Climate change: environmental induced phenotypic change, population dynamics, and long-term evolution

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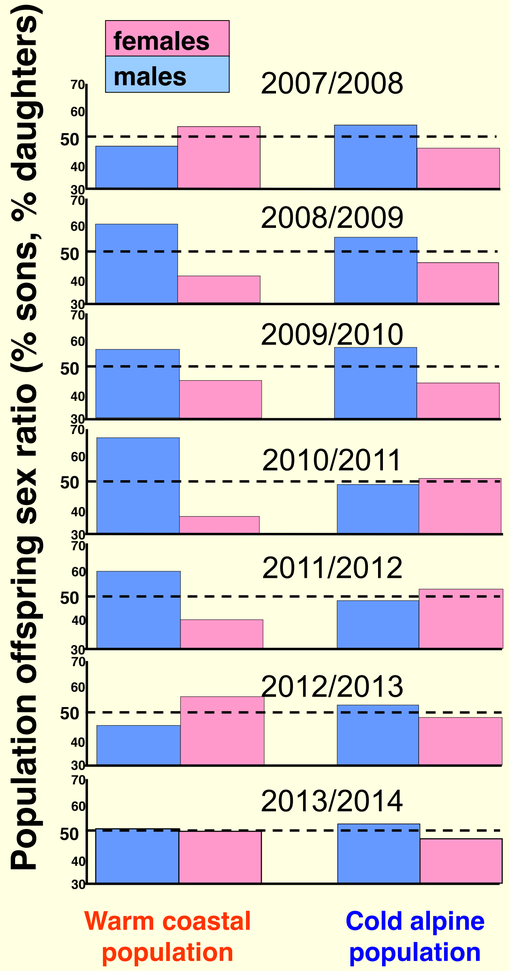
Background

- Climate change is having strong effects on the physiology, phenology and behaviour of species, with consequences for species abundance and distribution.
- Reptiles have low dispersal rates and are strongly affected by their thermal environment.
- Thus, they are ideal organisms to examine organismal responses to climate change and consequences for population dynamics and long term evolutionary processes.
- My research project was part of a broader research program testing how climate influences key offspring traits (date of birth and offspring sex) and implications of this for the ecological and evolutionary trajectory of populations.

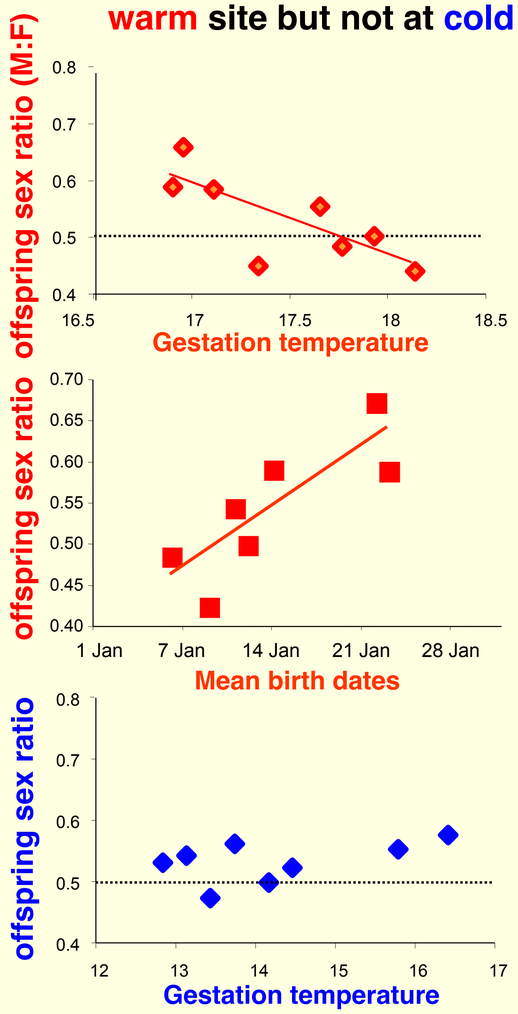
Study system and methods

- The spotted snow skink (*Niveoscincus ocellatus*) occupies a wide geographic and climatic range.
- Since 2000/2001, life history data has been collected at climatic extremes of its range (at a cold alpine site and a warm coastal site) (2400 females, 8400 offspring to date).
- ~95 % of females are captured each summer to give birth. Data on is collected on offspring traits.
- Detailed climatic data is utilised to examine how these traits vary with climate.
- Theoretical models are utilised to examine the consequences of climate induced variation in offspring traits for evolutionary and ecological change under future climate change.

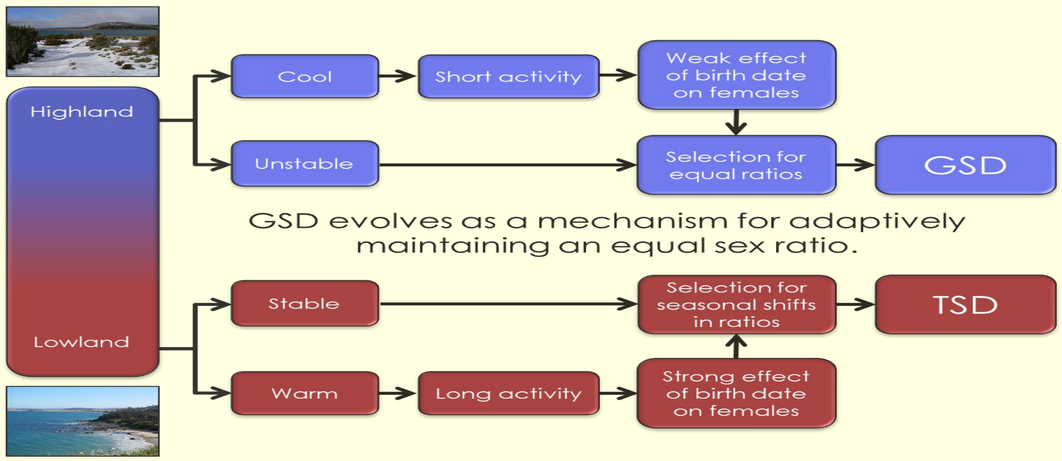
Sex ratio varies between years



Explained by temperature at warm site but not at cold



Suggests divergence in the effect of temperature on sex determination



Conclusions

- Sex ratio varies between years in the warm population but not in the cold population.
- This variation is a consequence of gestation temperature in the warm population.
- This suggests divergence in the influences of temperature on sex determination.
- Why does this divergence occur?

i) In warm population, seasonal shifts in sex ratios as a result of TSD are favoured because of sex-specific fitness returns of body size, which is affected by birth date.

ii) In cold population, such effects are reduced because of climate-induced reduction in activity periods, increased age at maturity, and effects on other life history and mating system traits.

Potential consequences

1. Impacts on population dynamics

- Climate change could lead to an over production of daughters in the warm population.
- If this translates to a skewed adult sex ratio, this could have positive effects on population viability by increasing effective reproductive size.
- But this will depend on the effects of climate change on other processes (changes in vegetation associations, food availability, presence of parasites or predators).

2. Shifts in Sex determining systems.