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The Uncertain Fate of the Endangered Mediterranean Monk Seal *Monachus monachus* in the 21st Century

Population, Ecology and Conservation Threats

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Introduction

> *"The seal… does not take water in but breathes and sleeps and gives birth on land, albeit near the beach, as if it belongs to the animals living on land. On the other hand, it spends most of its life in the water and gets its food from the water, therefore we should examine it along with the marine animals".*
>
> Aristotle, 4 B.C.

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In his 4th century B.C. seminal work the "History of Animals", Aristotle, the ancient Greek philosopher, penned the first known description of a pinniped in history. Aristotle described the only pinniped species inhabiting the Mediterranean Sea, the Mediterranean monk seal, which he encountered along the coasts of the Aegean Sea in Greece. The first description of this seal in modern times was published in 1779 by the German naturalist Johann Hermann (Hermann 1779). Hermann described the Mediterranean monk seal from an animal in a traveling exhibition in Strasbourg. Actually, Hermann is also responsible for naming the species a "monk seal". He came up with this name by combining the fact that around the area of Marseilles locals seemed to refer to the species with the name "moine" (monk in French), with the fact that the animal he had seen in Strasbourg resembled a monk wearing a cloak. It is unknown to us how many Mediterranean monk seals lived in Aristotle's world, or even Hermann's, but today the species is considered to be one of the rarest marine mammals and the most endangered seal on Earth. It is estimated that no more than 700 individual Mediterranean monk seals survive today (Karamanlidis and Dendrinos 2015, Karamanlidis et al. 2016a).

Taxonomy, Range, Population and Population Structure

It has been thoroughly documented that in the past Mediterranean monk seals lived throughout the Black and Mediterranean Sea, the island complexes of the Azores, Madeira, the Canary and Cape Verde Islands in the Atlantic Ocean, as well as at the northwestern coasts of Africa, from Morocco in the north to Senegal and quite possibly Gambia in the south (Johnson and Lavigne 1999, Johnson 2004, González 2015, Karamanlidis et al. 2016a). The systematic exploitation of the Mediterranean monk seal for its skin and oil during the ancient Greek and Roman times and the Middle Ages, appears to have been the main factor leading to the significant population decreases throughout the species' range (Johnson and Lavigne 1999, Johnson 2004, González 2015). The unabated exploitation of the species during the past two centuries ultimately led to the extinction of the Mediterranean monk seal from most countries in the Mediterranean and Black Sea, as well as from most parts of the Atlantic.

At present, the global range of the Mediterranean monk seal is extremely limited and fragmented. The species survives in four isolated subpopulations (Karamanlidis et al. 2016a): In the Mediterranean Sea, the stronghold of the species remains the islands of the Ionian and Aegean Sea in Greece, where Aristotle first described the species, almost 2,500 years ago. The species is also found along the coasts of mainland Greece, the Mediterranean coast of Turkey, and recently, along the coasts of Cyprus. Some individuals still survive in the Sea of Marmara, while in the Black Sea,

monk seals are believed to have gone extinct in the 1990s. It is estimated that the Eastern Mediterranean population may count up to 450 individuals. In the Atlantic, two subpopulations exist: one at the Cabo Blanco peninsula, at the border between Mauritania and Western Sahara, and one at the Archipelago of Madeira. In the mid-1990s, the population at Cabo Blanco was estimated at 317 seals.

However, a mass mortality event in 1997 reduced this population nearly by two thirds. Since then the population has been showing encouraging signs of recovery and in 2015 it was estimated that approximately 220 seals composed the second largest monk seal population in the world. The third largest population of approximately 40 monk seals survives in the Archipelago of Madeira, while an unknown number of monk seals might still survive along the Mediterranean coasts of Algeria and eastern Morocco. Without systematic monitoring and conservation activities however in place the status of the species in this area is uncertain.

According to the most recent observations, the monk seal populations at Cabo Blanco in the Atlantic (Martínez-Jauregui et al. 2012) and at the island of Gyaros in the eastern Mediterranean Sea (Karamanlidis et al. 2013) are the only large extant aggregations of the species that still preserve the structure of a colony; all other subpopulations in the eastern Mediterranean are composed of fragmented breeding groups of reduced size (usually less than 30 individuals) (Karamanlidis et al. 2016a).

During the last decade sporadic sightings of individual Mediterranean monk seals have been recorded in countries where the species has been considered to be extinct for a long time, such as Italy, Croatia and Albania in the central Mediterranean and Syria, Lebanon, Israel, Egypt, and Libya in the southern and southeastern Mediterranean Sea (see Fig. 1). In March 2015, a female monk seal was found trapped in fishing nets on the coast of Beirut, Lebanon. Sadly, the necropsy revealed that the animal was at the final stage of pregnancy. However unfortunate this incident might have been, it is, on the other hand, an encouraging sign of reproductive activity of the species from a region where it was long considered to be extinct.

According to the most recent taxonomic classification, the Mediterranean monk seal (*Monachus monachus*; Fig. 2) is the sole representative of the genus *Monachus* (Scheel et al. 2014). Examination of mitochondrial DNA has indicated genetic differences between Atlantic and eastern Mediterranean seal populations: only one haplotype was found in Mediterranean monk seals in Madeira and Cabo Blanco in the Atlantic in contrast to four different haplotypes found in monk seals in the eastern Mediterranean (Karamanlidis et al. 2016b). Also, a comparison of 24 nuclear microsatellite loci between eastern Mediterranean and Atlantic Mediterranean monk seal populations showed that the first group had 14 unique alleles and the second 18, highly significant differences in allele frequencies between the two subpopulations

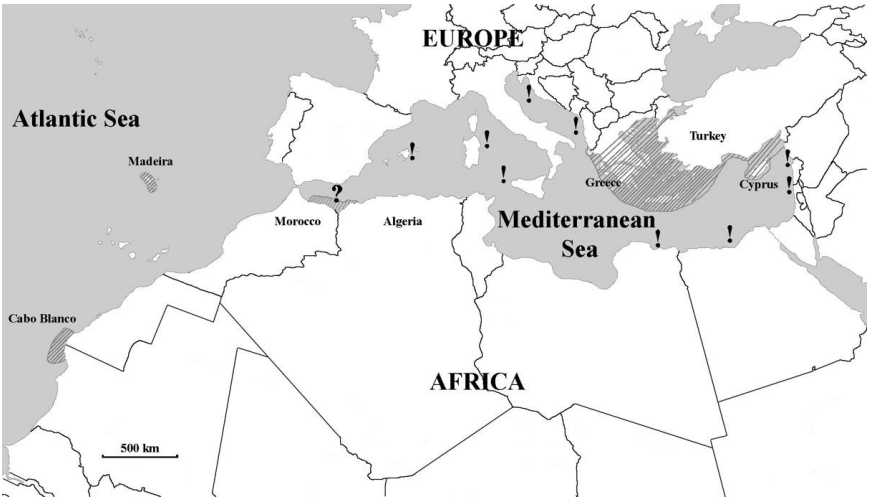

Figure 1. Map illustrating the current distribution and recent sightings of Mediterranean monk seal along the coastal regions of the Mediterranean Sea and North Africa. Cross-hatched areas indicate the geographical range of extant monk seal populations; the question mark indicates an area where the fate of the population is unknown; the exclamation marks indicate areas outside the current range where Mediterranean monk seals have recently been seen. Adapted from Karamanlidis et al. (2016a).

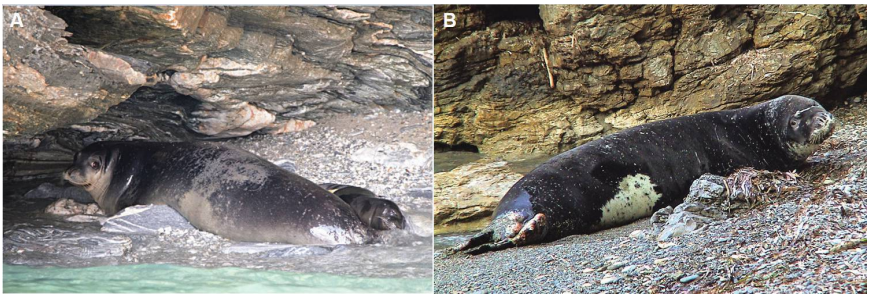

Figure 2. An adult female with her pup resting on an open beach near a pupping cave, in Greece (A); and, an adult male resting on an open beach in Greece (B). Photo credits: P. Dendrinos (Fig. 2A) and A.A. Karamanlidis (Fig. 2B)/MOm/Hellenic Society for the Study and Protection of the Monk Seal.

were found for 14 out of 17 loci (Pastor et al. 2007). Although until now no further taxonomic separation of the species has been suggested, given the genetic differences and the distance separating the two subpopulations it is considered appropriate to treat the Atlantic and the Eastern Mediterranean monk seal subpopulations as two separate management units (Karamanlidis et al. 2016b).

Biology

The Mediterranean monk seal is considered a medium-sized phocid. In the Cabo Blanco population, average lengths of 2.42 and 2.51 m have been recorded in adult females (Fig. 2A) and males (Fig. 2B), respectively. Data on adult body length from Greece suggest that Mediterranean monk seals in this population might be a little bit smaller than their counterparts in Cabo Blanco, while there are no significant differences between the two sexes. The average length of newborn pups is approximately 1 m and they weigh 15–26 kg; adult monk seals weigh 240–300 kg, with anecdotal records of a pregnant female reaching 302 kg and a male reaching 400 kg. Adult males are uniformly black with a white patch on their ventral side that is unique for every individual (Fig. 2B). Adult females are generally brown or gray, with the lower half of their body showing a lighter coloration. Adult Mediterranean monk seals undergo an annual molt, which appears to be a gradual process and therefore the color of the pelage can vary significantly throughout the year. The external appearance of the body includes also areas with multiple scars that are sustained during mating and social interactions. Females carry many scars on the back, while males often have an area of light coloration on the throat as a result of multiple scars from aggressive interactions with other males. Pups are born with a white belly patch on the otherwise black to dark chocolate, woolly coat (Badosa et al. 1998, Dendrinos 2011). The ventral patch is often marked by black spots and varies in shape, size and position between different individuals and according to gender (Badosa et al. 1998). Apart from the pups, which possess a soft and woolly pelt or "lanugo", juvenile and adult Mediterranean monk seals have very short and bristly hair, about 0.5 cm long; the shortest hair amongst pinnipeds (Ling 1970). The neonatal molt is progressive and is completed on average eight weeks postpartum. The completion of the neonatal molt is not associated with weaning, as molted pups have been observed to suckle (Gazo et al. 2006). Molting of juveniles and adults occurs over a very protracted period, extending throughout the year (Androukaki et al. 1999, Güçlüsoy and Savaş 2003b, Pastor and Aguilar 2003); there appears to be no significant difference in the molting period between monk seal populations in the eastern Mediterranean and the Cabo Blanco region. In the Cabo Blanco monk seal population, the intermolt period is close to one year, except in females nursing a pup. Such females have longer intermolt periods and can even molt while still lactating (Pastor and Aguilar 2003). In males, the process of developing the mature pelage pattern of bulls is gradual. It involves at least two annual molts and can be completed by the age of 4 years (Badosa et al. 2006).

Male Mediterranean monk seals are estimated to mate for the first time after their 6th year of age. Females are considered to attain sexual maturity

by the 4th year of their life, but most recent data suggests that they may reach sexual maturity as early as the age of three. This is considered to be the lowest known age of sexual maturity for any phocid species. Mating in Mediterranean monk seals occurs in the water (Karamanlidis et al. 2016a). Gestation lasts approximately 9 to 11 months (Marchessaux and Pergent-Martini 1991, Pastor and Aguilar 2003) and each female gives birth to one pup (Fig. 2) during every reproductive cycle (King 1956). Females can give birth in successive years. Before giving birth, females will often retreat to isolated areas within their pupping caves which they actively defend against other approaching seals (Layna et al. 1999). Aggressive interactions in the pupping caves between females and other females and pups have been documented using infrared cameras also in Greece (Karamanlidis et al. 2012).

Habitat and ecology

The life of the Mediterranean monk seal, as well as that of all pinnipeds is inextricably connected to land, where pupping occurs. Throughout their range Mediterranean monk seals use nowadays exclusively marine caves to give birth to their young. In Cabo Blanco, seals use less than five big caves for this task; these caves have large-sized entrances and extensive sandy beaches inside. In contrast, monk seals in the eastern Mediterranean use a wide network of sea caves of much smaller size than those of Cabo Blanco, with entrances that protect the inner beach (or beaches) from the outside environment. In Greece alone, a country with an extensive coastline (>16,000 km), more than 150 reproductive caves have been identified so far. A long term study of the reproductive biology of the Mediterranean monk seal in the National Marine Park of Alonnisos, Northern Sporades in Greece has concluded that the sea caves preferred by females for pupping share some specific morphological characteristics (Dendrinos et al. 2007b). In the Archipelago of Madeira in the Atlantic, the pupping habitat is very similar to the one in the Eastern Mediterranean (Karamanlidis et al. 2004), with the main difference being however that in Madeira, the intense sea tide greatly affects the use of caves by the seals (Pires et al. 2007). The exclusive use of sea caves by females for pupping is considered to be partially a consequence of the intense persecution by humans over the course of many centuries.

In regard to the use of marine caves by the Mediterranean monk seal and based on the available historical sources, it is still very difficult to draw a conclusion whether the species was using in the past exclusively open beaches or open beaches and caves for resting and pupping. It is interesting to note that in the first actual historical note of the Mediterranean monk seal, Homer's Odyssey, the "cave use" by the species is also mentioned. In Homer's monumental epos the sea nymph Eidothea is reported saying that

when emerging from the sea and after entering the "*arching caves,* (the sea god Proteus) *will pass along all the seals and count them; then, having viewed them and made his reckoning, he will lie down among them all like a shepherd among his flock of sheep*" (Odyssey, IV. 398 et seq.). A possible explanation for this is that the species has always used both, open beaches and caves to rest and reproduce and that because of the intense persecution by humans only the harder-to-access Mediterranean monk seal populations living in caves survived. It is also possible that the use of inaccessible habitat for reproduction has been throughout time a defense strategy to avoid predators that threatened the newborn pups, especially during times when mothers were out at sea to feed. In well-protected areas, lactating females have been recorded recently to lead their pups to open beaches close to the pupping caves and nurse them there for hours or even days. In some areas in Greece it is not uncommon nowadays to observe at times lone individuals hauling out on open beaches.

Regarding the use of the marine environment, the most recent data suggests that the Mediterranean monk seal is a coastal species as it searches for its food near the coasts and in depths rarely deeper than 200 meters. Compared to other well-studied pinnipeds, little is known about the diving capacities and behavior of Mediterranean monk seals. The maximum depth and duration of diving for one lactating female were 78 m and 15 minutes, respectively (Gazo et al. 2006); however, diving behavior of monk seals at Cabo Blanco appears to be limited by the topographic features of the marine environment in this area. In the eastern Mediterranean Sea (which is characterized by much deeper near-shore waters than the Cabo Blanco region), monk seals have been recorded to dive much deeper. Maximum dive depths for a rehabilitated male and a female juvenile monk seal were 196 and 205 m respectively (Dendrinos et al. 2007a, MOm/Hellenic Society for the Study and Protection of the Monk seal, unpublished data). Recently, researchers in Greece have documented monk seals sleeping at sea, at the water surface but also at the sea bottom (Karamanlidis et al. 2017).

Stomach content analysis of deceased Mediterranean monk seals indicates that monk seals feed on a large variety of prey including bony fishes, cephalopods, and crustaceans. In Greece, more than 530 prey species have been identified so far; the common octopus (*Octopus vulgaris* ~34%) and bony fishes from the family Sparidae (~28%) were identified most frequently in the stomachs of monk seals (Pierce et al. 2011). In the Archipelago of Madeira in the Atlantic, visual observations of individuals with prey at the surface included seals eating golden-grey mullet (*Liza aurata*), parrot fish (*Sparisoma cretense*), barred hogfish (*Bodianus scrofa*), salema (*Sarpa salpa*), cuttlefish (*Sepia officinalis*) and crabs (*Pachygrapsus*

spp.) (Neves 1998). In Cabo Blanco, stomach content analyses indicated that 71.3% of prey items by weight were cephalopods, from which 68.3% were octopuses. Fish species were mainly from the families Sparidae, Scianidae and Haemulidae (Muñoz Cañas et al. 2012). Collectively, results from stomach content and stable isotope analyses studies (Pinela et al. 2010, Karamanlidis et al. 2014) confirm that monk seals forage primarily on the continental shelf along the coast.

Threats

The Mediterranean monk seal is one of the most endangered pinniped species (Karamanlidis and Dendrinos 2015), and one of the most endangered Evolutionarily Distinct and Globally Endangered (EDGE) mammals on Earth (Isaac et al. 2007). The species has a long history of negative interactions with humans. The main reasons for the recent, dramatic population declines include increased human pressure displacing seals from their habitat, destruction/alteration of suitable habitat, continued mortality due to deliberate killing by fishermen, fisheries by-catch, and a mass die-off at the Cabo Blanco monk seal colony (Karamanlidis et al. 2016a). Potentially, limited availability of food sources, genetic inbreeding and pollution could also constitute a threat to the survival of the Mediterranean monk seal.

Habitat perturbation

Habitat deterioration, destruction, and fragmentation have played a significant role in the plight of the Mediterranean monk seal. Once a (partially?) open beach dweller, the species has been persecuted by humans for centuries and forced to occupy increasingly marginal habitat. The gradual process from occupying open beaches to using increasingly marginal habitat (i.e., smaller and more unsuitable marine caves) has been thoroughly documented (Johnson and Lavigne 1999). This threat is still in place today, particularly in the eastern Mediterranean (Kiraç et al. 2013). Critical Mediterranean monk seal habitat has been affected by increased tourism activities throughout Turkey, even in protected areas such as the Olympos Beydagları National Park, and the Kas, Kekova Specially Protected Area. Tourists and scuba divers in these areas appear to frequently visit important monk seal shelters. Although some resting activity of Mediterranean monk seals still continues, no pupping activity has been recorded in these caves recently (Gücü et al. 2009). With human populations and coastal activities increasing around the Mediterranean, there are potential threats to the species' habitat.

Fisheries interactions

Interactions with fisheries throughout the species range are of great conservation concern (Güçlüsoy and Savaş 2003a, Güçlüsoy 2008, Karamanlidis et al. 2008, Hale et al. 2011, González and Fernandez de Larrinoa 2012). Deliberate killing of Mediterranean monk seals mainly by fishermen was responsible for one-third of 79 mortalities investigated in Greece (1991–1995) and is considered the single most important source of mortality for this species in the eastern Mediterranean (Androukaki et al. 1999). Mediterranean monk seals have been entangled in a wide variety of fishing gear including set-nets, trawl nets, and long-lines (Johnson and Karamanlidis 2000) and entanglement remains a major source of mortality in the eastern Mediterranean Sea, especially for sub-adult animals (Karamanlidis et al. 2008, Kiraç et al. 2013). Adverse fishing interactions are also considered as one of the probable causes for the lack of recovery of the Cabo Blanco population after commercial sealing ended in the region. Currently, illegal industrial and artisanal fishing is one of the main threats to the survival of the colony, mainly for sub-adult seals (González and Fernandez de Larrinoa 2012). In comparison, the effect of negative seal-fisheries interactions in the Archipelago of Madeira is considered to be lower. Traps, purse seines, and illegally used gill nets are the main fishing gear posing a threat to the species in the region (Hale et al. 2011).

In southern Turkey, an important monk seal colony almost disappeared in the 1990s, when industrial-scale fishing in the area reduced the available fish sources and negative interactions of artisanal fishermen with monk seals (i.e., deliberate killings) increased. However, a series of regulations enforced to protect fish sources alleviated the problems and helped the local monk seal population to resume pupping in the area (Gücü et al. 2004).

Diseases and loss of genetic variability

Following the mass mortality event at Cabo Blanco in 1997, a morbillivirus was isolated from the deceased Mediterranean monk seals. The virus most closely resembled a dolphin morbillivirus that was previously implicated in the 1991 mass mortality of striped dolphins in the Mediterranean Sea (Osterhaus et al. 1992, van de Bildt et al. 1999). However, although this virus was already circulating in Mediterranean monk seals prior to the mass mortality, there is some doubt as to whether it was responsible for the deaths that occurred. Indeed, the active virus was found in pups that went into a rehabilitation center because their mothers had died, and none of them showed clinical signs and all survived the event without specific treatment.

Dinoflagellate-produced saxitoxins were found in tissues from animals that died during the mass mortality and the suddenness of death of the

animals and the general clinical symptoms suggest that the cause of death was from these toxins (Hernández et al. 1998). Toxic algal blooms (i.e., red tides) are favored by oceanographic conditions near Cabo Blanco and were reported from nearby Morocco during a 25-year period leading up to the mass mortality. Toxic algal blooms are unpredictable and following the catastrophic loss of Mediterranean monk seals in 1997 must be considered a serious threat to the species in the region (Reyero et al. 2000, UNEP 2005).

Genetic analyses of mitochondrial and nuclear DNA (Pastor et al. 2004, 2007, Karamanlidis et al. 2016b) have shown that, as a consequence of severe population bottlenecks and population/habitat fragmentation, all Mediterranean monk seal sub-populations have suffered a dramatic decrease in genetic variability. The genetic diversity of the species is among the lowest found in pinnipeds; it is comparable to Hawaiian monk seals and Northern elephant seals. The potential consequences of the loss of genetic variability and genetic inbreeding are still hard to evaluate for the Mediterranean monk seal; however, potential consequences of genetic inbreeding may include congenital defects leading to stillborn pups, something that has been recorded in several small monk seal populations (Bareham and Furreddu 1975, Pastor et al. 2004, MOm, unpublished data). Additionally, low fitness and increased susceptibility to disease may be an effect of genetic erosion that can compromise a population and lead to extinction.

Anthropogenic pollutants

Contaminant burdens have always been suspected to be a threat to the Mediterranean monk seal and thus monitoring pollutants has been considered a high conservation priority (Reijnders et al. 1993). However, information is only available on organochlorine pollutants and heavy metals. Organochlorine pollutants were analyzed in the 1990s in the Cabo Blanco and Greek monk seal subpopulations: Residue levels were found to be very low in the former subpopulation and moderate to high in the latter (Yediler et al. 1993, Borrell et al. 1997, Borrell et al. 2007). Recent research efforts in the eastern Mediterranean indicate that monk seals in Greece are not acutely threatened by heavy metals but that this threat should be closely monitored (Formigaro et al. 2016). Mediterranean monk seals are at an unknown, but suspected high level of risk from oil tanker and other ship accidents, spills, and groundings. This results from increased vessel traffic throughout the range of the species and a greater chance for accidents, disturbance, and collisions near important habitat. Four accidents or spills have occurred near important monk seal habitat in the recent past (Isräels 1992, Kiraç 1998, UNEP 2005). None of these spills or accidents had any known impacts on monk seals, but they highlight the threat from a major maritime accident near an important monk seal site (UNEP 2005).

Other threats

Although there is not enough information available to fully evaluate the magnitude of limited availability of food sources, genetic inbreeding and pollution as threats to the Mediterranean monk seal there is no indication that they are significantly affecting the Mediterranean monk seal at present (Karamanlidis et al. 2016a). More recently, the arrival of Lessepsian fishes in the eastern Mediterranean Sea, such as the toxic Pufferfish (*Lagocephalus sceleratus*), could also have a negative impact on Mediterranean monk seals in the region. The same applies to climate change (i.e., sea level rise) which could also have a negative impact, of unknown magnitude, on the habitat of the Mediterranean monk seal. Additional risks to the species come from the challenge of implementing effective conservation measures for a species in a complex, multi-national environment and the weak enforcement of agreements and international laws (Aguilar 1999).

Conservation

Nowadays the Mediterranean monk seal is legally protected throughout its range through national legislations, regional and international conventions, as well as European Union regulations. According to the European Council's Directive 92/43EEC, the Mediterranean monk seal is considered a species of community importance. Especially designed measures and regulations for the protection of important Mediterranean monk seal populations are currently in place in the following areas: the Desertas Islands Nature Reserve in the Madeira Archipelago, the National Marine Park of Alonnisos, Northern Sporades, the marine protected area in Northern Karpathos–Saria and the 3-mile no-take zone at the Island of Gyaros in Greece. With the same rationale and in order to protect the monk seal population and its pupping caves, a no-fishing area and a participative reserve have been created at the Cabo Blanco peninsula. In Turkey, similar measures have been put in place in five coastal locations in the country: Foça, Karaburun, Alaçatı-Sigacik, the Bodrum Peninsula, and the Cilician coast. Finally, the species is explicitly mentioned in 102 Natura 2000 sites within the European Union (82 sites in Greece, 10 in Italy, five in Spain, three in Portugal, and two in Cyprus) (Karamanlidis et al. 2016a). Based on the European legislation, Natura 2000 sites are legally considered by EU member states as Protected Areas and appropriate management actions should be implemented within their boundaries.

During the last two decades and throughout the range of the species, widespread action has been taken for the conservation of the Mediterranean monk seal. Especially, in areas where important monk seal populations live and breed (namely Greece, Turkey, Archipelago of Madeira and Cabo

Blanco), long-term initiatives have been carried out in order to sensitize the local human population towards monk seal conservation, to protect pupping sites, to restrict fishing gear use and relocate the most adverse fishing practices, to develop monitoring programs and intervention protocols, and to increase on-site capability to rehabilitate sick and injured individuals, particularly pups.

In addition, many workshops and conferences have brought together scientists and managers to discuss Mediterranean monk seal conservation issues and problems. Furthermore, numerous international bodies and fora, including the Regional Activity Center for Specially Protected Areas and the General Fisheries Commission for the Mediterranean, have put forward initiatives and proposals in order to ameliorate existing threats and mitigate pressures from relevant sectors (i.e., fisheries, bycatch, etc.). In Greece, the "National Strategy and Action Plan for the Conservation of the Mediterranean Monk Seal in Greece, 2009–2015" (Notarbartolo di Sciara et al. 2009) described in detail actions that had to be carried out in the country by 2015 in order to safeguard the future of the species. Similarly, in Turkey the National Monk Seal Committee has drafted a "National Action Plan for the Conservation of the Mediterranean monk seal *Monachus monachus* in Turkey" that has been approved by the Turkish Ministry of Forest and Water Works (Kiraç et al. 2013). Recently, a new Regional Strategy for the Conservation of the Mediterranean monk seal has also been adopted by the parties of the United Nations Environmental Program (Notarbartolo di Sciara 2013). Similarly, an Action Plan has been adopted for the recovery of the Mediterranean monk seal in the eastern Atlantic (UNEP 2005).

It appears that the management and protection actions that have been carried out so far have had some positive effects on Mediterranean monk seals, both, in the eastern Mediterranean as well in the Atlantic. In both areas, the populations of the species are showing now encouraging signs of recovery, giving hope for the future of the species. A reflection of the above, together with other factors, is the recent de-listing of the species in the IUCN Red Data list from "critically endangered" to "endangered" (Karamanlidis and Dendrinos 2015). Naturally, this change in IUCN category is no assurance for the species' future, since the populations that remain are still very small in size, while all threats described previously are still in place. The de-listing merely notes that we are moving in the right direction; systematic efforts to properly and efficiently manage and protect the species are obviously still necessary in order to secure the future of the species.

Keywords: Mediterranean monk seal, endangered, population, genetic inbreeding, habitat deterioration, fisheries interaction, pollution, conservation, Cabo Blanco, Atlantic Ocean, Island of Gyaros, eastern Mediterranean Sea

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