Title: Consumer-resource interactions of endangered mountain yellow-legged frog tadpoles.

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Outline:

Abstract:

Worldwide declines of amphibian populations and loss of amphibian biodiversity have prompted investigations into the ecological functions of endangered and declining amphibian species. In the Sierra Nevada of California, mountain yellow-legged frogs are nearly extinct, yet we have little explicit knowledge of their ecological interactions, especially for the grazing tadpoles. We performed two experiments to quantify the extent to which tadpole grazing can control abundance of benthic material, and to quantify to the extent to which tadpoles competed with another abundant grazer, mayflies (Ephemeroptera). In field enclosures in two remote high elevation lakes, we manipulated the densities of tadpoles and mayfly nymphs in a response surface design, and measured the abundance of benthic algae biweekly. We found little effect of either tadpole and mayfly density on algal abundance or on the size or growth rate of the corresponding competitor. To test the effects of consumers on algae, independent of potential effects of the lake, we performed mesocosms experiments in which we manipulated the presence and absence of high densities of tadpoles and mayflies. Tadpole presence had a negative effect on algal abundance and growth rate. Taken together, these two results suggest that the absence of endangered mountain yellow-legged frog tadpoles allows higher algal growth, this effect may be mediated by environmental conditions such as those found in natural lakes. The ecological effects of amphibian declines are likely to be context dependent, and may be small where abiotic conditions, rather than biotic processes, exert strong control of communities.

1. Introduction
   1. Amphibian declines
   2. Mountain yellow-legged frog declines
   3. Tadpoles as grazers and competitors
   4. Potential effects of tadpole loss
   5. Predictions/hypotheses:
      1. Abundance of algae lower in presence of tadpoles, and more so with higher densities of tadpoles
      2. In field enclosures: both consumers exhibit both intra and interspecific competition
         1. Tadpoles are smaller or slower growing at high densities
         2. Mayflies are smaller or slower growing/less emergent at high densities
         3. Mayflies are smaller or less emergenent in presence and at high densities of tadpoles.
      3. In Mesocosms, presence of tadpoles reduces algal abundance/growth
         1. Tadpoles reduce algae
         2. Mayflies reduce algae
         3. Tadpoles and mayflies each smaller when together
   6. Objective:
      1. To quantify the effect of MYLF tadpoles on resources and a potential competitor
2. Methods
   1. Field Enclosures (aka “Field”)
      1. Design: response surface, nestedness, blocking, sampling dates
      2. “Controls”: no consumer ‘bags’ sampled each week also
      3. Animal collections
      4. Sample collection: Algae for AFDM
      5. Other collections
         1. Tadpole wet weights, gosner stage, “emergence”,
            1. Vs. wild tadpoles
         2. Mayfly emergence, identity
            1. Vs. wild mayflies
   2. Mesocosms (aka “Mesocosm”)
      1. Blocking, randomization, sampling dates
      2. Animal collections/transportation
      3. Mayfly issue
      4. Sample collection: Algae for AFDM
      5. Other collections
         1. Tadpole
   3. Lab Processing
      1. AFDM of algae
      2. Tadpole, mayfly AFDM
   4. Analytical Methods
      1. Summary statistics –
         1. datasets separated by lake?
         2. Temporal patterns – or averaged over times?
      2. Independent variables
         1. Factors:
            1. F: Mayfly density, Tadpole density, estimated biomasses, change in estimated consumer biomass
            2. M: Tadpole presence/estimated biomass
         2. Covariates: Days of growth/SamplePeriod, substrates, insolation,
         3. Random:
            1. Field:

lakes (encompasses temperature, elevation, nutrient availability, etc)

date/Sample Number/block

* + - * 1. Mesocosm: block
    1. Dependent variables:
       1. Any of
          1. Algae AFDM,
          2. Algae AFDM/m2,
          3. Algae Growth Rate: change in AFDM between two samples, and Algae Growth Rate per m2.
          4. “Control Difference”: The experimental AGR/m2 subtracted from the “control” AGR/m2
       2. Field also included:
          1. Tadpole size/weight/stage
          2. Mayfly

1. Results
   1. Field
      1. Algae abundance/growth
      2. Mayfly
      3. Tadpoles
   2. Mesocosm
      1. Algae abundance/growth
2. Discussion
3. References
4. Tables
5. Figures
   1. Photos of enclosure in LeConte, mesocosms with tadpoles visible