Outline OGS 2024

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Causes and consequences of the Yellow-Bellied Marmot (YBM)'s body mass shift in the last half-century.

Introduction

- **Big question**: Climate change –> Life conditions shifts –> *Phenotypic response*.
- **Specific question**: Global warming –> Impact on the *body mass* –> not fully understood (lack of generalization[1]) ***Knowledge gap***
- **Research question**: Why the *YBM* are *evolving* (just now) to *bigger* individuals? And what could be the *consequences* of this evolution?

This body mass shift was first studied by (Ozgul et al. 2010), which conclude that this was mainly due to phenotypic plasticity. However, due to recent questioning with the using of IPMs for evolutionary inferences (Chevin 2015; Janeiro et al. 2017) and preliminary results indicating different results (Martin et al. unpublished), we conducted a quantitative genetic analysis of that case using Animal model with the Bayesian framework MCMCglmm (Hadfield 2010). These new results indicate a high evolutionary signal in addition to some plasticity leading to the need to rethink the evolutionary scenario of this phenotypic shift. Indeed, if the lengthening active season is a suitable explanation for an ecological driver for the phenotypic plasticity (as proposed by (Ozgul et al. 2010)) it can't explain the observed evolutionary signal as it represents a decreasing selective pressure for a bigger body mass.

We have an extensive database over the 2nd longest wild mammal population study in the world, let's use it!

Highlight the importance of the body mass for a hibernating species.

Attack axis: *Although the consensus to explain this major morphological shift in a well studied population was plasticity (mainly), our analysis highlight the need of a global re-thinking of that case.*

[1] Citation needed.

Hypothesis

The causes of this body mass shift are multimodal ([2] *explain the concept of multimodal causes*) due to the general environmental shift induced by climate change. The phenotypic shift on a life history-trait (LHT) will have significant consequences on several aspects of the population.

Objective and Methodology 1: Causes

The causes of this observed body mass evolution are multimodal

- **Punctual weather event**: weather data; population fluctuation (*looking for significant drops following strong weather events, indication a potential bottleneck that we can compare with the fluctuations of the body mass' genetic value*)
- **Predation**: predators population; death causes (*looking for a shift in the predators populations and species composition for an eventual shift in the death causes*)
- **Diet diversification**: diet habits - behavioral observations, isotopy; frequency of drying events and state of the vegetation (*looking for a shift to a more fibrous diet*)

+ Interconnection (multicausal)

Objective and Methodology 2: Consequences

The shift of a likewise LHT will have big consequences on both the population and the individual scale.

- **Density dependence emergence?**: *we know that this phenotypic shift is associated with a demographic explosion (Ozgul et al. 2010), and density dependence was not a problem yet*[3]. Could it become one?
- **Behavioral shift?**: *changing in the body condition could modify the mean behavior of the individuals (prediction: Bolder, because more able to defend themselves for example).*

Significance and Impact

- Better understanding of the phenotypic response to climate change thanks to a highly documented natural population; better understanding of the genotype/phenotype/environment relationship.
- Better understanding of the body mass response to global warming[4].
- Gaining more insights of the consequences of that kind of phenotypic shift.

[2] Citation needed.
[3] *Citation needed.*
[4] Citation needed.

References

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