Arctocephalus pusillus pusillus – Cape Fur Seal


G. J. Greg Hofmeyr

Regional Red List status (2016)	**Least Concern**
National Red List status (2004)	Least Concern
Reasons for change	No change
Global Red List status (2015)	Least Concern
TOPS listing (NEMBA) (2007)	None
CITES listing (1977)	Appendix II (species level)
Endemic	No

"This is a roaring, riotous period on the lone islets. No bull is satisfied until he has gathered twenty or thirty females round him. And no bull gathers his harem without being challenged every minute of the day. After watching the battle of the bulls I felt that the animal kingdom had nothing more to offer me in the way of heavy-weight fury. This is the age-old social order of the seals, and it is devastating in its ruthless adherence to the victory of the strongest" (Green 1950).

Taxonomy

Arctocephalus pusillus pusillus (Schreber 1775)

ANIMALIA - CHORDATA - MAMMALIA - CARNIVORA - OTARIIDAE – *Arctocephalus - pusillus - pusillus*

Synonyms: *Phoca pusilla* (Schreber 1775)

Common names: Cape Fur Seal, Afro-Australian Fur Seal, Brown Fur Seal, South African Fur Seal (English), Kaapsepelsrob (Afrikaans), Lenyedi (Sepedi), Sili Ya Vhukuse (Venda), Inja Yolwandle Yesakapa (Xhosa), Imvu Yamanzi (Zulu)

Taxonomic status: Subspecies

Taxonomic notes: Two subspecies are recognised: *Arctocephalus pusillus pusillus* (Cape Fur Seal) and *Arctocephalus pusillus doriferus* (Australian Fur Seal). The two recognised subspecies of *Arctocephalus pusillus* are almost identical in both anatomy and behaviour (Warneke & Shaughnessy 1985). Repenning et al. (1971) accorded them subspecific status based on one cranial character and separate geographic ranges. Very low genetic divergence indicates that they split relatively recently, with the Australian subspecies being the more recently established (Lento et al. 1997; Wynen et al. 2001).

Assessment Rationale

Due to its large population size, lack of major threats, and recently documented range expansions, the Cape Fur Seal of South Africa should remain classified as Least Concern. However, continued and increasing competition with fisheries, fisheries bycatch, entanglement in marine debris, and effects of climate change may threaten local colonies in the future. Mitigation measures should be put in place to counteract these threats.

Regional population effects: Breeding colonies occur at numerous island and mainland sites along the south and west coasts of South Africa and the population is contiguous with the population in Namibia (Oosthuizen 1991; Kirkman et al. 2013).

Distribution

It is thought that historically the Cape Fur Seal population occurred on most, if not all, the coastal islands off South Africa and Namibia. However, uncontrolled seal harvesting and habitat modification resulted in shifts in the distribution of the breeding population, with the bulk of the population currently breeding at mainland sites while colonies at many former breeding islands are extinct (Kirkman et al. 2007). Since the 1970s there has been range expansion and a considerable increase in the number of breeding colonies from 23 to 40 (Kirkman et al. 2013). While the eastern-most extent of the breeding range has remained at Algoa Bay in South Africa, the northern limit has recently extended from northern Namibia to Ilha dos Tigres in southern Angola. Angola has one breeding colony of Cape Fur Seals forming the north-western limit of the population's breeding distribution with Algoa Bay forming the eastern limit. Cape Fur Seals also occur at several non-breeding colonies or temporary haul-out sites throughout their range, while vagrants have been sighted as far afield as Gabon (Thibault 1999) and the Prince Edward Islands (Kerley 1983).

Within the assessment area, the range of the breeding population is between Black Rocks in Algoa Bay, and Buchu Twins, which lies just south of the Orange River mouth. New breeding colonies have been established within this range in recent years, and some locations of historical breeding colonies such as Vondeling Island (Kirkman et al. 2013) and the Robberg Peninsula in Plettenberg Bay (Huisamen et al. 2011) have been re-colonised.

Cape Fur Seals are generally not migratory. However, small numbers do move eastwards to follow the Sardine Run during winter (O'Donoghue et al. 2010). While this

Recommended citation: Kirkman SP, Hofmeyr GJG, Seakamela SM, Pistorius PA. 2016. A conservation assessment of *Arctocephalus pusillus pusillus*. 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.

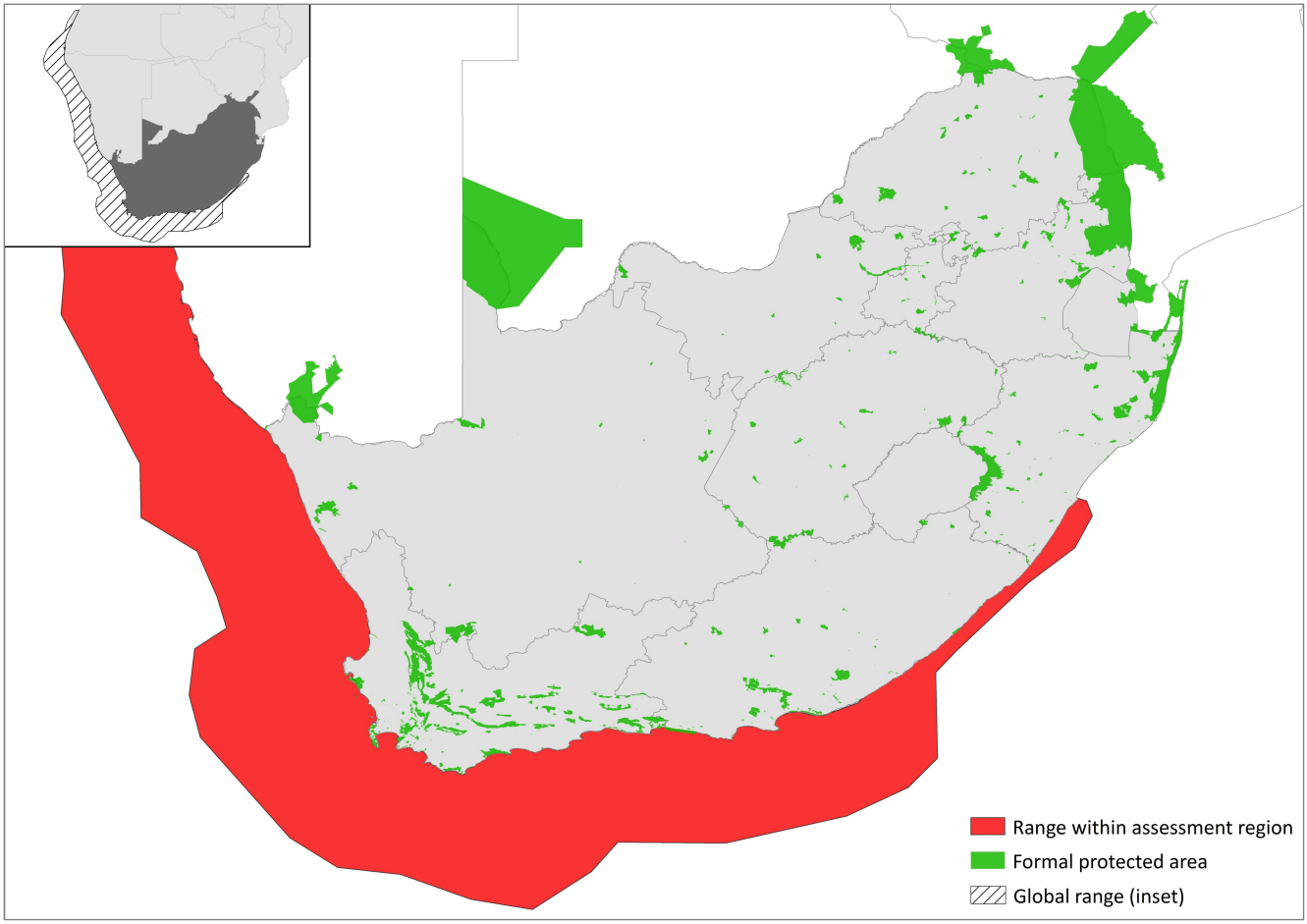

Figure 1. Distribution records for Cape Fur Seal (*Arctocephalus pusillus pusillus*) within the assessment region

Table 1. Countries of occurrence within southern Africa

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

species breeds seasonally, haul-outs are occupied year-round (David 1987a). Feeding is generally restricted to the continental shelf area (David 1987b).

Population

The size of the Cape Fur Seal population in the early 1990s was estimated at about 1.7 million individuals aged one and older (Butterworth et al. 1995). Despite range expansion, the overall population size appears to have remained relatively stable since the early 1990s, according to pup count trends (Kirkman et al. 2007). Several new breeding colonies have established, especially in the north of Namibia and southern Angola, offset by declines in other colonies, especially in the south of Namibia (Kirkman et al. 2013). Currently, approximately 40 breeding colonies are found throughout the range of the species, compared with 23 in the early 1970s (Kirkman et al. 2013). The current size of the population in South Africa also appears similar to the early 1990s, based on pup count trends (Kirkman et al. 2013). Given that some 40% of the total population occurs in South Africa (Kirkman et al. 2007, 2013), the population in this country (aged one and older) is expected to be about 680,000 individuals. There are currently 16 breeding colonies in South Africa (Kirkman et al. 2013).

While the breeding colonies are separated by distances of up to several hundred kilometres, tag data (Oosthuizen 1991) and genetic evidence indicate that there is substantial movement between them (Matthee et al. 2006). Thus, there is gene flow between Angolan, Namibian and South African populations.

In 2004, some 75% of Cape Fur Seals bred at three sites: the Atlas Bay-Wolf Bay-Long Islands Group and Cape Cross in Namibia, and Kleinzee in South Africa. While the abundances of the larger breeding colonies are relatively stable, they do experience fluctuations (Kirkman et al. 2013). These fluctuations are greater in southern Namibian breeding colonies (Kirkman et al. 2013), which have experienced major mortality events due to the impact of poor environmental conditions on prey populations (Roux 1998). In 2009, pup production at the Kleinzee breeding colony, which accounts for the majority of the South African population, had declined by about 40% from its peak rate (Kirkman et al. 2013). Smaller breeding colonies, most of which are estimated to contain more than 1,000 adults (Kirkman et al. 2007), tend to experience greater fluctuations than larger breeding colonies (Kirkman et al. 2007, 2013). Towards the east of their distribution, the relatively small colony on Robberg

Photo 1. Cape Fur Seals (*Arctocephalus pusillus pusillus*) showing the size dimorphism between the adult male in the centre and adult females around him, and also their tolerance of bodily contact (thigmotactism) (Francois Lampen).

Peninsula is increasing rapidly, now numbering well above 3,000 individuals (Huisamen et al. 2011).

Generation length has been calculated at 9.1 years (Pacifici et al. 2013). Population change over three generations from 1982–2009 has been positive (Kirkman et al. 2013).

Current population trend: Stable

Continuing decline in mature individuals: Not evident

Number of mature individuals in population: Approximately 1.7 million animals aged one and older in the entire population, including approximately 680,000 in the assessment region.

Number of mature individuals in largest subpopulation: > 1,000

Number of subpopulations: Based on molecular analyses there is no evidence for significant subpopulations (Matthee et al. 2006).

Severely fragmented: No

Habitats and Ecology

The Cape Fur Seal and the conspecific Australian Fur Seal are the largest of all the fur seals. They are also highly sexually dimorphic. Adult male Cape Fur Seals are 2–2.3 m long and average 247 kg in weight. Adult females are 1.2–1.6 m long and weigh an average of 57 kg. At birth they weigh around 6 kg (Shaughnessy 1979). Females become sexually mature at 3–6 years and males at 9–12 years (Wickens & York 1997). The annual pregnancy rate of mature females has been estimated at 71% (Wickens & York 1997). Gestation is known to last 51 weeks, including a three-month delay of implantation but longevity and adult mortality are unknown (Reijnders et al. 1993; Butterworth et al. 1995; Wickens & York 1997).

Cape Fur Seals are highly polygynous with breeding males defending territories where multiple females gather to pup. Breeding occurs from late October to the beginning of January, with adult males arriving at the colonies first. Females give birth 1.5–2 days after their arrival. The peak of pupping is in the first week of December, although there is some variation between colonies (David 1987a). Mothers attend to their pup for about 6-7 days before coming into oestrous, mating, and departing on their first foraging trip (Rand 1955). From then until the time of weaning, the mothers alternate between regular foraging trips to sea and shore visits to nourish their pups with milk. Pups are usually weaned at 10–12 months of age. The Cape Fur Seal and the Australian Fur Seal differ from other fur seals in that they are highly tolerant of bodily contact (thigmotactism), a behavioural trait that they have in common with sea lions.

Cape Fur Seals are generalist foragers that take a wide variety of pelagic, demersal and benthic prey, including cape hake (*Merluccius* spp.), horse mackerel (*Trachurus* spp.), Pelagic Goby (*Sufflogobius bibarbatus*), pilchards (*Sardinops* sp.), anchovy, squid of the genus *Loligo*, rock lobster, shrimp, prawns, and amphipods (David 1987a; de Bruyn et al. 2003; Mecenero et al. 2006; Huisamen et al. 2012). They (primarily rogue males) have also been reported to predate on seabirds, including the African Penguin (*Spheniscus demersus*) and the Cape Gannet (*Morus capensis*), both of which are of conservation concern (Crawford et al. 1989).

Great White Sharks (*Carcharodon carcharias*) (Martin et al. 2005) and Killer Whales (*Orcinus orca*) (Rand 1955) are predators of the Cape Fur Seal at sea. On shore their pups are preyed upon by Black-backed Jackal (*Canis mesomelas*) and Brown Hyaenas (*Hyena brunnea*) (Oosthuizen et al. 1997; Wiesel 2010).

Ecosystem and cultural services: The Cape Fur Seal is the only pinniped breeding in mainland South Africa. As a top predator they most likely have a critical role in prey regulation and the structure and functioning of the ecosystem. This role is difficult to elucidate especially given the complexity of the marine food web, but modelling studies have provided some insight in this regard. While Cape Fur Seals are frequently suggested to be significant competitors with commercial fisheries, modelling has suggested that predation by Cape Fur Seals on predatory fish (for example, hake) could possibly result in greater biomass of target fish available for fisheries, with potential for a net negative impact on the fishery if seal numbers were reduced (Punt & Butterworth 1995).

Changes in numbers, distribution or other characteristics of marine higher predators such as the Cape Fur Seal are frequently symptomatic of changes occurring at lower trophic levels, such as may be caused by effects of overfishing or other environmental (e.g. climatic) changes. Therefore they potentially serve as useful indicators of ecosystem health or changes in marine resources, especially because their habit of hauling out on land makes them accessible to researchers (Kirkman et al. 2011).

The Cape Fur Seal also serves as prey for other predators, including the iconic Great White Shark (Martin et al. 2005). The attractiveness of seal colonies on the southwest coast to Great White Sharks, and associated shark-seal predatory interactions, is important for the commercial success of the Great White Shark viewing ecotourism industry. Cape Fur Seal colonies provide a reliable attraction (unlike more elusive species targeted for tourist viewing such as some whales, dolphins and sharks) and are part of the viewing experience on offer by several ecotourism ventures. Some seal colonies on the mainland can also be viewed by land-based tourists, usually as part of a broader package. Examples are at the Kleinsee colony which is situated in a mining lease and is one of the viewing experiences on offer during mine tours, and the Bird Island Reserve in Lambert's Bay, where a seal colony is visible from a tourist hide beside the gannetry.

Use and Trade

The Cape Fur Seal was formerly harvested commercially in South Africa until this was suspended in 1990 (Hanks 1990; Wickens et al. 1991). The killing of seals for profit in South Africa is now prohibited in terms of the Marine Living Resources Act (MLRA 1998). It is still harvested commercially in Namibia and is also hunted for sport (trophy) in that country (Campbell et al. 2011; Japp et al. 2012). Products of commercial seal harvesting include fur products from pelts, leather products from skin, medicinal uses (genitalia and oil) and fodder (meat, bone meal and oil), as well as subsistence consumption (meat) (Campbell et al. 2011).

Threats

Bycatch in fisheries operations (e.g. trawls, purse-seines) and entanglement in marine debris (mostly materials associated with fishing) result in the mortality of Cape Fur Seals. Numbers affected have been estimated to be low (< 1% of population size) (Shaughnessy 1980; Wickens et al. 1992), although bycatch could result in localised depletion of numbers. The numbers of seals killed illegally by fishermen, especially where seals interfere with fishing operations (e.g. line or long-line fisheries) are unknown, but potentially higher than bycatch- or entanglement-related mortality levels (Wickens et al. 1992; David & Wickens 2003). Effects of seal-fishery operational interactions on the seal population should be re-

Table 2. Threats to the Cape Fur Seal (*Arctocephalus pusillus pusillus*) 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	*5.4.4 Fishing & Harvesting Aquatic Resources*: competition with fisheries resulting in loss of prey base; bycatch.	Wickens et al. 1992	Empirical	Regional	Increasing
		Roy et al. 2007	Indirect	Regional	
		Coetzee et al. 2008	Indirect	Regional	
2	*11.5 Climate Change & Severe* Weather: climate change affecting prey base.	Roy et al. 2007 Coetzee et al. 2008	Indirect Indirect	Regional Regional	Increasing
3	*5.1.3 Hunting & Collecting Terrestrial Animals*: illegal killing of seals.	-	Anecdotal	-	Unknown
4	*5.1.1 Hunting & Collecting Terrestrial Animals*: effects of continued harvesting in Namibia on population in assessment area.	Japp et al. 2012	Indirect	Regional	Unknown
5	*9.3.3 Agricultural & Forestry Effluents*: organochlorines causing mortalities.	-	Anecdotal	-	Increasing
6	*8.1.1 Invasive Non-Native/Alien Species/Diseases*: disease transmission from terrestrial animals.	-	Anecdotal	-	Unknown
7	*6.1 Recreational Activities*: human intrusions and disturbance due to ecotourism, at breeding grounds.	-	Anecdotal	-	Increasing

examined, especially given the growth of some fisheries since the previous assessments (e.g. long-lining, midwater trawling).

Seals prey on several species that are also targeted by commercial or recreational fisheries (David 1987b; Wickens et al. 1992). The effects of these trophic interactions with fisheries on the seal population are difficult to quantify given the complexities of the marine food web and the fact that seals also prey on a range of other species that are not targeted by fisheries (David 1987b). However, trophic interactions with fisheries potentially pose a much greater threat to the seal population than operational interactions, especially considering increasing trends in fishing effort and declining catch rate trends (e.g. Mann 2013). This may be exacerbated by shifts in prey distribution and abundance associated with ecosystem changes (e.g. related to climate change). As an example, there has been a recent south and eastward shift in the epicentre of anchovy and sardine biomass along the South African coast (Roy et al. 2007; Coetzee et al. 2008) which would have negatively impacted on availability of these prey items to some colonies.

The Cape Fur Seal has been impacted by natural mass mortality events (affecting pups as well as older age classes). These have been associated with unfavourable environmental conditions with detrimental effects on prey populations and therefore feeding conditions (Gerber & Hillborn 2001). Thus far, such events are only known for Namibia and one such event, in 1994/95, was the largest mass die off recorded for any seal species (Harwood 2002). However, ecosystem changes, possibly associated with climate change, could conceivably threaten the population in the assessment area with similar mass die offs in the future. Such events would likely be exacerbated by fishing pressure, just as the 1994/95 event in Namibia is believed to have been intensified by high levels of fishing at the time (Boyer & Hampton 2001). In recent years relatively high numbers of dead or malnourished stranded Cape Fur Seals have been observed on the west coast of the country, where fish stocks are known to be depleted (Department of Environmental Affairs unpubl. data).

Other potential threats of climatic changes include predicted sea level rises and increased frequencies of extreme weather events (e.g. storms). These may threaten the viability of seal colonies at small, low lying islands such as Black Rocks in Algoa Bay (Stewardson 1999) and could result in localised depletions of numbers. A further threat is increased mortality, especially of young pups, associated with increased incurrence of heat stress caused by increased air temperatures, a decrease in cooling winds or increased numbers of hot days per year. This threat may be most relevant to mainland colonies (e.g. de Villiers & Roux 1992).

Several morbillivirus epidemics have occurred in true seal (Phocid) populations in the northern hemisphere, and it is thought that the infections were transmitted to the seals by domestic dogs or terrestrial carnivores (Kennedy et al. 2000). Although no epidemic diseases are known to have infected Cape Fur Seals historically, there is considerable risk for disease transmission to the population through exposure to domestic or feral dogs and terrestrial carnivores such as Black-backed Jackal, potentially resulting in mass mortality. Jackals, which hunt and scavenge in mainland seal colonies, are thought to be ideal vectors of disease because they are highly sociable and may range far. The health of individuals and their vulnerability to disease can be affected by feeding conditions (availability of prey), therefore risk of disease may be exacerbated by the effects of climatic changes and/or overfishing on the ecosystem.

Cape Fur Seals were hunted heavily during the 17th to 19th centuries and were reduced to low levels, but have recovered under protective legislation first introduced in 1893 (Butterworth et al. 1995). Under protection, the population has increased greatly, although it is unknown whether it has recovered to pre-exploitation levels (Kirkman et al. 2007). Commercial seal harvesting in South Africa was suspended in 1990 but continues in neighbouring Namibia. Given ongoing high harvesting levels at the three largest seal colonies in Namibia (Japp et al. 2012), there is potential for Namibia to be a sink area for seals from the assessment region. These include breeding age males as well as first year animals, both of which have been recorded moving from South Africa to Namibia (Oosthuizen 1991). The extent of such movement or the rate at which these animals are harvested is unknown, but is unlikely to result in severe population declines in the assessment region.

Human disturbance, associated for example with tourist activities, can potentially impact the target species on both short- and long-term scales. Short-term changes are immediate and are often easily identifiable as behavioural responses. Cape Fur Seals typically flee from human presence when on land, so extreme cases of disturbance can result in stampeding, potentially causing injury or death, especially to pups. However, short-term behavioural changes may also lead to long-term changes that are more subtle but which may still impact negatively on individuals or populations. In the context of seal colonies, the effects of human disturbance could include modification of behaviour. If this results in increased activity, displacement of animals from favoured areas, it may lead to a decrease in available energy. Such disturbance could also potentially disrupt mother-pup bonds, leading to abandonment of offspring (Boren et al. 2002; Gales et al. 2003). This threat is localised affecting only the eight colonies currently associated with tourism. Changes in human land-use patterns are also of concern. The mainland colony at Kleinsee, which supports two-thirds of South Africa's pup production, is afforded some protection by virtue of the restricted access mining lease area within which it is situated (Shaughnessy 1980). Should mining cease and the area become accessible to the public, this colony may become threatened through human interference.

Like other fur seals, Cape Fur Seals are vulnerable to oil spills which can reduce the insulation properties of their fur or be ingested in toxic concentrations (Kirkwood & Goldsworthy 2013). Other anthropogenic toxins could potentially also lead to individual or mass mortalities by damaging the immune, endocrine or nervous systems of animals, and disrupting growth and resistance to disease (Kirkwood & Goldsworthy 2013). An example is organochlorines (pesticides) that can enter the marine environment in agricultural runoff or urban effluent. Because organochlorines are resistant to degradation they readily accumulate in marine food chains and can concentrate in higher predators such as the Cape Fur Seal.

Current habitat trend: Stable

Conservation

Although Cape Fur Seals have been protected in South Africa since 1893, they were still subject to government-run or government-authorised commercial harvests until 1990 (Wickens et al. 1991; Butterworth et al. 1995). The Seabirds and Seals Protection Act (SBSPA; Act no. 46 of 1973), provides broad protection for seals in South Africa, and killing of seals for profit is now prohibited in terms of the Marine Living Resources Act (Act no. 18 of 1998; Policy on the management of seals, seabirds and shorebirds. Government Gazette No. 30534, 2007).

Apart from the protection of island breeding habitat of seals in terms of the SBSPA, some of the seal colonies occur within or adjacent to marine protected areas (MPAs) or reserves. These include the colonies situated at:

- Black Rocks (Bird Island MPA, SANParks)
- Robberg Peninsula (Robberg Nature Reserve and Marine Protected Area, CapeNature)
- Quoin Rock and Geyser Rock (Dyer Island Nature Reserve Complex, CapeNature)
- Duikerklip (Table Mountain National Park MPA, SANParks)
- Vondeling Island (Vondeling Island Reserve, CapeNature)
- Bird Island, Lambert's Bay (Bird Island Reserve, CapeNature).

Besides Vondeling Island, seals also haul out on other islands adjacent to the West Coast National Park around which MPAs have been declared (e.g. Jutten Island, SANParks). Three mainland breeding colonies in the Northern Cape including the South Africa's largest Cape Fur Seal breeding colony near Kleinsee, occur in mining lease areas where human access is restricted, affording these colonies a level of protection.

While no specific interventions are necessary at present, Cape Fur Seals would benefit from more stringent regulation of fisheries and protection of breeding habitat. For example, mitigation measures in New Zealand's hoki trawl fishery reduced Hooker's Sea Lion (*Phocarctos hookeri*) bycatch by almost 90%, and the population showed signs of recovery following their implementation (Porritt & Goodman 2005). Ongoing monitoring and research within the assessment region is also required.

Recommendations for land managers and practitioners:

- Continuation of regular population censuses (aerial pup surveys).
- Monitor changes in key population parameters that may be related to climatic or other changes.
- Regional (transboundary) cooperation with regard to research and monitoring, including standardisation of research methods.
- Regulation of seal ecotourism activities.
- Ensuring protection of mainland seal colonies situated in current mining lease areas where human access has been restricted, in the event that these areas become accessible to the public.
- Prevention of direct mortality due to fisheries operations.

Research priorities: The following research topics are currently being investigated:

- Demography, diet and foraging behaviour of Cape Fur Seals in Algoa Bay (Port Elizabeth Museum, Nelson Mandela Metropolitan University and Department of Environmental Affairs, DEA).
- Seal-seabirds interaction at Vondeling Island (DEA/ CapeNature, ongoing).
- Diet of the Cape Fur Seal at key colonies on the West and South Coasts (DEA, long-term monitoring effort).
- Cape Fur Seal pup trends from comprehensive aerial surveys (DEA, long term monitoring effort).
- White Shark predation risk effects on seal foraging dynamics and stress levels: implications for ecosystem structure and function (DEA and University of Miami).
- Identifying important foraging zones for Cape Fur Seals (DEA/Deakin University).
- Monitoring of marine debris entangling the Cape Fur Seal (DEA long-term monitoring effort).
- Assessing the effects of "swim-with-seal" tourism activities on a seal colony (Nelson Mandela Metropolitan University/DEA).

Table 3. Conservation interventions for the Cape Fur Seal (*Arctocephalus pusillus pusillus*) 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	*3.1.1 Harvest Management*: regulate fisheries more stringently (in terms of bycatch thresholds, closed areas, net exclusion devices).	Porritt & Goodman 2005	Empirical	International	Sea lion (New Zealand) bycatch reduced by 90%.	Department of Environmental Affairs
2	*1.1 Site/Area Protection*: ensure adequate protection of breeding colonies (for example, inclusion in MPAs).	Kirkman et al. 2007	Empirical	National	Population stable since 1993.	Department of Environmental Affairs
3	*2.1 Site/Area Management*: minimise human disturbance at breeding colonies.	-	Anecdotal	-	-	Department of Environmental Affairs

The following research topics should be investigated:

- Updated assessments of extent of trophic interactions between seals and fishing, including development of population and bioenergetics models to determine consumption rates, and spatial models of foraging effort distribution.
- Updated assessments of operational interactions between seals and fisheries to provide estimates of effects on the population and revised recommendations for mitigation.
- Assessment of effects of seal ecotourism activities on seal colonies.
- Assessments of effects of variability in the environment and prey availability on the population, through long-term monitoring of key parameters or indices, e.g. diet, foraging trip duration, foraging distributions, breeding phenology, abortion rates, pup birth mass and growth, early survival rates, at key locations.
- Monitoring of incidences of dead or live stranded animals, including malnourished, sick or entangled animals and determining cause of death where applicable (relevant to monitoring the health of the population, detecting unusual events and identifying their causes).
- Investigation of population parameters required for extending pup counts to total population size (including e.g. birth and survival rates and variability in these between areas), given that assumptions for previous assessments may not be valid for the current population.

Encouraged citizen actions:

- Citizens can contribute by reporting of stranded, sick, injured or entangled seals to appropriate authorities, as opposed to intervening on their own, which could result in injury or disease transmission. This can also assist with monitoring the health of the population, detecting unusual events and identifying their causes.
- Report sightings on virtual museum platforms (for example, iSpot and MammalMAP), especially outside protected areas.

Data Sources and Quality

Table 4. Information and interpretation qualifiers for the Cape Fur Seal (*Arctocephalus pusillus pusillus*) assessment

Data sources	Field study (literature)
Data quality (max)	Estimated
Data quality (min)	Estimated
Uncertainty resolution	Confidence intervals
Risk tolerance	Evidentiary

References

Boren LJ, Gemmell NJ, Barton KJ. 2002. Tourist disturbance on New Zealand fur seals *Arctocephalus forsteri*. Australian Mammalogy **24**:85–95.

Boyer DC, Hampton I. 2001. An overview of the living marine resources of Namibia. South African Journal of Marine Science **23**:5–35.

Butterworth DS, Punt AE, Wickens PA. 1995. The effects of future consumption by the Cape fur seal on catches and catch rates of the Cape hakes. 3. Modelling the dynamics of the Cape fur seal *Arctocephalus pusillus pusillus*. South African Journal of Marine Science **16**:161–183.

Campbell R, Knowles T, O'Connor S. 2011. The economics of seal hunting and seal watching in Namibia. A report for Humane Society International, World Society for the Protection of Animals, Bont Voor Dieren (NL) and Respect for Animals (UK), prepared by Economists at Large. Melbourne, Australia.

Coetzee JC, van der Lingen CD, Hutchings L, Fairweather TP. 2008. Has the fishery contributed to a major shift in the distribution of South African sardine? ICES Journal of Marine Science **65**:1676–1688.

Crawford RJM, David JHM, Williams AJ, Dyer BM. 1989. Competition for space: recolonizing seals displace endangered, endemic seabirds off Namibia. Biological Conservation **48**:59–72.

David JHM. 1987a. Diet of the South African (Cape) fur seal. South African Journal of Marine Science **5**:693–713.

David JHM. 1987b. South African fur seal *Arctocephalus pusillus pusillus*. Pages 65–71 in Croxall JP, Gentry RL, editors. Status, Biology, and Ecology of Fur Seals. Proceedings of an International Symposium and Workshop, Cambridge, England, 23–27 April 1984. NOAA Technical Report NMFS 51, Seattle, Washington, USA.

David JHM, Wickens PA. 2003. Management of Cape fur seals and fisheries in South Africa. Pages 116–135 in Gales N, Hindell MA, Kirkwood K, editors. Marine Mammals: Fisheries, Tourism and Management Issues. CSIRO Publishing, Melbourne, Australia.

de Bruyn PJN, Bester MN, Mecenero S, Kirkman SP, Roux J-P, Klages NTW. 2003. Temporal variation of cephalopods in the diet of Cape fur seals in Namibia. South African Journal of Wildlife Research **33**:85–96.

de Villiers DJ, Roux J-P. 1992 Mortality of newborn pups of the South African fur seal *Arctocephalus pusillus pusillus* in Namibia. South African Journal of Marine Science **12**:881–889.

Gales N, Brennan A, Baker R. 2003. Ethics and marine mammal research. Pages 321–329 in Gales N, Hindell MA, Kirkwood K, editors. Marine Mammals: Fisheries, Tourism and Management Issues. CSIRO Publishing, Melbourne, Australia.

Gerber LR, Hillborn R. 2001. Catastrophic events and recovery from low densities in populations of otariids: implications for risk of extinction. Mammal Review **31**:131–150.

Hanks J. 1990. Report to the subcommittee of the Sea Fisheries Advisory Committee appointed at the request of the Minister of Environment Affairs and of Water Affairs, to advise the Minister on scientific aspects of sealing. Southern African Nature Foundation.

Harwood J. 2002. Mass die-offs. Pages 724–726 in Perrin WF, Wursig B, Thewisse JGM, editors. Encyclopaedia of Marine Mammals. Academic Press, New York, USA.

Huisamen J, Kirkman SP, Watson LH, Cockcroft VG, Jewell R, Pistorius PA. 2012. Diet of the Cape fur seal *Arctocephalus pusillus pusillus* in Plettenberg Bay, South Africa, and the implications for fisheries. African Journal of Marine Science **34**:431–441.

Huisamen J, Kirkman SP, Watson LH, Cockcroft VG, Pistorius PA. 2011. Re-colonisation of the Robberg Peninsula (Plettenberg Bay, South Africa) by Cape fur seal. African Journal of Marine Science **33**:453–462.

Japp DW, Purves MG, Wilkinson S. 2012. Benguela Current Large Marine Ecosystem: State of the Stocks Report 2012. Capricorn Fisheries Monitoring for Benguela Current Commission, Cape Town, South Africa.

Kennedy S, et al. 2000. Mass die-off of Caspian seals caused by canine distemper virus. Emerging Infectious Diseases **6**:639–639.

Kerley GIH. 1983. Comparison of seasonal haul-out patterns of fur seals, *Arctocephalus tropicalis* and *Arctocephalus gazella* on subantarctic Marion Island. South African Journal of Wildlife Research **13**:71–77.

Kirkman SP, Oosthuizen WH, Meÿer MA, Kotze PGH, Roux J-P, Underhill LG. 2007. Making sense of censuses and dealing with missing data: trends in pup counts of Cape fur seal *Arctocephalus pusillus pusillus* for the period 1972–2004. South African Journal of Marine Science **29**:161–176.

Kirkman SP, Oosthuizen WH, Meÿer MA, Seakamela SM, Underhill LG. 2011. Prioritising range-wide scientific monitoring of the Cape fur seal in southern Africa. African Journal of Marine Science **33**:495–509.

Kirkman SP, Yemane D, Oosthuizen WH, Meÿer MA, Kotze PGH, Skrypzeck H, vaz Velho F, Underhill LG. 2013. Spatio-temporal shifts of the dynamic Cape fur seal population in southern Africa, based on aerial censuses (1972–2009). Marine Mammal Science **29**:497–524.

Kirkwood R, Goldsworthy S. 2013. Fur Seals and Sea Lions. CSIRO Publishing, Collingwood, Australia.

Lento GM, Haddon M, Chambers GK, Baker CS. 1997. Genetic variation of southern hemisphere fur seals (*Arctocephalus* spp.): Investigation of population structure and species identity. Journal of Heredity **88**:202–208.

Mann BQ. 2013. Southern African Marine Linefish Species Profiles. Special publication No. 9. Oceanographic Research Institute, Durban, South Africa.

Martin AR, Hammerschlag N, Collier RS, Fallows C. 2005. Predatory behaviour of white sharks (*Carcharodon carcharias*) at Seal Island, South Africa. Journal of the Marine Biological Association of the U.K. **85**:1121–1135.

Matthee CA, Fourie F, Oosthuizen WH, Meÿer MA, Tolley KA. 2006. Mitochondrial DNA sequence data of the Cape fur seal (*Arctocephalus pusillus pusillus*) suggest that population numbers may be affected by climatic shifts. Marine Biology **148**:899–905.

Mecenero S, Roux JP, Underhill LG, Bester MN. 2006. Diet of Cape fur seals *Arctocephalus pusillus pusillus* at three mainland breeding colonies in Namibia. African Journal of Marine Science **28**:57–71.

O'Donoghue SH, Whittington PA, Dyer BM, Peddemors V. 2010. Abundance and distribution of avian and marine mammal predators of sardine observed during the 2005 KwaZulu-Natal sardine run survey. African Journal of Marine Science **32**:361–374.

Oosthuizen WH. 1991. General movements of South African (Cape) fur seals *Arctocephalus pusillus pusillus* from analysis of recoveries of tagged animals. South African Journal of Marine Science **11**:21–29.

Oosthuizen WH, Meÿer MA, David JHM, Summers NM, Kotze PGH, Swanson SW, Shaughnessy PD. 1997. Variation in jackal numbers at the van Reenen Bay seal colony with comment on likely importance of jackals as predators. South African Journal of Wildlife Research **27**:26–29.

Pacifici M, Santini L, Di Marco M, Baisero D, Francucci L, Grottolo Marasini G, Visconti P, Rondinini C. 2013. Generation length for mammals. Nature Conservation **5**:87–94.

Porritt J, Goodman J. 2005. Fishing for Good. Forum for the Future, London, UK.

Punt AE, Butterworth DS. 1995. The effects of future consumption by the Cape fur seal on catches and catch rates of the Cape hakes. 4. modelling the biological interaction between Cape fur seals *Arctocephalus pusillus pusillus* and Cape hakes *Merluccius capensis* and *M. paradoxus*. South African Journal of Marine Science **16**:255–285.

Rand RW. 1955. Reproduction in the female Cape fur seal, *Arctocephalus pusillus* (Schreber). Proceedings of the Zoological Society of London **124**:717–740.

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

Repenning CA, Peterson RS, Hubbs CL. 1971. Contributions to the systematics of the southern fur seals, with particular reference to the Juan Fernandez and Guadalupe species. American Geophysical Union, Antarctic Research Series **18**:1–34.

Roux J-P. 1998. The impact of environmental variability on the seal population. Namibia Brief **20**:138–140.

Roy C, van der Lingen CD, Coetzee JC, Lutjeharms JRE. 2007. Abrupt environmental shift associated with changes in the distribution of Cape anchovy *Engraulis encrasicolus* spawners in the southern Benguela. African Journal of Marine Science **29**: 309–319.

Shaughnessy PD. 1979. Cape (South African) Fur Seal. Pages 37–40 in Mammals in the Seas. Volume 2: Pinniped Species Summaries and Report on Sirenians. FAO and United Nations, Rome, Italy.

Shaughnessy PD. 1980. Entanglement of Cape fur seals with man-made objects. Marine Pollution Bulletin **11**:332–336.

Stewardson CL. 1999. The impact of the fur seal industry on the distribution and abundance of Cape fur seals *Arctocephalus pusillus pusillus* on the Eastern Cape coast of South Africa. Transactions of the Royal Society of South Africa **54**:217–245.

Thibault M. 1999. Sighting of a South African fur seal on a beach in south-western Gabon. American Journal of Ecology **37**: 119–120.

Warneke RM, Shaughnessy PD. 1985. *Arctocephalus pusillus*, the South African and Australian fur seal: taxonomy, evolution, biogeography and life history. Pages 53–77 in Ling JK, Bryden MM, editors. Studies of Sea Mammals in South Latitudes. South Australian Museum, Adelaide, Australia.

Wickens PA, David JHM, Shelton PA, Field JG. 1991. Trends in harvest and pup numbers of the South African fur seal: Implications for management. South African Journal of Marine Science **11**:307–326.

Wickens PA, Japp DW, Shelton PA, Kriel F, Goosen PC, Rose B, Augustyn CJ, Bross CAR, Penney AJ, Krohn RG. 1992. Seals and fisheries in South Africa - competition and conflict. South African Journal of Marine Science **12**:773–789.

Wickens P, York AE. 1997. Comparative population dynamics of fur seals. Marine Mammal Science **13**:241–292.

Assessors and Reviewers

Stephen P. Kirkman[1], G.J. Greg Hofmeyr[2,3], Mduduzi Seakamela[1], Pierre A. Pistorius[3]

[1]Department of Environmental Affairs Branch Oceans and Coasts, [2]Port Elizabeth Museum at Bayworld, [3]Nelson Mandela Metropolitan University

Contributors

Michael Meyer[1], Herman Oosthuizen[1], Lloyd Lowry[2], Samantha Page-Nicholson[3], Matthew F. Child[3]

[1]Department of Environmental Affairs Branch Oceans and Coasts, [2]IUCN SSC Pinniped Specialist Group, [3]Endangered Wildlife Trust

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

Wiesel I. 2010. Killing of Cape fur seal (*Arctocephalus pusillus pusillus*) pups by brown hyenas (*Parahyaena brunnea*) at mainland breeding colonies along the coastal Namib Desert. Acta Ethologica **13**:93–100.

Wynen LP, Goldsworthy SD, Insley SJ, Adams M, Bickham JW, Francis J, Gallo JP, Hoelzel AR, Majluf P, White RWG, Slade R. 2001. Phylogenetic relationships within the eared seals (Otariidae: Carnivora): Implications for the historical biogeography of the family. Molecular Phylogenetics and Evolution **21**:270–284.