

PHYSIOLOGICAL TOLERANCE AND CLIMATIC NICHE OF THE WEB-TOED SALAMANDERS (GENUS HYDROMANTES) OF THE SIERRA NEVADA

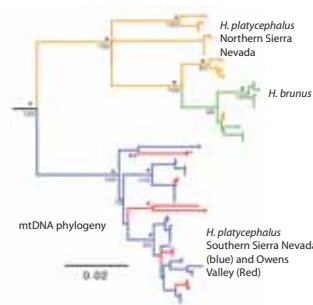
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Hydromantes in California

3 described species: *Hydromantes platycephalus* in Sierra Nevada and Owens Valley, *Hydromantes brunus* in Merced River Basin, *Hydromantes shastae* around Lake Shasta

Phylogenetic results show two highly divergent lineages of *H. platycephalus* in north and south Sierra Nevada, with each Owens Valley population most closely related to the southern Sierra *H. platycephalus*

H. brunus recently diverged from northern *H. platycephalus*



Populations from northern and southern Sierra Nevada, Merced River Basin and Owens Valley differ in genetics and morphology, but little data on physiology

Have the different thermal environments of these populations caused them to evolve different physiological tolerances? Could these affect the salamanders' ability to withstand future climate change?

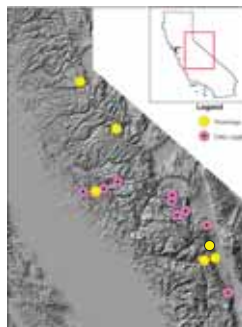


Methods

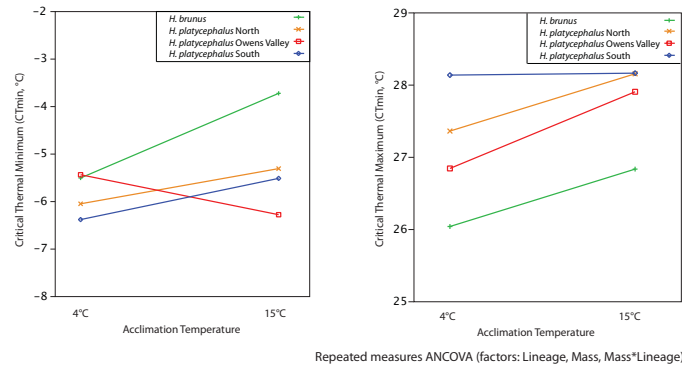
Measured Critical Thermal Minimum (CTmin) and Maximum (CTmax) of 10 salamanders from each group at two acclimation temperatures (4°C and 15°C)
- used righting response to test thermal limits

Measured dehydration and rehydration rates of salamanders

Collected temperature and relative humidity at 14 salamander sites with environmental data loggers



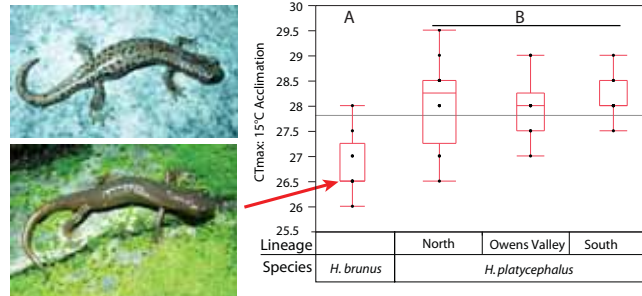
Results: Thermal Physiology



Lineages have significantly different CTmax ($p < 0.0001$) and are marginally significant for difference in CTmin ($p = 0.054$)

- *H. brunus* has a lower CTmax compared to all populations of *H. platycephalus*

Significant effect of acclimation on CTmin but not CTmax, perhaps because of a lack of an acclimation temperature higher than 15°C

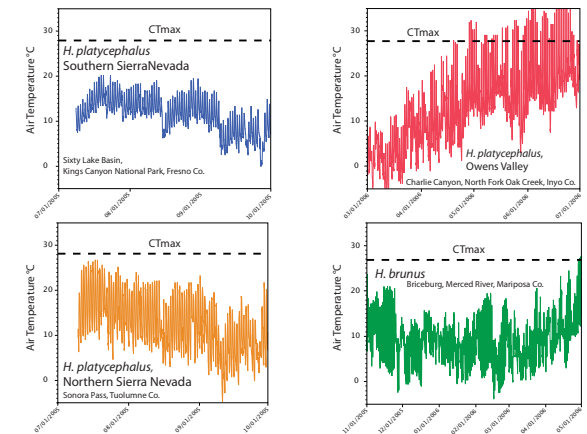


Dehydration and rehydration

No significant differences between lineages in dehydration rate (ANCOVA with factors Lineage, Mass, Relative Humidity, Lineage*Mass) or rehydration rate (ANCOVA with factors Lineage, Mass, Lineage*Mass)

Rate of dehydration and rehydration strongly dependent on mass of salamander
- behavioral modifications (change to less frequent or shorter foraging bouts) may be only way salamanders can respond to changes in relative humidity or water availability

Thermal Environment



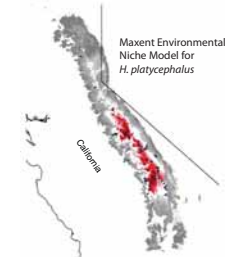
Salamanders rarely experience temperatures near CTmax or CTmin during season of surface activity. Differences in temperature between sites are less extreme when only seasons of surface activity are compared than when examined for the entire year.

Conclusions and Future Directions

H. platycephalus populations show little difference from one another in thermal limits, despite differences in environment between Owens Valley and Sierra Nevada.

H. brunus has a narrower thermal niche than *H. platycephalus*, perhaps because of lower temperature during its winter activity period.

Salamanders environmental conditions are currently far from thermal limits during periods of activity. Populations may be able to respond to changes in environmental conditions through phenotypic plasticity and phenology shifts rather than through adaptation to new thermal environments.



Physiology
Microclimate Data

Use physiological data to constrain bioclimatic models, and compare correlative modeling approaches to biophysical models that incorporate microclimate and physiology

Acknowledgements

This work was conducted at the Owens Valley Lab, White Mountain Research Station and was generously supported by a 2007 WMRS Minigrant. Thanks to Nathan Rank and Elizabeth Dahlhoff for use of environmental chambers, Ted Papenfuss for equipment, Jason Kolbe for advice and help with analysis and Sean Schoville for assistance in the field. Financial support for other components of this project was provided by the National Science Foundation and Museum of Vertebrate Zoology.