

BREEDING OF SOUTHERN GIANT PETREL *MACRONECTES GIGANTEUS* IN SOUTHERN CHILE

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ABSTRACT

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Here I review the current knowledge of the breeding status of the Southern Giant Petrel *Macronectes giganteus* in Chile and provide new data on the population at Isla Noir in the Región de Magallanes. Breeding numbers on Isla Noir are approximately six times greater than previously reported for the entire country, including all offshore islands except for the Diego Ramirez Archipelago, for which information is sparse. Here, I also describe the nests and eggs of this species found in Isla Noir, as well as feeding behavior, including consumption of carrion but also active hunting in penguin colonies. Only the Southern Giant Petrel, and not the Northern Giant Petrel *M. halli*, has been seen within Chilean fiords and nearshore waters.

Key words: census, breeding, Southern Giant Petrel, *Macronectes*, Isla Noir, southern Chile.

INTRODUCTION

The Región de Magallanes of southern Chile represents a broken and extensive coastline, with a large number of islands, islets, channels, and small bays. Although this area could contain large numbers of seabird colonies, many potential sites are difficult, if not impossible, to access. More than 30 years ago, Schlatter (1984) outlined the need to determine the total distribution and abundance of seabird colonies in this region, since, without that information, it is almost impossible to create a viable seabird conservation program. In particular, a focus is needed on procellariiform seabirds, which have a low reproductive rate, low clutch size, long nestling periods, and a prolonged stage of immaturity. These characteristics make them vulnerable to environmental impacts (Furness & Monaghan 1987).

The Southern Giant Petrel *Macronectes giganteus* is the size of a small albatross and is a common inhabitant of extreme southern Chile and the Chilean fiords (Venegas & Jory 1979). At sea, its circumpolar distribution extends from Antarctic to temperate waters, reaching well into tropical latitudes in the Pacific Ocean (Murphy 1936, Marchant & Higgins 1990). Within 20 km at sea from the main island maze and through the Chilean fiords (inside channels and fiords) between Puerto Montt and Cape Horn, only Southern Giant Petrels have been documented; Northern Giant Petrels *Macronectes halli* have been neither observed nor photographed by me or others between October and April 2001–2016. Accordingly, during the winter months (May and June), Jehl (1973) collected or photographed only Southern Giant Petrels along the Chilean fiords and observed that they were common along the Straits of Magellan and in coastal waters to 41°S. In this paper, I present the results of a census of the Southern Giant Petrel breeding colony at Isla Noir and review the published, mainly anecdotal, accounts for the island as well as for the southern Chilean coast and offshore islands.

STUDY AREA AND METHODS

Isla Noir (54°30'S, 72°58'W) is one of the outermost islands in the southern Chilean fiords, located about 21 km offshore from the great maze of islands composing this region. It is about 11 km long and 4 km wide; its maximum elevation is 350 m, with several peaks of 250–280 m. The higher parts of the island were mainly dominated by native rush *Juncus scheuchzeroides* and dwarf Ñirres trees *Nothofagus antarctica*, creating a very compact, stunted, thick forest (see Fig. 1A–C). Access in some areas is difficult. I visited Isla Noir on six occasions: 11–16 November 2003, 14–21 November 2004, 8–11 November 2005, 9–15 November 2009, 11–22 November 2010, and 20–29 November 2013. During visits in November 2005, 2009, and 2013, I conducted especially extensive surveys, involving point counts along the mountain ridges from different directions. On 23 November 2013, walking 4.5 km southeast to northwest along the upper ridge and having a clear view of at least 100 m or more, I stopped every 50–100 m, depending on terrain, to count nests and to avoid count duplication. Counts were aided by the use of Swarovski 10× binoculars. Nests were only to the west and southwest side of the island, the other side being mainly covered with pack and compressed forest or steep cliffs.

In addition, I traveled extensively through the Chilean fiords between Puerto Montt and Cape Horn, on dates ranging between October and April 2001–2016, obtaining data on seabirds. For geographical position, I used portable GPS units (Garmin e-Trex 10, 30, or 64s), or positions taken from Riso-Patrón (1924) or Chilean Navy navigational charts. The nomenclature of egg shapes follows those given by Preston in Palmer (1962). Egg measurements were taken with a dial caliper to the nearest 0.1 mm; nest measurements were taken with a 1 m measuring tape to the nearest 1 cm; and the egg mass estimated to the nearest gram was taken with a 300 g AVINET spring scale. The eggs were either fresh or slightly incubated.

RESULTS AND DISCUSSION

While the Southern Giant Petrel is one of the most abundant large flying seabirds in this region, little is known about its breeding populations and breeding habits along the western South American coastline. The first mention of breeding by the species for Chile was by De Agostini, who mentioned nests found on the highest peaks of Isla Negra (also known as Isla Noir) on 2 December 1929, noting “numerous nests among the rush,” all containing adults incubating eggs (De Agostini 2005). Later, Clark *et al.* (1984) and Clark (2000) visited the high peaks of the southeast portion of the island on 19 February 1984 (same area visited by De Agostini in 1929). Clark *et al.* (1984) reported >200 nests with well-grown nestlings, although more could be present in areas difficult to see and access. Kusch *et al.* (2007) described the bird fauna of the island and, based on visits to the mountain ridges on the northwest part of the island during November 2003 and 2004, documented approximately 1 000 breeding pairs.

Several other breeding sites are known in the Chilean region. One on Archipelago Diego Ramirez (56°31'S, 68°43'W) was initially referred to by Watson (1975), who mentioned a communication from C.C. Olog (April 1974) indicating breeding at this locality. This finding was confirmed by Schlatter in 1984, who found 182 individuals (91 breeding pairs). Later, Schlatter & Riveros (1997) reported the species as breeding on Islote Gonzalo (main island of the archipelago) but did not mention the number of nests or breeding pairs. Patterson *et al.* (2008) indicated a population of about 90 breeding pairs, on the basis of a communication from Schlatter. I made four short visits to Islote Gonzalo—two in January (2006, 2013) and two in February (2006, 2012)—during which I found no nests but observed large numbers of birds, e.g., on 1 January 2013, 55–60 individuals occupied a single beach (see

also below). At the same time, several petrels were present on the immediate surrounding islands. These numbers are more or less consistent with what was reported originally by Schlatter. However, these petrels have been observed to breed on Isla Bartolome as well (V. Raimilla, pers. comm.), although the number of breeding pairs has not been determined, and the species undoubtedly breeds in other islands in the archipelago.

The Isla Noir colony had a clear natural division of two main parts: one section in the southeast, which is the easiest to access, and the second in the central and northwest part of the island. The southeast part was the area visited by De Agostini in 1929 and Clark *et al.* in 1984. On my surveys, I counted 339 active nests in this part, with all of the birds sitting on eggs (200 pairs were estimated here by Clark *et al.* 1984). In regard to the central and northwest part of the island, with different colleagues, I visited only the extreme northwest part of the colony in 2003, 2004, 2005, and 2009 (see Kusch *et al.* 2007). This part of the island is more difficult to reach and contained 1 234 active nests. Several nests were more distant, and I may have missed ~50 lower on the slope and hidden behind taller rush or compact forest. In addition, I counted 133 fresh empty nests that had been occupied during the current season. In total, I counted about 1 756 breeding pairs nest on Isla Noir. The greatest concentration of active nests was found on the highest points of the island. However, several locations had solitary nests or small clusters. For example, on 10 November 2005, I found a solitary nest on the upper part of a beach about 20 m from the waterline on the northeast part of the island. The full Isla Noir colony, therefore, is an important and significant breeding site for Southern Giant Petrels. The great majority of the species' colonies through its range are small (i.e., on the order of a few hundred), and rarely do colonies exceed 1 500 breeding pairs (cf. Patterson *et al.* 2008).

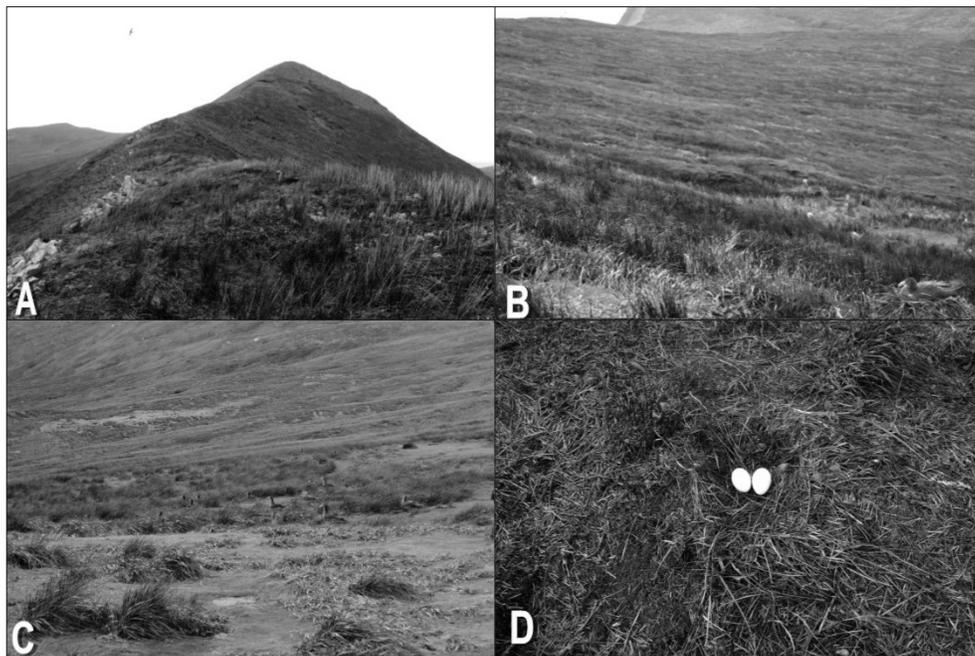


Fig. 1. Different parts of the colony at Isla Noir from the southeast to the northwest, clockwise: (a) mid-southeastern part along the ridges (a couple of nests are visible in the foreground); (b) mid-section, overlooking the southwest slopes in the foreground, where at least 15 nests with incubating birds can be seen; (c) gentle slopes of the northwest section and area, containing the largest concentration of nests and showing at least 21 nests as well many in the background with incubating birds; and (d) an unusual nest containing two eggs.

On 23 November 2013, the greatest number of empty nests was associated with the highest concentration of active nests, located at the highest elevations and in the central area on the northwest part of Isla Noir. Several scenarios may account for the large number of empty nests observed, but two are more likely. One would be that some pairs may not yet have produced eggs, meaning that egg laying would extend into early December. This could be the result of inter-annual variation, but that explanation is not likely. At other sites at similar latitude, e.g., on Macquarie (Australia) and Islas Malvinas/Falkland islands, laying should start in October and end in November (Serventy *et al.* 1971, Woods 1975). Another likely explanation involves the effects of numerous predators. Indeed, the area containing the greatest number of empty nests on Isla Noir was contiguous with territories of Striated Caracaras *Phalacrocorax australis* and Chilean Skuas *Stercorarius chilensis*. Both species are known predators of eggs and nestlings of Giant Petrels. Both species could attack the nests in pairs, having greater agility than the petrels. On 23 November, from a distance, I observed a pair of Striated Caracaras interacting with a nesting Southern Giant Petrel. One caracara distracted the incubating bird as the second came from behind and pushed the egg out of the nest. Once the egg was dislodged, the petrel continued to sit as if it was incubating and did not interact with the caracaras as they consumed the contents of the egg nearby.

Most nests observed on Isla Noir were shaped as a small platform with a slight depression and were built with native rush, a material abundant on the hill tops. Although it appeared that nests were constructed of materials from the very immediate surroundings (i.e., rush), some nests had parts of Ñirre incorporated into them. On average, the internal diameter of nests averaged 427 mm (standard deviation [SD] 3.0; range 390–470 mm; $n = 20$) and a depth of 112 mm (SD 17.2; range 80–130 mm; $n = 7$).

All eggs found in nests on Isla Noir were white (matte), with a slight porosity, and were of variable shape, including long oval (35.3%), oval (29.4%), long subelliptical (20.6%), and subelliptical (14.7%; $n = 34$). The shapes were similar to those described in our previous report (i.e., Kusch *et al.* 2007). The greatest variation was in egg length rather than width (Table 1). All nests observed contained a single egg, except for one nest that had two eggs, which is uncommon (Table 1, Fig 1D). Watson (1975) mentions that nests with two eggs have been reported for the species and thought it more likely that two females were using the same nest. Recently, Shaughnessy (2017) summarized and reported two-egg clutches and questioned whether they were cases of polygyny versus two-egg clutches, favoring the two-egg clutches idea. Resolution of this issue would require DNA fingerprinting.

In some cases, my visits revealed numbers of petrels along various beaches. The Southern Giant Petrel is not only a scavenger but also an active predator, capturing mainly penguins in Región de Magallanes (see also Reynolds [1935] in regard to observations

at Deceit Island [55°55'S, 67°03'W]). During all my visits to Isla Noir (2003–2013), on a beach at Rada Noir, large numbers of giant petrels and Striated Caracaras were present, primarily resting before and after hunting penguins. Close to this area, a large influx of Rockhopper Penguins *Eudyptes chrysocome* accessed their nesting colonies. On 17 November 2010, I observed a group of ~20 Southern Giant Petrels swimming in the water as one petrel captured a penguin. Within a few minutes, nothing was left of the penguin, all petrels having participated in the feast. Similarly, on Terhalten Island (55°34'S, 66°46'W) on 4 February 2006, a group of Southern Giant Petrels captured a juvenile Rockhopper Penguin on the water, and, once it was dead, it was devoured in less than 10 minutes (Marin *et al.* 2013).

To summarize, it appears that the breeding season of the Southern Giant Petrel in Chilean fiord region begins with egg laying in late October/November and extends through December, and hatching, and chick-rearing occur from late January to May. Known breeding sites of the region include Isla Noir along with Isote Gonzalo and Isla Bartolome, both on Archipelago Diego Ramírez (56°S). There may be additional sites on other islands of the Archipelago. However, the number of breeding pairs remains uncertain, and the potential numbers might be a significant contribution to the total regional population. Two areas where Southern Giant Petrels may nest are the islands of Vidal Gormaz and Diego de Almagro. Patterson *et al.* (2008) gave a population estimate of 290 breeding pairs for Chile, which now we know is a six-fold underestimate, given that 1 756 nests have been counted on Isla Noir alone. A more thorough survey, and periodic monitoring of all suitable nesting sites, should be completed in order to provide a comprehensive overview of this species' population in southern Chile, an important region for seabird conservation.

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TABLE 1

Dimensions and mass of Southern Giant Petrel eggs
($n = 34$, for mass $n = 21$) from Isla Noir, Magallanes, Chile

Feature	Mean	SD	SE	Range
Length (mm)	102.0	2.74	0.47	97.1–108.6
Width (mm)	64.2	1.67	0.28	60.9–67.7
Mass (g)	220.9	15.25	3.32	194–256

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