The Effects of Elevation on Vernal Pool Hydrology with Regards to California Tiger Salamander Populations

Vanessa Pennella^, August Stadtfeld^, Jonathan Edwards^, Dave Cook*, Derek Girman^
^Sonoma State, Department of Biology
*Sonoma County Water Agency

Introduction

The California Tiger Salamander is federally endangered, and restricted to a unique vernal pool habitat on the Santa Rosa Plain. The breeding and survival capabilities are dependent on a narrow range of suitable vernal pools habitats. These pools have been lost due to urban and agricultural development. We examined the pools available in order to see if we could find any connections between elevation and successful vernal breeding pools. We hypothesized that pools with lower elevation had a greater abundance of California Tiger Salamanders.

This figure shows an adult California Tiger Salamander

Question

Does elevation or maximum depth of vernal pools impact the success of California Tiger Salamander breeding?

Methods

-A Johnson Laser Level was used to assess the elevation of the 17 vernal pools relative to each other at Alton Preserve, Santa Rosa

-Odyssey depth loggers were placed in the vernal pools to record the changes in water depth

-Depth data was measured weekly, elevation data was measured once, and California Tiger Salamander data was measured once per pool

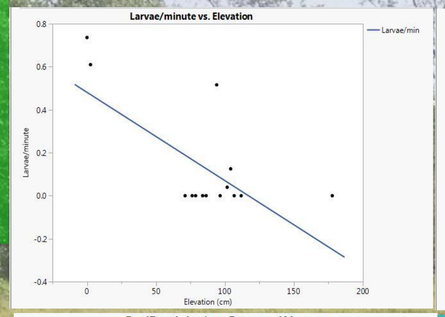
-We sampled these 17 pools for California Tiger Salamander presence and relative abundance as a measure of rate per capture per person per minute

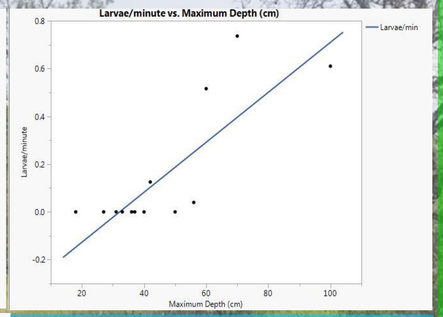
-We then assessed the topography of the preserve to get a big picture of the preserve

-We created graphs to show the effects of elevation and depth on California Tiger Salamander presence

-JMP was used for statistical analysis

Results





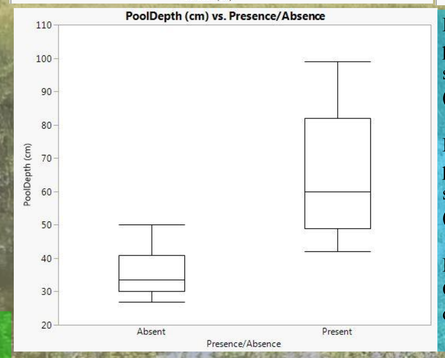


Figure 1: This graph shows the CTS larvae caught per minute per person at varied elevations, while sampling at the vernal pools at Alton Preserve. ($F_{1,1}$=3.69, p= 0.0706)

Figure 2: This graph shows the CTS larvae caught per minute per person at varied depths, while sampling the vernal pools at Alton Preserve. ($F_{1,1}$=14.06, p= 0.0028)

Figure 3: This graph shows presence or absence of CTS in pools with the corresponding maximum depths. Chi Squared= 9.004 p= 0.0027

Figure A shows the map of Alton Preserve and the vernal pools present
Figure B shows a larval California Tiger Salamander
Figure C shows the Johnson Laser Leveler used to measure elevation on the pools

Discussion

-Pool depth appears to have a major significant effect on the amount of California Tiger Salamanders found in a pool

-Pool elevation appears to have a minor effect on the amount of California Tiger Salamanders found in a pool

-Pool depth was found to have a significant effect on pool used for breeding

-These properties may play a role in maintaining an extended hydroperiod for the pool, which is favorable for completion of development to metamorphosis

-California Tiger Salamanders appear to be using the greatest maximum depth pools for breeding

-It may be that California Tiger Salamanders are using these pools for breeding due to either philopatry or through some mechanism of pool choice when coming to the pools for breeding

-It appears that the California Tiger Salamanders at these sites, use a minimum pool depth of 42 cm for breeding

-The results can be used to construct more successful breeding pools for the California Tiger Salamander in attempt to increase the endangered population size

-Additional studies in other populations are needed to determine if the results shown here can be applied broadly among California Tiger Salamander populations using vernal pools in a part of their life cycle

This figure shows a larval California Tiger Salamander

References

Ian J. Wang, Jarret R. Johnson, Benjamin B. Johnson, H. Bradley Shaffer. 2011. "Effective population size in strongly correlated with breeding pond size in the endangered California tiger salamander, *Ambystoma californiense*." *Conservation Genetics*. Vol 12, Issue 4: 911-920

Jamie L. King, Marie A. Simovich, Richard C. Brusca. 1996. "Species richness, endemism, and ecology of crustacean assemblages in northern California vernal pools." *Hydrobiologia*. Vol 382, Issue 2: 85-116

Christopher J. Javornik, Sharon K. Collinge. 2016. "Influences of annual weather variability on vernal pool plant abundance and community composition." *Aquatic Botany*. Vol 134: 61-67

Murielle Guestem, Roy C. Sidle, Alexia Stokes. 2011. "The influence of plant root systems of subsurface flow: implications for slope stability." *Bioscience*. Vol. 61, Issue 11: 869-879