
CRANIAL MORPHOMETRY OF ADULT MEDITERRANEAN MONK SEAL (*Monachus monachus*) FROM THE ADRIATIC SEA

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Abstract

The Mediterranean monk seal (*Monachus monachus*) is one of the most endangered animal species in the world. Historically, it was spread along the Adriatic Sea, but it is declared extinct in this region since the second half of the 20th century. Cranial morphometry of an adult Mediterranean monk seal skull from the Adriatic Sea was recorded. The skull originates from the year 1964 and it is presumed that the specimen was killed by a fisherman on the small island Biševo, close to the island Vis. Today, the skull is housed in the marine mammal collection of the Department of Anatomy, Histology and Embryology of the Faculty of Veterinary Medicine, University of Zagreb, Croatia. Twenty-four cranial measurements were taken using digital calipers. The aim of our study was to preserve craniometrical data of one of the last adult autochthonous specimen of the Mediterranean monk seal from the Adriatic Sea.

Keywords: cranial morphometry, skull, Mediterranean monk seal, *Monachus monachus*, Adriatic Sea

Introduction

The Mediterranean monk seal (*Monachus monachus*) is one of the most endangered animal species in the world. Once it ranged throughout the Mediterranean Sea, into the Black Sea, and south along the Atlantic coast and near-shore islands of northwestern Africa. Substantial reductions in range have accompanied large reductions in population size in all areas (REEVES et al.,

2002). Today, the Mediterranean monk seal lives in isolated populations in the north-eastern Mediterranean, the Capo Blanco Peninsula in Western Sahara, and the archipelago of Madeira in the Atlantic. It is categorized as Critically endangered on the IUCN Red List with less than 600 survived individuals. The main threats to the species' survival include habitat loss, intentional killing and accidental entanglement in fishing gear (PIRES et al., 2008).

The first description of the Mediterranean monk seal was made by Hermann on a specimen from the Adriatic Sea. Historically, it was spread along the Adriatic Sea, but it is declared extinct in this region since the second half of the 20th century (ANTICA et al., 1994; GOMERCIC et al., 1984; GOMERČIĆ and HUBER, 1984; GOMERČIĆ et al., 1997; RONALD, 1984), although data on occasional sightings were recorded (JARDAS and DRAGANOVIĆ, 1987). Today, the Adriatic Sea is inhabited by only one marine mammal species, the bottlenose dolphin (*Tursiops truncatus*). Other marine mammal species occur in this region only occasionally and are declared as non-breeding vagrants (GALOV et al. 2008; GOMERČIĆ et al. 2006a; DURAS GOMERCIC et al. 2008). Occasional sightings of the Mediterranean monk seal increased in the last five years in the northern Adriatic Sea (DURAS GOMERCIC et al., 2005; GOMERČIĆ et al., 2006b).

The osteology of genus *Monachus* has been described by KING (1956). She described all three species of the genus *Monachus* and among others also the skulls of twelve Mediterranean monk seals from different parts of the world. However, she did not describe any specimen from the Adriatic Sea. The only recent description of a Mediterranean monk seal from the Adriatic Sea was made by GOMERČIĆ and HUBER (1987, 1989) on a subadult skull.

This is the first description of an adult Mediterranean monk seal skull from the Adriatic Sea. The aim of this study is to contribute to the knowledge on the morphology of this highly endangered species.

Material and methods

The marine mammal collection of the Department of Anatomy, Histology and Embryology of the Faculty of Veterinary Medicine, University of Zagreb, Croatia houses two Mediterranean monk seal skulls (*Monachus monachus*). One skull belongs to a subadult specimen described by GOMERČIĆ and HUBER (1987, 1989). The other skull is the object of our study. Soft tissues

were removed from the skull and it was dried, not cooked. This skull has hardly visible skull bone sutures and was defined as adult (Fig.1.). The adult skull was found in Komiža, island Vis, middle Adriatic Sea. The exact cause of death is not known, but it originates from the year 1964 and it is presumed that the specimen was killed by a fisherman on the small island Biševo, close to the island Vis. Twenty-four cranial measurements were taken using digital calipers and read to the one tenth of millimeter. (Fig. 2.). DNA was isolated from dry tissue of dental alveoli in order to determinate the sex of the specimen. Polymerase chain reaction (PCR) was performed using four primers (GILSON et al., 1998).



Fig 1. Skull of the adult Mediterranean monk seal (*Monachus monachus*) from Biševo, Adriatic Sea, 1964.

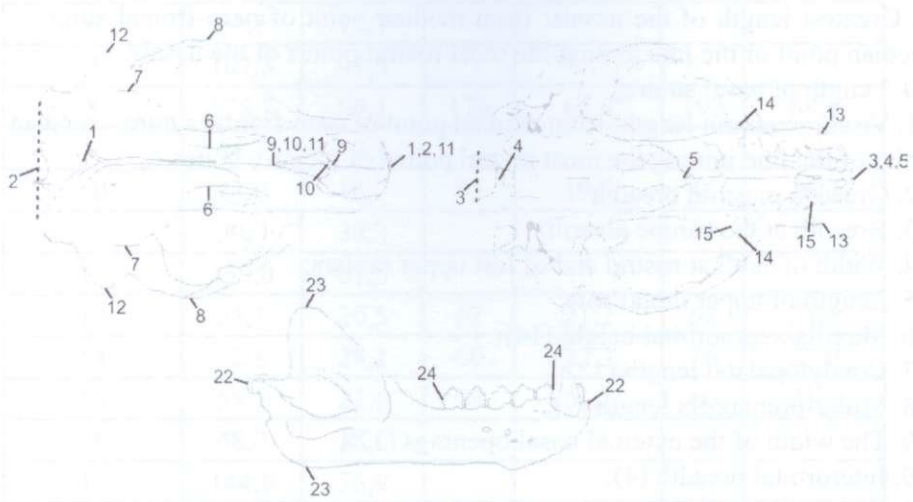


Fig. 2. Cranial measurements of the Mediterranean monk seal, the same ID number is used for the beginning and ending point of the measurement, dorsal view (top, left), ventral view (top, right), mandible (bottom)

Cranial measurements (Fig. 2.) are listed below. The measurements 16, 17, 18, 19, 20 and 21 are from GOMERČIĆ and HUBER (1989) and their original marking is in brackets.

1. Total length: from the most caudal point of vertex of the cranium in the median plane - median point of the line joining the most rostral points of incisive bones
2. Length from median point of the line joining the most caudo-dorsal points of the crista nuchae - median point of the line joining the most rostral points of incisive bones
3. Condylbasal length: caudal border of the occipital condyles - median point of the line joining the most rostral points of incisive bones
4. Basal length: from the basal border of the foramen magnum in the median plane - median point of the line joining the most rostral points of incisive bones
5. Palatal length: median point of the line joining the most rostral points of incisive bones – the most caudal point of the horizontal part of the palate in the median plane
6. Least breadth of skull – least breadth caudal of the supraorbital processes
7. Greatest neurocranium breadth – greatest breadth of the braincase
8. Zygomatic breadth;

9. Greatest length of the nasals: from median point of naso-frontal suture – median point of the line joining the most rostral points of the nasals
10. Length of nasal suture;
11. Viscerocranium length: from median point of naso-frontal suture – median point of the line joining the most rostral points of incisive bones
12. Greatest mastoid breadth
13. Breadth at the canine alveoli
14. Width of skull at rostral end of last upper molars;
15. Length of upper molar row;
16. Maxilla-supraorbital height (14);
17. Condylopalatal length (12);
18. Molar-premaxilla length (9);
19. The width of the external nasal openings (17);
20. Interorbital breadth (4);
21. Coronoid height (15);
22. Length of the mandible: from condyle process – most prominent median point at the rostral border of the alveoli of the incisors
23. Height of vertical ramus: basal point of angular process – highest point of the coronoid process
24. Length of the mandible molar row

Results

Twenty-four cranial measurements of the adult Mediterranean monk seal skull from the Adriatic Sea are presented in Table 1. The PCR reaction showed that the skull belonged to a female. Table 1. includes craniometrical data from adult Mediterranean monk seals published by KING (1956).

Cranial measurement	M. monachus (female), Adriatic Sea, this study		M. monachus (female), Madeira, KING 1956		M. monachus (male), Madeira, KING 1956	
	mm	%	mm	%	mm	%
1	247,7	95,7				
2	263,3	101,8				
3	258,7	100	268	100	281	100
4	237,8	91,9	251	93,6	263	93,5
5	106,6	41,2	110	41,0	117	41,6

6	27,7	10,7				
7	107,3	41,5				
8	178,7	69,1	176	65,6	193	68,6
9	44,7	17,3				
10	43,0	16,7	53	19,7	46	16,3
11	99,0	38,3				
12	159,0	61,5				
13	53,1	20,5	57	21,2	68	24,1
14	72,8	28,1	60	22,3	76	27,0
15	58,5	22,6	57	21,2	60	21,3
16	48,0	18,6				
17	144,6	55,9				
18	75,6	29,2				
19	36,2	14,0				
20	61,0	23,6				
21	82,1	31,7				
22	180,2	69,7				
23	76,8	29,7				
24	60,0	23,2				

Discussion and Conclusion

The aim of our study was to preserve craniometrical data of one of the last adult autochthonous specimen of the Mediterranean monk seal from the Adriatic Sea. Similar data for this species are very rare. Published morphometric data of the Mediterranean monk seal are to be found in GOMERČIĆ and HUBER (1987, 1989). They described craniometrical characteristics of a two-month old male. KING (1956) described twelve Mediterranean monk seals from the Mediterranean Sea and the Atlantic Ocean. Unfortunately, the most of the described animals were very young and some of them without the skull. Only two animals, one female and one male (Table 1.), were adults and they originated from the island Madeira, Atlantic Ocean. The skull of the Mediterranean monk seal from the Adriatic Sea tends to be slightly wider in proportion to their length than skulls of Mediterranean monk seals from Madeira (measurements 8. and 14.). The male skull is relatively wider than the female skull KING (1956), but the Adriatic female skull is wider than both skulls from Madeira. KING (1956)

points out that skulls of Mediterranean monk seal (*Monachus monachus*) tend to be slightly wider in proportion to their length than skulls of Caribbean monk seal (*Monachus tropicalis*) and Hawaiian monk seal (*Monachus schauinslandi*). This statement lets us conclude that the extinct Mediterranean monk seal from the Adriatic Sea had the relatively widest skull within the monk seals, i.e. the genus *Monachus*.

The adult female examined in our study lived in the Adriatic Sea in the first half of the 20th century. The Mediterranean monk seal is declared extinct from the Adriatic Sea since the second half of the 20th century. The described skull represents the last remains of the Adriatic indigenous population. The Mediterranean monk seals observed in the last years in the Adriatic Sea are not specimens of the indigenous population. These are probably animals from populations of the Ionian and Aegean Sea. Our results can be used as basic data for future morphological research on the differences between indigenous populations of the Mediterranean monk seals.

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