Linking the Densities of Coral Associated Fish Functional Groups to the Benthic Structure

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Introduction

Understanding trophic interaction and the ecological status of marine environment requires an assessment of benthic habitat, fish abundance and biomass. Indeed there is a relationship between benthic habitat and fish community (Pitman et al., 2007).

The taxonomic composition and ecological roles of fish functional groups are diverse. A total of 12 coral associated fish functional groups have been reported, namely piscivores, omnivores, corallivores, invertivores, planktivores, detritivores, large excavators, small excavators, scrapers, browsers, grazers and grazers-detritivores. This study identifies benthic sub-habitats and relate each sub-habitat to the densities of fish functional groups.

Material and methods

Table 1: Summary of objectives, method of data collection and data analysis applied.

Objective	Method	Variables	Data analysis
To determine the benthic sub-habitats with similar benthic structure.	Visual estimate of percent cover of benthic variables. 1-2 estimates per site.	Hard coral, soft corals, fleshy algae, turf algae, crustose coralline algae (CCA) and rubble.	Hierarchical cluster analysis, using SIMPROF test, of arsine square-root transformed data (Clarke et al. 2008).
To link densities of fish functional groups to the benthic sub-habitats.	Underwater Visual Census of selected fish functional species using 50 x 5 m belt transect. 3 -7 replicates per site.	Fish species comprising 12 functional groups	Comparisons of relative abundance of each functional groups across benthic sub-habitats.

Study area

This study uses benthic data collected by D. Obura and reef fish abundance data collected by M. Samoilys, from a total 32 sites from

- Tanzania,
- Northern Mozambique,
- Comoros and
- Northeast Madagascar.

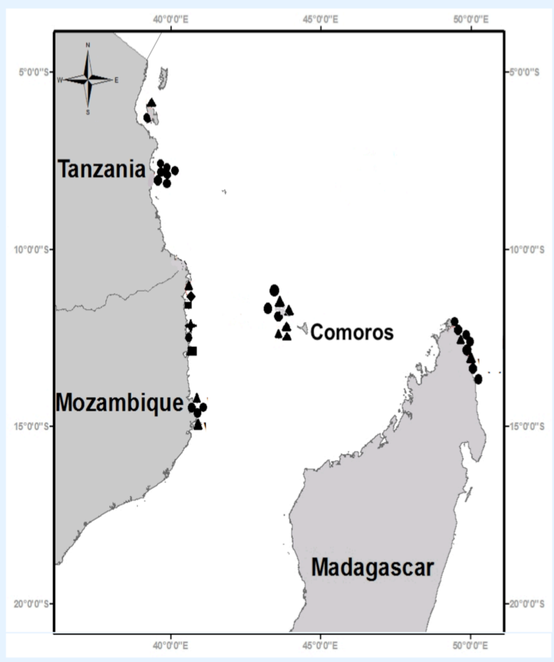

Figure 1: Map of the study area

Results

Hierarchical cluster analysis of the benthic variables using SIMPROF test revealed 5 distinct cluster groups A-E, henceforth called sub-habitats (ANOSIM R = 0.769, $p<0.001$, Fig. 2). The sub-habitats were characterized by dominance of different benthic variables: A dominated by turf algae at 42.0 ± 6.0 % (mean ± se), B and C by hard corals at 51.9 ± 3.3 % and 42.5 ± 3.2 % respectively, D by soft corals at 33.3 ± 8.8 %, and E by fleshy algae - 37.5 ± 6.0 % (Fig. 3).

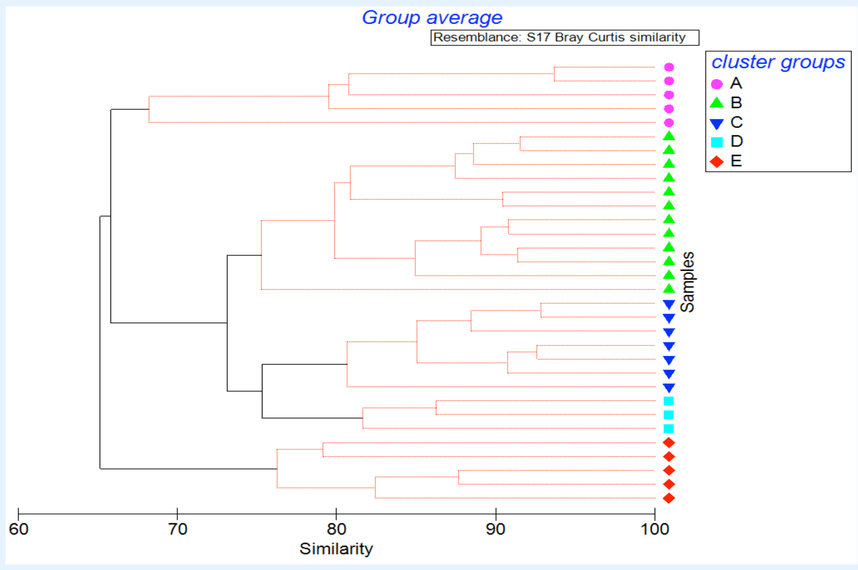

Figure 2: Cluster analysis of arcsine square-root transformed data of benthic variables.

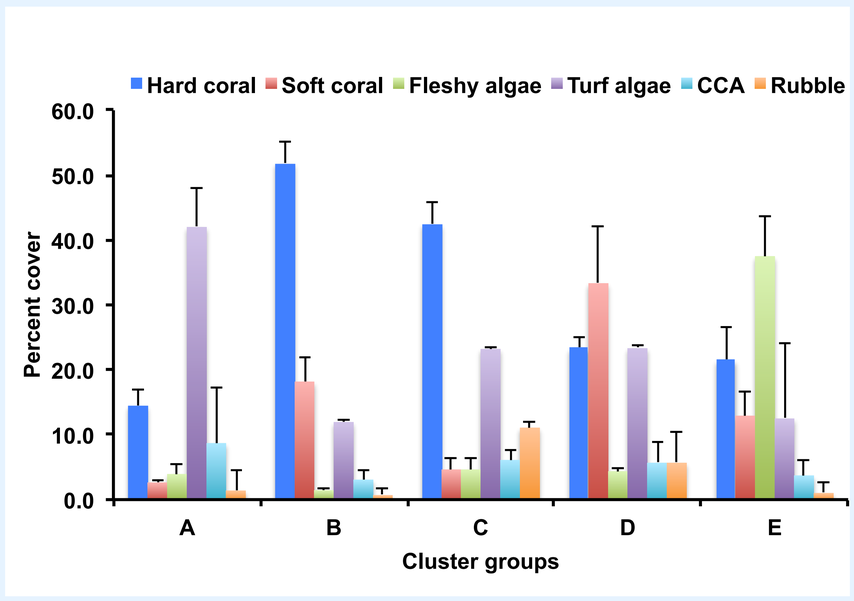

Figure 3: Mean benthic cover by cluster groups (sub-habitats)

Variability of the relative abundance of functional groups across the sub-habitats was observed, with only the piscivores and invertivores, showing significant difference ($p<0.05$; Fig. 4). Piscivores were higher in abundance in turf algae dominated sites (A) than in soft coral dominated sites (D) while invertivores showed higher relative abundance in hard coral dominated sites (C) than turf algae dominated sites (A).

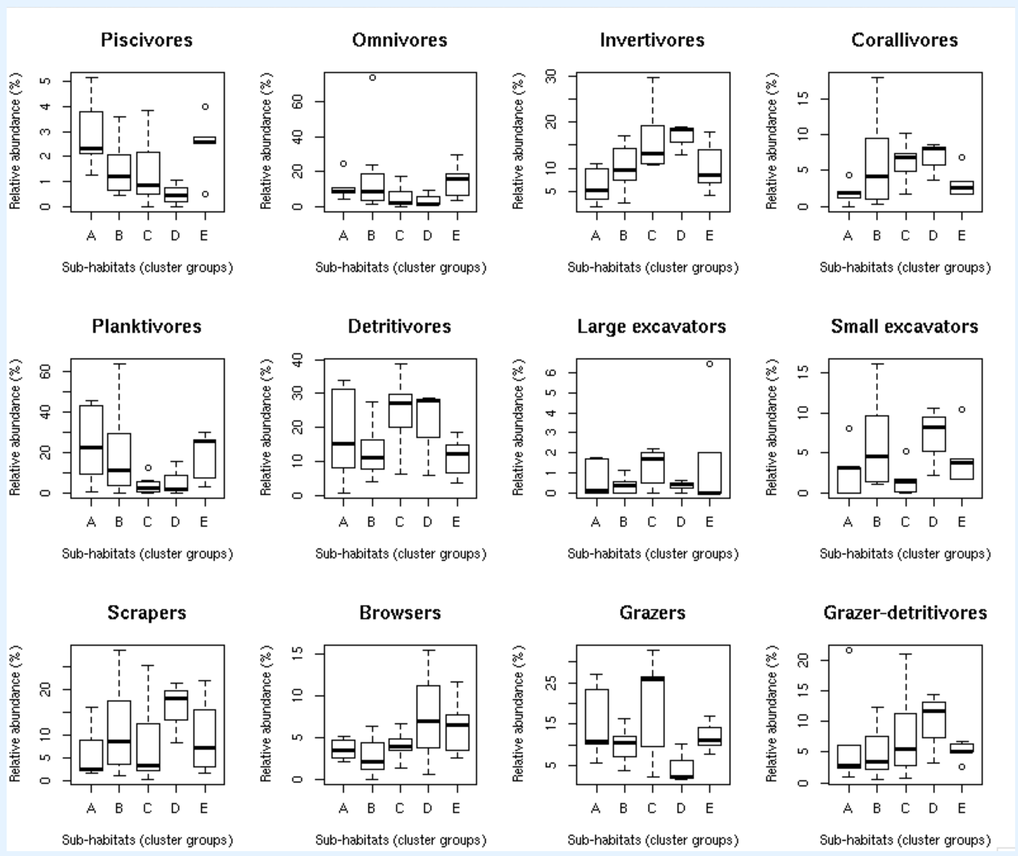

Figure 4: Relative abundance of 12 functional groups by sub-habitats

Conclusion

The study shows that on a broad scale, few functional groups show preference to particular benthic sub-habitats. It is also likely that biomass may show differences across the sub-habitats and probably the broad scale visual estimates of the benthic habitat structure do not fully explain the fish densities.

References
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Pittman S.J., Caldow C., Hile S.D. and Monaco M.E. 2007. Using seascape types to explain the spatial patterns of fish in the mangroves of SW Puerto Rico. Marine Ecology Progress Series, 348, 273-284.

Acknowledgement: Collection of data was supported by the Western Indian Ocean Marine Science Association (WIOMSA) through the Marine Science for Management (MASMA) programme. This study was supported by VLIR-UOS.