

Preliminary Research on the Aerial Vocalizations of Mediterranean Monk Seals (*Monachus monachus*) Native to Greece, Eastern Mediterranean



- 1) Gabriela Muñoz
- 2) Alexandros A. Karamanlidis
- 2) Panagiotis Dendrinis
- 1) Jeanette A. Thomas

- 1) Western Illinois University- Quad Cities
- 2) MOM/Hellenic Society for the Study and Protection of the Monk seal

Abstract

It is imperative that all aspects of the Mediterranean monk seal's (*Monachus monachus*) life history and behavior be understood to ensure effective management and conservation. Little to nothing is known about the acoustic properties of this species' vocalizations, vocal ontogeny, or the corresponding behavioral contexts. The purpose of this study was to document the aerial vocalizations of wild adult and pup seals and sounds produced by three rehabilitated pups. Behavioral and acoustic data were collected using a hand-held video recorder by MOM researchers of both wild and captive seals. This study provides preliminary research on the acoustic properties of the Mediterranean monk seal's sounds through sonographic analysis and comparison of sound type usage with behaviors of these elusive animals. This research will enable researchers to monitor and census these animals in their critical habitat, i.e. in caves, without needing visual confirmation. If the acoustic features of sounds indicate the age of a pup, this would be a good assessment tool, as well. Acoustic surveillance for monk seals could provide a remote means of monitoring for animals in often harsh dangerous terrain.

Introduction

•Mediterranean monk seals are critically endangered with approximately 400 known individuals left in the population, making them the most endangered pinniped in the world (IUCN 2006). The endangered status of this species is largely due to anthropogenic activities during the 20th Century.

• Pastor et al. (2007) conducted a genetic study that showed substantial genetic differentiation has begun to divide the species into two sub-populations due to geographic distance. These two populations are located 4000 km apart: one located in the Eastern Mediterranean (approx. 150-300 individuals) and one off the Western Sahara (approx. 100-130 individuals).

•There is little to no information in the peer-reviewed literature on the bioacoustics of Mediterranean monk seals, in air or under water.

•Anecdotal reports suggested that their vocalizations appear similar to other monachids, the Weddell seals (*Leptonychotes weddellii*) and leopard seals (*Hydrurga leptonyx*) in the Antarctic; both of which are quite vocal and have been extensively studied (Thomas & Kuechle, 1982; Golladay & Thomas, 1995; Terhune et al., 2008). In addition, the vocal ontogeny of Weddell seal pups was documented by Noe (2000).

•The purpose of this study was to document the types and acoustic properties of aerial vocalizations of wild adult and pup seals and the in-air vocalizations of three rehabilitated pups.

•Video tapes of behaviors and vocalizations of monk seal behavior were provided by The Hellenic Society for the Study and Protection of the Monk Seal (MOM) for analysis.

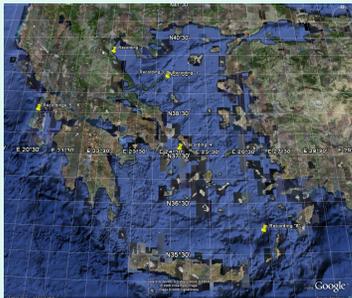


Figure 1. A Google Earth satellite image of the locations where video tape recordings of wild Mediterranean monk seal data were collected.

Materials & Methods

•**Study Site:**
Behavioral and vocal data were collected within the archipelago of Greece (Figure 1). Data from rehabilitated animals were collected at MOM's indoor rehabilitation center in Stani Vala on the island of Alonnisos, northern Sporades.

•**Field Technique:**
Behavioral and acoustic data were collected opportunistically by MOM researchers using hand-held Sony video recorders MODEL DCR TRV900E for both the wild and rehabilitated animals. Details of the acoustic system include: Rotary heads, PCM system Quantization: 12bits (Fs 32kHz, stereo 1, stereo 2), 16bits (Fs 48kHz, stereo).

•**Seal Population:**
Wild animals- Seven adult seals and seven pups were identified in 8 wild video recordings. One animal is of unknown age, sex, and species due to the inability to see it in the dark cave with the video recorder. All of the adult animals are assumed to be female due to their physical proximity to the pups.
Rehabilitated animals- Three pups (Artemis, Victoria, and Dimitris) were rescued, housed, and treated at MOM's rehabilitation facility.

•**Data Analysis:**
Acoustic data were analyzed using *Spectrogram* 16 software (Visualization Software LLC). Behavioral data were coded and analyzed using *EthoLog 2.2* software (Ottoni 2000). Statistical analysis was done using *MYSTAT 12* software (SPSS Inc.).

Results

Sonograms of vocalizations from a wild adult, wild pup, and the three rehabilitated pups in different behavioral contexts. Behaviors are defined in Table 1.

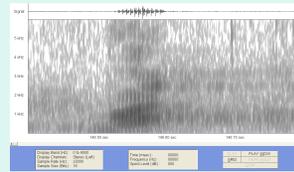


Figure 2. Sonogram: wild pup, unknown sex, swimming above water, outside cave

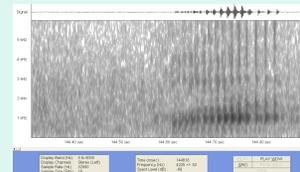


Figure 3. Sonogram: wild adult, female, swimming above water, outside cave

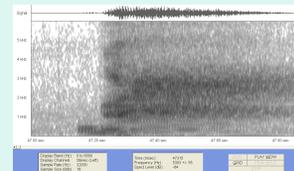


Figure 4. Sonogram: rehabilitated pup Artemis, female, hauled-out in facility

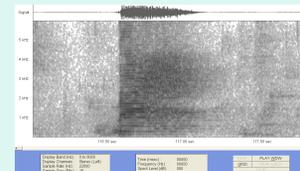


Figure 5. Sonogram: rehabilitated pup Victoria, female, feeding in facility

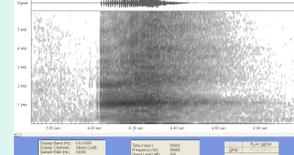


Figure 6. Sonogram: rehabilitated pup Dimitris, male, hauled-out in facility



Table 1. Behavioral definitions used for both wild and rehabilitated animals

Behavior	Definition
Hauled out	Lying on beach in or in a cave
Rest	Eyes closed with little to no movement
Feed	Consumption of other marine organisms
Swim under water	Movement beneath the water's surface
Swim at surface	Movement with part of the body in water and part in the air
Social	Any sexual, play, or aggressive behavior with another conspecific
Bob	Movement of body held vertically in water column with head above the surface
Other	Any non-definable behavior
Out-of-sight	No visual confirmation of animal

Discussion

•Visual and audible analysis of sonograms suggest that the vocalizations of Mediterranean monk seals are similar to those of other monachids

•Further research will include: 1) document the acoustics properties of airborne sounds from Mediterranean monk seals, 2) classify sound types, 3) document vocal ontogeny of a single pup, 4) correlate sound types of mothers and pups with their behavior, and 5) compare the vocal repertoire of the Mediterranean monk seal to that of other monachids, such as the Weddell and leopard seals.

•This research could enable the monitoring and censusing of these animals in critical habitat, such as caves, as described by Dendrinis, et al. (2007). This would decrease the manpower needed to monitor animals in often harsh dangerous terrain.

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- Figure 1. Created by Alexandros Karamanlidis using Google Earth.
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