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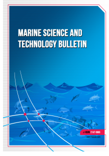

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RESEARCH ARTICLE

Composition of bivalve community in the coastal waters (0-4 m) of the Çanakkale Strait along with various environmental variables

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ABSTRACT

The present study focused on the soft bottom of the coastal waters (0-4 m) in the Çanakkale Strait. The objective was to determine the composition of bivalve species in the area. Sediment samples were collected using a 30×30 cm quadrat system by a SCUBA diver at eight sites between July 2008 and April 2009. The study recorded a total of 2299 individuals belonging to 55 species. The most abundant species in the study area was *Lucinoma borealis*. A significant positive correlation was found between seawater salinity and species diversity ($r_s = 0.59$; $p<0.05$). The highest similarity in species diversity between seasons occurred between autumn and summer.

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Introduction

The effects of global warming and anthropogenic impacts are increasingly evident in the world's seas and oceans. As a result, macrozoobenthic communities are adapting to current environmental conditions, leading to notable changes in species composition and distribution patterns within these communities. Some communities exhibit greater resilience to environmental impacts (López-Alonso et al., 2022).

The diversity of macrozoobenthos is influenced by various environmental variables, such as sediment particle size, pH, temperature, and nutrient levels. Changes in these factors can significantly impact macrozoobenthic communities, potentially causing substantial harm (Templado, 2011). Spatial and temporal variations in marine biodiversity often mirror the condition of the benthic ecosystem and its response to various disturbances. Species diversity plays a crucial role not only in the establishment of marine protected areas, but also in

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monitoring the impacts of human activities (Rufino et al., 2008). The species composition of marine benthic communities varies with depth, latitude, and longitude (Nybakken, 1998). While these factors are not environmental variables themselves, they often serve as primary structuring factors for communities. However, environmental factors such as sediment type, water temperature, and oxygen levels are closely associated with depth and geographical location (Rufino et al., 2008).

The predominant environmental factor influencing the distribution of marine benthic communities is sediment type. This factor is especially critical in the distribution patterns of bivalves, as demonstrated in studies by Guerra-García & García-Gomez (2004) and Van Hoey et al. (2004). The main factors influencing macrofauna abundance and diversity on soft sea bottoms are tidal strength and sediment type. Marine benthic organisms, particularly those involved in sediment morphodynamics, experience a highly dynamic environment (Magni et al., 2006). It is widely acknowledged that the activities of benthic communities influence seafloor sediments and thereby impact community structure. Previous studies have primarily linked species richness and abundance of macrobenthos to organic matter content and sediment grain size. Bivalves represent a dominant component of the biomass of macrozoobenthic communities found in shallow waters globally. They also play a significant role as bioturbators in coastal habitats (Jaramillo et al., 2008). Bivalves, a significant component of the benthic fauna, were selected for investigation into the correlation between diversity, sediment, and environmental variables (Compton et al., 2008).

In the context of bivalve community studies within the Turkish Straits System, Albayrak (2003) conducted research on bivalves along the shores of the Bosphorus. Subsequently, Albayrak et al. (2004) investigated the bivalve fauna and their ecology in the Sea of Marmara. Although studies in the Çanakkale Strait, another part of the Turkish Straits System, are limited, Palaz & Berber (2005) studied bivalve species in the infralittoral zone of the Çanakkale Strait. More recently, Aslan-Cihangir & Ovalis (2013) explored the ecology and zoogeographic distribution of molluscs, including bivalves, in the Çanakkale Strait. A comprehensive study on bivalve distribution in the Çanakkale Strait has yet to be conducted this study aims to elucidate the seasonal, spatial, and depth-dependent distribution of bivalve species about environmental variables.

Material and Methods

Sediment Samplings

For this study, 8 stations were selected in the Çanakkale Strait (Figure 1). Benthic samples were collected along 3 transects at depths ranging from 0 to 4 meters. Sampling was conducted in July and November 2008, and in February and April 2009, using a SCUBA diver equipped with a 30×30 cm quadrat system. Environmental variables of seawater (salinity, temperature, pH, and dissolved oxygen saturation) were measured in situ using a YSI 556 model MPS. The collected material was preserved in 4% neutralized formaldehyde in 5-liter plastic drums. In the laboratory, sediment samples were washed under pressure using a triple sieve system with mesh sizes of 0.5, 1, and 2 mm. Bivalve material retained on the sieves was subsequently fixed in 70% ethanol in 50 mL tubes.

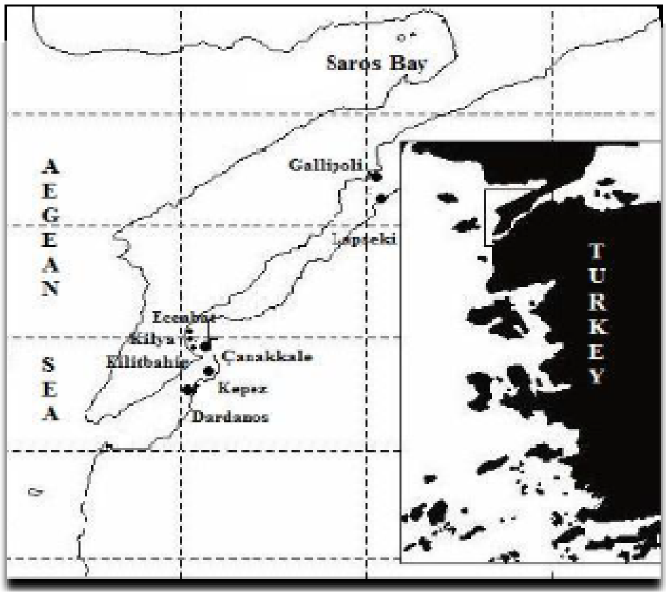

Figure 1. Map showing sampling locations in the Çanakkale Strait. St. 1: Gelibolu, St. 2: Lâpseki, St. 3: Çanakkale, St. 4: Kilya Cove, St. 5: Eceabat, St. 6: Kilitbahir, St. 7: Kepez Port, St. 8: Dardanos.

Granulometric Analysis

A sediment core containing 393 cm^3 of acrylic material was used for particle size analysis of the soft bottom at the sampling sites. A total of 32 samples were collected for analysis from the soft sediments at each sampling point during each sampling period. Particle size analysis of the sediment followed the methodology described by Allen (1997).

Faunistic Analysis

Bivalve specimens were identified using a trinocular stereomicroscope based on the taxonomic descriptions provided by Doğan (2005) and Öztürk et al. (2008). The dominance index (di%) formulated by Bellan-Santini (1969) was employed to calculate bivalve dominance. The correlations between environmental variables and bivalve abundance were assessed using Spearman's rank correlation coefficient (rs) in the PAST 4.02 software. The ecological quality of the study area was determined using the Shannon-Wiener Diversity Index (H′) as described by Shannon & Weaver (1949).

Statistical Analysis

The relationships between several environmental variables, species richness, and abundance were analyzed using Spearman's rank correlation (r_s). The relationship between environmental variables and the number of individuals was determined using a Principal Component Analysis (PCA). The relationship between the dominant species and the environmental variables was determined using a Canonical Correspondence Analysis (CCA). All statistical procedures were executed using SPSS 25.0 software and PAST 4.03 with a significance level set at 95% confidence.

Results

Faunistic Data

A total of 55 species and 2299 individuals belonging to the bivalves were recorded from samples collected in the soft bottoms at depths between 0 and 4 m across 8 different stations in the Çanakkale Strait (Table 1).

In the study, the most common species is *Lucinoma borealis*, representing 13.79% of the total population. This species is followed by *Parvicardium exiguum*, with a dominance value of 12.22%. The species with the lowest number (1 individual, %b=0.04) are *Modiolarca subpicta*, *Mimachlamys varia*, and *Mactra stultorum***.** The Shannon-Weaver Diversity Index (H′) values for the seasons were calculated, with the highest H′ value observed in the fall at 3.08. The spring had the lowest H′ value, at 2.49. Overall, the diversity index values for the seasons are generally low. The highest H′ value was recorded at station 7 (H′ = 3.01), while the lowest H′ values were recorded at stations 2 and 4 (H′=1.95).

Water Quality

The environmental variable values of seawater in the research area are presented in Table 2. According to this table, the station with the highest oxygen value (9.79 mg L^{-1}) is station 3 in April 2008, while the station with the lowest oxygen value (3.68 mg L^{-1}) is station 2 in July 2008. The annual mean oxygen concentration in the study area is 7.13±0.59 mg L^{-1}. The highest salinity value (30.5‰) was measured at station 8 in November 2008, while the station with the lowest salinity concentration (23.6‰) was station 2 in April 2009. The highest annual average dissolved oxygen and salinity values were recorded in February 2009 (DO=8.81 mg L^{-1}, salinity=27.61‰), while the lowest were observed in July 2008 (DO=5.76 mg L^{-1}, salinity=23.67‰) (Table 2).

Sediment Structure

A particle size analysis was performed on the samples obtained from the study area. The weighted average particle diameter of the samples was 1027 µm for station 3, 1046 µm for station 7, 342 µm for station 2, 235 µm for station 8, 636 µm for station 6, 364 µm for station 5, 465 µm for station 4, and 437 µm for station 1 (Table 3).

Correlations With Environmental Variables of Species Richness and Abundance

The relationships between several environmental variables, species richness, and abundance were analyzed using Spearman's rank correlation (r_s). The results indicated a moderate negative correlation (r_s =-0.72; p<0.05) between the annual mean temperature values measured at the stations and the number of species. Conversely, there was a moderate positive correlation between annual mean salinity values and the number of species (r_s = 0.59; p<0.05). A moderate positive correlation (r_s = 0.55; p<0.05) was observed between annual pH values and bivalve abundance. Spearman's rank correlation revealed a moderate positive correlation (r_s = 0.46; p<0.05) between the calculated sediment particle size values and the number of species. Conversely, a weak negative correlation (r_s=-0.17; p<0.05) was observed between sediment particle size and bivalve abundance (Table 4, Figure 2). Sediment particle size percentages were calculated for each station and are presented in Table 5. Here, the highest number of species was found on the bottoms with a sand content of approximately 83%, whereas the lowest number of species was observed on the bottoms with a higher sand content. No consistent relationship was observed between sediment particle size and species richness.

Table 1. The total number of individuals (Σ), occurrence frequency (%f), and dominance (%b) values of the bivalve species found in the study area

Species	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7	St. 8	Σ	f %	di %
	SM	*S*	*CSE*	*Si*	*SZ*	*SM*	*CSM*	*SZ*			
Abra alba (Wood W., 1802)	68	2	2	2	5	4	0	4	87	87.5	3.78
Abra prismatica (Montagu, 1808)	5	8	0	2	2	0	2	0	19	62.5	0.83
Acanthocardia paucicosta (Linnaeus, 1758)	2	0	0	0	0	14	0	0	16	25	0.7
Aequipecten opercularis (Linnaeus, 1758)	22	4	1	0	0	4	1	4	36	75	1.57
Anadara corbuloides (Monterosato,1880)	0	0	0	0	0	4	0	0	4	25	0.17
Anodontia fragilis (Philippi, 1836)	9	2	0	0	3	1	2	0	17	62.5	0.74
Arcopagia balaustina (Linnaeus, 1758)	0	0	2	0	0	0	0	0	2	12.5	0.09
Astarte sulcata (Da Costa, 1778)	0	2	3	4	1	21	4	1	36	87.5	1.57
Callista chione (Linnaeus, 1758)	1	2	2	0	0	9	0	5	19	62.5	0.83
Cardites antiquatus (Linnaeus, 1758)	1	0	0	0	0	0	1	4	6	37.5	0.26
Chamelea gallina (Linnaeus, 1758)	3	0	2	7	2	15	4	6	39	87.5	1.7
Clausinella fasciata (da Costa, 1778)	2	2	3	9	3	6	4	2	31	100	1.35
Centrocardita aculeata (Poli, 1795)	0	0	0	0	0	0	1	12	13	25	0.57
Ctena decussata (Costa O. G., 1829)	6	2	4	1	69	22	6	9	119	100	5.18
Donacilla cornea (Poli, 1795)	1	0	0	0	0	0	3	1	5	37.5	0.22
Donax trunculus Linnaeus, 1758	0	0	0	2	0	0	0	1	3	25	0.13
Flexopecten flexuosus (Poli, 1795)	13	0	0	0	0	2	2	1	18	50	0.78
Flexopecten glaber (Linnaeus, 1758)	2	0	0	0	0	0	0	1	3	25	0.13
Gari costulata (Turton, 1822)	4	0	1	2	0	4	2	0	13	62.5	0.57
Gastrochaena dubia (Pennant, 1777)	0	0	0	0	0	150	6	0	156	25	6.79
Gouldia minima (Montagu, 1803)	2	1	4	0	0	23	3	4	37	75	1.61
Irus irus (Linnaeus, 1758)	1	0	0	0	0	9	0	0	10	25	0.43
Kellia suborbicularis (Montagu, 1803)	2	57	17	8	10	20	28	0	142	87.5	6.18
Kurtiella bidentata (Montagu, 1803)	0	0	0	1	1	0	0	0	2	25	0.09
Limaria loscombi (Sowerby G. B. I, 1824)	0	0	0	0	0	2	2	0	4	25	0.17
Loripes lacteus (Lamarck, 1818)	73	51	25	0	22	37	13	8	229	100	9.96
Lucinella divaricata (Linnaeus, 1758)	39	1	3	5	32	13	5	2	100	100	4.35
Lucinoma borealis (Linnaeus, 1767)	132	90	9	7	27	2	14	36	317	100	13.79
Mactra stultorum (Linnaeus, 1758)	0	0	0	1	0	0	0	0	1	12.5	0.04
Mimachlamys varia (Linnaeus, 1758)	0	0	0	0	0	1	0	0	1	12.5	0.04
Modiolarca subpicta (Cantraine, 1835)	0	1	0	0	0	0	0	0	1	12.5	0.04
Modiolula phaseolina (Philippi, 1844)	0	0	0	0	0	2	0	0	2	12.5	0.09
Modiolus barbatus (Linnaeus, 1758)	0	0	0	0	0	0	6	0	6	12.5	0.26
Mytilaster lineatus (Gmelin, 1791)	0	1	7	1	1	8	6	0	24	75	1.04
Mytilus galloprovincialis Lamarck, 1819	2	13	2	3	21	5	4	0	50	87.5	2.17
Nucula nitidosa Winckworth, 1930	0	0	0	0	0	2	0	0	2	12.5	0.09
Nucula nucleus (Linnaeus, 1758)	3	0	0	1	0	1	0	2	7	50	0.3
Nucula sulcata Bronn, 1831	0	0	0	0	0	0	2	0	2	12.5	0.09
Papillicardium papillosum (Poli, 1795)	10	0	0	2	0	5	5	12	34	62.5	1.48
Pecten jacobeus (Linnaeus, 1758)	1	0	0	0	0	0	2	2	5	37.5	0.22
Pitar rudis (Poli, 1795)	6	2	1	1	0	17	7	7	41	87.5	1.78
Polititapes aureus (Gmelin, 1791)	2	0	2	0	0	5	4	1	14	62.5	0.61
Solen marginatus Pulteney, 1799	0	0	2	0	0	0	0	0	2	12.5	0.09
Striarca lactea (Linnaeus, 1758)	0	0	0	3	0	8	3	1	15	50	0.65
Talochlamys multistriata (Poli, 1795)	0	0	0	0	0	2	0	1	3	25	0.13
Tellina pulchella Lamarck, 1818	2	0	2	0	0	4	0	2	10	50	0.43
Tellina tenuis Da Costa, 1778	0	0	2	0	6	0	4	0	12	37.5	0.52
Thracia phaseolina (Lamarck, 1818)	1	0	1	0	0	5	0	0	7	37.5	0.3
Venus verrucosa Linnaeus, 1758	0	0	2	0	0	6	0	0	8	25	0.35

Note: St: Station, SM: Sand with *Mytilus galloprovincialis*, S: Sand, CSE: Coarse sand with *Enteromorpha linza*, Si: Silt, SZ: Sand with *Zostera marina*, CSM: Coarse sand with *Mytilus galloprovincialis*.

Table 2. Seasonal measurements of environmental variable values at the sampling stations

Sampling period	Stations	Variables			
		O_2	*T*	*S*	*pH*
July 2008	St. 1	5.58	25.03	22.8	8.33
	St. 2	3.68	24.57	22.6	8.15
	St. 3	4.19	23.7	23.3	8.21
	St. 4	8.46	26.77	23.1	8.53
	St. 5	7.4	25.6	22.9	8.39
	St. 6	5.16	25.1	23.1	8.31
	St. 7	5.14	24.39	23.5	8.3
	St. 8	6.49	24.36	28.1	8.44
November 2008	St. 1	5.56	16.17	25.5	8.51
	St. 2	3.34	15.7	24.6	8.25
	St. 3	5	15.25	25.6	8.32
	St. 4	5.9	16.3	25.7	8.55
	St. 5	6.01	16.01	25.5	8.46
	St. 6	5.68	16.37	25.6	8.33
	St. 7	5.28	16.22	26.1	8.45
	St. 8	5.83	16.07	30.5	8.7
February 2009	St. 1	9.61	8.87	27.6	7.48
	St. 2	9.65	9.31	27.4	6.4
	St. 3	9.63	9.18	27.8	5.3
	St. 4	9.25	9.24	26.5	7.55
	St. 5	9.56	9.24	27.4	8.09
	St. 6	9.2	9.12	27.6	8.79
	St. 7	5.68	9.65	28.3	5.44
	St. 8	7.94	9.61	28.3	5.13
April 2009	St. 1	8.13	13.1	24.3	6.5
	St. 2	8.72	13.68	23.6	6.85
	St. 3	9.79	14.26	24.4	7.07
	St. 4	7.95	13.5	23.3	6.48
	St. 5	8.9	13.31	24.2	6.52
	St. 6	8.9	13.23	24.3	7.05
	St. 7	8.65	14.1	24.8	6.74
	St. 8	8.04	15.75	28.6	6.88

Note: O_2: Dissolved oxygen (mg L^{-1}), T: Temperature (°C), S: Salinity (‰)

Table 3. Annual average values of several environment variables at the stations

Stations	PS (µm)	DO (mgL^{-1})	S (‰)	T (°C)	pH
St. 1	437±50	7.89±1.23	24.65±1.47	16.45±6.46	7.71±0.92
St. 2	342±83	7.96±1.37	25±1.66	16.04±6.02	7.41±0.93
St. 3	1027±198	7.24±1.82	25.15±1.66	15.95±5.87	7.23±1.40
St. 4	465±346	7.22±1.73	25.05±1.75	15.79±5.92	7.78±0.98
St. 5	364±74	6.34±2.85	24.55±1.79	15.81±5.55	7.87±0.91
St. 6	636±133	7.13±2.57	25.27±1.66	15.59±5.21	8.12±0.75
St. 7	1046±74	6.18±1.43	25.67±1.77	16.09±5.34	7.23±1.42
St. 8	235±390	7.07±0.94	28.87±0.95	16.44±5.24	7.29±1.65

Note: PS: Particle size, DO: Dissolved oxygen, S: Salinity, T: Temperature.

Table 4. Spearman correlation values (r_s; $p<0.05$) between various environmental variables, species richness, and abundance (ind. 0.09 m^{-2})

	PS (µm)	T (°C)	S (‰)	O_2 (mg L^{-1})	pH
Number of species	0.46	—0.72	0.59	—0.26	—0.42
Abundance (ind. 0.09 m^{-2})	—0.17	—0.30	—0.36	0.12	0.55

Note: PS: Particle size, O_2: Dissolved oxygen, S: Salinity, T: Temperature.

Table 5. Particle size, species number, and abundance values for the stations

Station	Particle grain size (%)				
	Gravel	***Sand***	***Silt***	***SN***	***A***
St. 1	6.3	93.22	0.44	33	655
St. 2	2.68	97.23	0.09	22	256
St. 3	10.19	89.76	0.05	27	111
St. 4	8.15	91.64	0.19	23	160
St. 5	0.15	99.59	0.26	19	233
St. 6	16.75	83.11	0.13	40	512
St. 7	26.96	73.01	0.04	33	212
St. 8	0.32	98.91	0.77	31	160

Note: SN: Species number, A: Abundance (ind. 0.09 m^{-2})

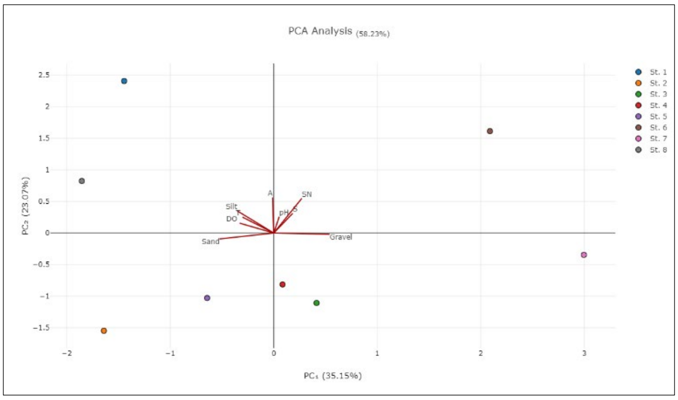

Figure 2. PCA ordination diagram of the spatial mean environmental variables, abundance and species number

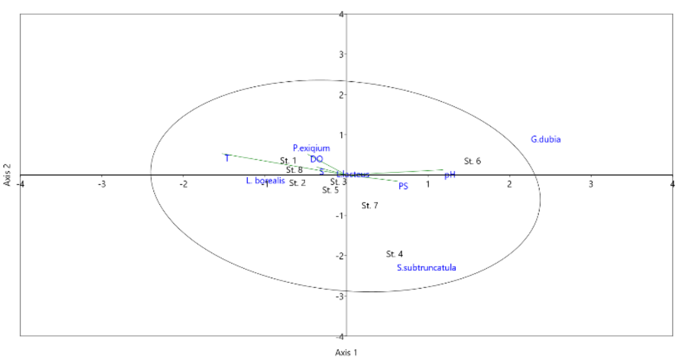

Figure 3. Canonical correlation analysis (CCA) between dominant species and environmental variables

Principal component analysis (PCA) was conducted to investigate the relationship between environmental variables and the species and individual counts of bivalves. The analysis accounts for 58.23% of the model's variance. According to the findings, salinity predominantly influences species richness, whereas pH emerges as the primary environmental determinant affecting the distribution of bivalve individuals. Canonical correspondence analysis (CCA) was conducted to assess the relationship between the most abundant species and environmental variables. Temperature was found to significantly influence the distribution of *Lucinoma borealis*, whereas dissolved oxygen (DO) played a crucial role in the distribution of *Parvicardium exiguum*. *Loripes lacteus* was associated with salinity, while *Spisula subtruncatula* showed correlation with particle size (Figure 3).

Discussion

Significant studies on bivalves in the Çanakkale Strait were conducted by Colombo (1885), Marion (1898), and Pallary (1917). Palaz & Berber (2005) subsequently reported 28 bivalve species from the Çanakkale Strait. More recently, Aslan-Cihangir & Ovalis (2013) documented a total of 80 bivalve species at depths ranging from 10 to 83 meters in the Çanakkale Strait. In their study, Aslan-Cihangir & Ovalis (2013) identified several species (*Nucula sulcata, Nucula nitidosa, Mytilaster lineatus, Anodontia fragilis, Lucinella divericata, Kellia suborbicularis, Kurtiella bidentata, Parvicardium scabrum, Tellina tenuis, Tellina donacina, Arcopagia balaustina, Abra prismatica*) as new records for the Çanakkale Strait. These newly recorded species had also been identified during our study conducted between 2008 and 2009.

A detailed study on the bivalve molluscs of the Turkish Aegean coasts was carried out by Doğan (2005). Doğan (2005) reported *Modiolarca subpicta* as the most dominant species in the coastal waters of the Aegean Sea, Türkiye, with a dominance of 7.57%. This study also identified a single specimen of *M. subpicta*. According to Doğan (2005), *Parvicardium exiguum* was the sixth most common species, with a relative abundance of 3.5%. Contrary, in the present study, *P. exiguum* was recorded as the second most prevalent species, with a relative abundance of 12.22%. The same author noted the highest species richness at stations with sandy bottoms. The species with the highest occurrence frequencies were *Papillicardium papillosum* (66.7%) and *Pitar rudis* (53.33%). Similarly, in this study, *P. rudis* and *P. papillosum* were commonly found in sandy bottoms, with frequencies of 87.5% and 62.5%, respectively.

In Greek waters of the Aegean Sea, Evagelopoulus & Koutsoubas (2008) identified *Loripes lacteus* as the most dominant species on sandy bottoms in shallow waters (0.2–0.5 m) off the coast of Lesvos Island, in the northeastern Aegean Sea, close to the Turkish coast. They reported a salinity range of 33-45‰ for this species. In contrast, salinity values measured in this study ranged between 22‰ and 30‰ annually. This suggests that *L. lacteus* exhibits a relatively wide salinity tolerance. In the western Mediterranean, Urra et al. (2011) found *Spisula subtruncata* to be the most abundant species throughout the year in shallow waters (5 m) of the Alboran Sea. In this study, *S. subtruncata* was most abundant (89 ind. 0.09 m^{-2}) on silt bottoms.

Albayrak et al. (2004) reported the presence of *Parvicardium exiguum* on sandy bottoms at a depth of 1 m, along with *L. lacteus* in sandy, muddy, and gravelly bottoms at the same depth. The same authors also recorded *S. subtruncata* at depths ranging from 1 to 42 m, with water temperatures between 14.8 and 23.4°C and salinity ranging from 19.9 to 37.5 ‰. Papazacharias et al. (1998) also reported *L. lacteus* as the dominant species on silt bottoms along the coast of Kavala.

With regard to the question of family dominance, Doğan (2005) reported Cardiidae and Veneridae as the most dominant families, comprising 9.09% of the dominance on the Aegean Sea coasts. Similarly, in this study, Veneridae was the most dominant family, accounting for 19.09% dominance. A comprehensive study was conducted by Mutlu & Ergev (2012) to observe the variability in bivalve abundance in shallow soft-bottom habitats across different depths and seasons in neritic waters (10-200 m) of the eastern Mediterranean. They identified *Corbula giba* and *Abra alba* as dominant species in sandy substrates of shallow waters up to 25 m depth. Melis et al. (2015) documented high bivalve species diversity at depths ranging from 1 to 12 m off the coast of Mersin (Elaiussa Sebaste) in their archaeological study. They highlighted *L. lacteus* and *Venericardia antiquata* as predominant species specifically at depths between 7 and 11 m. In this study, conducted in shallow waters down to 4 m depth, *Lucinoma borealis* was identified as the commonest species.

Based on statistical data, no significant relationship was found between temperature and species richness, whereas salinity appears to be a significant factor in species distribution. Analysing the relationships between species and individual numbers with environmental variables, a weak negative correlation was observed between annual mean temperature and the number of individuals, a similar weak negative correlation between salinity values and the number of individuals, a moderate positive correlation between pH values and the number of individuals, and a weak positive correlation between average oxygen concentrations and the number of individuals. Changes in pH and dissolved oxygen values from the obtained data exhibit stronger associations with species and individual distributions compared to other variables. Papazacharias et al. (1998) reported *Loripes lacteus* as dominant in the fine sand and silt substrates of Kavala Bay (northern Aegean Sea), with sediment grain sizes ranging from 4 to 1741 µm. In the Çanakkale Strait, which serves as the transition zone between the northern Aegean Sea and the Sea of Marmara, Meriç et al. (2009) reported an average silt content of 46%, a clay content of 9%, and a mud content of 27%. Additionally, they observed bivalve communities in sandy sediments, with distribution ranging from 0 to 9.7%. In this study, granulometric analyses were conducted to assess sediment structure, as sand content plays a crucial role in determining community structure. The sand, mud, and clay contents at the stations were recorded. A moderately positive correlation was found between particle size and species richness, while a weak correlation was observed between particle size and abundance. The station with the highest sand content was identified as Eceabat, with a value of 99.59%, while Kepez Port had the lowest sand content at 73.01%. Accordingly, Eceabat exhibited 19 species and 233 individuals, whereas Kepez Port had 33 species and 212 individuals. Overall, strong currents influenced by prevailing northerly, northwesterly, and southerly winds significantly impact the seabed structure in the study area.

Two environmental variables, sediment particle size and seawater salinity, moderately influence the species richness of bivalve species in the soft substrate of the shallow waters of the Çanakkale Strait. Sediment particle size directly affects bivalve feeding, filtration, and habitat preferences, as bivalve thrive in soft substrates enriched with small particles that offer abundant nutrients (Alexander et al., 1993). Optimal salinity levels are crucial for bivalve populations, as extremes can negatively impact their abundance. Understanding these factors is essential for biodiversity and habitat management in ecosystems like the Çanakkale Strait, informing conservation strategies and ecosystem management practices.

About to the study area's biodiversity, we found low values for the diversity index (H) and these values range from 1.95 to 3.01. However, according to Simboura & Zenetos (2002), the study area is characterized by low diversity. In the study conducted by Albayrak et al. (2007) in Edremit Gulf, H' values ranged from 2.5 to 5. The lower index values recorded in this study may be attributed to the irregularity of the environmental variables in the study area or the fact that some environmental variable values are lower than those measured in Edremit Bay.

Conclusion

Consequently, efforts were made to contribute to bivalve communities in the coastal waters of Çanakkale Strait. The community structure of bivalve populations on the soft bottoms of these coastal waters, an integral part of the Turkish Straits System, was examined. Based on the data obtained, Çanakkale Strait experiences strong current systems, leading to continuous changes in its seabed structure. These powerful waves and currents contribute to a dynamic alteration in the benthic fauna of the area. This study focused on the shallow waters of the strait ecosystem. Future comprehensive studies conducted at various depths could offer more detailed insights into the community structures formed by species distributed throughout Çanakkale Strait.

Compliance With Ethical Standards

Authors' Contributions

HY: Investigation, Methodology, Writing – review & editing

ASA: Writing – original draft, Writing – review & editing, Supervision

SA: Formal Analysis, Writing – original draft, Writing – review & editing

All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

For this type of study, formal consent is not required.

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Data Availability

The authors confirm that the data supporting the findings of this study are available within the article.

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