



## Consultation Document on Listing Eligibility and Conservation Actions

### *Arctocephalus tropicalis* (subantarctic fur seal)

You are invited to provide your views and supporting reasons related to:

- 1) the eligibility of *Arctocephalus tropicalis* (subantarctic fur seal) for inclusion on the EPBC Act threatened species list in the Endangered category; and
- 2) the necessary conservation actions for the above species.

Evidence provided by experts, stakeholders and the general public are welcome. Responses can be provided by any interested person.

Anyone may nominate a native species, ecological community or threatening process for listing under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or for a transfer of an item already on the list to a new listing category. The Threatened Species Scientific Committee (the Committee) undertakes the assessment of species to determine eligibility for inclusion in the list of threatened species and provides its recommendation to the Australian Government Minister for the Environment.

Responses are to be provided in writing either by email to:  
[species.consultation@environment.gov.au](mailto:species.consultation@environment.gov.au)

or by mail to:

The Director  
Marine and Freshwater Species Conservation Section  
Wildlife, Heritage and Marine Division  
Department of the Environment  
PO Box 787  
Canberra ACT 2601

**Responses are required to be submitted by 17 June 2016.**

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## **General background information about listing threatened species**

The Australian Government helps protect species at risk of extinction by listing them as threatened under Part 13 of the EPBC Act. Once listed under the EPBC Act, the species becomes a Matter of National Environmental Significance (MNES) and must be protected from significant impacts through the assessment and approval provisions of the EPBC Act. More information about threatened species is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/index.html>.

Public nominations to list threatened species under the EPBC Act are received annually by the department. In order to determine if a species is eligible for listing as threatened under the EPBC Act, the Threatened Species Scientific Committee (the Committee) undertakes a rigorous scientific assessment of its status to determine if the species is eligible for listing against a set of criteria. These criteria are available on the Department's website at:

<http://www.environment.gov.au/biodiversity/threatened/pubs/guidelines-species.pdf>.

As part of the assessment process, the Committee consults with the public and stakeholders to obtain specific details about the species, as well as advice on what conservation actions might be appropriate. Information provided through the consultation process is considered by the Committee in its assessment. The Committee provides its advice on the assessment (together with comments received) to the Minister regarding the eligibility of the species for listing under a particular category and what conservation actions might be appropriate. The Minister decides to add, or not to add, the species to the list of threatened species under the EPBC Act. More detailed information about the listing process is at:

<http://www.environment.gov.au/biodiversity/threatened/nominations.html>.

To promote the recovery of listed threatened species and ecological communities, conservation advices and where required, recovery plans are made or adopted in accordance with Part 13 of the EPBC Act. Conservation advices provide guidance at the time of listing on known threats and priority recovery actions that can be undertaken at a local and regional level. Recovery plans describe key threats and identify specific recovery actions that can be undertaken to enable recovery activities to occur within a planned and logical national framework. Information about recovery plans is available on the department's website at:

<http://www.environment.gov.au/biodiversity/threatened/recovery.html>.

## **Information about this consultation process**

Responses to this consultation can be provided electronically or in hard copy to the contact addresses provided on Page 1. All responses received will be provided in full to the Committee and then to the Australian Government Minister for the Environment.

In providing comments, please provide references to published data where possible. Should the Committee use the information you provide in formulating its advice, the information will be attributed to you and referenced as a 'personal communication' unless you provide references or otherwise attribute this information (please specify if your organisation requires that this information is attributed to your organisation instead of yourself). The final advice by the Committee will be published on the department's website following the listing decision by the Minister.

Information provided through consultation may be subject to freedom of information legislation and court processes. It is also important to note that under the EPBC Act, the deliberations and recommendations of the Committee are confidential until the Minister has made a final decision on the nomination, unless otherwise determined by the Minister.

# *Arctocephalus tropicalis*

subantarctic fur seal

## **Taxonomy**

Currently accepted as *Arctocephalus tropicalis* (Gray 1872). No subspecies are recognised.

A review of pinniped taxonomy (Berta & Churchill 2012) recommended that the genus *Arctocephalus* only apply to *A. pusillus* (Australian fur seal), with all other species/subspecies using the genus *Arctophoca*. However, the Marine Mammal Society's Committee on Taxonomy (2014) returned to using *Arctocephalus* for all southern fur seals until remaining uncertainty about phylogenetic relationships within the Order Carnivora were resolved. This was done by Nyakatura & Bininda-Emonds (2012) in their revision of the mammalian Order Carnivora. The Society's Committee on Taxonomy, as well as the International Union for the Conservation of Nature (IUCN) Pinniped Specialist Group (Hofmeyr 2015) have now reverted to using *Arctocephalus*. As such, this document (and the Department of the Environment) will continue to use *Arctocephalus tropicalis* as the species name.

## **Species Information**

### **Description**

The subantarctic fur seal has distinctive coloration that distinguishes it from its congeners – the Antarctic fur seal and the long-nosed fur seal. Adult males have chocolate brown to black fur on their upperparts with a contrasting yellow chest and face, and a well-developed mane, chest and shoulders. They have a crest of black fur on the top of the head which becomes erect when excited. Adult females are lighter in color, being dark grey or dark chocolate brown on their upperparts, and pale yellow on their chest and face. Pups are glossy-black with a dark chocolate brown belly. The species has long white sensory whiskers and external ears (Goldsworthy 2008; DEH 2004b).

The species is sexually dimorphic with adult males measuring 150–190 cm in length and weighing 90–160 kg; while adult females are 100–140 cm with a weight of 30–50 kg. Newborns are 60–70 cm and weigh 4–6 kg (Goldsworthy 2008).

### **Distribution**

Globally, the subantarctic fur seal has a wide southern hemisphere distribution, and a dispersed breeding distribution on isolated subantarctic and subtemperate islands north of the Antarctic polar front in the southern Indian and South Atlantic Oceans (Arnould 2009; Hofmeyr 2015).

In the Australian region, the only established breeding colony occurs on Macquarie Island, 1500 km south-southeast of Australia (Goldsworthy 2008). Some individuals occur at Heard Island, 4000 km southwest of Australia; and some wide-ranging vagrants occasionally reach beaches on Tasmania, the Australian mainland and offshore islands with more than 50 individuals having been recorded from New South Wales to Western Australia (Gales et al., 1992; Shaughnessy 1999; Mawson & Coughran 1999; Goldsworthy 2008). Jefferson et al. (2008) noted that subantarctic fur seals have also been recorded at the Davis and Mawson Australian Antarctic research stations on the Antarctic continent.

Fur seals were previously abundant at Macquarie Island, but were extirpated by intense sealing within a decade of discovery in 1810 (Ling 1999); although the species identity is not known, it has been suggested that these seals may have been mainly subantarctic fur seals (Shaughnessy & Fletcher 1987).

## Relevant Biology/Ecology

Most subantarctic fur seals, except for females with pups, spend much of their time at sea during winter and spring, but very little is known about their movements and behaviour at sea (Jefferson et al., 2008). These fur seals are opportunistic pelagic foragers that generally feed in areas of high productivity, including oceanographic fronts; their diet consists of various fish, cephalopods, crustaceans, and (at Amsterdam Island) penguins (Hofmeyr 2015; Jefferson et al., 2008). At Macquarie Island, they forage at night in mostly shallow 10–20 m depths, and feed mainly on *myctophid* (lantern) fish species, squid, and small numbers of crustaceans (Shaughnessy & Fletcher 1987; Robinson et al., 2002; Goldsworthy 2008). Foraging trips at Heard Island are longer than at Macquarie Island, where lactating females tend to feed at two locations about 30 km and 100 km north of the island (Shaughnessy & Goldsworthy 1993; Robinson et al., 2002).

Large males hold and defend beach territories for exclusive mating rights with small numbers of breeding females (Lancaster et al., 2006, 2007a). On Macquarie Island, the species prefers to breed in cobblestone boulder coves at Goat Bay and the southern regions of Secluded Bay, while non-breeding seals also use tussock slope habitats above the colonies (Shaughnessy 1999; Goldsworthy et al., 2009; Lancaster et al., 2010). The preferred breeding sites on Macquarie Island are estimated to be less than 1 km<sup>2</sup> in area (Lancaster et al., 2010; Goldsworthy pers. comm., cited in Woinarski et al., 2014). Males establish territories in late October, and pups are born from mid-November to early January with births peaking in December; females nurse pups on shore between foraging trips until weaning them about 300 days later in September (Shaughnessy et al., 1988; Goldsworthy 2008). There is sporadic pupping at Heard Island, where three subantarctic fur seal pups were recorded between 1987 and 2004, though there is little information on timing, breeding sites or weaning (Goldsworthy & Shaughnessy 1989; Page et al., 2003).

Females are sexually mature at approximately 3–6 years and have a mean birth interval of 1 year; males reach puberty at approximately 4 years or older but do not become sexually mature and hold territories until approximately 8–9 years of age or older (Bester 1990, 1995; Georges & Guinet 2001; Dabin et al., 2004). Longevity in the wild is 20–23 years for females (Arnould 2009), with some evidence of reproductive senescence in females older than 16 years from Amsterdam Island, possibly related to low food availability (Dabin et al., 2004). Generation length for the species is unknown, but generation length for the related long-nosed fur seal is estimated to be 9.9 years (Chilvers & Goldsworthy 2015). The overall rate of increase in the population is approximately 6.8 percent per year (Goldsworthy et al., 2008).

The percentage of female fur seals that produce pups at Macquarie Island and the rate of pup growth both show a very strong negative relationship with sea surface temperatures (SSTs) in the preceding autumn (Goldsworthy et al., 2008). Cool SSTs north of Macquarie Island are correlated with increased myctophid fish in the diet of Antarctic and other fur seals and increased female fecundity (Goldsworthy et al., 2008). Climate and oceanographic variability and change consequently appear to have important influences on breeding success through foraging success and subsequent fecundity and quality of offspring (Goldsworthy et al., 2008).

Subantarctic fur seals are not considered to be migratory although some individuals can travel widely across large ocean distances. A low level of continued immigration into the Macquarie Island population is indicated by sightings of animals originally tagged as pups at Marion and Amsterdam Islands more than 6000 km away; and by individuals occurring on the Australian mainland and on the Antarctic continent (Shaughnessy & Fletcher 1987; Shaughnessy et al., 1988; Mawson & Coughran 1999; Wynen et al., 2000; Goldsworthy et al., 2009). Two pups tagged at Marion Island were subsequently sighted at Heard Island, about 3000 km to the east (Goldsworthy 2008). However, it is not known if these immigrants remain in, or contribute significantly to, breeding in Australian colonies, or whether or not immigration is likely to decrease in the future.

The fur seal community at Macquarie Island is the only subantarctic island where all three sympatric (*Arctocephalus tropicalis* subantarctic; *A. gazella* Antarctic; and *A. forsteri* long-nosed) fur seal species are known to hybridise (Goldsworthy et al., 1999, 2008; Lancaster et al., 2006, 2007a, 2007b). Hybridisation rates among the fur seals at Macquarie Island have decreased from around 30 percent in 1994 to 16 percent in 2003 (Lancaster et al., 2006). At present there is little concern that continued hybridisation at Macquarie Island will threaten the genetic integrity of the species (Goldsworthy et al., 2009; Lancaster et al., 2010).

Hybridisation is also likely to be occurring at Heard Island. The few male subantarctic fur seals recorded have been juvenile or sub-adult males and there is no record of a male holding a breeding territory on the island (Page et al., 2003). Subantarctic fur seal females are expected to be mating Antarctic fur seal males as that population is increasing at 12–20 percent per year (Page et al., 2003).

## Threats

Threats to the subantarctic fur seal are outlined in the table below (modified from Woinarski et al., 2014 and DotE 2016).

Threat factor	Consequence rating	Extent over which threat may operate	Evidence base
Climate and oceanographic variability and change	Moderate	Large	Increased SST in the foraging grounds north of Macquarie Island during autumn have a strong negative relationship with fecundity rates in fur seals, leading to lower pupping rates and pup growth rates during the following breeding season. This is possibly due to nutritional stress from reduced food availability during warmer SST periods (Goldsworthy et al., 2008).
Predation of pup cohort at Macquarie Island	Moderate	Moderate	Goldsworthy et al. (2008) identified a necessity to further examine the role of pup predation by Hooker's sea lions. In the 1996/97 breeding season the level of predation (from one sea lion male) were up to 43% of the total fur seal pup cohort (Robinson et al., 1999). The population of Hooker's sea lions is increasing at the nearest colony, Campbell Island, New Zealand.
Fisheries entanglement and bycatch	Minor	Moderate	Seals entangled in fishing gear have been reported at Macquarie and Heard Islands, with two deaths reported from fishing nets from Western Australia (Shaughnessy 1999; Mawson & Coughran 1999; Shaughnessy et al., 2003). Four entanglements were reported in

			2011/12 and entanglements of any type are recorded every year. The origin of the gear involved is variable.
Pollution	Minor	Moderate	Fur seals are vulnerable to oil spills and other forms of chemical pollution and ingested plastic fragments, or micro-plastics, that can cause stress, impair health and potentially increase disease (Shaughnessy 1999; Kirkwood et al., 2003; Evans 2003).
Prey depletion due to fisheries	Minor	Minor	Competition with fisheries is considered unlikely to be an important threat to this species around Macquarie Island (Goldsworthy et al., 2001).

### **Assessment of available information in relation to the EPBC Act Criteria and Regulations**

<b>Criterion 1. Population size reduction (reduction in total numbers)</b>			
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	<b>Critically Endangered Very severe reduction</b>	<b>Endangered Severe reduction</b>	<b>Vulnerable Substantial reduction</b>
<b>A1</b>	<b>≥ 90%</b>	<b>≥ 70%</b>	<b>≥ 50%</b>
<b>A2, A3, A4</b>	<b>≥ 80%</b>	<b>≥ 50%</b>	<b>≥ 30%</b>
<div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <p>A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.</p> <p>A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.</p> <p>A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(a) cannot be used for A3]</p> <p>A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.</p> </div> <div style="flex: 1; font-size: 3em; margin: 0 10px;">}</div> <div style="flex: 1;"> <p style="text-align: center;"><i>based on any of the following</i></p> <p>(a) direct observation [except A3]</p> <p>(b) an index of abundance appropriate to the taxon</p> <p>(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat</p> <p>(d) actual or potential levels of exploitation</p> <p>(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites</p> </div> </div>			

### **Evidence:**

There are long-term monitoring data on pup abundance and population trends of subantarctic fur seals for the established breeding colony at Macquarie Island. Initial colonisation and population growth have been studied since 1948, with detailed monitoring occurring in many years since 1954; however, annual monitoring ceased in the 2011–2012 season (Shaughnessy and Fletcher 1987; Shaughnessy et al., 1988; Shaughnessy 1999; Goldsworthy et al., 1999, 2008, 2009; S. Goldsworthy pers. comm., cited in Woinarski et al., 2014). Data show that the colony size has been increasing steadily at approximately 6.8 percent per year (based on phenotypic assessment), and has not declined over the previous three-generation (30 year) period (Goldsworthy et al., 2008, 2009).

The small colony at Heard Island was monitored in 1987 and in 2000–2001 (Goldsworthy & Shaughnessy 1989; Page et al., 2003). There has been sporadic pupping, with no more than a single pup birth being recorded in the breeding seasons of 1987, 2000–2001 and 2003–2004 (Goldsworthy & Shaughnessy 1989; Page et al., 2003; S. Goldsworthy pers. comm., cited in Woinarski et al., 2014).

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

<b>Criterion 2. Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy</b>			
	<b>Critically Endangered Very restricted</b>	<b>Endangered Restricted</b>	<b>Vulnerable Limited</b>
B1. Extent of occurrence (EOO)	< 100 km <sup>2</sup>	< 5,000 km <sup>2</sup>	< 20,000 km <sup>2</sup>
B2. Area of occupancy (AOO)	< 10 km <sup>2</sup>	< 500 km <sup>2</sup>	< 2,000 km <sup>2</sup>
AND at least 2 of the following 3 conditions indicating distribution is precarious for survival:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

#### **Evidence:**

The extent of occurrence is estimated to be greater than 20 000 km<sup>2</sup> and the area of occupancy less than 2 km<sup>2</sup>, in the Australian component of the subantarctic fur seal's range (Woinarski et al., 2014). There is a single established breeding location, excluding the occasional records of breeding at Heard Island where the population is not sufficiently well-established to be considered self-sustaining. Though the species is very restricted in number of locations, the population is not declining and no extreme fluctuations have been recorded.

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

<b>Criterion 3. Population size and decline</b>			
	<b>Critically Endangered Very low</b>	<b>Endangered Low</b>	<b>Vulnerable Limited</b>
Estimated number of mature individuals	< 250	< 2,500	< 10,000
AND either (C1) or (C2) is true			
C1 An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future)	<b>Very high rate 25% in 3 years or 1 generation (whichever is longer)</b>	<b>High rate 20% in 5 years or 2 generation (whichever is longer)</b>	<b>Substantial rate 10% in 10 years or 3 generations (whichever is longer)</b>



C2	An observed, estimated, projected or inferred continuing decline AND its geographic distribution is precarious for its survival based on at least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b)	Extreme fluctuations in the number of mature individuals			

#### Evidence:

The breeding colony on Macquarie Island is small, with fewer than 50 breeding females recorded in 2007, and a very small number of breeding males holding territories (Goldsworthy et al., 2009). The most recent census (2011/12 season) estimated pup production to be 45 (Goldsworthy et al., 2009, Goldsworthy pers. comm., 2016). Based on this, the total subantarctic fur seal population at Macquarie Island is estimated to be approximately 200 (Goldsworthy pers. comm., 2016). As noted under Criterion 1, the species is not declining or exhibiting extreme fluctuations.

In contrast to Macquarie Island, the very small number of subantarctic fur seals at Heard Island (the 2000–2001 survey recorded at least eight individuals) does not appear to be increasing though sporadic pupping has been recorded (Page et al., 2003).

The data presented above appear to demonstrate the species is not eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

Criterion 4. Number of mature individuals			
	Critically Endangered Extremely low	Endangered Very Low	Vulnerable Low
Number of mature individuals	< 50	< 250	< 1,000

#### Evidence:

The total abundance of subantarctic fur seals in Australian waters is difficult to estimate due to their distribution on remote Macquarie and Heard subantarctic islands, with occasional records of individuals from southern Australia and Antarctica. In addition, hybridization and introgression with other species at Macquarie Island (Goldsworthy et al., 1999, 2009; Lancaster et al., 2006, 2007a) complicates assessment of the abundance of this breeding population. However, based on the 2011/12 season, total subantarctic fur seal population at Macquarie Island is estimated to be about 200 (Goldsworthy pers. comm., 2016). The number of mature individuals would be lower than this; estimated to be 50–100 (Goldsworthy et al., 2009; Woinarski et al., 2014). (See also Criterion 3).

The data presented above appear to demonstrate that the species is **eligible for listing as Endangered** under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.



Criterion 5. Quantitative Analysis			
	Critically Endangered Immediate future	Endangered Near future	Vulnerable Medium-term future
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

### Evidence:

A population viability analysis has not been undertaken at either Macquarie or Heard Island.

The data presented above appear to demonstrate there is insufficient data to demonstrate if the species is eligible for listing under this criterion. However, the purpose of this consultation document is to elicit additional information to better understand the species' status. This conclusion should therefore be considered to be tentative at this stage, as it may be changed as a result of responses to this consultation process.

## Conservation Actions

### Recovery Plan

The combined *Sub-Antarctic Fur Seal and Southern Elephant Seal Recovery Plan* (DEH 2004a) has two main objectives: to maintain current levels of protection for these two species to enable population growth so that these species can be removed from the threatened species list under the EPBC Act; and to ensure that any future anthropogenic impacts are not limiting their recovery. The Recovery Plan noted that in the absence of significant current anthropogenic threats, the only identified action was to monitor populations of these species in the Australian region to:

- determine population size and the rate of population change by completing scientifically robust, regular and repeatable population surveys; and
- identify any emerging impacts that will have an immediate effect on these species and their recovery, and to facilitate development of appropriate management responses.

The *Review of the Sub-Antarctic Fur Seal and Southern Elephant Seal Recovery Plan* (DotE 2016) was conducted in 2015 and found that population monitoring activities did occur at Macquarie Island, but not Heard Island. The annual survey for subantarctic fur seals on Macquarie Island (a 26 year dataset) ceased after the 2011/12 season as a result of reduced resources. Elephant seal monitoring is still undertaken (Isthmus counts each year and whole island surveys ever 5 years).

The review recommended that a recovery plan was not needed for the two species as significant anthropogenic threats were still not demonstrated and a revised Conservation Advice would update relevant information and conservation/research priorities. The review also noted that this status re-assessment would generate a new Conservation Advice and a decision whether to continue to have a recovery plan for the species would be part of the re-assessment process.

A decision about whether there should be a recovery plan for this species has not yet been made. The purpose of this consultation document is to elicit additional information to help inform this decision.

### Primary Conservation Action

Primary conservation actions are one or two actions that are key to the continued survival of the species. The primary conservation actions for this species have not been determined. The

purpose of this consultation document is to elicit additional information to help inform this decision.

### Conservation and Management Priorities

Both Macquarie and Heard Islands are managed under protection regimes associated with their status as World Heritage sites, as well as nature and wilderness reserves respectively. The waters around the islands are protected under Tasmanian legislation (Macquarie Island) as well as under Commonwealth legislation (Macquarie Island Marine Park and Heard and McDonald Islands Marine Reserve). In these reserve areas, fishing is restricted and the Heard Island/McDonald Island (HIMI) fishery must report on any interactions with seal species. Waters around Macquarie Island are protected 0–3 nm from the coast under Tasmanian legislation, and protected 3–200 nm from the coast in the Commonwealth Macquarie Island Marine Park. Waters down to 1000 m depth around Heard Island are similarly protected in the Commonwealth Heard Island and McDonald Islands Marine Reserve.

The *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life 2009-2014* (DEWHA 2009) is currently being reviewed and a new plan is expected in early 2016. The issue of impacts of marine debris in the Southern Ocean and subantarctic islands will be reflected in the revised plan.

Recommended management actions are outlined in the table below (modified from Woinarski et al., 2014 and DoE 2016).

Theme	Specific actions	Priority
Active mitigation of threats	Continue high levels of protection for subantarctic fur seals in important breeding, foraging and haul-out sites. Ensure Macquarie Island/HIMI management plans include reference to seal monitoring and protection.	High
	Continue, and where necessary adapt, management actions to reduce disturbance and pollution/marine debris impacts on subantarctic fur seals and their important breeding, resting and foraging habitats.	Medium-high
	Improve data collection and reporting of fisheries interactions throughout the seals' foraging ranges. Including improving species identification; expanding data collected by observers (photos/samples from mortalities); utilising deep sea observation systems (e.g. cameras) to observe underwater interactions.	Medium

## Survey and Monitoring priorities

Theme	Specific actions	Priority
Continue ongoing monitoring program based on Tasmanian DPIE (2005) survey methodology guidelines and the recommendations in the Goldsworthy et al. (2008) report.	Continue long-term annual monitoring at Macquarie Island and resurvey the population at Heard Island to better quantify abundance, pup production and population trends, movements, hybridisation rates and population structure.	High
Survey to better define distribution (with reference to guidance documents noted above)	Expand surveys to better define the fine-scale distribution and breeding interactions among species, population and annual pup abundance, and movements of individuals.	Medium-high

## Information and Research priorities

Theme	Specific actions	Priority
Assess impacts of threats on species	Improve understanding of the potential for climate and oceanographic change, and associated seawater temperature rises, to affect fur seal food resources and reproductive success	High
	Improve understanding of the potential risks of fisheries interactions, and potential prey depletion to affect the recovery and growth rates of populations. Including analysis of logbook data and any reported interactions between HIMI or Macquarie Island fisheries and seals.	Medium-low
	Assess the impacts of disturbance, pollution and associated risks of disease on the health status of subantarctic fur seals.	Low-medium
	Analysis of the occurrence and characteristics of marine debris (including micro-plastics) on remote sub-Antarctic islands and associated impacts on seal species.	Low-medium
Assess relative effectiveness of threat mitigation options	Assess the effectiveness of fisheries closures near colonies and other management actions in reducing potential impacts of fisheries on these fur seals.	Medium
Undertake research to develop new or	Expand genetic research to	Medium

enhance existing management mechanisms	monitor changes in hybridisation rates and gene flow through immigration, in order to identify the extent to which populations might be partially maintained by extra-limital populations.	
Assess diet, life history	Improve understanding of diet, foraging ecology, and life history parameters controlling population growth, and determine the generation length for Australian populations.	Medium
Assess habitat requirements	Expand research to better understand key foraging habitats for subantarctic fur seals and potential changes resulting from increased SSTs.	Medium
Undertake research to develop new or enhance existing management mechanisms	Investigate the efficacy of using remote survey techniques such as satellite imagery for census counts on remote islands	Low-medium

### **References cited in the advice**

- Arnould, J. P. Y. (2009). Southern Fur Seals *Arctocephalus* spp. In *Encyclopedia of Marine Mammals* (eds W. F. Perrin, B. Würsig & J. G. M. Thewissen), pp. 1079-1084. Academic Press, Amsterdam.
- Berta, A., & Churchill, M. (2012). Pinniped taxonomy: review of currently recognized species and subspecies, and evidence used for their description. *Mammal Review* 42, 207-234.
- Bester, M. N. (1990). Reproduction in the male sub-Antarctic fur seal *Arctocephalus tropicalis*. *Journal of Zoology* 222, 177-185.
- Bester, M. N. (1995). Reproduction in the female sub-Antarctic fur seal *Arctocephalus tropicalis*. *Marine Mammal Science* 11, 362-375.
- Chilvers, B. L., & Goldsworthy, S. D. (2015). *Arctocephalus forsteri*. The IUCN Red List of Threatened Species.  
Available on the internet at: <http://www.iucnredlist.org>.
- Dabin, W., Beauplet, G., Crespo, E. A., & Guinet, C. (2004). Age structure, growth, and demographic parameters in breeding-age female subantarctic fur seals, *Arctocephalus tropicalis*. *Canadian Journal of Zoology* 82, 1043-1050.
- Department of the Environment (DotE) (2016). *Review of 2004-2009 Recovery Plan for Subantarctic Fur Seal (Arctocephalus tropicalis) and Southern Elephant Seal (Mirounga leonina)*. Unpublished report.
- Department of the Environment and Heritage (DEH) (2004a). *Sub-Antarctic Fur Seal and Southern Elephant Seal Recovery Plan 2004-2009*.  
Available on the internet at: [www.environment.gov.au/resource/sub-antarctic-fur-seal-and-southern-elephant-seal-recovery-plan](http://www.environment.gov.au/resource/sub-antarctic-fur-seal-and-southern-elephant-seal-recovery-plan)
- Department of the Environment and Heritage (DEH) (2004b). *Biology, threats and conservation status of the sub-Antarctic fur seal and southern elephant seal in Australian waters*.

Available on the internet at: [www.environment.gov.au/resource/sub-antarctic-fur-seal-and-southern-elephant-seal-recovery-plan](http://www.environment.gov.au/resource/sub-antarctic-fur-seal-and-southern-elephant-seal-recovery-plan)

- Department of the Environment, Water Heritage and the Arts (DEWHA) (2009). The *Threat Abatement Plan for the impacts of marine debris on vertebrate marine life 2009-2014*. Available on the internet at: <http://www.environment.gov.au/marine/publications/threat-abatement-plan-impacts-marine-debris-vertebrate-marine-life>
- Evans, K. (2003). Pollution and marine mammals in the Southern Hemisphere: potential or present threat? In *Marine mammals: fisheries, tourism and management issues* (eds N. J. Gales, M. Hindell & R. Kirkwood), pp. 400–441. CSIRO Publishing, Melbourne.
- Gales, N. J., Coughran, D. K., & Queale, L. F. (1992). Records of sub-Antarctic fur seals *Arctocephalus tropicalis* in Australia. *Australian Mammalogy* 15, 135-138.
- Georges, J. Y., & Guinet, C. (2001). Prenatal investment in the subantarctic fur seal, *Arctocephalus tropicalis*. *Canadian Journal of Zoology* 79, 601-609.
- Goldsworthy, S. D. (2008). Subantarctic fur seal *Arctocephalus tropicalis*. In *The Mammals of Australia*. Third edition. (Eds S. Van Dyck & R. Strahan), pp. 726–727. Reed New Holland, Sydney.
- Goldsworthy, S. D., & Shaughnessy, P. D. (1989). Sub-Antarctic Fur seals *Arctocephalus tropicalis* at Heard Island. *Polar Biology* 9, 337-339.
- Goldsworthy, S. D., Boness, D. & Fleischer, R. (1999). Mate choice among sympatric fur seals: female preference for conspecific males. *Behavioural Ecology and Sociobiology* 45, 253-267.
- Goldsworthy, S. D., He, X., Lewis, M., Williams, R., & Tuck, G. (2001). Trophic interactions between Patagonian toothfish, its fishery and seals and seabirds around Macquarie Island. *Marine Ecology Progress Series* 218, 283-302.
- Goldsworthy, S. D., McKenzie, J., Page, B., Lancaster, M., & Bool, N. (2008). *Population status and trends in the abundance of the fur seals at Macquarie Island*. Report to the Department of the Environment, Water, Heritage and the Arts. SARDI Research Report Series No. 308, South Australian Research and Development Institute (Aquatic Sciences), Adelaide.
- Goldsworthy, S. D., McKenzie, J., Page, B., Lancaster, M. L., Shaughnessy, P. D., Wynen, L. P., Robinson, S. A., Peters, K. J., Baylis, A. M. M., & McIntosh, R. R. (2009). Fur seals at Macquarie Island: post-sealing colonisation, trends in abundance and hybridisation of three species. *Polar Biology* 32, 1473-1486.
- Hofmeyr, G. J. G. (2015). *Arctocephalus tropicalis*. The IUCN Red List of Threatened Species. Available on the internet at: <http://www.iucnredlist.org>.
- Jefferson, T. A., Webber, M. A., & Pitman, R. L. (2008). *Marine mammals of the world*. Elsevier, Amsterdam.
- Kirkwood, R., Boren, L., Shaughnessy, P. D., Szteren, D. M., Mawson, P., Huckstadt, L., Hofmeyr, G., Oossthuizen, H., Schiavani, A., Campagna, C., & Berris, M. (2003). Pinniped-focused tourism in the Southern Hemisphere: A review of the industry. In *Marine mammals: fisheries, tourism and management issues* (eds N. J. Gales, M. Hindell & R. Kirkwood), pp. 257-276. CSIRO Publishing, Melbourne.
- Lancaster, M. L., Gemmell, N. J., Negro, S., Goldsworthy, S. D., & Sunnucks, P. (2006). Ménage à trois on Macquarie Island: hybridization among three species of fur seal

- (*Arctocephalus* spp.) following historical population extinction. *Molecular Ecology* 15, 3681-3692.
- Lancaster, M. L., Goldsworthy, S. D., & Sunnucks, P. (2007a). Multiple mating strategies explain unexpected genetic mixing of New Zealand fur seals with two congeners in a recently recolonized population. *Molecular Ecology* 16, 5267-5276.
- Lancaster, M. L., Bradshaw, C. J. A., Goldsworthy, S. D., & Sunnucks, P. (2007b). Lower reproductive success in hybrid fur seal males indicates fitness costs to hybridization. *Molecular Ecology* 16, 3187-3197.
- Lancaster, M. L., Goldsworthy, S. D., & Sunnucks, P. (2010). Two behavioural traits promote fine-scale species segregation and moderate hybridisation in a recovering sympatric fur seal population. *BMC Evolutionary Biology* 10, 143.
- Ling, J. K. (1999). Exploitation of fur seals and sea lions from Australian, New Zealand and adjacent subantarctic islands during the eighteenth, nineteenth and twentieth centuries. *Australian Zoologist* 31, 323–350.
- Mawson, P. R., & Coughran, D. K. (1999). Records of sick, injured and dead pinnipeds in Western Australia 1980-1996. *Journal of the Royal Society of Western Australia* 82, 121-128.
- Nyakatura, K., & Birinda-Emonds, O. R. P. (2013). Updating the evolutionary history of Carnivora (Mammalia): a new species-level supertree complete with divergence time estimates. *BMC Biology* 10, 1-31.
- Page, B., Welling, A., Chambellant, M., Goldsworthy, S. D., Dorr, T., & van Veen, R. (2003). Population status and breeding season chronology of Heard Island fur seals. *Polar Biology* 26, 219-224.
- Robinson, S. A., Goldsworthy, S. D., Van Den Hoff, J., & Hindell, M. A. (2002). The foraging ecology of two sympatric fur seal species at Macquarie Island, *Arctocephalus gazella* and *A. tropicalis*, during the austral summer. *Marine and Freshwater Research* 53, 1071-1082.
- Robinson, S., Wynen, L., & Goldsworthy, S. D. (1999). Predation by a Hooker's sea lion (*Phocarcos hookeri*) on a small population of fur seals (*Arctocephalus* spp.) at Macquarie Island. *Marine Mammal Science* 15(3), 888-893.
- Shaughnessy, P. D. (1999). *The Action Plan for Australian seals*. Environment Australia, Canberra.
- Shaughnessy, P. D., & Fletcher, L. (1987). Fur seals *Arctocephalus* spp. at Macquarie Island. *NOAA Technical Report, NMFS* 51, 177-188.
- Shaughnessy, P. D., & Goldsworthy, S. D. (1993). Feeding ecology of fur seals and their management at Heard and Macquarie Islands. *Proceedings of the NIPR Symposium Polar Biology* 6, 173-175.
- Shaughnessy, P. D., Shaughnessy, G. L., & Fletcher L (1988). Recovery of the fur seal population at Macquarie Island. *Papers and Proceedings of the Royal Society of Tasmania* 122, 177-187.
- Shaughnessy, P. D., Kirkwood, R., Cawthorn, M., Kemper, C., & Pemberton, D. (2003). Pinnipeds, cetaceans, and fisheries in Australia: A review of operational interactions. In *Marine mammals: fisheries, tourism and management issues* (eds N. J. Gales, M. Hindell & R. Kirkwood) pp. 136–152. CSIRO Publishing, Melbourne.

Tasmanian Department of Primary Industries and Environment (Tas DPIE) (2005). *Part B – A survey methodology to monitor population change in Sub-antarctic fur seals and Southern elephant seals*. Second part of a report on *Population monitoring for Sub-antarctic fur seals (Arctocephalus tropicalis) and Southern elephant seals (Mirounga leonina)* for the Department of the Environment & Heritage. Unpublished report by the Nature Conservation Branch of the Tasmanian Department of Primary Industries and Environment.

Woinarski, J. C. Z., Burbidge, A. A., & Harrison, P. L. (2014). *The Action Plan for Australian Mammals 2012*. CSIRO Publishing, Collingwood.

Wynen, L. P., Goldsworthy, S. D., Guinet, C., Bester, M. N., Boyd, I. L., Gjertz, I., Hofmeyr, G. J. G., White, R. W. G., & Slade, R. (2000). Postsealing genetic variation and population structure of two species of fur seal (*Arctocephalus gazella* and *A. tropicalis*). *Molecular Ecology* 9, 299–314.

### **Other sources cited in the advice**

Committee on Taxonomy (2015). List of marine mammal species and subspecies. Society for Marine Mammalogy.

Available on the internet at:

<https://www.marinemammalscience.org/species-information/list-of-marine-mammal-species-subspecies/>.

Goldsworthy, S. D. (2016). Personal communication by email, January 2016. South Australia Research & Development Institute.

### **Consultation questions**

1. Do you agree with the current taxonomic position of the Marine Mammal Society Committee on taxonomy for this taxon (as identified in the draft conservation advice)?
2. Can you provide any additional references, information or estimates on longevity, age of maturity, average life span and generation length?
3. Has the survey effort for this taxon been adequate to determine its national distribution and adult population size?
4. Do you accept the estimate provided in the nomination for the current population size of the taxon?
5. For any population with which you are familiar, do you agree with the population estimate provided? If not, are you able to provide a plausible estimate based on your own knowledge? If so, please provide in the form:  
Lower bound (estimated minimum):  
Upper bound (estimated maximum):  
Best Estimate:  
Estimated level of Confidence: %
6. Can you provide any additional data, not contained in the current nomination, on declines in population numbers over the past or next 10 years or 3 generations, whichever is the longer?
7. Is the distribution as described in the nomination valid? Can you provide an estimate of the current geographic distribution (extent of occurrence or area of occupancy in km<sup>2</sup>) of this taxon? Do you have additional data on the level of connectivity?



- 7a. Do you have information on the level of connectivity between the populations on Macquarie Island and other subantarctic islands?
8. Has this geographic distribution declined and if so by how much and over what period of time?
9. Do you agree that the taxon is eligible for inclusion on the threatened species list, in the category listed in the nomination?
10. Do you agree that the threats listed are correct and that their effects on the taxon are significant?
11. To what degree are the identified threats likely to impact on the taxon in the future?
12. Can you provide additional or alternative information on threats, past, current or potential that may adversely affect this taxon at any stage of its life cycle?
13. In seeking to facilitate the recovery of this taxon, can you provide management advice for the following:
- What individuals or organisations are currently, or need to be, involved in planning to abate threats and any other relevant planning issues?
  - What threats are impacting on different populations, how variable are the threats and what is the relative importance of the different populations?
  - What recovery actions are currently in place, and can you suggest other actions that would help recover the taxon? Please provide evidence and background information.
14. Can you provide additional data or information relevant to this assessment?
15. Can you advise as to whether this species is of cultural significance to Indigenous Australians?