

Water quality as a determinant in California Tiger Salamander (*Ambystoma californiense*) breeding, growth, and development

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Questions

- How does water quality affect pool choice during mating and egg-laying?
- How does larval growth correlate to differences in water qualities?

Background

- CTS are endemic to California and the Sonoma County population has been listed as Federally endangered since 2003
- Significant habitat loss and fragmentation in the Santa Rosa Plain has led to a decrease in breeding grounds and population
- Major threats include habitat loss, predation by non-native species, and vehicular-related mortality during breeding migrations [2]
- The Sonoma County population is genetically distinct from other populations in California
- Preserves contain both natural pools and man-made pools created to combat habitat loss due to construction
- Previous research on larval Cascades Frogs has shown that water quality factors such as pH and nitrates have had an effect on larval survival [2]



Hypotheses

- We hypothesize that pool use by CTS for egg laying is determined by variances in pH, nitrates, and dissolved oxygen
- Relative abundance of CTS larvae is influenced by variances in pH, nitrates, and dissolved oxygen

Preliminary Results

- Egg laying was marginally significant in response to NO_3 ($F_{1,17}=3.84$, $p=0.0617$) (Fig. 1)
- Larval presence was significant in response to NO_3 ($F_{1,17}=4.77$, $p=0.0432$) (Fig. 2)
- Larval abundance was significant in response to dissolved oxygen ($F_{1,30}=6.51$, $p=0.0167$) (Fig. 3)

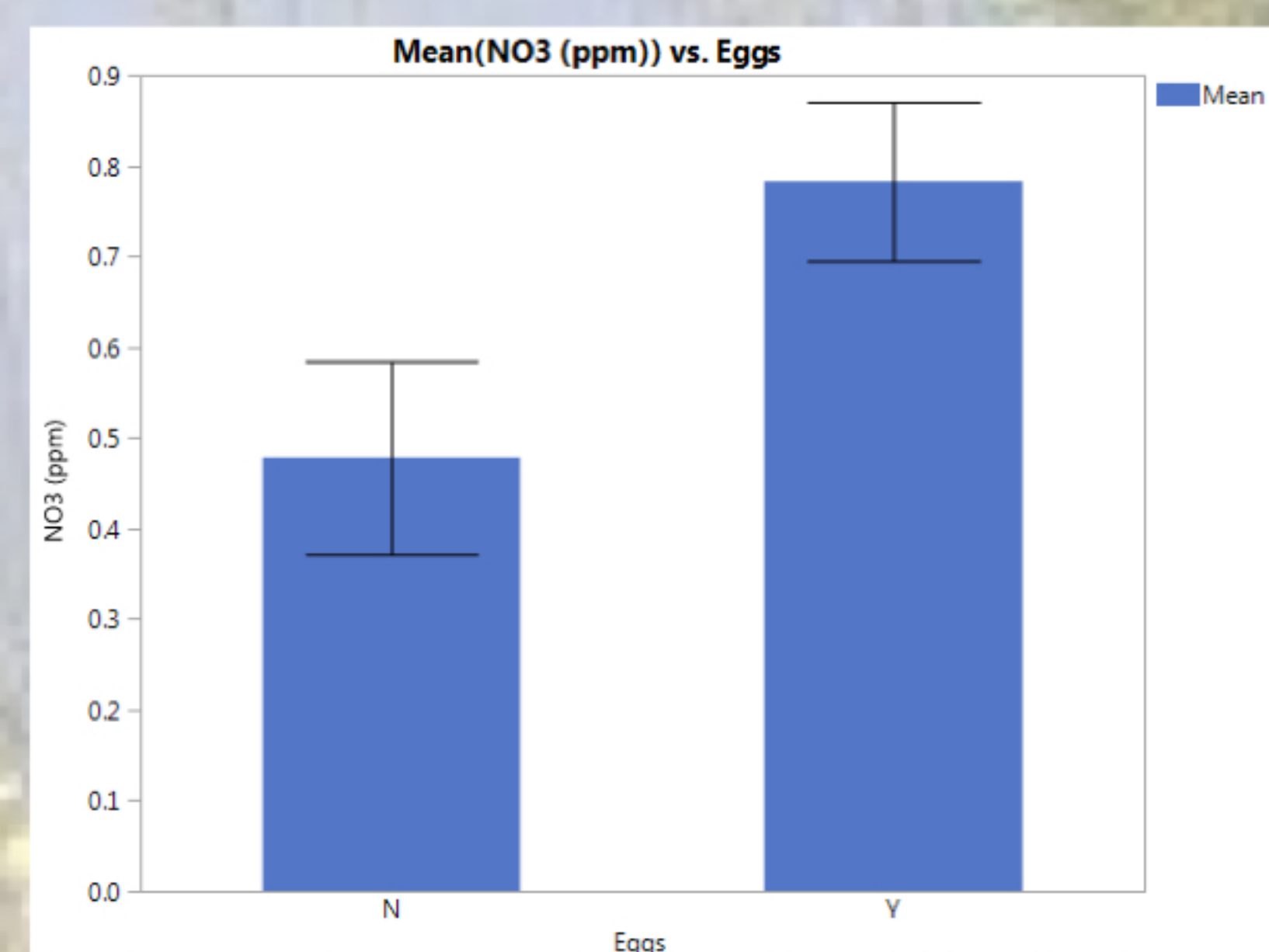


Fig. 1. CTS pond use for egg-laying as a function of nitrate levels. Means and standard errors are shown.

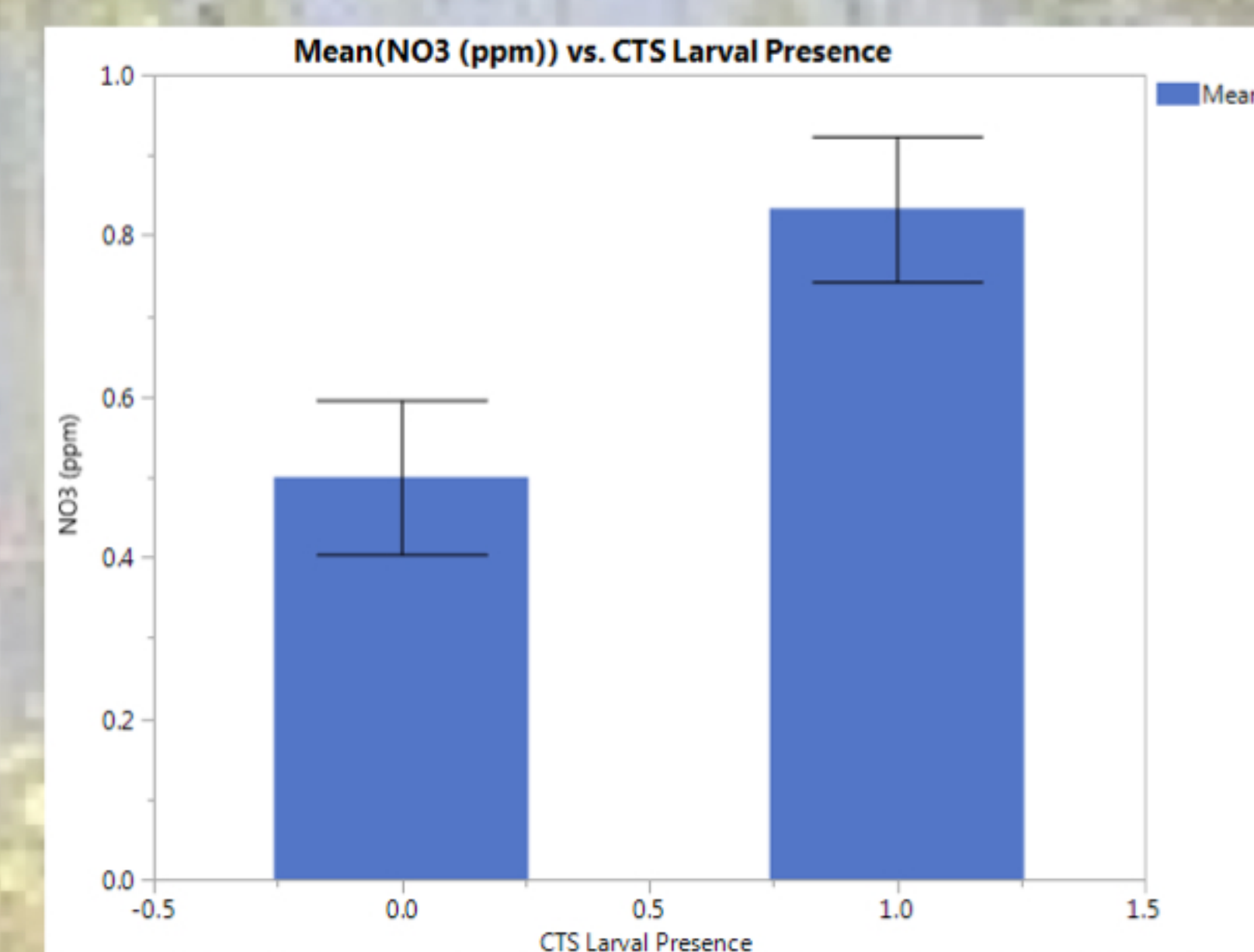


Fig. 2. CTS larval presence in ponds as a function of nitrate levels. Means and standard errors are shown.

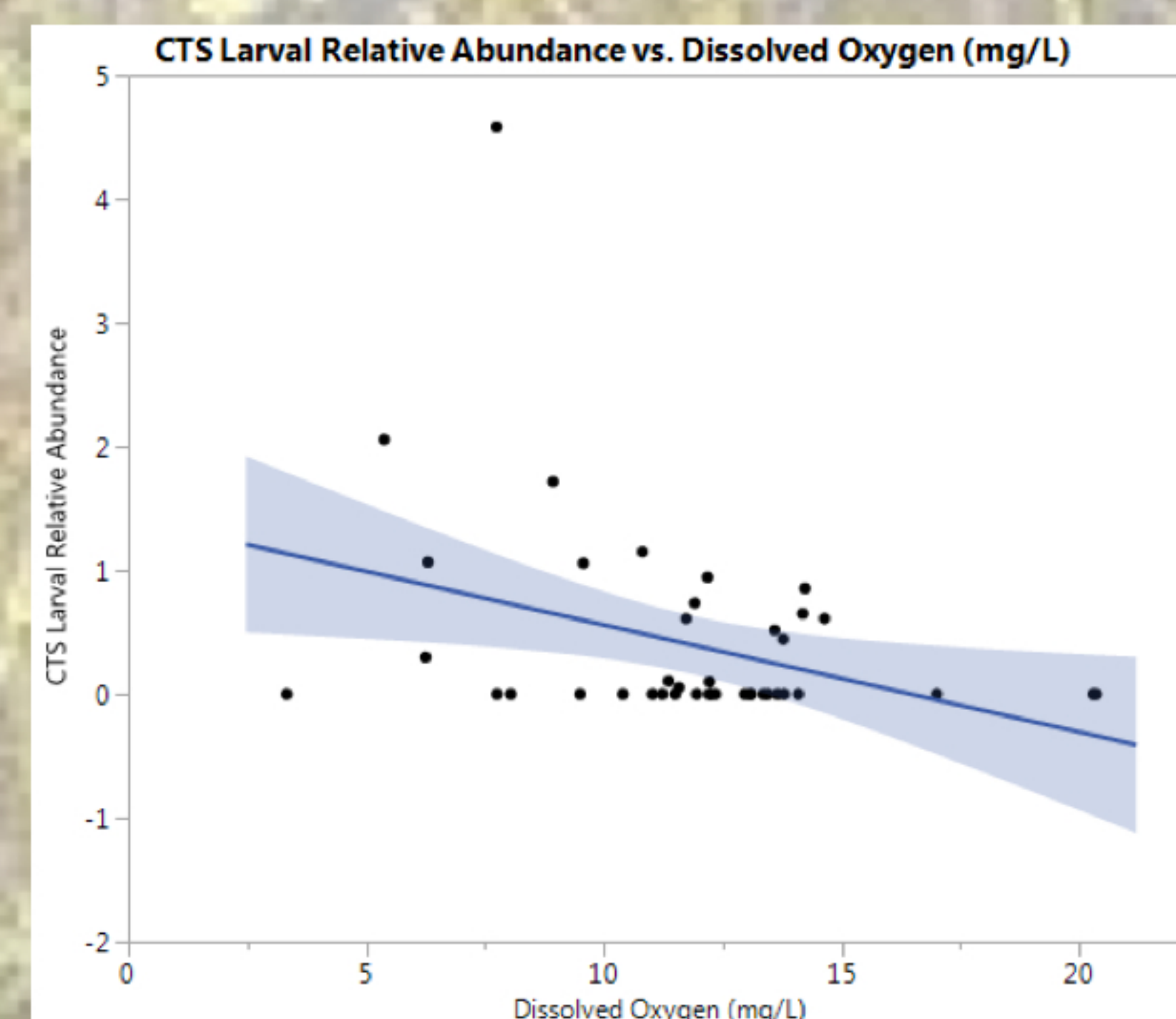


Fig. 3. Leverage plot for CTS larval relative abundance as a function of dissolved oxygen levels ($R^2 = 0.124$, slope = -0.087)

Ongoing Study Methods

- Vernal pools in four preserves (clockwise from left: Hall, Engel, Alton, and Yuba) within the Santa Rosa Plain were sampled at the start of hatching season and at the time of metamorphosis in mid-April
- Beginning in mid March, dip net surveys are conducted to track the occurrence and growth rates of CTS larvae
- API 5-in-1 Test Strips were used to test pH and Nitrates, and a Lab Quest 2 interface with Dissolved Oxygen sensor attachment was used to measure dissolved oxygen



Discussion

- There is an effect of both dissolved oxygen and NO_3 on the breeding biology of CTS. However, it is unclear what the underlying causes of these relationships are.
- Future research should include measures of vegetation cover as well as other components of the faunal community to generate a clearer picture of this complex seasonal ecosystem.

References

1. Loreda I., Morrison M.L., Vuren D.V. 1996. Habitat use and migration behavior of the California Tiger Salamander. *Journal of Herpetology* 30:2.
2. Blaustein A.R., Hatch A.C. 2014. Combined effects of UV-B, Nitrate, and low pH reduce the survival and activity level of larval Cascades Frogs (*Rana cascadae*). *Arch. Environ. Contam. Toxicol.* 39:494-2.