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Crayfish effects on fine particulate organic matter quality and quantity

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With 5 figures

Abstract: Coarse particulate organic matter (CPOM), especially leaves, plays a key role in food webs of many streams and can be converted to fine particulate organic matter (FPOM) by specific macroinvertebrate functional groups (i.e., shredders). In this study, we examined crayfish [*Orconectes obscurus* (Hagen)] effects on FPOM generation from two leaf types, red maple and white oak, that differ in recalcitrance and decomposition rates. Further, we examined potential quality differences between FPOM generated by crayfish via fragmentation and defecation. Crayfish were fed stream-conditioned maple or oak leaves in hanging 1-mm mesh-bottom baskets in aquaria. After 12 h, C:N ratios and dry/ash-free dry weights of remaining CPOM, FPOM fragments that fell through the mesh, and crayfish feces (collected using finger cots that encased the crayfish abdomens) were determined. Loss of CPOM attributable to crayfish feeding was higher for maple than oak; fragment FPOM and crayfish feces generation were also higher for maple. Maple CPOM percent organic matter was lower than oak CPOM but feces and fragment FPOM percent organic matter did not differ among leaf species suggesting that crayfish actions homogenize the properties of particulate organic matter. Both C:N ratios and bacterial abundance were also altered by crayfish processing and digestion underscoring potential crayfish effects on FPOM bioavailability. Overall, crayfish altered the ontogeny of the detritus, which may, in turn, affect stream FPOM dynamics.

Key words: crayfish, macroinvertebrates, leaves, FPOM, CPOM, detritus.

Introduction

In stream ecosystems, allochthonous detritus is of particular importance as a source of energy and nutrients (Wallace et al. 1982, Wallace et al. 1999, Webster et al. 2000). Therefore, understanding detrital processing is critical for conceptualizing how stream ecosystems function. Several macroinvertebrate functional groups, including shredders and collectors, play relatively specific roles in detrital processing (Cummins et al. 1973, Cummins & Klug 1979). As described in the shredder-collector facilitation hypothesis (Cummins et al. 1973, Heard & Richardson 1995), shredders convert coarse particulate organic matter (CPOM, particles ≥ 1 mm) to fine particulate organic matter (FPOM, particles < 1 mm), which is consumed by collectors (Cummins et al. 1973, Cummins & Klug 1979, Vannote et al. 1980, Heard & Richardson 1995, Short & Maslin 1977, Wallace & Webster 1996). In fact, shredders positively impact collector production in the laboratory (Dieterich et al. 1997), increase decomposition rates of leaf litter in the laboratory (McDiffett 1970, Cummins et al. 1973, Usio & Townsend 2001) and in the field (Usio 2000), and increase the amount of FPOM produced (Cummins et al. 1973, Grafius & Anderson 1979, Usio et al. 2001).

In spite of the clear connection between shredders and FPOM availability, little information is available on how FPOM quality is influenced by shredders. As shredders process CPOM, they release undigested

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