J. Black Sea/Mediterranean Environment
Vol. 19, No. 3: 365-379 (2013)

REVIEW ARTICLE

A proposal for new marine protected areas along the Turkish Black Sea coast

Bayram Öztürk*[1,2], Bülent Topaloğlu[12], Ahmet Kıdeys[3], Levent Bat[4], Çetin Keskin[1], Murat Sezgin[4], Ayaka Amaha Öztürk[12], Ahmet Cevdet Yalciner[5]

[1]Faculty of Fisheries, Istanbul University, Ordu St., No: 200, 34470, Laleli, Istanbul, TURKEY

[2]Turkish Marine Research Foundation, (TUDAV), P.O. Box: 10, Beykoz, Istanbul, TURKEY

[3]Institute of Marine Science, Middle East Technical University, P.O.Box 28, 33731, Erdemli, Mersin, TURKEY

[4]Faculty of Fisheries, Sinop University, 57000, Sinop, TURKEY

[5]The Ocean Engineering Research Center (OERC), Middle East Technical University, Inonu Boulevard, 06531, Ankara, TURKEY

*__Corresponding author:__ ozturkb@istanbul.edu.tr

Abstract

Marine living resources are diminishing in the Turkish Black Sea whilst marine biological diversity is facing various threats from overfishing as well as illegal, unreported or unregulated fishing, pollution - both vessel and land-based, alien species, marine litter, and climate change. The designation of Marine Protected Areas (MPAs) will greatly improve the protection of marine biodiversity and sustainable fisheries in the region. Five ecologically important sites were recommended for designation as MPAs along the Turkish coast, where currently no MPA exists. These were proposed by taking into account those criteria specified by the Convention of Biological Diversity (CBD), such as uniqueness, life history stages of species, importance for threatened, endangered species or habitats, vulnerability, fragility, sensitivity or slow recovery and biological productivity.

Keywords: Black Sea, Marine Protected Areas (MPAs), Turkey

Introduction

The coastline of Turkey which is surrounded by the Mediterranean, Aegean, Marmara and Black Seas is about 8,500 km in length, excluding islands. This extensive marine and coastal fringe supports a rich and important biodiversity. However, the coastal and marine biodiversity of the Turkish Black Sea is constantly under serious threat due to the pressures exerted by mankind. The major threats are posed by the destruction of marine habitats and ecosystems, over-exploitation of marine resources and the loss of coastal habitats through mass urbanization.

The Black Sea is an enclosed system encompassing the largest anoxic basin on the planet, due to the limited water renewal and exchange with the Mediterranean Sea and Atlantic Ocean through the Istanbul (Bosphorous) Strait. This unique property renders the Black Sea ecosystem rather vulnerable to anthropogenic pressures and require special protection for its biodiversity.

In addition, the Black Sea faces numerous problems, such as overfishing, illegal, unreported, unregulated (IUU) fishing (Öztürk 2013), ship-based pollution, e.g. oil spills and bilge water, the intentional and/or accidental introduction of alien species by various vectors (Kideys 2002; Zaitsev and Öztürk 2001), eutrophication, marine litter (Topçu and Özturk 2012), habitat destruction and climate change. Some commercial fish species such as bluefin tuna, sturgeons and mackerel, have been under threat from overfishing for the last 2-3 decades.

One of the most effective solutions for the recovery of a marine ecosystem is to designate Marine Protected Areas (MPAs) in certain areas of ecological or biological significance in the given sea according to the Convention of Biological Diversity (CBD). The main goals of assigning such protected areas are to preserve biological diversity and maintain essential ecological processes to both ensure the sustainable use of species and ecosystems and to protect environmental quality, the health and safety of coastal communities and of resource users (UNEP 1987).

Several MPAs and reserves have been designated by other Black Sea coastal states, with the exception of Turkey. According to the UNEP-World Conservation Monitoring Centre (World Protected Areas Data Base 2008), some 125 protected areas have been designated bordering the Black Sea coast. These vary in size from tiny scientific reserves of only 1 ha up to the newly designated Zernov's *Phyllophora* Field in the northwestern shelf of the Ukraine (402,500 ha). At present, it appears that some 1.1 million ha of coastal/marine protected areas have been designated by Black Sea countries, however about half of these are represented by the Danube Delta Biosphere Reserve in Romania alone, one of which is 2 Mai Vama Veche (Romania), entirely marine, covering 5,000 ha. Zernov's *Phyllophora* Field Botanical Reserve (Zakaznik),

declared in November 2008, is entirely marine and covers 402,500 ha. Chernomorskiy Biosphere Reserve (Ukraine) includes Tendrivsky and Yagorlitsky Bays which cover 74,971 ha of the area; and Bolshoi Utrish (Russia) has 2,530 ha of marine area up to 40 m deep extending 2 km offshore. The Bulgarian Black Sea comprises 42 designated protected areas: mainly coastal, terrestrial, wetlands and between them the Ivan and Peter Islands, Cape Caliakra Reserve and the Kolkheti National Park (wetland and marine component) are designated as marine protected areas among 23 other conservation sites in Georgia (BSC 2009).

MPAs can encompass intertidal or subtidal regions and are sometimes associated with land protected either by law or other effective means in order to safeguard areas of high biological importance and productivity**.** The idea of restricting human activities within the marine environment has existed for centuries in some regions of the world. Areas closed either seasonally or permanently to fishing have been set up and managed by local communities to help maintain fishery resources. Over the last century, MPAs, variously labelled as marine parks, reserves, or sanctuaries, have been created to help protect vulnerable habitats and threatened species, increase fishery production by protecting critical breeding, nursery and feeding grounds such as wetlands, seagrass beds, reefs and estuaries, protect breeding populations which can help restock and restore overexploited areas, reduce the impacts of tourism and other direct human pressures, and provide local communities with alternative livelihoods such as well- managed ecotourism.

Despite the length of the Turkish Black Sea coastline, no MPAs have to date been designated. The Turkish Black Sea is known to host sensitive and rich habitat diversity, with coastal dunes, marine caves, canyons, wetlands, reefs and islands. In addition, the Turkish Black Sea is a spawning ground for migratory fish species such as bonito (Demir 1957; Demir and Demir 1961), anchovy (Bingel and Gücü 2010), bluefish (Ivanov and Beverton 1985), and sprat (Avşar 1994). Furthermore the western region of the Turkish Black Sea is also reported as a calving and breeding area for cetacean species (Dede and Tonay 2009). Öztürk *et al.* (1988) reported that cetaceans are often sighted near the Istanbul Strait. In addition, several observations of bottlenose dolphins and harbour porpoises whose population levels have been decreasing during the last 20 years have been made between Şile to Kefken, mostly in winter (unpublished data). Two MPA sites are suggested by Öztürk (1998, 2003) in the Strategic Action Plan for the Turkish Black Sea. Those are the Prebosphoric area near the Istanbul Strait, which is extremely important for species migrating between the Black and Mediterranean Seas and the area between Doğanyurt – Cide for its caves and remote beaches being potential monk seal habitats. Topaloğlu and Öztürk (2008) suggested that the Kıyıköy region is also suitable due to high species diversity and unique habitats for benthic assemblages. However, no proposals as yet have been made for MPAs in the eastern Turkish Black Sea.

Recently, more effort is being spent to increase the number of MPAs as well as to enhance the networking of existing ones in the Black Sea as mentioned in the Strategic Action Plan adopted in 2007 by the Black Sea Commission within the framework of the Bucharest Convention to which all Black Sea coastal countries are signatory. Coupled with this, the EU-FP7 project, CoCoNet (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), is dedicated towards this aim. Four Turkish partners (Istanbul University - Faculty of Fisheries (IU-FF); Sinop University - Faculty of Fisheries (SNU-FF), Middle East Technical University (METU) - Institute of Marine Sciences (IMS) and METU - The Ocean Engineering Research Center (OERC)) are members of the consortium, involved in various tasks in the project, including the identification of potential MPAs in the western Turkish Black Sea. Recently, the Turkish Ministry of Forestry and Water Affairs has also started gathering information on the potential MPA sites and several universities have submitted their proposals to the Ministry. This paper aims to propose some of the potential marine protected areas which can be designated in the Turkish Black Sea as well as to provide background information to the decision makers and stakeholders for the protection of the Black Sea marine biodiversity, based on published papers, grey literature (reports of projects, expeditions and meetings), interviews with fishermen and local people in the targeted areas on the Turkish coast of the Black Sea.

The Turkish area of the Black Sea can be divided into two regions, namely eastern and western. The western region is partly under the influence of Mediterranean originated water and its biotic components through the Turkish Straits System which is the only source of water renewal and is of vital importance for the biodiversity of the Black Sea (Öztürk and Öztürk 1996; 2005). The eastern area of the Black Sea is considered from Sinop to the Georgian border and is not significantly influenced by the Mediterranean water.

MPAs Proposed for the Turkish Black Sea

Zone 1: İğneada region (Fig. 1)

Implementation of a regional strategy for conservation of the Black Sea is only possible by the establishment of transboundary protected areas, which currently do not exist. To start with, transboundary areas designated as MPAs between Turkey and Bulgaria and development of strategies for elaboration and implementation of bilateral management plans with assigned responsibilities between two states may be effective. Therefore, a protected area near the border between Turkey and Bulgaria is proposed. The İğneada region which lies on a coastal plain on the European and Turkish zones of the Black Sea is assessed to be the most appropriate location for such a transboundary protected area.. The potential area proposed comprisesthe İğneada coastal inshore marine area and a

terrestrial component, Strandja between Bulgaria and Turkey. The terrestrial portion of İğneada is already under protection due to its unique waterlogged forests, wetlands on alluvial soils and coastal sands. The area is of ultimate importance for biological diversity providing a habitat to many flora and fauna species. The human population density in this region is also very low for Turkey (as well as for Bulgaria) hence the anthropogenic stress is very limited on this coastal ecosystem.

Fish species, such as whiting *Merlangius merlangus,* red mullet *Mullus barbatus* and turbot *Scophthalmus maeotica,* are target species of large scale fisheries in the waters off İğneada (Keskin 2012). Shallow water in the region is utilized as the nursery grounds of these commercial species as well as by the juveniles of bonito *Sarda sarda* which have been bycaught in trawl fishing. Coastal marine biodiversity here is rich in terms of endemism (*i.e.* knout goby *Mesogobius batrachocephalus*) and rare species, such as the horse pipefish *Syngnathus tenuirostris* (Keskin 2010; 2012). The İğneada area also serves as a spawning and feeding ground of turbot *S. maeotica*. This species is under threat in the whole Black Sea due to overfishing and IUU fishing. Uyanık (2007) reported in İgneada and its adjacent waters several fish species including sturgeon and turbot, to be under threat due to overfishing.

Furthermore, the İğneada area lies close to already established Bulgarian MPAs, such as the Ivan and Peter Islands, therefore it can provide connectivity between two MPAs and may be able to facilitate joint action and management. Besides, Trayanov *et al.* (2007) proposed protected areas from Chernomorets to Resovska River near the Turkish border.

Zone 2: Şile -Kefken

The second proposed area in the western Black Sea between Şile and Kefken (Zone 2) has vital importance for the marine and coastal biodiversity of the Turkish Black Sea due to its close proximity to the Istanbul Strait which is a unique marine corridor. Such corridors preserve ecosystem structure, function and connectivity by linking core areas (e.g. feeding, breeding, nursery and wintering grounds) and can serve as stepping stones between the core areas where animals travel in large numbers between adjacent seas (Pickaver 2002).

Several migratory species including marine birds are observed in this region. Nankinov (2001) reported that the prebosphoric area is significant as a habitat for the Manx shearwater (*Puffinus puffinus*). Yarar and Magnin (1997) reported that the Şile islands are important sanctuaries mainly for cormorants and common gulls, because these islands have been protected for a historical reason since 1992. Besides, coastal sand dunes are found in the proposed area (Gehu and Uslu 1989). Özhatay (2010) reported sand dunes together with their associated floral species to be under threat on the coasts of Şile.

Small scale fisheries are important around Şile and therefore local fishermen will benefit from MPAs in most of the area. Sandy shallow waters along the Şile coast are important nursery areas especially for the species sand sole *Pegusa lascaris,* common sole *Solea solea* and turbot. In addition, this area is important for some fish species which are included in the IUCN Redlist, such as common thresher shark *Alopias vulpinus*, spiny dogfish *Squalus acanthias*, long-sounted seahorse *Hippocampus guttulatus* and European sturgeon *Huso huso.*

This region is also under the risk of alien species invasion. Twenty-eight alien species have been determined in the Turkish Black Sea and these invaders generally settle in the prebosphoric area, most probably due to easy acclimatization and intense shipping traffic between the Black and Mediterranean Seas.

Feeding grounds and distribution areas for the larvae and eggs of commercial fishes such as anchovy, sardine, sprat, mackerel, chub mackerel, whiting, mullet, Mediterranean horse mackerel and Atlantic horse mackerel, have been reported by Mater and Cihangir (1990) near the Istanbul Strait and around Şile.
The islands off Şile and Kefken include diverse habitats such as seagrass meadows, muddy bottom, rocky bottom, caves and reefs. These habitats signify a rich fauna of fish and invertebrates in Zone 2. In addition, with outstanding reefs and biogenic formations, this area deserves more stringent measures to be introduced for its conservation.

Zone 3: Cide – Doğanyurt
The third proposed zone is between Cide and Doğanyurt, where there are still some sightings of the Mediterranean monk seal *Monachus monachus***.** Berkes *et al.* (1979) mentioned at least 15 seals in the Turkish waters of the Black Sea. Öztürk (1996) identified two adult animals in the Cide, Çatalzeytin, İnebolu, Abana and Doğanyurt areas along the western Turkish Black Sea coast. The population status of the Mediterranean monk seal along the Turkish coasts of the Black Sea proves these creatures to be critically endangered and therefore the area between Doğanyurt and Cide deserves to be a marine protected area. Recently in 2010, two individuals of the Mediterranean monk seal were sighted on the coast of Doğanyurt.

Zone 4: Kızılırmak and Yeşilırmak Rivers and Deltas
The fourth proposed zone is between the Kızılırmak and Yeşilırmak Rivers and Deltas. These two rivers are the most important rivers which enrich the wetland and deltaic ecosystems in the Turkish Black Sea. Mainly in the deltas of the Kızılırmak River, sturgeon species spawn on the pebble bottom whereby their larvae drift downstream and feed in the deltas until the beginning of autumn whenthe now formed juveniles and adult individuals inhabit the open sea. The appearance of sturgeon species such as *Acipenser gueldenstaedtii, A. stellatus* and *Huso huso* throughout the Southern Black Sea coasts is the highest in the

Yeşilırmak-Kızılırmak Basin (Ustaoğlu *et al.* 2011). Furthermore, sturgeon stock enhancement programmes are continuing in and around the two rivers. The Kızılırmak and Yeşilırmak wetlands are not only supporting biodiversity but also play a vital role in groundwater discharge and recharge (Wilson and Moser 1994). The delta of the Kızılırmak river provides several habitat types, such as marine, riverine, lake, dunes, and forest, and such habitat diversity should be preserved (Yeniyurt *et al.* 2008). These important wetlands connected to a marine ecosystem are sensitive and dependant on each other. This delta was declared as a Ramsar site in 1998.

The Kızılırmak and Yeşilırmak Deltas are proposed as MPAs in the Turkish Black Sea and it is suggested that basin management and the ecosystem approach can be applied to both sites as both areas contain freshwater, terrestrial and marine habitats (BSC 2009). Moreover, the Ministry of Forestry and Water Affairs (2012) reported that the delta of the Yeşilırmak river necessitates protection due to its wetland characteristics.

Zone 5: Mezgit Reef off Trabzon

Zone 5 is a reef located near Trabzon. Reefs are important habitats for all marine life, particularly for benthic species. Mezgit Reef is one of the priority areas in terms of habitat diversity off Trabzon in the eastern Turkish Black Sea. This kind of habitat is rare and therefore needs to be protected. Demirel (1993) reported that Mezgit Reef is situated in the middle of the sea at a depth of 80-90 m, about 2 km in length and is found at a distance of 30 nmiles from Trabzon. The main fish species found there are turbot, whiting, mullet and red mullet. However, further investigation is needed.

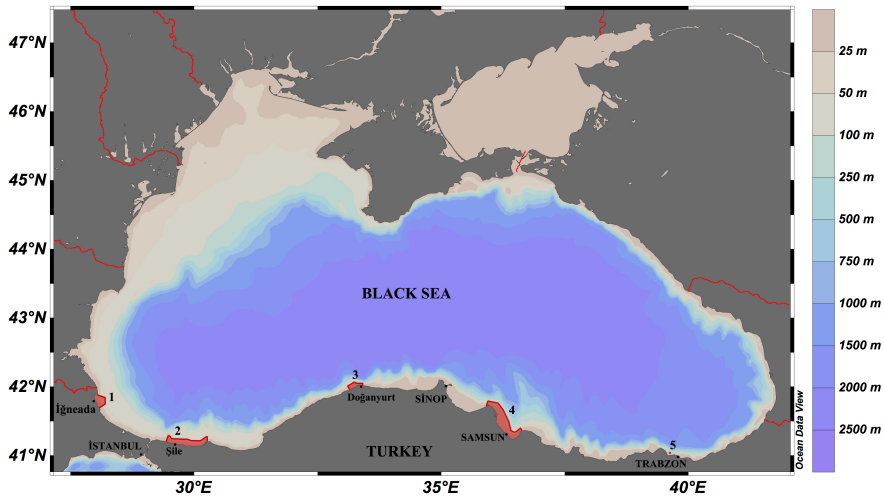

Figure 1. Proposed MPA sites for the Turkish Black Sea

Conclusion

Currently, only 2.8 % of Turkey's 8,300 km coastline is under protection with more than 60% of these MPAs restricted to the Aegean coast (Şekercioglu *et al.* 2011). Taşeli (2007) reported that 14 specially proteced areas (SPA's) exist in the Mediterranean region of Turkey, including terrestrial areas. However, there is no MPA in either the Black Sea or Marmara Sea at present. In fact, these seas are interconnected and form the migration routes of mainly high level pelagic species and cetaceans. This unique case illustrates the importance of establishing and designating MPAs in the Turkish Black Sea, due to its function for ecological connectivity both between basins and within a basin. Moreover, the careful preparation of management plans is also necessary in order to facilitate conservation efforts in the Black Sea and prior to the designation of MPAs.

In this paper, five distinct zones are proposed for MPA designation in the Turkish Black Sea covering a total surface area of 1189.9 km^2, comprising only 2 % of the Turkish territorial water in the Black Sea (see Table 1). The largest site proposed is that from Şile to Kefken with the smallest being the Mezgit Reef.

Table 1. Surface areas of the proposed MPA's in the Turkish Black Sea

Zones	Areas	Surface area (km^2)
Zone 1	İgneada	143
Zone 2	Şile - Kefken	366
Zone 3	Doğanyurt	37.4
Zone 4	Kızılırmak and Yeşilırmak	642
Zone 5	Mezgit Reef	1.5
	Total	1189.9

Turkey is a party of the CBD and one of the recent strategic goals is to improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity. Aichi Biodiversity has set targets that by 2020, at least 17 % of terrestrial and inland waters, and 10 % of coastal and marine areas, especially those areas of particular importance for biodiversity and ecosystem services, to be conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes. To reach this 2020 target, Turkey needs more MPAs, covering all Turkish waters, particularly the Black Sea.

The MPAs in the Turkish regions of the Aegean and Mediterranean Seas cover a total area of 13,358.68 km^2, of which 2,865.60 km^2 is marine and coastal, whilst 10.493.08 km^2 is terrestrial. Ten MPAs comprise only about 4 % of the total

marine areas in Turkey. If we accept this proportion as it is, the remaining 6% can be fulfilled by the Marmara Sea and Turkish zone of the Black Sea to reach 10%, a strategic goal for CBD.

Three zones were proposed for the western region of the Black Sea. İğneada Zone is located in the European part of the Turkish Black Sea. Zone 2 between Şile and Kefken has a connection with the Mediterranean Sea in terms of biodiversity components and water exchange. The Mediterranean monk seal is a critically endangered species and Zone 3 is proposed for the *in situ* protection of this single pinniped species in the Black Sea.

Several canyons and sea fans have been reported in the Turkish Black Sea by Aksu *et al.* (2002), Algan *et al.* (2002), Çiftçi *et al.* (2003), Flood *et al.* (2009) and Okay *et al.* (2011). Peculiar ecosystems, such as canyons, fans and cold seeps, should be studied in detail in terms of ecology and their functions as in the Mediterranean Sea.

In the eastern Black Sea, two zones are proposed due to large wetland areas, which are integral parts of the terrestrial, marine and coastal biodiversity. Some endangered fish species, such as sturgeon, are also found in this area. Kara *et al.* (1994), however, reported that between Sinop and Samsun main fish stocks were depleted due to overfishing.

Reefs and caves are priority habitats for the EU Marine Habitat Directives and Marine Strategy Framework. Mezgit Reef off Trabzon is a unique area for biological conservation.

In addition to the proposed sites, there are various places which may be candidates for MPAs, such as the Giresun Island and small islets including reefs off Tirebolu, but further detailed studies are required for these areas in order to determine their marine habitats and biodiversity. Moreover, the Georgian border needs to be studied for the transboundary nature of MPA.

Depth and habitat types are important for the designation of MPAs. In the five areas proposed in this paper, the depths ranged from 20 to 120 meters. Habitat types were muddy, rocky, sandy, caves and reefs. Depth ranges and habitat types are given in Table 2.

The designation of MPAs will also help reduce and mitigate illegal trawling activities which are particularly destructive to benthic communities. Trawling severely alters deepwater and coastal ecosystems and their associated fauna, reducing both the number of species and available habitats. This is particularly the case for Zones 1 and 2.

Table 2. Habitat types and depth range of the proposed MPA's in the Turkish Black Sea.

	Habitat Type						
	Muddy	**Rocky**	**Sandy**	**Mixed**	**Caves**	**Reefs**	**Depth range (m)**
Zone 1	x	x	x	x			0-100
Zone 2	x	x	x	x	x		0-150
Zone 3		x	x		x		0-100
Zone 4	x	x	x	x			0-100
Zone 5						x	65-100

Turkey operates different policies in the Black Sea and Mediterranean Sea in terms of marine resources management and governance, which is often a subject of controversy. The Turkish government supposes that the Mediterranean Sea is of greater importance in terms of tourism and biodiversity and is less important for fishing. In fact, there are 10 marine and coastal MPAs in the Turkish waters of the Aegean and Mediterranean Seas. For the Black Sea, however, the situation is completely different from the Mediterranean Sea and there no marine protected area has to date been established. The reason for the absence of any MPA in the Black Sea can be explained as follows. In the Mediterranean Sea, many coastal MPAs are established in various sizes, while the entire coastline has been allocated by practice as fishing grounds in the Black Sea. The Turkish authorities are reluctant for the designation of MPAs in the Black Sea due to reducing or diminishing fishing yields along the Turkish coasts and are afraid of the possible reaction from the fishing community in the case of closing or banning certain areas to fishing in the Black Sea. At present, 76.5% of the Turkish fishing yield originates from the Black Sea (TUIK 2012, Figure 2) and 5113 fishing boats are licensed to fish throughout the entire coast of the Black Sea, which accounts for 33% of the total Turkish fishing fleet.

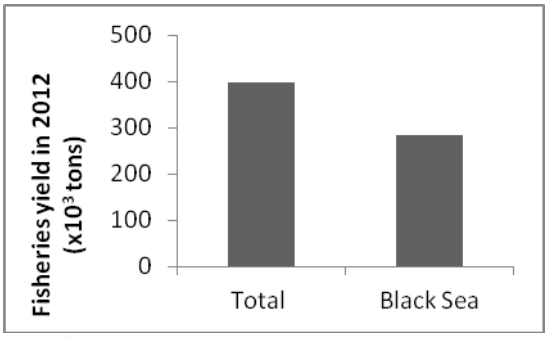

Figure 2. Total fisheries yield for Turkey and the Turkish Black Sea in 2012

GFCM (2013) recently adopted Recommendation (GFCM/37/2013/2) on the establishment of a set of minimum standards for bottom-set gillnet fisheries for turbot and the conservation of cetaceans in the Black Sea. Fisheries management measures related to turbot in the Black Sea and for the mitigation of marine mammals' by-catch also show how turbot stocks were depleted. In particular, Zones 1 and 2 are spawning and breeding grounds of turbot. In the case of MPA designation, the stocks of turbot can be recovered if properly managed.

Acknowledgement

This study was made possible by the contribution of 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) and contribution to European Community DG Environment under Grant Agreement number: 07.020400/20 12/616044/SUB/D2 for the project "MSFD Guiding Improvements in the Black Sea Integrated Monitoring System (MISIS)". The authors are also grateful to Allison Kideys for her help.

References

Akbulut, B., Zengin, M., Çiftçi, Y., Ustaoğlu Tırıl, S., Memiş, D. Alkan, A., Çakmak, A. Kurtoğlu, I.Z., Aydin, I., Üstündağ, E., Eroğlu, O., Serdar, S. (2011) Stimulating sturgeon conservation and rehabilitation measures in Turkey: an overview on major projects (2006–2009), Technical contribution. *J. Appl. Ichthyol*. 27: 415–419.

Algan, O., Gökaşan, E., Gazioğlu, C., Yücel, Z.Y., Alpar, B., Güneysu, C., Kirci, E., Demirel, S., Sari, E., Ongan, D. (2002) A high-resolution seismic study in Sakarya Delta and Submarine Canyon, southern Black Sea shelf. *Continental Shelf Research* 22: 1511–1527.

Bat, L., Erdem, Y., Ustaoğlu, 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.

Berkes, F., Anat, H., Esenel, H., Kışlalıoğlu, M. (1979) Distribution and ecology of *Monachus monachus* on Turkish coasts. In: The Mediterranean Monk Seal, the 1st workshop, 2-5 May 1978, Rhodes, Greece, UNEP Tech.Rep.,1. Pergamon Press, Oxford, pp. 113-127.

Bingel, F., Gücü, A.C. (2010) Black Sea anchovy and stock assessment. In: Proceedings of the Sustainable Fisheries Workshop, National Anchovy Workshop, June 17-18, 2010, Trabzon, pp. 38-57 (in Turkish).

BSC (2009) Implementation of the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (2002-2007). The Commission on the Protection of the Black Sea against Pollution (BSC), Istanbul. 252 pp.

Çiftçi, G., Dondurur, D., Ergün, M. (2003). Deep and shallow structure of large pockmarks in the Turkish shelf, eastern Black Sea. *Geo-Mar. Letter* 23: 311-322.

Dede, A., Tonay, T. (2010) Cetacean sightings in the Western Black Sea in autumn 2007. *Journal of Environmental Protection and Ecology* 11 (4):1491–1494.

Demir, M. (1957) Migrations of *Sarda sarda* Bloch in the Black, Marmara, and Aegean Seas; the probable spawning places and time. *GFCM Techn. Paper* No. 18: 127-134.

Demir, M., Demir, N. (1961) Contribution to the knowledge of the eggs of the common bonito (*Sarda sarda* Bloch). *GFCM Techn. Paper* No. 27: 213-218.

Demirel, O. (1993) Hydrographic plans and three dimensional images of bottom morphology by echosounder data. Karadeniz Technical University, Graduate School of Natural and Applied Sciences, Fisheries Technology Engineering Graduate Programme. May 1993, Trabzon (Master Thesis). 48 p. (in Turkish).

Ergün, M., Dondurur, D., Çiftçi, G. (2002) Acoustic evidence for shallow gas accumulations in the sediments of the Eastern Black Sea. *Terra Nova* 14: 313-320.

Flood, D.R., Hiscott, R., Aksu, A.A. (2009) Morphology and evolution of an anastomosed channel network where saline underflow enters the Black Sea. *Sedimentology* 56 (3): 807-839.

Gehu, J.-M., Uslu, T. (1989) Données sur la végétation littorale de la Turquie du Nord-Ouest (Data on the littoral vegetation of North-West Turkey). *Phytocoenologia* 17 (4): 449-505.

GFCM (2013) Thirty-Seventh Session of the Commission,13-17 May 2013. Split, Croatia.

Ivanov, L., Beverton, R.J.H. (1985) The Fisheries Resources of the Mediterranean. Part Two: Black Sea. Stud. Rev. GFCM 60. 135 pp.

Kara, Ö.F., Kaya, M., Benli, H.A., Mater, S. (1994) The productivity and hydrographic properties of the trawl areas of the middle and eastern Black Sea. In: Proceeding of the Black Sea Symposium, 16-18 Sep. 1991, (ed., K.C.

Güven), the Black Sea Foundation for Education, Culture and Protection of Nature, İstanbul, pp. 205 -222.

Keskin, C. (2010) Distribution of demersal fish species in the Black Sea, the Sea of Marmara and the Aegean Sea (NE Mediterranean). *Rapp. Comm. int. Mer Médit*. 39: 560.

Keskin, Ç. (2012) A preliminary study on demersal fishes in the south-western Black Sea shelf (NW Turkey). *J. Black Sea/Mediterranean Environment* 18 (3): 341-349.

Kutaygil, N., Bilecik, N. (1998) Study on the shark species spiny dogfish *Squalus acanthias* in Black Sea Anatolian littoral. T.C. T.K.İ.B. Su Ür. Ar. Ens. Müd. Bodrum. Seri B, No. 2. (in Turkish).

Mater, S., Cihangir, B. (1990) An investigation on the fish egg-larva distribution in the Black Sea entrance of the Bosphorus. X. Ulusal Biyoloji Kongresi 18-20 Temmuz 1990, Erzurum. pp: 209-215. (in Turkish).

Ministry of Forestry and Water Affairs (2012) Biodiversity research of wetlands in the Yeşilırmak Delta. Ministry of Forestry and Water Affairs, Directorate of Nature Conservation and National Parks, Samsun, 210 pp. (in Turkish).

Nankinov, N.D. (2001) Migration, seasonal and spatial distribution of Manx Sherarwater, *Puffinus puffinus* in the Black Sea basin. *Oceanology* 3: 170-179.
Özcan, İ., Cihangir, B. (2005). The distribution of juvenile fish and larva in the Black Sea in 2003. *Türk Sucul Yaşam Dergisi* 4: 1-8. (in Turkish).

Okay, S., Jupinet, B., Lericolais, G., Çiftçi, G., Morigi, C. (2011) Morphological and stratigraphic investigation of a holocene subaqueous shelf Fun, North of the İstanbul Strait in the Black Sea. *Turkish Journal of Earth Sciences* 20: 287-305.

Özhatay, N. (2010) Wild plants and important vegetation area in Şile. A light on the horizon. Uluslararası Deniz Feneri Sempozyumu, Işık Üniversitesi Yayınları, İstanbul, 1. Derleyen H. Ansal. pp. 29-40. (in Turkish).

Öztürk, B. (1996) Past, present and future of the Mediterranean monk seal *Monachus monachus* (Hermann,1779) in the Black Sea. In: Öztürk, B. (ed.), The Proceedings of the First International Symposium on the Marine Mammals of the Black Sea, Istanbul. UNEP, GEF/BSEP and Istanbul University, pp. 96-104.

Öztürk, B. (1998) Black Sea Biological Diversity. Environmental Series Vol. 9. UN Publications, New York. 144pp.

Öztürk, B. (2013) Some remarks of illegal, unreported and unregulated (IUU) fishing in the Turkish part of the Black Sea. *J. Black Sea/Mediterranean Environment* 19 (2): 256-267.

Öztürk, B., Erim, H., Çolak, A., Talu, U. (1990) Investigation on the Mediterranean monk seal in the caves along the coastline of western Black Sea, Marmara Sea and Aegean Sea. *Rapp. Comm. int. Mer Medit.* 32:321.

Öztürk, B., Öztürk, A. A. (1996) On the biology of the Turkish straits system. *Bulletin de L'Institut océanographique, Monaco*, No Special 17, CIESM Science Series No. 2: 205-221.

Öztürk, B., Öztürk. A.A. (2005) Biodiversity in the Black Sea: threats and the future. In: Mankind and Oceans, (eds., N. Miyazaki, Z. Adel, K. Ohwada), UN University Press, Tokyo, pp. 155-172.

Pickaver, A. (2002) Coastal and Marine Corridors. Colloquia on Marine and Coastal Ecological Corridors. Council of Europe Publishing. No: 55. Strasbourg. p.39.

Şekercioğlu, H.Ş., Anderson, S., Akçay, E., Bilgin, R., Can, E.Ö., Semiz, G., Tavşanoğlu, Ç., Yokeş, M.B., Soyumert, A., İpekdal, K., Sağlam, K.İ., Yücel, M., Dalfes, N.H. (2011) Turkey's globally important biodiversity crises. Biological Conservation 144: 2752-2769. doi:10.1016/j.biocon.2011.06.025.

Şile Belediye Başkanlığı (2000). First National Symposium on Black Sea Yacht Tourism. 46 pp. (in Turkish).

Taşeli, K.B. (2007) Nature Conservation efforts set for specially protected areas of Turkey, 2007. *Environmentalist* 27: 315-327.

Topaloglu, B. Öztürk, B. (2008) Investigations on the marine protected area in the western Black Sea coast of Turkey. 2nd biannual and Black Sea Scene EC Project Joint Conference, Sofia, p.111.

Topçu, E. N., Öztürk, B. (2010) Abundance and composition of solid waste materials on the western part of the Turkish Black Sea seabed. *Aquatic Ecosystem Health & Management* 13 (3): 301-306.

TUIK (Turkish Statistical Institute) (2012).
http://tuikapp.tuik.gov.tr/balikcilikdagitimapp/ balikcilik.zul

Trayanov, T., Raykov, V., Marinova, V., Michneva Zaharia, T., Maximov, V., Yankova, M., Golumbeanu, M. (2007). Marine Protected areas in the Northern

part of the Bulgarian Black Sea shelf. *Journal of Environmental Protection and Ecology* 8 (3): 574-590.

Ustaoglu Tiril, S., Zengin, M., Akbulut, B., Memis, D., Alagil, F., Dagtekin, M. (2011) A participatory approach to tagging and monitoring as an initial step in developing a sturgeon conservation strategy along the Turkish Black Sea Coast. *J. Appl. Ichthyol*. 27: 411–414.

Uyanık, O. (2007) My Heaven İğneada. Vebsan Matbaası, 240 pp. (in Turkish).
Wilson, A. M., Moser. M.E. (1994) Conservation of Black Sea wetlands: A review and preliminary action plan. IWRB Publication, 33:77 pp. Oxford.

Yarar, M., Magnin, G. (1997) Important Bird Areas of Turkey. Doğal hayatı koruma derneği. Ant Basım A.Ş. İstanbul. 313 pp. (in Turkish).

Yeniyurt, C., Çağırankaya, S., Lise, C., Ceran,Y. (2008-2012) Wetland plan of Kızılırmak Delta. Doğa Derneği. Ankara. pp.180. (in Turkish).

Zaitsev, Y., Öztürk, B. (2001) Exotic Species in the Aegean, Marmara, Black, Azov and Caspian Seas. Turkish Marine Research Foundation Publication number 8, İstanbul, Turkey. 263 pp.

Received: 01.12.2012
Accepted: 20.09.2013