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Marine fishes in the Black Sea: recent conservation status

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Abstract

A revised checklist of the fish fauna of the Black Sea is reported. This paper is the first attempt to present an actual Check List of the fishes in the Black Sea according to the data available in Black Sea countries, as well as their current conservation status, enlisted in IUCN. The total number of Black Sea fish species is 189. Concerning the conservation status, only two species (1.06 %) are extinct (*Acipenser nudiventris* and *A. sturio*), 3.70 % are critically endangered, 16.40 % are vulnerable, 1.06% are endangered; for 10.58 % there is a lack of data, 26.46% has been classified in the category "Least concern", 2.65 % are "Near threatened" and 38. 10% are "Not evaluated".

Keywords: Keywords: Black Sea, Ichtyofauna, list of species, IUCN.

Introduction

The first description of the Black Sea fishes has been performed by Pallas in 1811. The most complete information about the species composition of fishes in the Black Sea is given by Slastenenko (1955-1956), who listed 189 species. Data on fish species diversity in the Black Sea can be also found in the works of Berg (1949), Rass (1949, 1965), Svetovidov (1964) and Vasil'eva (2007). Svetovidov (1964) has presented 150 marine, diadromous fish species inhabited water of the Black Sea. Vasil'eva (2007) enlisted 176 species for the Black Sea.
In the Black Sea Red Data book (Dumont *et al*., 1999) 41 species for the Bulgarian Black Sea Coast were included. Chichkof (1912) described 51 fish species. Drensky (1921) reported 87 fish species for the Bulgarian Black Sea. Stoyanov *et al*. (1963) and Georgievr & Kolemanova (1978) reported 140 fish species for the Bulgarian Black Sea fish fauna.
Zhivkov *et al*. (2005) describe 218 species (107 freshwater and brakish and 111 marine species) for Bulgarian waters. Karapetkova & Zhivkov (2010) have presented 210 species of Bulgarian Ichtyofauna.

Literature reviews of the fish fauna of the Turkish Black Sea waters have been conducted by a number of scientists (Kocataş *et al*., 1987; Mater & Meriç 1996; Öztürk 1999; Bilecenoğlu *et al*., 2002; Bat *et al*., 2005; Fricke *et al*., 2007; Keskin 2010). According to these authors, there are different numbers of fish species in the Turkish Black Sea waters: Kocataş *et al*. (described 150 species, 1987), Öztürk (described 140 fish, 1999), Bilecenoğlu *et al*. (151 fish, 2002), Bat *et al*. (identified 94 fish, 2005), Fricke *et al*. (recorded 157 species, 2007) and Keskin (161 fish, 2010).

The total number of fish species found in the Ukrainian Black Sea waters is 141; among them, 4 species are freshwater inhabitants according to CIESM (2010). Boltachev and Karpova (2012) recorded 135 species in the Black Sea along the Crimean Peninsula.

The fishes of Georgia have been studied by Cuvier (1829), Günther (1866) and Sharvashidze (1982). Presently, the fish checklist of Georgia contains 167 species of which 61 are freshwater inhabitants, 76 marine and 30 species are migratory (Ninua & Japoshvili, 2008).

The aim of the study is to present the actual status of the Black Sea Fish Check List, combining the data from all Black Sea countries.

Materials and Methods

The fish species checklist for the Black Sea was prepared following an exhaustive bibliographic review and

analysis of published articles. The present compilation provides a review of data obtained from the literature. The checklist is based not only on recent and relevant publications, but also on older records. The Latin names of fishes are presented according to their taxonomic priority. Current and old names were analyzed and compared with the available data, in order to clarify the taxonomic status.

The nomenclature follows (Eschmeyer & Fongr, 2014). Fish diversity in the Black Sea was examined by country (including Black Sea region): Bulgaria, Georgia, Romania, Turkey, Ukraine and Russia. For Black Sea countries, research has not been carried out for all listed species regarding their IUCN status, and they have been scientifically determined and categorized. On account of this, possible categorization of the species according to IUCN criteria is not relevant at the moment for most of the listed species. The conservation status of Black Sea marine fishes was completed using the IUCN Red List categories and criteria (version 2 of 2013). All these assessments are available on the IUCN Red List website: http://www.IUCNredlist.org).

Results and Discussion

Table 1 presents the annotated list of 189 fish species in the Black Sea along with their distribution.

The nomenclature follows Eschmeyer & Fongr, (2014) catalogue with exception of the following species:

- *Atherina boyeri* Risso, 1810, listed as *Atherina pontica* (Eichwald, 1831). Based on genetic analysis, the authors have a lot of evidence that, in Black Sea waters, the correct name is *Atherina pontica* (Eichwald, 1831). (Dobrovolov & Georgiev, 1995; Dobrovolov & Ivanova, 1999; Dobrovolov *et al*., 2003).
- *Trachurus mediterraneus* Steindachner, 1868, listed as *Trachurus mediterraneus ponticus* Aleev, 1956. *Trachurus mediterraneus ponticus* Aleev, distinct from the Mediterranean one, i.e. *Tr. mediterraneus* Steindachner (1868), (Dobrovolov, 2000).
- *Scophthalmus maximus* (Linnaeus, 1758) listed as *Psetta maxima* (Linaeus, 1758). Currently, the genus affiliation of turbot in the Black Sea is not clearly defined. Intensive research (genetic and morphological study) is ongoing to establish genera and species status.

Species reported as alien in the Black Sea (Alexandrov *et al.*, 2007*),* such as *Oncorhynchus gorbuscha, Lateolabrax japonicus, Oncorhynchus mykiss and Plecoglossus altivellis, Salvelinus fontinalis, Salmo salar*, which were intentionally imported for aquaculture, are not included in our annotated list as they are mostly freshwater species.

The ichthyofauna of the Black Sea includes genera that are very different as regards their origin and ecology. Forty-two species were considered to be endangered to various extents: seven species were classified as "Critically endangered" (3.70 %), two as "Extinct" (1.06%) and two as "Endangered" (1.06%), thirty one as "Vulnerable" (16.40 %). Fifty species have been classified in the category "Least concern" (26.46%). Concerning the conservation status, 10.58 % are "Data Deficient" and 2.65 % "Near threatened". More information is needed, as many of these Data Deficient species may in fact be threatened. It is important to focus conservation efforts and research on these species. 38.10% of the species were considered to be "Not Evaluated" (Fig. 1, Table 1).

There is substantial lack of information on the conservation status of nearly 50% of Black Sea marine species (which are assessed as DD and NE). The high percentage of data deficient and not evaluated fish species in the Black Sea indicates the necessity for additional careful study of these species, because some of them could be threatened species. The diagram presents the species (percentage) for which no information is available (Fig. 1).

For these species, it is necessary to take urgent conservation and protection measures. It is also important to implement further monitoring and appropriate managements and recovery plans for these species.

Some commercial fish species are already under threat, such as Bluefin tuna, Sturgeons and Mackerel. The frequency of appearance of *Acipenser gueldenstaedtii*, *A. stellatus* and *Huso huso* throughout the Southern Black Sea coasts is the highest in the Yeşilirmak-Kizilirmak Basin and Sakarya Basin, Turkish coast (Ustaoğlu *et al*., 2011). *A. persicus* was newly recorded from the Sinop-Samsun coast of the Black Sea (Bat *et al.,* 2005). This species, like *A. nudiventris* and *A. sturio*, should to be marked as extinct (EX), in view of the literature data (Tsekov *et al*., 2008a). On the other hand, changes in Black sea ichthyofauna diversity are due to natural permanent penetration of alien species through the Bosphorus strait – "mediterranization" or economic activity – artificial introduction, shipping and other factors (Alexandrov *et al*., 2007; Yankova *et al*., 2013). Some of the new

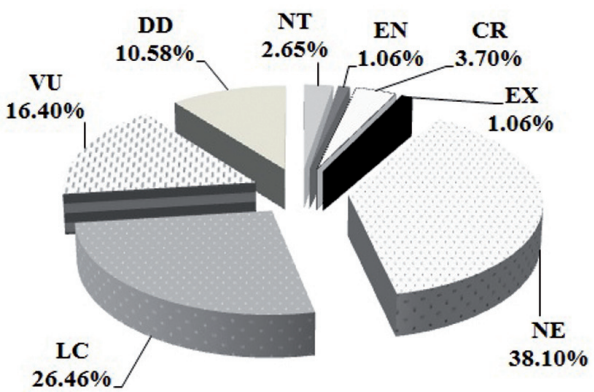

Fig.1: Regional Red List status of all marine fish species in the Black Sea.Categories are abbreviated as: EN-Endangered; CR-Critically Endangered; EX-Extinct; VU-Vulnerable; LC-Least Concern; DD-Data Deficient; NE-Not Evaluated; NT-Near Threatened.

Table 1. Fish species in the Black Sea. I. Origin: A (M) Atlanto-Mediterranean species, (C): cosmopolitans, E(M): Mediterranean endemic, E(B): Black Sea endemic, (IP): Indo-Pacific species, (Eu W): European Waters and rare species (*); II. Conservation status: extinct (EX); Critically endangered (CR), Vulnerable (VU); least concern (LC); Not evaluated (NE), No available information (DD), - Near Threatened (NT); III. Distribution: Bulgaria (1); Georgia (2); Romania (3); Russian Federation (4); Turkey (5); Ukraine (6).

Families / species	Origin	IUCN Status	Country of occupancy	References
Acipenseridae				
Acipenser gueldenstaedtii Brandt & Ratzeburg, 1833	E(B)	CR	1, 2, 3, 4, 5, 6	Bat *et al*., 2005; Dobrovolov *et al*., 2005 ; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Tsekov *et al.*, 2008a; Zivkov *et al.,* 2005,
Acipenser stellatus Pallas, 1771	E(B)	CR	1, 2, 3, 4, 5, 6	Bat *et al*., 2005; Dobrovolov *et al*., 2005 ; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Tsekov *et al.*, 2008a; Zivkov *et al.*, 2005,
Acipenser nudiventris Lovetsky, 1828	E(B)	EX	1, 2, 3, 4, 5, 6	Bat *et al*., 2005; Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013;
Acipenser ruthenus Linnaeus, 1758	EuW	VU	1, 5, 6	Dobrovolov *et al*., 2005; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Tsekov *et al.*, 2008a; Zivkov *et al.*, 2005;
Acipenser sturio Linnaeus, 1758	A(M)	EX	1, 2, 3, 4, 5, 6	Dobrovolov *et al*., 2005, Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013;
**Acipenser persicus* Borodin, 1897	E(B)	CR	2, 4, 5	Bat *et al*., 2005; Fricke *et al*., 2007; Oral *et al*., 2013;
Huso huso (Linnaeus, 1758)	E(B)	CR	1, 2, 3, 4, 5, 6	Dobrovolov *et al*. 2004, Dobrovolov *et al*., 2005, Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Tsekov *et al.*, 2008; Zivkov *et al.* 2005;
Alopidae				
**Alopias vulpinus* (Bonnaterre, 1788)	C	VU	5	Fricke *et al*., 2007; Geldiay, 1969; Kabasakal, 1998; Vasil'eva, 2007;
Ammodytidae				
Gymnammodytes cicerelus (Rafinesque, 1810)	E(M)	NE	1, 3, 4, 5, 6	Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005 ;
Anguillidae				
Anguilla anguilla (Linnaeus, 1758)	A(M)	CR	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005;
Atherinidae				
Atherina pontica (Eichwald, 1831)	A(M)	LC	1, 2, 3, 4, 5, 6	Dobrovolov & Georgievr, 1995; Dobrovolov & Ivanova, 1999; Dobrovolov *et al*., 2003;
**Atherina hepsetus* Linnaeus, 1758	A(M)	NE	1, 3, 4, 5, 6	Boltachev & Karpova, 2012; Dobrovolov & Georgiev, 1995; Erazi, 1942; Fischer *et al.*, 1987; Geldiay, 1969; Karapetkova & Zhivkov, 2010; Mater & Meriç, 1996; Mater & Bilecenoglu, 1999; Öztürk, 1999; Slastenenko, 1955-1956; Whitehead *et al.,* 1984-1986;
Balistidae				
**Balistes capriscus* Gmelin, 1789	A(M)	NE	5, 6	Bilecenoglu *et al*., 2002; Fricke *et al*., 2007; Oven & Salekhova, 1969; Svetovidov, 1964;
Belonidae				
Belone belone (Linnaeus, 1761)	E(M)	NE	1, 2, 3, 4, 5, 6	Bilecenoglu *et al*., 2002; Eschmeyer & Fongr, 2014; Karapetkova & Zhivkov, 2010; Zivkov *et al.*, 2005;
Blenniidae				
Aidablennius (*Blennius*) *sphynx* (Valenciennes, 1836)	E(M)	NE	1, 2, 3, 4, 5, 6	Karapetkova & Zivkov, 2006, 2010 ; Fricke *et al*., 2007; Oral *et al*., 2013; Zivkov *et al*., 2005 ;
**Blennius ocellaris* Linnaeus, 1758	A(M)	NE	2, 5, 6	Fricke *et al*., 2007;
Coryphoblennius galerita (Linnaeus, 1758)	E(M)	NE	1, 2, 3, 4, 5, 6	Bat *et al.,* 2006; Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al.*, 2005;
**Microlipophrys adriaticus* (Steindachner & KolomBatovic, 1883)	A(M)	DD	5, 6	Fricke *et al*., 2007; Eschmeyer & Fongr, 2014;
Parablennius (Blennius) zvonimiri (KolomBatovic, 1892)	A(M)	DD	1, 3, 4, 5, 6	Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005,
Parablenniuis (*Blennius*) *sanguinolentus* (Pallas, 1814)	A(M)	NE	1, 3, 4, 5, 6	Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Zivkov *et al.,* 2005 ;
Parablennius (*Blennius*) *tentacularis* (Brunnich,1768)	A(M)	NE	1, 3, 4, 5, 6	Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Zivkov *et al.*, 2005;
Parablennius gattorugine (Linnaeus,1758)	A(M)	LC	5	Bilecenoglu *et al*., 2002; Vasil'eva, 2007;
Parablennius incognitus (Bath,1968)	A(M)	NE	2, 4, 5, 6	Boltachev *et al*., 2009; Bilecenoglu *et al*., Fricke *et al*., 2007; 2002; Vasil'eva, 2007;

(continued)

Table 1 (continued)

Families / species	Origin	IUCN Status	Country of occupancy	References
Salaria (*Lipophrys*) *pavo* (Risso,1810)	A(M)	NE	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013 ; Zivkov *et al*., 2005;
Bothidae				
Arnoglossus laterna (Walbaum, 1792)	A(M)	NE	5	Bat *et al.,* 2005; Fricke *et al*., 2007;
Arnoglossus thori Kyle, 1913	A(M)	NE	5	Fricke *et al*., 2007;
Arnoglossus kessleri Schmidt, 1915	E(M)	DD	1, 2, 3, 4, 5, 6	Boltachev & Karpova, 2012; Karapetkova & Zhivkov, 2010; Svetovidov, 1964; Zivkov *et al.,* 2005;
Callionymidae				
Callionymus pusillus Delaroche, 1809	A(M)	NE	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005 ;
Callionymus risso Le Sueur, 1814 = (*C. belenus*)	A(M)	NE	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005 ;
Callionymus fasciatus (Valenciennes in Cuvier & Val enciennes,1837)	E(M)	LC	4, 5	Fischer *et al.,* 1987; Fricke *et al*., 2007; Mater & Meriç,1996; Mater & Bilecenoglu, 1999; Öztürk, 1999;
Callionymus lyra Linnaeus,1758	A(M)	NE	2, 4, 5	Fischer *et al.*, 1987; Fricke *et al*., 2007; Mater & Meriç, 1996; Mater & Bilecenoglu, 1999; Öztürk, 1999; Svetovidov, 1964; Whitehead *et al.,* 1984-1986;
Carangidae				
Lichia amia (Linnaeus, 1758)	A(M)	DD	1, 5	Bilecenoglu *et al*., 2002; Fricke *et al*., 2007; Keskin, 2010; Svetovidov, 1964; Karapetkova & Zhivkov, 2010; Stefanov, 2007; Vasil'eva, 2007; Zivkov *et al*., 2005;
Naucrates ductor (Linnaeus, 1758)	C	VU	1, 5, 6	Bilecenoglu *et al*., 2002; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Svetovidov, 1964; Stefanov, 2007; Vasil'eva, 2007; Zivkov *et al*., 2005;
Trachurus mediterraneus ponticus Aleev, 1956	A(M)	NE	1, 2, 3, 4, 5, 6	Aleev, 1956, 1957, 1959; Banarescu, 1964; Cautis, 1979; Cautis & Jonescu, 1979; Dobrovolov 1977; Dobrovolov 1981; Dobrovolov & Dobrovolova, 1983; Dobrovolov, 1986; Dobrovolov 1988; Dobrovolov & Terzieva, 1995; Dobrovolov 2000; Georgiev & Kolarov, 1962; Karapetkova & Zivkov 2006, 2010; Stoyanov *et al*., 1963;Vasil'eva, 2007;
Trachurus trachurus (Linnaeus, 1758)	A(M)	DD	5, 6	Fricke *et al*., 2007; Vasil'eva, 2007;
Centracanthidae				
Centracanthus cirrus Rafinesque, 1810	A(M)	DD	3, 5	Abaza *et al*., 2006; Fricke *et al*., 2007;
Spicara smaris (Linnaeus, 1758)	A(M)	NE	1, 2, 3, 5	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Spicara maena (Linnaeus, 1758)	A(M)	NE	1, 2, 4, 5, 6	Boltachev & Karpova, 2012; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Spicara flexuosa Rafinesque, 1810	A(M)	NE	1, 2, 3, 4, 5, 6	Boltachev & Karpova, 2012; Karapetkova & Zhivkov, 2010; Salekhova, 1979; Vasill'eva, 2007; Zivkov *et al*., 2005;
Clupeidae				
Alosa immaculata Bennett, 1835	E(B)	VU	1, 2, 3, 4, 5, 6	Dobrovolov *et al*., 2012, Fricke *et al*., 2007; Freyhof & Kottelat 2008; Keskin, 2010; Karapetkova & Zhivkov, 2010; Mezhzherin *et al*., 2009; Turan *et al*., 2010; Vasil'eva, 2007;
Alosa caspia (Eichwald, 1838)	E(B)	LC	1, 2, 3, 4, 6	Dobrovolov *et al*., 2012; Karapetkova & Zhivkov, 2010; Mezhzherin *et al*., 2009; Vasil'eva, 2007; Zivkov *et al.,* 2005;
Alosa tanaica (Grimm 1901)	E(B)	LC	2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010;
Alosa fallax (Lacepede, 1803)	A(M)	LC	1, 3, 4, 5, 6	Dobrovolov *et al*., 2012; Georgiev & Kolarov 1958; Karapetkova & Zhivkov, 2010;
Alosa maeotica (Grimm, 1901)	E(B)	LC	1, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010;
Clupeonella cultriventris (Nordmann, 1840)	E(B)	LC	1, 2, 3,4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al.,* 2005 ;
Sardina pilchardus (Walbaum, 1792)	A(M)	NE	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al.,* 2005 ;
Sprattus sprattus (Linnaeus, 1758)	A(M)	NE	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al.,* 2005 ;
Sardinella aurita Valenciennes, 1847	C	NE	1, 2, 3, 5, 6	Boltachev & Karpova, 2012; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al.,* 2005;
Chaetodontidae				
**Heniochus acuminatus* (Linnaeus, 1758)	A(M)	LC	6	Boltachev & Astakhov, 2004;
Congridae				
**Conger conger* (Linnaeus, 1758)	A(M)	DD	2, 5, 6	Fricke *et al*., 2007; Keskin, 2010;

(continued)

Table 1 (continued)

Families / species	Origin	IUCN Status	Country of occupancy	References
Dactylopteridae				
**Dactylopterus volitans* (Linnaeus, 1758)	A(M)	NE	6	Boltachev *et al*., 2013; Movchan, 2011;
Dasyatidae				
Dasyatis pastinaca (Linnaeus, 1758)	A(M)	DD	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al.,* 2005;
Echeneididae				
* *Echeneis naucrates* Linnaeus, 1758	C	NE	1	Valkanov, 1961;
Engraulidae				
Engraulis encrasicolus (Linnaeus, 1758)	E(B)	NE	1, 2, 3, 4, 5, 6	Chashchin, 1998; Dobrovolov, 1976; Fricke *et al*., 2007; Grant, 2005; Ivanova & Dobrovolov, 2006; Ivanova *et al*., 2013a; Keskin, 2010; Karapetkova & Zhivkov, 2010; Magoulas *et al*., 2006; Samsun *et al*., 2006; Turan *et al*., 2004;
Gadidae				
Merlangius merlangus (Linnaeus, 1758)	E(M)	NE	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Vasil'eva, 2007; Zivkov *et al*., 2005;
* *Micromesistius poutassou* (Risso, 1827)	A(M)	NE	6	Boltachev *et al*., 1999; Boltachev & Karpova, 2012;
Gasterosteidae				
Gasterosteus aculeatus Linnaeus, 1758	A(M)	LC	1, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al.,* 2005;
Pungitius platygaster (Kessler, 1859)	E(B)	LC	1, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al.,* 2005 ;
Gobiesocidae				
Apletodon dentatus (Facciolà, 1887)	A(M)	NE	3, 5	Bat *et al*., 2006;
Apletodon microcephalus (Brook,1890)	A(M)	NE	1	Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Diplecogaster bimaculata bimaculata (Bonnaterre, 1788)	A(M)	NE	1, 3, 4, 5, 6	Boltachev & Karpova, 2012; Erazi, 1942; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Slastenko, 1955-1956; Zivkov *et al.,* 2005;
Lepadogaster candolii Risso, 1810	A(M)	NE	1, 2, 3, 4, 5, 6	Boltachev & Karpova, 2012; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Lepadogaster lepadogaster (Bonnaterre, 1788)	A(M)	LC	1, 2, 3, 4, 5, 6	Boltachev & Karpova, 2012; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al.,* 2005;
Gobiidae				
Aphia minuta (Risso, 1810)	A(M)	NE	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012; Zivkov *et al.,* 2005;
Benthophiloides brauneri Beling & Iljin, 1927	E(B)	DD	1, 3, 6	Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012 ; Zivkov *et al*., 2005;
Benthophilus stellatus (Sauvage, 1874)	E(B)	LC	1, 3, 6	Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012; Zivkov *et al*., 2005;
Caspiosoma caspium (Kessler, 1877)	E(B)	LC	6	Eschmeyer & Fongr, 2014;
Chromogobius quadrivittatus (Steindachner, 1863)	A(M)	LC	1, 4, 6	Karapetkova & Zhivkov, 2010; Kovtun, 2013; Vassilev *et al*., 2010, 2012,Vasil'eva, 2007; Zivkov *et al.*, 2005 ;
**Chromogobius zebratus* (KolomBatovic, 1891)	E(M)	LC	6	Kovtun & Karpova, 2014;
**Gammogobius steinitzi* Bath, 1971	E(M)	DD	6	Kovtun & Manilo, 2013;
Gobius niger Linnaeus, 1758	A(M)	NE	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Ivanova *et al*., 2013b ; Vassilev *et al*., 2010, 2012 ; Zivkov *et al.,* 2005 ;
Gobius cobitis Pallas, 1814	A(M)	LC	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Vassilev *et al*., 2010, 2012 ; Zivkov *et al.,* 2005 ;
Gobius bucchichi Steindachner, 1870	E(M)	NE	1, 3, 4, 5, 6	Boltachev & Karpova, 2012; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Vassilev *et al*., 2010,2012 ; Zivkov *et al*., 2005 ;
Zosterisessor ophiocephalus (Pallas, 1814)	E(M)	DD	1, 5, 6	Boltachev & Karpova, 2012; Dobrovolov *et al*., 1995; Fricke *et al*., 2007; Ivanova *et al*., 2013b; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013;
Gobius paganellus Linnaeus, 1758	A(M)	NE	1, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012 ; Zivkov *et al*., 2005 ;
Gobius cruentatus Gmelin, 1789	A(M)	NE	5, 6	Boltachev *et al*., 2009; Engin *et al*., 2007; Fricke *et al*., 2007; Keskin, 2010; Slastenenko 1955-1956;

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Table 1 (continued)

Families / species	Origin	IUCN Status	Country of occupancy	References
Gobius xanthocephalus Heymer et Zander, 1992	E(M)	LC	4, 6	Boltachev *et al*., 2009; Boltachev & Karpova, 2012; Vasil'eva, 2007;
Knipowitschia cameliae Nalbant et Otel, 1995	E(B)	CR	3	Vasil'eva, 2007;
Knipowitschia caucasica (Berg, 1916)	E(B)	LC	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Ivanova *et al*., 2013b; Keskin, 2010; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012, Zivkov *et al*., 2005;
Knipowitschia longecaudata (Kessler, 1877)	E(B)	LC	1, 2, 3, 5, 6	Fricke *et al*., 2007; Ivanova *et al*., 2013b ; Keskin, 2010 ; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012 , Zivkov *et al*., 2005 ;
Mesogobius Batrachocephalus (Pallas, 1814)	E(B)	LC	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012; Zivkov *et al*., 2005 ,
Millerigobius macrocephalus (KolomBatovič, 1891)	E(M)	NE	6	Boltachev & Karpova, 2012;
Neogobius (*Ponticola) eurycephalus* (Kessler, 1874)	E(B)	LC	1, 3, 4, 5, 6	Keskin, 2010; Vassilev *et al*., 2010, 2012
Neogobius (Ponticola) platyrostris (Pallas, 1814)	E(B)	LC	1, 4, 5, 6	Keskin, 2010; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012 ; Zivkov *et al*., 2005;
Neogobius (Ponticola) cephalargoides (Pinchuk, 1976)	E(B)	NE	1, 3, 4, 6	Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012; Zivkov *et al*., 2005;
Neogobius (Ponticola) kessleri (Günther, 1861)	E(B)	LC	1, 3, 5, 6	Keskin, 2010; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012 ; Zivkov *et al*., 2005;
Apolonia fluviatilis (Pallas, 1814)	E(B)	LC	1, 2, 3, 4, 5, 6	Brown & Stepien, 2008; Dobrovolov *et al*., 1995; Fricke *et al*., 2007; Ivanova *et al*., 2013b; Keskin, 2010; Neilson & Stepein, 2009; Stepien & Tumeo, 2006;
Apolonia melanostomus (Pallas, 1814)	E(B)	LC	1, 2, 3, 4, 5, 6	Brown & Stepien, 2008; Dobrovolov *et al*., 1995; Fricke *et al*., 2007; Ivanova *et al*., 2013b; Keskin, 2010; Neilson & Stepein, 2009; Stepien & Tumeo, 2006;
Neogobius (Ponticola) ratan (Nordmann, 1840)	E(B)	NE	1, 2, 3, 4, 5, 6	Keskin, 2010; Vassilev *et al*., 2010, 2012 Zivkov *et al*., 2005;
Neogobius (Ponticola) syrman (Nordmann, 1840)	E(B)	LC	1, 3, 4, 5, 6	Ivanova *et al*., 2013b; Keskin, 2010; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012; Zivkov *et al*., 2005;
Babka gymnotrachelus (Kessler, 1857)	E(B)	LC	1, 2, 3, 4, 5, 6	Neilson & Stepein, 2009;
Pomatoschistus marmoratus (Risso, 1810)	A(M)	NE	1, 3, 4, 5, 6	Fricke *et al*., 2007; Ivanova *et al*., 2013b ;Keskin, 2010; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012 , Zivkov *et al*., 2005;
Pomatoschistus minutus (Pallas, 1770)	A(M)	NE	1, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012 ; Zivkov *et al*., 2005 ;
Proterorhinus marmoratus (Pallas, 1811)	E(B)	VU	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Vassilev *et al*., 2010, 2012; Zivkov *et al*., 2005 ;
Pomatoschistus Bathi Miller, 1982	E(M)	DD	1, 2, 4, 6	Boltachev & Karpova, 2012; Vasil'eva, 2007; Vassilev *et al*., 2010; 2012;
Pomatoschistus pictus (Malm, 1865)	E(M)	NE	4	Vasil'eva, 2007;
Tridentiger trigonocephalus (Gill, 1859)	IP	NE	6	Boltachev & Karpova, 2010;
**Zebrus zebrus* (Risso, 1827)	E(M)	LC	5, 6	Boltachev & Karpova, 2013; Kovačić & Engin, 2009; Keskin, 2010;
Gymnuridae				
**Gymnura altavela* (Linnaeus, 1758)	A(M)	VU	5	Bilecenoglu *et al*., 2002; Fricke *et al*., 2007; Keskin, 2010;
Hexanchidae				
Hexanchus griseus Bonnaterre, 1788	C	NT	5	Kabasakal, 2013;
Labridae				
**Coris julis* (Linnaeus, 1758)	A(M)	LC	1, 3, 5	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005,
Ctenolabrus rupestris (Linnaeus, 1758)	A(M)	NE	1, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Labrus viridis Linnaeus, 1758	A(M)	VU	1, 3, 4, 5, 6	Boltachev & Karpova, 2012; Erazi, 1942; Fischer *et al.,*1987; Fricke *et al*., 2007; Geldiay, 1969; Keskin, 2010; Karapetkova & Zhivkov, 2010; Mater & Meriç, 1996; Mater & Bilecenoglu, 1999; Öztürk, 1999; Slastenenko, 1955-1956; Svetovidov, 1964; Whitehead *et al.,* 1984-1986; Zivkov *et al*., 2005;
Symphodus cinereus (Bonnaterre, 1788)	A(M)	LC	1, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010;

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Table 1 (continued)

Families / species	Origin	IUCN Status	Country of occupancy	References
Symphodus roissali (Risso, 1810)	A(M)	LC	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010;
Symphodus tinca (Linnaeus, 1758)	A(M)	LC	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013
Symphodus ocellatus (Linnaeus, 1758)	E(M)	VU	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010;
Symphodus scina (Forsskål, 1775)	E(M)	VU	3, 4, 5, 6	Boltachev & Karpova, 2012; Vasil'eva, 2007;
Lophiidae				
Lophius piscatorius Linnaeus, 1758	A(M)	NE	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005 ;
**Lophius budegassa* Spinola, 1807	A(M)	VU	5	Fricke *et al*., 2007; Keskin, 2010; Mater & Bilecenoglu, 1999; Öztürk, 1999;
Moronidae				
Dicentrarchus labrax (Linnaeus, 1758)	A(M)	VU	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
* *Morone saxatilis* (Walbaum, 1792)	A(M)	NE	2, 4, 6	Aleev *et. al*., 2007; Black Sea Transboundary Diagnostic Analysis 2007; Vasil'eva, 2007; Zaitsev and Öztürk, 2001;
Mugilidae				
Chelon labrosus (Risso, 1827)	A(M)	LC	1, 5, 6	Antović, 2013; Boltachev & Yurakhno, 2002; Boltachev & Karpova, 2012; Dobrovolov *et al*., 2003; Erguden *et al*., 2010; Fricke *et al*., 2007; Keskin, 2010;Turan *et al*., 2005;
Liza aurata (Risso, 1810)	A(M)	LC	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010 ; Karapetkova & Zhivkov, 2010;
Liza ramada (Risso, 1827)	A(M)	LC	1, 3, 5, 6	Boltachev & Karpova, 2012; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010;
Liza saliens (Risso, 1810)	A(M)	LC	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010;
Mugil cephalus Linnaeus, 1758	A(M)	LC	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010;
Liza haematocheila (Temminck & Schlegel 1845)	IP	NE	1, 2, 3, 4, 5, 6	Karapetkova & Zivkov, 2006, 2010; Dobrovolov *et al*., 2003; Zivkov *et al*., 2005;
Mullidae				
Mullus barBatus (Linnaeus, 1758)	A(M)	LC	1, 2, 3, 4, 5, 6	Eschmeyer & Fongr, 2014; Fricke *et al*., 2007; Karapetkova & Zivkov, 2006, 2010; Keskin, 2010; Zivkov *et al*., 2005 ;
Mullus surmuletus Linnaeus,1758	A(M)	NE	2, 4, 5	Fricke *et al*., 2007; Ivanova *et al*., 2014 ; Keskin, 2010;
Merlucciidae				
**Merluccius merluccius* (Linnaeus, 1758)	A(M)	NE	5	Fricke *et al*., 2007; Keskin, 2010;
Ophidiidae				
Ophidion rochei Müller, 1845	E(M)	DD	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Percidae				
Percarina demidoffii Nordmann 1840	E(B)	NT	3, 6	Vasil'eva, 2007;
Sander marinus (Cuvier in Cuvier & Valenciennes, 1828)	E(B)	DD	1, 6	Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005
Pleuronectidae				
Platichthys flesus (Linnaeus, 1758)	A(M)	LC	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007 ; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005 ;
Pomacentridae				
Chromis chromis Linnaeus, 1758	A(M)	NE	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005 ;
Pomatomidae				
Pomatomus saltatrix (Linnaeus, 1766)	C	NE	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005 ;
Phycidae				
Gaidropsarus mediterraneus (Linnaeus, 1758)	A(M)	LC	2, 5	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010;
Rajidae				
Raja clavata Linnaeus, 1758	C	VU	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Salmonidae				

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Table 1 (continued)

Families / species	Origin	IUCN Status	Country of occupancy	References
Salmo labrax Pallas, 1814	E(B)	LC	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005 ;
Salmo coruhensis Turan, Kottelat & Engin, 2010	E(M)	DD	5	Oral *et al*., 2013;Turan *et al*, 2009;
Salmo rizeensis Turan, Kottelat & Engin, 2010	E(M)	DD	5	Oral *et al*., 2013; Turan *et al*, 2009;
Sciaenidae				
**Argyrosomus regius* (Asso, 1801)	A(M)	DD	5	Fricke *et al*., 2007; Keskin, 2010;
Sciaena umbra Linnaeus, 1758	A(M)	VU	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Umbrina cirrosa (Linnaeus, 1758)	A(M)	NE	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005 ;
Scombridae				
* *Auxis rochei rochei* (Risso,1810)	C	LC	5	Fricke *et al*., 2007; Keskin, 2010;
**Euthynnus alletteratus* (Rafinesque-Schmaltz, 1810)	A(M)	LC	1, 5	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Sarda sarda (Bloch, 1793)	C	LC	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Boltachev & Karpova, 2012; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Vasil'eva, 2007; Zivkov *et al*., 2005 ;
Scomber japonicus Houttuyn, 1782	A(M)	LC	1, 3, 4, 5, 6	Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Scomber scombrus Linnaeus, 1758	A(M)	LC	1, 2, 3, 4, 5, 6	Eschmeyer & Fongr, 2014, Karapetkova & Zhivkov, 2010; Vasil'eva, 2007; Zivkov *et al*., 2005;
Thunnus thynnus (Linnaeus, 1758)	A(M)	EN	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Vasil'eva, 2007; Zivkov *et al*., 2005;
Scophthalmidae				
Psetta maxima Linnaeus (1758)	A(M)	NE	1, 3, 4, 5, 6	Atanassov *et al,* 2011; Karapetkova & Zhivkov, 2006,2010; Tsekov *et al*, 2008b; Zivkov *et al*., 2005,.
Scophthalmus maeoticus (Pallas 1814)	A(M)	NE	1, 2, 3, 4, 5, 6	Vasil'eva, 2007;
Scophthalmus rhombus (Linnaeus, 1758)	A(M)	VU	1, 3, 4, 5, 6	Eschmeyer & Fongr, 2014; Fricke *et al*., 2007; Vasil'eva, 2007;
Scorpaenidae				
Scorpaena porcus Linnaeus, 1758	A(M)	NE	1, 2, 3, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Karapetkova & Zhivkov, 2006, 2010 ; Keskin, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005;
Scorpaena notata Rafinesque, 1810	A(M)	VU	3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010;
Scyliorhinidae				
Scyliorhinus canicula (Linnaeus,1758)	A(M)	VU	4, 5	Aksiray, 1987; Erazi, 1942; Fischer, 1973; Geldiay, 1969; Slastenenko, 1955-1956; Mater & Meriç, 1996; Mater & Bilecenoglu, 1999; Öztürk, 1999; Svetovidov, 1964; Vasil'eva, 2007;
Serranidae				
Serranus cabrilla (Linnaeus, 1758)	A(M)	NE	1, 2, 6	Boltachev & Karpova, 2013, Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
**Serranus hepatus* (Linnaeus, 1758)	A(M)	NT	3, 5	Dalgiç *et al*., 2013; Fricke *et al*., 2007;
Serranus scriba (Linnaeus, 1758)	A(M)	NT	1, 2, 5	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005; Zivkov *et al*., 2005;
Soleidae				
Buglossidium luteum (Risso, 1810)	A(M)	VU	4, 5	Fricke *et al*., 2007; Keskin, 2010; Vasil'eva, 2007;
Microchirus variegatus (Donovan, 1808)	A(M)	VU	5	Fricke *et al*., 2007; Keskin, 2010; Vasil'eva, 2007;
Solea nasuta (Pallas, 1814)	E(M)	NE	1, 2, 5	Karapetkova & Zhivkov, 2010; Vasil'eva, 2007; Zivkov *et al*., 2005;
Solea solea (Linnaeus, 1758)	A(M)	NE	4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010;
Sparidae				
Boops boops (Linnaeus, 1758)	A(M)	LC	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Dentex dentex (Linnaeus, 1758)	A(M)	VU	1, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Diplodus annularis (Linnaeus, 1758)	A(M)	VU	1, 2, 3, 5	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010 ; Karapetkova & Zhivkov, 2010; ; Zivkov *et al*., 2005;

(continued)

Table 1 (continued)

Families / species	Origin	IUCN Status	Country of occupancy	References
Diplodus puntazzo (Walbaum, 1792)	A(M)	VU	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Diplodus sargus sargus (Linnaeus, 1758)	E(M)	NE	1, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Tkachenko, 2013; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Diplodus vulgaris (Geoffroy Saint-Hilaire, 1817)	A(M)	NE	1, 5, 6	Bat *et al.,* 2005; Bilecenoglu *et al*., 2002; Eschmeyer & Fongr, 2014; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Svetovidov, 1964; Stefanov, 2007; Tkachenko, 2013; Vasil'eva, 2007; Zivkov *et al.,* 2005,
Lithognathus mormyrus (Linnaeus, 1758)	A(M)	NE	5, 6	Bilecenoglu *et al*., 2002; Boltachev *et al.,* 2013; Stefanov, 2007; Vasil'eva, 2007; Zivkov *et al*., 2005;
Oblada melanura (Linnaeus, 1758)	A(M)	NE	1, 3, 5	Karapetkova & Zhivkov, 2010; Stefanov, 2007; Vasil'eva, 2007; Zivkov *et al*., 2005;
Pagellus erythrinus (Linnaeus, 1758)	A(M)	NE	1, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Sarpa salpa (Linnaeus, 1758)	A(M)	NT	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Boltachev & Yurakhno, 2002; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Spondyliosoma cantharus (Linnaeus, 1758)	A(M)	NE	1, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Svetovidov, 1964; Vasil'eva, 2007; Zivkov *et al*., 2005;
Sparus aurata Linnaeus, 1758	A(M)	VU	1, 2, 3, 5, 6	Bat *et al.,* 2005; Boltachev & Yurakhno, 2002; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Sphyraenidae				
Sphyraena sphyraena (Linnaeus, 1758)	A(M)	VU	1, 3, 4, 5, 6	Boltachev *et al*., 2009; Boltachev & Karpova, 2012; Fricke *et al*., 2007; Karapetkova & Zhivkov, 2010; Keskin, 2010; Svetovidov, 1964; Vasil'eva, 2007; Zivkov *et al*., 2005;
Sphyraena pinguis Günther, 1874	IP	NE	6	Boltachev, 2009;
Sphyrnidae				
Sphyrna zygaena (Linnaeus, 1758)	C	VU	3	Vasil'eva, 2007;
Squalidae				
Squalus acanthias Linnaeus, 1758	C	EN	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Squalus blainville (Risso, 1827)	C	DD	1, 5	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Squatinidae				
**Squatina squatina* (Linnaeus,1758)	A(M)	CR	5	Bilecenoglu *et al*., 2002; Fricke *et al*., 2007; Keskin, 2010;
Syngnathidae				
Hippocampus hippocampus (Linnaeus, 1758)	A(M)	DD	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005;
Nerophis ophidion (Linnaeus, 1758)	A(M)	VU	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005 ;
Syngnathus abaster Risso, 1827	A(M)	VU	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005;
**Syngnathus acus* Linnaeus, 1758	A(M)	NE	1, 3, 4, 5, 6	Bat *et al.,* 2005; Boltachev *et al*., 2009; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005 ;
Syngnathus schmidti Popov, 1927	E(B)	NE	1, 5, 6	Bilecenoglu *et al*., 2002; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Syngnathus tenuirostris Rathke, 1837	E(M)	DD	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005 ;
Syngnathus typhle Linnaeus, 1758	A(M)	LC	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005;
Syngnathus variegatus Pallas, 1814	E(B)	VU	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005 ;
Trachinidae				
Trachinus draco Linnaeus, 1758	A(M)	NE	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005;

(continued)

Table 1 (continued)

Families / species	Origin	IUCN Status	Country of occupancy	References
Triglidae				
Chelidonichthys (Aspitrigla) cuculus (Linnaeus, 1758)	A(M)	NE	5, 6	Fricke *et al*., 2007; Keskin, 2010;
Chelidonichthys lucerna (Linnaeus, 1758)	A(M)	VU	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Svetovidov, 1964; Vasil'eva, 2007; Zivkov *et al*., 2005;
Eutrigla gurnardus (Linnaeus, 1758)	A(M)	VU	1, 5	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005 ;
Trichiuridae				
Lepidopus caudatus (Euphasen, 1788)	A(M)	NE	5	Fricke *et al*., 2007; Keskin, 2010;
Tripterygiidae				
Tripterygion tripteronotum (Risso, 1810)	E(M)	VU	3, 4, 5, 6	Boltachev & Karpova, 2012; Erazi, 1942; Geldiay, 1969; Keskin, 2010; Mater & Meriç, 1996; Mater & Bilecenoglu, 1999; Öztürk, 1999; Svetovidov, 1964; Slastenenko, 1955-1956; Vasil'eva, 2007; Whitehead *et al.*, 1984-1986;
Uranoscopidae				
Uranoscopus scaber Linnaeus, 1758	A(M)	VU	1, 2, 3, 4, 5, 6	Bat *et al.,* 2005; Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov, 2010; Oral *et al*., 2013; Zivkov *et al*., 2005;
Xiphiidae				
Xiphias gladius Linnaeus, 1758	C	LC	1, 2, 3, 4, 5, 6	Karapetkova & Zhivkov, 2010; Zivkov *et al*., 2005;
Zeidae				
Zeus faber Linnaeus, 1758	C	NE	1, 2, 3, 4, 5, 6	Fricke *et al*., 2007; Keskin, 2010; Karapetkova & Zhivkov BS TDA Zhivkov, 2010; Zivkov *et al*., 2005;

species form their own populations and become constant inhabitants of the Black Sea; others remain rare or known from single findings (Boltachev *et al*., 2009).

Analyzing the geographic origin of marine species, most of them (59.26%) have Atlanto-Mediterranean origin, 7.41% are cosmopolitans, 31.22% are endemics (Mediterranean and Black Sea) and 2.12% are introduced species (Indo-Pacific and European Waters) (Fig. 2, Table). The recent increasing species diversity in the Black Sea region is due to Mediterranean immigrants.

Marine fishes in the Black Sea are affected by a number of major threats as:

1) Over-exploitation of commercial fish stocks (for targeted species).
2) Industrial and domestic pollution.
3) Habitat loss - land use changes, river barriers, drainage.
4) Human disturbance fish farming, fishery management and the introduction of new species.

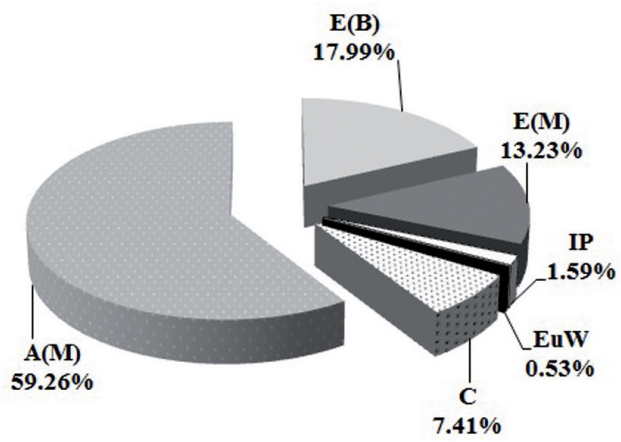

Fig. 2: Origin of marine species along the Black Sea Coast.

Conservation measures in the Black Sea, which should apply:

– Fishing restriction and management
– Marine Protected Areas are an important conservation tool. MPAs allow for the conservation of species and their biophysical environments and are an effective way to safeguard ecosystem services. When carefully designed and managed, MPAs can increase fish species richness (Tunesi & Molinari, 2005).
– Several international conventions and national initiatives exist to protect fish species. – Four International conventions such as CITES, the Bern Convention on the conservation of European wildlife and Natural Habitats and the Convention on the Conservation of Migratory species of wild animals (CMS or Bern Convention), are relevant to the conservation and management of Black Sea marine fish fauna.

The effective implementation and control of existing measures (national, international and regular) is very important for the survival of Black Sea fish species.

At national level, regulations are in place for the protection of red listed species. At the international level, however, no universal agreements between Black Sea countries exist extending protection to Red Listed species, with the exception of mammals.

Although some species are protected under national, regional or international conventions, the vast majority of

threatened species are not protected or subject to effective management plans. The creation of effective marine protected areas should be implementing in order to reduce pressure on fish populations and safeguard fish habitats. Further funding and research for endemic fish species is high priority.

Conclusions

This paper presents the actual and complete Black Sea fish check list as well as the conservation status of marine fish species. For most of the species (about 50% of all marine fish species), the conservation status was evaluated as data deficient and not evaluated. These groups may be included in the large proportion of threatened species

Sound fishery management and common conservation measures should be applied in all Black Sea countries. Priority areas for further research should be specified. Furthermore, monitoring of fish species and populations and genetical identification are needed for sustainable use of commercial fish species as well as protection of biodiversity. Scientific collaboration between Black Sea countries should continue in order to update the Check List and conservation status of marine fish species when new available information is obtained.

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