

# Sinop City Fishery of the Black Sea

Levent Bat\*, Murat Sezgin, Fatih Şahin, Zekiye Birinci Özdemir, Derya Ürkmez

Fisheries Faculty, Sinop University, Sinop, 57000, Turkey

**Abstract** The Black Sea has historically been one of the most biologically productive regions in the world. Although it has 168 fish species, there are only a few species of commercial importance and the supply of fishes is limited, because intensive fishing, industrialisation and urbanisation have caused the most favoured species to decline. This review prepared to give information on Sinop fisheries of Turkish coasts of the Black Sea.

**Keywords** Black Sea, Sinop, Fishery

## 1. Introduction

Turkey is bordered by seas on three sides having a total coastline of 8.333 km; 24 million ha of marine space and 1685 km of it is constituted of the Black Sea coasts. Turkish fishery production is based on marine fishery which produced 76% of the production for 2007. The amount of fishing carried out in 2007 in Turkish seas exceeded 500 thousand tons. For the main part the fishing carried out in our seas consisted of 385 thousand tons of anchovies, 21 thousand tons of sardines, 13 thousand tons of haddock, nearly 32 thousand tons of mackerel and the remainder of other marine produces[1]. 19.30% of the population in Turkey is habitant of coastal cities and 86% of this population live along the Black Sea coasts[2]. Since there is no considerable improvement in offshore fisheries, the Black Sea is the main region of fisheries in Turkey. 93.7% of fisheries production in Turkey is from the Black Sea (83.7%) and Sea of Marmara (10%)[3]. Turkey has the highest share of fisheries obtained through the catch and aquaculture among the Black Sea countries. The total amount of product obtains from the Black Sea by fishing is 48.13% in Turkey, whereas it is 32.70% in Ukraine, 10.08% in Russia, 4.14% in Georgia, 2.78 in Romania and 2.17% in Bulgaria[4]. Although the diversity of fish is limited in the Black Sea, the long coastline and the intensive fisheries of economical species have rendered fisheries an important source of income.

According to FAO[5] there are 7380, 2912, 2300, 1261, 880 and 324 fishing boats in Turkey, Russia, Ukraine, Bulgaria, Romania and Georgia, respectively. 65% of the total of fisheries production is covered by the Black Sea coast of Turkey[4].

Sinop (Figure 1) is considered to be the mid-point of the Black Sea in Turkey and is located on Boztepe peninsula which is the most extended point of Turkish Black Sea coastline towards north. The fact that three sides of the peninsula are surrounded by sea has made fisheries a significant means of income. Fishery has an important place in the economy of Sinop. In the centrum Ayancik, Gerze and Türkeliare coastal towns of Sinop. Commercial fisheries are presented with two different types as large scale (drag-net and trawl fishing) and small scale (fishing boats smaller than 12 meters which use long line, fishing line etc.) fisheries. About half of anchovy in the Black Sea is caught in Sinop coast. During the year according to the season and weather conditions, different kinds of fish are caught. Between August and November, blue fish, large bluefish, bonito; between November and April anchovy; between May and July grey mullet, horse mackerel, whiting, red mullet and red gurnard species are caught. For the fishing season turbot and shark are caught and exported. Sport fishing is also present in Sinop besides in addition to commercial fisheries.

A total of 3455 licensed fishermen and 536 fishing vessels are available in Sinop including its districts with harbors such as Ayancık and Gerze[6]. Fishing activities continue throughout the year depending on meteorological conditions except closed season and the duration of the catch season ranges between 60 and 270 days. The amount of catch shows variation. The catchment areas where coastal fisheries activities take place are Akliman, Sarıkum, İnceburun and Gerze (Çakıroğlu).

\* Corresponding author:

leventbat@gmail.com (Levent Bat)

Published online at <http://journal.sapub.org/ms>

Copyright © 2013 Scientific & Academic Publishing. All Rights Reserved

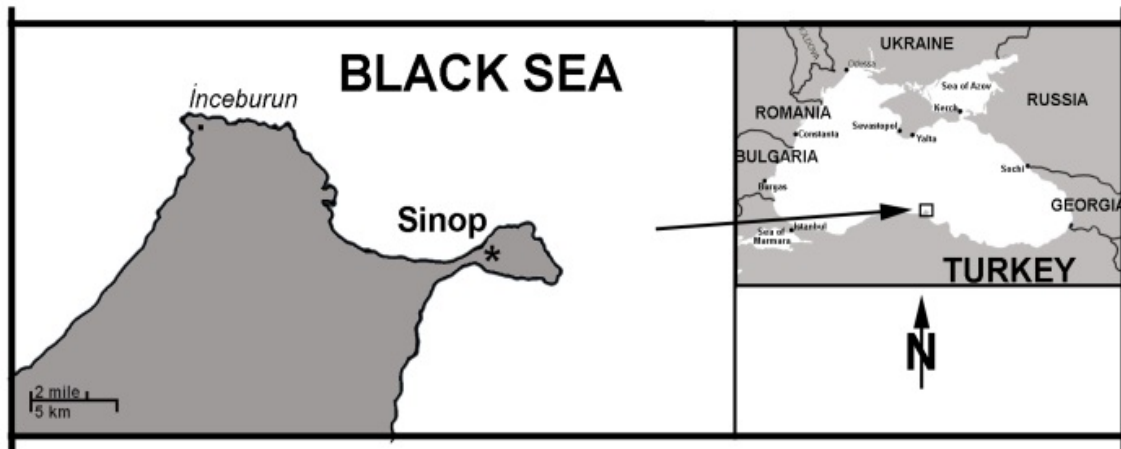


Figure 1. Sinop region

## 2. Fishing Vessels and Equipment

92% of 536 fishing boats (495) in Sinop are below 12 meters whereas 4% (20) are larger than 12 meters and 4% (21) larger than 20 meters (Figure 2)[6].

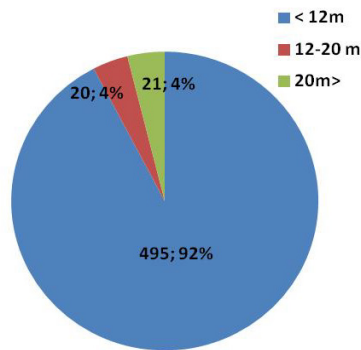


Figure 2. The lengths of the fishing boats in Sinop

58% of fishing boats are in the city centre of Sinop, 32% in Gerze and 10% in Ayancık districts.

The construction material of the fishing boats are mainly metal sheets or wood and fibre is generally not preferred. A great majority of the boats with a length below 17 meters is made of wood. The construction material is of significance in terms of several parameters such as safety, comfort and lifespan of the boat. 95% of boats are made of wood, 4% metal sheet and 1% fibre.

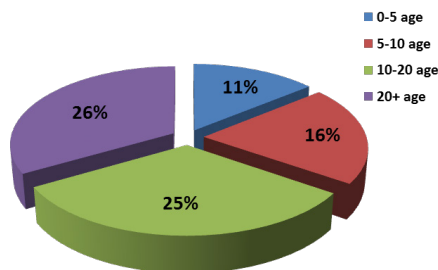


Figure 3. Distribution of the ages of fishing boats in Sinop

Half the amount of fishermen uses boats with a minimum age of 10 years and the new boats make up only 5% of the total (Figure 3)[6].

When the fishing equipment are considered, the most frequently used are gill nets (49%) due to the small and middle scale fishermen and it is followed by trammel nets (22%) and long line (11%) (Figure 4).

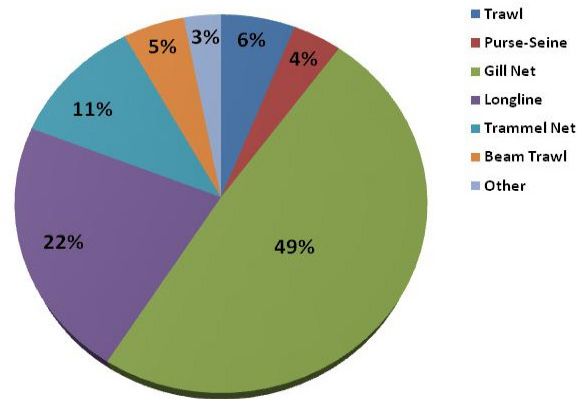


Figure 4. Fishing equipment used in Sinop

## 3. Socioeconomic Structure

Erk[7] has implemented a face-to-face inquiry among 80 selected fishermen between 2011 and 2012 in Sinop. The information given in this section has been prepared as a summary of this survey.

In this study, fishing activities performed by fishing boats below 12 meters has been regarded as Small Scale Fishery (SSF) and larger than 12 meters as Large Scale Fishery (LSF). As we consider the fishing periods of small scale fishermen, 34% of them are recognized to deal with fisheries for more than 30 years. The share of the fishermen performing fishing activities for 10-20 years is 43%. Among the large scale fishermen the highest ratio is 43% belonging to those continuing fisheries for 20-30 years (Table 1).

**Table 1.** The ratio of the duration of fishing activities carried out by fishermen in Sinop (%) (SSF: Small Scale Fishery, LSF: Large Scale Fishery)

Year	%	
	SSF	LSF
1-10	29	10
10-20	16	43
20-30	21	21
30+	34	26

37% of small scale fishermen are found to be high school graduates, whereas 29% middle school, 18% primary school and 16% vocational school graduates. 33% of large scale fishermen are primary and middle school graduates, 29% are high school graduates whereas 11% have a bachelor's degree (Table 2). No illiterates were encountered among these fishermen.

**Table 2.** The educational backgrounds of fishermen in Sinop (%) (SSF: Small Scale Fishery, LSF: Large Scale Fishery)

Educational Backgrounds	%	
	SSF	LSF
Primary School	18	33
Secondary school	29	33
High school	37	29
Higher education	16	11

2,27% of fishermen in the Black Sea were detected to be illiterate, 58,44% have a primary school education, 14,94% middle school, 20,78% high school and 3,57% university education[8]. The education level of fishermen in Sinop can be considered as above the mean of the Black Sea.

67% of fishermen have two children, 20% one child and 13% have three children. 58% of large scale fishermen have two children, 26% have three, 5% have five and 11% have four or more number of children (Table 3).

**Table 3.** The percentage of the number of children belonging to fishermen in Sinop (%) (SSF: Small Scale Fishery, LSF: Large Scale Fishery)

Number of Children	%	
	SSF	LSF
1	20	5
2	67	58
3	13	26
+4	0	11

55% of small scale fishermen have financial responsibility toward four people whereas 21% toward five or more people. 13% of single individuals live alone (Table 4). Remaining single individuals stated that they carry out fishing activities in order to support the budget of their family.

40% of large scale fishermen have financial responsibility toward four people whereas 45% toward five or more people.

When we analyse the social assurance of small scale fishermen in Sinop, 40% of them have assurance from Private Pension System, 8% from Social Insurance Institution and 18% from Superannuation Fund. There is also

a large amount of people (34%) who are not under social protection. 59% of large scale fishermen have no social assurance whereas 17% have from the Social Insurance Institution, 12% from the Private Pension System and 12% from Superannuation Fund (Table 5).

**Table 4.** The percentage of individuals toward whom fishermen have financial responsibility (SSF: Small Scale Fishery, LSF: Large Scale Fishery)

Number of Individuals	%	
	SSF	LSF
2	8	5
3	16	10
4	55	40
+5	21	45

**Table 5.** The percentage of social security institutions of fishermen in Sinop (%) (SSF: Small Scale Fishery, LSF: Large Scale Fishery)

Social Security	%	
	SSF	LSF
Social Insurance Institution	8	17
Private Pension System (BAGKUR)	40	12
Superannuation Fund	18	12
Not in Social Protection	24	59

A great majority of people who carry out small scale fisheries are retired and deal only with fishing activities. 34% of small scale and 79% of large scale fishermen only earn from fisheries. Besides, the amount of people dealing with fisheries as an extra is at a considerable level (Table 6).

**Table 6.** The percentage of professions observed among people carrying out fishing activities in Sinop (%) (SSF: Small Scale Fishery, LSF: Large Scale Fishery)

Number of Individuals	%	
	SSF	LSF
Retired	40	21
Worker	18	-
Civil Servant	8	-
Fisherman	34	79

## 4. Fish Species-Catch Amounts

The most comprehensive study of fish species in the Central Black Sea (Sinop-Samsun) Region is by Bat et al.[9] and a total of 94 species belonging to 44 families have been identified (Table 7).

Fisheries of economic fish species such as anchovy, horse mackerel, and bluefish (small), Whiting, Atlantic bonito, Allis shad, turbot and garfish are carried out in Sinop. According to the statistics of 2010, 96% (12374 tons) of fish caught are composed of anchovy followed by whiting (126,2 tons) and Atlantic bonito (102,1 tons), respectively (Table 8).

**Table 7.** The fishes of Sinop and Samsun coasts of the Black Sea. (Status as per International Red Data Book: IUCN Red Data List; LR: Lower Risk; nt: Near Threatened; EN: Endangered; DD: Data Deficient. Habitat: Mu-muddy, S- sandy, R- rocky, V-vegetation, G-Gravel, Bp- benthopelagic, Bd- Bathydemersal, P-pelagic, D- Demersal, M- Marine, O- Oceanodromous, C- Catadromus, A- Anadromous, Amp- Amphidromous, Br- Brackish, Fw-Freshwater, Nm- Nonmigratory, Ra- Reef-associated Zoogeographical origin: A-M- Atlanto Mediterranean, C- Cosmopolitan, P-C- Ponto Caspia, E- Endemic, I-P- Indo-Pacific)[9]

Species	Family	Status as per International Red Data Book.	Habitat	Zoogeographical Origin
<i>Squalus acanthias</i> Linnaeus, 1758	Squalidae	LR/nt	Mu,Bp,O,Br,M	A-M
<i>Squalus blainville</i> (Risso, 1827)	Squalidae	LR/nt	S-Mu,D,Br,M	A-M
<i>Raja clavata</i> Linnaeus, 1758	Rajidae	LR/nt	S-Mu,D,M	A-M
<i>Dasyatis pastinaca</i> (Linnaeus, 1758)	Dasyatidae	not in the list	S-Mu,D,Br,M	A-M
<i>Acipenser stellatus</i> Palas, 1771	Acipenseridae	EN	S-Mu,D,A,Fw,Br,M	P-C
<i>Acipenser nudiventris</i> Lovetzky,1828	Acipenseridae	EN	S-Mu,D,A,Fw,Br,M	P-C
<i>Acipenser persicus</i> Borodin,1897	Acipenseridae	EN	S-Mu,D,A,Fw,Br,M	P-C
<i>Acipenser gueldenstaedtii</i> Brandt & Ratzeberg, 1833	Acipenseridae	EN	S-Mu,D,A,Fw,Br,M	P-C
<i>Huso huso</i> (Linnaeus, 1758)	Acipenseridae	EN	D,A,Fw,Br,M	P-C
<i>Anguilla anguilla</i> (Linnaeus, 1758)	Anguillidae	not in the list	S-Mu,D,C,Fw,Br,M	A-M
<i>Conger conger</i> (Linnaeus, 1758)	Congridae	not in the list	S-R,D,O,M	A-M
<i>Alosa fallax nilotica</i> (Geoffroy St.- Hilaire, 1808)	Clupeidae	not in the list	Bp,A,Fw	A-M
<i>Alosa tanaica</i> (Grimm, 1901)	Clupeidae	not in the list	P,A,Fw,Br,M	P-C
<i>Alosa caspia bulgarica</i> Drensky, 1934	Clupeidae	DD	P,A,Fw,Br,M	P-C
<i>Alosa pontica</i> Eichwald, 1838	Clupeidae	DD	P,A,Fw,Br,M	P-C
<i>Sardina pilchardus</i> (Walbaum, 1792)	Clupeidae	not in the list	P,O,Fw,Br,M	A-M
<i>Sprattus sprattus phalericus</i> (Risso, 1827)	Clupeidae	not in the list	P,O,Br,M	E
<i>Engraulis encrasicolus ponticus</i> Aleksandrov, 1927	Engraulidae	not in the list	P,O,Br,M	E
<i>Salmo trutta labrax</i> Pallas, 1814	Salmonidae	*	D,A	E
<i>Merlangius merlangus euxinus</i> (Nordmann, 1840)	Gadidae	no information	S-Mu,Bp,O,M	A-M
<i>Gaidropsanus mediterraneus</i> (Linnaeus, 1758)	Lotidae	not in the list	R,D,O	A-M
<i>Ophidion rochei</i> Müller, 1845	Ophidiidae	not in the list	S-Mu	A-M
<i>Diplecogaster bimaculata euxinica</i> Murgoci, 1964	Gobiesocidae	not in the list	R,D,M	A-M
<i>Lepidogaster candollei</i> Risso, 1810	Gobiesocidae	not in the list	R,D,M	A-M
<i>Atherina boyeri</i> Risso, 1810	Atherinidae	DD	D,Amp	A-M
<i>Atherina hepsetus</i> Linnaeus, 1758	Atherinidae	not in the list	P,Br,M	A-M
<i>Aphanius fasciatus</i> (Valenciennes, 1821)	Cyprinodontidae	DD	D,Nm,Fw,Br,M	E
<i>Belone belone</i> (Linnaeus, 1761)	Belonidae	not in the list	P,O,Br,M	A-M
<i>Gasterosteus aculeatus</i> Linnaeus, 1758	Gasterosteidae	no information	Bp,A,Fw,Br,M	E
<i>Syngnathus abaster</i> Risso, 1827	Syngnathidae	DD	S-Mu-V,D,Amp,Fw,Br,M	A-M
<i>Syngnathus acus</i> Linnaeus, 1758	Syngnathidae	not in the list	S-Mu-V,D,Br,M	A-M
<i>Hippocampus hippocampus</i> (Linnaeus, 1758)	Syngnathidae	DD	V,D,Nm,M	A-M
<i>Scorpaena porcus</i> Linnaeus, 1758	Scorpaenidae	not in the list	R-V,D,Nm,M	A-M
<i>Chelidonichthys lucerna</i> Linnaeus, 1758	Triglidae	not in the list	S-Mu-G,D,M	A-M
<i>Dicentrarchus labrax</i> (Linnaeus, 1758)	Moronidae	not in the list	D,O,Fw,Br,M	A-M
<i>Serranus cabrilla</i> (Linnaeus, 1758)	Serranidae	not in the list	S-Mu-R-V,D,M	A-M
<i>Serranus scriba</i> (Linnaeus, 1758)	Serranidae	not in the list	R-V,D,M	A-M
<i>Pomatomus saltatrix</i> (Linnaeus, 1766)	Pomatomidae	not in the list	P,O,Br,M	A-M
<i>Trachurus trachurus</i> (Linnaeus, 1758)	Carangidae	not in the list	p,o	A-M
<i>Trachurus mediterraneus ponticus</i> (Aleev, 1956)	Carangidae	not in the list	P,O,Br,M	A-M
<i>Boops boops</i> (Linnaeus, 1758)	Sparidae	not in the list	D,O,M	A-M
Species	Family	Status as per International Red Data Book.	Habitat	Zoogeographical Origin
<i>Dentex dentex</i> (Linnaeus, 1758)	Sparidae	not in the list	R,Bp,M	A-M
<i>Diplodus annularis</i> (Linnaeus, 1758)	Sparidae	not in the list	S-V-R,Bp,Br,M	A-M
<i>Diplodus puntazzo</i> (Cetti, 1777)	Sparidae	not in the list	R,Bp,O,Br,M	A-M
<i>Diplodus sargus</i> (Linnaeus, 1758)	Sparidae	not in the list	R-S,D,O,Br,M	A-M
<i>Diplodus vulgaris</i> (Geoffrey Saint-Hilaire)	Sparidae	not in the list	R-S-V,Bp,O,M	A-M
<i>Oblada melanura</i> (Linnaeus, 1758)	Sparidae	not in the list	R-V,Bp,O,M	A-M
<i>Sarpa salpa</i> (Linnaeus, 1758)	Sparidae	not in the list	R-V,Bp,O,M	A-M
<i>Spanus aurata</i> Linnaeus, 1758	Sparidae	not in the list	S-V,D,Fw,Br,M	A-M
<i>Spondylusoma cantharus</i> (Linnaeus, 1758)	Sparidae	not in the list	R-S-V,Bp,O,M	A-M
<i>Spicara maena</i> (Linnaeus, 1758)	Centracanthidae	not in the list	S-Mu,P,M	A-M
<i>Spicara smaris</i> (Linnaeus, 1758)	Centracanthidae	not in the list	Mu-V,P,M	A-M

<i>Sciaena umbra</i> Linnaeus, 1758	Sciaenidae	not in the list	R-S,D,Br,M	A-M
<i>Umbrina cirrosa</i> (Linnaeus, 1758)	Sciaenidae	not in the list	R-S,D,Br,M	A-M
<i>Mullus barbatus ponticus</i> Essipov, 1927	Mullidae	not in the list	Mu-S,D,M	C
<i>Mullus surmuletus</i> Linnaeus, 1758	Mullidae	not in the list	S-R,D,O	E
<i>Mugil cephalus</i> Linnaeus, 1758	Mugilidae	not in the list	Bp,C,Fw,Br,M	A-M
<i>Mugil soñy</i> Basilevsky, 1855	Mugilidae	not in the list	D,C,Fw,Br,M	I-P
<i>Liza aurata</i> (Risso, 1810)	Mugilidae	not in the list	P,C,Br,M	A-M
<i>Liza saliens</i> (Risso, 1810)	Mugilidae	not in the list	P,C,Br,M	A-M
<i>Chromis chromis</i> (Linnaeus, 1758)	Pomacentridae	not in the list	R,Ra,Nm,M	A-M
<i>Labrus viridis</i> Linnaeus, 1758	Labridae	not in the list	R-V,Ra,M	A-M
<i>Symphodus cinereus</i> (Bonnaterre, 1788)	Labridae	not in the list	S-R-V,D,Br,M	A-M
<i>Symphodus ocellatus</i> (Forsskal, 1775)	Labridae	not in the list	R-V,Ra,M	A-M
<i>Symphodus roissali</i> (Risso, 1810)	Labridae	not in the list	R-V,Ra,Br,M	A-M
<i>Symphodus tinca</i> (Linnaeus, 1758)	Labridae	not in the list	R-V,Ra,Br,M	A-M
<i>Gymnamodytes cicereus</i> (Rafinesque, 1810)	Ammodytidae	not in the list	S,D,M	A-M
<i>Trachinus draco</i> Linnaeus, 1758	Trachinidae	not in the list	Mu-S,D,M	A-M
<i>Uranoscopus scaber</i> Linnaeus, 1758	Uranoscopidae	not in the list	Mu-S,D,M	A-M
<i>Tripterygion tripteronotus</i> (Risso, 1810)	Tripterygiidae	not in the list	R-V,,D,Nm,M	A-M
<i>Blennius ocellaris</i> Linnaeus, 1758	Blenniidae	not in the list	D,M	A-M
<i>Coryphoblennius galerita</i> (Linnaeus, 1758)	Blenniidae	not in the list	R-V,D,M	A-M
<i>Parablennius tentacularis</i> (Brünnich, 1768)	Blenniidae	not in the list	S-R-V,D,Br,M	A-M
<i>Parablennius sanguinolentus</i> (Pallas, 1814)	Blenniidae	not in the list	V-R,D,Nm,M	A-M
<i>Callionymus lyra</i> Linnaeus, 1758	Callionymidae	not in the list	Mu-S,D,M	A-M
<i>Callionymus fasciatus</i> Valenciennes, 1837	Callionymidae	not in the list	Mu-S,D,M	A-M
<i>Callionymus pusillus</i> Delaroche, 1809	Callionymidae	not in the list	Mu-S,D,M	A-M
<i>Gobius niger</i> Linnaeus, 1758	Gobiidae	not in the list	Mu-S,D,Br,M	A-M
<i>Gobius cobitis</i> Pallas, 1811	Gobiidae	not in the list	R,D,O,Br,M	A-M
<i>Gobius bucchichi</i> Steindachner, 1868	Gobiidae	not in the list	Mu-S,D,M	A-M
<i>Gobius paganelus</i> Linnaeus, 1758	Gobiidae	not in the list	R-V,D,O,Fw,Br,M	A-M
<i>Mesogobius batrachocephalus</i> (Pallas, 1814)	Gobiidae	DD	Mu-S,D,Br,M	A-M
<i>Neogobius melanostomus</i> Pallas, 1814	Gobiidae	DD	Mu-G-S,D,Fw,Br,M	A-M
<i>Zosterisessor ophiocephalus</i> (Pallas, 1814)	Gobiidae	DD	Mu-V,D,O,Br,M	A-M
Species	Family	Status as per International Red Data Book.	Habitat	Zoogeographical Origin
<i>Scomber scombrus</i> Linnaeus, 1758	Scombridae	not in the list	P,O,Br,M	C
<i>Scomber japonicus</i> Houttuyn, 1782	Scombridae	not in the list	P,O,M	C
<i>Sarda sarda</i> (Bloch, 1793)	Scombridae	not in the list	P,O,Br,M	C
<i>Psetta maxima</i> (Linnaeus, 1758)	Scophthalmidae	not in the list	Mu-S,D,O,Br,M	A-M
<i>Scophthalmus rhombus</i> (Linnaeus, 1758)	Scophthalmidae	not in the list	Mu-S,D,O,M	A-M
<i>Arnoglossus laterna</i> (Walbaum, 1792)	Bothidae	not in the list	Mu-S,D,M	A-M
<i>Platichthys flesus luscus</i> (Pallas, 1811)	Pleuronectidae	not in the list	Mu-S,D,Ca,F,B,M	A-M
<i>Solea lascaris</i> (Risso, 1810)	Soleidae	not in the list	Mu-S,D,Br,M	A-M
<i>Solea solea</i> (Linnaeus, 1758)	Soleidae	not in the list	Mu-S,D,O	A-M
<i>Lophius piscatorius</i> Linnaeus, 1758	Lophidae	not in the list	Mu-S,Bd,M	A-M

**Table 8.** Amount of fish caught in Sinop between 2005-2010 (tons)[10]

FISHES	2005	2006	2007	2008	2009	2010	TO TAL (ton)
Red mullet	7.25	7.9	6.94	10.05	18.535	14.05	64.725
Starry weever	-	-	0.55	5	28.2	26.55	60.3
Bluefish (small)	4.79	9.01	5.75	6.8	42.525	91.425	160.3
Brown meagre	-	-	0.07	0.19	0.4	0.4	1.06
Gilthead seabream	-	1.4	1.35	-	-	-	2.75
Anchovy	8535	11955.75	35093	1113.805	5301.731	12374.127	74373.413
Black scorpionfish	1	0.21	-	-	1.45	-	2.66
Annular seabream	5.33	-	0.99	1.26	3.65	1.025	12.255
Picarel	-	-	0.44	-	1	1.35	2.79
Horse mackerel	19.1	10.2	10.4	159.5	55.955	37.8	292.955
Flathead grey mullet	24.8	44.414	13.09	13.85	13.825	14.45	124.429
European seabass	0.255	1.673	1.72	0.05	0.075	0.6	4.373
Bluefish (adult)	0.9	0.204	1.75	0.1	1.85	0.4	5.204
Whiting	33	22.85	5.55	68.25	55.5	126.166	311.316
Atlantic bonito (small)	150.635	143.934	18.57	65.45	62.45	102.1	543.139
European pilchard	-	2.5	-	-	5.9	1.5	9.9
Allis shad	9.6	8.32	2.97	5.67	25.8	24.225	76.585
Atlantic bonito	1.725	0.231	-	2	0.25	-	4.206
Turbot	6.35	6.259	3.945	25.48	4.005	6.95	52.989
Garfish	6.05	0.235	1.45	0.9	1.7	14.978	25.313
<b>TO TAL (ton)</b>	<b>8805.785</b>	<b>12215.09</b>	<b>35168.535</b>	<b>1478.355</b>	<b>5624.801</b>	<b>12838.096</b>	<b>76130.662</b>

## 5. Fish Weight-Length Relationships

Anchovy, constituting 65% of Turkish fisheries production, is of significance for fisheries of Turkey as well as other Black Sea countries. Moreover, the anchovy has an important role in the Black Sea ecosystem. Population dynamics of foremost anchovy and several other economic fish species have been studied in the Black Sea. Growth parameters and growth performance values of anchovy obtained by various authors in the Black Sea are given in Table 9.

Important biological parameters and population dynamics of several fish species caught in highest amounts between Sinop and Samsun areas of the Central Black Sea are presented below (Tables 10).

In terms of fisheries economics, studies have been carried out on weight-length relationship and condition factors of economic fish species caught in Samsun and Sinop areas of the Central Black Sea where intensive fishing activities are observed. Some information on these studies is given in Table 11.

**Table 9.** Growth parameters and growth performance of anchovy (*Engraulis encrasicolus*) ( $L_{\infty}$ , K, to: Von Bertalanffy growth parameters,  $\Phi'$ : Growth performances)

Reference	$L_{\infty}$ (cm)	K	to	$\Phi'$
[11]	16,76	0,32	-2,0695	1,95
[12]	16,85	0,3241	-1,9882	1,96
[13]	14,14	0,9180	-0,3200	2,26
[14]	15,73	0,3166	-2,1966	1,89
[15]	17,51	0,2773	-2,937	1,93
[16]	15,01	0,607	-0,066	2,13
[16]	11,04	0,634	-0,746	1,89
[16]	23,38	0,174	-1,330	1,98
[16]	19,70	0,224	-1,101	1,94
[17]	15,82	0,340	-2,144	1,93
[18]	16,83	0,3102	-2,2093	1,94
[19]	17,42	0,284	-2,108	1,93
[20]	16,97	0,260	-6,145	1,87
[21]	15,66	0,3368	-2,526	1,92
[21]	17,07	0,2836	-2,1047	1,92
[22]	18,91	0,163	-3,700	1,77
[23]	21,17	0,196	-2,314	1,94
[24]	17,01	-	-	-

**Table 10.** Population parameters of some fishes ( $L_{\infty}$ , K: Von Bertalanffy growth parameters; Z : Total Instantaneous Mortality; S:Survival Rate; A:Real Rate of Mortality; M:Natural Mortality Rate; F:Fishing Mortality Rate; E: Exploitation Ratio)

FISHES	Reference	$L_{\infty}$	K	Z	S	A	M	F	E
Anchovy ( <i>Engraulis encrasicolus</i> )	[22]	18,91	0,163	2,07	-	-	0,30	1,77	0,86
Anchovy ( <i>Engraulis encrasicolus</i> )	[23]	-	-	1,85	-	-	0,34	1,51	0,82
Anchovy ( <i>Engraulis encrasicolus</i> )	[24]	17,01	-	2,73	-	-	0,41	2,18	0,80
Horse mackerel ( <i>Trachurus trachurus</i> )	[25]	17,68	0,399	1,550	0,21	0,79	0,55	0,99	0,64
Horse mackerel ( <i>Trachurus trachurus</i> )	[26]	24,12	0,170	1,290	0,27	0,73	0,36	0,93	0,73
Horse mackerel ( <i>Trachurus trachurus</i> )	[27]	26,74	0,138	1,260	0,28	0,72	0,27	0,99	0,79
Horse mackerel ( <i>Trachurus trachurus</i> )	[28]	26,09	0,125	3,730	0,24	0,76	0,21	3,52	0,94
Horse mackerel ( <i>Trachurus trachurus</i> )	[29]	22,54	0,160	1,202	0,30	0,70	0,47	0,73	0,61
Blue fish ( <i>Pomatomus saltatrix</i> )	[29]	30,9	0,210	1,35	0,26	0,74	0,52	0,83	0,62
Allis shad ( <i>Alosa alosa</i> )	[29]	32,02	0,23	1,211	0,30	0,70	0,48	0,73	0,60
Whiting ( <i>Merlangius merlangus euxinus</i> )	[30]	40,04	0,143	1,20	0,30	0,70	0,29	-	-
Whiting ( <i>Merlangius merlangus euxinus</i> )	[31]	31,9	0,203	1,41	0,24	0,76	-	-	-
Whiting ( <i>Merlangius merlangus euxinus</i> )	[32]	39,73	0,147	2,01	0,14	0,86	0,29	-	-
Whiting ( <i>Merlangius merlangus euxinus</i> )	[33]	29,89	0,204	1,36	0,26	0,74	0,38	-	-
Whiting ( <i>Merlangius merlangus euxinus</i> )	[34]	35,45	0,138	1,15	0,32	0,68	0,26	-	-
Whiting ( <i>Merlangius merlangus euxinus</i> )	[35]	31,33	0,201	1,243	0,289	0,711	0,383	-	-
Sprat ( <i>Sprattus sprattus</i> )	[24]	13,38	-	2,88	-	-	0,52	1,51	0,82
Turbot ( <i>Psetta maxima</i> )	[35]	90,57	0,132	0,451	0,637	0,393	0,217	-	-

**Table 11.** Weight-length relationship and condition factors of economic fish species caught in Samsun and Sinop areas of the Black Sea, Turkey

Species	Length Min-Max	a	b	r <sup>2</sup>	Cf	References
<b><i>Merlangius merlangus</i></b>						
	-	0,0043	3,1959	-	0,74	[30]
	-	0,0034	3,3	-	-	[36]
	-	0,0045	3,1872	-	0,81	[32]
	-	0,005	3,1581	-	-	[33]
	9-24	0,0039	3,24	-	0,74	[34]
	7.7-22.7	0,0067	3,0248	0,96	0,038	[37]
	8,4 -31,5	0,00427	3,2016	0,97	-	[38]
<b><i>Mullus barbatus</i></b>						
	-	0,007	3,17	-	-	[36]
	6.6-18.4	0,0111	2,9633	0,98	0,054	[37]
<b><i>Gobius niger</i></b>						
	-	0,018	2,81	-	-	[36]
	8.0-25.3	0,0166	2,8690	0,96	0,039	[37]
<b><i>Alosa pontica</i></b>						
	11.6-31.6	0,00212	3,39	0,98	-	[32]
	8,5-39,9	0,0027	3,3379	0,99	-	[39]
	-	0,0081	3,1	-	-	[36]
	11.9-27.6	0,0046	3,1237	0,94	0,048	[37]
	13,6-33,6	0,0039	3,18	0,99	-	[40]
<b><i>Spicara smaris</i></b>						
	-	0,061	3,22	-	-	[36]
	11.2-20.0	0,0063	3,1504	0,96	0,074	[37]
<b><i>Scorpaena porcus</i></b>						
	11-25	0,054	2,54	-	-	[41]
	-	0,018	3,08	-	-	[36]
	8.5-29.2	0,0173	3,0337	0,98	0,058	[37]

Species	Length Min-Max	a	b	r <sup>2</sup>	Cf	References
<i>Engraulis encrasicolus</i>						
	-	0.0047	3,1	-	-	[15]
	6,7-16,1	0,0023	3,41	-	-	[11]
	6-15	0.0076	2,92	-	-	[21]
	8.0-14.7	0.0174	2.6014	0.85	0.090	[37]
	-	0,0066	2,97	-	-	[23]
	-	0,0093	2,83	0,98	-	[40]
<i>Pomatomus saltatrix</i>						
	-	0.0388	2,56	-	-	[36]
	13.2-21.7	0.0130	2.8621	0.92	0,068	[37]
	-	0,006	3,195	0.98	-	[42]
	9.2-23.4	0,003	3,327	0.99	-	[43]
	-	0,003	3,4	0.99	-	[40]
<i>Trachurus trachurus</i>						
	-	0,0063	3,09	0.98	0,6299	[27]
	7.3-18.3	0.0086	2.9849	0.96	0,023	[37]
	-	0,007	3,02	0.99	-	[42]
	-	0,0074	3,04	0.98	-	[40]
<i>Sprattus sprattus</i>						
	5.2-12.5	0,0078	2,87	0.94	-	[44]
	5.60-12.6	0.0079	2.8676	0.88	0.030	[37]
	5.9-11.3	0,0092	2,81	0.99	-	[40]
<i>Scophthalmus maeoticus</i>						
	-	0,0047	4.188	-	-	[45]

## 6. Discussion and Conclusions

As a result of eutrophication caused by increased nutrient input via major north-western rivers during the last few decades, the Black Sea ecosystem has been subject to extreme changes in recent years. Abnormal changes due to altered nutrient balance were reflected in the qualitative and quantitative composition of biota including ichthyofauna [9]. Black Sea is a very narrow continental shelf and very thin oxygenated upper layer and eutrophic nature, favours pelagic fishes. This is caused in the catch composition of the landings, in which small pelagic fish more than 90% of the total catch [46]. Bottom trawls are efficient fishing gears for demersal fisheries and it is the most important fishing method in the catch of demersal fish species with a share of 60% [47]. The high economic value of marine products from the Black sea include anchovy, sprat, horse mackerel, bonito, bluefish of pelagic species and red mullet, whiting, turbot of demersal fishes and sea snails and mussels, respectively [4]. The catching of Sinop region was mainly constituted by same species. Moreover, the Black Sea especially in Sinop coast was the most important spawning area for all commercial fish species, including the predator species, which migrated for spawning or feeding [9]. Turkish fishery production is based on marine fishery which produced 76% of the production for 2007 [1]. According to TUIK [10] anchovy constitutes 67% of the Black Sea fisheries and 49% of Turkish fisheries. So, any change in the distribution of anchovy and the quantity of fishing in any fishing season has an important effect on total annual fishing amount [4]. The

Turkish Government applied two major items in order to reduce the cost of fishery by 1) Tax Relief Scheme for Diesel Oil Used in Fishing Vessel and 2) Subsidized Credit Scheme for Fishermen [46]. Gücü [46] also pointed out that reducing the cost of fishing relieved fisheries economy to a certain extent, but the impact of these decisions on fish stocks have been detrimental.

In general, Turkish fisheries including Sinop fishery display coastal fishing activities which are on a daily basis by leaving the local port, fishing throughout the day and returning back to the port [48]. However, it is quite clear that the Black Sea region including Sinop coast have a great impact of total production of marine fish of Turkish fisheries and Sinop fisheries constitute an important fishery industry and contribution to employment. There is an improvement in the availability of catch and biological data for economic species caught from the Sinop coast of the Black Sea. However biological and ecological data catch and effort statistics for all economical species are still incomplete. Thus, it is strongly recommended that further researches are needed before any conclusion is drawn.

## ACKNOWLEDGEMENTS

This study is a contribution to the European Community's Seventh Framework Programme (FP7/2007-2013) under Grant Agreement No. 287844 for the project "Towards COast to COast NETworks of marine protected areas ( from the shore to the high and deep sea), coupled with sea-based wind energy potential" (COCONET).



## REFERENCES

- [1] Anonymous, "Environmental indicators 2008", Department of Environmental Inventory, Republic of Turkey Ministry of Environment and Forestry ISBN 978-605-393036-5, 36 pages, Ankara, 2009. Available: <http://www.cevreorman.gov.tr/belgeler/cg2008.pdf>
- [2] Özdemir, S. "The effect of position and mesh size of square mesh panel applied in bottom trawl on catchability of different species", Ondokuz Mayıs Üniversitesi Fen Bilimleri Enstitüsü, (Doktora Tezi), SAMSUN, 2006.
- [3] Yiğit, Ü., "A Study on the Economic Analysis of Trawl Vessels in the Central Part of the Black Sea Region", Sinop University, Fen Bil Enst, Master Thesis, 74p., 2007.
- [4] Ak, O. and Genç, Y. The Black Sea Fishery. In: Tokaç, A., Gücü, A.C. and Öztürk, B. (Eds.), "The state of the Turkish fisheries", Publication Number 35, Published by Turkish Marine Research Foundation, p. 182-213, Istanbul, Turkey, 2012.
- [5] FAO (2010). Available: <http://www.fao.org/>
- [6] Anonymous, "2010 Yılı Balıkçı Tekneleri ve Av İstatistikleri", Tarım Bakanlığı, Sinop İl Müdürlüğü, Sinop, 2010a.
- [7] Erk, M.C. "Sinop İlindeki Balıkçılığın Sosyoekonomik Yapısı", Seminar Thesis, 21p (Unpublished Data), 2012.
- [8] Çeliker, S. A., Korkmaz, Ş.A., Dönmez, D., Gül, U., Demir, A., Genç, Y., Kalkanlar, Ş., Öz-demir, İ., "Karadeniz Bölgesi'nde Su Ürünleri Avcılığı Yapan İşletmelerin Sosyo-Ekonomik Analizi", Tarımsal Ekonomi Araştırma Enstitüsü, Ankara, 2006.
- [9] Bat, L., Erdem, Y., Ustaoglu, S., Yardım, Ö., Satılmış, H.H., "A Study on the Fishes of the Central Black Sea Coast of Turkey", J. Black Sea/ Mediterranean Environment, 11 (3), 287-302, 2005.
- [10] Anonymous. 2010 Yılı Su Ürünleri İstatistikleri. TÜİK, Ankara, 2010b.
- [11] Erkoyuncu, İ. and Özdamar, İ., "Estimation of the age, size and sex composition and growth parameters of Anchovy *Engraulis encrasicolus* (L) in the Black Sea" Fisheries Research, (7): 41-247, 1989.
- [12] Karaçam, H. and Düzgüneş, E., "Age, growth and meat yield of European Anchovy (*Engraulis encrasicolus* L., 1758) in the Black Sea", Fisheries Research, 9: 181-186, 1990.
- [13] Düzgüneş, E. and Karaçam, H., "Investigation on some population parameters and growth characteristics of anchovy (*Engraulis encrasicolus* L., 1758) in the Black Sea", Doğa Zooloji, (13): 7-83 (in Turkish), 1989.
- [14] Ünsal, N., "A study on age-length-weight relationship and determination of the smallest catching size of anchovy, *Engraulis encrasicolus* (L., 1758) in the Black Sea", Ist. Univ., J. Of Aquatic Products, 3(1-2): 17-28 (in Turkish), 1989.
- [15] Özdamar, E., Khiara, K. Sakuramoto, K. and Erkoyuncu, İ., "Variation in the population structure of European Anchovy, *Engraulis encrasicolus* L. In The Black Sea", Journal of the Tokyo University of Fisheries, (81)2: 123-134, 1994.
- [16] Bingel, F., A.C. Gücü, U. Nierman, A.E. Kıdeyş, E. Mutlu, M. Doğan, Y. Kayıkcı, D. Avşar, Y. Bekiroğlu, Y. Genç, H. Okur and M. Zengin, "Stock Assessment Studies of the Black Sea Coast", Tubitak, Final Report, 172, 1996.
- [17] Mutlu, C., Düzgüneş, E. and Şahin, C., "Some population parameters of european anchovy (*Engraulis encrasicolus* L., 1758) in the Eastern Black Sea", E. Anatolia Region I. Fish. Semp. 23-25 June 1993, Erzurum, Turkey, 423-431 (in Turkish), 1993.
- [18] Özdamar, E., Samsun O. and Erkoyuncu, İ., "The estimation of population parameters for anchovy (*Engraulis encrasicolus* L.) during 1994-1995 fishing seasons in the Turkish Black Sea region", Ege University Faculty of Fisheries, J. of Fish and Aquatic Science, 12(1-2), 135-144 (in Turkish), 1995.
- [19] Kayalı, E., "A research on bioecological properties of anchovy (*Engraulis encrasicolus*) and mackerel (*Trachurus mediterraneus*) fishes in the Eastern Black Sea Ecosystem", Msc. Thesis, K.T.U., Sci. Tech., 238 p. (in Turkish), 1998.
- [20] Gözler, A.M. and Çiloğlu, E., "A research on some population parameters of european anchovy (*Engraulis encrasicolus* L., 1758) caught in the Rize-Hopa coasts (in Turkish)", Eastern Anatolia Region III. Fisheries Semp. 10-12 June 1998, Erzurum, Turkey, 373-383, 1998.
- [21] Samsun, O., Samsun, N. and Karamollaoğlu, A., "Age, growth and mortality rates of the European anchovy (*Engraulis encrasicolus* L., 1758) in the Turkish Black Sea Coast", Turkish Journal of Veterinary and Animal Sciences, 28(5): 901-910, 2004.
- [22] Samsun, O., Kalaycı, F., Samsun, N. ve Bilgin, O., "Orta Karadeniz'de İki Tekne ile Çekilen Ortasu Trolünün Av Verimi ve Av Kompozisyonun Belirlenmesi", Ondokuz Mayıs Üniversitesi, Araştırma Fonu SSÜ 094 nolu Proje Sonuç Raporu, 97 s. (in Turkish), Samsun, 2006a.
- [23] Bilgin, S., Samsun, N., Samsun, O. ve Kalaycı, F., "Estimation of population parameters of anchovy, *Engraulis encrasicolus* L. 1758, at 2004-2005 fishing season in The Middle Black Sea, using length frequency analysis methods", Ege Üniversitesi, Su Ürünleri Dergisi, 23(1-3): 359- 364 (in Turkish), 2006.
- [24] Özdemir, S., Erdem, E. Aksu, H. ve Özdemir Birinci, Z., "Ortasu Tolu ile Avlanan Hamsi (*Engraulis encrasicolus*, L.) ve Çaç ( *Sprattus sprattus* L.) Balıklarının Av Verimi ve Boy Kompozisyonu ile Bazı Populasyon Parametrelerinin Tahmini", XV. Ulusal Su Ürünleri Sempozyumu, Abstract Book pp.479, 2009a.
- [25] Yücel, Ş. and Erkoyuncu, E., "Population Dynamics of Horse Mackerel (*Trachurus trachurus* L., 1758) Stocks in the Mid Black Sea, Turkey", Turkish Journal. of Biology, 24:543-552 (in Turkish), 2000.
- [26] Kalaycı, F., "The determination of population parameters and reproduction characteristics of horse mackerel (*Trachurus trachurus* L., 1758) caught in the middle Black Sea", Doktora Tezi, Ondokuz Mayıs Üniversitesi Fen Bilimleri Enstitüsü, 119s. (in Turkish), 2006.
- [27] Samsun, N., Kalaycı, F., Samsun, O. ve Bilgin, O., "The determination of some biological characteristics of horse

- mackerel (*Trachurus trachurus* L., 1758) caught in Samsun Bay". Ege Üniversitesi Su Ürünleri Dergisi, 23(1/3): 481-486 (in Turkish), 2006b.
- [28] Kasapoğlu, N., "Doğu Karadeniz'deki İstavrit (*Trachurus mediterraneus* Steindachner, 1868) Balığının Stok Yapısı ve Populasyon Parametreleri", Yüksek Lisans Tezi Karadeniz Teknik Üniversitesi Fen Bilimleri Enstitüsü Su Ürünleri A.B.D., 61s. (in Turkish), 2006.
- [29] Özdemir, S., Erdem, E., Özdemir Birinci, Z., Şahin, D., "Estimation of Population Parameters from Length Composition of Pelagic Species Caught in the Black Sea: Horse mackerel (*Trachurus trachurus*), Blue fish (*Pomatomus saltatrix*) and Shad (*Alosa alosa*)", Fırat Üniversitesi Journal of Science, 21(1):1-8. (in Turkish), 2009b.
- [30] Samsun, O., Özdamar, E. ve Aral, O., "Research on The Some Characteristics of The Whiting (*Gadus merlangus euxinus* Nordman, 1840) Caught By The Trawler in The Mid Black Sea Region From The Point of View of Fishery Biology", Ege Üniversitesi Fen Fakültesi Dergisi. Seri B. 16(1):1003 – 1011 (in Turkish), 1994.
- [31] Düzgüneş, E. and Karaçam, H., "Doğu Karadeniz'deki Mezgıt (*Gadus euxinus* Nord.,1840) Balıklarında Bazı Populasyon Parametreleri, Et Verimi ve Biyokimyasal Kompozisyon", Doğa-Tr. J. of Zooloji, 14, 345-352 (in Turkish), 1990.
- [32] Samsun, O., "Research On The Whiting (*Gadus merlangus euxinus* Nordman, 1840 ) Caught By The Bottom Trawlers In The Mid Black Sea Region From The Point of View of Fishery Biology Between 1991 And 1994 Fishery Season", Süleyman Demirel Üniversitesi, Eğirdir Su Ürünleri Fakültesi Dergisi. 4:273–282 (in Turkish), 1995.
- [33] Özdamar, E. and Samsun, O., "The Estimation Of Some Parameters Concerning Population Dynamics Of Whiting (*Gadus merlangus euxinus* Nord., 1840) Stock in The Samsun Bay", Ondokuz Mayıs Üniversitesi Fen-Edebiyat Fak. Fen Dergisi, 5(1): 128–140 (in Turkish), 1995.
- [34] Samsun, N. ve Erkoyuncu, İ., "The research on the estimation of some parameters of whiting (*Gadus merlangus euxinus* Nordmann, 1840) caught by the bottom trawlers in the area of Sinop (Black Sea) from the view point of fishery biology", E. Ü. Su Ürünleri Dergisi, 15 (1-2): 19-31 (in Turkish), 1998.
- [35] Özdemir, S., Erdem, Y. ve Sümer, Ç., "The comparison of population parameters of Turbot (*Psetta maxima*, Linnaeus, 1758) and Whiting (*Merlangius merlangus euxinus*, Nordman 1840) which are estimated by using age and length data", Ondokuz Mayıs Üniversitesi Ziraat Fakültesi Dergisi, 21(1), 71-75 (in Turkish), 2006.
- [36] Erkoyuncu, İ., Erdem, M., Samsun, O., Özdamar, E. and Kaya, Y., "A research on the determination of meat yields, chemical composition and weight-length relationship of some fish species caught in the Black Sea ", İstanbul University Journal of Aquatic Products, 8(1-2): 181-191 (in Turkish), 1994.
- [37] Kalaycı, F., Samsun, N., Bilgin, S. and Samsun, O., "Length-Weight Relationship of 10 Fish Species Caught by Bottom Trawl and Midwater Trawl from the Middle Black Sea, Turkey", Turkish Journal of Fisheries and Aquatic Sciences, 7: 33-36, 2007.
- [38] Samsun, S., "The Determination of Some Population Parameters of the Whiting (*Merlangius merlangus* Linnaeus, 1758) at 2001-2003 Fishing Season Caught in the Middle Black Sea", 22 (1):47-54 (in Turkish), 2010.
- [39] Özdamar, E., "Samsun Körfezinde Dip Trolüyle Avlanan Tırsı Balığının *Alosa pontica* (Eichwald, 1838) Balıkçılık Biyolojisi Yönünden İncelenmesi", Doğu Anadolu Bölgesi II. Su Ürünleri Sempozyumu, 14-16 Haziran 1995, Bildiriler Kitabı, 570-583 (in Turkish), 1995.
- [40] Özdemir, S., Erdem, E. Aksu, H. and Özdemir Birinci, Z., "Determination of catch composition and length-weight relationship of some pelagic fishes caught by pairly midwater trawl", J.FisheriesSciences.com. 4(4): 427-436, 2010.
- [41] Koca, H.U., "A Study on the determination of some parameters of the scorpion fish (*Scorpaena porcus* Linne., 1758) caught by bottom nets in the area of Sinop in terms of fishery biology", Turkish Journal of Veterinary and Animal Sci., 26: 65-69 8 (in Turkish), 2002.
- [42] Özdemir, S., Erdem, Y., Özdemir Birinci, Z., Erdem, E., "Comparison of catch efficiency and size composition of bluefish (*Pomatomus saltatrix*, L.) Fishing by bottom trawl in the blacksea in October and november months", Erciyes Üniversitesi Fen Bilimleri Dergisi, 25 (1-2). (in Turkish), 2009c.
- [43] Özdemir, S., Erdem, Y., Erdem, E., Özdemir Birinci, Z., "Comparison of size composition and catch Efficiency of horse mackerel (*Trachurus trachurus*, L.) and Blue fish (*Pomatomus saltatrix*, L.) Caught by bottom trawl from different fishing areas", Celal Bayar Üniversitesi Fen Bilimleri Dergisi, 5(1):19-26 (in Turkish), 2009d.
- [44] Kalaycı, F., Bilgin, S., Samsun, O. and Samsun, N., "Researching the place of fisheries industry and general state of the sprat (*Sprattus sprattus phalericus* Risso, 1826) fishing Middle Black Sea Region", Ege Üniversitesi Su Ürünleri Dergisi, 23(1/3): 449-455 (in Turkish), 2006.
- [45] Erdem, Y., "A study on the selectivity of Turbot (*Scophthalmus maeoticus* Pallas,1881) gill nets", Doktora Tezi, OMÜ., Fen Bilimleri Enst., 63s. (in Turkish), 1996.
- [46] Gücü, A.C. Small pelagic fish and fisheries in Turkey. In: Tokaç, A., Gücü, A.C. and Öztürk, B. (Eds.), "The state of the Turkish fisheries", Publication Number 35, Published by Turkish Marine Research Foundation, p. 1-17, İstanbul, Turkey, 2012.
- [47] Kaykaç M.H., Tosunoglu, Z., Tokaç, A. Trawl fisheries. In: Tokaç, A., Gücü, A.C. and Öztürk, B. (Eds.), "The state of the Turkish fisheries", Publication Number 35, Published by Turkish Marine Research Foundation, p. 316-328, İstanbul, Turkey, 2012.
- [48] Tokaç A. Classification of commercial fishing gears and methods in Turkish fisheries. In: Tokaç, A., Gücü, A.C. and Öztürk, B. (Eds.), "The state of the Turkish fisheries", Publication Number 35, Published by Turkish Marine Research Foundation, p. 154-181, İstanbul, Turkey, 2012.