



20 years of monitoring populations of Mediterranean monk seals in Greece

MOM/Hellenic Society for the Study and Protection of the Monk Seal

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MOM/The Hellenic Society for the Study and Protection of the Monk Seal is a Greek, non-governmental organization dedicated to the study and protection of the critically endangered Mediterranean monk seal (*Monachus monachus*). Founded in 1988 in Athens, the Society has been carrying out for more than 20 years research and conservation actions throughout Greece; MOM's researchers have participated also in research and conservation activities in Corsica, Cyprus, Madeira, Mauritania and Turkey.

Although the research and conservation actions of MOM are carried out throughout the entire country, MOM has invested considerable time and energy in studying and protecting the main reproductive monk seal populations identified until now in the country (i.e. Northern Sporades, Northern and southwestern Cyclades, Southern Dodecanese islands). In these areas, MOM's research team has developed new or applied or modified a variety of already existing methodologies while studying local seal populations.

MOM's research activities began in the area of the Northern Sporades islands; this area has gained notoriety, as it is here where the first marine park in Greece, the National Marine Park of Alonnisos, Northern Sporades (NMPANS) was established in 1992. The area is of international importance for the Mediterranean monk seal as it holds one of the largest populations of the species in the eastern Mediterranean Sea. The systematic monitoring of this population, carried out from 1990 to 2006, was based on two different methodological approaches. The first approach involved the frequent visit of coastal caves used by the species for resting and pupping and the use of



preprogrammed photographic cameras (Dendrinios *et al.* 1994, Dendrinios *et al.* 1999). During cave visits, the researchers recorded all indirect indications of previous use of the cave (such as tracks, scats, blood etc.) and documented direct observations with the use of photo- or video cameras. Preprogrammed photographic cameras were installed and programmed according to the general specifications of Hiby (1987); cameras were programmed to take pictures every two hours and were installed at six of the most frequently-used caves in the NMPANS. Throughout the project individual monk seal identification was based on the presence of the sexually dimorphic patch at pups and adult males and scars and other external morphological features at all other stages of development. Until 2002 MIO's researchers carried out 3395 visits to the caves in the NMPANS. In 30% of these visits seals were either directly observed or indirect evidence of their previous presence was recorded; only 15% of the adult individuals directly observed in the caves were males. The preprogrammed cameras took 4231 pictures, 395 of which had a total of 613 animals on them. As with the visits to the caves, 85% of the adult individuals on the pictures were females! The combined analysis of the data from the visits and the preprogrammed cameras indicates that female cave usage throughout the year is much more intense than male usage. Furthermore, adult males visit the caves constantly throughout the year, with a small peak in February when molting occurs, while female cave usage exhibits a prolonged peak from September to March, which includes pupping and molting. The second approach for monitoring the Mediterranean monk seal population in the NMPANS was based on the installation and operation of a remote infrared monitoring system at one of the main pupping sites of the species in the NMPANS (July - November 2003) (Dendrinios *et al.* 2007b). During this study the monitoring system recorded the presence in the cave of four adult females, one female pup and two juveniles of unidentified sex. It also recorded important information regarding haul-out patterns and social and reproductive aspects of the species behavior (Figure 1). During the entire period of the deployment of the monitoring system no adult males were observed in the cave.

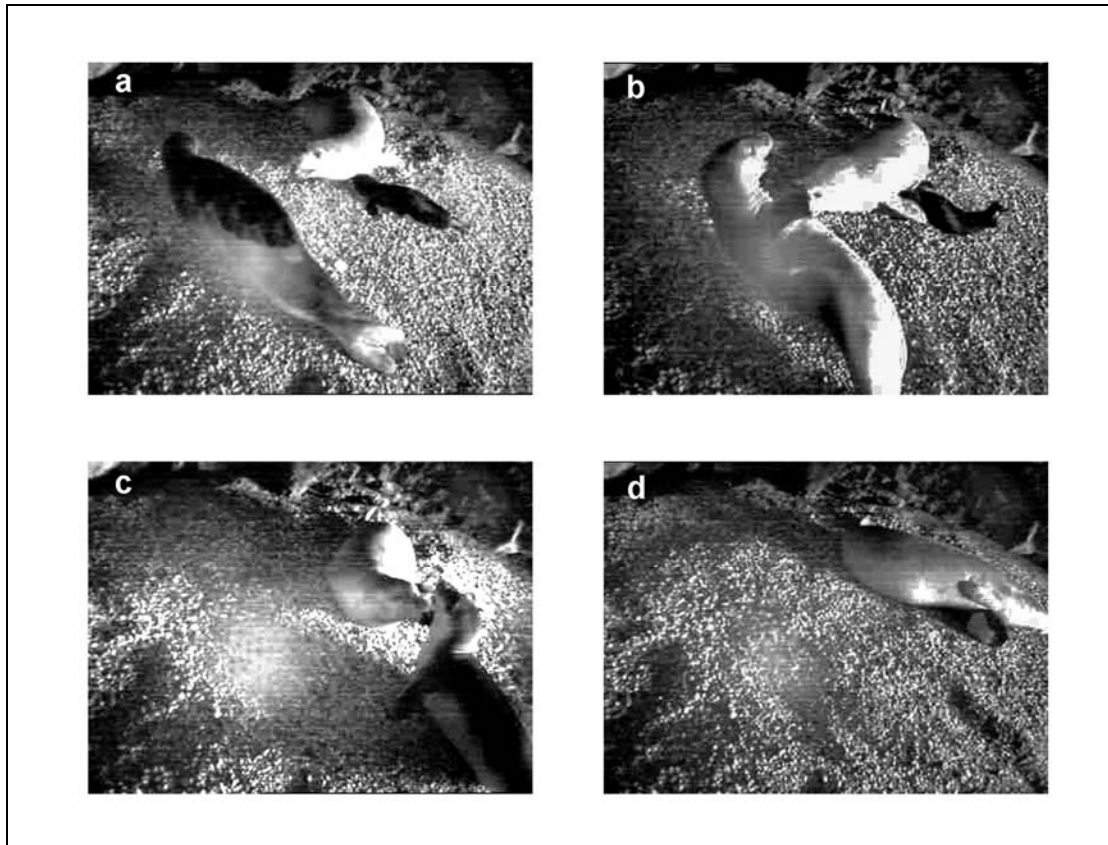


Figure 1: Sequence of images from the CCTV system installed in the NMPANS showing an aggressive interaction between a lactating Mediterranean monk seal and a juvenile. From top left to bottom right: a) Juvenile Mediterranean monk seal approaching a lactating female and its pup, b) Lactating female charging against the juvenile and biting it at its left fore flipper, c) Lactating female chasing the juvenile away, d) Lactating female pursuing the juvenile and trampling over its newborn pup.

The second area that has been systematically monitored by MOM are the islands of Gyaros in the Northern Cyclades (Dendrinou *et al.* 2008) and the islands of Kimolos and Polyaios in the southwestern Cyclades (MOM 2005). Monitoring monk seals in this area was based mainly on the methodology developed and applied in the NMPANS. Pupping activity at Kimolos and Polyaios was recorded in 13 of the 21 caves used by the species, while mean annual pup production was eight pups. In addition to the cave visits carried out in this area, in the summer of 2007 a remote infrared monitoring system was installed at one of the main pupping sites in the area (Karamanlidis *et al.* In prep.). The main difference to the system deployed at



the NMPANS was the option of remote control, via satellite link and Internet connection. During this research project two monk seal births were recorded and ten animals were identified (only one of them was an adult male!). The system enabled also the study of maternal attendance, haul-out patterns and aggressive interactions between females and non-affiliated pups (Fig. 2).



Figure 2: Sequence of images from an automatic infrared monitoring system installed in a coastal cave at the island of Kimolos, Greece to monitor Mediterranean monk seals (*Monachus monachus*). a) While trying to prevent her pup from being washed away by waves a female Mediterranean monk seal climbs over a 1.2m high bolder. b) Presentation of the second pup was head first. c) Moments after the birth of a male pup, the umbilicus cord was ruptured. d) Seconds after parturition the mother-pup pair engaged in intense nuzzling.

Monitoring the Mediterranean monk seal population in the area of Karpathos – Saria – Astakida in the southeastern Dodecanese islands was carried out from 1997 to 2005 and in 2008 (MOM 2008a). This area received protective status in 2007 (i.e. Karpathos – Saria Ecodevelopment Area).



Monitoring here was based also on the methodology applied in the NMPANS; three out of the 20 caves were used for pupping and mean annual pup production was five pups. In addition, three infrared photo cameras were installed in the summer of 2008 at the two most frequently-used pupping sites in the area. The difference to the cameras used in the NMPANS was that they were heat- and motion-sensitive. During their deployment, the cameras took 4767 images with seals on them and enabled the identification of twelve adult females, one juvenile male and six newborn pups (Fig. 3). Invaluable information on lactation and aggressive interaction between females was also collected.



ΚΑΡΤΕΛΑ ΦΩΤΟΓΡΑΦΙΚΗΣ ΑΝΑΓΝΩΡΙΣΗΣ

Όνομα: F_Kar_1

01/09/08 10:45



01/09/08 16:18



01/09/08 17:46



2

Figure 3: Photo-identification card of Female F_Kar_1



During the 20 years of monitoring Mediterranean monk seal populations in Greece, MOM's researchers have had to modify or adjust their research methodologies on various occasions and have gained valuable experiences regarding the advantages and disadvantages of using each one of them (Table 1).

Table 1: Advantages and disadvantages of the application of various methodologies in Mediterranean monk seal research in Greece

Research methodology	Advantage	Disadvantage
Recording the presence of the species at its terrestrial habitat	<p>Good monitoring of habitat quality</p> <p>Good recording of habitat use</p> <p>Accurate recording of basic reproductive parameters</p>	<p>Poor individual identification</p> <p>Poor quality of population estimates, due to the conspicuous absence of adult males in the caves</p> <p>Cost & logistic challenges</p>
Automatic photo cameras	<p>Low cost</p> <p>Good recording of natural behaviour</p> <p>Good individual identification</p> <p>Minimal disturbance</p>	Equipment is weather and damage prone
		Medium quality population estimates
Automatic video cameras	<p>Excellent recording of natural behaviour</p> <p>Good individual identification</p> <p>No disturbance</p> <p>Very good for public awareness</p>	Very expensive – can be used only very selectively
		Low quality population estimates

Taking into account the above, a pragmatic approach to monitoring monk seals in Greece should consider the following facts:

- Greece holds the largest population of Mediterranean monk seals in the world (MOM 2007, MOM 2008b, MOM 2009).
- The species is widely distributed throughout the country (Adamantopoulou *et al.* 1999); potential habitat is extensive among the 15,000 km of coastline and approximately 4,000 islands of Greece. Within this range, MOM has identified so far, more than 500 resting and



pupping sites, while having surveyed less than 30% of the entire coastline of the country (MOM 2007).

- The social and reproductive structure of the species leads it to occupy numerous, inaccessible caves (Dendrinos *et al.* 2007a).
- Logistic and financial resources for monitoring monk seals in the country are limited.

Bearing the above in mind, MOM's research strategy for monitoring Mediterranean monk seal populations in the coming years will evolve mainly around the following points:

- Systematic pup counts in selected core areas in order to monitor the reproductive potential and basic demographic trends of the species.
- Monitoring habitat quality and connectivity throughout the country; identifying new reproductive areas will be a priority.
- Continuation and further development of the Rescue and Information Network of MOM, in order to monitor geographical distribution and population and health status of the species throughout the country.
- Genetic tracking in order to assess demographic history, population dynamics and genetic status of Mediterranean monk seals in Greece.

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