

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

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

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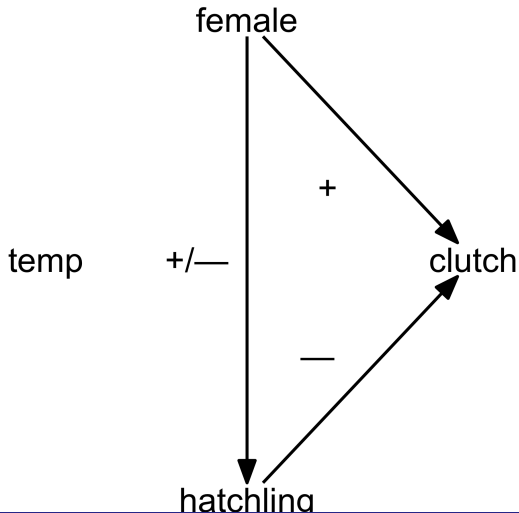
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- ▶ Chapter 2: The correlated evolution of foraging mode and reproductive effort in lizards
- ▶ Chapter 3: Foraging efficiency of rover and sitter larvae of *Drosophila melanogaster*
- ▶ Chapter 4: Geographic variation of the *for* gene revealed signatures of local adaptation in *Drosophila melanogaster*

Chapter 1:

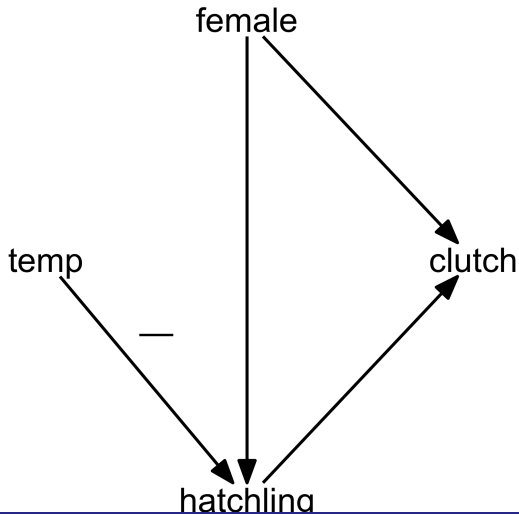
What is life history theory?



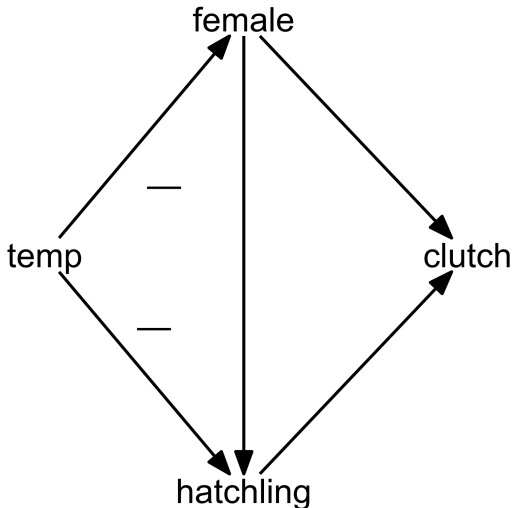
Optimal reproductive tactics



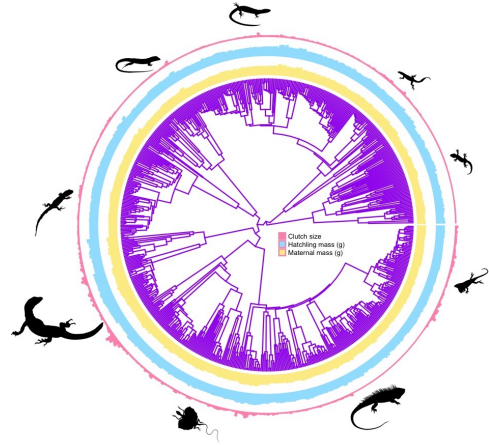
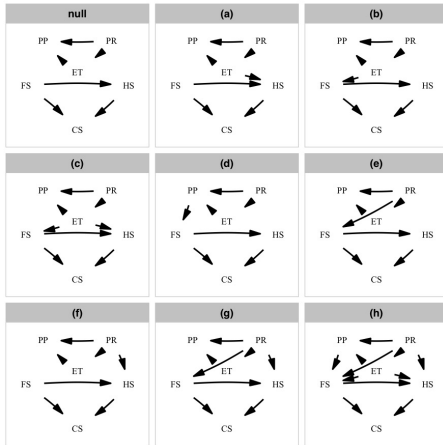
Optimal reproductive tactics



Optimal reproductive tactics



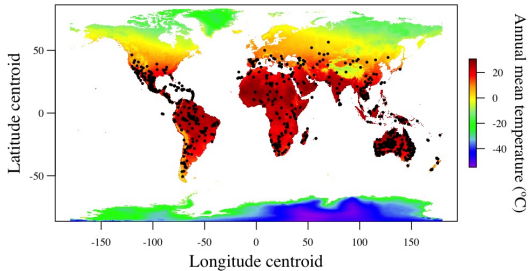
Relationships among environmental/body temperature and life-history traits





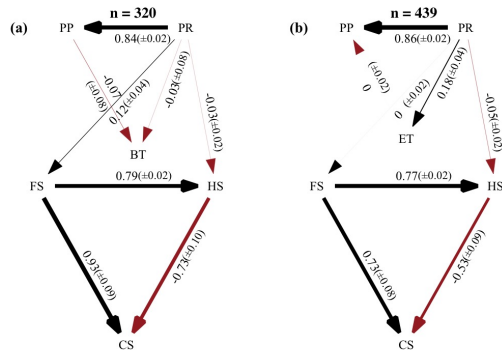
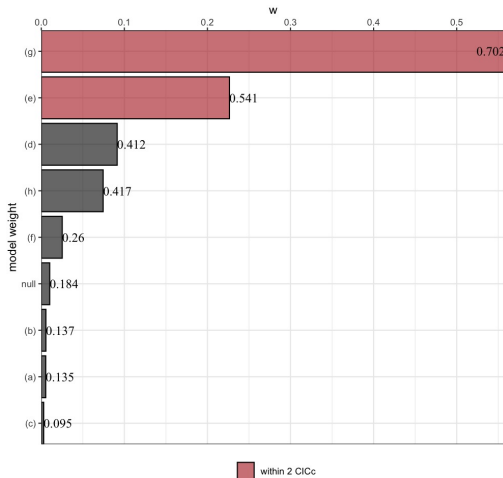
WorldClim - Global Climate Data

Free climate data for ecological modeling and GIS



Phylogenetic path analysis, package *phylopath* in R

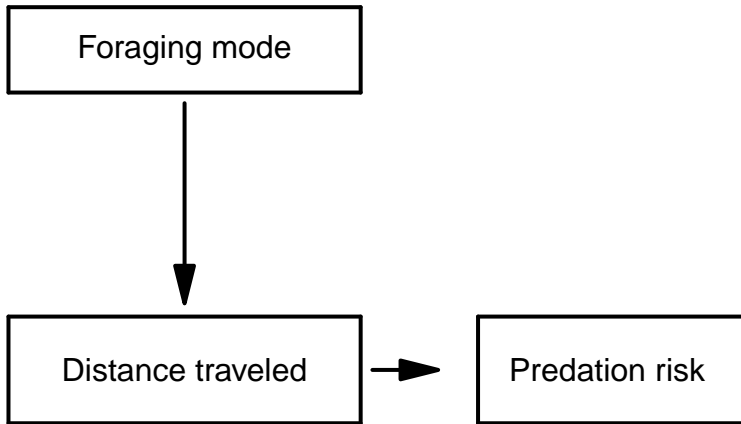
A model describing a direct and an indirect effect of precipitation on the evolution of reproductive traits was strongly supported

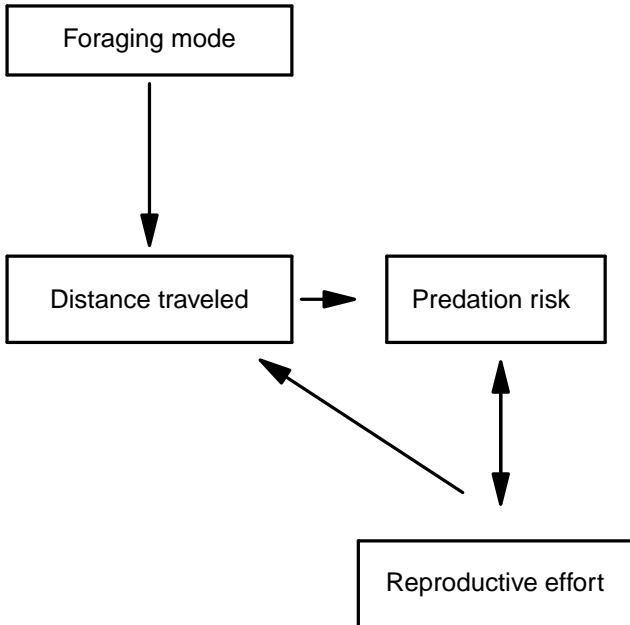


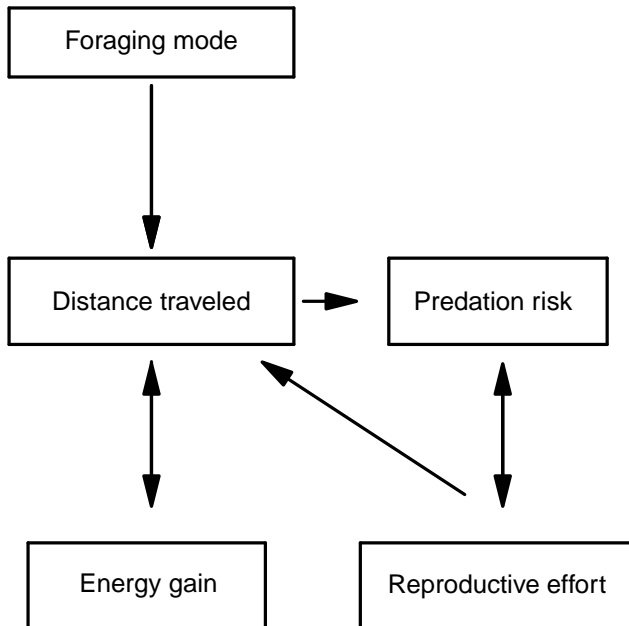
Chapter 2:

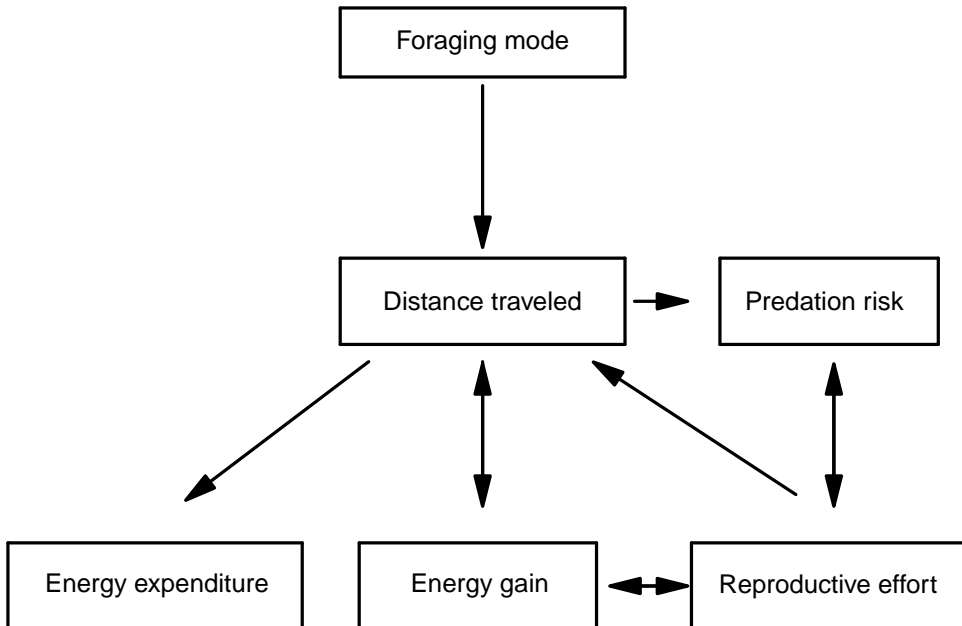
The foraging-mode paradigm



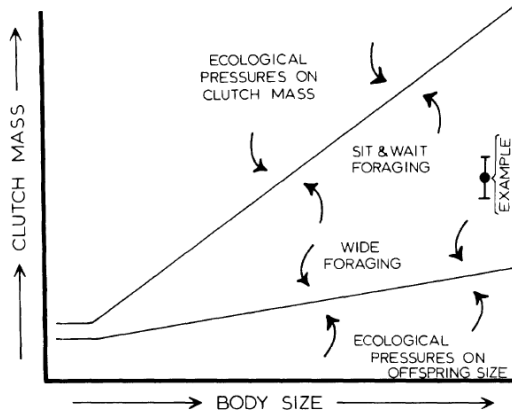








Functional reproductive volume



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^{1,2}

▶ Hatchling mass

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- ▶ Scaled-mass index

Ancestral reconstruction of foraging mode

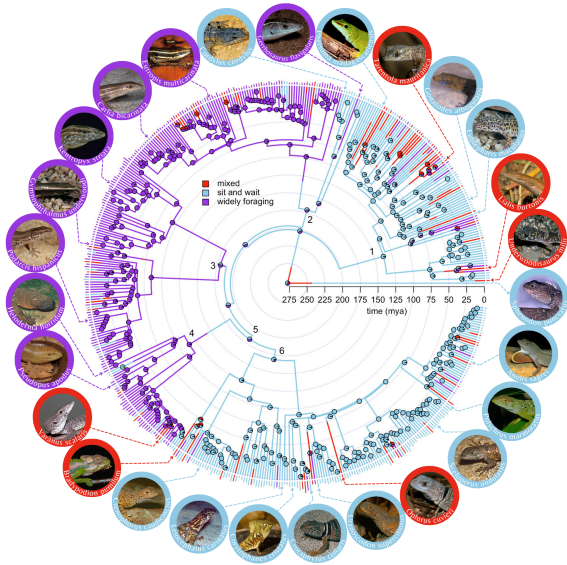
- ▶ We used a set of continuous-time, discrete-state Markov chain models

Ancestral reconstruction of foraging mode

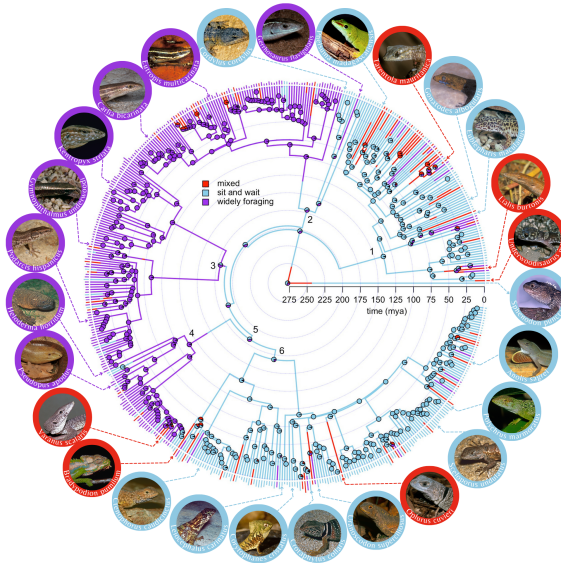
- ▶ We used a set of continuous-time, discrete-state Markov chain models
- ▶ We fitted three different models to our data, using the function `make.simmap` from the `phytools` package of R v.1.0.1

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

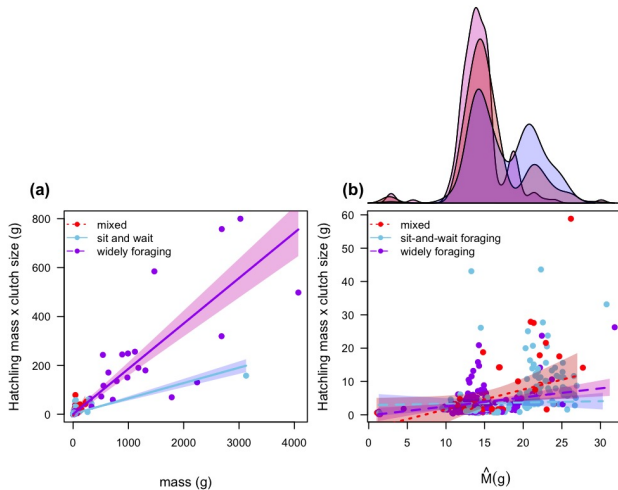


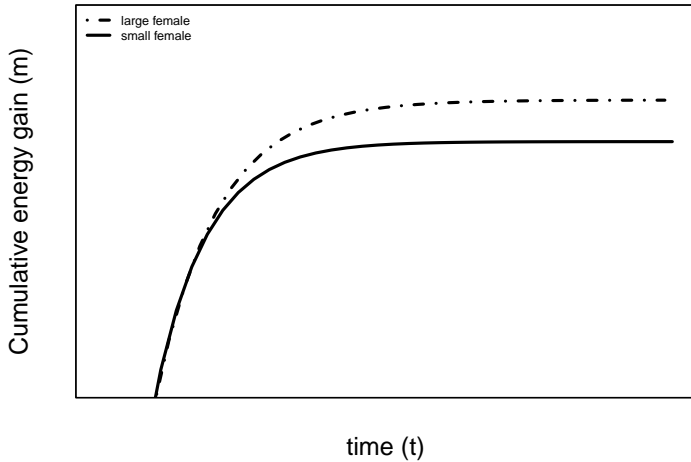
1. Sit-and-wait foraging is the most likely ancestral state

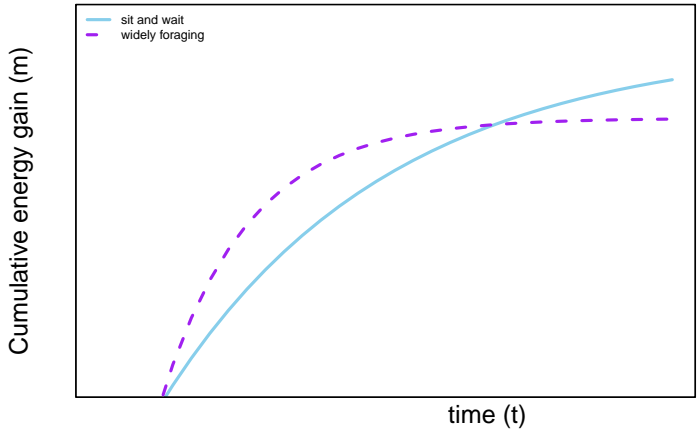


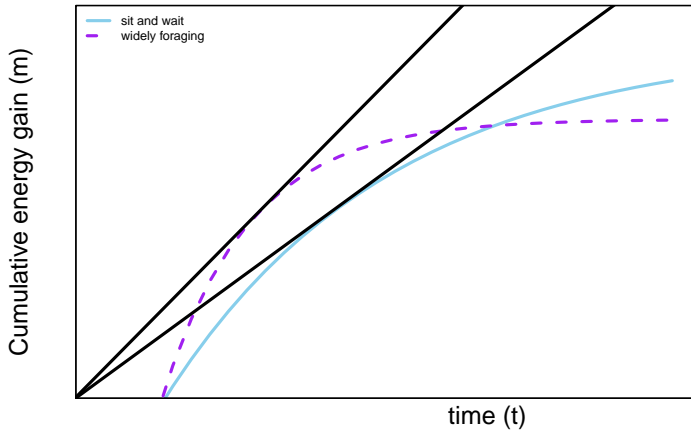
1. Sit-and-wait foraging is the most likely ancestral state
2. Foraging mode is conserved among lizards

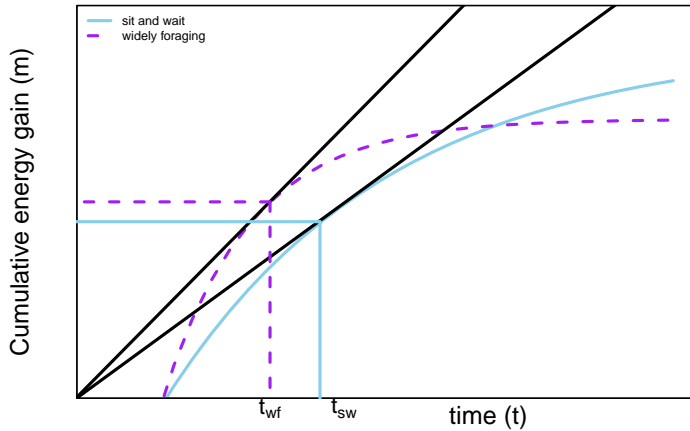
The evolution of reproductive effort in lizards was driven by an interaction between maternal mass and foraging mode

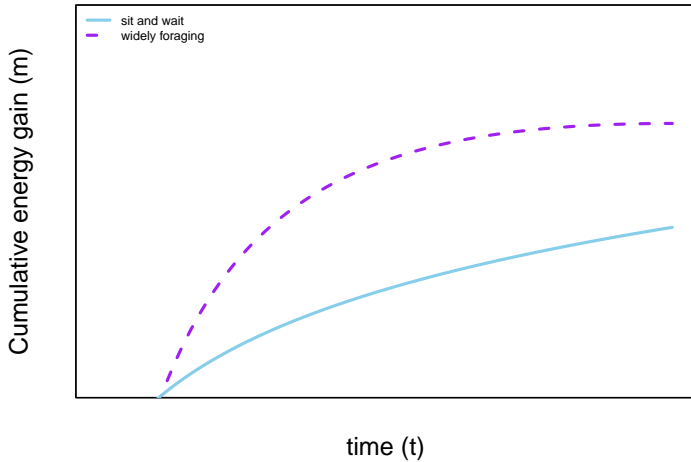






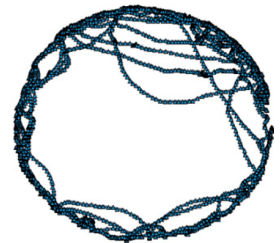
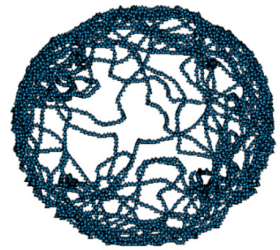
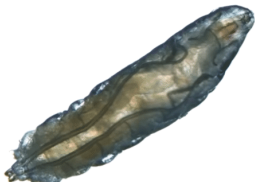
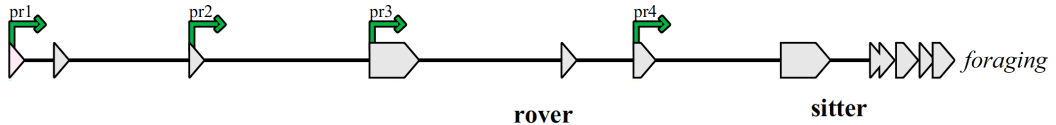




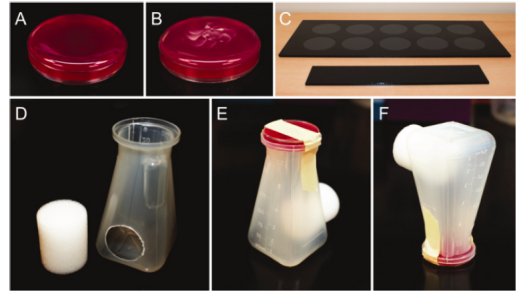
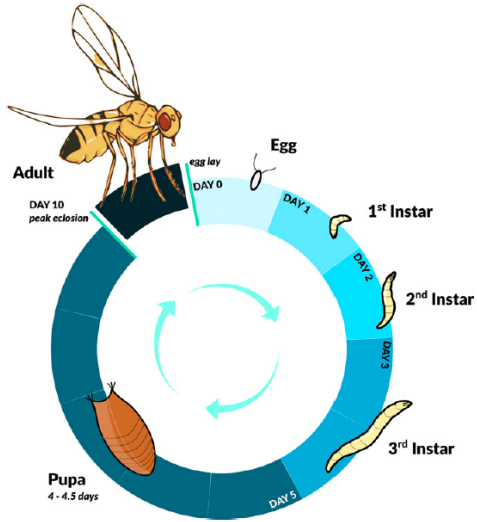


Chapter 3:

Drosophila melanogaster foraging behavior



Experimental design



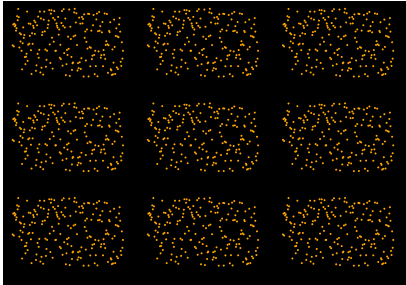


Figure 1: Schematic representation of an arena with a multi-patch distribution of resources.

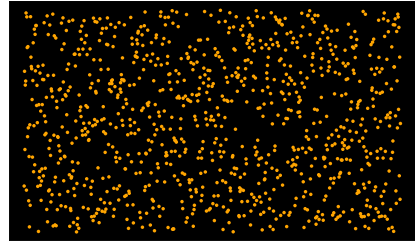
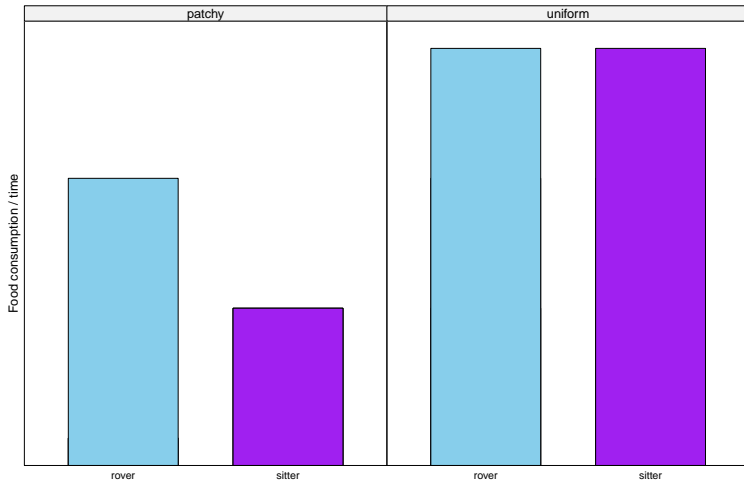


Figure 2: Schematic representation of an arena with a hypothetical uniform distribution of resources.

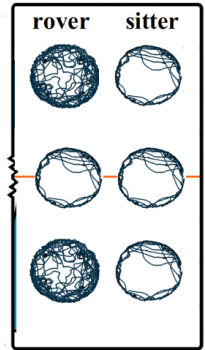
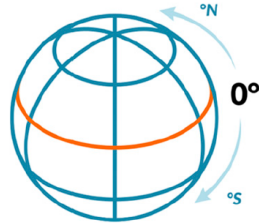
Predictions



Chapter 4:

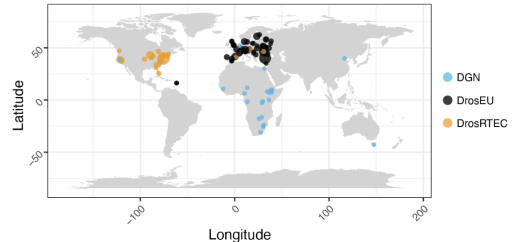
The *Drosophila foraging* gene provides an opportunity to understand the mechanisms underlying evolutionary responses to environmental variation

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

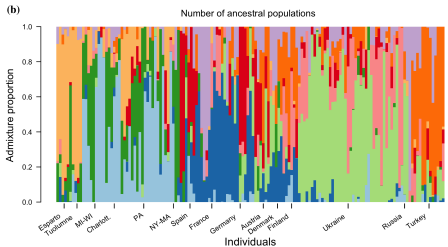
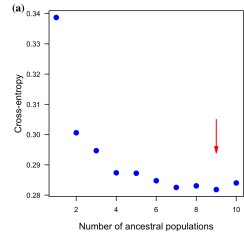
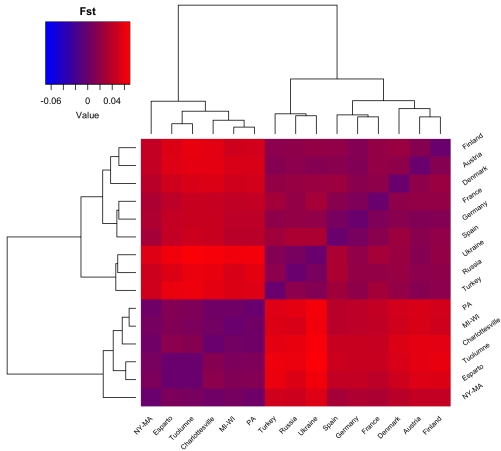


The *Drosophila foraging* gene provides an opportunity to understand the mechanisms underlying evolutionary responses to environmental variation

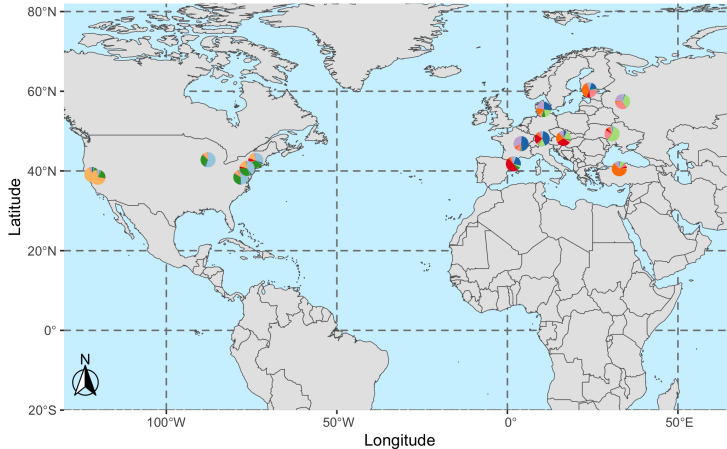
- 2. The DEST dataset enables one to study genetic variation across populations spanning America and Europe



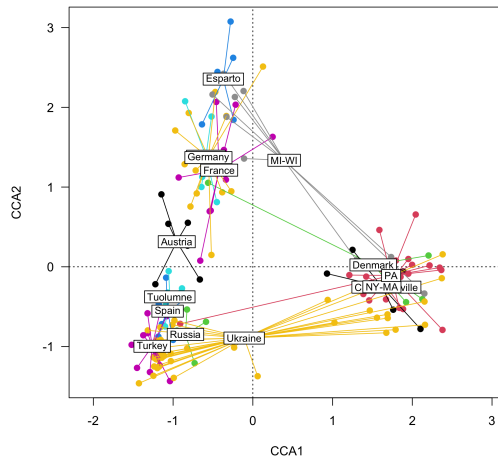
A genetic differentiation test, and an analysis of population structure revealed an east-west gradient in allele frequency



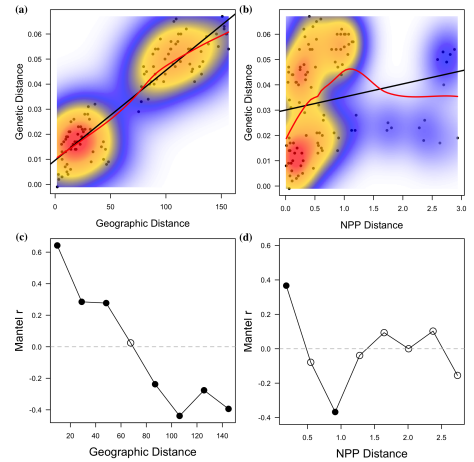
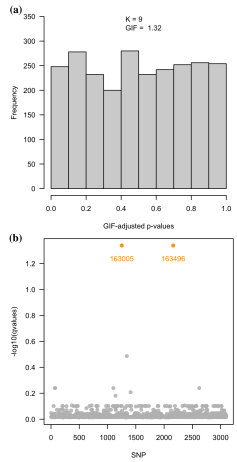
Stronger structure in populations collected in America than those collected in Europe, although the structure of pools from Ukraine, Turkey, and Russia stands out



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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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

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





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

Time for discussion!