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The Echinoderm Fauna of Gokceada Island (NE Aegean Sea)

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Abstract: The Echinoderm fauna of Gokceada island (NE Aegean sea) was studied in 2011 from 22 stations at depths ranging from 0.5-45 m by means of bottom trawling and snorkeling. Additionally, temperature, salinity, dissolved oxygen, pH, TDS and conductivity of water were measured on board. A total of 626 specimens belonging to 25 species (7 Asteroidea and Echinoidea, 6 Ophiroidea, 4 Holothoridea and 1 Crinoidea) were identified. The dominant species was the echinoid *Psammechinus microtuberculatus* (Blainville, 1825). According to the result of cluster analysis based on the precence/absence of *Echinoderm* species, Gokceada island had a species composition similar to that of Bozcaada island while both islands were different from the Canakkale strait. However, ANOSIM they were not found to be statistically different (p = 0.3).

Key words: Echinodermata, Gokceada island, Aegean sea, benthos, diversity, Turkey

INTRODUCTION

The Aegean sea is the Northeastern extension of the Mediterranean sea. Gokceada island, the biggest island of Turkey (289 km^2) which is located in the Northern Aegean sea at the mouth of the Canakkale strait is situated nearly 25 km off the coast of the mainland.

Although, the *Echinoderm* fauna of the Turkish Aegean sea coasts consist of 69 species (Ozaydin *et al*., 1995; Zaitsev and Ozturk, 2001; Cinar *et al*., 2002) according to the existing literature only *Antedon mediterranea* (Lamarck, 1816), *Amphiura chiajei* Forbes, 1843, *Ophiura ophiura* (Linnaeus, 1758), *Cidaris cidaris* (Linnaeus, 1758), *Sphaerechinus granularis* (Lamarck, 1816), *Spatangus purpureus* (Muller, 1776), *Stichopus regalis* (Cuvier, 1817), *Brisingella coronata* (Sars, 1871), *Brissopsis lyrifera* (Forbes, 1841) have been reported from Gokceada island (Ozaydin *et al*., 1995). It is obvious that the number of *Echinoderm* species must be higher than 9 species, taking into account that 23 species have been reported from Bozcaada island, located in adjacent water and smaller than Gokceada island and 25 species from the Canakkale strait (Aslan-Cihangir and Pancucci-Papadopoulou, 2011).

The purpose of this study was to determine the *Echinoderm* species living in the coast of Gokceada and to investigate some of their ecological properties.

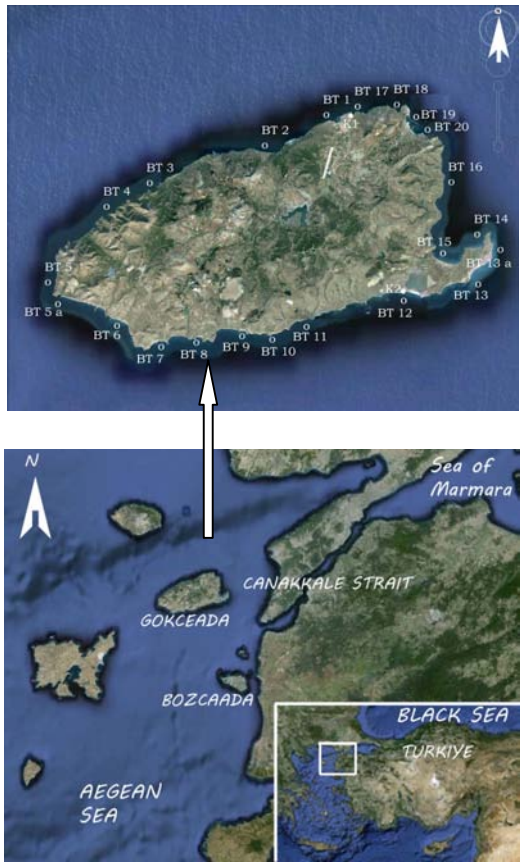

Fig. 1: Location of sampling Stations in Gokceada island

MATERIALS AND METHODS

Material examined in this study were collected between 25th March and 8th April, 2011 from depths ranging between 0.5 and 45 m by means of beam-trawl (Fig. 1) and by snorkeling. All benthic samples were sieved through a 0.5 mm mesh size sieve and fixed in 4% formaldehyde-sea water solution. In the laboratory, the

Table 1: General properties of the study area

No.of station	Latitude	Longitude	Date	Depth (m)	Sediment types
BT1	40°13'55"	25°52'54"	25.03.2011	20-45	Posidonia
BT2	40°12'45"	25°50'11"	25.03.2011	25-35	Posidonia
BT3	40°11'39"	25°45'07"	25.03.2011	20-40	Posidonia
BT4	40°10'40"	25°42'41"	25.03.2011	20-40	Posidonia
BT5	40°08'06"	25°39'50"	04.04.2011	25-30	Posidonia dead matte
BT5a	40°07'20"	25°40'11"	04.04.2011	20-30	Posidonia dead matte
BT6	40°06'25"	25°43'08"	04.04.2011	23-40	Posidonia dead matte
BT7	40°05'46"	25°45'06"	04.04.2011	12-25	Posidonia
BT8	40°05'56"	25°46'49"	04.04.2011	20-40	Posidonia
BT9	40°06'09"	25°48'56"	04.04.2011	20-35	Posidonia dead matte
BT10	40°06'01"	25°49'26"	05.04.2011	20-40	*Codium bursa*
BT11	40°06'38"	25°52'37"	05.04.2011	20-40	*Codium bursa*
BT12	40°07'31"	25°56'34"	05.04.2011	20-35	Posidonia dead matte
BT13	40°08'34"	26°00'59"	05.04.2011	10-20	Sandy
BT13a	40°09'06"	26°01'05"	05.04.2011	10-20	Sandy
BT14	40°09'32"	26°00'07"	05.04.2011	20-40	Posidonia
BT15	40°08'51"	25°58'34"	05.04.2011	20-40	Posidonia
BT16	40°11'48"	25°58'48"	05.04.2011	20-40	Posidonia
BT17	40°14'12"	25°54'17"	08.04.2011	20-40	Gravel
BT18	40°14'14"	25°56'17"	08.04.2011	25-35	Posidonia
BT19	40°14'02"	25°57'00"	08.04.2011	25-35	Posidonia
BT20	40°13'35"	25°57'25"	08.04.2011	25-35	Posidonia
K1	40°14'04"	25°54'11"	02.06.2011	0.5	Rocky
K2	40°14'04"	40°14'04"	03.06.2011	0.5	Rocky

Echinoderms were separated under a stereomicroscope and preserved in 70% ethanol. Spicules of *Holothuria* species were removed from various body parties in heated household bleach, washed and observed under a light microscopy. Temperature, salinity, dissolved oxygen concentration, pH, TDS and conductivity were measured on board by using the YSI 556 Multiprobe system (Table 1).

Soyer's Frequency index (F) was used to describe ecological importance of species. According to Soyer, species with F>50% are considered constant, those with F between 25 and 50% are common while those with F-values <25% are considered rare. Multivariate analyses were applied on presence/ absence data of echinoderm species using the PRIMER package Ver. 5.0 (Clarke and Warwick, 2001). Bray-Curtis similarity and Analyses of Similarity (ANOSIM) were used to assess and compare patterns of species distribution from Gokceada island and adjacent water. SIMPER analysis was performed to examine the contribution of each species to the similarity/dissimilarity among the groups identified from the clusters analysis.

RESULTS AND DISCUSSION

Surface water temperature ranged from 11.05-12.78°C. Regarding salinity, the minimum value of surface water salinity was 30.36 psu while the maximum reached 34.43 psu. pH was quite similar at all stations ranging from 8.2-8.3. Total Dissolved Solids (TDS) ranged from 30.46 (Station BT11) to 34.20 (Station BT14). Dissolved oxygen had its minimum at Station BT5 (9 mg L^{-1}) and maximum at Station BT11 (9.45 mg L^{-1}). The minumum conductivity value (46.86 mS cm^{-1}) was measured at Station BT11 and the maximum (52.39 mS cm^{-1}) at Station BT16.

A total of 626 specimens belonging to 25 *Echinoderm* species (7 Asteroidea and Echinoidea, 6 Ophiuroidea, 4 Holothurioidea and 1 Crinoidea) were caught in the study area.

Although, the highest species number was found at Station BT4 (10 species), the highest specimens number was found at Station BT3 (110 individuals). Additionaly, no *Echinoderm* specimens were obtained at Stations BT12, BT13 and BT13a were obtained from *Psammechinus microtuberculatus* (Blainville, 1825) showed the maximum number of specimens (301). In terms of frequency of occurence, *P. microtuberculatus* was the only constant species (F = 54.2%), the commonest species was *Ophiura albida* (F = 42%) followed by *Ophiura ophiura* (29.2%) and *Paracentrotus lividus* (25 %). The other 21 species were rare (Table 2).

Results from cluster analysis, performed applying presence/absence data of the community to the Bray-Curtis similarity index are shown in Fig. 2.

According to the results of the Cluster analysis based on the precence/absence of *Echinoderm* species (Fig. 3), Gokceada island was similar to Bozcada island at about 57.7% and the Canakkale strait was linked at a similar level of 37.3%. However, they were not found to be statistically different (p = 0.3, ANOSIM).

SIMPER was used to identify, the percentage contribution of each species made to the measure of similarity/dissimilarity. *H. mammata*, *Stichopus regalis*,

Table 2: Species composition, abundance/station, total abundance (N) and Frequency (F) of echinoderm fauna collected from Gokceada island coasts

	Stations/Beam-trawl																						Shore			
Species composition	1	2	3	4	5	5a	6	7	8	9	10	11	12	13	13a	14	15	16	17	18	19	20	K1	K2	N	F
Antedon mediterranea (Lamarck, 1816)	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	6	1	-	-	-	12	20.8
Ophiura ophiura (Linnaeus, 1758)	2	1	-	1	26	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	25	1	-	-	60	29.2
Ophiura albida (Forbes, 1839)	19	-	1	4	11	1	1	-	-	1	-	-	-	-	-	1	-	-	5	-	2	-	-	-	46	41.7
Ophiura grubei (Heller, 1863)	22	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	4	16.7
Ophiothrix fragilis (Abildgaard, 1789)	-	4	1	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	25	20.8
Ophioderma longicaudum (Retzius, 1805)	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	13	12.5
Amphipholis squamata (Delle Chiaje, 1828)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	4.2
Asterina gibbosa (Pennant, 1777)	-	4	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	16	12.5
Asterina pancerii (Gasco, 1870)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2	4.2
Astropecten spinulosus (Philippi, 1837)	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	4	8.3
Astropecten aranciacus (Linnaeus, 1758)	2	-	-	-	6	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	5	-	-	14	16.7
Echinaster sepositus (Retzius, 1783)	-	-	-	2	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2	-	-	-	-	7	16.7
Luidia ciliaris (Philippi, 1837)	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2	8.3
Luidia sarsi (Duben-Koren, 1846)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	4.2
Arbacia lixula (Linnaeus, 1758)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	20	45	8.3
Psammechinus microtuberculatus (Blainville, 1825)	-	32	105		15	29	1	-	-	-	-	-	-	-	-	-	-	51	2	7	12	4	-	-	301	54.2
Paracentrotus lividus (Lamarck, 1816)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	1	20	25	51	25.0
Sphaerechinus granularis (Lamarck, 1816)	-	2	3	1	1	-	-	-	1	1	41	-	-	-	-	-	-	1	-	-	-	-	-	-	8	20.8
Spatangus purpureus (O.F. Muller, 1776)	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	8.3
Echinocyamus pusillus (O.F. Muller, 1776)	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	2	8.3
Echinocardium cordatum (Pennant, 1777)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	4	12.5
Holothuria impatiens (Forskal, 1775)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	4.2
Holothuria mammata (Grube, 1840)	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	4.2
Holothuria polii (Delle Chiaje, 1823)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	4	4.2
Holothuria tubulosa (Gmelin, 1788)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	4.2
Total number of species	6	8	4	10	7	2	1	3	2	3	3	1	0	0	0	2	4	3	4	8	8	4	3	3	-	-
Total specimens	47	47	110	34	76	2	1	3	2	4	43	1	0	0	0	2	7	53	12	35	44	11	46	46	626	-

E. sepositus, *P. microtuberculatus*, *P. lividus*, *A. lixula*, *S. granularis*, *E. pusillus*, *E. cordatum*, *A. gibbosa*, *A. pancerii*, *A. aranciacus*, *A. mediterranea* and *O. albida* showed the highest similarity by the same species contribution (7.14%) both in Bozcaada and Gokceada islands. *Genocidaris maculata A.* (Agassiz, 1869) *Leptopentacta tergestina* (Sars, 1857), *Leptosynapta inhaerens* (Muller, 1776), *Thyone fusus* (Muller, 1776), *H. mammata*, *S. regalis*, *E. sepositus*, *A. lixula*, *S. granularis*, *E. pusillus*, *E. cordatum*, *Amphiura cherbonnieri* (Guille, 1972), *Amphiura securigera* (Duben and Koren, 1846), *Ophiopsila annulosa* (Sars, 1859), *Ophiopsila arenea* (Forbes, 1845), *Asterias rubens* (Linnaeus, 1758), *Astropecten platycanthus* (Philippi, 1837), *A. pancerii*, *Leptometra phalangium* (Muller, 1841) and *Antedon mediterranea*

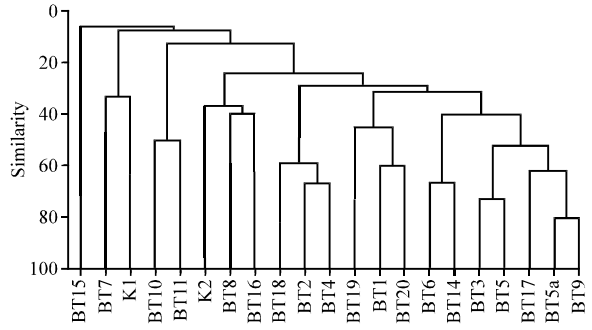

Fig. 2: Cluster analysis in each Stations in Gokceada island

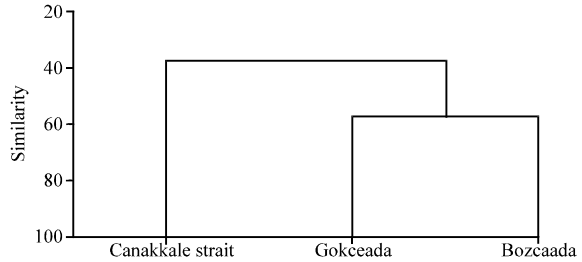

Fig. 3: Cluster analysis of the Canakkale strait and Islands of Gokceada and Bozcaada

were the most abundant discriminator species between the Canakkale strait and the islands (contribution 3.18%). This study has made it possible to determine 25 *Echinoderm* species, 21 of them being new records for Gokceada island. Thus, the number of species from the island has increased to 30 which corresponds to the 35% of the total number of *Echinoderm* species (86) reported from Turkish coast (Aslan-Cihangir and Pancucci-Papadopoulou, 2011). According to the literature, 23 *Echinoderm* species have been reported from Bozcada island and 26 from the Canakkale strait (Aslan-Cihangir and Pancucci-Papadopoulou, 2011) in adjacent waters to Gokceada island. However, 107 species have been recorded from Greece coasts (Pancucci-Papadopoulou and Hetaireia, 1996).

Bray-Curtis similarity index, SIMPER and ANOSIM took into account for presence/absence of *Echinoderm* species in Bozcaada and Gokceada island and the Canakkale strait.

CONCLUSION

This study shows that the Canakkale strait was different from both islands. It has been thought that the main reason may be the differences of using sampling tools. In addition, the depth and habitat were different in these areas. But at the result of ANOSIM, they were not found to be statistically different. The characteristics of the surface water of the Northern Aegean sea that surrounds the islands under the influence of Black sea waters through Canakkale strait and therefore, surface salinity varies seasonally between 26-35 psu (Yuce, 1995). The researchers think that the number of *Echinoderm* species known from the Turkish North Aegean sea will increase significantly if future research will extensively cover all kinds of habitats including those deeper than 45 m.

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