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Projections of future population decline emphasise the need to designate the emperor penguin as an Antarctic Specially Protected Species

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Working Paper submitted by SCAR

Summary

At the request of the UK, SCAR has initiated a review of the status of the emperor penguin, with the intention of considering it as an Antarctic Specially Protected Species. SCAR tasked the Expert Group on Birds and Marine Mammals (EG-BAMM) to undertake the review. SCAR finds that the emperor penguin is vulnerable to ongoing and projected climate change, warranting protection as an Antarctic Specially Protected Species. The outcomes of this assessment have relevance to the ATCM and CEP because of its implications for species-related conservation decision-making and conservation planning.

Background

The Committee for Environmental Protection (CEP) has repeatedly recognised the importance of receiving up-to-date scientific knowledge to evaluate the threats to Antarctic species. The future population status of the emperor penguin has been noted by the CEP in the past (e.g. ATCM XLII IP42 *Emperor penguins - vulnerable to projected rates of warming and sea ice loss; an international collaboration to inform species-related conservation decision-making and conservation planning*). For example, both the CEP Five Year Work Plan and the Climate Change Response Work Programme identify the need to understand population status, trends, vulnerability and distribution of key Antarctic species. In this Working Paper, we present work reported in an associated Information Paper (IP22 *Projections of future population decline indicate the need to designate the emperor penguin as an Antarctic Specially Protected Species*) that considers the conservation status of the emperor penguin, including identifying the next steps to ensure appropriate conservation decision-making and planning.

Loss of breeding habitats and the profound transformation of the foraging habitat associated with significant change in and loss of sea ice as part of climate change are the primary threats to emperor penguins. Emperor penguins initiate breeding during the Antarctic winter and are uniquely adapted to the cold. Breeding colonies occur in coastal locations around the continent, almost exclusively on land-fast ice (i.e. sea ice attached to the coast). A few colonies are located on ice-free land or nearby ice shelves in years when sea ice is of insufficient quality as a platform for breeding. As of 2009, the global population was estimated to be ~238,000 breeding pairs across 46 colonies; since then, an additional 15 colonies have been discovered via satellite imagery, bringing the total [likely] population to upwards of 256,000 breeding pairs.

Despite a number of important caveats, remote sensing contributes to an improved toolset for monitoring emperor penguin populations. Estimates of the global population are now more tractable, offering opportunities for monitoring regional and global change, as well as variation in phenology, population trajectories and correlation with environmental variables. In this context, the future loss or degradation of important habitats for emperor penguins will be highly informative (including changing environmental thresholds, such as fast ice availability and quality) given that emperor penguins have unique traits associated with almost total reliance upon sea ice as a specialised breeding habitat.

Much of the life history of emperor penguins remains data poor, especially at sea, and particularly for juveniles and non-breeding birds. Further work that will help reduce uncertainty about any potential, undetermined threats is detailed in a draft Species Action Plan (see Annex A, and IP22 *Projections of future population decline indicate the need to designate the emperor penguin as an Antarctic Specially Protected Species*).

Globally, the total abundance of emperor penguins is projected to decline by 99% (median of projections) relative to its initial size under the Representative Concentration Pathway (RCP) 8.5 climate scenario in which greenhouse gas emissions remain unmitigated throughout the 21st century. In contrast, under the Paris Agreement 1.5°C climate scenario, the global population is projected to only decline by 37% of its 2009 population size, but this scenario remains unlikely given the current emissions pledges and targets. All these analyses indicate that the species might best be classified within the IUCN Red List as Vulnerable. The species is currently listed as Near Threatened, and has not been up-listed due to the uncertainty about future greenhouse gas levels and emission scenarios, future sea-ice projections and because the assessment also depends upon a degree of model verification against population trend. However, support for up-listing is provided by Jenouvrier et al. (2014), who showed that the recent dynamics of the emperor penguin population at Pointe Géologie projects reasonably accurately past population dynamics that agree well with the observed number of penguins at Pointe Géologie. Moreover, current sea-ice projections suggest that the most rapid declines will occur after mid-century, when the loss of emperor penguin populations is likely to be rapid. The incidence of colonies that ‘blink’ (disappearing some years, reappearing in others), and of major environmental perturbations leading to massive breeding failure, also increase uncertainty about the future of emperor penguin population state but have been incorporated into the most recent, modelled population projections. Finally, climate change may also affect penguin prey species, many of which also depend on sea ice.

Loss of suitable breeding habitat is the most important challenge that emperor penguins face. Listing emperor penguins as a Specially Protected Species is a critical step forward in global endeavours to fight human-induced climate change via increasing greenhouse gas emissions. It would be precautionary, therefore, to reduce or eliminate other stressors that could otherwise add to the burden that emperor penguins face. Consequently, it is important to develop management options that are informed by the best available scientific evidence.

Conclusions

Based on the current scientific literature, and accepted IPCC climate model projections, SCAR reports that:

- emperor penguins are vulnerable in the foreseeable future due to the loss of their breeding habitat;
- species-related management options, informed by the best available science, should be reviewed and developed to reduce or eliminate other stressors from emperor penguins, thereby improving the protection of this species; and
- emperor penguins should continue to be the focus of collaborative international research on monitoring and multidisciplinary research climate impact assessment.

SCAR recommends that the Parties:

- 1) Support the formation of an Intersessional Contact Group (ICG) to review the draft Action Plan prepared by SCAR (Annex A, and IP22 *Projections of future population decline indicate the need to designate the emperor penguin as an Antarctic Specially Protected Species*).
- 2) Support a case to be made to the IUCN to uplist Emperor penguins to Vulnerable.
- 3) Tasked the ICG to report to ATCM XLIV - CEP XXIV in Berlin with a revised draft Action Plan, together with a recommendation about the emperor penguin’s conservation status, in accordance with the Guidelines for CEP Consideration of Proposals for New and Revised Designations of Antarctic Specially Protected Species under Annex II to the Protocol.

Annex A: Development of a draft Species Action Plan for the Emperor Penguin

Unambiguously, the largest threat to emperor penguins is the loss of Antarctic sea ice as result of global climate change. Mitigation of this threat will require coordinated and unified global action that is beyond the remit of this draft Action Plan. Nonetheless, there are several actions that can be taken to offset and reduce the effects of climate change. This draft Plan aims to manage all direct and indirect potentially harmful human interactions with free-living emperor penguins to reduce threats at every stage of their life cycle, and thereby ensure their continued existence in the wild until such time that risks posed by climate change are mitigated.

Specific Objectives

- Establish within SCAR's EG-BAMM an Emperor Penguin Working Group focused on the delivery of this draft Action Plan through liaison with all interested and affected parties, facilitating the provision of regular synthetic updates on the status of emperor penguins.
- Engage across the international science community to develop best practice guidelines for specific scientific procedures relevant to emperor penguins (e.g., Code of Conduct on using Antarctic Animals for Scientific Research, adopted by CEP in 2019). It is critical that all research is conducted ethically and we aim to seek collaborative opportunities to science facilities close to emperor penguin colonies, to increase awareness about the risks and threats to the species and to promote such ethical guidelines. Engage with Treaty Parties and their national Competent Authorities and with the Council of Managers of National Antarctic Programs to provide advice and recommendations and where appropriate facilitate distribution of new guidelines, including translations thereof to the predominant language used at a given facility.
- The Working Group will also convey the outcomes of relevant scientific assessments, with advice and recommendations to facilitate development of management actions to the ATCPs on a regular basis, or as any substantial changes might suggest, via Working Papers submitted either via the CEP or directly by SCAR in keeping with Article 10.2 of the Protocol on Environmental Protection to the Antarctic Treaty.
- As part of the five-yearly update of this draft Action Plan, provide information, advice and recommendations on the effectiveness of the management actions for emperor penguins and provide suggestions or recommendations for changes to management actions if these are required. Doing so should involve best practice decision-science and engage all stakeholders for maximum efficacy, and should be preceded in the year prior to the update by an online forum or meeting to assess the effectiveness of actions.
- Continue and expand demographic studies to improve documentation of the functional relationships between demographic parameters across different life history stages and environmental fluctuations.
- Build on analyses by Ainley et al. (2010), Jenouvrier et al. (2014; 2017; 2019, 2021) and Abadi et al. (2017) to develop new analyses of how emperor penguins are projected to respond to climate change using CMIP5 data, and when sufficiently mature, CMIP6 data. Consider the full circumpolar extent of emperor penguins with a special focus on inter-annual variation in breeding propensity (i.e. frequency of occurrence of breeding at colony sites) across different parts of the species range. Highlight the need for regional climate models that provide robust ecological projection capability at scales relevant to the ecology of emperor penguins. Develop modelling capacity to provide projections beyond the next 100 years.
- Undertake population assessment studies to monitor emperor penguins at the colony scale, the regional scale and the circumpolar scale. Liaise with and coordinate with interested parties to initiate ground counts and aerial counts to ground-truth and improve satellite remote-sensing population estimates. Evaluate population assessments based on satellite remote-sensing, with particular emphasis on short-term colony movement (see e.g. Richter et al., 2018), repeated observation within the same breeding season, and improved image analysis techniques.
- Collate all available tracking data to undertake a gap analysis. Then, if deemed necessary, undertake new telemetry studies to better document the preferred habitats of emperor penguins at different times of the year and across different life history stages.

- Better understanding of the energetic, physiological constraints and behavioural capacity of emperor penguins to adapt to new breeding conditions and altered food web interactions, including altered prey availability and changed predation risks.
- Identify and collate information on other potential threats to emperor penguins, especially those associated with human activities, such as fishing, plastic pollution, other pollutants, habitat degradation of the oceans, pathogens, etc. Quantify all such threats, both spatially and temporally, to determine where and how management actions can mitigate the impacts of these threats and improve the survival of emperor penguin breeding populations.
- Continue liaison with the Antarctic community, including Treaty Parties, their national competent authorities and International Association of Antarctica Tour Operators (IAATO) as required, to provide expert advice on responsible visitor management at emperor penguin colonies. Promote exchange of information across the Antarctic community to raise awareness about responsible visitation, conservation and reducing and offsetting global emissions. Identify collaborative opportunities to communicate this information and Antarctic Treaty System efforts to the wider public. Assess feasibility for research and monitoring using 'ships of opportunity' and other operators.
- Liaise with relevant Associations of Zoos and Aquaria about living collections and breeding programmes, including the identification of wild-caught specimens of emperor penguins. Link with such bodies to increase public awareness and need for conservation.
- Assess and revise this draft Action Plan every five years.