# MEDITERRANEAN MONK SEAL, *MONACHUS MONACHUS*, AND FISHERIES: CONSERVING BIODIVERSITY AND MITIGATING A CONFLICT IN HELLENIC SEAS

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## INTRODUCTION

As the awareness of the integral importance of marine mammals in healthy aquatic ecosystems has increased in recent years, so has the interest in all aspects of the lives of these animals, both by the general public and in the scientific and management communities. It has also become evident that a number of human activities, fisheries included, threaten their survival and their habitats. Numerous studies have tried to evaluate the extent of marine mammal and fisheries interactions. Most of these studies have focused on the operational interactions, i.e. the accidental entanglement or mortality of marine mammals in fishing operations and the damage caused by marine mammals to fishing gear. Several species or populations of marine mammals may be threatened with extinction or severe depletion from such interactions. In contrast, relatively fewer studies have addressed the possible biological aspect of such interactions, i.e. the competitive interactions between marine mammals and fisheries for food and fishery resources (NORTHRIDGE, 1991).

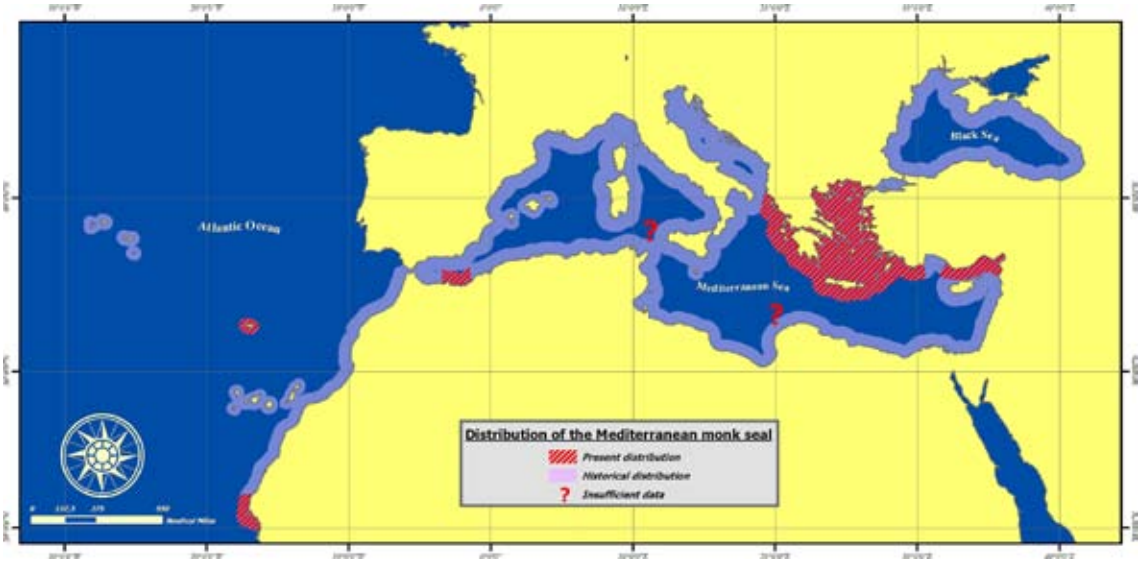
In the Mediterranean Sea a characteristic and a widely publicized example of such an interaction is the case of the Mediterranean monk seal, *Monachus monachus*, with coastal fisheries. The Mediterranean monk seal is one of the 33 extant species of Pinnipeds and belongs to a genus that inhabits exclusively subtropical and temperate waters. Population numbers declined dramatically in the past century and the species is currently considered "critically endangered" by the World Conservation Union (IUCN) (IUCN 2000).

**Photo 1:** Mediterranean monk seal in the Aegean Sea (©MOm/V. Paravas).

Historically, the Mediterranean monk seal occupied a wide geographical range. More recently, however, monk seals have disappeared from most of their former range, with the most severe contraction and fragmentation occurring during the

last century. The species is now mainly confined to two surviving populations, one occupying the Atlantic coast of northwest Africa, and the other, the northeastern Mediterranean (**Map 1**). The shy and reclusive nature of the species and the inaccessibility of its habitat have precluded accurate population estimations. Conventional wisdom, however, suggests that fewer than 600 individuals survive (REIJNDERS *et al.,* 1997).

and skin until the late Middle Ages, population collapse eventually brought an end to such exploitation. Deliberate killing of surviving individuals has continued by fishermen, angered over damaged nets and 'stolen fish' (JOHNSON & LAVIGNE, 1999). More recently, fish farm operators have also come into conflict with monk seals that raid their facilities, particularly where adequate protective netting




**Map 1:** Mediterranean monk seal distribution (©MOm).

Although their relative importance and intensity may vary from region to region, a consensus of scientific opinion holds that the following – often inter-relating – factors are the main threats to the survival of the species (REIJNDERS *et al.,* 1997):

- Habitat loss and deterioration (including increased pup mortality caused by pupping in unsuitable locations)
- Deliberate killing (mostly by fishermen)
- Accidental death due to entanglement in fishing gear
- Lack of food and depressed physical condition as a result of overfishing
- Lack of international coordination and funding of conservation and management actions
- Stochastic events (i.e. disease epidemics, cave collapses, oil spills, toxic algae blooms or other)

Threats b, c and d are directly linked to interactions with the fishing industry and are considered here in more detail:

- Deliberate killing: Although the Mediterranean monk seal was hunted commercially for its oil has not been installed (GÜÇLÜSOY & SAVAS, 2003).
- Entanglement in fishing gear: Accidental entanglement in fishing gear has been postulated to have posed a major threat to the Mediterranean monk seal and was considered to have played an important role in the extirpation of the species from several parts of its former range. However, recent evidence from the Eastern Mediterranean shows that the relative importance of entanglements may have been overestimated (ANDROUKAKI *et al.*, 1999). Entanglement is not restricted to a specific type of fishing gear. Unlike pelagic species, however, monk seals appear to be most vulnerable to entrapment in static gear and discarded nets in coastal areas (PANOU *et al.*, 1993).
- Overfishing: Although research on the cause and effect of this threat has not been carried out systematically, and consequently, only circumstantial evidence is available, overfishing has been considered to have had a negative

effect on monk seal populations in several areas (SALMAN *et al.,* 2001, GÜÇLÜSOY *et al.,* 2003).

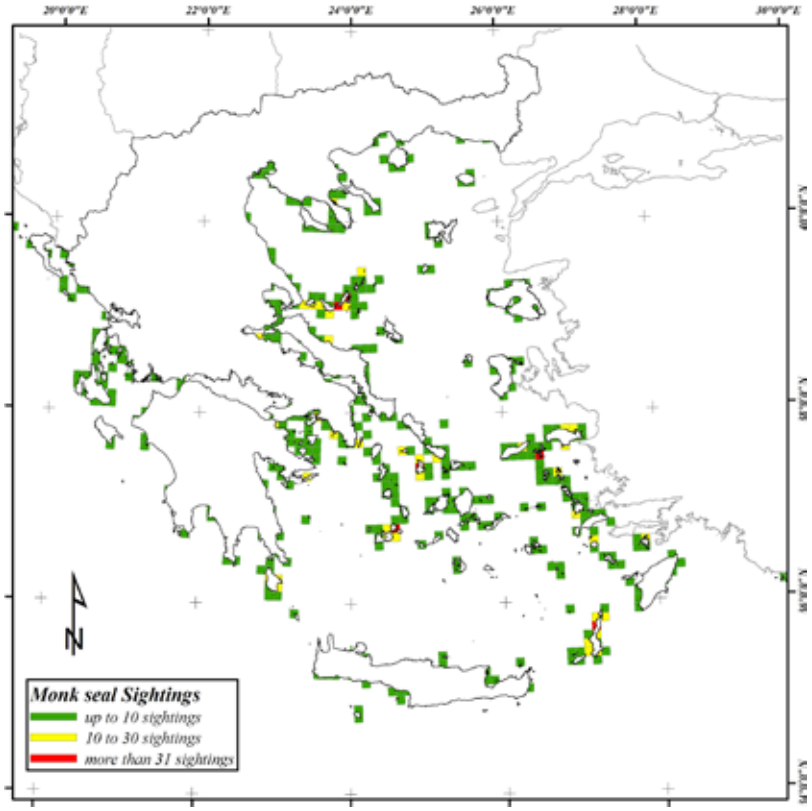
## THE MEDITERRANEAN MONK SEAL IN HELLAS: STATUS, DISTRIBUTION AND FISHERY-RELATED THREATS

Information on the abundance and distribution of Mediterranean monk seals in Hellas from ancient and classical times indicates that the species was abundant and distributed throughout the entire country (JOHNSON & LAVIGNE, 1999). As was the case throughout the species range, monk seals in Hellas experienced intense human pressure, especially in the 20th century. Already by the 1970s MARCHESSAUX and DUGUY reported the monk seal population in Hellas to be restricted mainly to the southern part of the mainland of the country and to the remote islands and islets of the Aegean and Ionian Seas and to number 260-360 individuals (MARCHESSAUX & DUGUY, 1977). One has to keep in mind, however, that such estimates were not based on the systematic monitoring of the species.

In order to fill critical gaps in the knowledge of the species status, an integrated research and conservation programme was initiated in 1990 by MOm/Hellenic Society for the Study and Protection of the Monk seal (a non-profit, non-governmental organization). Key objectives of the programme were to evaluate the distribution and abundance of Mediterranean monk seals within Hellas and identify and mitigate threats to the species' survival. Systematic research efforts focus on:

- Carrying out field surveys throughout the country in order to evaluate habitat availability, suitability and use, especially in relevance to breeding sites.
- Establishing and operating a Rescue and Information Network (RINT) that receives information on monk seal sightings from the entire country and responding to cases of emergency (rescuing orphaned pups, treating animals exposed to oil spills, etc.)
- Monitoring local monk seal populations in key areas of the species distribution.
- Monitoring mortality causes by carrying out necropsies on dead seals reported to the RINT.

The main results of the last 20 years of research, regarding the species' distribution and abundance, can be summarized as follows:




**Map 2:** Distribution of Mediterranean monk seal sightings in Hellas (1990 – 2005) (©MOm).

a) The species is still widely distributed throughout Hellas, showing a preference for secluded and inaccessible parts of the coastline (ADAMANTOPOULOU *et al.*, 1999) (**Map 2**).
b) More than 560 suitable monk seal shelters have been identified throughout the country. Ninety-nine of these shelters are considered to be suitable for pupping, while the rest are suitable only for resting (MOm 2007).
c) Seals are capable of covering considerable distances within the country and diving up to 125 m (DENDRINOS *et al.*, 2007), but they remain usually within the 200 m isobath.
d) Important colonies of the species have been identified in the Northern Sporades archipelago (DENDRINOS *et al.*, 1994), at the island complexes of Kimolos-Polyaigos and Karpathos-Saria (MOm 2005a) and in the Ionian Sea (PANOU *et al.,* 1993, WWF & Archipelagos, 1999)
e) The monk seal colony in the Northern Sporades archipelago is the most important of its kind in the Mediterranean. Up to date, 52 adult individuals have been identified, while the annual birth rate has increased since moni-

toring efforts started, and currently numbers eight pups per year (DENDRINOS *et al.,* 1994, 1999).

f) Population estimates for the island complexes of Kimolos-Polyaigos and Karpathos-Saria are 46 and 23 individuals, respectively, while annual birth rates are estimated to be 7.9 and 3.7 pups, (MOm 2007). In the Ionian islands important breeding populations are found in Zakynthos, Kephalonia and Ithaki (PANOU *et al.,* 1993, WWF & Archipelagos, 1999).

**Photo 2:** Mediterranean monk seal pup (©MOm/P. Dendrinos).

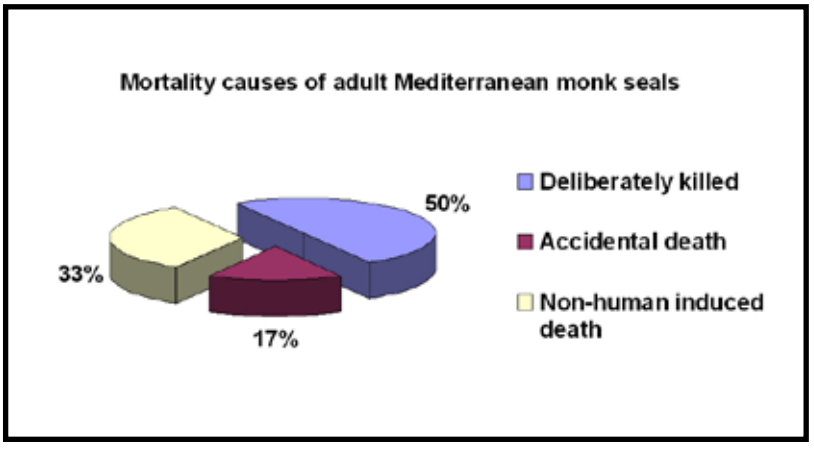



**Figure 1:** Mortality causes of adult Mediterranean monk seals based on necropsy results (1986 – 2005) (©MOm).

g) A conservative minimum estimation of the Mediterranean monk seal population in Hellas lies at 170 adult individuals (MOm 2007).

With respect to evaluating the fisheries-related threats to the species in Hellas, MOm's research efforts indicate the following:

1. Based on the results of more than 90 necropsies and on information received through the Rescue and Information Network, deliberate killing is the most frequent cause of non-natural death for the species in Hellas. Especially adult individuals are affected, as they are considered to be a threat to the livelihood of fishermen and aqua culturists. Approximately 50% of adult monk seals found dead in Hellas were deliberately killed (**Figure 1**), while juveniles and newborns were killed less frequently (i.e. 36% and 7%, respectively) (ANDROUKAKI *et al.,* 1999).
2. Accidental entanglement and death through drowning was also found to be a serious threat to the survival of the species in the country. It affects mainly inexperienced individuals, such as juveniles and pups (ANDROUKAKI *et al.,* 1999).
3. The effects of overfishing on the Mediterranean monk seal in Hellas have been difficult to assess so far. Circumstantial information has associated this threat with the disappearance of the species from certain parts of the country, as well as, with an increase in the frequency of attacks by seals on fishing nets and with abnormal feeding incidents (PANOU *et al.,* 1993, KARAVELLAS *et al.,* 1996).

## CONSERVATION OF THE MEDITERRANEAN MONK SEAL IN HELLAS

The fact that Hellas hosts the largest breeding population of the Mediterranean monk seal in the world, dictates the concentration of conservation efforts within the country. It has further attracted the attention of the international conservation community, making the protection of this species a key conservation issue. Even though conservation efforts began in Hellas in the early 1970s, it was not until much later that a concrete conservation strategy with distinct priorities was formulated (ARCHIPELAGOS & MOM, 1996). This strategy, which was adopted also by the national authorities, calls for a series of actions, such as protection of habitats, research, rehabilitation, awareness campaigns, etc., that aim at mitigating the major

threats for the survival of the species.

- **Protecting key breeding habitats**

A key priority in the conservation of the Mediterranean monk seal in Hellas during the last 15 years has been the protection, through the establishment and effective operation of protected areas, of key breeding habitats of the species. A major achievement towards this goal has been the establishment in 1993 of the National Marine Park of Alonnisos, Northern Sporades (NMPANS) in the northwestern Aegean Sea. The NMPANS is one of the largest protected areas in the Mediterranean Sea and constitutes the only area in Hellas, where conservation measures for the protection of the monk seal and of the local fish stocks have been actively enforced, with substantial results (MOm 2005b, 2007). A number of additional sites of importance for the species, such as the islands of Milos, Kimolos, Polyaigos, Karpathos, Saria and Samos in the Aegean and Zakynthos, Kephalonia and Ithaki in the Ionian Sea, have also been proposed as protected areas to the Hellenic State. However, up to date, little progress has been made towards the effective protection of these areas.

- **Tackling the seal- fisheries conflict**

In order to improve the conservation status of the European Union's largest population of the critically endangered Mediterranean monk seal, found in Hellas, it is imperative to mitigate the negative consequences of the interactions between the seals and the fishery sector. In the long-term, this can be achieved by mitigating at the same time the negative consequences to both, the seals (i.e. decreasing the overall mortality rate of

## A MONK SEAL-FISHERY PILOT STUDY IN COLLABORATION WITH THE FISHERMEN OF ALONNISOS

*In order to understand the nature and extent of fisheries-related threats to the critically endangered Mediterranean monk seal a questionnaire survey was carried out in the National Marine Park of Alonnisos, Northern Sporades (NMPANS). The questionnaire was designed to collect information on the size and nature of the fishing sector, the marine fauna of the NMPANS, the seal-fisheries interactions and their effect on the fishery sector, as well as proposals for possible solutions. One quarter (n=26) of the Alonnisos fishermen operating in the Park were interviewed. The results indicate that fishing in the NMPANS is coastal and low scale. The marine mega fauna of the area is rich, both in terms of species diversity and population size. Various species of dolphins and monk seals are observed frequently within the Park and are reported to cause damages to the fishermen. Although such damage does affect fishing gear and fish catches, it is not considered by the fishermen as the key problem for their livelihood. Based on their opinion, overfishing and illegal fishing practices are the main threats to their activities and most of the solutions proposed were related to stricter enforcement of the legislation and the promotion of sustainable fishing practices. These results are indicative of the change in the attitude of local fishermen towards marine species, especially within protected areas. This is further evident by the fact that during the last 15 years, no deliberate killing of monk seals has been recorded within the NMPANS (DENDRINOS et al., 2006).*

**Photo 3:** Characteristic "three-hole" damage caused by Mediterranean monk seals to static fishing gear (©MOm/V. Paravas).

the species) and the fishery sector (i.e. decreasing the loss of income through the implementation of socio-economic and technical measures or by providing incentives).

A key obstacle in achieving this objective is the lack of adequate data on the exact nature, extent and intensity of the interactions between monk seals and the fishing industry at both national and international levels. During the last two decades, MOm's and other researchers' work (e.g. PANOU *et al.,* 1993) provide a detailed account of the status and distribution of the Mediterranean monk seal in Hellas and of the effect of this interaction on the seal population. In contrast, information on the impact of the species on fisheries is scarce. The few studies (PANOU *et al.,* 1993, DENDRINOS *et al.,* 2006) that have investigated this issue have all been quite limited in their duration and geographical range (see Text box 1). Their conclusions, therefore, cannot be easily extrapolated on a national scale.

Recently, a new initiative has been launched, aiming at assessing the intensity and consequences of the seal-fishery interactions in a comprehensive manner at a national level and at developing a concrete action plan with specific measures to mitigate the consequences of the interaction. This initiative (the MOFI Project), supported by the LIFE financial instrument of the European Commission and by the Hellenic Ministries of Environment, Agriculture and Mercantile Marine, aims at examining monk seal-fisheries interactions at three interrelated levels:

- The two most important monk seal breeding sites in Hellas (the NMPANS in the Northern Sporades archipelago and the island complex of Kimolos-Polyaigos): In these two areas the actual intensity of the seal-fishery interaction, relative to the fishing effort, will be measured. This will take place in close collaboration with local fishermen.
- At 7 "hot spot" areas (areas with intense seal-fishery interactions that have been selected through the analysis of currently available data on monk seals and fisheries): In these areas open interviews with artisanal fishermen and aquaculture operators will provide information on the extent and effects of the seal-fishery interactions, as well as, on possible solutions proposed to resolve the existing conflict.
- At a national level: Questionnaires to artisanal fishermen and fishery related services will provide information on the overall distribution of the seal-fishery interaction, while stomach content analysis from samples collected throughout the country will enable, for the first time, the determination of the species' feeding preferences. In addition, mortality causes of the species will be monitored and by responding to reports of monk seal strandings, animals needing emergency care will be rescued and treated, leading to a reduction in the species' mortality.
- Based on the results of these activities and on the existing international experience, and in close consultation with all relevant stakeholders, an Action Plan with measures to mitigate the seal-fishery conflict will be elaborated and presented to the relevant national authorities. The objective of this Action Plan is to include specific, feasible and ready for immediate implementation, measures and to reach the maximum possible consensus among key stakeholders (fishermen, aquaculture owners, competent authorities and environmental organizations) so as to be integrated within the current national fisheries and nature conservation policies.

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