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Status of the Mediterranean Monk Seal, *Monachus monachus* (Hermann, 1779) in the Coastal Waters of Turkey

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Özet: ***Akdeniz keşiş foku,* Monachus monachus (*Hermann, 1779*)*'un Türkiye kıyılarındaki durumu***. Bu çalışmada, Akdeniz keşiş foklarının Türkiye kıyılarındaki dağılımı, durumu, yaşam alanları ve tür üzerindeki tehditler incelenmiştir. Çalışmanın sonuçları, yerel balıkçılar ile gerçekleştirilen anket çalışmaları ve karadan ve denizden potansiyel fok mağaralarının tespiti için arazi seferleri sonucunda elde edilmiştir. Makalede 1994 ve 1998 yılları arasında toplanmış olan fok görme verileri kullanılmıştır. Çalışma sırasında elde edilen veriler ışığında türün Türkiye kıyılarında parçalı bir dağılım gösterdiği ortaya çıkmış ve yaklaşık 104 fok bireyinin yaşadığı tahmin edilmiştir. 1994 ve 2002 yılları arasında 17 yavrulama ve 22 ölü fok kaydı elde edilmiştir. Türün üzerindeki ana tehditler, yaşam alanlarının tahribatı, kasti öldürmeler, balıkçı ağlarına takılma, balık stoklarında aşırı ve yasadışı avcılık sonucunda azalma olarak tespit edilmiştir.

Anahtar Sözcükler: *Monachus monachus*, durumu, yaşam alanı, tehditler, Türkiye kıyıları

Abstract: In this study, the distribution, status, habitats and threats upon the monk seals along the Turkish coasts were examined. The results were obtained through surveys based mainly on the information gathered from local fishermen and expeditions, both from land and sea, to explore coastlines offering potential seal caves. Sightings data collected between 1994 and 1998 were used in this paper. The data obtained during the study reveals a discontinuous distribution pattern of *Monachus monachus* along Turkish coasts. The number of seals living in the studied area was estimated to be approximately 104. 17 pupping and 22 dead seal records were obtained between 1994 and 2002. The main threats to *M. monachus* were found to be habitat destruction, deliberate killing, entanglement in fishing gear, overfishing and illegal fishing resulting in the depletion of fish stocks.

Key Words: *Monachus monachus*, status, habitat, threats, Turkish coasts

Introduction

The Mediterranean monk seal, *Monachus monachus* (Hermann, 1779), is Europe's most endangered marine mammal and it is protected by the Barcelona (Fourth protocol species), Bern (Appendix II), Biodiversity (Eligible species), Bonn (Appendix I and II) and CITES (Appendix I) Conventions. According to recent surveys, Turkey is one of the last strongholds of the species, throughout its distribution range (Marchesseaux, 1987; Güçlüsoy and Savaş 2003). The population of *M. monachus* on Turkish coasts was estimated to be between 150 and 300 animals – based mainly on interviews with fishermen– from 1976 to 1978 (Berkes *et al*., 1979), 50 to 100 in 1987 – based on interviews with fishermen – (Marchesseaux, 1987), and less than 50 in the early 90s – based on field surveys – (Öztürk *et al*., 1991). The species` population has found to be decreasing due to human impacts such as habitat destruction, disturbance by tourism during summer months, deliberate killing, overfishing and entanglement in the fishing nets (Berkes, 1982; Kıraç and Savaş, 1996; Yediler and Gücü, 1996).

Monk seals have been under official protection in Turkey since 1977 and 1978 by Ministry of Forestry and Ministry of Agriculture and Rural Affairs respectively. For the conservation of the species, Turkish National Strategy was prepared in 1991, and consequently a national seal committee was established for co-ordination of the monk seal conservation activities. Since then, several conservation projects were carried out by several national NGOs and universities. These initiatives have been independent from each other and focusing on the local seal populations. For example, as a pilot area, Foça, a small town on the Turkish Aegean coast bearing suitable habitats for the species, was selected for the implementation of the national strategy, and designated as Foça Pilot Monk Seal Conservation Area (Foça PMSCA) in 1991 (Güçlüsoy and Savaş, 2003). In that area the fishing activity is regulated and trawling and purse seining are prohibited by the Aqua Products Circular Decree 27 set in 1992 (Güçlüsoy and Savaş, 2003). Though, the national seal committee has decided on 5 most critical areas for the survival of the species as important monk seal sites to be urgently protected in 2000, no further attempt has been realised so far.

Our purpose in this study was to determine the distribution, status, habitats - mainly the coastal seal caves - and threats upon the monk seals along the Turkish coast.

Materials and Methods

Surveys along Turkish coasts were based mainly on the information obtained from local fishermen, who log many

hours in monk seal habitat, and expeditions both from land and sea to explore coastlines having potential seal caves.

In the first visits to the coastal towns and villages, interviews with local fishermen were carried out to collect seal sighting data utilising a standard seal sighting form which was also previously used by Ronald and Healey (1974) and Berkes *et al*. (1979). In most of the communities, data were collected based on interviews with one third to one-quarter of active fishermen. When possible, other locals, e.g. yacht captains and divers, were also interviewed. Only first-hand information was recorded from fishermen who could provide the date and location of their sighting(s). The parameters collected were: location, date, number and size of the seal observed, whether alive or dead. Data which could not be verified by consensus opinion, or which originated from questionable or second hand sources were rejected. All sightings obtained during the visits were stored in a computer database called FokData, using the software dbase III plus. Sightings data collected between 1st of January 1994 and 31st of December 1998 are used in this paper. During interviews, additional information was also collected on habitat of seals – locations of known seal caves – and their relations with fishermen.

Figure 1 shows the study area, major sites mentioned in the paper, and provinces at which information was collected from fishermen. Interviews were conducted for 56 days in the Black Sea, 30 days in the northern Aegean, 120 days in the southern Aegean and 11 days in the Mediterranean Sea coastal towns.

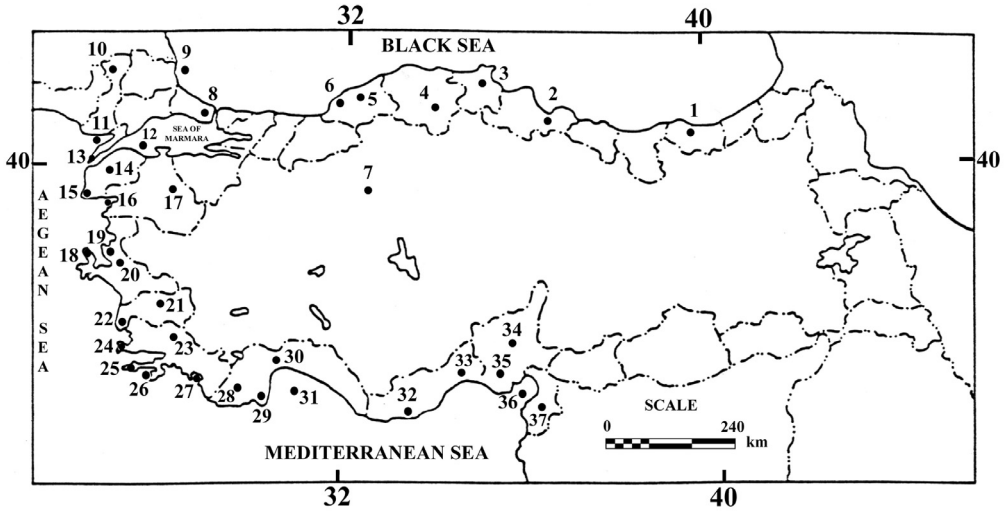

Figure 1. The study area, major sites mentioned, and provinces at which information was collected from fishermen (1.Trabzon; 2. Samsun; 3. Sinop; 4. Kastamonu; 5. Zonguldak; 6. Ereğli; 7. Ankara; 8. Istanbul; 9. Iğneada; 10. Edirne; 11. Saroz Bay; 12. Marmara Island; 13. Gelibolu Peninsula; 14. Çanakkale; 15. Cape Baba; 16. Edremit Bay; 17. Balıkesir; 18. Karaburun Peninsula; 19. Foça; 20. Izmir; 21. Aydın; 22. Dilek N.P.; 23. Muğla; 24. Bodrum Peninsula; 25. Datça Peninsula; 26. Hisarönü Bay and Bozburun Peninsula; 27. Fethiye Bay; 28. Cape Teke; 29. Olimpos - Bey Dağları National Park; 30. Antalya; 31. Antalya Bay; 32. Bozyazı; 33. Mersin; 34. Adana; 35. Çukurova Plane; 36. Iskenderun Bay; 37. Antakya)

For the study, natality and mortality records of monk seals were collected in two ways. One of them was the collection of these records during interviews, and the other one was the collection of the records upon the denunciation telephone calls – only in case of stranded animals – received from locals. After these calls one of the authors went to the site to collect biological information as well as the cause of deaths. The second way continued after the main study period until 2002. In addition, a potential breeding cave, reported by local fishermen and located in the Karaburun Peninsula, Izmir was checked in each October – when the breeding of monk seals usually reaches a peak (Sergeant *et al*. 1979) – for a possible breeding after the main study period until 2002.

Population (quadrate) estimates of *M. monachus* were calculated as follows; sighting data were pinpointed on a study map divided into 40 x 40 km quadrates since the dispersal distance of the species is estimated at around 40 km by Berkes (1978). As a second step, the number of the seals sighted together was considered to be the minimum number of individuals for each of the respectative quadrates in which they were sighted.

In order to support the population estimates, after the interview and questionnaire surveys, field observations were also carried out to identify monk seal individuals at various sites by the authors. For the study, size, sex, colour, scars and natural marks were used as an individual's identification criteria. This was achieved by studying the photographs taken and the video footages recorded by means of reflex photo cameras with telephoto and zoom lenses from 24mm up to 600 mm and Hi-8 and S-VHS-C video camcorders during the observational field expeditions. These expeditions were taken place in the Karaburun Peninsula and Yeni Foça of Izmir province, Yalıkavak of Bodrum Peninsula, Cape Kurtoğlu of Fethiye Bay, Kalkan and Kaş of Antalya province, Aydıncık

and Boğsak of Mersin province. The detailed photographs or video footages available from other sources were also studied for identification. This information was used to support the population estimates. However, numbers of seal observations were too small to provide data on seal biology and habits, but these studies also provided field confirmation of sighting information obtained from fishermen.

Using the information obtained from interviews, the coastal areas of the central Black Sea (in the Trabzon, Samsun, Sinop, Kastamonu and Zonguldak provinces for 15 days in July 1997) and the north and south Aegean (Karaburun Peninsula for 6 days between September and October 1994; Bodrum Peninsula for 23 days between August and November 1996; and Fethiye Bay for 21 days between July and September 1994) were explored in search of seal caves. When monk seal caves were found, possible threats such as recreational use or holiday housing around these caves were also determined.

The seal caves, discovered by the authors during coastline surveys by mainly skin diving, were those having underwater or surface entrance and rocky platform or sandy/pebble beach at the end of the cave. The seal caves described by local informants were also visited. During diving expeditions rubber inflatable or small scale fishing boats were used. When an underwater entrance cave was found, SCUBA equipment was used. The direct seal observations in the caves and any sign of seal presence – including body depressions, traces from movement on the soft ground surfaces and remains of faeces and hair – were registered as evidence that seals were using the cave.

Distribution of *Monachus monachus* on Turkish Coasts

The collected sighting information is categorised regionally and given in Table 1. When pinpointed on a study map, the data obtained during the study reveals a discontinuous distribution pattern of *Monachus* along Turkish coasts (Figure 2).

Table 1. Regional seal sightings with numbers of seals observed together along the Turkish Coasts between 1994 -1998

	Black Sea	Sea of Marmara	North Aegean Sea	South Aegean Sea	Mediterranean Sea
1 seal	115	1	124	173	96
2 seals	5	-	13	16	5
3 seals	-	-	4	4	1
4 seals	-	-	-	2	-
5 seals	-	-	-	-	1
> 5 Seals	-	-	2	-	-
Total	**120**	**1**	**143**	**195**	**103**

Black Sea Region: In the Turkish Black Sea, seals were sighted only in the central coasts of the region between Cide (Kastamonu province) and Yakakent (Samsun province) (Figure 2). From Yakakent (Samsun province) eastwards to Beşikdüzü (Trabzon province) no seal sightings were recorded. The young fishermen interviewed in this area were hardly aware of the species. On the other hand, even fishermen who knew about the seals and seal damage to fishing nets had not sighted any of the animals westwards from Cide (Kastamonu province) to Akçakoca (Bolu province). However the old fishermen interviewed in different localities reported that seals used to be seen between the easternmost Yakakent (Samsun province) and the westernmost coastline of the Istanbul province till Iğneada at the Bulgarian border. It was also recorded that small groups of seals (4-5) were regularly encountered in this area until the early 1970s. Dobrovolov and Yoneva (1994) reported that single seals were observed some years ago by tourists at the Southern Bulgarian Black Sea coast. They assumed that seals were visiting the Bulgarian waters for a short time and then returning to the Turkish side. However, Spiridonov and Spassov (1998) reported that the southern Bulgarian Black Sea coast was inhabited by 2 or 3 individuals. Previous records indicate that *M. monachus* was present along the entire Black Sea coast (Boulva, 1979). However, studies carried out since the 1960s reveal that the range of the seals' distribution shrank and concentrated on the central Black Sea coast (Mursaloğlu, 1964; Berkes *et al*., 1979; Öztürk, 1994a; Kıraç and Savaş, 1996). Indeed, our study confirms this trend.

Sea of Marmara Region: Although this region was not visited in this study, one sighting of a single animal was reported from Marmara Island by a fisherman interviewed in Çanakkale province (Figure 2; Table 1). Berkes *et al*. (1979) showed that the species was present on the southwest coasts of the Sea of Marmara between 1976 and 1978. Same authors have also stated that no seals could be encountered in the northern part of this region due to high population densities and intensive fishing activity.

Northern Aegean Region: For the purposes of this study, the provincial coasts (proceeding southwards) of Edirne, Çanakkale, Balıkesir and Izmir were delineated as the Northern Aegean region. The majority of the sightings obtained were from the large capes, Gelibolu (Gallipoli) the Karaburun Peninsula and Cape Baba. This was also confirmed by Öztürk (1998b) for the same period. This is consistent with the general behaviour of the species, living along rocky coasts geologically suitable for coastal cave formation (IUCN/UNEP, 1988). The most remarkable sightings were from Karaburun Peninsula where 7 and 12 seals were reportedly seen together in June 1995 and June 1996 respectively. Studies on the distribution and status of the species, carried out between mid-1960s and mid-1990s, suggest that *M. monachus* did not have a continuous presence in this region (Mursaloğlu, 1964, 1992; Berkes *et al*., 1979; Öztürk, 1998b). During our study, seal sightings increased from north to south with a peak in the Izmir province. This might be due to the fact that the northern part of this region has less suitable habitats (having low lands and beaches); while Karaburun and Çeşme (Izmir province) Peninsulas are relatively rocky and steep, with a greater probability of coastal caves.

Southern Aegean Region: For the purposes of this study, the Aydın and Muğla provincial coasts were considered as the Southern Aegean region. Distribution of the species was found to be continuous in this region (Figure 2). Sightings of a minimum of two seals together (Table 1) were concentrated on the Bodrum and Datça Peninsulas (12 and 7 sightings respectively). Presence of the species has been reported in this region by Berkes (1982), who also mentioned that seal sightings were mainly of single seals in 1976, by Mursaloğlu (1992) and by Öztürk (1992a), who also emphasised the decline of the species in Karaada (Bodrum Peninsula) between 1990 and 1992. According to Öztürk (1992b) and Kıraç and Veryeri (1996) who obtained the same results, seals were concentrated on the west coasts of the peninsula and on the islands off these coasts and Karaada. This is quite consistent with our findings. As observed in the northern Aegean region, seal sightings were also mainly concentrated on the large peninsulas which hold suitable monk seal habitats in this region; for example in Bodrum and Datça peninsulas. Moreover, considering the fact that this region is very close to the Greek islands such as Dodecanese islands, we believe that monk seals are using the habitats in both countries in the southeastern Aegean. Indeed, in these island complexes, breeding in the late 1990s was reported (Zavras, 1998). In our former study we also observed two seals moving in the direction of the Greek Island of Samos from the northern coasts of Dilek National Park in 1988. This may indicate an exchange of seals between Turkish mainland and Greek islands.

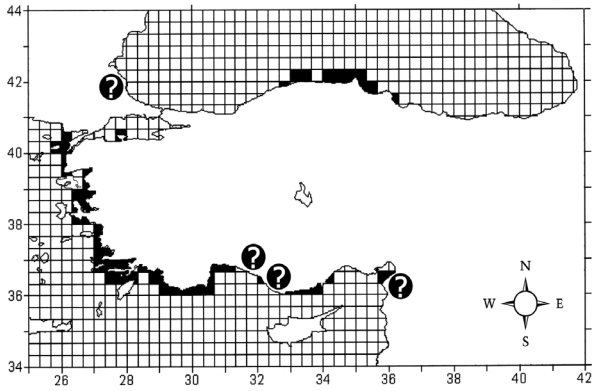

Figure 2. Distribution of *M.monachus* along the Turkish coasts [Question marks indicate the localities where further studies are required].

Mediterranean region: For the purposes of this study, the Antalya, Mersin, Adana and Antakya provincial coasts were considered as the Mediterranean region. Seal sightings were obtained mainly from Cape Teke and mountainous areas of the Mersin provincial coast (Figure 2). Few seal sightings were recorded in the large bays of this region in the Antalya province and Iskenderun Bays – close to Syrian border (Antakya province) and Çukurova plane (Adana province). Evidence for occurrence of *M. monachus* in this region has been given by Mursaloğlu (1964 and 1992), Berkes *et al*. (1979), Gücü (1998) and Öztürk (1998a) during the last 35 years. Even though the presence of the species has been mentioned in Mersin city and in the coastal strip between Mersin City and Taşucu (Mersin province) by Mursaloğlu (1964) in the early 1960s and Berkes *et al*. (1979) in the late 1970s respectively, no seal sightings were obtained from this coastal strip during this study. Recent studies reveal that the species appears to have been pushed towards more mountainous stretches of the Mersin province's coasts between Taşucu and Gazipaşa within a period of two decades (Gücü *et al*., 2004).

Natality and Mortality

During the investigation period 17 pupping (Table 2) and 22 dead seal records (Table 3) were obtained. No birth or death records could be obtained from Marmara region. It was difficult to obtain pupping records due to two main reasons. Firstly, people interviewed had difficulty in describing the animals in terms of dimension, colouration etc. Secondly, natality is generally low among *M. monachus* because a female seal must reach 5 years of age before she can breed, which means that she has to survive at least 5 years in spite of all the existing threats. When she is finally mature enough to breed, she can only give birth annually or biennially, and only to a single pup (IUCN/UNEP, 1988; Israëls, 1992). However, it was easier to obtain pupping records during potential breeding cave checks, and in case of any stranded dead pup/juvenile were found. Ten out of 17 pupping records – 5 during cave checks and 5 stranded – were gathered by this way. Of these 17 pups/juveniles, 11 have died, resulting in 35% survival rate between 1994 and 2002.

Pupping records were also obtained by the other researchers along the Turkish coasts. Mursaloğlu (1986) has reported 2 pups in the early 1980s in the Northern Aegean and Öztürk (1998b) reported 6 pups (2 of them found dead) along the entire Turkish Aegean coast between 1986-1996. Gücü *et al*. (2004) have recorded 11 pups from mountainous parts of the Mersin province in the Mediterranean region during a long term study from 1995 to 2002.

Previous studies seem to reveal a decrease in the number of breeding sites. Whereas Berkes (1982) had identified 11 breeding sites in the Southern Aegean in the late 1970s, Öztürk (1998b) reported only one between the mid 1980s and 1990s. This is also consistent with the data obtained during our study. Only in three locations have we recorded breeding in this region – two in Fethiye Bay and one in Dilek National Park. The decrease observed in number of breeding sites may point to a decrease in breeding.

Compared to breeding records, mortality records proved easier to obtain. Especially, stranded dead animals can easily be found at the stranding place by the local inhabitants. In our study, one of the main causes of death was found to be deliberate killing – occurred mainly along the Mersin provincial coast – by fishermen who regarded seals, dolphins and marine turtles as pests because of the damage these animals

are said to inflict on fishing equipment. Entanglement to fishing gear was the other main cause of monk seal mortality, especially along the Izmir provincial coast. We found out that entanglement is only dangerous for recently weaned juveniles since the types of artisanal fishing nets in use are not strong enough to retain the adults (Table 3). This was also observed among the juveniles of harp seals from the east coast of Canada and largha seals off Daikoku Island in Japan (Woodley and Lavigne, 1991), as well as among the juveniles of the monk seals from the eastern Atlantic (Anon., 2001). In line with these findings, Öztürk (1998b) reported 13 dead seals for the entire Turkish Aegean coasts from 1986 to 1996. 5 of them had been deliberately killed, 5 had drowned in fishing nets and 3 had died of unknown causes. For the Mersin provincial coasts, 10 deliberately killed seals were reported between 1994 and 1996 by Gücü (1998).

Table 2. Pups recorded or found along the Turkish Coasts from 1994 to 2002

Region	Location	Date	Sex	Found by authors
Black Sea	Inceburun, Sinop	VI.1996	? - (Juvenile)	—
Northern Aegean Sea	Foça PMSCA, Izmir	13.X.1995	Female	+
Northern Aegean Sea	Foça PMSCA, Izmir	16.X.1996	Male - (Died)	+
Northern Aegean Sea	Mordoğan, Izmir	4.XII.1999	Male - (Died)	+
Northern Aegean Sea	Mordoğan, Izmir	5.XI.2000	Female - (Died)	+
Northern Aegean Sea	Mordoğan, Izmir	X.2001	Male	+
Northern Aegean Sea	Karaburun, Izmir	07.VII.2002	Female - (Fetus)	+
Northern Aegean Sea	Çeşme, Izmir	18.XI.2002	Female - (Died)	+
Southern Aegean Sea	Fethiye, Muğla	V.1995	?	—
Southern Aegean Sea	Dilek N. P., Aydın	VI.1995	? - (Juvenile, died)	—
Southern Aegean Sea	Fethiye, Muğla	II.1996	?	—
Southern Aegean Sea	Datça, Muğla	23.III.2002	? - (Juvenile, died)	+
Mediterranean Sea	Aydıncık, Mersin	5.II.1994	?- (Juvenile, died)	—
Mediterranean Sea	Bozyazı, Mersin	23.VIII.1996	Female - (Died)	+
Mediterranean Sea	Aydıncık, Mersin	8.II.1997	? - (Two pups)	—
Mediterranean Sea	Çıralı, Antalya	31.III.1998	Female - (Juvenile, died)	+
Mediterranean Sea	Bozyazı, Mersin	XI.2000	? – (Died)	—

Table 3. Dead seals recorded or found along the Turkish coasts from 1994 to 2002 (BS= Black Sea; NA= North Aegean; SA= South Aegean; M= Mediterranean)

Locality	Date	Sex	Cause	Found by authors
Inceburun, Sinop, BS	VI.1995	? – Adult	?	—
Foça, Izmir, NA	10.II.1997	Male – Juvenile	Entangled and drowned	+
Foça, Izmir, NA	04.IV.1998	Female – Adult	Unknown disease	+
Çeşme, Izmir, NA	7.III.1999	Female – Adult	Unknown disease	+
Mordoğan, Izmir, NA	27.XI.1999	Male – Juvenile	Entangled and drowned	+
Mordoğan, Izmir, NA	26.I.2001	Female – Juvenile	Entangled and drowned	+
Karaburun, Izmir, NA	07.VII.2002	Female – Fetus	Abortion	+
Çeşme, Izmir, NA	18.XI.2002	Female – Pup	Entangled and drowned	+
Yalıkavak, Muğla, SA	05.II.1994	? – Adult	?	—
Dilek National Park, Aydın, SA	VI.1995	? – Juvenile	?	—
Yalıkavak, Muğla, SA	06.VII.1999	? – Adult	?	+
Kuşadası, Aydın, SA	28.XI.2002	Female – Adult	Trauma (knock on the head)	+
Datça, Muğla, SA	23.III.2002	? – Juvenile	?	+
Aydıncık, Mersin, M	05.II. 1994	Male – Adult	Shot (rifle)	—
Aydıncık, Mersin, M	05.II.1994	? - Juvenile	Entangled and drowned	—
Aydıncık, Mersin, M	24.II.1994	Male – Adult	Shot (rifle)	+
Kalkan, Antalya, M	1995	? – Adult	?	—
Gözce, Mersin, M	04.I.1995	Male – Adult	Shot (rifle)	+
Bozyazı , Mersin, M	23.VIII.1996	Female – Pup	Trauma	+
Aydıncık, Mersin, M	X.1996	? – Adult	Harpooned	—
Çıralı, Antalya, M	31.III.1998	Female – Juvenile	Entangled and drowned	+
Bozyazı, Mersin, M	XI.2000	?-Pup	Entangled and drowned	—

Population Estimates of *M. monachus* in Turkey

By using the quadrate method we estimated that 104 seals were living along the Turkish coasts. Population estimates specific to each region are given below. The quadrate method was used for initial estimates of the population. However, these estimates were corrected considering previous studies on population estimates and added factors which are explained below according to each region.

Black Sea Region: As an overall figure, we estimate that only 2-3 monk seals continue to survive in the central coasts of the Black Sea (Table 4). Even though 120 seal sightings have been collected during the study period, the monk seal population estimation can be seen as few. This can be explained by the fact that no damage was reported to set fishing nets during the interviews, and monk seal presence was not encountered during cave checks (only 1 seal trace was found out of 51 caves checked). In addition, no seals

were directly observed by the authors in this region. Furthermore, fur seal(s) mistaken for monk seals, might have been reported by fishermen and divers interviewed during the investigation period. These fur seals could either be the *Callorhinus ursinus* or the *Arctocephalus pusillus* that were reported to have escaped from the open pools of an experimental station at the Institute of Morphology of the Academy of Science of the former USSR (Kıraç and Savaş, 1996). With all this information, the initial quadrate estimate of 13 seals was corrected to 2-3 seals (Table 4). This result (2-3 seals on the central coasts of Black Sea) is also supported by Öztürk (1994b) who reported 1 adult and 1 juvenile seal in the Turkish Black Sea between 1987 and 1994. These were most probably the last representatives of *M. monachus* along the entire Black Sea coasts. Since there have been no seal sightings from the Istanbul Strait since the 1950s as indicated by Berkes *et al*. (1979), these individuals were isolated from possible genetic exchange with the Aegean population. According to our own findings and those of Berkes *et al*. (1979) in late 1970s, the population number dropped from 15 to 2 or 3 within 20 years. Finding only one dead animal and one probable breeding individual might reinforce the low population estimate in the region. Indeed, in a different investigation for the same region Öztürk (1994a) reported no dead, killed or wounded seals between 1986 and 1994. This might also indicate that *M. monachus* numbers were already very low.

Table 4. Regional population estimates of *M. monachus* (* identified individuals from Foça PMSCA in north Aegean and Mediterranean by Güçlüsoy and Savaş (2003) and Gücü *et al*. (2004), respectively)

	Black Sea	Sea of Marmara	North Aegean Sea	South Aegean Sea	Mediterranean Sea
Quadrate Estimation	13	1	35	28	23
Identified and Known Seals	0	0	2 + 9*	4	25*
Overall Estimation	2-3	≥1	35	≥ 28	≥ 37

Sea of Marmara Region: One sighting report of a single animal from Marmara Island in May 1994 might show that at least one animal was surviving in the region (Table 4). While Berkes *et al*. (1979) estimated 25 seals living in this region between 1976 and 1978, not more than two decades later, Öztürk (1994b) reported a drastic change in population number of the monk seals. This author estimated that only 2 individuals were surviving.

Northern Aegean Region: For this region, a population of 35 seals was estimated using the quadrate method (Table 4). The research team was able to observe on 6 occasions single seals and on 1 occasion two seals together in the Karaburun Peninsula, and also a single seal in Yenifoça (Izmir province). 3 of the single seal observations were of a territorial male identified from the eastern part of the Karaburun Peninsula. This specimen has typical male characteristics, as described by Samaranch and González (2000), having a dark brown dorsal colour and white ventral patch; it was approximately 3 meters in length. Additionally, 9 identified individuals from Foça PMSCA (Güçlüsoy and Savaş, 2003) were also taken into consideration. Moreover, another male identified from film footage from Çeşme (Izmir province) was also factored in. Berkes *et al*. (1979) estimated 90 seals living along the entire Aegean coasts in the late 1970s. Öztürk (1998b), however, estimated that this number had dropped down to 28 within two decades of that time for the same region. Among these 28 seals identified, 15 of them were from northern Aegean. However, during the present study, we estimate, as an overall, that approximately 35 seals were living along the northern Aegean. Considering the fact that 11 seals – in the area covering 25 % of the inhabited quadrates – were either identified or known from the outer part of Izmir Bay, it is reasonable to assume that this figure must be higher for the entire northern Aegean considering observations in the region and the historical distribution of the species (Figure 2). In comparison to fishermen interviewed from the Black Sea, there were also more complaints received from this region regarding fishing net damage. Moreover, we could encounter seals both during the cave checks and observations (Figure 3).

Figure 3. The female monk seal identified during cave checks in the Foça PMSCA (Photo: Harun Güçlüsoy).

Southern Aegean Region: For this region we estimate that 28 seals were living by using quadrate method (Table 4). The research team was able to observe a single seal on 21 occasions; 12 of these observations were of a male seal from the Yalıkavak region (Bodrum Peninsula) and was observed mainly on Büyük Kiremit and Çavuş Islands (Bodrum Peninsula) in 1994 and 1996 (Figure 4).

In addition to typical male characteristics, this specimen also had distinguishable small white spots on the right part of the neck and the head. Another male was observed and video-identified in September 1994 on Cape Kurtoğlu (Fethiye Bay). We could not identify other seals sighted due to excessively long distances between observer and specimen or short duration of sightings. Apart from these two identified males, photographs and video footage of one female and one juvenile seal from Bodrum Peninsula have been provided by a

local dive guide. In the mid 1970s Berkes (1982) estimated that 50-100 seals were present in this region. Ten years later in 1986 Öztürk (1998b) attempted to determine the status of the species along the entire the Turkish Aegean coast. The same author identified 13 seals within this region between 1986 and 1996. In 1987, Marchasseux (1989 cited in Öztürk, 1998b) also estimated that 20 individuals existed in the Dilek National Park and 6 seals in the Bodrum Peninsula and its small off-lying islands. However, we estimate, as an overall, that no less than 28 seals - maximum number of monk seals calculated by the quadrate estimation method - continue to survive in this region considering the quadrate distribution (Figure 2). In addition, the coastal areas geologically hold more suitable monk seal habitats compare to the northern Aegean region where minimum of 35 seals estimated living. We also believe that population numbers overestimated by Marchasseux for the Dilek National Park (1989 cited in Öztürk, 1998b) since we could not find any suitable caves during our former study carried out in the same place in 1988 (unpubl. data).

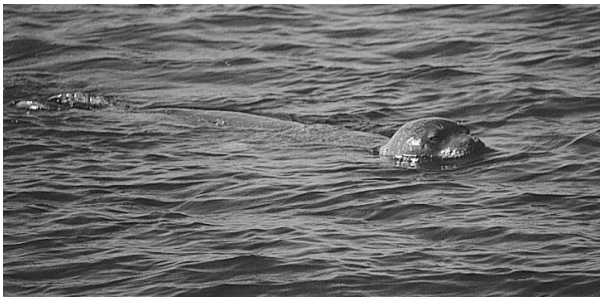

Figure 4. The male monk seal identified during observations on Bodrum Peninsula (Photo: Cem O. Kıraç / SAD-AFAG).

Mediterranean Region: For this region we estimate, using the quadrate method, that 23 seals were living (Table 4). The research team was able to observe single seals on 16 occasions; 7 times in Kalkan, 7 times in Kaş in the Antalya province and once each in Aydıncık and Boğsak in the Mersin province. However, in none of these observations could we identify the seals observed. In this region, which covers the Antalya, Mersin Adana and Antakya provinces, a population of 35 seals was estimated by Berkes *et al*. (1979) in the late 1970s, while 11 seals were identified in 1987 - 1994 surveys by Öztürk (1994b). After two decades we also estimate that a minimum of 37 seals continue to survive in this region (Table 4). This is mainly because, as a result of detailed, long term research, 25 seals have been identified only for the mountainous part of the Mersin province (Gücü *et al*., 2004). When the identified seals figure 25 from Mersin province replaced by those obtained from quadrate estimation, we reach the figure 37 for this region.

M. monachus Habitat: Coastal Caves

In the Black Sea Region, 51 coastal caves, including 3 which were mentioned in an earlier study by Kıraç and Savaş (1996) were found between Ereğli and Hamsaroz (Sinop province). Only one of them, in Doğanyurt (Kastamonu province) was found to be in use. These results lend additional weight to the view that the species only continues to survive in very small numbers along Black Sea coasts.

In the Northern Aegean Region, field surveys to determine the seal caves took place on the eastern coasts of Karaburun Peninsula, where 17 suitable coastal caves/caverns were found, and in the Foça PMSCA (Güçlüsoy and Savaş, 2003), where 11 caves were found. In the Karaburun Peninsula the most suitable cave, which has a protected beach inside and was reported as a breeding cave by the local fishermen of Mordoğan, 2 fresh tracks were found in September 1994. However, before and during the investigation period, the surrounding areas of this cave were heavily used for summer recreational activities, especially July and August, and almost no seals were observed during this period according to fishermen who use a lift-net installation approximately 50 meters away from the cave entrance. In two of the coastal caves which do not have any platform to rest or give birth on, two grey monk seals were encountered on two successive days in 1994. Unfortunately, holiday houses were being constructed just on top of one of these caves. The same seasonal abandonment was also reported by Öztürk *et al*. (1990). During the study they conducted in the summer of 1989, no evidence of seals using the caves was found in any of the 6 previously identified suitable caves, the locations of which were only known by these authors, in the northern Aegean region.

In the Southern Aegean Region, field surveys to determine the seal caves took place along the Bodrum Peninsula and Fethiye Bay. We found 11 coastal caves/caverns suitable for the species in the Bodrum Peninsula. In the coastal strip including Fethiye Bay and Cape Kurtoğlu to Dalaman Beach (Muğla province) in the north, 21 seal caves were found. Of these caves, 2 showed signs of recent seal presence. The region seems more favourable as monk seal habitat compared to the northern Aegean since the area holds more coastal caves due to its geological formation. Caves are concentrated in the vicinity of Fethiye and the coast between Kalkan and Kaş in the Antalya province. There are long stretches of coast in this region that, to a great extent are not yet spoilt.

Threats to *M. monachus*

Although in the last 20 years the main threats to *M. monachus* have not changed drastically, the necessity to deal with them has become more pressing and newer threats (e.g. holiday housing) have been added. Depletion of fish stocks, entanglement to fishing nets and habitat loss have become more and more problematic since the 1980s. Although the hunting of seals for blubber that occurred during dolphin hunts was a threat to the species before 1980 in the Black Sea region, this was no longer a problem after the ban imposed by the Turkish government on hunting dolphins (Kıraç and Savaş, 1996).

In all the studied regions, interviewed fishermen complaint depletion of fish stocks which is due to overfishing and illegal fishing (e.g. dynamite fishing). The major reason for the persecution of the seals (Table 3) was the fishermen's decreasing tolerance towards the species as the fish stock was being depleted due to overfishing and illegal fishing. During the 1980s, with the purse-seine fishery being encouraged in Turkey through government subsidies. Fishermen, mainly from the Black Sea, constructed large purse-seine vessels to fish the anchovy stocks of that region. In the Black Sea region, FAO reported that the Black Sea's total commercial fish catch dropped from close to 1 million tons to 100,000 tons between 1982 and 1992 (Hinrichsen, 1998). Furthermore, between 1960 and 1990, the number of commercially valuable species dropped from 26 to just 5 (Hinrichsen, 1998). By 1992 even the stocks of these 5 fish species were being severely exploited (Hinrichsen, 1998). The Turkish share of the anchovy fishery, for instance, fell to 15 percent of its 1985 level, from 300,000 tons to 66,000 tons (Hinrichsen, 1998). With the subsequent collapse of Black Sea fish stocks, the fleet turned to fishing in the Aegean, converting to the purse-seine fishery method that operates during the night with the help of several light-source boats to attract fish to the nets. This fishing method is regarded as destructive, wasteful and responsible for significant decreases in the fish stocks (Benli *et al*., 2000). Consequently, the catches of local, artisanal fishermen, were also negatively affected, resulting in a less tolerant attitude towards the monk seal. This was the major reason for the persecution of the species by the fishermen. The damage caused by seals to set fishing nets causes the fishermen to resent the animals and therefore deliberately kill them both while fishing at sea and also in their caves. However, fishermen could be more tolerant if they could rely on well-managed fish stocks, allowing them a sufficient catch to compensate for the losses caused by the seals. We observed this attitude among the fishermen in the Foça PMSCA. However, most continue to complain in the hope of receiving compensation due to for net damage.

It is also important to note that with the depletion of fish stocks, the seals are now faced with the threat of starvation. The fishermen's report of an increase in the frequency of seal attacks supports the claim made by IUCN Seal Specialist Group (1991 in Israëls, 1992) that the depletion of the fish stocks due to overfishing and illegal fishing causes the seals to be hungry and therefore attack fishing nets. The same behaviour was also observed among the harp seals (*Phoca groenlandica*) in the Barents Sea in 1987. Woodley and Lavigne (1991) also reported that the collapse of the capelin stock in the Barents Sea promoted the movement of harp seals to coastal waters of Norway and resulted in substantial incidental catches in gill nets. Furthermore, upon examination of the stomach content of a female seal found dead in Çeşme, Turkey, it was discovered that the animal had resorted to such unlikely food items as pieces of sponge, the roots and leaves of *Posidonia oceanica* (Salman *et al*., 2001). It was also discovered that the seal was suffering from osteoporosis due to a chronic lack of food. (Kompanje *et al*., 2000).

The entanglement of seals to set fishing nets is a constant threat to the species in all the studied regions except the Black Sea and Sea of Marmara (Table 3). Since the nets are nowadays made of stronger material (e.g. nylon threads), the seals' disentanglement becomes more difficult because the nets cannot be easily torn apart. Juvenile seals, especially recently weaned ones, were found to be more susceptible to entanglement (see Table 3) because they lack the strength and ability to release themselves from the nets.

For example, in Foça PMSCA, both pups that were born in 1995 and 1996 were entangled to set nets. Although we were able to rescue one of them the younger pup died drowning. Androukaki *et al*. (1999 in Androukaki, 2001) reported that in Greece, where accidental deaths in fishing gear account for 12% of the total deaths recorded, all animals found dead by drowning in fishing nets were juveniles. The higher mortality rate detected among juveniles in the Cap Blanc region, where a large number of boats fish in waters frequented by the seal colony, points to the same conclusion that juveniles seem to be more affected by entanglement than adults. (Anon., 2001).

Since the 1980s, habitat destruction due to holiday housing projects and industrialisation became another major threat (also see section 6. *M. monachus* Habitat: Coastal Caves). During this period, owning a holiday house became fashionable in Turkish society. The trend was also encouraged as a more secure investment opportunity and as a hedge against Turkey`s high inflation. Co-operatives were established to build holiday housing complexes in coastal areas without any Environment Impact Assessment studies. As a result, numerous pristine bays were ruined. The regions that were most affected by this were the North and South Aegean and Mediterranean, where summer recreational activities due to increased tourism and industrialisation were adding to the lethal disturbance of monk seal habitats and coastal caves. As an example, hotel construction was continuing on top of the monk seal cave, which was still intermittently in use, in Akyarlar Bay (Bodrum Peninsula) in 1997. Furthermore, holiday housing, now covering most of the coastal strip of the Bodrum Peninsula must be considered as constituting a major disturbance factor, especially during the summer months due to shore and sea based recreational activities. In the Mediterranean region, most of the coastal zone of the Olympos-Beydağları National Park, for example, has been developed with holiday villages, especially in Kemer and Göynük. Sıçan Island and Üç Adalar, which bear suitable monk seal habitats, were the most used places during summer months for recreational purposes. Diving tours organised by the diving club owners are another cause of disturbance to the species which may eventually obliges them to look for undisturbed habitats. Although, development of tourism along the Mersin provincial coasts was not found to be a major threat to the species, intensive urbanisation and rapid development of the area resulted in the loss of the species

along the coastal area between Mersin city and Taşucu (Mersin province).

Although monk seals are marine mammals, they require land to rest and to bear their young. Therefore, in order to protect the species, protection measures should include sea and land. When considering current protection legislation and its implementation in Turkey, the authorities involved are several and responsibilities are scattered. For example, the Ministry of Environment, co-ordinating body of the national monk seal committee, is not fully authorised in protection legislation e.g. to declare a marine protected area. Therefore, lack of single management authority brings about the difficulty of any conservation initiative in Turkey. Thus except few attempts to decrease aforementioned threats on monk seal since 1990, there are no promising conservation action took place by the government. A few project based independent studies focusing on local seal populations and aiming at habitat protection and public awareness were carried out to fill this gap by national NGOs and universities. However, these are not sufficient in term of sustainability and highly depend on duration of the projects. Since Turkey is still a developing country, funds allocated to conservation actions are insufficient within the Turkish national budget. Therefore, as well as monk seals, many other important protected species and habitats are under threat due to lack of funds and interest.

Conclusion

Despite its rapid decline about 50% in 20 years, *M. monachus* is still found along Turkish coasts. However the distribution of the species is patchy and fragmented. It occurs mainly all along the Aegean coasts except Saroz and Edremit Bays, and Teke Peninsula (Figure 1 and 2) and mountainous part of the Mersin provincial coasts of the Mediterranean. The last few specimens also are present on the central Black Sea coasts, southern Sea of Marmara coasts. Seals are also more concentrated around the large capes where the geological formation is suitable for cave formation and less suitable for coastal development. Breeding is still reported from the northern and the southern Aegean and Mediterranean regions. As the number of living seals observed increases progressively from the Black Sea towards the Mediterranean, so does the number of reported dead seals. The major problems in this regard are still deliberate killing (especially in the mountainous area of the Mersin provincial coasts) by artisanal fishermen who remain hostile towards the monk seal because of the damage the species inflicts on their fishing gear, and entanglement of juvenile seals to fishing gear. The Aegean and Mediterranean coasts of Turkey still hold small populations (we estimate approximately 100 seals) of *M. monachus*. However it is highly probable that it might disappear from the Sea of Marmara and the Black Sea coasts in near future. The main threats to *M. monachus* aside from habitat destruction and deliberate killing, are entanglement in fishing gear (mainly nylon nets), overfishing and illegal fishing resulting in the depletion of fish stocks. Historically, hunting and live capture hastened the species' decline, particularly in the Black Sea. Today, holiday housing, tourism development and associated recreational activities in the Aegean and Mediterranean present serious threats to the species. If the Turkish government does not improve their conservation measures, the extinction of the species is unavoidable in the near future.

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