Fatty Acids Composition of Consumer and Producers Along a Gradient of Water Flow

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Background: The energetic and nutritional content of an organism's food constrains their energy budget and is fundamentally linked to their fitness. The energetic budget, however, is not fixed. In the case of consumers, the energetic resources are not only affected by the quantity of the food they obtain but also by the quality of what they are consuming. In fact, the transfer of energy among the components of the food web is highly dependent upon the quality of the food source. Thus, examining the nutritional value of the diet to which a given species is exposed would allow us to better characterize the mechanisms driving demographic performance and local population dynamics.

Problem: Periphyton is an association of autotrophs and saprophytes that is the primary basal source of energy and elements for many aquatic food webs. Changes in water flow velocities can alter the species composition of the periphyton.. Because not all species are of equal nutritional value, it could be argued that the quality of periphyton as energy/food source, will be modified by changes in its species composition, abundance, and biomass. Few studies evaluate the relationship between environmental gradients and periphyton nutritional quality in wetlands, limiting our capacity to link it to population, and ultimately ecosystem, function.

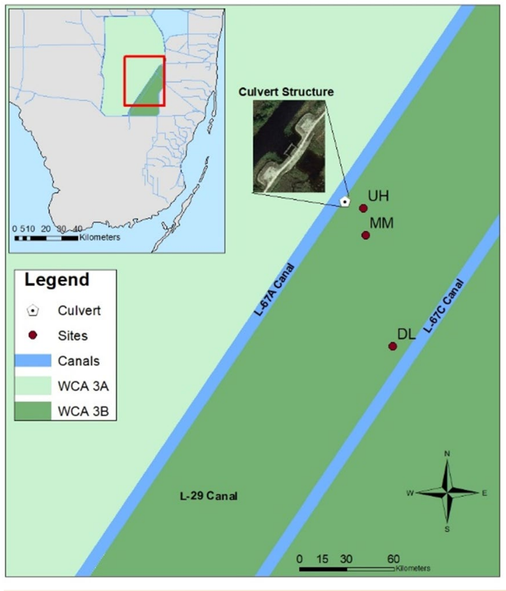

Figure 1: Map showing the study area. UH = upstream high-water, MM= midstream mid-water flow, DL = downstream low-water flow

Objective: This work describes a field experiment evaluating the impact of increasing water velocity on resource quality and resource-consumer relationships in the Everglades (Fig. 1).

Specific objectives:

1) Determine whether the nutritional quality (Fatty acid composition) of the periphyton (resource) vary with respect to increase in water increase water flow.

2) Determine whether changes in periphyton nutritional quality, if so, is reflected in fish consumers.

Figure 2: Fragment of a typical food web in the Everglades Example of the enclosures used during the experiment

Methods: We created a food-web fragment within enclosures established at three locations within the Everglades differing in water velocity (0 cm/s, 3-4 cm/s, 5-7 cm/s; Fig. 1). The food web consisted of primary producers (periphyton mats and biofilm), a grazer (Ramshorn snail), an omnivorous fish (Eastern Mosquitofish), and a carnivorous fish (Blue-Spotted Sunfish) (Fig. 2). After six weeks the components of the food web were retrieved and their fatty acids (FA) profiles were compared. We present the results for the fish and the periphyton, tissue samples from the Ramshorn snail are being processed.

Results: The Principal coordinate analysis (PCoA) clustered the FA profiles into two groups sharing 70% of similarity (Fig.3). One group corresponded to the species of fish and the other to the periphyton types.

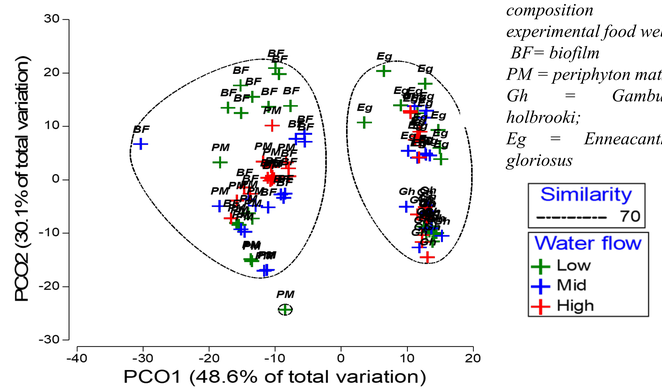

Figure. 3 Principal coordinate analysis (PCoA) for fatty acid composition of experimental food webs.
BF= biofilm
PM = periphyton mats;
Gh = Gambusia holbrooki;
Eg = Enneacanthus gloriosus

Results of the ANOSIM test indicates that irrespective of the biotic component, FA profiles tend to be similar among water flow treatments (Table 1). In contrast, R values close to 1, suggest that the FA profiles of producers and consumers are highly dissimilar (Table 2), supporting the separation of groups by the PCoA. Interestingly, it was found that the FA composition also varies considerably within groups (periphyton or fish).

Groups	R statistic	Significance
Low; Mid	0.364	0.001
Low; High	0.519	0.001
Mid, High	0.380	0.001

Table 1. Similarity values (ANOSIM) between fatty acid profiles of the food-web components in the Everglades with respect to water flow.

Groups	R statistic	Significance
Gh, PM	0.973	0.001
Gh, BF	0.935	0.001
Eg, PM	0.979	0.001
Eg, BF	0.909	0.001
Eg, Gh	0.829	0.001
PM, BF	0.718	0.001

Table 2. Similarity values (ANOSIM) between fatty acid profiles of the food-web components in the Everglades with resect to biotic component.

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