13

Prospects for Marine Protected Areas in the Turkish Black Sea

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Introduction

The Black Sea is one of the world's seas most isolated from major oceans, and the largest anoxic body of water on the planet (87% of its volume is anoxic). Even though the Black Sea is small in terms of volume compared to the Mediterranean Sea, it is very peculiar and has unique characteristics (Öztürk and Öztürk, 2005). It is connected to the Sea of Azov via the Kerch Strait in the north and to the Marmara Sea (which is connected to the Aegean Sea through the Canakkale (Dardanelles) Strait) via the Istanbul Strait (Bosporus) in the south-east. Moreover, the Black Sea is surrounded by six riparian countries whose socio-economic and political conditions differ greatly.

The unique basin-wide cyclonic boundary current (known as the rim current, Figure 13.1) is driven by prevailing winds and the large freshwater discharge from rivers, and is steered by the steep bottom topography around its periphery that consists of narrow shelves and a maximum depth of around 2200 m (Oguz *et al*., 2005). The cyclonic rim current encloses two cyclonic cells within the interior basin and separates the cyclonically dominated inner basin from the anticyclonically dominated coastal zone (Oguz *et al*., 1992). The anticyclonic eddies near the Istanbul Strait, Sakarya, Sinop, Kızılırmak and Batumi have been shown to be important for accumulation and transport of biota and fish larvae between the coastal zone and the open ocean (Oguz *et al*., 2002; Fach, 2014).

Since the late 1960s, a wide spectrum of anthropogenic influences on the Black Sea ecosystem has been apparent (Oguz and Velikova, 2010). Eutrophication has become the main issue, especially in the coastal sectors (Sapozhnikov, 1991; Mee, 1992; Zaitsev, 1993), due to large amounts of sediments, organic matter and pollutants discharged via large rivers especially the Danube, Dnieper and Dniester flowing into the north-western shelf of the Black Sea (Alexandrov *et al*., this volume). As Sur *et al*. (1996) state, eutrophication has increased significantly, influencing Secchi disc readings in the central Black Sea: from 20 m in the 1920s they had decreased to about 15 m by the mid-1980s and to 5–6 m in the early 1990s (Eremeev *et al*., 1992). In addition, a decline in the total stocks and species of fish has occurred, many organisms have disappeared from the region, and the Black

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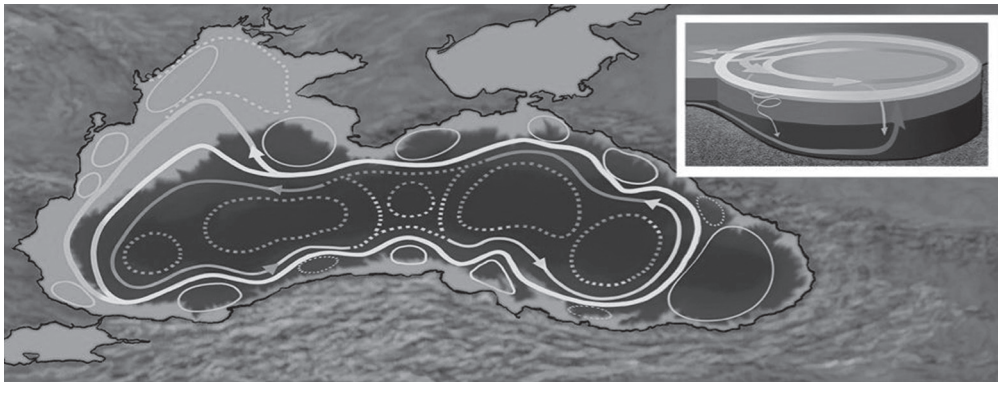

Figure 13.1 Circulation patterns in the Black Sea (see text for details). Artwork: Alberto Gennari.

Sea has been invaded by non-native opportunistic species (Zaitsev, 1991; Shiganova, 1998; Shiganova *et al*., 2001; Kideys, 2002).

The coastal and marine biodiversity of the Turkish Black Sea is constantly under serious threat due to human pressures. Major threats are posed by the destruction of marine habitats and ecosystems, overexploitation of marine resources and the loss of coastal habitats through extensive urbanization. In addition, illegal, unreported and unregulated (IUU) fishing poses a serious threat for Black Sea marine biodiversity (Öztürk, 2013). Pollution by ships (e.g. oil spills and discharging bilge water), the intentional and/or accidental introduction of alien species (Zaitsev and Öztürk, 2001; Galil, this volume), marine litter (Topçu and Öztürk, 2012), and climate change are other threats of concern. Some commercial fish species such as *Thunnus thynnus*, *Asipenser sturio* and *Scomber colias* have been under pressure from overfishing during the last few decades and some species such as *T. thynnus*, *S. colias* and *S. scombrus* have even disappeared from the basin completely.

As stated in the Black Sea Transboundary Diagnostic Analysis 2007 (BSC, 2007) and confirmed in the Black Sea Strategic Action Plan 2008, Marine Protected Areas (MPAs) form a key element of the ecosystem-based approach to managing and safeguarding the Black Sea marine environment, including improving the sustainability of fisheries. The aim of this management regime is to manage the use and values of ecosystems with all stakeholders in order to maintain ecological integrity together with consideration for the uncertainty and ever-changing nature of ecosystems. This approach also contains precautionary safeguards to account for common problems such as lack of scientific data, the uncertainty of natural processes and lack of fisheries management. In the case of the Black Sea, establishing MPAs is an important way to exercise these precautionary principles, as well as protecting ecosystems where the single-species management for threatened species such as *A. sturio*, *Scophthalmus maximus*, monk seal *Monachus monachus* and cetaceans has failed.

Overview of the Regional Situation

According to Alexandrov *et al*. (this volume), 37 protected areas have been designated around the Black Sea which include marine waters, totalling 755 840 ha. However, more than half of this area is represented by Zernov's Phyllophora Field Botanical Reserve

(in Ukraine), declared in November 2008, which covers 402 500 ha. Another major part is located in the Danube Delta Biosphere Reserve in Romania. There is at present not one MPA including offshore waters in the Turkish part of the Black Sea.

Turkish Perspectives and Rationale for Establishing MPAs

The length of the entire Turkish coastline is 8592 km (excluding coasts of islands), of which 1132 km are under protected designations such as National Parks, Ramsar Sites and Nature Parks. In addition, Special Protected Areas comprise 6.6% of all coasts. They have been designated to protect certain species such as the monk seal or for biodiversity objectives in the Aegean and Mediterranean Sea. The Black Sea coastline of Turkey is 1700 km long (Demirkesen *et al*., 2008); there are many protected areas, but no specific MPA has been designated, and it has the least coverage of coastal protected areas, compared with other Black Sea countries (Alexandrov *et al*., this volume). Several sites on the Turkish Black Sea coast are already recognized for their high ecological value, such as two internationally important wetlands: Kızılırmak Delta (designated in 1998 as a Ramsar Site) and the Yeşilırmak Delta, both of which are located in Samsun Province.

Recently, Öztürk *et al*. (2013) proposed five ecologically important sites for designation as MPAs along the Turkish coast of the Black Sea (Figure 13.2). These proposed sites comprise only 2% of the Turkish territorial water in the Black Sea. The largest site proposed covers the coastal waters from Şile to Kefken, and the smallest is the Mezgit Reef. The two deltas in Samsun Province mentioned above are also included as one

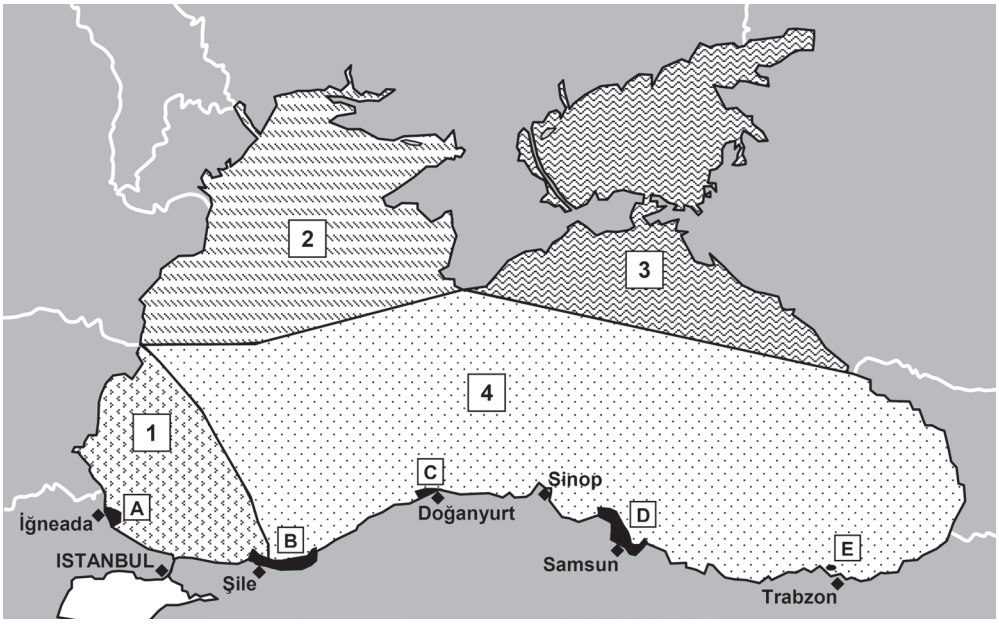

Figure 13.2 Sub-ecoregions of the Black Sea and proposed MPAs in Turkish Black Sea waters. 1, Pre-Bosphoric Region; 2, North-western Shelf; 3, Kerch Strait; 4, Southern Part. A, İğneada; B, Şile-Kefken; C, Doğanyurt; D, Samsun deltas; E, Mezgit Reef.

Table 13.1 Main threats identified for the proposed MPAs on the Turkish coast of the Black Sea.

	Type of threat						
Proposed area for MPA	**Land-based and ship-originated pollution**	**Overfishing**	**Illegal sand extraction**	**Reed burning**	**Coastal erosion**	**Agriculture**	**Forestry**
İğneada	Y	Y	Y	N	Y	Y	Y
Şile	Y	Y	N	N	Y	Y	Y
Doğanyurt	Y	Y	Y	N	N	Y	Y
Samsun deltas	Y	Y	Y	Y	Y	Y	Y
Mezgit Reef	Y	Y	N	N	N	N	N

Y, yes; N, no.

MPA. These areas were proposed by taking into account those criteria specified by the Convention on Biological Diversity (CBD, 2008), such as uniqueness; life history stages of species; importance for threatened, endangered species or habitats; vulnerability; fragility; sensitivity or slow recovery potential; and biological productivity.

Table 13.1 summarizes the threats these proposed areas currently face. Six major threats were identified, and apart from Mezgit Reef, all areas are under multiple threats.

Ecoregions of the Black Sea

Ecoregions are considered to be the smallest-scale units in Marine Ecoregions of the World (Spalding *et al.*, 2007). They show natural similarities and should be considered for nature planning and conservation. An ecoregion has a strong connection within itself and represents uniqueness, peculiar conditions and species diversity at a regional scale. Ecoregions are also connected to each other within wider geographical ranges. Although the Black Sea itself constitutes a single marine ecoregion (Spalding *et al.*, 2007), we suggest that four sub-ecoregions can be recognized within the Black Sea based on biodiversity characteristics as follows: 1. Pre-Bosphoric Region; 2. North-western Shelf; 3. Kerch Strait; and 4. Southern Part, which contains the Turkish and Georgian waters (Figure 13.2).

Among these sub-ecoregions, the Pre-Bosphoric Region is under the influence of the Mediterranean–Black Sea interaction due to the presence of the Istanbul Strait, and thus contains a critical biotope for migratory fish, mammals, birds and species of Mediterranean origin. The North-western Shelf is shallow and influenced by sediments deposited by the Danube and other rivers, making it the richest area in terms of primary production. The Kerch Strait has the unique peculiarity of freezing during most of the coldest winters, which causes a barrier between the Black Sea and the Sea of Azov, especially for migratory species. The last ecoregion is Southern Part which contains Ponto-Caspian species such as relict Gobiid fish species. The five MPAs proposed by Öztürk *et al.* (2013) are located inside sub-ecoregions 1 or 4, which lie along the Turkish coast.

Connectivity Between the Proposed Turkish Black Sea MPAs

It has been found that larval dispersal by ocean currents and connectivity between different oceanic regions are crucial factors

when designing MPAs (Cowen *et al*., 2006; Lester *et al*., 2009; Moffitt *et al*., 2009). Connectivity also plays a major role in assuring population persistence in an MPA network (Moffitt *et al*., 2011). Hence, a modelling study was carried out (not previously published) to assess the degree of connectivity between the five MPAs proposed above. The aim of this study was to identify basin-scale pelagic larval connectivity using an ecosystem-based approach (e.g. Coll *et al*., 2012; Guidetti *et al*., 2013) as opposed to focusing on one target species, such as the commercially important anchovy (Fach, 2014). The common trait of many of the pelagic fish species is that they have pelagic larval stages that stay in the water for different lengths of time, also referred to as pelagic larval duration (PLD).

Virtual pelagic larvae were released in the Black Sea surface current velocity fields for the years 2001–2003, obtained from the sbPOM model run for years 2000–2010, set up and validated for the Black Sea in the framework of the European FP7 OPEC project (http://marine-opec.eu; Allen *et al*., 2013). It was assumed that larval dispersal is dependent on the duration of larvae in the surface water (PLD), the timing of spawning and the circulation pattern. Particles were released in 10 different coastal areas using winter, spring and summer spawning times (1 January, 1 April and 1 July) as well as three different PLD times (30, 45 and 60 days) for the years 2001–2003 which are ecologically meaningful for a number of Black Sea organisms. In total, more than 3300 drifters were released every 2 km along the coast, up to 6 km offshore (Figure 13.3).

The particle drift study with a PLD of 45 days showed that Region (R) 1 where İğneada and Şile are located had a high level of connectivity (Figure 13.4) in all three years and at all spawning times. The area retained about 50% of the pelagic larvae starting there, while the other 50% were consistently transported downstream eastwards along the coast throughout all spawning times and years, mainly to Regions 2 (*c*.15%) and 3 (15%) as well as to R10 and open sea regions.

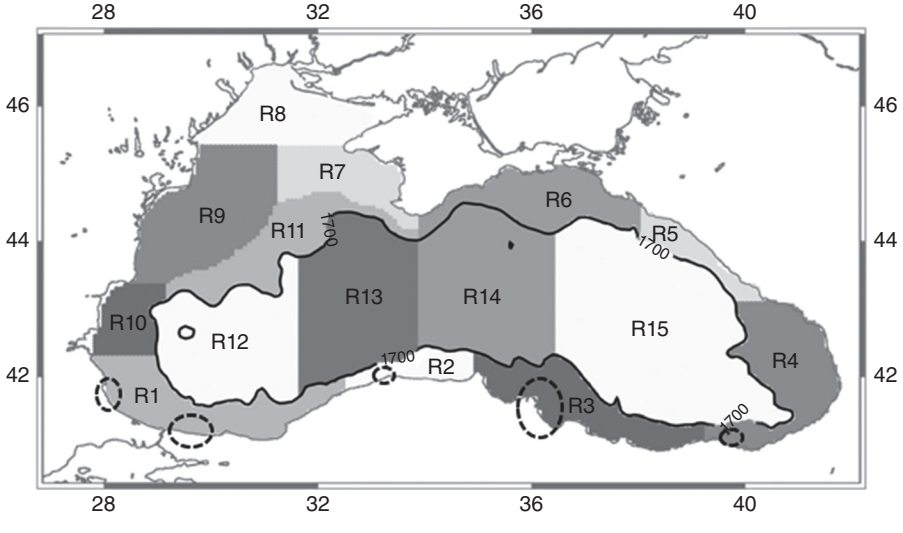

Figure 13.3 Sink regions for modelled pelagic larvae. Dashed lines encircle the proposed five MPAs for the southern Black Sea coast (see text). The thick black line marks the 1700 m isobath separating coastal regions from the open sea. Virtual larvae were released within the 6 km band surrounding the entire Black Sea coast.

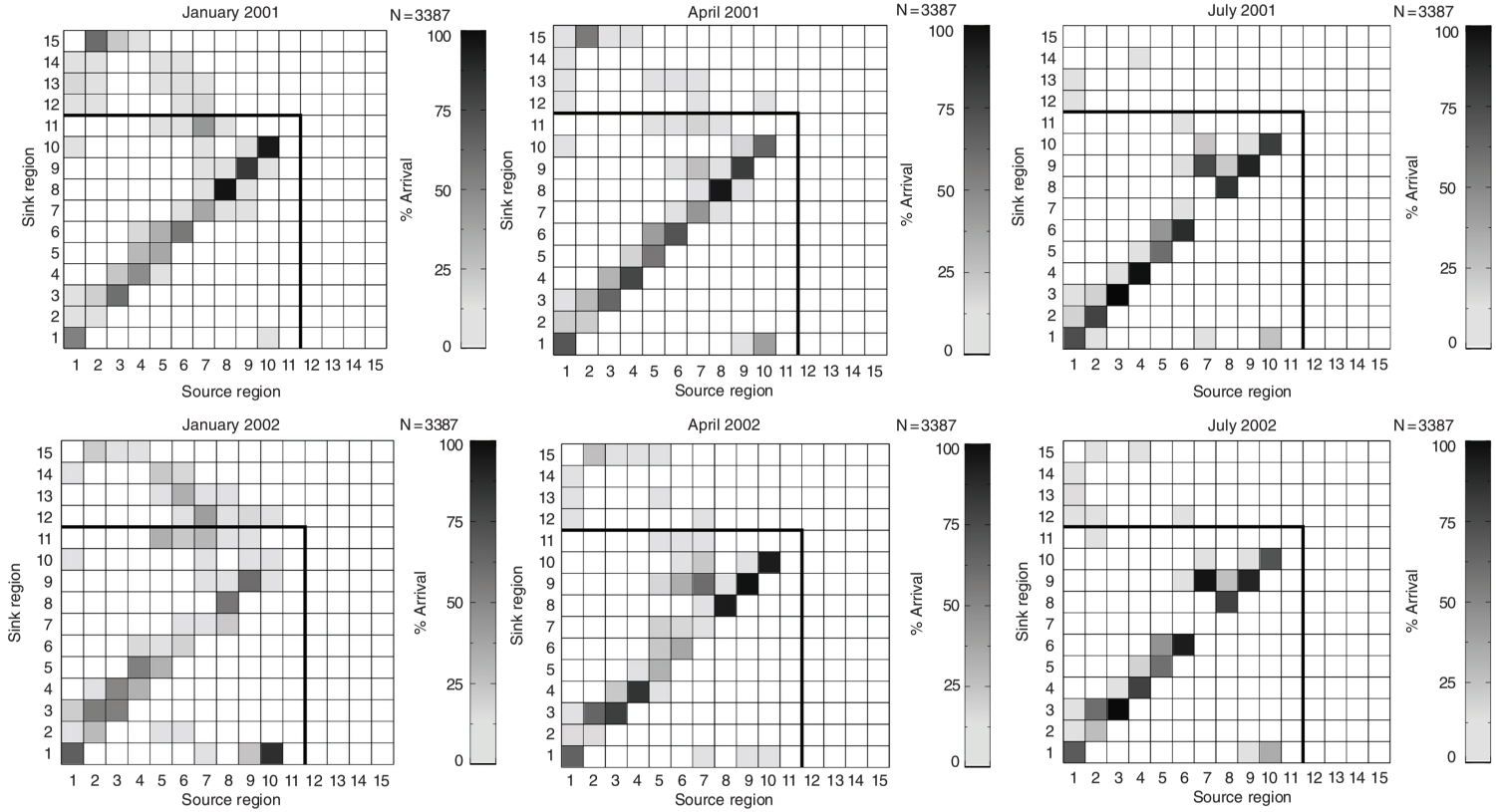

Figure 13.4 Connectivity matrices for modelled pelagic larvae released in coastal regions only (see Figure 13.2) on 1 January, 1 April and 1 July (first to third column) in each of the years 2001, 2002 and 2003 (first to third row) with a PLD of 45 days. Matrices indicate the probability (%) for larvae originating from a source region (*x*-axis) to be transported to a sink region (*y*-axis) estimated from individual 30-day trajectories. The thick black line separates shelf regions from open sea regions >1700 m deep (R12–15).

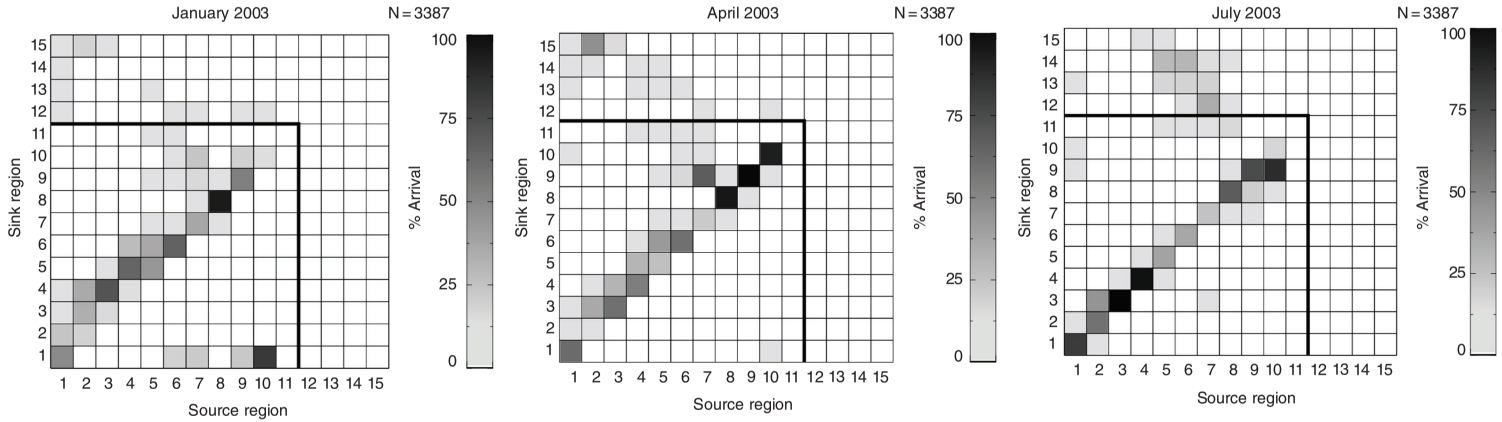

Figure 13.4 (Continued)

Region 1 also receives an inflow of pelagic larvae from R10 and the North-western Shelf (R7 and R9). Doğanyurt (R2) is connected downstream with R3 and the open sea R15 during spawning times in January and April of all years; in January 2002 and 2003 some drifters reach R4. Kızılırmak and Yeşilırmak (R3) have high retention rates: >80% during summer spawning times, 60–70% during spring spawning and approximately 50% in winter. The pelagic larvae that do leave are transported only as far as R4 and the adjacent open sea R15. Rather high retention rates also occur in R4, though not as much as in R3: the simulations show 70–80% retention in summer, 50–65% in spring and 20–40% in winter.

These transport patterns were broadly the same for smaller and larger PLD times, with generally higher retention during small PLD (30 days) and lower retention during longer PLD (60 days) as would be expected.

To illuminate the exact drift of the virtual pelagic larvae released within the five proposed MPAs along the Turkish coast, it is necessary to examine where they end up after the respective PLDs. Thus, when examining in detail the results of the model for July 2002 with a PLD of 45 days (Figure 13.5) it becomes clear that larvae originating in the İğneada region are not transported far at all but are retained or are merely transported a few kilometres downstream (Figure 13.5a). However, the larvae originating in the Şile region show much less retention and end up as far as R2 as well as far offshore in R12 (Figure 13.5a). Larvae originating in Doğanyurt are also transported long distances: there is no retention at all and larvae end up as far as Trabzon, close to Mezgit Reef (Figure 13.5b). This pattern is not surprising as this area is where the rim current flows close to shore and currents are fast and highly dynamic (Oguz *et al*., 1992, 1993; Oguz and Besiktepe, 1999). On the other hand, pelagic larvae released in Kızılırmak and Yeşilırmak are very much retained in the area and though some larvae leave the immediate area, they cannot even reach Trabzon (Figure 13.5c). This is expected because the region comprises a big river delta where water is retained, known for serving as a nursery area for many species. Pelagic larvae released at Mezgit Reef are transported downstream up to the Rioni River delta (Figure 13.5d).

From the above, it was found that out of the five MPAs proposed for the Turkish coast, Şile is particularly well connected to upstream regions, at long PLD even all the way to the Kerch Strait. Similarly, the proximity of Doğanyurt to the strong rim current flow enables pelagic larvae originating there to travel downstream to distant regions. Hence the Şile and Doğanyurt sites are good locations for establishing MPAs, and because they are well connected, can also play an important role in maintaining a Black Sea MPA network. The other three proposed sites (İğneada, Kızılırmak and Mezgit Reef) exhibit more or less high retention rates of pelagic larvae and therefore need protection because of their localized biodiversity characteristics.

A Case Study of Şile Proposed MPA

Among the five proposed MPAs, Şile is of special interest due to its closeness to the Istanbul Strait which has crucial importance for migration of marine species between the Black and Mediterranean Seas (unfortunately including alien marine organisms, of which 19 species have been reported from Şile). In addition, Şile can be a success story because as well as its nature value and growing environmental concern, it has historical sites that attract tourists who can provide a source of revenue.

Şile is one of the smaller districts of Istanbul (with about 137 000 inhabitants),

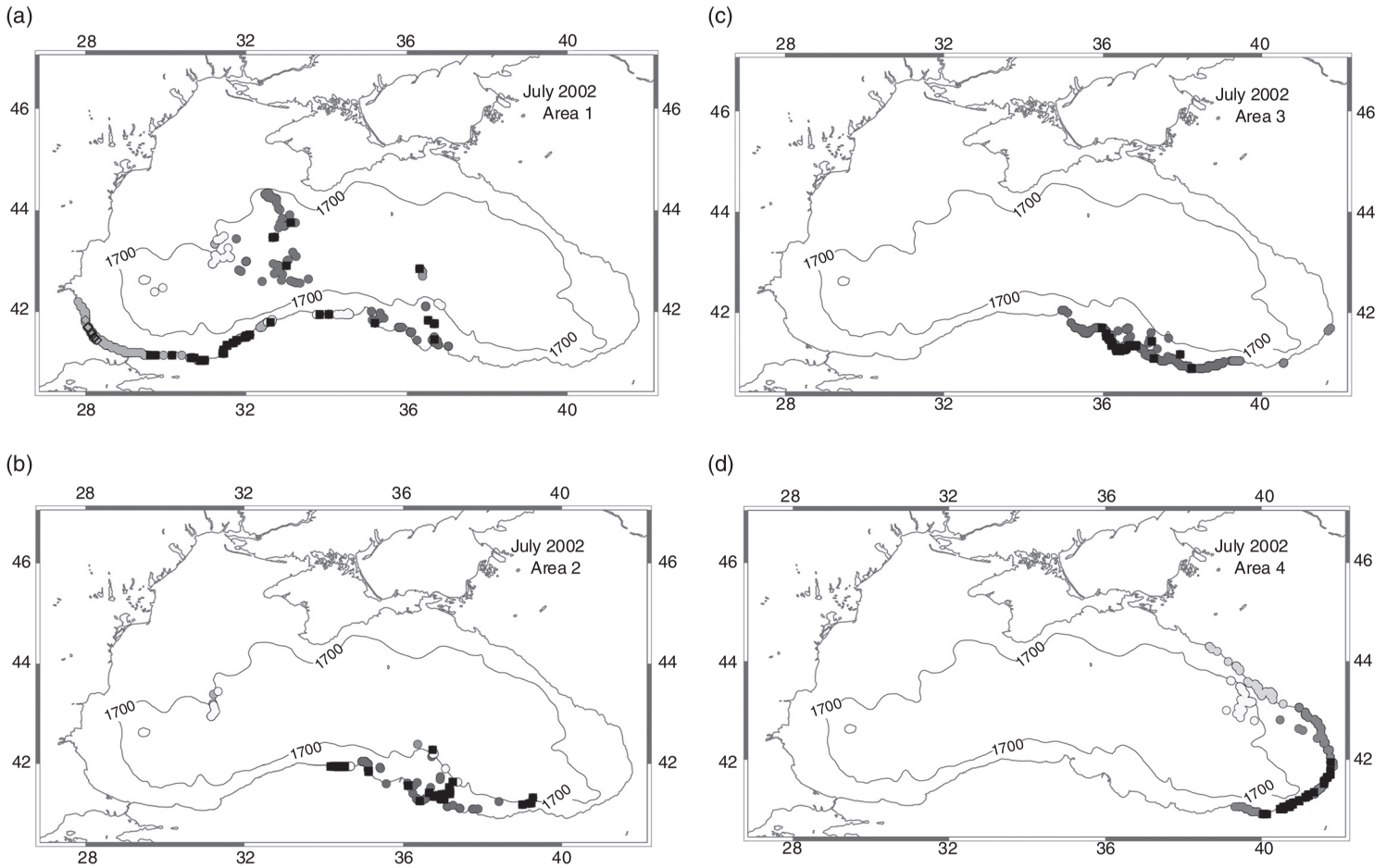

Figure 13.5 End points for modelled pelagic larvae with a PLD of 45 days released in coastal regions only (see Figure 13.2) on 1 July 2002 for the coastal region (a) 1, (b) 2, (c) 3 and (d) 4. Grey shades denote the different regions these larvae ended up in (see Figure 13.2). Black squares in (a), (b), (c) and (d) show the end points of pelagic larvae released in Şile, Doğanyurt, Kızılırmak and Mezgit Reef, respectively. Open black diamonds in (a) show the end points of those released in İğneada.

and only 70 km north of the city itself (Figure 13.2). It is one of the famous resort areas of the Black Sea, popular for its long sandy beach. In recent years, several hotels and many summer houses have been constructed for accommodating tourists.

Fishing

The Black Sea entrance of the Istanbul Strait and Şile are important areas for feeding, and for sheltering the larvae and eggs, of commercial fish such as *Engraulis encrasicholus*, *Sardina pilchardus*, *Sprattus sprattus*, *Scomber scombrus*, *S. colias*, *Merlangius merlangus* and *Trachurus trachurus* (Mater and Cihangir, 1990). Consequently, fishing is one of the major livelihoods of people in Şile (Table 13.2). In addition to 89 local fishermen, around 30 external fishermen arrive when the main fish migration period starts. They generally use artisanal methods such as set nets, gill nets and hand nets. The target species change seasonally, depending on the presence of migratory species such as anchovy, bluefish and horse mackerel. Demersal species (red mullet, turbot and whiting) are all fully or partially overfished. Most local fishermen complain about overfishing, pollution and disappearance of some of the commercially valuable species, such as *Scophthalmus rhombus*, *Xiphias gladius*, *S. scombrus*, *Pomatomus saltator* and *T. thynnus* in the Şile area. They also complain about fishermen coming from outside Şile. The total fish catch is estimated at 1000 tons and that of the Asian rapa whelk *Rapana venosa* as 750 tons. The latter is an alien species brought from the Sea of Japan and later commercially harvested in the Black Sea by diving, mostly in summer.

Table 13.2 Fishing methods and number of local and external fishermen.

Fishing method	Local fishermen	External fishermen
Trawling	4	10
Purse seining	3	12
Rapana diving	2	8
Set nets	30	—
Hand lines	30	—
Gill nets	20	—
Total	89	30

Source: Unpublished data acquired from the Şile Fisheries Cooperative.

As small-scale fisheries are important around Şile, it can be expected that the local fishermen would benefit from the designation of an MPA in most of the area. The sandy shallow waters along the Şile coast are important nursery areas, especially for species like sand sole *Pegusa lascaris*, common sole *Solea solea* and turbot *Scophthalmus maximus*. In addition, this area is important for some fish species which are included in the IUCN Red List, such as common thresher shark *Alopias vulpinus*, spiny dogfish *Squalus acanthias*, thornback skate *Raja clavata*, long-snouted seahorse *Hippocampus guttulatus* and European sturgeon *Huso huso* (Anonymous, 2010). Turkey has been making efforts to protect several marine species in the Black Sea which are reflected in Fisheries Law 1380, which includes some restrictions on harvesting species found in the Şile area, such as seagrass *Zostera* spp., the mollusc *Cerithium vulgatum*, sturgeons, and seahorse *Hippocampus hippocampus*.

The Working Group on the Black Sea of the General Fisheries Commission for the Mediterranean (WGBS-GFCM, 2015) reported the status of the Black Sea turbot population as both 'overexploited' and 'in overexploitation'. Similarly, the Black Sea anchovy population was found to be 'in overexploitation'. The Black Sea horse mackerel stock was reported as 'overexploited', while the spiny dogfish population was considered to be depleted at the Black

Sea scale. The implementation of a recovery plan for both turbot and spiny dogfish as well as the reduction of fishing of both anchovy and horse mackerel was recommended.

The islands off Şile and Kefken include diverse habitats such as seagrass meadows, muddy bottoms, rocky bottoms, caves, reefs and biogenic formations. These habitats signify a rich fauna of fish and invertebrates in the proposed MPA which deserves more stringent measures to be introduced for its conservation. In particular, the MPA would allow ecosystem-based fisheries management to be introduced. Furthermore, Akbulut *et al.* (2011) reported that sturgeons need *in-situ* protection, but without holistic and ecosystem-based management, success will be limited.

Marine Mammals

There are three cetacean species found in the Black Sea: harbour porpoise *Phocoena phocoena relicta*, bottlenose dolphin *Tursiops truncatus ponticus*, and short-beaked common dolphin *Delphinus delphis ponticus*. While the harbour porpoise and bottlenose dolphin are listed as Endangered (Birkun and Frantzis, 2008; Birkun, 2012), the common dolphin is considered Vulnerable (Birkun, 2008) in the IUCN Red List of Threatened Species. Dolphins were once harvested throughout the Black Sea until Turkey finally banned it in 1983. Their populations in the Black Sea have started to recover, but due to their slow breeding rate, as well as the existence of many threats such as lack of prey fish, bycatch, pollution and epidemics, their recovery cannot be realized without protection measures. Bycatch is the most serious problem: Tonay and Öztürk (2003) reported that during the turbot season at least 3000 individuals of harbour porpoises were stranded due to entanglement in turbot set nets. In addition, cetaceans are transboundary species and concerted actions are needed for effective protection.

Around Şile, the bottlenose dolphin and harbour porpoise are the most commonly seen cetaceans. The coastal waters off Şile, Agva, Kerpe and Kefken are feeding and calving grounds for them, and calves of bottlenose dolphins have been observed there during the summer and autumn seasons (BÖ, unpublished data). Furthermore, some bycatches have been reported due to turbot set nets in spring. A proposed MPA can provide better protection of these cetaceans in terms of reducing bycatch, recruiting more prey fish, and securing feeding and calving grounds.

There is also one pinniped species, the monk seal, which is one of the most critically endangered species in the world. It was last seen in the Turkish Black Sea coast in the 1980s between Şile and Zonguldak. While it is highly likely that monk seals are completely extinct in the Black Sea, they still occur in the Sea of Marmara, so it is important to designate some areas with caves and beaches for potential monk seal re-colonization of the Black Sea coast.

Legal Framework Concerning MPAs in the Turkish Part of the Black Sea

There are several laws on the protection of coastal areas, environment, natural resources, national parks, and natural and cultural values. However, there is no appropriate legal mechanism for establishing MPAs and this constitutes an obstacle for their designation in Turkey. Moreover, even existing measures for protection of the marine environment or biodiversity are very weak and poorly enforced in terms of imposing fines or penalties. This is also another

impediment for the conservation of the marine environment and nature protection as a whole. The legal instruments most relevant for MPAs are summarized below.

The purpose of the Coastal Law (number: 3621/3830, date: 1990/1992) is stated in Article 1 as 'to set out the principles for protection of the sea, natural and artificial lakes and river coasts and the shore buffer zones, which are extensions of these places and are under their influence, by paying attention to their natural and cultural characteristics and for their utilization towards the public interest and access for the benefit of society'. The Law defines the 'coastline' as 'the line along which water touches the land at the coasts of seas, natural or artificial lakes and rivers, excluding the inundation periods'.

The Environmental Law (of 9 August 1983, amended on 4 June 1986 and 3 March 1988) is administered by the Ministry of Environment and Urbanization. It covers environmental issues in general.

The Fisheries Law (22 March 1971, amended 15 May 1986) regulates the protection, exploitation, production and control of living resources. The responsible authority is the Ministry of Food, Agriculture and Husbandry (Nurlu and Erdem, 2002). It prohibits fishing certain species in certain areas, but does not designate particular protected areas. There are also the National Parks Law (9 August 1983); Law on the Protection of Cultural and Natural Wealth (21 July 1983); Council of Ministers' Decree (19 October 1989) for the establishment of an Agency for Specially Protected Areas (which is the legal base for special protected areas but not MPAs); the Coast Guard Security Force Law (9 July 1982); the Forestry Law (31 August 1956, amended 23 September 1983); the Law for the Protection of Cultural and Natural Values (Code No: 2863 of 1983); the Environmental Law (Code No: 2872 of 1983); and the National Parks Law (Code No: 2873 of 1993).

However, due to the lack of an appropriate law related to MPAs, we propose here to establish a specific law for the establishment and management of MPAs, independent from other laws.

Socio-economic Benefits of MPAs in the Turkish Part of the Black Sea

The Turkish part of the Black Sea coast is an area where a large number of human activities take place and several conflicts of interests exist between local people, fishermen, tourism operators, farmers and forestry. For local people, the coast is the area where they come into contact with the sea. One type of economic use of the coastal zone quite often denies opportunities for other activities: the construction of coastal highways limits the development of coastal tourism and wildlife reserves. The construction of hotels on the beach and in the immediate vicinity of the shore for tourism puts a burden of waste from human activities on the environment, and the quality of the beach and the coastal waters deteriorate even though wastewater discharge is forbidden by the Coastal Law.

The benefits of MPAs are generally accepted as natural capital for all stakeholders, but in particular for fishermen and the tourism industry. Tourism development is especially important for the Black Sea region where the most popular tourist destinations are the coastal areas, protected areas and historical settlements. If tourism is not sustainable, socio-economic and environmental problems will develop and pose extra stress for both coastal and marine environments. Accordingly, it is necessary to determine the carrying capacity and limiting factors for sustainable tourism. In recent years, coastal areas such as Şile have been subject to mass tourism, large-scale construction and infrastructure expansion,

intensive land development and extensive urbanization, which have caused episodes of intense land-based and marine pollution during a very short period in summer.

However, tourism in protected areas is associated with appreciating and observing nature, scientific endeavour and education. This type of tourism is called ecotourism and associated with minimal development of infrastructure and small-scale interventions. Therefore, this kind of tourism is promising for the Black Sea, which is already facing many anthropogenic threats. Sand dunes, long coasts, reefs and caves can be attractive for ecotourism, as also are bird and dolphin watching. Local fishermen can also benefit from this development in tourism as the demand for fish increases when more tourists visit the area. Moreover, fishermen can rent out their boats for extra income when tourists wish to swim or snorkel and visit MPAs close by. The designation of an MPA in the Şile area would help in creating a plan for the sustainable use of natural resources, provide more income for fishermen, attract ecotourism investors and help raise the environmental consciousness of local people. Furthermore, within MPAs, control and surveillance measures for illegal fishing practices are generally more strict and this is an advantage for local fishermen, although their fishing grounds may be limited spatially. Nevertheless, in the long term, the benefits of MPAs for nature and all stakeholders are obvious.

Conclusion

The Turkish government should act to designate MPAs in the Black Sea before it is too late: most of the fish resources have already diminished since the mid-1970s (Kutaygil and Bilecek, 1976). Designation of transnational marine and coastal protected areas around the borders of Turkey with Bulgaria and Georgia would help to develop integrated protection measures in the entire southern portion of the Black Sea (indeed, Bulgaria already has an MPA at Strandja, close to the Turkish border). Designation of MPAs would also contribute to securing the biological corridor of the Istanbul Strait between the Sea of Marmara and Black Sea. The modelling study described above showed clearly that of all the proposed MPAs, the sites at Şile and Doğanyurt are the two areas that are most beneficial for establishing MPAs, because they have a high inflow of pelagic larvae from upstream areas and themselves ensure a high transport downstream to other areas. It may even be beneficial to establish another MPA along the western part of the south coast between Kızılırmak and Mezgit Reef to achieve a well-connected network of MPAs, assuring the exchange of pelagic larvae necessary for population persistence in the MPA network as detailed in Moffitt *et al*. (2011). Marine Protected Areas can also help to establish sustainable fisheries, rather than simply reducing the damage of the local fisheries or traditional fishing practices in the Black Sea, as they protect nursery grounds of many commercial fish species. Besides, poor fishing practices are more strictly controlled in MPAs, so that the fishermen who conduct 'legal' fishing activities in the region will be better protected (Öztürk, 2013).

According to the International Maritime Organization's MARPOL Convention, the Black Sea is designated as a special area because of its oceanographical and ecological conditions, and its level of sea traffic. Special areas require the adoption of mandatory methods by the relevant authorities for the prevention of marine pollution. In this regard, Uysal *et al*. (2002) reported that the Şile area has shown some signs of pollution and its benthic community is characterized by notable species enrichment. The Şile area is the only transition zone in the Black Sea under the influence of Mediterranean water due to its close

geographical connection with the Sea of Marmara and Istanbul Strait, hence it needs special attention in terms of protection of marine biodiversity. The Sea of Marmara has a connection with the Black Sea in terms of maintaining some populations for breeding, over-wintering and/or migration, but it is not considered within the geographical scope of this chapter. For the designation of MPAs in the Black Sea, however, the Sea of Marmara should also be taken into account.

The European Union's goal of achieving Good Environmental Status (GES) in its seas by 2020 in accordance with the Marine Strategy Framework Directive (MSFD, 2008/56/EC) should be considered in parallel with Turkish initiatives for protecting the marine environment in the Black Sea, especially for the five proposed MPAs.

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. The CBD has set Aichi Targets in which by 2020 at least 17% of terrestrial and inland waters, and 10% of coastal and marine areas – especially those of particular importance for biodiversity and ecosystem services – should 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 in the Black Sea.

Finally, a robust, ecologically coherent network of MPAs in the Turkish part of the Black Sea as a whole will both contribute to, and depend on, the achievement of other conservation objectives concerning pollution reduction, sustainable fisheries management, improvement of legislation and enforcement, and capacity building as set out in the updated Black Sea Transboundary Diagnostic Analysis and Strategic Action Plan (BSC, 2007, 2009).

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