
Unravelling the relative importance of top-down and bottom-up environmental effects driving vital rates according to sex, colony and experience in long lived species, the snow petrel

Christophe Sauser*^{†1}

¹Centre d'étude biologique de chizé (CEBC CNRS) – CNRS : UMR7372 – 405 Route de Prissé la Charrière, 79360 Villiers-en-Bois, France

Abstract

Unprecedented climate change is expected to occur in the 21st century, with greater warming often reported for high latitudes. This should result in significant ecological impacts on ecosystems, from species to communities. Environmental factors and their ecological impacts on population dynamics need to be studied to understand the diversity of responses to climate change in living organisms. In our study, we used capture-recapture modelling based on a 36-year-long individual monitoring dataset to investigate bottom-up and top-down forcing on several demographic parameters according to the sex, the colony and the breeding status of individuals in a long-lived species, the snow petrel on Petrel island in Antarctica. Survival varied according to sex and previous state of breeding (reflecting the experience of birds). Experienced breeding males survive better than inexperienced non-breeding females. Predation and sea ice concentration had a greater negative impact on survival of inexperienced individuals. Breeding probability varied with the previous state of breeding, with a lower probability for inexperienced individuals, between colonies and previous breeding experience. Interannual variations of breeding probability for inexperienced breeders were partly explained by sea ice concentration during the pre-laying period. By contrast, sea ice concentration of the preceding summer had a positive impact on experienced birds. Hatching probability depended on colony, sex and previous state of breeding, and was negatively related to the southern annular mode and the number of snowy days during the incubation period. Air temperature and wind strength during the incubation period mainly affected non-breeders of the previous year. Fledging probability depended on colony and previous state of breeding, and its variations appeared to be better explained by local environmental factors. Breeding phenology partly explained variations in fledging probability. These results highlight the importance of top down and bottom up environmental factors on the demography of a long-lived species, and of taking into account multiple parameters to understand the demographic response to environmental fluctuations. We also emphasize the importance of local factors at the colony scale on demography, highlighting the need for multiple site studies to understand the impact of environmental changes on population dynamics.

Keywords: demography, sea ice, capture mark recapture, Antarctic, seabirds

*Speaker

[†]Corresponding author: christophe.sauser@cebc.cnrs.fr