

Spatial and temporal variation in food webs in water-filled treeholes

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Food webs have been drawn for the community of animals found in water-filled treeholes in south-east Queensland, Australia. Such webs have been constructed on a quarterly basis for each of 11 habitat units, using a technique which allows incorporation of relative abundance as well as presence or absence of a species. A significant inverse relationship was identified between the degree of similarity shown in the webs from pairs of treeholes and the intersite distances involved. No significant relationships could be identified between any of the foodweb characteristics – connectance, number of trophic levels, abundance indices or predators of saprophages – and the surface area of the treeholes. There was a significant inverse relationship between the mean relative abundance of the predators and the saprophages, their prey. Explanations for the results are examined, and the interaction of stochastic events and short- and mid-term environmental heterogeneity, it is suggested, best account for the observations. Such 'local' webs, shaped by stochastic events are contrasted with full 'regional' webs for which plausible deterministic explanations are available.

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Introduction

Considerable theoretical interest has been shown recently in the structure and control of food webs (see Cohen 1982, Strong et al. 1984). Although theoretical developments and field evaluation have not proceeded at the same pace, Briand (1983) was able to examine pattern and its environmental correlates across 62 real webs collated from a very scattered literature. The present work contributes to this body of fieldbased information.

Virtually all the studies from which food webs used in the analyses of Cohen (1978), Pimm (1982) and Briand (1983) are drawn, represent the results either of extensive study of a particular ecosystem at a particular time or more lengthy studies through time. By their very nature, these are unreplicated; for example, the food webs of Morgan's Creek, Kentucky or Bear Island are unique statements about particular places. Such summations are useful bases for the generation of general theories

about food web structure but food webs do vary in space and time on a local as well as on a biogeographic scale, and it is this local variation that is described here. For study of such smaller scale variation in web structure, ideally webs should be replicated within a given area. Plant-held waters or 'phytotelmata' provide one of the few situations in which such replication is commonplace and thus are ideal subjects for the study of food web variation (Kitching and Pimm 1985, Pimm and Kitching, in press, Beaver 1985). Phytotelmata are of five basic kinds: leaf and bract axils, bromeliad 'tanks', bamboo internodes, plant pitchers and water-filled treeholes. Each kind contains highly endemic, simple animal communities based, trophically, on the detritus which falls into them (see Frank and Lounibos, 1983, for a general treatment).

The food webs contained in water-filled treeholes have been described from several parts of the world and my own studies have focussed on English, Australian

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