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Importance of parasites and their life cycle characteristics in determining the structure of a large marine food web

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Summary

1. Despite their documented effects on trophic interactions and community structure, parasites are rarely included in food web analyses. The transmission routes of most parasitic helminths follow closely the trophic relationships among their successive hosts and are thus embedded in food webs, in a way that may influence energy flow and the structure of the web.

2. We investigated the impact of parasitism on the food web structure of a New Zealand intertidal mudflat community. Different versions of the food web were analysed, one with no parasites, one with all parasite species and several other versions, each including a single parasite species. We measured key food web metrics such as food chain length, linkage density and proportions of top, intermediate and basal species.

3. The inclusion of all parasite species in the food web resulted in greatly increased mean and maximum food chain length, but had little impact on linkage density and realized connectance. The main change caused by introduction of parasites was the relegation of a number of species from top predators to intermediate status, although the addition of parasites as top predators left the actual ratio of predators to prey relatively unchanged.

4. When individual parasites were added to the food web, their effect on food web properties was generally minimal. However, one trematode species that affected several host species, because of its complex life cycle and low host specificity, produced food web properties similar to those in the web version including all parasite species.

5. The respective effect of individual parasite species was roughly proportional to the number of host species they affected, and thus the life cycle characteristics of parasites determine to a large extent their impact on food web structure. The next step would be to quantify how they affect energy flow through the web.

Key-words: energy, helminths, host specificity, intertidal mudflat.

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Introduction

Food webs are networks of trophic relationships which map the location of energy flows in a community. While there has been criticism levelled at the approach because of historical problems with the quality of data (e.g. Paine 1988; Polis 1994), the best resolved food webs (e.g. Raffaelli & Hall 1992; Schmid-Araya *et al.* 2002; Thompson & Townsend 2003) seem to show attributes that are evocative of real patterning of ecological systems. Despite the increasing detail that has been incorporated into food webs, some functional groups have remained neglected. Among these are the parasites, which have rarely been incorporated into food web studies (Marcogliese & Cone 1997; but see Huxham, Raffaelli & Pike 1995). Host–parasite interactions, however, are ubiquitous in real systems (Poulin & Morand 2000, 2004) and are known to affect community structure (e.g. Minchella & Scott 1991; Combes 1996; Mouritsen & Poulin 2002), trophic relationships (Lafferty 1999; Marcogliese 2002) and energy flow (e.g. Anderson 1977; Mouritsen & Jensen 1998).

Food web context is also thought to have been important in the evolution of many of the characteristics observed in marine parasites, including complex

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