An Amphibian Community After Fish Removal: A Tale of Four Ponds

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Introduction

Habitat loss and fragmentation are important contributors to population declines in many species. Maintaining suitable habitat has become a priority for managing several amphibian species. The introduction of predatory fish can alter amphibian communities structure (1,4,7). Removing introduced fish can help restore suitable habitats for individual amphibian populations (8), but long-term assessments of such removals are lacking at the community level in the literature.

Rotenone™ is used commonly in fisheries management for the eradication of exotic and introduced fish (5). The most effective application time for Rotenone™ is in late fall or winter, when amphibians are not active, to limit the impact on non-target organisms, and yet remove introduced fish.

OBJECTIVE:

1. Determine the impact of fish removal on an amphibian community.

A. Determine changes in community structure

B. Determine changes in larval recruitment

Methods

❖Warbler Woods Nature Preserve (81.5 ha) contains secondary oak-hickory forest, old agricultural fields with tree seedlings, and four ponds (3 permanent ponds, and 1 ephemeral pond; labeled A,B,C, and D, respectively).

❖Drift fences with pit-fall traps were constructed around the majority of each pond. Since May 2000, traps were monitored every 48 hours, from mid-February to late-November.

❖Individuals collected from the traps were measured (snout-vent length [±1 mm], tail length [±1 mm]), toe-clipped by cohort, and released.

❖Rotenone™ was applied in Ponds B and C in 2002 (Year 3) to remove fish, and again in Pond B (Fig. 2) in 2003 (Year 4).

❖T-tests with a BACI design (6) were used for statistical analysis to test each species' abundance before and after fish removal in each pond.

❖An ANOVA was used to determine changes in juvenile recruitment pre and post fish removal.

Fish Removal Summary For Each Pond

Ponds A and D: Never contained fish (D is ephemeral, going dry on or before August 2)

Pond B: Black Bullhead catfish (*Ameiurus melas)* removed after the third year

Pond C: Bluegill (*Lepomis macrochirus)* & green sunfish (*Lepomis cyanellus)* removed after the second year

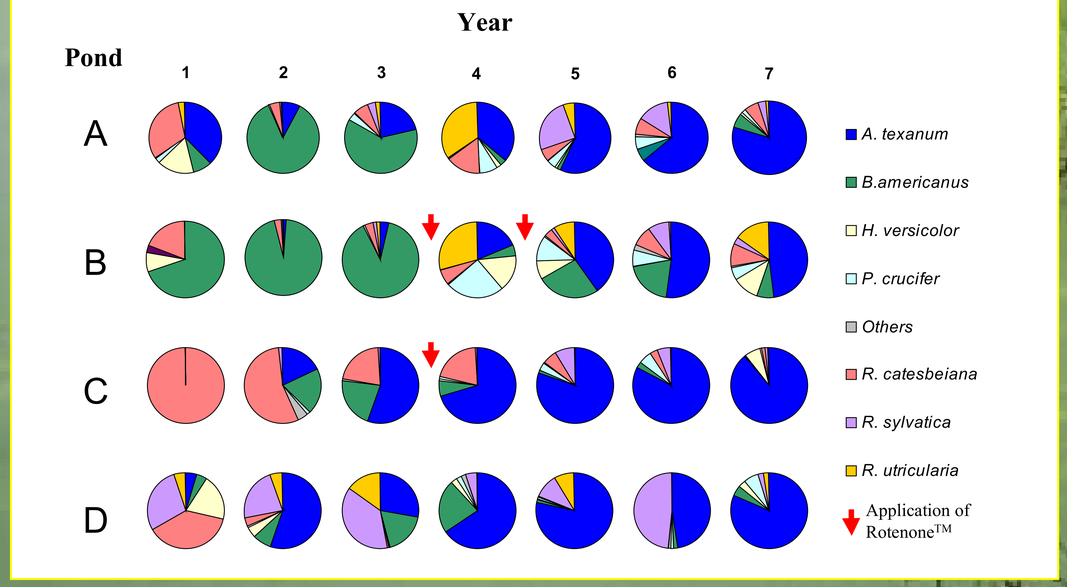

Figure 1: The proportional species abundance for each of the four ponds, for all seven years. *Bufo fowleri, Acris crepitans,* and *Pseudacris triseriata* are represented by the "others" category. The red arrow represents when the applications of Rotenone™ occurred. Years 1 and 7 comprise of partial data sets.

Figure 2: Rotenone™ application in pond B

References

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Results

❖The BACI analysis indicated differences in *A. texanum* abundance for pre- and post-fish removal periods in ponds A and B ($T = -2.78$, $P = 0.04$), as well as ponds A and D ($T = -2.75$, $P = 0.04$).

❖Juvenile recruitment in *A. texanum* was greater in mitigated ponds after fish removal ($F_{1,12} = 5.73$, $P = 0.034$).

❖There were no differences between any pond combinations in all other species.

Discussion

❖Amphibian populations are known to naturally fluctuate through time.

❖Only *A. texanum* populations increased following fish removal. Other species also exhibited trends in population fluctuation as a function of treatment type (Fig. 1), even though these were not significant.

❖It is unlikely that all the changes experienced by each species were due to natural population fluctuation. Fish had an influence on the amphibian community before their removal.

❖Prey species such as *B. americanus* and *R. catesbeiana* are avoided by fish (either due to unpalatability or predator gape limitation; 3,4,7). Both *R. catesbeiana* and *B. americanus* were dominant in ponds B and C when fish were present, but have diminished in abundance since the fish were removed (Fig. 1).

❖Other species – *A. texanum, R. sylvatica, P. crucifer, and H. versicolor* – are palatable to fish (3,4,7), and have increased their proportional abundance since fish were removed (Fig. 1).

❖Recruitment of larval smallmouth salamanders improved in the 2 years following fish removal; we suspect that similar improvements were experienced by other amphibian species, except for *B. americanus* which is an inferior competitor at the larval stage.

❖We do not believe that Rotenone™ had any negative impact on the amphibian community due to the fact that *R. catesbeiana* tadpoles were still present at time of application.

❖Rotenone™ is an effective way to remove fish from amphibian breeding habitat, especially in situations where continued monitoring of its long-term effects is possible.