WHERE DO THEY GO? YEAR-ROUND MOVEMENTS REVEAL A SHIFT IN THE DISTRIBUTION OF SOUTHERN GIANT PETRELS DURING WINTER

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Abstract: We aimed to evaluate the year-round distribution of an Antarctic population of the Southern Giant Petrel *Macronectes giganteus*. Twelve BAS MK9 geolocators were recovered in November 2011 from animals tagged in January 2011. We applied month Fixed Kernel Densities and compared the geographical positions of individuals between breeding and non-breeding periods. During breeding, petrels remained predominantly above the 60°S parallel, but during the non-breeding period they used mostly the areas below 60°S, with many individuals using the coast of Argentina, west of Falkland Islands. The results are exciting in the sense that now the information on where the Southern Giant Petrels spend the winter will allow the understanding of the influences of climate and fisheries over the population dynamics.

Keywords: Geolocation, Migration, Seabird Tracking, Year-Round Distribution.

Introduction

Home ranges of seabirds are very large over their entire annual cycle, but they may vary differently during breeding and non-breeding periods (Birdlife International, 2004). Areas vary according to the resource needs during such periods. The movements and foraging behavior of sub-Antarctic populations of the Southern Giant Petrel *Macronectes giganteus* is poorly known (González-Solís *et al.*, 2008; Copello *et al.*, 2011), although some information about movements of Antarctic populations exist. Southern Giant Petrels that breed in sub-Antarctic islands do not tend to disperse from breeding foraging areas, but clear variations in movements at-sea are apparent during incubation, hatching and chick rearing periods (González-Solís *et al.*, 2008; Copello *et al.*, 2011). Immature Southern Giant Petrels banded in Antarctic (Sander *et al.*, 2010) have been recovered in most south hemisphere continents, at distances far wide from breeding grounds. However, no evaluation

of movements of adults from Antarctic populations exists so far. Our objective is to investigate the year-round distribution of adult Southern Giant Petrels that use an Antarctic Island as breeding area.

Materials and Methods

The study was conducted in Stinker Point, at Elephant Island, maritime Antarctic Peninsula (61°13'20.5"S, 55°21'35"W). We tagged 20 birds with British Antarctic Survey (BAS) MK9 geolocators at the nests in January 2011. Tags were recovered (n=12) in November, in the same year. Geographical data from geolocators were processed using BAS Track Package. Points were excluded when the estimated velocity of the animal was above 45 km/h, as well as points one week pre- and post- equinoxes. We calculated month Fixed Kernel Density to evaluate the habitat used by the population in ArcGIS 9.3. The search radius

was 2.5° and the cell size was set to 0.05°. We compared geographic position among individuals and among breeding and non-breeding periods and the interaction between individuals and periods through factorial ANOVA assuming significance at $p < 0.05$. Latitudinal and longitudinal positions presented Gaussian distribution.

Results

Year-round distribution of Southern Giant Petrels covered three core areas: the extreme north of Antarctic Peninsula, south of the Elephant Island; the edge of the Antarctic zone, north of the Elephant Island; and the area

between Falkland Islands and south Argentina coastal waters. Distribution varied over the year, but Petrels always foraged preferentially above the 60°S parallel during the breeding period (from October to March). During the non-breeding period (from April to September), they used predominantly waters below 60°S, with many birds using Argentina Coastal waters (Figure 1).

There were significant differences in the latitude and longitude among individuals (Longitude $F_{7,3059} = 51.6$, $p < 0.001$; Latitude $F_{7,3059} = 7.5$, $p < 0.001$), between breeding and non-breeding periods (Longitude $F_{1,3075} = 466.3$, $p < 0.001$; Latitude $F_{1,3075} = 960.8$, $p < 0.001$) and a significant

Figure 1. Month Fixed Kernel Density for Southern Giant Petrels recovered in late November at Stinker Point.

interaction between period and individuals for longitude ($F_{7,3059}=41.1$ $p<0.001$) and latitude ($F_{7,3059}=18.5$, $p<0.001$). During the breeding period, most of the individuals were concentrated between 60°S-65°S and 53°W-56°W (with the exception of the individual 924) (Figure 2). During the non-breeding period, most of the individuals moved north and west, with the exception of the individual 938 that moved east (Figure 2).

Discussion and Conclusion

As expected for a pelagic large seabird, the Stinker point Southern Giant Petrel population presented a large year-round home range, despite this is not as large as one could suppose at a first when inferring adult movements based on immature band recovery (Sander *et al.*, 2010). In the other hand, the comparison of the present study with González-Solís *et al.* (2008) findings showed similar trends of foraging near breeding colonies during egg laying and incubation (October/November), hatching and rearing periods (January/ February) followed by a northward dispersion during the non-breeding period. At the end of the breeding season (March), the Petrels moved to high

latitudes just before moving to wintering grounds. This trend was also verified in populations of Cory's Shearwater in the North Atlantic, which moved north in direction of the Arctic waters, before moving south. However, in the case of Cory's Shearwaters, individuals move farther distances than the Giant Petrels (Cattry *et al.*, 2011). Authors believe this is explained by a pre-migration behaviour when seabirds recover physical conditions in highly productive waters before starting long travels over low productive waters. Such trend, although plausible for Giant Petrels, still needs to be empirically tested. However, during the non-breeding period, part of the population dispersed northwards, to the coast of Argentina, and part remained near the Antarctic border, probably by the ice-edges.

The present results are extremely important because they allow us to evaluate how climate, productivity and fisheries on wintering areas are affecting the population dynamics at Stinker Point. Particularly, understanding how climate change affects the behaviour of birds is of interest because the increase of the Stinker Point population is somehow related to an increase in the temperature (Krüger *et al.*, 2012). Fisheries are usually intense at productive waters of Argentina coast, especially during the months in which

Figure 2. Mean ($\pm$ SE), Latitudinal (Top) and Longitudinal (Bottom) position of each Tagged Southern Giant Petrel during the breeding (B) and non-breeding (NB) period.

Southern Giant Petrels use the region. This may lead to competition for resources with fisheries, or may cause Southern Giant Petrels to be caught on fishing gears.

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