

RESEARCH ARTICLE

Seasonal variations of microplankton composition in İzmit Bay (Sea of Marmara)

Ahmet Küçük and Halim Aytekin Ergül*

Department of Biology, Science and Arts Faculty, Kocaeli University, İzmit-Kocaeli,
TURKEY

*Corresponding author: halim.ergul@kocaeli.edu.tr

Abstract

In this study seasonal variations of microplankton composition were determined in İzmit Bay. Microplankton samples were taken vertically along 20 m water column at selected points in Eastern, Central and Western basins in April, July and, November 2009 and February 2010. Three major groups Dinoflagellata (55.88 %), Diatomae (29.41 %) and others (14.70 %) were determined during the study. The most abundant microplankton was observed in November 2009 in the Eastern basin of İzmit Bay. *Ceratium fusus*, *Ceratium furca*, *Protoperidinium depressum*, *Protoperidinium claudicans*, *Coscinodiscus radiatus*, *Coscinodiscus perforatus* and *Tintinnid* spp. were present in all seasons in the region.

Keywords: İzmit Bay, Marmara Sea, Microplankton, Dinoflagellata, Diatomae

Introduction

İzmit Bay is a semi-enclosed region located at the East of the Sea of Marmara. It is about 45 km long, 1.8-9 km wide and its surface is 261 km², is separated into three distinct regions as western, central and eastern which are connected each other with narrow passages (Güven and Ünlü 2000; Morkoç *et al.* 2001; Balkıs 2003). İzmit Bay is an important marine region of our country because of its strategic location on inner east of the Marmara Sea and productivity features. Sea water quality of İzmit Bay is under pressure because of, increasing population, heavy industry and marine traffic. Also, because of low renewal capacity of İzmit Bay, water quality deteriorates and it affects phytoplankton which make a large portion of primary production. Surface water of İzmit Bay flows from the Marmara Sea to interiors of İzmit Bay in summer and spring and to Marmara Sea in autumn and winter (Oğuz and Sur 1986). In published literature there are several studies present in limited number on distributions of phytoplankton in İzmit Bay (Aktan *et al.* 2005), physical and chemical properties (Morkoç 1991; Algan *et al.* 1999) and dominant zooplankton distribution (İşinibilir *et al.* 2000). In this study, we aimed to determine seasonal

distribution of microplankton in Eastern, Central and Western basins of İzmit Bay.

Materials and Methods

İzmit Bay microplankton composition was evaluated during 2009-2010 (April 2009, July 2009, November 2009 and February 2010). Microplankton samples were taken vertically along 20 m water column at selected points in Eastern, Central and Western basins (Figure 1). On April 2009, also horizontal microplankton samples were taken. Apstein type plankton net with 55 μm mesh size and 25 cm diameter was used in sampling. Samples were put into 500 mL polyethylene bottles, fixed with 4 % formaldehyde solution and immediately transferred to the laboratory.

Before counting process, samples were homogenized by shaking gently. 10 mL samples were put into 15 mL falcon tubes. At least 3 parallels were centrifuged 15 min. at 800 rpm and supernatant was removed. Nageotte type counting chamber and light microscope (Olympus BX51) were used to quantitative evaluation of microplankton.

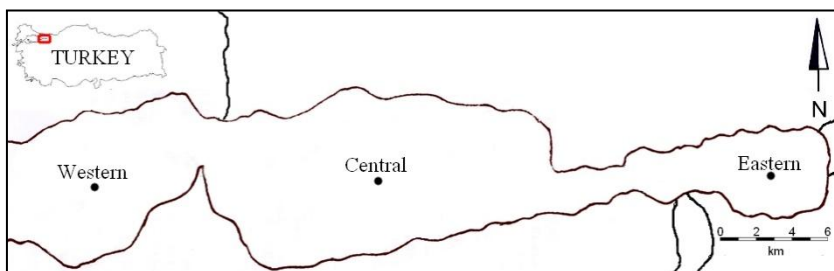


Figure 1. Sampling stations in the İzmit Bay Western, Central and Eastern basins

Results

Microplankton species and its distribution determined seasonally in three different basins water column of İzmit Bay. Three major groups as Dinoflagellata, Diatomae and others were observed in the region (Table 1).

During the study, 34 different species were identified. Maximum species diversity was observed in April 2009 and the minimum in November 2009 and February 2010 (Table 2).

Table 1. List and frequency distribution of microplanktonic species observed in the İzmit Bay Eastern, Central and Western basins water column.

Species	Period	Phylum -Density	April 2009			July 2009			November 2009			February 2010				
			Central*	Eastem	Central	Westem	Eastem	Central	Westem	Eastem	Central	Westem	Eastem	Central	Westem	
<i>Ceratium kofoidi</i>		Dinoflagellata (55.88 %)		+	+											
<i>Ceratium fusus</i>			+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Ceratium furca</i>			+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Ceratium teres</i>			+	+		+					+	+			+	
<i>Ceratium horridum</i>			+	+				+	+	+	+	+				
<i>Ceratium pulchellum</i>			+													
<i>Ceratium tripos</i>			+	+		+		+	+							+
<i>Protoperidinium granii</i>				+		+							+			
<i>Protoperidinium depressum</i>			+	+	+	+	+	+	+		+	+			+	
<i>Protoperidinium claudicans</i>			+		+		+	+	+		+			+	+	+
<i>Protoperidinium punctulatum</i>			+		+	+	+	+	+				+			+
<i>Podolampas palmipes</i>								+			+					
<i>Prorocentrum micans</i>						+	+	+					+		+	+
<i>Prorocentrum scutellum</i>			+		+	+	+	+	+				+		+	+
<i>Prorocentrum triestinum</i>							+	+	+							
<i>Dinophysis acuminata</i>			+	+	+				+							+
<i>Dinophysis caudata</i>			+		+				+			+				
<i>Phalacroma rotundatum</i>					+								+		+	+
<i>Heterocapsa triquetra</i>					+											
<i>Coscinodiscus radiatus</i>			+	+	+	+		+		+	+		+	+	+	+
<i>Coscinodiscus perforatus</i>			+	+	+	+			+	+	+		+	+	+	+
<i>Coscinodiscus granii</i>										+	+	+	+	+	+	+
<i>Thalassionema nitzschioides</i>					+											
<i>Pseudo nitzschia</i>										+						
<i>Chaetochyces sp.</i>					+							+				
<i>Proboscia alata</i>								+				+	+			
<i>Hemiaulus hauckii</i>									+	+	+					
<i>Dactyliosolen fragilissimus</i>				+												
<i>Dictyocha speculum</i>				+				+							+	
<i>Tintinnid spp.</i>		+	+		+	+			+	+	+	+	+	+	+	
<i>Anabeana sp.</i>							+	+								
<i>Triceratium favus</i>			+	+	+											
<i>Dictyocha fibula</i>									+		+					
		Other (14.70 %)														

* 500 m horizontal sampling

Table 2. Total species diversity according to periods and phylum.

		Period	April 2009	July 2009	November 2009	February 2010
Distribution			%			
Species diversity according to the phylum	<i>Dinoflagellata</i>		68,00	68,42	44,44	66,67
	<i>Diatomae</i>		20,00	15,79	44,44	22,22
	Others		12,00	15,79	11,11	11,11
Rate in total species			73,53	55,88	52,94	52,94

According to the obtained data, maximum microplankton abundance was present at the Central basin in April 2009, at the Eastern basin in July and November 2009, and at the western basin in February 2010. The most abundant microplankton was observed at November 2009 in the 20 m water column of İzmit Bay (Figure 2).

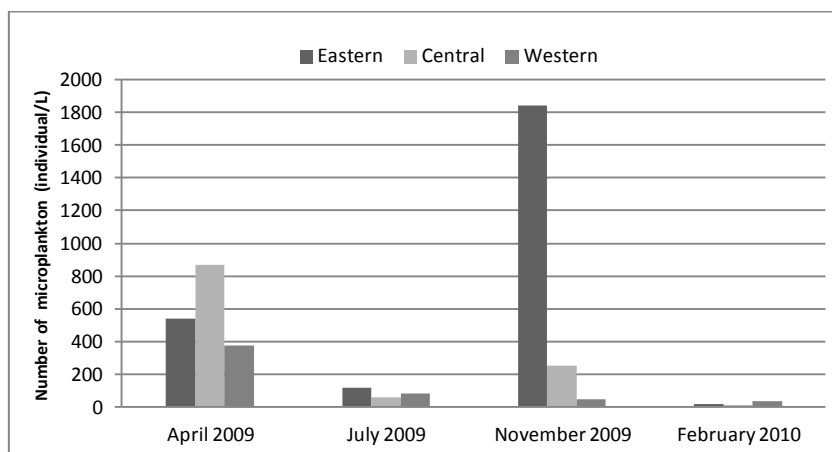


Figure 2. Microplankton abundance in Eastern, Central and Western basins of İzmit Bay in different samplings.

During the study *Dinoflagellata* were dominant at all basins except November 2009 when *Diatomae* were dominant. *Ceratium fusus* in April 2009, *Prorocentrum micans* in July 2009 and February 2010 and *Tintinnid* spp. in November 2009 were determined in the highest number. *Ceratium fusus*, *Ceratium furca*, *Protoperidinium depressum*, *Protoperidinium claudicans*, *Coscinodiscus radiatus*, *Coscinodiscus perforatus* and *Tintinnid* spp. were determined in each sampling period (Table 3).

Table 3. List and percent distribution of microplankton species observed in İzmit Bay Eastern, Central and Western basins water column.

Species	Period	April	July	November %	February
<i>Ceratium kofoidi</i>		1,12	a	a	a
<i>Ceratium fusus</i>		37,70	3,32	4,71	18,31
<i>Ceratium furca</i>		20,72	4,37	4,17	10,74
<i>Ceratium teres</i>		0,21	a	0,54	0,38
<i>Ceratium horridum</i>		0,07	1,17	0,51	a
<i>Ceratium pulchellum</i>		0,06	a	a	a
<i>Ceratium tripos</i>		0,80	1,03	a	0,58
<i>Protoperidinium granii</i>		0,55	a	a	1,56
<i>Protoperidinium depressum</i>		13,40	3,09	0,20	0,38
<i>Protoperidinium claudicans</i>		11,08	3,41	0,15	1,25
<i>Protoperidinium</i>		3,01	1,39	a	1,96
<i>Protoperidinium triestinum</i>		a	24,68	a	a
<i>Prorocentrum micans</i>		0,38	31,38	a	32,88
<i>Prorocentrum scutellum</i>		0,89	14,54	a	2,03
<i>Dinophysis acuminata</i>		0,83	0,90	a	1,44
<i>Dinophysis caudata</i>		0,22	0,42	0,08	a
<i>Phalacroma rotundatum</i>		0,16	a	a	4,05
<i>Heterocapsa triquetra</i>		1,87	a	a	a
<i>Podolampas palmipes</i>		a	0,56	0,08	a
<i>Coscinodiscus radiatus</i>		0,46	0,42	1,48	3,39
<i>Coscinodiscus perforatus</i>		0,38	0,30	0,54	4,42
<i>Coscinodiscus granii</i>		a	a	1,38	5,54
<i>Thalassionema nitzschioides</i>		0,41	1,25	a	a
<i>Pseudo nitzschia</i>		a	a	16,77	a
<i>Chaetochaeas sp.</i>		1,97	a	0,12	a
<i>Proboscia alata</i>		a	5,00	0,08	0,52
<i>Hemiaulus hauckii</i>		a	a	3,70	a
<i>Dactyliosolen fragilissimus</i>		0,77	a	a	a
<i>Ditalum brightwelli</i>		a	a	0,12	a
<i>Dictyocha speculum</i>		0,09	0,75	a	3,75
<i>Tintinnid spp.</i>		2,24	0,65	64,71	6,74
<i>Anabeana sp.</i>		a	1,45	a	a
<i>Triceratium favus</i>		0,62	a	a	a
<i>Dictyocha fibula</i>		a	a	0,71	a

a: absent

Discussion

In this study seasonal variations of microplankton composition were determined in İzmit Bay. In general Dinoflagellata and Diatomae species were dominant and most microplankton abundance was determined in spring and especially autumn season. In a previous study besides of five phyla, Dinoflagellata and Diatomae were reported as dominant groups in the region (Balkıs 2003). *Ceratium fusus*, *Ceratium furca*, *Protoperidinium depressum*, *Protoperidinium claudicans*, *Coscinodiscus radiatus*, *Coscinodiscus perforatus* and *Tintinnid* spp. were present in all seasons. It can be said these species have wide ecological tolerance and can be used as indicator species for the region. In a previous study, it was reported that some of these species such as *Ceratium fusus*, *Ceratium furca* and *Ceratium tripos* have wide ecological tolerance (Spector 1984). *Prorocentrum* species were determined in all samples except November 2009 and *Prorocentrum micans* from this genus was reported as responsible species for plankton bloom in the region in June 2010 (Ergül *et al.* 2010).

Because of heavy industrialization and rapid increase in population, treated or untreated industrial and domestic discharges bring large amount of nitrogen and phosphorus to İzmit Bay that supplies nutrient for primary production. It is known that changes in the environmental conditions can easily affect on planktonic organisms and determination of changes in the planktonic composition can supply valuable data about interested ecosystem. Heavy marine traffic and ballast originated waters also carry new plankton species to the region everyday. Although, several researches are present about plankton composition of İzmit Bay, these studies are very limited in their number and none of them is a long-term biomonitoring study. In this study microplankton species variations were determined seasonally. According to the information above, however, long-term biomonitoring studies would be beneficial for the region. In further studies not only planktonic composition but also the amount of nutrient and other oceanographic parameters, such as chlorophyll-*a*, pH, salinity and dissolved oxygen, need to be determined.

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İzmit Körfezi (Marmara Denizi) mikroplankton kompozisyonunun mevsimsel değişimi

Özet

Bu çalışmada İzmit Körfezi Mikroplankton kompozisyonundaki mevsimsel değişimler belirlendi. Mikroplankton örnekleri, İzmit Körfezinin Doğu, Merkez ve Batı basenlerinde

belirlenen noktadaki 20 m'lik su kolonundan Nisan, Temmuz, Kasım 2009 ve Şubat 2010'da dikey olarak alındı. 55 µm göz açıklıklı, 25 cm ağız çaplı Apstein tip plankton kepçesi kullanıldı. Dinoflagellata (% 55.88), Diatomae (% 29.41) ve diğerleri (%14.70) olmak üzere üç önemli grup belirlendi. En fazla mikrop plankton Kasım 2009 da Doğu baseninde gözlemlendi. *Ceratium fusus*, *Ceratium furca*, *Protopeiridium depressum*, *Protopeiridium claudicans*, *Coscinodiscus radiatus*, *Coscinodiscus perforatus* ve *Tintinnid* spp. her dönem rastlanan türlerdi.

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