

# Macro- and microevolutionary insights into the evolution of foraging behavior and life history traits

Dylan Padilla

## Oral comprehensive exam

Evolutionary Biology PhD Program  
School of Life Sciences  
July 18, 2023



# Outline

- ▶ Chapter 1: Macroclimatic and maternal effects on the evolution of reproductive traits in lizards

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- ▶ Chapter 2: The correlated evolution of foraging mode and reproductive effort in lizards

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- ▶ Chapter 3: Foraging efficiency of rover and sitter larvae of *Drosophila melanogaster*

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- ▶ Chapter 3: Foraging efficiency of rover and sitter larvae of *Drosophila melanogaster*
- ▶ Chapter 4: Geographic variation of the *for* gene revealed signatures of local adaptation in *Drosophila melanogaster*

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Chapter 2:  
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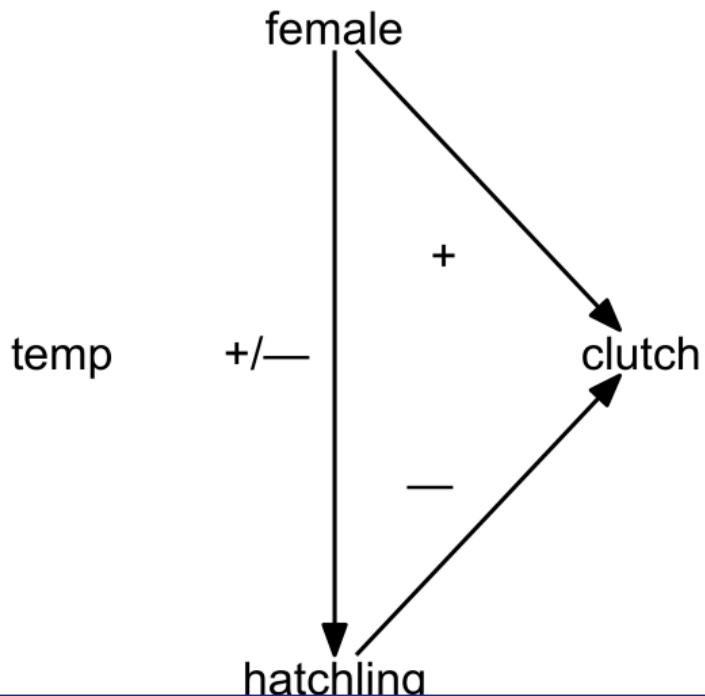
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# Chapter 1:

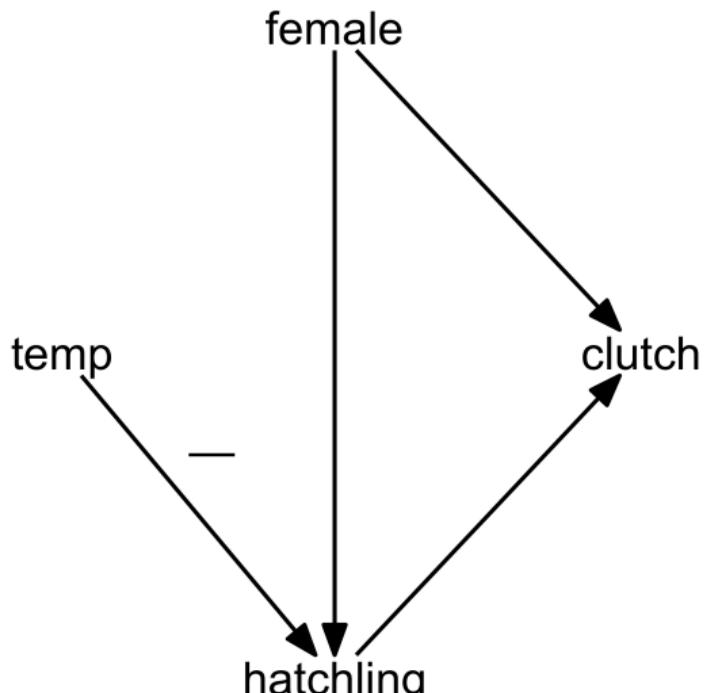
# What is life history theory?



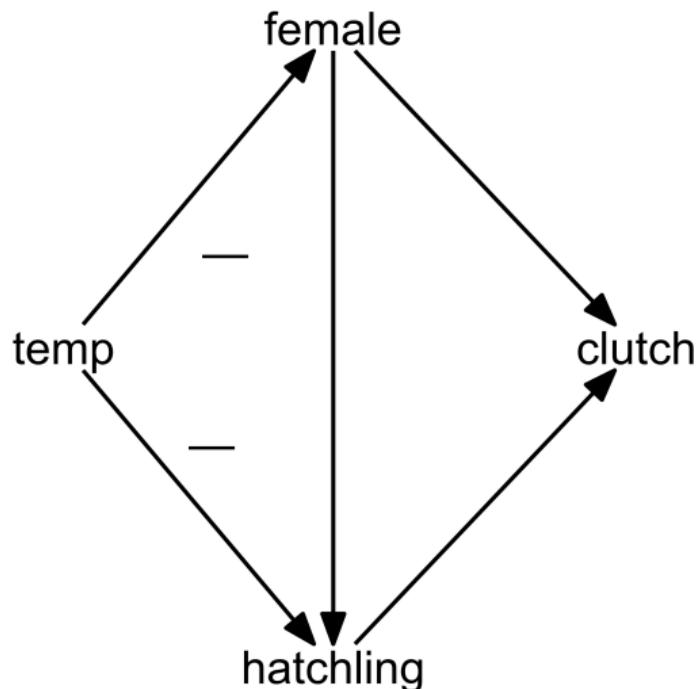
## Optimal reproductive tactics



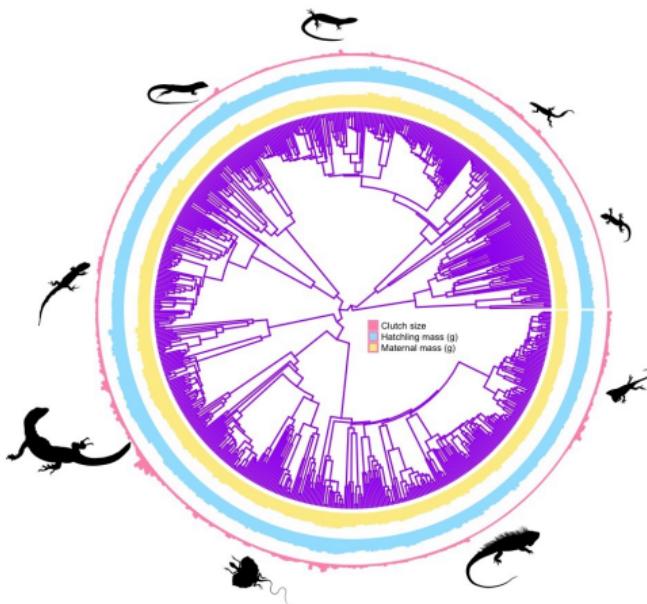
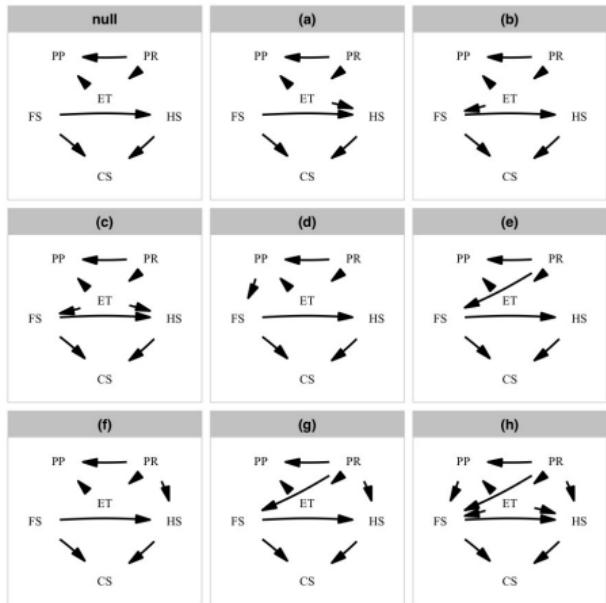
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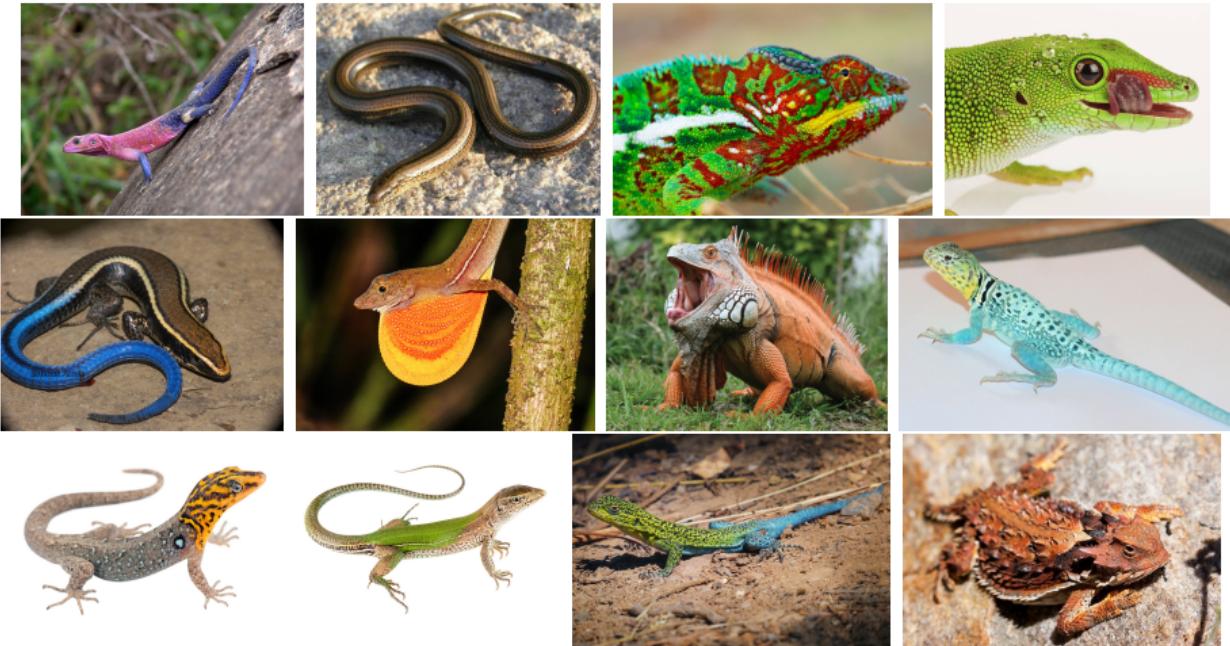


## Optimal reproductive tactics



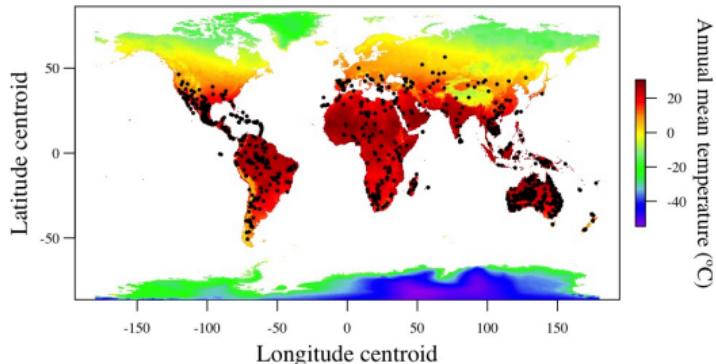
# Relationships among environmental/body temperature and life-history traits





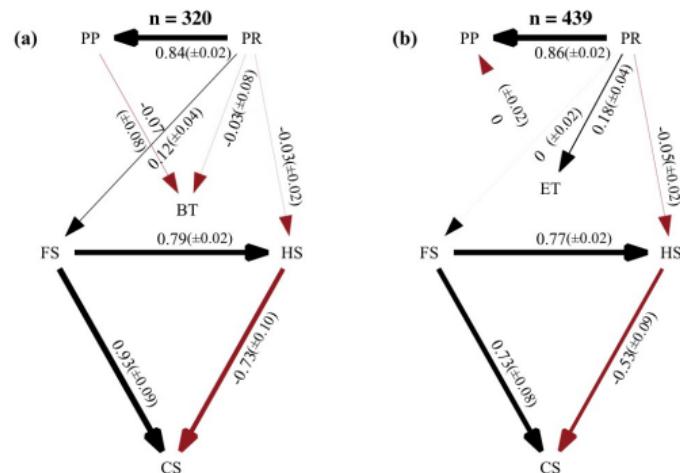
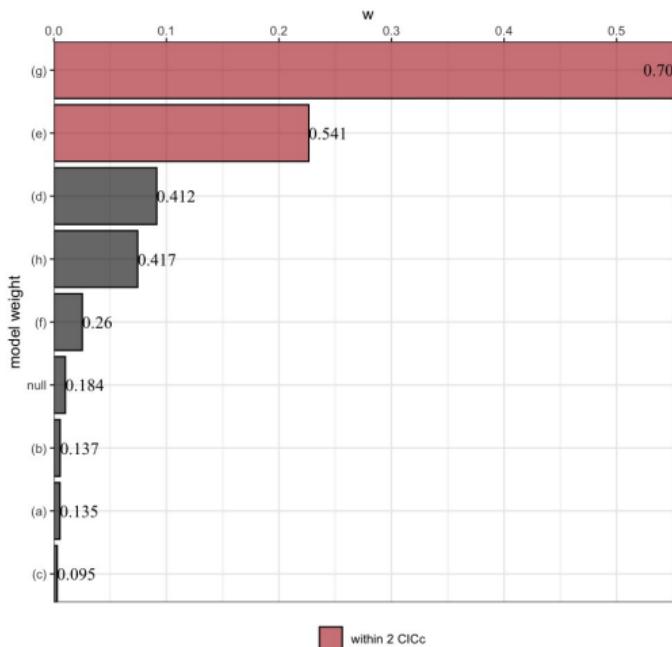
# WorldClim - Global Climate Data

*Free climate data for ecological modeling and GIS*



Phylogenetic path analysis, package *phylopath* in R

A model describing a direct and an indirect effect of precipitation on the evolution of reproductive traits was strongly supported



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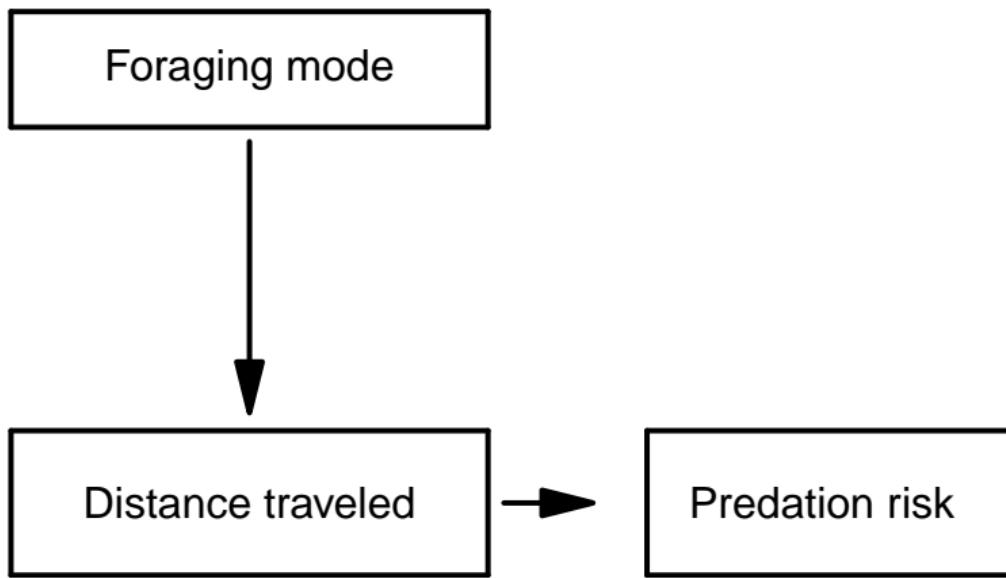
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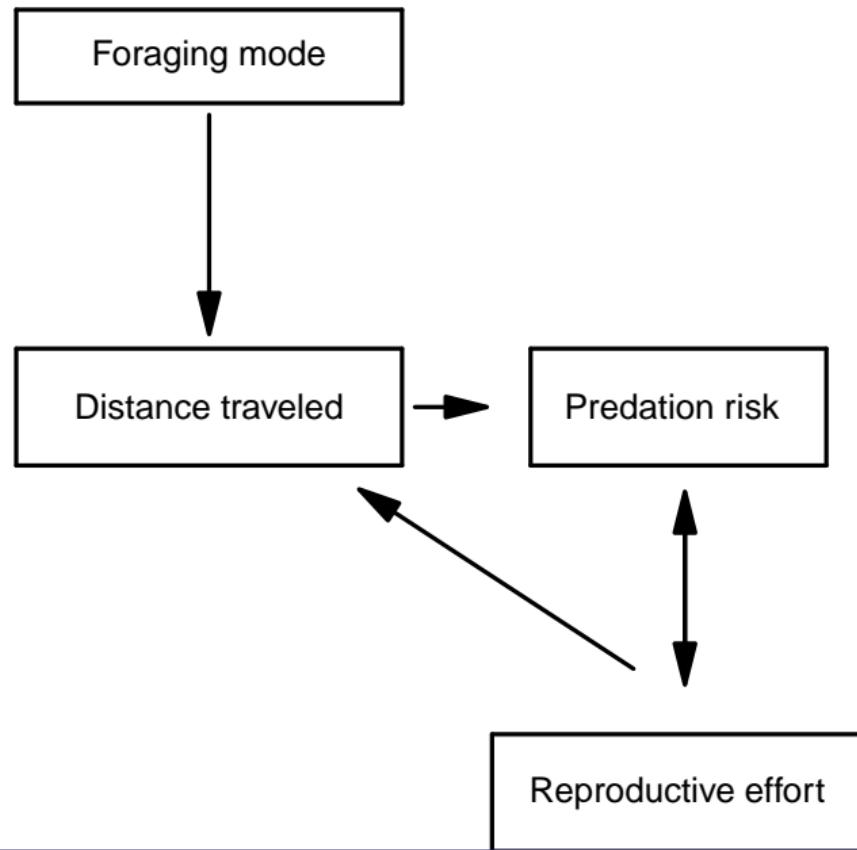
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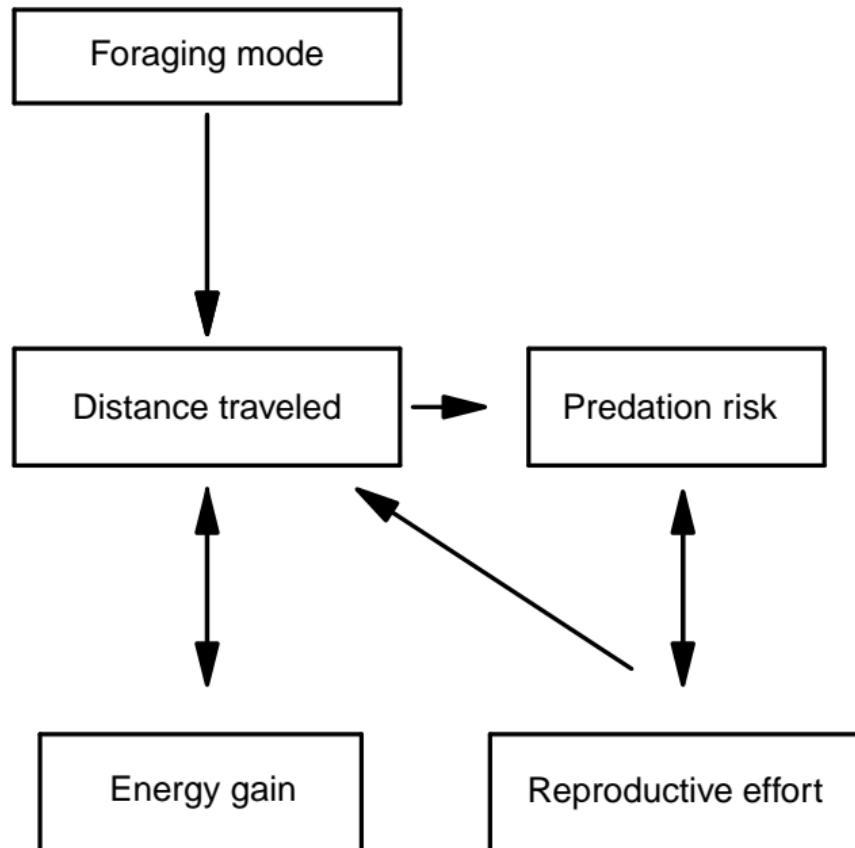
## Chapter 2:

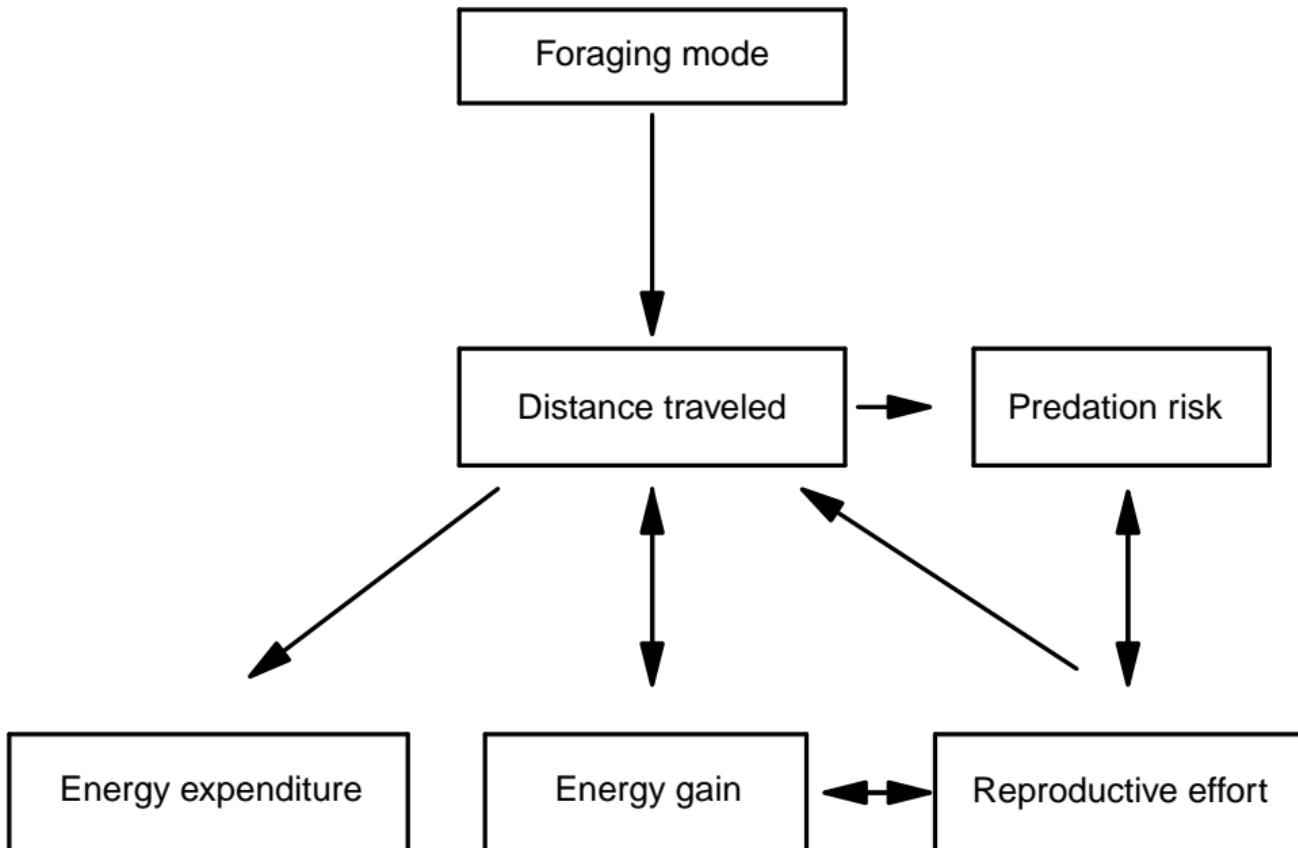
## The foraging-mode paradigm



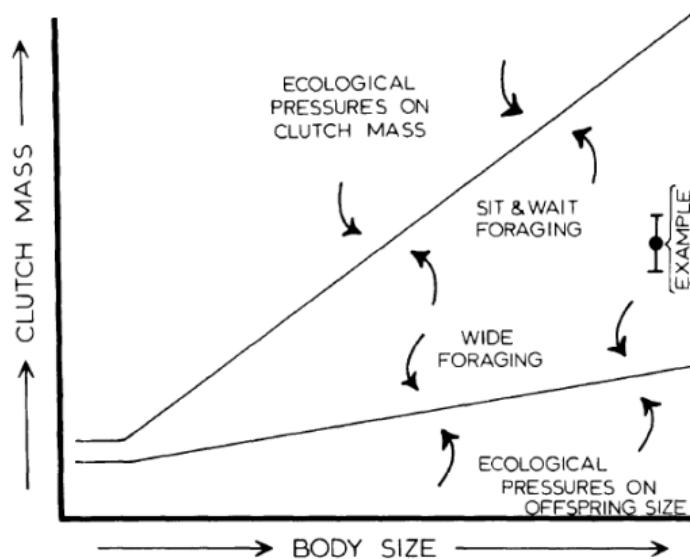








## Functional reproductive volume



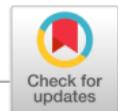
# Data source and description of variables

Received: 21 June 2017

Revised: 13 May 2018

Accepted: 22 May 2018

DOI: 10.1111/geb.12773

**RESEARCH PAPER****WILEY****Global Ecology  
and Biogeography**A Journal of  
Macroecology

## Traits of lizards of the world: Variation around a successful evolutionary design

**Shai Meiri<sup>1,2</sup>**

- ▶ Hatchling mass

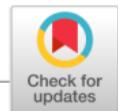
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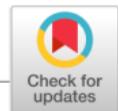
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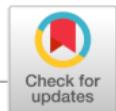
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## Traits of lizards of the world: Variation around a successful evolutionary design

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- ▶ Hatchling mass
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- ▶ Female mass
- ▶ Scaled-mass index

## Ancestral reconstruction of foraging mode

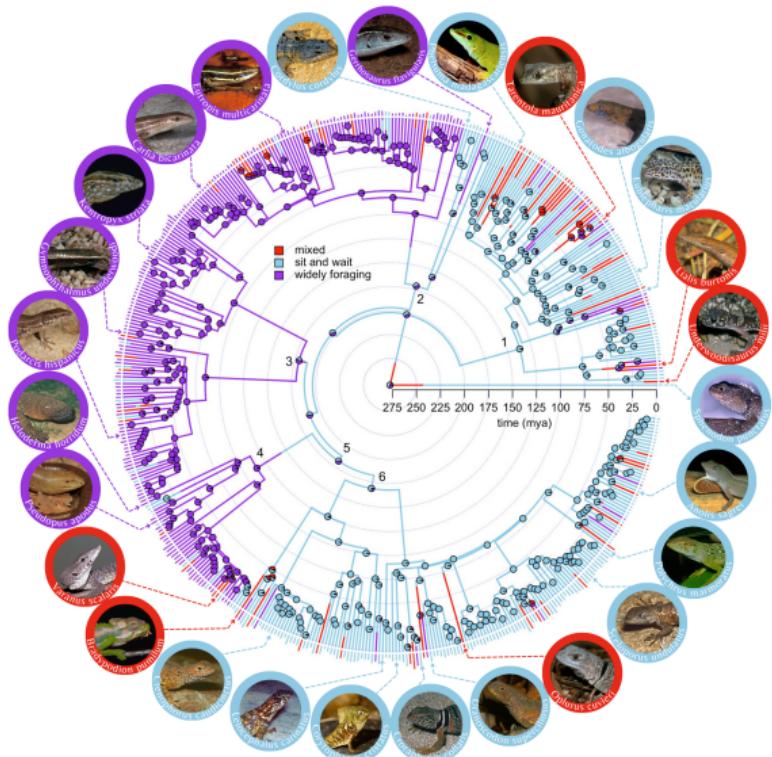
- ▶ We used a set of continuous-time, discrete-state Markov chain models

## Ancestral reconstruction of foraging mode

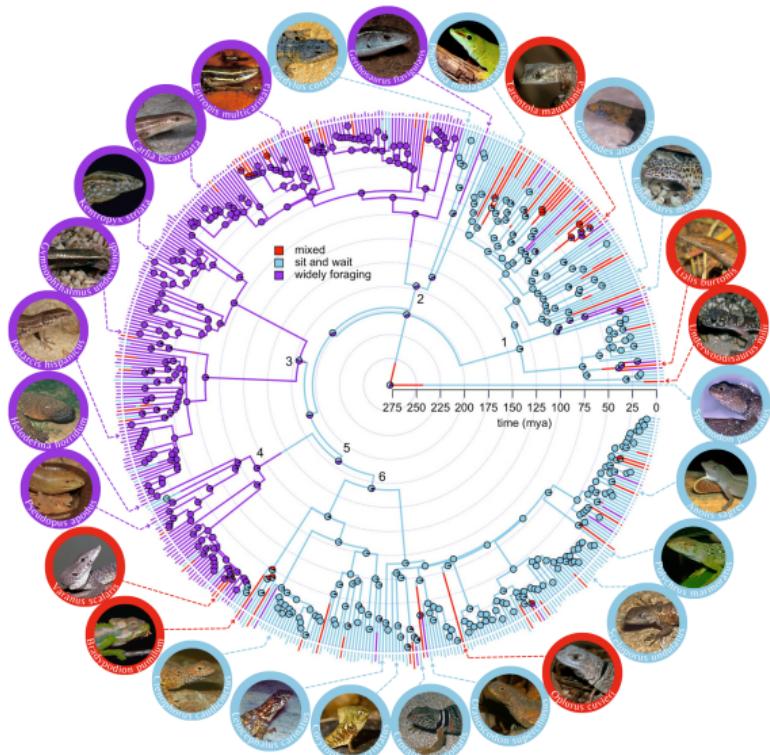
- ▶ We used a set of continuous-time, discrete-state Markov chain models
- ▶ We fitted three different models to our data, using the function `make.simmap` from the `phytools` package of R v.1.0.1

## Effects of maternal mass and foraging mode on reproductive output

- ▶ We used PGLS to model the relationship among maternal mass, foraging mode and reproductive output through the `gls` function from the `nlme` package of R v.3.1.153

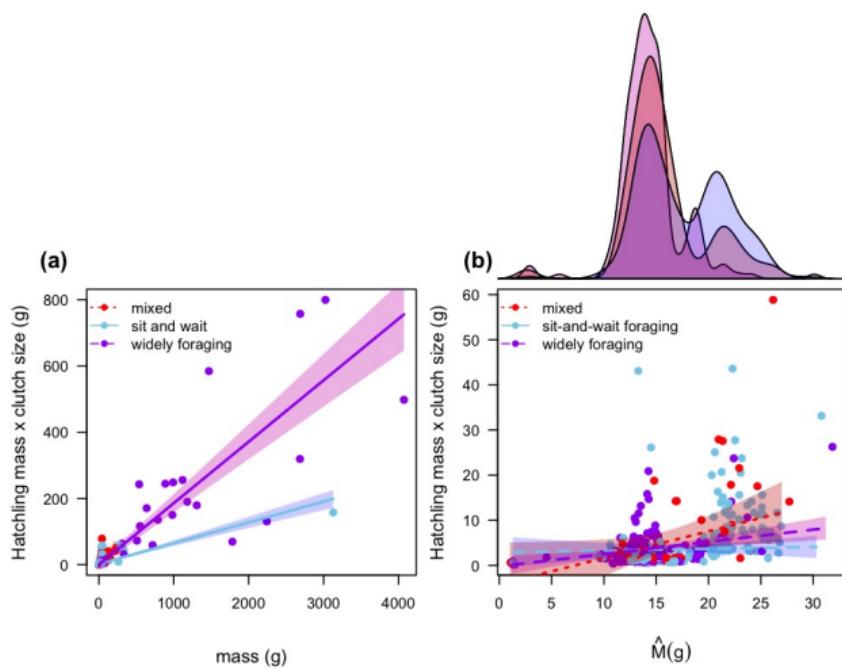


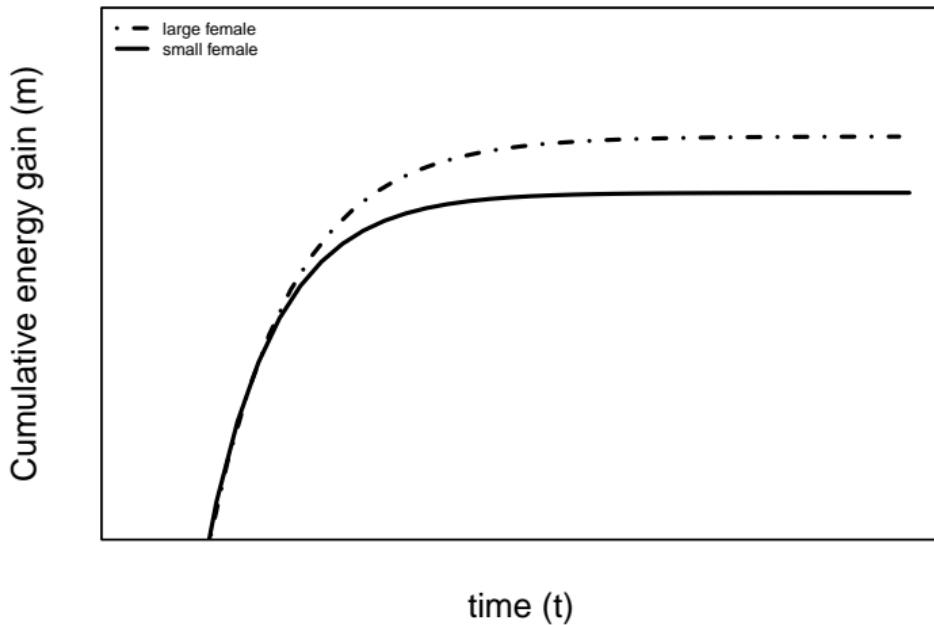
1. Sit-and-wait foraging is the most likely ancestral state

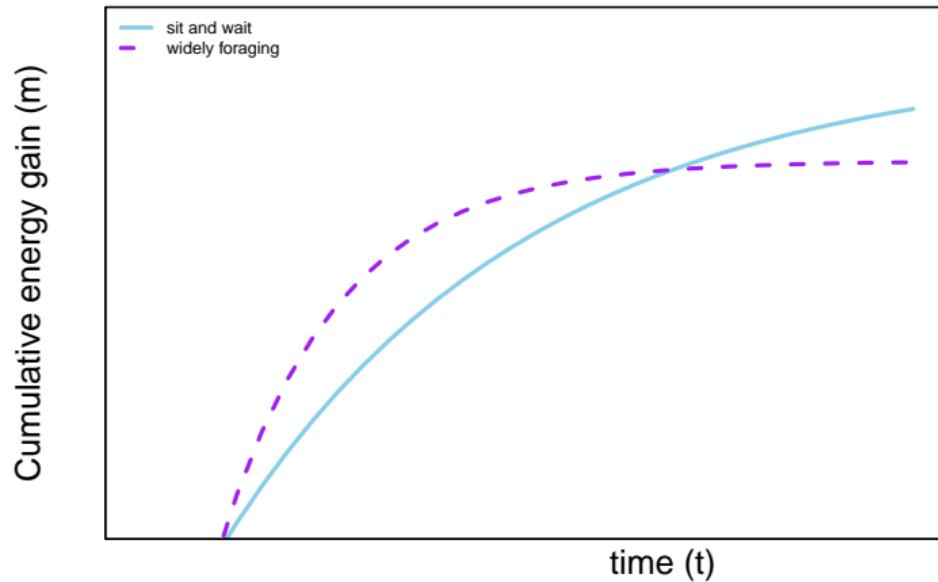


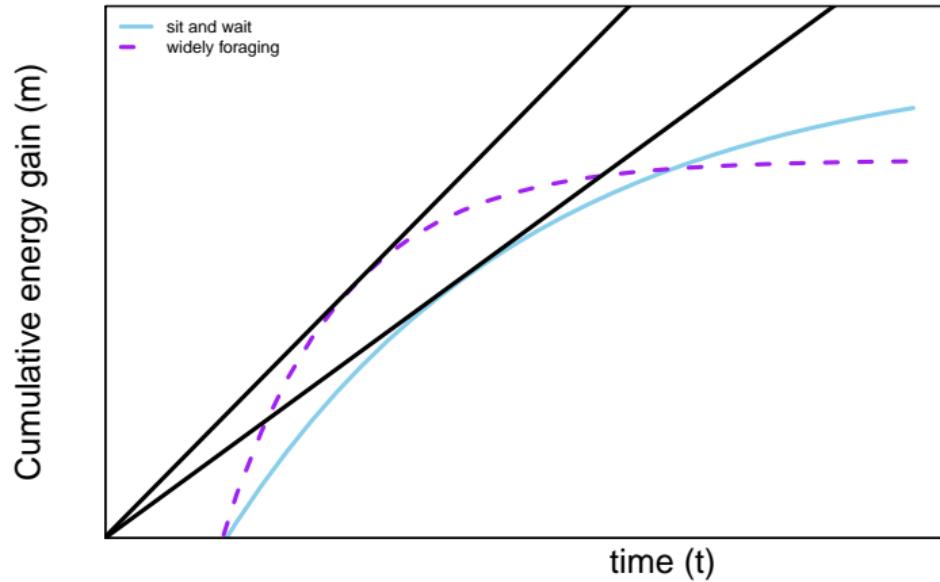
1. Sit-and-wait foraging is the most likely ancestral state
2. Foraging mode is conserved among lizards

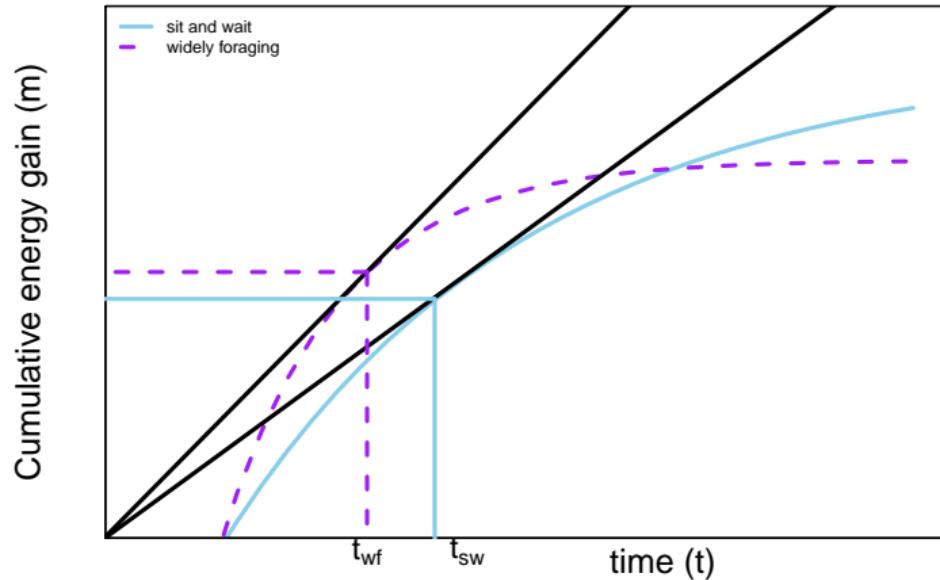
The evolution of reproductive effort in lizards was driven by an interaction between maternal mass and foraging mode

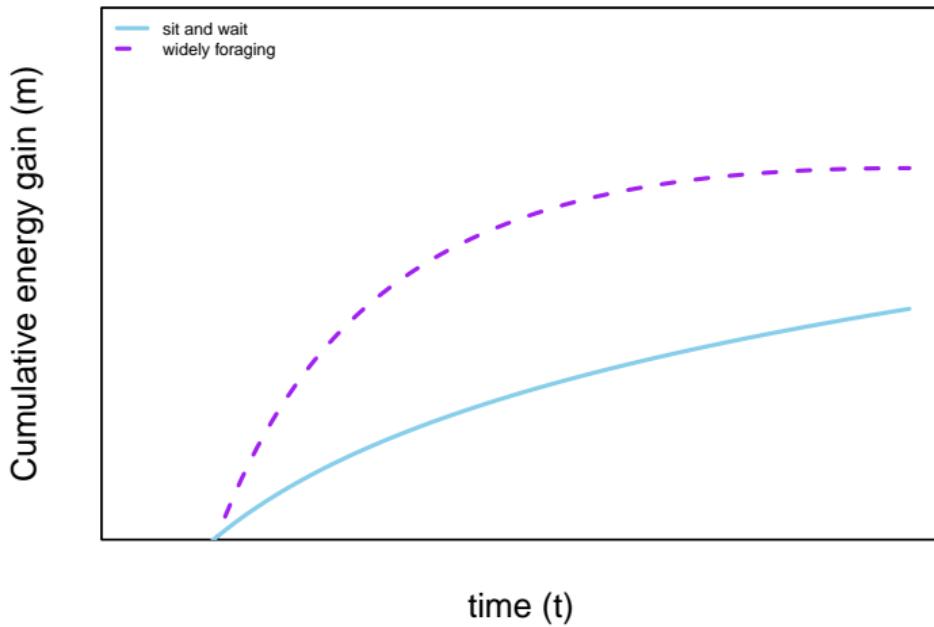












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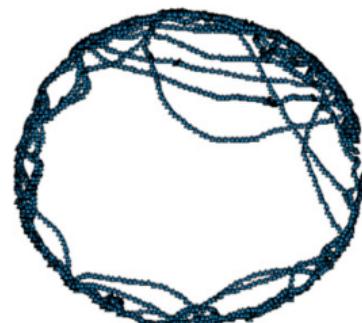
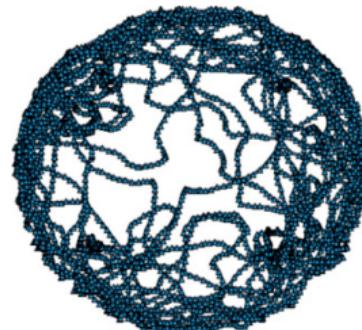
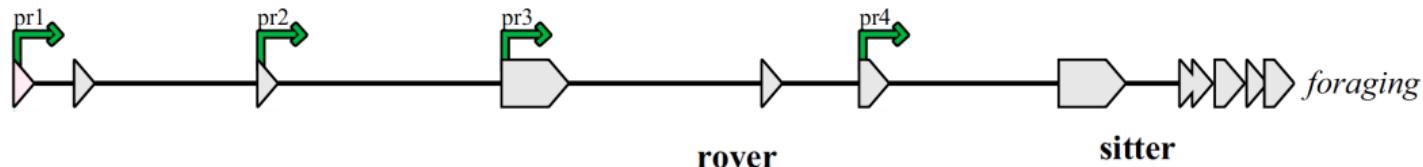
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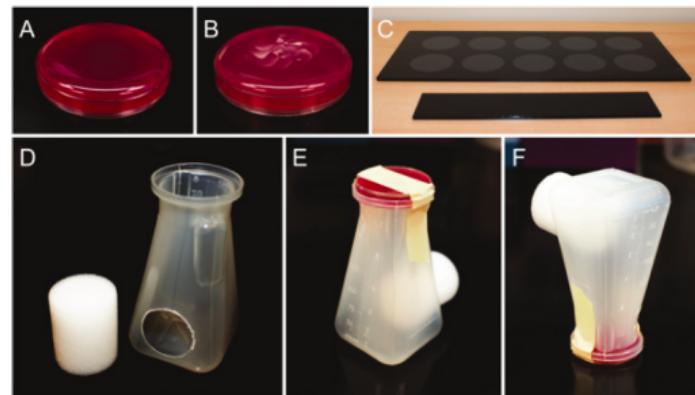
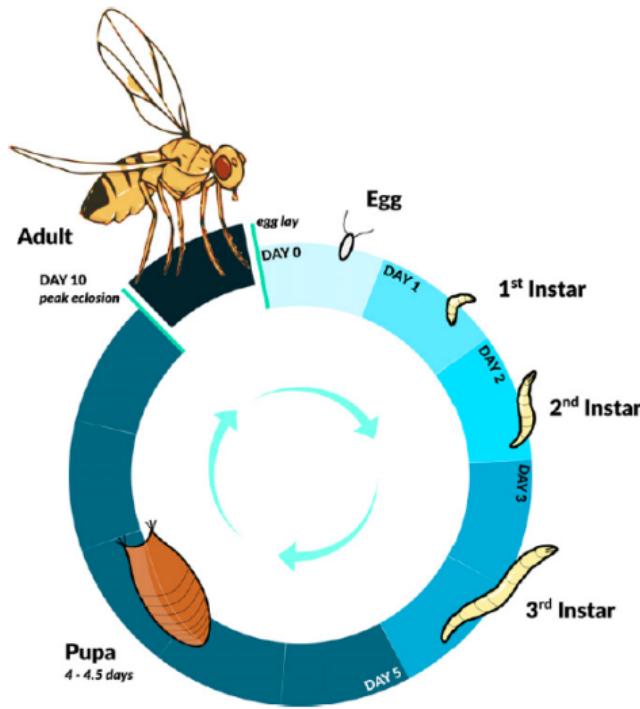
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## Chapter 3:

## *Drosophila melanogaster* foraging behavior



# Experimental design



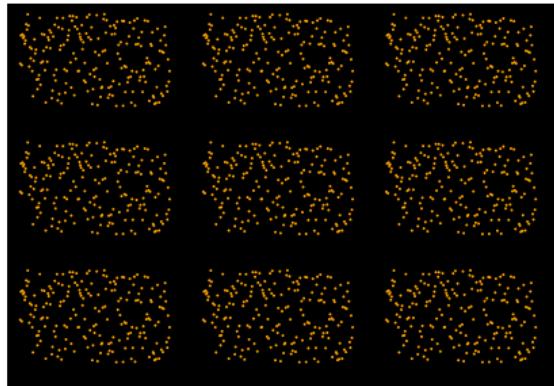


Figure 1: Schematic representation of an arena with a multi-patch distribution of resources.

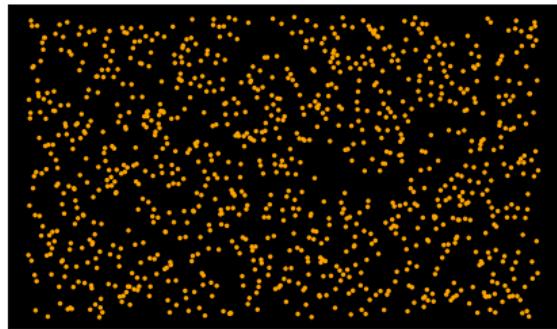
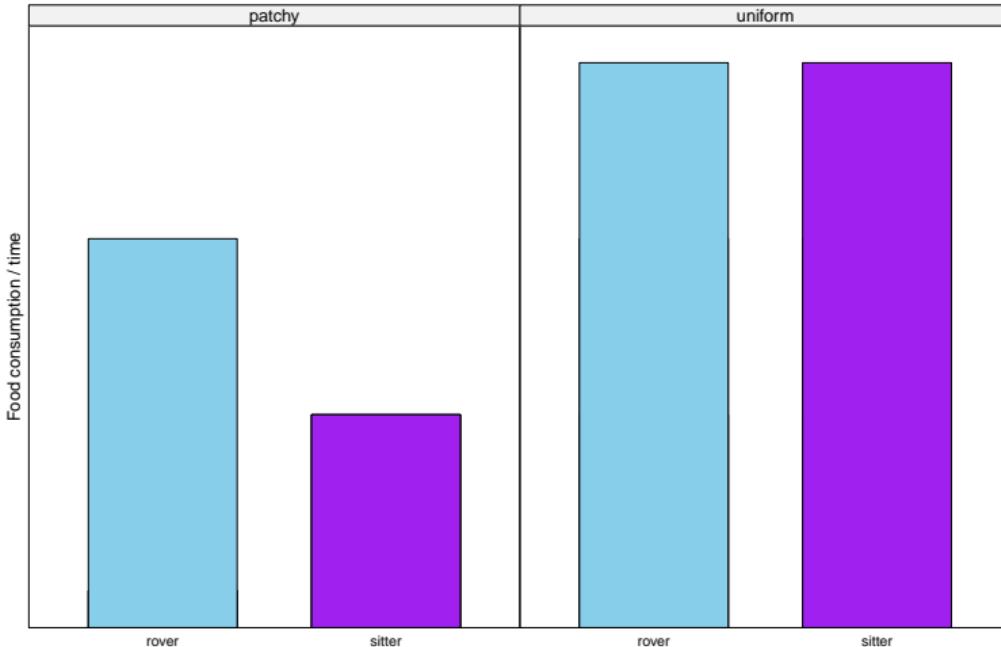


Figure 2: Schematic representation of an arena with a hypothetical uniform distribution of resources.

# Predictions



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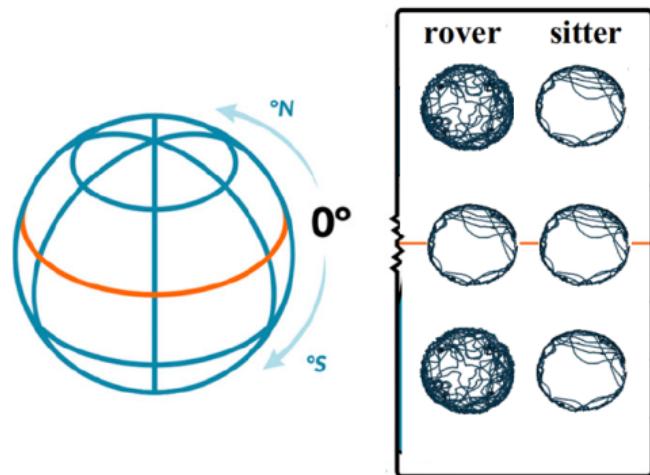
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## Chapter 4:

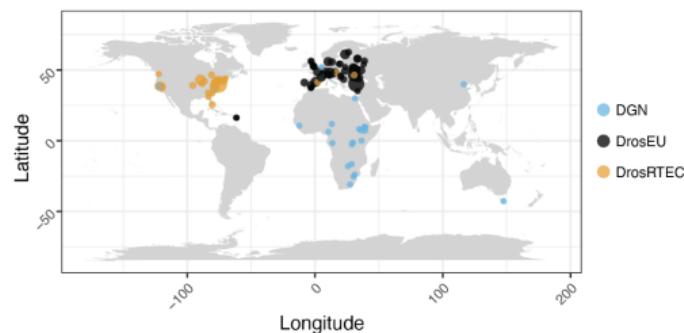
The *Drosophila foraging* gene provides an opportunity to understand the mechanisms underlying evolutionary responses to environmental variation

- Given its allelic variants, one should expect geographic variation of the *for* gene among populations

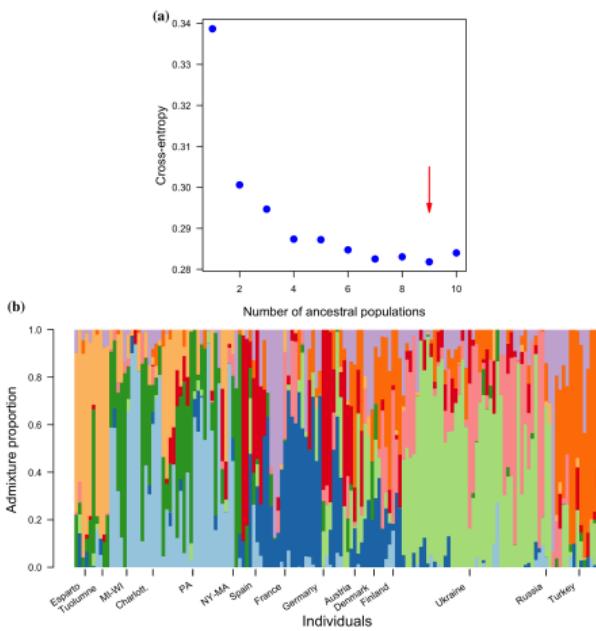
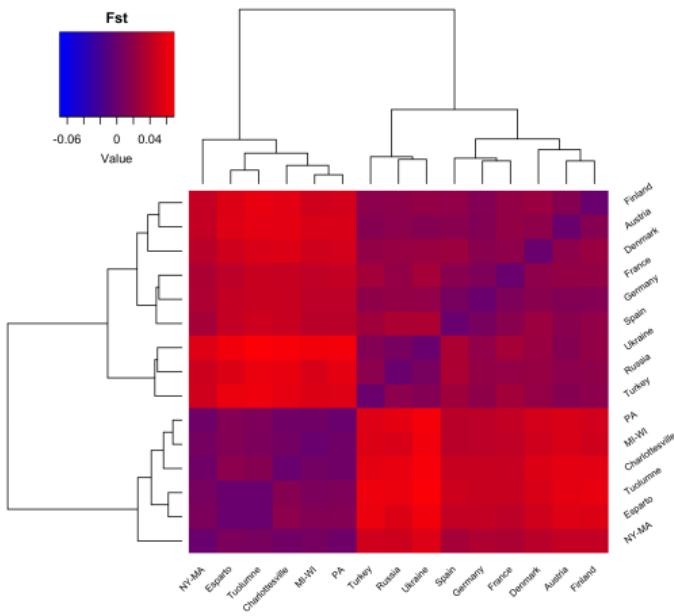


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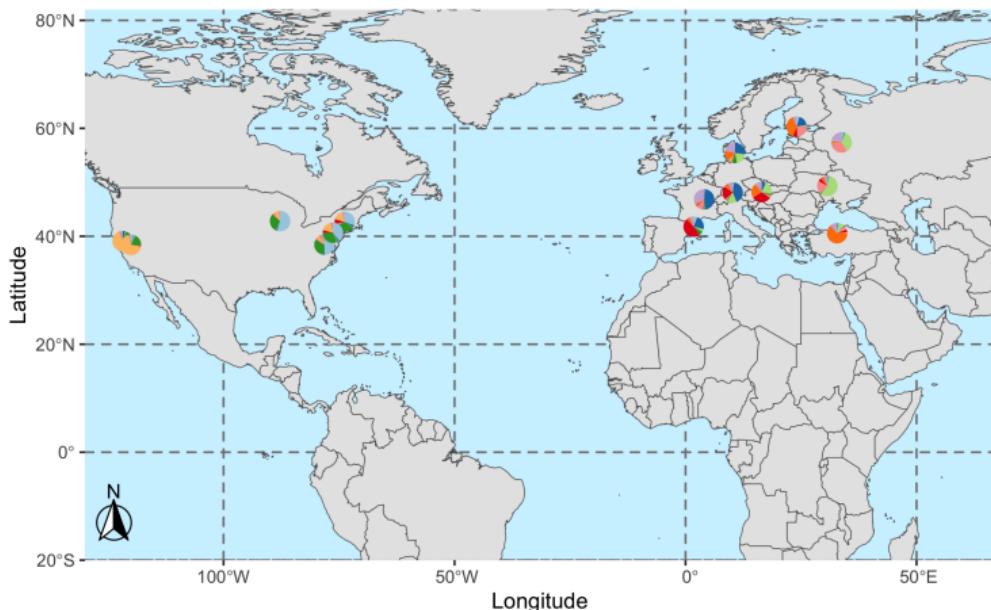
2. The DEST dataset enables one to study genetic variation across populations spanning America and Europe



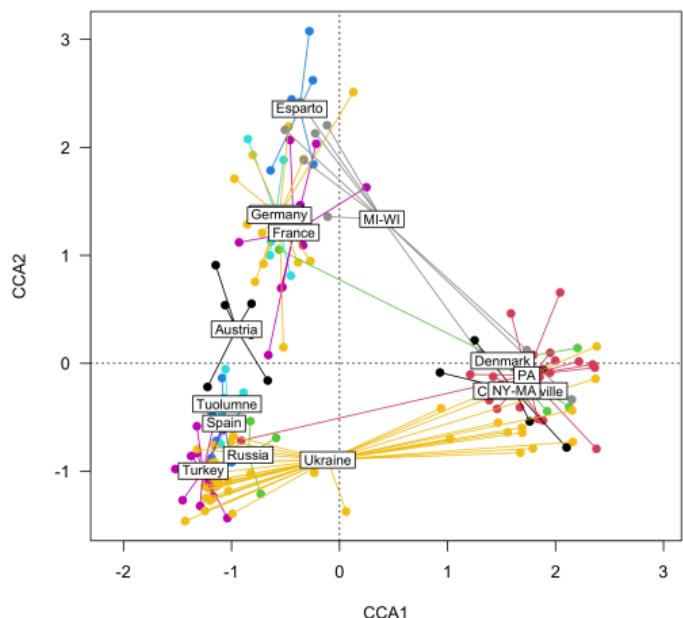
# A genetic differentiation test, and an analysis of population structure revealed an east-west gradient in allele frequency



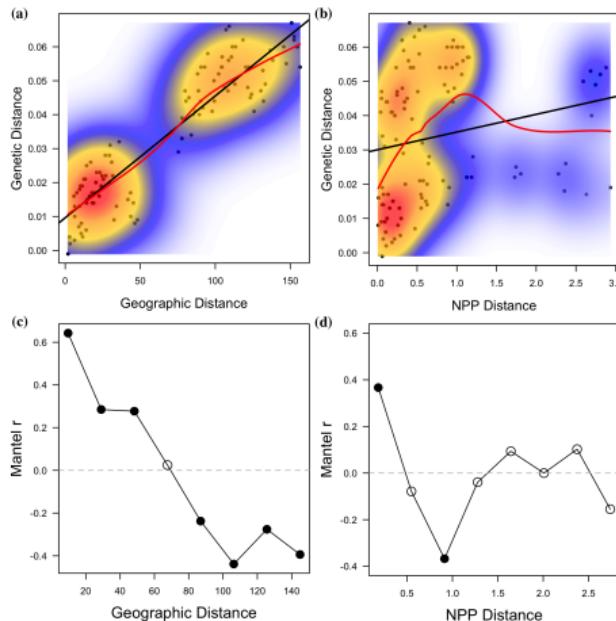
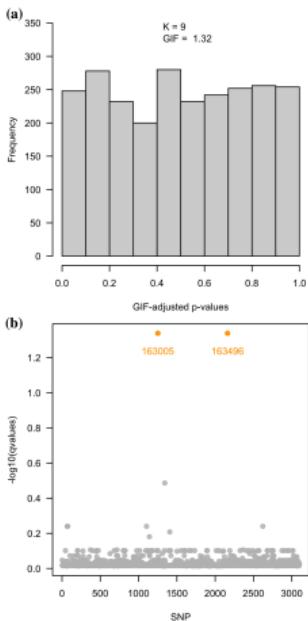
Stronger structure in populations collected in America than those collected in Europe, although the structure of pools from Ukraine, Turkey, and Russia stands out



# Spatially varying selection driven by the seasonality of net primary production



# Models of isolation by environment and isolation by distance are likely driving genetic differentiation among populations



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DOI: 10.1002/ece3.8885

**RESEARCH ARTICLE**

**Ecology and Evolution**

Open Access

**WILEY**

# Macroclimatic and maternal effects on the evolution of reproductive traits in lizards

Dylan J. Padilla Perez  | Michael J. Angilletta Jr.

## PROCEEDINGS B

[royalsocietypublishing.org/journal/rspb](https://royalsocietypublishing.org/journal/rspb)

## The correlated evolution of foraging mode and reproductive effort in lizards

Dylan J. Padilla Perez, Dale F. DeNardo and Michael J. Angilletta Jr

School of Life Sciences, Arizona State University, Tempe, AZ 85287, USA

 DOI: 10.1002/ece3.8885 | EID: 2020-0001-7276-1217 | PDF: [2020-0001-7276-0267](https://onlinelibrary.wiley.com/doi/10.1002/ece3.8885)

Research

Dylan Padilla

Macro- and microevolutionary insights into the evolution of foraging behavior and life history traits

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## Geographic variation of the *for* gene reveals signatures of local adaptation in *Drosophila melanogaster*

Journal:	<i>Journal of Evolutionary Biology</i>
Manuscript ID	JEB-2023-00177
Manuscript Type:	Research Article
Keywords:	foraging mode, landscape genetics, polymorphism, heterogeneous environments, path length

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Time for discussion!