ROCKY SHORE MOLLUSCAN ASSEMBLAGES FROM NATURAL AND ARTIFICIAL SUBSTRATA IN THE MALTESE ISLANDS

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Abstract
The mediolittoral macrofaunal assemblages associated with concrete jetties and natural rocky substrata in two Maltese bays were compared to assess potential differences in the molluscan assemblages between artificial and natural hard substrata. The whole extent of the mediolittoral zone was sampled and the molluscs present were identified and counted. Overall species richness was significantly lower on jetties. Densities of species common on the natural rock, such as *Cerithium* spp. and *Eatonina* spp., were lower on jetties; however, the densities of *Patella* spp. were higher.

Keywords: Artificial reefs, Coastal engineering, Mediolittoral, Mollusca, Sicily Channel

Introduction: Jetties differ from natural shores by being vertical, which results in differences in wave interactions with the structure surface, and by having a different substratum composition and topography. These factors have consequences for the microhabitats required by specialist fauna [1]. Additionally, on jetties, the steep slope results in a considerable reduction in the extent of the mediolittoral zone, such that the area available for colonisation is much smaller [2]. The present study was carried out to test whether jetties support a reduced molluscan diversity, as compared to natural rocky shores within the same locality.

Method: Two localities in northern Malta, with similar exposure and geomorphology, were studied: Ghajn Zejtuna and White Tower Bay. Four stations at each locality, two situated on jetties and two on natural rock, were sampled between August and September 2011. At each station, the biota within three replicate 10 cm-wide belt transects of variable length, extending from the lower to the upper limits of the mediolittoral zone, were scraped off. The length of each transect was measured in order to standardise counts to the same unit area. In the laboratory, all live molluscs were sorted out from each sample, identified to the lowest possible taxon, and counted. Statistical analyses were carried out using PRIMER 6 (Plymouth Routines In Multivariate Ecological Research, PRIMER-E Ltd) and GMAV 5 (Institute of Marine Ecology, University of Sydney, Australia).

Results and Discussion: ANOVA indicated that the total number of species (Fig. 1) was significantly different ($p<0.05$) between the two shore types, with jetties having lower values (range: 2 – 7 species) than natural shores (range: 19 – 25 species).

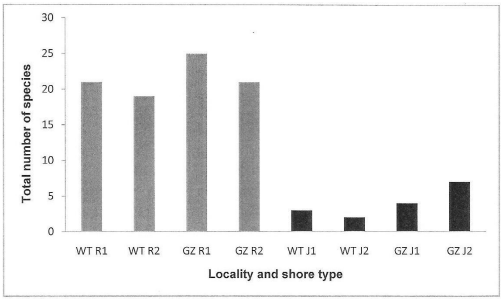

Fig. 1. Total number of mollusc species recorded at each station in the two localities; 'WT' and 'GZ' stand for White Tower Bay and Ghajn Zejtuna respectively; 'R' and 'J' stand for rocky shores and jetties respectively.

Nine species were common to both shore types, 20 species were only recorded on natural shores, while there were no species recorded solely on jetties (Tab.1). Total abundance of molluscs was always lower on jetties; however, this was not statistically significant. *Eatonina* spp. and *Patella* spp. contributed up to 50% to the dissimilarity (obtained from SIMPER analysis) between the two shore types at both localities; *Cerithium* spp. was also an important contributor to the dissimilarity between the two shore types at White Tower Bay.

Tab. 1. List of species recorded on both shore types, together with ones recorded only on natural shores, hence absent from jetties.

Species recorded from both shore types	Species recorded solely from natural shores	
Brachidontes pharaonis	Opisthobranchia sp.	*Lepidochitona corrugata*
Eatonina cossurae	*Acanthochitona* sp.	*Mitra cornicula*
Eatonina fulgida	*Alvania lanciae*	*Ocinebrina edwardsii*
Gibbula sp.	*Omalogyra atomus*	*Phorcus turbinatus*
Mytilaster minimus	*Cardita calyculata*	*Paludinella* sp.
Patella caerulea	*Cerithium* spp.	*Pisania striata*
Patella ulyssiponensis	*Columbella rustica*	*Pisinna glabrata*
Patella rustica	*Conus ventricosus*	*Setia* spp.
Skeneidae sp.	*Irus irus*	*Odostomia* sp.
	Jujubinus gravinae	*Rissoa* spp.

Eatonina spp. were recorded on natural shores at both localities; jetties at Ghajn Zejtuna had a lower abundance of these species, whilst these were absent on jetties at White Tower Bay. All local species of *Patella* (*P. rustica*, *P. ulyssiponensis* and *P. caerulea*) reached higher densities on jetties irrespective of locality. On the other hand, *Cerithium* spp. were absent on jetties in contrast to natural shores at White Tower Bay, whilst the same species were sparse at Ghajn Zejtuna independent of shore type. Most species recorded solely from the natural shores were small molluscs (not exceeding a maximum shell length of 6mm) with few exceptions; moreover, most of the individuals encountered in this study were juveniles. The majority of the species absent from jetties, as well as those recorded in higher abundances on rocky shores (e.g. *Eatonina* spp. and *Cerithium* spp.) are often recorded from the infralittoral or lower mediolittoral amongst algae, in sediment, or under stones[3][4] hence require a more or less moist environment. Such an environment is present within crevices in the mediolittoral zone but these microhabitats were sparse on the concrete jetties. The increased density of *Patella* spp. on jetties could possibly be due to a lower density of other grazers, thus reducing interspecific competition, or due to other biotic and/or physical factors. The present results corroborate those of previous studies that also recorded a lower diversity of mobile species on artificial structures when compared to natural rock, with a number of mollusc species typical of crevices and rock pools on rocky shores being absent from the artificial habitats [2].

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References
1 - Moreira, J. (2006). Patterns of occurrence of grazing molluscs on sandstone and concrete seawalls in Sydney Harbour (Australia). *Molluscan Research, 26* (1), 51–60.
2 - Chapman, M. G. (2003). Paucity of mobile species on constructed seawalls: effects of urbanization on biodiversity. *Marine Ecology Progress Series, 264*, 21–29.
3 - Cachia, C., Mifsud, C., & Sammut, M.P. (1996). *The marine molluscs of the Maltese Islands (Part II: Neotaenioglossa).* Backhuys Publishers; 228pp.
4 - Cachia, C., Mifsud, C., & Sammut, M.P. (2001). *The marine molluscs of the Maltese Islands (Part III: Prosobranchia).* Backhuys Publishers; 266pp.