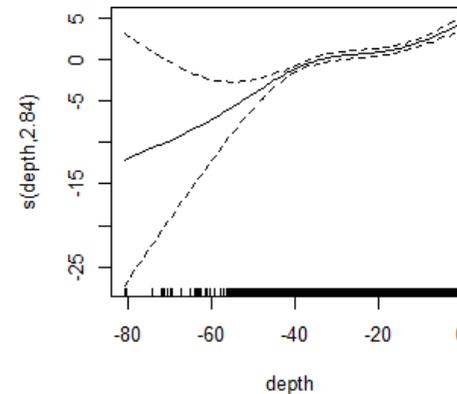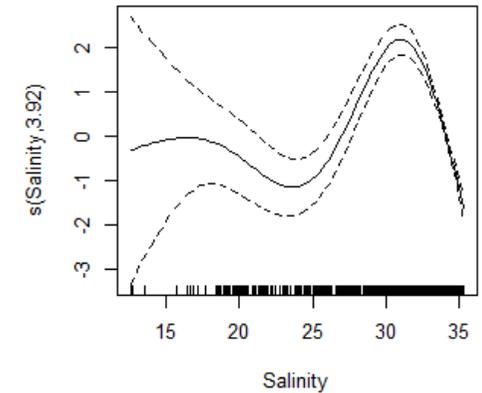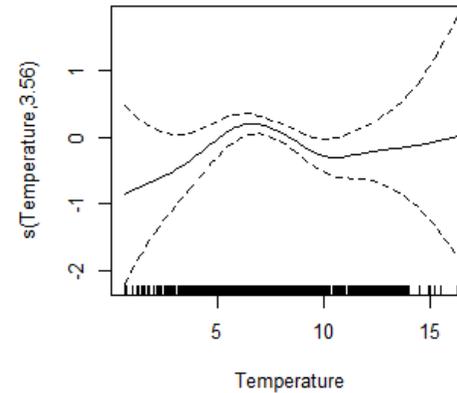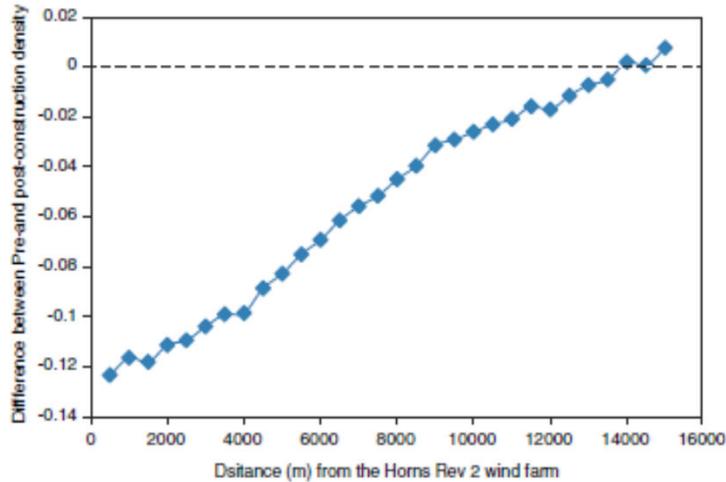
Results

Figure 20. Differences between pre- and post-construction densities (y-axis) of divers in the Horns Rev 2 survey area in relation to 500 meters distance intervals (x-axis) from the periphery of the Horns Rev 2 offshore wind farm. Negative values indicate lower densities after the construction of the Horns Rev 2 offshore wind farm.

Petersen et al. 2014

Figure 26. Differences between pre- and post-construction abundances by 0.25 km grid square (y-axis) of Common Scoters in the Horns Rev 2 survey area in relation to 500 meters distance intervals (x-axis) from the periphery of the Horns Rev 2 offshore wind farm. Negative values indicate lower abundances after the construction of the Horns Rev 2 offshore wind farm.
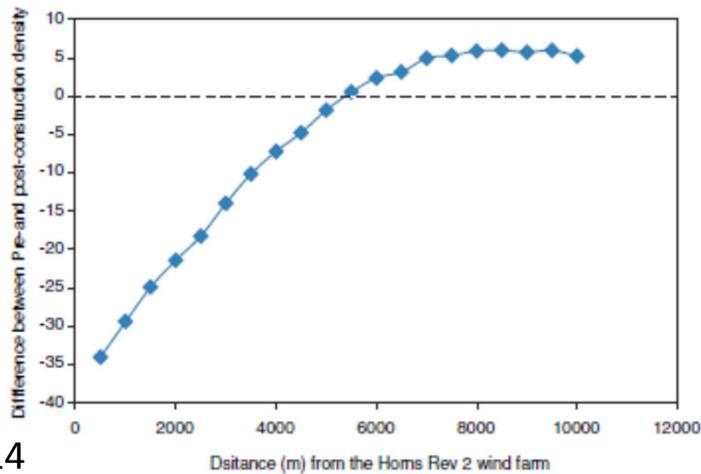
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...important variables and were excluded from
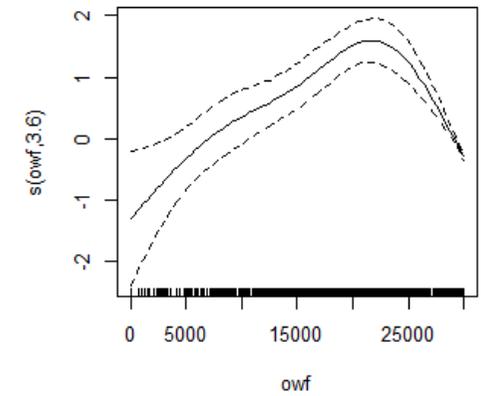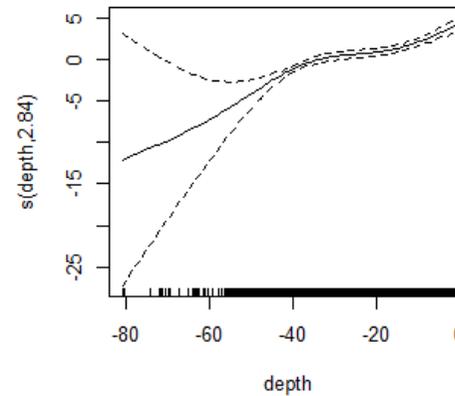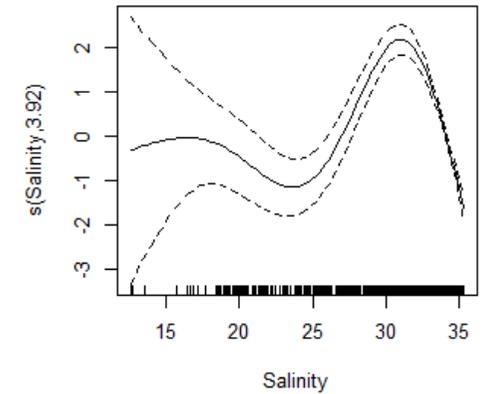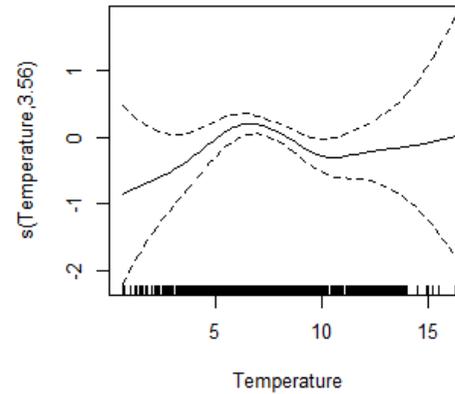
Conclusions

- Red-throated Divers aggregate on distinct frontal area in the German Bight, most distinguishing by salinity peak at 32 ppm. The frontal zone is created by Elbe outflow and tidal currents.

- The species has preference towards shallower depths.

- Divers clearly avoid being in the proximity of offshore wind farms. However this effect is over-emphasized in the model due to other confounding factors (the model shows avoidance up to 20 km).

- Habitat modelling using *gamm4* is rather problematic due to poor model convergence with increasing sample size (simple *gamm* fails even earlier). Alternative analysis methods should be explored aiming to find more stable solutions.

- Habitat choice of divers tracked across marine areas with different environmental characteristics should be analyzed in separate models due to likely different habitat preferences in different regions (e.g., North Sea *vs* Baltic Sea *vs* White Sea *vs* Kara Sea)

Thank you!