Agreement on the Conservation of Albatrosses and Petrels

Fifth Meeting of the Population and Conservation Status Working Group

Florianópolis, Brazil, 9 - 10 May 2019

Mapping the global distribution of seabird populations: a framework for integrating biologging, demographic and phenological datasets

Ana P. B. Carneiro, Elizabeth J. Pearmain, Steffen Oppel, Thomas A. Clay, Richard A. Phillips, Anne-Sophie Bonnet-Lebrun, Edward Abraham, Yvan Richard, Jonathan Handley, Ross M. Wanless, Cleo Small, Ben J. Dilley, Peter G. Ryan, Javier Arata, Elizabeth Bell, Leandro Bugoni, Letizia Campioni, Paulo Catry, Richard Cuthbert, Lorna Deppe, Graeme Elliott, Amanda Freeman, Jacob Gonzalez-Solis, Jose Pedro Granadeiro, David Grémillet, Todd J. Landers, Azwianewi Makhado, Deon Nel, David G. Nicholls, Christopher Robertson, Paul Sagar, Paul Scofield, Jean-Claude Stahl, Andrew Stanworth, Kim L. Stevens, Philip N. Trathan, David Thompson, Leigh Torres, Kath Walker, Susan M. Waugh, Henri Weimerskirch, Maria P. Dias

SUMMARY

The identification of geographic areas and periods when the densities of animals are highest across their annual cycles is a crucial step in conservation planning, including for the designation of protected areas and regulation of potentially detrimental human activities. Many species of marine megafauna are declining, however for the majority, the methods used to identify these important sites and times are usually biased towards adults, neglecting the distribution of other life-history stages even though they can represent a substantial proportion of the total population. Here we develop a methodological framework for estimating population-level density distributions at quarterly and annual resolutions, incorporating tracking data for all major life-history stages (adult breeders, adult non-breeders, juveniles and immatures). We incorporate demographic information (adult and juvenile survival, breeding frequency and success, age at first breeding) and phenological data (average timing of breeding and migration) to appropriately weight distribution grids according to the proportion of the population represented by each life-history stage. We demonstrate the utility of this framework by applying it to 21 species (including 28 populations) of albatrosses and petrels. The resulting distribution grids accounting for all major life-history stages highlight that omitting juveniles, immatures and adult non-breeders leads to spatial biases, particularly as these classes may account for 55-75% of all individuals for many species. As such, ignoring the distributions of pre-breeders and adult non-breeders is likely to bias estimates of overlap with threats, and potentially lead to suboptimal targeting of resources directed at management and conservation. Our framework synthesizes and improves on previous approaches to estimate seabird densities at sea, and provides a standard and replicable methodology that can be easily updated as new tracking and demographic data become available.