



Consultation Document on Listing Eligibility and Conservation Actions

Neophoca cinerea (Australian Sea Lion)

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

- 1) the eligibility of *Neophoca cinerea* (Australian Sea Lion) 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 and Energy.

Responses are to be provided in writing either by email to:
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 and Energy
PO Box 787
Canberra ACT 2601

Responses are required to be submitted by 3 August 2018.

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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>.

Privacy notice

The Department will collect, use, store and disclose the personal information you provide in a manner consistent with the Department's obligations under the Privacy Act 1988 (Cth) and the Department's Privacy Policy.

Any personal information that you provide within, or in addition to, your comments in the threatened species assessment process may be used by the Department for the purposes of its functions relating to threatened species assessments, including contacting you if we have any questions about your comments in the future.

Further, the Commonwealth, State and Territory governments have agreed to share threatened species assessment documentation (including comments) to ensure that all States and Territories have access to the same documentation when making a decision on the status of a potentially threatened species. This is also known as the '[common assessment method](#)'. As a result, any personal information that you have provided in connection with your comments may be shared between Commonwealth, State or Territory government entities to assist with their assessment processes.

The Department's Privacy Policy contains details about how respondents may access and make corrections to personal information that the Department holds about the respondent, how respondents may make a complaint about a breach of an Australian Privacy Principle, and how the Department will deal with that complaint. A copy of the Department's Privacy Policy is available at: <http://environment.gov.au/privacy-policy>.

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.

Neophoca cinerea

Australian Sea Lion

Taxonomy

Conventionally accepted as *Neophoca cinerea* Peron, 1816. It is the only species within the genus. No subspecies are recognised.

Species Information

Description

The Australian Sea Lion is the only pinniped species endemic to Australia (Gales et al. 1992). It has a blunt snout with small tightly rolled external ears. Males are a dark blackish or chocolate brown colour, with blondish white fur extending from the top of the head down to the nape of the neck. The neck is broad and obscure and the forequarters very large; the foreflippers are also large and broad. Females are silvery ash-grey above and yellow to cream underneath, and much smaller than the males (Gales 2008). Pups are dark chocolate brown to charcoal in colour at birth and lighten to a smoky grey before becoming brown (Goldsworthy 2015). The pelage of pups up until their moult at around four to five months of age (Higgins & Gass 1993; Dennis & Shaughnessy 1996) is highly variable (Goldsworthy 2015). After moulting the coat of a juvenile is similar to that of an adult female (Goldsworthy et al. 2009a).

Males reach a length of 185 cm to 225 cm from head to tail, while females reach a length of 130–185 cm (Gales 2008). Males weigh 180–250 kg, whereas females weigh 65–100 kg (Gales 2008).

Distribution

Breeding colonies for the Australian Sea Lion are found only in South Australian and Western Australian waters, from Kangaroo Island in South Australia to the Houtman Abrolhos Islands in Western Australia (Gales et al. 1994). However, the species is known to forage in Commonwealth waters adjacent to these states (DSEWPaC 2013a). The historical range for the species was thought to extend into Bass Strait (Ling 1999).

Breeding colonies occur on islands or remote sections of coastline. Lone or small numbers of animals will regularly visit known haul-out sites and occasionally visit other locations (Shaughnessy et al. 2011).

There are 81 known breeding sites (28 in Western Australia, 48 in South Australia), of which 58 are regular breeding colonies at which five or more pups per breeding cycle have been recorded (Shaughnessy et al. 2011). These 58 breeding colonies are considered to be habitat critical to the survival of the species, because they are used to meet essential life cycle requirements (DSEWPaC 2013b). An additional 151 locations have been identified as haul-out sites: 61 in Western Australia and 90 in South Australia (DSEWPaC 2013b). Only five sites produce more than 100 pups per breeding season, all of which are in South Australia (Goldsworthy et al. 2015). The average pup production per breeding site is just 40, with most sites (70 percent) producing fewer than 30 pups per breeding season (Goldsworthy et al. 2009a; Goldsworthy unpublished data; Goldsworthy 2015).

It is likely that other small breeding colonies exist but are yet to be discovered. Two of the breeding sites in Western Australia (George Island and Draper Island) were discovered relatively recently, during surveys undertaken in 2011–2014 (Friedman & Campbell 2014).

Based on geographic distance analysis among colonies, 13 distinct Australian Sea Lion metapopulations or regions can be identified. Six of these are in Western Australia, and seven are in South Australia (Pitcher 2018).

Relevant Biology/Ecology

Life cycle and breeding

The Australian Sea Lion is a large-bodied marine mammal that is slow to mature, with females having few young over their lifetime, to which they commit extended maternal care (Gales & Costa 1997). It is the only pinniped species which has a non-annual breeding cycle, with intervals between pupping seasons of 17 – 18 months (Ling & Walker 1978; Higgins & Gass 1993; Shaughnessy et al. 2006; Goldsworthy et al. 2014). Breeding seasons are protracted in duration (4 – 9 months) and occur asynchronously across the species' range, with breeding occurring at any time of the year (Shaughnessy et al. 2006; Goldsworthy et al. 2014). Predictions for the timing of breeding at many colonies can only be accurately predicted 1 - 2 seasons in advance, due to variation in the inter-breeding interval (S Goldsworthy pers comm, cited in Friedman & Campbell 2014).

Surveys undertaken in Western Australia during 2011 – 2014, using direct pup counts, revealed that a number of south coast colonies have shifted their timing of breeding (either earlier or later than the predicted timing) by up to six months compared to original observations from the 1990s (Friedman & Campbell 2014). These variations have likely occurred over the last 10 - 15 years and were not explained by any single or identified subset of environmental variables; it is possible that changes in the timing of breeding will continue (Friedman & Campbell 2014).

Female Australian Sea Lions become sexually mature at 4.5 – 6 years of age and males at six years or more (Goldsworthy 2015). The mean age of breeding females is 11 years, with the oldest breeding female recorded being 24 years old (McIntosh 2007). Age-specific survival probabilities are high (0.98) after six years of age and are similar for males and females; the maximum longevity recorded is 26 years for females and 21.5 years for males (McIntosh 2007).

For species with overlapping generations, generation time is defined as the mean age of mothers of all newborn females (the mean interval between the birth of a mother and the birth of her offspring, weighted by the proportion of individuals in each age class), assuming a stable distribution (Caughley 1977). Generation time for the Australian Sea Lion was calculated using a Leslie Matrix (a discrete, age-structured model of population growth) in Poptools (Version 2.7) (Hood 2006) based on data from the Seal Bay population on Kangaroo Island (Goldsworthy 2015). Generation length for the Australian Sea Lion is estimated to be 12.4 – 12.8 years (Goldsworthy & Page 2007).

Pups are continuously attended by their mother for the first 9 – 10 days after birth, after which adult females alternate between foraging trips to sea and nursing bouts ashore (Goldsworthy 2015). Lactation periods are protracted, with females nursing their pups for 15 – 18 months, usually weaning them before giving birth again (Goldsworthy 2015). However, females will nurse offspring for three or more years if they do not pup in the subsequent breeding season or their new pup dies (Goldsworthy 2015). Following their postnatal moult at 4 – 5 months of age pups will actively swim on their own, with pups exploring adult foraging habitat at least eight months prior to weaning (Lowther & Goldsworthy 2012).

Males defend harems of a few females at high density breeding sites, but only one at a time at less dense colonies (Gales 2008). Both males and females are very territorial during the breeding season, often becoming aggressive. When this aggression is directed towards pups it can contribute significantly to their mortality (Gales 2008). Adult females behave aggressively toward pups that are not their own (Goldsworthy 2015).

Some male Australian Sea Lions congregate in 'bachelor colonies' on islands adjacent to the Perth metropolitan region during the non-breeding season, and migrate up to 280 km north each breeding season (Gales et al. 1992). There is little or no movement of females between breeding colonies, even those separated by short distances (Campbell et al. 2008a; Goldsworthy & Lowther 2010; Lowther et al. 2012). Females show a high level of natal site fidelity, only breeding at the site where they were born (Campbell et al. 2008a).

Habitat and diet

The Australian Sea Lion uses a variety of habitats when onshore, including exposed islands and reefs, rocky terrain, sandy beaches and vegetated fore dunes and swales (Dennis & Shaughnessy 1996, 1999). They also use caves and deep cliff overhangs as haul-out sites or breeding habitat (Dennis & Shaughnessy 1996, 1999).

Foraging activities are restricted to waters on the continental shelf, with juveniles, adult females and adult males rarely exceeding diving depths of 90 m, 130 m, and 150 m respectively (Goldsworthy et al. 2010). Australian Sea Lions are benthic foragers, feeding on a wide variety of prey including fish, cephalopods (squid, cuttlefish and octopus), sharks, rays, rock lobsters and penguins (Gales & Cheal 1992; McIntosh et al. 2006; Baylis et al. 2009). The inshore breeding and foraging habitat of this species is responsible for interactions with fisheries and aquaculture (Gales 2008).

Australian Sea Lions forage at all times of day and dive continuously while at sea (Costa & Gales 2003). Individual dives rarely exceed eight minutes in duration (Kirkwood & Goldsworthy 2013). Foraging trips to sea are relatively short compared to other otariids, with maximum durations of 5.1, 6.2 and 6.7 days in juveniles, adult females and adult males respectively (Higgins 1993; Higgins & Gass 1993; Lowther & Goldsworthy 2011; Kirkwood & Goldsworthy 2013).

The maximum recorded foraging ranges of juveniles and adult females are 118 km and 190 km, respectively (Goldsworthy et al. 2010). Adult males range much further and have been tracked up to 340 km from their colony. There is marked within and between-colony variability in the foraging behaviour of juveniles, adult females, and males (Goldsworthy et al. 2009a; Goldsworthy et al. 2010; Lowther & Goldsworthy 2011; Lowther et al. 2012).

Threats

Historically, the main threat to the Australian Sea Lion was over-harvest due to commercial hunting during the late 18th, 19th and early 20th centuries (Ling, 1999). Although this activity ended in 1949 (Ling 1999), populations have not recovered to pre-exploitation levels (DSEWPac 2013a).

Current key threats to the Australian Sea Lion are fishing activities and entanglement in marine debris. Other known and potential threats are identified in Table 1. The species' long breeding cycle makes it more difficult for populations to recover after direct or indirect mortality (Orsini & Newsome 2005). These factors, along with the declining population size and fragmented distribution across many small colonies, makes the species vulnerable to threatening processes.

Table 1: Threats impacting the Australian Sea Lion in approximate order of severity of risk, based on available evidence

Number	Threat factor	Threat type and status	Evidence base
1.0	Fishing activities		
1.1	Fisheries bycatch	known current	Interactions with demersal gillnet operations are a significant cause of mortality and are likely to be limiting population growth in Australian Sea Lions (Goldsworthy et al. 2010). Once caught in a net, individuals often drown (Gales et al. 1994; Page et al. 2004) or may escape and die later from injuries (Hamer et al. 2011). The level of mortality has been estimated at 3.9 percent of the overall female

			<p>population during each breeding cycle (Goldsworthy et al, 2010).</p> <p>During 2010–2012, the Australian Fisheries Management Authority introduced a range of management measures (e.g. spatial closures, bycatch trigger limits for extended closures, and 100 percent observer coverage) in the Southern and Eastern Scalefish and Shark Fishery (SESSF) (gillnet hook and trap fishery) to mitigate the impacts of bycatch mortality on sea lion populations off South Australia (AFMA 2012, 2013, 2015). These measures have been effective in reducing mortalities of Australian Sea Lions (DotE 2016), however, the ongoing impact of fishing from both the SESSF and the Western Australian temperate demersal gillnet fisheries remains a concern (DSEWPac 2013a).</p> <p>Australian Sea Lion pups and juveniles can get caught inside rock lobster pots while attempting to predate on the lobsters (Campbell et al. 2008b). Quantitative studies are scarce, but mortality rates are lower than that from gillnets (Campbell et al. 2008b; Goldsworthy et al. 2010). Bycatch in rock lobster pots has been largely mitigated through the introduction of sea lion excluder devices in the Western Australian and South Australian Rock Lobster fisheries.</p>
1.2	Marine aquaculture	known current	Collision or entanglement with subsurface infrastructure in aquaculture facilities is a threat to the species. A small number of Australian Sea Lion deaths have been recorded as a result of drowning in anti-predator nets (Kemper & Gibbs 1997).
2.0	Marine debris		
2.1	Entanglement in marine debris	known current	Entanglement in marine debris is likely to be a significant source of mortality for Australian Sea Lions, and may be contributing to their lack of recovery in certain parts of their range (Page et al. 2004; Shaughnessy et al. 2006). A study at Seal Bay during the 1990s and early 2000s found that about 1.3 percent of the overall population was likely to have entanglements, one of the highest rates reported for any pinniped (Page et al. 2004). Entanglements have been observed in both South Australia and Western Australia (e.g. Mawson & Caughran 1999; Page et al. 2004).
3.0	Deliberate killing		
3.1	Shooting, spearing or clubbing by humans	known current	There have been numerous recorded instances of deliberate killing of Australian Sea Lions, and reports of fishers and aquaculture operators shooting individuals perceived to be a threat to their operations (Kemper et al. 2003). The overall mortality due to deliberate killings cannot be

			estimated as most deaths go unreported (DSEWPAC 2013b).
4.0	Disease and parasites		
4.1	Hookworm and tuberculosis	known current	<p>Some evidence suggests that disease is a significant cause of mortality in Australian Sea Lions. McIntosh (2007) undertook necropsies on 128 Australian Sea Lion pups to identify the cause of mortality; no direct cause could be identified in half of the cases, with the deaths likely attributable to disease and pathogens. Hookworm (Beveridge 1980) and tuberculosis (Mawson & Coughran 1999; Cousins et al. 2003) have been recorded in Australian Sea Lion colonies, and associated with the marked seasonal fluctuations in pup mortality that occurs between summer and winter breeding seasons (Marcus et al. 2015a,b).</p> <p>Haematophagus hookworm significantly affects two major breeding colonies in South Australia, with 100 percent of these colonies' pups infected (Marcus et al. 2015b). Overseas evidence suggests that hookworm can cause significant mortalities in Australian Sea Lion colonies in some years (DSEWPAC 2013b). The extent to which hookworm may be limiting growth in Australian Sea Lion colonies is unknown, but small colonies would be particularly susceptible to the impacts of a disease outbreak (DSEWPAC 2013b). Overseas, thousands of pinnipeds have died in short periods from disease outbreaks (Baker 1999).</p>
4.2	Toxoplasmosis	potential	<p>The parasite <i>Toxoplasma gondii</i> is an emerging pathogen of marine mammals, due to contamination of marine environments with terrestrial run-off containing <i>T. gondii</i> oocysts shed by feline hosts (R Gray 2018. pers comm 7 June). Top order marine predators are often infected after oocyst accumulation in prey species such as mussels and fish (Carlson-Bremer et al. 2015). In sea lions, as in most other species, toxoplasmosis causes abortion and disease in pups which have been infected via transmission from the mother (Carlson-Bremer et al. 2015).</p> <p>Susceptibility of the Australian Sea Lion to <i>T. gondii</i> is evident from reports of meningitis in an adult, and severe disease with subsequent mortality in a pup (Kabay 1996), but the presence of <i>T. gondii</i> was not confirmed. However, <i>T. gondii</i> DNA has been detected in the brain of a long-nosed fur seal found moribund and diseased on a northern Sydney beach; the first confirmed case of toxoplasmosis in an Australian pinniped (Donahoe et al. 2014). This suggests that <i>T. gondii</i> oocysts originating from mainland Australia may act as a disease threat to native marine fauna (Donahoe et al. 2014). However, the prevalence of <i>T. gondii</i> in</p>

			the Australian marine environment requires further investigation (Kirkwood & Goldsworthy 2013).
5.0	Habitat degradation and pollution		
5.1	Marine aquaculture	known current	The primary impact from marine aquaculture is loss of habitat. Finfish aquaculture activities may alter water chemistry due to nutrient influxes from fish effluent and unconsumed feed, leading to significant changes in the abundance and diversity of benthic flora and fauna (Brown et al. 1987). The use of rack and line structures for mussel and oyster farming in shallow waters often results in the loss of seagrass beds (Wear et al., 2004; Bryars et al. 2007), which are important foraging habitat for the Australian Sea Lion (Goldsworthy et al. 2009b; Lowther et al. 2011). These impacts from aquaculture are likely to be localised (DSEWPAC 2013b).
5.2	Oil spills	known past and potential	Oil spills pose a threat to all pinniped populations, especially those near major shipping lanes (Shaughnessy 1999). Oiling of pinnipeds can lead to hypothermia if the fur is affected, or poisoning if oil is ingested, resulting in reduced foraging and reproductive fitness or death (DSEWPAC 2013b). In Australia, two oil spills have affected seals to date, one in 1991 (Gales 1991) and one in 1995 (Pemberton 1999). Sub-surface oil contamination can also persist at sub-lethal levels for many years, affecting wildlife populations (Peterson et al. 2003). With increasingly busy transport shipping activity at the western and eastern ends of the Australian Sea Lion range, the risk and potential impacts of oil spills have increased (DSEWPAC 2013b).
5.3	Other development and pollution	known potential	Onshore and offshore development can degrade important coastal habitats for Australian Sea Lions (McIntosh 2007; Goldsworthy et al. 2009b). Land-based runoff and pollutants contribute to the threat, particularly if impacting on prey availability or feeding substrate (DSEWPAC 2013b). Organic contaminants may also accumulate in the bodies of Australian Sea Lions; however, the long-term impact of bioaccumulants on the species' health is unknown (DSEWPAC 2013b).
6.0	Human disturbance		
6.1	Tourism, recreational boating and aircraft	known current	Disturbance from land and boat based wildlife tourism, commercial and recreational boating activities, and aircraft may result in behavioural disturbance, including displacement from or abandonment of sites (Kirkwood et al. 2003; McIntosh 2007; Goldsworthy et al. 2009b). Disturbance of breeding colonies may be particularly detrimental, when the feeding of pups may be disrupted due to the mother fleeing (Orsini 2004), or when the colony stampedes towards the

			sea and tramples pups in the process (DSEWPAC 2013b). Similar situations for other pinniped species are known to contribute to shorter feeding times by mothers, resulting in a reduced growth rate of pups (Lidgard 1996).
6.2	Noise	known current	Studies of pinnipeds in the Northern Hemisphere indicate that exposure to sharp, short sounds of moderate intensity for extended periods (e.g. from seismic surveys, construction or operation activities) may cause avoidance behaviour and/or hearing threshold changes in pinnipeds (Gordon et al. 2003). Seismic pulses may also affect bony fish (e.g. Turnpenny & Nedwell 1994) which pinnipeds feed on.
7.0	Competition and prey depletion		
7.1	Competition with humans	known current	Several commercial fisheries exploit fish species that are important prey for the Australian Sea Lion, such as school shark and rock lobster, and the numbers of these are declining. The reduction of several important prey species may potentially reduce foraging and thus reproductive success. However, little is known about the direct impacts of competition with humans for the same fish stocks, or indirect impacts through alteration of trophic structures, on Australian Sea Lions (DSEWPac 2013b).
7.2	Competition with other pinnipeds	known current	Australian Sea Lions may compete for food with humans and other marine predators, particularly other pinnipeds. Much of their range overlaps with the long-nosed fur seal and, to a lesser extent, the Australian fur seal. However, the degree of inter-specific competition for prey resources is unknown; it is likely that the three species are able to exploit different food resources (DSEWPac 2013b).
8.0	Climate change		
8.1	Sea level rise and 'wave wash' events	potential	<p>Most breeding colonies of Australian Sea Lions are on very low lying islands. Under future climate change scenarios, it is projected that sea levels may rise by up to 82 cm by 2100, from 2005 levels (IPCC 2014). If this occurs, several smaller breeding colonies will become completely submerged.</p> <p>Climate change is also projected to result in an increased frequency and likelihood of extreme weather events (IPCC 2014). At sea these are associated with strong winds and large swells in shelf and coastal regions. Seal pups can be washed off rocks during bad weather, which will likely occur more often under climate change.</p>
8.2	Temperature rise	potential	Global mean surface temperature is projected to increase by up to 4.8°C by 2100, from 2005 levels (IPCC 2014). Higher temperatures may increase the likelihood of epizootics in pinniped populations

			(Shaughnessy 1999); mass seal mortalities have been associated with high ambient temperatures and high seal densities onshore (Lavigne & Schmitz 1990). Increasing ocean temperatures (IPCC 2014) could alter primary productivity and the amount and composition of prey that seals feed upon (Shaughnessy 1999).
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Assessment of available information in relation to the EPBC Act Criteria and Regulations

Criterion 1. Population size reduction (reduction in total numbers)			
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4			
	Critically Endangered Very severe reduction	-----Endangered Severe reduction	Vulnerable Substantial reduction
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%
<div> <div> A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased. 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. 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] 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. </div> <div> based on any of the following </div> <div> (a) direct observation [except A3] (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat (d) actual or potential levels of exploitation (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites </div> </div>			

Evidence:

Assessment is made here against Criterion 1A2(b) using pup numbers as an index of abundance. Pup numbers are used as the most reliable basis for determining population size in the Australian Sea Lion. Pups are the age group most likely to be on shore, as they have not developed at-sea foraging skills and are confined to breeding sites for at least the first five weeks of their life (McIntosh et al. 2011; Shaughnessy et al. 2011; DSEWPac 2013b).

South Australia

Between January 2014 and May 2015, pup abundance surveys were undertaken of Australian Sea Lions across the seven South Australian (SA) regions (Goldsworthy et al. 2015). A total of 176 surveys were carried out across 83 sites (42 of which were breeding sites) over the span of a single 18 month breeding cycle. Pup abundances were estimated using mark-recapture plus cumulative pup production at four of the breeding sites (Olive, Liliput and Blefuscu Islands, and Dangerous Reef), and direct counts of live and dead pups at the other breeding sites using cliff-top, ground or aerial/helicopter surveys (Goldsworthy et al. 2015).

Only five sites were found to produce more than 100 pups (Nuyts Reef, Olive Island, Dangerous Reef, Seal Bay and The Pages Islands); these sites accounted for 58 percent of the state's estimated pup abundance (Goldsworthy et al. 2015, p. 38). Six sites previously recognised from

surveys in 2004–2008 as breeding or haul-out sites with occasional pupping (Shaughnessy et al. 2011) were not recorded to have pups in the 2014–15 surveys (Goldsworthy et al. 2015).

Changes in pup abundance over at least two comparable surveys (with time-periods ranging from 6 to 44 years between surveys) were estimated for a subset of 28 (67 percent) of the 42 South Australian breeding sites (Table 2). These sites accounted for 83 percent of the total estimated pup abundance in SA. Decreases in pup counts were observed for 23 (82 percent) of these sites, with an average rate of decline of 2.95 percent per year per site (or 4.4 percent per breeding cycle) (Table 2). The rate of change in pup numbers was calculated using linear regression of the natural logarithm of pup numbers against year, with the slope of the regression line being the intrinsic rate of change (Goldsworthy et al. 2015).

The overall estimated change in pup abundance over three generations (38 years) was estimated following IUCN Red List assessment methods (IUCN Standards and Petitions Subcommittee 2017). For each breeding site, rates of change between past and present pup numbers were used to project pup numbers back to 1980 or forward to 2018, assuming a constant exponential rate of change (Goldsworthy et al. 2015; IUCN Standards and Petitions Subcommittee 2017). The overall change in the sum of pup numbers over three generations, weighted by the estimated size of each subpopulation three generations ago, was estimated to be -74.1 percent (Table 2). Analysis of trends in aggregated pup abundance indicated that declines were occurring across all regions, but were greatest in the west of the state and lowest in the east (Goldsworthy et al. 2015, p. 1).

Table 2: Summary of estimates of regional trends in Australian Sea Lion abundance across SA and WA, based on estimated changes in pup abundance over two surveys for individual breeding sites. Note that the columns “Pup abundance” and “Pup No’s current” may differ as the former is the sum of the most recent data for all sites, while the former is the sum or projected values only for those sites with time series data (*Sources:* Goldsworthy et al. 2015; S Goldsworthy 2018. pers comm 18 June).

Region	No. breeding sites	No. with time series	No. decreased	No. increased	Total pup abundance	Sites with time series		Change in 3-gen	Annual rate of change
						Pup No’s 3 gen ago	Pup No’s current		
Kangaroo Island (SA)	6	3	3	0	730	941	690	-26.7%	-0.82%
Spencer Gulf (SA)	11	7	6	1	802	2,221	555	-75.0%	-3.60%
SW-Eyre (SA)	6	2	1	1	119	39	39	0.3%	0.01%
Chain of Bays (SA)	7	6	5	1	380	1,529	337	-78.0%	-3.92%
Nuyts Archipelago (SA)	7	7	5	2	322	2,661	296	-88.9%	-5.64%
Nuyts Reef (SA)	1	0	-	-	105	-	-	-	-
Bunda Cliffs (SA)	4	3	3	0	26	85	20	-76.6%	-3.77%
Twilight Cove (WA)	1	0	-	-	4	-	-	-	-
Recherche Archipelago (WA)	11	6	6	0	220	194	104	-46.6%	-1.65%
Bremer Bay (WA)	4	2	2	0	77	87	36	-58.8%	-2.32%
Jurien Bay (WA)	3	3	2	1	177	185	177	-4.6%	-0.12%
Abrolhos Is (WA)	9	0	-	-	31	-	-	-	-
Total SA	42	28	23 (82%)	5 (18%)	2,484	7,477	1,936	-74.1%	-3.5%
Total WA	28	11	10 (91%)	1 (9%)	509	467	316	-32.2%	-1.0%
Total	70	39	33 (85%)	6 (14%)	2,993	7,943	2,253	-71.6%	-3.3%

Western Australia

Few Australian Sea Lion breeding colonies in Western Australia (WA) have accurate, long-term trend data for pup production. Good quality trend data only exists for the three Jurien Bay sites on the west coast, which comprise 11 percent of the number of known breeding sites in WA (S. Goldsworthy 2018. pers comm 5 March). Surveys have been undertaken more regularly for the west coast colonies compared to the south coast colonies of WA, due to the remoteness of the latter (Friedman & Campbell 2014).

Overall, time-series data exist for 11 (39 percent) of the 28 breeding sites in WA, covering three of the six metapopulation regions (Recherche Archipelago in Table 2 includes both Esperance and Eastern Recherche in Pitcher 2018) in the state. Changes in pup abundance over at least two comparable surveys were calculated as described above for South Australia (Table 2). The estimated decline over the past three-generation period was 32.2 percent. However, the overall decline in WA may be higher due to the limited data, and potential bias from the Jurien Bay sites where the populations are more or less stable (S. Goldsworthy 2018. pers comm 5 March). Pup abundance in the eastern group of islands in the Recherche Archipelago (Six Mile, Spindle and Ford Islands) should ideally be included in estimates of abundance and trends, as these populations represent approximately 20 percent of the population in WA (Friedman & Campbell 2014); however, robust pup abundance data are only available for Six Mile Island (S. Goldsworthy 2018. pers comm 5 March).

Total population

Across the species' range, the overall decline in the population is estimated to be 3.3 percent per year, and 71.6 percent over a three-generation period (Table 2). This population reduction has been observed based on an index of abundance appropriate to the taxon (changes in pup abundance), and causes of the reduction have not ceased (subcriterion A2(b)).

The data presented above appear to demonstrate that the species is **eligible for listing as Endangered (A2(b))** 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 2. Geographic distribution as indicators for either extent of occurrence AND/OR area of occupancy			
	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
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:

Section 4.10 of the IUCN Red List Guidelines states that "In some cases...the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon" (IUCN Standards and Petitions Subcommittee 2017). Consistent with these guidelines,

the Australian Sea Lion's area of occupancy (AOO) may be defined as the total area of occupied breeding colonies. Multiplying the number of breeding locations (81) by the minimum grid size (2x2 km) gives an AOO of approximately 324 km². The extent of occurrence is estimated to be greater than 100 000 km² (Woinarski et al. 2014).

To be eligible for listing under this criterion, the species must meet at least two of the three conditions indicating that distribution is precarious for survival. The distribution is not considered severely fragmented, because more than 50 percent of the population occurs in the five largest colonies, which does not meet the requirement that "most of its individuals are found in small and relatively isolated subpopulations" (section 4.8 of the IUCN Red List Guidelines). There is a continuing decline in population size, which meets subcriterion (b), however the species does not undergo extreme fluctuations. Therefore only one of the three conditions are met.

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 3. Population size and decline			
	Critically Endangered Very low	Endangered Low	Vulnerable Limited
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)	Very high rate 25% in 3 years or 1 generation (whichever is longer)	High rate 20% in 5 years or 2 generation (whichever is longer)	Substantial rate 10% in 10 years or 3 generations (whichever is longer)
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
(a) (ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b) Extreme fluctuations in the number of mature individuals			

Evidence:

In 2017, total pup production for the species was estimated to be 3009, with 2500 in South Australia and 509 in Western Australia (Table 2). Pup production to total population multipliers developed from life-table parameters for the species range from 3.83 to 4.08 (Goldsworthy & Page 2007, Goldsworthy et al. 2010) giving a total population estimate of around 11 900 (range 11 524 – 12 277). Based on an age-structured model (Goldsworthy et al. 2010), the number of mature individuals in the population is estimated to be 6350 (i.e. limited). This is likely to be an over-estimate as the age-structured model assumes a stable population (S. Goldsworthy 2018. pers comm 5 March), whereas the population is declining (see Criterion 1).

Based on past declines, the population is projected to undergo a continuing decline of at least 10 percent over three generations (i.e. a substantial rate of decline).

The largest subpopulation has more than 1000 mature individuals. Given the high level of genetic subdivision at the breeding colony scale, individual breeding colonies may be considered subpopulations (Campbell et al. 2008a, Lowther et al. 2012; Goldsworthy 2015). From the 2014–2015 census the largest colony, Dangerous Reef, has an estimated pup abundance of 485 (Goldsworthy et al. 2015, p. 15), which equates to 1373 mature individuals.

The data presented above appear to demonstrate that the species is **eligible for listing as Vulnerable (C1)** 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 number of mature individuals is estimated to be 6350 (see Criterion 3), which is not low.

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 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:

Population viability analysis appears not to have been undertaken, and there are 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

There is an existing recovery plan for the Australian Sea Lion (DSEWPaC 2013a).

The objectives of the plan are to:

- Mitigate interactions between fishing sectors (commercial, recreational and Indigenous) and the Australian Sea Lion to enable the recovery of all breeding colonies.
- Mitigate the impacts of marine debris on Australian Sea Lion populations.
- Mitigate the impacts of aquaculture operations on Australian Sea Lion populations.

- Investigate and mitigate other potential threats to Australian Sea Lion populations, including disease, vessel strike, pollution and tourism.
- Continue to develop and implement research and monitoring programs that provide outputs of direct relevance to the conservation of the Australian Sea Lion.
- Increase community involvement in, and awareness of, the recovery program.

Primary Conservation Actions

1. Minimise the bycatch of Australian Sea Lions in commercial fisheries.
2. Mitigate the impacts of marine debris on Australian Sea Lions.
3. Improve understanding of the threats posed to Australian Sea Lion populations, including cumulative impacts.

Conservation and Management Priorities

- Fishing activities
 - Implement management measures (including monitoring, management response, compliance and review) to minimise the bycatch of Australian Sea Lions in gillnet and rock lobster fisheries which overlap with the distribution of the Australian Sea Lion.
 - Implement mitigation measures in other fisheries (commercial, recreational and Indigenous) that have impacts on Australian Sea Lions, where required.
- Marine debris
 - Assess the impacts of marine debris on Australian Sea Lion populations, and identify the sources of marine debris which have an impact.
 - Develop and implement measures to mitigate the impacts of marine debris on the species (including reducing the amount of these marine debris entering the oceans), noting linkages with the Threat Abatement Plan for the Impact of Marine Debris on Vertebrate Marine Life.
- Deliberate killing
 - Collect data on deliberate killings, and encourage the reporting of deliberate killings to relevant jurisdictional bodies.
- Disease and parasites
 - Develop and implement measures to mitigate any significant factors affecting the health of Australian Sea Lions.
- Habitat degradation and pollution
 - Investigate the nature, extent and consequence of interactions between Australian Sea Lions and aquaculture activities, and mitigate any impacts (e.g. reduced habitat availability).
 - Implement measures to minimise the impacts of water pollution from marine aquaculture.
 - Require all vessels to have oil spill mitigation measures in place, and implement jurisdictional oil spill response strategies as required.
 - Protect all sea lion habitat from habitat degradation due to onshore and offshore developments.
- Human disturbance
 - Monitor and mitigate impacts (including cumulative impacts) of human interactions on Australian Sea Lion colonies.
 - Control access to breeding colonies to minimise the impacts of disturbance on Australian Sea Lions.

- Competition and prey depletion
 - Sustainability manage fish species that are important prey for Australian Sea Lions, and reduce fishing pressure if required.
- Climate change
 - Review and adjust management measures to address the threats from disease/parasites and prey depletion, if it is demonstrated that increased temperatures compound these threats.

Stakeholder Engagement

- Provide advice, education and support to fishers, community members, local governments, Indigenous organisations and regional natural resource management organisations on threats to the Australian Sea Lion and implementation of recovery actions.
- Develop and provide information for tourists and tourism operators to promote an understanding of Australian Sea Lion conservation issues and to emphasise the importance of minimising disturbance of Australian Sea Lion colonies during visits.
- Involve community groups and tour operators in research and monitoring programs, where practical.

Survey and Monitoring priorities

- Monitor population size, population trends and distribution by implementing the Australian Sea Lion monitoring framework (Lawrence & Bravington 2016; Pitcher 2018) across the species' range. In particular, monitor key colonies in Western Australia every breeding season to maintain knowledge of the breeding schedule and ensure accurate estimates of pup production.
- Develop standard forms for reporting and recording data, in order to provide consistent data collection; store data in a centralised online database for data management.
- Monitor the cumulative impacts of fisheries on Australian Sea Lion populations, including from bycatch, prey depletion, reduction in habitat availability, and entanglement in active fishing gear.
- Monitor the health of colonies for illness due to disease/parasites.
- Monitor the progress of recovery of Australian Sea Lion populations, including the effectiveness of management actions and the need to adapt them if necessary.

Information and Research priorities

- Undertake research to improve knowledge on behavioural ecology, trophic interactions and foraging ecology of the Australian Sea Lion – particularly in areas important to the survival of the species – and at scales relevant to human activities that can be managed.
- Improve knowledge on the impacts of fishing on populations, by assessing:
 - the impacts of fisheries other than the gillnet and rock lobster sectors;
 - the impacts of fishing on prey species of Australian Sea Lions;
 - the impacts of fishing gear and infrastructure on the preferred habitat of, or habitat availability for, Australian Sea Lions.
- Improve understanding of the threat posed to Australian Sea Lion populations by deliberate killings, vessel strike, pollution and oil spills, by:
 - developing protocols for the collection of biological samples (to determine the cause of ill-health or death) and ensure that a portion of each sample (including those already collected) is centrally archived;
 - collecting data on deliberate killings and confirmed vessel strikes.

- Improve understanding of the threat and importance of health-related factors to Australian Sea Lion populations by:
 - undertaking research to better understand pup mortality due to disease and parasites, and the drivers for variance in pup production and mortality across seasons (including apparent seasonal cycles) and between colonies;
 - undertaking research on the effects of providing a broad spectrum treatment to kill parasites and whether this affects pup mortality;
 - analysing the impacts of bioaccumulation of toxins on the health of Australian Sea Lions.
- Assess the level of human interactions with Australian Sea Lions, and identify the cumulative impact of human interactions on Australian Sea Lion populations.
- Investigate the impacts of climate change, including:
 - the impacts of increasing ocean temperatures on the susceptibility of Australian Sea Lions to disease/parasites, and on prey species of Australian Sea Lions;
 - identify colonies at risk of becoming submerged under projected sea level rise, and the potential impact on the recovery of the species.

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- Goldsworthy SD (2015) *Neophoca cinerea* (Australian Sea Lion), in The IUCN Red List of Threatened Species. Version 2017-3. Available on the internet at: www.iucnredlist.org
- Hood GM (2006) PopTools. Available on the Internet at: www.poptools.org

Consultation questions

PART 1 – INFORMATION TO AID LISTING ASSESSMENT

1. Do you agree that the data presented demonstrates that the species is **eligible for listing** as Endangered under Criterion 1 A2(b)?
2. Do you agree that the total population size is likely to be limited, the population likely to undergo a continuing decline of at least 10 percent over a three generation (38 year) period, and that the species is **eligible for listing as** Vulnerable under Criterion 3 C1?
3. Can you provide any additional information or data that would support assessment of the species against the listing criteria?

PART 2 – INFORMATION FOR CONSERVATION ADVICE ON THREATS AND CONSERVATION ACTIONS

7. Do you have further information on the current or potential **threats** facing the species?
8. Do you have further information on current or potential **management actions** to support protection and recovery of the species?
10. Are you aware of **other knowledge** (e.g. traditional ecological knowledge) that may help better understand the threats and management actions to aid recovery of the species?
11. Are you aware of any **cultural importance or use** that the species has?
12. What **individuals or organisations** are currently, or potentially could be, involved in management and recovery of the species?

PART 3 – **ANY** OTHER INFORMATION

13. Do you have comments on any other matters relevant to the assessment of this species?