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RELATIVE NUMERIC IMPORTANCE OF TWO DIFFERENT SOFT-BOTTOM BENTHIC GROUPS (MOLLUSCS AND CRUSTACEANS) IN THE SOUTHERN BLACK SEA

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ABSTRACT

Single bulk sediments were separately collected with a Van Veen grab from 20 stations along the Turkish coast of the Black Sea in September 1988 and in January 1989. The numeric indices converted from these samples pronounced that molluscs and crustaceans were distributed in the equal frequency of occurence while molluscs contributed highly much biomass (99%) and abundance (69%), mainly with a few certain species such as ***Modiolus phaseolinus, Mytilus galloprovincialis.*** *Crustaceans were considered to be relatively contributors (0.1% biomass, 30% abundance), with small size organisms such as* ***Synisoma capito, Iphinoe elisae*** *and* ***Cythereis antiquata.***

KEY WORDS: benthos, molluscs, crustaceans, Black Sea

INTRODUCTION

The scope of this study is to represent the relative importance of the macrobenthic molluscs and crustaceans and the important species in each group along the Southern coast of the Black Sea. Any overall research was not found in the literature on this field along the Turkish coast of the Black Sea in a large scale. The present work was thought to be relatively useful for benthic community of the Black Sea.

MATERIALS AND METHODS

Study area lies between the longitudes of 28°30'E and 40°32'E and has a coastal length of about 1027 km, with the depth ranging from 20 m (station B_{20}) to 112 m (station B_7) on the southern side of the continental shelf of the Black Sea (Fig.1).

All raw individual and biomass data used in the analysis which informs the relative importance between two macrobenthic communities (molluscs and crustaceans) along the Turkish coastal waters of the Black Sea was obtained from a research by MUTLU (1990). The identification examination of the species of the gastropod, bivalve and cumacean was made using the publications of GOFAS (1989), COSEL (1989) and BĂCESCU (1989)

Such numerical distribution was converted to the values of numerical occurrence of either individual or biomass and frequency of occurence by using methods given by HOLDEN and RAITT (1974).

To determine the dominancy of each species among the other species and stations, dominance values was computed.according to methods described by WINDELL and BOWEN (1978).

Frequency of occurrence:

$$FO_i = \frac{\sum F_i}{\sum F}$$

where $\sum F_i$ is total frequency of i^{th} species and $\sum F$ is the sum of the frequencies of all species in a region.

Dominancy:

$$D_i = \frac{\sum SF_i}{\sum S}$$

where $\sum SF_i$ is the number of stations where i^{th} species is found and $\sum S$ is total number of stations.

Numerical occurrence:

$$NO_i = \frac{\sum N_i}{\sum N}$$

where $\sum N_i$ is total individual number of i^{th} species in a region, $\sum N$ is total number of individual of all species.

To compare the relative importance of species among these benthic assemblages, a figure of frequency of occurrence versus numerical occurrence was established. In order to respect to the distributional importance of biomass, individual and frequency in both groups along the Turkish nearshore of the Black Sea, another similar figure was drawn. The relative importance of the method was consulted many times to solve variation in the diel diet of any fish species by a few authors (WINDELL and BOWEN, 1978; HOLDEN and RAITT, 1974).

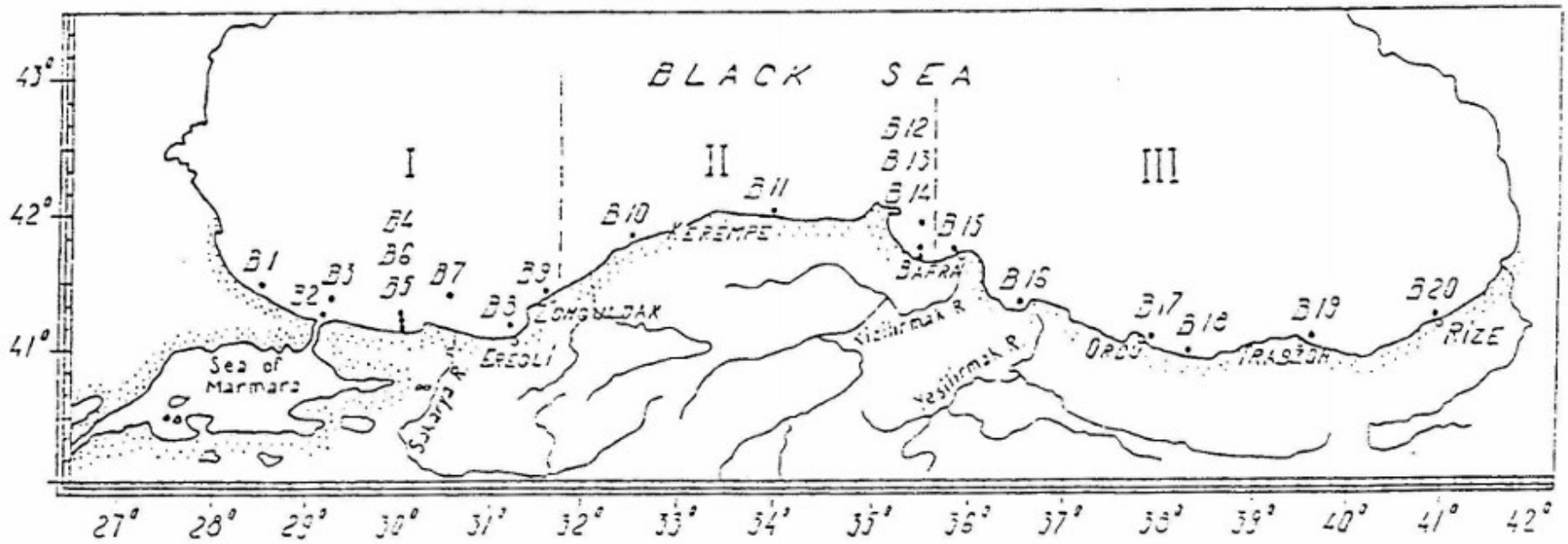

Fig. 1: Map showing the locations of the benthic sampling stations in the Black Sea
(I: Southwestern; II: Central and III: Southeastern part)

In more recent studies of soft-bottom benthos along the Turkish longshores of the Black Sea, totally 77 taxa whose 40 species were benthic crustacean and the rest molluscan community were identified by MUTLU et.al. (1990, 1991). Five-year effort concentrated on benthos along the Romanian coasts yielded a total of 286 (which belong to seven taxa groups Amphipoda, Cumacea, Cirripedia, Ostracoda, Decapoda, Tanaidae and Isopoda) crustacean and 174 molluscan species (to three groups: Prosobranchia, Opistobranchia and Lamellibranchia) (BĂCESCU et.al., 1971). In this detailed investigation, of course, a wide geographic area was covered in the different zones of Romania. However, during the present study, all representatives of these two faunal races could not be sampled. Therefore it could not recover the same results. Results of more recent occupation on benthos along the Soviet coast of the Black Sea and Azov Sea reported 239 molluscan species belonging to Chitonida, Prosobranchia, Opistobranchia and Lamellibranchia groups (BARANOVA, 1972) and 295 crustacean species by Cumacea, Anisopoda, Isopoda, Amphipoda, Ostracoda, Cirripedia and Anomura groups (BETSESCU et.al., 1969).

Individually relative importance of the species between two groups was exhibited in Fig.2 in the whole sampling area. As apparently seen, **Modiolus phaseolinus** which is a cosmopolite bivalve of the continental shelf deeper than 45-50 m, extended to 120-125 m in the Black Sea (YAKOBOVA, cf. ZENKEVICH, 1963). It was frequently and abundantly observed at 112 m in a study carried out by MUTLU et.al. (1990) while **Cythereis antiquata**, which is one of the best examples of the Ostracod species on the silty-mud bottom was put into the rare and abundant part of the Fig.2. However, **Xestoleberis cornelii** was scarcely and rarely sampled. Also, one of the scarce species, which is widespread in the Black Sea as frequently as M.phaseolinus, was Abra alba. In general, such dominant species were ones whose molluscan representatives had a wide vertical distribution in this sea (CASPERS, 1957). Many species of these faunal groups were rarely distributed in low number (Fig.2, II region). The moderate species with the fairly good abundance were represented by **Mytilus galloprovincialis** and **Iphinoe elisae**.

As it can be seen in Table 1, the species which were considered as important contributors to the benthic faunal groups in the present study, shared their own total individual numbers and maximum abundance with the sampling stations.

Figure 3 shows the relative importance as potential biomass contributor of crustacean and molluscan species to such available benthos along the Turkish coast of the Black Sea.

Mytilus galloprovincialis was an important contributor bivalve species in wet-weight and also has commercial importance of man's food resource in the Black Sea (BILECIK, 1975 cf. IVANOV, 1985; DIE, 1987). The mytilid mussels were moderately collected in abundance with grab sampler by MUTLU in 1988, 1989. However, it was more or less rarely sampled along Turkish coast-line of the Black Sea. CASPERS (1957) and ZANKEVICH (1963) stated with the results of this study which claimed that these mediterranean mussels occupied patchily and abundantly the bottom shallower than 50-60 m in this sea. BĂCESCU et.al. (1971) figured out the inhabitable locations of the Romanian coasts and approached to similar results. **Modiolus phaseolinus** appeared with the high contribution to biomass approximately as much as that to abundance along the coast. Although it was frequently collected, the proportion of its biomass contribution

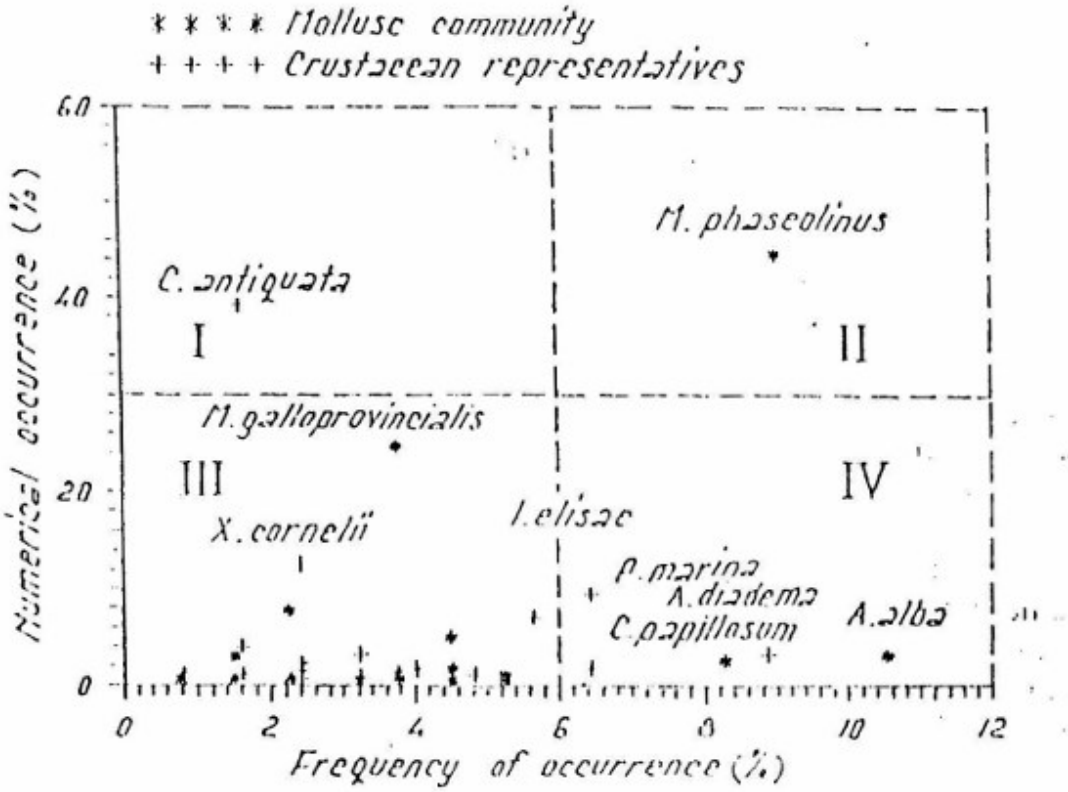

Fig 2: Distributional importance between crustacean and molluscan communities along the Turkish coast of the Black Sea. I : Region of rare and abundant species; II: Region of frequent and abundant species; III: Region of rare and scarce species; IV : Region of frequent and scarce species

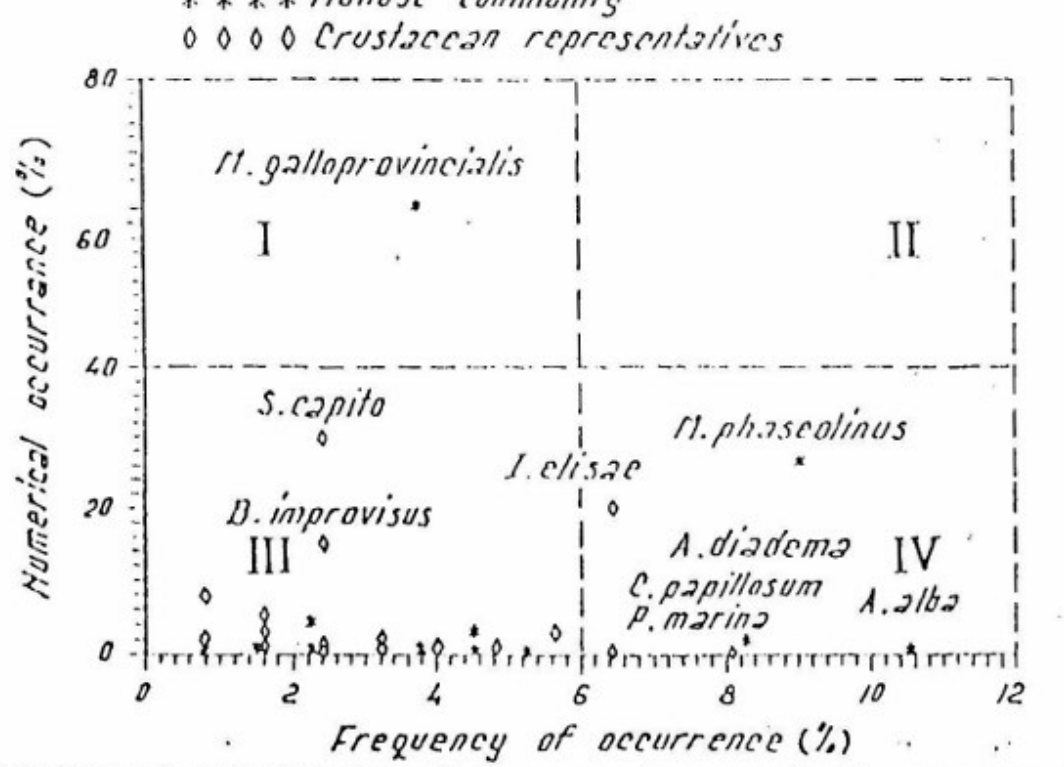

Fig.3: Percent wet-weight pattern between crustacean and molluscan communities along the Turkish coast of the Black Sea. I: Region of rare and abundant species; II: Region of frequent and abundant species; III: Region of rare and scarce species; IV: Region of frequent and scarce species

Table 1

Maxima in abundance and mean individual number of most important species along the longshores of the Black Sea (MUTLU, 1990)

Species	Maxima (ind/m²)	Station	Mean abundance (ind/m²)	
MOLLUSCA				
Abra alba	131	B_6	38	54
Cardium papillosum	126	B_{16}	31	56
Modiolus phaseolinus	3297	B_9	569	948
Mytilus galloprovincialis	3720	B_{15}	314	1255
CRUSTACEA				
Ampelisca diadema	103	B_{17}	18	33
Cythereis antiquata	4469	B_{11}	224	2240
Iphinoe elisae	651	B_{15}	53	132
Phlisica marina	143	B_{16}	30	60
Xestoleberis cornelii	1377	B_{11}	71	476

Second numbers under column "Mean abundance" refer to average values of species at stations where they were found first shows general mean along the study area.

Table 2

Maxima in biomass and mean biomass of most important species along the longshores of the Black Sea (MUTLU, 1990)

Species	Maxima (mg/m³)	Station	Mean biomass (mg/m³)	
MOLLUSCA				
Abra alba	2586	B_{11}	653	934
Cardium papillosum	9410	B_{15}	1992	3622
Modiolus phaseolinus	228500	B_9	31346	52243
Mytilus galloprovincialis	748500	B_8	74291	297164
CRUSTACEA				
Ampelisca diadema	258	B_3	27	48
Balanus improvisus	872	B_{20}	75	502
Iphinoe elisae	1929	B_{15}	101	251
Phlisica marina	83	B_{15}	9	19
Stenosoma capito	2349	B_{15}	149	476

was less than that of mytilid mussels. This is definitely due to very little organisms in size by comparing with the mediterranean mussel. Of molluscan species with low wet-weight potential, **Cardium papillosum** and **Abra alba** were, however very frequently encountered everywhere along the nearshores especially after 35-40 m depth. This analysis resulted in the following situations for macrobenthic crustacean assemblage as

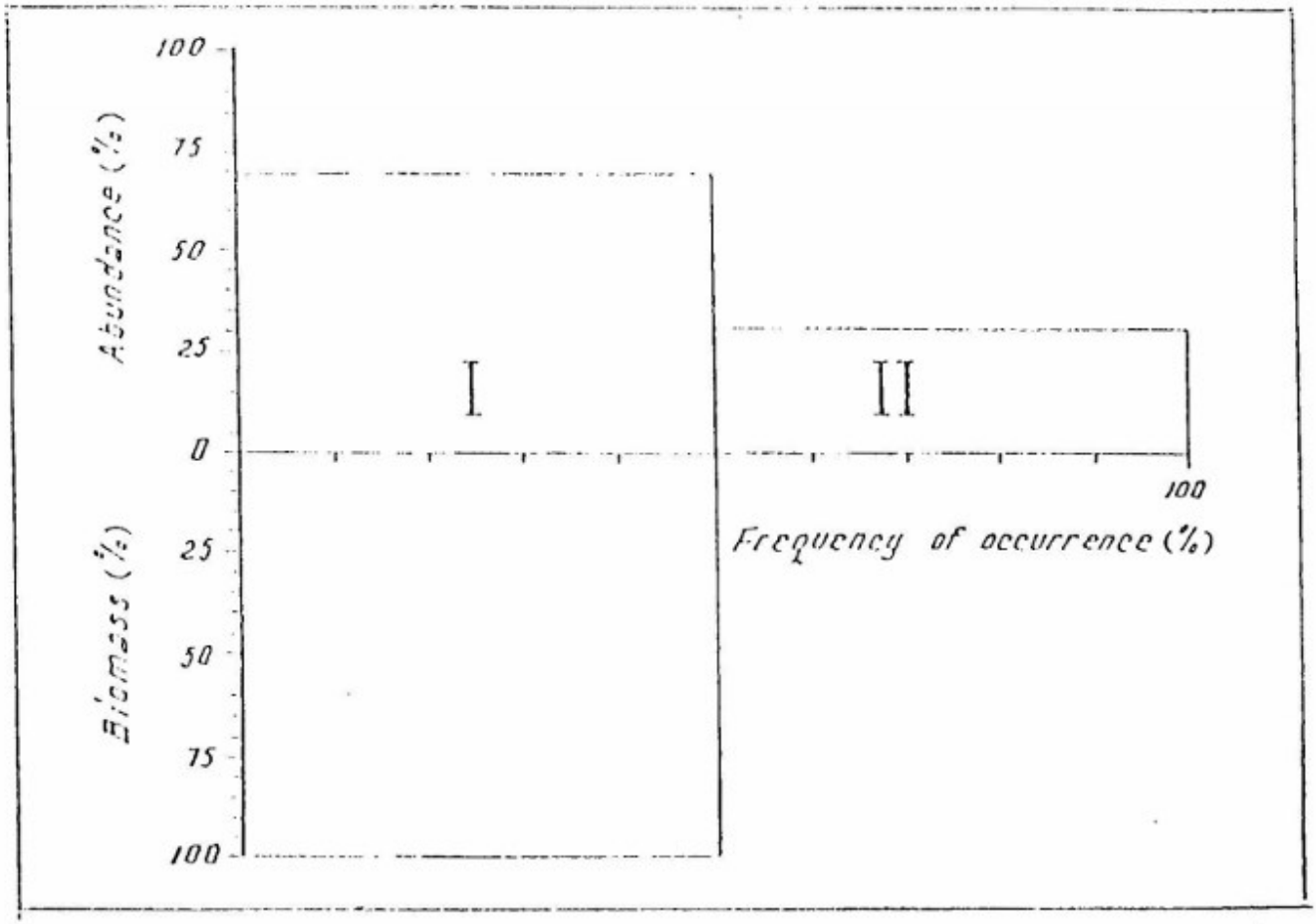

Fig.4: A simple diagram showing numerical importance between molluscan and crustacean communities. I - Mollusca, II - Crustacea

shown in Fig.3 and Table 2: **Stenosoma capito** (Tanaidae) and **Balanus improvisus** (Cirripedia) were leader members of the crustaceans representatives which were moderately gathered from the soft-bottom along the coasts of the Southern Black Sea. More frequently appeared Cumacean species, **Iphinoe elisae** was, however found in lower biomass. Other crustacean species to be mentioned were **Ampelisca diadema** and **Phtisica marina**.

This preliminary study demonstrated a further distributional pattern in three-dimensional relationship (abundance, biomass and occurrence) between two different macrobenthic groups (mollusca and crustacea) (Fig.4). Both groups were found to have equitable frequencies of occurrence in the purposed area (Fig.4, Tables 3 and 4). In other words, Mollusca and Crustacea shared equally the substratums to inhabit along the Turkish coast of the Black Sea. In spite of similar distribution amongst the groups, same results could not be observed for biomass and abundance. As it is well-known, there are many defined factors affecting relative importance due mainly to difference in size of organisms between groups particularly for biomass indices etc. However, the proportionality of biomass contribution of the crustacean members was almost negligible compared to that of molluscs. The relative importance of individual distribution of macrobenthic crustacean was half of those of molluscan species. That is, molluscs were individually collected twice more than the encrusted marine organisms.

Table 3

...onal composition of benthic mol... ...ly collected from the sampling stations.
(MUTLU ... 1990)

TAXA	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20
MOLLUSCA																				
Gastropoda						5	1	1	2	3	0	0	1	6	6	1	0	2	1	3
Prosobranchia																				
Bittium reticulatum	.	.	.	.	.	+	.	.			.	.	.	+	+	.	.	+	.	+
Calyptraea chinensis	.	.	.	.	+	.	.	.			.	.			.	.	.	.	.	.
Hydrobia ventrosa	.	.	.	.	.	+							.	+	.	.	.	.	.	+
Nassa reticulata	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Rissoa euxinica	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Trophonopsis breviatus	.	.	.	.	.	.	.	+	.	+	.	.	.	.	+	.	.	.	.	.
Turricaspia dybowski	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Opisthobranchia																				
Crysallida interstincta	.	.	.	.			.	.	.	.	.	.	.	+		.	.	.	.	+
Odostomia rissoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Retusa truncatula	.	.	.	.		+	.	.	.	+	.	.	+	.	+	+		+	+	.
Retusa variabilis	.	.				.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Bivalvia	2	1	0	2	4	5	1	8	[illegible]	1	5	2	1	13	13	0	4	[illegible]	6	8
Lamellibranchia																				
Abra alba	+	.	.	+	+	+	.	+	+	+	+	+	.	+	+	+	+	+	.	.
Abra prismatica	.	.	.	.	.	+	.	.	.	.	.	.	.	+	+	+	.	.	+	.
Acanthocardia paucicostata	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.
Acanthocardia tuberculata	.	.	.	.	.	.	.	.	.	.	.	.	.				+	.	.	.
Acanthocardia sp. (juvenile)	.	.	.	.	.	+	.	.	.	+	.	.	.	+	.	.	.	.	.	.
Arca lactea	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cardium exiguum	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	.	.
Cardium papillosum	+	.	.	.	+	+	.	+	.	.	+	.	+	+	+	+	+	+	.	.
Circomphalus casinus	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Divaricella divaricata	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+
Donax venustus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Gafrarium minimum	.	.	.	.	+	.	.	+	.	.	.	.	.	+	+	.	.	.	.	+
Hypanis plicatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Kellya suborbicularis	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Modiolus adriaticus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Modiolus phaseolinus	.	.	.	+	.	+	+	+	+	+	+	+	.	+	+	+	.	.	.	.
Mysella bidentata	.	.	.	.	+	.	.	.	.	.	.	.	.	+	+	+	.	+	.	.
Mytilaster lineatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Mytilus galloprovincialis	.	.	.	.	+	.	.	+	.	.	.	.	.	+	+	.	.	.	.	+
Ostrea edulis (juvenile)	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	.
Pitar mediterranea	.	.	.	.	+	.	.	+	.	.	.	.	.	+	+	.	.	.	+	+
Polititapes rostrata	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.
Spisula triangula	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.
Tellina tenuis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.
Venerupis aurea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+
Venus gallina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+
Species number	2	1	0	2	10	10	7	12	5	6	3	2	2	20	19	2	4	6	7	11

Taxanomical aspects and distribution of macrobenthonic crustaceans obtained from the turkish coast of the Black Sea (MUTLU et al, 1991)

TAXA	Southwestern sector									Central part					Southeastern sector					
	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20
Amphipoda	1	1	3	1	7	7	0	8	1	4	2	2	2	6	9	9	2	3	1	1
Aoplisca diadema	.	.	+	.	+	+	.	.	.	+	.	+	+	+	+	+	+	.	+	.
Dexamine spinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Caprella acanthifera	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.
Corophilus baeri	.	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Centromedon sp.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Corophium volutator	.	.	.	.	+	+	.	+	.	.	.	+	+	+	+	+	.	.	.	.
Hyale perieri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.
Jassa falcata	.	+	+	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.
Melita palmata	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Microdeutopus gryllotalpa	.	.	.	.	+	+	.	+	.	+	+	.	.	.	+	+	.	.	.	.
Pontocrates gibberus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Rhachotropis guttatus	.	.	.	.	+	+	.	+	.	.	.	.	.	.	+	.	.	.	.	.
Orchestia gammarella	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Perioculodes longimanus	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Pontocrates longimanus	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.
Pontocrates sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Urothoe poseidonis	.	.	.	+	+	+	.	+	+	+	.	.	.	+	+	+	+	.	.	.
Synchelidium maculatum	.	.	.	.	+	+	.	.	.	.	.	.	.	+	.	.	.	.	.	+
Stenothoe monoculoides	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Cumacea	2	0	0	0	3	5	0	1	0	0	0	1	0	3	7	4	0	3	4	2
Bodotria arcuata mediterranean	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cumella limicola	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Cumella aff. limicoloides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Cumella pygaea curonica	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.
Eudorella truncatula	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	+	.	+	+	.
Iphinoe elisae	.	.	.	.	+	+	.	.	.	.	.	.	.	+	+	+	.	+	+	+
Iphinoe maeotica	.	.	.	.	+	+	.	.	.	.	.	.	.	+	+	+	.	.	+	.
Iphinoe tenella	+	.	.	.	.	+	.	.	.	.	.	+	.	.	+	.	.	.	.	.
Pseudocuma longicornis	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Pseudocuma longicornis pontica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+
Ostracoda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2	0
Cythereis antiquata	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.
Carinocytereis rubra	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	.
Cytheridae sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	
Cytheries sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.
Xestoleberis corneli	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	.	.	.
Cirripedia	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	2
Balanus eburneus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Balanus improvisus	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	+
Isopoda	0	0	0	0	0	0	0	2	0	1	0	0	0	0	2	0	0	0	0	0
Sphaeroma serratum	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.
Stenosoma capito	.	.	.	.	.	.	.	+	.	+	.	.	.	.	+	.	.	.	.	.
Anisopoda	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0
Apseudes talpreillii	.	.	+	.	.	+	.	.	.	.	.	.	.	+	+	+	.	.	.	.
Decapoda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Diogenes pugilator	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Species number	3	1	4	1	10	13	0	13	1	5	2	3	2	14	22	9	2	6	7	6

CONCLUSIONS

This study showed the particular distribution pattern of molluscan and crustacean obtained from their numerical values. Molluscs contributed highly to the biomass of the Black Sea by comparing to crustaceans. But, abundance proportion of the crustaceans was remarkably considerable. Molluscs were double in individual number in the investigated area. Most important species were **Modiolus phaseolinus, Mytilus galloprovincialis** (Mollusca); **Cythereis antiquata, Iphinoe elisae** (Crustacea)

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