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RESEARCH ARTICLE

A preliminary study on demersal fishes in the south-western Black Sea shelf (NW Turkey)

Çetin Keskin*

Faculty of Faculty, Istanbul University, Ordu St. No: 200, 34470 Laleli, Istanbul, TURKEY

***Corresponding author**: seahorse@istanbul.edu.tr

Abstract

This preliminary study aimed to contribute to the knowledge on distribution, diversity, abundance and biomass of demersal fishes in the south-western Black Sea shelf. Samples were collected with bottom trawl net in November 2006 and October 2007. A total of eight hauls were conducted by R/V Yunus-S in the south-western Black Sea at the depths of 22 and 73 m. A total of 14,228 individuals (297.2 kg) belonging to 28 species were. *Merlangius merlangus* and *Mullus barbatus* were the main species in the whole catch, in terms of abundance and biomass.

Keywords: Demersal fish, diversity, abundance, biomass, south-western Black Sea.

Introduction

The Black Sea is located between latitudes 40°55'N and 46°32'N, longitudes 27°27'E and 41°42'E. Total area of the Black Sea is $422x10^3$ km^2 (volume: $540x10^3$ km^3) except for the Azov Sea. Mean and maximum depths of the Black Sea are around 1300 m and 2212 m, respectively. Shelf areas are narrow in south part of the Black Sea while the north part is wide.

It is connected to the Aegean and Mediterranean Seas through the Turkish Straits System, which consists of the Istanbul Strait (Bosphorus), the Sea of Marmara and the Çanakkale Strait (Dardanelles). Upper layer with low salinity (17-18 psu; 8-30°C) is superimposed on the cold intermediate layer in the Black Sea. The greatest part of the water column is occupied by deep water mass that is almost uniform vertically. River runoff (mainly Danube, Dniester and Dnieper) and high saline waters of the Mediterranean Sea coming through the Istanbul Strait leads the stable stratification. Restricted mixing between the brackish surface layers and the deeper, denser (22-24 psu; 8.5°C) waters is the

prevailing anoxic conditions, which make the Black Sea the world's largest anoxic basin. Anoxic water deeper than 150-200 m is contaminated with hydrogen sulphide (Oğuz *et al.* 1998).

The Black Sea is one of the special ecosystems in the world. Although 90% of the Black Sea volume is deprived of oxygen and contaminated with hydrogen sulphide, high productive waters of the upper layer in the Black Sea supply suitable habitats and niches for living resources in epipelagic and shelf areas (Zaitsev 2008). The fauna of the Black Sea is characterised with high endemism resulting from its complex geological history.

In the middle of the last century, purse seine fisheries were developed in the Black Sea for the pelagic fish (*Sarda sarda, Scomber scombrus, Engraulis encrasicolus, Trachurus mediterraneus*) and bottom trawl for the benthic (*Scophthalmus maeotica*) and benthopelagic (*Pomatomus saltatrix*) species (Ivanov and Beverton 1985). The catch from the Black Sea increased till 1988 with total landings attaining its maximum. Following this peak (1989-1991), the catch decreased to its minimum over the whole period. Fish landings partially increased in 1992 (Eremeev and Zuyev 2007). Since 1970s, the stocks of the traditional fish species have been dramatically decreased by fishing pressure, natural and/or man-made causes (Ivanov and Beverton 1985; Eremeev and Zuyev 2007; Caddy 2008).

The increase in nutrient runoff over the last decades and introduction of invader ctenophora *Mnemiopsis leidyi* have impacted the Black Sea ecosystem. Forage base depletion in planktivorous fish caused by mass development of *M. leidyi*, mass consumption of pelagic eggs and fish larvae by *M. leidyi*, extremely intensive but insufficiently regulated fishery, and unfavourable climatic changes all attributed the decrease of living resources of the Black Sea (Eremeev and Zuyev 2007).

About 76 % of the total Turkish fisheries yield was from the Black Sea and small pelagic species, especially anchovy and horse mackerel make up the bulk of the catch (TUIK 2012). Most of scientific interests have been focused on migration, biology and ecology of anchovy (SUMAE 2010 and references therein).

Considering demersal fish in the Black Sea, studies have been mostly focused on distribution and biology of picked dogfish (*Squalus acanthias*) (Kutaygil and Bilecik 1998); biology and population parameters of whiting (*Merlangius merlangus*) (İşmen 1995a,b; İşmen 2001, 2002, 2003), turbot (*Scophthalmus maeotica*) and other flatfishes (Zengin and Düzgüneş 2000, 2003; Zengin *et al.* 2006). Kara *et al.* (1991) studied the productivity and hydrographic properties in the trawl areas of the middle and eastern Black Sea. Bingel *et al.* (1993) estimated the fish stocks in the Black Sea. Genç *et al.* (2002) assessed the population parameters and landed fishing characteristics of whiting, red mullet (*Mullus barbatus*), turbot, plaice (*Platicthys flesus*) and picarel (*Spicara smaris*)

in the eastern Black Sea. Demirhan *et al.* (2005) studied the trawl catch composition in the eastern Black Sea. More scientific research is needed to understand the living resources in the Black Sea. This paper presents the preliminary results of demersal fish composition in the south-western Black Sea.

Materials and Methods

The sampling of the present study was carried out in the south-western Black Sea shelf (Figure 1), on board the R/V *Yunus-S* (31.8 m; 202 GT; 510 HP) in October 2006 and November 2007. Fish specimens were collected with a bottom trawl net (16 mm cod-end mesh size, estimated vertical and horizontal opening: 1.8 and 21.6 m, respectively). The general bottom feature was sandy and sandy mud.

A total of eight hauls were conducted at depths of 22-73 m (Table 1). CTD SBE-19 SEACAST Profiler equipped with oximeter was used to record the physical and chemical parameters in the water column during each haul. Mean depth, temperature, salinity and dissolved oxygen in the sampling stations are shown in Table 1. Each trawl duration was 30 minutes, and mean towing speed was about 2.4-2.5 knots. The positions at the start and the end of each trawl were recorded using a GPS (Global Position System). All fish species were identified, counted and weighted. Catches were standardized to swept area (km^2).

Table 1. The haul characteristics and mean depth (D; m), temperature (T; ºC), salinity (S; psu) and dissolved oxygen (DO; mg/l) in each sampling in the south-western Black Sea

Trawl/Date	Latitude (N)-Longitude (E)	D	T	S	DO
TR1/ 22.11.06	41°13'900N-29°09'920E	34	18.72	17.81	8.08
TR2/ 22.11.06	41°12'800N-29°37'200E	22	18.72	17.8	8.07
TR3/ 22.11.06	41°13'020N-29°37'620E	43	18.06	17.85	7.67
TR4/ 22.11.06	41°15'800N-29°01'200E	24	18.72	17.8	8.07
TR5/ 27.10.07	41°15'820N-28°59'873E	22	18.59	17.78	8.05
TR6/ 27.10.07	41°20'077N-28°49'054E	52	8.17	17.82	7.58
TR7/ 27.10.07	41°35'040N-28°35'520E	73	7.92	18.77	6.31
TR8/ 27.10.07	41°49'920N-28°08'867E	52	8.41	17.91	7.46

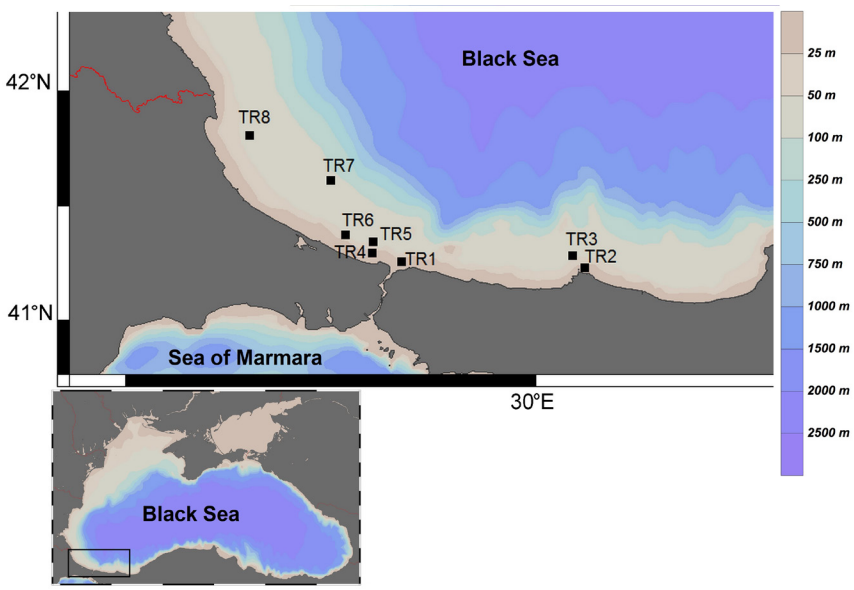

Figure 1. The study area in the Black Sea and sampling stations in the south-western Black Sea shelf

Results and Discussion

A total of 28 fish species belonging to 21 families were collected from the south-western Black Sea shelf (Table 2). Five species, *Alosa pontica, Engraulis encrasicolus, Trachurus trachurus, Trachurus mediterraneus* and *Pomatomus saltatrix*, were pelagic or semipelagic, and caught as by-catch. Among the total 23 demersal species; only three were cartilaginous (*Mustelus asterias, Raja clavata* and *Dasyatis pastinaca*), the rest being from the teleost.

Trachinus draco were the most frequent species between 22 and 73 m depth, followed by *Mullus barbatus, Mesogobius batrachocephalus* and *Scorpaena porcus*. *Dasyatis pastinaca, Mustelus asterias, Syngnathus acus, Syngnathus tenuirostris, Symphodus roissali, Symphodus mediterraneus, Spicara maena, Arnoglossus kessleri* and *Pegusa lascaris* were rare species collected from the same depth ranges (Table 2).

A total of 14,228 specimens (297.2 kg) were collected in the south-western Black Sea shelf. Fifteen species were commercial (see Table 2). *M. barbatus* and *Merlangius merlangus* were most abundant species in the whole catch (45% and 35% of the whole catch, respectively). In Turkey, *M. merlangus* is the target demersal species, while it is not with trawl fishery in the other Black Sea countries. The annual catch of *M. merlangus* in the Turkish Black Sea water has been reduced since 1988 and Knudsen and Zengin (2006) indicated that most of

whiting trawl catches was discarded due to their small size on average. The total catch of *M. merlangus, M. barbatus* and *Scophthalmus maeotica,* which are demersal key fishes, are lower now than in the past and has been tendency of reduction (TUIK 2012).

Demersal trawling in the Mediterranean Sea is generally characterised by a mixed catch with no single target species. Bottom trawl removes, destroy, and damages a number of organisms (Smith *et al.* 2000). The fishing pressure on large marine predators such as sharks, scates and large groundfish is high and depletion of top predators changes in community structure as a consequence of current fishing practice (Myers and Worm 2005). Considering commercial demersal species, solely *M. merlangus* and *M. barbatus* were target species in the whole catch, the others is by-catch with low commercial value. Also, considering the catches of sharks (*S. acanthias*) and skates (*Raja clavata*) coming from the western Black Sea were decreased from 2330 tons in 2000 to 11 tons in 2010 (TUIK 2012). Sharks and skates were shown as potential fisheries resources for the Black Sea trawl fishery in the past (Kutaygil and Bilecik 1998; Doğan 2006), the absence of these species in the present study can be an indicator of the changing community structure in the Black Sea.

Among the collected species from the south-western Black Sea shelf, *M. asterias* is categorized as an endangered species in the IUCN Red List of Threatened Species for the native marine fishes in the Mediterranean Sea (Abdul Malak *et al.* 2011). In addition, *S. tenuirostris, S. acus* and *Hippocampus guttulatus* are considered as vulnerable species in the IUCN Red List. *M. asterias* is among the collected species in the present study, it was caught firstly in 2000 near Şile by Eryılmaz *et al.* (2011).

Pontic relicts such as *Mesogobius batrachocephalus* and *Neogobius melanostomus* were among the frequent species in the whole sampling. Moreover, their biomass were higher than the other species except for *M. barbatus* and *M. merlangus*. The endemic fish fauna in the Black Sea is 30%, only 16.6% with strictly pontic species (Quignard and Tomasini 2000).

Illegal fishing, destructive harvest techniques, the lack of common regional management programme, eutrophication are threats for the sustainable use of marine living resources in the Black Sea during the last decade (Shlyakhov and Daskalov 2008; Öztürk *et al.* 2011). There is further need for scientific studies to monitor continuously the changing community structure. The results of the present preliminary study can be taken into account as a reference point for future studies on trawl fisheries in the south-western Black Sea.

Table 2. Fish species caught in the south-western Black Sea shelf. Commercial species (C), the frequency of appearance in the whole sampling (F: %), depth range (D: m), total number of specimens (N), total weight (W: kg), abundance (A: N/km^2), biomass (B: kg/km^2). * pelagic species

Family	Species		F	D	N	W	A	B
Triakidae	*Mustelus asterias* Cloquet, 1821	C	13	73	1	5,20	6	29,55
Rajidae	*Raja clavata* Linnaeus, 1758	C	63	24-73	7	3,57	40	20,27
Dasyatidae	*Dasyatis pastinaca* (Linnaeus, 1758)		13	52	1	4,80	6	27,27
Engraulidae	*Engraulis encrasicolus* (Linnaeus, 1758)*	C	13	45	1	0,01	6	0,08
Clupeidae	*Alosa pontica* (Eichwald, 1838)*	C	25	52	53	2,28	301	12,95
Lotidae	*Gaidropsarus biscayensis* (Collett, 1890)		50	24-52	13	0,59	74	3,33
Gadidae	*Merlangius merlangus* (Nordmann, 1840)	C	50	43-73	6197	105,28	35210	598,16
Syngnathidae	*Syngnathus acus* Linnaeus, 1758		13	22	1	0,00	6	0,03
Syngnathidae	*Hippocampus guttulatus* Cuvier, 1829		50	22-43	116	0,97	659	5,50
Syngnathidae	*Syngnathus tenuirostris* Rathke, 1837	C	13	52	2	0,08	11	0,45
Scorpaenidae	*Scorpaena porcus* Linnaeus, 1758	C	75	22-52	31	1,07	176	6,08
Pomatomidae	*Pomatomus saltatrix* (Linnaeus, 1766)*	C	50	22-52	362	10,40	2057	59,11
Carangidae	*Trachurus mediterraneus* (Steindachner, 1868)*	C	13	22-52	137	0,68	778	3,84
Carangidae	*Trachurus trachurus* (Linnaeus, 1758)*	C	38	22-52	88	1,08	500	6,15
Centracanthidae	*Spicara maena* (Linnaeus, 1758)	C	13	24	1	0,05	6	0,29
Mullidae	*Mullus barbatus* Linnaeus, 1758	C	75	22-52	6409	133,04	36417	755,92
Labridae	*Symphodus mediterraneus* (Linnaeus, 1758)		13	22	2	0,01	11	0,05
Labridae	*Symphodus roissali* (Risso, 1810)		13	34	1	0,03	6	0,15
Trachinidae	*Trachinus draco* Linnaeus 1758	C	88	22-52	51	2,95	290	16,77
Uranoscopidae	*Uranoscopus scaber* Linnaeus, 1758	C	50	22-52	60	2,73	341	15,54
Gobiidae	*Mesogobius batrachocephalus* (Pallas, 1814)		75	22-52	71	6,02	403	34,22
Gobiidae	*Gobius niger* Linnaeus, 1758		38	22-52	251	2,23	1426	12,65
Gobiidae	*Neogobius melanostomus* (Pallas, 1814)		63	22-52	332	10,70	1886	60,78
Scophthalmidae	*Scophthalmus maeotica* (Pallas, 1814)	C	38	24-52	9	2,74	51	15,55
Pleuronectidae	*Platichthys luscus* (Pallas, 1814)	C	38	22-52	6	0,51	34	2,88
Bothidae	*Arnoglossus laterna* (Walbaum, 1792)		25	24-52	2	0,06	11	0,36
Bothidae	*Arnoglossus kessleri* Schmidt, 1915		13	24	20	0,06	114	0,36
Soleidae	*Pegusa lascaris* (Risso, 1810)	C	13	22	3	0,09	17	0,48
Total					14,228	297	80,843	1688.77

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Güneybatı Karadeniz kıta sahanlığı demersal balıkları üzerine ön çalışma

Özet

Bu ön çalışma güneybatı Karadeniz kıta sahanlığında bulunan demersal balıkların çeşitliliği, bolluğu ve biyoması ve dağılımına katkı sağlamak amacıyla yapılmıştır. Örnekler Kasım 2006 ve Ekim 2007 de dip trolü kullanılarak toplanmıştır. Toplam 8 trol çekimi, RV/Yunus-S ile 22 ile 73 m derinlikler arasında gerçekleştirilmiştir. Güneybatı Karadeniz kıta sahanlığında toplam 28 familyaya ait 14,228 birey (297.2 kg) yakalanmıştır. Tüm av içinde *Merlangius merlangus* ve *Mullus barbatus* bolluk ve biyomas bakımından öncelikli türlerdir.

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