UNIVERSITÀ DEGLI STUDI DI PADOVA
Department of Comparative Biomedicine and Food Science

First Cycle Degree (B.Sc.)
in Animal Care

The Mediterranean Monk Seal: Distribution, Stranding and Major threats

Supervisor
Prof. Cinzia Centelleghe
Co-supervisor
Dott. Nicola Pussini

Submitted by
Ilaria Gradella
Student n.
2033611

ACADEMIC YEAR 2023/2024

INDEX

SUMMARY

The Mediterranean Monk Seal is the sole pinniped inhabiting the Mediterranean Sea and sadly, it ranks among the most critically endangered marine mammals globally. Over recent decades, this species has faced a brutal decline both in its distribution and population numbers, leading to sporadic sightings today.

The focal point of this thesis is to provide an updated assessment of the current status of the Mediterranean Monk Seal. This will be achieved through an attentive examination of the latest publicly available documents concerning its distribution, incidences of strandings, and the principal threats it encounters within the Mediterranean region. By synthesizing and analyzing these sources, the thesis aims to contribute to a deeper understanding of the challenges faced by this elusive predator.

Understanding the distribution patterns of the Mediterranean Monk Seal is crucial for identifying its remaining habitats and potential areas for conservation interventions. Documenting and analyzing stranding cases not only sheds light on individual incidents but also helps to reveal broader trends and potential causes of mortality. Furthermore, identifying and assessing the major threats faced by the species, such as habitat degradation, human disturbance, and climate change, is essential for developing effective conservation strategies.

In conclusion, by consolidating the latest research findings and insights, this thesis seeks to provide a comprehensive overview that can inform conservation policies and actions aimed at mitigating the decline of the Mediterranean Monk Seal and promoting its long-term survival in the face of ongoing environmental challenges.

1. INTRODUCTION

With its 2,5 million of km2 and 46.000 km of coastal areas, the Mediterranean Sea boasts being a cradle of biodiversity, the importance of which is known since antique times. The so-called "Mare Nostrum" by ancient Romans, has always been the home of the most elusive and endangered pinniped in the world, the Mediterranean Monk Seal (*Monachus monachus*).

Although it might be considered now a rather obscure species with only occasionally sporadic sightings registered, the Mediterranean Monk Seal appeared in many ancient myths and legends, indicating that it was a well-known resident of the Mediterranean Sea (W. M. Johnson and D. M. Lavigne, 1999a). First described by the German naturalist Johann Hermann back in 1779, its former range also included the waters of the Black Sea and the Atlantic Ocean areas from northern Spain to southern Morocco, including the Canary Islands, Azores, and Madeira.

Today, because of changes driven by habitat deterioration, unpredictable threats as well as anthropogenic disturbances, the Mediterranean Monk Seal can be observed in three subpopulations located in the Capo Blanco peninsula, in the Madeira's archipelago and in the Eastern Mediterranean, mainly between Greece, Cyprus and Turkey (A.A Karamanlidis et al., 2015) but occasional encounters far from those areas, such as the one occurred on the Apulian coast in 2020, might be a sign of an ongoing recolonization.

Despite the important threats that the species is facing nowadays, the total population seems to be increasing. From being catalogued as Critically Endangered in 2008, the Mediterranean Monk Seal is now listed as Vulnerable under IUCN Red list, with the number of mature individuals being between 444-600 individuals (A.A Karamanlidis et al., 2023).

The Mediterranean Monk Seal is currently protected at the national level in all the countries within its historical range and is listed in the main international conventions, such as the Council of European Communities Directive 92/43/EEC, the Bonn, Bern, CITES, Barcelona and Rio Conventions.

However, specific conservation measures, including but not limited to habitat protection, contingency plans for disastrous events, mitigation of conflicts between seals and fishermen, increased scientific research involving the monitoring of monk seal distribution and abundance, as well as raising awareness among the population and the development of a monk seal rescue and rehabilitation network, are needed.

2. **SPECIES PROFILE**

2.1 PHYLOGENETIC

The Mediterranean Monk Seal (*Monachus monachus*, Hermann 1779) is one of the 33 species that make up the *Pinnipedia* order, which includes all semi-aquatic carnivorous mammals with limbs modified into flippers. These animals lead dual lives, spending considerable amounts of time in the water, performing activities such as hunting, while still relying on land or ice to rest, molt and give birth – characteristic that made them different when compared to other marine mammals such as cetaceans or sirenians, which are completely adapted to the aquatic environment.

The current school of thought, after many years of debate, sees the *Pinnipedia* order as monophyletic with *Mustelidae*, that contains animals such as weasels, raccoons, skunks, and the red panda. The *Pinnipedia* order can be further divided into three monophyletic families: *Otariidae* (the eared seals, including sea lions and fur seals) and *Odobenidae* (with the walrus as the only living species) that form a clade by themselves and *Phocidae* (the earless or true seals) (T. Park et al., 2024)

The Mediterranean Monk Seal is the rarest extant member of the last family and the sole representative of the genus *Monachus*. Its closest relatives, the endangered Hawaiian Monk Seal (*Neomonachus schauislandii*) (C. Littnan et al., 2015) and the extinct Caribbean Monk Seal (*Neomonachus tropicalis*) (L. Lowry, 2015), are classified in the new genus *Neomonachus* as they diverged from the Mediterranean Monk Seal lineage around 6.3 million years ago (D.M Scheel et al., 2014).

These two, once three, are the only pinniped species to inhabit exclusively low-latitude, temperate and tropical waters.

2.2 BIOLOGY

2.2.1 *External appearance and anatomy*

The *Monachus monachus* is considered a medium-sized phocid; adult males average about 2.4 meters in length and can weigh up to 315 kg, while females are slightly shorter and weigh around 300 kg (P. Dendrinos et al., 2022). Nevertheless, episodic records registered a male reaching up to 400kg (D. Sergeant et al., 1978). The Mediterranean Monk Seal can live up to 30 years in the wild. However, little is known about their lifespan and breeding in captivity. Despite historical records of wild-captured specimens, these animals have rarely adapted well to captivity and often died within weeks of capture (W. M. Johnson, 2004).

Most of the somatic characteristics of the Mediterranean Monk Seal are shared with the rest of the *Phocidae* family: an elongated and tapered body, covered by a thick layer of fat, without any external protrusions except for the limbs and the coat composition linked with sebaceous glands which make them perfectly adapted to the aquatic environment. However, some distinct traits make this species unique; for example, when comparing the *Monachus* with the *Neomonachus* genus, some differences include, but are not limited to, the average body size, with *Neomonachus* species being smaller; the coat coloring, with *Monachus* having a distinctive ventral white patch on the pelage; and skull morphology, which is narrower and more fragile in *Neomonachus* with less developed sagittal and occipital crests (D. M. Scheel et al., 2014).

Mediterranean Monk Seals show sexual dimorphism. On average, adult males are heavier and overall larger but only about 5% longer than females, unlike other phocid species (e.g., elephant seals), where males can be significantly longer than females. This can be because Mediterranean Monk Seal appears to mate only in the water, opposite to other species which do mate on land (T. Pastor et al., 2011). Another difference is found by looking at their pelage. Adult males are entirely covered by an overall black pelage with a whitish belly patch, while females are generally grey or brown with dorsal marks and a lighter belly. Usually, black spots are present within the patch (E. Badosa et al., 2006a). Dorsal marks appear to be more common in females rather than in males, suggesting that they are caused by males during mating (L. M. Gonzales et al., 2000).

All the three species of Monk seals, hold the record of the shortest hair length among Pinnipeds, being approximately 0.5cm long (J. K. Ling, 1970).

2.2.2 *Molting*

Mediterranean Monk Seal appearance changes gradually between neonatal and adult pelage in a continuous process (L. M. Gonzales, 2000). At birth, pups are covered with a dark lanugo, which is approximately 1-1,5 cm long (P. Fernández de Larrinoa et al., 2021) with a whitish ventral patch. The shape of the ventral patch is sexually dimorphic, in females the caudal margin of the light spot is close to the tail and straight, with the umbilical slit falling within it. On the other hand, in males the caudal margin reaches, or almost reaches, the umbilical slit. The penile opening falls outside the ventral patch (E. Badosa et al., 2006a). Females lose the lanugo earlier and faster compared to males, so they complete the molt when they are significantly younger (64 days) than males (82 days). After shedding the lanugo, molted pups have a greyish dorsal and white ventral pelage. In females, the grey pelage is maintained in subsequent molts and throughout their lifespan (E. Badosa et al., 2006b). On the other hand, when males become bulls, they acquire a black pelage with a white, spotted ventral patch, that resembles their pup lanugo (L. M. Gonzales et al., 2000). In males, the process of developing the

mature pelage pattern of bulls is gradual. It involves at least two annual moults and can be completed by the age of 4 years. The intermolt period is close to one year, except in females nursing a pup. Such females have longer intermolt periods and can even molt whilst lactating (E. Badosa et al., 2006b).

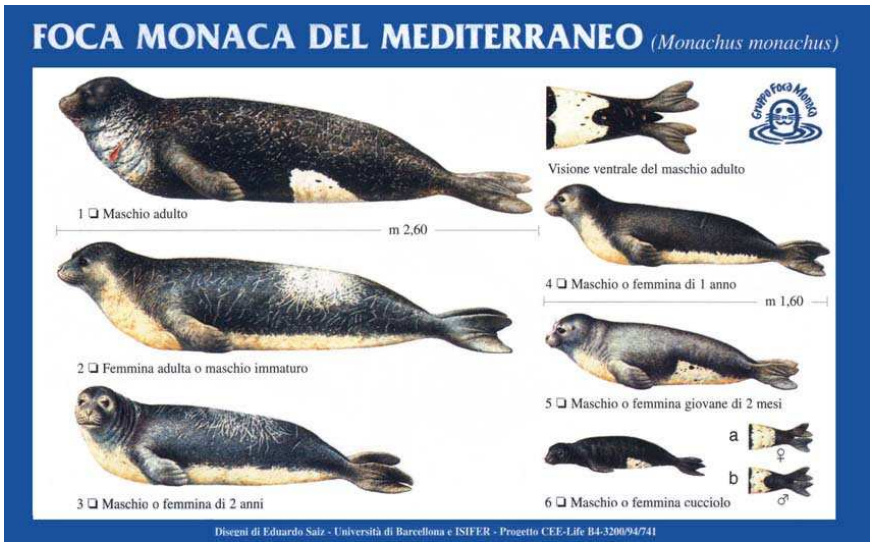

Figure 1. Morphological stages of MMS. From Gruppo Foca Monaca APS (2024)

2.2.3 *Reproductive biology*

Historical sources mention that Mediterranean Monk Seals once hauled out on open beaches (Lavigne and Johnson, 1999). Nevertheless, nowadays, they almost exclusively give birth and raise their offspring in marine caves (P. Dendrinos et al., 2007a). This behavior appears to have developed as an adaptation to centuries of human persecution, even though it is not ideal for pups (A. A. Karamanlidis, 2015). It has been shown that pupping Mediterranean Monk Seals prefer caves where they cannot be seen, but that are not completely dark, have multiple escape routes, are not easily accessible to humans, have a low risk of pup washout, and benefit from beaches with a soft substrate. These requirements for the interior of the caves seem to be more important than the prevailing weather conditions and human activity outside (P. Dendrinos et al., 2007a).

Unlike other phocids from higher latitudes, the pupping season for the Mediterranean Monk Seals seems extremely protracted. Births are generally recorded all throughout the year, with a small peak in October (M. Gazo et al., 1999); however, differences have been observed between the main populations. Monk Seal pupping season in the eastern Mediterranean Sea and the Archipelago of Madeira is quite synchronous, occurring mainly in October and November, while in the Cabo Blanco Peninsula, births can take place throughout the year (A. A. Karamanlidis et al., 2023). This non-seasonal breeding activity is thought to be related to the generally stable weather conditions and relatively constant productivity that characterizes the area inhabited by the seals (M. Gazo et al., 1999).

Sexual maturity is reached at around 3 years of age in females, while for males it takes longer, reaching it around the age of 6, after the second molt (P. Dendrinos et al., 2022). *Monachus monachus* have a moderately polygynous mating system (A. A. Karamanlidis., 2015), meaning that one male lives and/or mates with multiple females.

Sexual activities have been observed in the aquatic territories outside the entrance of the caves, but none have been observed inside (T. Pastor et al., 2011). Some males defended aquatic territories surrounding the entrance to the breeding caves, while a larger number of males defended aquatic territories located along cliffs 5 to 30 km away from the breeding caves (T. Pastor et al., 2011).

The gestation period lasts approximately 10 months, after which a single pup is born on land. Newborns are toothless with almost a fully black "lanugo" except for the unique whitish ventral patch (P. Fernández de Larrinoa et al., 2021). At birth, pups are approximately 1 meter long and weight between 15 to 18 kg. (MOm, 2023).

The lactation period lasts between 4 and 5 months, which is significantly longer compared to other true seal species. During the first week after birth, the mother stays with the pup, constantly nursing it. After this week, the time spent nursing decreases as the mother begins to forage at sea, leaving the pup alone in the cave. Already since birth, pups are active and mobile, and swam frequently before molting or weaning occurred (A. Aguilar et al., 2007).

2.2.4 *Feeding habits*

The transition from suckling to active feeding is an important challenge that all mammal species face. Indeed, particular attention has been given to the diet during the post-weaning phase of the pups.

Cem Orkun Kıraç and Meltem Ok (2019) conducted the only study regarding the diet of a juvenile molted male Mediterranean Monk Seal pup of about 5 months. Throughout the analysis of the stomach contents, a total of 6 prey items from 2 families, respectively *Octopodidae* and *Congridae* were identified. Cephalopods represented the largest component (90.8% of the stomach contents), followed by teleost's (8.9%). These results are coherent with other available literature (Pierce, 2011), in which members of the *Octopodidae* appear to be the preferred prey items for adult Mediterranean Monk Seals. Indeed, the *Monachus monachus* has been defined as a generalist opportunistic predator with a wide diet consisting mainly of cephalopods, such as *Octopus, Sepia*, and the squid *Loligo* spp.; fish of the families *Mugilidae*, *Sparidae*, and *Clupeidae*; and crustaceans such as lobsters (*Palinurus* spp.) (L. M. González, 1999). In some cases, also the presence of sponge (*Sarcotragus* sp.) and sea grass (*P. oceanica*) was unexpectedly detected (A. Salman et al., 2001).

2.2.5 *Perception and Communication*

Mediterranean Monk Seals are perfectly adapted to their aquatic life. In water, they are able to see well; however, vision is limited in turbid conditions or when diving deeply or at night, so they also rely on their long vibrissae. The vibrissae are highly sensitive organs whose primary function is to detect vibrotactile information from the environment. In most phocid seals vibrissae are beaded in morphology with repeated crests all along their length; nonetheless, exceptions are seen in the Mediterranean Monk Seal, Hawaiian Monk Seal and Bearded Seal, which exhibit a smooth profile (C. Summarell et al., 2012).

The sense of smell covers an important role in the life of the Mediterranean Monk Seals. In the first weeks of life, newborns strongly rely on smell to communicate and find their mother in the darkness of the caves where they live (MOm, 2023).

As the other species belonging to the *Phocidae* family, Mediterranean Monk Seals don't have an external ear lobe. Nevertheless, the sense of hearing is well developed, allowing them to hear higher sound frequencies then humans (MOm, 2023).

Pinnipeds are among the most vocal of all mammalian taxa. Seals perform most vocalizations underwater (R. J. Schusterman et al., 2001). Isabelle Charrier et al. (2023) conducted the first and only study about underwater vocalization of the Mediterranean Monk Seal, in which 18 different call types have been described. The aerial vocal repertoire of the *Monachus monachus* has only recently been studied, and so far, five different call types have been identified and described: bark, chirp, grunt, short scream, and scream, with bark and scream being the two main call types (I. Charrier et al., 2017).

2.2.6 *Thermoregulation*

The Mediterranean Monk Seal inhabits a warm water environment, which is unusual for most other pinnipeds. This species can tolerate high temperatures and avoid hyperthermia by maintaining a low metabolic rate while resting and by exposing its lighter belly (D. Marchessaux et al., 1987).

The normal body temperature is approximately 38°C (MOm, 2023), and under the skin, there is a thick layer of fat known as blubber. The primary function of the blubber is to act as an insulator, keeping the body temperature constant both in water and on land.

2.2.7 *Diving behavior*

Compared to other pinnipeds, there is limited information on the diving capacities and patterns of Mediterranean Monk Seals.

Pups enter in water already during their first week of life and their diving performance increases progressively with age (M. Gazo et al., 2006). Their swimming activity was recorder to be greater at night than during the day. (M. Gazo et al., 2006).

Cem Orkun Kıraç et al. (2002) observed the diving behavior of free ranging Mediterranean Monk Seals in Turkish waters from 1993 to 1998. Over these five years, 20 separate diving episodes were recorded, 18 involving adult specimens and 2 involving juveniles. They calculated the mean dive duration and mean surface interval for both adults and juveniles. The results for adults were 384.9 seconds (6.4 minutes) and 48.9 seconds (0.81 minutes), while for juveniles, the results were 407.9 seconds (6.8 minutes) and 32.6 seconds (0.54 minutes) respectively. In most of the cases, the animals dived in limited areas near the coast and in relatively shallow waters, between 2 and 15 meters of depth. Only in 3 cases, the seals reached deeper waters, between 9.6 and 20 meters deep.

The greatest depth recorded for the species was achieved by a rehabilitated juvenile Monk Seal, which reached an impressive 123 m (P. Dendrinos et al., 2007b).

2.2.8 *Ethology*

The elusive nature of the Mediterranean Monk Seal complicates the study of its behavior. Moreover, their tendency of inhabiting marine caves, beaches on remote islands and near cliff-bound continental coastlines has made it hard to even reach possible study areas.

In 2003, P. Dendrinos et al (2007c) managed to determine and successfully place a video surveillance system in some caves within the National Marine Park of Alonissos, a complex of islands located in the northwestern Aegean Sea, which has been identified as an extremely important area for the survival of the species in Greece. This study allowed for the first time to shed a light on the social life of the Mediterranean Monk Seal.

The name “Monk” mistakenly suggests that this seal species is solitary, unlike other phocids. This misconception originated from Johann Hermann, who named the species after the Greek word for monk, “Monachos”; however, the same word also means “alone”. This, added to the fact that Mediterranean Monk Seals are rarely seen in groups when at sea, made up the wrong idea that the species is solitary (P. Dendrinos et al., 2022).

As already mentioned, historical evidence states that human pressures were actively responsible for driving seals to retreat in marine caves inhospitable for humans, instead of hauling out on sandy open beaches, their preferred habitat (Lavigne and Johnson, 1999).

Recent evidence from the Mediterranean Monk Seal population in the Aegean Sea suggests that aggregations of around 10 animals may occur in larger and higher-quality pupping caves, especially during pupping seasons. In these caves, females gather to give birth, while males range in the nearby waters to gain access to receptive females. (P. Dendrinos et al., 2022).

Monachus monachus seems to have a complex matriarchal society, in which females higher up in the hierarchy gain access to the higher-quality pupping caves, while males compete for access to receptive females, with stronger males maintaining a loose harem. Younger or weaker males tend to be more solitary and less frequently seen in the caves (P. Dendrinos et al., 2022).

3. DISTRIBUTION AND SIGHTING ANALYSIS BETWEEN 2015 and 2024

3.1 HISTORIC DISTRIBUTION

Monachus monachus were once widely distributed throughout the Mediterranean and Black Seas, as well as the Canary, Madeira, and Azores Archipelagos (A.A. Karamanlidis, 2015). They also inhabited the coastal areas of northwestern Africa and the Iberian Peninsula in the northeastern Atlantic Ocean (L. M. González, 2015).

Today, due to habitat exploitation and human persecution (Lavigne and Johnson, 1999; L. M. González, 2015), the population has been reduced to fewer than 1,000 mature individuals distributed among three different populations: one in the eastern Mediterranean Sea and two in the northeastern Atlantic Ocean (A. A. Karamanlidis et al., 2023). Recently, sightings of individuals have been recorded in Israel, Cyprus, Croatia and Italy (MOm, 2023).

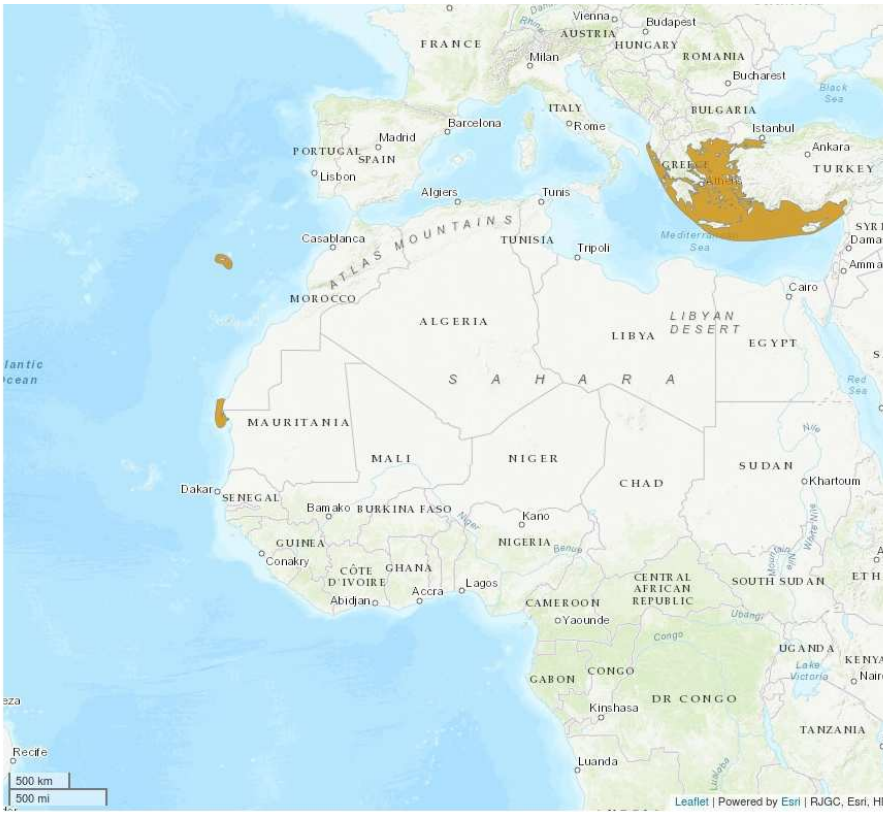

Figure 2. Distribution map of Monachus monachus 2023. Compiled by European Red List; IUCN & EU 2023

3.2 CURRENT DISTRIBUTION

3.2.1 *Eastern Mediterranean basin*

The Eastern Mediterranean basin presents significant challenges for estimating demographic parameters of the rare species *Monachus monachus*. The complex coastal morphology, with its numerous islands, and the species' distribution across the waters of several countries make it

extremely difficult to establish accurate demographic criteria, often resulting in imprecise estimates (G. Pietroluongo et al., 2022a). The largest populations of Mediterranean Monk Seals are primarily found in the Ionian and Aegean Seas, along the coastlines of Greece and Turkey (MOm, 2023).

In Greece, the Mediterranean Monk Seal is widely distributed along the 16,000 km of coastline and across more than 4,000 islands and islets. Thanks to the Hellenic Monk Seal Rescue and Information Network (RINT) by MOm, significant areas for the species have been identified, such as the island complex of Kimolos, Polyaigos, and Gyaros in the Cyclades, and the island complex of northern Karpathos, Saria, and Astakidonisia in the Dodecanese. Using a new approach based on "pup multipliers", Alexandros A. Karamanlidis (2024a) estimated that the total number of individuals in Greece ranges between 337 and 450, including 187 to 262 mature individuals. However, the challenging relationship between Mediterranean Monk Seals and fisheries necessitated the development of specific legislative, management, and financial measures to protect the species without adversely affecting the fishing community. In response, MOm created the "Action Plan for the Mitigation of Monk Seal and Fisheries Interactions in Greece" in 2009, in collaboration with various national and international experts.

In Turkey, the distribution of the Mediterranean Monk Seal is highly fragmented, mainly along the Aegean coasts, except for Saroz and Edremit Bays, and the Teke Peninsula, as well as the mountainous part of the Mersin provincial coasts in the Mediterranean (H. Güçlüsoy et al., 2004). A few individuals are also present along the southern Sea of Marmara coast (Ö. Emek Inanmaz et al., 2014), while the species is thought to be extinct in the Black Sea, with the last sighting occurring in 1997 (C. Kıraç, 2001). Important population nuclei have been identified on the island of Gökçeada in the northern Aegean Sea (A. Dede et al., 2019), in Gökova Bay (E. Saydam and H. Güçlüsoy, 2023), and along the northeastern Mediterranean coast of Turkey (M. Kurt and A. C. Gücü, 2021).

The Mediterranean Monk Seal has been under official protection in Turkey since 1977, and in 1991, a Turkish National Strategy for the conservation of the species was implemented. Since then, several minor conservation projects have been carried out by smaller individual parties (H. Güçlüsoy et al., 2004). The total population of seals in Turkey is estimated to be between 76 and 102 individuals, including 42 to 59 mature ones (A. A. Karamanlidis, 2024a). However, deliberate killings by artisanal fishermen, entanglements in fishing gear, overfishing, and habitat destruction remain serious threats to the conservation of the species (Güçlüsoy, 2004).

3.2.2 *Archipelago of Madeira*

Historical evidence indicates that when the first Europeans arrived in Madeira in 1420, the Mediterranean Monk Seal population was thriving. However, the species experienced a significant

decline throughout the area due to brutal commercial expansion and increased human activity (R. Pires et al., 2008). To address this, the Parque Natural da Madeira Service initiated a Monk Seal Conservation and Monitoring Program in 1988, and two years later, the Desertas Islands were declared a Nature Reserve. Thanks to these conservation efforts (H. C. Neves and R. Pires, 1999) and continuous monitoring of the area, the Monk Seal population reached 27 individuals by 2021 (R. Pires et al., 2023).

3.2.3 *Cabo Blanco peninsula*

At the start of the 20th century, the species was considered extinct due to the massive hunting along the rapid development of the coastal areas, until the colony in Cabo Blanco was discovered in 1945. Half a century later, in 1994, the CMS Parties involved in the COP meeting in Nairobi, fostered the development of a conservation plan for the Mediterranean Monk Seal (CMS, 2021). Then, the occurrence of a devastating mass die-off in the spring of 1997 reduced the population size from a previous 350 individuals (CMS, 2021) to just 109 individuals. Since mortality was age-specific, with adults being the most affected, the population's age composition changed, leading to a decrease in the reproductive potential (J. Forcada et al., 1999).

Maribel Reyero et al. (1999) conducted a study to determine the cause of the population decimation. Their research indicated that the decline was due to a toxic algal bloom, most likely originating from the dinoflagellate *Gymnodinium catenatum*, combined with a morbillivirus outbreak. Cultures of *G. catenatum* typically exhibit a broad toxin profile capable of killing a large number of adult seals.

Under the framework initially established by CMS, an Action Plan implemented by several nations has yield impressive results in the recovery of the population (CMS, 2021). Nowadays, the Cabo Blanco Peninsula is home to a large population of Mediterranean Monk Seals, estimated at approximately 330 individuals (A.A. Karamanlidis, 2015; P. Dendrinos et al., 2022) that retains the structure of a colony as seen in other pinnipeds (L. M. González et al., 1997; M. Martínez-Jauregui et al., 2012).

3.2.4 *Sightings in Italy*

The current status of the Mediterranean Monk Seal in Italy remains largely unknown. The limited information available (G. Mo, 2011; G. La Mesa et al., 2021), which mostly comes from sporadic third-party sightings, is insufficient to confirm the presence of a resident population (G. Mo, 2013).

The aim of this chapter is to collect and analyze data obtained from sightings, environmental DNA, camera traps, and necropsies of deceased specimens along the Italian coasts between 2015 and 2024. This analysis seeks to identify signs of a potential recolonization of *Monachus monachus* in Italy.

The sightings mentioned in this chapter have all been validated by ISPRA, SNPA, ANSA and other reliable sources, and are supported by video and/or photographic evidence.

In 2015, a group of divers exploring a cave in the Marine Protected Area of Portofino (AMP Portofino) in Liguria encountered a seal. One of the divers managed to capture a photograph of the animal, and another diver estimated its length to be around 2 meters. The location of the encounter is consistent with the preferred habitat of the species, characterized by numerous caves and big rocks that form natural pools, as well as the presence of the species' preferred prey, such as the Common Octopus and the Common Cuttlefish. In the days following the encounter, the director of the AMP monitored that area and other potential habitats for the Mediterranean Monk Seal. However, these efforts were unsuccessful as the animal was not sighted again.

During the winter of 2016, a Mediterranean Monk Seal was captured by camera traps in a cave within the Marine Protected Area of the Egadi Islands in Sicily. This sighting reaffirms the area's strategic importance for the species. Notably, this was not the first instance; another seal was recorded several times in the same location during the winter of 2011-2012, years in which the monitoring program with camera traps started. These data suggest the presence of multiple individuals in the Egadi Islands over recent years. In fact, the region provides an ideal habitat for the Monk Seal, with numerous caves and an abundance of prey such as the Common Octopus. During the summer, another Mediterranean Monk Seal was reportedly sighted in the Venice Lagoon. However, no concrete evidence, such as photographs or videos, was collected to verify the sighting. In the same area, several reports occurred in 2013 and during one of these fortunate events, a video was made, capturing the presence of a seal in the Grand Canal of Venice.

In 2017, another Mediterranean Monk Seal was captured by camera traps in the Marine Protected Area of the Egadi Islands. In the same year, a seal was spotted off the port of Tricase, in Salento (Apulia). The last reported sighting in Apulia dates to May 1983 reported in the same location (P. Di Turo, 1984).

Between 2018 and 2019, no sightings have been reported and validated by ISPRA or other reliable sources.

On January 27th, 2020, a female monk seal pup was spotted near “Torre di San Gennaro” in Apulia. The specimen was found emaciated and lethargic. Despite intervention from the regional veterinary team, it died the following day. A necropsy performed within 12 hours of its death by S. Mazzariol et al. (2021) revealed the presence of *Cetacean Morbillivirus* (CeMV) and a co-infection of *Toxoplasma gondii,* which probably resulted from CeMV-induced immunosuppression (A. Petrella et al., 2021).

In June, following several reports at Capraia Island (Tuscan Archipelago), two researchers from ISPRA inspected the "Cave of the Seal" and observed a specimen resting inside. To avoid disturbing the animal, they exited the cave and returned the next day to collect fecal samples and install a camera trap. In October, another seal was sighted and captured by a video in the Tuscan Archipelago, this time off the east coast of Pianosa Island. Following these sightings, the National Park of the Archipelago in collaboration with ISPRA, initiated a monitoring program by installing additional camera traps in caves deemed suitable for the species. In November, a Mediterranean Monk Seal was captured by a video off Lampedusa Island shore.

Several sightings occurred in Apulia in 2021 off the shores of Gallipoli, Nardò, and Porto Cesareo (G. Mo, 2021). The coasts of Salento are part of the historic range of the Mediterranean Monk Seal, characterized by numerous caves with emerged areas and submerged entrances that are difficult for humans to access. Additionally, given the proximity of these areas to the main reproductive colonies in Greece, it is plausible that some individuals from these colonies could reach and frequent the Apulian coasts (G. Mo, 2021). In light of this evidence, camera traps have been placed in certain suitable caves of the Special Zone of Conservation of Torre Uluzzo (LE) and a monitoring program has been initiated (G. Mo, 2021). Apart from Apulia, the presence of the *Monachus monachus* was reported also in Basilicata and Calabria. A particularly noteworthy sighting occurred in the Marine Protected Area of Capo Rizzuto (CR), where a seal was observed for at least an hour, surfacing every five minutes. During one of these events, a video was captured as evidence. This pattern suggests that the animal was either hunting or sleeping underwater, surfacing only to breathe. Recent studies on the sleeping behavior of the Mediterranean Monk Seal indicate that, like other true seal species, it is able to sleep underwater (A. A. Karamanlidis, 2017).

Between 2020 and 2021, data collected through an environmental DNA-based technique by researchers from the University of Milan – Bicocca, in collaboration with Gruppo Foca Monaca APS, identified six "hot-spots" where Mediterranean Monk Seals are found. These include five areas in Italy and one in the Balearic Archipelago. The five areas in Italy are the upper Adriatic between Istria and the Venice Lagoon, Salento-Gulf of Taranto, the smaller Sicilian islands, eastern Sardinia-Caprera Canyon, and the Tuscan Archipelago.

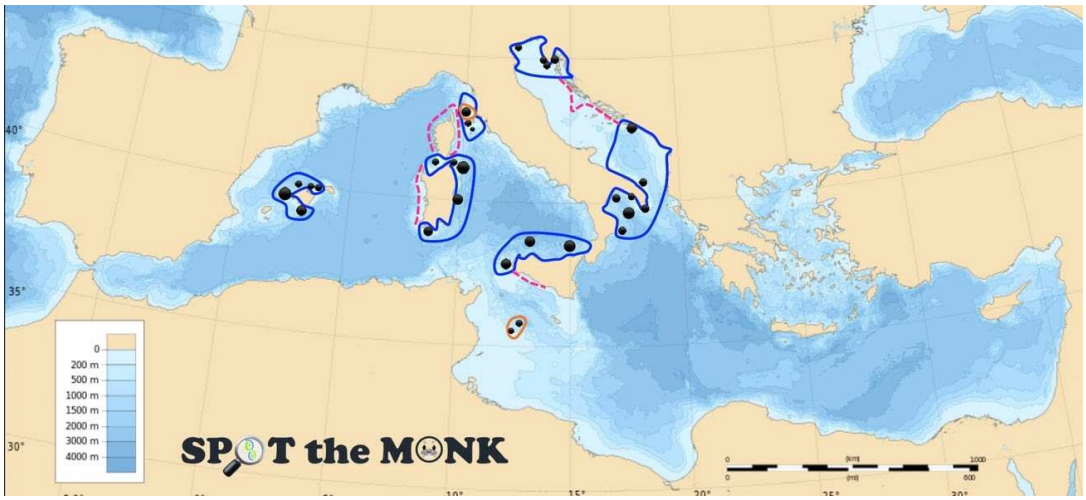

Figura 3. Map indicating the distribution of the 6 "hot-spots" for the MMS in the Mediterranean Sea (2021). Developed by "SPOT the MONK" project by University of Milan-Bicocca

In 2022, the camera traps installed at Capraia in 2020 captured footage of a Mediterranean Monk Seal resting in the dry part of the cave. The consistent presence of seals in this area over the years is well-justified by its favorable characteristics. In the same year, a project supported by the Blue Marine Foundation was initiated, involving several Italian Marine Protected Areas (MPAs). The specific aim of the project in the Tuscan Archipelago is to develop an action plan for the protection and mapping of marine caves, with particular attention to those suitable for the seals. A part for Tuscany, several sightings mentioned in the dedicated Facebook page of ISPRA have been reported in Apulia, Calabria, east side of Sicily and its minor islands.

During May 2023, a new sighting was documented off the west coasts of Capri and off the shores of Lesina (FG), while in June, another specimen was confirmed visiting a cave in Capraia. The images obtained by the cameras in the Tuscan Archipelago are the last validated news about the Mediterranean Monk Seal along Italian coasts. In the same year, a new research initiative for the monitoring of the *Monachus monachus* involving environmental DNA (eDNA) was launched in the Pelagos Sanctuary, located in the northwestern Mediterranean Sea.

Through the collection of all the information mentioned in this chapter, it was possible to build an updated map regarding the current distribution of the *Monachus monachus* in Italy between 2015 and 2024. By comparing this map with the one developed by Spot the Monk (2021) (Figure 3) it's noticeable that the Italian "hot-spots" mostly align with where these elusive marine mammals have

been sighted. This coherence underscores the reliability of the data and emphasizes the importance of these areas for *Monachus monachus* conservation efforts in Italy.

Figure 4. Map showing the sightings of MMS between 2015 and 2024. Each point represents a verified sighting, indicating the seal's presence and potential recolonization of its historic range. The color coding has been selected in respect of the year of the sighting: ***2015****: purple;* ***2016****: blue;* ***2017****: burgundy;* ***2020****: green;* ***2021****: yellow;* ***2022****: orange;* ***2023****: violet.*

Although the recolonization of the species' ancient range seems distant, the collection and validation of sightings, combined with scientific methodologies, the development of targeted projects, and specific legislation, are beginning to show promising results in enhancing the protection and potential re-establishment of the Mediterranean Monk Seal.

4. METHODOLOGIES AND eDNA

4.1 e-DNA

Over the past few years, Environmental DNA (e-DNA) has emerged as a revolutionary tool for cost-effective, sensitive, and non-invasive species monitoring (P. Suarez-Bregua et al., 2022). It can be extracted from environmental samples such as water, soil, or air without firstly isolating any target organism (P. Taberlet et al., 2012). There are 3 major steps to detect aquatic macroorganisms from water samples. Firstly, the e-DNA is collected through filtration, precipitation or centrifugation and ultrafiltration of a water sample, then, the e-DNA is extracted and purified using a commercial kit or through a liquid phase extraction method and finally, based on the aim of the research, the e-DNA is detected through a species-specific detection method or by e-DNA metabarcoding. (S. Tsuji et al., 2019).

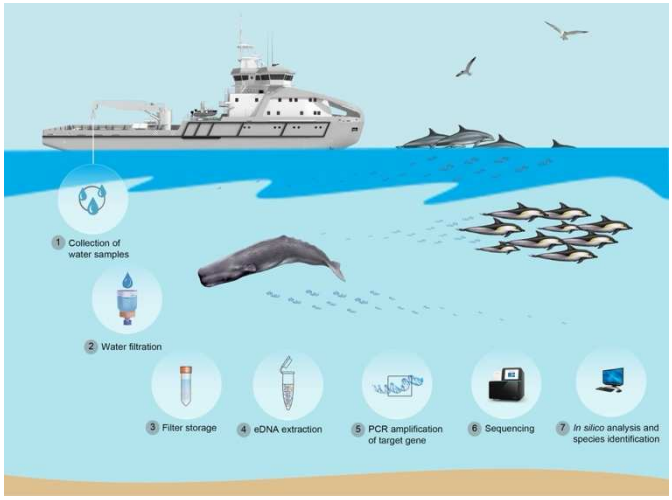

Figure 5. Application of e-DNA methodology for marine mammals monitoring (single species, biodiversity and genetic characterization). From P. Suarez-Bregua et al. (2022)

As mentioned multiple times throughout the chapters, the current distribution of the Mediterranean Monk Seal is still only partially defined, mostly relying on sporadic sightings that may remain unverified and on remote camera traps placed at sites where adult females are known to reproduce (E. Valsecchi et al., 2022). In addition, little is known about their foraging areas, social interactions, and actual range during non-breeding seasons (E. Valsecchi et al., 2022). The *Monachus monachus* is an ideal species to be monitored with e-DNA. In fact, this method can represent a valid approach for regular monitoring of priority conservation areas or other defined sites, such as near breeding/pupping sites or expected underwater resting/sleeping sites. It can also be used to validate observations outside monitoring areas, investigate range expansions, and explore yet unstudied facets of the biology of this threatened species, such as habitat use, feeding habits, and movements during non-reproductive seasons, with a particular focus on offshore waters (E. Valsecchi et al., 2022).

4.2 VISUAL METHODS

4.2.1 Remote camera traps

The use of remote cameras has proven to be a valuable methodological tool, enabling researchers to gain insights into species like *Monachus monachus*, which are difficult to observe directly and present ethical and conservation challenges (S. Hamel et al., 2013). Due to its critical population status, the chosen study methods should aim to avoid disturbing the animals. On the other hand, the obtained pictures and videos need to meet specific criteria to be useful for further research (A.C. Gucu, 2009).

Ali Cemal Gucu (2009) conducted a study on the possible deterrent effect of visual-flash photo traps in caves attended by Mediterranean Monk Seals. Two different modern systems were used for this research: one with photo traps equipped with an infrared light source, which is invisible to the seals, and the other with a built-in flash that provides enough light to capture detailed pictures even in total darkness. The study demonstrated that even if the seals noticed both types of photo traps, they never fled the cave but returned to rest. However, a significant difference was found in the average haul-out time, with seals exposed to the visible flash hauling out longer compared to those exposed to the infrared light.

In conclusion, while e-DNA techniques are under development, the use of photo traps is still a vital tool to shed a light on the elusive lifestyle of this pinniped.

4.2.2 Sighting network

Prior to the development of modern technologies, assessing the existence of a rare species was only possible through occasional chance sightings (A. R. Solow, 1993). Especially in low-density areas like Italy, whenever a sighting occurs, it is most likely to be validated by experts from the Major Institute for the Protection and Environmental Research (ISPRA) or Gruppo Foca Monaca (GFM) ASP. GFM was established in 1976 under WWF Italy, with the aim of promoting the protection of the last nuclei of Mediterranean Monk Seals present on some Italian coastlines (Gruppo Foca Monaca, 2024). A similar association is also present in Greece, under the name of The Hellenic Society for the Study and Protection of the Monk seal (Mom).

Since the possibility of encountering a seal along the Italian coasts is increasing, both ISPRA and GFM have established guidelines to avoid disturbing the animals while informing researchers and the port authority. It is important to observe the seals from a safe distance, noting their behavior and physical characteristics, such as fur color, body dimensions, and shape (ISPRA). After the encounter, is good to fill out a specific “form for sightings” present on the website of Gruppo Foca Monaca.

4.3 PASSIVE ACOUSTIC MONITORING

Passive acoustic monitoring (PAM) has become a feasible method for investigating acoustic behavior and measuring the temporal and spatial distributions of marine mammals over large areas (H. Frouin-Mouy et al., 2016). This technology involves autonomous underwater recorders that document vocalizations useful in management applications across all spatial scales (S. M. Van Parijs et al., 2009).

Although PAM has primarily been used with cetaceans, it now holds potential for studying many other marine animals, such as pinnipeds, sirenians, and fishes (S. M. Van Parijs et al., 2009). It can track and localize marine animals by utilizing their underwater vocalizations (S. M. Van Parijs et al., 2009). Considering that the first study of underwater sounds of Mediterranean Monk Seals was only recently conducted by Isabelle Charrier et al. (2023), the findings of this research can be used to develop a long-term acoustic monitoring scheme for the reproductive areas of this species, as well as for identifying new potential areas of species occurrence.

4.4 CITIZEN SCIENCE

The terminology "*Citizen Science*" broadly refers to the active engagement of the general public in scientific research tasks (K. Vohland et al., 2021). In fact, citizen science can expand research capacity, offer stimulating opportunities for participants, engage volunteers directly in conservation science and management, and enhance science and environmental literacy (E. R. Ellwood et al., 2017).

Nowadays, even though Marine Citizen Science is still underrepresented compared to Terrestrial Citizen Science (S. Adamantopoulou et al., 2023), important studies like the one conducted by E. Valsecchi et al. (2022), in which most of the water samples were collected through a citizen science project, have demonstrated the reliability of this tool in marine mammal conservation

5. STRANDING FINDINGS AND MAJOR THREATS IN THE MEDITERRANEAN AREA

5.1 PARASITES AND INFECTIOUS DISEASES

5.1.1 Parasites

Very little is known about the parasites of *Monachus monachus*. However, ectoparasites as well as endoparasites and protozoa have been identified so far (Table 1).

Ectoparasites	Mites	*Orthohalarachne diminuata*	(E. Danyer et al., 2017)
		Halarachne halichoeri	(N. Athinaiou et al., 2023)
	Lice	*Lepidophthirus piriformis*	(D.I. Blagoveshtchensky, 1966)
Endoparasites	Nematodes	*Anisakis pegreffii*	(C. Crety, 1890)
		Contracaecum sp.	(B. Schnapp et al., 1962)
		Acanthocheilonema spirocauda	(E. Papadopoulos et al., 2010)
		Uncinaria hamiltoni	(A. Th. Komnenou et al., 2021)
		Pseudoterranova spp.	(E. Koitsanou et al., 2022)
	Platyhelminths	*Diphyllobothrium elegans*	(S. Marowski, 1952)
		Diphyllobothrium sp.	(B. Schnapp et al., 1962; K. Ronald, 1973)
		Diplogenophorus tetrapteus	
		Bothriocephalus sp.	
		Cysticerus cellulosae	
		Braunina cordiformis	(E. Danyer et al., 2017)
Protozoa	Kinetoplastea	*Leishmania* sp.	(N. Toplu et al., 2007)
	Apicomplexa	*Toxoplasma gondii*	(S. Mazzariol et al., 2021)

Table 1. Summary of the main parasites detected in MMS.

5.1.2 Zoonoses

In 2007, for the first time in a Mediterranean Monk Seal, *Parapoxvirus* infection was found by N. Toplu et al. (2007). The genus *Parapoxvirus* belongs to the subfamily *Chordopoxvirinae* of the family *Poxviridae* (M. H. V. Van Regenmortel and B. W. J. Mahy, 2008); however, they possess a unique spiral coat that distinguishes them from other poxviruses (A. M. López López et al., 2019).

Another important zoonosis found in Mediterranean Monk Seals is *Morbillivirus*. According to recent findings by S. Mazzariol et al. (2021) on a stranded pup along the southern Adriatic Italian coast,

Cetacean Morbillivirus was detected, indicating that interspecies transmission from cetaceans to pinnipeds has occurred.

5.2 UNPREDICTABLE THREATS

Unpredictable threats, such as cave collapses (L. M. González et al., 1997) and mass mortality events like the one that occurred in Cabo Blanco in 1997 (J. Forcada, 1999), have severely impacted the species in recent years. These threats are particularly significant in the northeastern Atlantic due to the species' limited geographical range in the region (A. A. Karamanlidis and P. Dendrinos, 2024).

5.3 INTERACTIONS WITH FISHERIES

The innate curiosity and ingenuity of the Mediterranean Monk Seal have enabled it to find creative solutions in its search for food. The main strategy involves interactions with fisheries; in fact, this species has learned how to steal fish from fishing gear. This has created problems with local fishermen, resulting in deliberate killing and entanglement episodes. On the other hand, overexploitation of fish stock may be a significant threat for the seals (P. Dendrinos et al., 2022).

5.3.1 Intentional killing

The Mediterranean Monk Seal is often blamed for the financial losses associated with its interactions with coastal fisheries, as fishermen perceive the seals as competitors (P. Dendrinos et al., 2022). The interaction between seals and fishermen often results in damage to fishing gear, leading to aggressive responses that usually result in the intentional killing of the animals (M. Solanou et al., 2024). The most common methods used by fishermen to deter seals include lights, feeding them pesticide-injected fish, noise generation, warning shots, direct shots with rifles, and physical exclusion to keep them away from cages and nets (H. Güçlüsoy and Y. Savaş, 2003). This problem, exacerbated by overfishing, appears to be a major factor in the species' significant decline over time (P. Dendrinos et al., 2022).

5.3.2 Entanglement

Accidental entanglement in fishing gear has been identified as one of the most important threats to *Monachus monachus* (A. A. Karamanlidis et al., 2008). While stealing from fishing gear may provide a convenient foraging technique, it comes with a high risk, especially for inexperienced young specimens (A. A. Karamanlidis et al., 2008). Accidental drowning after entanglement may account for more than 46% of recorded deaths among subadult monk seals (MOm, 2023).

5.3.4 Overfishing

In the Mediterranean Sea, the largest portion of fisheries resources has already been exploited to an unsustainable degree and continues to decrease in biomass (P. Dendrinos et al., 2022). The decline of target species for the Mediterranean Monk Seal, such as the common octopus, can negatively affect the population (A. Salman et al., 2001) by reducing reproduction rates, lowering pup and juvenile survival rates, and ultimately compromising the viability of the entire population (P. Dendrinos et al., 2022).

5.4 HABITAT DEGRADATION

Increased human activity in coastal areas has gradually degraded suitable habitats for the Mediterranean Monk Seal. Over the centuries, this has become a major threat, forcing the seals to rely predominantly on marine caves, thereby decreasing their overall chances of survival (MOm, 2023).

5.4.1 Tourism

Mass tourism has been identified as one of the most significant causes of decline affecting this species in several key areas, such as France and Corsica, Spain and the Balearic islands, Croatia, Italy and Sardinia, and Tunisia (W. M. Johnson and D. M. Lavigne, 1999b). The growing popularity of recreational aquatic activities such as snorkeling, scuba diving, yachting, and kayaking, coupled with a rising public interest in nature and animals, has led to increased encroachment on marine caves (P. Dendrinos et al., 2022), which are of furthermore importance for this species to breed successfully (W. M. Johnson and D. M. Lavigne, 1999b).

5.4.2 Costal development

The ongoing expansion of coastal development to accommodate tourism, along with urbanization, is affecting the terrestrial habitat of the Mediterranean Monk Seal. Unsustainable coastal development, combined with the recreational aquatic activities mentioned in the previous chapter, results in the loss of suitable habitat for this endangered species (P. Dendrinos et al., 2022).

5.5 POLLUTION

Coastal ecosystems are subjected to greater anthropogenic impact compared to other environments. Pollutants and biologically active substances are often released in large quantities into coastal areas without adequate treatment and control (R. Danovaro, 2003). In the Mediterranean Sea, pollution is also evidenced by the high quantities of contaminants such as micro-litter (G. Pietroluongo et al., 2022b), organochlorine compounds and polycyclic aromatic hydrocarbons (F. Capannia et al., 2024), and heavy metals (A. Yediler et al., 1993) found within the tissues and hairs of stranded marine mammals, including the Mediterranean Monk Seal.

5.6 OTHER SOURCES OF MORTALITY

5.6.1 Climate change

Climate change is predicted to have a serious impact on the marine ecosystem. Even if no direct effect has been documented so far (A. A. Karamanlidis and P. Dendrinos, 2024) for the *Monachus monachus*, a rise in sea level or the increased occurrence of intense weather phenomena can compromise suitable caves and beaches for the species, affecting breeding as well (P. Dendrinos et al., 2022). Furthermore, an increase in sea temperature can result in the arrival of alien species in the Mediterranean Sea, particularly from the Red Sea, which could potentially affect the feeding habits of the species (A. A. Karamanlidis and P. Dendrinos, 2024).

5.6.2 Genetics

Especially when discussing endangered species such as the Mediterranean Monk Seal, the potential impact of a lack of genetic diversity should not be underestimated (A. A. Karamanlidis et al., 2016). Low genetic variability can increase the species' vulnerability to infectious diseases (S. J. O'Brien and J. F. Evermann, 1988), leading to devastating effects in small populations, as seen in the 1997 mass die-off in Cabo Blanco. Another issue is inbreeding, which is often a result of small population sizes or bottlenecks (P. W. Hedrick and S. T. Kalinowski, 2000). This can lead to low natality rates (A. C. Gucu et al., 2004) and poses a significant threat to the species' recovery.

5.6.3 Eventual predation

The Mediterranean Monk Seal is the only seal species inhabiting the Mediterranean Sea. Although there is currently no scientific literature indicating competition between this species and other megafauna for food sources (A. A. Karamanlidis and P. Dendrinos, 2024), an instance of predation by a Great White Shark in the Balearic Islands was described by Juan Antonio Pujol Fructuoso (2015).

6. INTERNATIONAL LEGISLATION AND CONSERVATION PRIORITIES

The Mediterranean Monk Seal is currently protected throughout its range by various national laws and several regional and international treaties. These include the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on the Conservation of Migratory Species of Wild Animals, the Convention on the Conservation of European Wildlife and Natural Habitats, the Convention on Biological Diversity, and the United Nations Convention on the Law of the Sea. Additionally, European Union regulations such as Council Directive 92/43/EEC-Natura 2000 on the Conservation of Natural Habitats of Wild Fauna and Flora, and Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008, also provide protection (L. D. E. Isräels, 1992; A. A. Karamanlidis, 2024b). Under this legal framework, most countries within the Mediterranean Monk Seal's range have identified conservation priorities and are undertaking essential conservation actions. These actions are incorporated into local, national, and regional plans for the species' protection (A.A. Karamanlidis, 2024b).

Although the relative importance of identified conservation priorities varies among countries due to differences in population dynamics, public acceptance, and available funding (A. A. Karamanlidis et al., 2015), a summary of the main priorities is generally consistent globally. The conservation actions for the Mediterranean Monk Seal include (A. A. Karamanlidis et al., 2023)

1. Strengthening the legal framework for the protection of the terrestrial and marine habitat of the species, especially in the area of Cabo Blanco
2. Effective protection of the species (i.e. reduction of deliberate killing) and its terrestrial and marine habitat
3. Scientific population and habitat monitoring (including, for example, estimating population demographics and vital rates and determining food availability and primary causes of death)
4. Rescue and rehabilitation of injured, orphaned and sick individuals to increase neonatal survival rates
5. Public awareness and education
6. Monitoring and mitigating negative seal–fishery interactions
7. Expansion of the species' current geographic range in the Atlantic Ocean (L. M. González, 2015)

Despite recent positive population trends in some key subpopulations, the Mediterranean Monk Seal remains one of the most endangered marine mammals on Earth (A. A. Karamanlidis et al., 2015). To ensure the continued recovery of this species, it is essential to pursue all previously mentioned priority conservation actions vigorously and systematically (A. A. Karamanlidis, 2024b).

7. CONCLUSIONS

The Mediterranean Monk Seal, once considered a symbol of the Mediterranean Sea, has experienced a severe decline, primarily due to historical human hunting. Today, the species is confined to three small populations spread between the Mediterranean Sea and the Pacific Ocean, facing daily challenges from significant threats.

However, recent data collected through both established and forward-looking techniques indicate that the Mediterranean Monk Seal is resiliently battling against extinction. Over the years, advancements in scientific monitoring, such as remote cameras, acoustic technologies, and genetic analyses, have provided invaluable insights into the behavior, distribution, and health of this elusive pinniped. These efforts have revealed encouraging signs of recovery in certain subpopulations, underscoring the species' capacity for survival despite formidable challenges.

As of today, concerted and sustained conservation efforts can ensure the continued recovery and preservation of this species. By protecting habitats, mitigating threats, and fostering a deeper understanding and appreciation of this enigmatic species, we can secure a future where the Mediterranean Monk Seal thrives once again in its historic home, the “Mare Nostrum”.

BIBLIOGRAPHY

1. Adamantopoulou, S., Karamanlidis, A.A., Dendrinos, P. and Gimenez, O. (2023), Citizen science indicates significant range recovery and defines new conservation priorities for Earth's most endangered pinniped in Greece. Anim Conserv, 26: 115-125. https://doi.org/10.1111/acv.12806
2. Aguilar, Alex & Cappozzo, Humberto & Gazo, Manel & Pastor, Teresa & Forcada, Jaume & Grau, E.. (2007). Lactation and mother-pup behaviour in the Mediterranean monk seal Monachus monachus: An unusual pattern for a phocid. Journal of the Marine Biological Association of the United Kingdom. 87. 93 - 99. 10.1017/S0025315407056147.
3. Al via nuovo studio sulla foca monaca nel Santuario Pelagos - Natura - Ansa.it. (2023). Agenzia ANSA. https://www.ansa.it/canale_scienza/notizie/terra_poli/2023/08/31/al-via-nuovo-studio-sulla-foca-monaca-nel-santuario-pelagos_621422a4-88e8-4b87-b976-71739cc3556b.html
4. Avvistamento di una foca monaca nel Parco Nazionale dell'Arcipelago Toscano. (2023). Pelagos Sanctuary. https://pelagos-sanctuary.org/it/avvistamento-foca-monaca-toscana/
5. Avvistato e filmato un rarissimo esemplare di foca monaca nel Foggiano - Italia - Ansa.it. (2023). Agenzia ANSA. https://www.ansa.it/sito/videogallery/italia/2023/05/08/avvistato-e-filmato-un-rarissimo-esemplare-di-foca-monaca-nel-foggiano_b58f5820-2ffc-474d-a611-a234f38b6fe0.html
6. Badosa, Enric & Grau, Esteve & Aparicio, Fernando & Layna, Jorge & Cedenilla, Miguel. (2006). Individual variation and sexual dimorphism of coloration in Mediterranean monk seal pups (Monachus Monachus). Marine Mammal Science. 14. 390 - 393. 10.1111/j.1748-7692.1998.tb00732.x
7. Badosa, Enric & Pastor, Teresa & Gazo, Manel & Aguilar, Alex. (2006). Moult in the Mediterranean monk seal from Cap Blanc, Western Sahara. African Zoology. 183-192. 10.3377/1562-7020(2006)41[183:MITMMS]2.0.CO;2.
8. Blagoveshtchensky DI (1966) New forms of Lice (Siphunculata) parasites of Pinnipeds and Hares. Entomol Obozr 45:806–813
9. Blue Marine Foundation collabora a un progetto con il Parco Nazionale Arcipelago Toscano - Parco Nazionale Arcipelago Toscano. (2022). Parco Nazionale Arcipelago Toscano - Parco Nazionale Arcipelago Toscano. https://www.islepark.it/il-parco-informa/news/1787-blue-marine-foundation-collabora-a-un-progetto-con-il-parco-nazionale-arcipelago-toscano
10. Buone pratiche in caso di avvistamento di una foca monaca. (s.d.). ISPRA. https://www.isprambiente.gov.it/files2023/notizie/buone-pratiche-ispra-m-monachus.pdf
11. Francesca Capanni, Alexandros A. Karamanlidis, Panagiotis Dendrinos, Annalisa Zaccaroni, Costanza Formigaro, Antonella D'Agostino, Letizia Marsili, Monk seals (Monachus monachus) in the Mediterranean Sea: The threat of organochlorine contaminants and polycyclic aromatic hydrocarbons, Science of The Total Environment, Volume 915, 2024, 169854, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2023.169854.
12. Charrier, I.; Huetz, C.; Prevost, L.; Dendrinos, P.; Karamanlidis, A.A. First Description of the Underwater Sounds in the Mediterranean Monk Seal Monachus monachus in Greece: Towards Establishing a Vocal Repertoire. Animals 2023, 13, 1048. https://doi.org/10.3390/ani13061048.
13. Charrier, Isabelle & Marchesseau, Schédir & Dendrinos, Panagiotis & Tounta, Eleni & Karamanlidis, Alexandros. (2017). Individual signatures in the vocal repertoire of the endangered Mediterranean monk seal: New perspectives for population monitoring. Endangered Species Research. 32. 10.3354/esr00829.
14. Colegrove KM, Burek-Huntington KA, Roe W, Siebert U. Pinnipediae. Pathology of Wildlife and Zoo Animals. 2018:569–92. doi: 10.1016/B978-0-12-805306-5.00023-7. Epub 2018 Oct 26. PMCID: PMC7150363.
15. Crety C (1890) Sopra alcuni Cisticerchi di una Foca (Monachus albiventer Gray). Boll Soc Natur Nap (Ser 1) 4:106–108
16. Danovaro, Roberto (2003) 'POLLUTION THREATS IN THEMEDITERRANEAN SEA: AN OVERVIEW', Chemistry and Ecology, 19:1, 15 - 32T o link to this article: DOI: 10.1080/0275754031000081467

17. Danyer E, Danyer IA, Tonay A (2017) Mediterranean monk seal parasites from Eastern Mediterranean coast of Tur- key: two new records. In: Galatius A, Salling A, Iversen M, Palner M (eds) Conservation in the light of marine spatial use. Proc 31st Conf Eur Cetacean Soc, Middelfart, 1–3 May 2017. European Cetacean Society, Liège, p 218 (Abstract) https://www.europeancetaceansociety.eu/sites/default/files/AbstractBook_0.pdf
18. Dede A, Tonay AM, Gönülal O, Güreşen O, Öztürk B (2019) Camera-trap surveillance of the endangered Mediterra- nean monk seal in the Gökçeada Island, Northern Aegean Sea, Turkey. In: Together for science and conser- vation. Proc World Mar Mammal Conf, Barcelona, 9–12 December 2019. Society for Marine Mammalogy and European Cetacean Society, p 185 (Abstract)
19. Di Turo, P. (1984). PRESENZA DELLA FOCA MONACA (Monachus monachus) NELL'AREA MEDITERRANEA CON PARTICOLARE RIFERIMENTO ALLA PUGLIA[Università del Salento]. https://doi.org/10.1285/i15910725v14p66
20. Dendrinos, P., Karamanlidis, A.A., Androukaki, E. and McConnell, B.J. (2007), Diving Development and Behavior of a Rehabilitated Mediterranean Monk Seal (Monachus monachus). Marine Mammal Science, 23: 387-397. https://doi.org/10.1111/j.1748-7692.2007.00115.x
21. Dendrinos, Panagiotis & Adamantopoulou, Styliani & Tounta, Eleni & Koemtzopoulos, Kimon & Karamanlidis, Alexandros. (2022). The Mediterranean Monk Seal (Monachus monachus) in the Aegean Sea. "The Living Myth of the Sirens". 10.1007/698_2022_897.
22. Dendrinos, Panagiotis & Karamanlidis, Alexandros & Kotomatas, Spyros & Legakis, Anastasios & Tounta, Eleni & Matthiopoulos, Jason. (2007). Pupping habitat use in the Mediterranean monk seal: A long-term study. Marine Mammal Science. 23. 615 - 628. 10.1111/j.1748-7692.2007.00121.x.
23. Dendrinos, Panagiotis & Tounta, Eleni & Karamanlidis, Alexandros & Legakis, Anastasios & Kotomatas, Spyros. (2007). A Video Surveillance System for Monitoring the Endangered Mediterranean Monk Seal (Monachus monachus). Aquatic Mammals. 33. 179-184. 10.1578/AM.33.2.2007.179.
24. Elizabeth R. Ellwood, Theresa M. Crimmins, Abraham J. Miller-Rushing, Citizen science and conservation: Recommendations for a rapidly moving field, Biological Conservation, Volume 208, 2017, Pages 1-4, ISSN 0006-3207, https://doi.org/10.1016/j.biocon.2016.10.014.
25. Emek Inanmaz, Ö., Değirmenci, Ö., & Gücü, A. C. (2014). A new sighting of the Mediterranean Monk Seal,Monachus monachus(Hermann, 1779), in the Marmara Sea (Turkey). Zoology in the Middle East, 60(3), 278–280. https://doi.org/10.1080/09397140.2014.944438
26. Fernández de Larrinoa P, Baker JD, Cedenilla MA, Harting AL and others (2021) Age-specific survival and reproductive rates of Mediterranean monk seals at the Cabo Blanco Peninsula, West Africa. Endang Species Res 45:315-329. https://doi.org/10.3354/esr01134.
27. Foca monaca ISPRA. (2021). https://www.riservamarinacaporizzuto.it/index.php?mod=news&nid=122
28. Frouin-Mouy, H., Mouy, X., Martin, B. and Hannay, D. (2016), Underwater acoustic behavior of bearded seals (Erignathus barbatus) in the northeastern Chukchi Sea, 2007–2010. Mar Mam Sci, 32: 141-160. https://doi.org/10.1111/mms.12246
29. Gazo M, Layna JF, Aparicio F, Cedenilla MA, González LM, Aguilar A. Pupping season, perinatal sex ratio and natality rates of the Mediterranean monk seal (Monachus monachus) from the Cabo Blanco colony. Journal of Zoology. 1999;249(4):393-401. doi:10.1111/j.1469-7998.1999.tb01208.x.
30. Gazo, M., C. Lydersen e A. Aguilar. "Diving behaviour of Mediterranean monk seal pups during lactation and post weaning". Marine Ecology Progress Series308 (16 febbraio 2006): 303–9. https://doi.org/10.3354/meps308303.
31. González, L. M. (1999). Update on the situation of the Mediterranean monk seal. 9th Meeting of the Convention on the Conservation of Migratory Species of Wild Animals, Cape Town. 16 pp. + 6 maps.
32. González, L.M. (2015), Prehistoric and historic distributions of the critically endangered Mediterranean monk seal (Monachus monachus) in the eastern Atlantic. Mar Mam Sci, 31: 1168-1192. https://doi.org/10.1111/mms.12228.
33. Gruppo Foca Monaca. (s.d.). Gruppo Foca Monaca. https://focamonaca.it

34. Gucu AC (2009) Preliminary study on the effects of photo traps used to monitor Mediterranean monk seals Monachus monachus. Endang Species Res 10:281-285. https://doi.org/10.3354/esr00208
35. Ali Cemal Gucu, Gul Gucu, Hasan Orek, Habitat use and preliminary demographic evaluation of the critically endangered Mediterranean monk seal (Monachus monachus) in the Cilician Basin (Eastern Mediterranean), Biological Conservation, Volume 116, Issue 3, 2004, Pages 417-431, ISSN 0006-3207, https://doi.org/10.1016/S0006-3207(03)00234-9.
36. Güçlüsoy, Harun & Kıraç, Cem & Veryeri, Nesimi & Savaş, Yalçın. (2004). Status of the Mediterranean Monk Seal, Monachus monachus (Hermann, 1779) in the Coastal Waters of Turkey.. Journal of Fisheries & Aquatic Sciences Cilt Sayı/Issue. 21. 3-4.
37. Güçlüsoy, Harun & Savaş, Yalçın. (2003). Interaction between monk seals Monachus monachus (Hermann, 1779) and marine fish farms in the Turkish Aegean and management of the problem. Aquaculture Research 9 (2003) 34. 34. 10.1046/j.1365-2109.2003.00884.x.
38. Hamel, S., Killengreen, S.T., Henden, J.-A., Eide, N.E., Roed-Eriksen, L., Ims, R.A. and Yoccoz, N.G. (2013), Towards good practice guidance in using camera-traps in ecology: influence of sampling design on validity of ecological inferences. Methods Ecol Evol, 4: 105-113. https://doi.org/10.1111/j.2041-210x.2012.00262.x
39. Hedrick, P. W., & Kalinowski, S. T. (2000). Inbreeding Depression in Conservation Biology. Annual Review of Ecology and Systematics, 31(1), 139–162. https://doi.org/10.1146/annurev.ecolsys.31.1.139
40. ISPRA - Foca Monaca. (n.d.). Informazioni sulla foca monaca. Recuperato da https://www.facebook.com/p/Foca-monaca-ISPRA-100067785949344/?locale=it_IT
41. Istituto Superiore per la Protezione e Ricerca Ambientale (ISPRA) (2023). “Foca Monaca: avvistamento al largo di Capri”. https://www.isprambiente.gov.it/it/archivio/notizie-e-novita-normative/notizie-ispra/2023/05/foca-monaca-avvistamento-al-largo-di-capri
42. Istituto Superiore per la Protezione e Ricerca Ambientale (ISPRA) (2016). “Nuovo esemplare di Foca Monaca alle Egadi, ISPRA e AMP Egadi rilanciano la campagna per le segnalazioni in tutti i mari italiani”. https://www.isprambiente.gov.it/files/comunicati-stampa/2016/2016_luglio__foca_monaca_Egadi.pdf
43. Istituto Superiore per la Protezione e Ricerca Ambientale (ISPRA) (2020). “NON CE L’HA FATTA IL CUCCIOLO DI FOCA MONACA RITROVATO NEL LECCESE**”** https://www.isprambiente.gov.it/files2020/area-stampa/comunicati-stampa/COMUNICATOSTAMPAfoca28gen.pdf
44. Istituto Superiore per la Protezione e Ricerca Ambientale.(ISPRA) (2020). “ISOLA DI CAPRAIA: LA FOCA MONACA TORNA A CASA.” https://www.isprambiente.gov.it/it/istituto-informa/comunicati-stampa/anno-2020/comunicato-foca-monaca.pdf
45. Istituto Superiore per la Protezione e Ricerca Ambientale (ISPRA) (2020). “Isola di Pianosa: la foca monaca sceglie ancora un'isola dell'Arcipelago Toscano” https://www.isprambiente.gov.it/it/istituto-informa/comunicati-stampa/anno-2020/isola-di-pianosa-la-foca-monaca-sceglie-ancora-unisola-dellarcipelago-toscano
46. Isräels LDE (1992) Thirty years of Mediterranean monk seal protection – a review. Mededelingen 28: 1–65.
47. Johnson W.M. 2004. Monk-seal in post-classical history. The role of the Mediterranean monk seal (Monachus monachus) in European history and culture, from the fall of Rome to the 20th century. Nederlandsche Commissie voor Internationale Natuurbescherming Mededelingen No. 39.

48. William M. Johnson & David M. Lavigne. (1999b). MASS TOURISM and the MEDITERRANEAN MONK SEAL. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=7c55b1a504b220dc48e6df196f398d4819f66f08
49. Karamanlidis AA (2024b) Current status, biology, threats and conservation priorities of the Vulnerable Mediterranean monk seal. Endang Species Res 53:341-361. https://doi.org/10.3354/esr01304
50. Karamanlidis A.A (2024a) Using 'pup multipliers' to estimate demographic parameters of Mediterranean monk seals in the eastern Mediterranean Sea. Endang Species Res 53:261-270. https://doi.org/10.3354/esr01301
51. Alexandros A. Karamanlidis and Panagiotis Dendrinos. (2024). Mediterranean Monk Seal Monachus monachus (Hermann, 1779). https://doi.org/10.1007/978-3-319-65038-8_143-1
52. Karamanlidis, A., Androukaki, E., Adamantopoulou, S., Chatzispyrou, A., Johnson, W., Kotomatas, S., Papadopoulos, A., Paravas, V., Paximadis, G., Pires, R., Tounta, E., & Dendrinos, P. (2008). Assessing accidental entanglement as a threat to the Mediterranean monk seal Monachus monachus. Endangered Species Research, 5, 205–213. https://doi.org/10.3354/esr00092
53. Karamanlidis, A.A., Dendrinos, P., Fernandez de Larrinoa, P., Kıraç, C.O., Nicolaou, H. & Pires, R. (2015) The Mediterranean monk seal Monachus monachus: status, biology, threats, and conservation priorities.
54. Karamanlidis, A.A., Dendrinos, P., Fernandez de Larrinoa, P., Kıraç, C.O., Nicolaou, H. & Pires, R. 2023. Monachus monachus. The IUCN Red List of Threatened Species 2023: e.T13653A238637039. https://dx.doi.org/10.2305/IUCN.UK.2023-1.RLTS.T13653A238637039.en.
55. Karamanlidis, Alexandros & Dendrinos, Panagiotis & Larrinoa, Pablo & Gucu, Ali Cemal & Johnson, William & Kıraç, Cem & Pires, Rosa. (2015). The Mediterranean monk seal Monachus monachus: Status, biology, threats, and conservation priorities. Mammal Review. 46. n/a-n/a. 10.1111/mam.12053.
56. Karamanlidis, A. A., Lyamin, O., Adamantopoulou, S., & Dendrinos, P. (2017). First observations of aquatic sleep in the Mediterranean monk seal (Monachus monachus). Aquatic Mammals, 43(1), 82.
57. Alexandros A. Karamanlidis, Stephen Gaughran, Alex Aguilar, Panagiotis Dendrinos, Djuro Huber, Rosa Pires, Jennifer Schultz, Tomaž Skrbinšek, George Amato,
58. Shaping species conservation strategies using mtDNA analysis: The case of the elusive Mediterranean monk seal (Monachus monachus), Biological Conservation, Volume 193, 2016, Pages 71-79, ISSN 0006-3207, https://doi.org/10.1016/j.biocon.2015.11.014.
59. Kıraç, Cem. (2001). WITNESSING THE MONK SEAL'S EXTINCTION IN THE BLACK SEA. 4 (2).
60. Kıraç, Cem & Ok, Meltem. (2019). Diet of a Mediterranean monk seal Monachus monachus in a transitional post-weaning phase and its implications for the conservation of the species. Endangered Species Research. 39. 10.3354/esr00971.
61. Kıraç, Cem & Savaş, Yalçın & Güçlüsoy, Harun & Veryeri, Nesimi. (2002). Observations on diving behaviour of free ranging Mediterranean monk seals Monachus monachus on Turkish coasts. The Monachus Guardian. 5.
62. Koitsanou, E.; Sarantopoulou, J.; Komnenou, A.; Exadactylos, A.; Dendrinos, P.; Papadopoulos, E.; Gkafas, G.A. First Report of the Parasitic Nematode Pseudoterranova spp. Found in Mediterranean Monk Seal (Monachus monachus) in Greece: Conservation Implications. Conservation **2022**, 2, 122–133. https://doi.org/10.3390/ conservation2010010
63. Komnenou,A.T.;Gkafas, G.A.; Kofidou, E.; Sarantopoulou, J.; Exadactylos, A.; Tounta, E.; Koemtzopoulos, K.; Dendrinos, P.; Karamanlidis, A.A.; Gulland, F.; et al. First Report of Uncinaria hamiltoni in Orphan Eastern Mediterranean Monk Seal Pups in Greece and Its Clinical Significance. Pathogens 2021, 10, 1581. https://doi.org/10.3390/ pathogens10121581
64. Kurt, M., & Gücü, A. C. (2021). Demography and population structure of Northeastern mediterranean monk seal population. Mediterranean Marine Science, 22(1), 79–87. https://doi.org/10.12681/mms.21913

65. La Mesa, G., Lauriano, G., Mo, G., Paglialonga, A., & Tunesi, L. (2021). Assessment of the conservation status of marine species of the Habitats Directive (92/43/EEC) in Italy: results, drawbacks and perspectives of the fourth national report (2013–2018). Biodiversity and Conservation, 30(14), 4251–4264. https://doi.org/10.1007/s10531-021-02303-7
66. La nuova Venezia (2013). "C'è una foca monaca in Laguna: avvistamenti in Laguna e a Bibione" https://nuovavenezia.gelocal.it/venezia/cronaca/2016/08/17/news/in-laguna-e-ritornata-la-foca-monaca-1.13977046
67. La nuova Venezia (2016). "Avvistata una foca monaca. In natura ne restano solo 700" https://nuovavenezia.gelocal.it/venezia/cronaca/2016/06/23/news/avvistata-una-foca-monaca-1.13710390
68. La Repubblica (2017). "Salento, sorpresa al largo di Tricase: spunta un raro esemplare di foca monaca" https://video.repubblica.it/edizione/bari/salento-sorpresa-al-largo-di-tricase-spunta-un-raro-esemplare-di-foca-monaca/278517/279119
69. Lavigne, D. M. & Johnson, W. M. The Mediterranean Monk Seal (Monachus monachus) in Ancient History and Literature Monk Seals in Antiquity. (1999a).
70. Ling JK. Pelage and molting in wild mammals with special reference to aquatic forms. Q Rev Biol. 1970 Mar;45(1):16-54. doi: 10.1086/406361. PMID: 5446769.
71. Littnan, C., Harting, A. & Baker, J. 2015. Neomonachus schauinslandi. The IUCN Red List of Threatened Species 2015: e.T13654A45227978. http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T13654A45227978.en.
72. Lowry, L. 2015. Neomonachus tropicalis. The IUCN Red List of Threatened Species 2015: e.T13655A45228171. http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T13655A45228171.en.
73. Alicia Minerva López López, Julio César Salas Alanis, Samuel Amezcua Gudiño, Manuel Soria Orozco, Marisol Ramírez Padilla, Bertha Lissette Sotelo García,
74. Orf dermatovirosis in a farm in a developing country: guiding the diagnosis with clinical, histopathology, and electron microscopy, Piel, Volume 34, Issue 3, 2019, Pages 144-146, ISSN 0213-9251, https://doi.org/10.1016/j.piel.2018.04.014.
75. Marchessaux, D. and N. Muller. 1987. Le Phoque Moine, Monachus monachus: Distribution, statut et biologie sur la cote saharienne. Scientific Reports of the Port Cros National Park 13: 25-84.
76. Markowski S (1952) The Cestodes of Pinnipeds in the Arctic and other regions. J Helminthol 26:171–214
77. Martínez-Jauregui, M., G. Tavecchia, MA Cedenilla, T. Coulson, P. Fernández de Larrinoa, M. Muñoz e LM González. "Population resilience of the Mediterranean monk seal Monachus monachus at Cabo Blanco peninsula". Marine Ecology Progress Series461 (8 agosto 2012): 273–81. https://doi.org/10.3354/meps09811.
78. Sandro Mazzariol, Cinzia Centelleghe, Antonio Petrella, Federica Marcer, Matteo Beverelli, Cristina E. Di Francesco, Gabriella Di Francesco, Ludovica Di Renzo, Giovanni Di Guardo, Tania Audino, Letizia Tripodi, Cristina Casalone, Atypical Toxoplasmosis in a Mediterranean Monk Seal (Monachus monachus) Pup, Journal of Comparative Pathology, Volume 184, 2021, Pages 65-71, ISSN 0021-9975, https://doi.org/10.1016/j.jcpa.2021.02.005. (https://www.sciencedirect.com/science/article/pii/S0021997521000256)
79. Mo, G. (2021). Foca monaca in Puglia, iniziate attività di monitoraggio – SNPA – Sistema nazionale protezione ambiente. SNPA – Sistema nazionale protezione ambiente – La rete delle agenzie ambientali (Arpa-Appa-Ispra) per l'ambiente. https://www.snpambiente.it/uncategorized/foca-monaca-in-puglia-iniziate-attivita-di-monitoraggio/
80. Mo, G. (2013). Monachus Monachus. iucn.it. https://www.iucn.it/scheda.php?id=-1678273882
81. Mo, G. (2011). Mediterranean Monk Seal (Monachus monachus) Sightings in Italy (1998-2010) and Implications for Conservation. Aquatic Mammals, 37(3), 236 240. https://doi.org/10.1578/am.37.3.2011.236

82. Mediterranean Monk Seal Back from the Brink | CMS. (s.d.). CMS | Convention on the Conservation of Migratory Species of Wild Animals. https://www.cms.int/en/news/mediterranean-monk-seal-back-brink.
83. Neves, H.C. & Pires, R. (1999) O Lobo Marinho no Arquipelago da Madeira. Parque Natural da Madeira, Funchal, Portugal.
84. Stephen J. O'Brien, James F. Evermann, Interactive influence of infectious disease and genetic diversity in natural populations, Trends in Ecology & Evolution, Volume 3, Issue 10, 1988, Pages 254-259, ISSN 0169-5347, https://doi.org/10.1016/0169-5347(88)90058-4.
85. Papadopoulos E, Loukopoulos P, Komnenou A et al (2010) First report of Acanthocheilonema spirocauda in the Mediterranean monk seal (Monachus monachus). J Wildl Dis 46:570–573. https://doi.org/10.7589/0090-3558-46.2.570
86. Pastor, Teresa & Cappozzo, Humberto & Grau, E. & Amos, William & Aguilar, Alex. (2011). The mating system of the Mediterranean monk seal in the Western Sahara. Marine Mammal Science. 27. E302 - E320. 10.1111/j.1748-7692.2011.00472.x.
87. Penco, A. (2015). Esclusivo ! Avvistata una Foca monaca nell'Area Marina Protetta di Portofino. scubaportal.it. https://www.scubaportal.it/foca-monaca-portofino/
88. Petrella A, Mazzariol S, Padalino I, Di Francesco G, Casalone C, Grattarola C, et al. Cetacean Morbillivirus and Toxoplasma gondii Co-infection in Mediterranean Monk Seal Pup, Italy. Emerg Infect Dis. 2021;27(4):1237-1239. https://doi.org/10.3201/eid2704.204131
89. Pierce, Graham & Hernandez-Milian, Gema & Santos, M. & Dendrinos, Panagiotis & Psaradellis, Marianna & Tounta, Eleni & Androukaki, Evgenia & Edridge, Alex. (2011). Diet of the Monk Seal (Monachus monachus) in Greek Waters. Aquatic Mammals. 37. 284-297. 10.1578/AM.37.3.2011.284.
90. Pires, R & Aparicio, F & Baker, JD & Pereira, S & Caires, N & Cedenilla, MA & Harting, Albert & Menezes, D & Larrinoa, Pablo. (2023). First demographic parameter estimates for the Mediterranean monk seal population at Madeira, Portugal. Endangered Species Research. 51. 10.3354/esr01260.
91. Pietroluongo, G.; Martín-Montalvo, B.Q.; Ashok, K.; Miliou, A.; Fosberry, J.; Antichi, S.; Moscatelli, S.; Tsimpidis, T.; Carlucci, R.; Azzolin, M. Combining Monitoring Approaches as a Tool to Assess the Occurrence of the Mediterranean Monk Seal in Samos Island, Greece. Hydrobiology 2022b, 1, 440–450. https://doi.org/10.3390/ hydrobiology1040026
92. Pietroluongo, G.; Quintana Martín-Montalvo, B.; Antichi, S.; Miliou, A.; Costa, V. First Assessment of Micro-Litter Ingested by Dolphins, Sea Turtles and Monk Seals Found Stranded along the Coasts of Samos Island, Greece. Animals 2022a, 12, 3499. https://doi.org/10.3390/ ani12243499
93. Pires, Rosa & Neves, Henrique & Karamanlidis, Alexandros. (2008). The Critically Endangered Mediterranean monk seal Monachus monachus in the archipelago of Madeira: Priorities for conservation. Oryx. 42. 278 - 285. 10.1017/S0030605308006704.
94. Pujol Fructuoso, Juan. (2015). Un antiguo caso de predación de foca monje mediterránea adulta, Monachus monachus (Hermann, 1779) por tiburón blanco, Carcharodon carcharias (Linnaeus, 1758) en las Islas Baleares, España. Boletín de la Real Sociedad Española de Historia Natural. Sección biológica. 109. 71-74.
95. Reyero M, Cacho E, Martínez A, Vázquez J, Marina A, Fraga S, Franco JM (1999) Evidence of saxitoxin derivatives as causative agents in the 1997 mass mortality of monk seals in the Cape Blanc peninsula. Nat Toxins 7: 311−315.
96. Ronald K (1973) The Mediterranean monk seal, Monachus monachus. In: Holloway CW (ed) Seals proceedings of a working meeting of seal specialists on threatened and depleted seals of the world. IUCN Publications, Morges, Switzerland, University of Guelph, Canada, pp 30–41
97. Salman, Alp, Murat Bilecenoglu e Harun Güçlüsoy. "Stomach contents of two Mediterranean monk seals (Monachus monachus) from the Aegean Sea, Turkey". Journal of the Marine Biological Association of the United Kingdom81, n. 4 (agosto 2001): 719–20. https://doi.org/10.1017/s0025315401004519.

98. Samaranch, R. and González, L.M. (2000), Changes in Morphology with Age in Mediterranean Monk Seals (Monachus monachus). Marine Mammal Science, 16: 141-157. https://doi.org/10.1111/j.1748-7692.2000.tb00909.x.
99. Saydam, Ezgi & Güçlüsoy, Harun. (2023). Revealing the Mediterranean Monk Seal (Monachus monachus)'s Cave Preference in Gökova Bay on the Southwest Coast of Türkiye. Sustainability. 15. 12017. 10.3390/su151512017.
100. Scheel DM, Slater GJ, Kolokotronis S-O, Potter CW, Rotstein DS, Tsangaras K, Greenwood AD, Helgen KM (2014) Biogeography and taxonomy of extinct and endangered monk seals illuminated by ancient DNA and skull morphology. ZooKeys 409: 1–33. doi: 10.3897/zookeys.409.6244.
101. Schusterman, R.J., Southall, B.L., Kastak, D. and Reichmuth Kastak, C. (2001), Pinniped Vocal Communication: Form and Function. https://bpb-us e1.wpmucdn.com/sites.ucsc.edu/dist/d/804/files/2019/06/pub_103_2001.pdf.
102. Sergeant, D., Ronald, K., Boulva, J., & Berkes, F. (1978). The recent status of Monachus monachus, the Mediterranean monk seal, Biological Conservation, Volume 14, Issue 4, Pages 259-287, ISSN 0006-3207, https://doi.org/10.1016/0006-3207(78)90044-7.
103. Schnapp B, Hellwing S, Ghizelea G (1962) Contributions to the knowledge of the Black Sea Seal (Monachus monachus). Herm Trav Mus Hist Nat "Gr Antipa" 3: 383–400
104. Solanou, M.; Panou, A.; Maina, I.; Kavadas, S.; Giannoulaki, M. Ten Years of Mediterranean Monk Seal Stranding Records in Greece under the Microscope: What Do the Data Suggest? Animals 2024, 14, 1309. https://doi.org/10.3390/ani 14091309
105. Solow, Andrew R. "Inferring Extinction from Sighting Data." Ecology 74, no. 3 (1993): 962–64. https://doi.org/10.2307/1940821.
106. Suarez-Bregua P, A´ lvarez-Gonza´ lez M, Parsons KM, Rotllant J, Pierce GJ and Saavedra C (2022) Environmental DNA (eDNA) for monitoring marine mammals: Challenges and opportunities. Front. Mar. Sci. 9:987774. doi: 10.3389/fmars.2022.987774
107. Summarell, Carly & Dewitt, Thomas & Fish, Frank & Marshall, Christopher. (2012). Fused Traditional and Geometric Morphometrics Demonstrate Pinniped Whisker Diversity. PloS one. 7. e34481. 10.1371/journal.pone.0034481.
108. Taberlet, P., Coissac, E., Hajibabei, M. and Rieseberg, L.H. (2012), Environmental DNA. Molecular Ecology, 21: 1789-1793. https://doi.org/10.1111/j.1365-294X.2012.05542.x
109. Toplu, N., Aydoğan, A., & Oguzoglu, T. C. (2007). Visceral Leishmaniosis and Parapoxvirus Infection in a Mediterranean Monk Seal (Monachus monachus). Journal of Comparative Pathology, 136(4), 283–287. https://doi.org/10.1016/j.jcpa.2007.02.005
110. Travis Park, Gustavo Burin, Daniela Lazo-Cancino, Joseph P G Rees, James P Rule, Graham J Slater, Natalie Cooper, Charting the course of pinniped evolution: insights from molecular phylogeny and fossil record integration, Evolution, 2024;, qpae061, https://doi.org/10.1093/evolut/qpae061
111. Valsecchi, E., Coppola, E., Pires, R. et al. A species-specific qPCR assay provides novel insight into range expansion of the Mediterranean monk seal (Monachus monachus) by means of eDNA analysis. Biodivers Conserv 31, 1175–1196 (2022). https://doi.org/10.1007/s10531-022-02382-0
112. Valsecchi, E., Tavecchia, G., Boldrocchi, G. et al. Playing "hide and seek" with the Mediterranean monk seal: a citizen science dataset reveals its distribution from molecular traces (eDNA). Sci Rep 13, 2610 (2023). https://doi.org/10.1038/s41598-023-27835-6
113. Van Parijs SM, Clark CW, Sousa-Lima RS, Parks SE, Rankin S, Risch D, Van Opzeeland IC (2009) Management and research applications of real-time and archival passive acoustic sensors over varying temporal and spatial scales. Mar Ecol Prog Ser 395:21-36. https://doi.org/10.3354/meps08123
114. M. H. V. Van Regenmortel & Mahy, B. W. J. (2008). Encyclopedia of Virology. Elsevier Science & Technology Books.
115. VIDEO Eccezionali riprese all'infrarosso documentano ancora la presenza della Foca monaca a Capraia - Parco Nazionale Arcipelago Toscano. (2022). Parco Nazionale Arcipelago Toscano - Parco Nazionale Arcipelago Toscano. https://www.islepark.it/il-parco-informa/news/1830-video-

eccezionali-riprese-all'infrarosso-documentano-ancora-la-presenza-della-foca-monaca-a-capraia?highlight=WyJmb2NhIiwibW9uYWNhIiwiZm9jYSBtb25hY2EiXQ==
116. Vohland, K., Land-Zandstra, A., Ceccaroni, L., Lemmens, R., Perelló, J., Ponti, M., Samson, R., & Wagenknecht, K. (A cura di). (2021). The Science of Citizen Science. Springer International Publishing. https://doi.org/10.1007/978-3-030-58278-4
117. Yediler, A., Panou, A., & Schramel, P. (1993). Heavy metals in hair samples of the Mediterranean Monk Seal (Monachus monachus). Marine Pollution Bulletin, 26(3), 156–159. https://doi.org/10.1016/0025-326x(93)90127-6