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State of Macrozoobenthic Community in the Adriatic Rocky Shores of Albania in Spring Season

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Abstract:

The present study aims to assess and analyze the species composition, abundance and environmental state of the macrozoobenthic community in the shallow rocky areas along the Adriatic coast of Albania. Benthic samples have been taken during April – May 2011 in four rocky coastal areas: Shën Pjetër, Kallm, Spille and Triport. Standard replicated quantitative samples have been taken in the supralittoral, mediolittoral and upper limit of infralittoral, by using a reticulated frame. A total of 106 taxa of benthic macroinvertebrates has been recorded. The groups with the highest abundance and presence were mollusks of the families Patellidae and Trochidae in all sites. A considerable difference in species composition between the four sites has been recorded. Two alien gastropods for the Mediterranean, *Rapana venosa* and *Cellana rota*, were found in the studied area. From a preliminary assessment, the benthic community in the studied area seems to have a relatively low stability and unfavorable environmental state.

The species composition and abundance of benthic macroinvertebrates seem to be effected by macroalgal cover at the sites, exposal level of the coast and human impact in the studied areas.

Keywords: Adriatic coast, macrozoobenthic community, species composition.

1. Introduction

Main text paragraph. Rocky areas in the Albanian part of Adriatic Sea are very interesting habitats. They represent short and isolated segments within sandy coast that dominates the Albanian Adriatic, which is under continuous impact of erosion. For these reasons and especially due to the small surface and habitat fragmentation, their benthic communities are characterized by a high ecological sensitivity [1]. This study has been carried out in shallow rocky coasts of the Albanian Adriatic areas including Shën Pjetër, Kallm, Spille, Triport. Except some recent studies on macrozoobenthos of Vlora Bay, the macrozoobenthos of the other rocky areas of Albanian Adriatic coast is very poorly studied. Most of existing information is very general and has been provided under several rapid and sporadic assessments. Environmental impacts in most of these areas have increased during the last 20 years due to uncontrolled urban and tourism development [10]. These are some reasons that make this area sensitive in ecological and environmental point of view, but also with economic interest, and consequently of study interest, too.

This is the first study focused on the macrozoobenthic community of the rocky coastal fragments along the Adriatic coast of Albania and it aimed to make a preliminary assessment of the species composition, abundance and environmental state of the macrozoobenthic populations of these areas.

2. Materials and methods

Benthic samples have been taken during April – May 2011 in four rocky coastal areas: Shën Pjeter, Kallm, Spille and Triport (Figure 1), in very shallow water, including the supralittoral, mediolittoral and upper limit of infralittoral. Samples were taken through standard methods for benthic sampling in hard bottoms, within a frame 50 x 50 cm for the quantitative assessment [21; 4; 8]. In each site the sampling was done along three transects, distanced 50 m from each other. In each transect 6 frame samples have been taken, of which 3 in supralittoral and 3 in medio and upper infralittoral. So, 18 samples have been taken in each site and 72 samples in total for the all sites.

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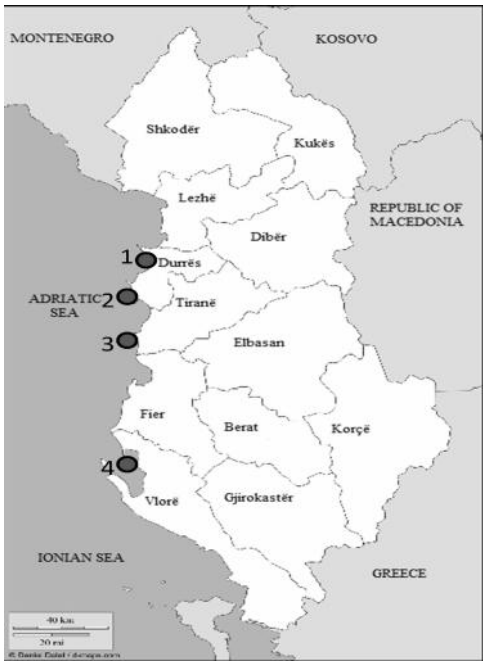

Figure 1. Map of Albania with the sampling sites: 1. Shën Pjetër; 2. Kallm; 3. Spille, 4. Triport

The species composition and the average abundance of all species in each site has been evaluated, as well as the abundance of each species in each sample, based on the recorded number of individuals within the standard frame. Frequency for the patellids and trochids, as the most commune and abundant groups, has been evaluated.

The frequency has been calculated after the formula, $F = \frac{n}{N} \times 100$ where:

F – Frequency

n – number of individuals of a species in a sample
N – total number of individuals in a sample.

Species identification and taxonomic nomenclature has been based on literature [5; 6; 7; 9; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 22]

3. Results and discussion

106 species of benthic macroinvertebrates have been found in the studied area, of which gastropods had the highest number of species (the full list of recorded species for each site is given in the Appendix 1).

Species number of each large taxa is in the following:

Cnidaria	5	Bivalvia	10
Nematoda	1	Polychaeta	3
Echiurida	1	Crustacea	16
Polyplacophora	2	Echinodermata	7
Gastropoda	59	Bryozoa	2

This species number can be considered as a relatively high number, taking into account that the sampling has been done in very shallow water, during one season only, and that these sites represent very small areas, as short segments of rocky coasts, fragmented and isolated among the sandy Adriatic coast of Albania.

It is also worthy to note the presence of *Rapana* venosa and *Cellana rota* as the alien species for the Mediterranean. With this record of *R. venosa,* the number of marine alien species reported for Albania reaches 22, referring to a recent publication [2] that has reported 21 marine alien species for Albania, including macroalgae, macroinvertebrates and fish species.

The presence of alien species shows the regional importance of the Albanian coast as a corridor for the distribution of alien species from the Ionian Sea northward to the Adriatic Sea, as it has also been highlighted in [2].

As it is shown in the Figure 2 and Figure 3, the lowest species number and abundance of benthic macroinvertebrates was found in Spille (32 species with an average abundance of 17.8 individuals per site), while the highest was found in Kallm (70 species with an average abundance of 51.2 individuals per site). The lower presence (both in species number and abundance) of benthic macroinvertebrates in Spille may be related to several factors: a high sedimentation regime at the coast and dense cover of the mediolittoral with silt, as it has been recorded during the sampling; the macroalgal cover is smaller compared to the other sites, therefore, several macroinvertebrate species that are known to shelter in coastal macroalgae referring to [20] were missing in this site; Spille area has an exposed coast, which is different comparing to the other three sites that have a much less exposed coastline.

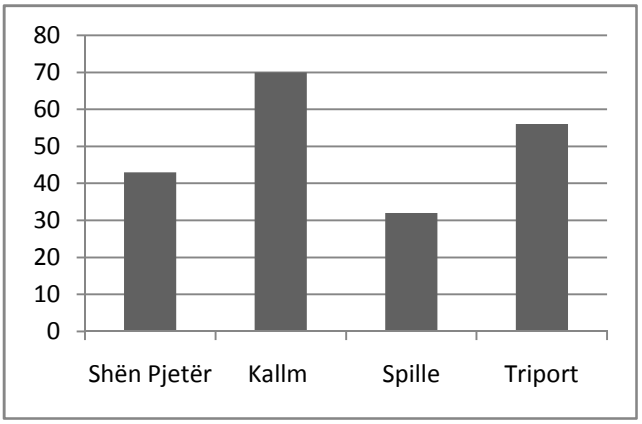

Figure 2. Species number of benthic macroinvertebrates in each sampling site

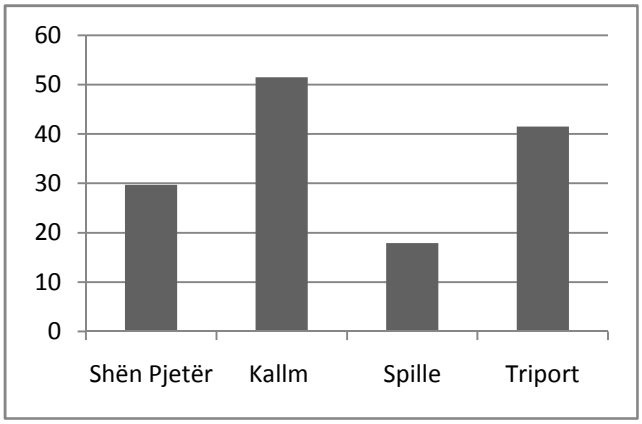

Figure 3. Average abundance of benthic macroinvertebrates in each sampling site

The highest species number and abundance of benthic macroinvertebrates in Kallm may be mainly related to the large and dense macroalgal cover of the coast in this site. The presence of a well developed *Posidonia oceanica* meadow in the close vicinity of this sampling site can be considered as an indicator for the good environmental situation in Kallm area. Additionally, the human impact is more limited in this site, comparing to the three other sampling sites. Recently, the areas of Shën Pjetër and Spille are having an increased impact, mainly related to the tourist and urban development, while the Triport area is being impacted by the industrial developments in Vlora coast, besides the urban and tourist activities that were increased since earlier. Although detailed assessments of these impacts have not been done yet, the wastes, sewage, alteration and degradation of natural habitats is quite evident in these areas. These considerations are also supported by several recent publications [23; 10].

Patellidae and Trochidae families had the highest abundance in all sites. The total abundance and relative frequency of patellids and trochids for each site is given in the Table 1.

Table 1. Total abundance and frequency of patellids and trochids in each sampling site.

Sampling site	**Patellidae**		**Trochidae**	
	Total abundance	Frequency (%)	Total abundance	Frequency (%)
Triport	113	21.12	145	27.10
Spille	105	11.32	205	22.11
Currila	79	24.53	172	53.41
Shën Pjetër	133	17.80	263	35.20

One reason for the high abundance of patellids and especially trochids may be related to the dense macroalgal cover in most of the studied sites, as most of the recorded macroinvertebrate species from these families are known to shelter in habitats with macroalgal cover, after [20]. However, the high predominance of two families (Patellidae and Trochidae), consisting in high frequency values like 77.94% in Spille, or 53% in Triport, over a considerable number of groups presented in the samples, indicate a degraded structure of zoobenthic community in these areas.

The relatively small number of filter feeder organisms, mainly bivalves and very few from the

other groups, could be an indicator of a degraded water quality and an unfavorable ecological state in the studied areas, as the filter feeders in general are more sensitive to the water quality, after [3].
However, the present data and considerations about the benthic community of these studied areas should be treated as preliminary, as they belong to one sampling period only. A more completed understanding of the situation of benthic community and a more complex elaboration of data would be provided after further sampling and assessments in other seasons, in a more extended period of study in these areas.

4. Conclusions

106 taxa of macrozoobenthos have been recorded in the shallow rocky areas of the Adriatic coast of Albania in spring (April – May) 2011.
Gastropods were the predominant group in species number with 59 recorded taxa, followed by crustaceans with 16 taxa and bivalves with 10 taxa.
The highest abundance of Patellidae and Trochidae families in all sites, may be related to the dense macroalgal cover in most of the studied sites.
Although their small size and being extended in short and fragmented segments, the rocky coasts of the Adriatic Sea in Albania are important habitats for benthic macroinvertebrates in national and regional level, as a relatively high species number has been recorded, including two marine species that are alien for the Mediterranean Sea.
Referring to the low presence of filter feeder organisms as indicators of water quality, benthic communities of these area seems to be very sensitive in ecological and environmental point of view, as well as due to the increasing human impact in these areas, mainly related to the tourism, urban and industrial developments.
The species composition and abundance of benthic macroinvertebrates in the studied areas seem to be effected by macroalgal cover at the sites, exposal level of the coast and the human impact.

5. References

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Appendix 1

List of the benthic macroinvertebrates recorded for each sampling site

Nr.	Taxa	Shën Pjetër	Kallm	Spille	Triport
	Cnidaria				
1.	*Actinia cari* Delle Chiaje, 1822	+			
2.	*Actinia equina* (Linnaeus, 1758)	+		+	+
3.	*Anemona sulcata* (Pennant, 1777)	+	+		
4.	*Aulactinia verrucosa* (Pennant, 1777)				+
5.	*Paranemonia cinerea* (Contarini, 1844)				+
	Nematoda				
6.	Enoploida (unidentified)	+	+		
	Echiurida				
7.	Echiurida (unidentified)		+		
	Polyplacophora				
8.	*Chiton olivaceus* Spengler, 1797	+	+		+
9.	*Acanthochitona fascicularis* (Linnaeus, 1767)				+
	Gastropoda				
10.	*Patella caerulea* Linnaeus, 1758	+	+	+	+
11.	*Patella rustica* Linnaeus, 1758	+		+	+
12.	*Patella ullyssiponensis* Gmelin, 1791	+	+	+	+
13.	*Patella sp.* Linneus, 1758	+			+
14.	*Cymbula nigra* (da Costa, 1771)	+	+		
15.	*Cellana rota* (Gmelin, 1791)			+	+
16.	*Iothia fulva* (Müller O.F., 1776)				+
17.	*Clanculus cruciatus* (Linnaeus, 1758)				+
18.	*Clanculus jussieui* (Payraudeau, 1826)		+		
19.	*Jujubinus exasperatus* (Pennant, 1777)		+		
20.	*Gibbula adriatica* (Philippi, 1844)	+	+	+	+
21.	*Gibbula albida* (Gmelin, 1791)	+	+	+	+
22.	*Gibbula divaricata* (Linnaeus, 1758)			+	+
23.	*Gibbula racketti* (Payraudeau, 1826)	+	+	+	+
24.	*Gibbula rarilineata* (Michaud, 1829)				+
25.	*Gibbula varia* (Linnaeus, 1758)	+	+		+
26.	*Phorcus richardi* (Payraudeau, 1826)	+	+		
27.	*Monodonta articulatus* (Lamarck, 1822)	+	+	+	+
28.	*Monodonta turbinatus* (Born, 1778)	+	+	+	+
29.	*Tricolia pullus* (Linnaeus, 1758)		+	+	
30.	*Tricolia tenuis* (Michaud, 1829)		+		+
31.	*Smaragdia viridis* (Linnaeus, 1758)		+		
32.	*Cerithium vulgatum* Bruguiére, 1792	+	+		+
33.	*Bittium reticulatum* (da Costa, 1778)	+	+	+	+
34.	*Epitonium clathrus* (Linnaeus, 1758)		+		
35.	*Littorina neritoides* (Linnaeus, 1758)		+	+	+
36.	*Alvania cimex* (Linnaeus, 1758)		+		
37.	*Alvania discors* (Allan, 1818)		+	+	
38.	*Rissoa guerinii* Récluz, 1843		+		
39.	*Rissoa membranacea* (J. Adams, 1800)		+		
40.	*Pusillina lineolata* (Michaud, 1832)	+	+	+	+
41.	*Pusillina sp.* Monterosato, 1884		+		
42.	*Vermetus triquetrus* Bivona Ant. 1832	+	+		

Nr.	Taxa	Shën Pjetër	Kallm	Spille	Triport
43.	*Vermetus sp.* Daudin, 1800	+	+	+	+
44.	*Dendropoma petraeum* (Monterosato, 1884)		+		+
45.	*Euspira sp* . Agassiz, 1838		+		
46.	*Hexaplex trunculus* (Linnaeus, 1758)	+	+		+
47.	*Ocenebra erinaceus* (Linnaeus, 1758)				+
48.	*Ocinebrina edwardsii* (Payraudeau, 1826)	+	+		+
49.	*Ocinebrina hispidula* (Pallary, 1904)		+	+	
50.	*Ocinebrina ingloria* (Crosse, 1865)		+		
51.	*Muricopsis cristatus* (Brocchi, 1814)				+
52.	*Muricopsis sp.* Bucquoy & Dautzenberg, 1882			+	
53.	*Stramonita haemastoma* (Linnaeus, 1767)	+			
54.	*Rapana venosa* (Valenciennes, 1846)		+		
55.	*Vexillum sp.* Röding, 1798		+		
56.	*Euthria cornea* (Linnaeus, 1758)		+		
57.	*Pisania striata* (Gmelin, 1791)	+	+	+	+
58.	*Pollia dorbignyi* (Payraudeau, 1826)	+	+		+
59.	*Nassarius cuvierii* (Payraudeau, 1826)	+	+		
60.	*Nassarius incrassatus* (Ström, 1768)		+		+
61.	*Nassarius reticulatus* (Linnaeus, 1758)		+	+	
62.	*Columbella rustica* (Linnaeus, 1758)	+	+	+	+
63.	*Mitrella scripta* (Linnaeus, 1758)		+		
64.	*Fasciolaria lignaria* (Linnaeus, 1758)	+			
65.	*Mangelia sandrii* (Brusina, 1865)		+		
66.	*Conus mediterraneus* Hwass in Bruguiére, 1792	+	+		+
67.	*Phyllaplysia lafonti* P. Fischer, 1872		+		+
68.	Nudibranchia (unidentified)		+		
	Bivalvia				
69.	*Striarca lactea* (Linnaeus, 1758)		+		
70.	*Mytilaster minimus* (Poli, 1795)				+
71.	*Mytilus galloprovincialis* Lamarck, 1819	+	+	+	
72.	*Lithophaga lithophaga* (Linnaeus, 1758)			+	
73.	*Modiolus adriaticus* (Lamarck, 1819)	+			
74.	*Modiolus barbatus* (Linnaeus, 1758)				+
75.	*Ostrea edulis* Linnaeus, 1758			+	
76.	*Ostrea stentina* Payraudeau, 1826				+
77.	*Chama gryphoides* Linnaeus, 1758				+
78.	*Papillicardium papillosum* (Poli, 1795)		+		
	Polychaeta				
79.	Nereidae 1 (unidentified)	+	+		
80.	Nereidae 2 (unidentified)	+	+	+	
81.	Serpulidae (unidentified)	+	+	+	+
	Crustacea				
82.	*Acanthonyx lunulatus* (Risso, 1816)	+	+	+	+
83.	*Pachygrapsus marmoratus* (Fabricius, 1787)		+	+	
84.	*Porcellana platycheles* (Pennant, 1777)	+			
85.	*Carcinus aestuarii* Nardo, 1847				+
86.	*Xantho hydrophylus* (Herbst, 1790)				+
87.	*Xantho sp.* Leach, 1814		+		
88.	Paguridae (unidentified)	+	+		+
89.	*Macrobrachium sintangense* (De Man, 1898)				+
90.	*Palaemonella rotumana* (Borradaile, 1898)				+

Nr.	Taxa	Shën Pjetër	Kallm	Spille	Triport
91.	*Chthamalus depressus* (Poli, 1795)		+	+	+
92.	*Cthamalus stellatus* (Poli, 1795)		+	+	+
93.	*Balanus sp.* Costa, 1778		+		
94.	*Sphaeroma serratum* (Fabricius, 1787)		+		+
95.	*Ligia oceanica* (Linnaeus, 1767)		+		
96.	Izopoda (unidentified)		+		
97.	*Gammarus sp.* Fabricius, 1775	+	+	+	+
	Echinodermata				
98.	*Asterina gibbosa* (Pennant, 1777)	+			
99.	*Ophiothrix fragilis* (Abildgaard, 1789)				+
100.	Ophiura (unidentified)		+		
101.	*Arbaxia lixula* (Linnaeus, 1758)	+			
102.	*Sphaerechinus granularis* (Lamarck, 1816)		+		
103.	*Paracentrotus lividus* (Lamarck, 1816)	+			
104.	*Holothuria tubulosa* Gmelin, 1790				+
	Bryozoa				
105.	*Reteporella sp.* Busk, 1884				+
106.	Bryozoa (unidentified)				+
Total species number for each site		**43**	**70**	**32**	**56**