The Retrospective Analysis of Antarctic Tracking Data identifies Areas of Ecological Significance in the Southern Ocean

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1. Summary

In 2009, the marine predator research community was invited to provide tracking data to the Scientific Committee for Antarctic Research's Expert Group on Birds and Marine Mammals. Over the next decade, the Retrospective Analysis of Antarctic Tracking Data (RAATD) team collated and painstakingly quality-controlled and filtered over 4,000 tracks (3 million locations) from 17 marine predator species, studied between 1991 and 2016. This dataset, published in a recent data paper (Ropert-Coudert et al. 2020), includes contributions from more than 70 scientists from 12 National Antarctic Programs and represents the field efforts of hundreds of individuals. An important feature of the dataset is that it is freely available to everyone. The data underpinned a second paper, published in the journal *Nature* this year (Hindell et al. 2020), wherein the RAATD team identified 'Areas of Ecological Significance' in the Southern Ocean, and highlighted the relevance of these areas for management and conservation of the region.

2. Background

Identifying which oceanic areas warrant special protection from existing, developing and forthcoming threats is inherently difficult in the vast Southern Ocean. However, GPS and satellite tracking data from birds and marine mammals can be used to provide fundamental insights into zones that are relevant to their biology. The approach relies on a simple principle - these mobile animals primarily go to places where they find food. Therefore, identifying areas of the Southern Ocean where predators most commonly go tells us where their prey can be found. For example, whales and penguins go to places where they can feed on krill, whereas seals and albatrosses go where they can find fish, squid, or other prey. If different predators and their diverse prey are found in the same place then this area has both high diversity and abundance of species from multiple trophic levels, indicating that the area is of high ecological significance.

3. Key Findings

Hindell et al. (2020) used these animal tracking data to model the circumpolar habitat preferences of 17 marine predator species to identify the most important places across the species, termed 'Areas of Ecological Significance'.

The most important of these areas are scattered around the Antarctic continental shelf and in two wider oceanic regions, one projecting from the Antarctic Peninsula engulfing the Scotia Arc and another surrounding the sub-Antarctic islands in the Indian sector of the Southern Ocean (Figure 1).

Existing and proposed MPAs for the Southern Ocean overlap to a large extent with the Areas of Ecological Significance identified in the study (Figure 1), highlighting the value of these regions in the context of CCAMLR's objective to develop a representative system of MPAs,

and the need for circumpolar perspectives in developing effective conservation and management.

The establishment of MPA networks that encompass Areas of Ecological Significance will provide long-term mitigation of growing pressures on Southern Ocean ecosystems. However, using climate model projections to look at how these Areas of Ecological Significance may change by 2100 shows that the existing MPAs (with their fixed boundaries) may not remain aligned with important habitats in the future.

This underscores the need for adaptive management strategies to best protect Areas of Ecological Significance into the future. While many of the areas identified in existing and proposed MPAs will remain important, regular and evidence-based review of MPAs will be required to ensure conservation success in the longer-term, for example through adjusting boundaries. Continued predator tracking work will provide an important means to guide our understanding of the efficacy of MPAs, and to inform such dynamic management into the future. Combining this work with regular surveys of the distribution and abundance of prey species, for example using the increasing capabilities of new research vessels and the fishing industry, would make a significant contribution to this process.

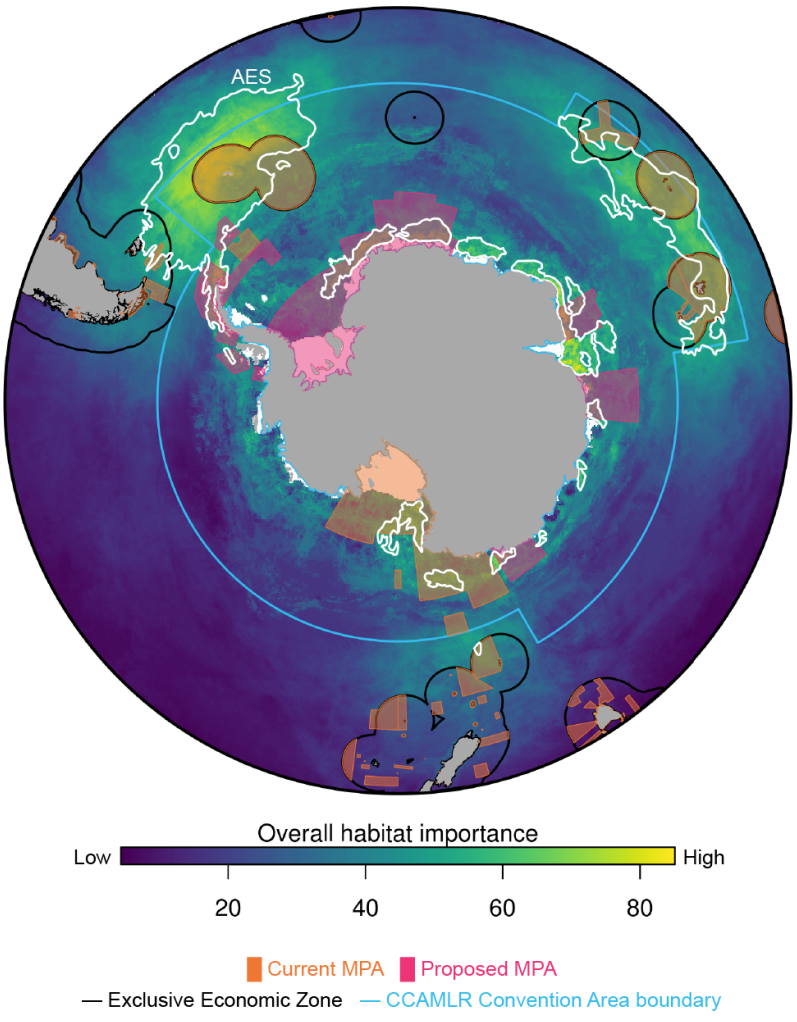

Figure 1. Current (orange polygons) and proposed (magenta polygons) Marine Protected Areas (MPAs) superimposed on overall habitat importance (blue to yellow) identified from the analysis of tracking data from 17 species (1991-2016). White contours denote Areas of Ecological Significance (AES), black lines show national Exclusive Economic Zones, and the blue line denotes the CCAMLR Convention Area Boundary.

4. Conclusions

The findings of Hindell et al. (2020) highlight how adaptive management of MPAs, updated over time in response to ongoing change, is needed to ensure the continued protection of Southern Ocean ecosystems and their resources in the face of growing demand by current and future generations. This work highlights where future science-informed policy efforts might best be directed, including both adaptive spatial protection and improved robust management of fisheries.

5. References and links

Hindell, M. A., Reisinger, R. R., Ropert-Coudert, Y., et al. (2020) Tracking of marine predators to protect Southern Ocean ecosystems. *Nature* 580, 87-92, doi:10.1038/s41586-020-2126-y.

Ropert-Coudert, Y., Van de Putte, A., Reisinger, R. R., et al. (2020) The retrospective analysis of Antarctic tracking data project. *Scientific Data* 7, doi:10.1038/s41597-020-0406-x.