NOTES ON THE BIRDS OF SCHIRMACHER OASIS, DRONNING MAUD LAND, EAST ANTARCTICA

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ABSTRACT

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The Schirmacher Oasis in central Dronning Maud Land, East Antarctica, has a long history of ornithological observations and is one of the few areas in East Antarctica experiencing a warming climate. Snow Petrels *Pagodroma nivea* and Wilson's Storm Petrels *Oceanites oceanicus* were reported to breed at Schirmacher Oasis in the past, but currently the only confirmed regular breeding species is the South Polar Skua *Stercorarius maccormicki*. This note summarises observations at the Oasis in November and December 2023. Wilson's Storm Petrels were the most abundant bird, breeding at several sites along the northern scarp in December. Pairs of Adelie Penguins *Pygoscelis adeliae* were seen at two sites, but no breeding was observed. A pair of Southern Fulmars *Fulmarus glacialoides* displaying on a cliff in December represent the first record of this species for the Oasis. Snow Petrels were only recorded in November, commuting through the area, presumably to breeding sites farther inland. Three pairs of South Polar Skuas were recorded incubating in mid-December, with the first chick hatching on 18 December. Numbers of skua pairs have decreased steadily from 10 pairs in the 1980s and 1990s, presumably due to removal of food subsidies from station scraps.

Key words: Antarctica, Adelie Penguin, Snow Petrel, South Polar Skua, Southern Fulmar, Wilson's Storm Petrel

INTRODUCTION

The Schirmacher Oasis (hereafter the Oasis) is a 34 km^2 ice-free area on the Princess Astrid coast of central Dronning Maud Land, East Antarctica. It is the closest ice-free land to the ice-shelf edge in the region and has been ice free for the last 22 000–35 000 y (Dharwadkar *et al.* 2018, Roy *et al*. 2023). The Oasis lies 10 km north of Novo Runway, the gateway for aerial logistical flights into Dronning Maud Land. It is home to two year-round national research stations, Novolazarevskaya (Russia, established 1961) and Maitri (India, established 1985), and two summer non-governmental visitor camps Ultima Antarctic Expeditions (South Africa) and White Desert (United Kingdom). From 1976 to 1993, it also housed the German Democratic Republic's Georg Forster Station. Given this relatively long history of human occupation, there is a substantial record of the birds from the Oasis, although much of it is in obscure literature that is hard to access (e.g., Richter *et al*. 1990). Konovalov (1964) recorded Snow Petrels *Pagodroma nivea* and Wilson's Storm Petrels *Oceanites oceanicus* breeding at the Oasis in 1959/60. Observations by personnel from Maitri Station have been summarised by Pande *et al*. (2020), who also undertook a systematic ornithological survey of all ice-free areas in the Oasis over 20 d in late summer (mainly March, but some January observations) of three successive years, 2014 to 2016.

Pande *et al*. (2020) reported that the South Polar Skua *Stercorarius maccormicki* was the only regular breeding species, with seven pairs at the Oasis. The occasional pair of Adelie Penguins *Pygoscelis adeliae* has attempted to breed, but there is no evidence of any chicks being raised. There were "multiple sightings" of Wilson's Storm Petrels along the northern cliffs where they were suspected to breed, but the low numbers of Snow Petrels that visit the Oasis no longer breed there (Pande *et al*. 2020). Flocks of Antarctic Petrels *Thalassoica antarctica* occasionally fly over the Oasis in October (Konovalov 1964, Pande *et al*. 2020), but there are no breeding records for the species.

The average January air temperature at the Oasis has increased from 1960 to the mid-1980s, and ice core data from south of the Oasis indicate a *ca.* 1 °C temperature increase during the 20th century, which makes central Dronning Maud Land one of the few areas in East Antarctica to demonstrate a small but significant warming trend over the period (Naik *et al*. 2010). Storm events accompanied by heavy snowfall significantly impact breeding success in petrels at inland nunataks in the Muhlig-Hofmannfjella (Descamps *et al*. 2015) and severe storms resulted in widespread breeding failure of petrels and South Polar Skuas during summer 2021/22 (Descamps *et al*. 2023). Climate change can have unexpected consequences for breeding birds, such as altering depredation pressure (van Franeker *et al*. 2001). This note reports ornithological observations at the Schirmacher Oasis in November and December 2023, including observations for one previously unreported species for the site.

STUDY AREA AND METHODS

The Oasis is a 34 km^2 ice-free area on the Princess Astrid coast of central Dronning Maud Land. Including outlying ice-free outcrops, it extends 20 km largely west to east and is between 1 to 3 km north-south (Fig. 1). Most of the Oasis is a plateau with approximately 120 lakes and low hills, but the northern boundary is characterised by steep rocky slopes and cliffs that rise to 150 m above the Lazarev/Nivlisen Ice Shelf (Dharwadkar *et al*. 2018, Roy *et al*. 2023). The continental ice sheet lies to the south, with only a few small nunataks until the Wohlthat Mountains arise 70–80 km farther inland (Fig. 1).

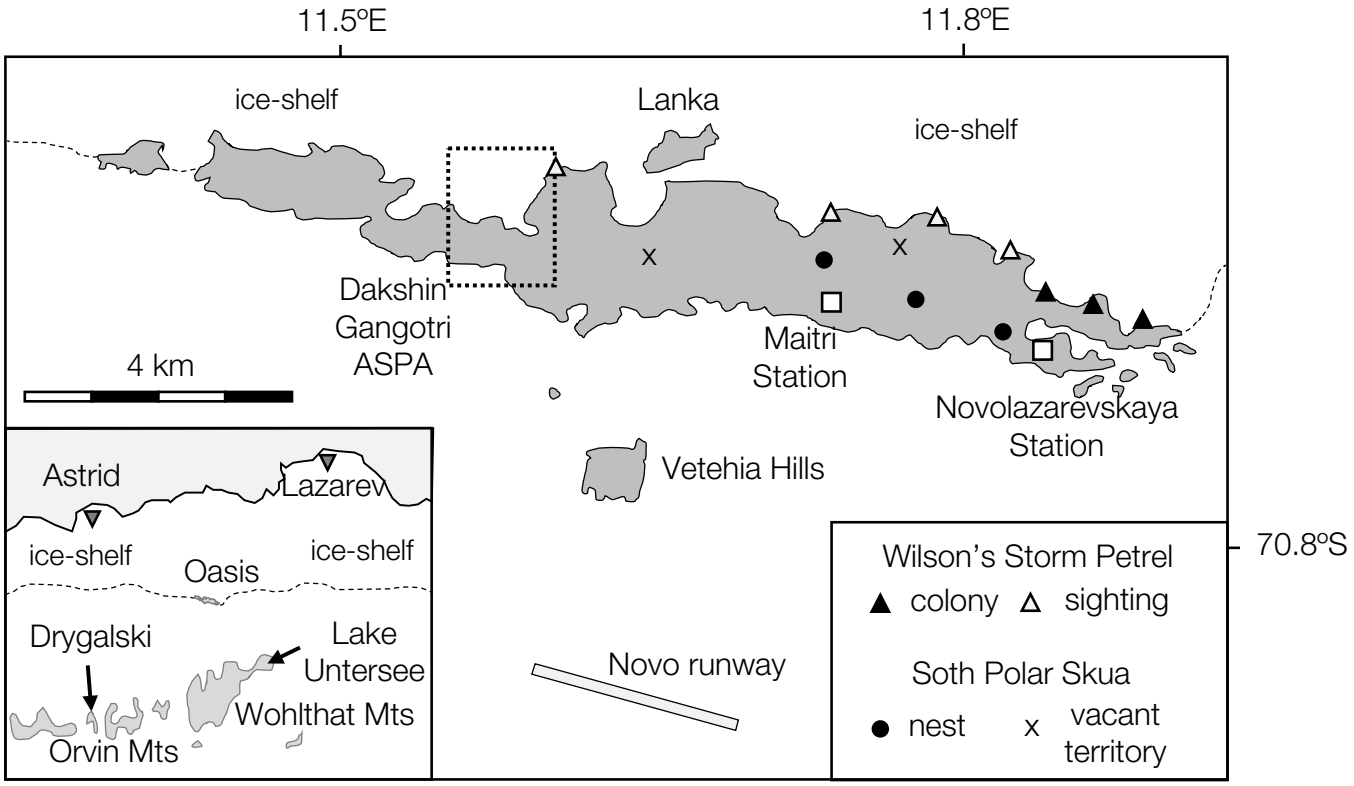

Fig. 1. The Schirmacher Oasis in central Dronning Maud Land, East Antarctica, showing Wilson's Storm Petrel *Oceanites oceanicus* colonies and other sites where storm petrels were observed along the northern cliffs, and South Polar Skua *Stercorarius maccormicki* nests and vacant territories that were occupied in 2013–2015 (from Pande *et al.* 2020). The inset shows the location of the Oasis in relation to the adjacent mountains, ice shelf, and the two nearby Emperor Penguin *Aptenodytes forsteri* colonies (inverted triangles). The dotted line indicates the approximate location of the coastline/ice-shelf boundary.

Ad hoc ornithological observations were made between visits to Emperor Penguin *Aptenodytes forsteri* colonies in the region. From 04 to 12 November 2023, I was based at Novo Runway and visited the Oasis on 05, 08, and 09 November, exploring the area east of the Dakshin Gangotri Glacier Antarctic Specially Protected Area (ASPA), i.e., east of 11.617°E. This is the area around Novolazarevskaya Station and north of Maitri Station (Fig. 1). From 15 to 21 December 2023, I was based near Novolazarevskaya and had time to visit most of the ice-free areas east of the Dakshin Gangotri Glacier ASPA. I used binoculars to scan for birds, and I used play-back to elicit calls from Wilson's Storm Petrels in their burrows. I made a specific effort to search for skua nests in the areas where they were observed by Pande *et al*. (2020). However, I was unable to visit the immediate surrounds of the two national research stations, which included two skua nest sites at Maitri Station. I examined prey remains at skua nest sites to infer their main prey while provisioning chicks. I did not explore the 0.75 km^2 Vetehia Hills (70.79°S, 11.63°E), 2 km south of the Oasis, or the 0.65 km^2 offshore 'island' Lanka (70.74°S, 11.66°E), 0.2 km north of the Oasis (Fig. 1).

In addition to the Oasis, I made brief visits to a small (0.8 km^2) nunatak 20 km southeast of the Oasis (70.916°S, 12.248°E) on 08 November and 19 December. Konovalov (1964) indicated a Snow Petrel colony there, but I did not observe any birds at this location. I also visited the Lake Untersee area (71.33°S, 13.45°E) in the Gruber (Wohlthat) Mountains on 06 November, the Drygalski (Orvin) Mountains (71.86°S, 8.28°E) on 11 November, and the Astrid Emperor Penguin colony (69.94°S, 8.31°E, 150 km WNW of the Oasis) on 07 November and 15 and 18 December.

RESULTS AND DISCUSSION

Adelie Penguin

Two pairs of Adelie Penguins were seen: one north of Novolazarevskaya on 05 November (Fig. 2A) and one 3.5 km west of Novolazarevskaya on the seaward slope north of Maitri on 08 November. Numerous penguin tracks were seen in both areas, and it is likely they were two different prospecting pairs. A single bird was on Novo Runway, 10 km south of the Oasis, on 07 November. On that day, eight Adelie Penguins were seen attending nests made from ice pellets on the edge of the ice shelf at the Astrid Emperor Penguin colony. No Adelie Penguins were seen in December, but a *Pygoscelis* penguin called several times from the bottom of the cliff near the eastern boundary of the Dakshin Gangotri Glacier ASPA on 17 December and presumably was an Adelie Penguin.

Low numbers of Adelie Penguins regularly visit the Oasis in summer and occasionally attempt to breed (Artem'ev 1964, 1965, Haendel *et al.* 1986, Woehler 1993, Pande *et al*. 2020). One pair was photographed incubating two eggs on the northern shore on 24 November 2008 (Pande *et al*. 2020), close to where the pair was observed on 08 November 2023. Pande *et al*. (2020) also listed seven pairs apparently breeding on Vetehia Hills, 2 km south of the Oasis, in 1996, but they provided no further information. Adelie

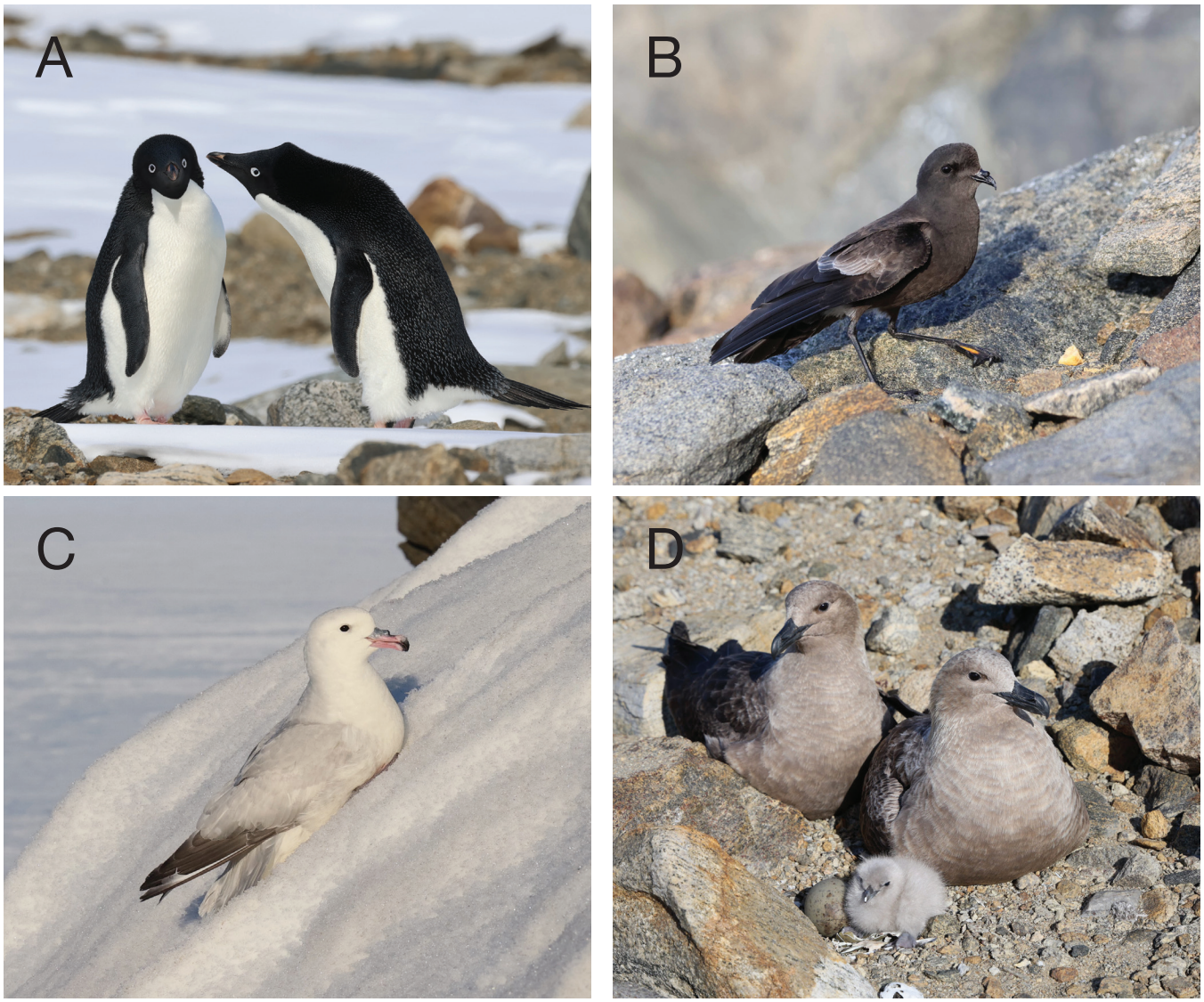

Fig. 2. A pair of Adelie Penguins *Pygoscelis adeliae* (A), a Wilson's Storm Petrel *Oceanites oceanicus* in the cliff-top colony (B), one of two Southern Fulmars *Fulmarus glacialoides* in the same storm petrel colony (C), and a pair of South Polar Skuas *Stercorarius maccormicki* with a newly-hatched chick (D).

Penguins are constrained by the paucity of ice-free areas on which to breed, and they occasionally resort to attempting to breed on ice (Konovalov 1964, LaRue *et al*. 2019), as was observed at the Astrid Emperor Penguin colony in November 2023. They have also attempted to breed on the Nivlisen Ice Shelf (Pande *et al*. 2020), but it is unclear if this breeding attempt occurred on ice or on equipment left on the ice shelf (Mathew 1986).

The Oasis is the closest ice-free area to the sea in central Dronning Maud Land and thus attracts prospecting Adelie Penguins. However, their occasional breeding attempts are likely to fail given the very long commute to the sea (*cf*. Ropert-Coudert *et al*. 2018). Should the ice shelf break up in this area, it may allow Adelie Penguins to breed at the Oasis in the future (LaRue *et al*. 2013). Such a radical change to sea ice conditions would likely have adverse impacts on other species, especially Emperor Penguins (Trathan *et al*. 2020), which have two colonies in the area (Fretwell & Trathan 2020, Fretwell 2024; Fig. 1).

Wilson's Storm Petrel

Wilson's Storm Petrels were not observed in early November, but they were the most abundant bird at the Oasis in mid-December, when they were also seen at Novo Runway and on both visits to the Astrid Emperor Penguin colony. Occasional storm petrels were seen flying along the northern cliffs of the Oasis during the day along the entire length visited (Fig. 1), but their numbers increased in the evening (when the sun was still up, but low in the south). Tens of birds were seen flying back and forth along the cliffs at two sites north of Novolazarevskaya, where other birds were calling from rock crevices. At one site (70.772°S, 11.850°E), occupied crevices were among loose scree near the top of the cliff (Fig. 2B). However, it was not possible to check crevices for eggs without causing significant disturbance, especially early in the season. The presence of birds in nest sites during the day was confirmed by their response to playback. At a second site (70.768°S, 11.831°E), the colony was lower on the cliff and not readily accessible. One bird

was seen landing among boulders in a third likely breeding area at the foot of the scarp near the eastern extent of the Oasis (70.773°S, 11.875°E). Although most calling was by birds on the ground, on one occasion the same harsh call was given by two birds flying together over a colony.

Wilson's Storm Petrel almost certainly breeds at numerous sites along the northern scarp of the Oasis. Based on multiple sightings along its northern cliffs, Pande *et al*. (2020) thought that the species probably bred at this location, but they failed to locate any nesting sites. Based on the wide distribution of storm petrels and the numbers of birds readily observed in the area each evening, I estimate that there are at least several hundred (likely more than 200) breeding pairs at the Oasis. The figure in Konovalov (1964) is not very clear but appears to show storm petrels breeding at a small nunatak 25 km south-southeast of the Oasis. Elsewhere in Dronning Maud Land, low numbers of Wilson's Storm Petrels (< 10 pairs) are known to breed much farther west at Basen in Vestfjella (73.02°S, 13.40°W; Johansson & Thor 2004) and Robertskollen in the Ahlmannryggen (71.45°S, 3.32°W), where they occupy a sheltered, north-facing slope (Ryan & Watkins 1988, Steele & Newton 1995). The closest breeding records to the east of the Oasis are from Ongul, one of the Flatvaer Islands (69.00°S, 39.50°E; Marchant & Higgins 1990).

Southern Fulmar

A pair of Southern Fulmars was observed calling and displaying together on a small snow bank (Fig. 2C) in the most accessible Wilson's Storm Petrel colony north of Novolazarevskaya on the evening of 16 November. When approached, one bird flew off and circled the area before landing nearby, where it was joined by the second bird. However, they were not seen again, despite checking each evening thereafter. Southern Fulmars occasionally occur along the ice-shelf edge north of the Oasis (Mathew 1986, Pande *et al*. 2020, Cruewels *et al*. 2007) but have not been recorded from the mountains of central Dronning Maud Land; Steele & Newton (1995) reported two sightings of birds in flight at Robertskollen in the Ahlmannryggen in January 1993. There are no breeding records of Southern Fulmar west of 50°E in East Antarctica (Marchant & Higgins 1990, Creuwels *et al.* 2007).

Snow Petrel

Snow Petrels were only observed at the Oasis on 09 November when several small flocks were seen flying inland both at the Oasis and Novo Runway. Two birds were seen circling the northern cliffs, but there was no calling or other indications of breeding, and there were no birds in this area on subsequent visits. No Snow Petrels were seen anywhere in December. Farther inland, Snow Petrels were abundant, breeding among large boulders on the western shore of Lake Untersee, and one Snow Petrel was seen flying east of Ritscher Peak, the highest point in the Gruber Mountains, south of Lake Untersee. It is also probable that Snow Petrels were breeding at a small nunatak (71.819°S, 8.278°E) located 1.4 km northeast of Tungespissen, at the northern tip of the main Drygalski Mountain range. I visited this area on 11 November. Numerous birds were seen flying around the nunatak and could be heard calling from more than 1 km away, but I was unable to visit the breeding site.

The Snow Petrel is the most widespread breeding bird species in Dronning Maud Land and is known to breed at various sites in the Orvin and Wohlthat mountains (Croxall *et al*. 1995). The site in the Drygalski Mountains is not listed in Croxall *et al*. (1995), but Konovalov (1964) maps a breeding site in this area. Lake Untersee is one of the largest known Snow Petrel colonies, with approximately 10 000 pairs (Croxall *et al*. 1995), and it is listed as an Important Bird and Biodiversity Area (AQ113; datazone.birdlife.org; Harris *et al*. 2015). Dating of the accumulations of dried stomach oil (mumiyo) indicate that Snow Petrels have occupied this site continuously for the last 8000 y, with some deposits dating to 34 000 years before present (Hiller *et al*. 1988). The absence of breeding Snow Petrels from the Oasis is surprising. Although much of the geomorphology is unsuitable for the species, being either fine-grained moraines or solid rock, there are some large boulder fields that offer apparently suitable nesting sites. Snow Petrels apparently bred at the Oasis and adjacent nunataks 20–30 km farther south in 1959/60 (Konovalov 1964), but there is no recent evidence of breeding (Pande *et al*. 2020). Depredation by South Polar Skuas may account for their disappearance as a breeding species from the vicinity of the Oasis (Bhatnagar 1999, see below), although direct human disturbance might also have played a role.

South Polar Skua

South Polar Skuas were observed at the Oasis, Novo Runway, Lake Untersee, and the Astrid Emperor Penguin colony in November and December. Breeding was only observed at the Oasis but also occurred at Lake Untersee (D. Anderson pers. comm.). A pair occupied a territory at Novo Runway and was observed calling and displaying, but the pair apparently did not attempt to breed. At the Oasis, nests of three of five pairs reported by Pande *et al*. (2020) were located in December (Fig. 1). There was no sign of birds in the "long lake" or "big valley" territories (unofficial place names from Pande *et al*. 2020). Each pair was incubating two eggs. One egg was pipped on 17 December, and the chick hatched the following day (Fig. 2D). Prey remains at nest sites were old, dating to previous breeding years. The main prey remains were Snow Petrels (at least 80 skulls plus postcranial bones and occasional wings). The partial remains of two skuas were probably chicks that died before fledging. No penguin remains were found, even though four to six skuas were present during each visit to the Astrid Emperor Penguin colony.

The number of South Polar Skua breeding pairs at the Oasis decreased from 10 in the 1980s and 1990s (Richter *et al*. 1990, Venkataraman & Hazra 2005) to seven pairs in 2013–2015 (Pande *et al*. 2020), and three to five pairs in 2023/24. Most South Polar Skuas breed in association with penguin colonies, where the number of pairs is closely linked to the numbers of penguins (Wilson *et al*. 2017, Pacoureau *et al*. 2019). There are fewer data for the relationship between skua numbers and the numbers of petrels at inland nunataks. A strong relationship could be expected given the distance to other food sources (e.g., marine prey or Emperor Penguin colonies; Brooke *et al*. 1999). At Svarthamaren, 260 km west of the Oasis, breeding skuas rely entirely on local breeding petrels (Brooke *et al*. 1999), and they fail to breed in years when petrel breeding fails due to adverse snow conditions (Descamps *et al*. 2023). Venkataraman & Hazra (2005) reported that a pair of breeding skuas killed a Snow Petrel at the ice shelf edge 100 km from the Oasis, but this is surprising because one member of a pair normally remains on the territory throughout the breeding season.

In 1991/92, approximately 144 000 pairs of Antarctic and 10 000 pairs of Snow Petrels supported 250 skuas at Svarthamaren (Brooke *et al*. 1999). No skuas bred at Robertskollen, where there were 500–600 pairs of Snow Petrels (Ryan & Watkins 1988, Steele & Newton 1995). Konovalov (1964) did not report the numbers of Snow Petrels breeding at the Oasis in 1959/60, but he indicated that throughout the region they "nest in small groups" and "do not form large colonies" (p. 157), suggesting that they were not particularly abundant at the time. The Oasis has an unusually high concentration of breeding skuas relative to the small numbers of potential prey. Their high numbers in the 1980s and 1990s resulted from scavenging waste food from research stations (Bhatnagar 1999), and the resultant increase in depredation pressure may explain the loss of breeding Snow Petrels from the Oasis and adjacent nunataks. Depredation on breeding seabirds may be exacerbated by food subsidies increasing populations of predators such as gulls *Larus* spp. (Oro *et al*. 2013, Hoeg *et al*. 2021), and Great Skua *Stercorarius skua* depredation can cause seabird prey populations to decrease (Votier *et al*. 2006, Newson *et al*. 2008). The most effective way to address this issue is to remove the anthropogenic food source (Carmona *et al*. 2021). The cessation of dumping of food wastes from stations at the Oasis presumably accounts for the steady decrease in the number of skua breeding pairs over the last few decades, and it would be interesting to determine the diet and breeding success of the few remaining pairs.

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