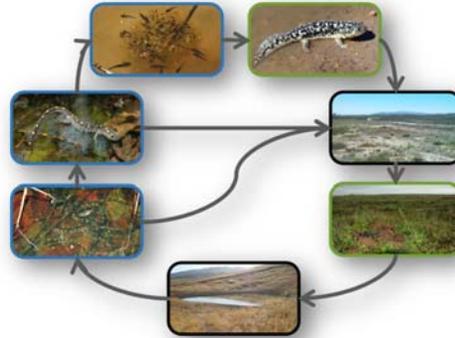


# Bounded hybrid superiority may limit the scope of a hybrid invasion

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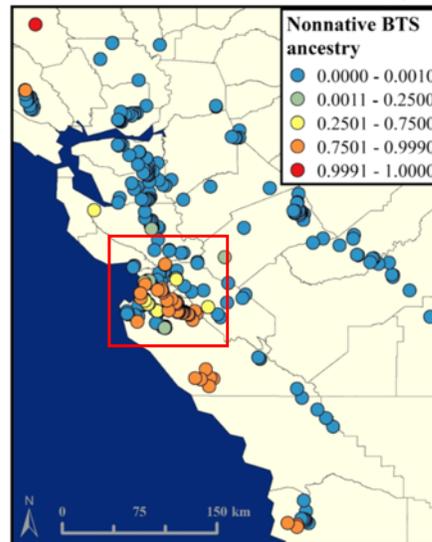
**Can transgressive segregation in physiological niche explain multiscale dynamics of a hybrid invasion?**

*Transgressive segregation* = Formation of extreme phenotypes in hybrid offspring (e.g., hybrid vigor)



(From Ryan, Johnson, and Fitzpatrick, 2009, PNAS)

**Study system:** Hybridization between imperiled California tiger salamanders (CTS) and Barred tiger salamanders (BTS) introduced from TX/NM in 1950s



Data via Evan McCartney-Melstad, UCLA  
See his Evolution 2017 talk on YouTube!

Transgressive segregation is the formation of extreme or novel phenotypes in hybrid offspring.

Central question: can transgressive segregation in physiological niche explain multiscale dynamics of a hybrid invasion?

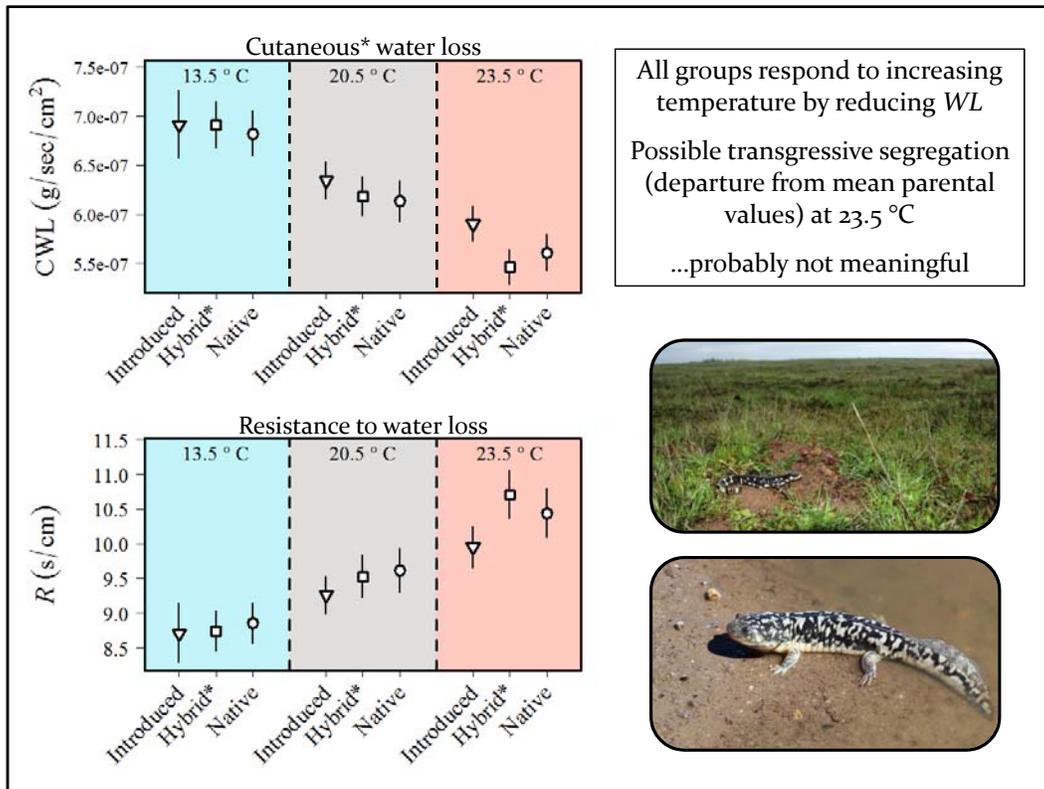
Hybridization between imperiled native CTS (*Ambystoma californiense*) and nonnative BTS (*Ambystoma mavortium*), which were introduced to California in the 1950s.

Previous work shows that hybrids in this system do exhibit transgression in body size (lower left), but..

Due to how physiological parameters often scale with mass, we actually might NOT expect this to be an advantageous trait across all life stages or life history events

Collected eggs and larvae from native, hybrid, and introduced populations from throughout CA & reared them in common environmental conditions.

Measured water loss and metabolic rate in a flow-thru respirometry system. at three experimental temps based on field data during major life history events.



The three temperature treatments include:

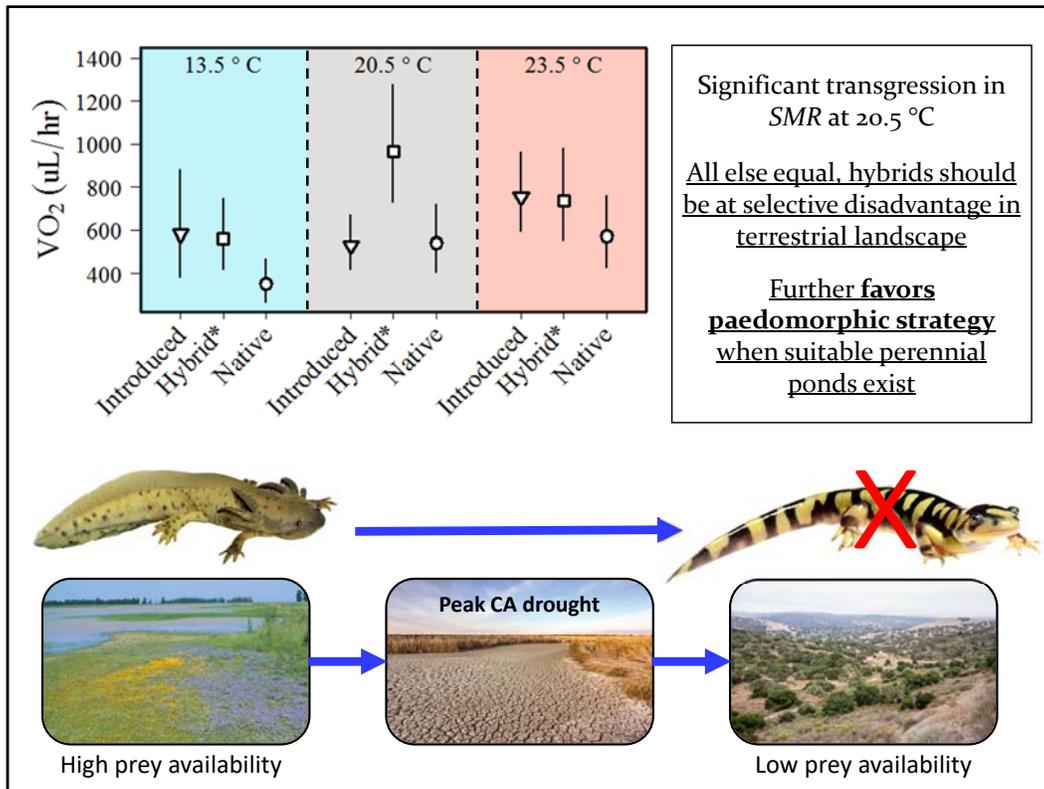
13.5 – winter breeding migrations

20.5 – mean temperature of summer burrows and ponds (most common temp experienced by any stage class)

23.5 – metamorph dispersal

One interesting finding here is that all groups responded to increasing temperature by reducing water loss and increasing cutaneous resistance to water loss.

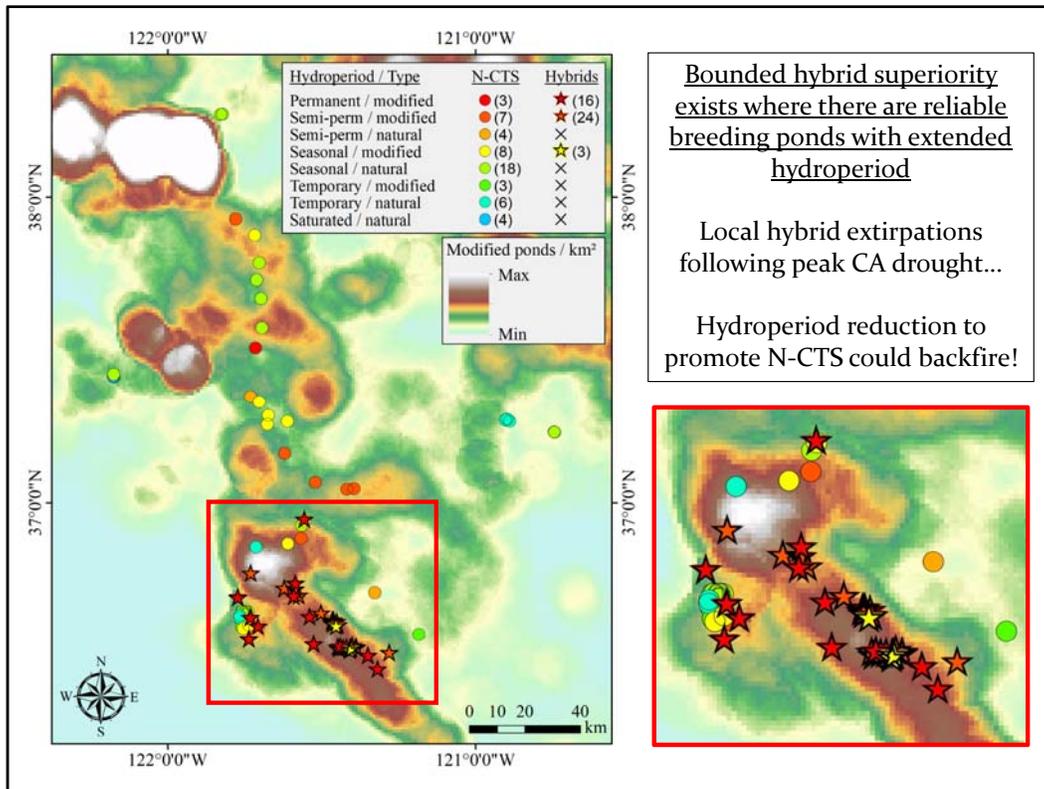
There is possible transgression in water loss and cutaneous resistance at 23.5 degrees but it's a very small difference and probably not biologically relevant



We see obvious transgression in metabolic rate, but only at the 20.5 treatment (LONG-TERM POND AND BURROW TEMPS)

When considering that food resources are relatively limited within the terrestrial landscape compared to ponds that have an abundance of amphibian and invertebrate prey, this should actually place terrestrial hybrids at a disadvantage and...

.. It should further favor an aquatic paedomorphic strategy



In one of the first treatments of the bounded hybrid superiority model, Anderson (1945) predicted that hybrids were superior in intermediate habitats where parental lines meet. In his case, that happened to be disturbed habitat. He hypothesized that as habitats returned to a pre-disturbance state, hybrids would decline and eventually be replaced by the original parental species that had evolved under those conditions.

Interestingly, we may be seeing this unfold as several hybrid populations experienced extreme declines or extirpation, particularly in isolated hybrid perennial ponds that went dry for the first time in 40-50 years during the recent CA drought.

Hydroperiod reduction could be effective to promote N-CTS, but care needs to be taken in how this is implemented as it could promote further introgression, particularly if hydroperiod is reduced in the middle of the hybrid swarm where there is a large source of hybrid genotypes.