THE MACROZOOBENTHIC COMMUNITIES IN THE ROCKY MIDLITTORAL ZONE, CONSTANTZA CITY AREA, BETWEEN 2004 AND 2005

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ABSTRACT

The paper analyses the structure and the evolution of the macrozoobenthic communities between 2004 and 2005, in the rocky middlittoral zone of the Black Sea, near Constantza city. The results are based on the processing of 74 quantitative zoobenthic samples, collected in the 2004 and 2005, in summer and winter season. The recording of the structure, the specific composition and the abundance of the species and groups show the differences between the two seasons. The ecological indicators evince the place that every species is placed on, in the rocky middlittoral biocoenoses.

KEY WORDS : macrozoobenthos, middlittoral

MATERIAL AND METHOD

In order to accomplish the proposed study, stones from the rocky medium-seacoast from Constantza's area (between Mamaia and Constantza Port) have been collected.

The samples have been collected during four campaigns, two in the summer season (July 2004 and August 2005) and two in the cold season (December 2004 and 2005), during each campaign being collected stones with approximate dimensions (L X 1 X h) of 20 X 15 X 15 cm. At each drawing, the stones have been lifted at a distance of approximately 2.5 – 3 meters from the shore and a depth of 15 – 25 centimeters. At the moment of the collection, the sea water had 25°C, respectively 24°C, in the warm season, and 13°C, respectively 11°C in the cold season.

After the withdrawing from the marine environment, the stones have been put in containers with water from the sea, well closed, to avoid their dehydration, then they have been taken in the lab, for processing. Here, the rocks have been curetted, each sample being then conserved in containers, with 4% formaldehyde, for ulterior processing.

For the quantitative and qualitative analyses that have been done, the material curetted from each surface have been passed through the granulometric screen of 1 mm, thing that made easier the ulterior operations.

All the obtained values have been written in tables and statistically analyzed. With the help of some known formulas some important ecological indexes have been calculated, that have allowed, together with the graphical charts that were made, the wording of some conclusions regarding the discussed biocoenosis.

RESULTS AND DISCUSSIONS

In order to decipher the established relations between the different species of a biocoenosis, their simple identification is not sufficient. The image of these relations is well reflected by the synecological analysis. This type of analysis allows the identification of the species which are more important in the ecosystem under the aspect of the energy changes with the environment they live in, which are the species that characterize one biotope and which are the taxons that have accidentally arrived in the researched area, establishing in an equal measure which are the interrelationships between the different species that participate in the forming of the biocoenosis.

The dominance and constancy of the species typical for the biocoenosis

Depending on the data obtained from the analysis of the qualitative and quantitative structure of the collected organisms from the rocky area in Constantza (Table 1), I tried to establish the role and the place of the macrobenthal organisms in the *Mytilaster* – *Balanus* – *Mytilus* subcenosis (Tables 2 and 3), depending on the season.

Table 1

The qualitative and quantitative structure of the macrozoobenthos in the rocky medium-seacoast of the Black Sea – Constantza area

Species	**Total number in samples (ex.)**		
	Warm season	**Cold season**	**Total**
Mytilaster lineatus	23436	20904	44340
Idotea baltica	156	2112	2268
Sphaeroma pulchellum	903	372	1275
Nereis diversicolor	1104	363	1467
Balanus improvisus	204	627	831
Hyale pontica	243	0	243
Mytilus galloprovincialis	996	381	1377
Actinia equina	135	489	624
Actinothoe clavata	0	72	72
Rissoa splendida	252	15	267
Scapharca cornea	11	0	11
Lentidium mediterraneum	13	0	13
Total	**27453**	**25335**	**52788**

Table 2

The dominance and constancy of the species in the warm season samples

Species	**constancy (C %)**	**dominance (D %)**	**Ecological characteristic**
Mytilaster lineatus	100	85.39	euconstant, eudominant
Idotea baltica	65	0.57	constant, subrecedant
Sphaeroma pulchellum	76	3.28	euconstant, subdominant
Nereis diversicolor	89	4.02	euconstant, subdominant
Balanus improvisus	32	0.74	accessory, subrecedant
Hyale pontica	56	0.87	constant, subrecedant
Mytilus galloprovincialis	100	3.63	euconstant, subdominant
Actinia equina	55	0.48	constant, subrecedant
Rissoa splendida	66	0.92	constant, subrecedant
Scapharca cornea	10	0.03	accidental, subrecedant
Lentidium mediterraneum	10	0.05	accidental, subrecedant

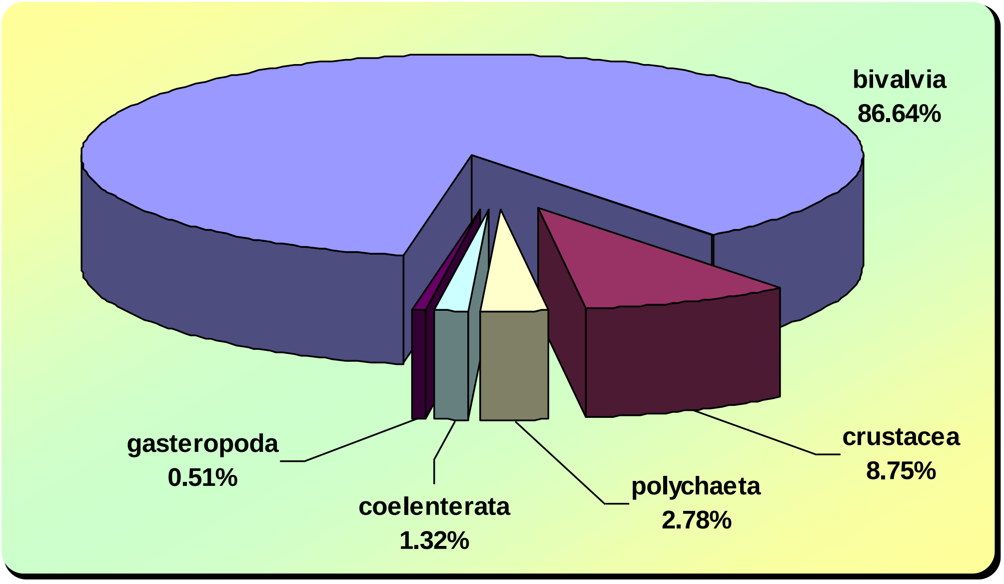


Fig. 1 – The quantitative structure of the macrobenthos in the the rocky medium-seacoast of the Black Sea – Constantza area

It can be easily seen that during the summer season, the sessile bivalves - *Mytilaster lineatus* and *Mytilus galloprovincialis* present the biggest value of the constancy (100 %). Euconstants are also two vagile species (*Nereis diversicolor* and *Sphaeroma pulchellum*) (Table 2).

Table 3

The dominance and constancy of the species in the cold season samples

Species	constancy (C %)	dominance (D %)	Ecological characteristic
Mytilaster lineatus	100	82.52	euconstant, eudominant
Idotea baltica	100	8.34	euconstant, dominant
Sphaeroma pulchellum	100	1.47	euconstant, recedant
Nereis diversicolor	78	1.42	euconstant, recedant
Balanus improvisus	76	2.46	euconstant, recedant
Mytilus galloprovincialis	76	1.51	euconstant, recedant
Actinia equina	75	1.95	euconstant, recedant
Actinothoe clavata	32	0.28	accessory, subrecedant
Rissoa splendida	22	0.05	accidental, subrecedant

In what concerns the dominance, only *Mytilaster lineatus* is eudominant, the other macrobental species being subdominant, respectively subrecedant (Table 2).

Once the water from the medium-seacoast area has cooled, on the rocky substrate, the qualitative palette is more limited, *Mytilaster lineatus* keeps it status of euconstant and eudominant species, but the number of the euconstant species is growing at 77.7% from the total (Table 3).

Concerning the dominance, *Idotea baltica* presents during the winter as a dominant species, the rest of the identified organisms being recedant or subrecedant species (Table 3).

The ecological significance index (W)

For the species identified in the samples collected during the warm season, the values of the ecological significance index varies between 85.30% (*Mytilaster lineatus*) and 0.004 for *Lentidium mediterraneum*. “The little white shell” – as BACESCU (1971) named the *Corbula mediterranea* is an endopsamic species, therefore its presence in the area with rough substrate is probably due to the larva taken by the stream, which found small quantities of sediment between the bissus threads of the epibiont shellfishes, where just a few individs have surpassed the veliconc phase. The same finding is available also for *Scapharca cornea*, Constantza area, being situated as a “geometrical place” of the northern and southern sector, presents elements characteristic to the fauna for each of them.

The rigors of the winter (with lower temperatures, but also with a stronger dynamism of the water masses) have consequences also for what concerns the position of the macrobental species in the biocoenosis. Only *Mytilaster lineatus*, the ruling species in the biocoenosis, keeps its rank, the cirriped *Balanus improvisus*, with the body stuck to the substrate, finds its place among the first three species from the biocoenosis, while *Mytilus galloprovincialis*’s position, less resistant to the rough waters of the winter solstice, goes down to the 6th rank.

The cenotic affinity index

On the basis of the effected calculus (according to the most used method – the one proposed by Jaccard) (GOMOIU, SKOLKA, 2001), it was possible to appreciate the affinities between the identified species (Fig. 3 and 4).

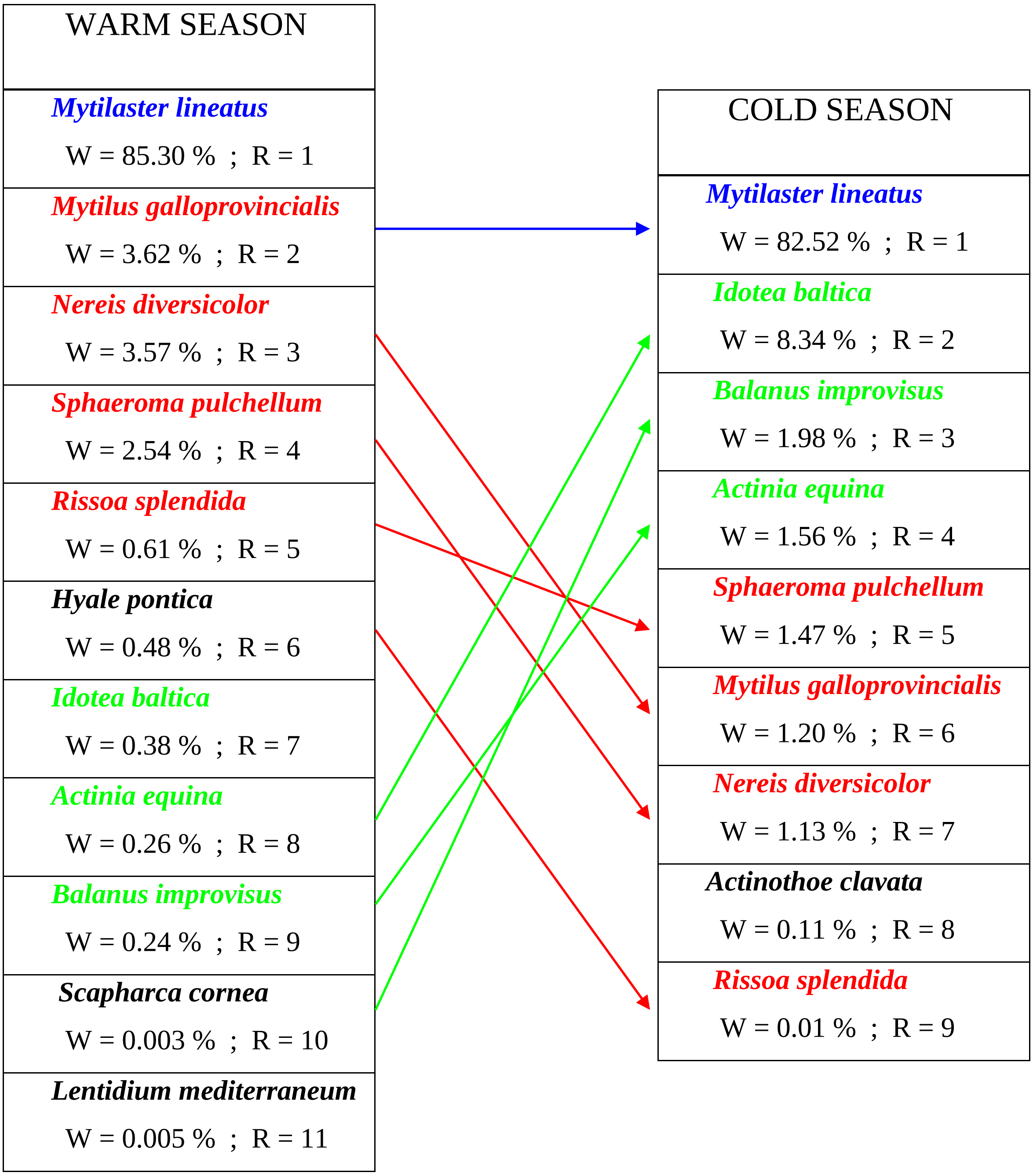


Fig. 2 – The values of the ecological significance index (W%) and the rank of each species from the *Mytilaster* – *Balanus* – *Mytilus* biocoenosis in Constantza city area

Mytilus galloprovincialis – **foto original**

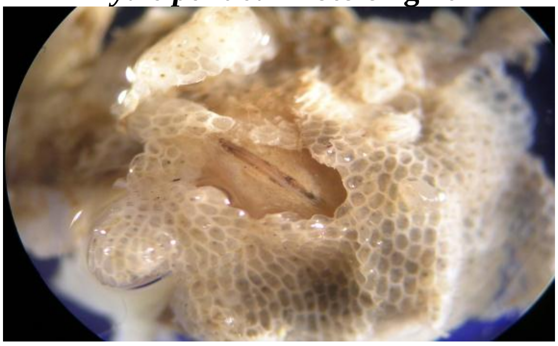
Mytilaster lineatus – **foto original**

Sphaeroma pulchellum – **foto original**

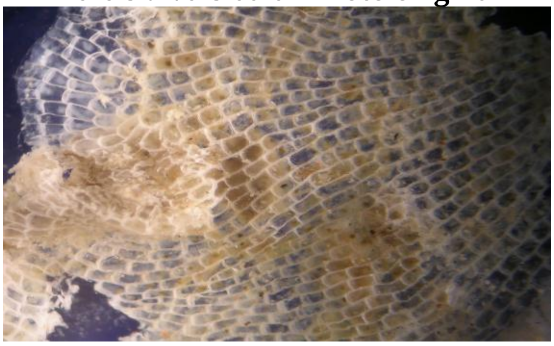
Idotea baltica – **foto original**

Hyale pontica – **foto original**

Nereis diversicolor – **foto original**



Balanus improvisus – **foto original**



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	M.l.	*M.g.*	*Ner.*	*Sph.*	*Ris.*	*Hyl.*	*Idot*	*Act.*	*Bal.*	*Don*	*Len.*
Mytilaster lineatus		100	88	77	66	55	66	55	44	11	11
Mytilus galloprovincial			88	77	66	55	66	55	44	11	11
Nereis diversicolor				87	55	62	75	62	50	13	13
Sphaeroma pulchellum					44	50	63	50	38	14	14
Rissoa splendida						38	50	83	43	17	17
Hyale pontica							83	43	29	20	20
Idotea baltica								57	43	17	17
Actinia equina									50	20	20
Balanus improvisus										25	25
Scapharca cornea											100
Lentidium mediterraneum											

Fig. 3 - The diagram of the cenotic affinity index (for the warm season)

The values of the cenotic affinity coefficient are being shown as following :

0 – 25 % = ; 25.1 – 50 % = ; 50.1 – 75 % = ; 75.1 – 100 % = .

Studying the diagrams, there can be noticed that no matter what season is, the species with a big cenotic affinity are at the same time the species that are characteristic for the studied biocoenosis, and these are: *Mytilaster lineatus*, *Mytilus galloprovincialis*, *Nereis diversicolor*, *Sphaeroma pulchellum*, meaning that the species are characteristic to the areas with a rough substrate.

During the winter, when the food resources are being reduced, the isopods, *Balanus* and *Actinia* depend on the organic substance taken from the water, so that the value of the cenotic affinity coefficient that characterizes them is bigger (Fig. 4).

	M.l.	*Idot.*	*Bal.*	*Act.*	*Sph.*	*M.g.*	*Ner.*	*A.cl.*	*Ris.*
Mytilaster lineatus		100	80	100	100	80	80	40	20
Idotea baltica			80	100	100	80	80	40	20
Balanus improvisus				80	80	100	60	50	25
Actinia equina					100	80	80	40	20
Sphaeroma pulchellum						80	80	40	20
Mytilus galloprovinciai							60	50	25
Nereis diversicolor								50	25
Actinothoe clavata									50
Rissoa splendida									

Fig. 4 - The diagram of the cenotic affinity index (for the cold season)

For the dominant species, *Mytilaster lineatus*, some biometrical measurements were made, concerning the length and biomass. On this basis I calculated the average length of this bivalve (Xmed = 6.93 mm), with S = 2.48, which indicates a close grouping of the values around the average. The accuracy coefficient, m% = 0.66, evinces that the obtained average value is representative for the present samples.

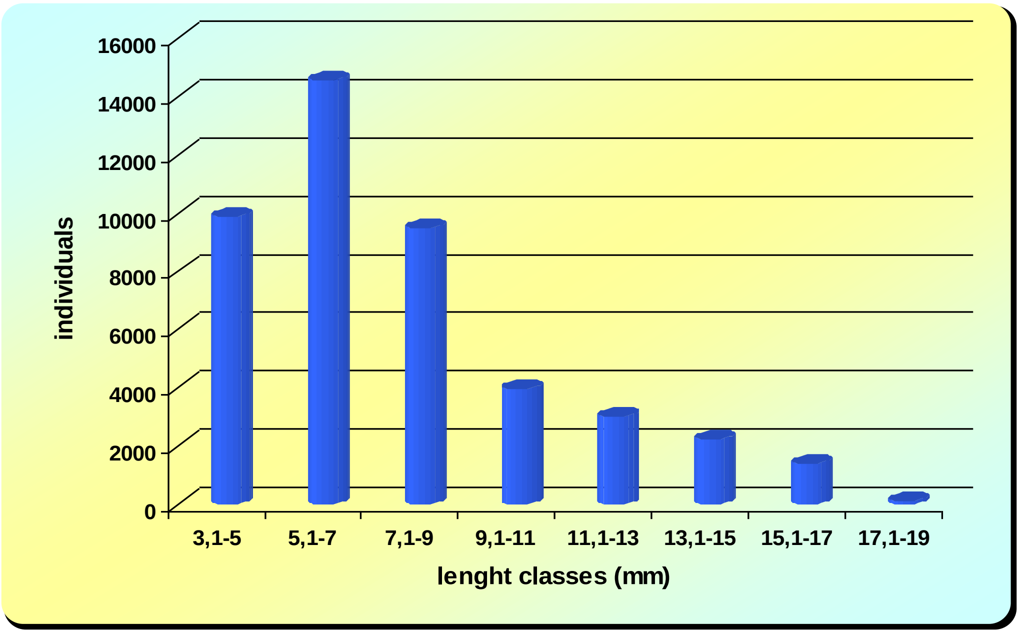

Fig. 5 – The distribution by length classes for *Mytilaster lineatus*

During the length and biomass measurements I noticed that for each length class there was a growth of the average biomass from the warm season to the cold one. The minimum growth was recorded for the 5-6 mm length class, and it was of about 7,6% and the maximum one was for the 9-10 mm class, about 39,7%.

Between the individuals collected in the warm season and the ones collected in the cold season, there was an average biomass growth of about 21,75%, probably due to the nutritional factors.

The two dominant length classes (a principal one, 3-5 mm, and a secondary one, 11-13 mm) was explained in 1976 on the basis of the severe winter in that year, and this was probably the cause for the average length of only 3,27 mm.

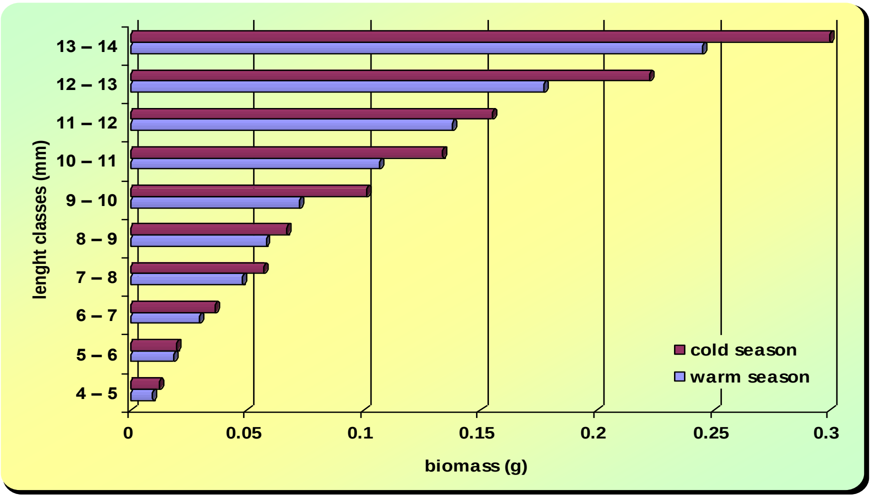

Fig. 6 – The average biomass growth for *Mytilaster lineatus*,depending on the season

In 2004 and 2005, the bivalve had an uniform length class distribution, and this, correlated with the average length of about 6,93 mm, indicates the proper environment conditions that *Mytilaster* developed in, and it could be a valuable information on the improvement of the ecological conditions in the Black Sea midd-littoral.

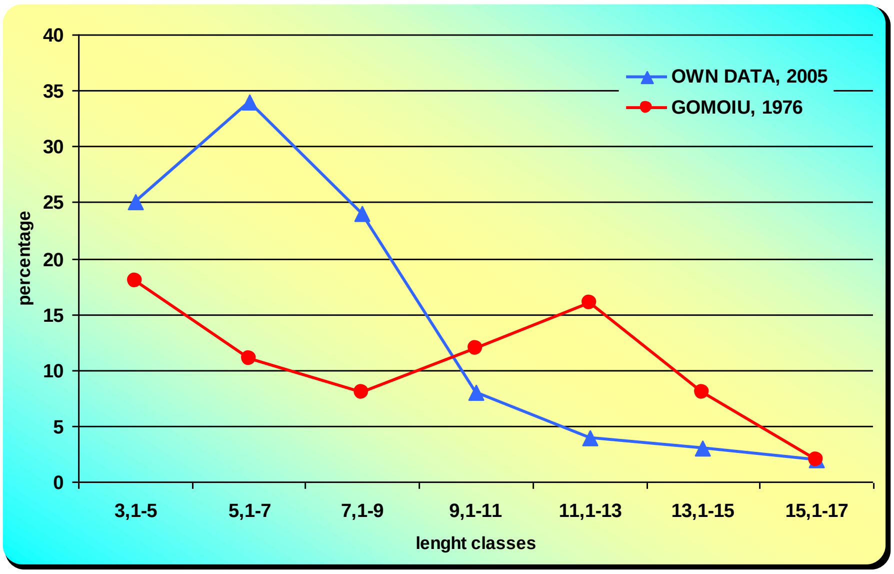

Fig. 7 - The length class population structure for *Mytilaster lineatus*, in 1976 and 2005

CONCLUSIONS

From the quantitative and qualitative data obtained from the analyze of the benthos samples collected from the rocky midd - littoral of the Black Sea – Constantza area, drawn during the hot season and respectively during the cold season, colligated with the data from the literature, some conclusions can be drawn :

Mytilaster lineatus has an ecological significance index with an important value (W% = 85.30 for the samples from the warm season and W% = 82.52 for those from the cold season), having in both cases the 1st rank in the biocoenosis, a fact that puts in evidence that it is the dominant species of the rocky midd-littoral biocoenosis in Constantza area.

The other sessile bivalve species, *Mytilus galloprovincialis*, rather belongs to the rocky infra-seacoast, in the medium-seacoast its growing being disturbed by the often emergences. This way, the values of the ecological significance index for this species were of 3.62% and 1.20%, inferior to the previous ones.

The analysis of the presence of the macrobenthal crustaceans puts in evidence the thermal preferences of the main species of isopods : during the warm season, *Sphaeroma pulchellum* has an appearance in sample (W% = 2.54) superior to that of *Idotea baltica* (W% = 0.38). Instead, in the samples collected during the cold season, the last species had an ecological significance index of 8.34% while *Sphaeroma pulchellum*, that likes the warmer water, appears rarely. The amphipods (*Hyale pontica*) proved their preference for the warmer waters, so, although in the samples collected during the summer they had the 6^{th} rank in the biocoenosis, in the winter samples, they lacked completely.

In the cold season, when the water temperature diminishes, at the same time with the diminution of the lasting of the bright period of the day, it is favored the vertical expansion of some cryophilic species and with a strong negative phototropism, like *Actinothoe clavata*, and the growing of other's abundance, very oxyfile, which, under the conditions of low temperature, find more oxygen, for example *Actinia equina* (from W% = 0.26 during the summer, to W% = 1.56 during the winter).

In the reference zone and in the study interval, the tighter cenotic affinities are between *Mytilaster lineatus, Balanus improvisus, Mytilus galloprovincialis* and *Actinia equina* respectively, motivating that the location for collecting the samples has been in a passing area between medium- and infra-seacoast, where there is the transition between the two biocoenosis characteristic for the rough substrate: *Mytilaster - Balanus - Mytilus* and *Mytilus - Balanus - Actinia*.

In 2004 and 2005, *Mytilaster* had an uniform length class distribution, and this, correlated with the average length of about 6,93 mm, indicates the proper environment conditions that the bivalve developed in, and it could be a valuable information on the improvement of the ecological conditions in the Black Sea middlittoral.

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