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MONITORING OF THE DYNAMIC AND SPATIAL DISTRIBUTION OF ANTARCTIC SEABIRD POPULATIONS IN THE SOUTH SHETLAND ISLANDS

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Antarctic seabirds are affected by Climate Changes and the increase of human activities. Global changes affect seabirds through an indirect effect on food webs; human activities have a direct impact on breeding colonies. Consequences can be seen mainly on seabird breeding success, whose populations may decrease in the future. Thus, contextualized by the increasing human presence in the circumpolar islands of Antarctica and the climatic changes occurring more drastically in Polar Regions, the project is monitoring an important component of top predator communities. The UNISINOS Team has been sampling on South Shetland Islands since the early years of the Brazilian Antarctic Programme, making possible long term analysis of Antarctic Seabird populations.

The effect of Climatic Changes on Antarctic seabirds is seen in two ways. Ice cap variation has an impact on sea productivity and therefore on krill reproduction. Increased ice caps in unusually cold years reduces the incidence of light on the seawater, thus reducing the algae bloom, and, smaller ice caps reduces the optimal habitat for krill larvae to develop. Over the annual variations, birds may respond changing their breeding chronology, breeding in spite of the reduced food intake and raise an "unprepared" offspring, or simply abort breeding. Thus seabird monitoring gives insight on the actual status of productivity and Antarctic food web status. The other impact is a little more direct, though more simple. During unusually cold summers, when there is late de-icing on land, there is reduced availability of optimal area for nesting. Also, they may synchronize their breeding to ideal periods, or even choose not to reproduce in such years.

UNISINOS is sampling seabird populations on South Shetlands, nowadays, the monitoring aims to compare population dynamics in King George Island in comparison to other South Shetland islands, and the annual variation of distribution of breeding colonies. The study of seabirds includes population counting, estimates of reproductive success, banding for demographic analysis and mapping through GPS technology. The project is intended to include the use of Light Level Geolocators technology to the activities next summer.

By means of the atypical cold year of 2009/2010 austral summer, we had the opportunity to evaluate the responses of seabirds, which would affect the annual offspring. Southern Giant Petrels from Elephant Island presented a success rate of less than 6% of mating couples having successful fledglings. Although, the potential number of 2009/2010 summer breeding pairs estimated from average Population Growth Rate (λ=1.019659 ± 19.13%.) in the years 1986 until 1993 is close to the actual verified population (Figure 1). The relationship between average temperature at the beginning of breeding season and number of offspring is significant in three models of regression (Linear R^2= 0.54, p=0,06; Quadratic R^2=0.68, p=0.1; Cubic R^2=0.94, p=0.02) (Figure 2).

Similar responses may be expected from other species. The relationship between penguin breeding pairs and temperature indicated a low number of *Pygoscelis antarctica* breeding pairs in the 2009/2010 season as a response to the atypical year, and a slight decrease in *P. papua* pairs was also observed. The *Larus dominicanus* breeding pairs figure also declined that season in Admiralty Bay (Figure 3).

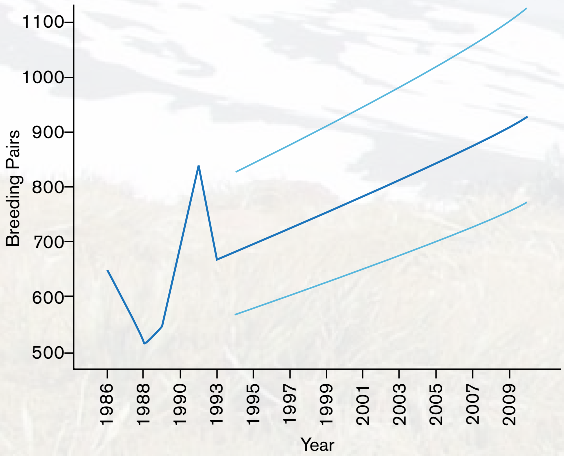


Figure 1. Population variation of Southern Giant Petrel on Elephant Island between 1986 and 1993 breeding season, in the following years the expected population increases are based on the average lambda of 1.019659 ± 19.13%. Note the potential number of breeding pairs in 2009/2010 breeding season is close to the real observed.

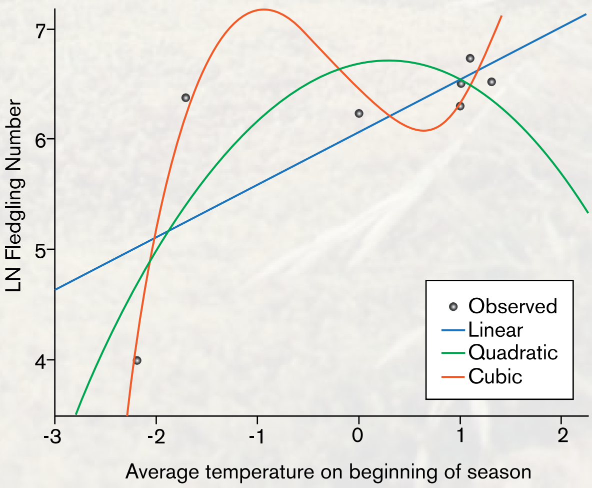


Figure 2. Relations between average temperature at the beginning of the breeding season and logaritmized fledgling number of southern giant petrels. Three models were tested, and all were significant under $\alpha = 90\%$. The model probably describing better the relation between the variables is the quadratic, since the increase in temperature is also expected to influence the breeding season.

Furthermore in relation to temperature, we believe there is a main influence of de-iced land area, in turn, influencing available breeding grounds. Satellite analysis in the future, whereas also more detailed analysis on the influence of temperature on demography plus geolocator information will allow detecting what is the exact influence.

Studies on community ecology and species interaction are also in development. I.e., Brown Skuas (*Catharacta lonnbergi*) may have the effect of proximity with penguin colonies and with conspecific nearest neighbor on their breeding success (Figures 4 and 5).

The distribution maps will be revaluated each year to detect any possible change in colony areas, size and seabird density over the years (Figure 6).

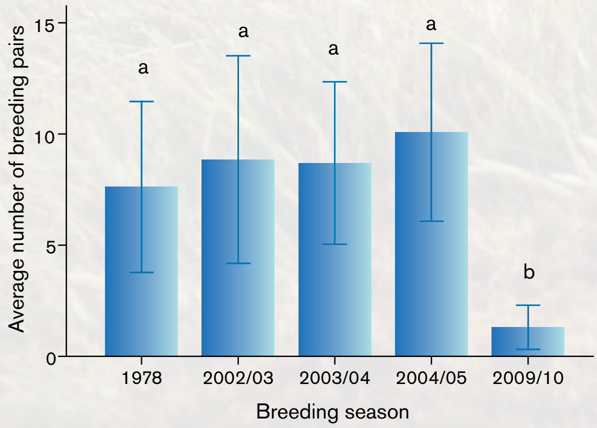
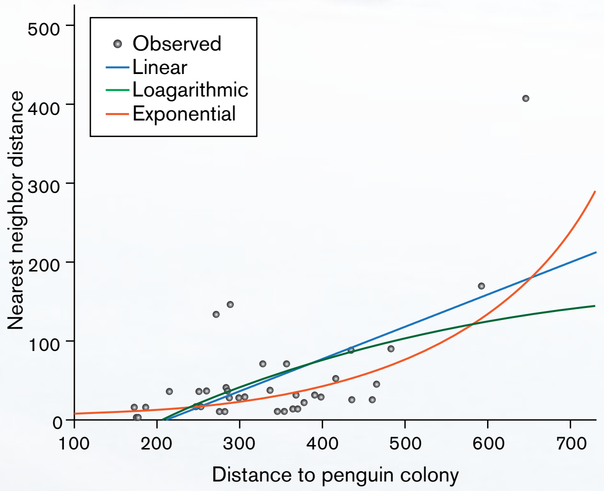


Figure 3. Average number of *L. dominicanus* breeding pairs at different breeding seasons in Admiralty Bay. The difference in the last sampled season is significantly different from the previous years (Repeated Measures Anova, F*4,48*=2.81; p=0,036).



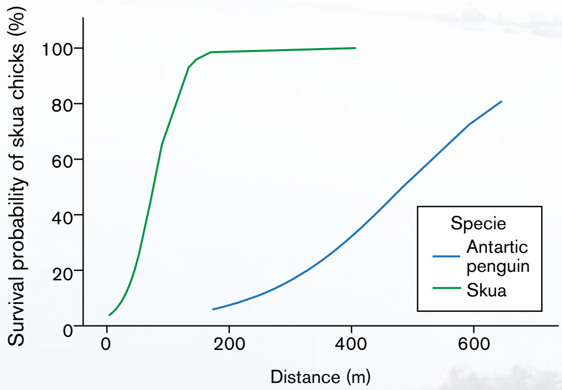


Figure 4. The positive relation between Penguin Colonies and the Conspecific Nearest Neighbour Distance indicates Brown Skua nests close to Penguins are also the closest nests, potentially increasing intra-specific competition and predation.

Figure 5. The survival probability of Brown Skua Chicks is influenced by the Distance of Penguin Colonies and Conspecific Nearest Neighbours. Near to Penguin colonies the Skua nests are closer to each other, enhancing the intra-specific competition and predation.

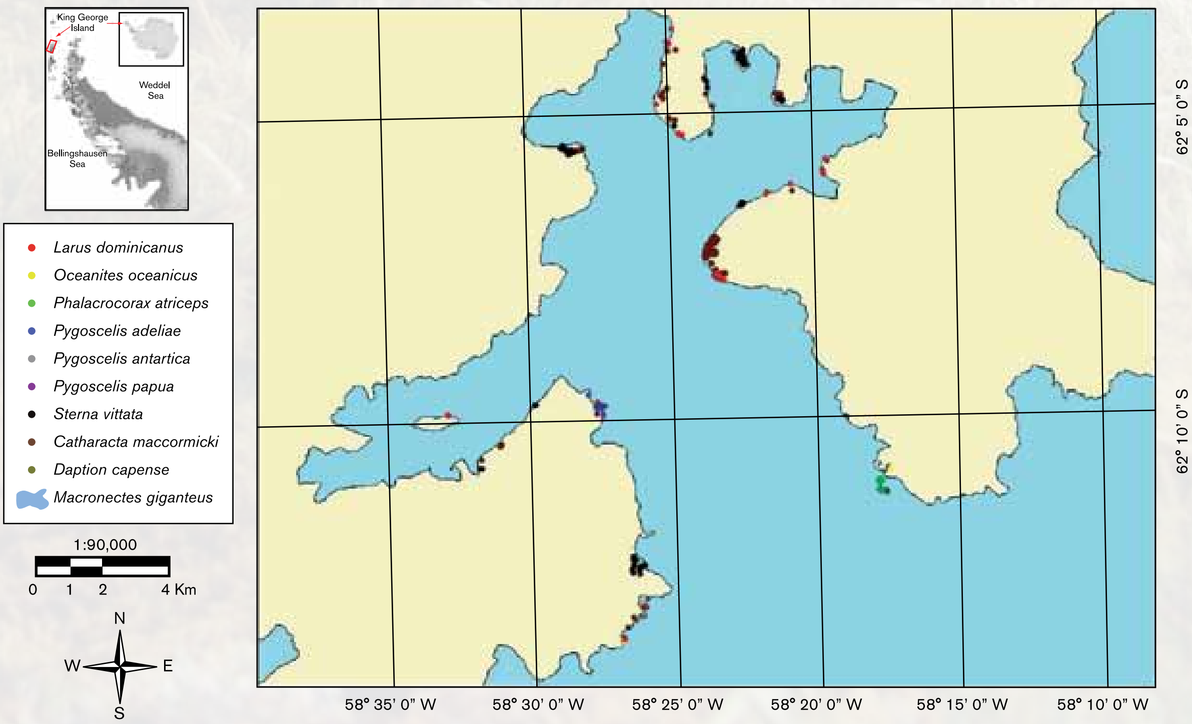


Figure 6. Distribution map of breeding seabird populations at Admiralty Bay during the 2009/2010 season.

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