

Stable isotope compositions at microhabitat scale of macrofauna inhabiting a tropical freshwater stream (Pérou River, Guadeloupe)

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Introduction: Many tropical freshwater trophic webs are described as detritus-based systems, characterized by short food chains, with a high degree of omnivory. In the highly turbulent tropical insular rivers, autochthonous production of organic matter is limited and is mainly represented by scarce filamentous green algae and an abundant epilithic biofilm growing on wet stones and on macrophytodebris, in the river bed.

The habitats and life cycles of the freshwater species of the French West Indies are today exposed to threats. A better knowledge of the trophic relationships between freshwater resident species is necessary to bring to light the fluxes of matter and pollutants in these insular ecosystems in order to manage and to conserve this vulnerable freshwater fauna.



Figure 1: Pérou River sampling site (Guadeloupe)

Material and methods:

A section of 80 m in the river Pérou (figure 1) was divided in 132 quadrates. Electric fishing was performed in each quadrate and individual isotopic measurements using EA-IRMS (Isoprime, UK) were done using abdominal muscles for crustaceans and lateral muscles for fishes. Potential food sources (green ripisylve, macrophytodebris, epilithic biofilm and deriving organic material) were sampled and analyzed for their isotopic compositions.

Results I: Nine species were recorded belonging to four decapod families (n= 8 species) and one fish family (n= 1 species). This fauna, dominated by crustaceans (figure 2), was typical of high and medium elevations of Caribbean rivers in relatively pristine area. In these turbulent biotopes, species encountered are strongly linked to the hydrological characteristics of their microhabitat. Dominant species such as the decapods *Atya innocous* have well defined preferenda for turbulent water.



Figure 2: Example of crustacean species found the river Pérou fauna: *Atya innocous* (Atyidae) (a) ; *Macrobrachium heterochirus* (Palaemonidae) (b) ; *Xiphocaris elongata* (Xiphocarididae) (c) (photos: Nicolas Marichal)

Results II: Autochthonous biofilm displayed less negative delta ¹³C values than macrophytodebris food sources and than deriving material (mostly composed of fragmented macrophytodebris) (figure 3).

Two species were mainly biofilm consumers in this area: the gobiid fish *Sicydium* sp. and the crustacean decapod *Xiphocaris elongata*. The other species displayed mixed diet, partly composed of macrophytodebris from ripisylve. The way for biofilm consumption may differ between species: browsing or sucking directly on the rocks or on the macrophytodebris surface and/or consumption of macrophytodebris and digestion of associated decomposing microbes.

Delta ¹⁵N value differences between analysed food sources and consumers were relatively high (Δ¹⁵N between 2 and 4 ‰) for crustacean (and particularly for detritivorous consumers). This indicated probably a certain degree of carnivorous consumption for some species (such as the edible decapod *Macrobrachium heterochirus*) and/or the recycling of their chitinous molting cuticles.

In this river section, consumers did not conserve any trace of their larval stage in the sea, contrary to individuals living nearer the sea (Coat et al., 2008). Indeed, all the analyzed species are amphidromous and colonize the river as walking/swimming juveniles, climbing progressively to the head of the river.

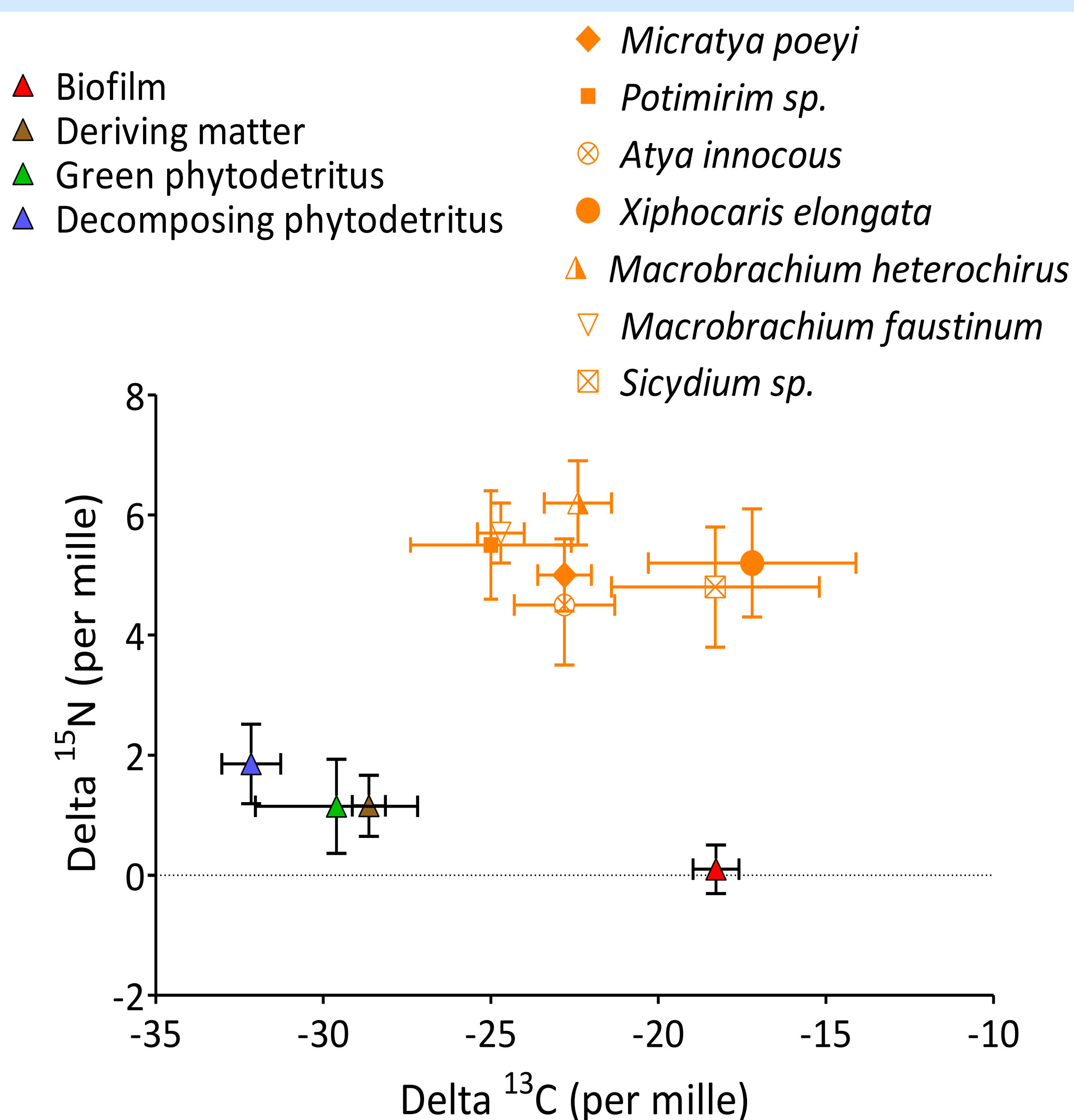


Figure 3 : Stable isotopic compositions of potential food sources and consumers sampled in the River Pérou (Guadeloupe)

Take home message:

- Only few species, dominated by the decapods species *Atya innocuous*, were found in this turbulent section of a little tropical stream,
- Autochthonous material (biofilm) and allochthonous (macrophytodebris) both fuelled this simplified trophic web,
- In this river section, all the consumers were in isotopic equilibrium with their local food sources and did not show no more trace of their marine life time,
- Predatory (or molt recycling) compartment is probably involved in the diet of some species.