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SHORT COMMUNICATION

A preliminary study on juvenile fishes in the Istanbul Strait (Bosphorus)

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Abstract

The study was carried out in July and August 2011 in shallow water of the Istanbul Strait to understand the ichthyological fauna of the area. Samples were collected over sandy, gravel and algal bottoms by using beach seine. A total of 583 individuals belonging to 25 species were collected. Among them, 32% of sampled individuals were juvenile or sub-adult fish.

Key words: Fish, juvenile, nursery area, Istanbul Strait

Introduction

The Istanbul Strait forms a part of the boundary between Europe and Asia and connects the Sea of Marmara to the Black Sea. The Strait is defined by the line connecting Rumeli Feneri and Anadolu Feneri in the north and that connecting Ahırkapı Feneri (Sarayburnu) and Kadıköy İnciburnu Feneri in the south. It is 31 km long, with a width of 3600 m at the northern entrance and 2826 m at the southern entrance. Its maximum width is 3420 m between Umuryeri and Büyükdere Limanı, and minimum width 698 m between Rumelihisarı and Anadoluhisarı. The depth of the strait varies from 35 to 120 m in midstream with an average of 60 m (Ozsoy *et al*. 2000; Tarkan 2010).
This narrow strait is used very heavily for international navigation as a part of Turkish Straits System (TSS: Istanbul and Çanakkale Straits and the Sea of Marmara). There is also very heavy ferry traffic, which crosses between the European and Asian sides of the city. The shores of the strait are heavily populated by 12.9 million inhabitants living in the metropolitan area of Istanbul.

In the Istanbul Strait there are two different current systems. The surface layer, under the influence of cold and less saline Black Sea water, strongly flows from the Black Sea to the Sea of Marmara. Temperature and salinity show high seasonal fluctuations at the surface layer. The strong currents and physiochemical characteristics of the waters of the strait constitute an area of fundamental importance for biodiversity in the Black Sea and the Sea of Marmara and also in the Mediterranean Sea. Strong and counter currents, low temperature, less saline and productive water of the surface layer determines an ecological rearrangement that simulates Black Sea conditions for species with a prevailing western distribution while the warm and saline waters of the deep water layer most-eastern distribution of the Mediterranean species (Oguz and Ozturk 2011). Some Black Sea species, for example gobies, also present in the Sea of Marmara (Keskin 2010), succeeding in establishing themselves in the Istanbul Strait is an evidence of the optimal environmental conditions in the strait which serves as a biological corridor between the Mediterranean and Black Seas (Ozturk and Ozturk 1996).

The Strait is a migration route between the Black Sea and the Aegean Sea for pelagic fish such as Atlantic bonito (*Sarda sarda*), bluefish (*Pomatomus saltatrix*) and horse mackerel (*Trachurus mediterraneus*) (Kosswig 1953: Demir 1957; Türgan 1959). Seasonal migrations of these fish determine the fishing activity in the Istanbul Strait. Migratory fish have been harvested very intensively during their migration in the Strait by purse-seiners (Aasen *et al*. 1956; Ozturk *et al.* 2002 and references there in). Also, small-scale fishing activities have been carried out using pots, dredges, trap nets, beach seine nets, lift-nets, lines, gill nets, trammel nets, and diving (Ozturk *et al.* 2002).

The Istanbul Strait is also important for long-distance natural expansion of fish eggs and larvae as a water way between the Black Sea and the Sea of Marmara (Oguz and Ozturk 2011). Heavy ship traffic, pollution and fishing activity threaten the life in the water body and coastal habitats along the strait, especially; pollution has affected the ecological stability of the inlet in the strait (Topaloglu and Kihara 1993).

Shallow waters of bays and estuaries in the Sea of Marmara are suitable nursery and reproduction areas for fishes (Arım 1957; Mater and Cihangir 1990; Demirel *et al*. 2007; Keskin 2007). The aim of this preliminary study was to investigate to the juvenile fish population in the nearshore water in the north entrance of the Istanbul Strait, and determine the nursery areas in some parts of the Strait.

Materials and Methods

Sampling

The study was carried out in July and August 2011 in shallow water of the Istanbul Strait (Figure 1). Five stations (depth range: 1 to 2 m) were sampled over the sandy, gravel and algal bottoms. Samples were collected by using a 35 m long beach seine. Net depth at the beginning of wings was 40 cm and 250 cm at the central part together with the sac. The mesh size was 6 mm at the outer wing and 4 mm at the central sac.

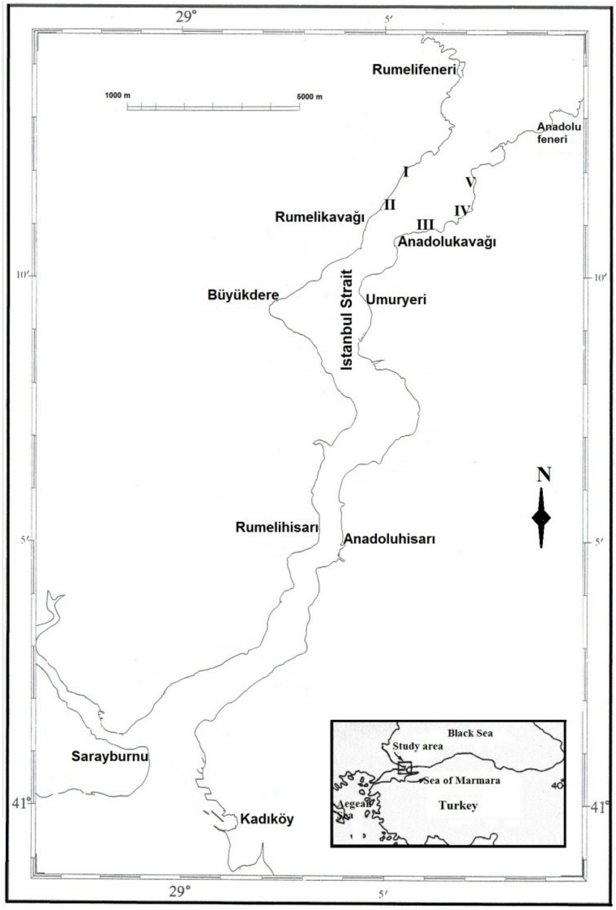

Figure 1. Sampling stations in the north part of the Istanbul Strait in July and August 2011.

Fish species were identified according Whitehead *et al.* (1984-1986), and Padoa *et al.* (1931-1956) and the number of individuals of each species was counted. Mean abundance by sampling number were calculated for each station. All the individuals were counted by species and sized to the nearest millimetre.

The bottom type was sandy in stations I and II and gravel in station III and IV. The bottom of station V was covered with macro algae patches (*Ulva lactuca*) and seagrass meadows (*Zostera marina* and *Cymadocea nodosa*). A total of 16 hauls were carried out from offshore to the beach along the 20 m line at the sampling stations. The parameters of temperature and salinity were measured with Multi-parameter (Model Hach Lange HQ 40D). Temperature ranged from 25.2 to 25.9℃ and salinity from 15.6 to 17.2 psu in the sampling stations.

Results and Discussion

A total of 583 individuals belonging to 25 species (13 families) were collected in the shallow waters of the Istanbul Strait (Table 1). Among the collected species, *Scophthalmus maeotica* and *Neogobius melastomus* were endemic species to the Black Sea.

Atherina boyeri and *Liza aurata* were the most abundant open water species in the whole catch. These species use seagrass meadows as shelter during night to escape from predators, but inhabit both seagrass meadows and bare substrate during the day (Guidetti and Bussotti 2000; 2002). *Symphodus ocellatus* was the dominant necto-benthic species in shallow areas in the Strait.

A total of 19 fish species was represented exclusively by juveniles and/or sub-adults and composed 32% of the whole catch in terms of abundance. The number of species for which juveniles were found varied between 1 and 12 by sampling stations (Table 2). Station I was the highest in terms of species richness while the stations III was the lowest. Mean abundance of juveniles and sub-adults collected at the sampling stations are shown in Table 2.

Arnoglossus kessleri was the most abundant benthic juvenile fish in stations I and II, in which the bottom was covered with sand. Most of other flat fish species, *Pegusa lascaris, Solea solea* and *Scophthalmus maeotica,* were collected also at these stations. Species richness also was the highest in station I due to the sandy patches covered by dead leaves of *Cymodocea nodosa* and *Zostera marina*, which increased the structural complexity and species diversity. *Liza aurata* is the most common open water juvenile fish at all the sampling stations and it was the most abundant in station IV. *Symphodus ocellatus* was the most abundant species in station V where the bottom was covered with macro algae and seagrass meadows.

In the Istanbul Strait, most of the seagrass meadows are closely interspersed with sandy patches. However, the highest abundance of necto-benthic species reinforced the idea that seagrass meadows in the Istanbul Strait still play an important ecological role as a food and shelter provider for both juvenile and sub-adult fishes.

Table 1. Total number of individuals according to demographic structure of collecting species from the north part of the Istanbul Strait in July and August 2011. (N: number of individuals; TL: total length (mm); * species of commercial interest).

Familia	Species	Juvenile-Subadults		Adults	
		TL (min-max)	N	TL (min-max)	N
Ammodytidae	*Gymnammodytes cicerelus* (Rafinesque 1810)	63-64	4		
Atherinidae	*Atherina boyeri* Risso, 1810	34-38	4	47-96	112
Blennidae	*Parablennius sanguinolentus* (Pallas, 1814)	27-54	7	64-12	18
	Parablennius tentacularis (Brünnich 1768)	28	1	62-97	3
Bothidae	*Arnoglossus kessleri* Schmidt, 1920	41-56	37	58-88	19
Callionymidae	*Callionymus pusillus* Delaroche, 1809			61-104	3
Gobiidae	*Gobius paganellus* Linnaeus, 1758			50-75	6
	Gobius niger Linnaeus, 1758			50-66	6
	Neogobius melanostomus (Pallas, 1814)			53-81	22
	Pomatoschistus marmoratus (Risso, 1810)			49-62	9
	Pomatoschistus minutus (Pallas 1770)	35	1	44-63	27
Labridae	*Symphodus cinereus* (Bonnaterre, 1788)	35	3	90-134	15
	Symphodus ocellatus (Linnaeus, 1758)	25-45	33	57-101	90
Mugilidae	*Liza aurata* (Risso, 1810)	60-125	52		
	Liza saliens (Risso, 1810)	85-131	3		
Mullidae	*Mullus barbatus* Linnaeus, 1758	74-89	19	92-12	15
Scopthalmidae	*Scophthalmus maeotica* (Pallas, 1814)	48-66	3		
Scorpaenidae	*Scorpaena porcus* Linnaeus, 1758	57-72	6	91-105	3
Soleidae	*Pegusa lascaris* (Risso 1810)	97-135	3		
	Solea solea (Linnaeus, 1758)	75	1		
Sygnathidae	*Nerophis ophidion* (Linnaeus, 1758)			14.6-188	2
	Syngnathus abaster Risso, 1827	63-72	6	104-13	36
	Syngnathus typhle Linnaeus, 1758	10-112	3	13-208	11
Trachinidae	*Trachinus draco* Linnaeus, 1758	42	1		
Triglidae	*Chelidonichthys lucerna* (Linnaeus, 1758)	87	1		

The temporary species spent one part of their life elsewhere and use the considered habitat only as a nursery or reproductive ground. *Liza aurata, Pegusa lascaris, Solea solea* and *Scophthalmus maetica* probably are temporary species in the Istanbul Strait because they were caught only as juveniles. In the whole catch, 32 % of 583 sampled individuals were either juveniles or sub-adults. Nine of 25 fish are commercial species in Turkey and most of them were represented by juveniles or sub-adults. This study showed that the shallow waters (0-2 m) of the Istanbul Strait are used as a nursery area by juveniles of economical value.

The present study was made only in the summer season and a long term study covering all seasons is necessary to better understand juvenile fish communities in the Istanbul Strait with some extended stations near the Sea of Marmara and Black Sea as well. Besides, the protection of the juvenile fish species and nursery areas in the Istanbul Strait may help to protect Black Sea marine biodiversity since the Strait is a unique propagating zone for several migratory fish species. In that manner, the near shore areas of the Strait need to be protected from the anthropogenic stress and excessive fishing activities for sustainable fisheries.

Table 2. Mean abundance (number of individuals/sampling number) of juvenile fishes in the sampling stations, and relative abundance of each species (%N) collected in the north part of the Istanbul Strait in July and August 2011.

Species	**I**	**II**	**III**	**IV**	**V**	**% N**
Symphodus ocellatus (Linnaeus, 1758)	2.0	1.0		0.2	11.5	23.6
Liza aurata (Risso, 1810)*	1.0	1.3	4.5	5.0	1.5	21.5
Arnoglossus kessleri Schmidt, 1920	7.6	4.0				18.7
Parablennius sanguinolentus (Pallas, 1814)	0.3			0.8	5.0	9.9
Mullus barbatus Linnaeus, 1758*	1.7	1.0		0.8	1.0	7.2
Scorpaena porcus Linnaeus, 1758*	1.0			0.2	1.0	3.5
Syngnathus typhle Linnaeus, 1758		1.0		1.0		3.2
Atherina boyeri Risso, 1810*		0.3			1.0	2.1
Liza saliens (Risso, 1810)*	1.0					1.6
Scophthalmus maeotica (Pallas, 1814)*	1.0					1.6
Symphodus cinereus (Bonnaterre, 1788)	0.3	0.3		0.3		1.6
Pegusa lascaris (Risso, 1810)*				0.3	0.5	1.3
Gymnammodytes cicerelus (Rafinesque 1810)				0.7		1.1
Pomatoschistus marmoratus (Risso, 1810)					0.5	0.8
Chelidonichthys lucerna (Linnaeus, 1758)*	0.3					0.5
Parablennius tentacularis (Brünnich 1768)	0.3					0.5
Solea solea (Linnaeus, 1758)*	0.3					0.5
Trachinus draco Linnaeus, 1758	0.3					0.5
Pomatoschistus minutus (Pallas 1770)				0.2		0.3
Number of species	12	7	1	10	8	19

İstanbul Boğazı'ndaki juvenil balıklar üzerine bir ön çalışma

Özet

Çalışma Temmuz ve Ağutos 2011 tarihlerinde İstanbul Boğazı kıyısal sığ sularında balık faunasını ortaya koymak için gerçekleştirilmiştir. Örnekler kumlu, çakıllı ve algli zeminlerde kıyı ığrıbı kıllanılarak toplanmıştır. Yakalanan 25 familyaya ait toplam 583 bireyin %32'sini juvenil ya da henüz ergenliğe ulaşmış bireyler oluşturmaktadır.

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