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Effects of functional group diversity on size & stability of hard-bottom community functioning

Introduction

Species diversity is suspected to beget stability in community functioning. Niche complementary (e.g. resources partitioning) and sampling effects are two processes by which diversity may operate to cause positive effects on functional community responses.

Hereby, we ask whether size and stability (= temporal variance) of community function (= clearance rate) is higher in poly- (3 species) than in the respective monospecific assemblages and whether such patterns could be explained by niche complementary or sampling effects.

Fig 1 Polyculture including 3 functional groups, namely barnacles, colonial ascidians, and mussels.

Material and methods

In field experiments clearance rates (CR) of mono- and polyspecific communities were measured. The experiment was replicated at 2 locations: Helgoland island, Germany and Plymouth, UK.

Artificial substrata were made up of 2.5 × 2.5 cm PVC-settlement panels, which were exposed at a range of depths and locations with each site to natural colonisation for 6 months. Colonisers were categorised into 3 functional groups, covering panels monospecifically. Panels were assembled into experimental units containing 9 panels to create assemblages of defined functional diversity. These consisted of the 3 monocultures and one polyculture including all groups (Fig 1). Assemblages were kept in the sea at 1 m depth for 5 months after assemblage, allowing for natural settlement. Clearance rates and species composition of developing assemblages were 5 and 7 times measured during the assay period, respectively.

Temporal variability was expressed as SD Log(y) for CR and the Bray-Curtis dissimilarity index for species composition, which were calculated between 2 consecutive sampling events. Variability measures were summed across all sampling intervals to produce gross variability of CR and species composition during the experiment.

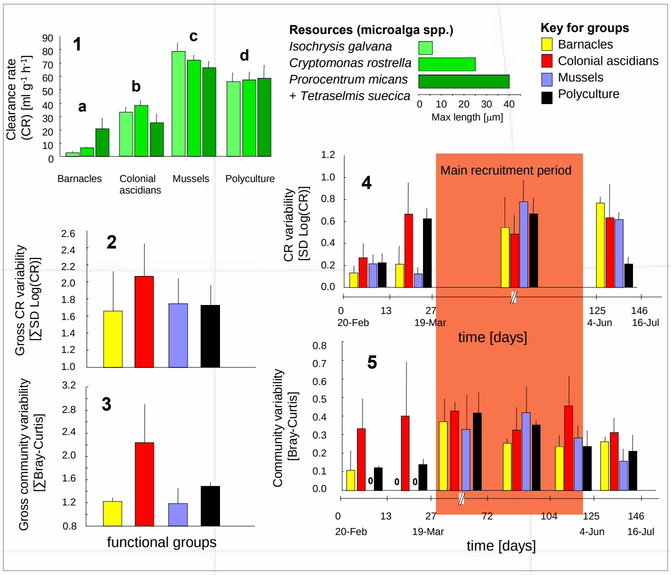

Fig 2. (1) *Clearance rates* (CR) *of functional groups and polyculture on three microalga species; letters denote sig. difference between functional groups. Gross temporal variability (across all sampling events) of* (2) *clearance rates and* (3) *species composition.* (4, 5) *Changes in temporal variability over time.*

NOTE: values are given as **MEAN±SEM, n = 3**

Results

Mussels preformed largest clearance rates (CR), followed by polyculture, colonial ascidians, and barnacles (Fig 2.1, ANOVA $p = 0.014$). The smallest differences were observed between mussels and polycultures (Fig 2.1). There was a non-significant trend for barnacles preferring larger- and mussels preferring smaller-sized prey (Fig 2.1). Neither gross variability of CR nor of community composition significantly depended upon functional group diversity (Fig 2.2, 2.3, ANOVA, $p > 0.19$). However, variability of monocultures of colonial ascidians tended to be higher than in all remaining treatments (Fig 2.2, 2.3). Temporal variability of CR and species composition significantly changed over the experimental period (Fig 2.4, 2.5, ANOVA, $p < 0.008$).

The smallest variability values of CR and species composition occurred at the first two sampling intervals (Fig 2.4, 2.5) Largest variability occurred during the main recruitment period (April-June).

Summary

No clear differentiation in resource utilisation among functional groups suggests the lack of resources partitioning mechanisms. Similarly, no differences in temporal variability among diversity treatments were found.

CR of mussels seems to decrease when is present in polyspecific assemblages, hinting to effects of species density on community functioning.

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