

Observations on the biology and behaviour of the Mediterranean monk seal

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The range of the Mediterranean monk seal (*Monachus monachus*) extends from the Atlantic coast of northwest Africa along the south and eastern Mediterranean coasts and up to Yugoslavia and into the Black Sea. It is a highly-endangered pinniped, of which no more than 500 are estimated to remain (Ronald pers. comm.). The species is reclusive, inhabiting remote cliffbound coastlines and uninhabited islets, and retreating to sea caves to shelter and reproduce. Therefore, although references to this relict marine mammal date back to classical times, little is known of the monk seal's biology or behaviour.

There are comparatively few records of Mediterranean monk seals in captivity (Table 1). The Zoological Society of London acquired three monk seals between 1882 and 1910 (Flower 1882, Anon. 1894, 1910). The first did not survive for long; the fate of the others is not known. Two females captured in Algeria in 1926 were held at the Laboratoire de Castiglione (Gavard 1927). Several monk seals have been held at the Ankara Zoo, including a young female born there on 5 May 1962 (Mursaloglu 1964). Two stranded animals were acquired by the Tunis Zoo between December 1960 and January 1961 (Sergeant *et al.*). In 1978, a female monk seal died at the Aquaria Vasco de Gama in Lisbon, after 24 years in captivity (Denis pers. comm., Ronald & Dougan 1980). Staff at the Aquario made every effort to sustain a monk seal pup brought to them in October of 1975 (Ronald 1976); however, it died after 16 days in captivity (Inacio pers. comm.). Two monk seals were held in the Nouadhibou Zoo in Mauritania (Duguy pers. comm., Ronald & Healey 1974). Two pups taken in Tunisia in 1971 were taken to the Institute National Scientifique et Technique d'Océanographique et de Pêche and later transferred to a zoo. They died after about 45 days in captivity (Greenwood pers. comm., Ronald & Dougan 1980). Monk seals have also been held at Marseille (Boulva 1979), at the Zoo de Los Palmas (Boulva 1979), in Senegal (Boulva 1979), (Duguy & Maigret 1976), in the Istanbul Zoo, (Duplaix-Hall 1973), (Ronald & Healey 1974),

and in Italy, at the Giardino Zoologico di Oria (Jarvis 1966).

For some years, staff at the Aquarium of the Hydrobiological Station at Rhodes in Greece have asked local fishermen to report to them any sightings of monk seals, and to bring to the Aquarium any seals found wounded, orphaned, or abandoned. The response indicate that *Monachus* inhabits most of the Dodecanese. Recent surveys (Ronald *et al.* 1984) show the species to be thinly distributed throughout most of the eastern Mediterranean archipelago.

Since 1974, detailed records have been kept on three monk seals held at the Aquarium. These provided some insight on the species' behaviour in captivity, and on preferred holding techniques. It is hoped that with such knowledge other endangered animals brought into captivity may have a better chance of survival.

Seal 1: An adult male monk seal was brought to the Aquarium by a fisherman; a piece of wood had been used in its capture, and the animal was nearly unconscious, having sustained a severe blow to the head. Although the wound healed quickly, the seal remained antagonistic towards humans for the 10 years it remained at the Aquarium, even towards those with whom it came into daily contact. The seal lived and ate in a small freshwater pool, which offered no shelter from sun or wind. When brought inside, it sought refuge in storage areas and other dark places.

Seal 2: In January of 1975, a neonatal monk seal was found apparently abandoned in a small cave near Rhodes and brought to the Aquarium. On arrival, it weighed 20 kg, and was approximately 95 cm long. A few teeth were evident on both the upper and lower jaw, and the umbilical cord had only recently been lost.

At the time of the pup's arrival, 2 harbour seals (*Phoca vitulina*) were held at the Aquarium in a small seawater pool. The monk seal was placed in one corner of the pool, isolated by a partition. The

Table 1. *Monachus monachus* in captivity

Held at	Date Acquired	Details	Ref. No.
Ankara Zoo (Turkey)	Unknown	Old male; died after 2 years in captivity	Mursaloglu 1964, Boulva 1979
	1957	Female	Mursaloglu 1964, Boulva 1979
	1962	Young male	Mursaloglu 1964, Boulva 1979
	1961	Female; gave birth to pup	Mursaloglu 1964, Boulva 1979
	1962	Female pup born in captivity	Mursaloglu 1964, Boulva 1979
Aquario vasca da gama (Portugal)	1951	Female; died 1969	Ronald & Healey 1974
	1954	Female; died 1978	Denis pers. comm.
	1975	Pup; died after 16 days in captivity	Ronald 1976, Inacio pers. comm.
Dakar Zoo (Senegal)	1974	Monk seal; died soon after capture	Boulva 1979, Duguay & Maigret 1976
Giardino Zoologico di Oria	1965	Monk seal	Jarvis 1966
Institute National Scientifique et de peche	1971	2 pups; later transferred to zoo Died after approximately 45 days in captivity	Greenwood pers. comm., Ronald & Dougan 1980
Istanbul Zoo	1970	8-10 year old female	Ronald & Healey 1974, Duplaix-Hall 1973
Kayar Zoo (Senegal)	1976	Monk seal; died 26 days after capture	Boulva 1979, Duguay & Maigret 1976
Laboratoire de Castiglione	1926	Female; 2.42 m long and 300 kg Died 71 days after capture	Boulva 1979, Gavard 1927
	1926	Young female; weight 120 kg Died 4 months after capture	Boulva 1979, Gavard 1927
Marseille	1955	Monk seal; died Feb-Mar 1955	Boulva 1979
Rhodes Aquarium	1960-70	5 monk seals	this paper
	1974	1 adult male	this paper
	1975	1 neonate; died one month after capture	this paper
	1980	1 neonate; died after 12 days in captivity	this paper
Tunis Zoo	1960	Monk seal; refused food for 3 weeks	Sergeant <i>et al.</i> 1978
	1961	Monk seal; fasted for 5 days	Sergeant <i>et al.</i> 1978
Zoo de Cansado (Nouadhibou)	Unknown	2 monk seals	Duguay pers. comm., Ronald & Healey 1974
Zoo de Los Palmas	1958	40-50 kg pup	Boulva 1979
Zoological Society of London	1882	One monk seal; died soon after capture	Flower 1882
	1894	One monk seal	Anonymous 1894
	1910	One monk seal	Anonymous 1910

monk and harbour seals appeared indifferent to one another. After two days, the barrier was removed, and the seals mingled freely; they appeared friendly. The newcomer exercised regularly, swimming in the pool during the early morning and afternoon, and retreating to an artificial cave to rest.

The monk seal refused to take food. After 10 days of unsuccessful attempts to coax it to feed, force-feeding was initiated. Food was pushed gently into the seal's mouth with a pair of wooden pincers. On the first day of force-feeding, the seal ate about 1 kg of fish. On the second day, in two feedings it

consumed 1.5 kg of fish, a 200 mg tablet of sodium chloride, and a tablet of Safari Fish Eater supplement. Force-feeding continued, and the seal began to gain weight. After one month, it had begun to moult and appeared to be recovering from its earlier self-enforced starvation, although it was not self-feeding.

The animal apparently never completely accepted captivity. Often, when left with the other two seals, it would call loudly and on being removed from the water it exhibited tremors.

It died on 3 February 1975, after one month in captivity. That morning, it had eaten about 750 g of fresh fish and supplements and had rested in its cave for about 10 to 15 minutes, before rejoining the harbour seals in the pool. Death was apparently not related to food-poisoning; the other seals had eaten 4 kg of the same food and had suffered no apparent ill-effects. Cause of death was not recorded.

Seal 3. On 3 November 1980, fishermen at Kastellorizo saw two seals (an adult and a pup) swimming near the beach. The older animal was about 2 m long and dark brown in colour. The fishermen kept the adult seal away and lifted the pup into their boat; it offered no resistance. They forced it with milk for 3 days before bringing it to the Aquarium at Rhodes on 6 November 1980.

The seal was neonatal; it weighed just 9.5 kg and had not yet begun to shed its laguno, which was mostly black with some white hairs apparent on the underside. A few teeth had erupted.

It was placed in a pool with a harbour seal already held at the Aquarium. After a few moments of initial hesitation, the seals appeared to accept each other. Like its predecessor, the young monk seal soon settled into a routine of swimming in the pool with the harbour seal and resting in the artificial cave. It frequently cried out. When brought into the museum, it would 'play' with the employees, running after them in much the same manner as a young dog.

In the hopes of initiating self-feeding, the seal was offered many varieties of food and many methods of presentation were tried, but again all efforts failed, and force-feeding began. On 6 November 1980, milk was fed through a plastic pipe attached to a metal syringe. Every effort was made to avoid injuring or choking the animal. Initially, the seal resisted, but it never displayed overt aggressive behaviour. That evening, the seal consumed 50 g of milk, some fish, and some dietary supplements.

On 7 November 1980, a more acceptable feeding-method was employed: a large spoonful of 'Ovaltine' was added to equal parts of boiled water and milk (the latter heated to a temperature of 38–40°C) and the mixture fed through a baby's bottle. Two hundred grams of milk were fed in the

same way on 8 November 1980. After feeding, the seal entered the pool, and remained in the water for a considerable time; staff became concerned and it was removed from the water and towel-dried. It retired to its cave and ate only 50 g of Ovaltine and sugar, refusing plain milk.

On 9 November 1980, the seal refused cold milk, but drank warm milk willingly. The next day, it drank milk between 38–40°C, but refused milk warmer than 40°C.

Feeding continued for the next few days. To facilitate an eventual change of diet, attempts were made to familiarize the seal with the handler. The animal continued to exercise regularly.

On 18 November 1980 (12 days after its arrival at the Aquarium) the seal drank all of its milk, retired to its cave, and apparently died in its sleep.

Discussion

Section G of the Plan of Action adopted by the participants in the First International Conference on the Mediterranean monk seal (Ronald 1978) identifies the need for research into procedures for holding wounded or abandoned animals, prior to their return to the wild. It stresses that *only* those individuals found wounded or abandoned (and therefore unlikely to survive without human intervention) should be brought into captivity.

One of the major hurdles to the successful maintenance of *Monachus* is the refusal of the captive animal and eat voluntarily. Many seal species fast naturally while moulting or during reproductive periods, and the occasional refusal of food by a captive animal is no cause for concern (Geraci 1978). However, if this persists for long periods, force-feeding should be attempted, preferably through the manual feeding of *whole* fish; if these are large, then through longitudinal slices of whole fish.

To overcome the problem of self-starvation, a variety of feeding methods have been tried. A monk seal acquired by the Tunis Zoo in 1960 rejected food for the first three weeks of captivity. To coax it to feed voluntarily, live eels were dangled before it for three successive days, either attached to a string or swimming freely. Eventually, the seal ate one eel, and then gradually began to eat other fish. After a 5 day fast, a second monk seal held by the zoo in 1961 began to eat eels before accepting other food (Sergeant *et al.* 1978). A pup held at the Aquaria Vasco de Gama in 1975 was hand-fed every day with five sardines or mullets plus 300–500 g of Vitamin B₁. It preferred live fish to dead, and never accomplished self-feeding (Ronald 1976).

An interesting method of fish-cleaning is described in the case of a captive monk seal held at the Laboratoire de Castiglione. This seal also underwent an initial fast (for 6 days), but eventually self-

fed. All but the smallest fish were seized with the teeth, grasped at the belly, and shaken vigorously until the abdominal wall and intestine were detached. It was only after these tissues had been removed that the rest of the fish was eaten (Gavard 1927, Sergeant *et al.* 1978). This feeding behaviour has been observed at sea in wild *Monachus* (Ronald pers. comm.).

This report covers the few attempts at hand-rearing monk seals. Elsewhere in the world other seals have been successfully reared to long-term captive survival. It does appear therefore that depositories for endangered and rare seals are essential. These should be sites where seals are or have been endemic, or sites where there is particular expertise to keep marine mammals alive. The latter should obviously be close to airports or major transportation systems. Elsewhere, it has been suggested that aquaria are prime sites for such depositories, at sites such as Rhodes, Split, and Naples. Seals could also be flown to other zoological gardens or aquaria who would accept such animals and have adequate physical and human resources to ensure their good health and survival. The University of Guelph stands ready as such a site, where the holding facility and personnel are ready at any time to receive endangered or rare species of pinnipeds, or to send handling experts to capture-sites. Six species of pinniped have been handled successfully at Guelph; some still survive 14 years later. Guelph's survival rate far exceeds that of nature.

In summary, our recommendations are that any monk seals brought into captivity immediately be given priority as to treatment for injuries and a feeding regime designed for the animal's survival. The latter would include the carefully-controlled force-feeding of supplements and slices of non-toxic fish species over a 24 hour period, to ensure the animal achieves a nutritional minimum and that its biochemistry is properly balanced. If such an imbalance goes uncorrected, the animal will probably only survive for a few months.

The status of the monk seals of the world is such that any animal found abandoned or injured immediately demands the attention of all conservationists, scientists, and governments, to ensure that this curiously unknown species is not driven to a man-made extinction.

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