Mirounga leonina – Southern Elephant Seal

Regional Red List status (2016)	Near Threatened A2b*
National Red List status (2004)	Endangered A2b
Reasons for change	Genuine change: Increase in population
Global Red List status (2015)	Least Concern
TOPS listing (NEMBA) (2007)	None
CITES listing (1975)	Appendix II
Endemic	No

*Watch-list Threat

The largest seal species in the world. Deepest known diving mammal (to depths of > 2.1 km). Most sexually dimorphic mammal in the world.

Taxonomy

Mirounga leonina (Linnaeus 1758)

ANIMALIA - CHORDATA - MAMMALIA - CARNIVORA - PHOCIDAE - *Mirounga* - *leonina*

Common names: Southern Elephant Seal, South Atlantic Elephant-seal, Southern Elephant-seal (English)

Taxonomic status: Species

Taxonomic notes: None

Assessment Rationale

No serious threats have been affecting the land breeding colonies at Prince Edward Islands in the last 30 years (three generations time). The population on Marion Island, as estimated through annual pup production, declined by 83% between 1951 and 1994, which prompted the Endangered A2b listing in 2004. At its nadir in 1997 annual pup production at Marion Island was 421, but this has gradually increased to around 552 pups in 2015, representing a mature population of 1,740. If females not breeding in that year and neighbouring Prince Edward Island's population are included, it probably equates to about 3,000 individuals in total for the Prince Edward Island population. Thus, although the population declined by 37% between 1986 and 1994, over the past three generations (1986–2015), the population only declined (from 690 pups in 1986 to 552 pups in 2015) by about 20% and in fact pup production has increased by 33% between 1997 and 2015, providing hope for a sustained positive population trajectory.

A 20% reduction over the last three generations is close to the threshold for applying the Near Threatened listing for the A criterion (20–25% reduction; IUCN Standards and petitions Subcommittee 2014). Thus, with no major current threats that could cause rapid population decline, and currently increasing pup production, we list the national population of Southern Elephant seals as Near Threatened A2b, with a prediction that this species can be further downlisted to Least Concern in the next revision. It is also worth noting that we do not fully understand the cause/s of the past decline, albeit attributed to food limitation. The causes of changes in food availability remains poorly understood. In all likelihood climate related impacts and oceanographic changes have influenced prey availability and distribution as well as spatial distribution of southern elephant seal foraging efforts.

Regional population effects: The global range is continuous and connected by movement of individuals between islands, with potential for augmentation or rescue of locally declining or extinct subpopulations. There is connectivity with the Îles Crozet but also with distant Îles Kerguelen (see Oosthuizen et al. 2011).

Distribution

Southern Elephant Seals have a circumpolar distribution in the Southern Hemisphere. Although they reach the Antarctic continent and even very high latitude locations such as Ross Island, they are most common north of the seasonally shifting pack ice, especially in Subantarctic waters where most rookeries and haul-outs are located. The northern-most breeding locality for the species is Gough Island, southern Atlantic, although the population is tiny (pup production *c*. 18 / year; Bester et al. 2001).

Some pups are also born on the Antarctic continent. Southern Elephant Seals prefer sandy and cobble beaches, but will haul-out on sea ice, snow and rocky terraces and regularly rest (but especially moult) above the beach in tussock grass, other vegetation, and mud wallows. At sea, females and males tend to disperse to different feeding grounds, although there is large individual variation in foraging site fidelity, and some overlap between the sexes and ages.

Within the assessment region, this species breeds on Prince Edward Island and Marion Island. Movement at sea is considerable and, even though breeding colonies are disjunct or fragmented, there is movement of individuals between colonies to ensure gene flow, and in one instance, Marion Island to Gough Island, which likely represents gene flow between provinces (Kerguelen and South Georgia provinces – see Reisinger & Bester 2010).

Recommended citation: De Bruyn PJN, Bester MN, Oosthuizen WC, Hofmeyr GJG, Pistorius PA. 2016. A conservation assessment of *Mirounga leonina*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

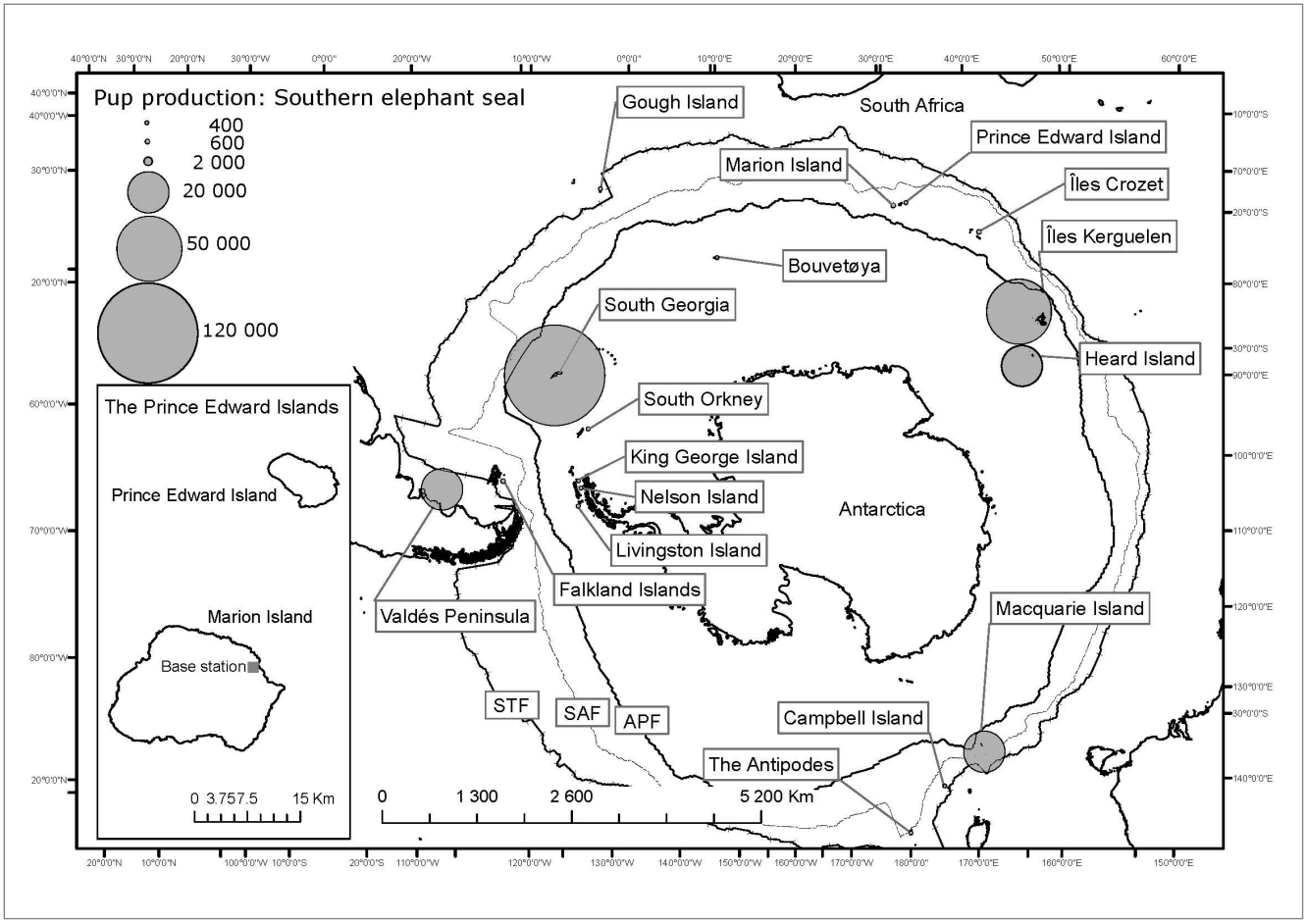

Figure 1. Pup production for the Southern Elephant Seal (*Mirounga leonina*) within the assessment region

Table 1. Countries of occurrence within southern Africa

Country	Presence	Origin
Botswana	Absent	-
Lesotho	Absent	-
Mozambique	Absent	-
Namibia	Absent	-
South Africa	Extant	Native
Swaziland	Absent	-
Zimbabwe	Absent	-

Wandering and vagrant Southern Elephant Seals reach southern Africa (with 1–3 sightings per year off South African coastlines).

Pup production at each location is presented by graduated symbols (Figure 1; pup production data obtained from Scientific Committee of Antarctic Research Expert Group on Seals). The average position of major fronts of the Antarctic Circumpolar Current (Subtropical Front, STF; Subantarctic Front, SAF; Antarctic Polar Front, APF) is indicated.

Population

The worldwide population of Southern Elephant Seals was estimated to be 650,000 in the mid-1990s. No recent integrated estimate is available throughout the entire distribution.

Traditionally, three distinct provinces/populations have been distinguished: South Georgia, Macquarie and Îles Kerguelen. However, Elephant Seals breeding at Península Valdes on the mainland of South America and at the Falkland (Malvinas) Islands are now thought to be a distinct province/population from those at South Georgia. Similarly, the elephant seal populations at the Prince Edward Islands and Îles Crozet are also considered to be distinct from those at Îles Kerguelen and Heard Island, and the small subpopulation at Gough Island may also be distinct. Additionally, some colonies have unknown affiliations (e.g. Bouvet). Thus, there may be at least five and perhaps more, distinct breeding populations, although their foraging areas overlap quite extensively at sea (Reijnders et al. 1993; Bailleul et al. 2007; Biuw et al. 2007) and we suspect there is gene flow between the subpopulations (Reisinger & Bester 2010).

Due to the strict conservation status of Prince Edward Island access is sporadic and difficult. Population monitoring of Southern Elephant Seals is therefore based on annual censuses conducted on Marion Island which hosts the bulk of the Prince Edward Islands population. Adult females haul out synchronously to reach a peak on 15 October during which island-wide counts of females and pups are conducted. Based on life table analyses it has been estimated that the entire population can be estimated through multiplying pup numbers by a conversion factor of 3.15 (Pistorius et al. 1999). However, this is based on the assumption that all females (past primiparity) breed annually, which is not the case (de Bruyn et al. 2011). In fact about half seem to breed annually, so the correction factor based on 552 pups (2015) would give us around 1,740 animals from all sex-

age categories annually, but because of skipping we would actually have a higher number in the mature population.

Within the assessment region, two periods of population decline are recorded: hunting pressure during the 1900s significantly reduced population size, which then recovered until the 1950s, but then saw a sharp decline of 83% between 1951 and *c*. 1994/1997 (Pistorius et al. 1999; McMahon et al. 2009), for largely unknown reasons although the "food limitation hypothesis" (suspected loss of prey availability, the drivers of which remain speculative) has received most support (Pistorius et al. 1999). Between 1986 and 1994 the population declined by 37% (2,120 [690 pups born] to 1,330 [437 pups born] individuals, Pistorius et al. 1999). Over the last three generations (1984/1986 – 2015), the population decline decelerated to 20% (from 690 pups to 552 pups) and in fact pup production (based on direct counts) has increased by 33% between 1997 and 2015 (from 421 to 552 pups), providing hope for a sustained positive population trajectory.

The population remained stable between 1993 and 1999 (Pistorius et al. 2004, but see McMahon et al. 2009) and has since shown a general increase; numbering about 1,740 individuals (552 pups born) in 2015 at Marion Island alone (Pistorius et al. 2011). By utilizing total peak breeding season counts at Marion Island and including conversion factors from pup numbers, the mature archipelago population, including the smaller Prince Edward Island population, numbers between 2,500 and 3,200 individuals (Mammal Research Institute, unpubl. data).

Current population trend: Stable

Continuing decline in mature individuals: No

Number of mature individuals in population: 2,500–3,200

Number of mature individuals in largest subpopulation: 1,740 on Marion Island.

Number of subpopulations: Two; Marion Island and Prince Edward Island.

Severely fragmented: No

Habitats and Ecology

The Southern Elephant Seal is the largest pinniped species. Adult males typically reach 4.5 m and a maximum of 5.8 m in length, and weigh 1,500–3,000 kg, with a maximum weight of about 4,000 kg. Adult females are similar in size and weight to Northern Elephant Seal females weighing 350–600 kg with exceptionally large females reaching 800 kg. Newborn pups are about 1.3 m and 40–50 kg. Pups are born in a long woolly black lanugo coat that is shed at about 3 weeks of age, to reveal a silver grey counter-shaded coat that is yellowish grey ventrally.

Females reach sexual maturity between 3 and 5 years and males reach sexual maturity at an age of 5 years. However, few males breed until they reach social maturity at an age of least 10 years (Jones 1981). At Marion Island, rather anomalously, many males commence breeding at 7 or 8. Ninety percent of males die before the age of 10 years while 90% of females die before the age of 14 years (McCann 1980; Pistorius et al. 1999).

Elephant Seals have an annual cycle with two well-defined pelagic phases, with transitions being marked by moult and reproduction. Adult males and females come ashore to reproduce from August to October. This species provides one of the most extreme examples of polygyny among mammals on land, but recent evidence suggests an alternative strategy in the species with some females mating pelagically (de Bruyn et al. 2011). Although females are capable of annual pup production, many females skip breeding seasons (de Bruyn et al. 2011). The social units are harems, each held by a single dominant male that monopolizes access to around 60 sexually receptive females (at Marion Island) for a period of approximately two months. Early in the breeding season males establish dominance hierarchies on beaches via impressive displays, which include rearing up on the hindquarters and lifting almost two-thirds of the body straight up to fight with a peer or issue vocal challenges to nearby bulls.

Vocalizations include a booming, loud call of the adult male in the breeding season, variously called a bubbling roar, a harsh rattling sound, and a low pitched series of pulses with little variation in frequency. Adult females have a high-pitched yodelling call which they use when distressed, and to call their pups. They will also utter a low pitch, sputtering growl. Pups call to their mothers with a sharp bark or yap, which is also used when interacting with other seals.

Southern Elephant Seals spend a large percentage of their lives at sea (McIntyre et al. 2010) and only return to land to give birth, breed and moult, although especially young animals sometimes engage in a little-understood winter rest haulout. At sea, they range far from their rookeries and predominantly feed between the Subantarctic Convergence and the northern edge of the pack ice, south of the Antarctic Convergence. Adult males typically venture further south than females, and are known to forage at the seaward edge of the Antarctic continental shelf. However, at Marion Island they forage pelagically over very deep water, unlike many of the other populations that feed benthically or over much shallower water (McIntyre et al. 2011).

Foraging Elephant Seals combine exceptionally deep diving with long-distance travelling, covering millions of square kilometres while traversing a wide range of oceanographic regions during periods of up to seven months at sea (McIntyre et al. 2010). The seals spend most of their at-sea time in particular water masses that include frontal systems, currents and shifting marginal ice-edge zones. Studies of foraging locations suggest that seals are sensitive to fine-scale variation in bathymetry and ocean surface properties (sea-ice concentration and sea surface temperature) (McIntyre et al. 2011; Tosh et al. 2015).

Although not well understood, prey consists predominantly of squid and fish. Antarctic *Notothenia* fishes are thought to be important prey when these seals are near the Antarctic continental shelf. Most feeding by females occurs in deep ocean areas at mid-water depths (McIntyre et al. 2010).

Prince Edwards Islands have been proclaimed a Marine Protected Area, although human traffic due to research activities may have a minor and spatially limited disturbance effect on Marion Island.

Subantarctic islands (the pebble or sand beaches in particular) are vital haul-out habitats for breeding and moult in the species.

Ecosystem and cultural services: Southern Elephant Seals are major consumers in the Southern Ocean, playing a critical role as indicators of change in the ecosystems. As ubiquitous visitors to land, these apex predators provide opportunity for dedicated long term life history studies by field researchers. They are therefore a useful model species for assessment of demographic change, drivers of change and consequences thereof within this ecosystem. As top predators within the Prince Edward Islands ecosystem, they form important links in the islands' marine food web. Through import of large quantities of nutrients from the ocean when they breed and moult on the islands they markedly enhance soil and plant nutrient status in the vegetated areas in which they occur (Smith 2008).

In addition their value in the historical "sealing" industry is useful for understanding socio-political and economic drivers of 19th and 20th century human endeavours into unchartered territories in the southern latitudes of our world.

Use and Trade

Southern Elephant Seals were historically commercially harvested, starting in the early 19th century and not ending completely until 1964 at South Georgia. They were prized for their large quantity of blubber that could be rendered to fine, valuable oil. This hunting caused precipitous declines. However, this species is no longer commercially harvested.

Threats

There are few threats and conflicts today, as Southern Elephant Seals live far from human population centres and have minimal interactions with commercial fisheries, but are affected to various degrees by entanglement in fishing gear (Hofmeyr et al. 2002; Campagna et al. 2007). Intensive fishing could potentially deplete important prey stocks. However, relatively little is known about their feeding habits. There is no evidence that recent declines for animals breeding in the Indian and Pacific Oceans are related to fisheries in the Southern Ocean. However, development of new fisheries at high latitudes in the future could have a significant impact on Elephant Seal populations.

Southern Elephant Seals that haul out at mainland sites could come in contact with feral dogs and other terrestrial carnivores and be exposed to a variety of diseases including morbilliviruses (Bester 2014).

The possible effects of global climate and associated oceanographic change on Southern Elephant Seals are not well understood. Learmonth *et al.* (2006) suggest that while the effects of global climate change are uncertain, the species is likely to decline as a result of habitat and ecosystem changes. For example, predicted reduction in sea ice habitats due to continued climate warming will impact the distribution of food and breeding habitat for the species. Predictions are not clear yet regarding how these effects will impact the size of the populations.

Small population sizes facilitate minor threats such as predation and genetic drift, which may threaten local breeding colonies. Reisinger et al. (2011) refuted the claim that predation from Killer Whales is a current threat at the Prince Edward islands, although such predation undoubtedly plays some regulatory role on this population. Furthermore, there is immigration into the Prince Edward Islands population from elsewhere (particularly the French Islands to the east). Changes in Elephant Seal numbers at these islands could impact on local population growth.

Current habitat trend: Stable. However, the threat of global warming could cause an associated oceanographic change by causing a reduction in sea ice habitats.

Conservation

Any future exploitation within the Antarctic Treaty area (south of 60ºS) would be regulated by the Convention for the Conservation of Antarctic Seals. Listed on CITES Appendix II.

Seals on the Prince Edward Islands are protected by virtue of these islands' status as a special nature reserve and also by the South African Seabirds and Seals Protection Act (PEIMP 2010), and thus the breeding grounds within the assessment region are secure.

Recommendations for land managers and practitioners:

- Continuation of monitoring and research programme conducted to date (over the past 3 decades) by the Marion Island Marine Mammal Programme under the auspices of the Mammal Research Institute, University of Pretoria.

Table 2. Threats to the Southern Elephant Seal (*Mirounga leonina*) ranked in order of severity with corresponding evidence (based on IUCN threat categories, with regional context)

Rank	Threat description	Evidence in the scientific literature	Data quality	Scale of study	Current trend
1	*11.5. Climate Change & Severe Weather*: climate change affecting prey base and facilitating disease transmission.	Learmonth et al. 2006	Simulation	National/ regional	Increasing
2	*5.4.3 Fishing & Harvesting Aquatic Resources*: entanglement in coastal fisheries.	Hofmeyr et al. 2002	Empirical	Local	Increasing
3	*8.1.1 Invasive Non-Native/Alien Species/Diseases*: disease transmission from domestic animals.	Bester 2014	Empirical	Local	Stable
4	*5.4.4 Fishing & Harvesting Aquatic Resources*: competition from new fisheries at higher latitudes.	-	Anecdotal	-	Increasing

Table 3. Conservation interventions for the Southern Elephant Seal (*Mirounga leonina*) ranked in order of effectiveness with corresponding evidence (based on IUCN action categories, with regional context)

Rank	Intervention description	Evidence in the scientific literature	Data quality	Scale of evidence	Demonstrated impact	Current conservation projects
1	*1.1 Site/Area Protection*: minimise human disturbance at breeding colonies.	-	Anecdotal	-	-	-
2	*3.1.1. Harvest Management*: regulate fisheries more stringently (in terms of bycatch thresholds, closed areas, net exclusion devices).	-	Anecdotal	-	-	-

Research priorities:

- Understanding cause of decline since the 1950s, and reasons for current increase.
- Understanding the causes and consequences of skipping behaviour in breeding female southern elephant seals
- Understanding individual temporal and spatial variation in foraging behaviour
- The effect of global climate change on the foraging and breeding behaviour of this species.
- The incredible physiological feats shown by the species, for example deep diving, breath holding and fasting abilities, provide challenging questions to enhance our broader understanding of ecophysiology, environmental adaptation and evolution in mammals more generally.

Encouraged citizen actions:

- Foraging ecology research is progressing but impeded by the financial investment that is required for satellite telemetry. Aid in funding this aspect can be securely provided through: http://www.givengain.com/cause/4655/

Data Sources and Quality

Table 4. Information and interpretation qualifiers for the Southern Elephant Seal (*Mirounga leonina*) assessment

Data sources	Field study (literature, unpublished)
Data quality (max)	Estimated
Data quality (min)	Estimated
Uncertainty resolution	Best estimate
Risk tolerance	Evidentiary

References

Bailleul F, Charrassin JB, Monestiez P, Roquet F, Biuw M, Guinet C. 2007. Successful foraging zones of southern elephant seals from the Kerguelen Islands in relation to oceanographic conditions. Philosophical Transactions of the Royal Society B, Biological Sciences **362**:2169–2181.

Bester M. 2014. Marine Mammals – Natural and Anthropogenic Influences. Pages 167–174 in Freedman B, editor. Global Environmental Change. Springer, Dordrecht, Netherlands.

Bester MN, Möller H, Wium J, Enslin B. 2001. An update on the status of southern elephant seals at Gough Island. South African Journal of Wildlife Research **31**:68–71.

Biuw M et al. 2007. Variations in behavior and condition of a Southern Ocean top predator in relation to in situ oceanographic conditions. Proceedings of the National Academy of Sciences of the United States of America **104**:13705–13710.

Campagna C, Falabella V, Lewis M. 2007. Entanglement of southern elephant seals in squid fishing gear. Marine Mammal Science **23**:414–418.

De Bruyn PJN, Tosh CA, Bester MN, Cameron EZ, McIntyre T, Wilkinson IS. 2011. Sex at sea: alternative mating system in an extremely polygynous mammal. Animal Behaviour **82**:445–451.

Hofmeyr G, De MM, Beste M, Kirkman S, Pistorius P, Makhado A. 2002. Entanglement of pinnipeds at Marion Island, Southern Ocean: 1991–2001. Australian Mammalogy **24**:141–146.

Jones E. 1981. Age in relation to breeding status of the male southern elephant seal, *Mirounga leonina* (L.), at Macquarie Island. Australian Wildlife Reseach **8**:327–334.

Learmonth JA, Macleod CD, Santos MB, Pierce GJ, Crick HQP, Robinson RA. 2006. Potential effects of climate change on marine mammals. Oceanography and Marine Biology: An Annual Review **44**:431–464.

McCann TS. 1980. Population structure and social organization of southern elephant seals *Mirounga leonina*. (L). Biological Journal of the Linnean Society **14**:133–150.

McIntyre T, Ansorge IJ, Bornemann AH, Plötz J, Tosh CA, Bester MN. 2011. Elephant seal dive behaviour is influenced by ocean temperature: implications for climate change impacts on an ocean predator. Marine Ecology Progress Series **441**:257–272.

McIntyre T, de Bruyn PJN, Ansorge I, Bester MN, Bornemann H, Plötz J, Tosh CA. 2010. A lifetime at depth: vertical distribution of southern elephant seals in the water column. Polar Biology **33**:1037–1048.

McMahon CR, Bester MN, Hindell MA, Brook BW, Bradshaw CJ. 2009. Shifting trends: detecting environmentally mediated regulation in long-lived marine vertebrates using time-series data. Oecologia **159**:69–82.

Oosthuizen WC, Bester MN, Tosh CA, Guinet C, Besson D, de Bruyn PJN. 2011. Dispersal and dispersion of southern elephant seals in the Kerguelen Province Southern Ocean. Antarctic Science **23**:567–577.

Pistorius PA, Bester MN, Kirkman SP. 1999. Survivorship of a declining population of southern elephant seals, *Mirounga leonina*, in relation to age, sex and cohort. Oecologia **121**:201–211.

Pistorius PA, Bester MN, Lewis M, Taylor FE, Campagna C, Kirkman SP. 2004. Adult female survival, population trend, and the implication of early primiparity in a capital breeder, the southern elephant seal (*Mirounga leonina*). Journal of Zoology **263**:107–119.

Pistorius PA, de Bruyn PJN, Bester MN. 2011. Population dynamics of southern elephant seals: a synthesis of three decades of demographic research at Marion Island. African Journal of Marine Science **33**:523–534.

Reijnders P, Brasseur S, van der Toorn J, van der Wolf P, Body I, Harwood J, Lavigne D, Lowry L. 1993. Seals, fur seals, sea lions, and walrus. Status survey and conservation action plan. IUCN, Gland, Switzerland.

Reisinger RR, Bester MN. 2010. Long distance breeding dispersal of a southern elephant seal. Polar Biology **33**:1289–1291.

Reisinger RR, de Bruyn PJN, Bester MN. 2011. Predatory impact of killer whales on pinniped and penguin populations at the Subantarctic Prince Edward Islands: fact and fiction. Journal of Zoology **285**:1–10.

Smith VR. 2008. Energy flow and nutrient cycling in the Marion Island terrestrial ecosystem: 30 years on. Polar Record **44**: 211–226.

Tosh CA, de Bruyn PN, Steyn J, Bornemann H, van den Hoff J, Stewart BS, Plötz J, Bester MN. 2015. The importance of seasonal sea surface height anomalies for foraging juvenile southern elephant seals. Marine Biology **162**:2131–2140.

Assessors and Reviewers

P.J. Nico de Bruyn[1], Marthán N. Bester[1], W. Chris Oosthuizen[1], G.J. Greg Hofmeyr[2,3], Pierre A. Pistorius[3]

[1]University of Pretoria, [2]Port Elizabeth Museum at Bayworld, [3]Nelson Mandela Metropolitan University

Contributors

Stephen P. Kirkman[1], Herman Oosthuizen[1], Mike Meyer[1], Mdu Seakamela[1], Lloyd Lowry[2], Cheryl A. Tosh[3], Samantha Page-Nicholson[4], Mia Wege[3], Matthew F. Child[4]

[1]Department of Environmental Affairs, [2]IUCN SSC Pinniped Specialist Group, [3]University of Pretoria, [4]Endangered Wildlife Trust

Details of the methods used to make this assessment can be found in *Mammal Red List 2016: Introduction and Methodology.*