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Abundance and size distribution of *Phallicthys amates* in different vegetation types

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Abstract: Fish abundance and size structure in different vegetation types may vary according to predation risk and prey abundance. In daylight, dense submerged vegetation may offer more protection from visual predators than does floating vegetation. Thus, we predicted that small mosquito fish (*Phallicthys amates*) would be more abundant in submerged than in floating vegetation in daytime samples. We found a greater abundance of *P. amates* in the submerged vegetation, but contrary to our hypothesis, the fish were smaller in floating vegetation.

Key Words: *microhabitat distribution, predation pressure,* Ceratophyllum spp., Eichornia crassipes.

INTRODUCTION

In the freshwater marsh near the Rio Tempisque at the Palo Verde National Park, Costa Rica, submerged vegetation appears more structurally complex than that dominated by *Eichornia crassipes* (floating water hyacinth). Fish size and abundance vary with structural complexity of microhabitats, possibly because a complex habitat provides cover from visually feeding predators (Blue *et al.* 1993). Prey abundance also depends on habitat complexity. Zooplankton, prey for the small mosquito fish, *Phallicthys amates*, (Carson *et al.*, 1995) are more abundant in submerged than in floating vegetation during the day (Poulin *et al.*, 1998). We therefore hypothesized that *P. amates* would be more numerous in submerged than in floating vegetation during the day. Second, because small fish tend to be more susceptible to visually feeding piscivores, smaller fish should be more abundant in submerged than in floating vegetation. Finally, we hypothesized that there should not be a difference in the abundance or size of fish found in the two vegetation types at night, due to reduced visual predation pressure.

METHODS

We sampled *P. amates* using seine hauls and minnow traps on 11-12 January 1999. Sample sites were randomly chosen in a sunny marsh bordering the air strip, approximately 200 m north-west of the bird tower. We defined two types of microhabitats: "submerged" areas were dominated by a dense matrix of *Ceratophyllum spp.* 1-2 cm below the surface, with no plants above this matrix; "floating" areas were completely covered by a surface mat of *E. crassipes* , with roots extending into the water column.

Three 2 x 2 m seine hauls were done in submerged macrophytes; two 2 x 1.5 m hauls and one 2 x 1 m haul were done in floating vegetation. Three minnow traps (6.0 mm mesh) were set in each microhabitat for 6 hrs in the day and 14 hrs at night. Traps set in submerged vegetation were at least 0.5 m from emergent macrophytes. Length was recorded for each *P. amates* collected. Fish abundance data from the hyacinth seine hauls were adjusted to correct for the smaller area sampled.

RESULTS

Total *P. amates* abundance in seine hauls was greater in submerged than in floating vegetation (Table 1; Pearson Test, X^2=28.5, df=1, P < 0.0001). There was no significant difference in abundance of *P. amates* between vegetation types for day traps (Table 1; Wilcoxon Test, X^2=0.17, df=1, P=0.68).

The mean length of *P. amates* in day traps was 32.6 mm (SE = 1.42) in submerged vegetation and 28.6 mm (SE. = 1.10) in floating vegetation (Fig 1; Wilcoxon Test, X^2=5.9, df=1, P=0.016). Seine hauls revealed no significant relationship between mean fish length and microhabitat (Wilcoxon test, X^2=1.00, df=1, P=0.32). No *P. amates* were captured in the traps at night.

Table 1. Abundance of *P. amates* in different vegetation types during the day, compared between two sample types. Values are totals for 3 seine hauls and for 3 minnow traps (for 6 hrs) in each vegetation type.

Sample Type	Submerged Vegetation	Floating Vegetation
Seine Hauls	56	9
Minnow Traps	22	13

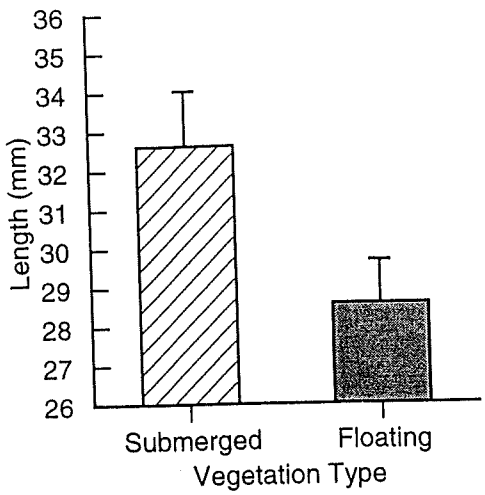

Fig. 1. Length of *P. amates* individuals caught during 6 hours of passive sampling at Rio Tempisque in Palo Verde, Costa Rica (mean ± 1 S.E.; submerged, n= 22; floating n = 13).

Discussion

As hypothesized, total abundance was higher in submerged than floating vegetation, suggesting that zooplankton density influences the spatial distribution of *P. amates*. However, contrary to our second hypothesis, *P. amates* under floating vegetation tended to be smaller than those under submerged vegetation during the day. This suggests that differences in predation pressure between the habitats, and differences in the vulnerability of small vs. large *P. amates*, may differ from our initial assumptions. *E. crassipes* forms a dense layer of surface vegetation that may provide shelter from wading birds that eat small fish. Also, larger *P. amates* may be more visible to predatory fish, and therefore more vulnerable to predation than juveniles; if so, larger *P. amates* would be expected in the complex submerged vegetation than in the floating vegetation.

Due to a large mesh size, the minnow traps were not as effective as seining for capturing juveniles. Also, larger fish are often able to escape seines (P. Pickhardt, *pers comm*). Thus, these two methods resulted in different size distributions sampled from the same population.

We were unable to catch fish at night to test our hypothesis that the abundance and size distribution of *P. amates* at night should be uniform across habitats. At night, *P. amates* may frequent parts of the marsh different from those that we sampled, or our sampling method may have been ineffective at catching them.

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