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Seasonal comparisons of the state of benthic macroinvertebrate assemblages from different rocky areas of the Adriatic Sea in Albania

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Abstract

This paper represents seasonal comparisons of the characteristics of macrozoobenthic assemblages from the shallow rocky areas of the Adriatic Sea in Albania. Sampling has been carried out in four areas, namely Shën Pjetër, Kallm, Spille and Triport, in Spring, Summer and Autumn 2011, in very shallow water, including the supralittoral, mediolittoral and upper limit of infralittoral. The groups with the highest presence and abundance were mollusks of the families Patellidae, Trochidae, Cerithiidae, Buccinidae and Columbellidae, crustaceans of the families Cancridae, the echinoderms Arbaciidae and the cnidarians Actiniidae. Trochid gastropods had the highest abundance in all sites and in all sampled seasons. Species composition, abundance and their seasonal differences have been analyzed in a comparative way between the four studied areas. A possible important factor influencing the species presence and quantitative characteristics of macrozoobenthic assemblages, as well as their seasonal differences in the studied areas seems to be closely related to the algal cover.

Keywords: Macrozoobenthos, rocky coast, hard bottoms, Adriatic Sea, Albania.

Introduction

Rocky areas in the Albanian part of Adriatic Sea represent short segments, isolated within sandy coast that dominates the Albanian Adriatic coast that is under continuous impact of erosion. For this reason they represent ecologically sensitive areas for the benthic communities that have been established there [1]. The existing data on macrozoobenthos of the rocky areas of Albanian Adriatic coast are relatively poor and recent. Studies focused on macrozoobenthos of these areas, aiming to assess the species composition, abundance, environmental status of macrozoobenthic populations and their seasonal comparisons are limited. During the last 25 years, environmental impacts in most of these areas have increased due to uncontrolled urban and tourism development [8]. These are some of the reasons that make it important to study the rocky coast of the Adriatic Sea in Albania, for the assessment of coastal biodiversity, its ecological and environmental sensitivity, but also in terms of social and economic aspects, related to impacts originated from urban and coastal tourism development, as well as from fisheries.

Materials and methods

Samples have been taken during three seasons, Spring, Summer and Autumn, respectively in April, July and October 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. Sampling was carried out according to the standard methods for benthic sampling in hard bottoms, after the methods of [19, 2, 6, 21], within a frame 50 x 50 cm for the quantitative assessment. In each site sampling was done along three transects, distanced 50m from each other. In each transect 6 frame samples have been taken, of which 3 in supralittoral and 3 in mediolittoral and upper infralittoral. For each site have been taken 18 samples in each season resulting

in a total of 216 samples for the four sites during the three sampling seasons. After sampling the material was preserved in alcohol (ethanol) 75% and transported to the laboratory for taxa identification and relevant assessments.

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

Identification of species and taxonomic nomenclature has been based on [3, 4, 5, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20]. The species composition and the average abundance of all species in each site and in each season 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. In all sampling sites has also been evaluated the algal cover (in percentage). Seasonal comparisons were referred to the differences between species number and between the abundance of collected benthic macroinvertebrates in Spring, Summer and Autumn in the sampling sites.

1. Results and discussion

The total number of taxa recorded in both seasons in the four studied areas was 194. 105 taxa were found in April, 139 taxa in August and 113 taxa in October. The total number of taxa recorded for each site was Shën Pjeter 104, Kallm 108, Spille 79 and Triport 110.

The total number of taxa has not significant difference between Shen Pjeter, Kallm and Triport. Contrary, the number of taxa recorded in Spille (79) is considerably lower compared the other three sites.

In Spring and Summer season the highest species number has been found in Kallm respectively 61 and 83 species, while in Autumn the highest species number has been found in Shën Pjetër (70). The lowest species number was recorded in Spille in Spring and Summer seasons respectively 33 and 50 species, while in Autumn season the lowest species number was recorded in Spille and Triport, the same number of species 50 (Figure 2).

Three alien mollusk species for the Mediterranean has been recorded: the gastropods *Cellana rota* and *Rapana venosa*, and the bivalve *Arcuatula (Musculista) senhousia*.

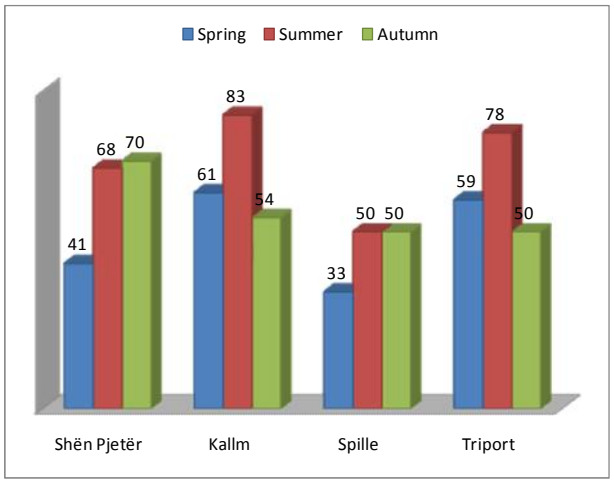

Figure 2. Species number of benthic macroinvertebrates in each site for each sampling season.

For most of the groups there is no important difference in the number of taxa between the three seasons, as shown in the table 1. The highest seasonal difference has been recorded for the predominant groups, such as gastropods, bivalves and crustaceans. For these groups the highest number of taxa has been found in Summer. The species composition of the gastropods' population is not very different between the three seasons, despite the difference in the total number of taxa. Crustaceans and bivalves show a higher seasonal difference in the species composition.

The families with the highest density were the gastropods Trochidae, Patellidae, Buccinidae, Columbellidae and Cerithiidae, the crustaceans Cancridae, the echinoderms Arbaciidae and the cnidarians Actiniidae (Table 2). The highest density has been recorded for the trochid gastropods that show an evident difference compared to the other groups in all sampling sites. Comparing the three sampling seasons, in general we noticed that the lowest density for the most abundant families has been recorded in Autumn in all sampling sites.

Table 1. Number of taxa for each group of benthic macroinvertebrates for each season.

Taxa	*Spring*	*Summer*	*Autumn*
Porifera	-	1	-
Cnidaria	5	6	4
Nematoda	1	1	-
Echiurida	1	-	1
Polyplacophora	2	2	3
Gastropoda	59	72	60
Bivalvia	10	21	13
Polycheta	3	3	4
Crustacea	16	26	20
Echinodermata	7	6	4
Bryozoa	2	-	-
Tunicata	-	1	2

Table 2. The average density for the most abundant families for each season in the mediolittoral of each sampling site.

	Average density											
Families	**Shën Pjetër**			**Kallm**			**Spille**			**Triport**		
	Spr.	Sum.	Aut.	Spt.	Sum.	Aut.	Spr.	Sum	Aut.	Spr.	Sum.	Aut.
Actiniidae	1.66		11.4	4.27	3.72	2.55					1.22	
Trochidae	14.09	14.53	2.83	20.86	16.19	9.15	18.98	20.2	8.16	22.53	15.41	6.15
Patellidae	5.21	5.54	7.38	5.32	6.98	3.38	5.21	8.43	5.6	6.21	7.97	9.54
Buccinidae	3.44	1.21	1.83	4.20	1		0.33	1.99	2	4.11	5.88	2.22
Columbellidae	3.33	4.44	1.94	3.77	3.99		0.22	2		3.22	1.44	
Cerithiidae	1.21	1.65		13.44	2.66		0.66	0.22		5.11	10.55	
Cancridae	2.72	2.22		4.11	2.16	2.44	1.22	5.61	2.27	5.77	2.11	5.77
Arbaciidae	1.77	2.11	3.94									

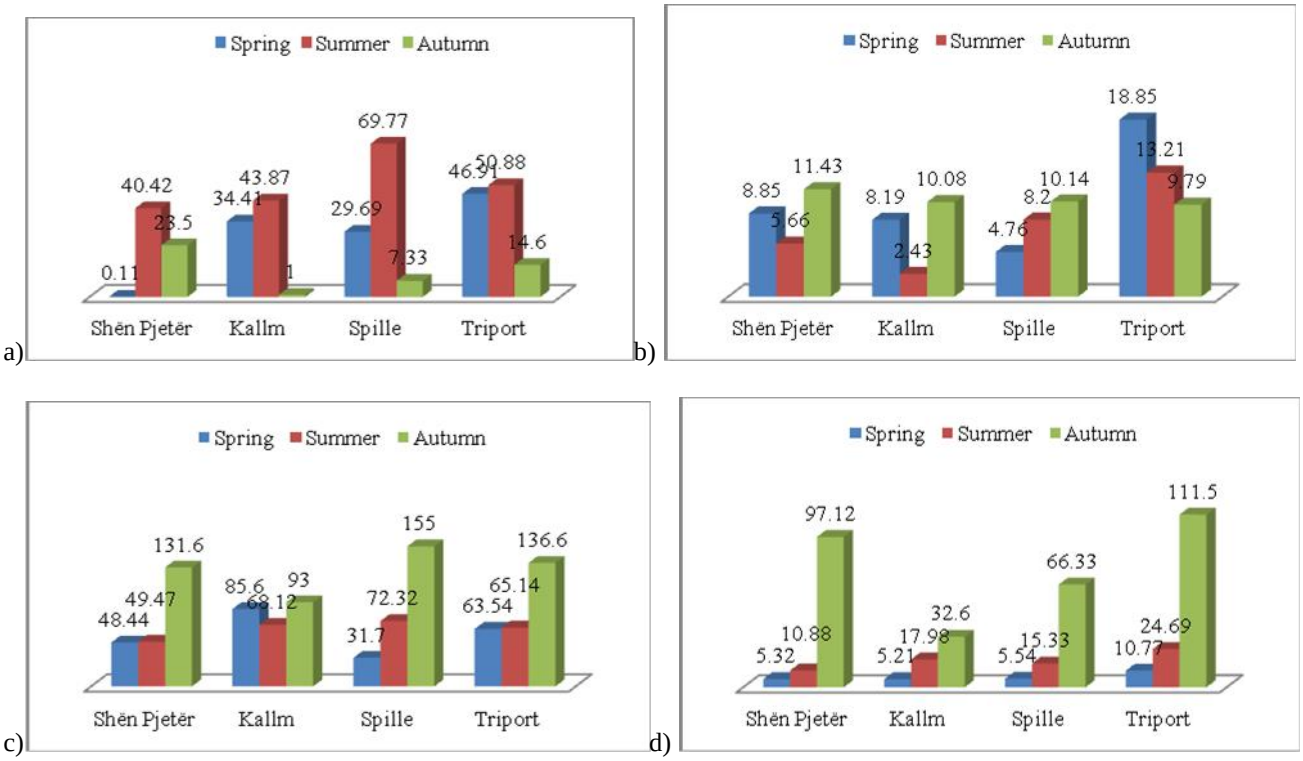

Figure 3. The total average abundance of benthic macroinvertebrates for each site in each season: a) supralittoral for non-colonial species; b) mediolittoral for non-colonial species; c) supralittoral for colonial species; d) mediolittoral for colonial species.

As shown in the figure 3, in supralittoral the highest abundance has been recorded in Spille for the non-colonial species in Summer season. In the same site, Spille, it has also been recorded the highest cover for the colonial species in Autumn season. In mediolittoral the highest abundance has been recorded in Triport for the non-colonial species in Spring, while for the colonial species the highest cover in the same site has been recorded in Autumn. The seasonal differences of the abundance and cover of benthic macroinvertebrates are evident in most of the cases, as shown in the Fig.3. Generally, the highest seasonal difference has been recorded for Spille.

As shown in the Fig. 4, there is a small difference of algal cover between Shën Pjetër, Kallm and Triport, while Spille shows a higher difference compared to the other sites. The highest seasonal difference of algal cover has also been recorded in Spille with respectively 18% in Spring, 42% in Summer and 24% in Autumn. The highest seasonal difference of the abundance of benthic macroinvertebrates in Spille in all cases, as mentioned above and showed in the Fig. 4, besides other reasons, might also be related to the highest seasonal difference of algal cover in this site. As it is known, many benthic invertebrate species use the algal cover for food and shelter [18].

The highest algal cover has been recorded in Summer season. In Summer season has been found the highest species number of benthic macroinvertebrates in all sites.

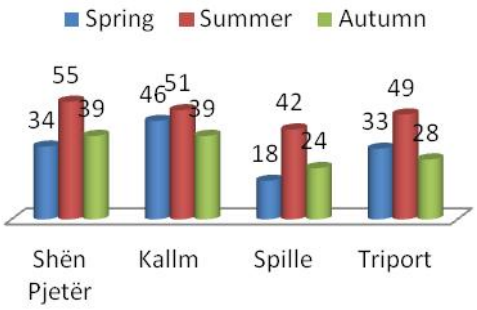

Figure 4. The average of algal cover (in %) for each site in each season

Another possible factor influencing the species presence of macrozoobenthic populations and their abundance might be related to the exposure of the cost. Highest exposure and consequently higher wave activities at the coast have been recorded during the sampling in Triport and Spille.

Table 3. Species similarity coefficient (Sokal & Sneath) between sampling sites for each season.

a) Spring

Sites	*Shën Pjetër*	*Kallm*	*Spille*	*Triport*
Shën Pjetër		24.13%	25.92%	25%
Kallm	24,13%		26.76%	25.80%
Spille	25.92%	26.76%		23.37%
Triport	25%	25.80%	23.37%	

b) Summer

Sites	*Shën Pjetër*	*Kallm*	*Spille*	*Triport*
Shën Pjetër		24.6%	22.35%	20,6%
Kallm	24.6%		17.9%	17.4%
Spille	22.35%	17.9%		22.9%
Triport	20,6%	17.4%	22.9%	

c) Autumn

Sites	*Shën Pjetër*	*Kallm*	*Spille*	*Triport*
Shën Pjetër		24.13%	19.25%	22.75%
Kallm	24.13%		30.27%	35.35%
Spille	19.25%	30.27%		21.95%
Triport	22.75%	35.35%	21.95%	

The species similarity coefficient (in the Table 3) does not show significant differences between the four sites in Summer season. The highest differences have been recorded in Spring and Autumn seasons. However, these differences seem to be more related to the algal cover, rather than to exposure of the coast. In the four studied areas, most of the algae species of annual life cycle, start its development in Spring and their degradation in Autumn, referring to the descriptions done in [15, 18, 20] for the species found in our samples. The highest algal cover and stability seems to be in Summer season, as also shown in the Figure 4 here above.

Conclusions

In the shallow rocky coasts of the Adriatic Sea in Albania 194 taxa of benthic macroinvertebrates have been recorded in the survey carried out in 2011 in the supralittoral, mediolittoral and upper limit of infralittoral in Shen Pjeter, Kallm, Spille and Triport.

105 taxa were found in Spring season, 139 taxa in Summer and 113 taxa in Autumn. Spille has a considerably lower number of taxa compared to the other three sites, while for the other sites the difference in species number is not significant.

This area is important in national and regional level for the species number and the presence of alien species.

Gastropods, bivalves and crustaceans were represented with the highest species number in three seasons, with an evident predominance of gastropods. The same groups have the highest seasonal difference in species number. The abundance of benthic macroinvertebrates has evident seasonal differences in most of sites, with the highest difference in Spille.

The algal cover and the exposal of the coast play an important role in the species composition and abundance of macroinvertebrate populations in the studied area. The seasonal difference of algal cover seems to be an importnat reason for the high seasonal difference of the abundance of benthic macroinvertebrates between the studied sites.

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