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DISTRIBUTION OF THE MEDITERRANEAN MONK SEAL (*Monachus monachus*) IN GREECE: RESULTS OF A PAN-HELLENIC QUESTIONNAIRE ACTION, 1982 - 1991

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Abstract In the past decade, a periodical assessment of the population of the highly endangered Mediterranean monk seal, *Monachus monachus*, was launched on a pan-hellenic level using standartized questionnaires. The periods covered were 1982/83, 1984/85 and 1990/91. The evaluation of the data revealed that monk seals still exist almost all over the coastal part of Greece where half of the remaining world population lives and breeds. The population is not concentrated only in the N. Sporades, Aegean Sea, the Ionian Sea and some few other regions as often is assumed. Pups were reported from throughout the country in all three phases of the study. Reproductive events appear to have fluctuated during the period of investigation. Our data will hopefully help conservation efforts to include new areas of particular importance for the seals.

Περίληψη Την τελευταία δεκαετία, έγινε μια περιοδική εκτίμηση του πληθυσμού της απειλούμενης με εξαφάνιση μεσογειακής φώκιας *Monachus monachus* σε πανελλαδικό επίπεδο με χρήση ερωτηματολογίων. Οι χρονικές περίοδοι που καλύφθηκαν ήταν το 1982/83, το 1984/85 και το 1990/91. Η αξιολόγηση των στοιχείων δείχνει ότι υπάρχουν ακόμη φώκιες σχεδόν σε όλη την παράκτια ζώνη της χώρας όπου ζει και αναπαράγεται περίπου ο μισός από τον συνολικό πληθυσμό του είδους. Ο πληθυσμός δεν είναι συγκεντρωμένος μόνον στις Β. Σποράδες στο Αιγαίο, στο Ιόνιο πέλαγος και σε μερικές άλλες περιοχές, όπως συχνά θεωρείται. Μικρά παρατηρήθηκαν σε όλη την Ελλάδα και σε όλες τις φάσεις της μελέτης. Φαίνεται ότι υπήρξαν διακυμάνσεις στον αριθμό γεννήσεων κατά την διάρκεια της μελέτης. Ελπίζουμε ότι τα στοιχεία μας θα συμβάλουν στο να συμπεριληφθούν και νέες σημαντικές για την φώκια περιοχές μέσα στο γενικό πλαίσιο των προσπαθειών για την προστασία της.

INTRODUCTION

In ancient times, the Mediterranean monk seal, *Monachus monachus* (Hermann), was quite common throughout the Mediterranean Sea, the Black Sea and the northwest coast of Africa including the Canaries and Madeira. Nowadays, it is the most endangered marine mammal species in Europe and is threatened with extinction (IUCN 1966, IUCN/UNEP 1988). The total world population is estimated to be comprised of about 400-500 individuals; approximately half of them live in Greek waters (REIJNDERS *et al.* 1993). Unless effective measures are taken promptly, the species is likely to disappear in the next couple of decades (GOEDICKE 1981, REIJNDERS *et al.* 1993). Human caused mortality related to fisheries and loss of habitat have been established as the two main factors threatening the Greek monk seal population (JACOBS & PANOU 1988, IUCN/UNEP 1988, PANOU *et al.* 1993, ARCHIPELAGOS & MOM 1996). In order to increase the probability of survival of the species it is imperative that a network of conservation areas with strategic distribution throughout the country be established (DURANT & HARWOOD 1992, ARCHIPELAGOS & MOM 1996).

Since the mid-80's, systematic conservation projects commenced on a pan-european level. In Greece, studies have been focused mainly on the Northern Sporades archipelago, Aegean Sea, where the first Greek national marine park was established in 1992 (SCHULTZE-WESTRUM 1976, MATSAKIS *et al.* 1985, CHRISTOU 1987, HSSPMS 1995), and on parts of the Ionian Sea (HARWOOD 1987, JACOBS & PANOU 1988, 1996, JACOBS *et al.* 1990, KARAVELLAS *et al.* 1996). The establishment of conservation measures in the latter area is presently under way (JACOBS *et al.* 1995, ARCHIPELAGOS 1996, KARAVELLAS *et al.* 1996). Only fragmentary data exist about local populations in other areas of the monk seal's range in Greece (SERGEANT *et al.* 1978, HSSPMS 1989, 1992, 1994, LAZARIDIS & VLACHOUTSIKOU 1991, CEBRIAN & ANAGNOSTOPOULOU 1992). Moreover, the methodologies used in these investigations varied considerably from each other not allowing an overall evaluation. In the most recent study by ADAMANTOPOULOU *et al.* (this volume), the methodology used is consistent in itself; however, the data cover only the period from 1990 onwards.

Within the above frame, an assessment of the seal population was launched on a national level, covering a decade (1982-1991) and using a standardised methodology. Main aims were (1) to evaluate the current trends in the geographical distribution of the population and its dynamics, and (2) to provide the necessary background information for the expansion of conservation efforts to other areas of interest thereby creating the basis for the establishment of a network of reserves throughout Greece.

METHODS

An assessment of the total Greek monk seal population using the network of port police authorities that is established in all principal coastal towns of Greece was first carried out in a questionnaire campaign in the late 70's (VAMVAKAS *et al.* 1979).

In order to periodically assess the monk seal population at the national level we used later the same network in three successive questionnaire campaigns. Survey forms were distributed through the Ministry of Mercantile Marine to all port police stations of Greece. Each port authority collected information from the local professional fishermen about the number of adult seals and the youngs/pups they had observed over the periods 1982/83, 1984/85 and 1990/91 respectively, and returned the completed forms. The questionnaires of each survey covered a full two-year period. Information about place, date and time of the observation along with other details on colour, size, behaviour of the animals, etc., were also collected (VERRIOPOULOS 1985, VERRIOPOULOS & KIORTSIS 1985, VERRIOPOULOS & HARWOOD 1987). Different to the study by ADAMANTOPOULOU *et al.* (this volume), we restricted ourselves to the categories youngs/pups and adult seals only since juveniles are difficult to be reliably distinguished from adults by inexperienced observers. Thus, the latter category includes the sightings of juvenile seals.

In this study, only data about the presence of seals and of youngs/pups by location of the local port police stations are presented. The actual size of the seal population in the Greek waters and its dynamics are not considered here. Thus, our data provide (1) an indi-

cation of the geographical distribution of the species throughout the country over time, and (2) an indication about the reproduction of the species. Since the forms used by VAMVAKAS *et al.* (1979) were different from ours, earlier data are not compared with data obtained within the frame of the present study.

RESULTS AND DISCUSSION

Altogether, over 3,000 reports of seal sightings by individual fishermen were received from a total of 123 areas (= locations of the local port police stations). Over the total period of investigation, the presence of seals was stated from 111 areas throughout the country. Possible "spreading" effects (possible seasonal movements, etc.) do not play a major role here since the fishermen were asked to report their sightings over the whole two-year period of each campaign. Absence of seals was reported from a total of 12 areas.

The species' geographical distribution is shown on Map I. Only the positive replies are indicated here. The population is not concentrated only in the N. Sporades, the Ionian Sea and some few other regions as often is assumed. Several seal sightings were reported even from areas densely populated and heavily used such as the Saronic Gulf where Athens and Piraeus are situated. These results are in accordance with the results of MARCHESSAUX & DUGUY (1977) and SERGEANT *et al.* (1978) as also with the results of the first questionnaire survey in the 70's (VAMVAKAS *et al.* 1979).

The geographical distibution shown on Map I represents the minimum distribution of the species in the Greek waters. The absence of data over some large Greek coastlines represents either the absence of a reply or a negative reply. However, the absence of a reply or a negative reply does not necessarily indicate seal absence since:

(1) In several sparsely populated areas port police stations did or still do not exist; thus, these areas were not covered by the campaign. This was, for instance, the case in Alonnisos, N. Sporades, where one of the most important seal populations lives and breeds (MATSAKIS *et al.* 1985, PANOU & RIES 1985, HSSPMS 1990, 1995).

(2) Negative replies from some areas may rather reflect a low observers' effort (intensity, range and type of fishing activities) and/or a "random effect" (low numbers of observers; limited contact with isolated regions, etc.) than seal absence. Furthermore, several of these areas are often located close to areas where seals were regularly reported from while seal movements appear to be very probable. For instance, negative replies were received from cap Trikkeri in the southeast of Pagasitikos Gulf, Thessalia, although seals were reported from Volos in the very back of Pagasitikos, from the towns Stylida and Aidipsos in the west as also from Skiathos and Skopelos islands, N. Sporades, in the east where the permanent presence of seals is confirmed through long monitoring activities by scientists.

Limited contact to isolated areas certainly plays a major role in data accuracy. By contrast, the close contact to collecting centres may enhance the motivation to reply. For example, several seal sightings were reported in each of the three periods of investigation from the Greater Athens area where the Ministry of Mercantile Marine and six local port

police stations are based. The same applies for Kefalonia island, Ionian Sea, where the questionnaires yielded numerous seal sightings from the southwestern part of the island where the two main port authorities are based but remarkably few from the northwestern part where seals are more abundant but no port authorities existed (VERRIOPOULOS & HARWOOD 1987, JACOBS & PANOU 1988).

In Table 1, the number of replies that were received per survey and the number of areas with stated seal presence are shown. Both figures show a progressive decline over the total period of investigation although the number of potential observers increased: for the entire country, there were 10,761 fishermen registered in 1981, 12,973 in 1985 and 21,407 in 1991 (NATIONAL STATISTICAL SERVICE OF GREECE 1984, 1987, 1994). By contrast, the percentage of positive statements per reply remains relatively high in all three periods. The latter is a parameter independent of the number of responses.

The progressive decline in responses during the course of the surveys is due to a number of reasons: the termination of operation of port police stations in small settlements such as Kioni, Ithaca island, changes in the personnel and a certain fatigue or growing indifference in repeatedly filling questionnaires additionally to the routine work might have been the most important ones.

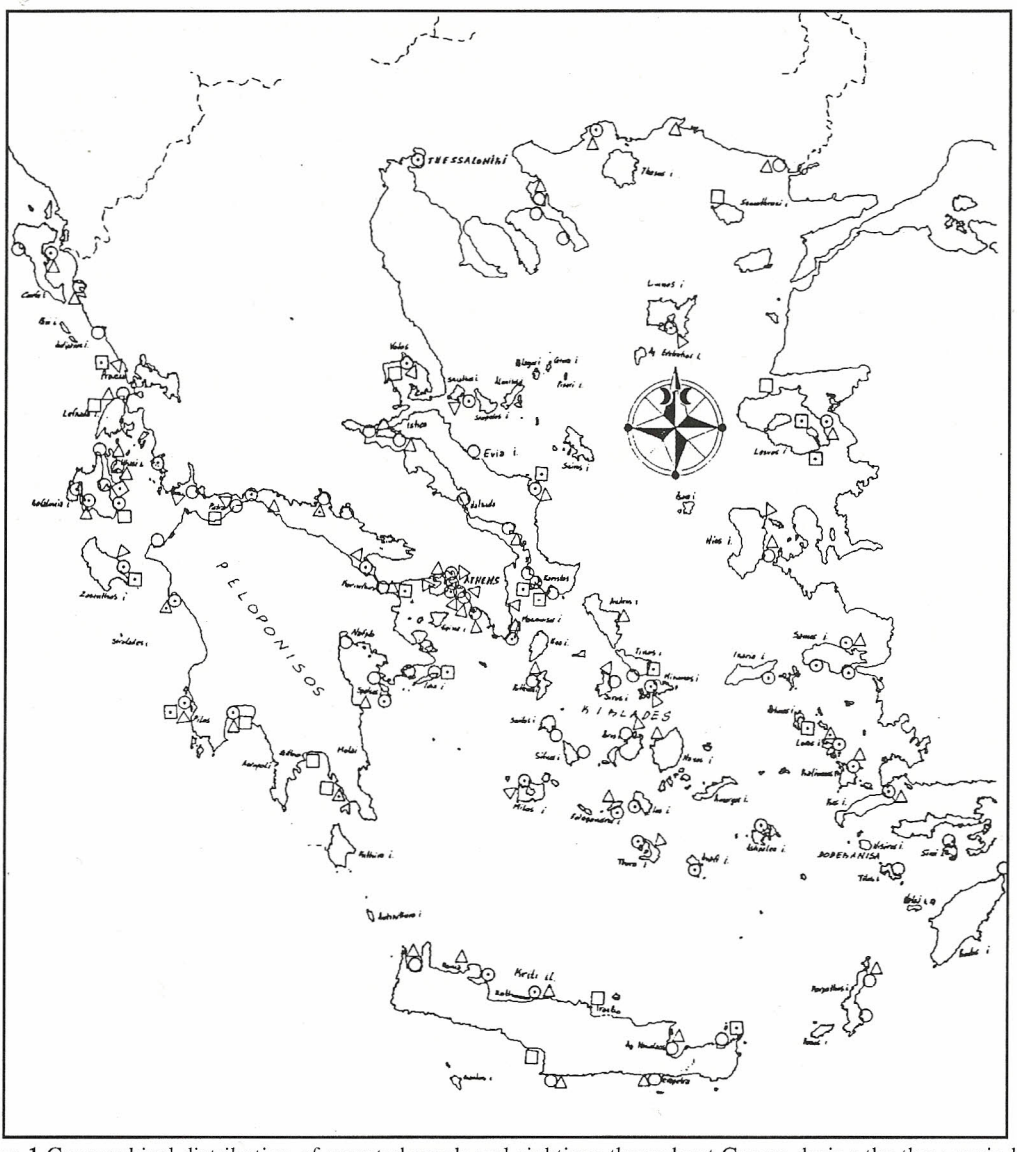
Obviously, the decline in the number of areas with stated seal presence over the total period of investigation is due to a large extent to the decline in the overall number of

Table 1 Results of the questionnaire campaigns over the three phases of investigation in 1982/83, in 1984/85 and in 1990/91.

	1982/83	1984/85	1990/91
Number of areas with reply	100	69	32
Number of areas with positive reply (seal presence stated)	89	64	24
Number of areas with reported youngs/pups	39	5	13
Percentage of areas with stated seal presence per reply	89%	93%	75%
Percentage of areas with youngs/pups per positive reply	44%	8%	54%

Table 2 Chi-square values on pairwise comparison between the different observation periods (confidence level 99%). Significant values are marked with an asterisk (*).

	82/83-->84/85	84/85-->90/91	82/83-->90/91
Percentage of areas with stated seal presence per reply	$\div^2 = 0,67$	$\div^2 = 6,14$	$\div^2 = 3,86$
Percentage of areas with youngs/pups per positive reply	$\div^2 = 23,56$*	$\div^2 = 23,56$*	$\div^2 = 0,81$



Map 1 Geographical distribution of reported monk seal sightings throughout Greece during the three periods of investigation (1982/83; 1984/85; 1990/91). Dots represent areas with reported youngs/pups. 1982/83: circles, 1984/85: triangles, 1990/91: squares.

responses. This is corroborated by the fact that the percentage of positive statements per reply did not change much in all three survey periods. A pairwise comparison of the values revealed no significant differences between the three periods of investigation (Table2).

In spite of the inherent limited reliability of this type of questionnaire campaigns in general, these results may indicate that the overall occurrence of the Greek monk seal population may not have changed much over the period investigated.

Pups/youngs were reported in all three periods of investigation from throughout Greece with no obvious concentration in particular "breeding centres" (Map I). Most pups/youngs were reported in 1982/83, followed by the period 1990/91 while the minimum number was reported in 1984/85 (Table 1). The percentage of areas with youngs/pups per positive statement as a parameter independent of the number of areas with seal presence in general was in 1984/85 also fairly lower than in the two other periods of investigation (Table 1).

A comparison of the percentage of areas with youngs/pups per positive statement between 1982/83 and 1984/85, and between 1984/85 and 1990/91 revealed a significant difference while the values between the first and the last period did not vary significantly (Table 2). It is unlikely that, in 1984/85, the motivation of participants from throughout Greece to report observed pups was considerably lower than in any of the two other periods of investigation while their reports about general seal presence per area of reply was the highest. Thus, the low percentage of youngs/pups per positive statement in the period 1984/85 may be considered as an indication for a real fluctuation in the number of reproductive events. Reproduction in this period may have been lower than in the previous and the following ones, due to unknown reasons.

From our data it is clearly demonstrated that monk seals exist almost all over the coastal part of Greece, mainland and islands. The population's geographical distribution has been relatively stable within the past decade. There were actively reproducing groups scattered throughout the Greek waters over the total period of investigation. These results will hopefully help conservation efforts to include new areas of particular importance for the monk seals and eventually to establish a network of reserves throughout Greece.

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REFERENCES

ARCHIPELAGOS 1996. *Monk Seal Conservation in Greece. Part 3., Central Ionian Sea.* Final Report to the EU, contract B4-3040/95/009/AO/D2, Archipelagos - marine and coastal management, Argostoli, Kefalonia, Greece. February 1996. 75p.

ARCHIPELAGOS & MOM 1996. *Strategy for the protection of the Mediterranean monk seal,* Monachus monachus, *in Greece.* Archipelagos - marine and coastal management and Hellenic Society for the Study and Protection of the Monk Seal (HSSPMS), Athens.

CEBRIAN D. & ANAGNOSTOPOULOU K. 1992. *Status of the population and habitat of the Mediterranean monk seal in Cyclades islands (First Approach).* Report to the Hellenic Society for the Protection of Nature and Cultural Heritage,. Environmental Research Bureau. June 1992. 17p. + Annexes

CHRISTOU K. 1987. *Environmental planning of the terrestrial and marine sources of the N. Sporades and organization model for the Marine Park.* Ministry of Environment and Polytechnic School. 417p +

Appendices.
DURANT S. & HARWOOD J. 1992. Assessment of monitoring and management strategies for local populations of the Mediterranean monk seal *Monachus monachus*. *Biol. Cons.* 61: 81-92.
GOEDICKE T.R. 1981. Life expectancy of Monk seal colonies in Greece. *Biol. Cons.* 20: 173-181.
HARWOOD J. (ed.) 1987. *Population Biology of the Mediterranean Monk Seal in Greece*. Final report, contract ENV 853 UK, DG XI of the Commission of the EC, Sea Mammal Research Unit (SMRU), Cambridge, U.K. 72p.
HSSPMS 1989. *Observations related to the status of the monk seal population in St. Efstratios. Mapping of the island's seal shelters*. Report, Univ. of Athens, Hellenic Society for the Study and Protection of the Monk Seal, Athens. 10p.
HSSPMS 1990. *Census and observations of the monk seal population in the National Marine Park of Sporades, Summer 1990*. 34p.
HSSPMS 1992. *Monk seal population and its shelters in the Dodecanese area*. Report, contract EEC No. 4-3040(91) 7808. Hellenic Society for the Study and Protection of the Monk Seal, Athens, Greece. 19p. + Annexes.
HSSPMS 1994. *Establishment of a Rescue and Information Network for Orphan, Wounded and Sick Seals and gathering of seal observations from the whole of Greece*. Final Report to the EU. Hellenic Society for the Study and Protection of the Monk Seal, Athens, Greece. 85p. + Annexes.
HSSPMS 1995. *Continuation of the Monitoring of the Mediterranean Monk Seal in the National Marine Park of Alonnisos, Northern Sporades*. Final Report to the EU. 42p.
IUCN 1966. *Red Data Book*. Species Survival Commission, Gland.
IUCN/UNEP (1988). *Report on the Joint Expert Consultation on the Conservation of the Mediterranean Monk Seal, 11-12 January 1988, Athens, Greece*. Document IUCN/UNEP/MEDU/MM-IC/5.
JACOBS J. & PANOU A. 1988. *Conservation of the Mediterranean Monk Seal,* Monachus monachus*, in Kefalonia, Ithaca and Lefkada isl., Ionian Sea, Greece*. Final report, contract 6611/28,"Descriptive Analysis and Pilot Project for the Establishment of a Conservation Strategy for the Monk Seal and its Habitat". Institute of Zoology, University of Munich, Germany, December 1988. 221p.
JACOBS J. & PANOU A. 1996. *Conservation programme for the Ionian: Activity 1: Kefalonia & Ithaca.* Final Report, WWF Project GR0034.01. Institute of Zoology, University of Munich, Germany. February 1996. 95p.
JACOBS J., PANOU A., ANTZOULATOS Y. & CHAROKOPOU A. 1995. *Management of monk seal habitats in the Central Ionian Sea (Kefalonia & Ithaca); Preliminary management proposal.* WWF Project GR0034.01 "Conservation programme for the Ionian: Activity 1: Kefalonia & Ithaca". June 1995. 48p.
JACOBS J., PANOU A. & VLACHOUTSIKOU A. 1990. *Special report on activities in Zakynthos island, Ionian Sea, Greece*. WWF Project 3871 Greece-"Monk Seal conservation in the Eastern Mediterranean". Project Progress Report. February 1990.
KARAVELLAS D.P., IOANNOU G. & SAMARAS A. 1996. *Intergated Ionian Project for the Study and Conservation of the Mediterranean Monk Seal* Monachus monachus *on Zakynthos*. Final Report, January 1996.
LAZARIDIS Y. & VLACHOUTSIKOU A. 1990. *Monk seals in Greece*. Report to the European Nature Heritage Fund, Germany.
MARCHESSAUX D. & DUGUY R. 1977. Le phoque moine en Grece. *Mammalia* 41: 419-440.
MATSAKIS J., KOUROUTOS V., YANNAROS T. & KOKKINIA P. 1985. *Programme "Sporades du Nord": B. Etat de la population du phoque moine*. Université d' Athènes, Rapport au Ministère de l'Environnement et a la CEE.
NATIONAL STATISTICAL SERVICE OF GREECE 1984. *Results of the sea fishery survey by motor vessels for the year 1981*. Athens 1984.
NATIONAL STATISTICAL SERVICE OF GREECE 1987. *Results of the sea fishery survey by motor vessels for the year 1985*. Athens 1987.
NATIONAL STATISTICAL SERVICE OF GREECE 1994. *Results of the sea fishery survey by motor vessels for the year 1991*. Athens 1994.

PANOU A., JACOBS J. & PANOS D. 1993. The Endangered Mediterranean Monk Seal, *Monachus monachus*, in the Ionian Sea, Greece. *Biol. Cons.* 64: 129-140.

PANOU A. & RIES E. 1985. Preliminary report on some data on the biology and behavior of the Monk Seal, *Monachus monachus*. *Rapp. Comm. int. Mer Medit.* 29(8): 173-174.

REIJNDERS P.H.J., BRASSEUR S., VAN DER TOORN J., VAN DER WOLF P., BOYD I., HARWOOD J., LAVIGNE D., LOWRY L. 1993. *Seals, Fur Seals, Sea Lions, and Walrus, Status Survey and Conservation Action Plan.* IUCN/SSC Seal Specialist Group, 88p.

SCHULTZE-WESTRUM TH. 1976. *Marine National Park Project, Northern Sporades*. Manuscript, Munich, Germany. 10p.

SERGEANT D., RONALD K., BOULVA J. & BERKES F. 1978. The recent status of *M. monachus*, the mediterranean monk seal. *Biol. Cons.* 14: 259-288.

VAMVAKAS C., TSIMENIDIS N. & KAINADAS H. 1979. Contribution to the Knowledge of the Distribution of the Monk Seal *Monachus monachus* in the Greek Seas. Conservation plan by the establishment of marine parks. In: Ronald K. & Duguy R. (eds.), *The Mediterranean Monk Seal.* UNEP Technical Series 1, Pergamon Press, New York, 31-55.

VERRIOPOULOS G. 1985. Comparaison entre diverses donées sur l'evolution des populations du phoque moine en Grèce. *Rapp. Comm. int. Mer Medit.* 29(8): 167-168.

VERRIOPOULOS G. & HARWOOD J. 1987. Fishermen's assessment of monk seal abundance and distribution in Kefalonia. In: Harwood J. (ed.), *Population Biology of the Monk Seal in Greece*. 40-41, SMRU, Cambridge, U.K.

VERRIOPOULOS G. & KIORTSIS V. 1985. Frequence et répartition du phoque moine (*Monachus monachus*) en Grèce. Resultats d'une enquête (1982-1984). *Rapp. Comm. int. Mer Medit.* 29 (8): 169-170.

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