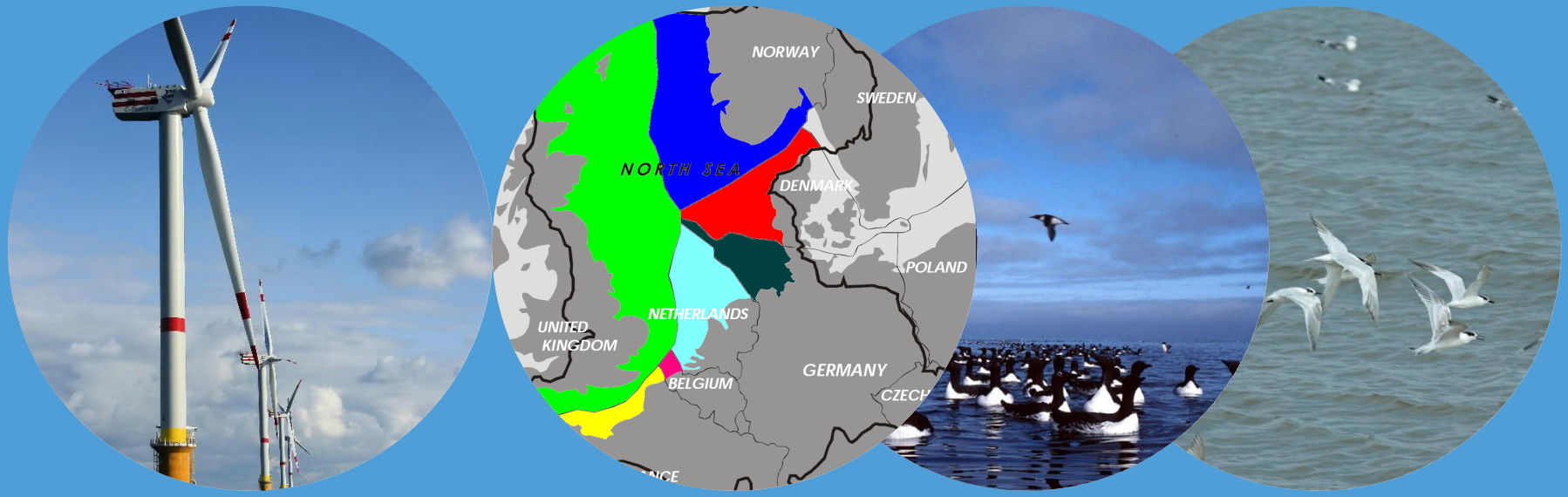
Windmolens op zee en habitatverlies: Populatie effecten voor vijf soorten zeevogels

F. H. Soudijn, D. Benden, C. Chun, M. Leopold, I. Tulp, T. van Kooten



WAGENINGEN UNIVERSITY & RESEARCH
100years 1918 — 2018
WOZEP DUTCH GOVERNMENTAL OFFSHORE WIND ECOLOGICAL PROGRAMME

Offshore wind farms (OWF) vs. seabirds

- Research project “Kader Ecologie en Cumulatie”
  - Populations of porpoises, birds, bats
  - Cumulative effect of OWF deployment planned up to 2030 outside of 12 miles zone
- Effects of OWF on seabirds
  - Collisions
  - Habitat loss

Habitat loss: avoidance of “Lucht ter Duin” by common guillemot

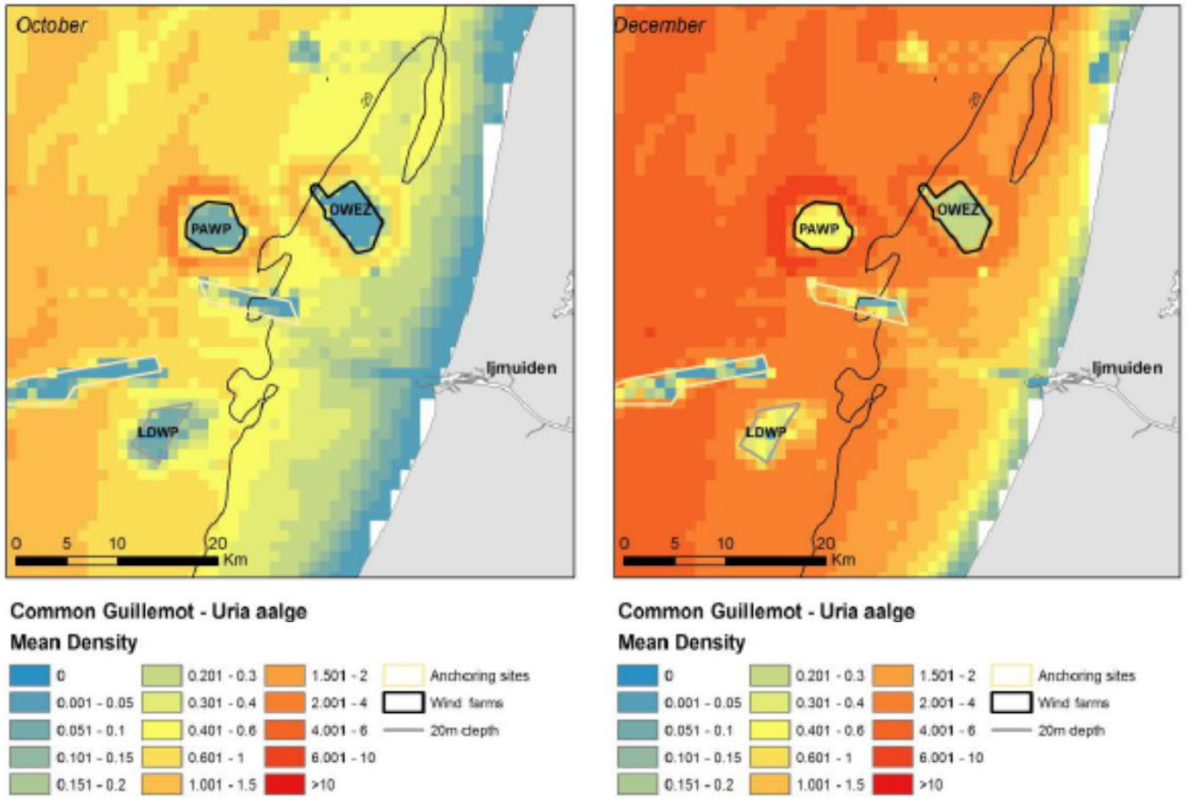


Figure 23. Predicted monthly distribution (n/km^2) of wintering Common Guillemot during the LUD TConstr surveys 2014.

Lucht ter duin, Skov et al. 2015

What are the population level effects of habitat loss due to offshore wind deployment?

Northern gannet
(Jan van Gent)

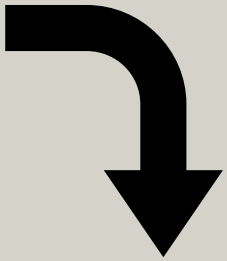
Sandwich tern
(Grote stern)

Common guillemot
(Zeekoet)

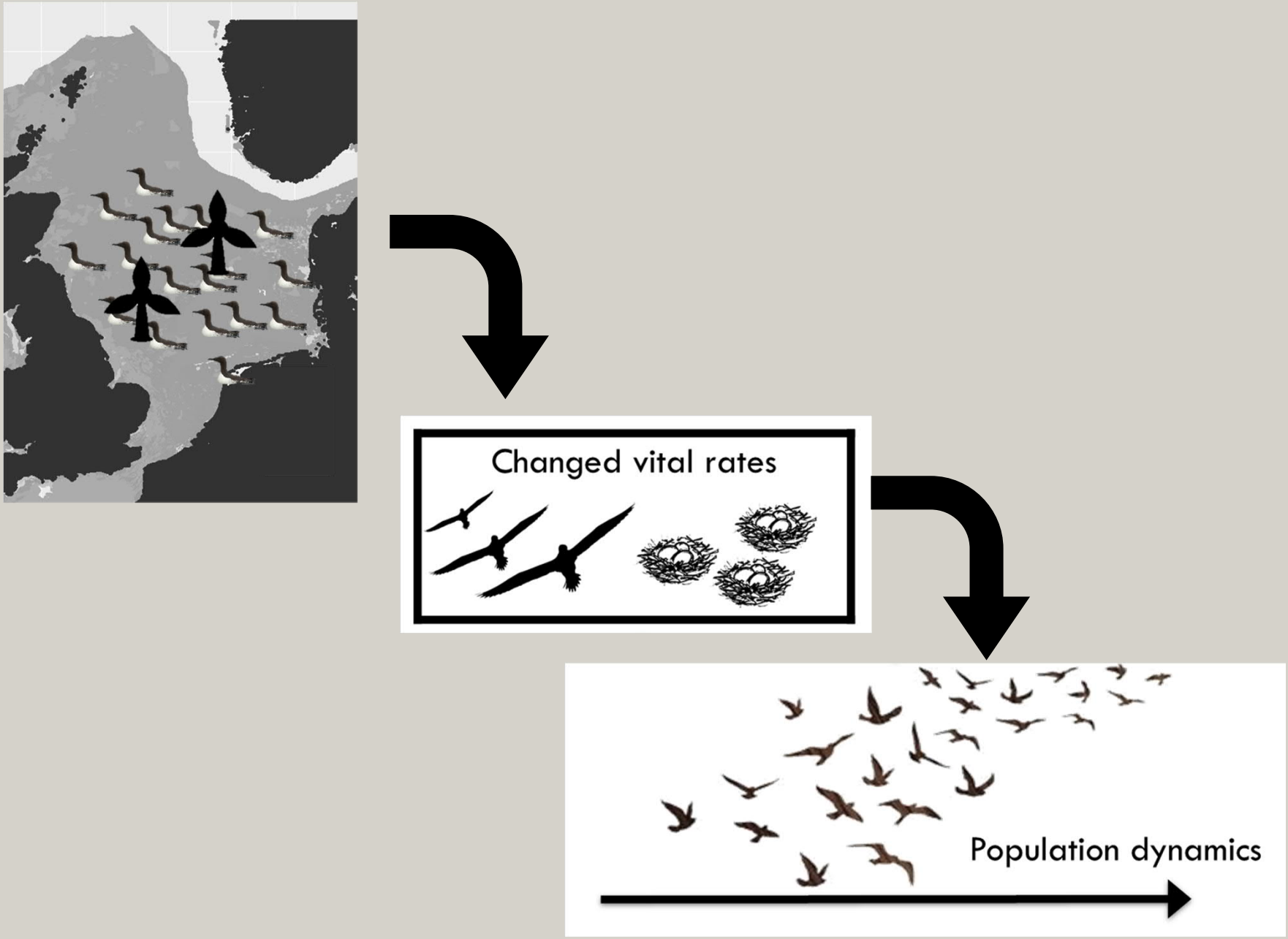
Red throated diver
(Roodkeelduiker)

Razorbill
(Alk)

Dierschke, Furness & Garthe, 2016




Changed vital rates


Changed vital rates
Population dynamics

Red throated diver

Migrating/ flying around (April-May)

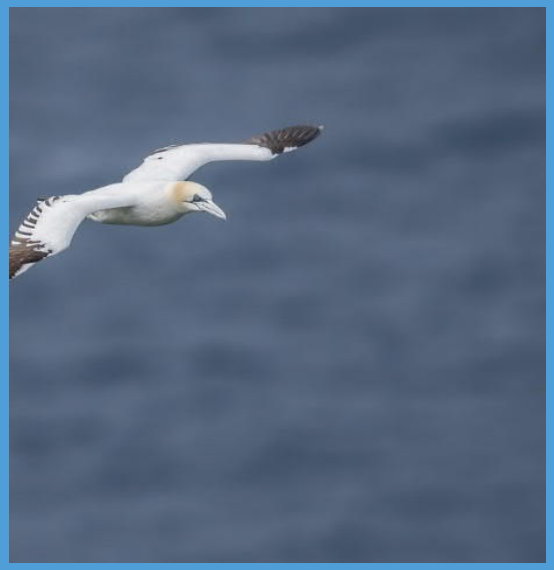
Solitary breeding near small lake (June-Sept) – Russia/Scandinavia

Wintering (Oct-March) – along European coast

Northern Gannet

Breeding (April- Aug.) – Rocky Islands

Migrating/ flying around// wintering (Sept-March)



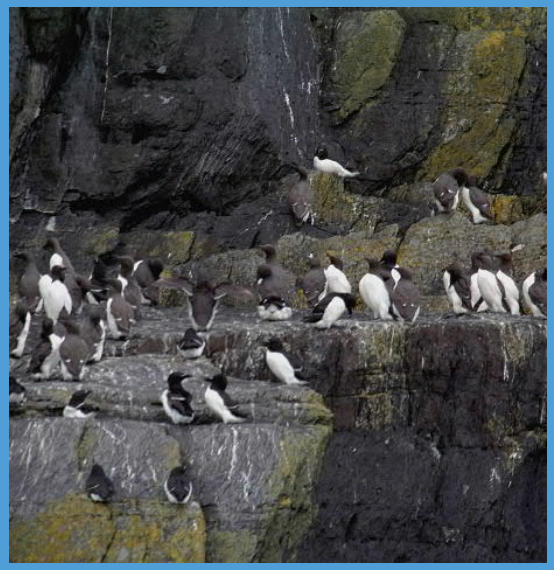
Sandwich tern

Breeding in dense colonies (April - July) – Sandbanks

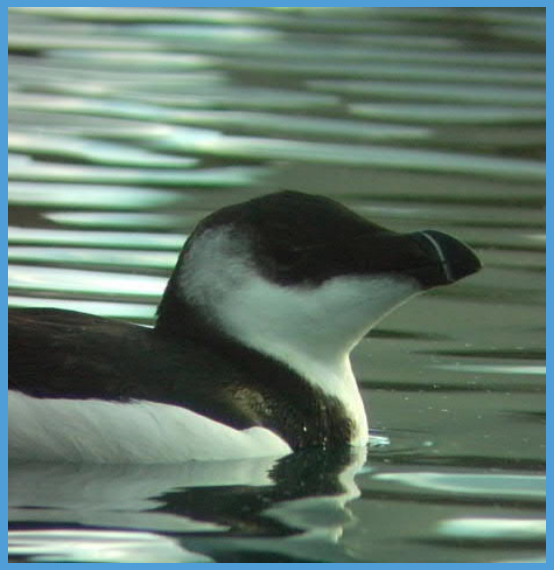
Migrating/ flying around (August – October) – ??

Wintering (November – March) – Africa/Southern Europe

Razorbill & common guillemot

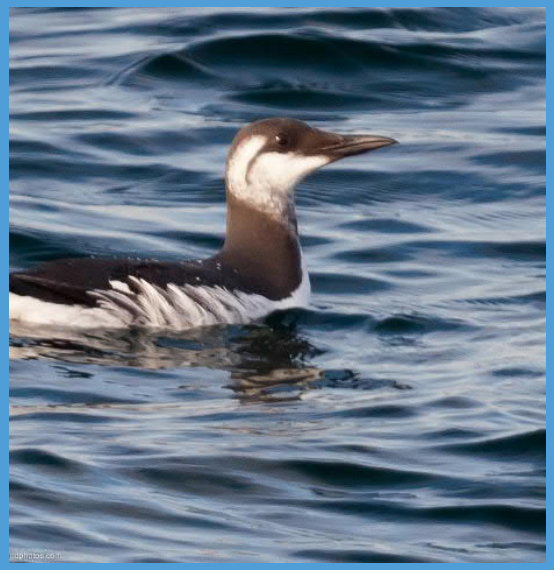


Dense (mixed) colonies, rocky shores



Breeding (~Apr. –Aug.)

Drifting // wintering (~Oct. – Mar.)



Breeding (~May. – June)

Drifting // wintering (~July. – Apr.)

Different life-history per species; presence in study area

Northern gannet
April-Aug (5 mo); Sept-March (7 mo)

Sandwich tern
April-August (5 mo)

Common guillemot
July-April (10 mo)

Red throated diver
Oct-March (6 mo)

Razorbill
Oct-March (6 mo)

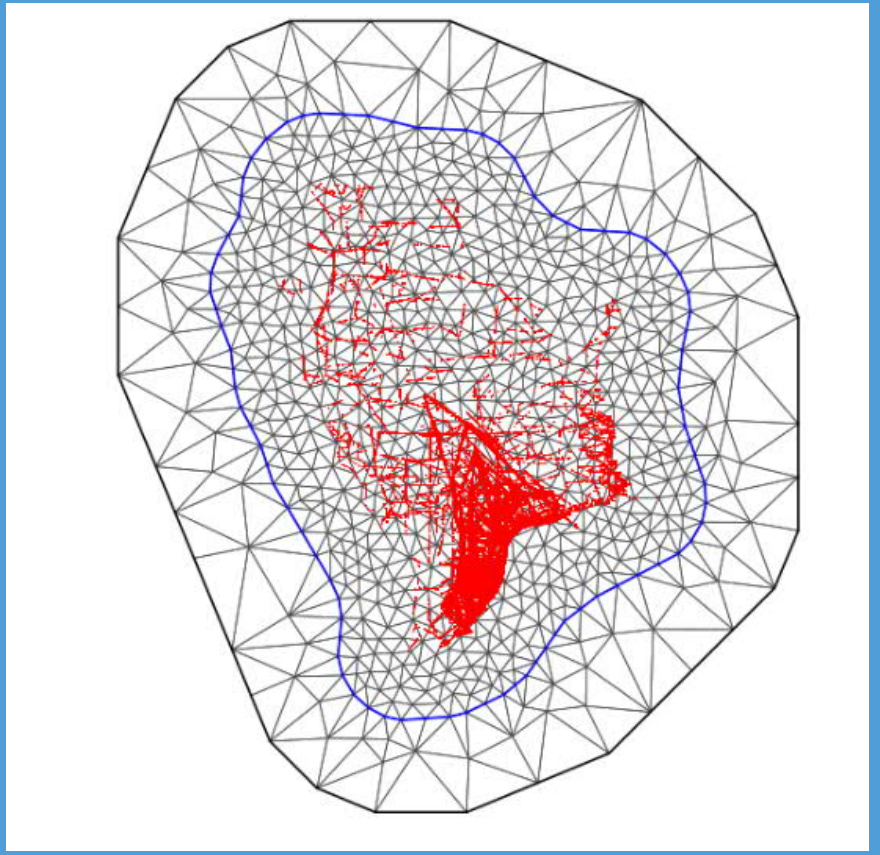
WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

WOZEP DUTCH GOVERNMENTAL OFFSHORE WIND ECOLOGICAL PROGRAMME

Step 1: How do the birds use the study area?

- Spatial Statistical model
- Bird count data (MWTL & ESAS)
- Abiotic variables
  - Sediment type
  - Water depth
  - Distance to coast
  - Distance to colony
  - Seafloor slope

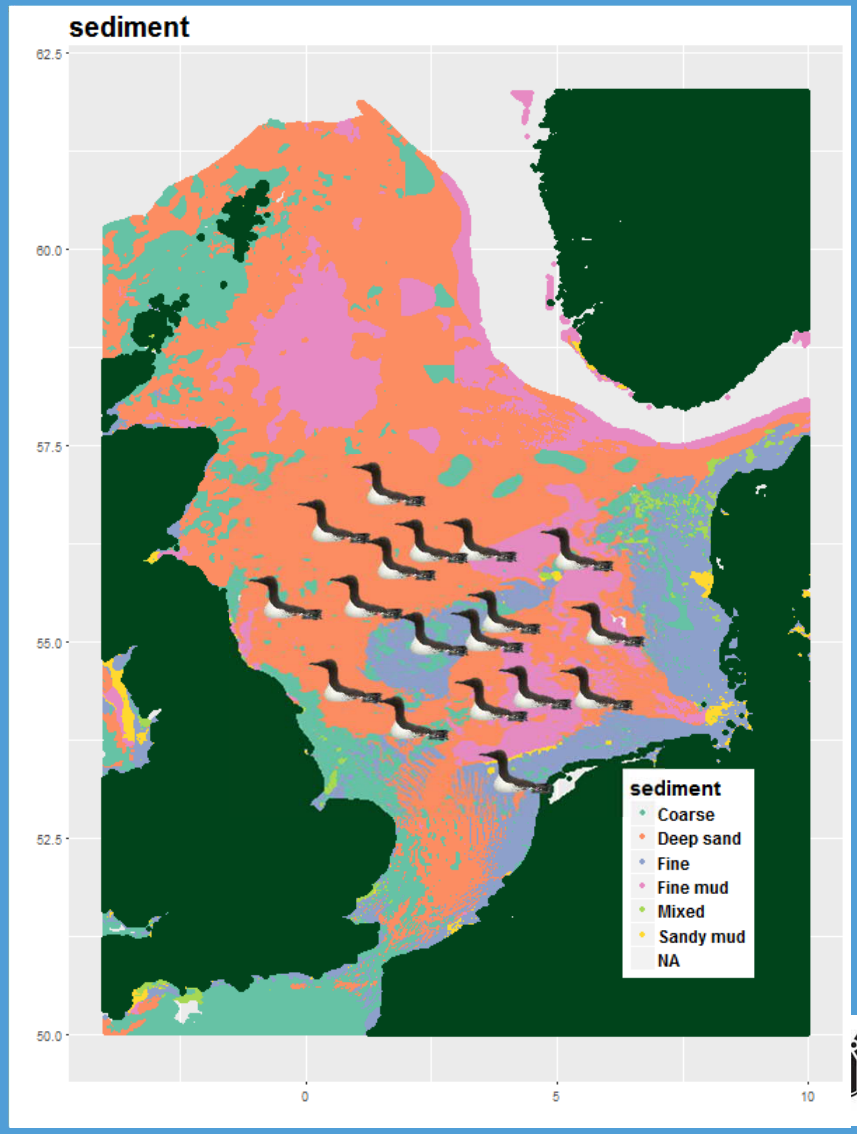


WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

WOZEP DUTCH GOVERNMENTAL OFFSHORE WIND ECOLOGICAL PROGRAMME

Data input – abiotic variables

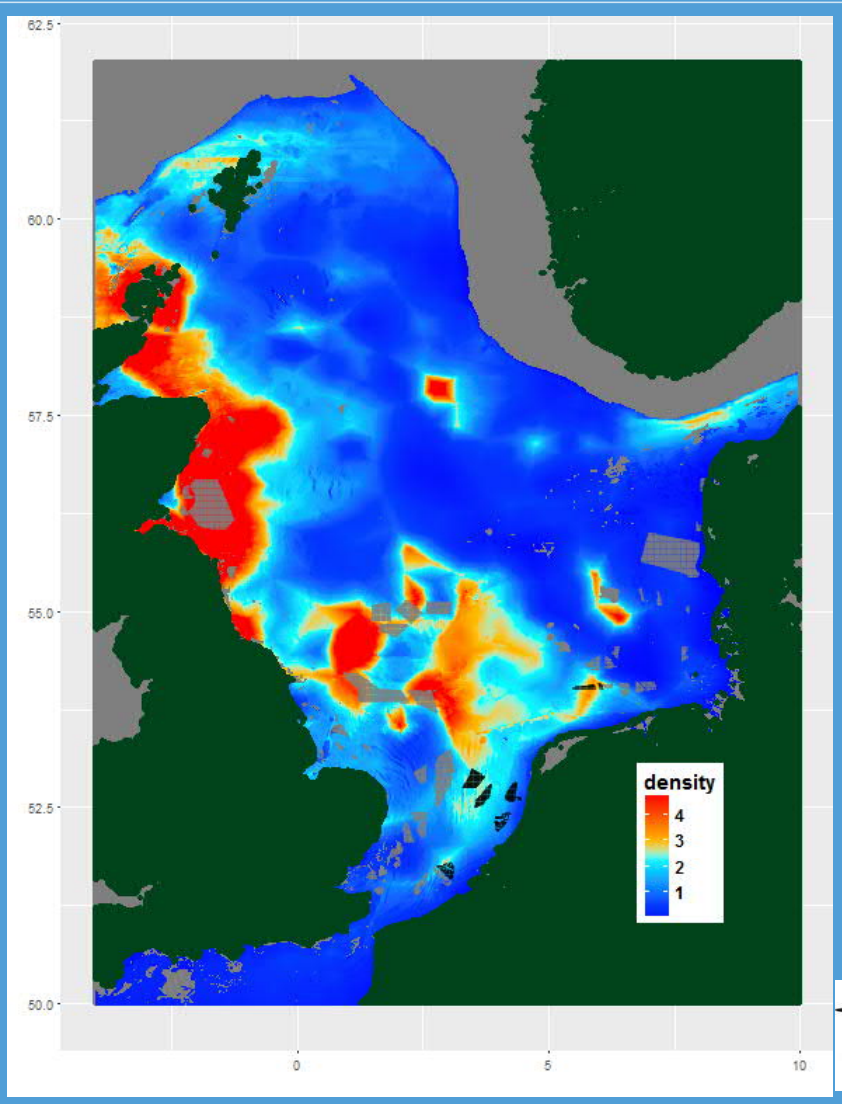


WAGENINGEN
UNIVERSITY & RESEARCH

100years
1918 — 2018

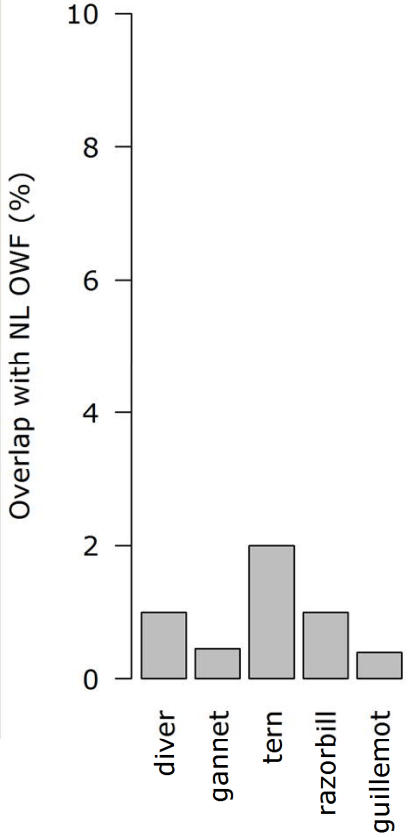
WOZEP
DUTCH GOVERNMENTAL OFFSHORE
WIND ECOLOGICAL PROGRAMME

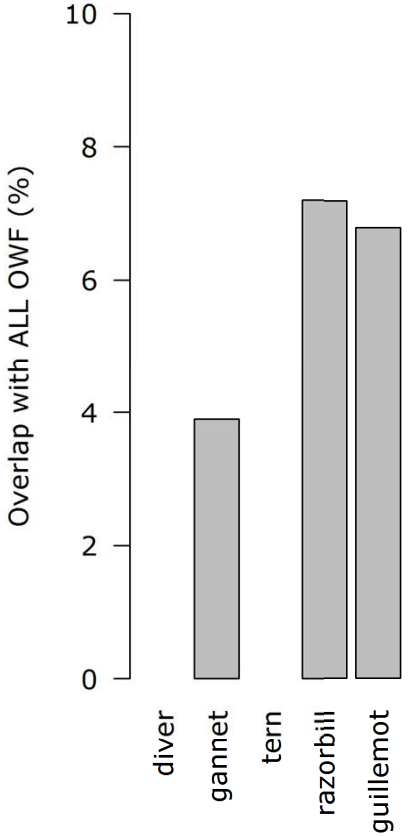
Guillemot density based on habitat suitability // OWF overlap=> baseline for the rest of the calculations



Overlap between population distribution and OWFs

< 2 %





4 - 7 %

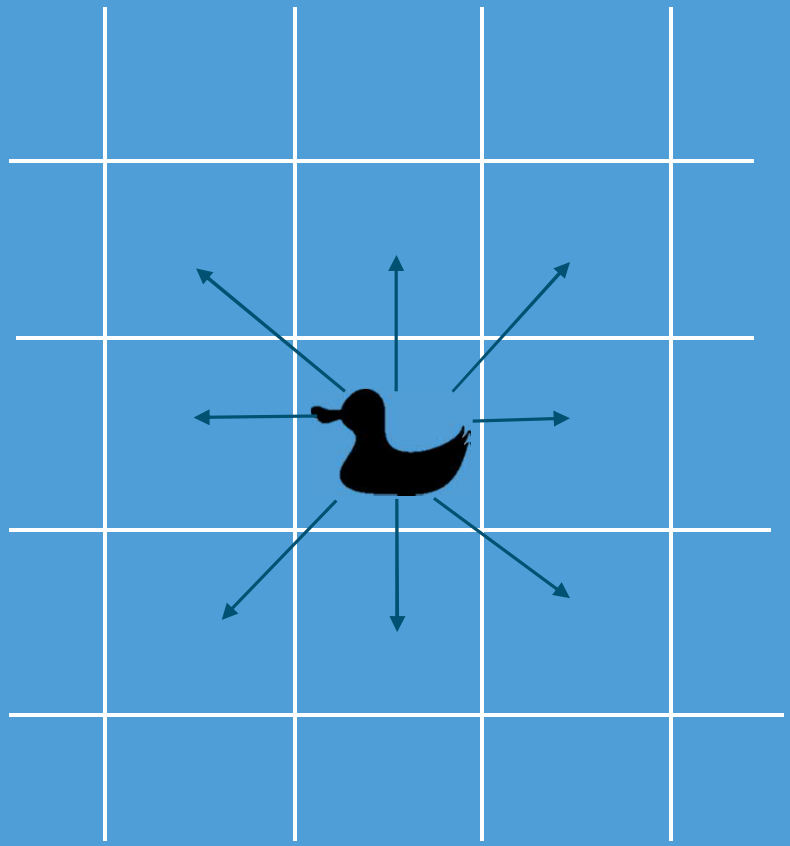
WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

DUTCH GOVERNMENTAL OFFSHORE WIND ECOLOGICAL PROGRAMME

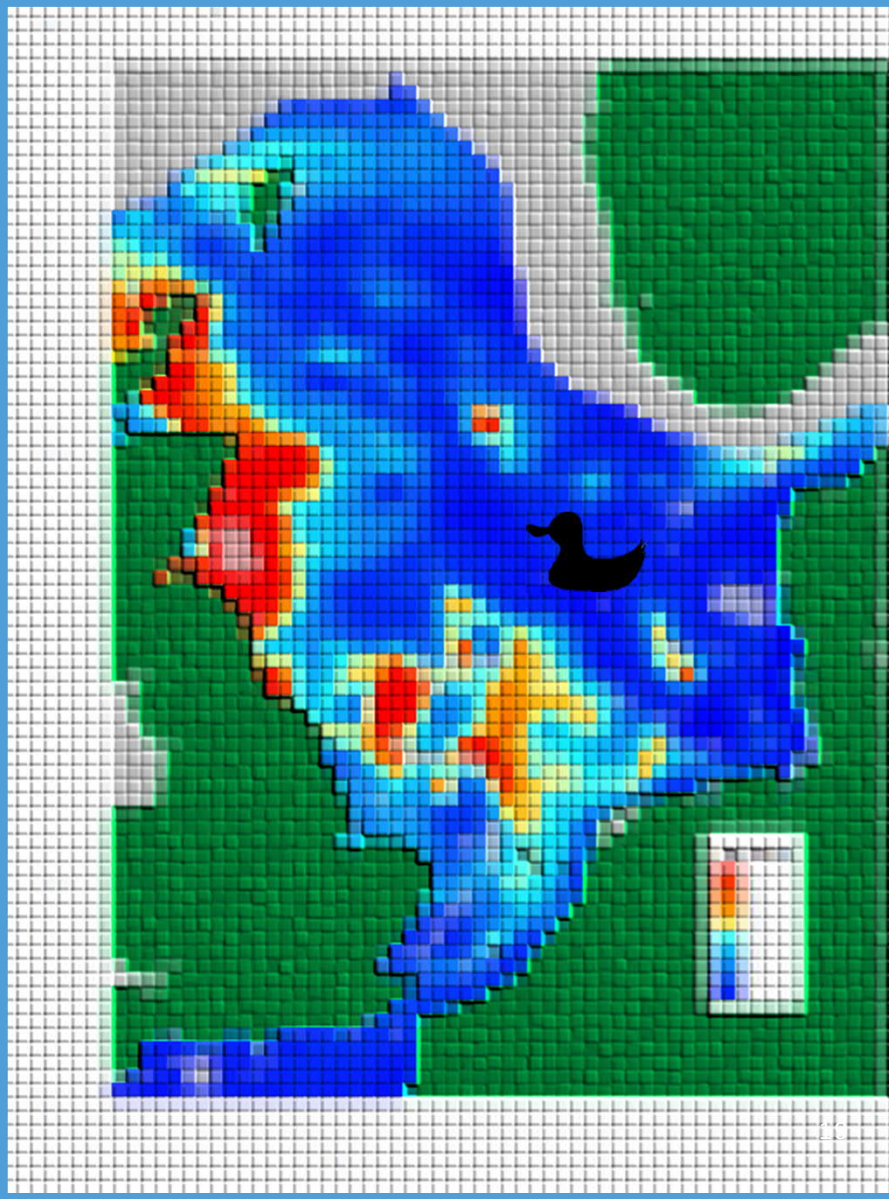
Step 2: What are the costs of habitat loss for the birds?

- Individual based model



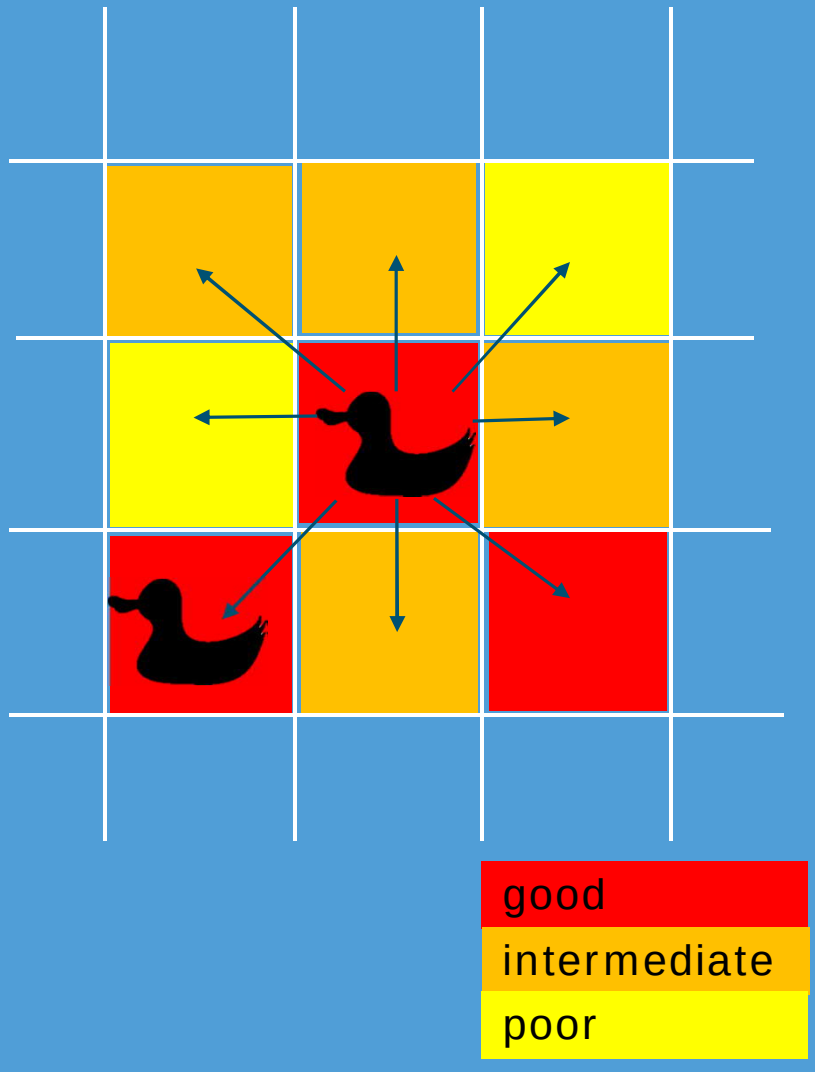
Step 2: Moving around the map

- Predict where the birds move to:
  - Bird density map (habitat suitability model) is used as food quality map
  - Higher probability of going to or staying in grid cell with high food density



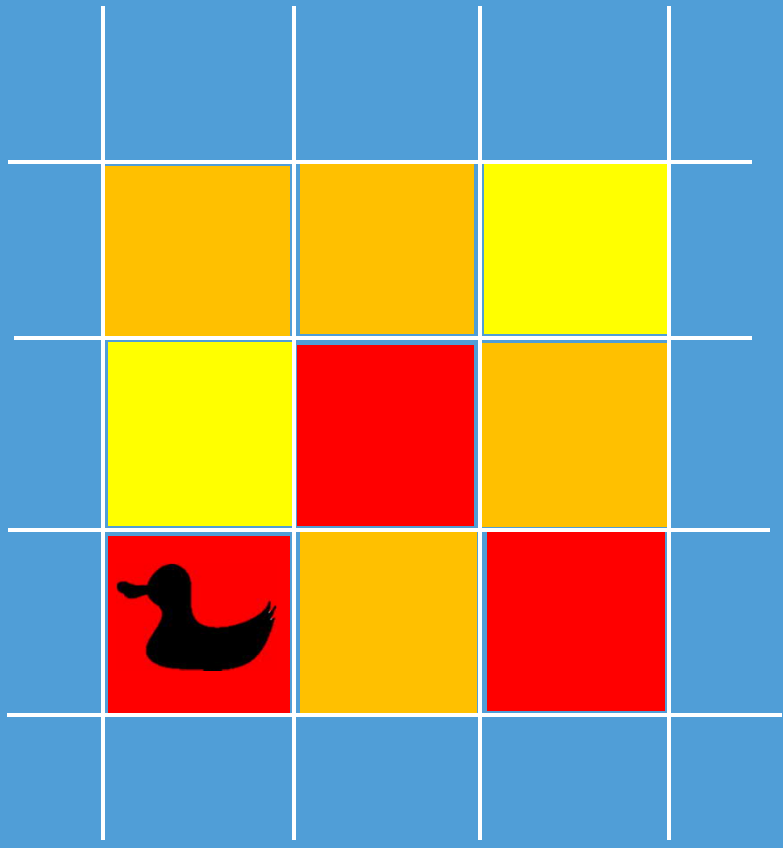
Step 2: Moving around the map

- Individual based model
- Bird density map (habitat suitability model) is used as food quality map
- Higher probability of going to or staying in grid cell with high food density



Step 2: Food intake -> Survival

- Higher food intake in grid cell with high food density
- Energy budget, estimates survival.
- Bird dies if energetic demands cannot be met



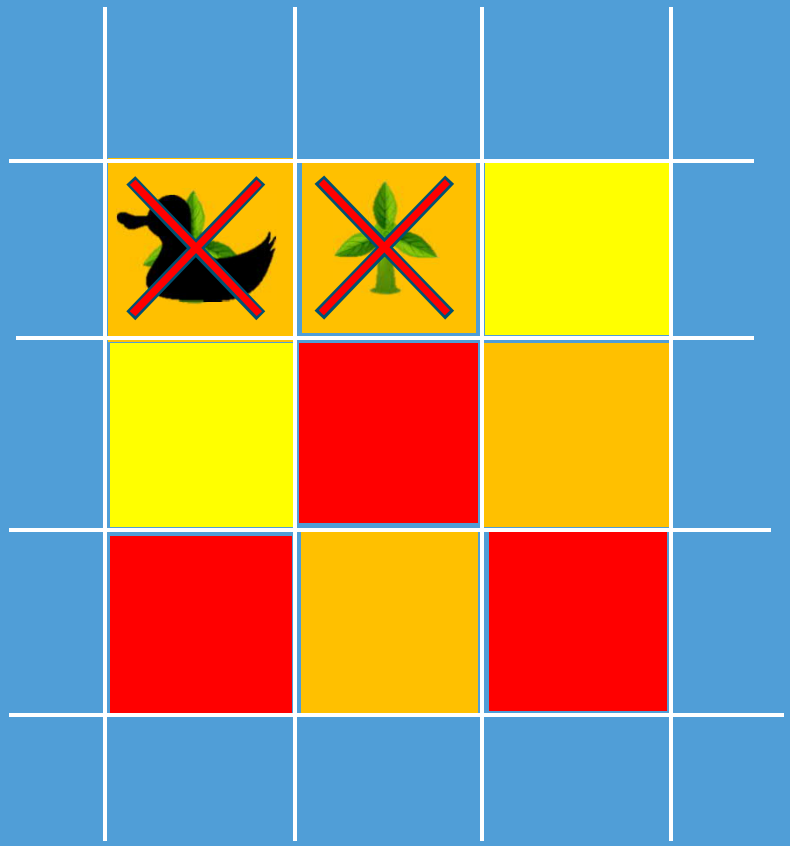
good
intermediate
poor

WAGENINGEN
UNIVERSITY & RESEARCH

100years
1918 — 2018

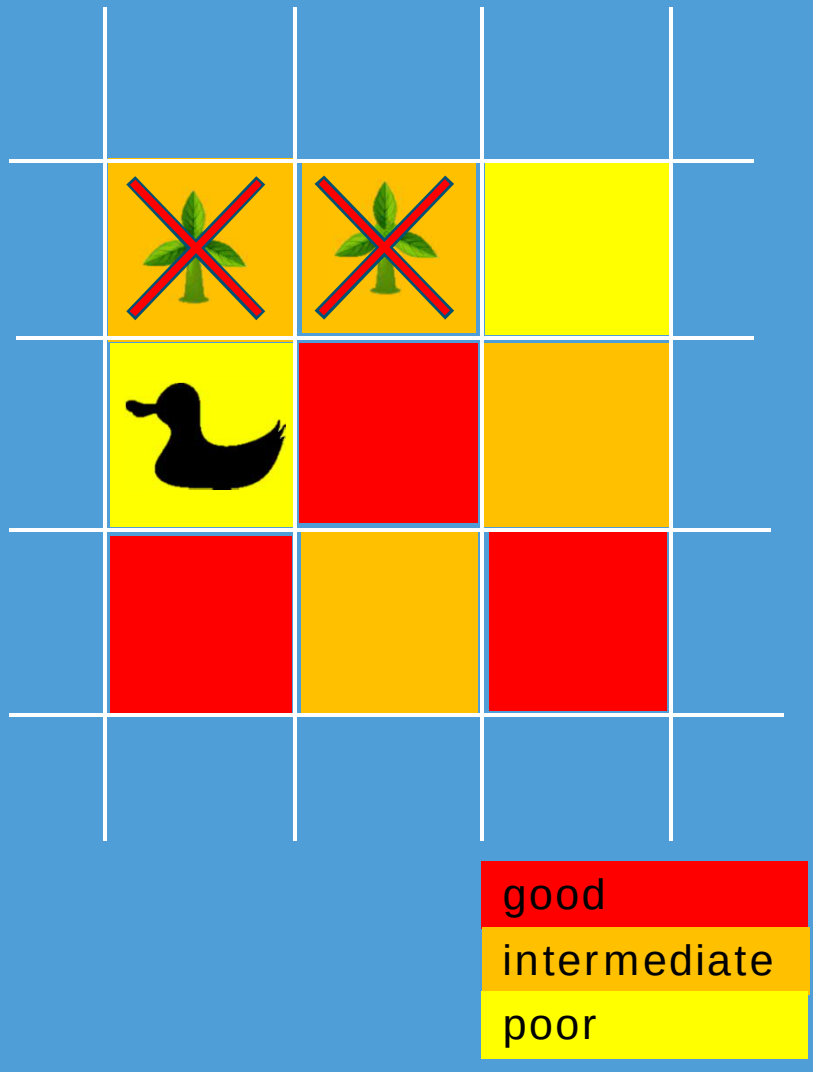
Step 2: Change in experienced food quality -> Survival

- OWFs reduce available habitat
- Estimate of effect on survival
- Bird dies if energetic demands cannot be met



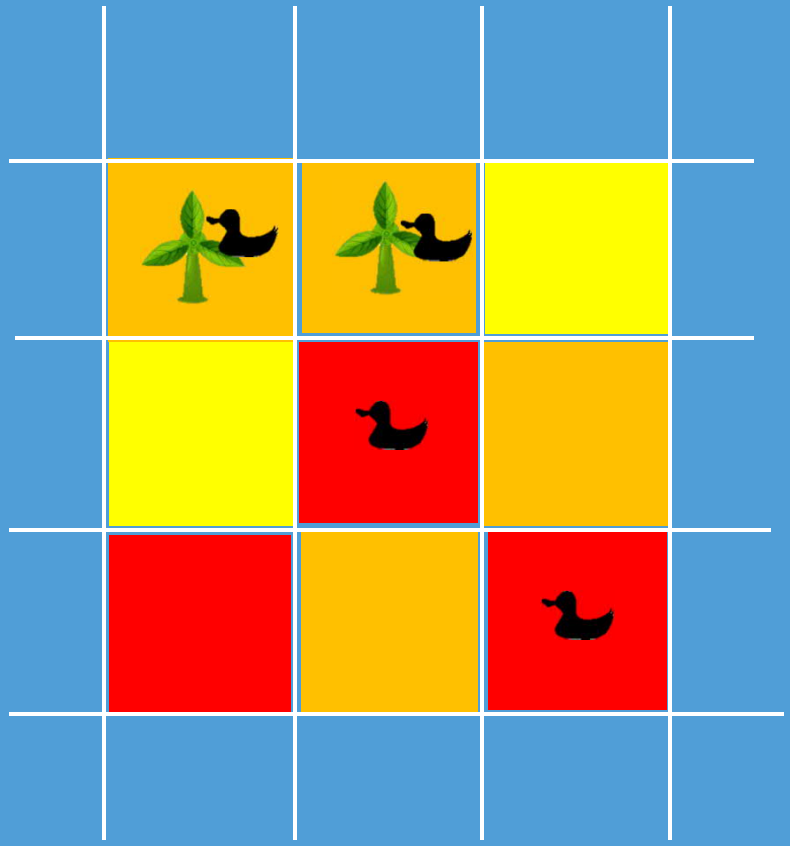
Step 2: Change in experienced food quality -> Survival

- OWFs reduce available habitat
- Estimate of effect on survival
- Bird dies if energetic demands cannot be met



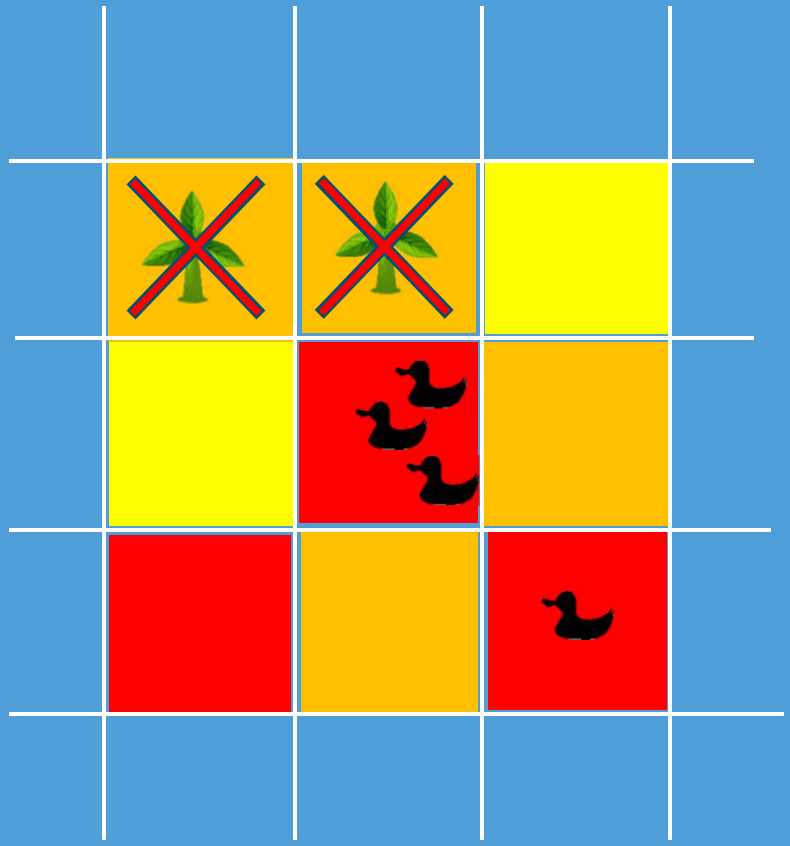
Step 2: No density dependence

- No density dependence; effect of change in habitat quality

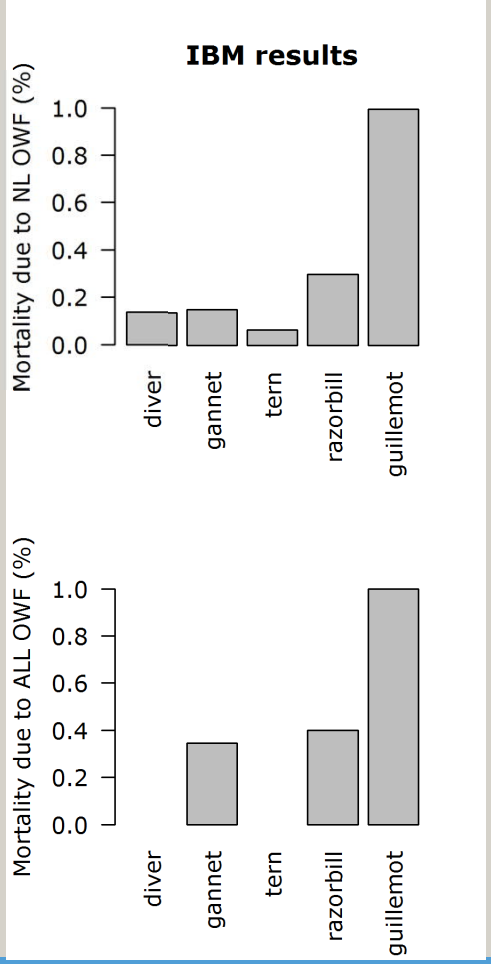


Step 2: No density dependence

- No density dependence; effect of change in habitat quality

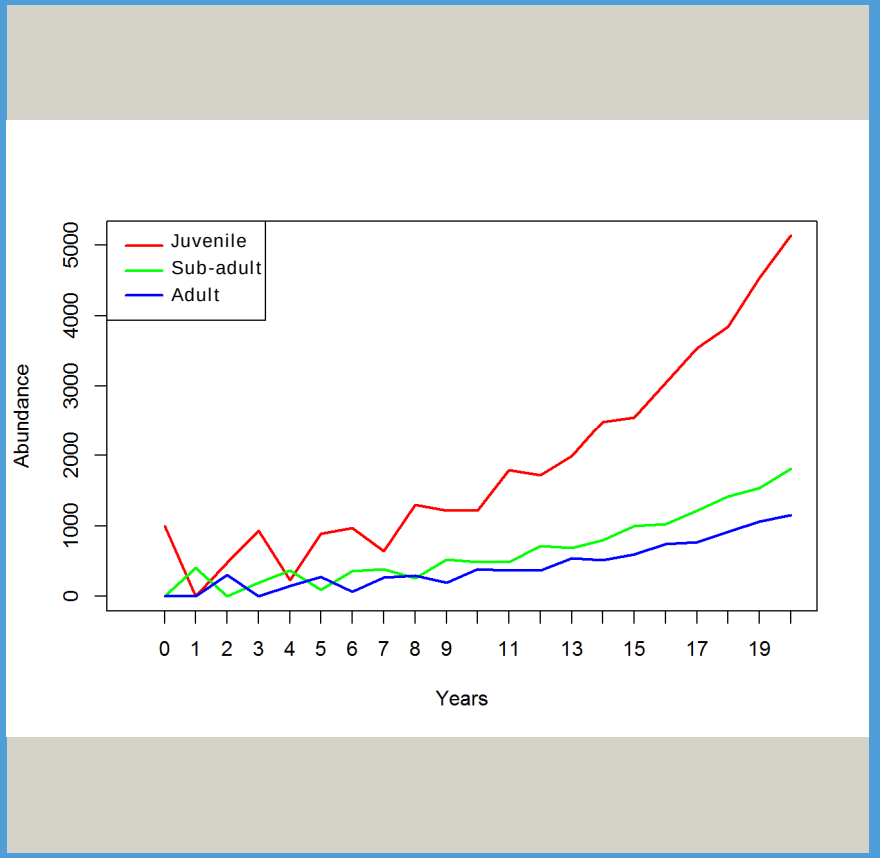


Additional annual mortality < 1%!



Step 3: What is the effect of the changes in mortality at the population level?

- Matrix population model
  - Age structure
  - Annual survival
  - Age of recruitment
  - Annual fecundity
- Species specific parameters (Horswill & Robinson 2015)
- Population projection through time



WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

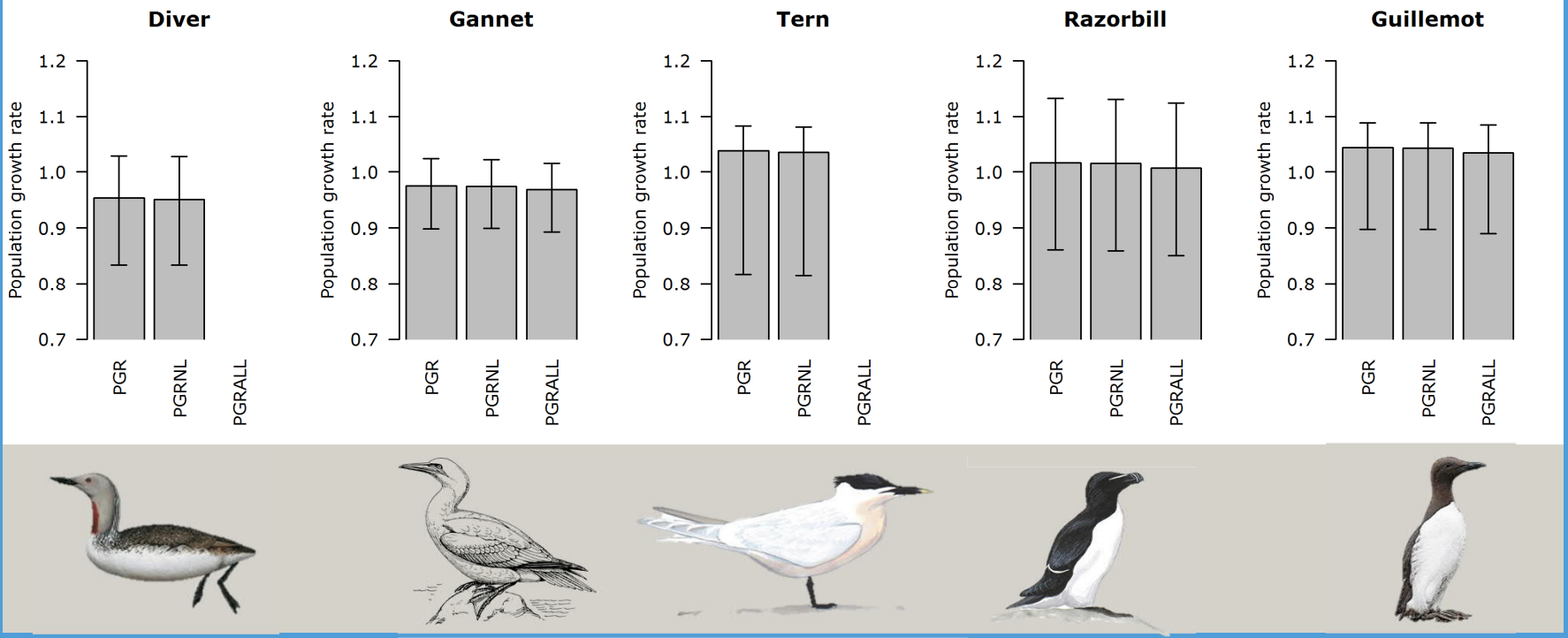
DUTCH GOVERNMENTAL OFFSHORE WIND ECOLOGICAL PROGRAMME

Step 3: Population growth rate

- Population growth rate (PGR)
- No density dependence (exponential growth/decline)

$$\frac{N_1}{N_0} = \lambda$$

OWF and population growth rate



In summary

- The bird populations in our study overlap about 1-2% with NL OWFs and 4-7% with international OWFs.
- Individual based model predicts declines in survival <1%
- We found only a small effect of OWFs on the population level of the seabirds

WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

WOZEP DUTCH GOVERNMENTAL OFFSHORE WIND ECOLOGICAL PROGRAMME

Disclaimers

- Effects of even larger OWF areas are not clear
- Other seabird species may show different patterns
- Data availability international areas bird counts is very limited.
- Habituation of birds may lead to shift from habitat loss to collision victim

References

Dierschke V, Furness RW, Garthe S (2016) Seabirds and offshore wind farms in European waters: Avoidance and attraction. Biol Conserv 202:59–68.

Horswill, C., & Robinson, R. A. (2015). Review of Seabird Demographic Rates and Density Dependence. JNCC Report 552. Peterborough, UK.

WAGENINGEN
UNIVERSITY & RESEARCH

100years
1918 — 2018

WOZEP
DUTCH GOVERNMENTAL OFFSHORE
WIND ECOLOGICAL PROGRAMME

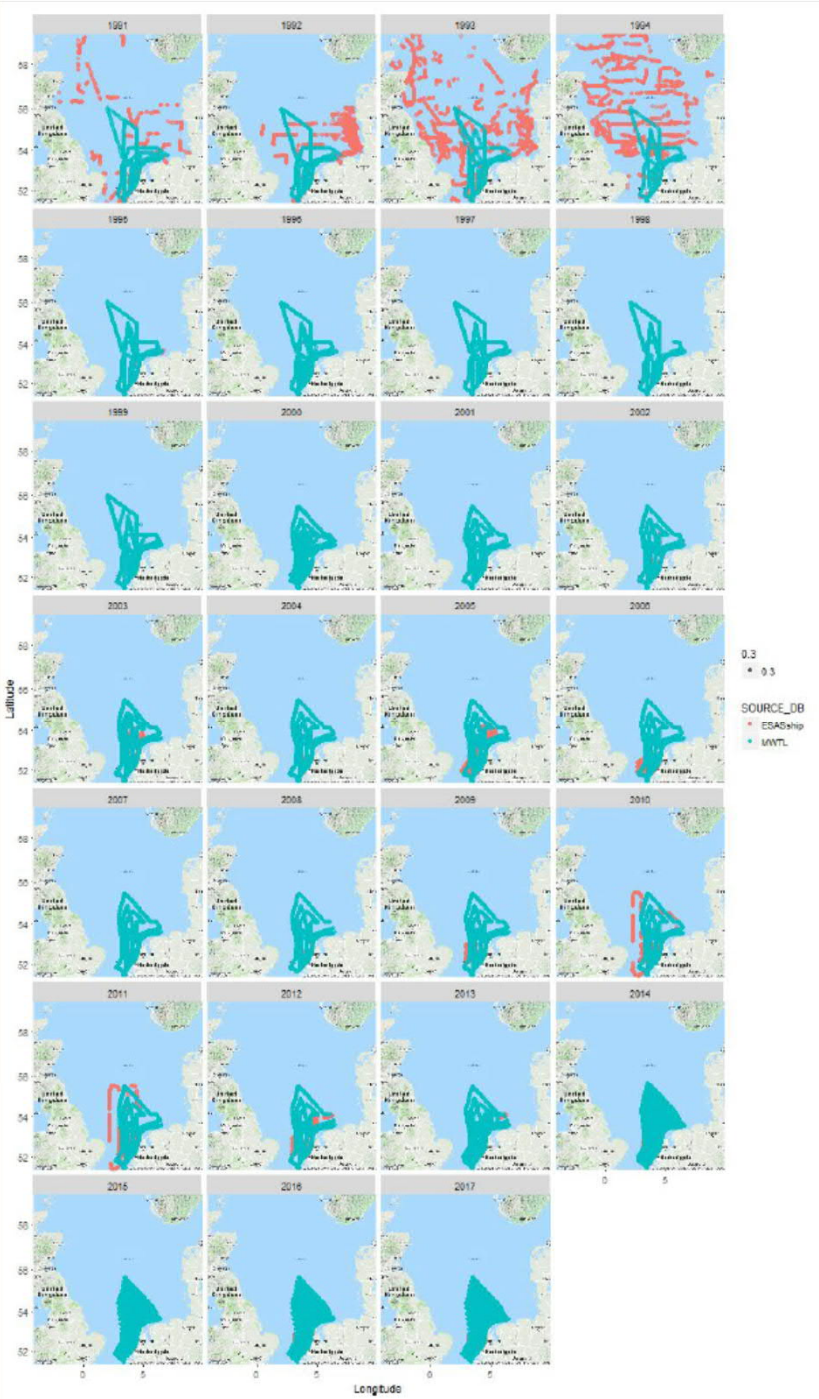


Figure 2.1. Overview of observer effort per year for the two data sources.

Worst 5% of additional annual mortality IBM is comparable to mortality 10% rule