

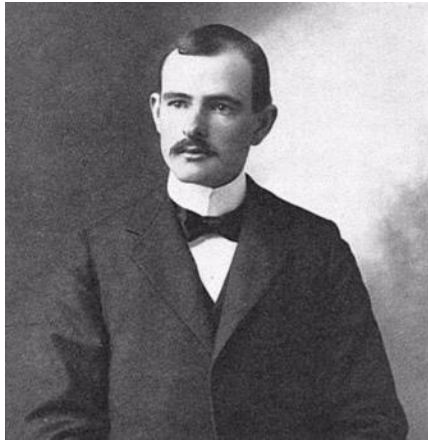
Individuelle Nischen:

# Rauhaut- und Weißrandfledermaus im Vergleich



Markus Milchram

# Ökologische Nischen

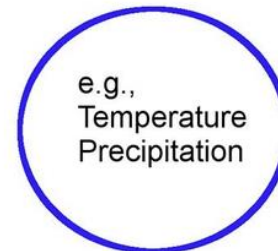


Joseph Grinnell



George Evelyn Hutchinson

**Grinnellian niche**



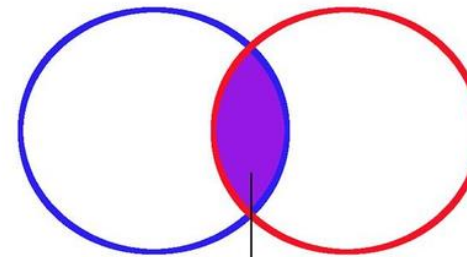
Abiotic

**Eltonian niche**



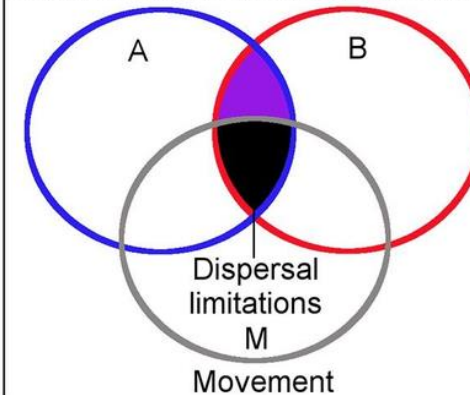
Biotic

**Hutchinsonian niche**

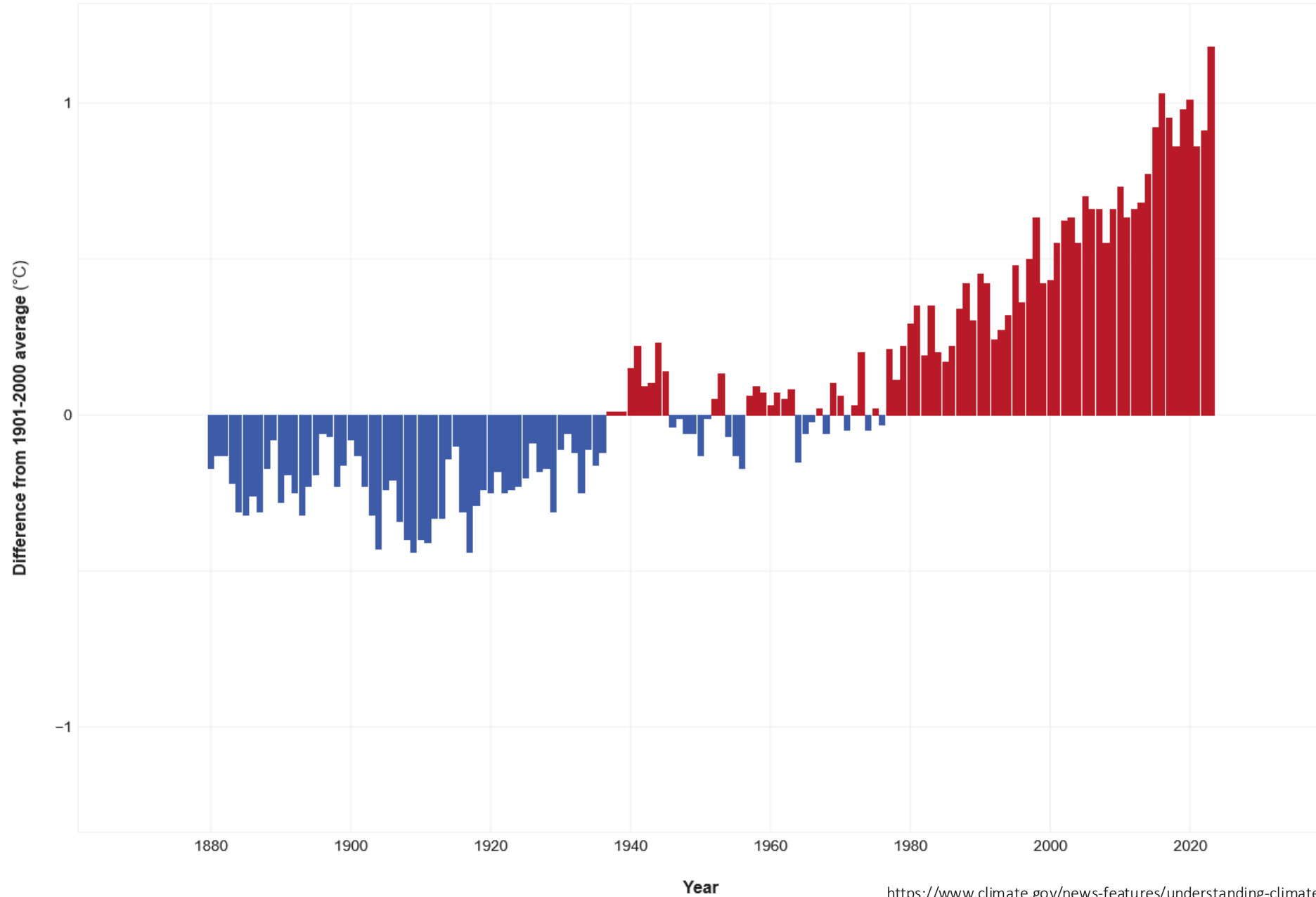


Biotic interactions limit the use of Abiotic

**Soberón and Peterson framework**

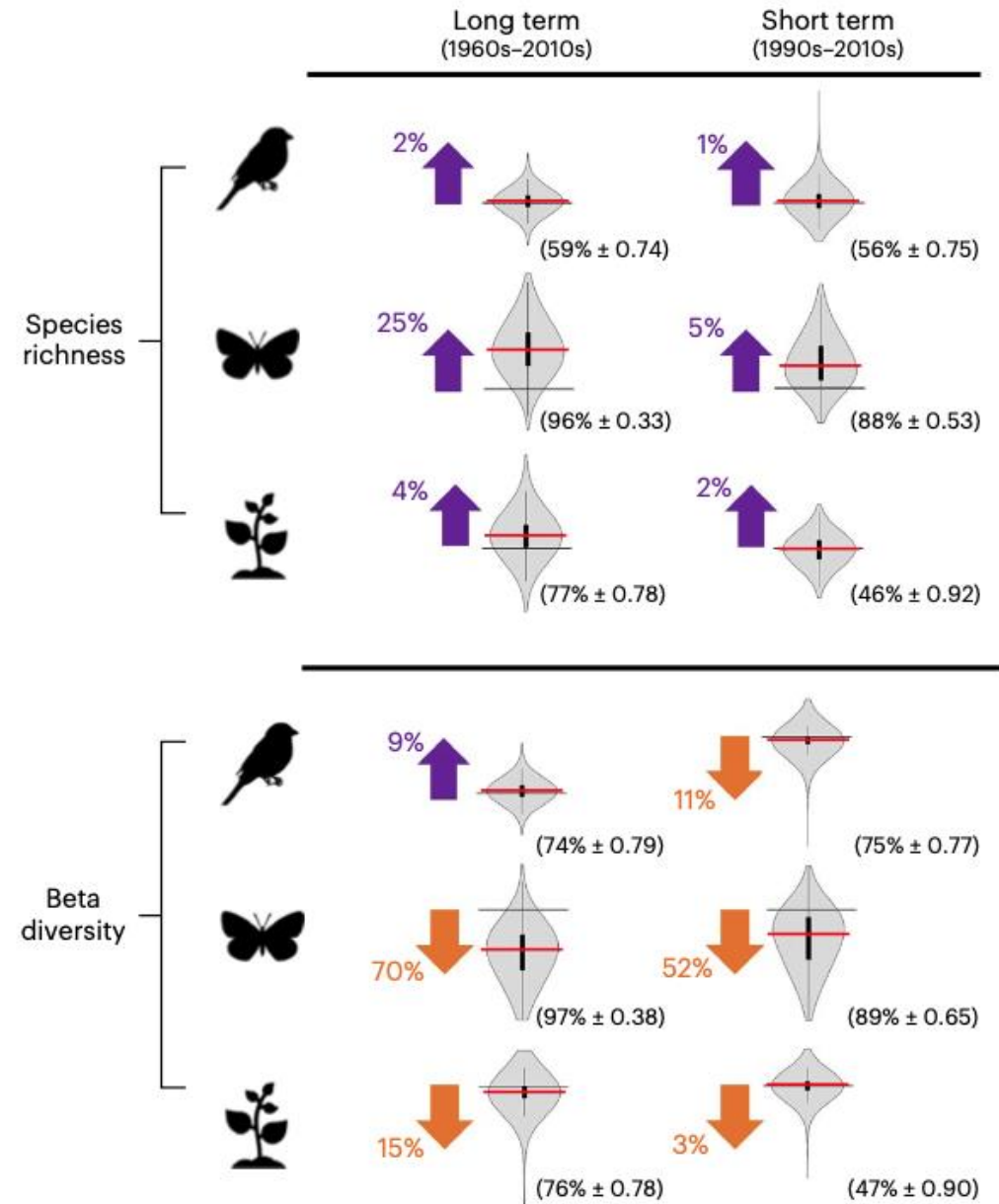
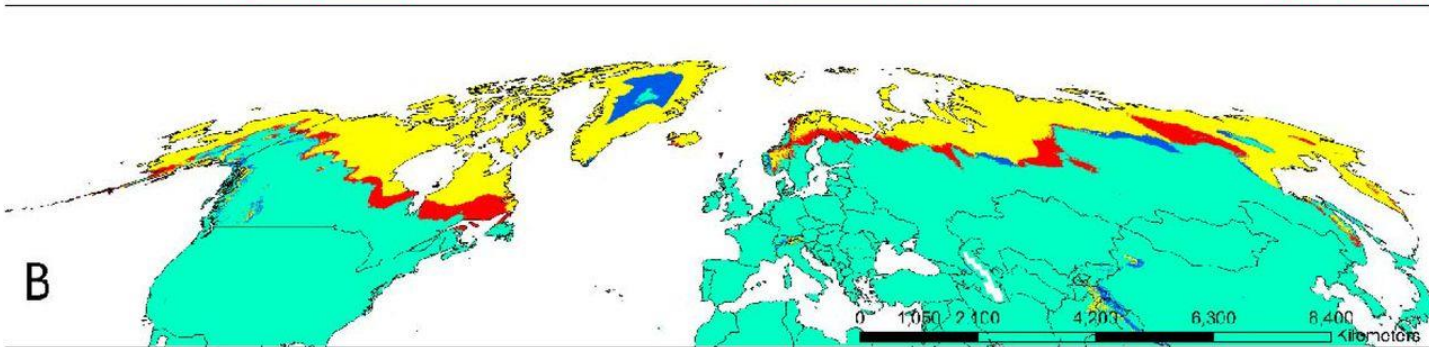
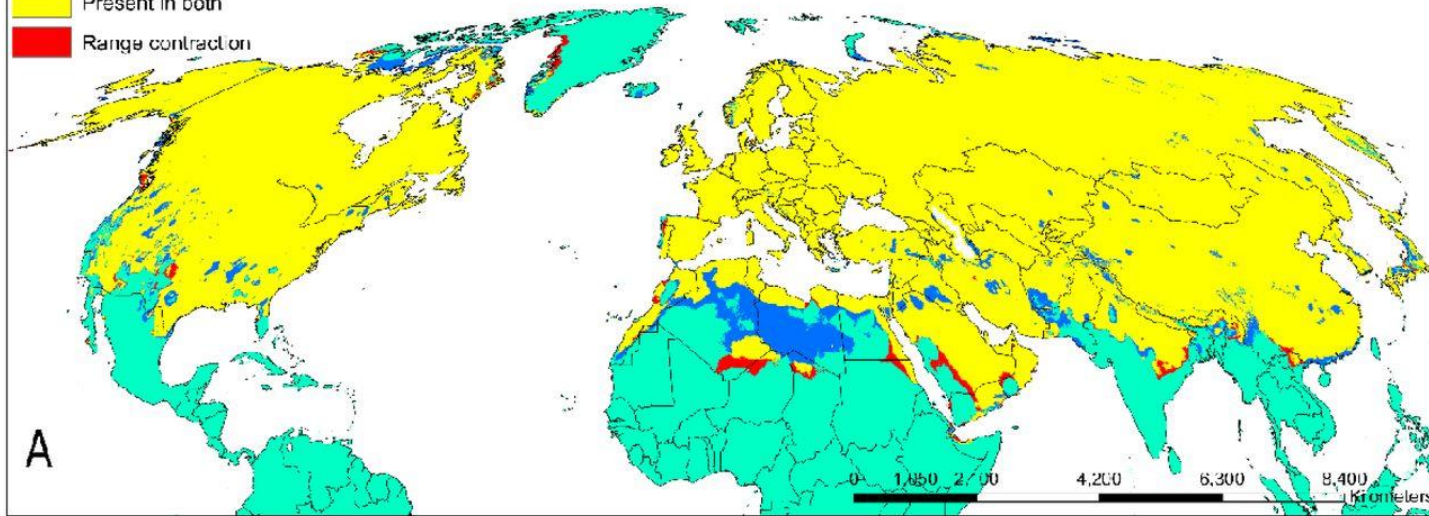


# GLOBAL AVERAGE SURFACE TEMPERATURE

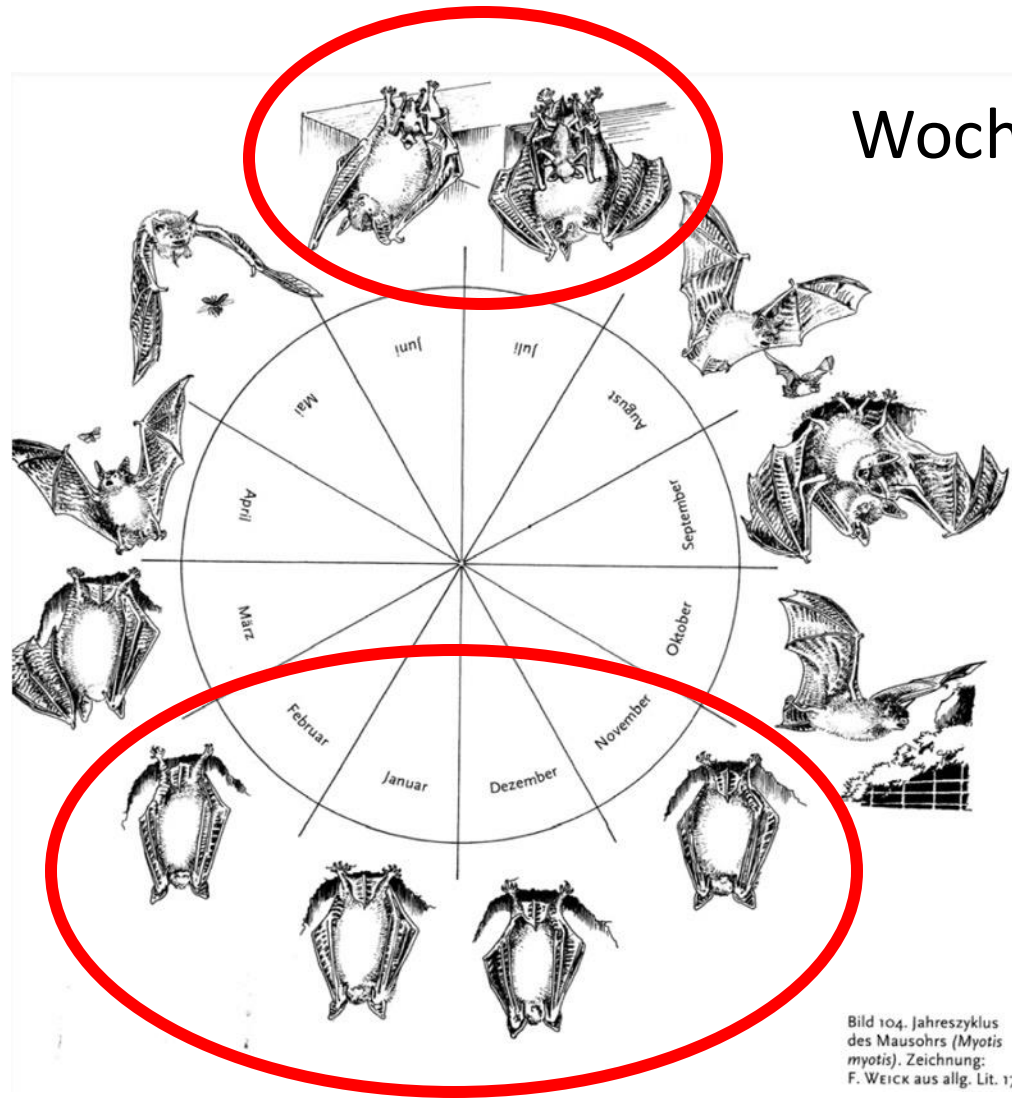


### Range changes over time

- Range expansion
- Absent in both
- Present in both
- Range contraction



Steigende Temperaturen führen zu  
Verbreitungsänderungen von Arten



Wochenstubenzeit

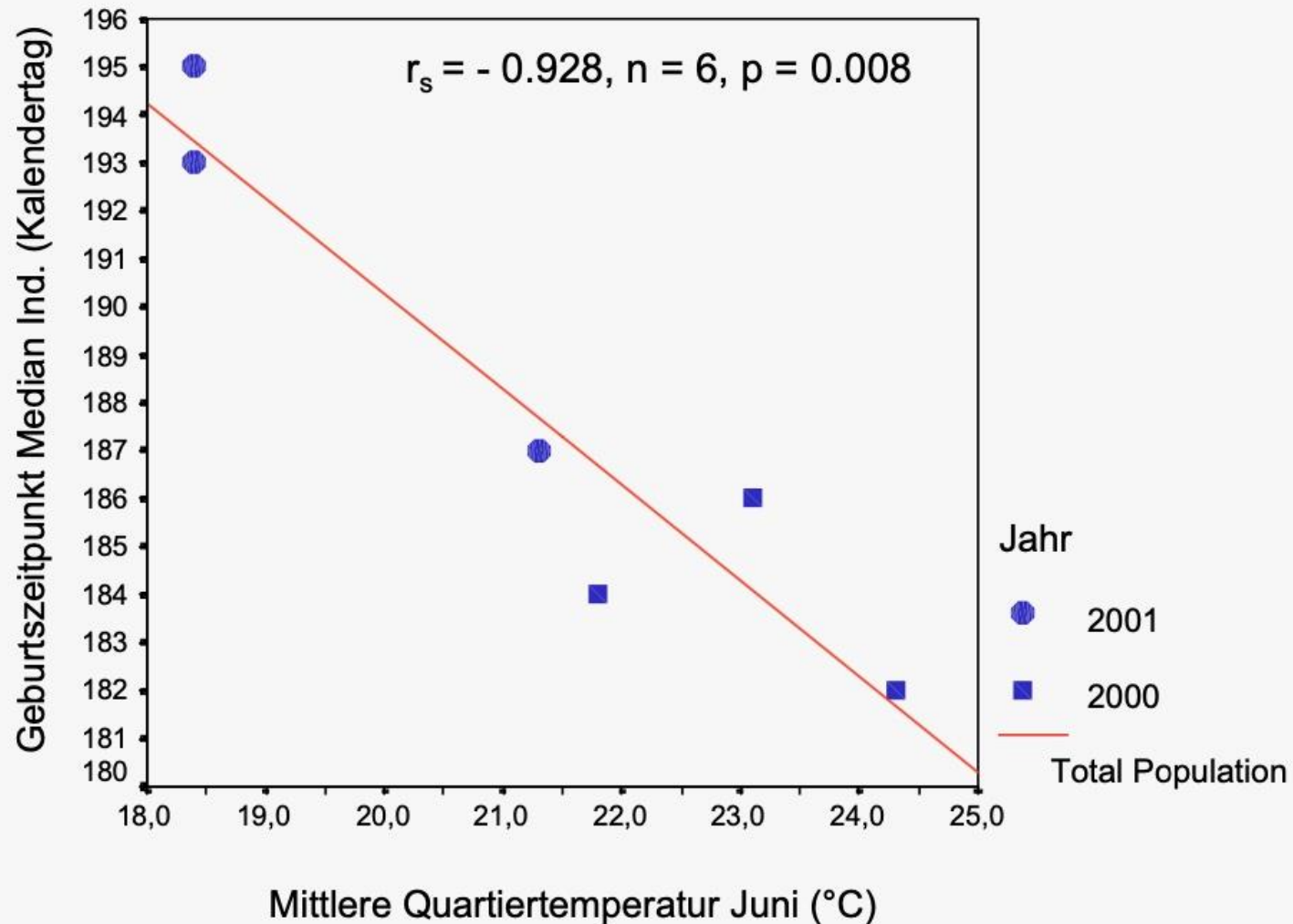
Winterschlaf



Mausohr  
*Myotis myotis*

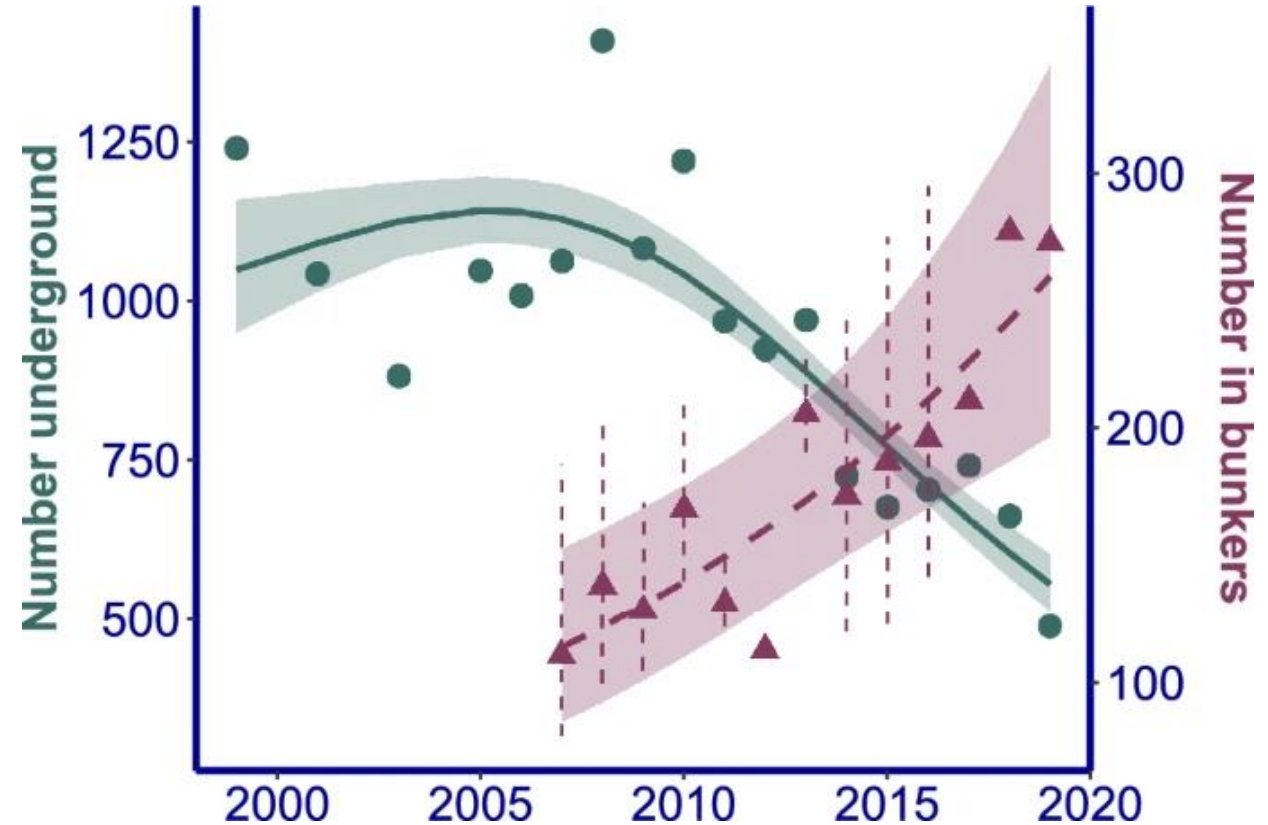
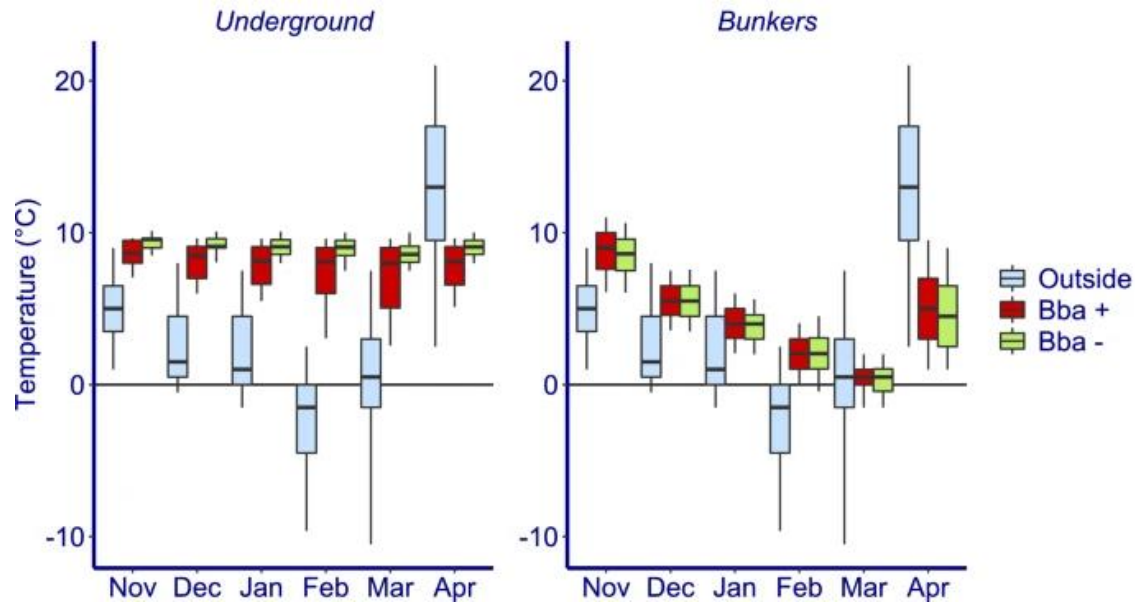
Braun and Weick (1994)

# Auswirkung der Temperatur auf den Geburtszeitpunkt



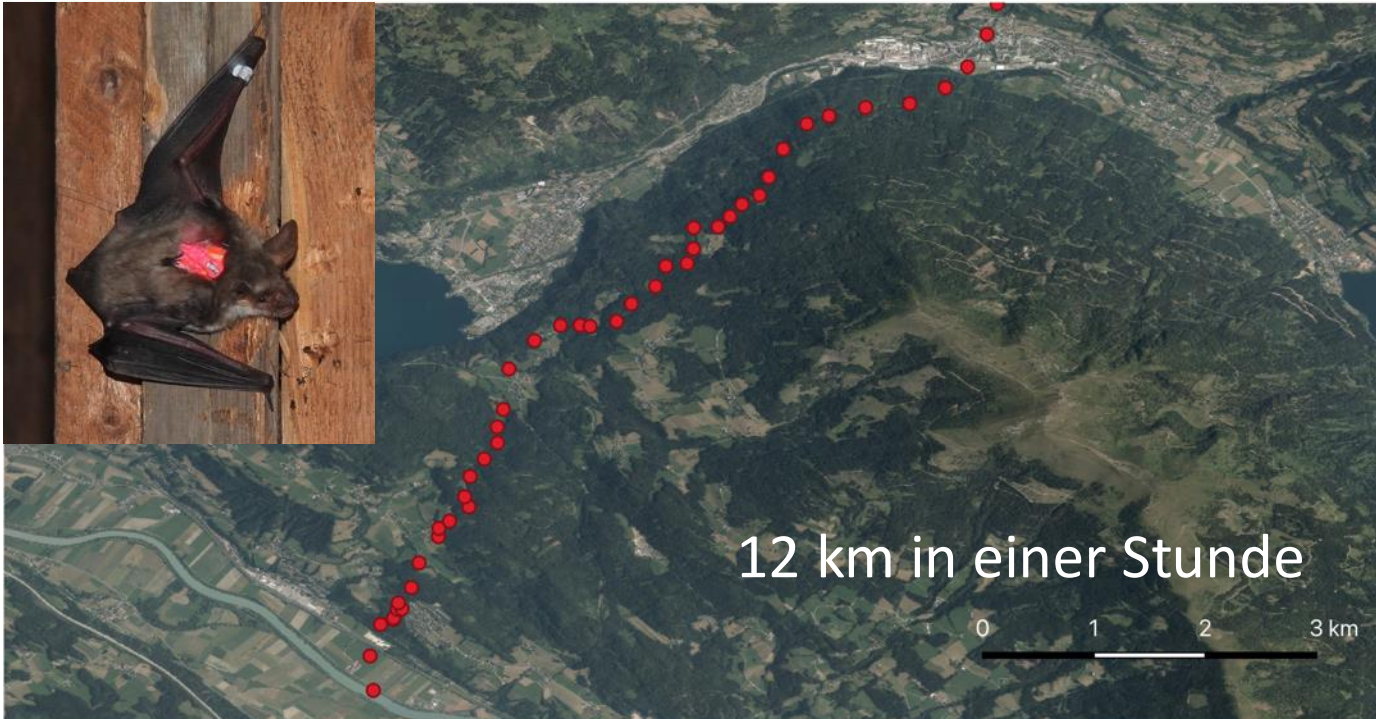
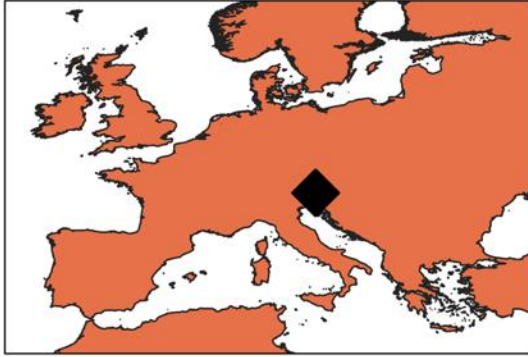
Kleine Hufeisennase  
*Rhinolophus hipposideros*

# Auswirkung der Temperatur auf den Winterschlaf



Mopsfledermaus  
*Barbastella barbastellus*

# Hohe Mobilität von Fledermäusen



Mausohr  
*Myotis myotis*

Milchram et al. in prep.



Sci Nat (2016) 103: 15  
DOI 10.1007/s00114-016-1334-7



-00564-2022

## ORIGINAL PAPER

Climatic C  
DOI 10.10

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**Abstract**  
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## Extraordinary range expansion in a common bat: the potential roles of climate change and urbanisation

L. Ancillotto<sup>1</sup> · L. Santini<sup>2</sup> · N. Ranc<sup>3,4</sup> · L. Maiorano<sup>2</sup> · D. Russo<sup>1,5</sup>

Received: 13 August 2015 / Revised: 27 December 2015 / Accepted: 13 January 2016 / Published online: 2 February 2016  
© Springer-Verlag Berlin Heidelberg 2016

**Abstract** Urbanisation and climate change are two global change processes that affect animal distributions, posing critical threats to biodiversity. Due to its versatile ecology and synurbic habits, Kuhl's pipistrelle (*Pipistrellus kuhlii*) offers a unique opportunity to explore the relative effects of climate

I used museum records, pu  
and organizations to deter  
48 years across eastern No  
Coast, Carolinas, and south  
maternity season. During th  
movements and have been  
Over the past 48 years, the

*P. kuhlii* and showed an increasing trend in the study period; mean annual precipitation and precipitation seasonality were also relevant, but to a lower extent. Although urbanisation increased in recently colonised areas, it had little effect on the species' presence predictability. *P. kuhlii* expanded its geo-

Brazilian free-tailed bats (*Tadarida brasiliensis*) are one of the most widely distributed bat species in the Americas, often engaging in rapid, long-distance dispersals. Here, we document that, since ca. 2007, these bats model was applied to historical and projected climate data to examine changes in suitable range (1940–2080) of this species. We tested the predictive ability of the model with known records in the UK after 2006 and applied the model to the

expanding

RAINER<sup>5</sup>,

d Life Sciences, Vienna,

ling, Austria

0115 Berlin



in climate and landscape. These range  
may alter local bat communities. The

7-R, JJK,

University Park, PA 16802, USA (RFB)

IT 59717, USA (DNJ)

R)

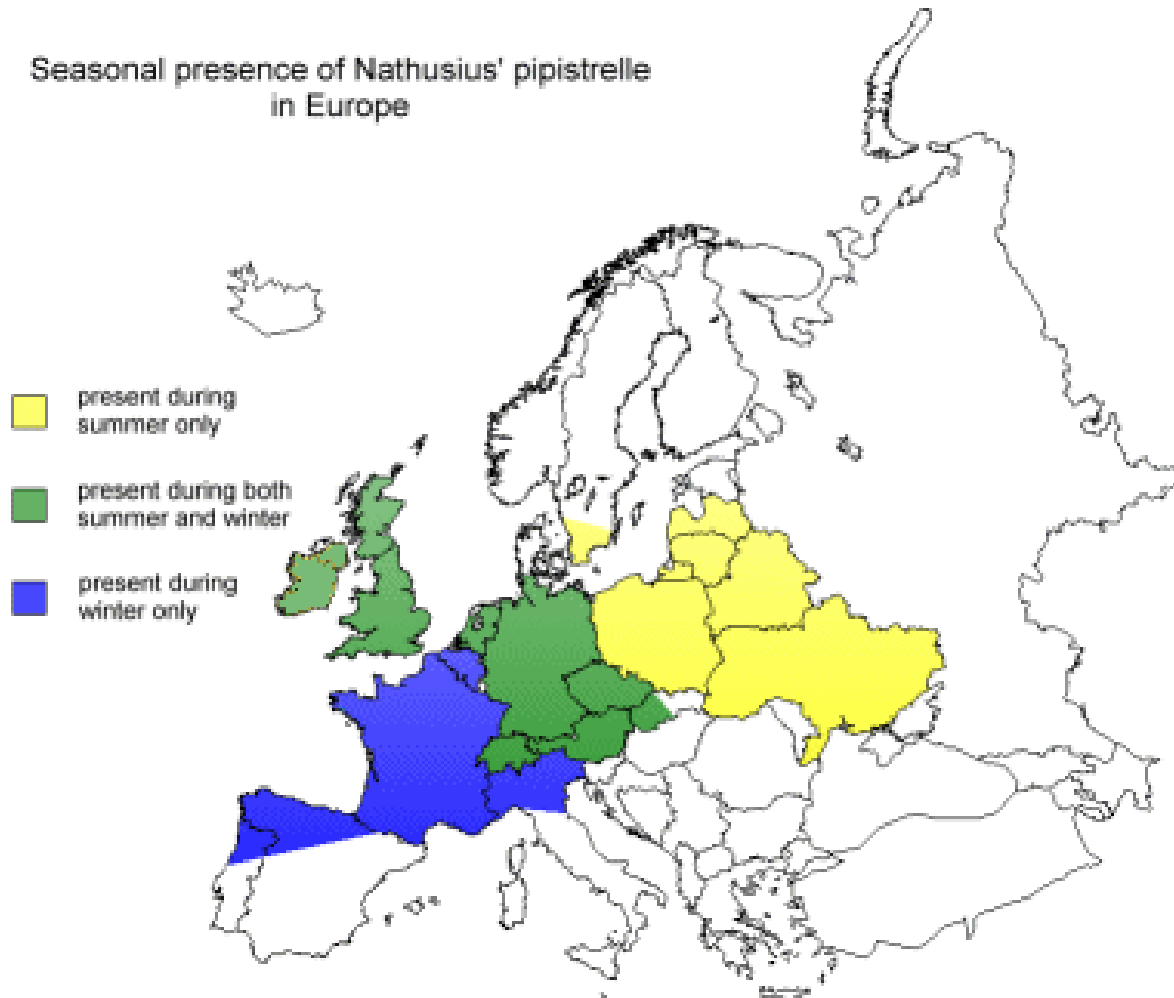


**Fig. 1** Eurasian range of *Pipistrellus kuhlii* (shades of grey). Dark grey historical range (after Stebbings and Griffiths 1986), light grey current range comprising 1980–2013 occurrence data



Weirandfledermaus  
*Pipistrellus kuhlii*

Seasonal presence of Nathusius' pipistrelle  
in Europe



Rauhautfledermaus  
*Pipistrellus nathusii*

Ähnliche Morphologie  
Ähnliches Rufverhalten  
Ähnliches Jagdverhalten  
Starke Überlappungen im Vorkommen



Weißrandfledermaus  
*Pipistrellus kuhlii*



Rauhautfledermaus  
*Pipistrellus nathusii*

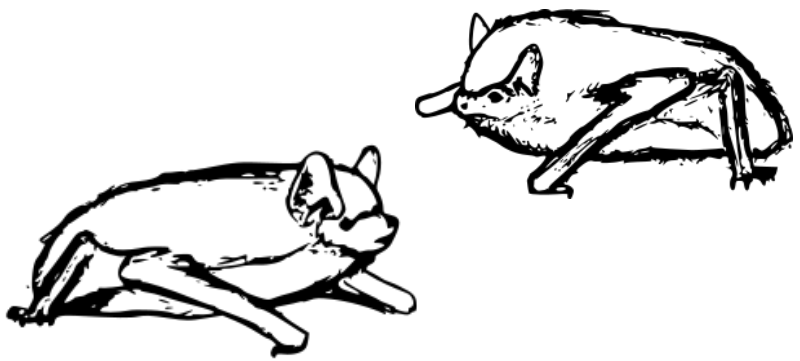
# Wie nischen sich Rauhaut- und Weißrandfledermaus ein?

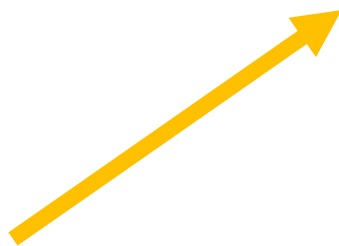


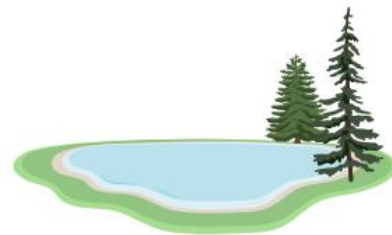
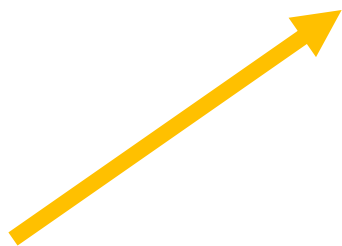
Weißrandfledermaus  
*Pipistrellus kuhlii*



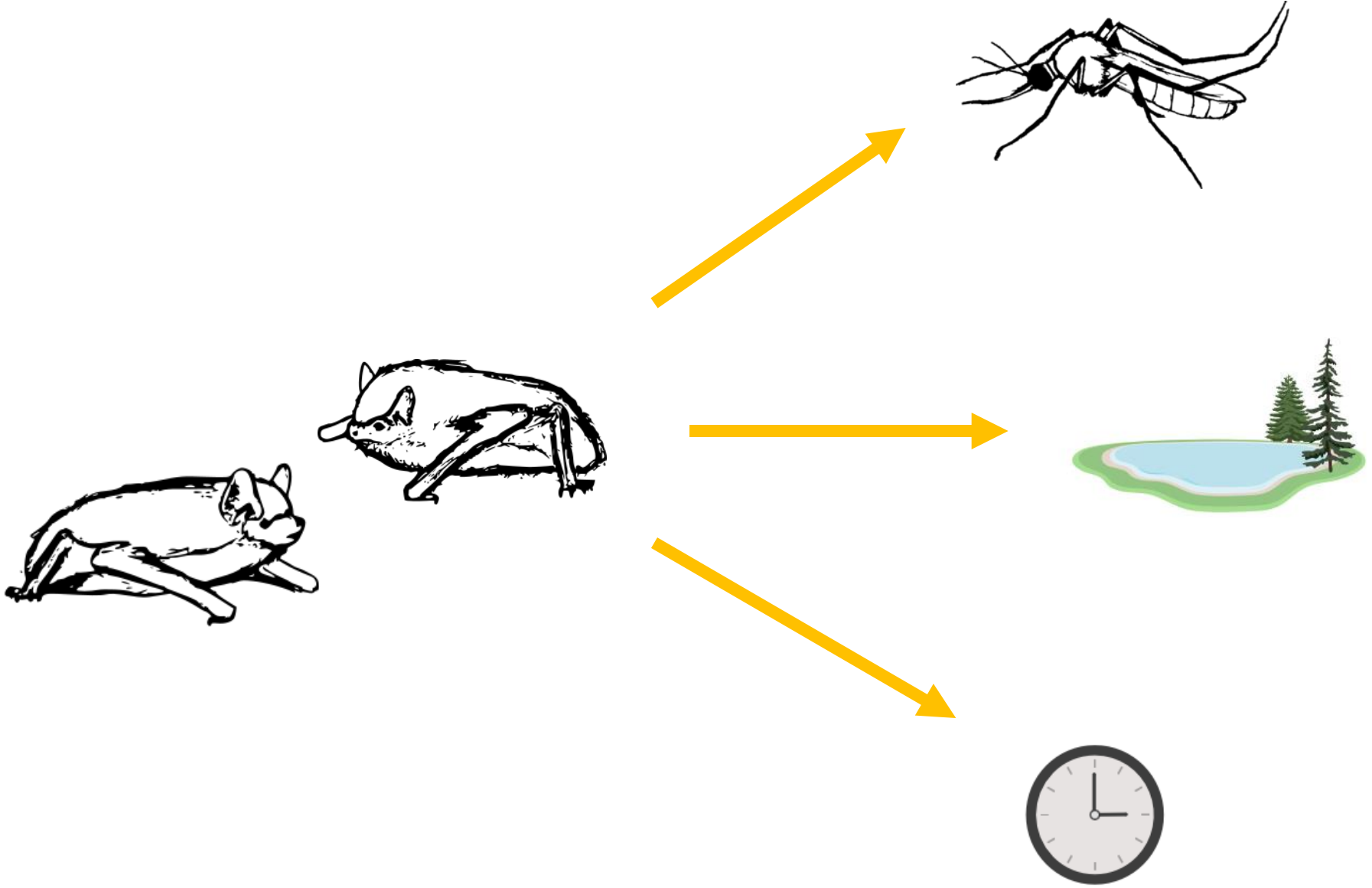
Rauhautfledermaus  
*Pipistrellus nathusii*





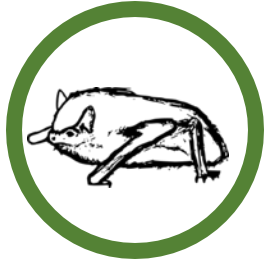






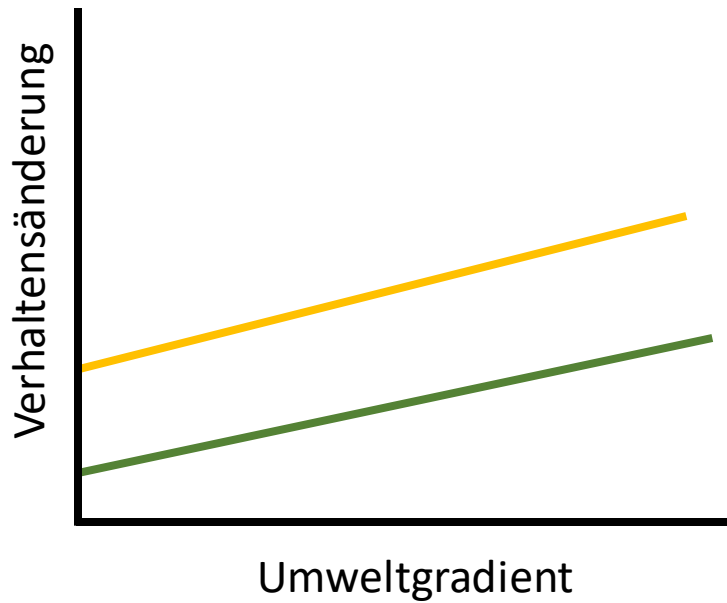


*Pipistrellus kuhlii*



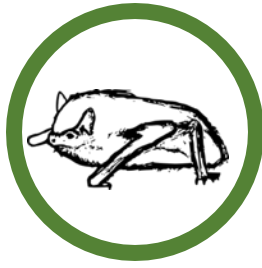
*Pipistrellus nathusii*

### Variation zwischen Arten



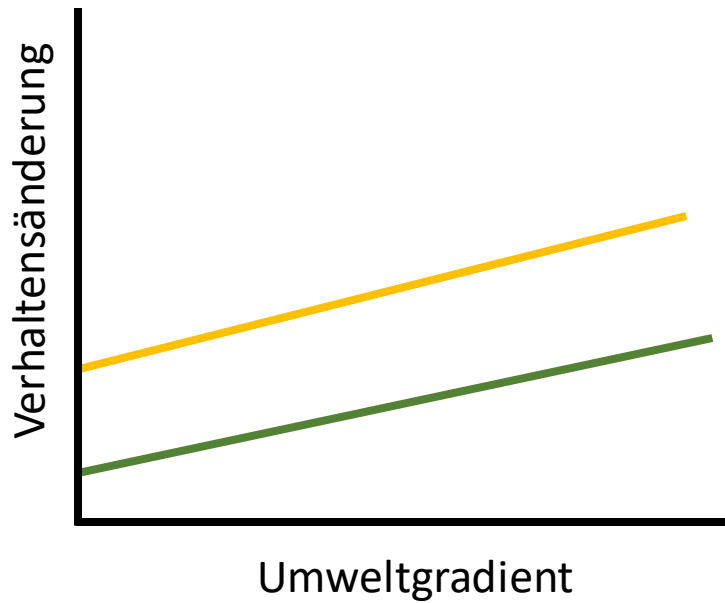


*Pipistrellus kuhlii*

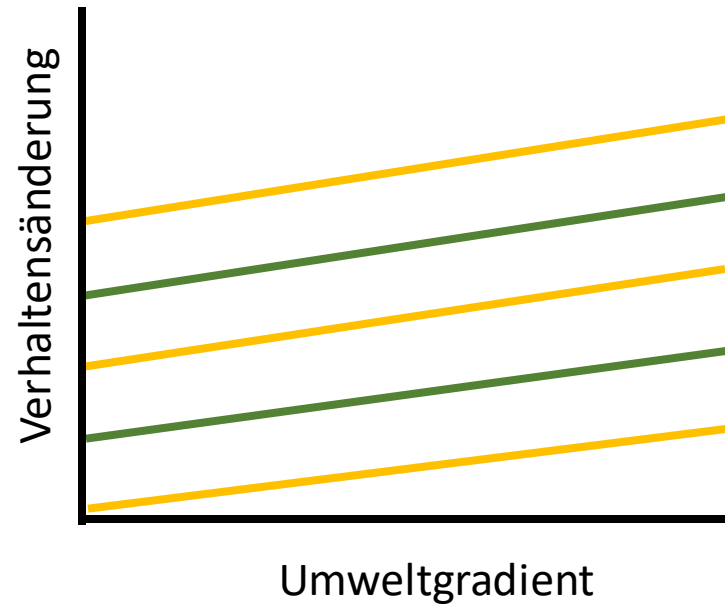


*Pipistrellus nathusii*

### Variation zwischen Arten

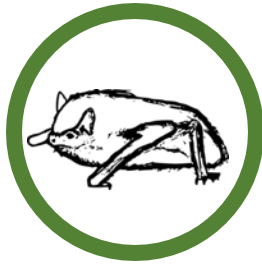


### Variation zwischen Individuen



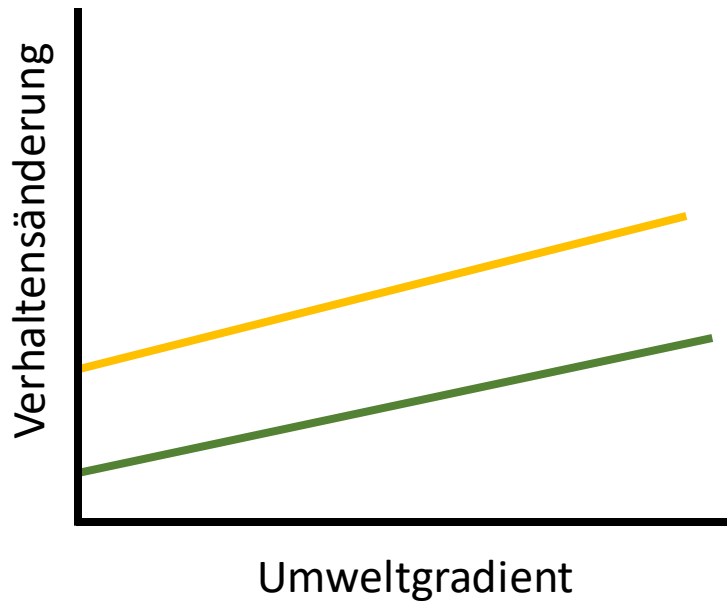


*Pipistrellus kuhlii*

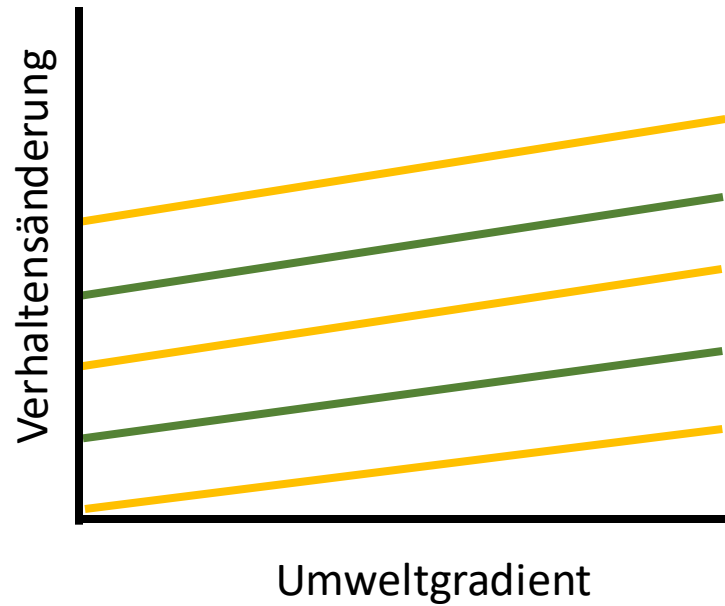


*Pipistrellus nathusii*

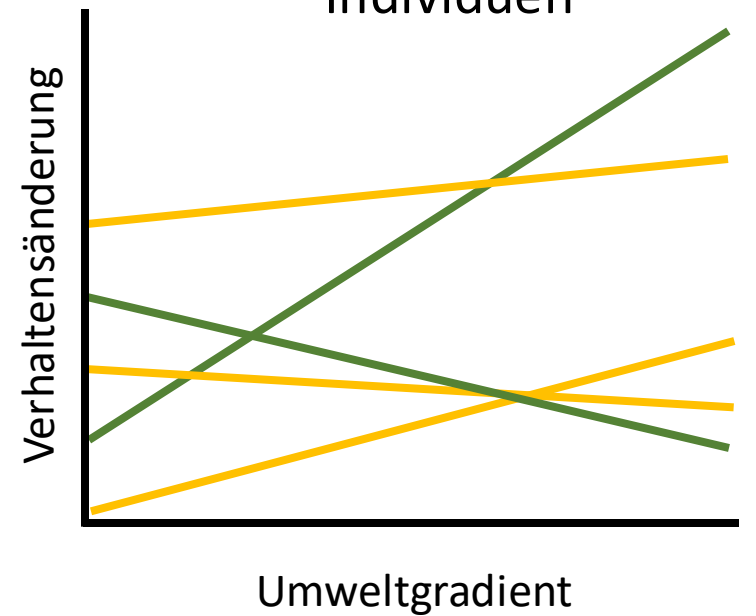
### Variation zwischen Arten



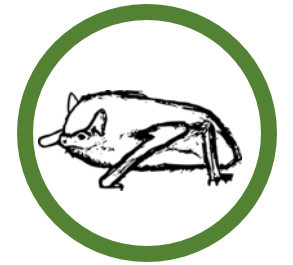
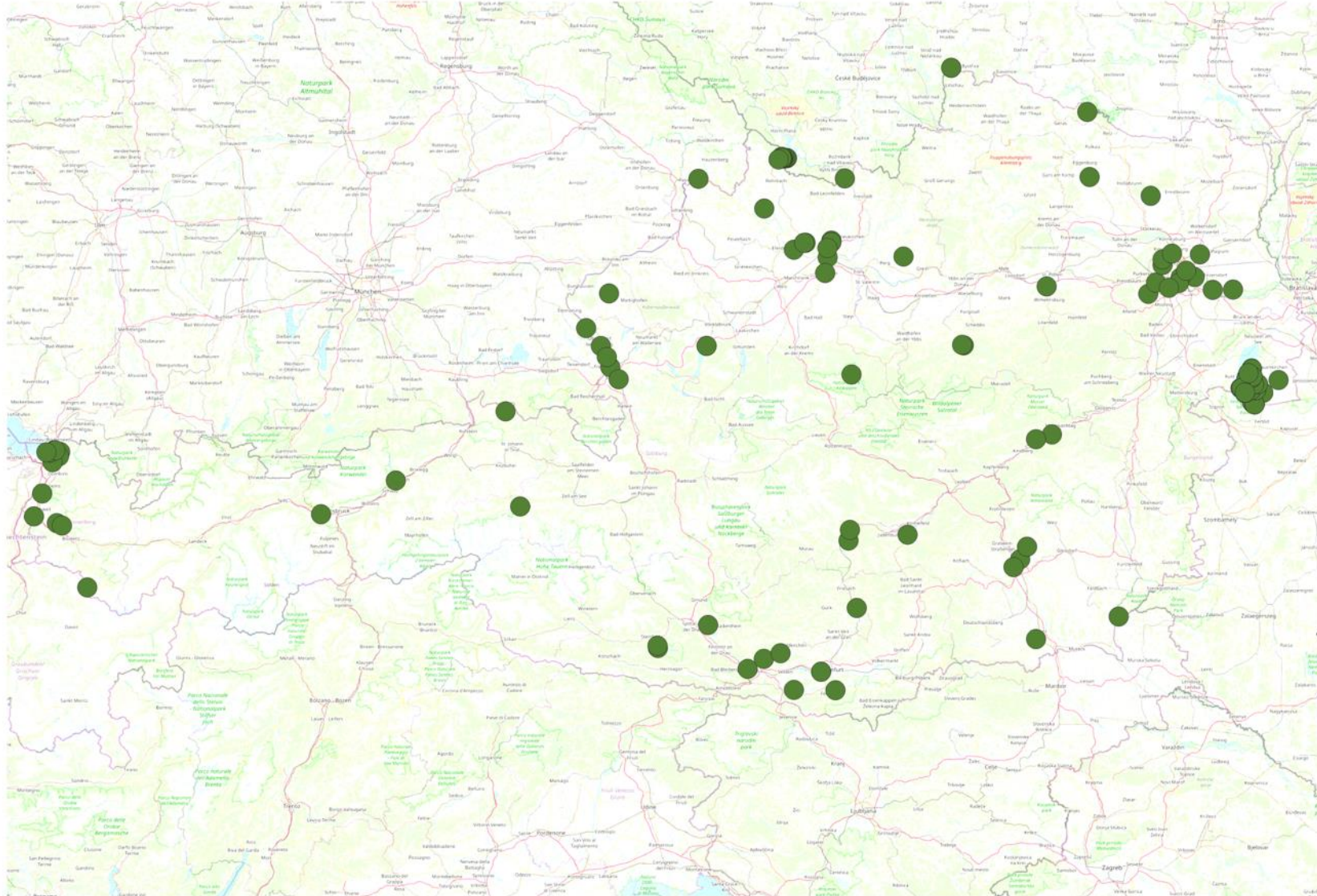
### Variation zwischen Individuen



### Variation innerhalb der Individuen

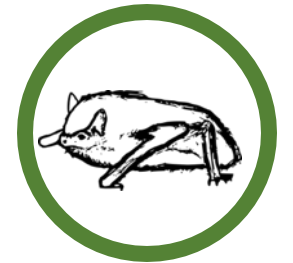
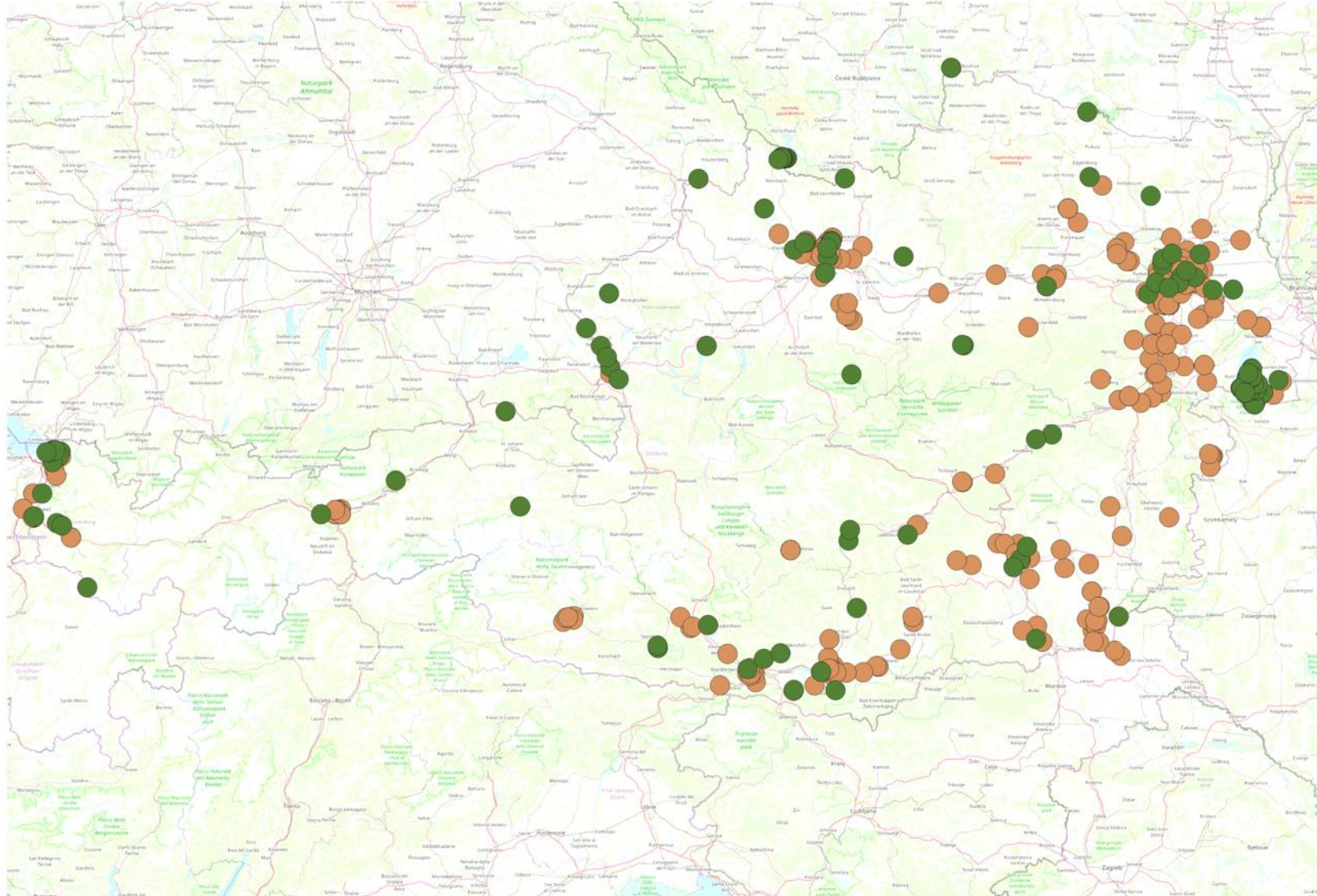


# Sommervorkommen der Rauhautfledermaus in Österreich



*Pipistrellus nathusii*

# Sommervorkommen der Weißrandfledermaus in Österreich



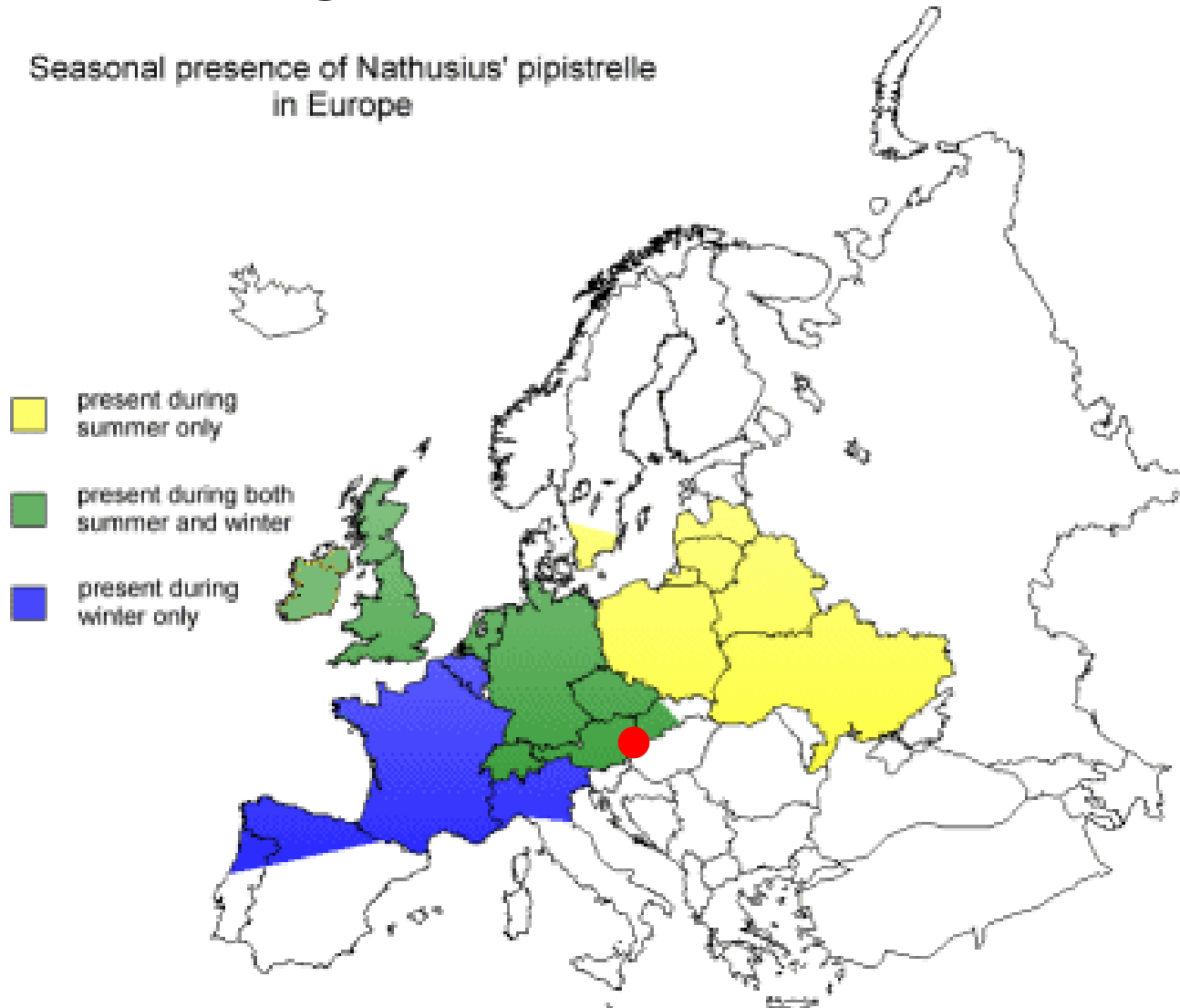
*Pipistrellus nathusii*



*Pipistrellus kuhlii*

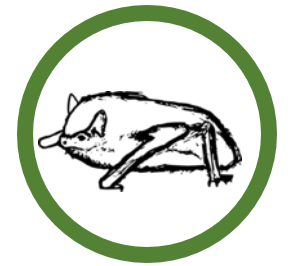
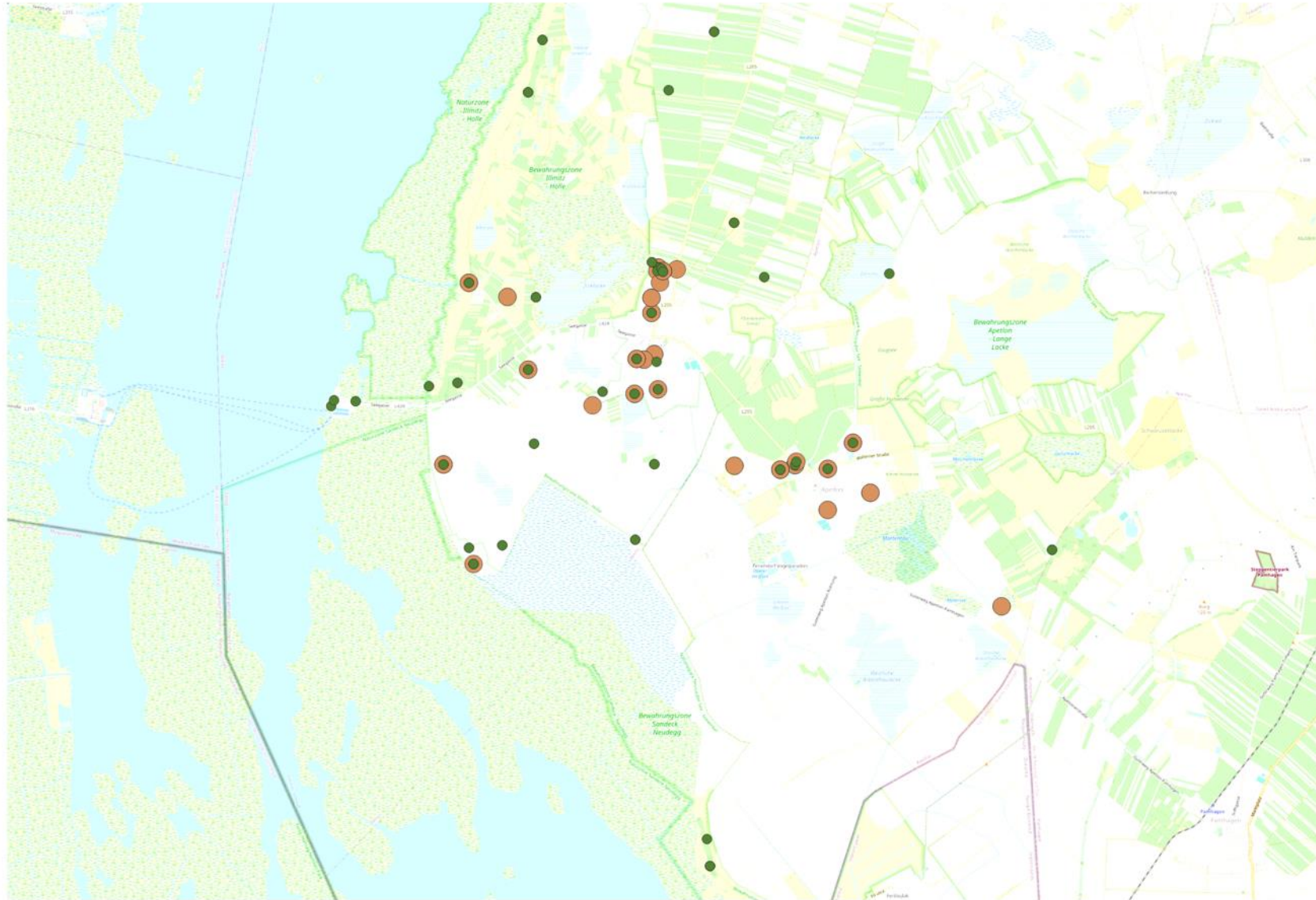
# Studiengebiet

Seasonal presence of *Nathusius' pipistrelle*  
in Europe



Rauhautfledermaus  
*Pipistrellus nathusii*

# Studiengebiet - Seewinkel



*Pipistrellus nathusii*



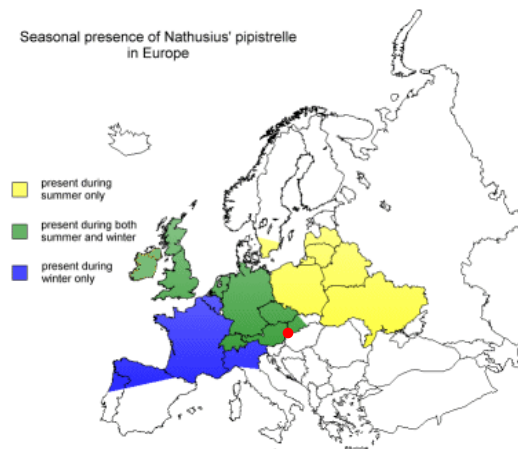
*Pipistrellus kuhlii*



# Studienggebiet - Seewinkel



- Sowohl *P. kuhlii* als auch *P. nathusii* sind sehr häufig
- Mähwiesen, Weiden, Schilf, Kleine Laubwäldchen, Sodalacken, Siedlungsgebiete
- Automatisiertes VHF Telemetriesystem mit 10 Aufnahmestationen (Abdeckung von ca. 85 km<sup>2</sup>)



# Automatisches VHF-System

4 direktionale  
Antennen

Raspberry Pi

USB  
receiver

WiFi modem

Photovoltaik +  
Autobatterie



Aufnahmestation

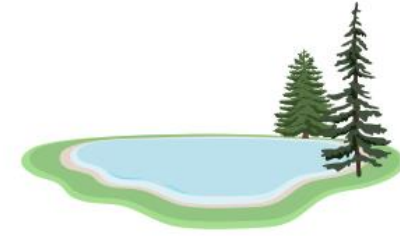
# Methoden



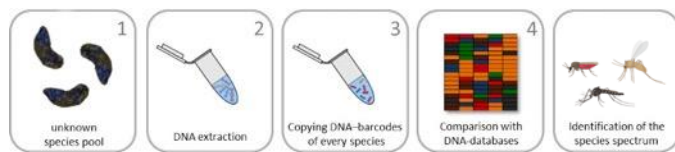
Netzfang



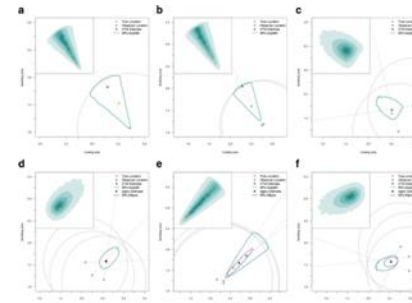
Besenderung



Automatische VHF-Telemetrie



Metabarcoding vom Guano



Berechnung der Positionen mit Bayesschen Azimuthal Telemetry Modellen

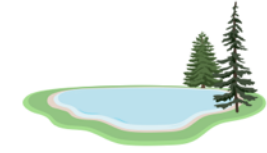
# Methoden

- 58 Individuen (24 *P. nathusii* and 34 *P. kuhlii*) in 2022 und 2023
- 170 Fledermaus-Nacht Kombinationen
- 700 000 berechnete Postitionen





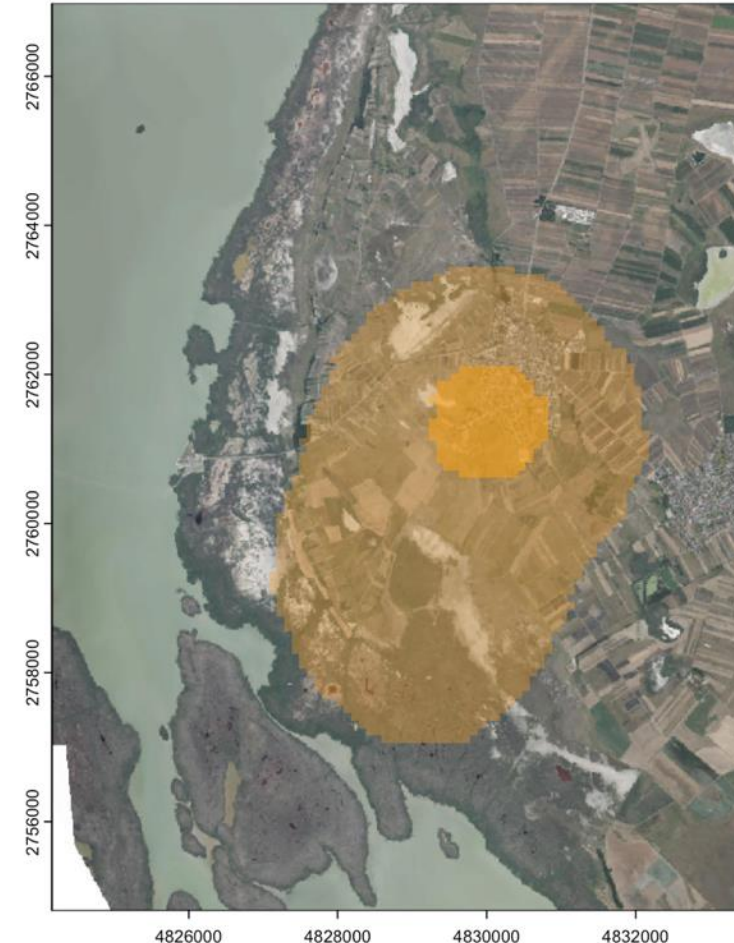
# Dynamische Brownian Bridge Movement Modelle



- Korrigiert für **Unterschiede in der Aufnahmefrequenz**
- Korrigiert für die **zeitlich räumliche Autokorrelation**
- Berücksichtigt die **Unsicherheit in der Positionsberechnung**
- Erlaubt sogenannte **Nutzungsareale** zu berechnen



*Pipistrellus kuhlii*



# Berechnung der zeitlichen Habitatselektion



$$\text{Habitatselektion Ratio}_{ij} = \frac{\text{Nutzung}_{ij}}{\text{Verfügbarkeit}_i}$$

$$\text{Habitatselektion Ratio}_{ij} = \frac{\text{Nutzung}_{ij}}{\text{Verfügbarkeit}_i}$$

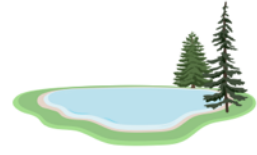
**Nutzung:** Anteil der Landschaft in 50% Nutzungsareal vom Individuum  $i$  in einem 30 Minutes time interval  $j$

**Nutzung:** Anteil der Landschaft in 50% Nutzungsareal vom Individuum  $i$  in einem 30 Minutes time interval  $j$

**Verfügbarkeit:** Anteil der Landschaft in 95% Nutzungsareal vom Individuum  $i$

**Verfügbarkeit:** Anteil der Landschaft in 95% Nutzungsareal vom Individuum  $i$

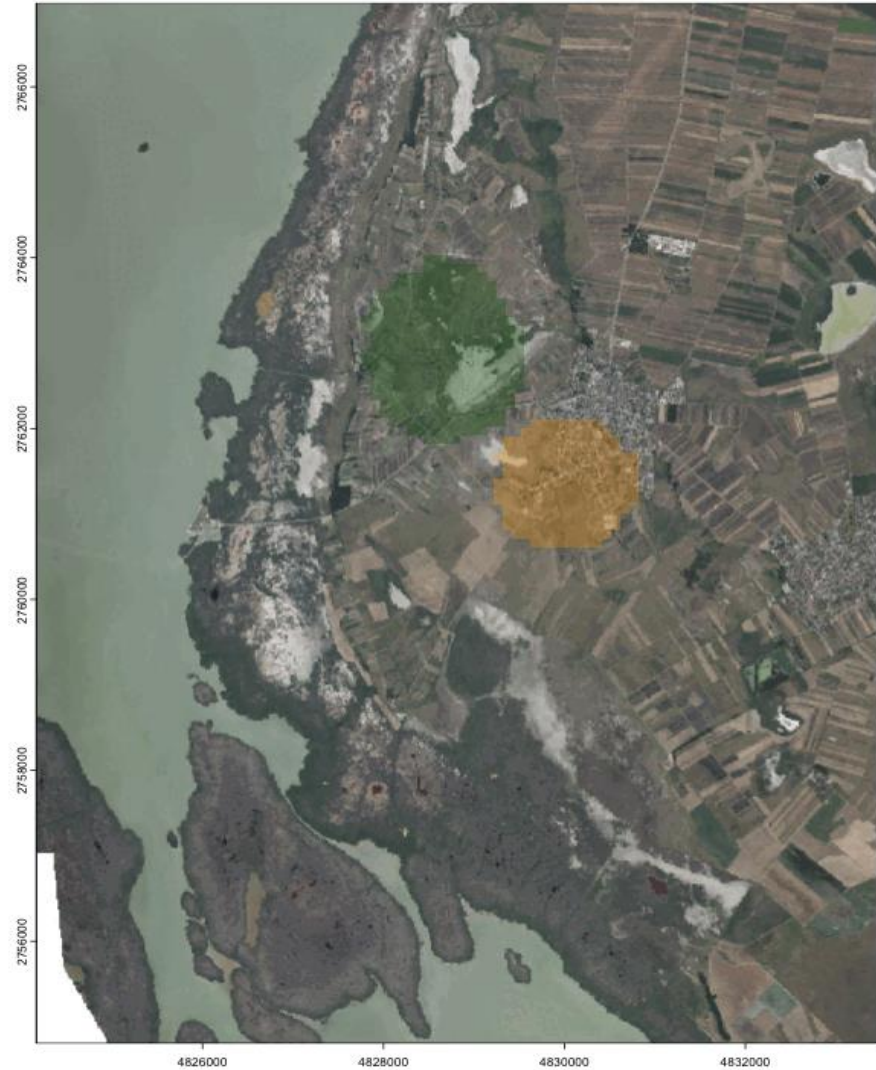
# Methoden



Kuhl's Pipistrelle  
*Pipistrellus kuhlii*

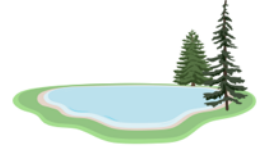


Nathusius' Pipistrelle  
*Pipistrellus nathusii*

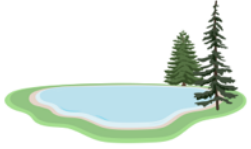




# Multivariates Nischenmodell



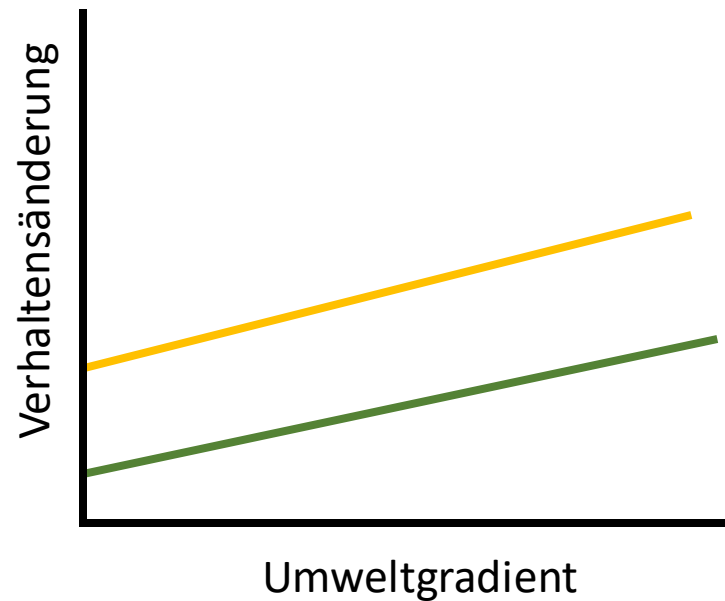
- Habitatselektion Ratios von Landschaftstypen
- In Abhängigkeit von: **~Zeit nach Sonnenuntergang** in 30 minutes  
Zeitintervallen  
**~Art**  
**~Zeit:Art**  
**~Distanz zu Quartieren**
- Korrigiert für: **Aufnahmenacht, Individuen**

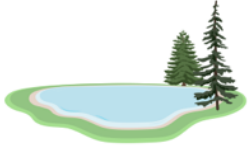


# Variation zwischen Arten: Effekte der Habitatselektion

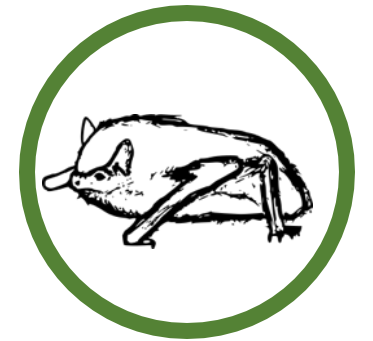
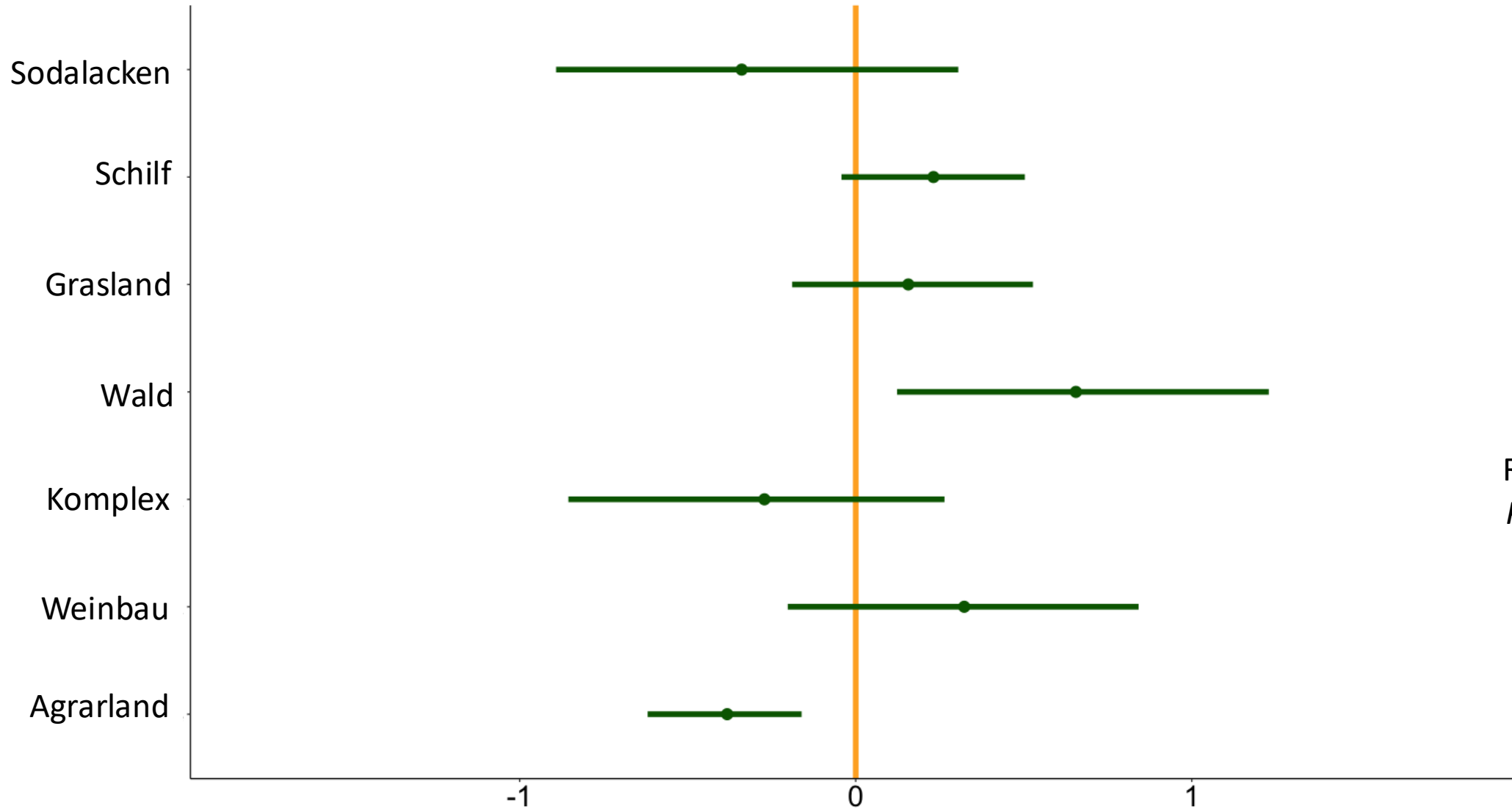


Variation zwischen Arten





# Variation zwischen Arten: Effekte der Habitatselektion



Rauhautfledermaus  
*Pipistrellus nathusii*

Estimates of Species Effects on Habitat Selection +/- 95% CIs



# Variation zwischen Arten: Effekte der zeitlichen Habitatnutzung

Sodalacken

Schilf

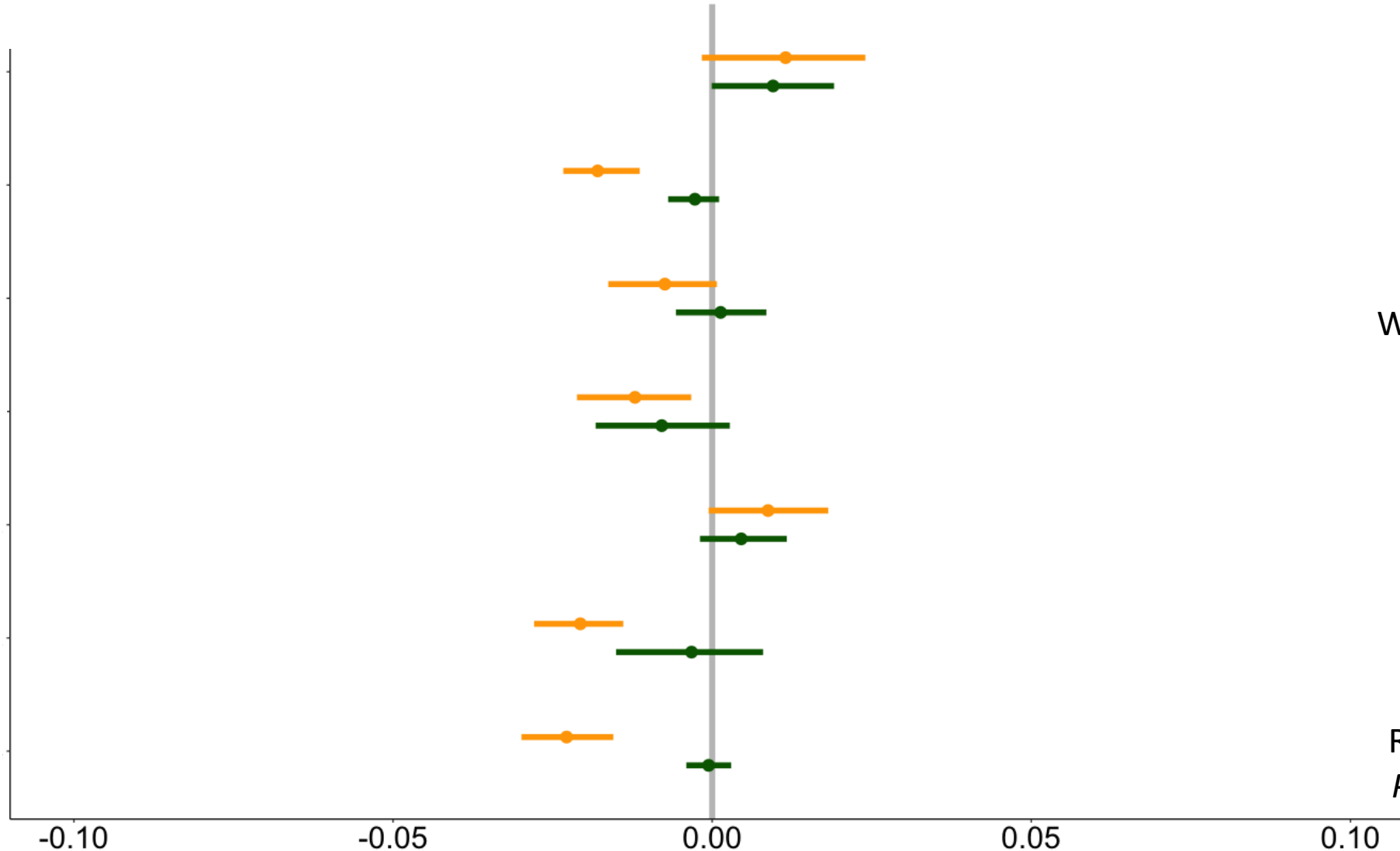
Grasland

Wald

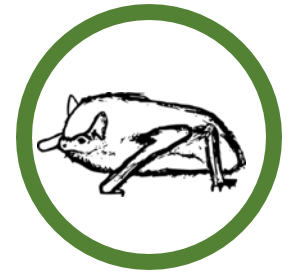
Komplex

Weinbau

Agrarland



Weißrandfledermaus  
*Pipistrellus kuhlii*

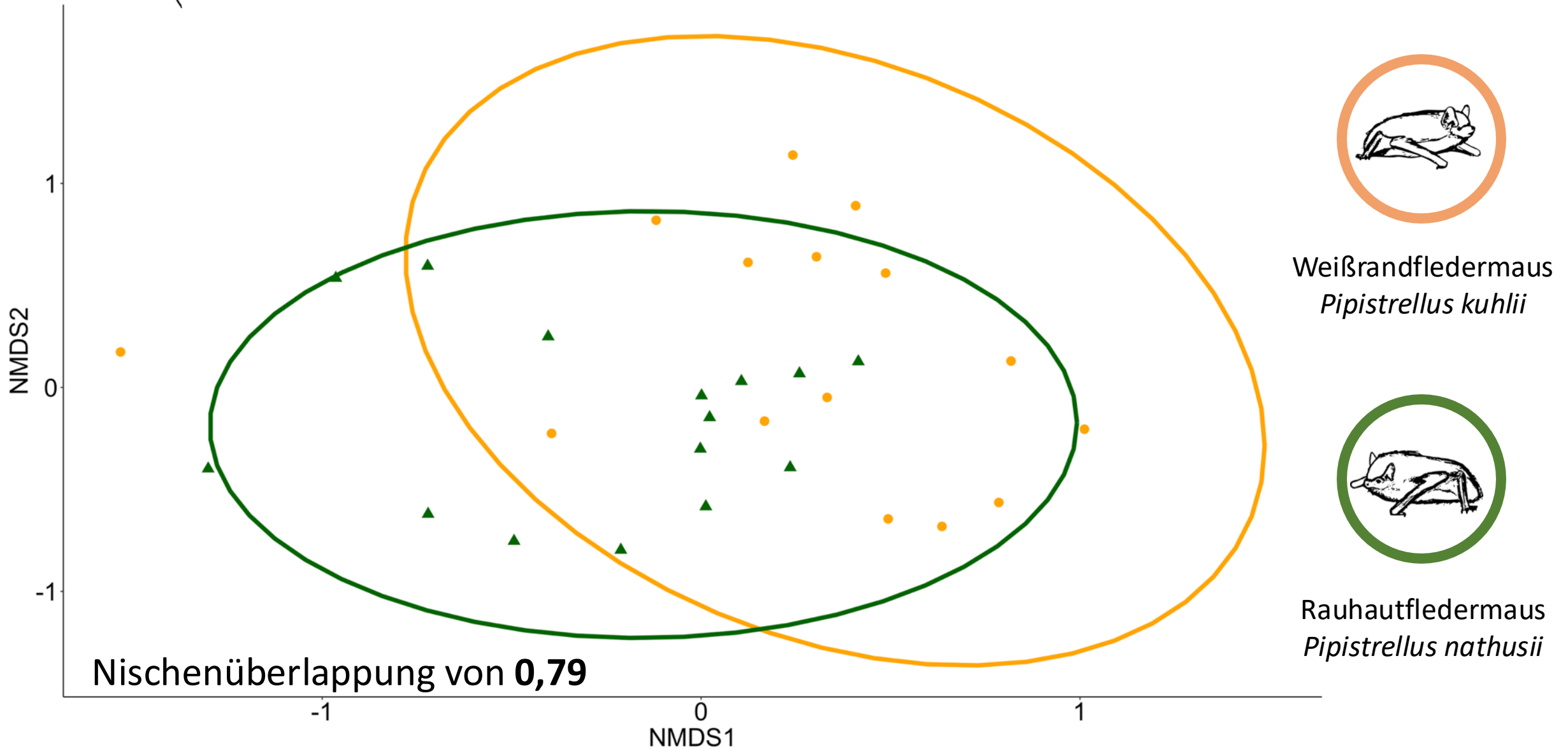


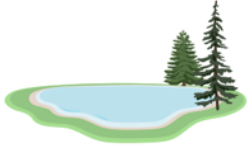
Rauhautfledermaus  
*Pipistrellus nathusii*

Estimates of Time Effects on Habitat Selection +/- 95% CIs



# Variation zwischen Arten: Effekte der Beuteorganismen

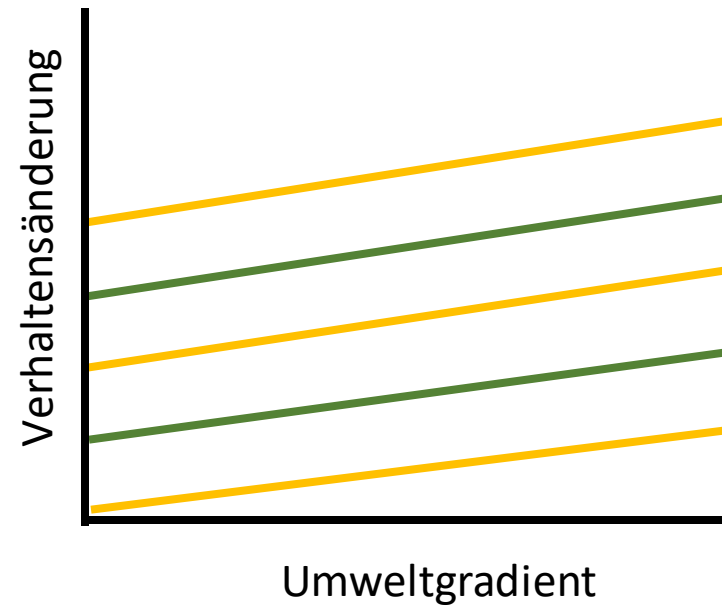


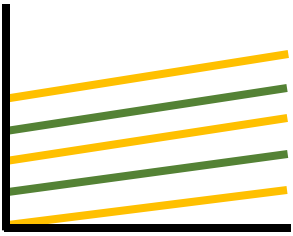


# Variation zwischen Individuen: Effekte der Habitatselektion

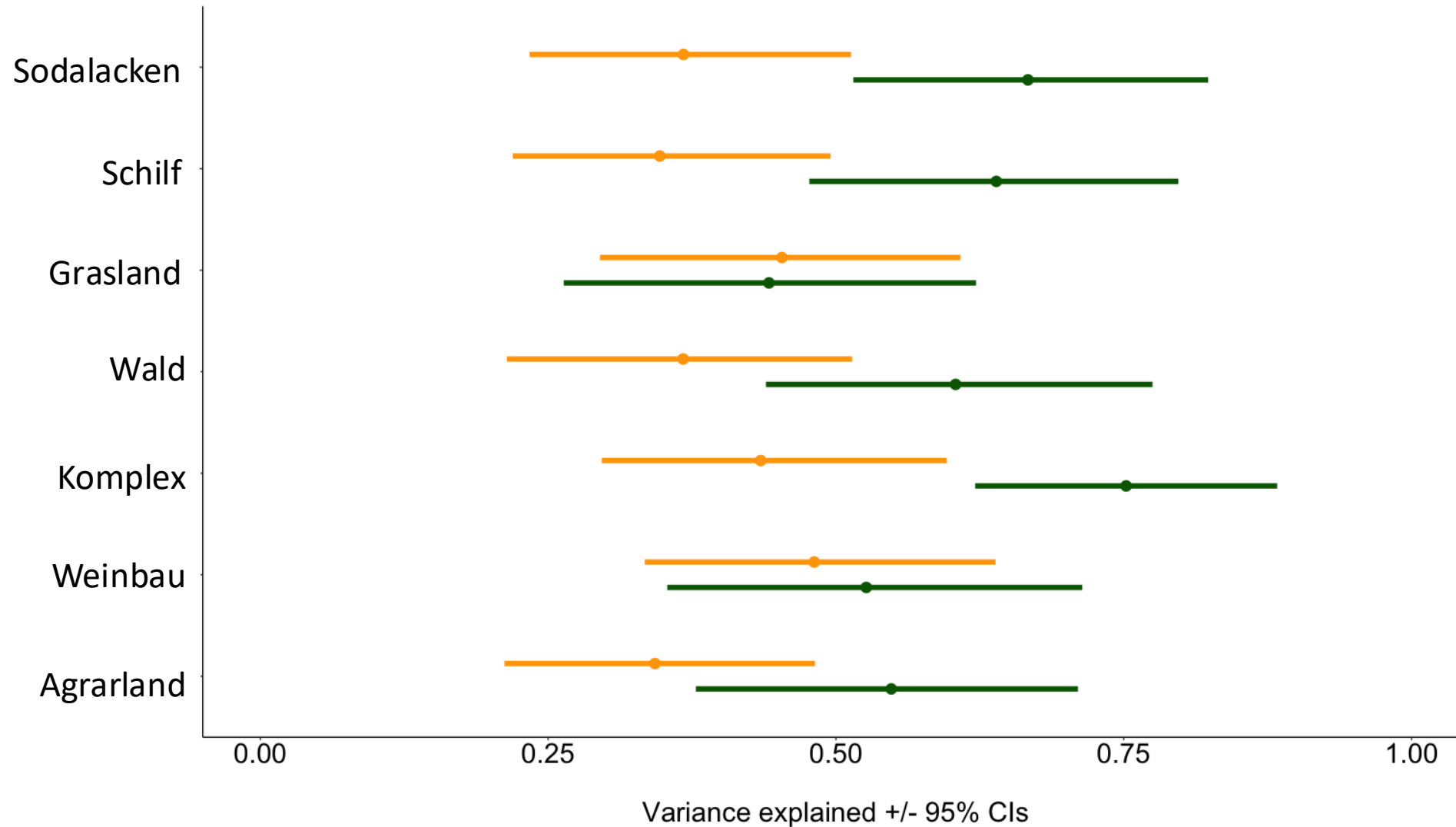


## Variation zwischen Individuen

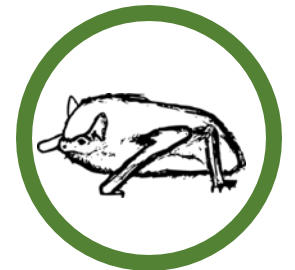




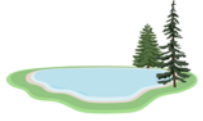
# Variation zwischen Individuen



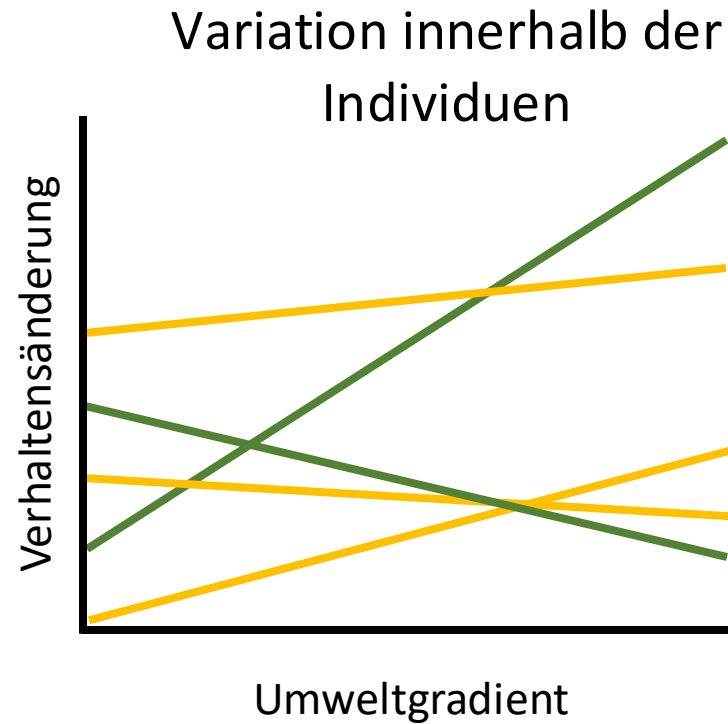
Weißrandfledermaus  
*Pipistrellus kuhlii*



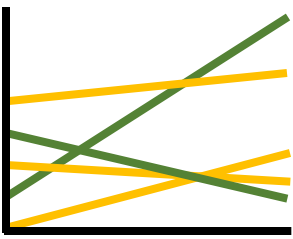
Rauhautfledermaus  
*Pipistrellus nathusii*



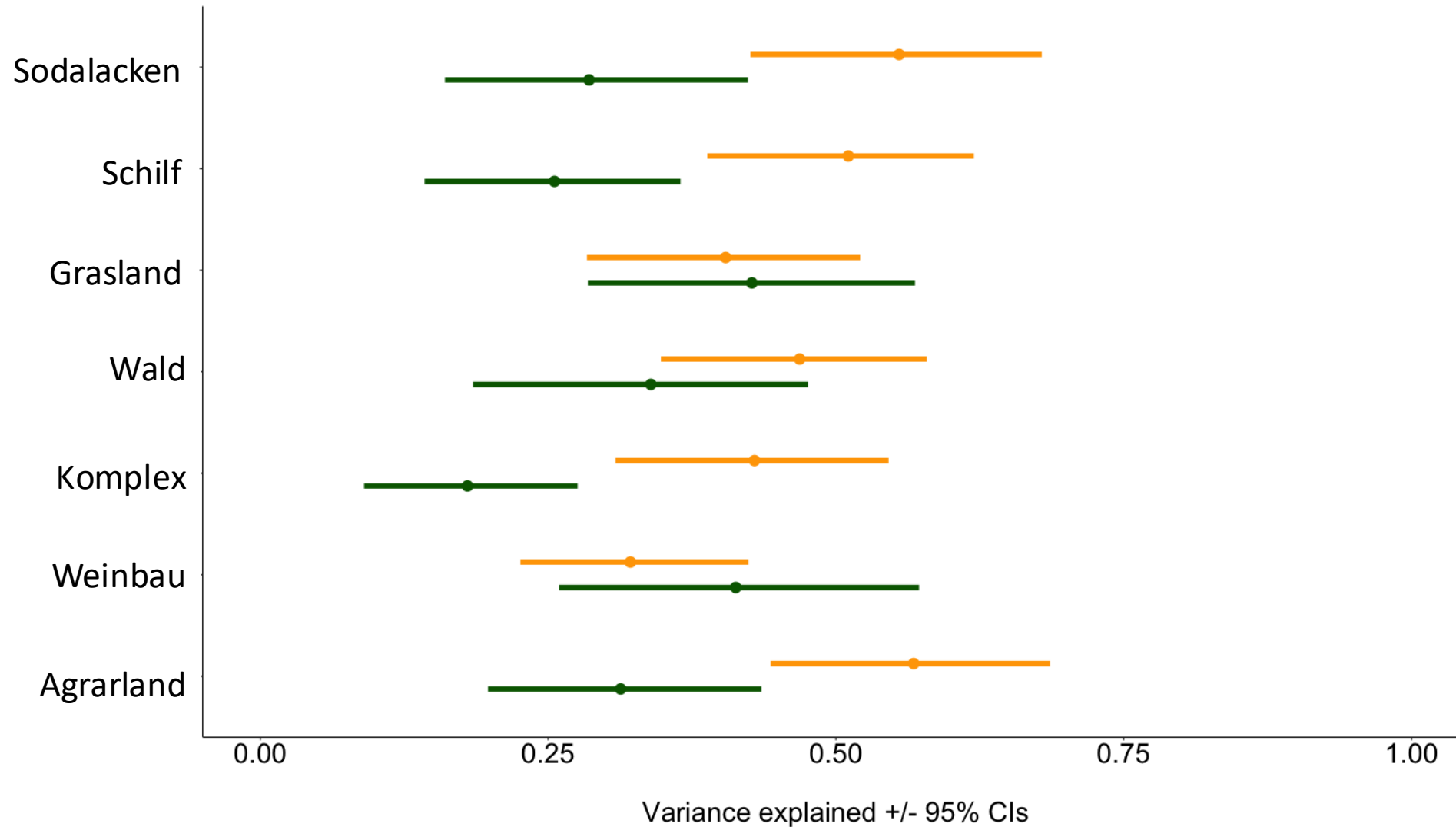
# Variation innerhalb von Individuen: Effekte der Habitatselektion



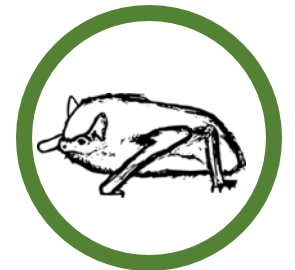




# Variation innerhalb der Individuen

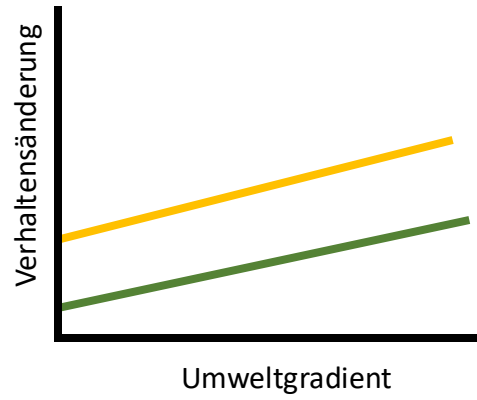


Weißrandfledermaus  
*Pipistrellus kuhlii*

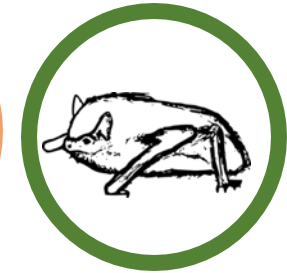


Rauhautfledermaus  
*Pipistrellus nathusii*

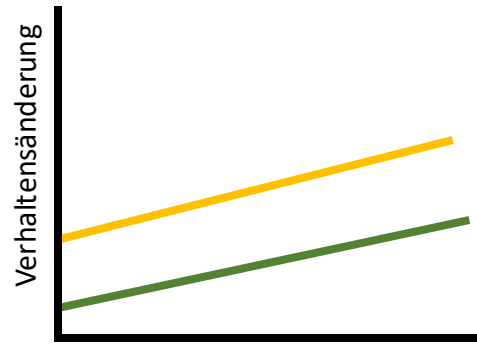
# Zusammenfassung



Schwache Effekte auf Artebene

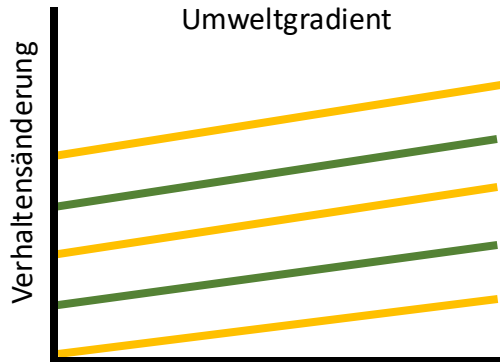
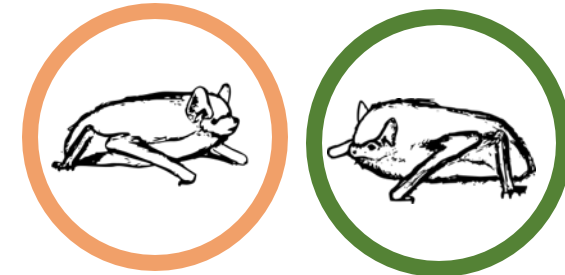


# Zusammenfassung



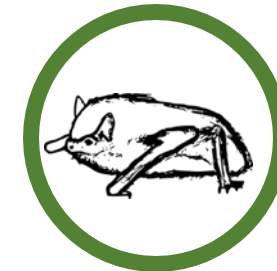
Umweltgradient

Schwache Effekte auf Artebene

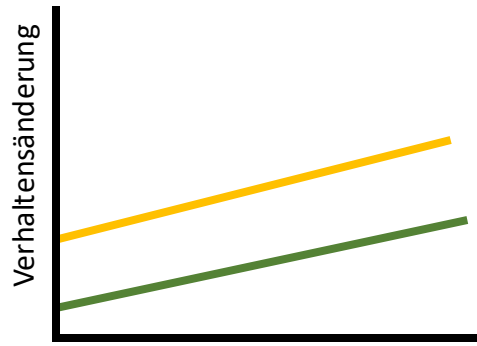


Umweltgradient

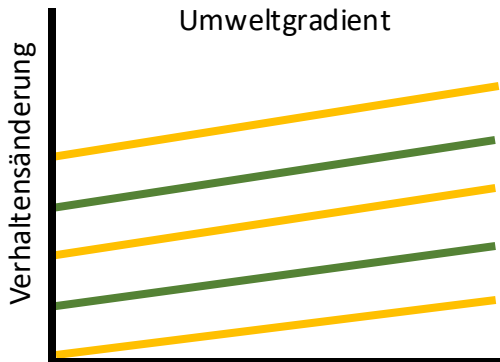
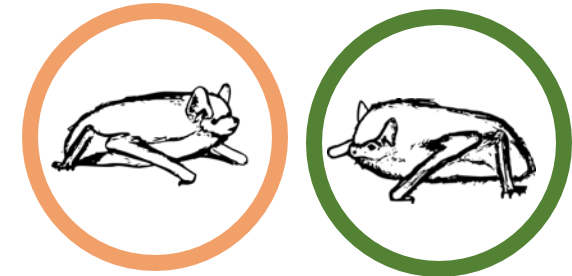
Starke Variation zwischen den Individuen der Rauhautfledermaus



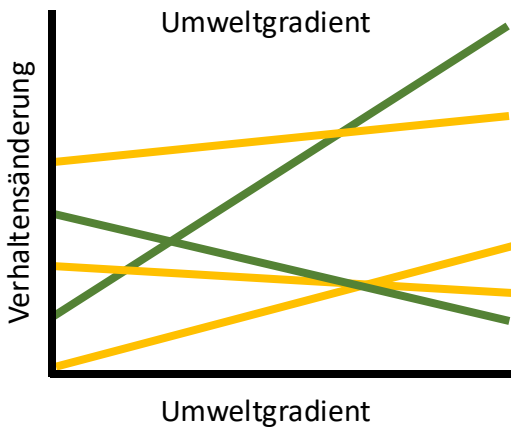
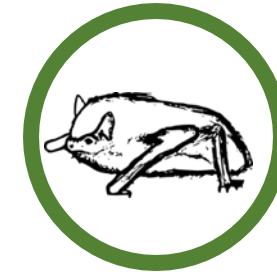
# Zusammenfassung



Schwache Effekte auf Artebene

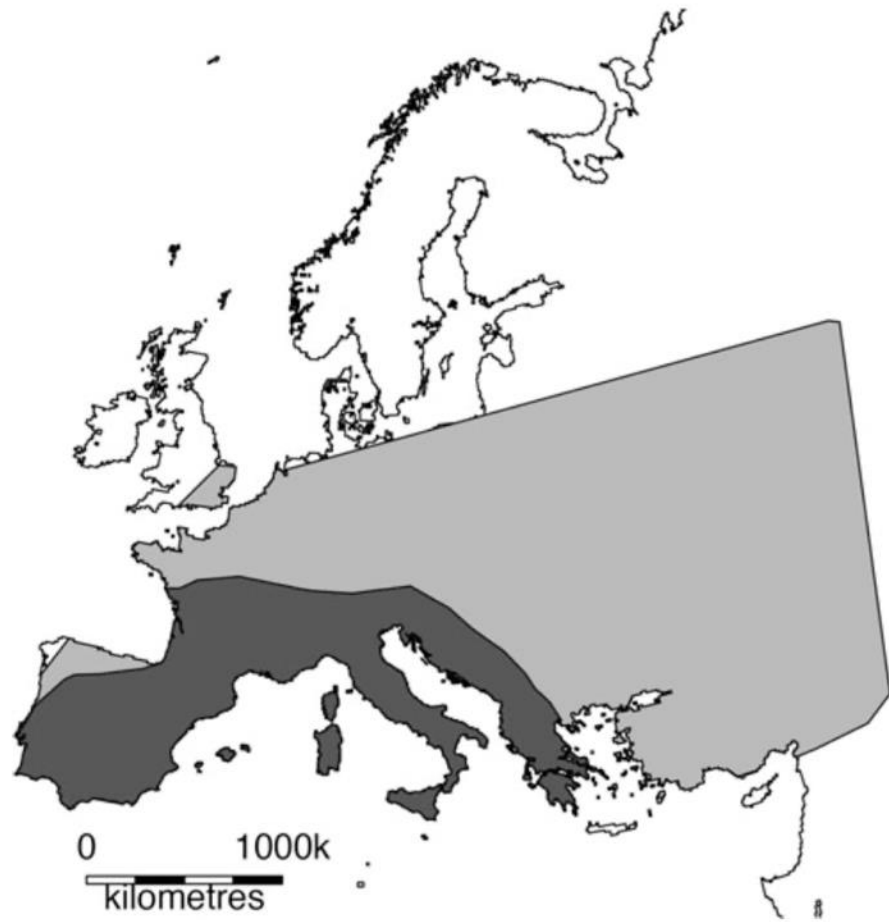


Starke Variation zwischen den Individuen der Rauhautfledermaus



Starke Variation innerhalb der Individuen der Weißrandfledermaus





**Fig. 1** Eurasian range of *Pipistrellus kuhlii* (shades of grey). Dark grey historical range (after Stebbings and Griffiths 1986), light grey current range comprising 1980–2013 occurrence data



Weißrandfledermaus  
*Pipistrellus kuhlii*

Vielen Dank!



Lena



Georg



Bernhard



Samira



Monica



Julia und Johanna

# Vielen Dank!

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Thomas Zechmeister

Carina Suchentrunk

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Anne Schlegel

Paul Griesberger

Stefan Wegleitner

Guido Reiter

Julien Peters

Claudia Kubista



Danke für die  
Aufmerksamkeit!







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