6th European Congress of Conservation Biology
"Biodiversity crisis in a changing world"

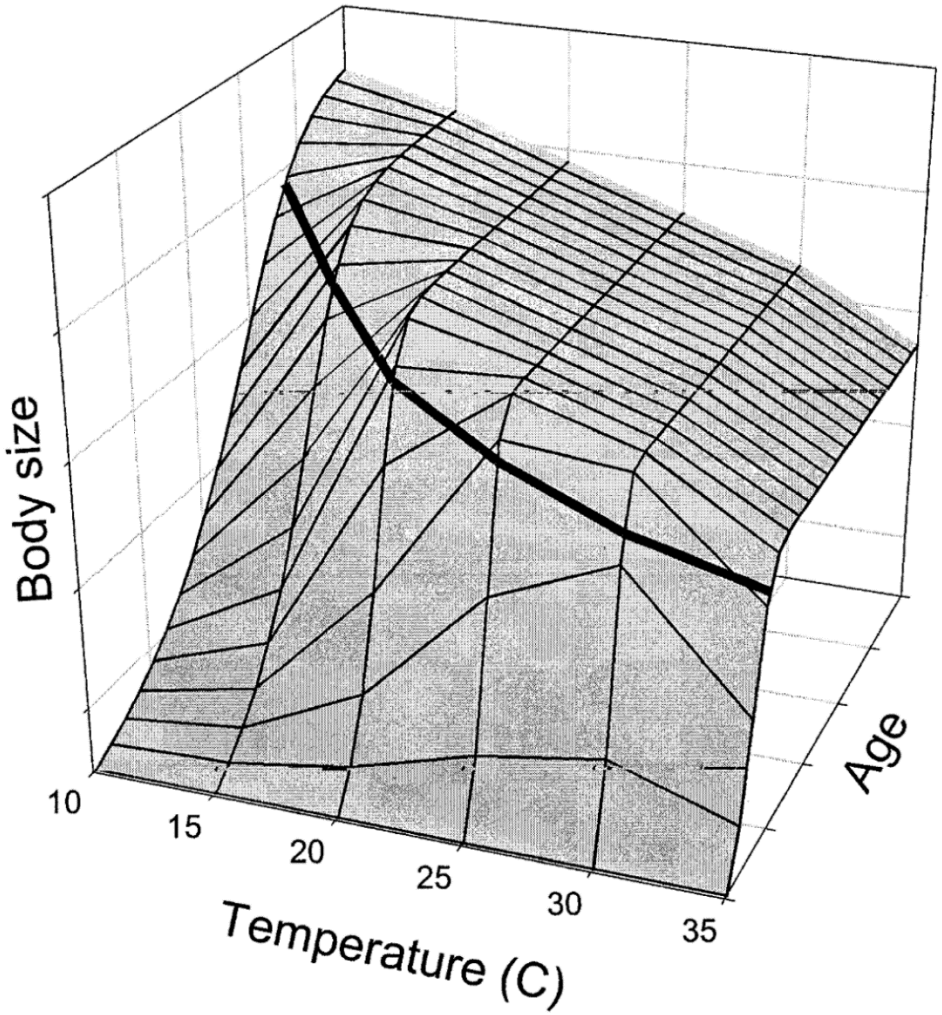
Body size response to climate variables: a case study on reptiles

Telea, E.A., Vlad, E. S., Cogălniceanu, D., Fănaru, G., Carlsson, M.,
Iosif, R., Drăgan, O., Plăiașu, R., Băncilă, R.

BACKGROUND

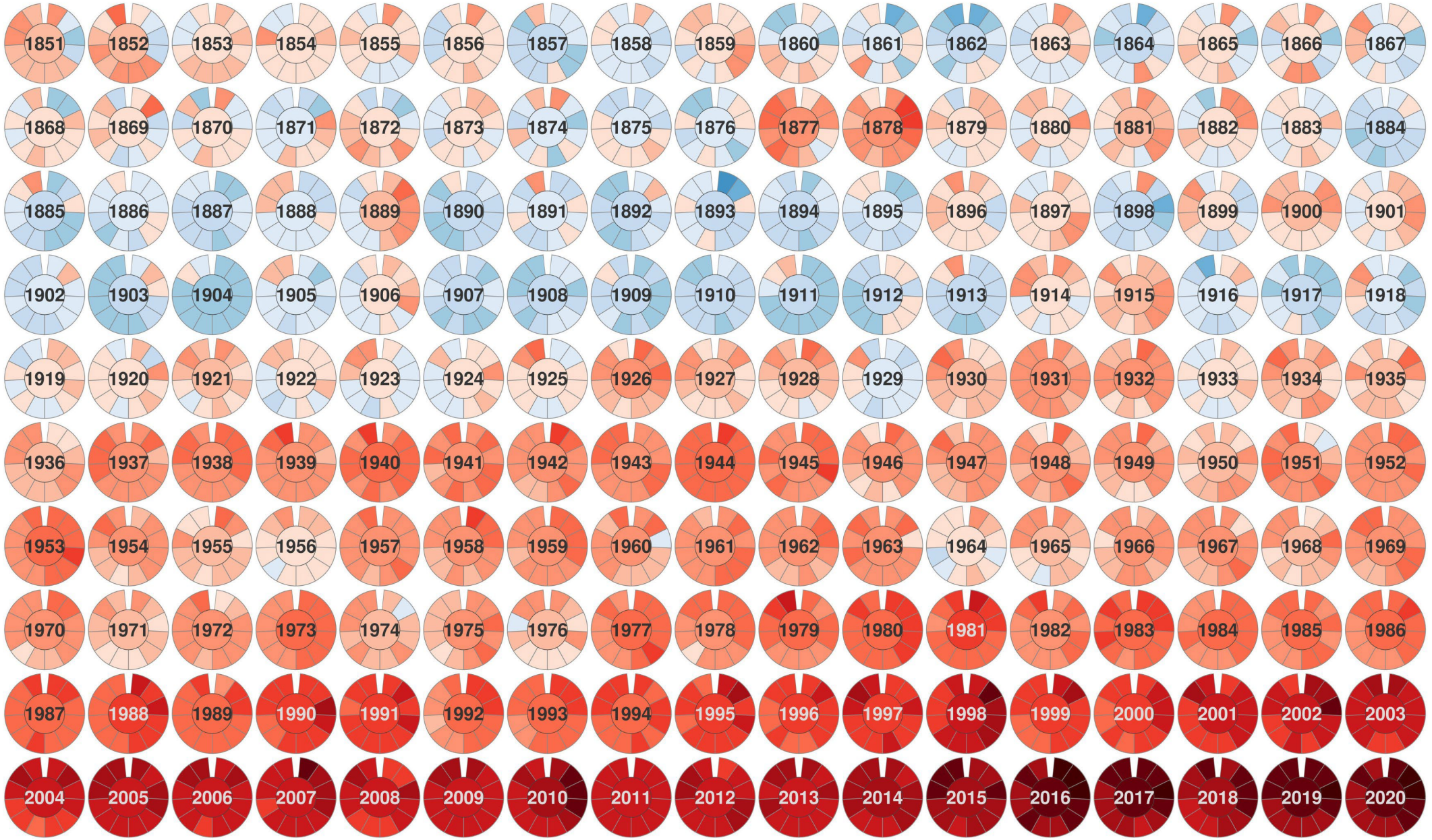
Climate warming determines three universal responses from animals:

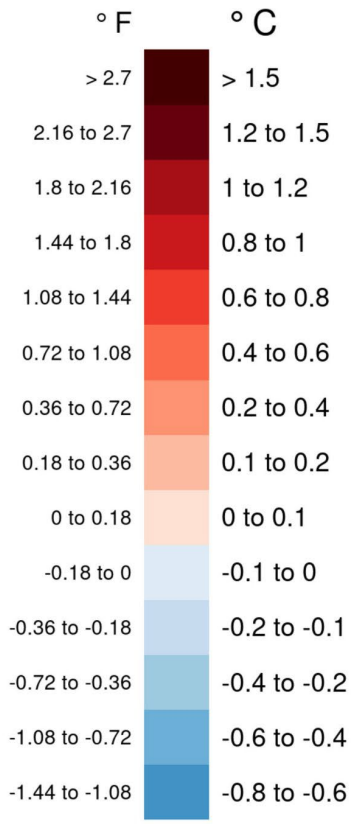
1. Spatial response
2. Phenological shift
3. Reduction in body size



Influence of environmental temperature on body size throughout ontogeny in ectotherms (after Angilletta, 2004)

Monthly global mean temperature 1851 to 2020 (compared to 1850-1900 averages)







Data: HadCRUT5 - Created by: @neilrkaye

The **aim** of the present study was to test if

1. Body size of reptile species changed over time
2. Which climate variables can explain this response
3. If the response to climate variables is species-specific

We used a large data set from over 15 years on body size (body mass and body length) of four reptile species from natural populations located in southern Danube Delta Biosphere Reserve, Romania

STUDY AREA

Southern Danube Delta Biosphere Reserve

Histria Archeological Complex







HABITATS





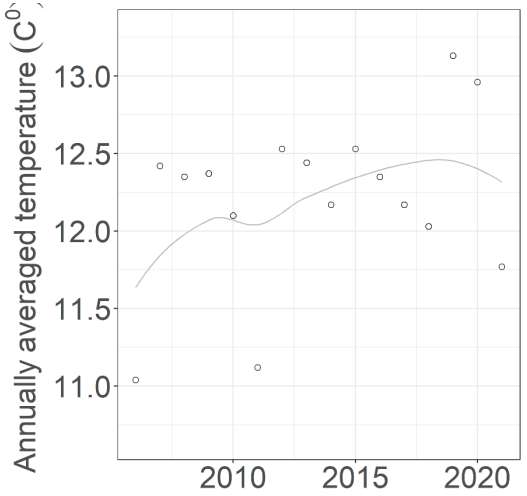


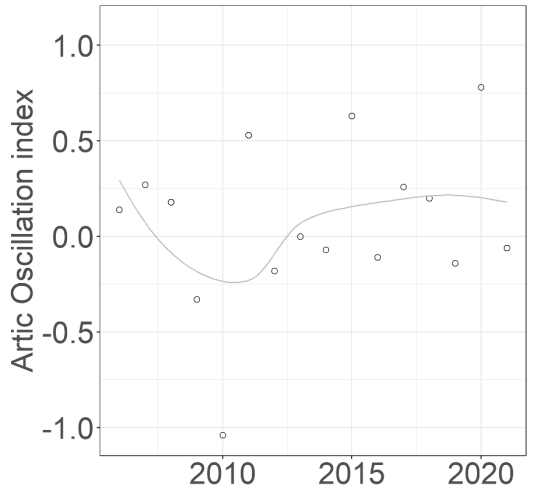


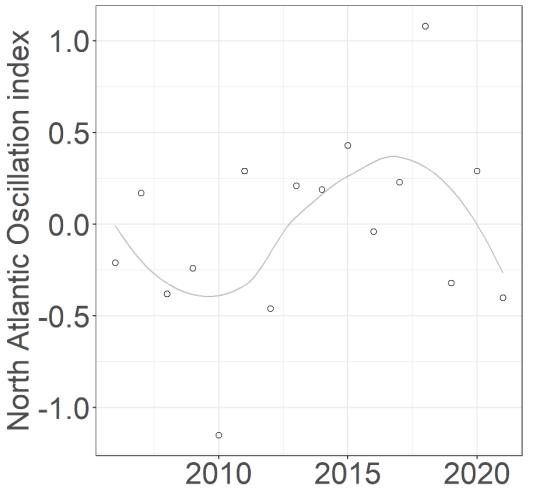
VARIATION OF CLIMATE VARIABLES OVER THE LAST 15 YEARS

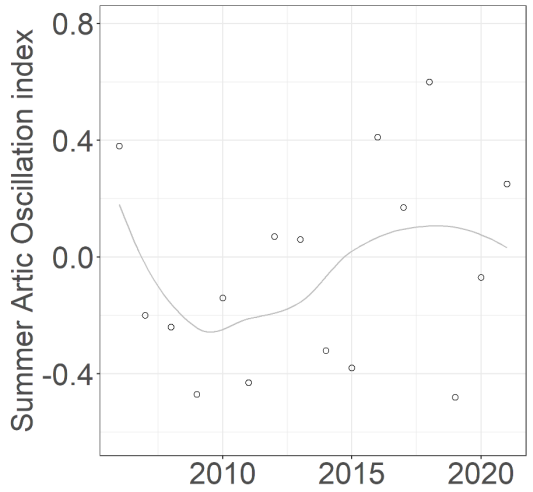
2006-2021

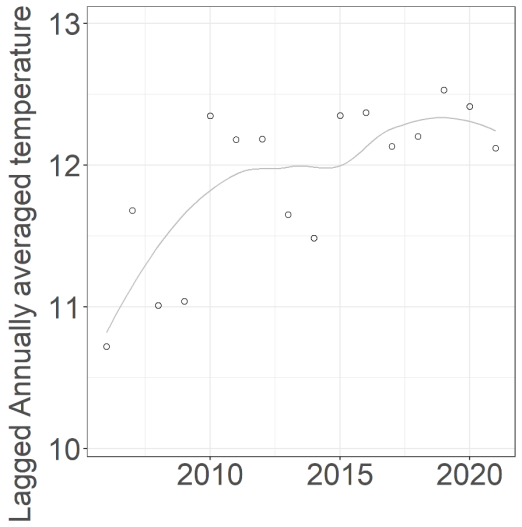
southern Danube Delta Biosphere Reserve

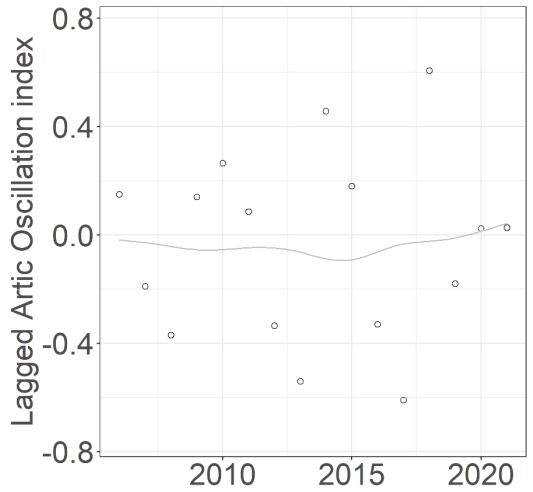


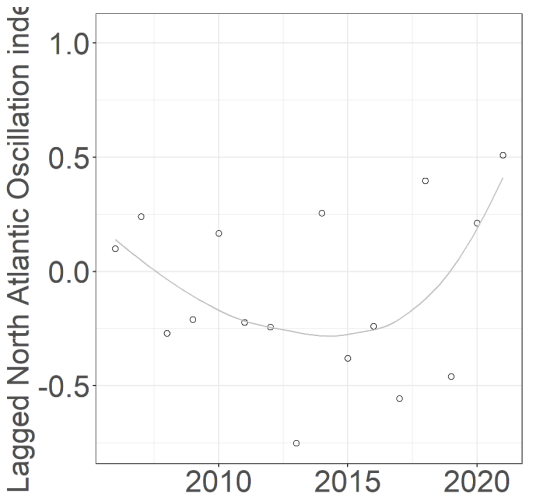


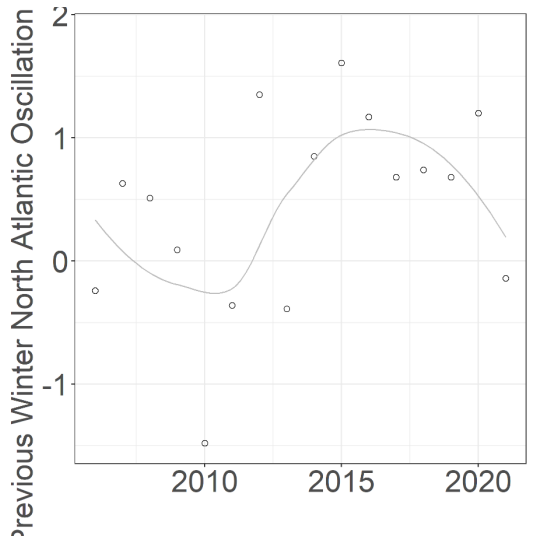












MODEL REPTILE SPECIES

Testudo graeca
Spur-thighed Tortoise



Habitat: grasslands, steppe, rocky outcrops, archeological dig sites

Trophic spectrum: plants, dead animals

Dolichophis caspius
Whip Snake



Habitat: grasslands, steppe, rocky outcrops, archeological dig sites, fortress walls

Trophic spectrum: invertebrates, small mammals, small birds, eggs, small reptiles and other snakes

MODEL REPTILE SPECIES

Natrix tessellata

Dice snake



Habitat: wetland, aquatic habitats, marine coastal areas, fortress walls

Trophic spectrum: amphibians, fish

Natrix natrix

Grass Snake

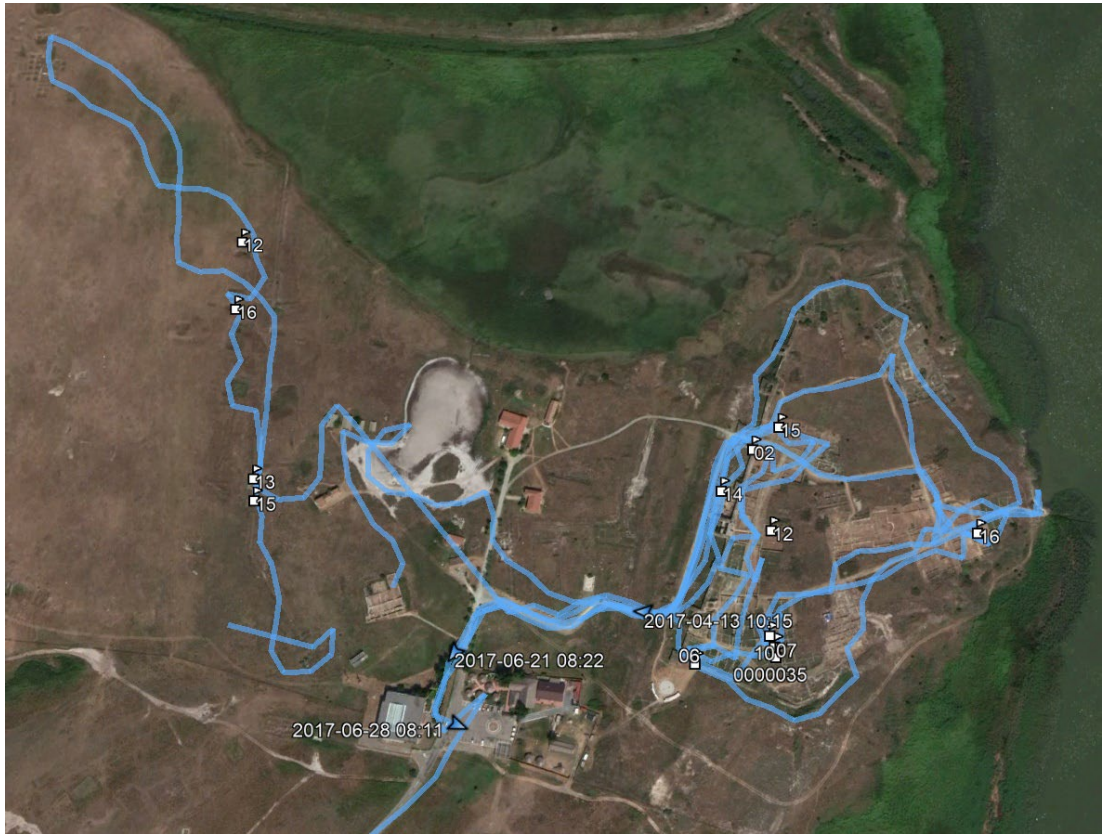


Habitat: grassland, wetlands, coastal areas, archaological dig sites, fortress walls

Trophic spectrum: invertebrates, amphibians, lizards, small mammals and birds, eggs

CAPTURE

Active search along a transect
In the past depending on resources
Since 2019: 3-5 continuous days/month



Tortoises measured at capture location
Snakes measured at field-lab

Each captured animal: measured, weighed, marked





RESULTS

Predicted body sizes (body length and body mass) over time

Testudo graeca

F=573, M=905
2013 - 2021

Dolichophis caspius

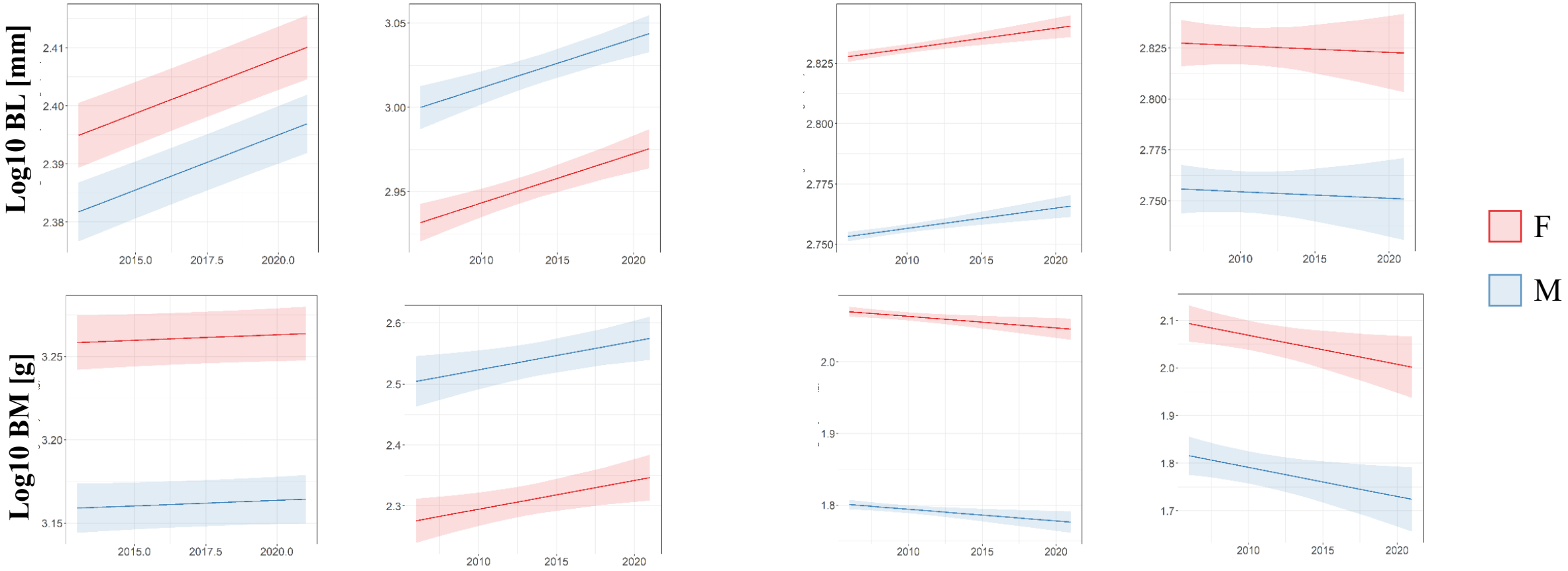
F=158, M=132
2006 - 2021

Natrix tessellata

F=3563, M=4066
2006 - 2021

Natrix natrix

F=172, M=140
2006 - 2021

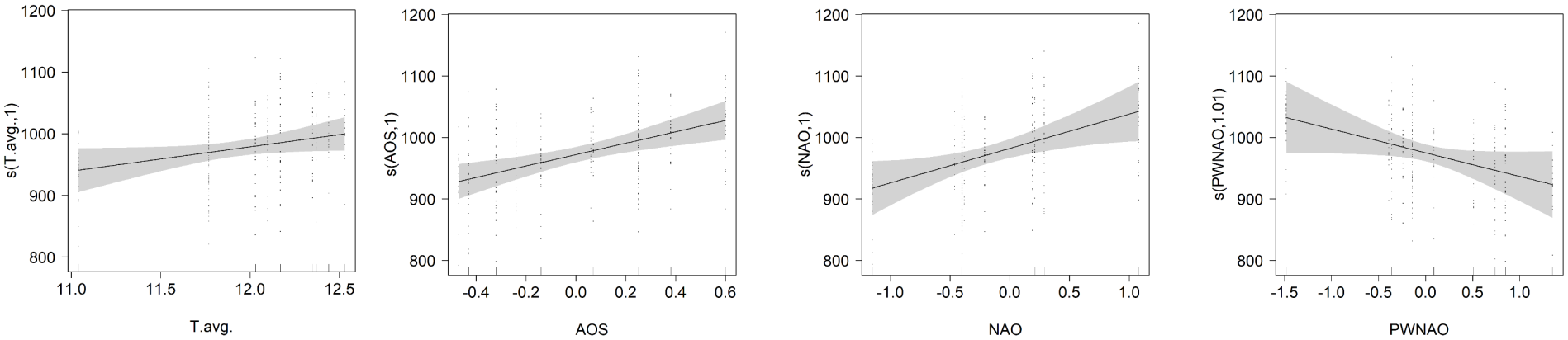


RESULTS

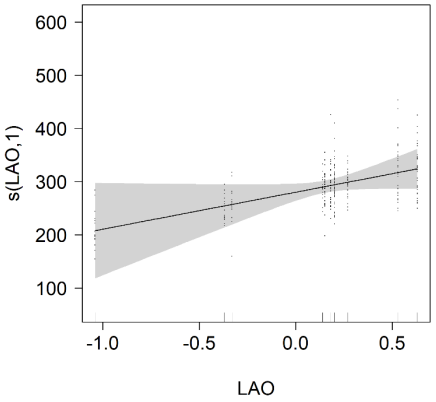
- effect of climate variables on body sizes of *D. caspius* -



Body length [mm]



Body mass [g]



BL increases with T. avg., AOS and NAO and decreases with PWNAO

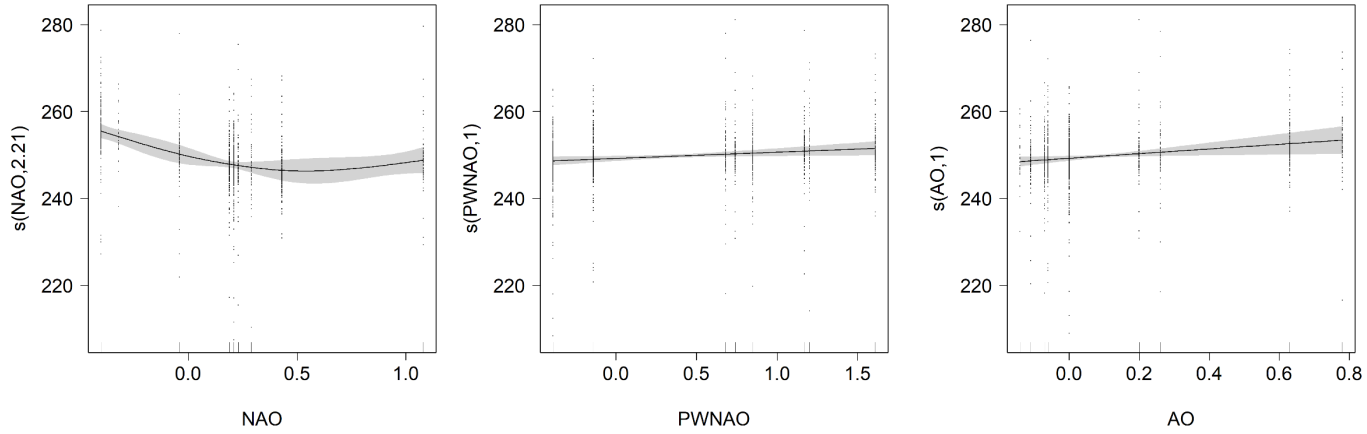
BM increases with LAO

RESULTS

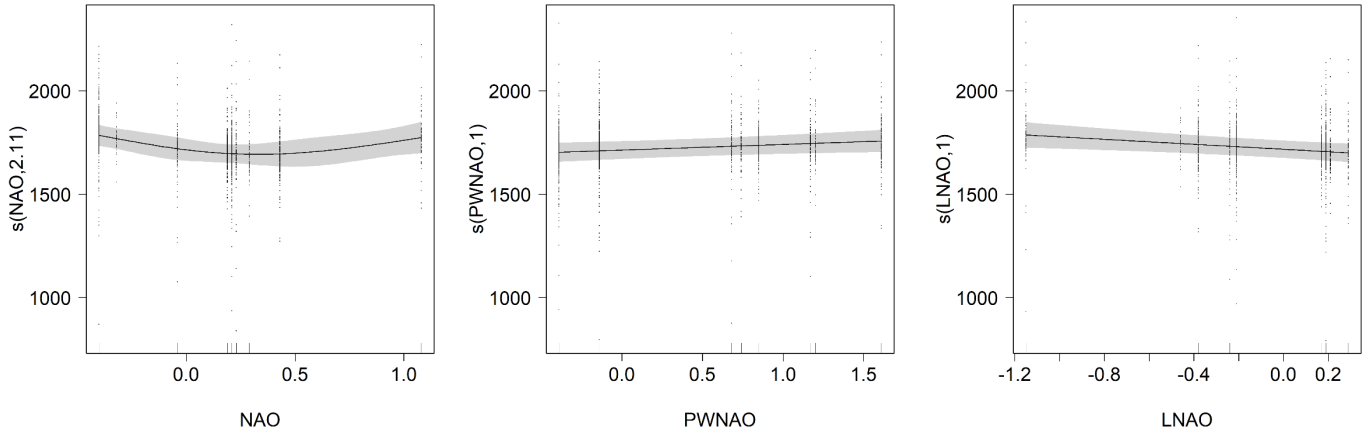
- effect of climate variables on body sizes of *T. graeca* -



Body length[mm]



Body mass [g]



BL increases with PWNAO and AO, decreases with NAO

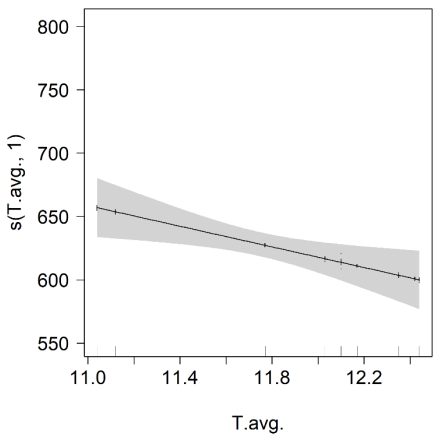
BM increases with PWNAO, decreases with NAO and LNAO

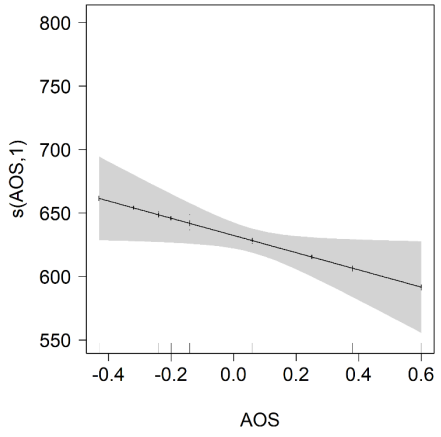
RESULTS

- effect of climate variables on body sizes of *N. natrix* -

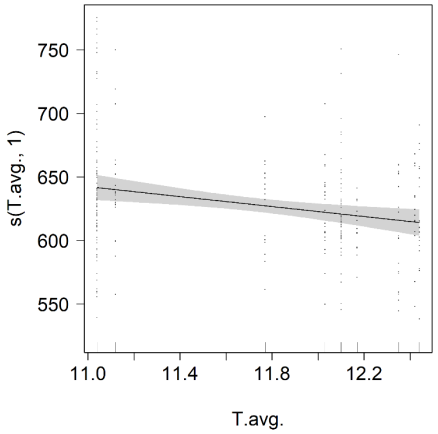


Body length[mm]





Body mass [g]



BL decreases with T. avg. and AOS

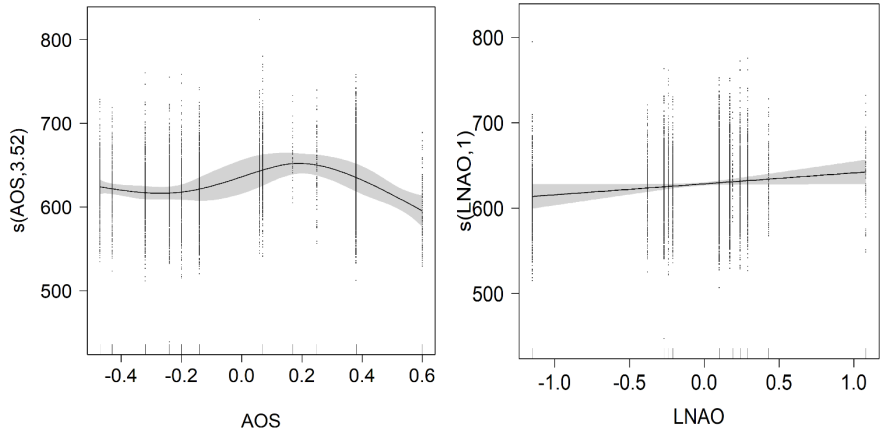
BM decreases with T. avg

RESULTS

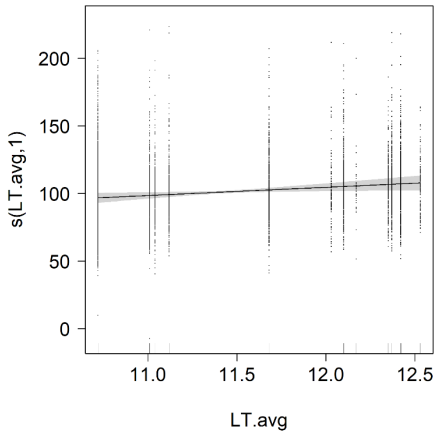
- effect of climate variables on body sizes of *N. tessellata* -

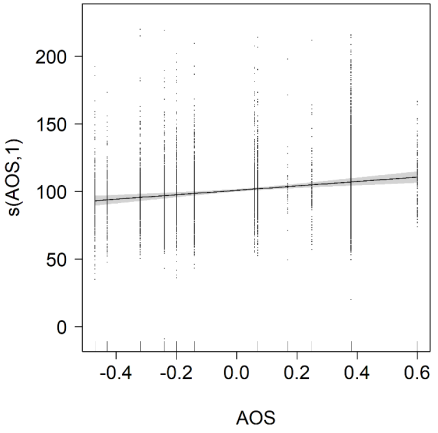


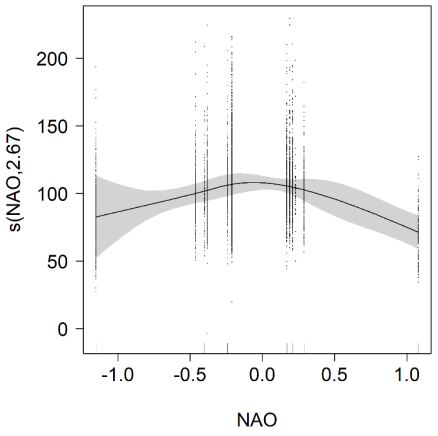
Body length[mm]



Body mass [g]



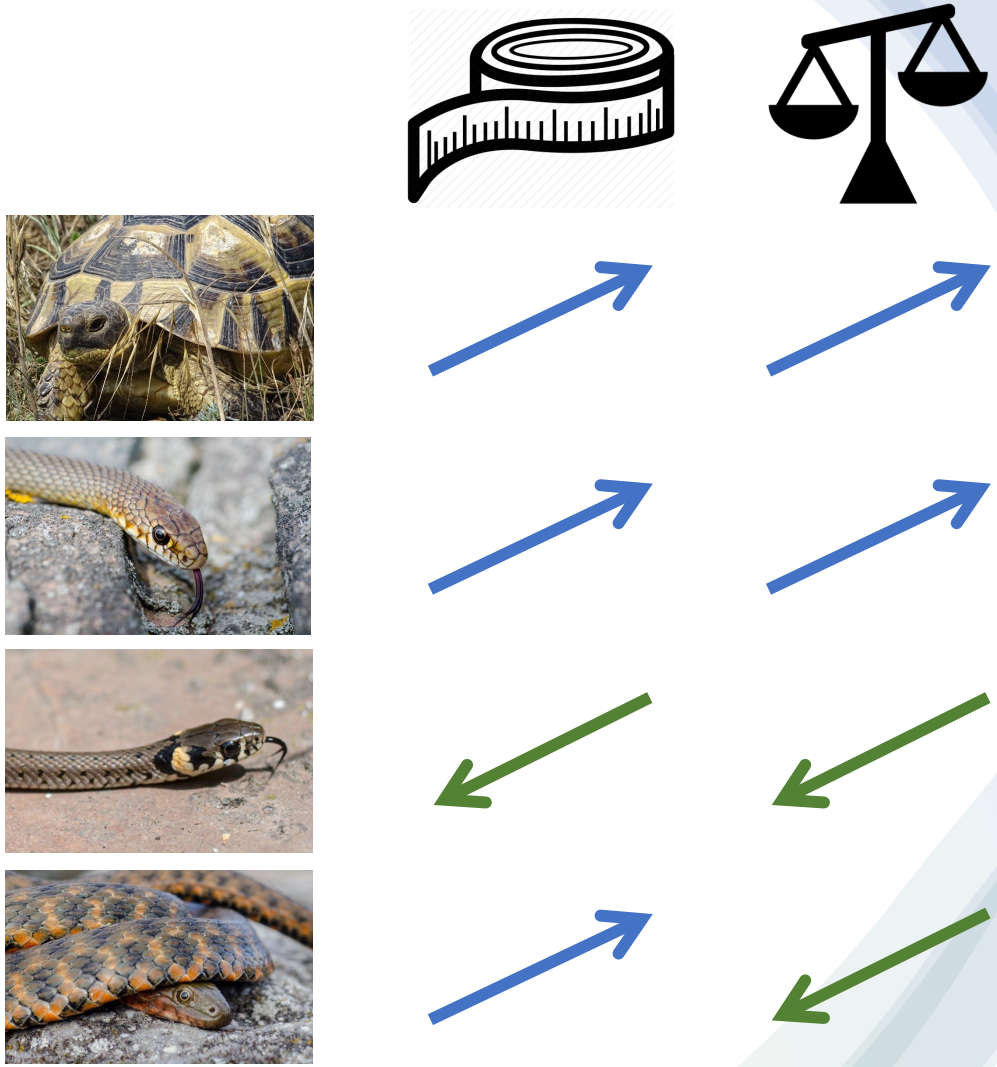




BL increases with LNAO and decreases with AOS.

BM increases with LT. avg and AOS, but decreases with NAO

Reptiles respond to increased climate variables with changes in body size over time?



- There is variation over time in both body mass and body length
- There is a species-specific response, most probably due to an interaction between climate, habitat quality and trophic availability

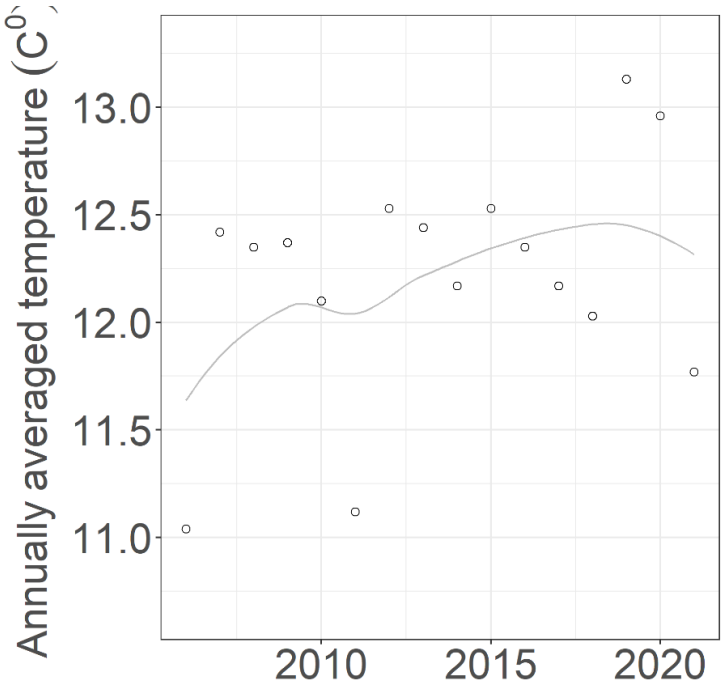
Which climate variables explain the response in body size change?

- Variation in body length and body mass is explained by different climatic variables for each species.
- We hypothesize a second indirect effect of climate variables on environmental factors such as habitat quality and food availability

Annual average temperatures

- Positive trend has been correlated with smaller body size in other animal taxa

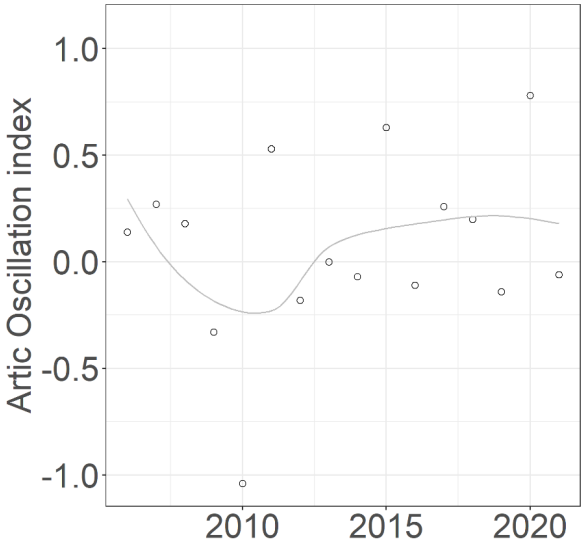
- In our study it correlates with the decrease in BM & BL in *N. natrix*

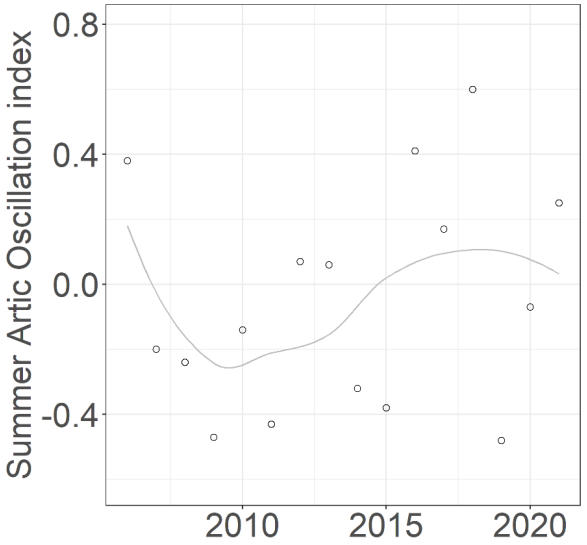


Arctic Oscillation index and Summer AO index

- Positive AO is correlated with mild winters, earlier snowmelt, hotter summers and draughts

- In our study it correlates with:
  - → *D. caspius* increase BL
  - → *T. graeca* increase BM
  - → *N. natrix* decrease BL
  - → *N. tessellata* decrease BL and increase BM

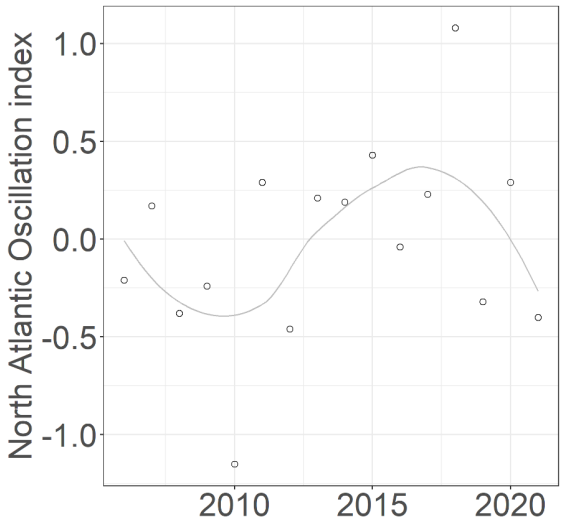


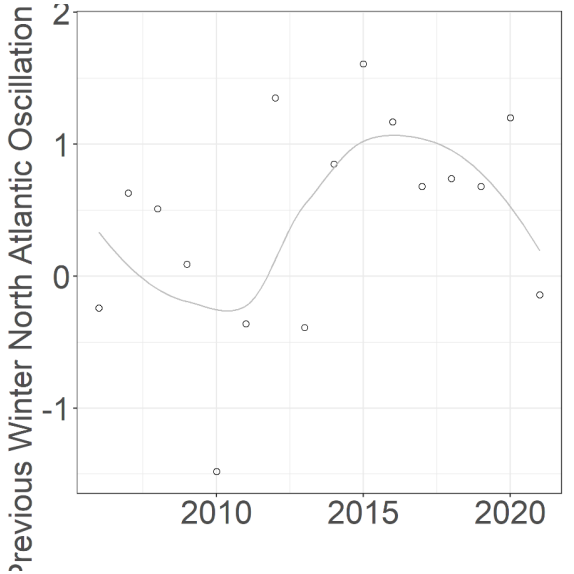


North Atlantic Oscillation index and Previous Winter NAO index

- Positive NAO is correlated with warmer and wetter winters, less intense winds and storms, hotter summers and draughts

- In our study it correlates with:
  - → *D. caspius* increase BL *
    - * Previous winter NAO decrease BL
  - → *T. graeca* decrease BL & BM*
    - * Previous winter NAO increase BL & BM
  - → *N. tessellata* decrease BM





Thank you for your attention!

