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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

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Information Paper submitted by the United Kingdom, Australia, Finland, France, Germany, Monaco, Norway, SCAR and ASOC

Summary

An international group of scientists from the United Kingdom, Australia, Finland, France, Germany, Monaco, Norway, the United States and SCAR, including the majority of those holding long-term data and having experience of working with emperor penguins, have formed an international collaboration to review the dependence and vulnerability of emperor penguins to ongoing and projected climate change. The outcomes of this work will have relevance to the ATCM and CEP because of its implications for species-related conservation decision-making and conservation planning.

Introduction

CEP has repeatedly recognised the importance of receiving up-to-date scientific knowledge to evaluate the threats to Antarctic species; 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 Information Paper, we consider the conservation status of the emperor penguin and set out next steps to ensure appropriate conservation decision-making and planning.

Emperor penguins initiate breeding during the Antarctic winter and as such are uniquely adapted. Breeding colonies occur in coastal locations around the continent with almost all on land-fast ice (i.e. sea ice attached to the coast). Currently, 54 breeding colonies are known, though a few small sites might still remain to be found. One colony probably moved due to the much reduced fast ice at Emperor Island (ASPA 107) following regional warming (Trathan et al., 2011), whilst others have relocated following changes in ice shelf morphology. The use of remote sensing satellite technology for the discovery of new colonies has enabled a revised estimate of population distribution and size. Currently, approximately 256,500 breeding pairs is considered a plausible breeding estimate, excluding juveniles, non-breeders, and birds of breeding age from the small colonies found since 2014.

Remote sensing, despite a number of important caveats (Fretwell et al., 2012), contributes to an improved toolset for monitoring emperor penguin populations. Global breeding population estimates 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 their unique traits associated with almost total reliance upon sea ice as a specialised breeding habitat.

Climate change

The current era of rapid environmental warming is projected to negatively impact the global population of emperor penguins (e.g. Ainley et al., 2010; Trathan et al., 2011; Jenouvrier et al., 2017; Abadi et al., 2017; see also the brief review at https://environments.aq/emerging-issues/climate-change-as-an-emerging-threat-to-emperor-penguins/), particularly by changing the extent, formation and persistence of sea ice, especially fast ice. Climate change may also affect their prey, where prevalence is also related to sea ice. Owing to regional differences in climate, different colonies may have different population trajectories, in some cases related to immigration/emigration (Jenouvrier et al., 2017). Although our understanding of the influence of climate change on emperor penguin populations is not yet fully developed, the Fifth Report of the Intergovernmental Panel on Climate Change (IPCC; Larsen et al., 2014) reported that there was *high*

agreement amongst studies and highlighted that negative climate change-related impacts on the emperor penguin can be considered *likely*.
Robust demographic modelling analyses that incorporate IPCC climate model projections have already been undertaken for emperor penguins (e.g. Ainley et al., 2010; Jenouvrier et al., 2017). All these analyses point to the fact that the species might best be classified within the IUCN Red List Categories as Vulnerable. The species is currently listed as Near Threatened on the IUCN Red List.
Recent research has noted that emperor penguins are highly sensitive to climate change, given their critical reliance on sea ice during breeding (e.g. Ainley et al., 2010; Jenouvrier et al., 2017). They are also exposed to climate change, given their current circumpolar distribution, which includes areas of recent, rapid, regional warming (Trathan et al., 2011), coupled with the fact that most climate models agree that future global climate change will lead to reductions in sea ice area of close to 30% (or 40%) over the 21st century following medium (or high) emission scenarios (Bracegirdle et al., 2008). As such, researchers have concluded that emperor penguins are highly vulnerable to climate change.

Protecting emperor penguins

Loss of suitable breeding habitat is one of the most important challenges that emperor penguins face. In the recent past, some colonies have successfully relocated onto ice shelves, as opposed to sea ice (Fretwell et al., 2014). However, this is only possible where the ablation of shelf fronts or the presence of snow bridges enables access. In a warming environment that will potentially result in increased calving of ice shelves, opportunities for such access might change. Ice-free ground is not a preferred habitat for emperor penguins and is rare in Antarctica (less than 1% of Antarctica). In a warming world it is also unlikely that ice-free ground would ever become a preferred habitat, as the chances that suitable rock areas for breeding will emerge is low, particularly as sea levels will also rise. Under the strongest forcing scenario, ice-free rock areas could expand by around 25%, but most of this will be inland in the Antarctic Peninsula, in areas where emperor penguin colonies cannot relocate (Lee et al., 2017).
The implications of climate change in Antarctica, mean that emperor penguins continue to be threatened (e.g. Ainley et al., 2010; Trathan et al., 2011; Jenouvrier et al., 2017; Abadi et al., 2017). It is vital, therefore, to reduce or eliminate other stressors that could otherwise add to the burden that emperor penguins face. Consequently, in the future, it is important that management options are developed that are informed by the best available scientific evidence.

Conclusions

Based on the current literature (e.g. Ainley et al., 2010; Trathan et al., 2011; Larsen et al., 2014; Jenouvrier et al., 2017; Abadi et al., 2017), and IPCC climate model projections (e.g. Bracegirdle et al., 2008), the co-sponsors of this paper consider that:

- emperor penguins are threatened through the loss of their breeding habitat;
- species-related management options, informed by the best available science, should therefore be developed in order to reduce or eliminate other stressors from emperor penguins and thereby improve the protection of this species; and
- emperor penguins should continue to be the focus of collaborative international research.

Next Steps

- The co-sponsors will liaise with the IUCN Species Survival Commission Penguin Specialist Group and BirdLife International to inform SCAR's evaluation of the threat status of emperor penguins and will report back to CEP XXIII in 2020.
- Should an assessment of 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*, determine that the species is at significant risk of extinction (e.g. the conservation status is determine to be 'Vulnerable' or higher), the co-sponsors propose seeking Antarctic Protected Species Status for the species. A draft species Action Plan would then be developed

collaboratively amongst interested Parties, including through an Intersessional Contact Group, if agreeable to the CEP.

References

Abadi, F., Barbraud, C. & Gimenez, O. (2017). Integrated population modelling reveals the impact of climate on the survival of juvenile emperor penguins. Global Change Biology 23, 1353-1359. doi: 10.1111/gcb.13538.

Ainley, D., Russell, J., Jenouvrier, S., Woehler, E., Lyver, P.O'b., Fraser, W.R. & Kooyman, G.L. (2010). Antarctic penguin response to habitat change as Earth's troposphere reaches 2°C above pre-industrial levels. Ecological Monographs 80(1), 49-66.

Bracegirdle, T.J., Connolley, W.M. & Turner J. (2008). Antarctic climate change over the twenty first century. Journal of Geophysical Research 113, D03103. doi: 10.1029/2007JD008933.

Fretwell, P.T., Larue, M.A., Morin, P., Kooyman, G.L., Wienecke, B., Ratcliffe, N., Fox, A.J., Fleming, A.H., Porter, C. & Trathan, P.N. (2012). An emperor penguin population estimate: the first global, synoptic survey of a species from space. PLoS ONE 7: e33751. doi: 10.1371/journal.pone.0033751.

Fretwell, P.T., Trathan, P.N., Wienecke, B. & Kooyman, G.L. (2014). Emperor penguins breeding on ice shelves. PLoS ONE 9, e85285. doi: 10.1371/journal.pone.0085285.

Jenouvrier, S., Garnier, J., Patout, F. & Desvillettes, L. (2017). Influence of dispersal processes on the global dynamics of Emperor penguin, a species threatened by climate change. Biological Conservation 212, 63-73.

Larsen, J.N., Anisimov, O.A., Constable, A., Hollowed, A., Maynard, N., Prestrud, P., Prowse, T., Stone, J., Callaghan, T., Carey, M., Convey, P., Derocher, A., Forbes, B.C., Fretwell, P.T., Glomsrød, S., Hodgson, D., Hofmann, E., Hovelsrud, G.K., Ljubicic, G.L., Loeng, H., Murphy, E., Nicol, S., Oskal, A., Reist, J.D., Trathan, P.N., Weinecke, B. & Wrona, F. (2014). Polar Regions. In Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. (Eds. Barros, V.R., Field, C.B., Dokken, D.J., Mastrandrea, M.D., Mach, K.J., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., Girma, B., Kissel, E.S., Levy, A.N., Maccracken, S., Mastrandrea, P.R. & White, L.L.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Lee, J.R., Raymond, B., Bracegirdle, T.J., Chadès, I., Fuller, R.A., Shaw, J.D. & Terauds, A. (2017). Climate change drives expansion of Antarctic ice-free habitat. Nature 547, 49-54. doi: 10.1038/nature22996.

Trathan P.N., Fretwell, P.T. & Stonehouse, B. (2011). First recorded loss of an emperor penguin colony in the recent period of Antarctic regional warming: implications for other colonies. PLoS ONE 6, e14738.