# A bird’s eye view onto GPS tracking

## a decade of gull tagging along the Flemish and Dutch coast


LifeWatch BELGIUM

*Biodiversity Day*
*28/10/2021*

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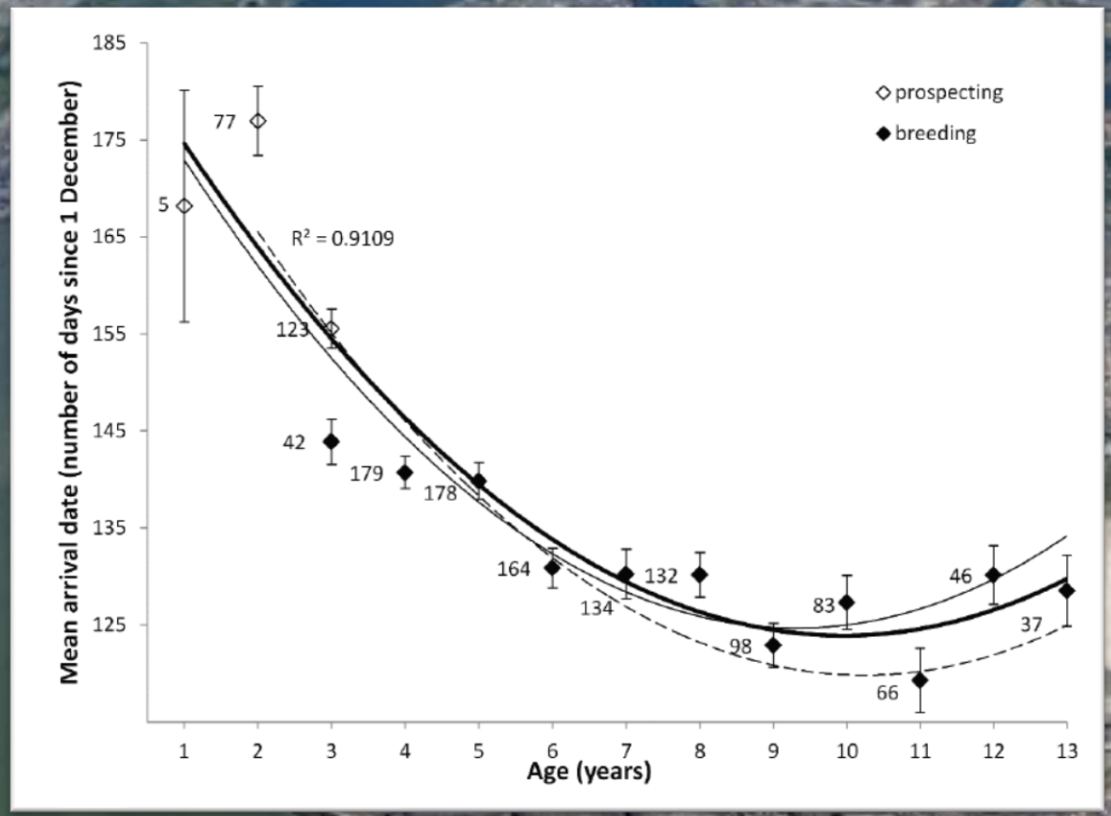
# A bird’s eye view onto GPS tracking

## a decade of gull tagging along the Flemish and Dutch coast

- Generalist species
- Exploit anthropogenic resouces
- Benefit from global change


- Easy to observe
- Easy to access nests and handle chicks
- Pronounced personalities
- Long-lived species with high site fidelity


Bosman et al. 2013, Plos ONE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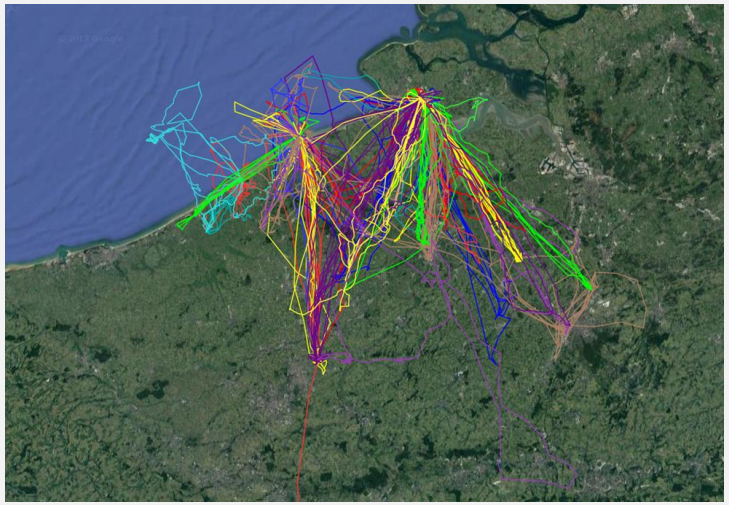
+15 billion GPS locations and annotated data
Photo Gallery / Vlaams Instituut voor de Zee (VLIZ)

# NGAT

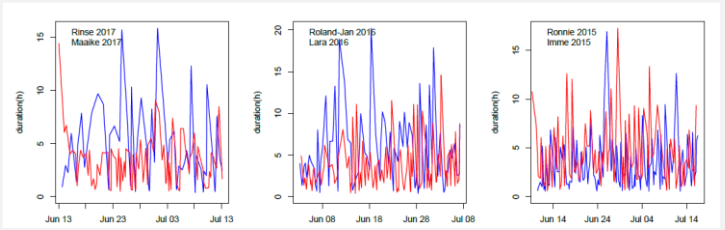
## Deciphering the ecological code

In recent years, large-scale scientific initiatives have spurred the development of affordable lightweight tracking devices such that movement data are now collected in unprecedented quantities for a huge variety of species. Yet, appropriate tools to exploit the full potential of these tracking data are lagging behind.

# Deciphering the ecological code

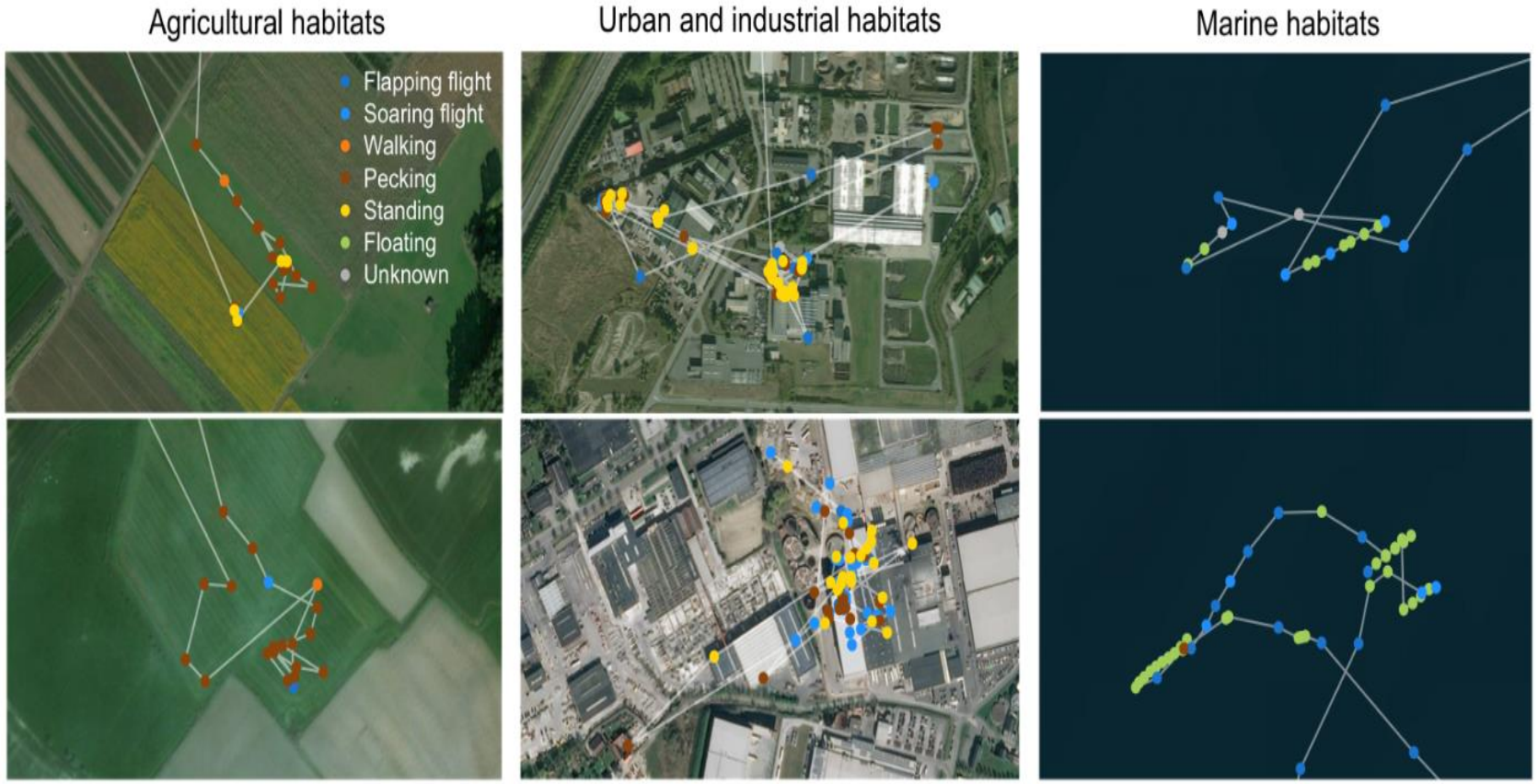


- To go beyond the analysis of basic time-integrated parameters.



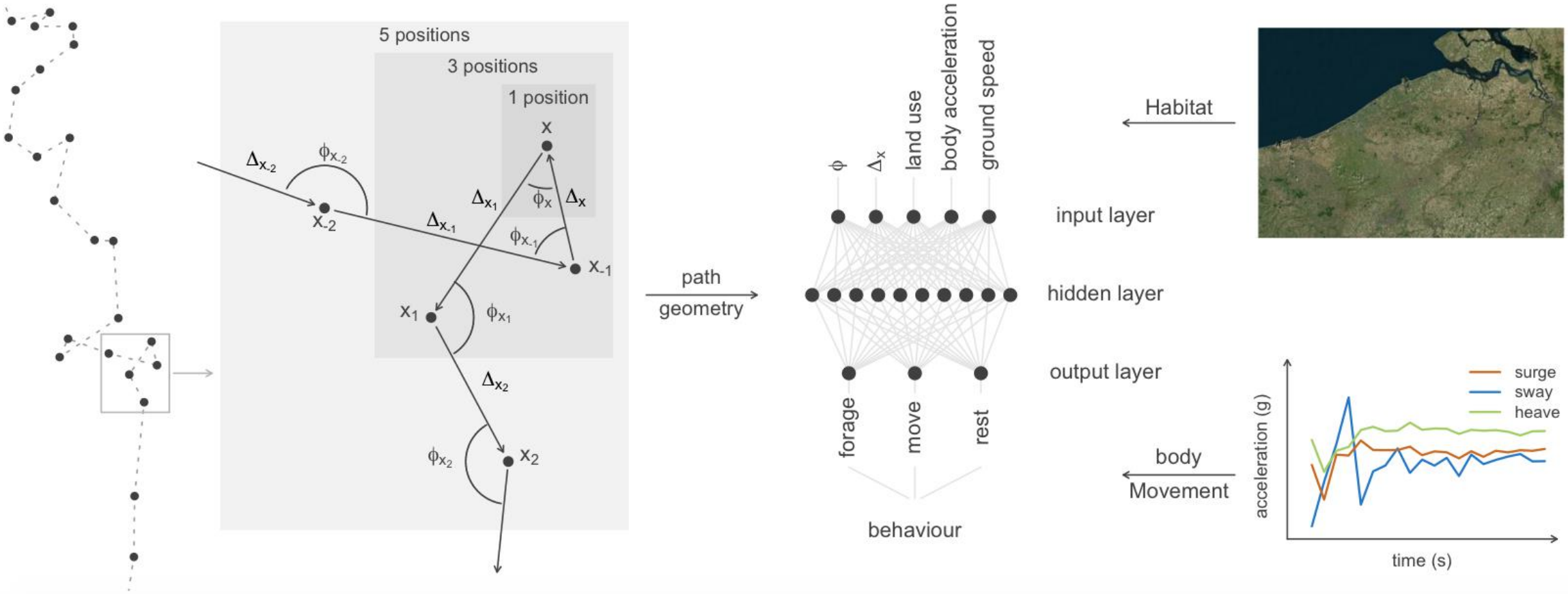

- To better exploit the full potential of high resolution data streams.

# Deciphering the ecological code




Baert et al. unpubl. data

# Deciphering the ecological code

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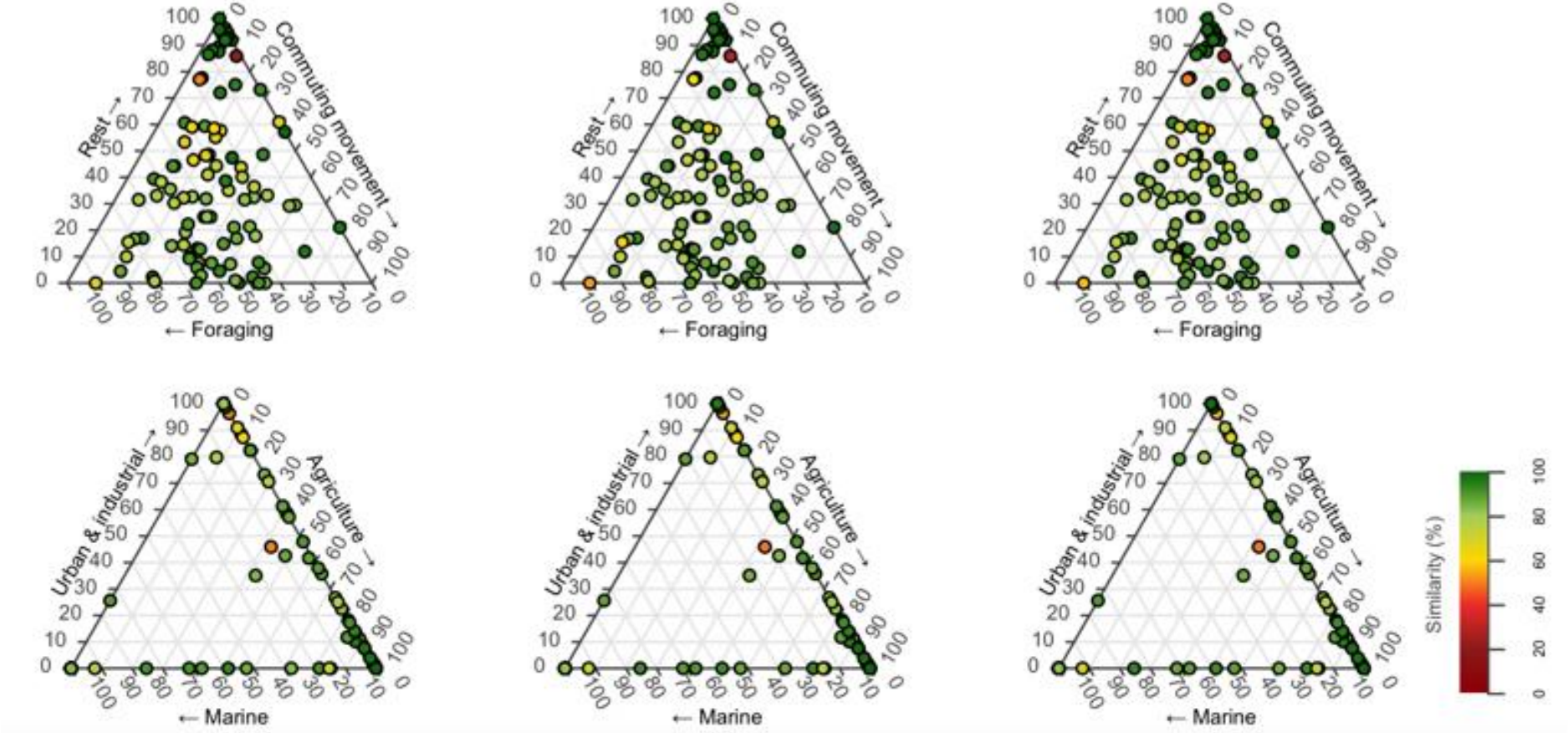


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# GPS tracking and life history concepts

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## Towards individual fitness landscapes

- Migration
- Parental Care

- Optimal foraging
- Ontogeny: nature and nurture

# GPS tracking and life history concepts

## Towards individual fitness landscapes

- Migration

  Adjusting migratory behavior (in times of global change)

- Parental care

  How do breeding partners coordinate the feeding of their offspring?

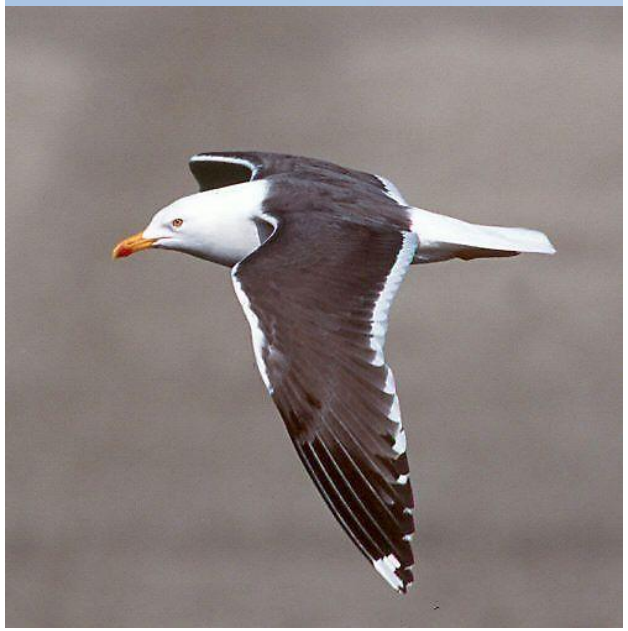
- Optimal foraging

  Generalists versus specialists: does spatio-temporal consistency in foraging matter?

- Ontogeny: nature and nurture

  Sources of variation in consistent adult behaviour

# Migration



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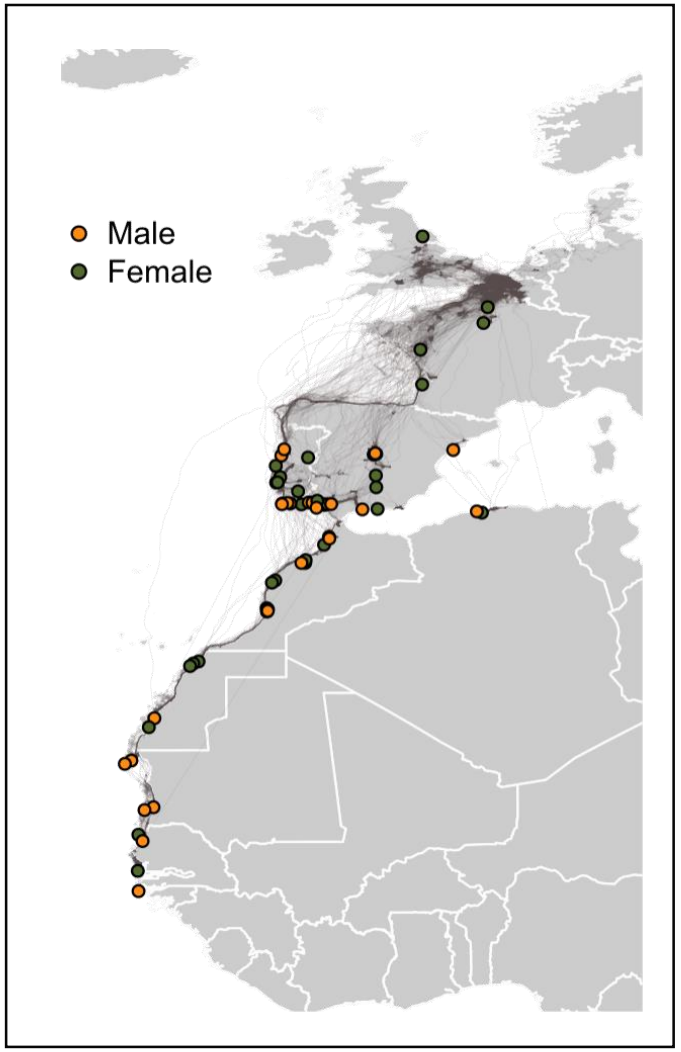

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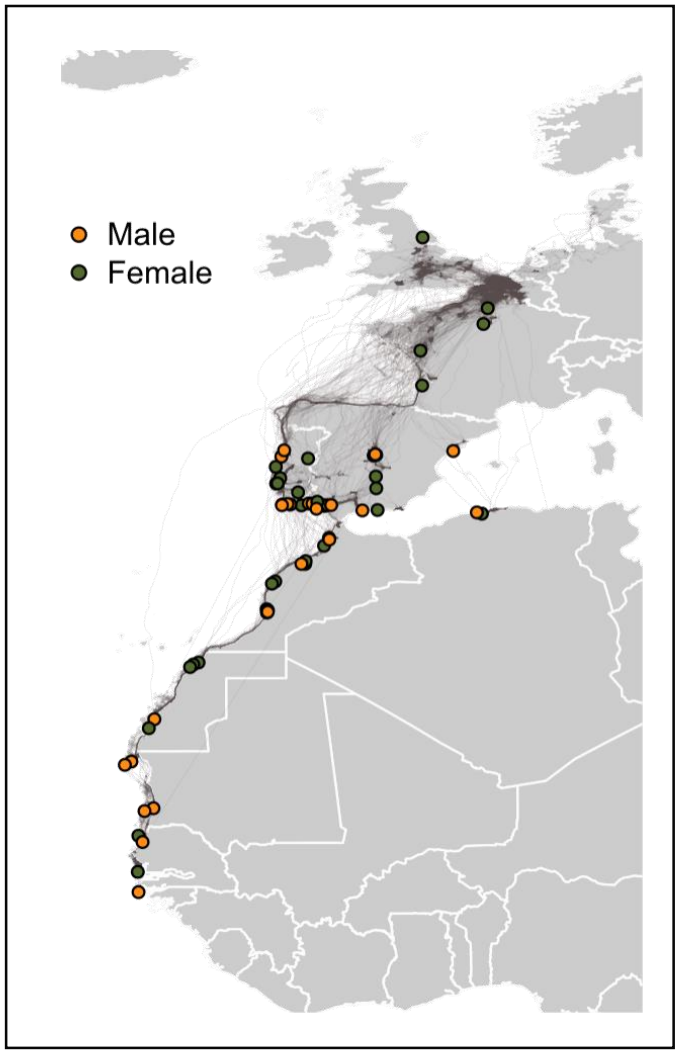
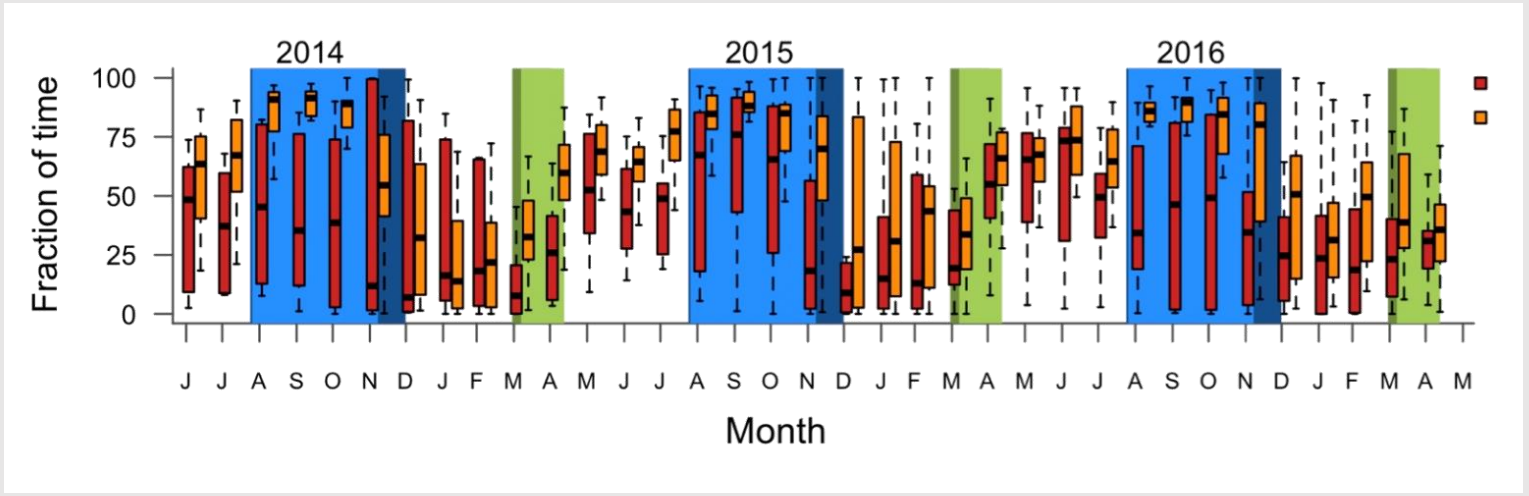
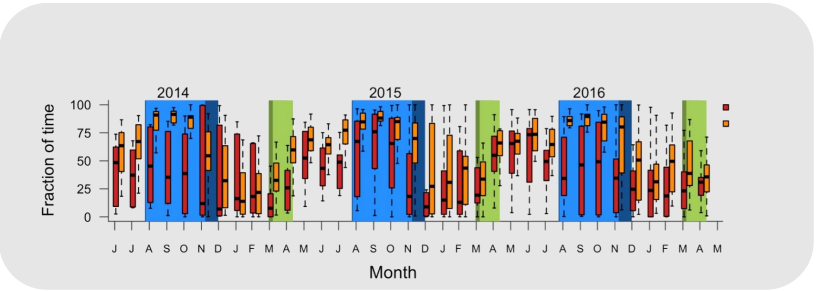
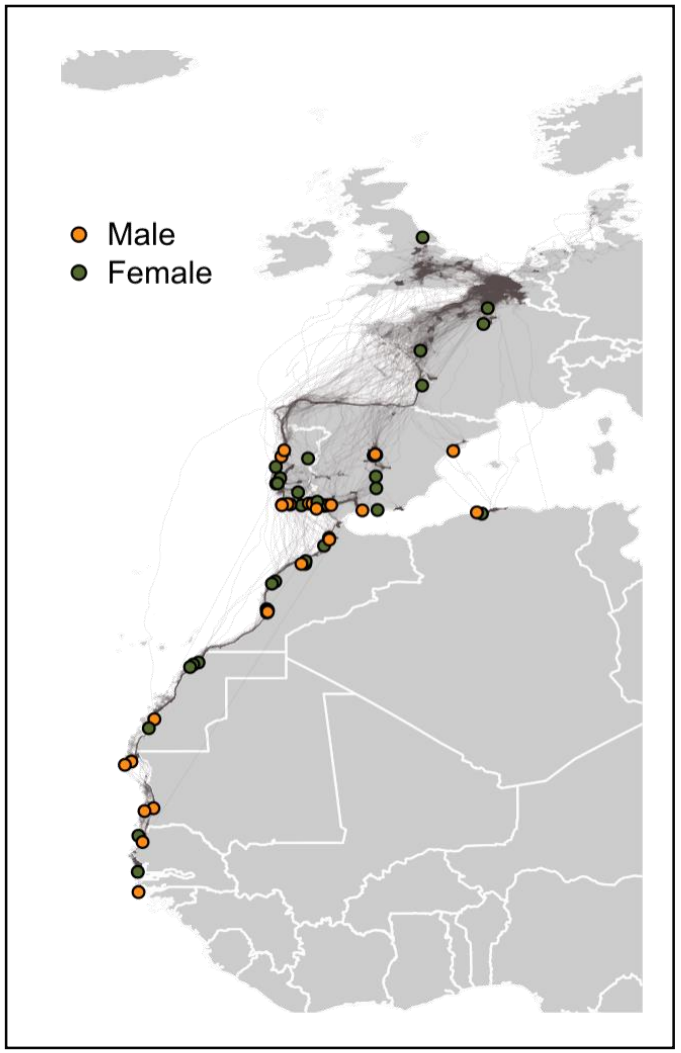


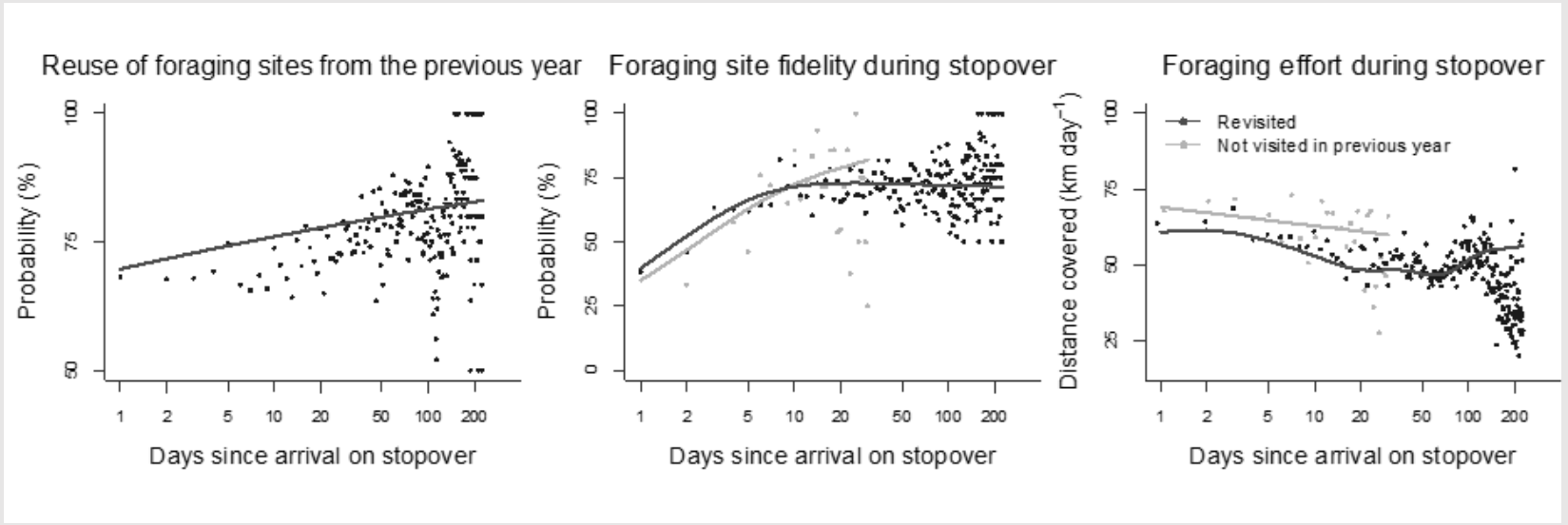




Females and males differ in their habitat requirements during migration

# Migration

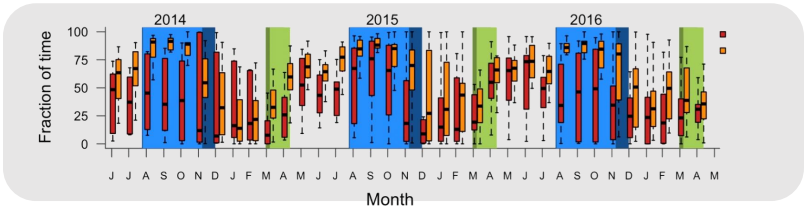


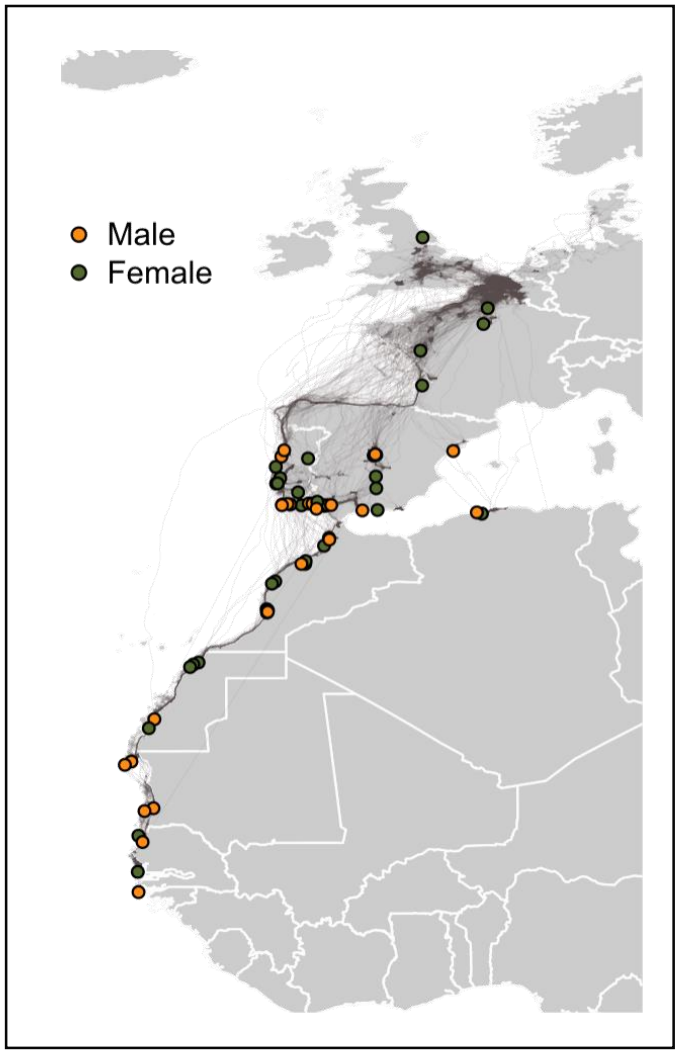



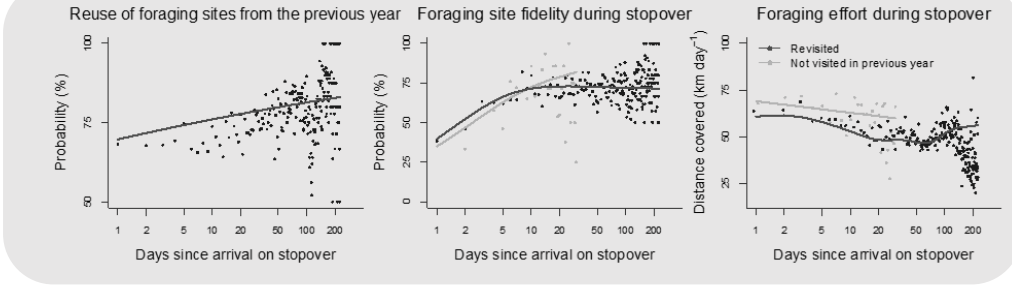



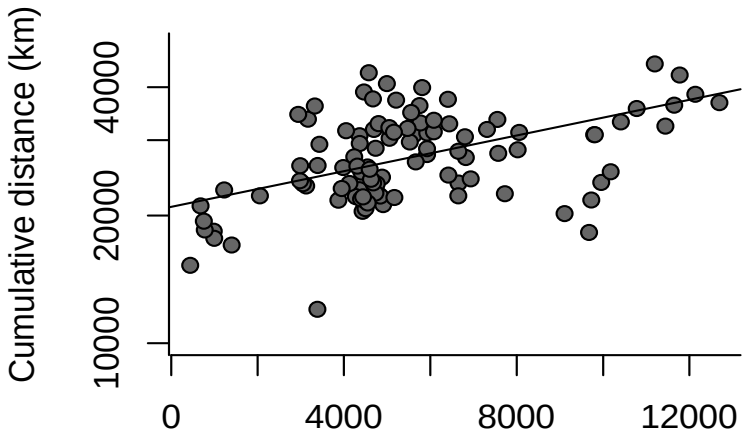

Gulls rely on spatio-temporal knowledge of stopover to optimize migration

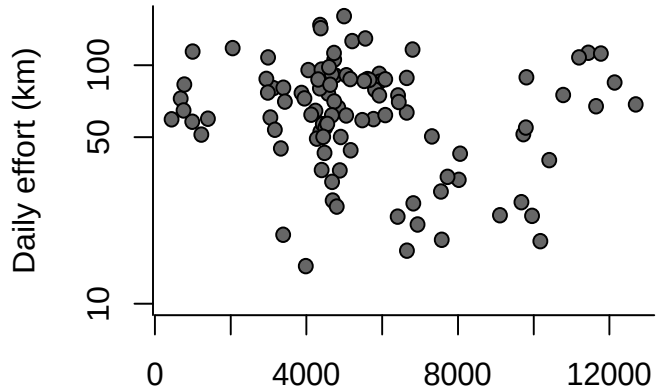
# Migration




But why do they (still) migrate thus far?

# GPS tracking and life history concepts

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- Optimal foraging
- Ontogeny: nature and nurture

# Exploring trade-offs during reproduction

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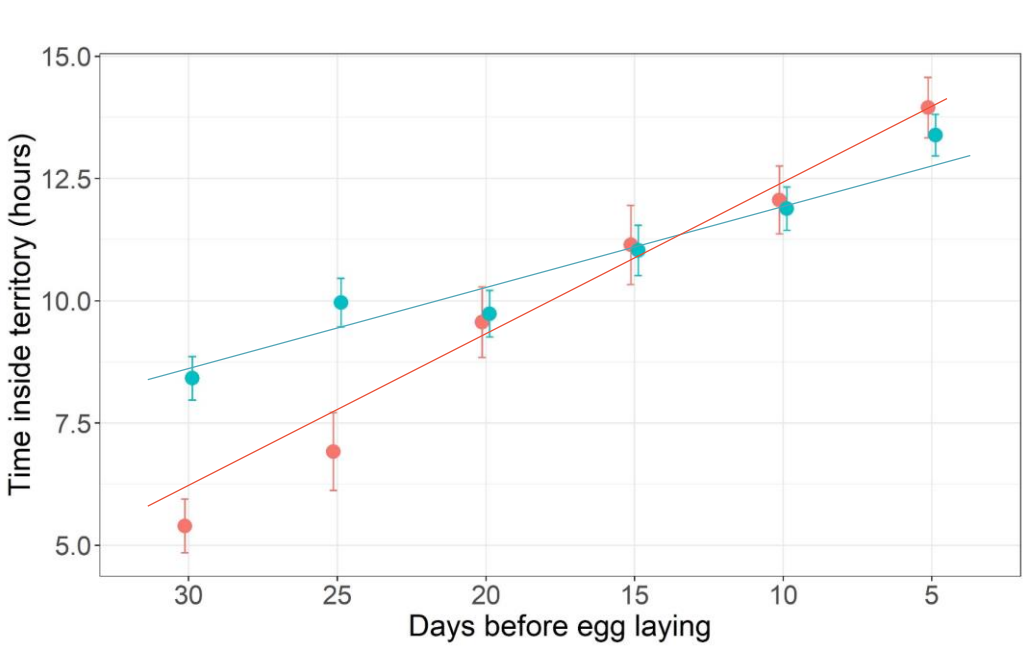
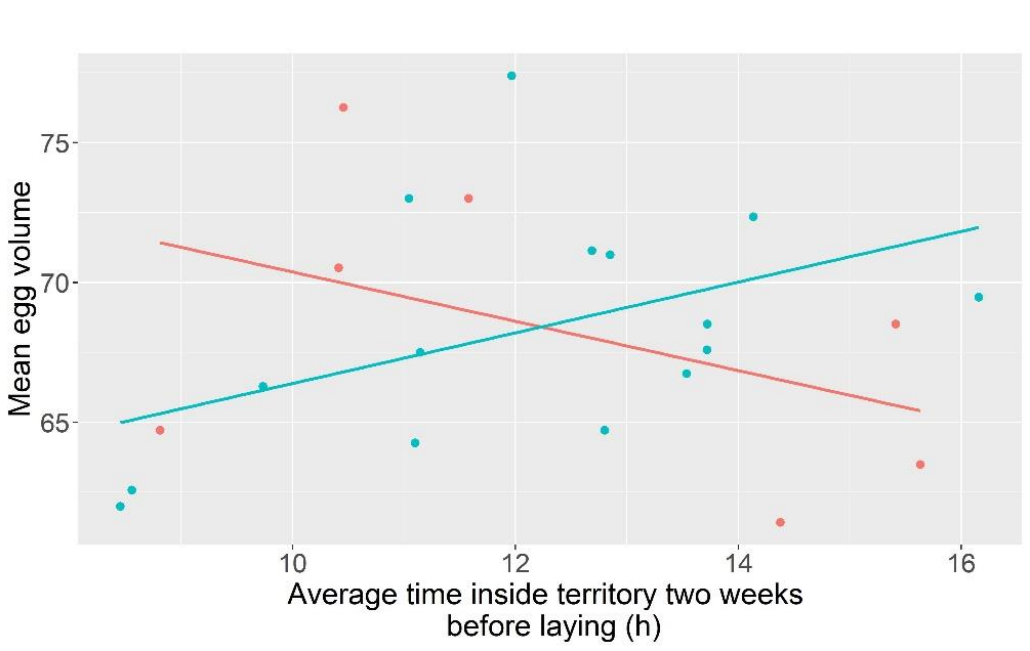
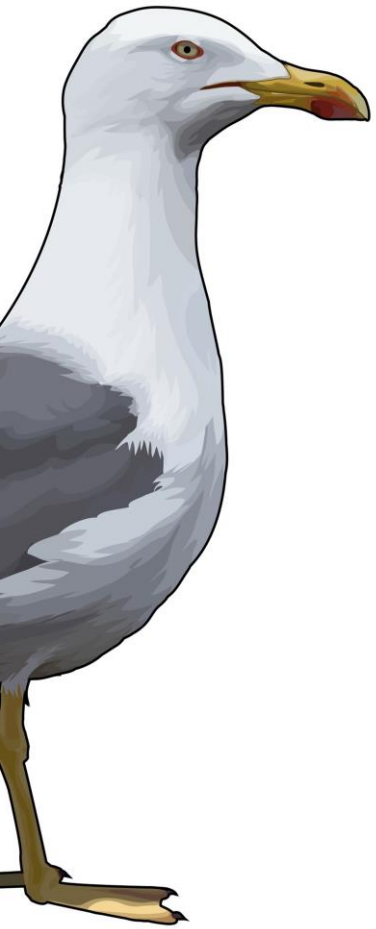
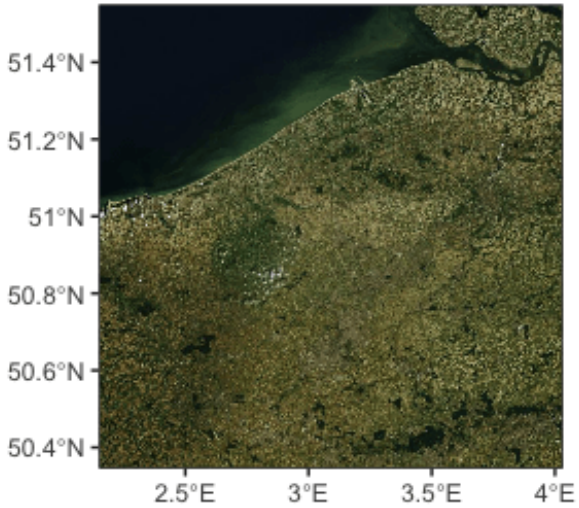


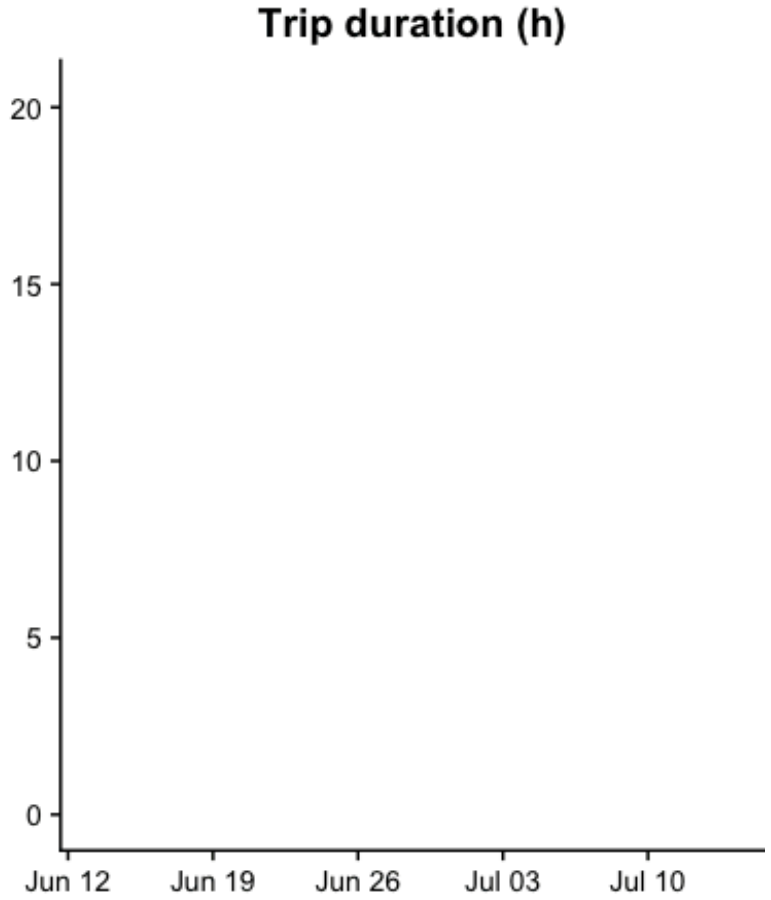



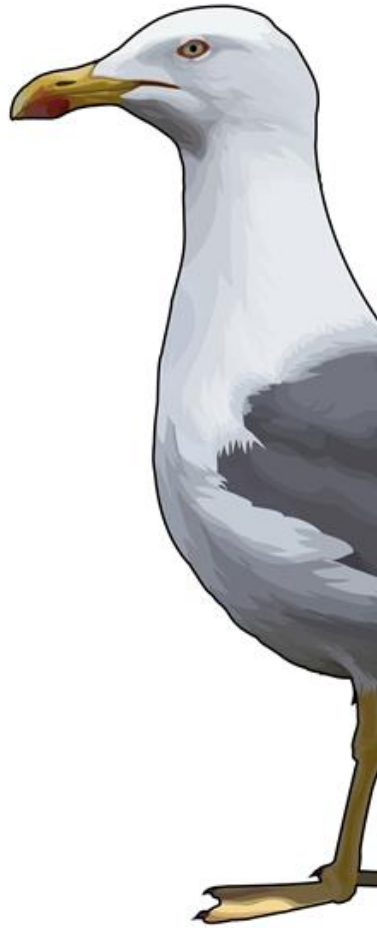

Birds spending more time inside their territory can forage less, which comes at a reproductive cost

# The coordination of parental care



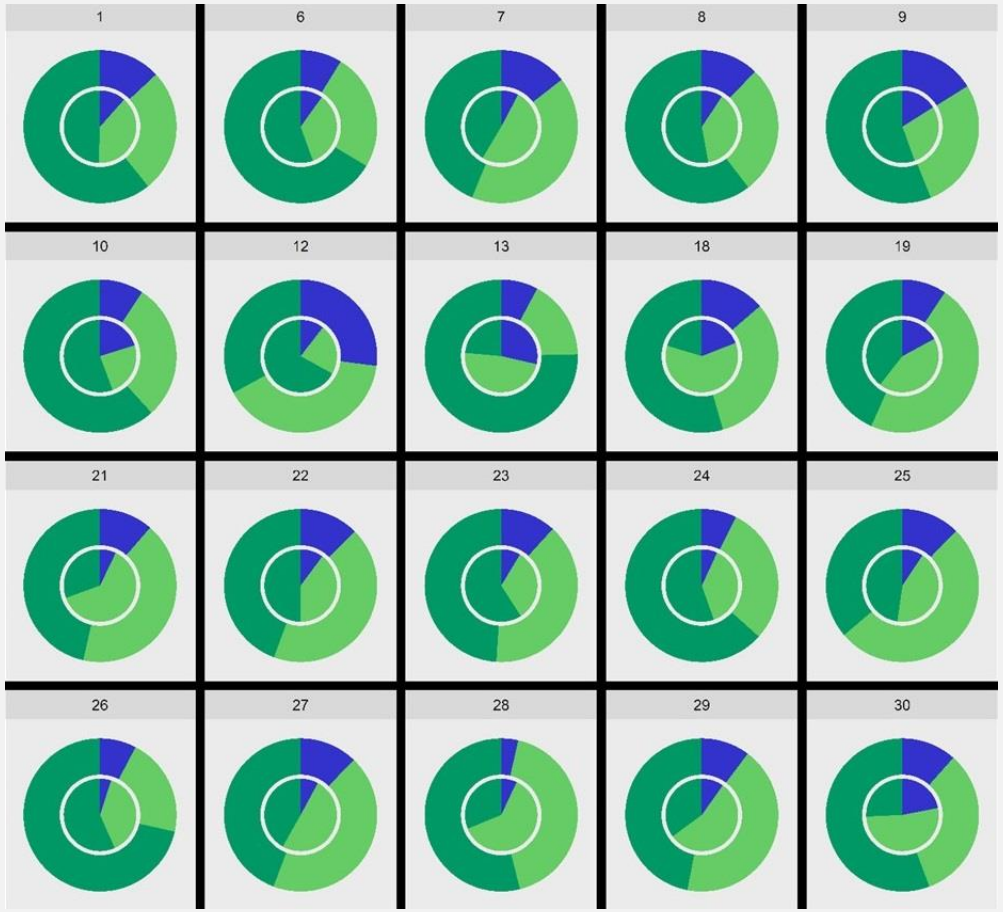


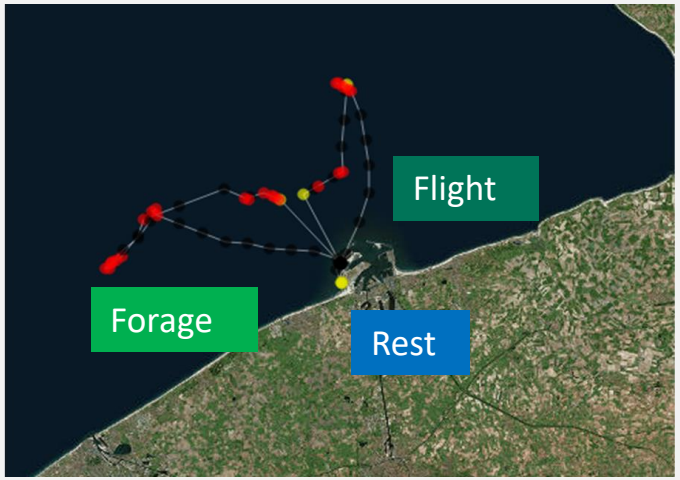



Partners do not co-adjust their foraging effort from trip to trip

# The coordination of parental care




Individuals are most similar to their partner

Coordinated pairs have higher reproductive success

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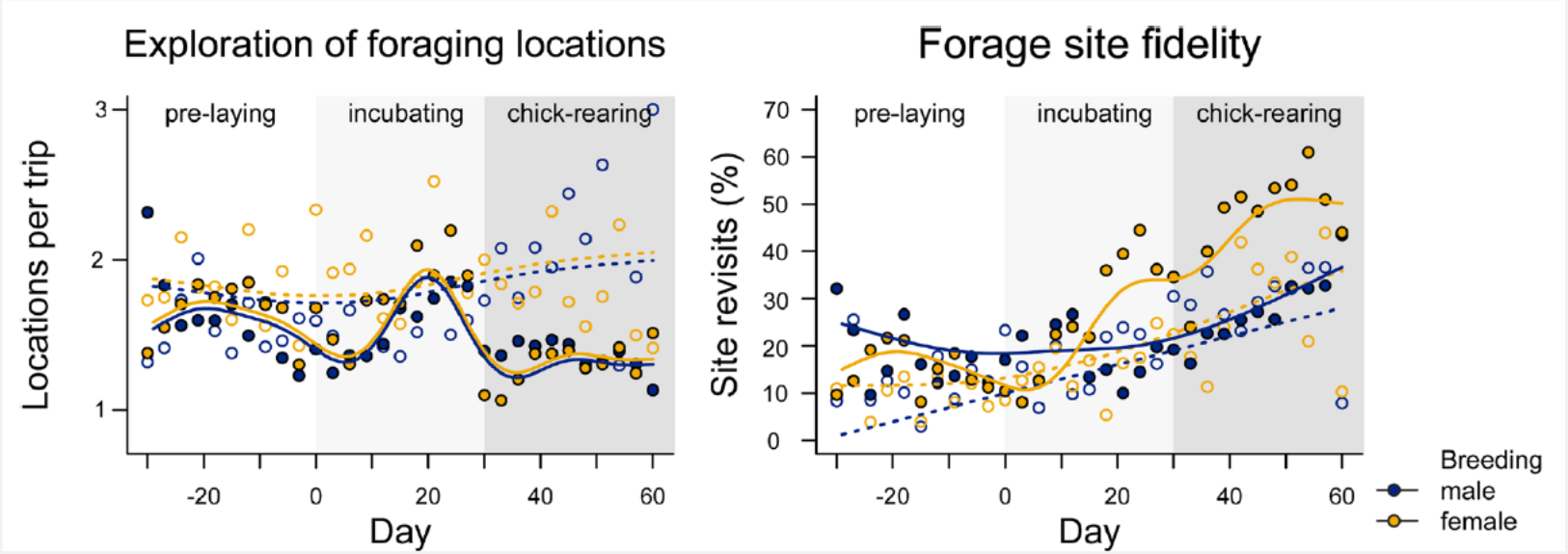
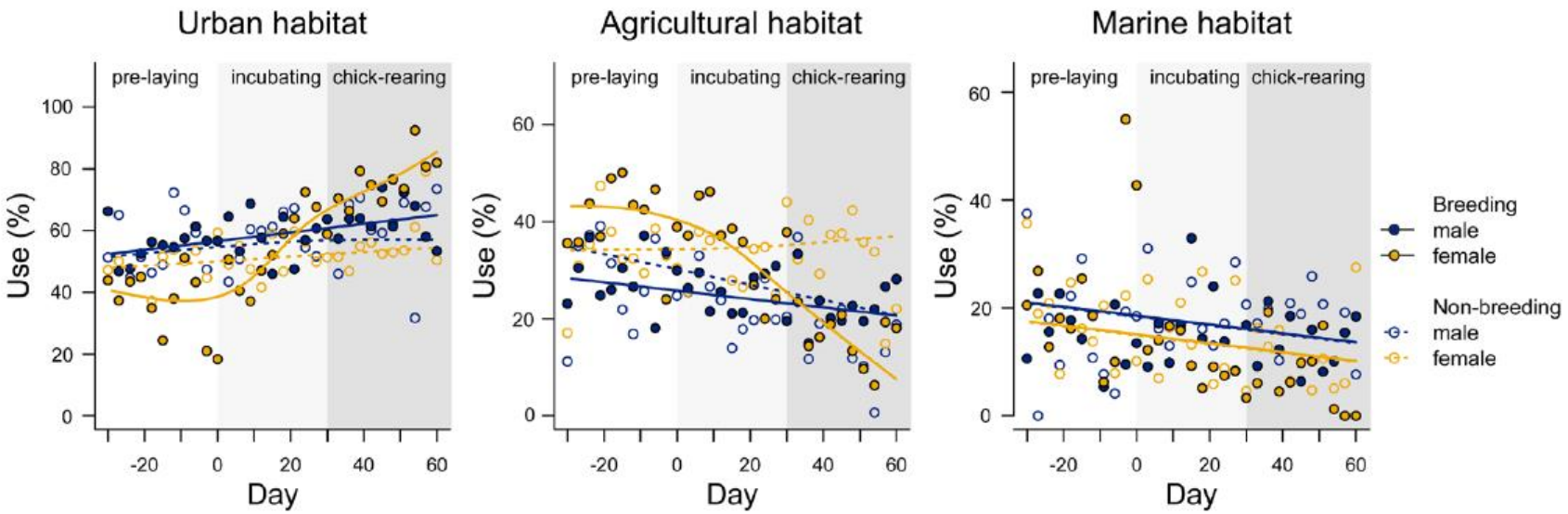
# Adaptive significance of foraging specialization




Baert et al. 2021, Oikos

# Adaptive significance of foraging specialization




Baert et al. 2021, Oikos

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# Nature and Nurture

## Ontogeny of individual foraging specialization

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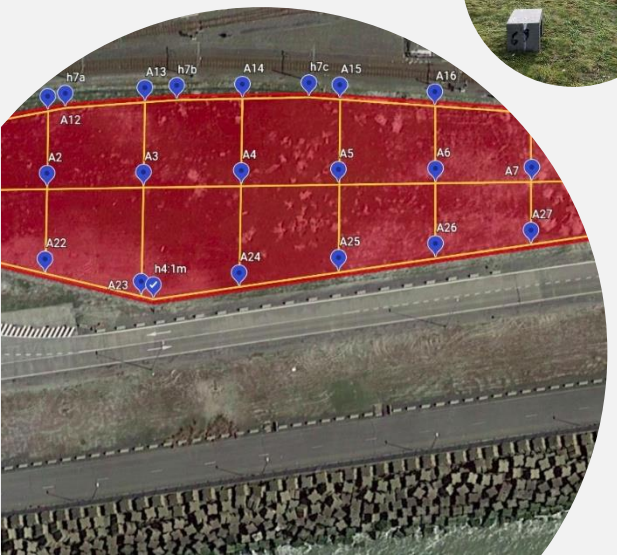
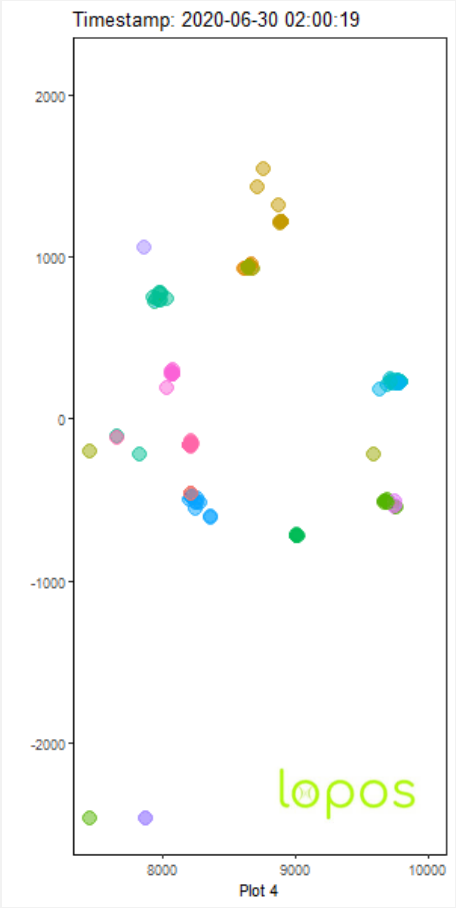



## The set-up

- Gull colony divided into compartments where breeding densities can be manipulated
- UWB tracking (LOPOS/IMEC), anchor nodes installed throughout entire colony
- Measurements (and manipulation) of chick growth and development
- Behavioural data (accelerometer, video, and testing)

# Nature and Nurture

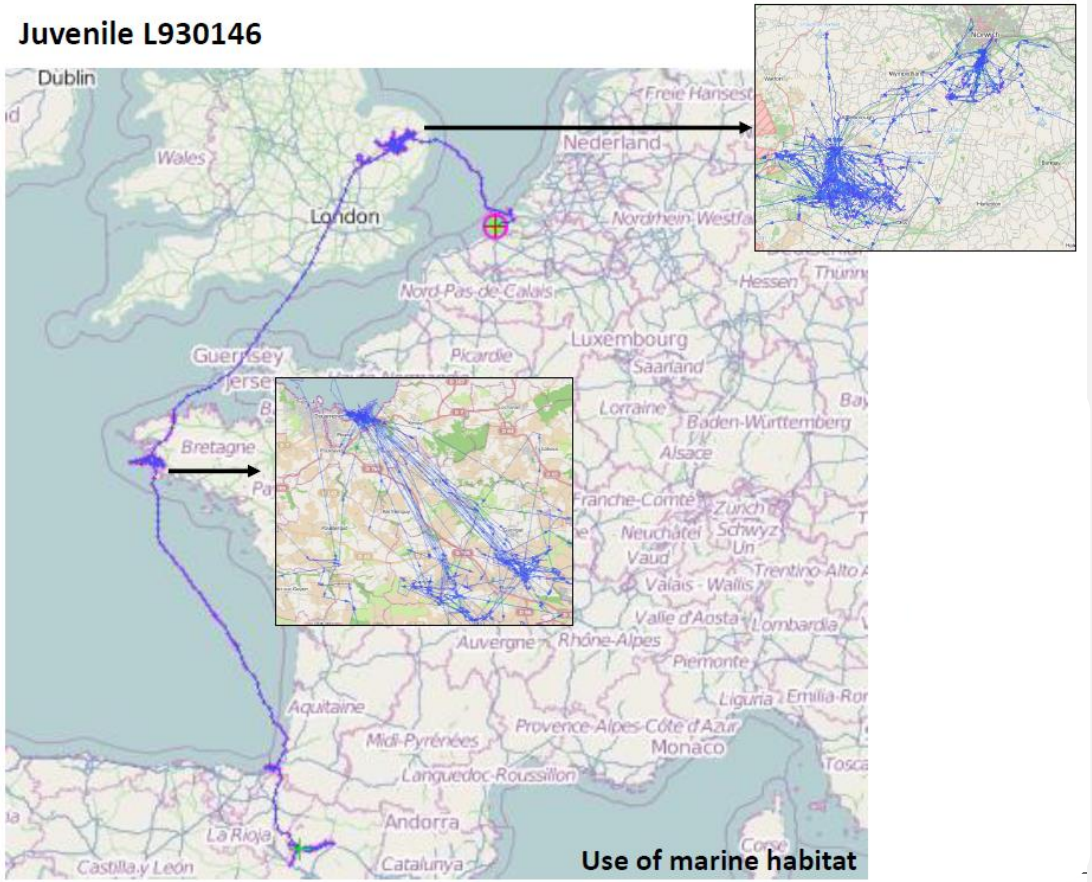
## Ontogeny of individual foraging specialization




- Social network approaches
- Combination of movement patterns with phenotypic information
- To predict individual foraging specialization

# Nature and Nurture

## Ontogeny of individual foraging specialization



# Applied insights and future prospects

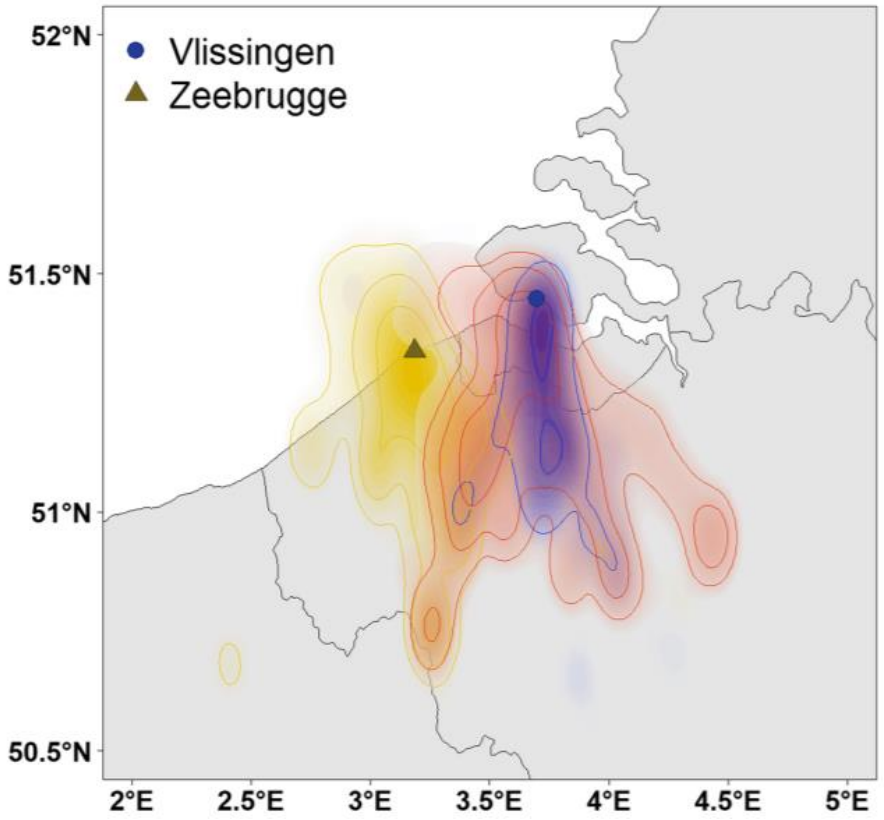
# Habitat loss

© Foto Vogelbescherming Vlaanderen

**Meeuwenkolonie legt bouwwerken in haven stil**

Habitat loss can force animals to relocate to new areas, where they would need to adjust to an unfamiliar resource landscape and find new breeding sites.

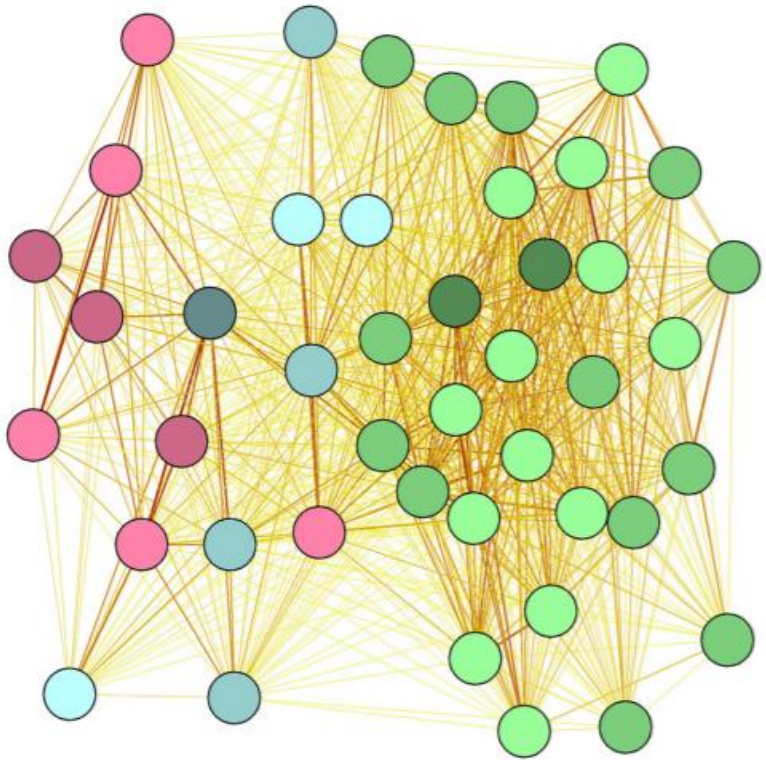
# Habitat loss




Autocorrelated kernel density distribution with 25%, 50%, 75% and 95% space use isopleths for Vlissingen residents, Zeebrugge residents, and relocated individuals.

Kavelaars et al. 2020, Movement Ecology

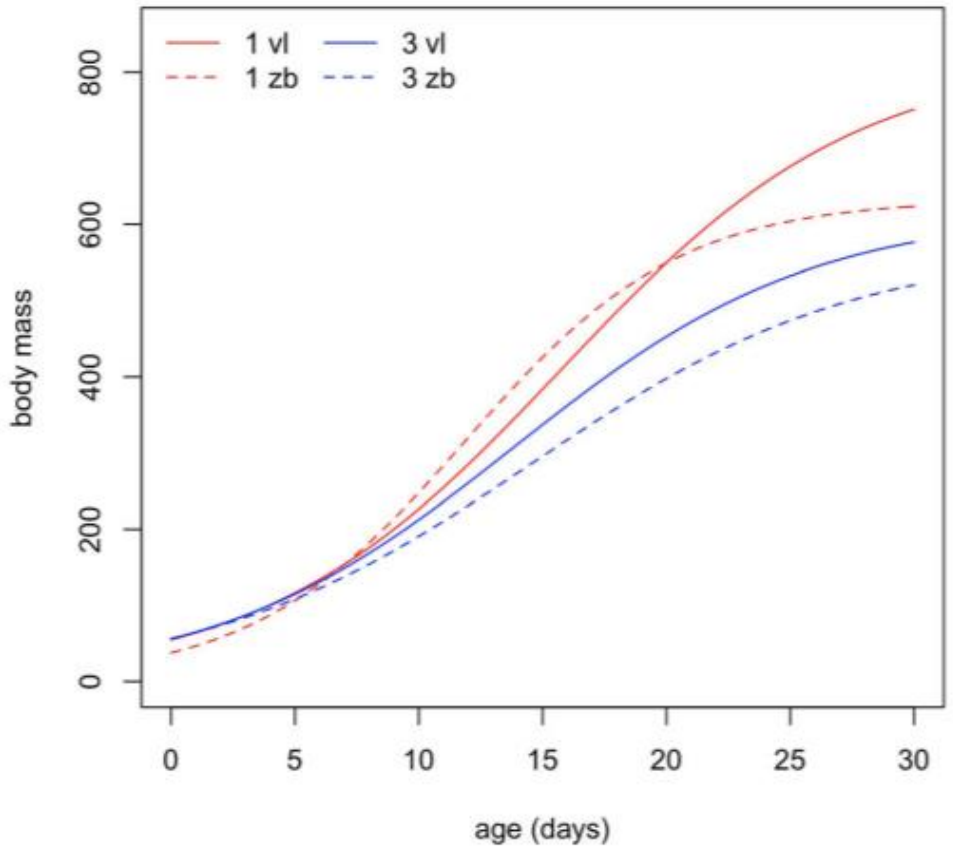
# Habitat loss



Spatial network diagram based on estimated home range overlap between relocated birds, Vlissingen residents, and Zeebrugge residents,

Kavelaars et al. 2020, Movement Ecology

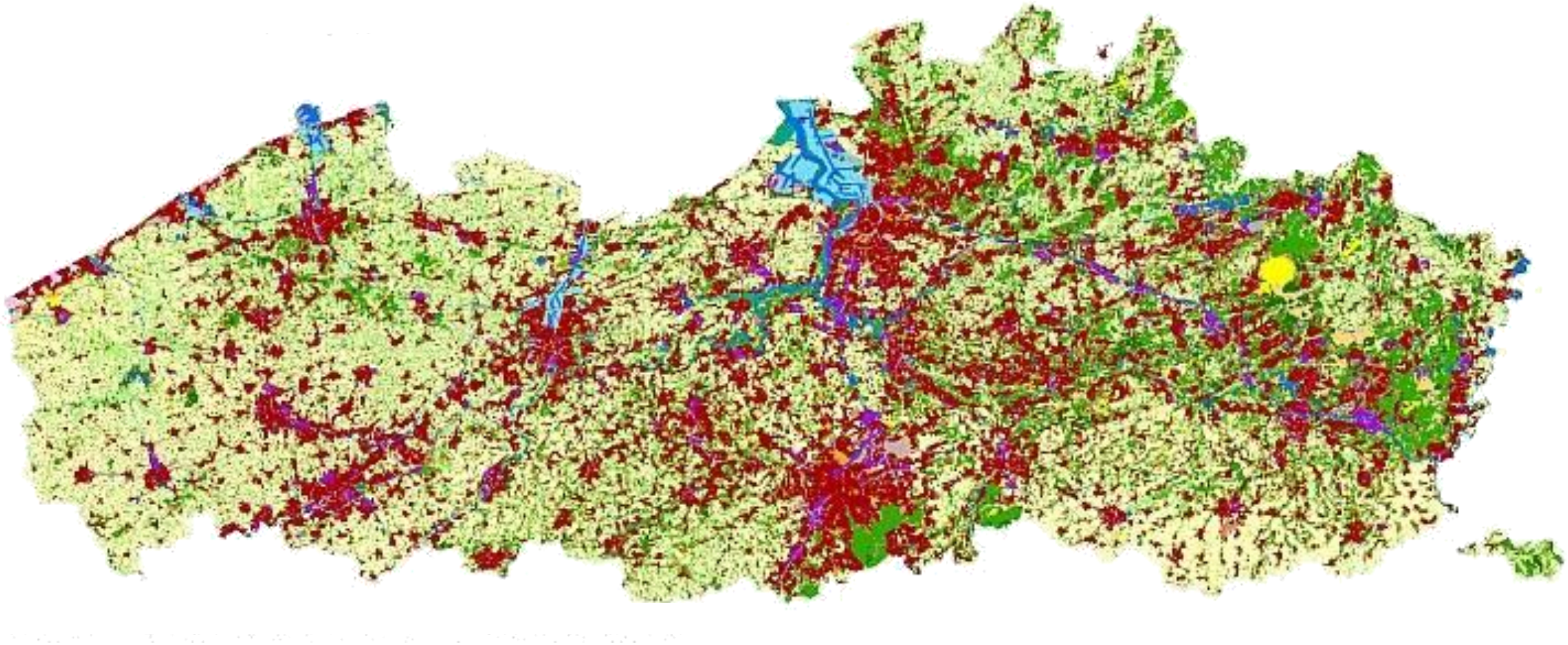
# Habitat loss




Growth curves based on model estimates for male offspring in nests with 1 chick and 3 chicks
Dashed lines represent chicks of pairs with a relocated parent.

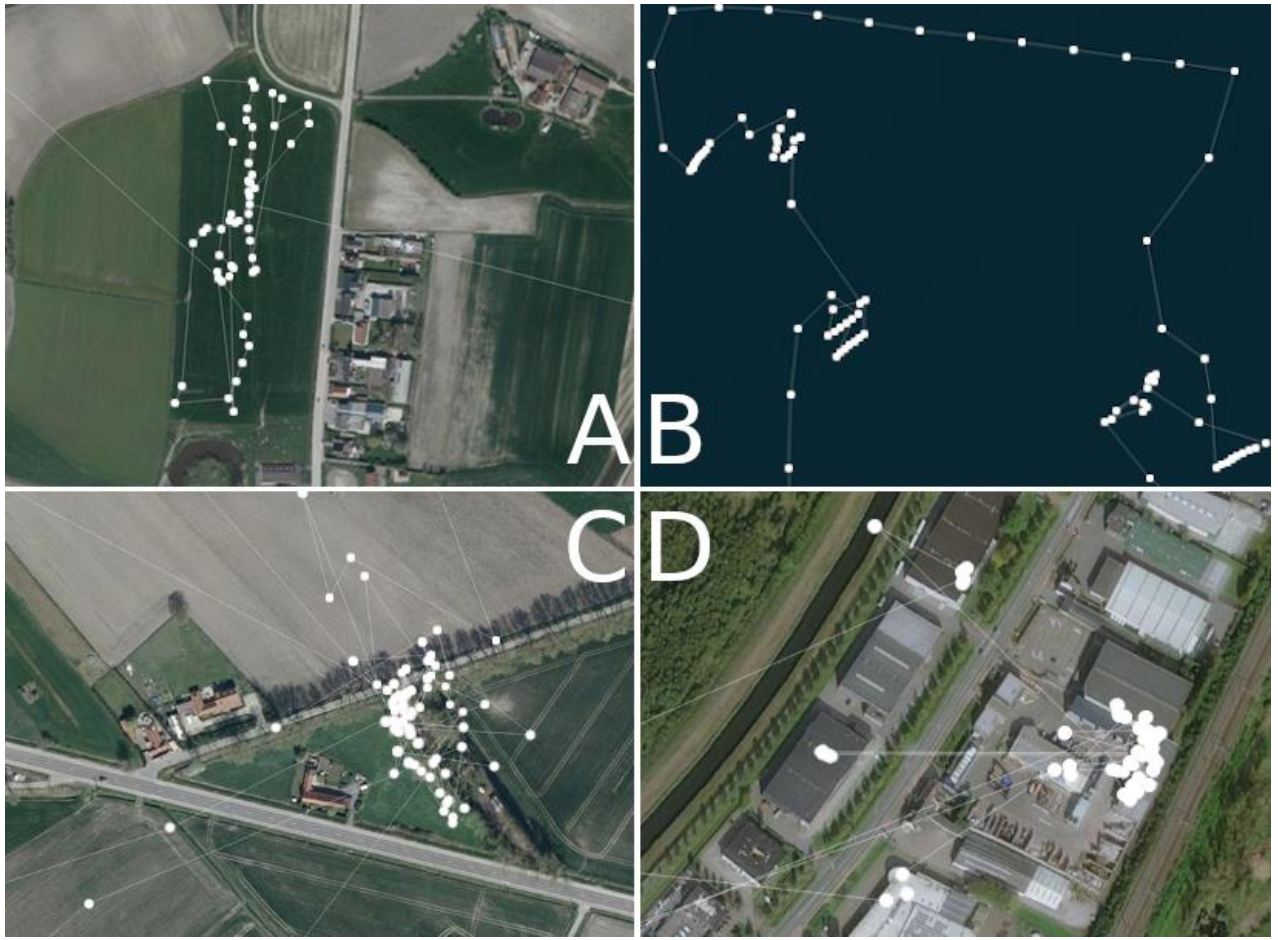
Kavelaars et al. 2020, Movement Ecology

# Urbanization



Source: VITO 2020

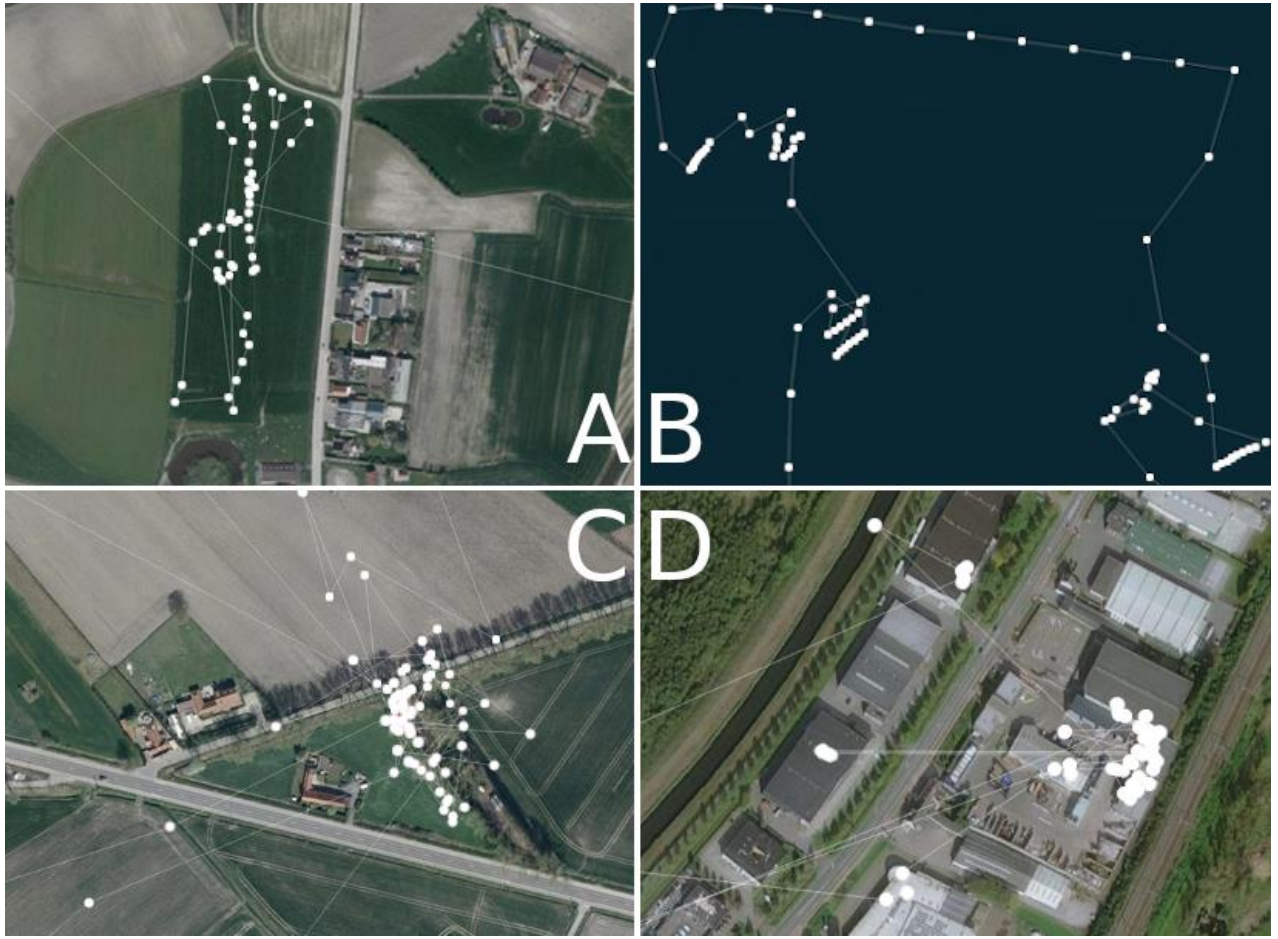
# Urbanization




Typical GPS tracks when feeding in fields and pastures (A), at sea (B), near built-up sites (C) and in urbanized areas (D)

Sotillo et al 2021, Landscape & Urban Planning

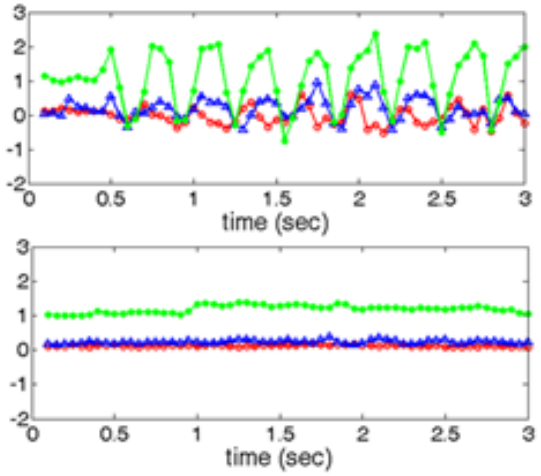
# Urbanization

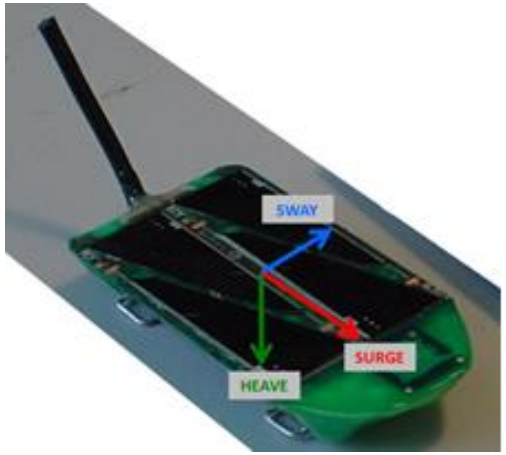



Do climate-related changes in wind speed and soil moisture induce responses in foraging effort and thereby drive the use of urban foraging habitat.

Sotillo et al 2021, Landscape & Urban Planning

# Urbanization

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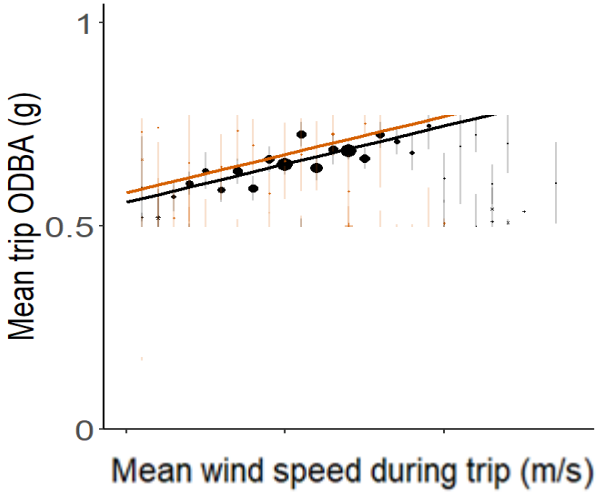


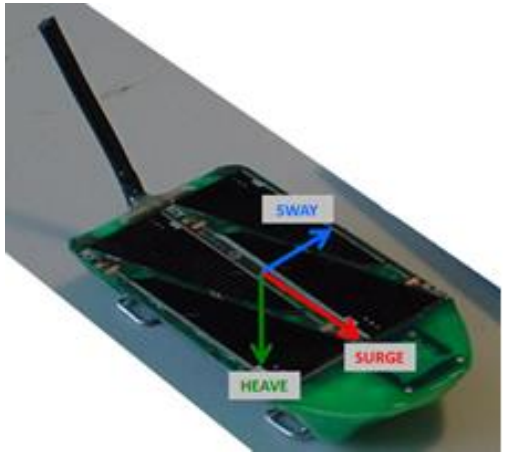


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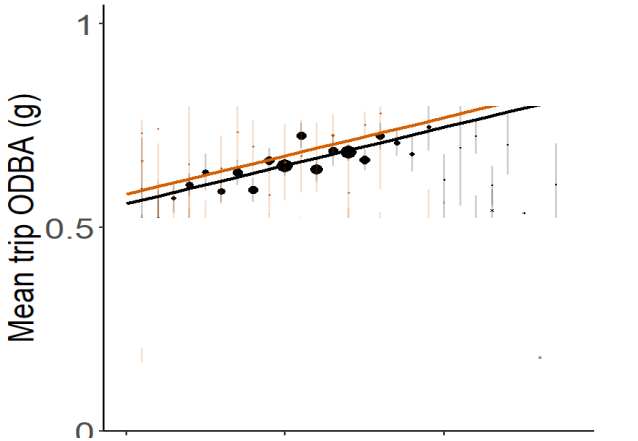


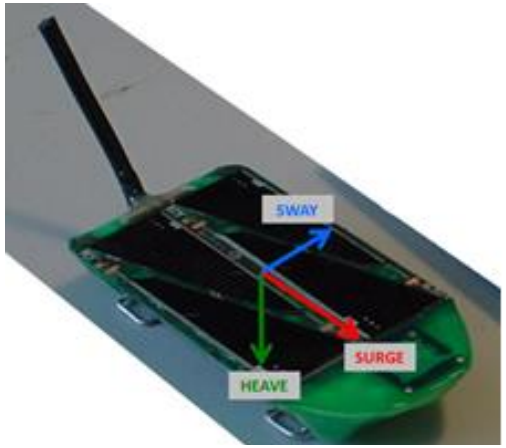



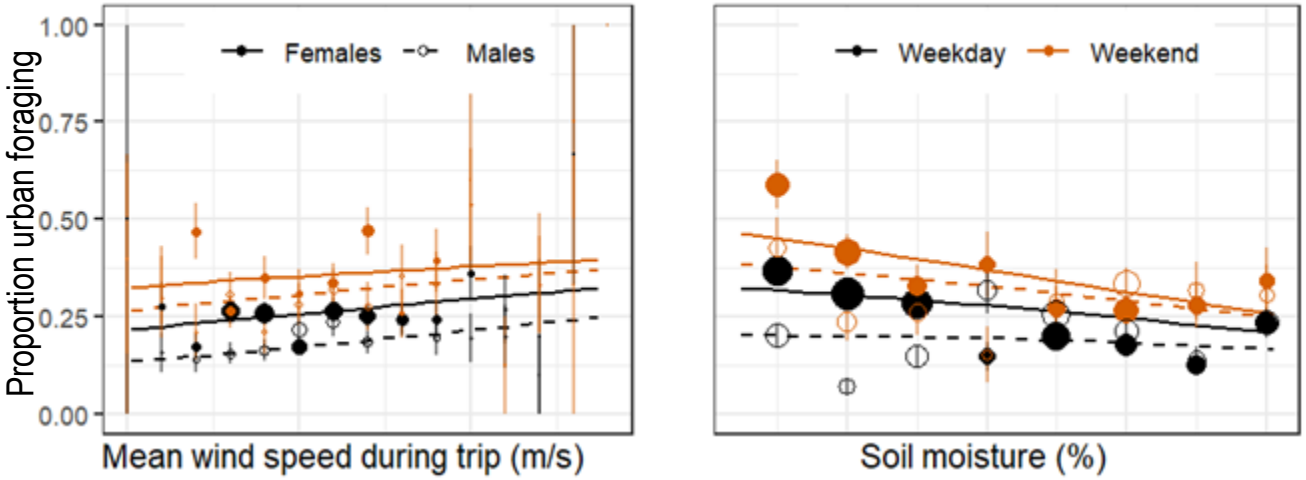



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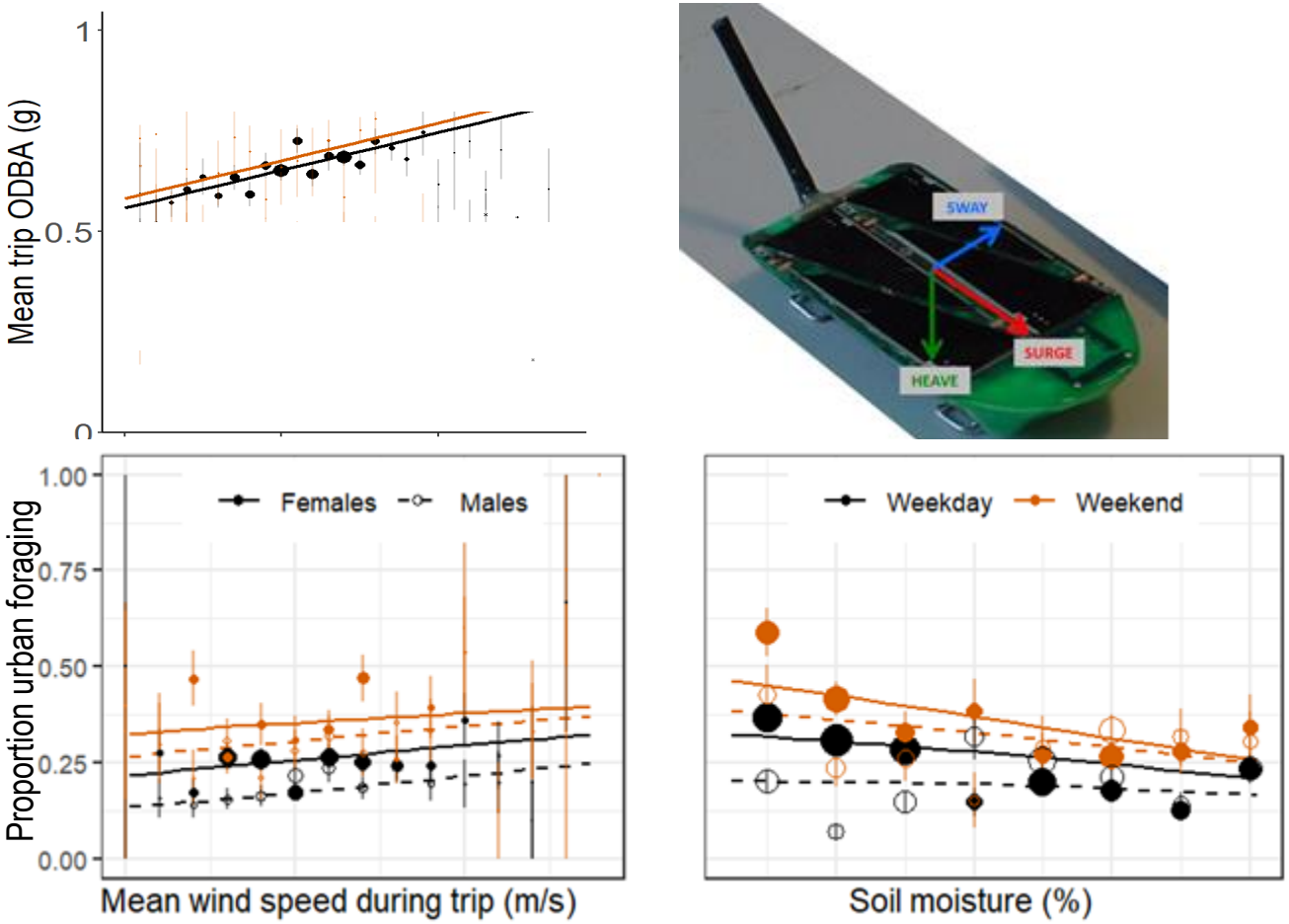


Expected increase in frequency and severity of extreme weather events under global change may result in a long-term increase in the use of urban habitats by opportunistic species.

Sotillo et al 2021, Landscape & Urban Planning

# Animal cognition in an urbanized world

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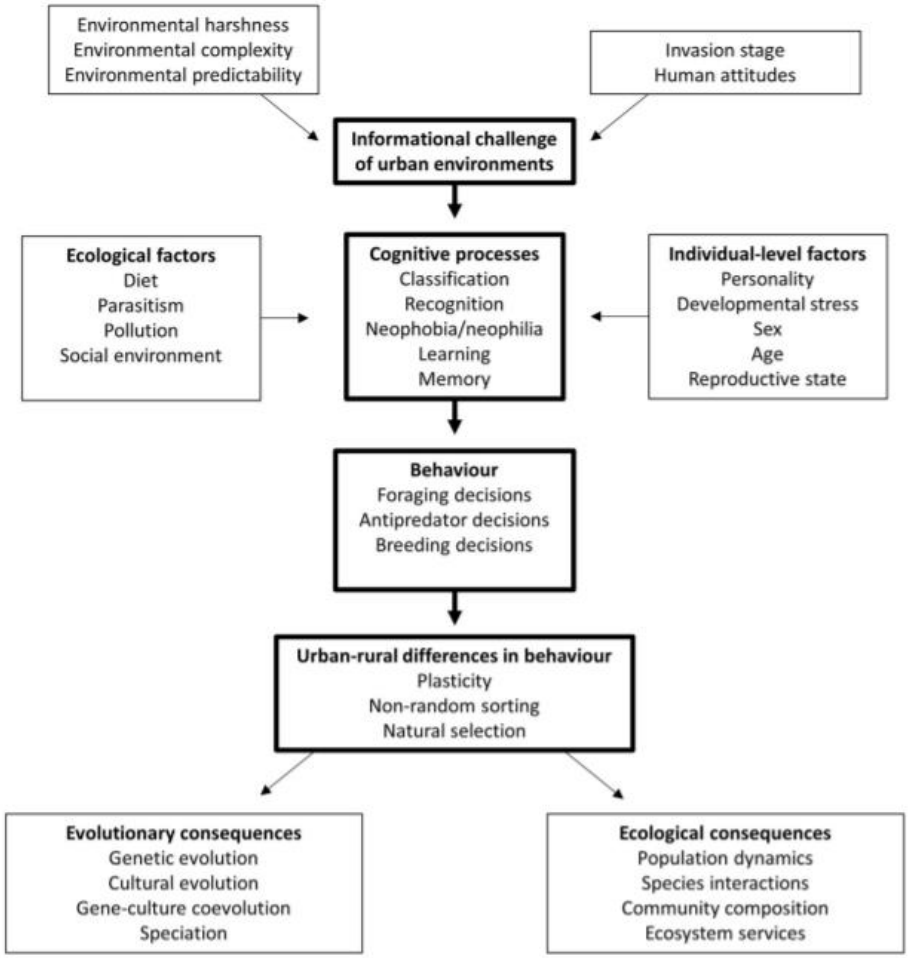
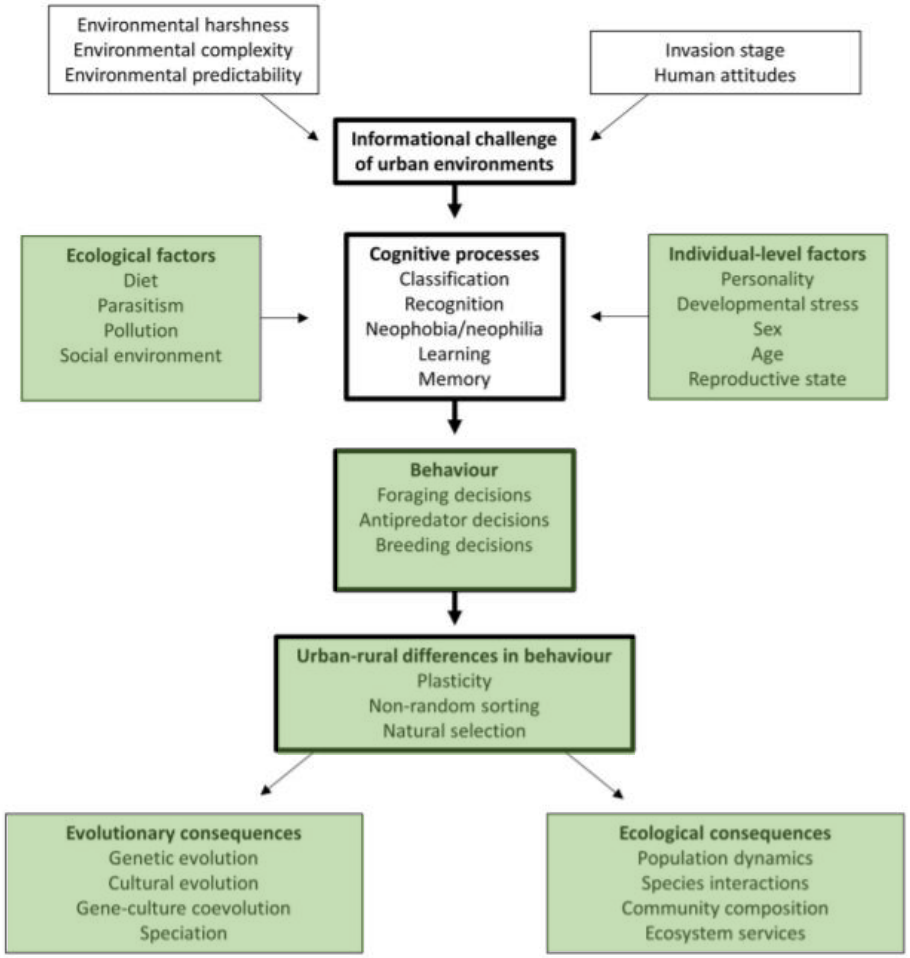



Lee & Thornton 2021, Frontiers in Ecology and Evolution

# Animal cognition in an urbanized world

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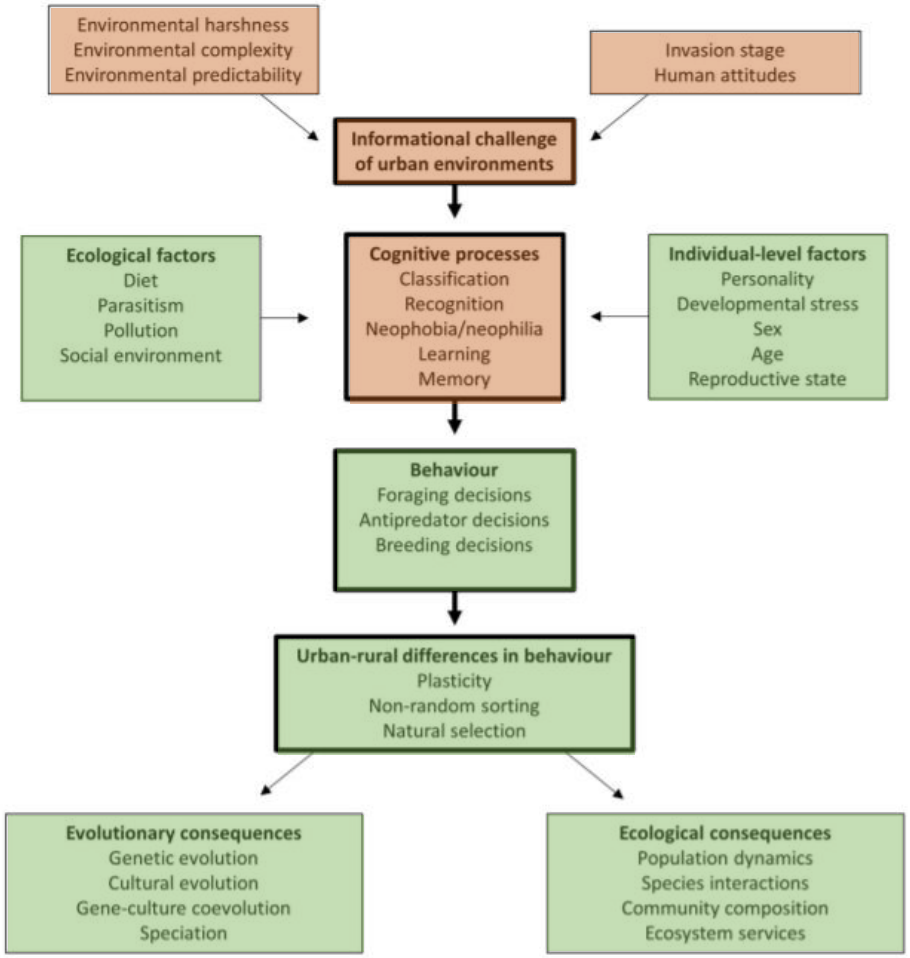
# Animal cognition in an urbanized world

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# Animal cognition in an urbanized world

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FACULTY OF SCIENCES

FACULTY OF VETERINARY MEDICINE

UNIVERSITY OF EXETER

University of St Andrews

# Animal cognition in an urbanized world


Thank you !