Food Web Structure of Benthic Macroinvertebrates in a Second Order Stream of the Hanjiang River Basin in Middle China

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ABSTRACT

Because few detailed invertebrate food webs on riverine ecosystems have been reported in Asia, we undertook a dietary study on Heizhuchong Stream, a second order stream in Hubei Province, China. Dietary information was obtained from foregut content analysis of the dominant benthic macroinvertebrates from June 2003 to June 2004. Allochthonous inputs were the most important food sources for the macroinvertebrate community; amorphous detritus comprised 38.3-98.8% of their diets.

INTRODUCTION

The major goal of food web theory is to learn the operational patterns of natural communities (Pimm et al. 1991). Early analyses of collections of the reported food webs from various habitats suggested that food webs show consistent structural patterns (Briand and Cohen 1984, Cohen et al. 1990, Pimm et al. 1991). However, these patterns were widely debated among the later researchers (Polis 1994, Dunne 2005). The main debates were focused on limitations of data employed for these analyses, such as the poor quality of many food web data, the small subsets of trophic species analyzed, differences in the methodologies used, the definition of a linkage by ignoring the linkage strength, the level and standardization of taxonomic resolution, and mathematical artifacts (Lawton 1989, Winemiller 1990, Hall and Raffaelli 1991, Martinez 1991 and 1993, Closs et al. 1993, Thompson and Townsend 2000). In recent years food webs constructed with a higher taxonomic resolution (Hall and Raffaelli 1991, Martinez 1991, Tavares-Cromar and Williams 1996, Schmid-Araya et al. 2002a) invalidated some earlier generalizations (e.g., constant L/S, where L is the number of linkages between species of a community, S is the total number of species) and showed that features such as short food chain and omnivory are common in riverine food web structure (Motta and Uieda 2005).

In the 1980s, Benke et al. (1984) recognized the flaws in qualitative methods, and developed detailed quantitative food webs for assemblages of caddisflies, mayflies, and chironomids in streams by combining measures of energy flow (secondary production) with gut content analysis. Later on, other ecologists followed their approach or a variation of their approach to conduct studies on functioning analysis of various ecosystems (Cohen et al. 1993, Tavares-Cromar and Williams 1996, Benke and Wallace 1997, Johnson et al. 2000, Benke et al. 2001, Hall et al. 2001). Thus far, much progress has been made in quantitative description of food webs in aquatic ecosystems (Schmid-Araya et al. 2002b, Zanda and Fetzer 2007). However, most work has been done on the aquatic communities in the USA and European countries (Benke and Wallace 1997, Benke et al. 2001, Tavares-Cromar and Williams 1996, Zanda and Fetzer 2007). As known, food web structure varies spatially and temporally and markedly varies in riverine landscapes of different land use modes (Woodward and Hildrew 2002). Asia is a typical agricultural continent. There land use modes differ greatly from those of the

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