

REVIEW ARTICLE

Annotated check list of the non-native fish species (Pisces) of the Black Sea

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Abstract

Reviewing published data, we present a list of invasive alien fish species in the Black Sea coast, including data for year and place of the first occurrence in the national waters. Twenty-one species belonging to eight genera are listed.

Key words: Black Sea, invasive species.

Introduction

Invasive species are one of the great problems of the modern times (Skolka and Preda 2010). Globalization, increase of commercial trades and climatic changes make invasive species a general threat for all kinds of terrestrial, freshwater or marine ecosystems (Mooney 2005; Perrings *et al.* 2010).

The Black Sea is a particular marine basin, with special hydrological characteristics. It (~41–46° N) is a semi-enclosed basin whose only connection to the world's oceans is through narrow straits (<110 m depth), the Canakkale Strait (Dardanelles) and the Istanbul Strait (Bosphorus), both connecting to the Marmara Sea. The less saline water of the Black Sea (salinity ~17‰) flows to the Mediterranean Sea via an upper layer flows and more saline Mediterranean water (~38.5‰) flows to the Black Sea in a lower current. The low salinity, low species diversity and coastal ecosystems highly affected by eutrophication, combined with the high trade rate in the area, have encouraged the establishment of alien species with high ecological plasticity (Leppäkoski and Mihnea 1996).

Skolka and Preda (2010) summarized the data about non-native fishes established in the Romanian Black Sea coast. Many papers have also described new findings of single species in the Turkish Black Sea coast (*e.g.* Bat *et al.* 2005; Bat *et al.* 2006; Oral 2010; Balık and Turan 2004; Zaitsev and Öztürk 2001). The aim of the present paper is to compile a list of the invasive alien species in the Black Sea coast.

Results and Discussions

All non-native fish species known from the Black Sea were collected by reviewing published data are included in the list (Table 1).

In the last few decades, new findings on the introduced and rare species in the Black Sea show that the fish diversity in the Black Sea has been changed by the natural process of “mediterrization” (such as penetration of *Micromesistius poutassou*), extension of ranges of invading species (such as *Sphyraena obtusata*, *Sphyraena pinguis*), and the accidental introducing of exotic species (such as *Tridentiger trigonocephalus*) with ballast waters of vessels (Boltachev *et al.* 2009). Two specimens of the Indo West Pacific red barracuda, *Sphyraena pinguis* Gunther, 1874, were captured in Balaklava Bay on 20 August 1999, with a stake trap net (Boltachev and Yurakhno 2002). Blue whiting *Micromesistius poutassou* (Risso, 1827) was captured off Cape Aiya on 19 January 1999 with hooks and lines (Boltachev *et al.* 1999). This Atlantic Boreal species, widely distributed in most parts of the Mediterranean Basin (Fischer *et al.* 1937), is eurythermal, but stenohaline and inhabits oceanic waters of salinity not lower than 33‰ (Svetovidov 1964). This determines the uniqueness of finding blue whiting in the Black Sea water with an abnormally low salinity of 18.0‰.

Three specimens of *S. acus* were captured in the mouth of the Chernaya River, two of them (male and female) on 21 November 2006, and one specimen (female) on 27 August 2007 at a depth of 1.0–1.5 m. In the Black Sea, *S. acus* is first mentioned by Kessler (1877), but subsequently it was reidentified as *S. variegatus* Pallas, 1814 and excluded from the list of Black Sea fish species, but comparatively recently was found off the coasts of Turkey (Vasil'eva 2007).

The first finding of *Parablennius incognitus* (Bath 1968), in the Black Sea, according to Bogorodskii (2006), was recorded off the coast of Abkhazia in 2001. This species was also found off the coasts of Turkey and in the Kerch Strait (Vasil'eva 2007). Off the Crimean coasts, *P. incognitus* was first recorded in the area of Sevastopol in summer 2002, and in 2003, it was already found in mass at open rocky sites off the coast from Sevastopol to Fiolent. In the subsequent years, the numbers of this species slightly decreased, but continued to remain rather high. Possibly, *P. incognitus* appeared here slightly earlier, but was not recorded because of its low numbers and a great external similarity to another species typical for this locality- *P. zvonimiri*. At present, according to our observations, this species is spread along the entire southern coast of Crimea up to Karadag (Boltachev *et al.* 2009). The first findings of *Gobius cruentatus* (Gmelin, 1789) were recorded by the authors near Sevastopol in the area of Martynovaya Bay in 2002. Two specimens were captured in July 2007 off the western coast of the Sevastopol region (Boltachev *et al.* 2009). Recently *G. cruentatus* was found in the Black Sea off the coasts of Turkey (Engin *et al.* 2007), on the coasts of the Crimea, it is reported for the first time. Up to present, a steady increase in its number in the coastal zone and in the bays of Sevastopol has been observed. Two species *Pomatoschistus marmoratus* (Risso, 1810) and *Pomatoschistus bathi* Miller, 1982 were described by Vassilev *et al.* (2010) as a species inhabited the Bulgarian Black Sea coast. Nineteen samples of *Mugil soiyuy*, caught along the Bulgarian Black Sea coast, now accepted as *Liza haematocheila* Temminck *et* Schlegel, 1845 were genetically analyzed (Dobrovlov *et al.* 2003). The authors proved that this species should be included in Genus *Mugil*, not *Liza*. Raykov *et al.* (2012) reported the discovery of one specimen of *Umbra krameri* Walbaum, 1792 in the Black Sea in 2010. The species was found in Romanian territorial waters, in south-eastern direction from mouth of Sf. Gheorge, the Danube River arm at 36.3-41 m depth.

Table 1. Non-native fish list species in the Black Sea

	Place / Year of the first occurrence in national waters					Cited in
	BG	GE	RO	RU	TR	
Blenniidae						
<i>Parablennius incognitus</i> (Bath, 1968)						Crimea coast near Sevastopol 2002 Boltachev et al. 2009
Chaetodontidae						
<i>Heniochus acuminatus</i> (Linnaeus, 1758)					Balaklava Bay 2003	Boltachev and Astachov 2004
Centrarchidae						
<i>Lepomis gibbosus</i> (Linnaeus, 1758)			Danube Delta			Busnita 1929; Aleksandrov et al. 2007; TDA 2007
Clupeidae						
<i>Sardinella aurita</i> Valenciennes, 1847					Balaklava Bay 1999	Aleksandrov et al. 2007
Cyprinidae						
<i>Carassius gibelio</i> (Bloch, 1782)					1987	Salehova et al. 1987; Boltachev et al. 2009
Gadidae						
<i>Micromesistius poutassou</i> (Risso, 1827)					Cape Aiya 1999	Boltachev et al. 1999
Gobiidae						
<i>Gobius cruentatus</i> Gmelin, 1789					BS coastal zone 2006	Engin et al. 2007; Boltachev et al. 2009

Table 1. Continued

	Place / Year of the first occurrence in national waters					Cited in	
	BG	GE	RO	RU	TR		UA
<i>Gobius xanthocephalus</i> Heymer et Zander, 1992	2000s	Abkhazia Coast				Crimea coast zone 1967	Boltachev <i>et al.</i> 2009
<i>Millerigobius macrocephalus</i> (Kolombatović, 1891)						Sevastopol Bay 2009	Boltachev <i>et al.</i> 2010
<i>Tridentiger trigonocephalus</i> Gill, 1859						Sevastopol Gulf 2006	Boltachev and Karpova 2010; Oral 2010
<i>Pomatoschistus marmoratus</i> (Risso, 1810)	Marine, benthic 2010						Vassilev <i>et al.</i> 2010
<i>Pomatoschistus bathi</i> Miller, 1982	Marine, benthic 2010					Crimea coast near 2000	Boltachev and Karpova 2010; Vassilev <i>et al.</i> 2010
Moronidae							
<i>Morone saxatilis</i> (Walbaum, 1792)		Coastal zone 1965				Dniester liman 1965	Zaitsev and Öztürk 2001; Aleksandrov <i>et al.</i> 2007; TDA 2007
Mugilidae							
<i>Liza haematocheila</i> Temminck et Schlegel, 1845	Shelf area 2000	Shelf area 1975	Shelf area 1975	Shelf area	Shelf area	1968	Aleksandrov <i>et al.</i> 2007; TDA 2007; Dobrovolov <i>et al.</i> 2003
Poeciliidae							
<i>Gambusia holbrooki</i> (Girard, 1859)			Danube Delta			Sevastopol Bay / 2003	Manea 1985; Aleksandrov <i>et al.</i> 2007; TDA 2007

Table 1. Continued

	Place / Year of the first occurrence in national waters					Cited in
	BG	GE	RO	RU	TR	
Sparidae						
<i>Lithognathus mormyrus</i> (Linne, 1758)			Shelf area 1980			Stanciu and Ilie 1980; TDA 2007
Sphyraenidae						
<i>Sphyraena sphyraena</i> (Linnaeus, 1758)	Coastal area		Coastal waters 1905		Bosphorus region	Odessa coast 1905 Boltachev 2009
<i>Sphyraena pinguis</i> Günther, 1874					Balaklava Bay 1999	Boltachev and Yurakhno 2002
Syngnathidae						
<i>Syngnathus acus</i> Linnaeus, 1758					BS coastal zone 2006	Chernaya river mouth 2006 Boltachev <i>et al.</i> 2009
Sparidae						
<i>Sarpa sarpa</i> (Linnaeus, 1758)					Sinop-Samsun rocky,vegetation 1998	Crimea 1999 Bat <i>et al.</i> 2005
Umbridae						
<i>Umbrina krameri</i> Walbaum, 1792			Black Sea 2012			Raykov <i>et al.</i> 2012

BS states: BG- Bulgaria; GE- Georgia; RO- Romania; RU- Russian Federation; TR- Turkey; UA- Ukraine

Conclusion

The list of non-native fishes recorded in this study includes 21 species. It is also noted that this list of Black Sea non-native species in this area remains open to further recording.

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References

- Aleksandrov, B., Boltachev, A., Kharchenko, T., Liashenko, A., Son, M., Tsarenko, P., Zhukinsky, V. (2007) Trends of aquatic alien species invasions in Ukraine. *Aquatic Invasion* 27 (2): 215-242.
- Balık, S., Turan, D. (2004) A first record for the bighead goby (*Neogobius kessleri* Günther, 1861) along the Turkish Eastern Black Sea Coast. *Tr. J. Zool.* 28: 107-109.
- Bat, L., Demirci, G. G., Öztürk, M. (2006) Occurrence of *Apletodon dentatus bacescui* (Murgoci, 1940) (Gobiesocidae) and *Coryphoblennius galerita* (Linnaeus, 1758) (Blenniidae) at the central Black Sea coast of Turkey. *J. Black Sea/ Mediterranean Environment* 12 (1): 59-65.
- Bat, L., Erdem, Y., Ustaoglu, S., Yardım, Ö., Satılmış, H. H. (2005) A study on the fishes of the central Black Sea coast of Turkey. *J. Black Sea/ Mediterranean Environment* 11 (3): 287-302.
- Bogorodskii, S. V. (2006) Discovery of *Parablennius incognitus* (Blenniidae) off the Eastern Coast of the Black Sea, Northern Abkhazia. *Journal of Ichthyology* 46: 18-24.
- Boltachev, A. R. (2009) Specifying species belonging of Barracuda of Group *Sphyraena obtusata* (Pisces: Sphyraenidae) found in the Black Sea. *Voprosy Ikhtiologii* 49 (1): 135-137.
- Boltachev, A. R., Astakhov, D. A. (2004) An unusual finding of pennant coralfish *Heniochus acuminatus* (Chaetodontidae) in Balaklava Bay (Sevastopol, Southwestern Crimea). *Journal of Ichthyology*, 44 (6): 853-854 (in Russian).
- Boltachev, A. R., Gaevskaya, A. V., Zuev, G. V., Yurakhno, V. M. (1999) The blue whiting, *Micromesistius poutassou* (Risso, 1826) (Pisces: Gadidae), the new species for the Black Sea fauna. *Ecologiya Morya* 48: 79-82 (in Russian).

- Boltachev, A. R., Karpova, E. P. (2010) Bath's goby *Pomatoschistus bathi* (Perciformes, Gobiidae) is the new species for the ichthyofauna of the Crimean Black Sea coastal zone. *Marine Ecological Journal*. T. 9 (2): 57 (in Russian).
- Boltachev, A. R., Karpova, E. P., Danilyuk, O. N. (2009) Findings of new and rare fish species in the coastal zone of the Crimea (the Black Sea). *J. Ichthyology* 49: 277-291.
- Boltachev, A. R., Yurakhno, V. M. (2002) New evidences of the Black Sea ichthyofauna mediterraneanization. *Voprosy ichtiologii*. T. 42 (6): 744-750 (in Russian).
- Busnita, T. (1929) Fishery, Issue Sept. (in Romanian).
- Dobrovolov, I., Ivanova, P., Vasilev, V. P., Jonkov, J. I. (2003) Genetic divergence of mugilid fishes (Genus Mugilidae, Pisces) in the Bulgarian Black Sea coastal waters. Proceeding of the 30th International Conference *Pacem in Maribus*, A year after Johannesburg. Ocean Governance and Sustainable Development: Ocean and Coasts – a Climpse into the Future, October 27-30, 2003, Kiev, Ukraine.
- Engin, S., Turan, D., Kovacic, M. (2007) First record of the red-mouthed goby, *Gobius cruentatus* (Pisces: Gobiidae), in the Black Sea. *International Journal of Ichthyology CYBIUM* 31 (1): 87-88.
- Fischer, W., Bauchot, M. L., Schneider, M. (1937) Fiches FAO d'identification des espèces pour les besoins de la pêche. (Revision 1), Méditerranée et mer Noire, Zone de Pêche 37, 2, Vertébrés FAO, 761-1530 pp.
- Kessler, K. T. (1877) The Aralo-Caspian Expedition. IV. Fishes of the Aralo-Caspio-Pontine ichthyological region. St. Petersburg. *Naturgeschichte der Fische Islands*, 360 pp.
- Leppäkoski, E., Mihnea, P. E. (1996) Enclosed seas under man-induced change: a comparison between the Baltic and Black Seas. *Ambio* 25 (6): 380-389.
- Manea, Gh. (1985) Acclimatization of New Species of Fish and Other Aquatic Organisms. Ceres Publishing House, Bucharest.
- Mooney, H. A. (2005) The nature of the problem. In: *Invasive Alien Species*, (eds., A. H. Mooney, N. R. Mack, A. J. McNeely, E. L. Neville, P. J. Schei, K. J. Waage), A New Synthesis, SCOPE 63. Island Press, Washington DC., 1-15 pp.
- Oral, M. (2010) Alien fish species in the Mediterranean-Black Sea Basin. *J. Black Sea/Mediterranean Environment* 16 (1): 87-132.
- Öztürk, B., Turan, C. (2012) Alien species in the Turkish Seas. In: *The State of the Turkish Fisheries*, (eds., A. Tokaç, A. C. Gücü, B. Öztürk), Turkish Marine Research Foundation, Istanbul, 92-130 pp.

Perrings, C., Mooney, H., Williamson, M. (2010) *Bioinvasions and Globalization: Ecology, Economy, Management and Policy*. Oxford University Press, 266 pp.

Raykov, V., Panayotova, M., Ivanova, P., Dobrovolev, I., Maximov, V. (2012) First record and allozyme data of European mudminnow *Umbra krameri* Walbaum, 1792 (Pisces: Umbridae) in the Black Sea. *Comptes rendus de l'Academie bulgare des Sciences* 65 (1): 49-52.

Salehova, L. P., Kostenko, N. S., Bogachik, T. A., Minibaeva, O. N. (1987) The composition of fish fauna in the area of Karadag State Reserve (Black Sea). *Journal of Ichthyology* 27(6): 898-905 (in Russian).

Skolka, M., Preda, C. (2010) Alien invasive species at the Romanian Black Sea coast – present and perspectives. *Travaux du Muséum National d'Histoire Naturelle «Grigore Antipa»* LIII: 443-467 (in Romanian).

Stanciu, M., Ilie, G. (1980) *Lithognathus mormyrus*, a new species of Sparidae at the Romanian littoral // Pontus Euxinus, *Studii si cercetari CSMN-Constanta*, 1: 107-110 (in Romanian).

Svetovidov, A. N. (1964) *The Fishes of the Black Sea*. *Opred Faune SSSR*, 86 pp (In Russian).

TDA (2007) *Black Sea Transboundary Diagnostic Analysis*. 227 pp.

Vasil'eva, E. D. (2007) *Fishes of the Black Sea. Key to Marine, Brackish-Water, Eurihaline and Anadromous Species with Color Illustrations* collected by S.V. Bogorodsky. VNIRO Publishing, Moskow, 237 p. (in Russian).

Vassilev, M., Apostolou, A., Velkov, B., Ivanova, P., Panayotova, M., Pehlivanov, L. (2010) Status of Gobiid ichthyofauna (*Gobiidae*) in Bulgaria: taxonomical, conservative, ecological and social aspects. IV International Symposium of Ecologists of the Republic of Monte Negro, Budva, 6-9 October 2010, *Natura Montenegrina, Podgorica*, 10 (2): 115-124.

Zaitsev, Yu., Öztürk, B. (2001) *Exotic species in the Aegean, Marmara, Black, Azov and Caspian Seas*. Turkish Marine Research Foundation, Istanbul, Turkey, No: 8, 267 pp.

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