The IUCN Red List of Threatened Species™
ISSN 2307-8235 (online)
IUCN 2008: T13653A45227543

Monachus monachus, Mediterranean Monk Seal

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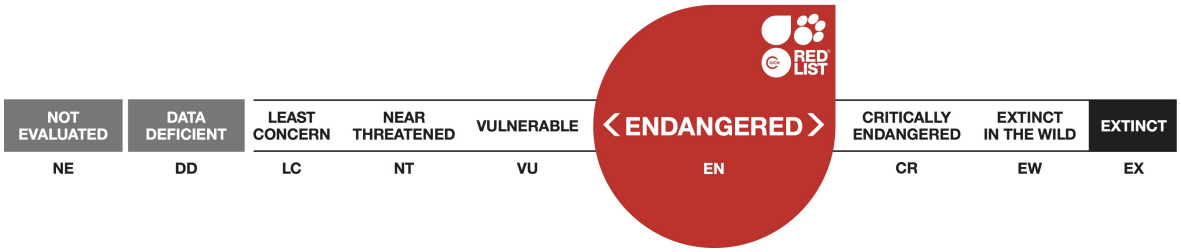

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Citation: Karamanlidis, A. & Dendrinos, P. 2015. *Monachus monachus. The IUCN Red List of Threatened Species 2015*: e.T13653A45227543. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T13653A45227543.en

Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Carnivora	Phocidae

Taxon Name: *Monachus monachus* (Hermann, 1779)

Synonym(s):

- *Phoca monachus* Hermann, 1779

Regional Assessments:

- Mediterranean
- Europe

Common Name(s):

- English: Mediterranean Monk Seal
- French: Phoque-moine Méditerranéen
- Spanish: Foca Monje

Taxonomic Source(s):

Scheel D.M., Slater G.J., Kolokotronis S-O., Potter C.W., Rotstein D.S., Tsangaras K., Greenwood, A.D. and Helgen, K.M. 2014. Biogeography and taxonomy of extinct and endangered monk seals illuminated by ancient DNA and skull morphology. *ZooKeys* 409: 1-33.

Taxonomic Notes:

The Mediterranean Monk Seal (*Monachus monachus*) is the sole representative of the genus *Monachus* (Scheel *et al*. 2014). Differences in skull morphology between Mediterranean Monk Seals from the Atlantic and the western Mediterranean, including differences in the occurrence of dental aberrations, have been suggested based on a limited sample size (van Bree 1979). Examination of mitochondrial DNA has also indicated genetic differences between Atlantic and eastern Mediterranean Monk Seal populations: only one haplotype was found in Monk Seals in Madeira and Cabo Blanco in the Atlantic in contrast to four different haplotypes found in Monk Seals in the eastern Mediterranean (i.e., Libya, Croatia, and Greece; Karamanlidis *et al*. 2014a). Furthermore, a comparison of 24 nuclear microsatellite loci in eastern Mediterranean and western Sahara (Atlantic) Monk Seals showed that the first group had 14 unique alleles and the second had 18; highly significant differences in allele frequencies between the two subpopulations were found for 14 out of 17 loci (Pastor *et al*. 2007). All this suggests substantial (genetic) differentiation between subpopulations, but to date no separation of this species has been suggested taxonomically.

Assessment Information

Red List Category & Criteria: Endangered C2a(i) ver 3.1

Year Published: 2015

Date Assessed: July 16, 2015

http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T13653A45227543.en

Justification:

Historically, the Mediterranean Monk Seal was reduced to small numbers as a consequence of commercial seal hunting and human persecution. This produced a severe bottleneck that significantly reduced genetic variability. For most of the twentieth century, numbers continued to decline mostly as a consequence of human invasion of habitat and adverse fishing interactions. This resulted in the fragmentation of the species into many subpopulations and the disappearance of several of them. There is evidence for recent small increases in Mediterranean Monk Seals at each of the main three identified subpopulations, but their numbers remain very small. The number of mature individuals in the eastern Mediterranean (the largest subpopulation) is likely fewer than 250, and 100-200 occurring in the other known subpopulations.

Monk Seals continue to be exposed to a number of substantial threats, including habitat loss and deterioration, displacement and persecution. Unpredictable threats from disease and toxic algal blooms (red tides) also pose a threat to the remaining small population, as exemplified by the mass mortality at Cabo Blanco when more than 200 animals died in one mass-mortality event in 1997.

With the advantage of new data being available for this species, it is now thought that the previous assessment (Critically Endangered A2abc: Aguilar and Lowry 2008) was an overestimate of the scale of decline in the global population over the previous 33 years, since most of the reduction in population size likely happened more than three generations ago. Endangered (EN C2a(i)) would have been a more appropriate assessment at that time. It is clear that the population size has been reduced to below the IUCN threshold for EN under criterion C: currently the population contains 350-450 mature individuals, with less than 250 mature animals in the largest subpopulation. There is evidence of recent small increases in each of the main three subpopulations, however it is not clear when this increasing trend began or whether this trend is likely to continue into the future. Continuing decline in population size is therefore retained as a precautionary approach for this assessment. It is important to monitor the situation over the next five years to establish whether the population is genuinely increasing and whether this increase is likely to continue into the future. Maintaining and adding to conservation measures that are already in place for this species will help to secure its future. The species is here listed as Endangered (EN C2a(i)), and reassessment of its status in five years' time is recommended.

Previously Published Red List Assessments

2013 – Critically Endangered (CR) – http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T13653A43702988.en

2008 – Critically Endangered (CR)

1996 – Critically Endangered (CR)

1994 – Endangered (E)

1990 – Endangered (E)

1988 – Endangered (E)

1986 – Endangered (E)

1965 – Very rare and believed to be decreasing in numbers

Geographic Range

Range Description:

Mediterranean Monk Seals were once widely and continuously distributed in the Mediterranean and Black Seas, and in the North Atlantic waters from Morocco to Cabo Blanco, including the Canary Islands, Madeira Islands and the Azores (Johnson *et al*. 2006). A few individuals have been recorded in Senegal, the Gambia and the Cape Verde Islands at the southern end, as well as in Portugal and Atlantic France at the northern end of the species' distribution (Johnson *et al*. 2006), but the origin of these individuals is unknown.

Today the distribution of the Mediterranean Monk Seal is highly fragmented and consists of 3–4 isolated subpopulations. In the Mediterranean Sea, the stronghold of the species is at islands in the Ionian and Aegean Seas (Adamantopoulou *et al*. 1999), and along the coasts of mainland Greece, Cyprus, and western and southern Turkey (Güçlüsoy *et al*. 2004; Gücü *et al*. 2004, 2009; MOm 2007; Nikolaou pers. comm). In the Turkish Black Sea, Mediterranean Monk Seals are believed to be extinct since 1997 (Kiraç and Savas 1996, Kiraç 2011); some individuals still survive in the Sea of Marmara (Inanmaz *et al*. 2014). In the North Atlantic, two subpopulations exist: one at Cabo Blanco (also known as Cap Blanc) at the border of Mauritania and Western Sahara (Gonzáles and Fernandez de Larrinoa 2012, Martínez-Jauregui *et al*. 2012), and one at the Archipelago of Madeira (Pires *et al*. 2008). An unknown number of Monk Seals might still survive at the Mediterranean coasts of eastern Morocco (and perhaps Algeria) (Mo *et al*. 2011), but without ongoing systematic monitoring and conservation actions the status and fate of this subpopulation is in question.

The extent of occurrence for Mediterranean Monk seals is approximately 5,000,000 km² and the area of occupancy is 315,000 km².

Country Occurrence:

Native: Croatia; Cyprus; Greece; Mauritania; Portugal (Azores - Regionally Extinct, Madeira); Turkey; Western Sahara

Possibly extinct: Albania; Egypt; France (Corsica, France (mainland) - Regionally Extinct); Israel; Italy (Italy (mainland), Sardegna, Sicilia); Lebanon; Libya; Spain (Baleares, Canary Is. - Regionally Extinct, Spain (mainland) - Regionally Extinct); Syrian Arab Republic; Tunisia

Regionally extinct: Bosnia and Herzegovina; Bulgaria; Montenegro; Romania; Slovenia

FAO Marine Fishing Areas:

Native: Atlantic - eastern central, Mediterranean and Black Sea -

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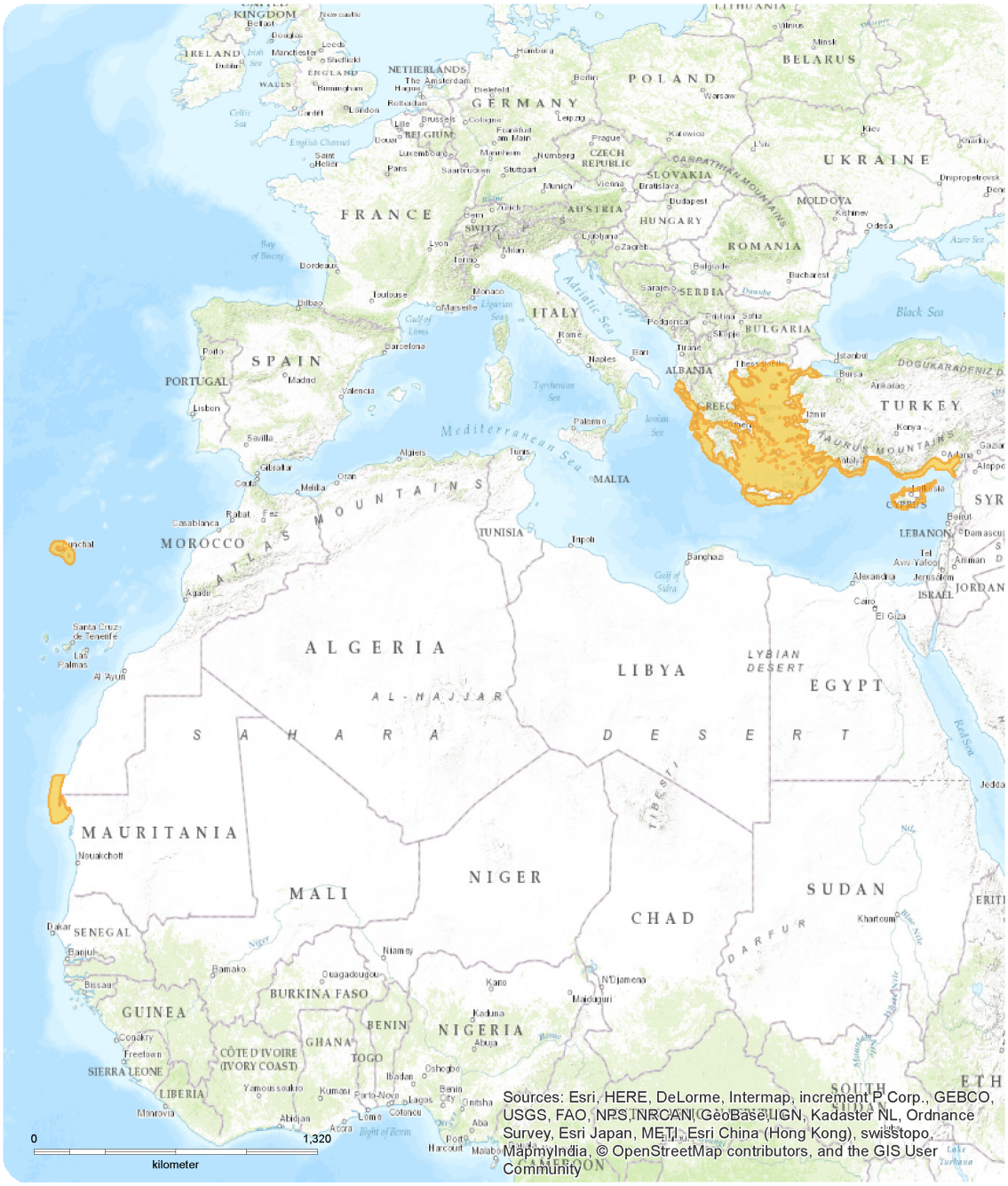
Distribution Map



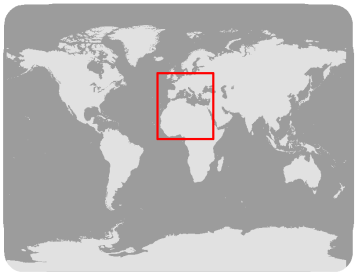
Monachus monachus

NE DD LC NT VU EN ENDANGERED CR EW EX

Range

Extant (resident)

Compiled by:
Alex Karamanlidis



The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.

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Population

The once abundant Mediterranean Monk Seal has disappeared from most of its former range, with the majority of the decline in the global population seen over the last century having occurred more than three generations ago.

Conservation measures introduced over the last 30 years have helped to stem the decline, and there is now evidence of recent small increases in all known subpopulations. However at present it is not clear whether these increases are likely to continue into the future. The Mediterranean Monk Seal population remains very small and still faces many threats (see the Threats section below). It is regarded as one of the most endangered pinniped species in the world, with approximately 600-700 animals in the population (an estimated 350-450 of these are mature individuals). The population has also been fragmented into 3–4 subpopulations:

• The largest subpopulation is located in the eastern Mediterranean Sea and numbers 350-450 individuals (including mature and immature individuals). It is estimated that 300–400 live in Greece (MOm 2007, 2008, 2009) and about 100 in Turkey (Güçlüsoy *et al*. 2004). Based on data from the closest extant relative of the Mediterranean Monk Seal (i.e., the Hawaiian Monk Seal) the number of mature individuals in the eastern Mediterranean is likely fewer than 250.

• Approximately 220 seals currently inhabit the second largest subpopulation at the Cabo Blanco area. Recent monitoring efforts have individually identified at least 116 adult and sub-adult Monk Seals in this subpopulation (i.e., >3 years old; Martínez-Jauregui *et al*. 2012). Maximum counts of seals hauled-out at one time was 146 in 2009, and 159 individual adult seals were identified at the end of 2013 (CBD Habitat, P. Fernandez de Larrinoa pers. comm). In the early 1990s this subpopulation was estimated at about 317 seals but a mass mortality event in 1997 reduced numbers to nearly a third (Forcada *et al*. 1999, Forcada and Aguilar 2000). Martínez-Jauregui *et al*. (2012) estimated that there were 85 adult seals at Cabo Blanco in 2007.

• The third subpopulation is located in the archipelago of Madeira and numbers approximately 40 seals (Pires *et al*. 2008, R. Pires pers. comm). Once restricted to the remote Desertas Islands (Neves and Pires 1999), Monk Seals have recently recolonized the main island of Madeira (Pires 2011), where suitable habitat for the species still exists (Karamanlidis *et al*. 2003). There are even strong indications of pupping on the island (R. Pires pers. comm).

• The number of Mediterranean Monk Seals that might still survive at the Mediterranean coasts of eastern Morocco (and perhaps Algeria) is unknown (Mo *et al*. 2011).

The subpopulations at Cabo Blanco in the Atlantic (Martínez-Jauregui *et al*. 2012) and at the island of Gyaros in the eastern Mediterranean (Karamanlidis *et al*. 2013) are the only large extant aggregations of the species that still preserve the structure of a colony; the other subpopulations in the eastern Mediterranean are composed of loose groups of extremely reduced size (usually less than 20 individuals).

Monk Seals continue to be exposed to a number of substantial threats, as exemplified by the mass mortality at Cabo Blanco when more than 200 animals died in one mass-mortality event in 1997 (Martínez-Jauregui *et al*. 2012). Such unpredictable threats could rapidly impact any or all of the

subpopulations in future.
Current Population Trend: Increasing

Habitat and Ecology (see Appendix for additional information)

Mediterranean Monk Seals are medium-sized phocids that reach 2.3-2.8 m in length (Gilmartin and Forcada 2002). Based on seals examined after a mass mortality at Cabo Blanco, average adult lengths were estimated at 2.42 m in females and 2.51 m in males. Pups up to 3 months of age averaged 1.08 m with a range of 0.74-1.38 m (Samaranch and Gonzalez 2000). In the eastern Mediterranean, newborn pups averaged 102.6 cm in length (i.e., total length from the snout to the end of the hind flippers; N = 8, SD = 10.74) and 15.5 kg in weight (N = 3, SD = 1.5; Dendrinos 2011). Adults weigh from 240-300 kg, and newborns 15-26 kg (Boulva 1979, Gilmartin and Forcada 2002), with records of a male reaching 400 kg and a pregnant female reaching 302 kg (Sergeant *et al*. 1978).

Adult females moult an average of 134 days after parturition, and sometimes begin the moult prior weaning their pup (Pastor and Aguilar 2003). In males, the process of developing the mature pelage pattern is gradual; it involves at least two annual moults and can be completed by the age of 4 years (Badosa *et al*. 2006). Mediterranean Monk Seal pups at the Cabo Blanco region moult on average 64 days after birth in the case of females and on average 82 days in the case of males; the molt occurs partly in the water and takes an average of 15 days to be completed (Badosa *et al*. 2006). In the eastern Mediterranean in contrast the first molt occurred 19-57 days postpartum (N = 16; Mean 37.5 days, SD = 9.85; Dendrinos 2011).

Mediterranean Monk Seals once hauled out on open beaches (Johnson and Lavigne 1999b, Johnson 2004) but today they use marine caves with sea entrances for hauling out, resting and pupping throughout their range. In recent years in areas where conservation measures are in place and/or human activity is low, such as the protected areas at Cabo Blanco (Gilmartin and Forcada 2002, Fernandez de Larrinoa *et al*. 2007, P. Fernandez de Larrinoa pers. comm.), the Desertas Islands Nature Reserve (Pires and Neves 2000) and the island of Gyaros (Dendrinos *et al*. 2008), Monk Seals are frequently observed to haul out on open beaches. On some occasions even births on open beaches have been recorded in these areas.

Most marine caves used by Mediterranean Monk Seals for resting and pupping possess a set of common geophysical characteristics, that include an entrance above or below water level, an entrance corridor, and a dry surface/area, where the seals haul out (Dendrinos *et al*. 2007b). Seal preferences regarding the use of a cave as a resting or pupping site are influenced by these parameters (Karamanlidis *et al*. 2004). Cave selection (i.e., usage frequency and intensity) may also be influenced by changes in the internal morphology of a cave, as has been seen to occur at Cabo Blanco (González *et al*. 1997) or the state of the tide (only in the Atlantic populations, as tides in the Mediterranean are negligible) (Pires *et al*. 2007).

A major difference in the terrestrial habitat of Mediterranean Monk Seals occupying the area of Cabo Blanco and the rest of their range is the number of marine caves used by the species. Whereas in Cabo Blanco, the entire Monk Seal population uses a small number (<5) of marine caves for resting and pupping (Marchessaux and Muller 1987, Francour *et al*. 1990, González *et al*. 1997, Martínez-Jauregui *et al*. 2012) in the archipelago of Madeira (Karamanlidis *et al*. 2004) and in the eastern Mediterranean this

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number is much higher (Gücü *et al*. 2004; MOm 2007, 2008, 2009). In a study that covered 250 km of coastline inhabited by Monk Seals in the Cilician Basin region of southern Turkey, 282 caves were searched. Of these, 39 showed evidence of Monk Seals, including three that were used for pupping and 16 that were actively being used at the time of the survey (Gücü *et al*. 2004). Similarly, in Greece more than 500 caves have been found to be occupied by the species and more than 100 to be used for pupping (MOm 2007, 2008, 2009). Monk Seal activity in the marine caves in the eastern Mediterranean is highest in autumn and winter and coincides with the pupping season of the species (Gücü *et al*. 2004, Dendrinos 2011).

In the Cabo Blanco region prior to the mass die off in 1997, most pups were born from summer to early winter, with a small peak of births in October; 84% of the births took place in only two caves separated by 1.1 km (Gazo *et al*. 1999, Pastor and Aguilar 2003). Following the mass die-off a change in the reproductive parameters of the colony was registered (González *et al*. 2002): currently births are recorded from April to November, with a clear peak in September (Cedenilla *et al*. 2007). In all other parts of the species range, pupping appears to be even more synchronous. In the archipelago of Madeira most pups have been recorded in the months October and November (i.e., 38 out of 48 recorded from 1989 to 2012; Pires *et al*. 2008, R. Pires pers. comm). The same pupping season was recorded for 11 pups born at Turkey's Cilician Basin and for more than 220 pups born in Greece from 1990 to 2014 (Dendrinos *et al*. 1994, 1999; Dendrinos 2011).

Pups begin to catch fish toward the end of their lactation period (Pastor and Aguilar 2003). Pups are weaned when they are about four months old, with up to five months reported (Pastor and Aguilar 2003, Aguilar *et al*. 2007). Fostering and milk stealing are not uncommon and have been recorded at Cabo Blanco (Aguilar *et al*. 2007), Madeira (Pires 2004), and in Greece (Karamanlidis *et al*. 2012). At the Cabo Blanco colony, in 26.6% of the suckling episodes observed in mother–pup pairs of known identity, pups suckled from females other than their mothers. Some females nursed more than one pup, at least occasionally, and in some cases a pup was fostered long-term by an unrelated female (Aguilar *et al*. 2007). Pups enter the water and begin diving during their first week and from that point onwards spend 55-74% of their time at sea (Dendrinos 2011). Three pups tagged with time depth recorders spent more time at sea and diving at night than during the day; most dives were to the bottom for relatively long periods, probably indicating foraging. The mean depth of dive was 11.6 m and its mean length was 149 seconds (Gazo *et al*. 2006). In the Northern Sporades Islands in Greece, two rehabilitated weaned pups dived on average to greater depths and even managed to dive to a depth of 200 m (Dendrinos *et al*. 2006, 2007a).

Generation length for this species is 11.2 years (Pacifici *et al*. 2013). Female Mediterranean Monk Seals probably become sexually mature at 3-4 years of age. One female at Cabo Blanco became pregnant at 2.1 years and gave birth at 3.1 years, the youngest age known for this species (P. Fernandez de Larrinoa pers. comm.). Females can give birth in successive years. Although birthing is not strictly seasonal, individual females have been documented to give birth close to the same time in successive years, within a 15 day span (Pastor and Aguilar 2003). The annual reproductive rate in Mediterranean Monk Seals at Cabo Blanco prior to the mass die-off was extremely low, at 0.25-0.43 pups to each sexually mature female (Gazo *et al*. 1999, 2000). Since the mass die-off event the population appears to be recovering and currently annual reproductive rates average 0.76 pups/adult female (P. Fernandez de Larrinoa pers. comm.). Females caring for pups will go to sea to feed for up to 17 hours, with an average time of 9 hours (Gazo and Aguilar 2005). Females tend to forage longer further into nursing.

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Prior to the mass mortality event, pup survival at Cabo Blanco was extremely low; just under 50% of the pups born annually managed to survive their first two months, and most mortalities occurred in the first two weeks. This very low survival rate was associated with mortality caused by severe storms, and high swells and tides, but impoverished genetic variability and inbreeding might also have been factors (Gazo *et al*. 2000). Currently, annual pup survival has increased considerably and numbers 65% (54-76%, depending on weather conditions; P. Fernandez de Larrinoa pers. comm.). In Greece annual pup survival appears to be even higher (Dendrinos 2011); this is most likely due to the fact that lactating females and their pups have a higher number of suitable caves to choose from when seeking refuge from severe weather conditions.

Compared to most other pinnipeds, little is known about the diving capacities and behavior of Mediterranean Monk Seals. The maximum depth and duration of diving for one lactating female were 78 m and 15 minutes, respectively (Gazo and Aguilar 2005) and 100 m for an adult male (P. Fernandez de Larrinoa pers. comm.). However, diving behaviour of Monk Seals at Cabo Blanco appears to be constricted by the topographic features of the marine environment in the region, as Monk Seals in the Mediterranean Sea (which is much deeper than the Cabo Blanco region) have been recorded to dive much deeper. Maximum dive depths for a rehabilitated male and a female juvenile Monk Seal were 196 m (Dendrinos *et al*. 2007a) and 205 m (MOm unpublished data), respectively. Neves (1998) observed two types of diving in shallow near-shore waters, which are thought to be associated with “spot resting” and “transit feeding”. When “spot resting”, seals dove as though headed into a current for 8-12 minutes, surfaced at about the same location, and usually repeated this pattern for approximately three hours. Underwater observations by divers indicate that while doing this seals rest at the bottom of the sea (R. Pires pers. comm). Transit feeding dives lasted 5-7 minutes, during which the seal moved continuously along a shoreline apparently foraging. A similar behaviour has been observed in Turkey, where adult Monk Seals dove for approximately 6.5 minutes and rested at the surface for approximately one minute (Kiraç *et al*. 2002). Monk seals in the eastern Mediterranean have been recorded to travel long distances, for example ~288 km in three months with a maximum straight distance travelled of ~78 km (Adamantopoulou *et al*. 2011).

Stomach content analysis of dead Monk Seals has revealed that they have a heterogeneous diet consisting of bony fishes, cephalopods, and crustaceans. In Greece, Monk Seals are known to eat more than 530 prey species (50% cephalopods, 48% fishes, 1.5% non-cephalopod molluscs, 0.4% crustaceans; Pierce *et al*. 2011). The common octopus (*Octopus vulgaris* ~34%) and bony fish from the family Sparidae (~28%) were identified in Monk Seal stomachs most frequently (Pierce *et al*. 2011). In the Atlantic, at the Desertas Islands off Madeira, visual observations of Monk Seals with prey at the surface included seals eating Golden-grey Mullet (*Liza aurata*), Parrot Fish (*Sparisoma cretense*), Barred Hogfish (*Bodianus scrofa*), Salema (*Sarpa salpa*), Cuttlefish (*Sepia officinalis*) and Crabs (*Pachygrapsus* spp.). Other prey reported includes Eels (*Anguilla* spp.), Limpets (*Patella* spp.) and Rays (*Raja* spp.) (Neves 1998). In Cabo Blanco, stomach content analyses indicated that 71.3% of prey items by weight were cephalopods and 68.3% were Octopus. Fish species were mainly from the families Sparidae, Scianidae and Haemulidae (Muñoz Cañas *et al*. 2012). Collectively, results from stomach content (Marchessaux 1989, Neves 1998, Salman *et al*. 2001, Karamanlidis *et al*. 2011, Pierce *et al*. 2011, Muñoz Cañas *et al*. 2012) and stable isotope analyses (Pinela *et al*. 2010, Karamanlidis *et al*. 2014b) studies suggest that Monk Seals forage primarily on the continental shelf along the coast.

Systems: Terrestrial, Marine

Use and Trade

In the past, Mediterranean Monk Seals were hunted by humans for their fur, oil, meat and for medicinal use. Evidence suggests that the species was severely depleted during the Roman era (Johnson *et al*. 2006). Today there is no commercial exploitation of this species.

Threats (see Appendix for additional information)

The Mediterranean Monk Seal is one of the most endangered pinniped species, and one of the most endangered Evolutionarily Distinct and Globally Endangered (EDGE) mammals on Earth (Isaac *et al*. 2007, EDGE web site).

Mediterranean Monk Seals have a long history of interaction with humans that includes exploitation for subsistence needs, commercial harvest, and persecution as a competitor for fisheries resources or because it produced actual and perceived damage to fishing gear (Johnson and Lavigne 1999b, Stringer *et al*. 2008). Once abundant, Monk Seals were written about and illustrated in the literature and depictions of classical antiquity (Johnson 2004). Along the coast of northwest Africa, they became the target of a commercial harvest for skins and oil by the Portuguese as early as the 15th century (Isräels 1992).

Reasons for population decline declines in the 20th century include: increased human pressure displacing seals from their habitat; destruction/alteration of suitable habitat; continued mortality due to deliberate aggression by fishermen to eliminate a competitor, even in countries and areas where the species is legally protected; fisheries by-catch; and a mass die-off at the Cabo Blanco Monk Seal colony.

Habitat deterioration, destruction, and fragmentation have played a significant role in the plight of the Mediterranean Monk Seal. Once an open beach dweller, the species has been persecuted by humans for centuries and forced to occupy increasingly marginal habitat. The gradual process from occupying open beaches to being displaced and forced into increasingly marginal habitat (i.e., smaller and more unsuitable marine caves) has been thoroughly documented (Johnson and Lavigne 1999a). This threat is still in place today, particularly in the eastern Mediterranean (MOm 2007, Notarbartolo di Sciara et al. 2009, Kiraç et al. 2013). An alarming decline in pupping success has been recorded in the most important pupping location of the species in southern Turkey (where up to seven pup births have been recorded) due to increased human activity (i.e., industrial development, including the construction of a thermal and nuclear power plant and a marine terminal). Critical Monk Seal habitat has been affected by increased tourism activities throughout Turkey, even in protected areas such as the Olympos Beydagları National Park, and the Kas, Kekova Specially Protected Area. Tourists and scuba divers in these areas appear to frequently visit Monk Seal shelters. Although some resting activity of Mediterranean Monk Seals continues, no pupping activity has been recorded in these caves (Gücü et al. 2009). With human populations and coastal activities increasing around the Mediterranean, so do potential threats to the species habitat.

Interactions with fisheries are of great conservation concern, throughout the species range (Güçlüsoy and Savas 2003, Güçlüsoy 2008, Karamanlidis *et al*. 2008, Hale *et al*. 2011, González and Fernandez de Larrinoa 2013). Deliberate killing of Monk Seals mainly by fishermen was responsible for one-third of all

mortalities of 79 stranded animals in Greece (1991-1995) and is considered the single most important source of mortality for this species in the eastern Mediterranean (Androukaki *et al*. 1999). Deliberate killing, hunting, and capturing live animals for exhibition purposes were the main cause for the population reduction of the species in Turkey until 1980 (Kiraç *et al*. 2013).

Mediterranean Monk Seals have been entangled in a wide variety of fishing gear including set-nets, trawl nets, and long-lines (Johnson and Karamanlidis 2000) and entanglement remains a major source of mortality in the eastern Mediterranean Sea, especially for sub-adult animals (Karamanlidis et al. 2008, Kiraç et al. 2013). Adverse fishing interactions are also considered as one of the probable causes for the lack of recovery of the Cabo Blanco population after commercial sealing ended in the region. Currently, illegal industrial and artisanal fishing is one of the main threats to the survival of the colony, mainly for sub-adult seals (González and Fernandez de Larrinoa 2013). In comparison, the effect of negative seal-fisheries interactions in the archipelago of Madeira is considered to be lower. Traps, purse seines, and illegally used gill nets are the main fishing gear posing a threat to the species in the region (Hale et al. 2011). However, concurrent with the recent expansion of the species' range to the island of Madeira, signs of animosity towards the species by fishermen have been recorded, that potentially could pose a future threat (R. Pires pers. comm).

A *Morbillivirus* was isolated from Mediterranean Monk Seals after the mass mortality at Cabo Blanco in 1997. The virus most closely resembled a Dolphin *Morbillivirus* that was previously implicated in the 1991 mass mortality of Striped Dolphins in the Mediterranean Sea (Osterhaus *et al*. 1992, van de Bildt *et al*. 1999). However, although this virus was already circulating in Monk Seals prior to the mass mortality, there is some doubt as to whether it was responsible for the deaths that occurred. Indeed, the active virus was found in pups that went into a rehabilitation center because their mothers had died, and none of them showed clinical signs and all survived the event without specific treatment. Dinoflagellate-produced saxitoxins were found in tissues from animals that died during the die-off and the suddenness of death of the animals and the general clinical symptoms suggest that the cause of death was from the toxins rather than a *Morbillivirus* epidemic (Hernandez *et al*. 1998). Toxic algal blooms (red tides) are favored by oceanographic conditions near Cabo Blanco and were reported from nearby Morocco during a 25-year period leading up to the mass mortality. Toxic algal blooms are unpredictable and following the catastrophic loss of Monk Seals in 1997 must be considered a serious threat to the species in the region (Reyero *et al*. 2000, UNEP 2005).

Potentially, limited availability of food sources, genetic inbreeding, and pollution could constitute a threat to the survival of the species. Currently, not enough information is available to fully evaluate the magnitude of these threats, however there is no indication that they are significantly affecting the population at present.

In southern Turkey an important monk seal colony almost disappeared in the 1990s, when industrial-scale fishing in the area reduced the available fish sources and negative interactions of artisanal fishermen with monk seals (i.e., deliberate killings) increased. However, a series of regulations enforced to protect fish sources alleviated the problems and helped the local monk seal population to resume pupping in the area (Gücü *et al*. 2004).

Genetic analyses of mitochondrial and nuclear DNA (Pastor *et al*. 2004, Pastor *et al*. 2007, Karamanlidis *et al*. 2014a) have shown that, as a consequence of severe population bottlenecks and

population/habitat fragmentation, all sub-populations have suffered a dramatic decrease in genetic variability over the last few centuries. The genetic diversity of Mediterranean Monk Seals is among the lowest found in pinnipeds; it is comparable to Hawaiian Monk Seals and Northern Elephant Seals. The potential consequences of the loss of genetic variability and genetic inbreeding are still hard to evaluate for the Mediterranean Monk Seal, however potential consequences of genetic inbreeding include congenital defects leading to stillborn pups, something that has been recorded in several small Monk Seal populations (Bareham and Furreddu 1975, Pastor *et al*. 2004, MOm, unpublished data). Additionally, low fitness and increased susceptibility to disease may be an effect of genetic erosion that can compromise a population and lead to extinction.

Contaminant burdens have always been suspected to be a threat to the Mediterranean Monk Seal and thus monitoring pollutants has been considered a high priority (Boulva 1979, Reijnders *et al*. 1993). However, information is only available on organochlorine pollutants, which were analysed in the blubber of individuals collected during the 1990s from the Cabo Blanco and the Greek subpopulations. Residue levels were found to be very low in the former subpopulation and moderate to high in the latter (Yediler *et al*. 1993; Borrell *et al*. 1997, 2007); currently, efforts are underway to more fully evaluate the effects of pollution on the Mediterranean Monk Seal through the analysis of more recent samples from the eastern Mediterranean (Marsili *et al*. 2014, Zaccaroni *et al*. 2014).

Mediterranean Monk Seals are at an unknown, but suspected high, level of risk from oil tanker and other ship accidents, spills, and groundings. This results from increased tanker traffic in the area, and a greater chance for accidents, disturbance, and collisions near important habitat. Four accidents or spills have occurred near Monk Seal habitat in the recent past, including a supertanker that spilled oil off Morocco in 1989 (Isräels 1992), an oil spill in the Madeira Islands in 1990 (UNEP 2005), and the grounding of a bulk carrier near Cabo Blanco in 2003 (UNEP 2005). None of these spills or accidents had any known impacts on Monk Seals, but they highlight the threat of significant impacts from a major maritime accident near an important Monk Seal site (UNEP 2005). In contrast, a ship accident that occurred at Çavuş Island near Bodrum in southwest Turkey in 1996 directly affected Monk Seals and their habitat (Kiraç 1998). A clean-up operation lasting until 1997 effectively restored the habitat to its original quality. In response to this accident regulatory measures have been taken in Turkey to reduce the threat from oil spills (Kiraç and Guclusoy 2007).

More recently, the arrival of Lessepsian fishes in the eastern Mediterranean Sea, such as the toxic Pufferfish (*Lagocephalus sceleratus*), could have a negative impact on Monk Seals in the region. The Pufferfish has been implicated in the death of a Monk Seal at Cyprus (A. Gücü pers. comm). Additional risks to Mediterranean Monk Seals come from political instability in some parts of their range, the challenge of implementing effective conservation for a species in a complex multi-national environment, weak enforcement of agreements and international laws, collapse of occupied pupping caves, and reduction of the carrying capacity of the environment as a consequence of fishing overexploitation (Aguilar 1999).

Conservation Actions **(see Appendix for additional information)**

The Mediterranean Monk Seal is legally protected throughout its range through numerous national laws and regional and international treaties, as well as European Union regulations. Legislative measures and research, management, and conservation actions to effectively protect important Mediterranean Monk Seal populations are currently in place in the following areas: the Desertas Islands Nature Reserve in the

Madeira Archipelago, the National Marine Park of Alonnisos, Northern Sporades Islands, the marine protected area in Northern Karpathos–Saria and the 3-mile no-take zone at the Island of Gyaros in Greece, the no-fishing area of the Cap Blanc Peninsula and the participative reserve that has been created to protect the pupping caves of the Cabo Blanco Monk Seal population. In Turkey similar actions are carried out in five coastal locations in the country: Foça, Karaburun, Alaçatı-Sigacik, the Bodrum Peninsula, and the Cilician coasts (Kiraç *et al*. 2013).

Additionally, the species is explicitly mentioned in 102 Natura 2000 sites within the European Union (82 sites in Greece, 10 in Italy, five in Spain, three in Portugal, and two in Cyprus). According to the Council's Directive 92/43EEC "on the conservation of natural habitats of wild fauna and flora" the Mediterranean Monk Seal is considered as a species of community importance. Based on the above Directive, Natura 2000 sites are legally considered by EU member states as Protected Areas.

Throughout the range of the species, widespread action has been taken to sensitize the local human population towards Monk Seal conservation, to protect breeding caves, to restrict fishing gear and relocate the most adverse fishing practices, to develop monitoring programs and intervention protocols, and to increase on-site capability to rehabilitate sick and injured individuals, particularly pups. Numerous agreements, conventions, and treaties (on a regional, national, and international level) are in force to protect Monk Seals, and many workshops and conferences have brought together scientists and managers to discuss Monk Seal conservation issues and problems. Furthermore, numerous international bodies and fora, including the Regional Activity Center for Specially Protected Areas and the General Fisheries Commission for the Mediterranean, have put forward initiatives and proposals in order to ameliorate existing threats and mitigate pressures from relevant sectors (i.e., fisheries, bycatch, etc.). Isräels (1992) summarized 30 years of this conservation history, and provided details on accomplishments and failures to meet objectives. Currently, there is a UNEP/Mediterranean Action Plan (first issued in 1978 and revised in 1988) in force for the conservation and management of Monk Seals in the Mediterranean and an Action Plan for the recovery of the Monk Seal in the eastern Atlantic under the Migratory Species of Wild Animals Convention (Bonn Convention) (González *et al*. 2006). In the context of the plan a list of actions have been implemented, such as the establishment of mechanisms to coordinate and finance the conservation, the population monitoring and study, habitat protection and environmental education.

In Greece, the "National strategy and action plan for the conservation of the Mediterranean Monk Seal in Greece, 2009-2015" (Notarbartolo di Sciara *et al*. 2009) describes in detail actions that have to be carried out in the country by 2015 in order to safeguard the future of the species. Similarly, in Turkey the National Monk Seal Committee has drafted a "National Action Plan for the Conservation of Mediterranean Monk Seal *Monachus monachus* in Turkey" that has been approved by the Turkish Ministry of Forest and Water Works (Kiraç *et al*. 2013).

Recently a new Regional Strategy for the Conservation of the Mediterranean Monk Seal has been adopted also by the UNEP parties (Notarbartolo di Sciara 2013).

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Citation

Karamanlidis, A. & Dendrinos, P. 2015. *Monachus monachus. The IUCN Red List of Threatened Species 2015*: e.T13653A45227543. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T13653A45227543.en

Disclaimer

External Resources

For Images and External Links to Additional Information, please see the Red List website.

Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
9. Marine Neritic -> 9.1. Marine Neritic - Pelagic	Resident	Suitable	Yes
10. Marine Oceanic -> 10.1. Marine Oceanic - Epipelagic (0-200m)	Resident	Suitable	Yes
12. Marine Intertidal -> 12.1. Marine Intertidal - Rocky Shoreline	Resident	Suitable	Yes
12. Marine Intertidal -> 12.2. Marine Intertidal - Sandy Shoreline and/or Beaches, Sand Bars, Spits, Etc	Resident	Suitable	Yes
13. Marine Coastal/Supratidal -> 13.1. Marine Coastal/Supratidal - Sea Cliffs and Rocky Offshore Islands	Resident	Suitable	Yes
13. Marine Coastal/Supratidal -> 13.2. Marine Coastal/supratidal - Coastal Caves/Karst	Resident	Suitable	Yes

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
1. Residential & commercial development -> 1.1. Housing & urban areas	Ongoing	Majority (50-90%)	Slow, significant declines	Medium impact: 6
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
1. Residential & commercial development -> 1.2. Commercial & industrial areas	Ongoing	Majority (50-90%)	Slow, significant declines	Medium impact: 6
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
1. Residential & commercial development -> 1.3. Tourism & recreation areas	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
4. Transportation & service corridors -> 4.3. Shipping lanes	Ongoing	Majority (50-90%)	Slow, significant declines	Medium impact: 6
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.2. Intentional use: (large scale)	Past, unlikely to return	-	-	-
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.4. Unintentional effects: (large scale)	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		

		2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.5. Persecution/control	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
6. Human intrusions & disturbance -> 6.1. Recreational activities	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7
	Stresses:	2. Species Stresses -> 2.2. Species disturbance		
6. Human intrusions & disturbance -> 6.2. War, civil unrest & military exercises	Ongoing	Minority (50%)	Negligible declines	Low impact: 4
	Stresses:	2. Species Stresses -> 2.2. Species disturbance		
7. Natural system modifications -> 7.3. Other ecosystem modifications	Unknown	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
8. Invasive & other problematic species & genes -> 8.1. Invasive non-native/alien species -> 8.1.2. Named species (Lagocephalus sceleratus)	Ongoing	Majority (50-90%)	Negligible declines	Low impact: 5
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
8. Invasive & other problematic species & genes -> 8.2. Problematic native species	Ongoing	Whole (>90%)	Causing/could cause fluctuations	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
9. Pollution -> 9.1. Domestic & urban waste water -> 9.1.3. Type Unknown/Unrecorded	Ongoing	Majority (50-90%)	Negligible declines	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
9. Pollution -> 9.2. Industrial & military effluents -> 9.2.1. Oil spills	Ongoing	Whole (>90%)	Negligible declines	Medium impact: 6
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
9. Pollution -> 9.2. Industrial & military effluents -> 9.2.3. Type Unknown/Unrecorded	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
9. Pollution -> 9.3. Agricultural & forestry effluents -> 9.3.4. Type Unknown/Unrecorded	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
11. Climate change & severe weather -> 11.1. Habitat shifting & alteration	Ongoing	-	-	-
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		

Conservation Actions in Place

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions in Place
In-Place Research, Monitoring and Planning
Action Recovery plan: Yes

Conservation Actions in Place
Systematic monitoring scheme: Yes
In-Place Land/Water Protection and Management
Conservation sites identified: Yes, over part of range
Occur in at least one PA: Yes
Percentage of population protected by PAs (0-100): 41-50
Area based regional management plan: Yes
Invasive species control or prevention: Not Applicable
In-Place Species Management
Harvest management plan: No
Successfully reintroduced or introduced beningly: No
Subject to ex-situ conservation: Yes
In-Place Education
Subject to recent education and awareness programmes: Yes
Included in international legislation: Yes
Subject to any international management/trade controls: Yes

Conservation Actions Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions Needed
1. Land/water protection -> 1.1. Site/area protection
1. Land/water protection -> 1.2. Resource & habitat protection
2. Land/water management -> 2.1. Site/area management
3. Species management -> 3.2. Species recovery
4. Education & awareness -> 4.1. Formal education
4. Education & awareness -> 4.2. Training
4. Education & awareness -> 4.3. Awareness & communications
5. Law & policy -> 5.2. Policies and regulations
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.2. National level

Research Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T13653A45227543.en

Research Needed
1. Research -> 1.1. Taxonomy
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.3. Life history & ecology
1. Research -> 1.5. Threats
1. Research -> 1.6. Actions
2. Conservation Planning -> 2.1. Species Action/Recovery Plan
2. Conservation Planning -> 2.2. Area-based Management Plan
3. Monitoring -> 3.1. Population trends
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km²): 314880
Continuing decline in area of occupancy (AOO): No
Extreme fluctuations in area of occupancy (AOO): No
Estimated extent of occurrence (EOO) (km²): 4993004
Continuing decline in extent of occurrence (EOO): No
Extreme fluctuations in extent of occurrence (EOO): No
Number of Locations: 5-20
Continuing decline in number of locations: No
Extreme fluctuations in the number of locations: No
Lower elevation limit (m): 0
Upper elevation limit (m): 3
Lower depth limit (m): 250
Upper depth limit (m): 0
Population
Number of mature individuals: 350-450
Continuing decline of mature individuals: Yes
Extreme fluctuations: No
Population severely fragmented: No

http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T13653A45227543.en

Population
No. of subpopulations: 3-4
Continuing decline in subpopulations: No
Extreme fluctuations in subpopulations: No
All individuals in one subpopulation: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: Yes
Generation Length (years): 11.2
Movement patterns: Not a Migrant

The IUCN Red List Partnership

The IUCN Red List of Threatened Species™ is produced and managed by the IUCN Global Species Programme, the IUCN Species Survival Commission (SSC) and The IUCN Red List Partnership.

The IUCN Red List Partners are: BirdLife International; Botanic Gardens Conservation International; Conservation International; Microsoft; NatureServe; Royal Botanic Gardens, Kew; Sapienza University of Rome; Texas A&M University; Wildscreen; and Zoological Society of London.