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Professional paper

DIVERSITY OF BENTHIC MACROMOLLUSCAN COMMUNITIES ON THE ROCKY SHORES OF TRIPORTI, VLORE, ALBANIA

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Abstract

Over recent decades, numerous experiments have consistently demonstrated that species richness significantly influences ecosystem multifunctionality. These variations within ecosystems arise from natural progressions, as well as from human and natural events. Our study focuses on analyzing both the composition and quantitative characteristics of benthic macroinvertebrate populations along the rocky shores of Triport in Vlora, aiming to assess their ecological conditions.

Our case study involves three observation sites on the rocky shores of Triport in Vlora, where we examine macroinvertebrates. A key objective of our research was to investigate seasonal variations in population traits across different zones, conducting fieldwork during the spring and summer of 2018 (June and August). We calculated both the total and average densities for each species at each site and during each sampling period. Another critical goal was to evaluate species composition and population quantity traits, comparing these across different seasons and sites, as well as within each site. We also performed statistical analyses to explore changes in species composition and population density and their interrelationships across different seasons and sites.

The study identified 67 taxa of benthic macroinvertebrates, predominantly gastropods. Our research highlighted the presence of an intriguing and relatively underexplored group, the Macrozoobenthos, within the study areas. This group's significance is tightly linked to the structure and function of the coastal ecosystem, indicated by the dominance of invertebrate species within the benthic community. Many species within this group serve as indicators of the marine ecosystem's health.

In conclusion, the sparse density and unstable nature of the macrozoobenthic community are strong indicators of the poor ecological conditions and environmental stresses affecting the study areas. Factors significantly influencing the characteristics of the macrozoobenthic population include algal cover, the diversity of microhabitats along the shores, and the degree of exposure to wave action.

Keywords: Adriatic Sea, Mediterranean Sea, Triport, Mollusca, Gastropoda, Macrozoobenthos

1. Introduction

Coastal regions in Albania are characterized by a diverse range of habitats, communities, and plant and animal species that are integral to the country's natural heritage and the broader Mediterranean region (Kashta et al., 2011). Over the past two decades, Albania has witnessed significant changes due to substantial investments along its coastline. These investments have impacted ecosystems, leading to alterations in habitat structure, eutrophication issues, and an increase in sea urchin populations (Fraschetti et al., 2011; Maiorano et al., 2011). The waters of Vlora Gulf, in particular, have been significantly affected by these changes and human activities (Maiorano et al., 2011). Ongoing research on species composition and community structure in this gulf provides valuable data for assessing the environmental impact of these activities on the gulf's ecosystem.

Recent information on the macrozoobenthos of the rocky areas of the Albanian Adriatic coast, particularly in Vlora, is limited and often restricted to malacofauna. Studies conducted on the rocky coasts of Vlora to enumerate and evaluate the macrozoobenthos species, their abundance, and the environmental conditions of the biocenosis of this phylum are also insufficient and typically performed on a seasonal basis.

The Adriatic coastal area extends from Vlora in the south to the Gulf of Drin in the north. This region comprises a low accumulative coast with sections of cliff-type marine erosion and areas where marine

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waters have encroached inland. Some areas also feature rocky coastlines. In the accumulative coastal areas, there are small erosive sectors. The approximately 100 km long rocky coastline of the Adriatic facilitates erosive processes. The four erosive sectors are the cliffs of Rodoni, Palit, Lagji, and Triporti, (Ruci et al., 2014) with Triporti being the focus of this research due to its significance in observing anthropogenic environmental impacts on ecosystems, as illustrated in Figure 1.

Figure 1: A representation of the Triporti rocky shore (research area).

These sectors represent the erosive configuration of the Adriatic coastline of Albania. The cliffs are composed of anomalously thick limestone rocks of the Periadriatic depression anticline. The primary objective of this research is to examine the ecological conditions of the study area. The investigation focused on snails inhabiting the rocky intertidal zones, aiming to achieve three main objectives: (1) determining species diversity among these mollusks; (2) mapping their distribution across state boundaries; and (3) understanding changes in species diversity due to aquaculture activities. This research aims to enhance our understanding of the rocky infralittoral zone of the Vlora Gulf by providing data on the presence of molluscan species from three different stations within the infralittoral zone.

2. Material and Method

The study area

Triport, located on the southern edge of the Adriatic coast, features a high rocky shore with low limestone cliffs and extensive terrace development. This coastal strip extends for 8 km, with a width ranging from 50-100 m in the narrowest parts to approximately 2 km in the widest parts in the south.

The coastline of Triport exhibits significant morphological diversity and dynamic changes, driven by several factors including the steepness of the seabed, substantial river flows, prevailing wind directions and intensities from the west and northwest, and the impact of wave action (Kabo & Krutaj, 1996).

To assess the benthic macroinvertebrate fauna, benthic algae assemblages were collected from three stations along the rocky shores of Triport. Field expeditions were conducted in 2018 during two seasons—June and August—corresponding to the spring and summer periods. The study station map is shown in Figure 2.

Figure 2: Map of the study area.

Sampling method

Benthic sampling on solid grounds followed protocols established by Cattaneo et al. (1978) and Revkov et al. (1999), emphasizing quantitative measurements of benthic communities during spring and summer across supralittoral and medio-littoral zones. Due to challenges in distinguishing between medio-littoral and infralittoral zones, areas within the higher infralittoral were also included in the study.

The collection process targeted both surface-dwelling macroinvertebrates on rocks and those residing within algae. Samples were taken from various types of cover to provide a comprehensive understanding of the biological communities. At each station, two transects were sampled, each separated by a distance of 15 meters. Three samples were collected from each transect: three from the supralittoral zone, three from the medio-littoral zone, and three from the upper infralittoral zone. This resulted in a total of 9 samples per station per time period, totaling 27 samples across the three stations for each sampling round, and a grand total of 60 samples across all sampling sessions.

Quantitative data on macrobenthos was collected using a test quadrat measuring 50 cm x 50 cm, subdivided into 16 smaller squares for detailed quantitative evaluations. In these subdivided areas, individual organisms were counted or analyzed based on percentage coverage for entities such as algae and small colony-forming species like *Chthamalus, Mytilaster,* and *Serpu*la. Specimens were collected by hand, preserved in 75% ethanol, and subsequently transported to the laboratory for further examination.

3. Results and discussion

Based on our research, it was found that a totally of 67 different species were collected from the three sampling stations. Three important classes of mollusks were identified: Polyplacophora, Gastropoda, and Bivalvia. In the Polyplacophora class, two families were determined such as: Leptochitonidae and Chitonidae, where each includes 1 species.

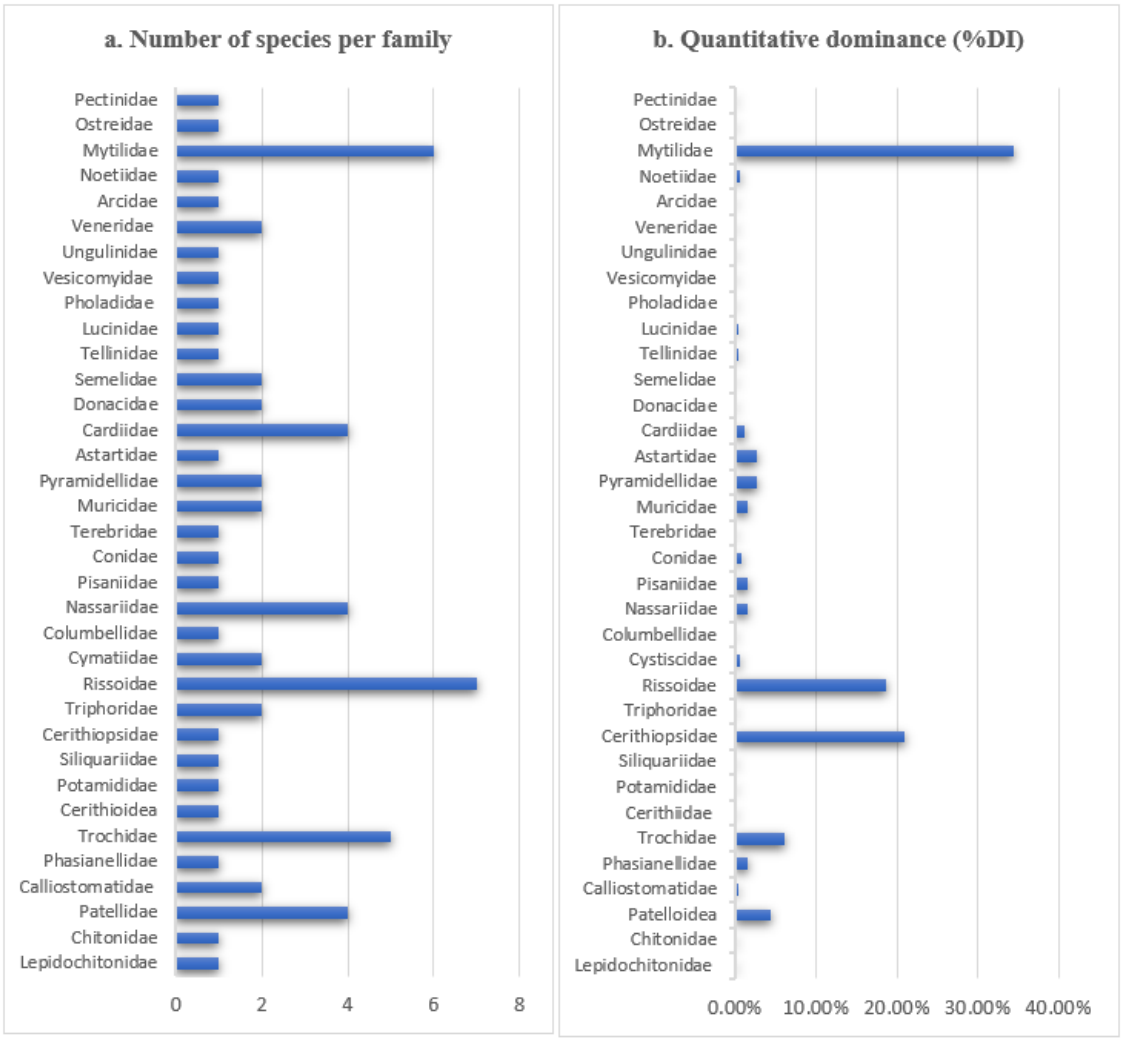

Figure 3. A representation of the families investigated during the study indicating species richness(a) and percentages of abundance (%DI - b).

The other class, Gastropoda one was composed of 18 distinct families with a total of 39 species as follow: Muricidae (comprising 2 species), Conidae (with 1 species), Nassariidae (consisting of 4 species), Cymatiidae (including 2 species), Triphoridae (encompassing 2 species), Siliquariidae (1 species), Cerithioidea (with 1 species), Phasianellidae (1 species), Patellidae (consisting of 4 species) Clliostomatidae (with 2 species), Trochidae (consisting of 5 species), Potamididae (1 species), Cerithiopsidae (1 species), Rissoidae (including a different count of 7 species), Columbellidae (1 species), Pisaniidae (1 species), Terebridae (1 species) and Pyramidellidae (comprising 2 species). Whereas, Bivalvia class includes 15 distinct families with a total number of 26 species: Astartidae (1 species), Pectinidae (comprising 1 species), Mytilidae (accounting for 6 species), Ungulinidae (with 1 species), Pholadidae (1 species), Tellinidae (1 species), Donacidae (inclusive of 2 species), Cardiidae (encompassing 4 species), Semelidae (with 2 species), Lucinidae (1 species), Vesicomyidae (1 species), Veneridae (accounting for 2 species), Arcidae (1 species), Noetiidae (1 species), Ostreidae (1 species) and Pectinidae (with 1 species), as it is shown on Figure 3a.

As shown in Figure 3b, it can be said that the Mytilidae family based on percentages of abundance dominates with an average of 34.49%, followed by the Cerithiopsidae family with an average of 20.99% and Rissoidae family with 18.62%. The species with the highest frequency values are *Bittium reticulatum* 36.53%, *Rissoa ventricosa* 23.71% and *Mytilus galloprovincialis* 16.78%.

Abundance, frequency biodiversity analysis

According to the analysis of the number of taxa (Figure 3a) and the abundance of individuals for each taxon, Station 1 exhibited the highest species abundance during the spring sampling. Comparing the two sampling seasons, there was a greater number of species present during the spring season compared to the autumn season. Regarding the abundance of mollusk species, the total abundance of the sample was calculated along with other invertebrate species. In all stations, mollusk fauna dominated the majority of the sample (Figure 3b).

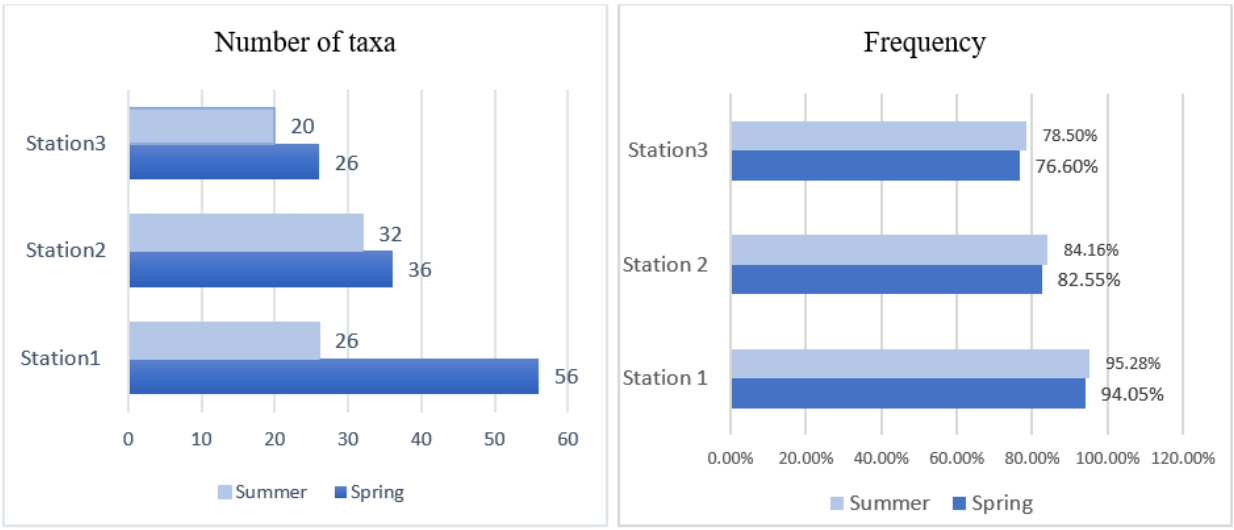

Figure 3. A representation of the number of taxa analysis(a) and frequency of Mollusca in macroinvertebrate samples (b).

Univariate Analysis of Diversity

The univariate analysis of diversity reveals that Station 3 has moderate diversity, which increases significantly at Stations 1 and 2 (table 1). This observation is not surprising, as Station 3 is characterized by the lowest number of species present among the three stations. The reduced diversity at Station 3 can be attributed to various ecological factors that limit species richness and abundance in this area. Furthermore, when examining the total abundance of invertebrates at Station 3, it becomes evident that there is a comparatively lower biomass of both macroalgae and invertebrates. This suggests that the ecological conditions at Station 3 are less favorable for supporting a diverse and abundant community of benthic organisms. In contrast, Stations 1 and 2, with their higher species diversity and greater biomass of macroalgae and invertebrates, indicate more conducive environmental conditions for sustaining a rich benthic community.

Table 1. Univariate diversity indices analysis.

Sample	S	N	d	J'	Brillouin	H'(loge)	H'(log2)	1-Lambda'
ST1 Spring	56	109	11,72	0,5881	1,993	2,367	3,415	0,8108
ST1 Summer	26	35	7,007	0,6599	1,616	2,15	3,102	0,8303
ST2 Spring	36	32	10,09	0,7433	1,9	2,664	3,843	0,9007
ST2 Summer	32	18	10,82	0,8086	1,746	2,802	4,043	0,955
ST3 Spring	26	51	6,358	0,3501	0,7901	1,141	1,646	0,3991
ST3 Summer	20	39	5,198	0,4692	1,064	1,406	2,028	0,5562

4. Conclusions

This study has generated an extensive dataset regarding the mollusk fauna inhabiting the study area, accompanied by an analysis of the ecological conditions observed throughout the monitoring period. Our findings emphasize the crucial role of habitat complexity, shaped by biological structures on substrates, in influencing mollusk communities. This influence spans from the infralittoral to the circalittoral zones of the Triporti area. Particularly noteworthy is the significance of abundant algae and a highly heterogeneous hard substrate in shaping communities dominated by gastropods. These communities exhibit a diverse array of both micro- and macro-grazers with high mobility.

Looking ahead, the urbanization planning of this area has the potential to adversely impact benthic communities. However, it is essential to conduct further assessments to thoroughly evaluate the potential effects of new urban projects on the area. Such evaluations are crucial for informing sustainable management strategies aimed at mitigating negative impacts while promoting the conservation and resilience of these fragile marine habitats.

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