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THE BIRDS OF THE POTTER PENINSULA, KING GEORGE ISLAND, SOUTH SHETLAND ISLANDS, ANTARCTICA, 1965–1998

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SUMMARY

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Records of breeding and non-breeding birds of the Potter Peninsula, King George Island, South Shetland Islands, Antarctica, part of which is a Site of Special Scientific Interest (SSSI), are reviewed from 1965 to 1998. The numbers of breeding pairs of skuas *Catharacta* spp. (max. 85) and Wilson's Storm Petrels *Oceanites oceanicus* (1400–2300) are much higher than previously assumed. Breeding is confirmed for the Black-bellied Storm Petrel *Fregetta tropica*. Pintado or Cape Petrel *Daption capense* and Imperial or Blue-eyed Cormorant *Phalacrocorax atriceps* are at least occasional breeders. Seven non-breeding taxa are added to the bird list of Potter Peninsula, now totalling 27 taxa, of which 13 species have been recorded breeding. Differences between previously published records and our own surveys cannot sufficiently be explained by temporal changes and reflect methodological problems with the latter. The boundaries of the SSSI should be enlarged to include the storm petrel populations of Three Brothers Hill.

INTRODUCTION

In a recent paper, Aguirre (1995) gives an overview of the birds he found at the Potter Peninsula, King George Island, South Shetland Islands, Antarctica (62°15'S, 58°36'W, Fig. 1) during the 1987/88 and 1988/89 austral summers. With the presentation of his data he intended to contribute '... to facilitate protection and conservation of this diverse Antarctic seabird community ...' (p. 23). In order to support Aguirre's (1995) goal, and noting that much of the Potter Peninsula falls within Site of Special Scientific Interest (SSSI) No. 13 in terms of the Antarctic Treaty System (Anon. 1998), we review all information dating from 1965, including unpublished observations from the erstwhile East German Antarctic Programme. We have, however, no access to other unpublished sources. We furthermore correct some mistakes that have arisen from incomplete use of the published literature by Aguirre (1995) and give some results of our own surveys from the 1993/94, 1994/95, 1995/96 and 1997/98 seasons. We give our population estimates in detail and argue that the differences between our and Aguirre's (1995) results are more due to methodological problems (e.g. the obvious lack of nocturnal controls or inappropriateness of restricted coastal censuses) than to actual changes in the abundances of the respective species over time. We provide a complete list of the birds of the Potter Peninsula as an expansion of the brief listing of the SSSI's bird species given in its management plan (Anon. 1998) and because accurate censuses of breeding pairs and non-breeders will be required for food web models for the region.

BREEDING SPECIES

Penguins *Pygoscelis* spp.

Table 1 summarizes numbers for the three species of *Pygoscelis* penguins at Stranger Point from published and unpublished sources. Aguirre (1995) stated that Shuford & Spear (1988a) recorded 150–200 breeding pairs of Chinstrap Penguins *P. antarctica* during 1986/87. In another paper by Shuford & Spear (1988b), which obviously reports on the same census and season, a total of 150–200 breeding individuals is given for this species, reducing the number of breeding pairs to 75–100. Peter *et al.* (1989) gave a summary for Chinstrap Penguin colony development at Stranger Point. For the Gentoo Penguin *P. papua* Mönke & Bick (1987) reported 1500 moulting birds at Stranger Point on 1 March 1986. Unfortunately, we did not undertake censuses of penguins at Potter Peninsula, so are unable to present data for the 1990s.

Southern Giant Petrel *Macronectes giganteus*

Additional to the 75 breeding pairs mentioned by Aguirre (1995) for the 1988/89 season, which is very close to the estimate of 78 pairs by Araya & Arieta (1971) for 1966/67 but which was not mentioned by Aguirre (1995), a few further records exist. In the 1983/84 season, about 120 occupied nests were found between Three Brothers Hill and Stranger Point (Lorenz 1985) and Peter *et al.* (1988) counted *c.* 59 pairs at the

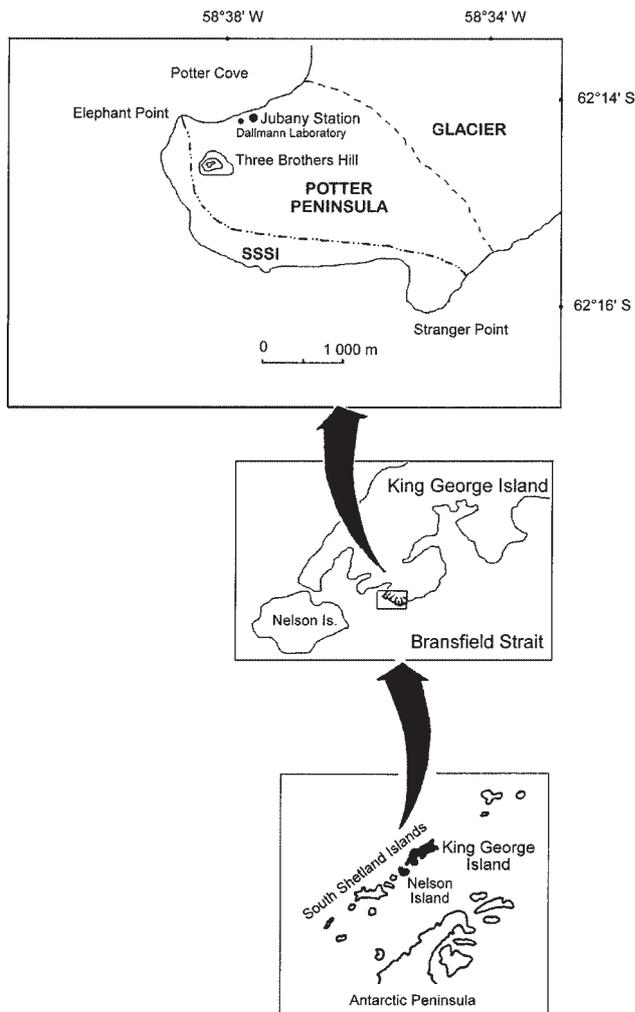


Fig. 1. The Potter Peninsula census area, showing the geographical names used in the text and the borders of SSSI No. 13 (Site of Special Scientific Interest) and the glacier.

same site. The most recent count in February 1998 revealed a total of 46 occupied nests (H.-U. Peter, P. Quillfeldt & T. Schmoll unpubl. data).

Pintado or Cape Petrel *Daption capense*

Aguirre (1995) did not record the Pintado Petrel as a breeding bird within his study area but did note that it bred on rock stacks offshore. In an unpublished report, three breeding pairs were recorded in February 1986 at Stranger Point (Zippel 1986). Anon. (1998) reports the species as breeding within the Potter Peninsula SSSI without providing further information. There are offshore stacks at Stranger Point, but it is not completely clear from the management plan (Anon. 1998, Map No. 3) whether they fall within the boundaries of the SSSI No. 13 or not.

Wilson's Storm Petrel *Oceanites oceanicus*

For the estimation of the colony sizes of Wilson's Storm Petrel we first tried to identify the number of breeding birds by the method of Copestake *et al.* (1988). Birds were mist-netted on 24 nights from 28 December 1995 to 8 March 1996 in one area of the colony on the southern slope of Three Brothers Hill, an area falling outside the SSSI (Fig. 1). A 12-m mist-net was used

in the same position each night. Storm petrel colonies are typically attended by a large number of pre-breeders. Their number can be determined using measurements of cloaca width because breeding females have enlarged cloacas before and after egg-laying. Cloacal width was measured to the nearest 0.1 mm using Vernier calipers. Birds with cloacas wider than 5.3 mm were assumed to be breeding females (Copestake *et al.* 1988).

The peak of cloacal width of females within the colony was recorded on 8 January 1996. During the interval of five days before and after the peak, (3 to 13 January), we caught 37 birds on their nests. Eighteen (48%) of those were breeding females according to their cloaca measurements. Assuming an equal sex ratio, 95% of the breeding females were identifiable during the 10-day period. At the same time 245 birds were caught by mist-net. Of these, 25 individuals (10.2%) had a cloaca wider than 5.3 mm. Because only 95% of the breeding females can be identified and 5% will not be recorded at that point of time, the true proportion of breeding females in the sample is 105% of 10.2% = 10.7%. Assuming again equal sex ratio, the proportion of breeding birds is twice this value, thus 21.4% of all specimens caught.

The recapture of birds that were originally marked on their nests allowed an estimation of the total area from which birds flew into the net. By using a 12-m net we trapped only birds from nests that were not more than 30 m away from our net site.

For the calculation of the total population size, we applied Bailey's modification of the Lincoln index (Begon 1979), a method that was successfully used for Wilson's Storm Petrels by Copestake *et al.* (1988). There, population size is $N = r(n + 1) / (m + 1)$ where n is the total number of birds trapped, m the total number of retraps and r the number of ringed birds at risk of recapture. In our case, we retrapped 17 out of 649 specimens caught. The average Lincoln index calculated from 24 nights was 825 ± 166 (S.E.) individuals. Given the estimation of 21.4% breeding birds (see above), this equals 177 breeding birds, or 88 pairs, within the 30-m circle.

Estimation using mist-netting

The circumference of the Three Brothers Hill is about 1500 m. Sites that are suitable for breeding are situated in a ring of 30-m height around the hill. This gives an area of about 45 000 m². By using the above estimate of 88 pairs in a 30-m circle (area: 2826 m²), the total number of breeding pairs is calculated as: population size = $45\,000 / 2826 \times 88 = 1401$.

Estimation using identified nests

Before egg-laying, 60 nests were marked from birds which were calling at night. Of these, 40 (67%) were found to contain an egg later in the season from which 16 chicks (40%) hatched.

Later in the season, we searched for chicks in an area of one third to one half of the whole colony (the southern slope). Within this area, we found 67 chicks. We additionally searched for chicks in the circle of 30 m around the mist-net. A total of 19 nests containing chicks was identified here, being 22% of the 88 pairs calculated in the mist-net estimation (see above). The remaining 78% of the estimated number of nests were not discovered. This figure was used to estimate the total number of nests in the southern slope: number of chicks = $67 \times 100\% / 22\% = 305$ chicks.

TABLE 1

Numbers of penguin breeding pairs at Stranger Point, Potter Peninsula, King George Island

Season	Adélie Penguin <i>P. adeliae</i>	Gentoo Penguin <i>P. papua</i>	Chinstrap Penguin <i>P. antarctica</i>	Reference
1965/66	6440	2920	950	White (in Croxall & Kirkwood 1979)
1966/67	c. 15 000 adults	c. 3000 adults	c. 2200 adults	Araya & Arieta (1971)
1971/72	c. 18 000	c. 1000	c. 200	Müller-Schwarze & Müller-Schwarze (1975)
1980/81	18 412	2584	495	Jablonski (1984)
1984/85	17 000	1900	350	Peter <i>et al.</i> (1988)
1985/86	16–17 000	2500	500	Zippel (1986)
1986/87	?	1500–2000	150–200	Shuford & Spear (1988a), as cited in Aguirre (1995)
1986/87	?	?	75–100	Shuford & Spear (1988b)
1987/88	14100/15491			Nadler & Mix (1989), Aguirre (1995)
1988/89	14554	2325	265	Aguirre (1995)

The area of the southern slope contained an estimated 305 chicks or, considering the hatching success, 760 breeding pairs (eggs). A projection to the total area of the colony accounts for a total of 1520 to 2280 breeding pairs, which is in reasonable agreement with the estimate of 1401 from mist-netting.

Aguirre (1995) mentioned three breeding colonies of Wilson's Storm Petrels from the Potter Peninsula. Most of the nests found in 1995/96 during this study were situated in an area not surveyed by Aguirre: the scree slopes at the southern side of Three Brothers Hill, the side farthest away from Jubany Station. It is generally difficult to estimate the number of breeding pairs in Wilson's Storm Petrel colonies due to the characteristics of their nest sites and their nesting behaviour:

- 1) Many of the nests are in the deeper layers of the scree slopes, and hence can not be reached or identified;
- 2) It is very difficult to use calls for estimating breeding density, because nests are so close together that single calls overlap and the calls from underneath the rocks often produce echos that make the localization of the caller or the separation of different callers extremely difficult;
- 3) The proportion of non-breeders in the population appears to be extremely unstable, and probably depends not only on the time of the season, but also on weather and food conditions in the colony and in the foraging area, making the use of mist-nets for population studies difficult; and
- 4) Most of the calls are given during the night.

The numbers estimated by us, 1401 and 1520 to 2280 breeding pairs exceed Araya & Arieta's (1971) 500 nests around Three Brothers Hill and 30 around Stranger Point. Our data also exceed those given by Aguirre (1995) who assumed an average population size of 25 with a range from 1 to 222 but also gave a figure of 100 to 200 nests. He believed these figures to be correct with a $\pm 50\%$ error.

We have presented our data in greater detail in order to give a clear understanding of our calculations and to encourage further studies on the population size of Wilson's Storm Petrel on the Potter Peninsula.

Since Aguirre (1995) did not provide breeding data, we add some observations from the 1995/96 summer season. The laying period was spread from 16 December to 15 January, hatching occurred from 23 January to 1 March, and departure, if this term refers to fledging, started on 11 March, the latter

being similar to Aguirre's (1995) departure date of 5 March. The linear regression of the proportion of young still in the nest (y) gives the following function: $y = 102.4 - 2.81x$ ($P = 0.004$), where x is days after the first hatching event. The value $y = 0$ is reached at $x = 36.4$ days. This equals an end of the fledging period on 15 April. Departure of adult breeding birds occurs at the same time.

Black-bellied Storm Petrel *Fregata tropica*

The Black-bellied Storm Petrel is best recognized by its short, whistle-like call 'puiii'. The description by Beck & Brown (1971) might have partially caused the overlooking of Black-bellied Storm Petrels since the call does not last four seconds, as stated by the authors, but has a length of one second followed by a one-second break. This sequence is repeated several times. A further trilling call 'pee-eep-pip-pip-pip' with repetitions was heard near the nest.

Araya & Arieta (1971) did not find Black-bellied Storm Petrels during their survey, whereas Aguirre (1995) observed several around Three Brothers Hill where he thought they may breed.

In the 1994/95 season, we caught 26 specimens. Three nocturnal surveys covering the major part of the peninsula were carried out in January 1995, when we estimated there to be approximately 350 to 400 callers around Three Brothers Hill, two at Stranger Point and one near Jubany Station. In the following season, in January 1996, we counted about 300 calling birds on three surveys, mist-netted 166 birds and found 34 in their cavities. Because the recapture rate of birds banded in the 1994/95 season was low, being six birds out of 26 (23%) in 1995/96 (one from the same cavity where it was banded the year before) and the percentage of breeders among the callers is unknown, we applied Bailey's modification of the Lincoln Index as described for Wilson's Storm Petrel (Copestake *et al.* 1988 and above). The time of greatest cloacal width was found to be from 18 to 28 January 1996. In 16 mist-netting nights (until 17 February 1996) 103 birds were caught, 26% of which had a cloaca wider than 7.0 mm. Nineteen were recaptured. The average value of the population size from 16 nights was then calculated to be 213 ± 61 (S.E.) birds. The area in which we carried out the trapping corresponded to about one third to one fourth of the total area around Three Brothers Hill which was considered suitable for breeding. The total number of birds that we estimate on this basis is thus 639–852 birds. From this

figure we are not able to deduce the total number of breeding birds, because only 13 nest sites were found. However, from the cloaca data, 26% of the birds appeared to be breeding females. Given equal activities of the two sexes, this would indicate that about half of the birds caught might have been breeding individuals.

The first egg was found on 27 December 1995. The hatching period was between 4 and 25 February 1996. Derived from chick masses on 20 March 1996 (70.4 to 105.0 g, $n = 6$), the departure time of the adults is assumed to be around mid-April.

Imperial or Blue-eyed Cormorant *Phalacrocorax atriceps*

This species is an occasional breeder at Stranger Point as is indicated by the record of 'one or two breeding pairs' from 18 January 1985 (Peter *et al.* 1988). Aguirre (1995) reported breeding without details of numbers outside his study area on the offshore rock stacks at Stranger Point. In 1997/98, as in other years, some breeding pairs were observed on these rock stacks (E.R. Barrera-Oro pers. comm). The species is not listed as breeding within the SSSI by Anon. (1998).

Greater Sheathbill *Chionis alba*

Aguirre (1995) knew of 'no previous published records'. However, Araya & Arieta (1971) found two nests in 1966/67 and estimated the total number to be about 30. Twelve breeding pairs are mentioned by Peter *et al.* (1988) for the season 1984/85 and 14 were found the next season (Zippel 1986). In the 1987/88 season, Favero (1993a) found six breeding pairs. Favero (1993b) published a paper on chick growth and breeding ecology of this species on Potter Peninsula and at two other localities. Recently, Favero (1996) reported on the foraging ecology of the Greater Sheathbill on Potter Peninsula.

South Polar Skua *Catharacta maccormicki*

In population surveys during 1993/94, 1994/95 and 1997/98 we attempted to mark all nests. Totals of 40, 41, and 44 nests were found, respectively. In addition, four, five and six territories without nests were located in the respective years. The median hatching date was 28 December 1993 (one-egg and two-egg clutches combined). Aguirre (1995) did not differentiate between the skua species for non-breeders. For breeders, he records two nests in the text but 20 in his Table 1. Older records exist in Araya & Arieta (1971) and Peter *et al.* (1988) who both found one pair close to Stranger Point.

Subantarctic Skua *Catharacta antarctica*

In the breeding seasons 1993/94, 1994/95 and 1997/98, 35, 29 and 26 nests were marked, respectively. One territory was found without a nest (1994/95) and three such territories in 1997/98. The median hatching date, combined for one-egg and two-egg clutches, was 28 December 1993 and was similar to the one found by Aguirre (25 December) who recorded a total of 20 nests. Peter *et al.* (1988) mention six breeding pairs from the coastal plain at Stranger Point. Araya & Arieta (1971) found only eight pairs in 1966/67, including one trio on Potter Peninsula.

Mixed pairs *Catharacta antarctica* x *Catharacta maccormicki*

In the 1993/94 season, 10 mixed pairs of Subantarctic and

South Polar Skuas or of a hybrid with either skua species were found. Seven such pairs were recorded in the summer of 1994/95, 13 in 1997/98. Another type of mixed pair was mentioned by Reinhardt *et al.* (1997) who found a pair of a South Polar Skua and a hybrid South Polar/Chilean Skua at Potter Peninsula. This hybrid bird was still present in the 1997/98 season.

Altogether, 85 skua nests of all species were found in 1993/94, 77 in 1994/95, and 83 in 1997/98. Furness (1982) compared the census techniques of skua colonies for the Great Skua *Catharacta skua* of the Northern Hemisphere. He found the method of marking nests as the most exact one. Counting nests by recording aggressive behaviour in territories and counting apparently occupied territories both underestimate the actual number of nests. Although Aguirre (1995) did not mention his census method it appears that he did not fully cover the whole peninsula nor did he correctly apply either technique. This resulted in a nearly four-fold lower number of skua nests in his study. In the absence of diseases (e.g. fowl cholera, *Paramelee* *et al.* 1979) the numbers of breeding pairs of the Subantarctic Skua appears to be fairly stable over several years (Peter *et al.* 1990), whereas those of the South Polar Skua are more variable.

Kelp Gull *Larus dominicanus*

Aguirre (1995) mentions 44 breeding pairs and considered this the first published record. However, at least 10 breeding pairs were estimated for 1966/67 by Araya & Arieta (1971), 25 in 1985 (Peter *et al.* 1988), and at least 15 in 1986 (Zippel 1986).

Antarctic Tern *Sterna vittata*

Araya & Arieta (1971) observed about 50 Antarctic Terns around Three Brothers Hill in 1966/67 but found no nests. Peter *et al.* (1988) recorded about 55 breeding pairs at Stranger Point. Favero (1994) found 358 breeding pairs during the 1987/88 season. For the same season and the same site, Aguirre (1995) estimated the number to be about 200 pairs (and 100 in 1988/89). The data for adult arrival also differ between Aguirre (1995) and Favero (1994), the former mentioning 5 November, the latter observing a range from 12 September to 3 October 1987. A recent estimate in 1997/98 revealed about 250 breeding pairs, including a few on top of Three Brothers Hill.

NON-BREEDING SPECIES

Macaroni Penguin *Eudyptes chrysolophus*

In addition to the observations of Aguirre (1995), Peter *et al.* (1988) recorded this species on 8 March 1984, a bird that had been banded by Brazilian ornithologists on 2 February 1984 (M. Sander pers. comm.). H.-U. Peter (unpubl. data) observed another unmarked individual in January 1994 at Stranger Point.

Wandering Albatross *Diomedea exulans*

Peter *et al.* (1988) recorded one individual near Stranger Point on 20 March 1985.

Snow Petrel *Pagodroma nivea*

Between 10 and 12 October 1987, Nadler & Mix (1989) counted 250 to 300 birds flying past Stranger Point during five hours of observation. Aguirre (1995) reported the species flying along the coast in September and October but gave no numbers.

Antarctic Fulmar *Fulmarus glacialisoides*

Between 10–17 October 1987, Nadler & Mix (1989) observed three to six birds daily, with a maximum of about 300 birds on 16 October 1987 flying past close to the edge of the pack ice. Aguirre (1995) observed one bird in October 1988.

Antarctic Petrel *Thalassoica antarctica*

Nadler & Mix (1989) observed single birds flying southwards on 12, 16, and 17 October 1987 at Stranger Point. These records represent an addition to the bird list of Potter Peninsula.

Prions *Pachyptila* sp.

In January 1994, a skull and parts of two wings of a prion were found on the beach. The species could not be confirmed.

Leach's Storm Petrel *Oceanodroma leucorhoa*

The first record of this species on 22 February 1996 from the Potter Peninsula, and for King George Island, is given by Hahn & Quillfeldt (1998). The bird was caught by mist-net and had a bare brood patch.

Cattle Egret *Bubulcus ibis*

Records additional to those given by Aguirre (1995) are to be found in Silva *et al.* (1995) for the Stranger Point region.

Yellow-billed Pintail *Anas georgica*

In addition to Aguirre's (1995) data, the wing of a dead individual was found by us in the 1995/96 season.

Black-necked Swan *Cygnus melancoryphus*

Four individuals were observed by us in the summer of 1995/1996. Aguirre (1995) and Silva *et al.* (1995) reported earlier observations.

White-rumped Sandpiper *Calidris fuscicollis*

Silva *et al.* (1995) recorded five and two birds from Stranger Point in December 1993 and January 1994 respectively, to add to the records of Aguirre (1995).

Chilean Skua *Catharacta chilensis*

On 6 December 1993, a bird which was morphologically indistinguishable from the Chilean Skua was observed and photographed at Potter Peninsula (Reinhardt *et al.* 1997), representing a new record for the locality.

Arctic Tern *Sterna paradisaea*

During December and January 1993/94 and 1994/95, several terns in non-breeding plumage without any brownish colouration patterns on the back or the wings were observed. They are, therefore, unlikely to be juvenile Antarctic Terns and were probably Arctic Terns, but remain unconfirmed. Arctic Terns were not reported by Aguirre (1995).

European or Barn Swallow *Hirundo rustica*

Two European Swallows were transported from Buenos Aires

to the Potter Cove by the icebreaker *Almirante Irizar*. During the exchange period of Jubany Station personnel, they were observed flying over Potter Cove (Fig. 1) for at least two minutes in the evening hours of 29 and 30 November 1993.

DISCUSSION

The record of Leach's Storm Petrel (Hahn & Quillfeldt 1998), the five- to 10- fold higher estimates for Wilson's Storm Petrel and a much higher number of Black-bellied Storm Petrels (in comparison to Aguirre 1995) were found through intensive nocturnal mist-netting. Mist-netting was not undertaken by Aguirre (1995). The methods applied by Aguirre (1995) were probably not appropriate for the censuses of several species. For instance, South Polar Skuas tend to nest farther inland when sympatric with Subantarctic Skuas (Peter *et al.* 1990). This might explain why Aguirre (1995) found only two pairs with his 'near-coast censuses'. The Subantarctic Skuas that nest closer to the coast (Peter *et al.* 1990), to the station and to penguin colonies are easier to record but nevertheless seem to be more a more abundant breeder than was shown by Aguirre (1995). We conclude that the differences between our data and Aguirre's (1995) are primarily due to methodology rather than to actual changes in the abundances of the species over time.

This review sets the number of known breeding species for the Potter Peninsula at 13. Aguirre (1995) recorded only 10 breeding species within his study area, but his total for the area we review (which includes the Stranger Point offshore stacks) was 12. Anon. (1998) notes 10 breeding species, but lists only nine by name. Future versions of the Management Plan for SSSI No. 13 should thus be suitably updated, preferably with the addition of quantitative data as well. For non-breeding species the Potter Peninsula appears to be more important than previously reported (Araya & Arieta 1971, Aguirre 1995) with our additional records of seven taxa, including an unidentified prion and the unconfirmed observations of Arctic Terns. The total number of bird taxa now stands at 27.

The current boundaries of SSSI No. 13 do not include Three Brothers Hill (Anon. 1998, Fig. 1). Consideration should be given to expanding the boundaries of the site to include this hill and its important storm petrel populations.

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