Amphipod Predation on Northern Red-Legged Frog Embryos

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Introduction
- Predation on early anuran life stages has potential to
  influence population dynamics\(^1,2\), act as an important evolutionary force\(^3\), and link anurans to breeding pond food webs\(^4\).
- Amphipods can be found in freshwater ponds but are usually considered detritivores.\(^7\)
- Amphipods have been documented to consume a variety of small organisms under certain conditions,\(^3,4,7\) but amphipod predation on amphibian embryos or larvae has never been documented.
- Here, we report on predation of Northern Red-Legged Frog (Rana aurora) embryos by the amphipod Crangonyx spp.

Study Sites:
- **Big Lagoon, CA (BL)**
  - Closed canopy
  - Sparse emergent vegetation
  - Cold, deep water
  - Common potential egg predators = caddisfly larvae, northwestern salamanders
  - No amphipods

- **Humboldt Bay National Wildlife Refuge, CA (HBNWR)**
  - Open canopy
  - Abundant emergent vegetation
  - Warm, shallow water
  - Common potential egg predators = diving beetles, giant water bugs, mosquito larvae, caddisfly larvae, dragonfly larvae, rough-skinned newts
  - Abundant amphipods (Crangonyx spp)

Methods:
- To determine predation rates of *R. aurora* embryos, we performed experiments with a paired design by enclosing pieces of egg masses in chambers that excluded predators of various sizes.

**At BL Site**
- **Open treatment:** all predators can access eggs
- **Screened treatment:** only predators ~ 1.5 mm diameter can access eggs

**At HBNWR Site**
- **Open treatment:** all predators can access eggs
- **Screened treatment:** only predators ~ 1.5 mm diameter can access eggs

**Amphipod-addition treatment:** amphipods added to enclosed chambers at approximately 2X ambient pond density

**Amphipod-exclusion treatment:** no visible predators can access eggs

- We calculated predation rates as the ratio of viable embryos that disappeared prior to the week before hatching (because tadpoles could easily swim out of open chambers once hatching began) to the number of viable embryos originally put in the container.

Conclusions:
- Amphipods act as a major embryo predator at HBNWR. There, predation by amphipods was about as significant as predation at BL by larger organisms such as salamanders.
- Growing amphipods may have become trapped in screened chambers, inflating the screened predation rate or conditions within the enclosed amphipod-addition chambers may not have been optimal for amphipod survival, reducing the amphipod-addition predation rate.
- The significance of predation by amphipods for whole egg masses in the open pond at HBNWR is likely affected by amphipod density and food availability and the size and cohesiveness of egg masses.
- Differences in biotic communities and environmental conditions likely explain why embryo predation by amphipods was observed at HBNWR but not BL.
- This is the first published account of amphipods acting as predators on amphibians.
- Amphipods can be predators and their role in the food web may vary considerably depending on the specific system studied. As with any ecological interaction, the influence of amphipod predation on amphibian population growth or evolution is likely to be highly context dependent.

Results:

<table>
<thead>
<tr>
<th>Site</th>
<th>Open Treatment</th>
<th>Screened Treatment</th>
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<tbody>
<tr>
<td>BL</td>
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<tr>
<td>HBNWR</td>
<td><strong>A+</strong></td>
<td><strong>A-</strong></td>
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</tbody>
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Predation rates of *R. aurora* embryos at different levels of predator exposure at 2 breeding ponds in Humboldt County, California. A+ and A- represent amphipod addition to and exclusion from chambers, respectively. Error bars indicate ±1 standard error.

Literature Cited:

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