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Demography and breeding success of Falklands skua at Sea Lion Island, Falkland Islands

Field work report - Update 2018/2019

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Summary

The Falklands skua is an important, but understudied, component of the Falklands marine megafauna and biodiversity. We carried out field work on skua at Sea Lion Island during the 2018-2019 breeding season, to follow up a long-term study of skua demography and breeding success that we begun in 2014. We collected data on nest location and spatial distribution, nesting habitat, and reproductive success. In this report we present the results of the field work. Although there was a large number of skua pairs that tried to nest, the maximum ever recorded during the study, the nest abandonment rate was very high, and the total breeding success of the population was low, although it was greater than the previous breeding season (2017-2018), in which the breeding success was close to zero. We confirmed that almost all skuas nest in groups distributed over two different zones of Sea Lion Island: 1) the Lodge zone, close to gentoo penguin colonies, and 2) the West end of the island, including the Sheffield Memorial area, close to the rockhopper penguin and king cormorants colonies. The nest abandonment rate was higher, and the breeding success lower, in the West end zone, although most differences were not statistically significant. The reduction in breeding success is probably related to the interaction between prey abundance and to the number of the only potential skua predator, the striated caracara. We think that when food resources are scarce, due to low breeding success of marine birds, skuas can be less effective at protecting nests, eggs and chicks, and, therefore, the caracara predation rate may be higher. Due to the important role of the Falklands skua in the food chain of the South Atlantic ocean, both on land and at sea, the drivers of their demography and population dynamics at Sea Lion Island and in the Falklands at large deserve further investigation.

Introduction

The Falkland skua *Stercorarius antarctica antarctica*, is a taxon nearly endemic to the Falkland Islands, has been rarely studied in the islands and showed a sharp demographic decrease in its biggest colony, New Island (Catry et al. 2011). Anecdotal information indicates that the decrease may have happened also in other places (Carcass Island, Robert McGill, pers. comm.; Saunders Island, David Poole-Evans, pers. comm.). The species is an important component of the South Atlantic biodiversity (Phillips et al. 2007), has a very interesting demography, breeding biology and social behaviour. At Sea Lion Island, skuas are a potentially important regulator of the population dynamics of various marine bird species, because they prey on eggs and chicks and can produce a significant reduction in the breeding success of those species.

Project objectives

Our project has three main objectives:

- to determine the timing of the breeding season and events
- to locate and map the nests, to study grouping and habitat choice of skua pairs
- to estimate the nesting and breeding success.

Methods

We carried out field work at Sea Lion Island (SLI, hereafter) during the skua breeding season (November 2018 - March 2019). We searched the whole island to locate skuas nests. Skuas are territorial and, therefore, it is usually easy to identify nests by observing the behavioural reaction of the adults when approached by an operator (Catry et al. 2011). After locating a nest, we took its position using GPS receivers (GPSMap 60, Garmin). We gave each nest a serial number, and we collected data about the aspect of the nest, the nearby substrate and vegetation (circle of 5 m radius centred on the nest), the reaction and behaviour of the skua(s) in attendance, and the remains of prey and food leftovers in proximity to the nest.

We checked each nest once per week, and we recorded the number of adults, number of eggs and chicks, size and colour of adults, and size and moult level of the chicks. During each visit at the nest, we recorded the behavioural reaction of adults and chicks to the operator approach, and we took detailed notes on the vocal and visual displays, also to monitor the impact of our visits on the skua welfare. Apart from the weekly censuses, we recorded ad libitum observations of nesting activity all along the breeding season. All together, we obtained 1775 skua records from 18/10/2016 to 16/03/2017. Of these, 1635 records regarded nesting pairs. During the weekly censuses, we obtained an average of 10.7 weekly records per nest ($SD = 1.3$, $CV = 0.12$). Number of records per nest was quite variable (6-14) due to frequent nest abandonment (see Results), and the difficulty to locate abandoned nests with no adult in attendance.

We tried to avoid excessive disturbance of nesting pairs by checking nests once per week. The study required no handling or marking of adults or chicks, and was fully non invasive. Although in the past we used numbered flags to help locating nests, now we are not using flags anymore, because GPS positions are accurate enough to permit to identify nests even without flags. In our Sea Lion Island research projects we strictly follow professional guidelines for the study of wildlife (Association for the Study of Animal Behaviour 2012; Fair et al. 2010).

Results

Timing of the breeding season and nesting areas

The first skua was observed on the 28th of October. The first day we observed a significant number of skuas was the 2nd of November, but skuas were close to the gentoo colonies and far away from the nesting areas. We observed the first clear sign of nesting about two weeks later, on the 11th of November.

We located and monitored 153 nests, with an overall density, calculated on an estimated SLI area of 940 ha, of 0.16 nests/ha. There were two main nesting zones (Figure 1). The first was close to Sea Lion Lodge and the gentoo penguin colonies ("Lodge" zone, Figure 2), and included 69 nests; the second was at the west end of the island and included 82 nests ("West end" zone, Figure 3). Apart from the nests of the main zones, we found two nests, one close to the other but isolated from the two main zones, north of the Long Pond and close to the north coast (Figure 1, arrow).

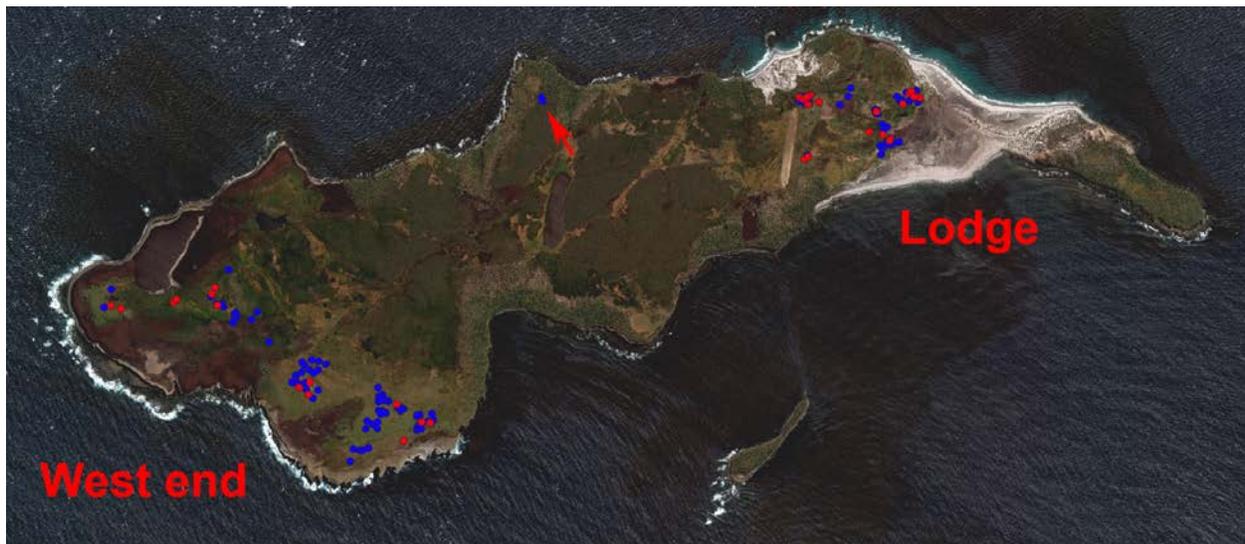


Figure 1 - Distribution of Falklands skua nests at Sea Lion Island, in the West end zone (left) and in the Lodge zone (right). Blue dots: abandoned nests; red dot: active nests.

Spatial distribution of nests

We found ten isolated nests (6.5%), five of which in the Lodge zone (7.8%) and five in the West end zone (6.1%), but all other nests were in groups of two or more. In the Lodge zone nests were distributed in six groups of 3-23 nests (mean = 10.7, SD = 8.0), while in the West end area there were five groups with 4-35 nests (mean = 15.4, SD = 12.8). The difference in grouping level between Lodge and West end zones was not significant (t test with randomization: mean diff. = -4.7, $t = -0.74$; $P = 0.48$). In the Lodge zone the largest group of nests ($N = 23$) was found on a grass area above a small temporary pond, while in the West end zone the largest group of nests ($N = 35$) was found at the two sides of the track to the Sheffield Memorial. Overall, the mean number of nests per group was 10.8 (SD = 10.2), confirming that skuas have moderately colonial habits even in places where favourable nesting habitat is abundant. We observed a large increase in the number of nests compared to the previous (2017-2018) breeding season (109.6%). The increase was greater in the Lodge zone (115.6%) than in the West end zone (100.0%). The difference in increase of nests number between the two zones was significant (Exact McNemar's test: $P = 0.01$).



Figure 2 - Detail of the location of nests in the Lodge zone. Blue dots: abandoned nests; red dot: active nests.

Breeding success

We observed a very high rate of nest abandonment in both study zone. Only one nest was abandoned before the laying of any egg. The overall mean number of eggs laid per nest was 1.65 (SD = 0.49). Of the nest in which eggs were observed, 38 (24.8%) were abandoned before hatching of any chick. Those nest had a mean of 1.45 eggs (SD = 0.50). Of the remaining nests

in which at least one chick hatched ($N = 114$), 80 (70.2%) produced no fledglings. The mean number of eggs of those abandoned nests was 1.71 ($SD = 0.46$) and the mean number of hatched chicks was 1.14 ($SD = 0.35$). The remaining non abandoned nests that produced at least one fledgling ($N = 34$) had a mean of 1.76 eggs ($SD = 0.43$), 1.47 hatchlings ($SD = 0.51$) and 1.24 fledglings ($SD = 0.43$). Only 8 pairs (5.2%) were able to produce two fledglings. The overall fledging success (fledglings per nest) was only 0.27 ($SD = 0.55$).

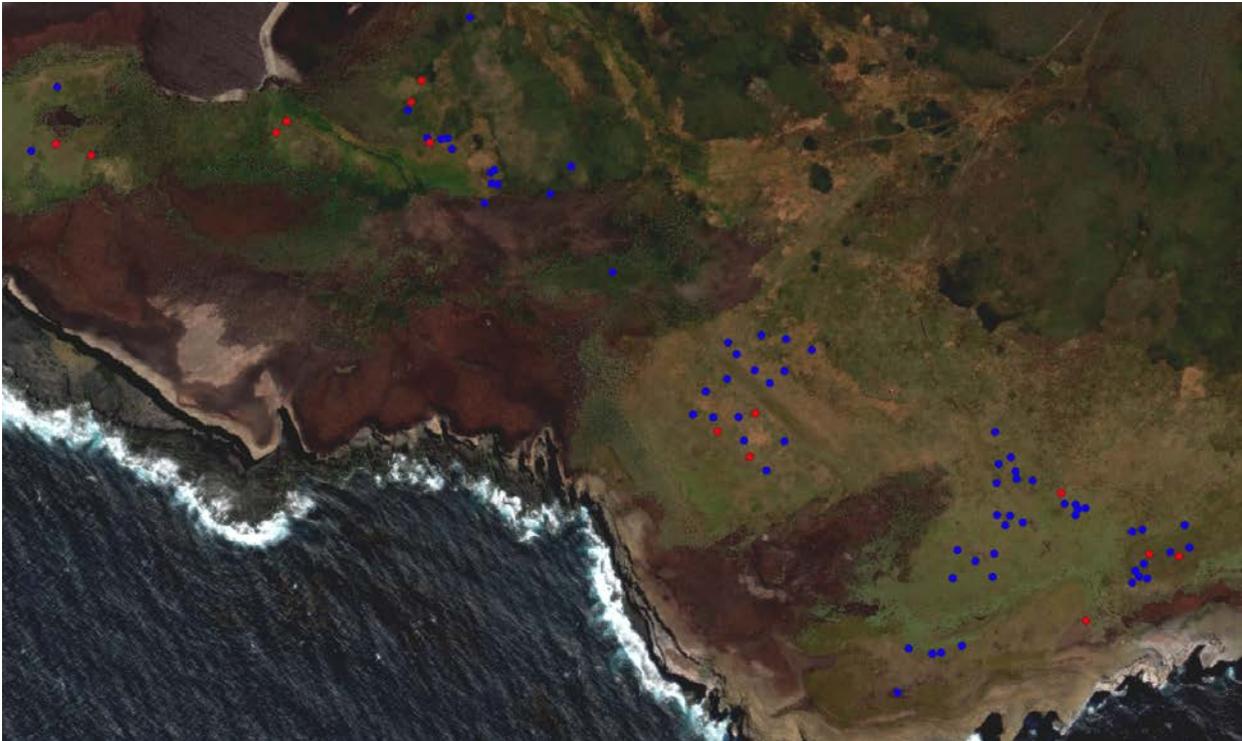


Figure 3 - Detail of the location of nests in the West end zone. Blue dots: abandoned nests; red dot: active nests.

The breeding success was quite similar between the Lodge and the West end zone. The percentage of abandoned nests was higher in the West end (82.9% vs 71.0%), but the difference was not statistically significant (Fisher's exact test: $P = 0.12$). The mean number of eggs per nest was slightly greater in the West end zone (1.70 vs 1.59) but the difference was not statistically significant (t test with randomization: mean diff. = -0.10, $t = 1.25$, $P = 0.20$). The mean number of hatchlings was about the same in both zones (0.93 vs 0.91). The mean number of fledglings was lower in the West end zone (0.21 vs 0.36), but the difference was again not statistically significant (t test with randomization: mean diff. = 0.16, $t = 1.72$, $P = 0.08$). Considering just the successful pairs, the fledging success was very similar between the West end and the Loge zone (1.21 vs 1.25).

Discussion

In the 2018/2019 breeding season there was a very large increase in the number of nesting pairs ((153 vs 73) and fledging success (0.27 vs 0.08) over the previous (2017/2018), but the percentage of abandoned nests was high and the fledging success was low, in particular if compared to the previous seasons (2015/2016: 1.23, 124 nesting pairs; 2016/2017: 0.67, 100 nesting pairs). Altogether, it seems that the reduction in the breeding success was mainly due to many pairs not being able to sustain the effort of defending and feeding chicks after hatchlings.

The reduction in skua nesting and breeding success observed in the past two season should be related to changes in availability of the skua main food resources, i.e., eggs and chicks of nesting marine birds. The skuas of the Lodge zone depend mostly on gentoo penguin (*Pygoscelis papua*) eggs and chicks, and their nesting areas are located on vantage points around and above the gentoo nesting colonies. The skuas in the West end zone seem to have a more variable diet. Pairs nesting close to the Sheffield Memorial should prey mostly on rockhopper penguins (*Eudyptes chrysocome chrysocome*), while observation of food remains around nests the Beaver Pond shows that those pair feed mostly on Magellanic penguin (*Spheniscus magellanicus*) chicks. Food remains show that pairs that nest close to the main king cormorant (*Phalacrocorax atriceps albiventer*) colony prey on that species eggs and chicks. These pairs showed the greatest reduction in success during the last two breeding season (0 fledging success), and that can be related to the complete failure of breeding in the main king cormorant colony observed in these two seasons.

It has been suggested that striated caracara (*Phalcoeboenus australis*) can regulate Falklands skua populations by predation on chicks, and that an increase in caracara number and density was the main determinant of the skua decrease in the biggest skua colony in the Falklands, New Island (Cathry et al. 2011). Contrary to this expectation, the skuas decrease observed at SLI was probably not directly related to a change in the caracara population, because at Sea Lion Island the number of resident caracaras (nesting pairs/trios and non nesting territorial adults) has been almost steady (ESRG unpublished data). A more reasonable explanation, is that when food resources are scarce, nesting adults leave the nest, eggs or chicks unprotected, and, therefore, caracaras it can be easier for caracaras to predate on eggs and chicks, although we never directly observed any event of caracara predation of skuas, notwithstanding the large field work effort.

Conclusion and perspectives

The Falklands skua is a very important component of the biodiversity of the island, but has been rarely studied. The species is part of the food chain of the island, and may play an important role in regulation of demography of penguins, and seabirds at large. Therefore, we plan to carry on our study in following breeding seasons if funds and research licenses can be secured, also because the huge drop in nesting and breeding success observed in recent seasons deserves

further investigation. Only the long term follow up of the population will permit estimation of population trend, and determination of factors affecting it. In particular, we would like to study the joint variation of skuas, their potential preys (penguins and cormorants), and their potential predator, the caracara, to test of hypothesis of an increased caracara predation rate when food resources are scarce, and adult skuas may be less able to attend and protect nest, eggs and chicks.

Acknowledgments

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