COMPOSITION OF PELAGIC FISH COMMUNITIES IN POOLS FORMED DURING THE DRY SEASON IN CORCOVADO NATIONAL PARK, COSTA RICA

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Abstract. The drop in water level of Corcovado's Rio Danta during the dry season results in the formation of pools ranging from 0.1-43.1m^3 . The fish in these pools are predominantly pelagic feeders. The total biomass of fish in a pool was significantly and positively correlated with pool volume. Although we predicted that the amount of foliage cover over a pool, our estimate of the amount of allochtonous food input, would affect the total biomass of its resident fish, no relationship was found. Furthermore, no relationship appears to exist between the amount of detritus in a pool and fish biomass. In conclusion, the criterion used by fish in the selection of pools appears to be pool size, and not the availability of food resources. (ABS)

INTRODUCTION (EWG)

During the dry season in Corcovado National Park, stream water levels drop dramatically, forming isolated pools of various size. We observed that most of the fish in these pools were pelagic, feeding primarily on allochtonous material, such as insects and plant matter, which fell from the overhanging vegetation. We also observed that larger fish seemed to inhabit pools of larger volume; it is likely that large pools provide protection from wading and diving birds as well as accumulate more food than small pools by virtue of their size. Percent foliage cover and detrital load were also examined as indicators of food input. We hypothesized that pools with the highest foliage cover, detrital load, and volume would have larger fish and greater total fish biomass.

METHODS (JJB)

Study site. We studied a small (~0.5km) portion of the Rio Danta, that passed through an area of primarily second growth forest, containing high densities of *Cecropia* and *Balsa* trees. The onset of the dry season reduced the water level of the river, exposing most of the stream bed and confining the remaining water to pools. These pools were isolated from one another or connected by low flow areas of shallow riffles. As a result, the fish populations in these pools were also isolated from one another.

We found six species of fish and three were identified as benthic feeders by their wide, flat ventral surface and a ventrally located, sucking mouth; benthic fish are not included in our analysis. The three pelagic species observed consisted of (i) a cichlid, (ii) a species resembling a large tetra, and (iii) a species with a characteristic minnow shape. Cichlids occurred sporadically in the large, deep pools. Minnows made up roughly 5% of the sample, while tetras constituted the vast majority of pelagic individuals. The pelagic fish, with the exception of the cichlids, fed almost exclusively at the surface/air interface. They were observed converging on surface disturbances, including fallen insects, balsa flowers which contained insects, and non-food items such as sticks or rocks. When the surface water was undisturbed, the fish swam, either in small schools or singly, in the

Table 1. Contingency table comparing fish size to pool size.

		Fish Size		
Pool Volume	n	Small (0-4cm)	Medium (4-8cm)	Large (>8.0cm)
Small (0-1.5m^3)	20	356	7	0
Med. (1.5-9.0m^3)	24	1957	225	61
Large (>9.0m^3)	12	2246	494	245

epipelagic zone, almost never venturing into the benthic zone. Especially in the dry season when flow between pools is restricted, most of the diet of these fish probably consists of direct terrestrial input of Arthropods, some of which are associated with falling plant material.

Field Methods. On 27 January 1992, we sampled the first 56 pools we encountered as we traveled downstream from the intersection of the Rio Danta and the Pavo trail in Corcovado National Park, Costa Rica. A pool was defined as an isolated body of water with an undetectable flow rate. Flow was measured as the distance a seed of neutral buoyancy traveled in one minute. We established fish size classes based on preliminary observation. Small fish were <4cm long, medium fish ranged from 4-8cm, and large fish were >8cm. All observed fish in each pool were counted and placed into the preestablished size classes. In places where fish could not be clearly seen, buoyant objects, such as sticks, were tossed on the water surface. Nearby fish would converge on these areas, facilitating counting. We collected fish with a net, then weighed and measured them in order to establish a biomass to size relationship.

Physical attributes of each pool were also recorded. Measurements of length, width, and average depths were recorded, and multiplied together to obtain a volume index. Detrital load was estimated as low, medium, or high. Estimates of both canopy and understory foliage cover were also made; the two estimates were then averaged to establish a single value for total vegetative cover.

RESULTS (ABS)

Large pools contained significantly longer fish than small pools (χ^2=206.11, p<.005; Table 1). The fish length to fish biomass relationship established from our capture and release data (Table 2) enabled us to calculate the total biomass of fish in each pool sampled. The relationship between the natural logarithm of total fish biomass and pool volume (Figure 1) was significant (r=.71, p<.005).

Table 2. Biomass of Rio Danta fish by size class.

Fish size	Biomass(g) of sampled individuals
Small (0-4cm)	1.5, .75, .5, .5, .5, <.5
Medium (4-8cm)	4.5, 7.0
Large (>8cm)	14.0

To our surprise, we found that foliage cover was significantly correlated with pool volume (r=.26, p<.025). Using multiple regression analysis (independent variables: foliage cover and pool volume), the relationship between total fish biomass and volume was slightly stronger (r=.74). The rela

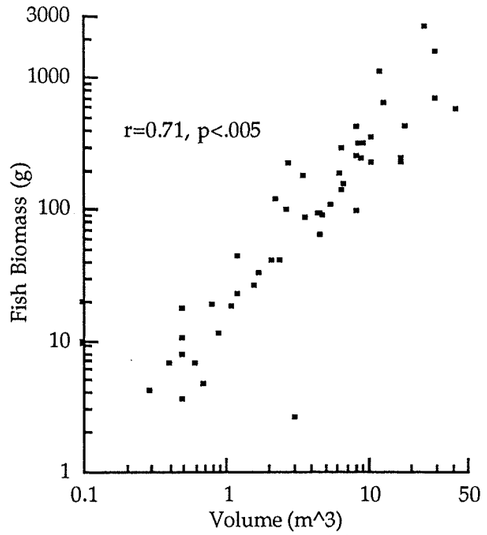

Figure 1. Total biomass of fish in pools of various size.

tionship between foliage cover and fish biomass was negative (r=-0.11).

In an attempt to determine if detrital load influenced biomass of fish, we grouped our pools into volume classes and plotted these two variables against one another (Figure 2). In large pools, the biomass of fish appears to increase with detrital load while in medium sized pools high amounts of detritus has the opposite effect. In small pools, detrital load appears not to affect fish biomass.

Discussion (JAR)

The significant relationship between pool volume and fish biomass, and the observation that large pools contain significantly more large fish than small pools both agree with our initial hypothesis. These results suggest that large fish are selecting large pools as the water level falls during the onset of the dry season. Small fish appear not to select for large pools since they were consistently found in pools of all sizes.

The selection of large pools by large fish could result in a decreased risk of predation for these individuals. Potential predators such as the kingfishers and herons, which were frequently observed in the area, would most likely have a more difficult time catching fish in a large pool than in a small pool. Differences in predation rates between pool sizes, rather than pool selection on the part of the fish, could, therefore, be the cause of the observed relationships.

Although no significant correlation exists between foliage cover and biomass, the fact that the correlation coefficient is negative is interesting in itself. The negative value suggests that biomass decreases as foliage cover, increases, contrary to our initial hypothesis. Such a relationship could possibly be explained by the amount of detritus in the pools. High foliage

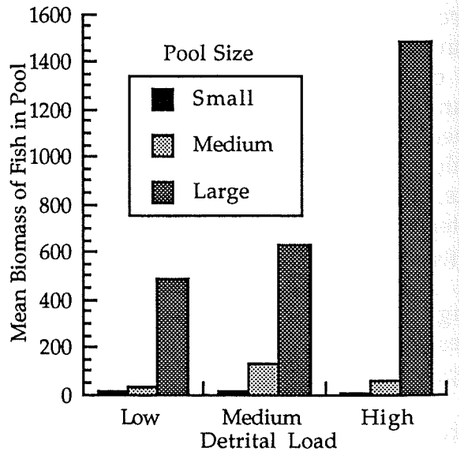

Figure 2. Comparison of detrital load and fish biomass in small, medium, and large pools.

cover could result in increased detrital input, possibly producing anoxic conditions in the pool due to increased decomposition. Another possibility is that high detrital loads result in intolerable concentrations of chemicals leached from the leaves. We found, however, conflicting trends for the effects of detrital loads on fish biomass. In medium pools, increasing detritus seemed to support less fish biomass, but this trend was reversed in large pools. No trend was noted for small pools. This pattern could be explained by the possibility that the chemicals leached from the detritus and the anoxic conditions produced by decaying detritus have less influence on the total water quality in larger pools. Additional studies in which pool water was chemically analyzed and detrital loads were quantified more precisely would be useful.