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A preliminary view on the faunal assemblage of soft-bottom crustaceans along the nearshores of the Turkish Black Sea

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Beginning in August-1988 and ending in January-1989, single samples of the soft-bottom benthos were collected with a Van Veen grab (0.175 m²) from 20 stations along the Turkish coasts of the Black Sea.

A total of 40 crustacean species was identified. The diversity and quantity of the fauna tend to decrease with increasing depth after 50-60 m due to significant reduction in O_2 level and to muddy basin. The most important crustaceans were Cythereis antiquata, Xestoleberis cornelii, Iphinoe elisae, Microdeutopus gryllotalpa *and* Ampelisca diadema *in the shallower waters and common amphipod species,* Ampelisca diadema *in the deeper zones where the mud fraction was predominant. The coastal pure sandy bottom was characterized by means of a few psammophilic representatives such as* Diogenes pugilator *and* Synchelidium maculatum.

Centromedon *sp. was a newly reported first member of this genus in the Black Sea.*

INTRODUCTION

The Black Sea is a unique largest anoxic basin of world's water bodies characterized by a permanent halocline (MURRAY and IZDAR, 1989).

The zoobenthos of the Black Sea is four or five times poorer than that of the Mediterranean Sea and also Sea of Marmara due to its lower salinity (19%) and to presence of intensive anoxic water body and of a narrow habitable upper layer in this sea (ZENKEVITCH, 1963). The number of recent macrozoobenthic species in the Black Sea amounts to about 751 whose 188 species belong to the phyla of Crustacea (ZENKEVITCH, 1963; CASPERS, 1957). BACESCU *et al.* (1971) reported more lately 1785 zoobenthic species. The lower limit of colonization of the bottom is controlled by the hydrolytic factors. The extent of habitable water depth of the benthos is restricted by the lower limit of living plankton. So far, few studies have been done in the study area (BILECIK, 1975; KOCATAS and KATAGAN, 1980).

Therefore, the aim of this paper was to present a preliminary view about the macro benthic crustacean fauna along the Turkish coasts of the Black Sea.

INVESTIGATION AREA

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 20m (sta. B20) to 112m (sta. B7) on the southern side of the continental shelf of the Black Sea, along the Turkish coasts (Fig. 1).

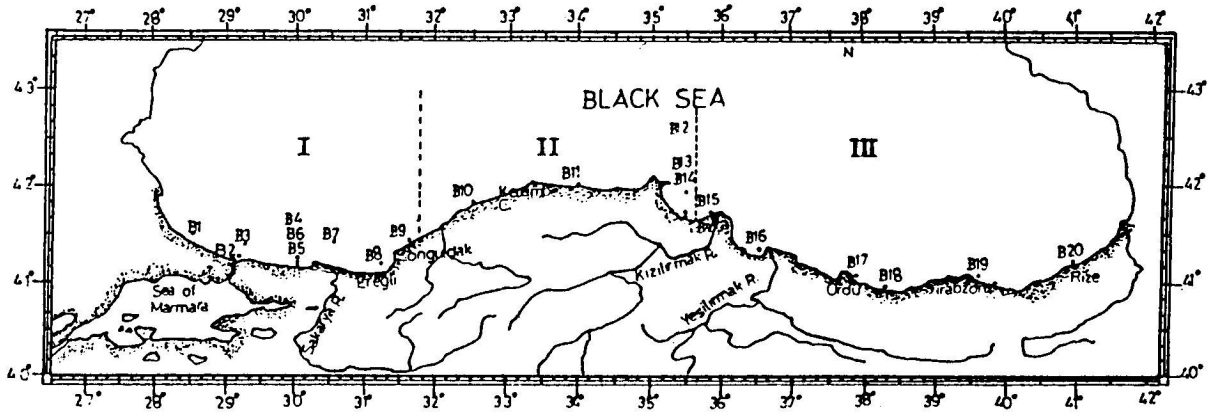

Fig. 1. Map showing the locations of the benthic sampling stations in the Black Sea (I: Southwestern; II: Central and III: Southeastern part)

Hydrographical factors of this region have recently been studied by some researchers (DBT-DEU, 1986; OGUZ *et al.*, 1989, 1990; MURRAY and IZDAR, 1989). Its hydrographical peculiarities are mainly caused by the narrow and shallow connection with the Seas of Marmara and Azov, the strong inflow of fresh water from rivers, and heavy rainfall.

The sediment pattern is governed by surface and longshore bottom currents and wave action in the nearshore zone, and by an isolated cyclonic current system and bottom morphology in the deep basins of the Black Sea (SHIMKUS and TRIMONIS, 1974).

MATERIAL AND METHODS

The sampling method corresponds closely to the recommendations on a basis of procedures given by ŠTIRN (1981). Single quantitative samples of the soft-bottom benthos were collected with the help of van Veen grab (0.175-m²) and a clamshell snapper (0.015-m²) from 20 stations chosen within nearly equal intervals (Fig. 1) in August-1988 and January-1989. During the sampling, some hydrological parameters (temperature, salinity, dissolved oxygen, depth) were measured with the CTD-probe. A small split of the bulk sediment samples was separated and then stored in the deep-freezer for subsequent grain size analysis based on Folk's method (1974). The samples were sifted through a 0.5-mm sieve, handpicked when possible, and stored into 5% neutralized formalin solution.

In the laboratory, the organisms were sorted from the sifted sediment under binocular microscope and stored in 70% alcohol. Then, species composition, abundance and biomass were determined. Such animals were identified to species level when possible. For certain cumacean species consultance of authories was asked. The biomass was determined as formalin wet weight after at least one month's preservation to obtain constant figures. To determine the dominancy of each species within the other species and stations, the occurrence of frequency and dominance values were computed according to methods described by HOLDEN and RAITT (1974).

Frequency of occurrence:

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

Where ΣF_i is total frequency of i^{th} species and ΣF is the sum of the frequencies of all species in the region.

Dominancy:

$$Di = \frac{\Sigma SF_i}{\Sigma S}$$

Where ΣSF_i is the number of stations where i^{th} species is found and ΣS is total number of stations.

Numerical occurrence:

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

Where ΣN_i is total individual number of i^{th} species in a region, ΣN is total number of individual of all species.

The species diversity was calculated according to Shannon's formula (PIELOU, 1969).

$$H' = \sum_{i=1}^{\varsigma} p_i \ln p_i$$

Where ς is the number of species and p_i is the proportion of the abundance of individuals belonging to the i^{th} species ($P_i=n_i/N$).

RESULTS AND DISCUSSION

Unfortunately, a few studies dealing with the qualitative and quantitative distribution of macrobenthic especially, mixobenthic organisms existing along the Turkish long shores of the Black Sea were performed up until now. The most recent investigations are as follows: benthic amhipoda in some localities of the Turkish Black Sea (KOCATAS and KATAGAN, 1980), a coarse qualitative distribution of macrobenthos in this Sea (FISCHER *et al.*, 1988).

Some variables of the hydrographical peculiarities simultaneously obtained *in situ* and sedimentological properties are given in Table 1.

In order to gain better understanding in the faunal distribution of macrobenthic crustaceans in their autecology, it was thought that the area

Table 1. Some hydrographical and sedimentological measurements at the stations during the sampling

Station code (West to East)	Depth (m)	Dis. Oxygen (ml/l)	Temperature (C)	Salinity (‰)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
B1	76	3.44	7.23	18.46	2.7	12.5	47.8	37.0
B2	68	1.76	14.64	36.64	71.3	28.3	<1	<1
B3	100	3.45	9.08	22.81	–	–	–	–
B4	94	2.59	7.86	20.23	–	–	–	–
B5	58	–	–	–	6.0	66.9	13.4	13.7
B6	44	6.94	7.53	18.24	4.9	17.1	41.8	36.2
B7	112	2.41	7.63	19.78	–	–	–	–
B8	34	–	–	–	<1	3.7	53.5	42,2
B9	70	–	–	–	16.6	9.3	41.4	32.7
B10	80	0.47	8.22	20.61	4.9	4.0	55.0	36.1
B11	90	3.90	7.56	19.59	1.9	6.8	55.4	36.0
B12	101	1.68	8.05	20.01	1.2	7.1	49.2	42.3
B13	80	3.88	7.89	20.01	1.5	1.5	48.0	49.0
B14	28	–	–	–	<1	18.4	58.4	23.2
B15	40	–	–	–	16.9	19.1	35.2	28.9
B16	48	–	–	–	<1	<1	47.6	51.5
B17	63	–	–	–	<1	17.4	55.0	26.9
B18	49	9.78	7.78	18.02	<1	13.2	64.3	22.2
B19	36	7.21	7.69	18.00	<1	18.0	61.5	19.9
B20	20	8.17	7.93	18.05	<1	93.9	5.0	<1

Lines: not measured
Percent mud could be obtained from 'silt + claye

surveyed was objectively divided within a logic of the following descriptions into three sites, namely: SW-BS (Southwestern sector; sts., B1-B9; Fig. 1) where some impacts of underwater current with the Mediterranean Sea waters through the Bosphorus and deltaic system of Sakarya River were available; SC-BS (central part; sts., B10-B14; Fig. 1) was situated along the long shores which were isolated from any effluent of the river system or another terrestrial inflow except flood or climatic actions etc.; finally, SE-BS (Southeastern nearshores; sts., B15-B20; Fig. 1).

Variation in specimen

A total number of 11489 specimens at the whole sampling area was enumerated. Fauna was composed mainly of Ostracoda (53%), Amphipoda (27.6%), Cumacea (7.4%), Isopoda (3%), Anisopoda (1.5%), Cirripedia (0.8%) and Decapoda-Anomura (0.14%). The mean abundance of macrobenthic crustaceans accounted along the Turkish coasts of the Black Sea was recorded to be an approximate number of 689 ind./m2. The individuals gathered per square meter were 136, 1327 and 604 in three sub spaces from west to east, SW-BS, SC-BS and SE-BS, respectively.

The highest individual number among the localities of each subarea was 304 at station B6, 6361 at sta. B14 and 2702 specimens m^{-2} at sta. B15 from west to east. While such numerical variation was between 6 (sta. B4) and 6361 ind./m^2 (sta. B14) around the nearshore off Bafra, station B7 which has a deepest bottom was somewhat, devoid of macrobenthic crustaceans. The fluctuation in abundance among the three subdivisions meant that there was not a moderate and even individual distribution within the localities.

It was considered that the number of individual at each station changed mainly interrelating to the depth. It is very effective in faunal composition, especially above the 50 m bottom depth. Consequently, some variations in textural appearance of the superficial sediment and concentration of dissolved oxygen affected importantly the distributional pattern of the individuals along the nearshores of the Turkish coast of the Black Sea. The typical abundance amounted to an average value of 1300 ind./m^2 at depths less than 50m where the dissolved oxygen condition was very favourable (a mean value of 7.98 ml/l). Unlike, on bottom surrounded by waters with lower O_2 level (2.39 ml/l) after 50m, remarkable low mean value of 90 specimens per square meter was calculated (Fig. 2).

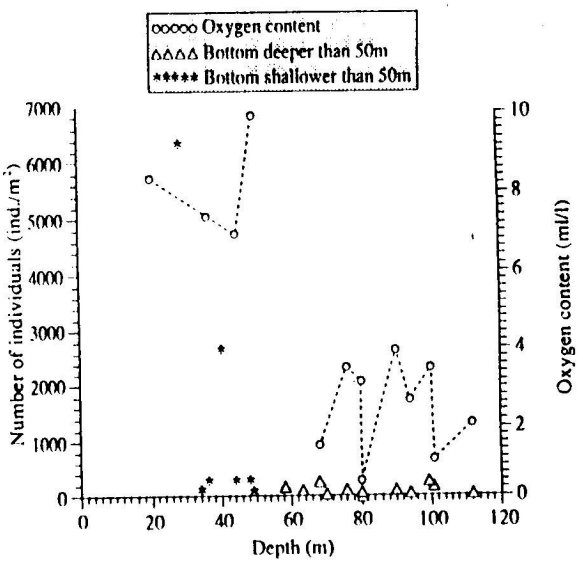

Fig. 2. Changes in individual number of macro-benthic crustacean with the depth and dissolved oxygen content

Table 2 expressed that mean abundance increased with averaged mud content of the superficial sediment at each subregion.

Table 2. Mean abundance and percent mud within the three basic regions of the investigation area

Regions (west to east)	Mean abundance (ind./m^2)	Mean mud content (%)
Southwestern coast	136	58
Southcentral longshores	1327.8	91
Southeastern parts	604	69

Of small sized organisms, *Cythereis antiquata* constituted 39% of the total individual

number as much as *Xestoleberis cornelii* had (Table 3). The greatest abundance and biomass for these species were as follows: 4469 specimens m^{-2}, 277 mg/m^2 for the *Cythereis antiquata;* 1377 and 116 at station B14 (28m) at which the soft bottom was predominantly characterized by sand or silty mud fraction. *Xestoleberis cornelii* had a large vertical distribution up to the *Phyllophora* zone everywhere in the Black Sea. *Cythereis antiquata* was also found in the mussel mud of the northwestern and western parts along the Romanian coast of the Black Sea. The common cumacean species, *I. elisae* had the highest contribution with 1929 mg and 651 ind. per square meter at 40m depths. Also BACESCU *et al.* (1971) pronounced that this species was very abundantly observed with 2000 specimens m^{-2} at 75m in the Bulgarian long shores nearly as much as that reported in the present study. The same authors found the same species in high numbers at the depths of 48-60m along the Romanian coasts so it was three or nearly four times more than ours.

Amphipoda commonly represented by *Microdeutopus gryllotalpa* (623 specimens/m^2 with 232 mg/m^2 at sta., B15), *Caprella acanthifera* (434 with 120 at sta., B15; 40m) and *Ampelisca diadema* (103 with 20.6 at sta., B12; 101m: but, 23 with 81 at sta., B19; 36m depth)

Table 3. Percent individual distribution of the most abundant macrobenthic crustacean species among the sampling stations

Taxa	STATIONS																			
	Southwestern sektor									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																				
Ampelisca diadema	–	–	33	–	–	–	–	–	–	–	–	75	35	–	–	–	50	–	–	–
Caprella acanthifera	–	–	–	–	–	–	–	–	–	14	–	–	–	–	16	–	–	–	–	–
Centromedon sp.	20	–	17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Corophium volutator	–	–	–	–	12	–	–	–	–	–	–	17	65	–	–	–	–	–	–	–
Jassa falcata	–	100	–	–	–	–	–	–	–	–	34	–	–	–	–	–	–	–	–	–
Microdeutopus gryllotalpa	–	–	–	–	27	10	–	–	–	22	76	–	–	–	23	–	–	–	–	–
Periculodes longimanus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19	–	–
Phtisica marina	–	–	–	100	21	38	–	–	100	43	–	–	–	–	–	46	50	–	–	–
Stenothoe monoculodes	–	–	–	–	–	–	–	22	–	–	–	–	–	–	–	–	–	–	–	–
Cumacea																				
Cumella limicola	–	–	–	–	–	–	–	11	–	–	–	–	–	–	–	–	–	–	–	–
Iphinoe elisae	–	–	–	–	–	24	–	–	–	–	–	–	–	–	24	17	–	46	7	–
Iphinoe maeotica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	61	23
Iphinoe tenella	60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	14	–
Pseudocuma longicornis	20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	9	–	–
Ostracoda																				
Cythereis antiquata	–	–	–	–	–	–	–	–	–	–	–	–	–	70	–	–	–	–	–	–
Carinocythereis rubra	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–
Xestoleberis cornelli	–	–	–	–	–	–	–	–	–	–	–	–	–	22	–	–	–	–	–	–
Cirripedia																				
Balanus eburneus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	27
Balanus improvisus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	27
Isopoda																				
Stenosoma capito	–	–	–	–	–	–	–	22	–	–	–	–	–	–	–	–	–	–	–	–
Anisopoda																				
Apseudes latreillei	–	–	33	–	–	–	–	–	–	–	–	–	–	–	–	7	–	–	–	–
Decapoda																				
Diogenes pugilator	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	13

was an important crustacean group. The species *Microdeutopus gryllotalpa* was concentrated at the depth ranging from 30 to 70 m in the central part of the infralittoral zone of the Romanian coasts and it had 10 spp. and 26 mg per square meter at 75m depth in the Bulgarian coasts (BACESCU *et al.*, 1971). The abundance and biomass of *Caprella* species were 1300 ind./m² and 1.17g/m² off Constanta and it was recorded to be 20 specimens/m² and 0.01g/m² at 29m depth off Sulina (BACESCU *et al.*, 1971). A study, reflecting recent distribution of benthos in the Black Sea, carried out by BACESCU *et al.* (1971), had a good distributional pattern in some Figures about such animals. This figured out that *Ampelisca diadema* was generally found to have an average abundance of 400 ind. and a maximum biomass of 20-24 g/m² in its wide vertical distribution area in the Black Sea. The other distribution area to be mentioned was in front of the Bosphorus where this species was found to be 300-400 ind./m² (BACESCU *et al.*, 1971).

Another most important factor in controlling such numerical and qualitative patterns was sediment transfer by rivers. The gradually changing effects of the rivers differentiated faunal composition from coast to offshore. Euryhaline benthic organisms inhabit the coastal zone off river discharge system to benefit some phytoplankton as major filter-feeding component (sta. B15 and B8).

Wet weight

The average biomass of these animals gathered during the investigation amounted to 530 mg/m². The wet weight distribution of three basic subareas was as follows: 191 mg/m² between a spanning coastal line including nine stations (B1-B9); 118 along the central part of the area and 1282 in the southeastern longshores of the Black Sea. The distributional pattern of the alive weights of some taxa groups of macro benthic crustaceans within the sampling localities is illustrated on Figure 3. The contribution of each crustacean group to total biomass was as follows: Ostracoda (4.1%), Amphipoda (14.56%), Cumacea (21.1%), Isopoda (34.9%), Anisopoda (0.5%), Cirripedia (16.9%) and Decapoda-Anomura (7.6%). The

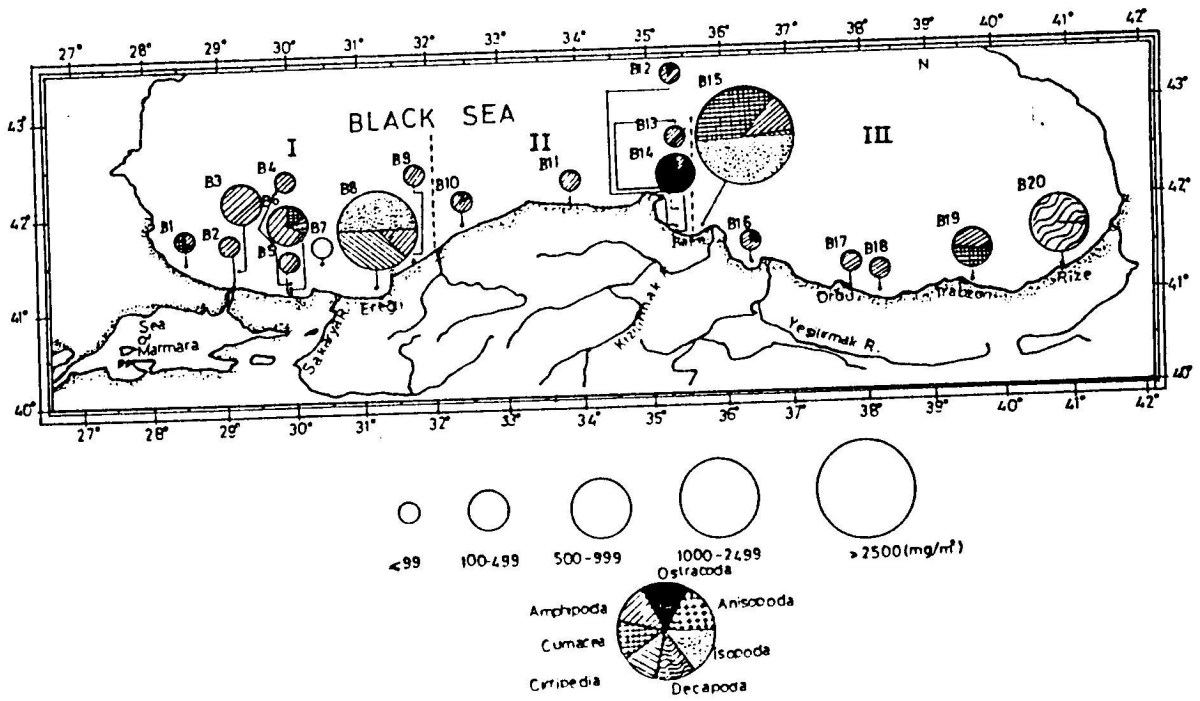

Fig. 3. Map showing biomass distribution of macro-benthic crustacean groups at the stations

densest localities in regard to biomass among three fundamental places were observed at station B8 with 1209 mg per square metre; sta. B14 with 480 and sta. B15 with 5535 from west to east. In general, most (17 sts., over 20 sts.) of the sampling stations were very poor in macro benthonic crustacean biomass (less than 0.5 g/m² in mean biomass; Fig. 3). The shallowest locations (sts., B8, B15 and B20) were characterized by means of massive faunal community of such organisms (Fig. 3). The bottom less than 50m inclined to have much more alive (biotic) mass belonging to these animals rather than that after this critic depth where the vital condition was too unfavourable for them to develop (Fig. 4). A typical mean biomass value was calculated to be 1055 along the shallower waters and a low value of approximately 45 mg/m2 on the deeper bottom while the dissolved oxygen content was measured to be a mean value of 7.89 and 2.38 ml/l, respectively (Fig. 4).

The dense species which had very importance in the biomass contribution were *Stenosoma capito, Iphinoe elisae, Balanus improvisus* and *Diogenes pugilator* etc. The percent contributions of such important species at each station are represented in Table 4.

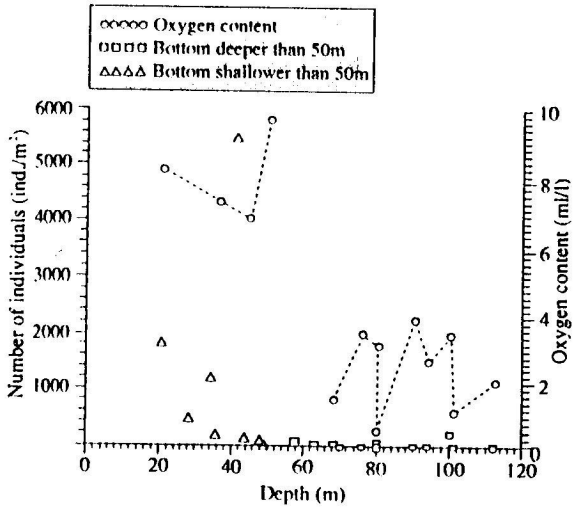

Fig. 4. Biomass distribution in the changing depth and dissolved oxygen content of the sampling stations

Faunal quality and diversity

Totally 40 species belonging to seven basic orders which could be retained by 0.5 mm² mesh size were identified. Of these groups, Amphipoda (47.5%; 19 species) was represented by the richest assemblage in regard to faunal quality. The remaining ones with their represesentative distributional percentage were as fol-

Table 4. Percent incividual distribution of the densest macrobenthic crustacean species among the sampling stations

Taxa	STATIONS																		
	Southwestern sektor									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																				
Ampelisca diadema	–	–	90	–	51	36	–	–	–	38	–	72	50	–	–	29	88	–	46	–
Centromedon sp.	29	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Corophium volutator	–	–	–	–	–	–	–	–	–	–	–	12	50	–	–	–	–	–	–	–
Jassa falcata	–	100	–	–	–	–	–	–	–	–	30	–	–	–	–	–	–	–	–	–
Melita palmata	–	–	–	–	–	–	–	12	–	–	–	–	–	–	–	–	–	–	–	–
Microdeutopus gryllotalpa	–	–	–	–	16	–	–	–	–	26	70	–	–	–	–	20	–	–	–	–
Perioculodes longimanus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	14	–	–
Perioculodes sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	11	–	–
Phtisica marina	–	–	–	100	8	23	–	–	100	24	–	–	–	5	–	25	12	–	–	–
Cumacea																				
Iphinoe elisae	–	–	–	–	–	–	–	–	–	–	–	–	–	–	35	–	–	28	31	–
Iphinoe maeotica	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	21	–
Iphinoe tenella	56	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pseudocuma longicornis	15	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pseudocuma longicornis pontica	–	–	–	–	–	–	–	–	–	–	–	16	–	–	–	–	–	–	–	–

Table 4. Continued

Taxa	STATIONS																		
	Southwestern sektor									Central part					Southeastern sector				
	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18	B19	B20
Ostracoda														58	–	–	–	–	–	–
Cythereis antiquata	–	–	–	–	–	–	–	–	–	–	–	–	–	24	–	–	–	–	–	–
Xestoleberis cornelli	–	–	–	–	–	–	–	–	–	–	–	–	–							
Cirripedia																				10
Balanus eburneus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	48
Balanus improvisus	–	–	–	–	–	–	–	34	–	–	–	–	–	–	–	–				
Isopoda															9					
Sphaeroma serratum															42	–	–	–	–	–
Stenosoma capito	–	–	–	–	–	–	–	52	–	–	–	–	–	–						
Anisopoda																7	–	–	–	–
Apseudes latreillei	–	–	8	–	–	–	–	–	–	–	–	–	–	–	–					
Decapoda																				42
Diogenes pugilator	–	–	–	–	–	12	–	–	–	–	–	–	–	–	–	–	–	–	–	

lows: Cumacea (25%; 10), Ostracoda (12.5%; 5), Cirripedia (5%; 2), Isopoda (5%; 1), Decapoda (2.5%; 1) and Anisopoda (2.5%; 1). BACESCU *et al.* (1971) found 107 species from Amphipoda; 21 from Cumacea; 77 from Ostracoda; 5 from Cirripedia; 34 from Isopoda; 6 from Tanaidae and 36 from Decapoda. Most recent study concerning the qualitative distribution of Amphipoda was carried out by KOCATAS and KATAGAN (1980). They pointed out that 39 separate representatives of this crustacean order in the materials collected from some photophilic algae (36 species) and soft-bottom (5 species) were found along the Turkish coast of the Black Sea. These numeric expressions do not correspond to those obtained previously since the samples could not be taken from the different zones along the Turkish shores of the Black Sea. Thus, all taxa of the macro benthonic crustacean could not be found.

Interacting with the depth and DO content, the equity proportion of the individual distribution within the species at each station was indicated in Fig. 5. The average value of this relative diversity calculated by means of Shannon-Weaver (PIELOU, 1969) seemed to have a negative relationship with the depth and DO content of the bottom water (Fig. 5). The mean diversity values were as follows: 0.69 bits/m² for the macro bentic crustacean community at the zone deeper than 50m in the Turkish Black Sea, but; 1.72 bits/m² in the shallower waters (Fig.5). Table 5. shows the average diversity, depth and DO content in each subdivision.

Table 5. Variations in mean diversity with mean depth and DO content of three subregions

Subregions (west to east)	Mean diversity (bits/m²)	Mean depth (m)	Mean DO content (ml/l)
Southwestern	0.94	72.8	3.28
Central part	0.86	75.8	2.13
Southeastern	1.52	42.6	8.38

While the number of species varied between 1 (sta., B2, B4 and B9) and 22 species (sta., B15) per square meter, station B7 which was one of the deepest stations, however, was devoid of any macrobenthic crustaceans. This was a consequence of the weakness and negative adaptation of such group against unfavourable conditions with the low dissolved oxygen content.

The diversity and richness of the macrobenthic crustaceans species along the nearshore waters of the Turkish Black Sea depend mainly on the favourability of the environmental conditions, particularly on the DO content of the bottom waters. The species richness and quality became poor with increasing the bottom

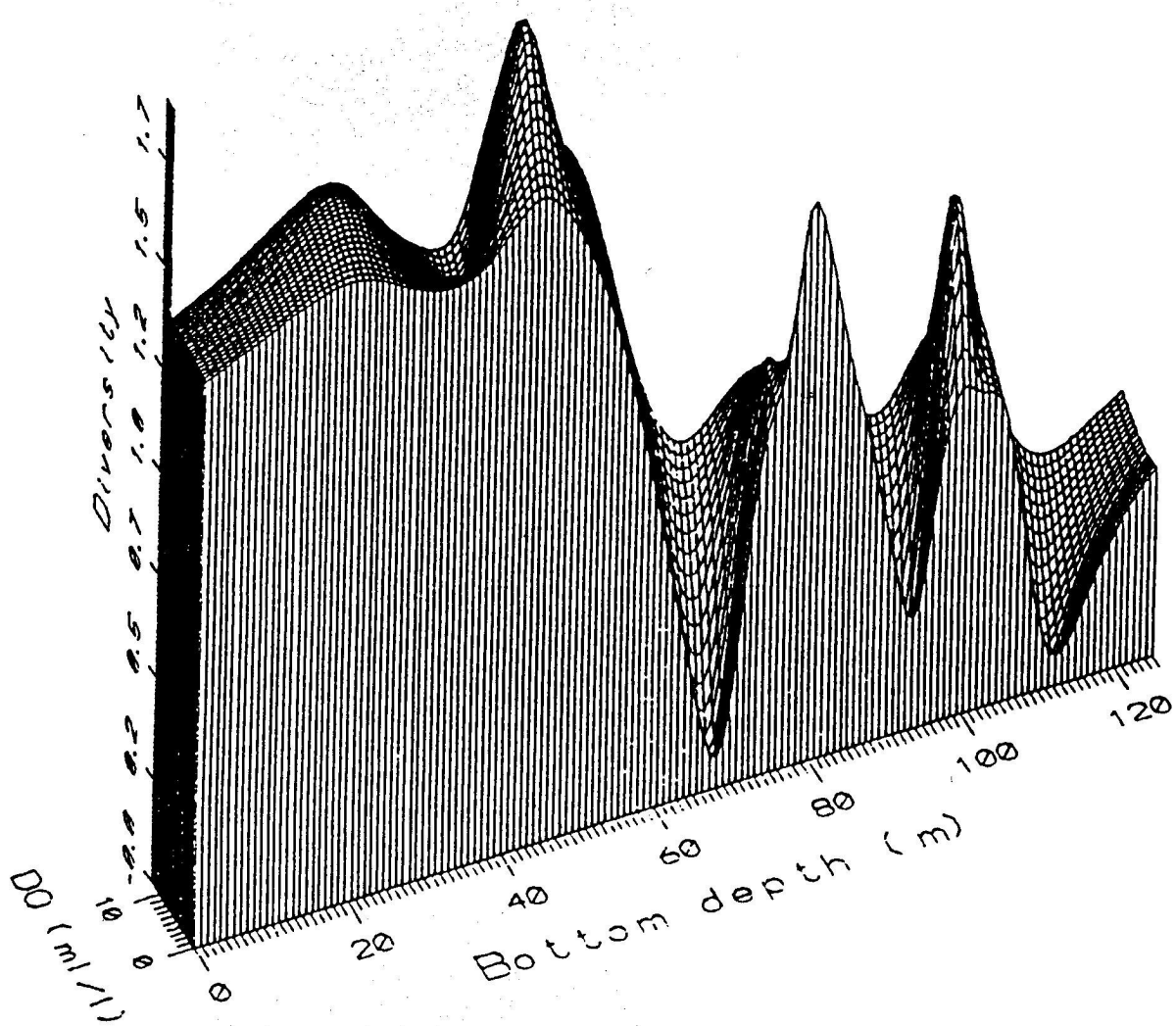

Fig. 5. Three-dimensional demonstration of relationship between Shannon Weaver's diversity, depth and dissolved oxygen content along the coast of the Southern Black Sea

depth and decreasing dissolved oxygen content (Fig. 6). Of course, in the Black Sea the lower limit of the arising suboxic zones in times start beneath 120-125 m along the coastal waters but in the open waters or regions just below 80-85 m depth (OGUZ *et al.*, 1990; personal observations, 1988, 1989 and 1990). On the other hand, the vital condition of such sedentary animals is going from bad to worse near these depths. In the present time, the critical bottom depth which about 50m, arranges the distributional pattern of such animals. The variation in mean number of species was found to be about 11 species on the bottom below 60m and 2 above this depth. The mean number changed also with the concentration of dissolved oxygen. It was 8 for the depths containing mean dissolved oxygen greater than 4 ml/l and was approximately 2 species at the bottoms bearing the less concentration. (Fig. 6). The peak fluctuation in the number of species on the bottom less than 60m showed a steady state phenomena in comparison to that of deeper bottoms.

During the present study, the frequent species that could be observed were *Ampelisca diadema, Phtisica marina, Corophium volutator, Iphinoe elisae* and *Microdeutopus gryllotalpa* etc. Some values of the frequency of occurrence and dominancy, calculated for the most frequent species found along the long shores of the Turkish Black Sea, is given in Table 6.

The common species in low DO content and at deep bottom was though to be *Ampelisca diadema*. It has a wide tolerance against the

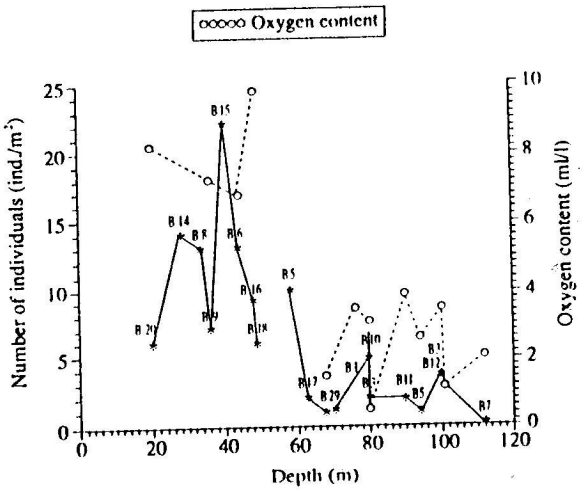

Fig. 6. Decrease of number of macro-benthic crustacean species with the unfavourable conditions (depth and oxygen content)

prevailing ecological parameters, especially to muddy bottom depth more than 36-40 down to 101 m, where DO content ranged from approximately 1 to 9.8 ml/l and salinity from 18 to 23 ppt during this study. This prebosphoric species spread a wide inhabitable geographic area along the Romanian coasts (10 to 150 m, in general at 40-45m) (BACESCU, *et al.*, 1971). In the zone deeper than 50m, the second but less effective species was a lamelipod, *Phitisica marina*. It accompained generally by *Ampelisca diadema*. Also this similar phenomena was observed in the distributional pattern down to 120m along the Romanian coasts by TIGANUS (1987). However, any representative of the remaining sub taxonomical groups in the deeper part (>50m) on the continental shelves do not show wide tolerance to the exposure of unfavourable conditions such as low DO content. *Corophium volutator*, an euryhaline species was moderately found at 35-40% of the total sampling stations. BACESCU and ACAD (1971) noted that *Corophium* spp., exist in the mussel muds where the depth ranged from 30 to 40 m, (in some places, to 70m) along the Romanian coasts. The most common cumacean species, *Iphinoe elisae* was observed together with *Eudorella truncatula* and identified between the depths of 20 and 58 m, particularly at 40-50m, along the southern part of the Black Sea. *Centromedon* sp. was recently found in the Black Sea (Stations B1 and B3; Fig. 1).

Table 6. Frequency of occurrence and dominance belonging to the most frequent species of each taxon group of macrobenthic crustacean along the Turkish coast of the Black Sea.

Species	Frequency of occurrence (%)	Dominancy (%)
Ampelisca diadema	8.87	55
Phtisica marina	8.07	50
Corophium volutator	6.45	40
Microdeutopus gryllotalpa	6.65	35
Iphinoe elisae	6.45	40
Eudorella truncatula	4.03	25
Apseudes Latreillei	4.03	25
Xestoleberis cornelii	2.42	15
Balanus improvisus	2.42	15
Stenosoma capito	2.42	15
Cythereis antiquata	1.61	10
Sphaeroma serratum	1.61	10
Diogenes pugilator	0.81	5

The sediment type (shelly gravel; 75%) of the bottom was as effective as the salinity (36 ppt) at station B2 and it determined the faunal composition of this assemblage. The euryhaline species, *Jassa falcata* was identified near the Black Sea exit of the Bosphorus. DEMIR (1954) found this amphipod species towards the Bosphorus in the Sea of Marmara. Also, the bottom of station B20 was found to be composed mainly of very-fine sand and a psammophilic amphipod, *Synchelidium maculatum* occurred in low individual number (6 ind./m²) in the Bay of Rize. In the same sampling place, a hermit crab, *Diogenes pugilator* was the most representative species of the psammophilic benthos with 17 ind./m² and 770 mg./m² at 20m depth. ZENKEVITCH (1963) reported that the mean biomass recorded for this hermit crab was 3.2 g/m² in the Black Sea. In the Bulgarian coasts where the psammophilic bivalve, *Gafrarium* and *Chione* were abundant. The *Diogenes pugilator* appeared with an abundance of 20 specimens m⁻² at 7m and 7 ind./m² at 17m depth (BACESCU *et al.*, 1971).

Absence-presence of all crustacean species found among the stations in this study is illustrated in Table 7.

Table 7. Taxonomical aspects and distribution of macrobenthonic crustaceans obtained from the Turkish coasts of the Black Sea.

Taxa	STATIONS																			
	Southwestern sektor									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	4	2	3	1	1
Ampelisca diadema	–	–	+	–	+	+	–	–	–	+	–	+	+	+	+	+	+	–	+	–
Dexamine spinosa	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–
Caprella acanthifera	–	–	–	–	–	–	–	–	–	+	–	–	–	–	+	–	–	–	–	–
Cardophilus baeri	–	–	–	–	–	+	–	–	–	–	–	–	–	+	–	–	–	–	–	–
Centromedon sp.	+	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Corophium volutator	–	–	–	–	+	+	–	+	–	–	–	+	+	+	+	+	–	–	–	–
Hyale perieri	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–
Jassa falcata	–	+	+	–	–	–	–	+	–	–	+	–	–	–	–	–	–	–	–	–
Melita palmata	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–
Microdeutopus gryllotalpa	–	–	–	–	+	+	–	+	–	+	+	–	–	–	+	+	–	–	–	–
Monoculodes gibbosus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–
Nototropus guttatus	–	–	–	–	+	+	–	+	–	–	–	–	–	–	+	–	–	–	–	–
Orchestia gammerella	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–
Orchomene humulis	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–
Perioculodes longimanus	–	–	–	–	+	–	–	–	–	–	–	–	–	+	–	–	–	+	–	–
Perioculodes sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–
Phtisica marina	–	–	–	+	+	+	–	+	+	+	–	–	–	+	+	+	+	–	–	–
Synchelidium maculatum	–	–	–	–	+	+	–	–	–	–	–	–	–	+	–	–	–	–	–	+
Stenothoe monoculodes	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–
Cumacea	2	0	0	0	3	5	0	1	0	0	0	1	0	3	7	4	0	3	4	2
Bodotria arenosa mediterranea	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cumella limicola	–	–	–	–	+	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–
Cumella aff. limicoloides	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–
Cumella pygmea euxinica	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	+	–
Eudorella trucatula	–	–	–	–	–	+	–	–	–	–	–	–	–	–	+	+	–	+	+	–
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	4	4	0	0	0	2	0
Cythereis antiquata	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	+	–
Carinocthereis rubra	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	–	–	–	+	–
Cytheridae sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–
Cytheries sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	–	–	–	–	–
Xestoleberis cornelii	–	–	–	–	–	–	–	+	–	–	–	–	–	+	+	–	–	–	–	–
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 latreillei	–	–	+	–	–	+	–	–	–	–	–	–	–	+	+	+	–	–	–	–
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

Forty species of mexisto and mixo benthic crustaceans were distinguished along the longshores of the Black Sea. The faunal composition in number of seven main taxa groups was as follows: Amphipoda by 19, Cumacea by 10, Ostracoda by 5, Cirripedia by 2, Isopoda by 2, Tanaidacea (Anisopoda) by 1 and Decapoda by 1 species. Whilst the distribution of biomass ranged from 0.28 to 5535 mg/m^2 and abundance from 6 to 6361 ind/m^2. The mean values of the materials collected from the Turkish nearshores of the Black Sea were 530 mg/m^2 and 689 specimens m^{-2}. Such animals exhibited their own faunal and numerical characters depending on the favourability of the DO content and also the bottom depth.

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Preliminarna opažanja o fauni rakova mekih podloga uzduž turske obale Crnog mora

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KRATKI SADRŽAJ

Pojedinačni uzorci bentosa mekih podloga sakupljani su Van Veen-ovim grabilom (0.175 m^2) na 20 postaja uzduž turske obale Crnoga mora od kolovoza 1988. do siječnja 1989.

Određeno je ukupno 40 vrsta rakova. Različitost i količina faune opada na dubinama većim od 50-60m vjerojatno zbog znatnog smanjenja razine O_2 i zbog muljevite podloge. Najvažnije vrste rakova su *Cythereis antiquata, Xestoleberis cornelii, Iphinoe elisae, Microdeutopus gryllotalpa* i *Ampelisca diadema* u plićim vodama i amfipodni rak *Ampelisca diadema* u dubljim područjima gdje prevladava muljevita komponenta. Obalna, čisto pjeskovita dna obilježava prisustvo psamofilskih predstavnika kao što su *Diogenes pugilator* i *Synchelidium maculatum.*

Centromedon sp. je novi prvi član ovog roda zabilježen u Crnom moru.