**[Draft] Specially Protected Species Action Plan for the emperor penguin, *Aptenodytes forsteri* Gray, 1844**

A group of penguins walking on a beach

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Image: Roger Kidd

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# 1. Introduction

The Antarctic Treaty Consultative Meeting (ATCM) has developed this Specially Protected Species Action Plan for the emperor penguin (Aptenodytes forsteri Gray, 1844) in response to concerns about the long-term protection of the species. The anticipated future impact of climate change in the Antarctic region, with the potential loss of the sea ice habitat relied upon by emperor penguins, is recognised as the most significant threat to the species in the coming decades. Human interactions with emperor penguins at or adjacent to colonies and with birds while they are away from their breeding locations, may present further threats to the species. Other environmental threats to emperor penguin populations, such as changes in food availability, may also assume greater importance because of the changing climate in the Antarctic.

The goal of the Action Plan is to reduce and, where practicable, prevent threats to emperor penguins and their habitat at all stages of their life cycle, taking into account observed and potential impacts of climate change on emperor penguins, in order to improve the threat status and degree of endangerment of the species through the implementation of management measures. The Action Plan identifies and promotes actions by Antarctic Treaty Parties that are needed to avoid or minimise the threats to the conservation of the emperor penguin arising from the effects of climate change and also from activities in the Antarctic Treaty area. The Action Plan allows all Parties to agree on actions to assess and mitigate threats to the emperor penguin. It promotes a precautionary approach to action, drawing on the best available science, while also advancing priority research and monitoring activities that will contribute to the protection and management of the emperor penguin. In this way, Parties may work towards the conservation of the species and help in the maintenance, or recovery where appropriate, of its populations.

The Action Plan does not attempt to mitigate global climate change, which requires coordinated and unified global action. However, the Action Plan promotes collaboration by Antarctic Treaty Parties to encourage action to address global climate change for the benefit of the emperor penguin.

## 1.1 Action Plan structure

The Action Plan is comprised of several sections. Section 2 provides background information on emperor penguin biology, conservation status, vulnerability to direct and indirect threats and also provides details of Antarctic Treaty System (ATS) agreements and management tools that are in place to protect this species. In Section 3, the Action Plan goal is established and in Section 4 the overarching objectives to deliver the goal are set out. In Section 5, specific actions are described for each objective, including the provision of information on the relevant spatial scale of each action, the emperor penguin life cycle stage the action is relevant to and the identification of the organisation(s) that will lead work to deliver the action.

The protection and management of emperor penguin habitat under the Antarctic Treaty and the Protocol and/or through the ATS has been established in a hierarchical way. The Action Plan presents a framework for protection of the emperor penguin and management of its habitat, which include, with increasing restrictions:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | ↓ |  |
| (i) | general guidance for authorised/permitted visits to any colonies; | Increasing restrictions |
| (ii) | restricting access to some areas for only specified purposes; |
| (iii) | restricting access to some colonies for only specified purposes; and |
| (iv) | keeping some colonies largely free from visitation, with the exception of very infrequent visits for scientific research that is strongly justified for conservation purposes |

## 1.2 Review of the Action Plan

The Action Plan shall be assessed and revised every 5 years. Each review should revise the actions presented in the Action Plan, as necessary, and ensure that the Action Plan information is up to date, based upon best available science.

As part of the Action Plan review, the Committee should consider the outcomes from research and monitoring programmes and assess the effectiveness of existing management actions in the conservation of the emperor penguin. To audit the efficacy of recovery actions, the Committee should assess the present and likely future risk of extinction of the species. Such assessments should take account of the status and trends of the species at circumpolar, regional and local scales. During the review of the Action Plan, the Committee should take into account scientific data and information provided by members, as well as observers such as SCAR, CCAMLR and COMNAP and experts such as IAATO and ASOC.

# 2. Background information

## 2.1 Species description

The emperor penguin (*Aptenodytes forsteri* Gray, 1844) was first described scientifically and distinguished from its closest relative, the king penguin (A. patagonicus Miller, 1778), in 1844 by George Robert Gray. The emperor penguin is the largest, tallest and heaviest of all living penguin species. Measured from the tip of the beak to the end of the tail, adults measure between 110 to 120 cm, and body mass varies seasonally, ranging from about 23 to 45 kg. Males and females are similar in plumage and size, although males tend to be slightly larger than females. Emperor penguins require large reserves of energy-giving body fat, particularly at the commencement of the breeding season and prior to the annual moult. They have excellent insulation in the form of several layers of very dense scale-like feathers, and strong claws for gripping the ice.

A group of penguins standing in the snow

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Figure 1. Female (left) and male (right) emperor penguins with their chick (centre).

Image: Mark Ryan.

## 2.2 Species reproductive ecology

The emperor penguin is the only warm-blooded Antarctic species that breeds during the austral winter in the region. As with many seabirds, emperor penguins are long-lived with an age at first breeding of five or six years old, although some birds attempt to breed when they are three years old (Jenouvrier et al., 2005). The average annual survival rate for adult emperor penguins is estimated to be over 95%, with an average generation length of 22.4 years (BirdLife International, 2020) and with approximately 1% living to age 50 years (see also Mougin and van Beveren, 1979, and Bird et al., 2020). For long lived species with low productivity – only ~19% of chicks survive their first year of life (Williams, 1995) – future predicted declines in population numbers will likely become more important as adults age and die.

Breeding commences in March/April when the adults return to their breeding colony. All colonies so far studied have a similar annual schedule (Figure 2) (Trathan et al., 2020). The emperor penguin is a serially monogamous species; courtship takes about six weeks (Ancel et al., 2013), and laying starts in May and continues into June. Females lay only one egg in each season. The male incubates the egg on his feet while the female leaves the colony to forage, and after about 65 days, the egg hatches. Females start to return in mid-July and take over the care of the egg or the newly hatched chick. Males go to sea to forage and build up body fat reserves after a fast that lasts nearly four months. Chicks are initially unable to regulate adequately their body temperature and are dependent upon their parents for warmth for about 50 days (Figure 3). Once the chicks are able to withstand the prevailing environmental conditions, their development and growth requires both parents to hunt and supply food. Chicks fledge in December/January, and the adults that have bred go to sea to build up resources prior to the annual moult that lasts for about one month. Thus, emperor penguins require stable fast ice for at least nine months to rear their chicks successfully (Jouventin, 1971).

Chart, sunburst chart

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Figure 2. Breeding cycle of the emperor penguin (figure taken from Trathan et al., 2020).

A group of penguins walking on snow

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Figure 3. Adult emperor penguin with chick within the colony. Image: Steven Marshall.

## 2.3 Species diet and foraging ecology

The diet of the emperor penguin is diverse and its composition varies between years, colony, season and foraging location. For example, at the Drescher Inlet (72°52’S, 19°25’W) the summer diet of emperor penguins was dominated by squid species *Alluroteuthis antarcticus*, *Moroteuthopsis longimana* and *Psychroteuthis glacialis* (~93%) followed by fish, krill, amphipods and isopods (Piatkowski & Pütz, 1994). Some years later at the same colony, the penguins’ summer diet was largely Antarctic krill *Euphausia superba* (~75%); the remaining diet was fish (~17%), as well as some amphipods and small numbers of various squid species (Pütz, 1995). In contrast, emperor penguins at Amanda Bay (69°17’S, 76°46’E) mainly consumed Antarctic silverfish *Pleuragramma antarctica* (~78%), some squid species and amphipods, but hardly any euphausiids (Gales et al., 1990). Most prey species of emperor penguins are pelagic, but demersal and benthopelagic species are also consumed (Kirkwood & Robertson, 1997; Wienecke & Robertson, 1997). Emperor penguins also forage at the under-surface of the sea ice (e.g., for the bald rockcod *Pagothenia borchgrevinki* (Ponganis et al., 2000)).

Emperor penguins are formidable divers, foraging mostly at depths from 50 to 250 m (Wienecke & Robertson, 1997; Zimmer et al., 2010). Occasionally, emperor penguins dive deeper and can reach depths in excess of 500 m. For example, of nearly 130,000 dives reported by Wienecke et al. (2007), only 264 (0.2%) were deeper than 400 m, and only one of 93 birds dived to >500 m. Generally, dives last three to six minutes, thus remaining within their aerobic dive limit (Kooyman & Kooyman, 1995). However, extremely long dive durations can occur when emperor penguins are diving under fast ice or are trapped under pack ice. Dives can last over 30 minutes, but dives exceeding 20 minutes are exceedingly rare (Wienecke et al., 2007; Goetz et al., 2018).

## 2.4 Physiology, morphology and behaviour

Emperor penguins are well adapted for life on ice in terms of their behaviour, morphology and physiology (Kooyman et al., 1971; McCafferty et al., 2013). Their highly social, non-territorial character enables them to huddle and share body warmth, an effective strategy to reduce energy expenditure. When resting or incubating, the birds lift the plantar surfaces of the feet off the ice and tuck their toes into the belly feathers. Body fat reserves (up to 30% of the body mass) and a reduction in the basal metabolic rate limits energy expenditure. Furthermore, their round bodies give a low surface to volume ratio, and their extremities are very small in relation to their overall size. The feathers are very small, overlap extensively, and are very dense (Williams et al., 2015). The plumage can reach nearly ambient temperatures at the outside but accounts for about 85% of the resistance to heat transfer from the body. Counter-current heat exchange warms the venous blood and cools the arterial blood in the nasal passages, the flippers and legs. All these adaptations keep the core temperature at around 38 °C (McCafferty et al., 2013).

## 2.5 Past and present distribution including critical habitat

The emperor penguin is endemic to Antarctica and colonies occur in coastal locations around Antarctica with almost all colonies occurring on fast ice, which is sea ice held in place by geographic features and grounded icebergs (Fretwell & Trathan, 2020) (Figure 4). However, when fast ice is present for an insufficient period (Fretwell et al., 2014), or of inadequate quality and subjected to sustained winds that cause early ice break up (Zitterbart et al., 2014), colonies may shift onto ice shelves or icebergs, or even land. Currently, only one colony is entirely located on land (Taylor Glacier) where it has been for at least 70 years (Fretwell et al., 2012; Wienecke et al., 2010), but others have access to small islands or exposed rock areas for part of the season. At present, it is not known whether access to land is important for these latter colonies.

Emperor penguin colonies are evenly distributed around the Antarctic continent along the fast ice (mean separation distance ~220 km ± 17 km), which may suggest intra-specific competition for resources (Ancel et al., 2017; Santora et al., 2020). Although many colonies are predictable in locations (Robertson et al., 2014), Very High Resolution (VHR) satellite image analysis has also indicated that entire colonies can appear or disappear from year to year, suggesting movement among colony locations (LaRue et al., 2015, Jenouvrier et al., 2017). From 2015–2017 the breakout of fast ice in October/November led to complete breeding failure of the Halley Bay colony, one of the largest emperor penguin colonies. From 2016–2018, the size of the Dawson Lambert colony, about 55 km south of Halley Bay, increased more than 10-fold (Fretwell and Trathan 2019). How these shifts affected breeding success is unknown.

Map

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Figure 4. Distribution of emperor penguin breeding colonies. The size of each colony is proportionate to the symbol size. Colonies that have been visited on the ground are shown in red, those that have been overflown are in blue, and those only observed by satellite are in green. Colony names are: 1 - Cape Colbeck, 2 - Rupert Coast, 3 - Ledda Bay, 4 - Thurston Glacier, 5 - Bear Peninsula, 6 - Brownson Islands, 7 - Noville Peninsula, 8 - Bryan Coast, 9 - Smyley Island, 10 - Rothschild Island, 11 - Snow Hill Island, 12 - Larsen Ice Shelf, 13 - Dolleman Island, 14 - Smith Peninsula, 15 - Gould Bay, 16 - Luitpold Coast, 17 - Halley Bay, 18 - Dawson-Lambton Glacier, 19 - Stancomb-Wills Glacier, 20 - Drescher Inlet, 21 - Riiser-Larsen Ice Shelf, 22 - Atka Bay, 23 - Sanae, 24 - Astrid Coast, 25 - Lazarev Ice Shelf, 26 - Ragnhild, 27 - Riiser-Larsen Peninsula/Gunnerus Bank, 28 - Umebosi Rock, 29 - Amundsen Bay, 30 - Kloa Point, 31 - Fold Island, 32 - Taylor Glacier, 33 - Auster, 34 - Cape Darnley, 35 - Amanda Bay, 36 - Barrier Bay, 37 - West Ice Shelf, 38 - Burton Ice Shelf, 39 - Haswell Island, 40 - Shackleton Ice Shelf, 41 - Bowman Island, 42 - Peterson Bank, 43 - Sabrina Coast, 44 - Dibble Glacier, 45 - Pointe Géologie, 46 - Mertz Glacier, 47 - Mertz break off, 48 - Davis Bay, 49 - Cape Roget, 50 - Coulman Island, 51 - Cape Washington, 52 - Franklin Island, 53 - Beaufort Island, 54 - Cape Crozier. Figure taken from Trathan et al. (2020). Additional colonies have been reported by Fretwell and Trathan (2020), though these are all relatively small.

## 2.6 Population trends

### 2.6.1 Past and present population estimates

Due to advances in survey and monitoring techniques, knowledge of the global population size of the emperor penguin has increased in recent years. The global emperor penguin population was estimated as 135,000-175,000 breeding pairs in 1992 (Martinez, 1992), but several colonies were not included in this estimate. The most recent global survey of emperor penguins by VHR satellite imagery, revealed that the population comprised ~238,000 breeding pairs, or ~595,00 birds (Fretwell et al., 2012), calculated across 46 colonies. Since then, additional apparent breeding locations have been discovered, bringing the total to 61 colonies with probably c. 256,500 breeding pairs (Fretwell & Trathan, 2020).

Colonies expand and contract, depending upon prevailing weather conditions (Richter et al., 2018). Movement between colonies appears to occur (LaRue et al., 2015; Cristofari et al., 2016), whilst individual colony population counts within a region are known to increase and decrease in differing ways (Kooyman & Ponganis, 2017). Surveys of the northernmost emperor penguin colony on Snow Hill Island have recorded stable population values in recent years compared to the first counts made a few years ago (Libertelli & Coria, 2017a, Libertelli & Coria, 2017b).

The population trend of the species is predicted to be strongly linked to the condition of ice cover around Antarctica in future. The most recent assessment of emperor penguin conservation status by the International Union for Conservation of Nature (IUCN) indicated that the current population trend is considered *stable* ([Birdlife International, 2020](https://www.iucnredlist.org/species/22697752/157658053)). However, the future trend is predicted to show an increasingly rapid rate of decline once changes to the availability of suitable land-fast sea ice begin to affect breeding success. Therefore, the latest IUCN assessment considered the future population trend will be *decreasing* ([Birdlife International, 2020](https://www.iucnredlist.org/species/22697752/157658053)) (see next section).

### 2.6.2 Future population trends

Historical information about global emperor penguin population size, including any directional change, does not exist as the number of colonies and the global population size were only fully assessed this century. Until 2011, the IUCN Red List assessment for emperor penguins was based upon inadequate data, leading to the assessment of *Least Concern*. With the first robust global population assessment in 2012 (Fretwell et al., 2012), the species was subsequently assessed as *Near Threatened* (Bird Life International, 2020). Projected future population size has now been modelled and assessed to be critically linked to sea ice change (Jenouvrier et al., 2021). Changes in sea ice as a major threat to emperor penguins is supported by modelled colony population forecasts, which are now available over the entire species range (Jenouvrier et al., 2014; 2020; 2021). Although there is large uncertainty in the magnitude of future sea ice decline, a loss of Antarctic sea ice in the future is almost certain given increasing greenhouse gas concentrations and rising global temperatures (Ibid). Projected changes in sea ice show that regional patterns are highly likely to exist, but ultimately, sea ice will decline around the entire Antarctic continent. In this context, it should be taken into account that the extent of sea ice around Antarctic reached a record low in early 2022. Patterns of change in emperor penguin populations are also therefore likely to be regional, but ultimately all regions will show population decline (Jenouvrier et al., 2021).

Under different plausible greenhouse gas (GHG) emission scenarios, it is estimated that the emperor penguin population will decline by c. 27% to 89% by 2070, with the eventual outcome depending upon policy decisions at a global scale and the resulting emission scenario. This period corresponds to three generations of emperor penguins (Jenouvrier et al., 2021). The predicted rapid rate of population decline, particularly from mid-century onwards, means the species will quickly become *Vulnerable*, or even *Endangered* under the IUCN criteria (IUCN, 2012, 2019), due to emerging threats, such as loss of sea ice habitat, alteration in food availability, changes to the currents in the Southern Ocean and extreme storm events (see Trathan et al., 2020; Fretwell and Trathan, 2019; Jenouvrier et al., 2021 and references therein). The Climate Action Tracker (CAT; https://climateactiontracker.org/) is an independent scientific analysis produced by research organisations tracking climate action since 2009. CAT tracks progress towards the globally agreed aim of holding warming below 2°C, and pursuing efforts to limit warming to 1.5°C. The most optimistic scenario reported by CAT, assuming all climate pledges are implemented, projects a global temperature increase of 1.8°C. Jenouvrier et al. (2021) show that with a global temperature increase of 1.5°C, the global emperor penguin population is projected to decline by more than 50%.

Jenouvrier et al. (2021) considered the resiliency, redundancy and representation (3Rs) of the emperor penguin within the foreseeable future (to the year 2100). Resiliency is the ability to withstand stochastic (or random) disturbance, which may be measured through population size, growth rate, and connectivity among populations. Redundancy is the ability to withstand catastrophic events, and considers the number, distribution, resiliency, and connectivity of populations. Representation is the ability to adapt to changing environmental conditions, and is related to capturing the geographic, genetic, and life history variation that exists across the species’ ecological setting. Together, the 3Rs encompass aspects that contribute to species persistence (e.g., demography, spatial distribution, diversity) and are important for assessing climate change threats in the foreseeable future. Jenouvrier et al. (2021) determined that if sea ice declines at the rate projected by climate models under current energy system trends and policies, the 3Rs would be dramatically reduced and almost all colonies would become quasi-extinct by 2100. Pursuing efforts to limit warming to 1.5°C are therefore vital.

Jenouvrier et al. (2021) considered levels of uncertainty associated with their analysis, as their population viability analyses are projections and are expressed as conditional statements based on the structure of the models producing the results. This includes links in the climate models to the species life cycle model, but with long-term and statistically rigorous estimates of the functional relationship between sea ice and vital rates (reproduction, survival, etc.) at Pointe Géologie extended to all other colonies, with sea ice concentrations measured over large spatial scales (Jenouvrier et al., 2014). Jenouvrier et al. (2021) included individual dispersive behaviours and extreme perturbations that were documented using satellite imagery (Trathan et al., 2020) to capture potential dynamics observed over geological scales. Importantly, Jenouvrier et al. (2021) included multiple sources of stochasticity and uncertainties related to climate and demography, including the chaotic temporal evolution of the coupled ocean–atmosphere system (often called ‘natural variability’), and demographic parameter ‘unexplained’ temporal variance in demographic rates that is not accounted for by sea ice (Jenouvrier et al., 2020). Jenouvrier et al. (2021) make assumptions about the ecology of emperor penguins based on over 60 years of research. They assume ecological carrying capacity remains constant over time. However, a probable impact of sea ice loss will be on Antarctic trophic food web structure, including on emperor penguin prey. Decreased foraging habitat and availability (or abundance) of prey will reduce carrying capacity. Thus, though the species may adapt in part, it is uncertain whether this is a long-term solution as birds would still be subject to the consequences of an altered food web.

Jenouvrier et al. (2021) note that accurate measurement and modelling of environmental features that directly affect emperor penguin life cycle, such as fast ice extent, remain challenging, especially at the circumpolar scale (e.g., Fraser et al., 2021), and these features are not projected by climate models. Trends in overall sea ice extent (largely contributed by the trend in pack ice extent) are potentially independent of what might be happening with coastal fast ice. Nevertheless, an analysis of circumpolar fast ice extent shows similarities with overall sea ice extent (Fraser et al., 2021), suggesting that in the long-term, sea ice at the large-scale probably determines the ultimate condition of fast ice as a breeding platform for penguins. Finally, Jenouvrier et al. (2021) note that with time, many uncertainties will decrease as the response of emperor penguins to climate change becomes progressively apparent.

#### 2.6.2.1 Uncertainties concerning Antarctic sea ice and associated impacts upon emperor penguin population trends

It is worth noting the influence of the uncertainties in the Antarctic sea ice modelling. Antarctic sea ice has experienced both increases and decreases in sea ice area over 1979–2019, and substantively lower levels since 2016 (with a record minimum extent recorded in 2022), with only minor differences between decadal means of sea ice area for the first (for February 2.04 million km2, for September 15.39 million km2) and last decades (for February 2.17 million km2, for September 15.75 million km2) of satellite observations (high confidence). There remains low confidence in all aspects of Antarctic sea ice prior to the satellite era owing to a paucity of records that are highly regional in nature and often seemingly contradictory. There is low confidence in model simulations of past and future Antarctic sea ice evolution due to deficiencies of process representation, in particular, at the regional level.

The multi-model ensemble mean of historical simulations from CMIP5 and CMIP6 models show a decrease of the total Antarctic sea ice extent during the satellite era, in contrast to the positive trend that satellites observed (Shu et al., 2015; 2020). Not only the positive trends of total Antarctic sea ice, but also regional trends are not reproduced by the CMIP5 and CMIP6 models, specifically the sea ice decrease in the Amundsen and Bellingshausen Seas and the increase in the Weddell and Ross Seas (Shu et al., 2015; 2020). The low confidence in the projections of Antarctic sea ice gives large uncertainty to prediction for the coming 100 years(IPCC, 2019). The sea ice simulation by Community Earth System Model (CESM)/Community Climate System Model (CCSM) also obtained negative trends for the total Antarctic during 1979 to 2005, in contrast to the positive trend that satellites observed(Shu et al., 2015), therefore, modelled colony population forecasts of emperor penguins include large uncertainty.

There are also substantial uncertainties over future changes in the patterns of weather variables and how these are likely to impact the species, as well as whether there will be a lag in the decline of mature individuals as recruitment falls, or whether this decline will be proportional to the loss of colonies as climatic changes result in the increased mortality of mature individuals. The degree to which the predicted declines will be realised will depend upon a large number of variables, but there is a strong indication that if declines are detected in the emperor penguin population, they will then be suspected to proceed at an increasingly rapid rate necessitating the listing of the species at a higher threat category. In the absence of a decline, and noting that the major disruption to ice availability is predicted to begin after the middle of the century, the future rate of population reduction is suspected to be between 20-29% over three generations (Birdlife International, 2020).

## 2.7 Genetics

Recent studies have shown that emperor penguins comprise at least four meta-populations: in the Weddell Sea, on the Mawson Coast, at Amanda Bay/Pointe Géologie and in the Ross Sea (Younger et al., 2015; 2017), though other work suggested little or no genetic difference among colonies (Cristofari et al., 2016).

## 2.8 Conservation status

### 2.8.1 Antarctic Treaty System

[In 202Y, through Measure XXX, emperor penguins were designated as an Antarctic Specially Protected Species in accordance with Article 3 of Annex II to the Protocol on Environmental Protection to the Antarctic Treaty (Environmental Protocol).]

### 2.8.2 IUCN Red List

The IUCN Red List of threatened species status for the emperor penguin was last assessed in August 2019 ([BirdLife International, 2020](https://www.iucnredlist.org/species/22697752/157658053)) under the IUCN Red List Categories and Criteria (IUCN, 2012, 2019). The assessment identified the emperor penguin as *Near Threatened* as the species is projected to undergo a moderately rapid population decrease as Antarctic sea ice begins to disappear within the next few decades because of climate change ([BirdLife International, 2020](https://www.iucnredlist.org/species/22697752/157658053)). By the end of the 21st century, under current levels of CO2 emission, more than 80% of the population is projected to be lost, but major changes to sea ice prevalence are not projected to begin until after 2050. As such, the assessment concluded that while declines over the next three generations are not expected to exceed thresholds for listing as threatened, future climate scenarios predict a rapid increase in the rate of population decline, such that without mitigation the species will begin to decline rapidly within one to two generations.

## 2.9 Agents of decline/threats (including uncertainties and potential future threats)

Table 1 provides a summary of threats to the emperor penguin in the marine and terrestrial environment.

### 2.9.1 Climate change

Rapid environmental change is projected to negatively affect the emperor penguin. Emperor penguins depend upon sea ice for breeding habitat. Climate change will alter the extent, formation and persistence of sea ice, especially fast ice, leading to a loss of habitat and reduced reproductive success (Jenouvrier et al., 2009; 2012; 2014, 2017; Ainley et al., 2010; Trathan et al., 2011). Population models indicate that negative climate change-related impacts on the emperor penguin can be considered likely (Jenouvrier et al., 2014; Larsen et al., 2014), with high agreement amongst experts (Ainley et al., 2010; Larsen et al., 2014; Trathan et al., 2020).

Currently, most climate models indicate that future climate change will lead to reductions in Antarctic sea ice area of close to 30% (or 40%) by 2100 under medium (or high) emissions scenarios, although confidence in the rate of loss is limited (Bracegirdle et al., 2008; 2015; Palerme et al., 2017; Roach et al., 2020). The projected loss of sea ice habitat will affect emperor penguins (Ainley et al., 2010; Jenouvrier et al., 2014; 2017). Emperor penguins are, however, likely to be affected well before the end of the century as a destabilization of their breeding platforms prior to fledging seriously diminishes their chances of breeding successfully, and hence reduces recruitment. Other factors that may affect the trajectory of emperor penguin populations include: (i) penguin emigration/immigration between colonies, if this affects survival rates (Cristofari et al., 2016; Jenouvrier et al., 2017); (ii) how the survival of juvenile emperor penguins is affected by climate variability (Abadi et al., 2017; Labrousse et al., 2019); and (iii) the availability of predictable food resources, which may change with sea ice loss (Massom et al., 2009; Ancel et al., 2017).

Owing to regional differences in climate change effects, colonies may be affected to different degrees in the future (Barber-Meyer et al., 2008; Kooyman & Ponganis, 2017; Jenouvrier et al., 2014). Constraints associated with a breeding location will affect a colony's population size if conditions are no longer suitable year on year. Currently occupied sites will be affected by climate change in the Antarctic and many sites may no longer be sustainable. Therefore, emperor penguins may have to relocate, but areas with reliable fast ice conditions will be more difficult to find (Ainley et al., 2010; Trathan et al., 2011; LaRue et al., 2015; Jenouvrier et al., 2017).

### 2.9.2 Other threats

Other known and emerging terrestrial and marine threats affecting emperor penguin are considered as relatively small if not negligible (Trathan et al., 2015) (see Table 1). Threats at local scales, e.g., infrastructure construction, scientific activities or tourist/recreational visitation, require assessment and appropriate mitigation through the Environmental Impact Assessment process, set out in Annex I to the Protocol. The level of collection of eggs or adults for zoological gardens has not been quantified. Maintaining emperor penguin colonies in captivity has proven challenging, with breeding programmes proving successful in only a small number of zoological gardens (Todd, 1987; Diebold et al., 1999). Other threats, such as by-catch in fisheries (e.g., Crawford et al., 2017) and resource competition from fisheries are apparently currently non-existent, but may be possible under future scenarios where fishing activities may overlap more substantially with emperor penguin foraging areas. Currently, there is no commercial harvest for Antarctic silverfish. The regional commercial fishery for Antarctic krill operates distant from emperor breeding sites; however, changes in extent and duration of sea ice are likely to enable fisheries to move farther south than in the past, and hence, operate closer to emperor penguin colonies. Little is known about the distribution of juveniles and non-breeding birds, which can forage far from the continent (Kooyman et al., 1996; Kooyman & Ponganis, 2008; Wienecke et al., 2010; Thiebot et al., 2013; Goetz et al., 2018; Labrousse et al., 2019). Possible threats may include ingestion of plastics and other pollutants, pathogens that may jump species in a warming ocean and interactions with fisheries. Changing predation pressure, ocean acidification, underwater noise, decreasing sea ice extent and decreasing salinity may affect the availability of emperor penguin prey species.

The level of sensitivity to disturbance exhibited by emperor penguins varies with the stage of the life cycle. The precise dates for each of the life cycles stage will vary for each colony and each individual. Emperor penguins are not highly synchronised and all breeding stages stretch over about 6-7 weeks. However, as a guide, emperor penguins are particularly sensitive to disturbance during the following periods (see Figure 2 and Table 1):

* from early May to late July when they are laying, incubating and hatching eggs;
* from late July to late September when adults are brooding chicks;
* from late November to late December when the chicks moult and fledge; and
* from mid-January to late February during the adults’ moult.

## 2.10 Management/conservation measures

### 2.10.1 Guidelines

#### 2.10.1.1 General Guidelines for Visitors to the Antarctic

The [General guidelines for visitors to the Antarctic](https://documents.ats.aq/recatt/att707_e.pdf) (Attachment to Resolution 3 (2021)) contain some general information regarding visitor conduct near wildlife. Examples include, keeping at least 5 metres from wildlife on land, moving slowly, keeping noise to a minimum, giving animals right of way and not blocking their access routes between land and sea or nesting sites, remaining observant for eggs, chicks or nests on the ground to avoid trampling, avoiding entering colonies, taking care not to leave food scraps and remaining vigilant for changes in animal behaviour and being prepared to move away if observed. No information specific to emperor penguins is provided.

#### 2.10.1.2 Guidelines for the Operation of Aircraft near Concentrations of Birds in Antarctica

The [Guidelines for the operation of aircraft near concentrations of birds in Antarctica](https://documents.ats.aq/recatt/Att224_e.pdf) (Recommendation 2 (2004)) set out measures to reduce disturbance of birds by fixed and rotary wing aircraft. Measures include a minimum overflight altitude and landing distance from a concentration of birds. No measures specific to emperor penguins are provided.

#### 2.10.1.3 Environmental Guidelines for Operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica

The [Environmental guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica (v 1.1)](https://documents.ats.aq/recatt/Att645_e.pdf) (Resolution 4 (2018)) include guidance for the conduct of operations over or near wildlife. No measures specific to emperor penguins are provided.

#### 2.10.1.4 CEP Non-native Species Manual

The [CEP non-native species manual](https://documents.ats.aq/ATCM42/WW/ATCM42_WW008_e.pdf) (Resolution 4 (2016)) contains a section entitled ‘Preventing, detecting and responding to diseases in Antarctic wildlife resulting from human activities’, which provides information relevant to the issue of human transmission of avian pathogens to and between bird colonies.

#### 2.10.1.5 Site Guidelines for Visitors

Non-binding [Site Guidelines for Visitors](https://www.ats.aq/devAS/Ats/VisitorSiteGuidelines) have been prepared for areas that receive substantial or increasing amounts of visitation. Site Guideline No. 21 Cape Royds, No. 28 Seabee Hook, Cape Hallett, No. 32 Mawson’s Huts and Cape Denison, No. 43 Cape Evans, No. 44 Hut Point, and No. 45 Cape Adare, mention that emperor penguins are occasional visitors to these areas but provide no further information specific to this species. Across the Site Guidelines that include mention of emperor penguins, recommended minimum approach distances to wildlife and/or penguin species (in general) vary from 5 to 15 metres.

#### 2.10.1.6 Interim Guidelines

At CEP XX (2017), the Committee considered a proposal by Argentina to evaluate the different protection mechanisms for the Snow Hill Island emperor penguin colony, in the current context of climate change and anthropogenic pressures (ATCM XL/WP44). The application of ‘[The guidelines for behaviour near the Snow Hill Island emperor penguin colony](https://documents.ats.aq/ATCM40/wp/ATCM40_wp044_e.doc)’ was agreedas an interim measure until the need to develop more restrictive mechanisms of protection had been evaluated. For the Snow Hill colony, recommended measures included: (i) a specific approach direction for ships, (ii) a helicopter minimum flight altitude (610 m/2000 ft) and landing distance from the colony (1 km), (iii) a minimum approach distance of visitors that varied from 30 to 60 m, depending upon the life cycle stage of the penguins, (iv) the adoption of a low hunched position by visitors when near the colony, (v) the avoidance of visitation between 22:00 and 04:00 (local time) and (vi) a maximum of one ship visit per week.

### 2.10.2 Area protection and management

#### 2.10.2.1 Antarctic Specially Protected Areas

All parts of Antarctica are afforded protection through the general provisions of the Environmental Protocol. Some emperor penguin colonies have been afforded additional protection through the designation of Antarctic Specially Protected Areas (ASPAs), in accordance with the criteria set out in Annex V to the Protocol on Environmental Protection to the Antarctic Treaty. Eight ASPAs have been designated with protection of emperor penguins as the primary value identified for protection within the Area (Article 3 (2c)): ASPA No. 101 Taylor Rookery, Mac. Robertson Land; ASPA No. 105 Beaufort Island, McMurdo Sound, Ross Sea; ASPA No. 107 Emperor Island, Dion Islands, Marguerite Bay, Antarctic Peninsula; ASPA No. 120 Pointe Géologie Archipelago, Terre Adélie; ASPA No. 124 Cape Crozier, Ross Island; ASPA No. 127 Haswell Island; ASPA No. 169 Amanda Bay, Ingrid Christensen Coast, Princess Elizabeth Land, East Antarctica; and ASPA No. 173 Cape Washington and Silverfish Bay, Victoria Land (see Table 2 for more details). Emperor penguins may be present in other ASPAs, where they will be afforded additional protection alongside other values.

The emperor penguin populations in ASPAs have fluctuated through the years according to time-series data (see MAPPPD available at: <http://www.penguinmap.com/>). The declining population of the colony in ASPA 107 Emperor Island, which decreased from c.150 pairs in the 1970s to fewer than 20 pairs by 1999, and then disappeared by 2009, has been linked to a decrease in seasonally stable sea ice suitable for breeding (Trathan et al. 2011); recent observations have identified attempted breeding, but it is unknown whether any chicks have successfully fledged. The colony may have moved to a location with more stable ice (LaRue et al. 2015).

#### 2.10.2.2 Antarctic Specially Managed Areas

The Management Plan for ASMA No. 6 Larsemann Hills, East Antarctica, states that emperor penguins occasionally visit the Area. In Appendix 1 Environmental Code of Conduct, it is noted that disturbance may be expected to occur when approaching emperor penguins (in colonies, huddling, moulting, with eggs or with chicks) on foot to less than 50 metres. The Management Plan for ASMA 7 Southwest Anvers Island and Palmer Basin notes that emperor penguins are occasional visitors to the Area. Emperor penguins are not mentioned or afforded additional protection in any of the remaining ASMA Management Plans.

### 2.10.3 CCAMLR Measures

The Ross Sea region Marine Protected Area (RSRMPA) was designated by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) in 2016 (Conservation Measure 91-05; [CCAMLR, 2016](http://www.ccamlr.org/en/measure-91-05-2016)) and, under the mandate of CCAMLR, includes some protection for emperor penguins. The Conservation Measure includes an objective to protect ‘core foraging areas for land-based top predators or those that may experience direct trophic competition from fisheries’ including specifically emperor penguins (Annex 91-05/B, 1 (vii)(b)). Seven emperor penguin breeding sites, Cape Roget, Coulman Island, Cape Washington, Franklin Island, Beaufort Island, Cape Crozier and Cape Colbeck, are located within the RSRMPA.

Each of the three MPA proposals for the Weddell Sea, East Antarctica and Domain 1 / Antarctic Peninsula, which are being considered by CCAMLR, include measures as well as research and monitoring activities, which upon future adoption of these MPAs will improve the conservation of emperor penguins and their foraging areas, and thereby provide considerable support to the implementation of this Action Plan.

### 2.10.4 Guidelines/tools of other organisations endorsed through Resolution by the ATCM

#### 2.10.4.1 SCAR Codes of Conduct

The Scientific Committee on Antarctic Research (SCAR) has produced guidelines that relate to scientific activities involving or in the vicinity of birds including:

* [SCAR’s code of conduct for the use of animals for scientific purposes in Antarctica](https://documents.ats.aq/recatt/att670_e.pdf) (Resolution 4, (2019))
* [SCAR’s environmental code of conduct for terrestrial scientific field research in Antarctica](https://documents.ats.aq/recatt/att646_e.pdf) (Resolution 5, (2018))

#### 2.10.4.2 Important Bird Areas

Through Resolution 5 (2015) the ATCM welcomed and acknowledged the report on identified Important Birds Areas in Antarctica (IBAs). Many emperor penguin colonies have been recognised by BirdLife International as IBAs (see: <http://www.era.gs/resources/iba/Important_Bird_Areas_in_Antarctica_2015_v5.pdf>). Several colonies discovered more recently have not yet been assessed for their suitability as IBAs, but given their small size (Fretwell and Trathan 2020), it is unlikely that these colonies would fall within IBA criteria A4 (>1% of the global population), but some may fall within criteria B3 (>1% of a biogeographic population) (see: <http://datazone.birdlife.org/site/ibacriteria>).

### 2.10.5 Guidelines/tools of other organisations

[Emperor penguin colony visitor guidelines](https://iaato.org/wp-content/uploads/2020/04/Emperor-Penguin-Guidelines.EN_072560.pdf) have been developed by the International Association of Antarctica Tour Operators (IAATO) for those IAATO Members providing visits to emperor penguin colonies (see: ATCM XXXIX/IP121).

## 2.11 Legal framework under the Protocol/Antarctic Treaty System

The legal framework of Antarctic Specially Protected Species is mainly provided for in Article 3 of Annex II Conservation of Antarctic Fauna and Flora to the Protocol on Environmental Protection to the Antarctic Treaty, but some other relevant agreements are described in this section.

### 2.11.1 Annex II to the Protocol: Conservation of Antarctic Fauna and Flora

Through Annex II to the Protocol, taking or harmful interference with native fauna and flora shall be prohibited, except in accordance with a permit issued by an appropriate national authority and under a limited number of circumstances (Article 3 (1), (2) and (3)).

Annex II allows for the designation of Antarctic Specially Protected Species (Article 3 (4)). A permit shall not be issued to take a Specially Protected Species unless it is for a compelling scientific purpose and will not jeopardise the survival or recovery of that species or local population (Article 3(8)). Furthermore, the use of lethal techniques on Specially Protected Species shall only be permitted where there is no suitable alternative technique (Article 3 (9)). All taking of native mammals and birds shall be done in the manner that involves the least degree of pain and suffering practicable.

Annex II also provides for the criteria and procedure for the designation of Special Protected Species. The designation of a species as a Specially Protected Species shall be undertaken according to agreed procedures and criteria adopted by ATCM (Article 3 (5)). The CEP shall review and provide advice on the criteria for proposing native mammals, birds, plants or invertebrates for designation as a Specially Protected Species (Article 3 (6)). Any Party, the Committee, SCAR or CCAMLR may propose for designation by submitting a proposal with justification to the ATCM (Article 3 (7)). Proposals for the designation of a species as a Specially Protected Species shall be forwarded to the Committee, SCAR and, for native mammals and birds, the CCAMLR, and as appropriate, the Meeting of the Parties to the ACAP and other organisations. In formulating its advice to the ATCM on whether a species should be designated as a Specially Protected Species, the Committee shall take into account any comments provided by the SCAR, and, for native mammals and birds, the CCAMLR, and as appropriate, the Meeting of the Parties to the ACAP and other organisations (Article 3 (10)). Each Party shall make publicly available information on prohibited activities and Specially Protected Species to all those persons present in or intending to enter the Antarctic Treaty area with a view to ensuring that such persons understand and observe the provisions of this Annex (Article 5).

#### 2.11.1.1 Guidelines for CEP consideration of proposals for new and revised designations of Antarctic Specially Protected Species under Annex II of the Protocol

In 2005, CEP VIII adopted [*Guidelines for CEP consideration of proposals for new and revised designations of Antarctic Specially Protected Species under Annex II of the Protocol*](https://documents.ats.aq/ATCM28/WW/ATCM28_WW002_e.doc)(Annex 8 to the CEP VIII Final Report). The guidelines provide that proposals for new designations of species as Antarctic Specially Protected Species should include scientific justification and a draft Action Plan using the attached template as a guideline, to the extent possible with available data and knowledge (Article 1).

On receipt of a proposal, the CEP should invite SCAR to assess the status of the species, using the most up-to-date IUCN criteria to assess the risk of extinction of the species (Article 2 and 3). If SCAR’s assessment determines that the species is at significant risk of extinction (e.g., the conservation status is determined to be “vulnerable” or higher), then the CEP should recommend Specially Protected Species designation to the ATCM and initiate a process to finalise the Action Plan for the species, in accordance with the guideline (Article 4(a)).

The CEP should determine whether other authorities or organisations have a role in protective action and should consult accordingly. For species of interest to CCAMLR or ACAP, the CEP should forward the proposal and the draft Action Plan, and any advice from SCAR, to CCAMLR or ACAP for advice on practical measures to provide special protection. The Action Plan should be finalised taking account of advice from any authority or organisation, as appropriate, and reported to the next meeting.

The guidelines provide useful information concerning the proposed assessment process for species proposed for designation, revision or de-listing as an Antarctic Specially Protected Species. The guidelines also contain a *Guideline template of an Action Plan for a species proposed for designation as an Antarctic Specially Protected Species*, which provides useful guidance for the preparation of an Action Plan. The template presents examples for an overall goal (e.g., to downgrade the threatened status/degree of endangerment by reducing threats to adults and critical stages of the life cycle) and specific objectives (e.g., to quantify and reduce threats to survival of breeding population, quantify and reduce threats to reproductive success, develop or maintain existing monitoring of populations, educate base staff and other relevant human agencies and assess and revise the Action Plan every 5 years).

### 2.11.2 Other related provisions of the Protocol and its Annexes

#### 2.11.2.1 Annex I Environmental Impact Assessment

Article 3 of the Environmental Protocol provides that activities in the Antarctic Treaty area shall be planned and conducted on the basis of information sufficient to allow prior assessments of, and informed judgements about, their possible impacts on the Antarctic environment and dependent and associated ecosystems and on the value of Antarctica for the conduct of scientific research. Article 8 of the Protocol requires that proposed activities shall be subject to the procedures set out in Annex I for prior assessment of the impacts of those activities on the Antarctic environment or on dependent or associated ecosystems. Guidance for preparing environmental impact assessments is presented in the *Guidelines for Environmental Impact Assessment in Antarctica* (EIA Guidelines), the most recent version of which was adopted through [Resolution 1 (2016)](https://documents.ats.aq/recatt/att605_e.pdf).

#### 2.11.2.2 Annex V Area Protection and Management

Annex V to the Protocol allows for the designation of Antarctic Specially Protected Areas (ASPAs) to protect environmental values, including areas with important or unusual assemblages of species, including major colonies of breeding native birds or mammals (Article 3 (2c)). To date, eight ASPAs have been designated by the Antarctic Treaty Consultative Parties that include protection for emperor penguins at their breeding colonies. The designated ASPAs are shown in Table 2.

### 2.11.3 CAMLR Convention

The Convention on the Conservation of Antarctic Marine Living Resources (CAMLR Convention) is an international treaty that was adopted in 1980. The objective of the CAMLR Convention is the conservation of Antarctic marine living resources, where the term conservation includes rational use. The Convention also provided for that any harvesting and associated activities in the Convention Area shall be conducted in accordance with the provisions of the Convention and with the conservation principles set out in Article II.3

The status of the emperor penguin was discussed by the CCAMLR Scientific Committee in 2019 (SC-CAMLR-38, paragraphs 9.7 to 9.10). In 2021, the SC-CAMLR was briefed under the climate change agenda item on the ongoing work of the CEP on emperor penguins and invited to engage in the process (SC-CAMLR-40/09). The SC-CAMLR welcomed the analysis and encouraged CCAMLR Members to contribute to further development of the Action Plan through Dr K. Hughes as Convenor of the CEP Intersessional Contact Group (paras. 5.6 and 5.7 of SC-CAMLR). The Scientific Committee Report was also noted by the Commission (CCAMLR-40 Report, para. 8.1).

# 3. Goal

The goal of this Action Plan is:

To reduce and, where practicable, prevent threats to emperor penguins and their habitat at all stages of their life cycle, taking into account observed and potential impacts of climate change on emperor penguins, in order to improve the threat status and degree of endangerment of the species.

This goal will be advanced through:

* the provision of additional management measures that increase restrictions on human actions, including taking and/or harmful interference in Antarctica; and
* the provision of information and support to Parties in issuing permits in accordance with Article 3 of Annex II to the Protocol.

# 4. Objectives

The following objectives have been identified to deliver the goal detailed above. The objectives have been grouped under the following headings: ‘A. Understanding and knowledge of the conservation status of and threats to the emperor penguin’, ‘B. Protection and management’ and ‘C. Communication and awareness’.

**A. Understanding and knowledge of the conservation status of and threats to the emperor penguin**

Objective A1. Identify priorities for compelling research and monitoring activities in order to promote conservation, minimise unnecessary pressure on the species and avoid duplication of research effort.

Objective A2. Monitor emperor penguin population size and trends and identify environmental factors that may affect the species over time and at different spatial scales (particularly the effects of climate change on sea ice extent/duration).

Objective A3. Identify and prioritise the threats to emperor penguin populations, including through research on agents of decline, population dynamics, distribution and management techniques and their effectiveness.

**B. Protection and management**

Objective B1. Ensure the protection and management of emperor penguin populations within their habitats in the Antarctic through the application of management tools that regulate interaction with human activities.

Objective B2. Reduce threats to breeding and foraging populations of emperor penguins, including due to taking or harmful interference by human activities, taking into consideration life cycle stages when birds are most sensitive to threats.

Objective B3. Develop effective management measures that avoid or minimise identified marine threats.

**C. Communication and awareness**

Objective C1. Improve community awareness, understanding and support for the conservation of the emperor penguin, including through education of the general public and continuing education of national Antarctic programme personnel, non-governmental operators including tour and fishing agencies and other relevant human agencies/institutions that would visit or be present in the Antarctic Treaty area.

Objective C2. Improve global community awareness, understanding and support for conservation of the emperor penguin by Parties working collaboratively to encourage action on addressing global climate change, including through collaborative advocacy in other relevant forums (e.g., IPCC, UNFCCC).

# 5. Actions to achieve each objective

This section sets out the actions that have been identified to deliver the objectives detailed previously. The actions for each objective are set out in Table format with the following column headings:

**Action.** The action identified to deliver the stated objective

**Scale.** Spatial scale to which the identified action may apply: Local (L), Regional (R), Continent (C), Global (G).

**Life cycle stage.** Range of emperor penguin life cycle stages to which action may be relevant: Laying (L), Hatching (H), Brooding (B), Crèche (C), Fledge (F), Moult (M), at Sea (S).

**Lead.** The main body or bodies responsible for coordinating or delivering the identified action.

**Time frame.** Proposed time frame for delivery of identified actions following agreement of the Action Plan. ‘<3 y’: delivered within 3 years; ‘<5 y’: delivered within 5 years. ‘<10 y’: delivered within 10 years; ‘∞’: on-going or repeated activity'.

**Progress.** This column has been included to facilitate the evaluation of progress in the delivery of the identified action, including the date the action was achieved.

## 5.1 Actions to achieve objectives concerning: A. Understanding and knowledge of the conservation status of and threats to the emperor penguin

**Objective A1. Identify priorities for compelling research and monitoring activities in order to promote conservation, minimise unnecessary pressure on the species and avoid duplication of research effort.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Action** | **Scale** | **Life cycle stage** | **Lead** | **Time frame** | **Progress** |
| **A1.1** | Undertake a comprehensive review of emperor penguin research and monitoring activities and identify gaps relevant to the protection and management of the species. | L, R, C | All | CEP & SCAR | <3 y |  |
| **A1.2** | Identify compelling research and monitoring priorities that directly contribute to the conservation of emperor penguins. | L, R, C | All | CEP & SCAR | <3 y |  |
| **A1.3** | Develop a coordinated international research and monitoring programme for the emperor penguin to advance compelling research and monitoring priorities and to minimise unnecessary pressure due to overlapping research programmes. | L, R, C | All | CEP & SCAR | <3 y |  |

**Objective A2. Monitor emperor penguin population size and trends and identify environmental factors that may affect the species over time and at different spatial scales (particularly the effects of climate change on sea ice extent/duration).**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Action** | **Scale** | **Life cycle stage** | **Lead** | **Time frame** | **Progress** |
|  | *Population size and trends* |  |  |  |  |  |
| **A2.1** | Undertake population assessment studies to monitor emperor penguin population size and trends at the colony scale, the regional scale and the circumpolar scale. | L, R, C | As relevant | Parties & SCAR | ∞ |  |
| **A2.2** | Liaise and coordinate activities of interested Parties and stakeholder organisations (e.g., IAATO) to deliver ground counts and aerial counts to ground-truth and improve satellite remote-sensing population estimates, to reduce the variability between on-ground/aerial and satellite-based population estimates for the emperor penguin. | L, R, C | As relevant | CEP & SCAR | <5 y |  |
| **A2.3** | Undertake research to provide more information on the distribution of juveniles, breeding birds and non-breeding birds, which sometimes forage far from the Antarctic continent. | C | S | Parties & SCAR | <5 y |  |
| **A2.4** | SCAR will provide the CEP with a report on the conservation status of emperor penguin every 5 years after the adoption of this Action Plan. The Committee should use these reports to inform its future revisions of this Action Plan. | R, C | As relevant | SCAR & CEP | <5 y |  |
| **A2.5** | Update population trends for the emperor penguin in light of new information and communicate it to the ATCM every 5 years, or more regularly if appropriate. | R, C | As relevant | CEP & SCAR | ∞ |  |
|  | *Environmental factors* |  |  |  |  |  |
| **A2.6** | Undertake further modelling of climate change impacts on emperor penguin populations over different spatial and temporal scales, taking into consideration Antarctic environmental factors (e.g., sea ice extent) and global responses to climate change (e.g., changes in greenhouse gas emissions). | R, C | As relevant | Parties & SCAR | <5 y |  |

**Objective A3. Identify and prioritise the threats to emperor penguin populations, including through research on agents of decline, population dynamics, distribution and management techniques and their effectiveness.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Action** | **Scale** | **Life cycle stage** | **Lead** | **Time frame** | **Progress** |
| **A3.1** | Identify and prioritise threats to breeding populations of emperor penguins by direct and indirect activities (see also Table 1). | L, R, C | L, H, B, C, F, M | CEP & SCAR | <3 y |  |
| **A3.2** | Work with CCAMLR, COMNAP, IAATO and other relevant organisations to identify and prioritise threats to emperor penguins within the marine environment. | L, R, C | S | CEP & SCAR | <5 y |  |
| **A3.3** | Work with CCAMLR to develop a plan to study and monitor potential interactions between emperor penguins and fisheries in order to assess the impact of this activity on the species. | C | S | Parties & SCAR | <5 y |  |

## 5.2 Actions to achieve objectives concerning: B. Protection and management

**Objective B1. Ensure the protection and management of emperor penguin populations within their habitats in the Antarctic through the application of management tools that regulate interaction with human activities.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Action** | **Scale** | **Life cycle stage** | **Lead** | **Time frame** | **Progress** |
|  | *Area management and protection* |  |  |  |  |  |
| **B1.1** | Use existing management tools to regulate human activity in the vicinity of each emperor penguin colony (e.g., through development of Site Guidelines for Visitors or designation of the location as an Antarctic Specially Protected Area (ASPA)), as appropriate. | L | L, H, B, C, F, M | CEP | <3 y |  |
| **B1.2** | Establish and implement measures that restrict access to some colonies only for specified purposes. | L, R, C | L, H, B, C, F, M | CEP & Parties | <3 y |  |
| **B1.3** | Where a colony is already afforded protection through designation of an ASPA, evaluate the effectiveness of the protected areas in providing heightened protection. Parties managing ASPAs that protect emperor penguin colonies shall provide regular updates to the CEP on the status of the emperor penguin population within the Area. | L | L, H, B, C, F, M | CEP | <5 y |  |
| **B1.4** | Consider the designation of further protected areas to afford additional protection to emperor penguin colonies that are representative of: (i) climate change refugia populations, and (ii) genetically distinct meta-populations, which may be important for future resilience to environmental change. | L, R, C | All | CEP & Parties | <5 y |  |

**Objective B2. Reduce threats to breeding and foraging populations of emperor penguins, including due to taking or harmful interference by human activities, taking into consideration life cycle stages when birds are most sensitive to threats.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Action** | **Scale** | **Life cycle stage** | **Lead** | **Time frame** | **Progress** |
|  | *Guidelines* |  |  |  |  |  |
| **B2.1** | Review existing guidelines concerning direct human behaviour and activities in the vicinity of Antarctic wildlife, taking into consideration their effectiveness concerning emperor penguins at different stages of their breeding cycle. Update the guidelines as necessary to provide additional protection mechanisms. Examples of such guidelines are, the ‘General guidelines for visitors to the Antarctic' contained in Resolution 4 (2021), the ‘Guidelines for the operation of aircraft near concentrations of birds' contained in Resolution 2 (2004) and the ‘Environmental guidelines for operation of Remotely Piloted Aircraft Systems (RPAS) in Antarctica’ contained in Resolution 4 (2018). | L | All | CEP | <3 y |  |
| **B2.2** | Using the best available science, and working with SCAR, COMNAP, IAATO and other relevant organisations, develop species specific guidelines for visits to emperor penguin colonies. To ensure the minimization of disturbance to emperor penguin colonies, establish specific guidelines on, for example, (i) emperor penguin approach distances by visitors, (ii) the use of small boats and overland vehicles, (iii) the establishment of camps, refuges or hides; (iv) biosecurity measures; (v) limits on the frequency of visits; (vi) limits on the number of visitors, (vi) visitor behaviour; and (viii) effects of the presence of vessels on local sea-ice margins. | L | All | CEP | <3 y |  |
|  | *Management of research activities* |  |  |  |  |  |
| **B2.3** | Develop guidelines to assist Parties to apply the provisions of Article 3.8 of Annex II, i.e., what would constitute a ‘compelling scientific purpose’ for taking of an emperor penguin. In particular, establish between the Parties (i) the specific conditions under which capture or taking of emperor penguin individuals or use of invasive or disruptive scientific techniques (best practice) should be permitted (including, e.g., strict limitations on the age of birds and the timing of sampling); and (ii) which scientific techniques for use on emperor penguins may be restricted or prohibited. | L | L, H, B, C, F, M | CEP & Parties | <3 y |  |
|  | *Management of logistical activities* |  |  |  |  |  |
| **B2.4** | Consider how planned activities in the vicinity of emperor penguin colonies (including on ground and aerial activities) could be better communicated in advance of any planned activity (including between national Antarctic programmes and tourism operators, for example) so that disturbance is limited over time and in duration (e.g., by working with CCAMLR, COMNAP and/or IAATO). | L | L, H, B, C, F, M | CEP | <3 y |  |
| **B2.5** | Consider the potential for emperor penguins to move to other habitats during differing stages of their life cycle as loss of sea ice increases. | L | L, H, B, C, F, M | Parties | <10 y |  |

**Objective B3. Develop effective management measures that avoid or minimise identified marine threats**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Action** | **Scale** | **Life cycle stage** | **Lead** | **Time frame** | **Progress** |
| **B3.1** | Promote action by all operators to address potential threats to the conservation of emperor penguins while at sea (e.g., by working with CCAMLR, COMNAP, IAATO and other relevant organisations). | C | S | CEP | <5 y |  |

## 5.3 Actions to achieve objectives concerning: C. Communication and awareness

**Objective C1. Improve community awareness, understanding and support for the conservation of the emperor penguin, including through education of the general public and continuing education of national Antarctic programme personnel, non-governmental operators including tour and fishing agencies and other relevant human agencies/institutions that would visit or be present in the Antarctic Treaty area.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Action** | **Scale** | **Life cycle stage** | **Lead** | **Time frame** | **Progress** |
|  | *General public* |  |  |  |  |  |
| **C1.1** | Promote exchange of information across the Parties concerning methods to raise community awareness about conservation of emperor penguins. For example, promote awareness of (i) the iconic emperor penguin as a southern sentinel of the impacts of climate change and a species of significant conservation concern and (ii) the vulnerability of the species to direct and indirect human impacts. | G | All | CEP | <3 y |  |
| **C1.2** | Identify collaborative opportunities to communicate to the wider public information on the status of emperor penguins and the conservation efforts of the Antarctic Treaty System. | G | All | CEP | <5 y |  |
| **C1.3** | Liaise with relevant associations of zoological gardens and aquaria about existing living collections and breeding programmes, including the identification of wild-caught specimens of emperor penguin. Work with such bodies to increase community awareness of the need for conservation of the species and the actions ordinary citizens can take to reduce climate change impacts. | G | All | Parties | <3 y |  |
| **C1.4** | Seek to raise awareness about the need to protect the emperor penguin as part of the annual World Penguin Day initiative. | G | All | Parties | <5 y |  |
|  | *National Antarctic programme personnel, tour operators, fishing operators and other relevant agencies* |  |  |  |  |  |
| **C1.5** | Liaise with the personnel of national Antarctic programmes and other relevant agencies, and with organisations carrying out commercial activities, (e.g., tour operators/tourists and fishing industry companies) to continue to develop and use tailored education and outreach opportunities to raise awareness about (i) the direct and indirect threats to emperor penguin populations and (ii) practical measures to avoid direct impact/disturbance to the species across all of its life stages. | C | All | CEP & Parties | <3 y |  |

**Objective C2. Improve global community awareness, understanding and support for conservation of the emperor penguin by Parties working collaboratively to encourage action on addressing global climate change, including through collaborative advocacy in other relevant forums (e.g., IPCC, UNFCCC).**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No.** | **Action** | **Scale** | **Life cycle stage** | **Lead** | **Time frame** | **Progress** |
| **C2.1** | When engaging in climate change forums, Antarctic Treaty Parties should work collaboratively to inform those forums and participating nations and other stakeholders, as relevant, of the implications of climate change on the protection of emperor penguin, and to encourage prompt and effective action on global climate change (consistent with Resolution 8 (2021) on ‘Antarctica in a Changing Climate’). | G | All | ATCM & Parties | <3 y |  |

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Table 1. Identified threats and their known or potential effects on emperor penguins, as at 2022.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Threat** | **Direct and/or indirect** | **State** | **Life cycle stage impacted** | **Spatial scale** | **Temporal scale** | **Current intensity of impact** | **Trend** | **Within scope of the Action Plan** |
| Fast-ice, ice shelf or terrestrial environment |  |  |  |  |  |  |  |  |
| **Climate change**: Threats from climate changes resulting in significant weather changes, and changes to the nature and extent of suitable land-fast, sea-ice breeding habitats, beyond historical variance including 'blinking' and extreme events | Direct and indirect | Known | Laying, hatching, brooding, crèche, fledge, moult | Continental or regional | On-going | Medium | Increasing | Yes |
| **Human disturbance**: Threats from human disturbance at, above or adjacent to breeding colonies including direct habitat destruction, damage and disturbance during scientific or recreational visits, as well as interactions with built structures and artificial lighting. | Direct | Known | Laying, hatching, brooding, crèche, fledge, moult | Local | Transient to on-going | Low | Unknown | Yes |
| **Disease**: Threats from native and non-native pathogens—as a consequence either of climate change or human disturbance. | Direct | Potential | Laying, hatching, brooding, crèche, fledge, moult | Regional and local | Unknown | Unknown | Unknown | Yes |
| Marine Environment |  |  |  |  |  |  |  |  |
| **Climate change**: Threats from climate change resulting in significant weather changes and changes to the nature of the marine environment beyond historical variance. | Direct and indirect | Known | At sea\* | Continental | On-going | Low | Increasing | Yes |
| **Human disturbance**: Threats from human disturbance in the marine environment to emperor penguins while they are away from breeding colonies—including interactions with vessels | Direct | Potential | At sea | Regional | Transient to seasonal | Low | Unknown | Yes |
| **Marine pollution**: Threats from marine pollution—including oil spill emergencies, contamination by heavy metals and persistent organic pollutants, and debris including plastics and microplastics. | Direct and Indirect | Potential | At sea | Continental, regional or local | On-going | Low | Increasing | Partially |
| **Fishing industry**: Competition with fishing industry for food resources. By-catch due to entanglement with fishing gear. | Indirect | Potential | At sea | Regional or local | Seasonal | Low | Unknown | Yes |

\*Impacts upon penguins at sea may have indirect effects on reliant chicks remaining within colonies, particularly should the adult fail to return

Table 2. Antarctic Specially Protected Areas designated to protect emperor penguin colonies, as at 2022

(Information obtained from the Antarctic Treaty Secretariat’s Antarctica Protected Areas database, available at: <https://www.ats.aq/devph/en/apa-database>)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name and No.** | **Original designation** | **Current Management Plan** | **Proponent Party or Parties** | **Summary** |
| ASPA No. 101 Taylor Rookery, Mac. Robertson Land | Rec. IV-1 (1966) | Measure 2 (2021) | Australia | The Area consists of the whole of the northernmost rock exposure on the east side of Taylor Glacier, Mac. Robertson Land. It contains a colony of emperor penguins which is the largest of two known colonies of this species located entirely on land. The rookery is important because of long-term monitoring of the population of the penguins (since 1954). |
| ASPA No. 105 Beaufort Island, McMurdo Sound, Ross Sea | Rec. IV-5 (1966) | Measure 6 (2021) | New Zealand | The Area encompasses the whole of Beaufort Island above the mean high water mark, and includes the adjacent fast-ice occupied by breeding emperor penguins. The island contains substantial avifauna and it is one of the most important breeding areas in the region. It possesses a significant area of vegetation on an ice-cored moraine bench which is exceptional both in its quantity and quality, and is the most extensive, continuous area of mosses yet known for the McMurdo Sound region. It also represents one of the most southerly locations where red snow algae have been observed. |
| ASPA No. 107 Emperor Island, Dion Islands, Marguerite Bay, Antarctic Peninsula | Rec. IV-7 (1966) | Measure 1 (2002) | United Kingdom | The Dion Islands, a small archipelago comprising several islands, rocks and reefs, are situated 13.5 km south of the south-western extremity of Adelaide Island in Marguerite Bay. The site contains the only colony of emperor penguins known to exist on the west side of the Antarctic Peninsula, and the isolation of this colony from others of the same species makes it of outstanding scientific interest. It is also the most northerly and probably the smallest emperor penguin colony, and one of only two in which breeding occurs on land. Adélie penguins and blue-eyed shags also breed here. |
| ASPA No. 120 Pointe Géologie Archipelago, Terre Adélie | Measure 3 (1995) | Measure 8 (2021) | France | The ASPA protects four islands (Rostand, Le Mauguen, Lamarck and Claude Bernard Islands), a nunatak and a breeding ground for emperor penguins located in the heart of the Pointe Géologie Archipelago in the coastal area of Terre Adélie. The ASPA is an important site for scientific research for Antarctic seabirds and seals where long-term studies of the population dynamics and social behaviour of emperors are undertaken. |
| ASPA No. 124 Cape Crozier, Ross Island | Rec. IV-6 (1966) | Measure 3 (2014) | United States | Cape Crozier is at the eastern extremity of Ross Island, where an ice-free area comprises the lower eastern slopes of Mount Terror. The Area is situated in the vicinity of Post Office Hill, extending to encompass the adjacent Ross Ice Shelf, where large cracks in the ice shelf are covered by fast-ice that is occupied annually by breeding emperor penguins. The area supports rich bird and mammal fauna as well as microfauna and microflora, and the ecosystem depends on a substantial mixing of marine and terrestrial elements of outstanding scientific interest. Protection is afforded to the long-term studies of the population dynamics and social behaviour of emperor and Adélie penguin colonies, as well as skua populations and vegetation assemblages. |
| ASPA No. 127 Haswell Island | Rec. VIII-4 (1975) | Measure 5 (2016) | Russian Federation | The Area is defined by a polygon which comprises Haswell Island (the largest island in the archipelago), its littoral zone, and the adjacent section of fast ice in the Davis Sea. The site is a unique and exceptionally important breeding site for almost all breeding bird species in East Antarctica, including five species of petrel, one species of skua, and one species of penguin. The Area also supports five species of pinnipeds, including the Ross seal which is a Specially Protected Species. It has one of a few emperor penguin colonies in the vicinity of a permanent Antarctic station, providing advantages for the study of the species and its habitat, |
| ASPA No. 169 Amanda Bay, Ingrid Christensen Coast, Princess Elizabeth Land, East Antarctica | Measure 3 (2008) | Measure 10 (2014) | Australia and China | Amanda Bay is located on the Ingrid Christensen Coast of Princess Elizabeth Land, East Antarctica. The Area was designated to protect the breeding colony of several thousand pairs of emperor penguins annually resident in the south-west corner of Amanda Bay, while providing for continued collection of valuable long-term research and monitoring data and comparative studies with colonies elsewhere in East Antarctica. The accessibility of Amanda Bay is advantageous for research purposes, but also creates the potential for human disturbance of the birds. |
| ASPA No. 173 Cape Washington and Silverfish Bay, Victoria Land | Measure 17 (2013) | Measure 9 (2019) | Italy and the United States | Cape Washington and Silverfish Bay are located in northern Terra Nova Bay, Victoria Land, Ross Sea. One of the largest emperor penguin colonies in Antarctica breeds on sea ice adjacent to Cape Washington, with around 20,000 breeding pairs comprising approximately eight percent of the global emperor population and ~21% of the population in the Ross Sea. Several factors, such as location, ice conditions, weather and accessibility provide relatively consistent and stable opportunities to observe emperor chick fledging reliably and the presence of a variety of other species make it an ideal place to study ecosystem interactions. The extended record of observations of the emperor colony at Cape Washington is of important scientific value. Approximately 20 km west of Cape Washington, the first documented ‘nursery’ and hatching area for Antarctic silverfish is located at Silverfish Bay. Recent research has shown that the concentration of spawning on occasions extends all the way across the embayment to Cape Washington. The first ground-breaking studies on the life-history of this species have been made at the site, and its relative accessibility to nearby research stations make the Area important for biological research. The Area also has important geoscientific values, as it features extensive volcanic rock exposures originating from the nearby active volcano Mount Melbourne. |