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Composition of Species and Biomass of Coastal Fish around Gökçeada Island (NE Aegean Sea)

Gökçeada Kıyı Balıklarını Tür Kompozisyonu ve Biyoması

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Abstract
Biomass of the coastal fish fauna of Gökçeada Island was seasonally investigated at different stations between August 1995 and June 1996. Fish species were collected by means of trammel net and gill net from 6 stations around the island. Biomasses of the 59 species were calculated (260.647 g). Seasonal productivity index (P') among the stations was determined by means of Shannon-Weaver Index. Productivity index was the highest in the spring at the stations I (P': 3.995) and III (P': 3.673).
Key words: Fish fauna, productivity, Aegean Sea

Introduction

Gökçeada, the largest island of Turkey, is located in the northern Aegean Sea (25°40' E- 26°02'E longitudes; 40°05' N- 40°14' N latitudes). The coastal line of the island is 92 km and its surface area is 279 km^2. Because of the small population of the island, probability of the marine pollution caused by the domestic wastes is low. Furthermore, the island is located rather far from the main maritime lines. Therefore a rather high fishing productivity can be assumed.
The ichthyofauna of the northern Aegean Sea has been studied by Papaconstantinou (1992); Papaconstantinou and Tortonese (1980);

Papaconstantinou and Tsimenidis (1985); Papaconstantinou and Tsimenidis (1979). Productivity of the ichthyofauna and fish stocks in the Turkish territorial waters of Aegean Sea have been studied (Kaya and Mater, 1994); Kaya (1993), Kara and Gurbet (1993); Alpbaz and Kinacigil (1988); and Hoşsucu and Metin (1993). The coastal ichthyofauna of Gökçeada has been studied from a systematic point of view by Ulutürk (1987), coastal ichtyofauna of Gökçeada by Keskin and Ünsal (1998), some demersal fishery resources by Benli *et al.* (1999).

Material and Method

This research was carried out around Gökçeada at 6 stations between August 1995 and June 1996 (Fig. 1). Bottom type and temperature (°C), salinity (ppt), and dissolved oxygen (DO) at each station were determined (Table 1, 2).

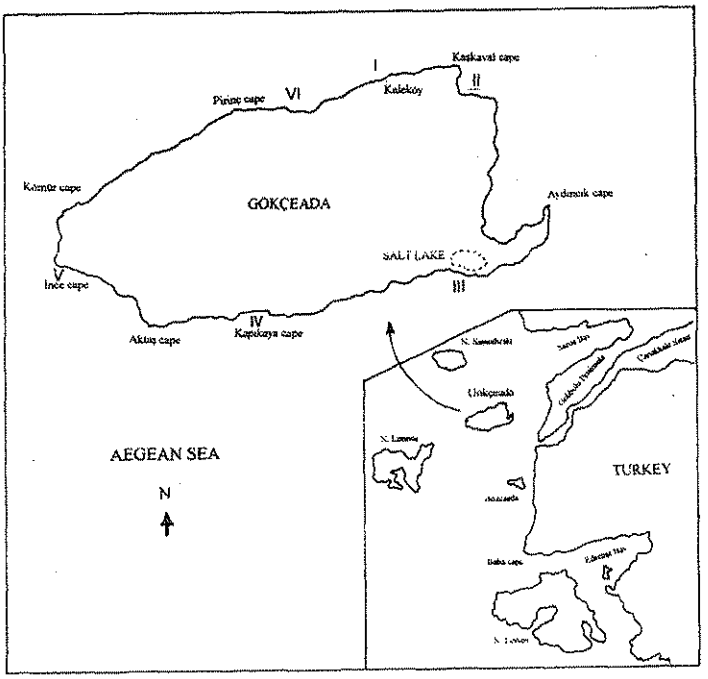

Figure 1. Sampling stations around Gökçeada Island

Table 1. Bottom type at stations

No	Station	Locality		Bottom Type
I	Kaleköy	25°53'20"E	40°14'00"N	Sand+Stone+Seagrass
II	Kuzu	25°57'28"E	40°13'48"N	Sand+Stone
III	Kefaloz	25°57'00"E	40°07'24"N	Sand+Stone
IV	Laz Koyu	25°50'55"E	40°06'20"N	Sand+Gravel
V	Gizli	25°41'05"E	40°06'48"N	Sand+Gravel
VI	Tepeköyaltı	25°50'10"E	40°13'00"N	Seagrass

Sampling were carried out seasonally and gill and trammel nets were set at the bottom, 5 and 15 m depth at each station. The trammel net was 180 m long, 90 cm high, and 18 mm mesh size; the gill net was 120 m long, 240 cm high, and 23 mm mesh size.
Identification and taxonomic nomenclature of the fish species followed by Whitehead *et al.* (1984), and Fischer *et al.* (1987). The number of the individuals of each species was counted and their total weight was measured.
Diversity Index (H'), and productivity Index (P') were calculated using the following Shannon-Weaver formula (Odum, 1971): $H' = -\sum_{i=1}^{s} p_i . \log_2 p_i$. Number of the individuals was taken into account for calculating the Diversity Index (H'), and total weight of the individuals of each species for the Productivity Index (P').

Results

Dissolved oxygen concentration, salinity and temperature of sea water at stations were determined seasonally and their mean values were calculated. These parameters did not differ significantly among the stations. Temperature and salinity values were 10.1 °C and 31.94 ppt in winter, and 24.4 °C and 32.50 ppt in summer

respectively; dissolved oxygen concentration was 6.6 mg/L in summer and 9.0 mg/L in winter (Table 2).

Table 2. Seasonal Dissolved oxygen, salinity and temperature values

	Winter	Spring	Summer	Autumn
Dissolved oxygen (mg/L)	9	8	6.6	7.4
Salinity (ppt)	31.94	31.82	32.5	31.82
Temperature (°C)	10.1	18.5	24.1	19.4

A total of 3291 specimens, representing 59 species were collected. The total weight of the collected specimens was 260.647 g. Among the collected species, *Boops boops, Spicara maena, Diplodus annularis, Scomber japonicus* and *Mullus surmuletus* dominated the catches throughout the year in all seasons. The first five rank of the catch occupied by *Spicara maena, Boops boops, Scomber japonicus, Mullus barbatus* and *Mullus surmuletus* at station I; *Spicara maena, Boops boops, Diplodus annularis, Dasyatis pastinaca* and *Scorpaena porcus* at station II; *Spicara maena, Boops boops, Raja miraletus, Uranoscopus scaber* and *Mullus surmuletus* at station III; *Boops boops, Dasyatis pastinaca, Uranoscopus scaber, Scomber japonicus* and *Pagellus eritrynus* at station IV; *Boops boops, Uranoscopus scaber, Myliobatis aquila, Pagellus erithrynus* and *Mullus surmuletus* at station V; *Boops boops, Spicara maena, Symphodus (Cr.) cinereus, Serranus scriba* and *Sardinella aurita* at station VI (Table 3).

Productivity Index (P′) was at its highest value in spring (P′: 3.705) and lowest in winter (P′:2.120) (Table 4, Fig. 2). With regards to stations, Productivity Index exhibited the maximum value at station I (P′: 3.175) and the minimum value at station IV (P′: 2.618) (Table 5, Fig. 3).

Diversity Index (H′) was at its maximum value in spring (H′: 3.631) and minimum in winter (H′: 2.065). With regards to stations, diversity Index exhibited the maximum value at stations III (H′: 3.219) and the minimum value at station V (H′: 2691).

Table 3. Weight (g) of species by seasons among stations

SPECIES	I	II	III	IV	V	VI	Total	Winter	Spring	Summer	Autumn
Boops boops	5440	10430	6875	5650	9080	23805	61280	30835	6660	13655	10130
Spicara maena	6104	13080	7830	885	1610	15430	44939	17780	12080	7459	7620
Diplodus annularis	2618	3850	1230	880	1735	2015	12328	1503	3290	3000	4535
Scomber japanicus	4235	550	650	2420	1130	2900	11885	955	9810	1120	
Mullus surmuletus	3320	750	2040	1430	1850	2110	11500	2640	5200	2860	800
Trachurus trachurus	1218	450	1815	625	3695	2645	10448	785	3740	1068	4855
Uranoscopus scaber	1605	800	3195	2840	1690		10130	485	4455	5190	
Dasyatis pastinaca	1185	3180	1500	3000	175	980	10020		5525	4195	300
Sardinella aurita	1125	1170	880	1260	1585	2095	8115	1555	6210	110	240
Scorpaena porcus	2120	1380	1990	680	250	1285	7705	695	4055	1745	1210
Symphodus (Cr.) cinereus		1340				5815	7155	2535	2050	2230	340
Serranus scriba	1348	120	370			3925	5763	55	2500	3108	100
Raja miraletus	1000	70	3580	510	510		5670	4020	1650		
Mullus barbatus	3790	820	885	20			5515	335	5160	20	
Oblada melanura	2405	580	650	550	520	250	4955	155	500	870	3430
Pagellus erithrynus	193	315	365	1750	2300		4923	55	1865	2738	265
Pagellus acarne	1310	400	700	1100	1340		4850		4580	270	
Sarpa Salpa	2390	715	890		450		4445	1375		1000	2070
Scorpaena notata	2850	470	170			550	4040	50	3640	350	
Spicara simaris	1430	650	860		80		3020	140	2880		
Symphodus (Cr.) tinca	100	600				1795	2495	1885	500		110
Myliobatis aquila					2480		2480			1500	980
Ophidium barbatum	350	180	520	720	600		2370		1280	450	640
Diplodus vulgaris	1060		1230			70	2360			420	1940
Torpedo nobiliana	1025			100			1125		825	300	
Serranus cabrilla	280	290	150	105	45	155	1025		615	410	
Solea nasuta				200	800		1000		1000		
Crhomis chromis	23	60	250		30	595	958		195	763	
Trachinus draco	55	230	350	90	110		835		795	40	
Symphodus (Cr.)mediterraneus		40				735	775	40	580	25	130
Raja radula	20	150			600		770		20	750	
Coris julis	180	125				375	680	125	225	330	
Labrus merula		645					645	645			
Merluccius merluccius	205	250	180				635		635		
Pomatomus saltator						500	500				500

Table 3 (contiuned)												
Trachinus radiatus					500		500			500		
Trachinus araneus				400			400			400		
Arnoglossus thori	95	40	80	105	65		385		365	20		
Dentex dentex	80	90				40	210			40	170	
Engraulis encrasicolus	15		40			150	205			145	60	
Spondyliosoma cantharus	32		125			40	197	75		82	40	
Phycis phycis						195	195	195				
Lithognathus mormyrus	80				90		170	65	90	15		
Monohirus hispidus				60	45	25	130		130			
Torpedo marmorata				120			120				120	
Arnoglossus imperialis	110						110		110			
Alosa fallax nilotica			90				90				90	
Oedalechilus labeo			90				90				90	
Symphodus (Cr.) roissali						80	80	40	40			
Diplodus sargus		15				60	75			15	60	
Puntazzo puntazzo	70						70	70				
Gobius cobitis						60	60			60		
Trachurus mediterraneus	60						60			60		
Symphodus cf. rostratus						45	45		45			
Arnoglossus laterna	35						35		35			
Sphyraena sphyraena						35	35				35	
Bothus podas podas					30		30			30		
Gobius sp.	10						10			10		
Buglossidium luteum	6						6		6			
TOTAL	49577	43835	39580	25500	33395	68760	260647	69093	93341	57353	40860	

Table 4. Productivity (P') and diversity (H') indices of species

SPECIES	Weight (g)	P'	Individual	H'
Boops boops	61280	0,491047	607	0,449810
Spicara maena	44939	0,437250	691	0,472796
Diplodus annularis	12328	0,215739	324	0,329263
Scomber japanicus	11885	0,208209	94	0,146519
Mullus surmuletus	11500	0,203134	176	0,225943
Trachurus trachurus	10448	0,198650	104	0,157497
Uranoscopus scaber	10130	0,180725	42	0,080299
Dasyatis pastinaca	10020	0,155837	17	0,039242
Sardinella aurita	8115	0,150175	105	0,158571
Scorpaena porcus	7705	0,148397	86	0,137403
Symphodus (Cr.) cinereus	7155	0,142388	146	0,199391
Serranus scriba	5763	0,121588	109	0,162825
Raja miraletus	5670	0,120136	10	0,025410
Mullus barbatus	5515	0,117698	111	0,164928
Oblada melanura	4955	0,108684	42	0,080299
Pagellus erithrynus	4923	0,108158	72	0,120643
Pagellus acarne	4850	0,106956	109	0,162825
Sarpa salpa	4445	0,100170	39	0,075830
Scorpaena notata	4040	0,093179	35	0,069713
Spicara simaris	3020	0,074518	59	0,104010
Symphodus (Cr.) tinca	2495	0,064201	33	0,066581
Myliobatis aquila	2480	0,063898	2	0,006493
Ophidium barbatum	2370	0,061659	32	0,064995
Diplodus vulgaris	2360	0,061454	15	0,035449
Torpedo nobiliana	1125	0,033908	4	0,011771
Serranus cabrilla	1025	0,031422	21	0,046530
Solea nasuta	1000	0,030792	10	0,025410
Crhomis chromis	958	0,029727	45	0,084674
Trachinus draco	835	0,026545	14	0,033509

Table 4 (contiuned)				
Symphodus (Cr.)mediterraneus	775	0,024958	20	0,044743
Raja radula	770	0,024824	4	0,011771
Coris julis	680	0,022390	19	0,042933
Labrus merula	645	0,021427	2	0,006493
Merluccius merluccius	635	0,021149	6	0,016590
Pomatomus saltator	500	0,017315	1	0,003550
Trachinus radiatus	500	0,017315	1	0,003550
Trachinus araneus	400	0,014346	1	0,003550
Arnoglossus thori	385	0,013889	30	0,061781
Dentex dentex	210	0,008280	3	0,009206
Engraulis encrasicolus	205	0,008111	12	0,029533
Spondyliosoma cantharus	197	0,007838	4	0,011771
Phycis phycis	195	0,007769	1	0,003550
Lithognathus mormyrus	170	0,006902	3	0,009206
Monohirus hispidus	130	0,005471	6	0,016590
Torpedo marmorata	120	0,005103	1	0,003550
Arnoglossus imperialis	110	0,004731	5	0,014224
Alosa fallax nilotica	90	0,003971	1	0,003550
Oedalechilus labeo	90	0,003971	1	0,003550
Symphodus (Cr.) roissali	80	0,003582	2	0,006493
Diplodus sargus	75	0,003385	2	0,006493
Puntazzo puntazzo	70	0,003186	1	0,003550
Gobius cobitis	60	0,002782	2	0,006493
Trachurus mediterraneus	60	0,002782	1	0,003550
Symphodus cf. rostratus	45	0,002158	2	0,006493
Arnoglossus laterna	35	0,001727	1	0,003550
Sphyraena sphyraena	35	0,001727	1	0,003550
Bothus podas podas	30	0,001506	2	0,006493
Gobius sp.	10	0,000563	1	0,003550
Buglossidium luteum	6	0.000355	1	0,003550
TOTAL	260647	4.149753	3291	4.092088

Table 5. Seasonal variation of productivity index (P') among stations

P'	Stations						
Seasons	I	II	III	IV	V	VI	Mean
Winter	2.835	2.471	2.448	1.321	2.069	1.578	2.120
Spring	3.995	3.712	3.673	3.750	3.517	3.585	3.705
Summer	3.422	2.599	3.286	2.285	2.834	3.159	2.930
Autumn	2.448	2.008	3.164	3.119	3.083	3.067	2.814
Mean	3.175	2.697	3.142	2.618	2.875	2.847	

Table 6. Diversity index value by seasons among stations

H'	Stations						
Seasons	I	II	III	IV	V	VI	Mean
Winter	2.538	2.279	2.888	1.106	1.785	1.792	2.065
Spring	3.861	3.657	3.696	3.757	3.267	3.549	3.631
Summer	3.572	3.005	3.109	3.136	2.619	3.047	3.081
Autumn	2.457	2.104	3.184	3.259	3.093	2.513	2.768
Mean	3.107	2.761	3.219	2.815	2.691	2.725	

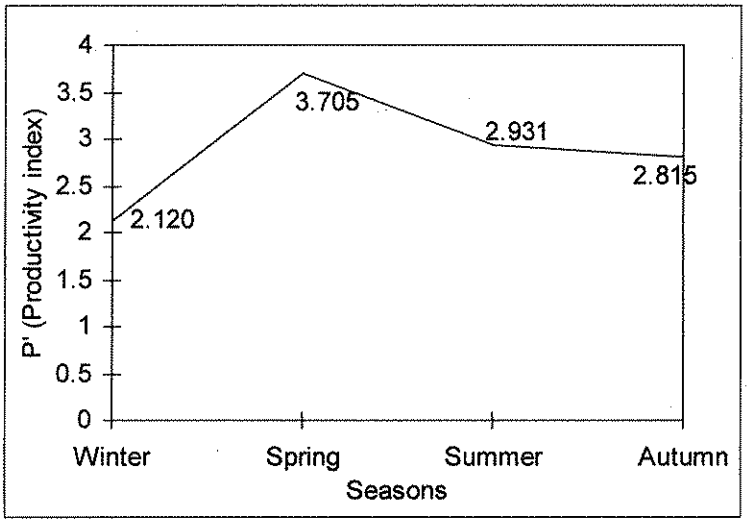

Figure 2. Seasonal variation of productivity index (P')

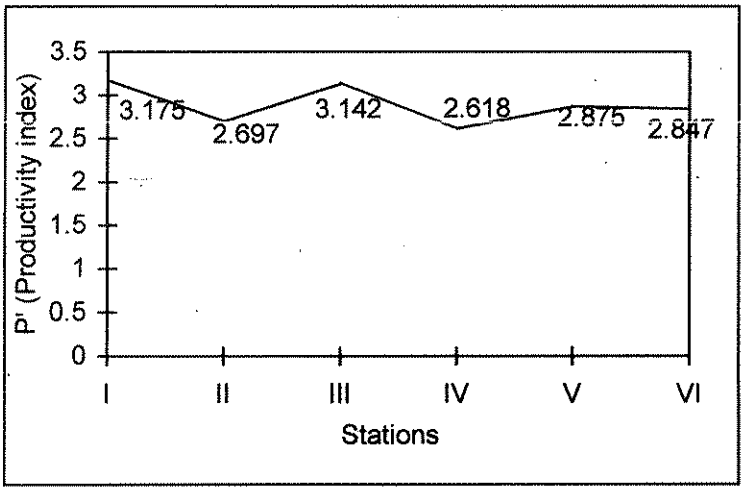

Figure 3. Variation in productivity (P') index among stations

Discussion

In the present study the attempt was to provide data on species composition of the coastal ichthyofauna, and its productivity based on the weight data with regards to stations and seasons.

Qualitative assessment was resulted in 59 fish species; however, the fish fauna of Gökçeada consisted of more species than the ones recorded in the present study. Due to the limited sampling depth varied between 5 and 15 m, and utilisation of certain fishing gears, only the dominant species of the coastal ichthyofauna of the area were collected.

Before the present study, fishfauna of Gökçeada was listed by Ulutürk (1987). The author gave the name of 144 fish species caught around the island.

The data of the present study suggest that productivity at its maximum value in the spring at all the stations. The difference between the mean values of productivity with regard to stations did not differ significantly. Teleost fish occurring in the sea of Turkey are generally spring spawners, and therefore, they inhabit in the coastal zone during the spring. This increasing productivity of the ichthyofauna during the spring may have resulted by this means. The increasing fishing activity during the spring has harmful effects on the coastal fish fauna. Therefore, summer and autumn are suitable seasons for an effective coastal zone fishery in relation to productivity (Table 5; Fig. 2, 3). The highest productivity was recorded from station I (P': 3.175), and this may have resulted by the occurrence of three different biotopes (sand, stone, and seagrass) in the area. Station IV having a mixed bottom of sand and gravel (Table 5; Figs.2, 3) exhibited the lowest productivity (P': 2.618).

The Productivity Index allowed us to evaluate the fish fauna of the area with regards to its productivity. In the calculation of the Productivity Index, it was seen that recorded total weights of some species that represented fewer specimens were higher than the total weight of the other species that represented numerous individuals.

Consequently; summer and autumn are suitable seasons for commercial fishery, although the productivity is the highest level in the spring. Furthermore, the productivity exhibited the highest value in the biotopes having a mixed bottom of sand, stones, and seagrass, and the lowest productivity was recorded from the biotopes having bottoms of sand and gravel. Therefore, fishing activities would be more effective in summer and autumn in the bays, having these three different biotopes.

Özet

Bu araştırmada, Ağustos 1995 – Temmuz 1996 tarihleri arasında, Gökçeada çevresin kıyı balıklarının istasyonlara ve mevsimlere göre biyomas değişiminin incelenmesi amaçlanmıştır. Örneklemeler ada çevresinde belirlenen 6 istasyonda fanyalı ağ ve galsama ağı kullanılarak yapılmıştır. 59 türe ait toplam biyomas 260.647 g' dır. Verimlilik indeksi (P'), Shannon-Weaver indeksine kullanılarak hesaplanmış ve ilkbahar mevsiminde I. ve III. istasyonlarda en yüksek değerlerde olduğu görülmüştür.

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